ROOSTER RIVER
Watershed Based Plan

September 2013

Prepared by

FUSS & O'NEILL

FUSS & O'NEILL

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Rooster River Watershed Based Plan

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Executive Summary

The Rooster River watershed is an approximately 15.3 square-mile sub-regional basin in the southwestern portion of Connecticut. The Rooster River forms the border between Bridgeport and Fairfield and eventually flows to Black Rock Harbor and Long Island Sound via the Ash Creek Estuary. Ash Creek is part of the Rooster River watershed and consists of the tidal portion of the Rooster River. The watershed is primarily located within three communities - Bridgeport, Fairfield, and Trumbull - and is home to approximately 80,000 people. The watershed is dominated by developed land uses, with residential land uses comprising approximately 58% of the watershed and commercial, institutional, industrial, mixed-use, and roadway land uses comprising another 30%.

Issues Facing the Watershed

The Rooster River, like many other urbanized rivers and streams in Connecticut, has been impacted by historical development and land use activities in its watershed. The water quality in the Rooster River is degraded due to elevated bacteria levels resulting from sewer overflows, point discharges from industrial facilities, and nonpoint sources such as stormwater runoff from developed areas and impervious surfaces. The water quality of the Rooster River does not meet minimum standards for recreation, and the water quality in Ash Creek does not meet minimum standards for contact recreation, marine aquatic life, or commercial shellfishing. The poor water quality in these "impaired" water bodies is generally the result of historical land use and urbanization within the watershed.

A Total Maximum Daily Load (TMDL) (i.e., a "pollution budget") developed for the Rooster River by the Connecticut Department of Energy and Environmental Protection (CTDEEP) in 2005 indicates that bacteria loads to the Rooster River must be reduced by over 90% for the impaired segments to meet water quality standards and once again support contact recreation.

The Rooster River watershed has a long history of flooding as a result of historical development of the watershed. Flooding problems along the Rooster River have been studied by various agencies and organizations since the 1950s, and flood mitigation projects have significantly altered the river and the face of the watershed. Despite past flood protection efforts, flooding and drainage problems persist in many areas of the watershed. While water quality is the primary focus of this watershed based plan, flooding is also addressed as a related issue, along with habitat protection and restoration.

Why Local Water Quality Matters

Clean waterways can increase neighborhood prosperity by providing access to healthy natural resources and cultural landscapes within a vibrant urban context. Watershed planning can strengthen water conservation, stormwater management, and improve water quality. Rather than shunting surface water runoff directly into sewers, urban landscapes can be designed and modified to absorb and clean polluted runoff with green infrastructure. Stream buffers can improve water quality and aquatic life while restoring native habitat for wildlife and increasing the tree canopy, as well as potentially increasing urban property values. Watershed management planning identifies ways to balance high-density development with healthy natural environments through traditional and innovative approaches to stormwater and nonpoint source pollution control and sustainable development practices.

While there are many challenges associated with improving water quality in the Rooster River, the river also has the potential to serve as a tremendous asset and a focal point for urban/suburban community collaboration. It can be perceived as a natural feature that could help define the character of the urban/suburban nexus. Cities across the United States are beginning to rediscover their connections to rivers and waterways.

The Rooster River has many natural areas along its banks as it flows from its headwaters into Ash Creek. The linear nature of rivers provides a tangible link and the potential for communities to collaborate on revitalization efforts. The potential exists for a regional vision to be developed where the upper watershed communities can offer substantial water quality and habitat protection benefits while the urban areas can provide the urban river experience with the river forming a physical and emotional connection to the community.

The Need for a Comprehensive Watershed Plan

The watershed communities and the CTDEEP recognize the need to address the water resource issues of the Rooster River, Ash Creek, and their tributaries using a watershed-based approach. A primary way to do this is by developing and implementing a comprehensive watershed management plan to protect and restore water resource conditions throughout the watershed.

The City of Bridgeport worked collaboratively with the Southwest Conservation District (SWCD), the CTDEEP, and the other watershed municipalities (Fairfield and Trumbull) to develop a watershed based plan for the Rooster River. Funding for this project was provided through the SWCD in the form of a CTDEEP Water Quality Management Planning Grant under section 604(b) of the Clean Water Act. Fuss & O'Neill, Inc. and Connecticut Fund for the Environment/Save the Sound (CFE/STS) were retained to lead the development of the watershed based plan, working with a project steering committee.

The objective of this watershed based plan is to characterize the watershed conditions, identify, investigate, and address the current and emerging issues facing the watershed, and have the clear potential to affect on-the-ground change within the watershed by recommending specific, measurable actions to protect and improve water resource conditions.

Plan Development Process

The watershed plan has been developed consistent with State and Federal guidance for the development of watershed-based plans. Following this approach will enable implementation projects under this plan to be considered for funding under Section 319 of the Clean Water Act and improve the chances for funding through other State and Federal sources.

Development of the watershed plan consisted of the following major tasks.

- **Steering Committee** – A project steering committee was formed to guide the plan development. The steering committee consisted of representatives from the watershed municipalities, government organizations, educational institutions, non-profit organizations, and others who live and work within the watershed. The watershed plan reflects the combined efforts of the steering committee, the watershed municipalities, Save the Sound and Fuss & O'Neill, SWCD, CTDEEP, and other stakeholders.

- **State of the Watershed Assessment** – A baseline assessment was performed to develop an understanding of the current water resource conditions in the Rooster River watershed, which is documented in *Technical Memorandum #1: State of the Rooster River Watershed.* This document serves as a basis for the watershed management plan recommendations and also provides a background reference document to support future implementation activities within the watershed.

- **Low Impact Development and Green Infrastructure Assessment** – A watershed assessment was performed to identify opportunities and develop concepts for site-specific Low Impact Development (LID) and green infrastructure retrofits. The site-specific project concepts are intended to serve as potential on-the-ground projects for future implementation and examples of the types of projects that could also be implemented for other similar land uses and locations in the watershed. The methods and findings of this assessment are documented in *Technical Memorandum #2: Low Impact Development and Green Infrastructure Assessment.*

- **Plan Goals and Objectives** – The project team developed a series of goals and objectives for the watershed based upon the findings of the watershed assessments. The goals and objectives were further refined by the project steering committee with input from each of the watershed municipalities.

- **Plan Recommendations** – Potential management actions were identified for each of the plan goals and objectives and subsequently refined based upon input from the project steering committee through workshop meetings and coordination with municipal staff and boards, culminating in the plan recommendations that are presented in this document. Management actions include ongoing, short, medium and long-term recommendation, as well as watershed-wide and site-specific actions. Site-specific retrofit and restoration concepts were developed based on the watershed assessments summarized in Technical Memorandum #1 and Technical Memorandum #2.

- **Public Outreach** – Public outreach was conducted during the watershed planning process to increase public understanding of issues affecting the watershed and to encourage participation in the development of the watershed plan.

Watershed Management Goals

The watershed management goals for the Rooster River watershed are:

- **Goal 1 – Capacity Building for Plan Implementation.** Build a foundation for successful implementation of the watershed management plan by the watershed municipalities, non-governmental organizations (environmental groups and non-profits), residents, local businesses, and other stakeholders.

- **Goal 2 – Water Quality.** Improve the water quality of the Rooster River and its tributaries so that impaired reaches of the river will consistently meet their designated uses for fish and wildlife habitat and recreational use, along with improving the downstream water bodies of Ash Creek

Estuary, Black Rock Harbor, and Long Island Sound. Protect and enhance the water quality of water bodies that are not impaired.

- **Goal 3 – Habitat Protection and Restoration.** Protect and improve terrestrial, riparian, and aquatic habitat in the watershed to maintain and increase the watershed's diversity of plant and animal species.

- **Goal 4 – Sustainable Land Use and Open Space.** Promote sustainable growth and appropriate development in the watershed while preserving and improving the watershed's natural resources, providing public access to open space, and addressing current and future flooding problems.

- **Goal 5 – Education and Stewardship.** Promote stewardship of the Rooster River watershed through education and outreach. Target appropriate messages to specific audiences, and promote stewardship opportunities through citizen involvement in science, conservation, and restoration activities.

Summary of Recommendations

A set of specific objectives and recommended actions were developed to satisfy the management goals for the watershed. The plan recommendations include watershed-wide recommendations that can be implemented throughout the Rooster River watershed, targeted recommendations that are tailored to issues within specific subwatersheds or areas, and site-specific recommendations to address issues at selected sites that were identified during the watershed field inventories. Recommendations are classified according to their timeframe and overall implementation priority.

- **Ongoing Actions** are actions that should occur annually or more frequently such as routine water quality monitoring, as well as actions that occur on an ongoing basis such as fundraising, education and outreach, and coordination between watershed stakeholders.

- **Short-Term Actions** are initial actions to be accomplished within the first one to two years of plan implementation. These actions have the potential to demonstrate immediate progress and success and/or help establish the framework for implementing subsequent plan recommendations. Such actions include adoption of the plan by the watershed municipalities and formation of a watershed organization; revising local land use regulations; outfall inventories and illicit discharge investigations; and stream walks to assess the condition of the streams and riparian corridors, identify retrofit opportunities and problem areas, and involve the public. Small demonstration projects could be completed during this phase, with volunteer service events. Construction of larger retrofits and restoration projects requiring extensive design, engineering, and permitting should be planned for later implementation.

- **Mid-Term Actions** involve continued programmatic and operational measures, delivery of educational and outreach materials, and construction of larger retrofit and/or restoration projects over the next two to five years. Progress on land conservation, especially the protection of headwaters and unique landscapes, LID and green infrastructure implementation, and stream walk follow-up activities should be completed during this period, as well as project monitoring

and tracking. A sustainable funding and maintenance program should also be established for watershed-wide green infrastructure programs and implementation of stormwater retrofits through regional collaboration.

- **Long-Term Actions** consist of continued implementation of any additional projects necessary to meet watershed objectives, as well as an evaluation of progress, accounting of successes and lessons learned, and an update of the watershed management plan. Long-term recommendations are intended to be completed during the next 5- to 10-year timeframe and beyond. The feasibility of long-term project recommendations, many of which involve significant infrastructure improvements, depends upon the availability of sustainable funding programs and mechanisms such as user fees, stormwater utility districts, infrastructure banking, public-private partnerships, etc.

Priority Actions for the Rooster River Watershed

The actions in the following table are a subset of the over 100 recommended actions that have been identified in this watershed management plan. These "priority" recommendations are actions that are most critical to the success of this watershed plan and will have the greatest benefit to water resource conditions in the Rooster River and its watershed. The table lists the related plan goals and includes references to specific sections of the plan for more information on each recommendation.

Appendix E of the watershed plan contains a "roadmap" for plan implementation, including responsible parties, suggested timeframes, milestones, and evaluation criteria for specific recommendations. Potental funding sources are identified in *Appendix F*.

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Priority Actions for the Rooster River Watershed

Priority Action and Timeframe	Related Goal	For More Information
1. Adopt the plan through a formal agreement between the watershed municipalities. Form a watershed organization with representatives from Bridgeport, Fairfield, Trumbull, and other groups. (S)	Capacity Building	Section 3.1.1
2. Actively seek and obtain funding to implement plan recommendations. (O)	Capacity Building	Section 3.1.2
3. Conduct stream walks and related watershed field inventories. (S)	Capacity Building	Section 3.1.4
4. Conduct routine water quality (chemistry and biological assessments) monitoring to augment existing and previous CTDEEP and USGS water quality monitoring efforts. Monitoring would include regular sampling at fixed locations within the Rooster River and Ash Creek. (M, O)	Water Quality	Section 3.2.1
5. Eliminate the remaining Combined and Sanitary Sewer Overflow discharges to the Rooster River and Ash Creek. (L)	Water Quality	Section 3.2.6
6. Promote/require green infrastructure and low impact development for private development and municipal infrastructure. (O)	Water Quality	Section 3.2.2
7. Pursue sustainable, long-term funding sources for green infrastructure projects such as user fees, stormwater utility districts, infrastructure banking, public-private partnerships, etc. (M, O)	Water Quality	Section 3.2.2
8. Implement priority stormwater retrofits, beginning with high-profile demonstration sites in each watershed community. (S, O)	Water Quality	Section 3.2.3 Section 4
9. Encourage riparian commercial property owners along the Rooster River and its tributaries to provide stormwater detention and recharge facilities as a retrofit to existing building and parking areas when new tenants are accepted. Require stormwater retrofits for additions or new development on these properties. (M, O)	Water Quality	Section 3.2.3 Section 4
10. Implement priority stream buffer and habitat restoration projects, and adopt local stream buffer regulations. (L)	Water Quality; Habitat; Land Use and Open Space	Section 3.2.5 Section 3.3.1 Section 3.4.1
11. Implement selected water quality and habitat-related recommendations of the Ash Creek Estuary Master Plan. (M, O)	Habitat	Section 3.3.4
12. Strengthen municipal land use regulations to improve stormwater management using low impact development, riparian buffer protection, and tree canopy preservation. (M)	Land Use and Open Space	Section 3.4.1
13. Implement green infrastructure and other innovative techniques to address urban flooding problems in the watershed using an integrated, watershed-based approach. The emphasis is on restoring the functions, and often the forms, of the resources provided by natural riverine, wetland, and estuarine systems. (L)	Land Use and Open Space	Section 3.4.2
14. Increase public access to the river to enhance recreational opportunities and stewardship of the river. (L)	Land Use and Open Space	Section 3.4.4
15. Promote public education and stewardship of the watershed through continuing engagement activities, such as stream walks, invasive plant removals, clean-ups, streambank buffer plantings, and river festivals/events. Create a web-site to inform the public about the watershed plan, watershed issues, and stewardship opportunities. (S,O)	Education and Outreach	Section 3.5

Timeframe: O = Ongoing S = Short-term M = Mid-term L = Long-term

1 Introduction

1.1 Background

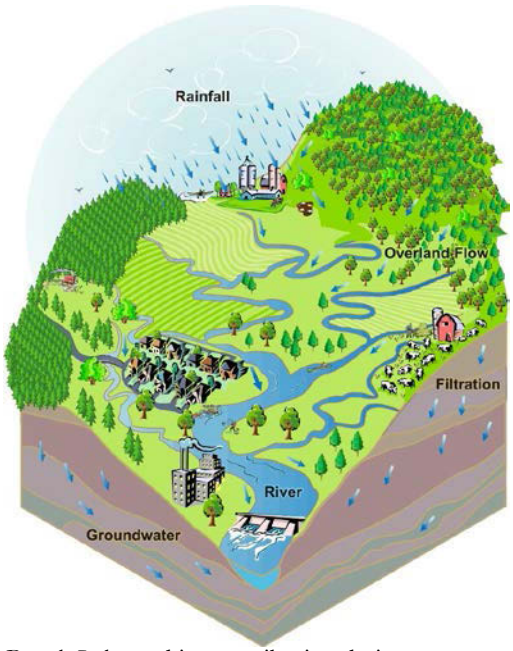
Watershed Overview

The Rooster River watershed is an approximately 15.3 square-mile[1] sub-regional basin in the southwestern portion of Connecticut (*Figure 1-1*). The Rooster River forms the border between Bridgeport and Fairfield and eventually flows to Black Rock Harbor and Long Island Sound via the Ash Creek Estuary. Ash Creek is part of the Rooster River watershed and consists of the tidal portion of the Rooster River. The watershed consists of six primary subwatersheds – Rooster River (main stem), Horse Tavern Brook, Long Hill, Londons Brook, Ash Creek, and Turney Creek.

The Rooster River (including Ash Creek) has a highly urbanized watershed that encompasses portions of Bridgeport, Fairfield, and Trumbull and is home to approximately 80,000 people. The watershed is roughly parallel to State Route 25 (Colonel Henry Mucci Highway) and the combined State Routes 25 and 8 in Bridgeport. State Route 15 (the Merritt Parkway) runs east-west through the upper portion of the watershed and the Interstate 95 (I-95) corridor runs through the southern portion of the watershed, near the confluence with the Ash Creek Estuary (*Figure 1-2*). The watershed is dominated by developed (mostly residential) land uses, and the amount of impervious surfaces nearly doubles moving south through the watershed, with effective impervious cover at approximately 33% near the watershed outlet.

What is a Watershed?

A watershed is the area of land that contributes runoff to a specific receiving water body such as a lake, river, stream, wetland, estuary, or bay.



[1] Watershed mapping available from CTDEEP indicates that Canoe Brook Lake and its contributing drainage area are contained within the Rooster River watershed. Through local stakeholder input in the watershed planning process, the outlet of Canoe Brook Lake was confirmed to exist on the western side of the lake, flowing east to the Mill River, rather than on the southeastern side of the lake, as indicated on the existing CTDEEP basin mapping. Although not within the overall Rooster River watershed, Canoe Brook Lake and its contributing drainage area are included in this watershed based plan, consistent with the original scope of work for the project. Inclusion of the Canoe Brook Lake drainage area in the watershed based plan will benefit water quality of Canoe Brook and Canoe Brook Lake, as well as downstream water quality in the Mill River. Both the Rooster River and Mill River watersheds have bacterial impairments that are addressed through the regional TMDL for the Mill River, Rooster River, and Sasco Brook (CTDEEP, 2005).

Issues Facing the Watershed

The Rooster River, like many other urbanized rivers and streams in Connecticut, has been impacted by historical development and land use activities in its watershed. The water quality in the Rooster River is degraded due to elevated bacteria levels resulting from sewer overflows, point discharges from industrial facilities, and nonpoint sources such as stormwater runoff from developed areas and impervious surfaces.

Based on water quality monitoring conducted by the Connecticut Department of Energy and Environmental Protection (CTDEEP), the U.S Geological Survey, and other organizations, the water quality in the Rooster River currently does not meet minimum standards for recreation, and the water quality in Ash Creek does not meet minimum standards for contact recreation, marine aquatic life, or commercial shellfishing. The poor water quality in these "impaired" water bodies (*Figure 1-3*) is generally the result of historical land use and urbanization within the watershed.

It is important to note that not all segments of the Rooster River or its tributaries have been assessed for support of aquatic life or recreation due to limited data; segments of the river that have not been formally assessed by the CTDEEP may also not meet Water Quality Standards.

Degraded Water Quality

The water quality in the Rooster River is degraded due to elevated bacteria levels resulting from sewer overflows, point discharges from industrial facilities, and nonpoint sources such as stormwater runoff from developed areas and impervious surfaces.

In 2005, CTDEEP developed a Total Maximum Daily Load (TMDL) for the Rooster River, Mill River, and Sasco Brook to begin to address the bacteria impairments in these water bodies. The TMDL identified reductions in indicator bacteria loads to the Rooster River (92% and 91% reductions in regulated point sources and nonpoint sources, respectively) that are necessary for the impaired segments to meet State water quality standards and once again support contact recreation.

A primary focus of this watershed based plan is to address the water quality impairments in the Rooster River and Ash Creek in order to restore the recreation, aquatic life, and commercial shellfishing uses that have been lost due to degraded water quality. Similar to watershed based plans, TMDLs provide a quantitative framework to restore impaired waters by establishing the maximum amount of a pollutant that a water body can assimilate without adverse impact to aquatic life, recreation, or other public uses. For impaired waters, the TMDL also establishes pollutant load reduction targets for the water body to attain water quality standards.

The Rooster River TMDL can be achieved by implementing specific actions that will reduce indicator bacterial loads using a watershed framework. This watershed based plan therefore provides a roadmap for implementing the TMDL. Ultimately, the goal of both the watershed based plan and the TMDL is to

Rooster River Watershed

Massachusetts
New York
Connecticut
Rhode Island
Rooster River Watershed
Long Island Sound

Horse Tavern Brook
Canoe Brook Lake
Long Hill
Horse Tavern Brook
Horse Tavern Reservoir
Londons Brook
Horse Tavern Brook
Londons Brook
Rooster River
Moodys Mill Pond
Rooster River
Turney Creek
Rooster River
Ash Creek
Ash Creek
Bellarmine Pond

EASTON
TRUMBULL
FAIRFIELD
BRIDGEPORT

Rooster River

Ash Creek/
Ash Creek Estuary

Bridgeport Harbor
Long Island Sound

Legend
- Rooster River Watershed
- Subwatershed
- Stream/River
- Culvert/Connector
- Surface Water
- Marsh/Wetland
- Interstate
- US Route
- State Route
- Town

0 1,600 3,200
Feet

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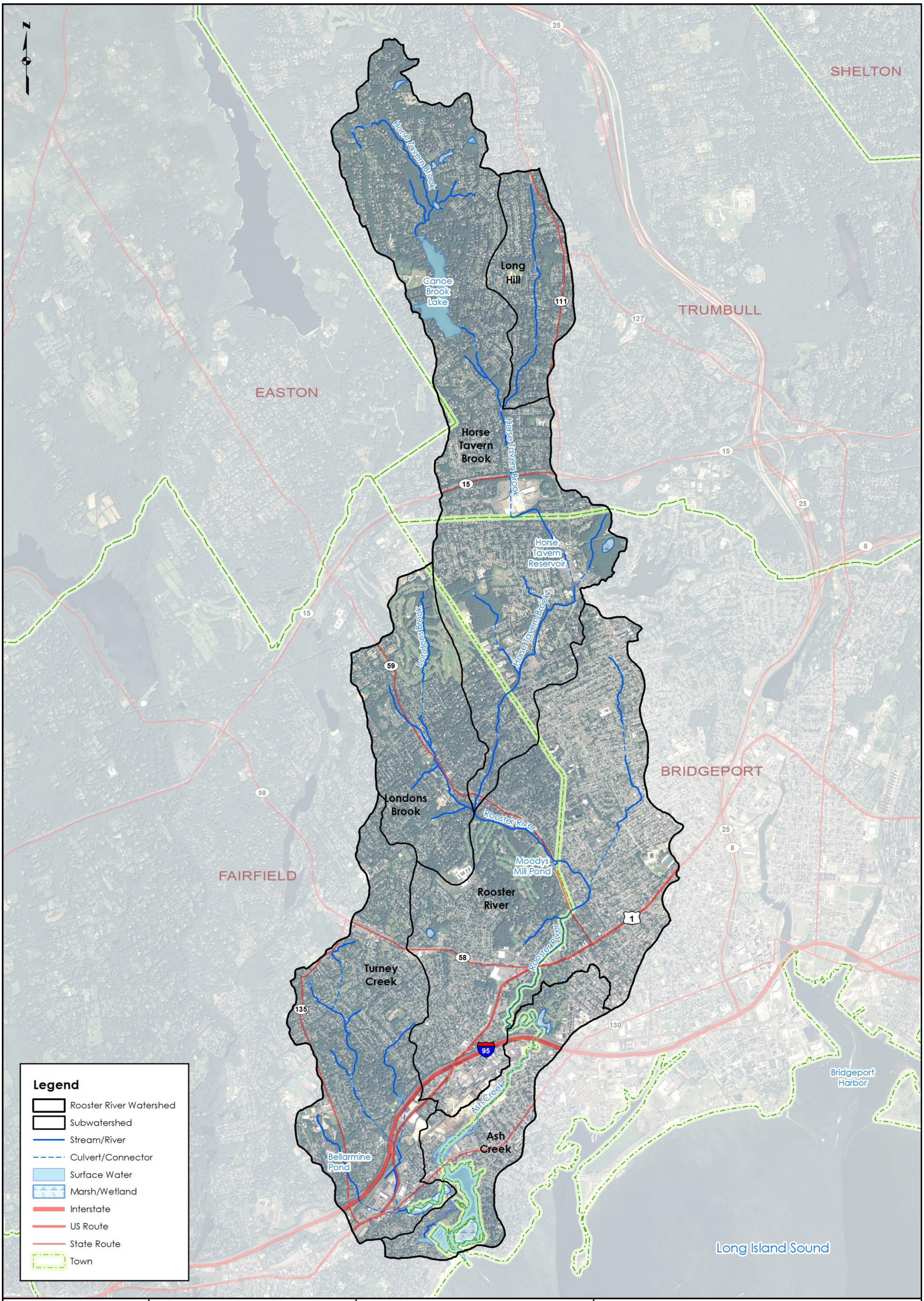
Map References: Connecticut Department of Energy & Environmental Protection (CTDEEP), Watershed Boundaries 1:24,000 scale; Hydrography 1:24,000 scale by USGS and CTDEEP, Hillshade 2000 from http://www.ctecoapp2.uconn.edu/arcgis/services.

ROOSTER RIVER WATERSHED BASED PLAN

FIGURE 1-1
ROOSTER RIVER WATERSHED



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Map References: Connecticut Department of Energy & Environmental Protection (CTDEEP), Watershed Boundaries 1:24,000 scale; Hydrography 1:24,000 scale by USGS and CTDEEP, 2010 statewide 4 band orthophotography of Connecticut: Ortho_2010_4Band_Color_NAIP from CTDEEP.

ROOSTER RIVER WATERSHED BASED PLAN

FIGURE 1-2
WATERSHED AERIAL PHOTOGRAPH

Legend

- Rooster River Watershed
- Subwatershed
- Town

2012 Assessment Results - River

- Not Supporting for Recreation; Not Assessed for Aquatic Life

2012 Assessment Results - Estuary

- Not Supporting for Recreation, Marine Aquatic Life,

Waterbodies Not Assessed

- Surface Water
- Marsh/Wetland
- Stream/River
- Culvert/Connector

Routes

- Interstate
- US Route
- State Route

SHELTON
TRUMBULL
EASTON
FAIRFIELD
BRIDGEPORT
Long Island Sound
Horse Tavern Brook
Canoe Brook Lake
Long Hill
Horse Tavern Brook
Horse Tavern Brook
Horse Tavern Reservoir
Londons Brook
Horse Tavern Brook
Londons Brook
Rooster River
Moodys Mill Pond
Rooster River
Turney Creek
Rooster River
Ash Creek
Ash Creek
Bellarmine Pond
Bridgeport Harbor
25
15
111
127
15
25
8
15
58
59
58
1
135
95
130

Rooster River-01
Not Supporting for Recreation
(Mill River, Rooster River and Sasco Brook E.coli TMDL)
Not Assessed for Aquatic Life

LIS WB Inner - Ash Creek, Fairfield
Not Supporting for Recreation,
Marine Aquatic Life,
or Commercial Shellfishing

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Miles

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Map References: Connecticut Department of Energy & Environmental Protection (CTDEEP), Watershed Boundaries 1:24,000 scale; Hydrography 1:24,000 scale by USGS and CTDEEP, "State of Connecticut Integrated Water Quality Report, Draft September 19, 2012"

ROOSTER RIVER WATERSHED BASED PLAN

FIGURE 1-3
WATER QUALITY IMPAIRMENTS

improve water quality of the impaired segments to meet water quality standards and remove the Rooster River and Ash Creek from the impaired waters list.

The Rooster River watershed has a long history of flooding as a result of historical development of the watershed. Flooding problems along the Rooster River have been studied by various agencies and organizations since the 1950s, and flood mitigation projects have significantly altered the river and the face of the watershed. Despite past flood protection efforts, flooding and drainage problems persist in many areas of the watershed. While water quality is the primary focus of this watershed based plan, flooding is also addressed as a related issue, along with habitat protection and restoration.

Why Local Water Quality Matters

Clean waterways can increase neighborhood prosperity by providing access to healthy natural resources and cultural landscapes within a vibrant urban context. Watershed planning can strengthen water conservation, stormwater management, and improve water quality. Rather than shunting surface water runoff directly into sewers, urban landscapes can be designed and modified to absorb and clean polluted runoff with green infrastructure. Stream buffers can improve water quality and aquatic life while restoring native habitat for wildlife and increasing the tree canopy, as well as potentially increasing urban property values. Watershed management planning identifies ways to balance high-density development with healthy natural environments through traditional and innovative approaches to stormwater and nonpoint source pollution control and sustainable development practices.

While there are many challenges associated with improving water quality in the Rooster River, the river also has the potential to serve as a tremendous asset and a focal point for urban/suburban community collaboration. It can be perceived as a natural feature that could help define the character of the urban/suburban nexus. Cities across the United States are beginning to rediscover their connections to rivers and waterways.

The Rooster River has many natural areas along its banks as it flows from its headwaters into Ash Creek. The linear nature of rivers provides a tangible link and the potential for communities to collaborate on revitalization efforts. The potential exists for a regional vision to be developed where the upper watershed communities can offer substantial water quality and habitat protection benefits while the urban areas can provide the urban river experience with the river forming a physical and emotional connection to the community.

Watershed Stewardship Efforts

Until recently, water resource planning and stewardship efforts within the Rooster River watershed have been limited to traditional land use and open space planning by the individual watershed municipalities. Over the past few years, the watershed municipalities and other stakeholders have recognized the need for a watershed-based approach to address the water resource issues that face the Rooster River

watershed and neighboring coastal urban watersheds. Notable recent, ongoing and planned water quality restoration and related stewardship efforts within the Rooster River watershed are highlighted below.

- **Pequonnock River Initiative and Watershed Based Plan** – In 2010, the Pequonnock River Initiative was formed as a partnership between the City of Bridgeport and the Towns of Monroe and Trumbull to develop a watershed plan for the Pequonnock River watershed. In September 2011, a watershed based plan was completed for the Pequonnock River watershed (http://www.gbrct.org/projects/environment-sustainability-2/pequonnock-river-watershed/). The plan identifies specific, measurable actions to address the water quality impairments in the Pequonnock River in order to restore the recreation and habitat uses that have been lost due to degraded water quality. The PRI, in conjunction with the Conservation Technical Advisory Committee of the Greater Bridgeport Regional Council and the watershed municipalities, is implementing various recommendations from the watershed based plan, which will serve as a model for the Rooster River plan.

- **Ash Creek Estuary Ecological Master Plan** – Ash Creek is one of Connecticut's few remaining ecologically-significant tidal estuaries located within a heavily urbanized area. The Ash Creek Estuary provides a diverse ecosystem of vegetation and wildlife and plays an important role in improving water quality and protecting shoreline areas from coastal flooding and erosion. Ash Creek also provides open space and recreational opportunities and an aesthetic identity to the surrounding neighborhoods. The Ash Creek Conservation Association, working with a project advisory committee consisting of representatives from the Town of Fairfield, the City of Bridgeport, and neighborhood groups, completed a comprehensive ecological restoration plan for the Ash Creek Estuary (http://www.ashcreekassoc.org/categories/ecological-master-plan) in 2012. The plan identifies specific habitat and water quality recommendations for restoration of the Ash Creek Estuary.

- **Green Infrastructure Feasibility Scan** – Connecticut Fund for the Environment and Save the Sound recently completed a project to assess the feasibility of green infrastructure implementation in New Haven and Bridgeport. A feasibility scan was conducted for both cities to evaluate opportunities to incorporate green infrastructure into ongoing wet weather management efforts. Results of the feasibility scan indicate that green infrastructure can serve as an effective approach to managing Combined Sewer Overflows (CSOs) and other wet weather issues within Bridgeport and New Haven. The study is intended to serve as a foundation for future detailed planning and design efforts within these communities. It also demonstrates the applicability of green infrastructure approaches in similar urban communities including those within the Rooster River watershed (Save the Sound, http://reducerunoff.org/newhaven.htm).
- **Stormwater Authority Feasibility Study** – The City of Bridgeport, in collaboration with the Bridgeport Water Pollution Control Authority, is evaluating the feasibility of creating a stormwater authority and related stormwater utility in the City of Bridgeport. The purpose of the stormwater authority and associated utility is to maintain and finance green infrastructure and other stormwater projects in the City, while equitably distributing the burden of stormwater costs to parties who contribute most to these issues.

The Need for a Comprehensive Watershed Plan

The watershed communities and the CTDEEP recognize the need to address the water resource issues of the Rooster River, Ash Creek, and their tributaries using a watershed-based approach. A primary way to do this is by developing and implementing a comprehensive watershed management plan to protect and restore water resource conditions throughout the watershed.

Rooster River and Ash Creek

Ash Creek is part of the Rooster River watershed and consists of the tidal portion of the Rooster River. The primary focus of this watershed planning process is on the Rooster River, the non-tidal portion of the river upstream of the Ash Creek estuary. However, the watershed plan also includes recommendations for Ash Creek.

The City of Bridgeport worked collaboratively with the Southwest Conservation District (SWCD), the CTDEEP, and the other watershed municipalities (Fairfield and Trumbull) to develop a watershed based plan for the Rooster River. Funding for this project was provided through the SWCD in the form of a CTDEEP Water Quality Management Planning Grant under section 604(b) of the Clean Water Act. Fuss & O'Neill, Inc. and Connecticut Fund for the Environment/Save the Sound (CFE/STS) were retained to lead the development of the watershed based plan, working with a project steering committee.

The objective of this watershed based plan is to characterize the watershed conditions, identify, investigate, and address the current and emerging issues facing the watershed, and have the clear potential to affect on-the-ground change within the watershed by recommending specific, measurable actions to protect and improve water resource conditions.

1.2 Plan Development Process

The Rooster River Watershed Management Plan is the culmination of desktop analyses and field assessments performed by the project team under the direction of the project steering committee. The plan synthesizes information from earlier studies and reports on the watershed, Geographical Information System (GIS) mapping and analyses, and a field assessment of watershed restoration opportunities in the watershed.

EPA Nine Key Elements

1. Impairment
2. Load Reduction
3. Management Measures
4. Technical & Financial Assistance
5. Public Information & Education
6. Schedule
7. Milestones
8. Performance Criteria
9. Monitoring

The watershed plan has been developed consistent with the U.S. Environmental Protection Agency (EPA) and CTDEEP guidance for the development of watershed-based plans. The guidance outlines nine key elements that establish the structure of the plan, including specific goals, objectives, and strategies to protect and restore water quality; methods to build and strengthen working partnerships; a dual focus on addressing existing problems and preventing new ones; a strategy for implementing the plan; and a feedback loop to evaluate progress and revise the plan as necessary. Following this approach will enable implementation projects under this plan to be considered for funding under Section 319 of the Clean Water Act and improve the chances for funding through other State and Federal sources.

Development of the watershed based plan consisted of the following major tasks.

- **Steering Committee** – A project steering committee was formed to guide the plan development. The steering committee consisted of representatives from the watershed municipalities, government organizations, educational institutions, non-profit organizations, and others who live and work within the watershed. Representatives from each of the watershed communities – Bridgeport, Fairfield, and Trumbull – participated in the steering committee process and served to interface with municipal staff and boards from their respective communities during the plan development process. A series of workshop meetings were held with the steering committee to reach consensus on watershed planning goals and objectives and to discuss specific recommended actions. The steering committee also guided the plan development process by providing review comments on draft deliverables. The watershed plan reflects the combined efforts of the steering committee, watershed municipalities, the Save the Sound and Fuss & O'Neill project team, the SWCD and CTDEEP, and other stakeholders. Members of the project steering committee and others involved in the plan development process are listed in the Acknowledgments section at the beginning of this document.

- **State of the Watershed Assessment** – A baseline assessment was performed to develop an understanding of the current water resource conditions in the Rooster River watershed. The project team reviewed existing watershed data, studies, and reports; compiled and analyzed GIS mapping of the watershed and various subwatersheds; and developed pollutant loading and impervious cover estimates for the watershed. *Technical Memorandum #1: State of the Rooster River Watershed* serves as a basis for the watershed plan recommendations and also provides a background reference document to support future implementation activities within the watershed. A copy of the technical memorandum is provided on CD in *Appendix A* of this plan.

- **Low Impact Development and Green Infrastructure Assessment** – A watershed assessment was performed to identify opportunities and develop concepts for site-specific Low Impact Development (LID) and green infrastructure retrofits. The site-specific project concepts are intended to serve as potential on-the-ground projects for future implementation and examples of the types of projects that could also be implemented for other similar land uses and locations in the watershed. The methods and findings of this assessment are documented in *Technical Memorandum #2: Low Impact Development and Green Infrastructure Assessment.* A copy of the technical memorandum is provided on CD in *Appendix B* of this plan.

- **Plan Goals and Objectives** – The project team developed a series of goals and objectives for the watershed based upon the findings of the watershed assessments. The goals and objectives were further refined by the project steering committee with input from each of the watershed municipalities.

- **Plan Recommendations** – Potential management actions were identified for each of the plan goals and objectives and subsequently refined based upon input from the project steering committee through workshop meetings and coordination with municipal staff and boards, culminating in the plan recommendations that are presented in *Section 3* of this document.

Management actions include ongoing, short, medium and long-term recommendation, as well as watershed-wide and site-specific actions.

1.3 Public Outreach

Public outreach was conducted during the watershed planning process to increase public understanding of issues affecting the watershed and to encourage participation in the development of the watershed plan. The following public outreach activities were held during the watershed planning process:

- **November 2012 –** The project steering committee was formed, consisting of representatives from Bridgeport, Fairfield, and Trumbull; the Ash Creek Conservation Association; Save the Sound; Fairfield County Community Foundation; Greater Bridgeport Regional Council; Black Rock Neighborhood Revitalization Zone; and representatives from the Connecticut Department of Environmental Protection and the Southwest Conservation District.

- **December 2012 –** A kickoff meeting for the Rooster River watershed planning process was held on December 10, 2012 at the Black Rock Library in Bridgeport with 18 people in attendance representing the project team and steering committee.

  A watershed questionnaire was developed and distributed to the steering committee members at the kickoff meeting. The purpose of the questionnaire was to identify issues of concern and watershed planning priorities of the steering committee members and the general public. Questionnaire responses are included in *Appendix G*.

- **January 2013** – A steering committee meeting was held on January 22, 2013 at Beardsley Zoo in Bridgeport. The purpose of the meeting was to summarize the results of the watershed questionnaire and review baseline watershed conditions.

- **May 2013** – Two public workshop meetings were held on May 8, 2013 at Discovery Museum in Bridgeport. The workshops consisted of a presentation on the current watershed conditions and major issues facing the Rooster River watershed, followed by group discussion of local issues of importance and desired outcomes of the watershed planning process.

- **September 2013** - A steering committee meeting was held on September 9, 2013 at Bridgeport City Hall Annext. The purpose of the meeting was to review the findings and recommendations of the Low Impact Development and Green Infrastructure Assessment, and to review the proposed watershed plan goals, objectives, and action items.

- **October 2013** – The watershed plan was presented to the public at Bridgeport City Hall Annex on October 15, 2013. Questions and comments were received during and following the meeting. Public comments have been incorporated into the final watershed based plan.

2 Watershed Management Goals and Objectives

This section presents overall management goals for the watershed and specific objectives to achieve these goals. The goals and objectives were developed in conjunction with the project steering committee. The goals and objectives reflect specific priorities identified by the watershed municipalities and other stakeholder groups based upon the results of the watershed assessments. Recommended actions to achieve these goals and objectives are presented in *Section 3* of this plan.

2.1 Watershed Management Goals

The watershed management goals for the Rooster River watershed are:

- **Goal 1 – Capacity Building for Plan Implementation.** Build a foundation for successful implementation of the watershed management plan by the watershed municipalities, non-governmental organizations (environmental groups and non-profits), residents, local businesses, and other stakeholders.

- **Goal 2 – Water Quality.** Improve the water quality of the Rooster River and its tributaries so that impaired reaches of the river will consistently meet their designated uses for fish and wildlife habitat and recreational use, along with improving the downstream water bodies of Ash Creek Estuary, Black Rock Harbor, and Long Island Sound. Protect and enhance the water quality of water bodies that are not impaired.

- **Goal 3 – Habitat Protection and Restoration.** Protect and improve terrestrial, riparian, and aquatic habitat in the watershed to maintain and increase the watershed's diversity of plant and animal species.

- **Goal 4 – Sustainable Land Use and Open Space.** Promote sustainable growth and appropriate development in the watershed while preserving and improving the watershed's natural resources, providing public access to open space, and addressing current and future flooding problems.

- **Goal 5 – Education and Stewardship.** Promote stewardship of the Rooster River watershed through education and outreach. Target appropriate messages to specific audiences, and promote stewardship opportunities through partnering with local educational institutions and citizen involvement in science, conservation, and restoration activities.

2.2 Watershed Management Objectives

Specific objectives associated with the watershed management goals are described below. Recommended management strategies to achieve the plan objectives, including implementation priority, schedule, costs, funding sources, and implementation responsibilities, are presented in later sections of this plan.

2.2.1 Goal 1 – Capacity Building for Plan Implementation

- **Objective 1-1.** Establish a watershed organization to coordinate and oversee the implementation of the watershed based plan and promote inter-municipal coordination.
- **Objective 1-2.** Identify and secure funding to implement the recommendations outlined in this plan.
- **Objective 1-3.** Promote regional collaboration with other watershed organizations in Connecticut and around Long Island Sound to share ideas and strengthen regional watershed management efforts.
- **Objective 1-4.** Conduct stream walks to assess the condition of the streams and riparian corridors, identify retrofit opportunities and problem areas, and involve the public and volunteers as a form of outreach.

2.2.2 Goal 2 – Water Quality

- **Objective 2-1.** Continue water quality monitoring programs to identify pollution sources, follow long-term trends in water quality, and track the progress of the watershed based plan.
- **Objective 2-2.** Reduce the impacts of stormwater on hydrology and water quality through the use of Low Impact Development (LID) practices and Green Infrastructure approaches.
- **Objective 2-3.** Implement municipal stormwater management programs to comply with state and federal permit requirements.
- **Objective 2-4.** Protect existing and restore degraded riparian buffers.
- **Objective 2-5.** Remove Combined and Sanitary Sewer Overflows.
- **Objective 2-6.** Reduce bacteria loads from overpopulation of nuisance waterfowl and pet waste.
- **Objective 2-7.** Identify and remove illicit wastewater and non-stormwater discharges into the Rooster River and its tributaries.

- **Objective 2-8.** Reduce the threats to water quality from land uses with higher pollution potential and hotspot sites.

2.2.3 Goal 3 – Habitat Protection and Restoration

- **Objective 3-1.** Protect and restore in-stream and riparian habitat along the Rooster River, its tributaries, and the Ash Creek Estuary.
- **Objective 3-2.** Protect and enhance forested areas and urban tree canopy within the watershed.
- **Objective 3-3.** Locate, control or diminish the prevalence of invasive species.
- **Objective 3-4.** Implement water quality-related recommendations of the Ash Creek Master Plan.

2.2.4 Goal 4 – Sustainable Land Use and Open Space

- **Objective 4-1.** Strengthen municipal land use policy and regulations.
- **Objective 4-2.** Address flooding issues through a coordinated, watershed-wide approach.
- **Objective 4-3.** Preserve and protect existing open space and continue to protect/acquire open space that meets resource protection and recreational goals.
- **Objective 4-4.** Increase public access to the river corridor to improve public appreciation and stewardship.

2.2.5 Goal 5 – Education and Stewardship

- **Objective 5-1.** Create a website for the watershed based plan.
- **Objective 5-2.** Advance local government and community business awareness of the Rooster River through pollution prevention education and watershed restoration outreach activities.
- **Objective 5-3.** Build awareness of land stewardship and management practices and reduce nonpoint source impacts in residential areas.
- **Objective 5-4.** Enhance school education and stewardship programs.

3 Plan Recommendations

This section describes recommended actions to meet the watershed management goals and objectives outlined in *Section 2*. The recommendations include watershed-wide and targeted actions:

- **Watershed-wide Recommendations** are those recommendations that can be implemented throughout the Rooster River watershed. These basic measures can be implemented in each of the watershed municipalities, are applicable in most areas of the watershed, and are intended to address nonpoint source pollution through municipal land use regulations and planning, green infrastructure and smart growth, public education and outreach, urban watershed forestry, and watershed monitoring. The water quality and natural resource benefits of these measures are primarily long-term and cumulative in nature resulting from runoff reduction, source control, pollution prevention, and improved stormwater management for new development and redevelopment projects.

- **Targeted Recommendations** are tailored to address issues within specific subwatersheds or areas, rather than watershed-wide. Targeted recommendations also include actions to address common types of problems that were identified at representative locations throughout the watershed, but where additional studies or evaluations are required to develop site-specific recommendations. Targeted recommendations can have both short and long-term benefits.

Additional site-specific watershed retrofit and restoration concepts are described in *Section 4* of this plan.

The recommendations presented in this section are classified according to their timeframe and overall implementation priority. Recommendations can be viewed as ongoing, short-term, mid-term, and long-term actions:

- **Ongoing Actions** are actions that should occur annually or more frequently such as routine water quality monitoring, as well as actions that occur on an ongoing basis such as fundraising, education and outreach, and coordination between watershed stakeholders.

- **Short-Term Actions** are initial actions to be accomplished within the first one to two years of plan implementation. These actions have the potential to demonstrate immediate progress and success and/or help establish the framework for implementing subsequent plan recommendations. Such actions include:
    - Adoption of the plan by the watershed municipalities and formation of a watershed organization
    - Revising local land use regulations
    - Outfall inventories and illicit discharge investigations
    - Stream walks to assess the condition of the streams and riparian corridors, identify retrofit opportunities and problem areas, and involve the public

  Small demonstration projects could be completed during this phase, with volunteer service events. Construction of larger retrofits and restoration projects requiring extensive design, engineering, and permitting should be planned for later implementation.

- **Mid-Term Actions** involve continued programmatic and operational measures, delivery of educational and outreach materials, and construction of larger retrofit and/or restoration projects over the next two to five years. Progress on land conservation, especially the protection of headwaters and unique landscapes, LID and green infrastructure implementation, and stream walk follow-up activities should be completed during this period, as well as project monitoring and tracking. A sustainable funding and maintenance program should also be established for watershed-wide green infrastructure programs and implementation of stormwater retrofits through regional collaboration.

- **Long-Term Actions** consist of continued implementation of any additional projects necessary to meet watershed objectives, as well as an evaluation of progress, accounting of successes and lessons learned, and an update of the watershed management plan. Long-term recommendations are intended to be completed during the next 5- to 10-year timeframe and beyond. The feasibility of long-term project recommendations, many of which involve significant infrastructure improvements, depends upon the availability of sustainable funding programs and mechanisms.

The remainder of this section describes the recommended actions presented in this watershed management plan. The recommended actions are categorized according to the five major goals of this plan – (1) capacity building for plan implementation, (2) water quality, (3) habitat protection and restoration, (4) sustainable land use and open space, and (5) education and outreach.

Where applicable, plan recommendations are also organized by the three municipalities that comprise most of the Rooster River Watershed – Fairfield, Trumbull, and Bridgeport – since all three municipalities will play a key role in the plan implementation.

3.1 Capacity Building for Plan Implementation

Goal Statement: Build a foundation for successful implementation of the watershed management plan by the watershed municipalities, non-governmental organizations (environmental groups and non-profits), residents, local businesses, and other stakeholders.

3.1.1 Endorse the Plan and Establish a Watershed Organization

The success of the watershed management plan will depend on local adoption of the plan and active participation by the individual watershed municipalities, as well as cooperation between the municipalities during implementation. Endorsement of the watershed management plan by the project steering committee and each of the three major watershed municipalities is an important first step in implementing the plan recommendations.

During the planning process, the steering committee provided direction and local knowledge of the watershed in guiding the watershed assessments, determining priorities, and developing the watershed management recommendations. As the focus of the planning process moves towards implementation,

the steering committee should transition to a formal watershed organization that will take a leadership role in implementing the plan.

Many of the recommendations in this watershed management plan – like the construction of stormwater retrofits in the various watershed communities, stream assessments and water quality monitoring, and watershed education efforts – can benefit from a partnership among the watershed municipalities. Applying jointly for grants to fund the implementation of these activities allows the sharing of grant-writing assistance, and the leveraging of match and in-kind services. Additionally, a watershed partnership permits the sharing of technical and human resources, volunteers, equipment, and materials. The watershed organization should therefore consist of a partnership between the watershed municipalities, as well as other local, regional, and state organizations and groups.

The watershed organization should also involve and integrate the various land use agencies within each municipality, given their respective overlapping roles (e.g., planning, zoning, inland wetlands and watercourses, flood and erosion control, stormwater management, open space and conservation, etc.) relative to water quality and watershed protection. The watershed organization should therefore include representatives of or liaisons to the various municipal land use agencies within each community.

Recommended Actions

Rooster River Watershed Organization

Establish a watershed organization such as a partnership or coalition that includes representatives from Bridgeport, Fairfield, and Trumbull and other groups. The organization could be modeled after successful watershed initiatives such as the Norwalk River Initiative and Pequonnock River Initiative.

- The project steering committee should endorse the Rooster River Watershed Based Plan and present it to the governing bodies of Bridgeport, Fairfield, and Trumbull for municipal adoption. Encourage adoption of the watershed based plan by the watershed municipalities through a Memorandum of Agreement (MOA), inter-municipal agreement, compact or similar mechanism to encourage inter-municipal coordination and accountability and to formalize the municipalities' agreement to support the watershed planning effort through funding, staff, or other resources.
- Establish a watershed organization such as a partnership or coalition that includes representatives from local, regional, state, and federal environmental organizations (e.g., the Ash Creek Conservation Association), businesses, institutions, neighborhood groups, interested members of the public, and municipal liaisons from Bridgeport, Fairfield, and Trumbull. The organization could be modeled after successful watershed groups such as the Norwalk River Initiative and Pequonnock River Initiative. Consider housing the organization within the Greater Bridgeport Regional Council, through its environment and sustainability committee, which currently provides a project website and administrative support for the Pequonnock River Initiative. The Pequonnock and Rooster River watershed plan implementation efforts could be combined under a single "Pequonnock-Rooster River Initiative."
- Secure funding for and hire a long-term Watershed Coordinator. Potential funding sources include grant funding (e.g., Section 319 Nonpoint Source Program) or an intermunicipal agreement and voluntary "dues" contributed by each watershed municipality.

- Establish subcommittees for implementation of Goals 2-5 of the watershed based plan (Water Quality, Habitat Protection and Restoration, Sustainable Land Use and Open Space, and Public Education and Stewardship).
- The watershed organization and Watershed Coordinator for the Rooster River watershed would coordinate and oversee watershed management plan implementation activities. Potential activities could include:
  - Identifying funding sources, as well as pursuing grant funding for projects identified in the watershed plan.
  - Periodically reviewing and updating action items in the plan,
  - Developing annual work plans (i.e., specific "to-do" lists),
  - Coordinating and leading public outreach activities,
  - Hosting public meetings to celebrate accomplishments, recognize participants, review lessons learned, and solicit feedback on plan updates and next steps.

3.1.2 Identify and Secure Funding

Many actions in this plan are only achievable with sufficient funding and staffing. Therefore, a variety of funding opportunities should be pursued to implement the recommendations outlined in this plan.

Recommended Actions

- Review and prioritize potential funding sources that have been preliminarily identified in this watershed based plan (see *Section 6*). Prepare and submit grant applications for projects identified in this plan on an ongoing basis.
- Pursue funding for ongoing, long-term water quality monitoring within the watershed.
- Advocate for state and federal funding, working jointly with other watershed organizations in Connecticut and around Long Island Sound.

3.1.3 Promote Regional Collaboration

Many watershed organizations and municipalities in Connecticut are involved in watershed management planning to meet common resource protection objectives and are faced with similar water quality issues. Lessons learned from other watershed planning efforts in Connecticut and throughout Long Island Sound can help to improve the effectiveness of this watershed based plan. This objective is to strengthen coordination of water quality planning activities with other watershed organizations, particularly the Pequonnock River Initiative, to share ideas and strengthen regional watershed management efforts.

Recommended Actions

- Combine efforts and resources with the Pequonnock River Initiative through the common watershed communities of Bridgeport and Trumbull, as well as the Greater Bridgeport Regional Council, through its Conservation Technical Advisory Committee.
- Organize a periodic meeting series with representatives from other watershed groups and agencies within Connecticut and the Long Island Sound area to share information on ongoing activities, new advances in science and technology, and discuss lessons learned.

- Share outreach materials with other watershed managers and participate in coordinated events to gain experience in other methods and approaches.
- Facilitate broad support of the plan from public and private economic and business sectors.

3.1.4 Conduct Stream Walks

Visual stream assessments or stream walks are an easy-to-use assessment protocol to evaluate the condition of aquatic ecosystems associated with streams. They help to evaluate the overall condition of the stream, riparian buffer, and floodplain, based on a consideration of in-stream habitat, vegetative protection, bank erosion, floodplain connection, vegetated buffer width, floodplain vegetation and habitat, and floodplain encroachment. Visual stream assessments also help to identify problem areas and provide a basis for further detailed field investigation and potential restoration opportunities. Stream walks also provide an ideal opportunity to involve the public and volunteers as a form of outreach.

Stream assessments were not performed as part of the watershed plan development process since the scope of the project was limited. The City of Bridgeport and other stakeholders, with the assistance of staff from the Natural Resources Conservation Service (NRCS), are planning to conduct stream walks of priority segments of the Rooster River and its tributaries as an initial implementation project.

Recommended Actions

- Conduct stream walks during the summer of 2014 using the NRCS "Stream Visual Assessment Protocol" or similar method for citizen stream walks, led by individuals trained and experienced in stream assessment methods. The stream walks will help to evaluate overall stream health and identify potential restoration and retrofit projects and other target areas for outreach activities. Recruit volunteers from the watershed municipalities, watershed groups (e.g., Ash Creek Conservation Association), and local schools and universities.
- Following the stream walks and evaluation of the assessment results, plan and conduct track-down surveys of identified or suspected pollution sources.
- Stream assessments and track-down surveys should be updated every five to ten years to monitor changing watershed conditions and the progress of plan implementation.

Rooster River Stream Walks

The City of Bridgeport and other stakeholders, with the assistance of staff from the Natural Resources Conservation Service, are planning to conduct stream walks of priority segments of the Rooster River and its tributaries as an initial implementation project. The stream walks will involve volunteers from the watershed municipalities, watershed groups (e.g., Ash Creek Conservation Association), and local schools and universities.

3.2 Water Quality

Goal Statement: Improve the water quality of the Rooster River and its tributaries so that impaired reaches of the river will consistently meet their designated uses for fish and wildlife habitat and recreational use, along with improving the downstream water bodies of Ash Creek Estuary, Black Rock Harbor, and Long Island Sound. Protect and enhance the water quality of water bodies that are not impaired.

3.2.1 Conduct Water Quality Monitoring

Ongoing water quality monitoring is recommended for the Rooster River watershed to refine the understanding of water quality impacts from potential point and non-point pollution sources in the watershed, to continue developing a water quality database for the watershed to guide environmental decision-making, to measure the progress toward meeting watershed management goals and TMDL pollutant load reductions, and ultimately support removal of the Rooster River from the impaired waters list.

Very limited bacteria monitoring data exists for the Rooster River despite the bacteria TMDL developed by CTDEEP in 2005. The bacteria monitoring data, which are the basis for the TMDL, were collected at the Route 1 Rooster River monitoring station between August 1999 and May 2002. The TMDL monitoring data also pre-date the elimination of several Combined Sewer Overflow (CSO) discharges in the vicinity of the Route 1 monitoring location. The Rooster River has also not been assessed for aquatic life (healthy macroinvertebrate community). Routine bacteria and benthic macroinvertebrate monitoring of the Rooster River are necessary to evaluate whether the Rooster River supports its designated uses.


Benthic macroinvertebrate monitoring

Recommended Actions

- Develop a routine, fixed-station water quality (chemistry and biological assessments) monitoring program for the watershed to augment existing and previous CTDEEP and USGS water quality monitoring efforts.
- Conduct routine bacteria monitoring at the 3 previous CTDEEP monitoring sites – Horse Tavern Brook at Rooster River Boulevard, Rooster River at Westwood Road, and Rooster River at Route 1, which was the basis for the 2005 TMDL – to measure progress toward achieving the watershed plan and TMDL

Expand Water Quality Monitoring

Develop a routine, fixed-station water quality (chemistry and biological assessments) monitoring program for the watershed to augment existing and previous CTDEEP and USGS water quality monitoring efforts. Monitoring would include regular sampling at fixed locations within the Rooster River and Ash Creek.

pollutant load reduction goals. Sampling should be scheduled at regularly spaced intervals during the recreational season (typically May through September). Therefore, the data set at the end of each season will include ambient values for both "wet" and "dry" conditions in relative proportion to the number of "wet" and "dry" days that occurred during the monitoring period. The TMDL calculations can be updated over time to compare the percent reductions needed under "dry" and "wet" conditions to the percent reductions that were needed at the time of TMDL adoption in 2005.

- Consider conducting routine benthic macroinvertebrate monitoring in the Rooster River through the state-wide Rapid Bioassessment in Wadeable Streams & Rivers by Volunteer Monitors (RBV) program or other groups such as the NRCS, Trout Unlimited, and the Southwest Conservation District. Benthic monitoring should be performed at common chemical monitoring locations, where feasible.
- Consider conducting bacteria and benthic monitoring in several of the major Rooster River/Ash Creek tributaries including Ox Brook, Londons Brook, and Turney Creek.
- Establish 1 or 2 routine, fixed-station monitoring sites within Ash Creek for routine analysis of bacteria (Enterococcus) during the recreational season and regular but less frequent analysis of nutrients, metals, and organic compounds associated with common industrial contaminants). Potential locations include (from upstream to downstream) the Scofield Avenue Bridge, Brewster Street Bridge, Fairfield Avenue Bridge, and near the mouth at Jennings Beach.
- Coordinate monitoring with wet and dry weather conditions to assist in assessing potential causes and sources of water quality impacts.
- Monitoring should be performed under an EPA and CTDEEP-approved Quality Assurance Project Plan (QAPP) to ensure that the data collected is of sufficient quality for regulatory decision-making.
- Involve students and research faculty from local schools and universities.
- Pursue dedicated funding to finance future monitoring efforts.

3.2.2 Promote Low Impact Development and Green Infrastructure

Since much of the watershed was developed prior to the adoption of stormwater quality regulatory requirements, most of the existing drainage infrastructure consists of traditional storm drains/catch basin and storm pipes that discharge directly to surface waters without treatment, other than detention to maintain peak rates of discharge. Urban stormwater runoff, in the form of point discharges from stormwater collection systems and nonpoint sources such as diffuse runoff from parking lots and other impervious surfaces, is a significant cause of water quality impairments in the Rooster River watershed and Ash Creek. An important objective of this watershed management plan is to reduce the impacts of stormwater runoff on hydrology and water quality through the use of Low Impact Development and Green Infrastructure.

What Is Low Impact Development and Green Infrastructure?

Low Impact Development (LID) and green infrastructure are the preferred approaches by EPA and CTDEEP for stormwater management in urban and suburban areas. The two terms are often used interchangeably, but are generally used in different contexts.

LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product.

The goal of LID is to mimic a site's pre-development hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to its source. Instead of conveying and managing/treating stormwater in large, costly end-of-pipe facilities located at the bottom of drainage areas, LID addresses stormwater through small, cost-effective landscape features located at the lot level. LID is a versatile approach that can be applied equally well to new development, urban retrofits, and redevelopment projects.

Green infrastructure refers to systems and practices that use or mimic natural processes to infiltrate, evapotranspire, or reuse stormwater. In an urban context, green infrastructure includes decentralized stormwater management practices such as rain gardens, permeable pavement, green roofs, green streets, infiltration planters, trees and tree boxes, and rainwater harvesting, for example. These practices capture, manage, and/or reuse rainfall close to where it falls, thereby reducing stormwater runoff and keeping it out of combined sewer systems so it does not contribute to sewer overflows.

While LID is generally used to describe development approaches and practices at the site level, the term "green infrastructure" is typically used in a broader range of contexts and scales. At the largest scale, the preservation and restoration of natural landscape features (such as forests, floodplains and wetlands) are components of green infrastructure. On a smaller scale, green infrastructure practices also include rain gardens, permeable pavement, green roofs, green streets, infiltration planters, trees and tree boxes, and rainwater harvesting for non-potable uses such as toilet flushing and landscape irrigation (EPA Green Infrastructure Website, Accessed June 24, 2010).

Table 3-1 summarizes various types of green infrastructure practices approaches and the scales at which they are typically applied. Many of the site and neighborhood-scale practices are also considered LID techniques.

In addition to reducing polluted runoff and improving water quality, green infrastructure has been shown to provide other social and economic benefits relative to reduced energy consumption, improved air quality, carbon reduction and sequestration, improved property values, recreational opportunities, overall economic vitality, and adaptation to climate change. For these reasons, a number of communities are exploring or have adopted green infrastructure within their municipal infrastructure programs.

Table 3-1. Green Infrastructure Practices

Scale	Green Infrastructure Practices
Site	Green Roofs and Blue Roofs Green Walls Rain Harvesting Downspout Disconnection Planter Boxes Rain Gardens/Bioretention Permeable Pavement Vegetated Swales Stormwater Wetlands Stormwater Infiltration Systems Brownfield Redevelopment Infill and Redevelopment
Neighborhood	Green Parking Green Streets & Highways Trees & Urban Forestry
Watershed	Wetland/Riparian Buffers Urban Forests

Source: Adapted from EPA Green Infrastructure Website, Accessed June 24, 2010.

Perceived Obstacles to Green Infrastructure

Although many communities have begun to embrace green infrastructure for addressing sewer overflows and stormwater pollution, concerns still persist over the feasibility of green infrastructure in highly urbanized areas. This is in part because of a perception that insufficient land is available for green infrastructure implementation in cities. However, the major perceived obstacle is that green infrastructure is costly to retrofit or introduce into urban landscapes.

Although green infrastructure is in many cases less costly than traditional methods of stormwater and sewer overflow control, some municipalities continue to invest only in conventional controls rather than trying an alternative approach (NRDC, 2006). Additionally, public agencies generally do not pay for green infrastructure or LID retrofits on private property. Private property owners may marginally benefit from onsite green infrastructure in terms of increased real estate value, reduced risk of flooding, etc., but usually bear most of the cost of installation and maintenance of green infrastructure and LID practices (Montalto et al., 2007). Cities and towns have developed successful green infrastructure programs and incentives such as stormwater utility fees.

Figure 3-1. Examples of Low Impact Development Practices

a. Site Planning

b. Reduced Clearing Limits

c. Vegetated Swales

d. Increased Flow Travel Time

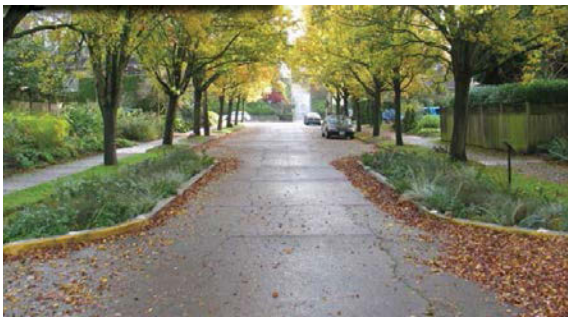
e. Parking Lot Bioretention

f. Stormwater Planters

g. Permeable Pavement

Source: Larry Coffman, Low Impact Development Center (a through f), University of Connecticut (g).

Figure 3-2. Examples of Green Infrastructure Practices



a. Stormwater Curb Extensions

b. Stormwater Planters

c. Green Roofs

d. Blue Roofs

e. Rain Harvesting

f. Urban Forestry

Source: University of Connecticut (c) and EPA, 2008.

Recommended Actions

Recommended actions relative to the implementation of LID and green infrastructure in the watershed municipalities include:

- Implement LID and green infrastructure demonstration projects at highly visible locations in the watershed to demonstrate the feasibility and multiple benefits of these approaches to the public and elected officials. The watershed municipalities should take a leadership role by implementing green infrastructure retrofits at municipal facilities and in roadway projects in the context of comprehensive "complete streets" or "green streets" approaches. Private development projects that implement LID or green infrastructure should also be highlighted through a recognition program that could consist of public awards, websites, meetings, media, and other methods. Such a program could be led by the municipalities or future Rooster River watershed organization.
- Green infrastructure demonstration sites should be used for educational purposes, including interpretive signs to inform and inspire the public about responsible watershed management practices.
- The watershed municipalities should incorporate LID and green infrastructure requirements into their local land use regulations to: 1) satisfy existing and future municipal stormwater program regulatory requirements, 2) require LID practices and green infrastructure approaches to be implemented for new development and redevelopment projects, 3) identify instances in which retrofits are required (i.e., to meet TMDL and/or MS4 Permit requirements), and 4) address other local drainage and natural resource protection issues identified by the municipalities.
    - The watershed municipalities should conduct a comprehensive regulatory review of local land use regulations, ordinances, and policies relative to LID and green infrastructure. The regulatory review would guide the revision of local land use regulations to require the use of LID and green infrastructure and to remove any barriers to the use of such techniques in the current regulations. Screening-level regulatory reviews were conducted in 2010 for Bridgeport and Trumbull in support of the Pequonnock River Watershed Based Plan development. The watersheds should work collaboratively to identify common opportunities and recommendations for strengthening local land use regulations and policies.
    - The watershed municipalities of Fairfield and Trumbull should consider potentially revising their existing stormwater design standards based on the regulatory review.
- Provide education and outreach for designers, land use commissioners, municipal staff, and the public.
- Pursue sustainable, long-term funding sources to move beyond the demonstration phase and create a watershed-wide comprehensive green infrastructure program. Pursue alternative funding sources for green infrastructure projects such as user fees, stormwater utility districts,

infrastructure banking, public-private partnerships, etc. The City of Bridgeport and several other Connecticut communities have or are in the process of evaluating the feasibility of stormwater utilities as a long-term funding mechanism.

Innovative Financing for Green Infrastructure – Prince George's County Watershed Protection and Restoration Program

Innovative financing mechanisms are being explored at the national level, particularly tapping into the resources of the private sector through public–private partnerships (P3s). Traditionally, water and wastewater infrastructure has been funded through municipal bonds, with help from EPA State Revolving Loan funds, while stormwater is typically funded either through its limited share of local general funds or stormwater utilities. The Chesapeake Bay states are exploring P3s to meet TMDL obligations for nutrients and sediment. A P3 is an arrangement between government and the private sector in which the private sector assumes a large share of the risk in terms of financing, constructing, and maintaining the infrastructure. Government repays the private sector over the long term if the infrastructure is built and maintained according to specifications. Prince George's County is launching a P3 pilot program in the fall of 2013 to retrofit 2000 acres of impervious surfaces in the public right of way. Private funds will finance 30% to 40% of the program costs upfront, enabling project construction to begin sooner and proceed more quickly. This program is part of the County's Watershed Protection and Restoration Program.

- The City of Bridgeport should continue its city-wide green infrastructure initiatives, as identified in its BGreen 2020 sustainability master plan, including the use of green infrastructure to address CSO overflows and stormwater management through stormwater retrofits at vacant or underutilized parcels, stormwater harvesting and reuse, and integration of stormwater management and public infrastructure improvements through the City's "complete streets" policy.
- Ultimately, the remaining CSO discharges to the Rooster River must be eliminated to realize improvements in water quality in the Rooster River and Ash Creek. The City of Bridgeport should continue to implement its CSO LTCP, and consider green infrastructure and LID alternatives in combination with traditional grey infrastructure solutions to further reduce runoff volume and stormwater pollution from existing outfalls and new outfalls that result from sewer separation efforts. This would include development of green infrastructure strategies in more detail.
- The City should implement the recommendations of the green infrastructure feasibility scan (http://reducerunoff.org/bridgeport.htm).
- The City should implement the recommendations of the ongoing stormwater authority feasibility study. Findings of the feasibility study may also provide useful information for Fairfield and Trumbull to begin considering similar alternative funding mechanisms.

3.2.3 Implement Stormwater Retrofits


Planting a Rain Garden

Stormwater retrofits are structural practices installed in existing developed areas to capture, treat, and store or infiltrate stormwater runoff before it is discharged to a water body or wetlands. Stormwater retrofits include end-of-pipe treatment measures installed near the outlets of existing drainage systems, as well as stormwater management practices distributed throughout a site using LID and green infrastructure approaches.

End-of-pipe stormwater retrofits, such as the installation of a stormwater basin at an existing outfall pipe to capture and treat the first flush of runoff, tend to be larger and more expensive, but they generally provide treatment for a larger area and can be more cost-effective when installed as a retrofit (although recent research, including the Jordan Cove Urban Watershed Project in Waterford, Connecticut, has shown them to be less cost-effective than LID measures when installed as part of new construction). In contrast, LID and green infrastructure retrofits are distributed practices that can often be integrated into the existing landscape with minor infrastructure modifications. LID practices typically place maintenance responsibilities on individual property owners.

As discussed in *Section 4* of this plan, opportunities for stormwater retrofits exist throughout the Rooster River watershed. The most promising retrofit opportunities are generally located on publicly-owned land and include:

- Parking lot upgrades (bioretention, pervious pavement, vegetated buffers, water quality swales)
- Municipal and institutional properties (bioretention, pervious pavement green roofs, blue roofs, tree planting, stormwater harvesting)
- Athletic fields at parks and educational institutions (water quality swales, vegetated buffers, infiltration, bioretention, stormwater reuse for irrigation)
- Road repair/upgrades (green or "complete" streets – bioretention, water quality swales, tree planters, below-ground infiltration chambers)
- Roadway stormwater outfalls, particularly at or near roadway stream crossings
- Vacant or underutilized parcels owned by the watershed municipalities

Residential lots offer opportunities for small-scale LID retrofits such as roof leader and downspout disconnection, rain barrels, and rain gardens, but typically require homeowner incentives and outreach/education for widespread implementation. Commercial and industrial facility retrofits can also be effective as these sites are typically characterized by high impervious cover and pollutant sources. However, commercial and industrial retrofits also require incentives and cooperation of private land owners if they are not regulated through a local, state, or federal permit program.

Recommended Actions

- Initially consider implementing the potential retrofit opportunities that were identified during the watershed LID and green infrastructure assessment (see *Section 4*). These and other potential project sites identified in *Section 4* are not intended to be all-inclusive. Rather, the identified potential retrofit sites are representative of the types of retrofit opportunities that exist throughout the watershed and can be replicated at other sites in the watershed.
- Further evaluate the feasibility of potential retrofits based on consideration of site-specific factors including hydraulic head, available space, soil conditions, land ownership, and site access.
- Refine and select projects based on the following criteria:
    - Capital cost
    - Maintenance
    - Public perception
    - Homeowner impact
    - Soil infiltration capacity
    - Pollutant load reduction (pollutant concentrations and runoff volumes)
    - Stormwater quality improvement
    - Infrastructure reduction
- Consider implementing stormwater retrofits by identifying "seed" funding for the initial design phases, followed by the development of subwatershed plans with conceptual designs for specific structural BMPs, which will increase the chances of state and federal funding for these projects.
- Encourage riparian commercial property owners along the Rooster River and its tributaries to provide proportioned or phased stormwater detention and recharge facilities as a retrofit to existing building and parking areas when new tenants are accepted. Stormwater retrofits should be required for any additions or new development on these properties. The Westfield Shopping Center (Trumbull Shopping Mall) is a prime example of where this could significantly improve downstream water quality and flow conditions in Horse Tavern Brook and the Rooster River.

Stormwater Retrofit Requirements for Commercial Properties

The Westfield Shopping Center is a prime example of where stormwater retrofits could significantly improve downstream water quality and flow conditions in Horse Tavern Brook and the Rooster River. Stormwater retrofits on commercial properties could be required through modified land use regulations or as financial incentives to reduce effective impervious cover through the use of stormwater utility fees. Stormwater retrofits of commercial properties along flood-prone riparian areas should also be coordinated with local and regional flood control efforts.

3.2.4 Implement Municipal Stormwater Management Programs

The stormwater collection and drainage systems within the watershed consist of drainage infrastructure operated and maintained by the watershed municipalities and the Connecticut Department of Transportation. Each of these entities is a regulated small Municipal Separate Storm Sewer System (MS4) under the CTDEEP General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 Permit).

Through their MS4 Permit stormwater management programs and other planning initiatives, the watershed municipalities have developed and implemented a variety of Best Management Practices to address stormwater quality and quantity issues associated with municipal activities as well as land development and redevelopment projects. The municipalities have also begun to address historical development and nonpoint source pollution impacts in the watershed by identifying potential sites for stormwater retrofits.

Recommended Actions

The watershed municipalities should work cooperatively through the future Rooster River watershed organization to implement municipal stormwater management programs for their regulated MS4s, as required by the MS4 Permit. The six minimum control measures of the MS4 Permit include public education, public involvement, illicit discharge, detection and elimination, construction site runoff control, post-construction runoff control, and pollution prevention and good housekeeping. The CTDEEP is currently in the process of revising and reissuing the MS4 General Permit, which represents an opportunity for the watershed municipalities to review and update their municipal stormwater management programs relative to the MS4 Permit requirements and to achieve meaningful pollutant reductions relative to the bacteria TMDL. Specific recommendations include:

- The watershed municipalities should work cooperatively to cost-effectively address the public education and outreach, monitoring, mapping, and illicit discharge detection and elimination requirements of the revised MS4 Permit, which is expected to be re-issued by CTDEEP by January 2015.
- The municipalities should consider requesting approval from CTDEEP for an alternative MS4 Permit monitoring program to more effectively address the bacteria impairments in the Rooster River. Monitoring may be performed by municipal staff, citizen volunteers, or contracted to an environmental consulting firm. The program must include sampling to address both objectives (source detection and progress quantification). Source detection monitoring may include such activities as visual inspection of storm sewer outfalls under dry weather conditions, event sampling of individual storm sewer outfalls, and monitoring of ambient (in-stream) conditions at closely spaced intervals to identify "hot spots" for more detailed investigations leading to specific sources of high bacteria loads.

Reissunce of CTDEEP MS4 Permit

The CTDEEP is currently in the process of revising and reissuing the MS4 General Permit, which represents an opportunity for the watershed municipalities to review and update their municipal stormwater management programs relative to the MS4 Permit requirements and to achieve meaningful pollutant reductions relative to the bacteria TMDL for the Rooster River.

3.2.5 Protect Existing and Restore Degraded Riparian Buffers

Riparian buffers are naturally vegetated areas adjacent to streams, ponds, and wetlands. Vegetative buffers help encourage infiltration of rainfall and runoff, and provide absorption for high stream flows, which helps reduce flooding and drought. The buffer area provides a living cushion between upland land use and water, protecting water quality, the hydrologic regime of the waterway and stream structure. The naturally vegetated buffer filters out pollutants, captures sediment, regulates stream water temperature and processes many contaminants through vegetative uptake. The vegetative community of riparian buffers provides habitat for plants and animals, many of which are dependent on riparian habitat features for survival. Since, in many areas, riparian buffers are becoming reduced in size and impacted by roadways and development, many species of plants and animals that are dependent on the unique blend of characteristics that buffers provide are threatened or endangered species.

As discussed in *Technical Memorandum #1: State of the Rooster River Watershed*, development along the stream corridors in the watershed has resulted in substantial loss of riparian vegetation. The high degree of stream buffer encroachment along the watercourses in the Rooster River watershed has a significant impact on overall stream and habitat conditions. Overall, the watershed has less than 20% forest cover within the 300-foot riparian corridor

A recent LISS-funded study, conducted by the Center for Land Use Education and Research (CLEAR), characterized Connecticut's watersheds and their riparian areas through the use of remotely-sensed land cover during the 1985 to 2006 time period. Results of this study indicate that the Rooster River watershed experienced a 0.5 to 2 percent loss of forested land within the 300-foot riparian corridor (i.e., within 300 feet on either side of the streams and rivers in the watershed) between 1985 and 2006 (CLEAR, 2011). Overall, the watershed has less than 20% forest cover within the 300-foot riparian corridor.

An objective of this plan is to protect and restore degraded riparian buffers in the watershed to protect and improve water quality. Related recommendations for protection and restoration of riparian habitat, including in-stream habitat, are addressed in *Section 3.3* of this plan.

Recommended Actions

- Implement priority buffer reforestation projects identified during stream walks and watershed field inventories. Focus efforts on publicly-owned, high-profile sites such as existing parks along the Rooster River corridor and tributaries, as well as smaller headwater tributaries. *Section 4* identifies several potential buffer restoration candidates based on limited field inventories. Site-specific concepts for several of these potential opportunities are presented in *Section 4*. Further

evaluate the feasibility of buffer restoration at specific sites based on consideration of site-specific factors including site access, available land area, land ownership, soil conditions, appropriate buffer width, and native plant species.

- In general, riparian buffers are most effective along smaller, headwater streams, although larger streams, ponds, and areas along the tidal portion of the Lower Rooster River could also benefit from buffer enhancements. Potential buffer restoration approaches for the watershed include:
    - Installation of new buffers
    - Widening existing buffers
    - Invasive species removal/management
    - Tree planting/reforestation
- Pending enabling state legislation, adopt riparian buffer protection regulations that would establish a regulated riparian zone on both sides of the Rooster River and its tributaries to ensure that remaining undeveloped riparian areas remain in a natural, undisturbed state.
- Adopt or modify local land use regulations to incorporate site design credits or other similar incentives for developers to restore or establish vegetative buffers as part of new development or redevelopment.
- Engage volunteers in riparian buffer implementation projects.
- Educate developers, designers, municipal staff, and the public about the value and importance of riparian buffers.
- Consider implementing buffer restoration projects by identifying "seed" funding for the initial design phases, followed by the development of subwatershed plans with more detailed designs, which will increase the chances of state and federal funding for these projects.
- Preserve and enhance riparian buffers for projects that provide public access to the Rooster River and Ash Creek and its tributaries.
- Develop riparian corridor workshops for officials of the watershed municipalities in partnership with the future Rooster River watershed organization. The workshops would address, at a minimum: (a) roles and functions of riparian areas, emphasizing both coastal and inland habitats; (b) factors affecting the health and function of riparian areas; (c) status of riparian areas within the Rooster River watershed; (d) planning methods for protecting riparian zones (targeted toward local land use officials); and, (e) an overview of methods for restoring damaged or cleared riparian areas with suggestions for both coastal and inland plantings. These workshops would incorporate results from the CLEAR study of the status of riparian corridors in Connecticut. The workshops would build on the recent success creating riparian corridor programming in the Niantic River Watershed towns of Waterford, East Lyme, Salem and Montville.

3.2.6 Remove Combined and Sanitary Sewer Overflows

Green Infrastructure and CSO Control

Bridgeport, like many large cities and urban areas, has combined sewers that convey sewage and stormwater runoff to water pollution control facilities for treatment. Combined sewers are designed to convey sewage and a limited amount of stormwater runoff. When runoff exceeds available system capacity, combined sewer overflows (CSOs) occur as direct discharges of untreated sewage to water bodies, contributing to degraded water quality and habitat conditions. CSOs are a significant source of

water quality impairment in urban areas throughout the United States, including a significant source of impairment in the lower portions of the Rooster River and Ash Creek.

Conventional approaches to CSO abatement generally seek to increase storage or conveyance capacity within the sewer system. Two common designs are in-line storage systems and CSO tanks. In-line storage systems add storage volume within the sewer system, while CSO tanks are large underground chambers situated at CSO discharge points. Both systems avert discharges by storing and, in some cases, also treating excess sewer flow before releasing it slowly back to the sewer system. These approaches can be effective but are often expensive and difficult to site, especially in urban areas where the availability of land is limited and land acquisition costs can be relatively high.

Green infrastructure can be both a cost-effective and an environmentally-beneficial approach to reduce stormwater and other excess flows entering combined or separate sewer systems in combination with centralized hard infrastructure solutions. Other U.S. cities have incorporated green infrastructure approaches into their CSO control programs and are using green infrastructure to reduce stormwater pollution for compliance with municipal stormwater permit requirements (NRDC, 2006). Green infrastructure can also reduce the need for more expensive grey infrastructure, thus saving on municipal wastewater treatment costs and allowing a potential reduction in sewer use fees.

Ongoing CSO Control and Green Infrastructure Efforts

As described in *Technical Memorandum #1: State of the Rooster River Watershed*, Bridgeport, along with several other communities in Connecticut, is working to address CSOs and improve water quality in local receiving waters and Long Island Sound. Bridgeport is at the forefront of these efforts, having developed a Long-Term Control Plan to reduce or eliminate the frequency of CSO events and the discharge of untreated CSOs.

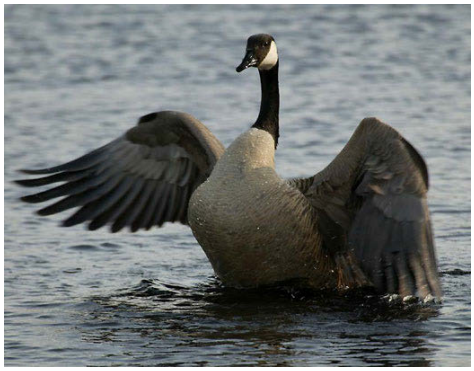
Since the 1980s, the City of Bridgeport has implemented a number of major facility upgrades and CSO separation projects throughout the portions of the City with combined sewers. More recently, the City prepared a new Long-Term Control Plan in response to a CTDEEP Administrative Order. The LTCP identified a number of traditional grey infrastructure CSO abatement projects (e.g., illicit connection elimination, sewer separation, and CSO storage tanks and tunnels), as well as potentially cost-effective green infrastructure technologies including pervious pavement, rain barrels and cisterns, infiltration basins, rain gardens, tree planting, and green roofs. The City is also using green infrastructure approaches for meeting overall sustainability and planning objectives.

The City of Bridgeport has partnered with Save the Sound, the Natural Resources Defense Council (NRDC), and the CTDEEP to evaluate the economic and technical feasibility of implementing green infrastructure in Bridgeport. The feasibility study assessed the effectiveness of green infrastructure stormwater control measures for addressing CSO issues, including the use of green infrastructure as an alternative to or to augment CSO abatement strategies that rely on traditional grey infrastructure approaches. The study also identified several site-specific and neighborhood-scale green infrastructure projects that the City is pursuing. More recently, the City has begun to evaluate the feasibility of creating a stormwater authority and related stormwater utility to maintain and finance green infrastructure and other stormwater projects in the City.

Recommended Actions

- The City of Bridgeport should eliminate the last remaining CSO discharge location in the watershed, located at State Street and Dewey Street in the upper portion of Ash Creek.
- The Town of Fairfield should eliminate the Sanitary Sewer Overflow (SSO) along the East Trunk Sanitary Sewer where overflows have been observed in the Rooster River floodplain area north of Interstate 95, east of Berwick Avenue, and south of the Kings Highway East (Route 1) bridge over the Rooster River (North Avenue Bridge).

3.2.7 Reduce Nuisance Waterfowl



Fecal material from nuisance waterfowl such as mute swans and Canada geese is a source of nonpoint source pollution, particularly pathogens and nutrients. Reducing these populations could improve water quality by reducing bacterial and nutrient loadings to the Rooster River, particularly in the public parks, golf courses, and cemeteries that exist along the river corridor.

The watershed communities have existing bans on feeding of waterfowl. However, enforcement of such regulatory controls is difficult. Furthermore, there are no easy solutions to nuisance waterfowl problems. Canada geese are persistent when they have become habituated to an area (CTDEEP, 2011). A more effective nuisance waterfowl control strategy is needed, focusing on education and outreach and other proven control methods.

Recommended Actions

- Continue waterfowl deterrent efforts to reduce feeding of waterfowl by the public, waterfowl nesting, and terrestrial waterfowl habitat in the watershed. Existing regulatory controls prohibiting the feeding of waterfowl should be augmented through additional signage in public parks and other educational tools, in addition to the potential for fines.
- Assess problem areas to determine the attraction to nuisance waterfowl, and work with landowners to implement appropriate population control, habitat reduction, and deterrence measures.

3.2.8 Identify and Eliminate Illicit Discharges

Illicit discharges are non-stormwater flows that discharge into the stormwater drainage system or directly into surface waters. Wastewater connections to the storm drain system and illegal dumping are among the types of illicit discharges that may exist in residential and commercial areas within the watershed. Nearly the entire Rooster River watershed is served by municipal sanitary sewers, and failing septic systems are not a significant issue in the watershed. Depending on the source, an illicit discharge may contain a variety of pollutants that can impact both human health and the aquatic environment.

Identifying and eliminating these discharges is an important means of pollution source control for the watershed.

All of the watershed municipalities are subject to the requirements of the NPDES Phase II stormwater program, which is regulated under the CTDEEP General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 Permit). The MS4 Permit regulates the quality of discharges from municipal storm drainage systems. The program requires municipalities to implement an ordinance or other regulatory mechanism to effectively prohibit non-stormwater discharges into the municipal storm drainage system, as well as sanctions to ensure compliance. This includes developing an Illicit Discharge Detection and Elimination (IDDE) Plan to detect and eliminate existing and future non-stormwater discharges, including illegal dumping.

The CTDEEP is currently in the process of revising and reissuing the MS4 General Permit, which represents an opportunity for the watershed municipalities to review and update their municipal stormwater management programs relative to current and future MS4 Permit requirements, including IDDE efforts.

Recommended Actions

- Ensure that IDDE efforts of the watershed municipalities (required by the MS4 Permit) include their respective areas of the Rooster River watershed.
- Ensure that the watershed municipalities implement IDDE programs as required by the existing and future re-issued MS4 Permit, including an ordinance or other regulatory mechanism to effectively prohibit non-stormwater discharges into the regulated municipal separate storm sewer system and an IDDE Plan to detect and eliminate existing and future non-stormwater discharges, including illegal dumping.
- Educate municipal staff and the public.
- Implement priority stream cleanups identified by stream walks.
- Conduct follow-up illicit discharge investigations at priority outfalls identified during stream walks.

Other sources of information on performing illicit discharge investigations include:

- *Illicit Discharge Detection and Elimination Manual - A Handbook for Municipalities,* New England Interstate Water Pollution Control Commission (2003) http://www.neiwpcc.org/neiwpcc_docs/iddmanual.pdf
- *Illicit Discharge Detection and Elimination - A Guidance Manual for Program Development and Technical Assessments*, Center for Watershed Protection (2004)

3.2.9 Reduce Impacts from Hotspot Land Uses

Hotspot land uses are land uses with higher potential pollutant loads due to the nature of the activities and pollutant sources associated with these land uses. Hotspot land uses within the Rooster River watershed include commercial land use, existing and former industrial sites, gas stations and automotive repair facilities, and high-use parking lots.

An objective of this watershed management plan is to reduce the threat to water quality from land uses with higher potential pollutant loads through good housekeeping and pollution prevention, improved compliance at regulated facilities, and cleanup and sustainable re-use of contaminated (i.e., brownfield) sites. Related education and outreach recommendations are addressed in *Section 3.5* of this plan.

Recommended Actions

- Improve housekeeping programs and stormwater compliance at public works facilities and parks.
- Develop a watershed-specific outreach program to dovetail with CTDEEP industrial stormwater permitting requirements, showing facility operators the impacts of their activities on associated receiving waters.
- Develop strategies and/or regulations to pursue parcels that contribute higher pollutant loads.
- Ensure that reissued NPDES industrial water discharge permits contain provisions for TMDL implementation, LID, runoff volume reduction, and water quality protection.
- Incorporate source controls, green infrastructure, and LID practices into brownfield redevelopment projects to reduce pollutant loads and runoff volumes.

3.3 Habitat Protection and Restoration

Goal Statement: Protect and improve terrestrial, riparian, and aquatic habitat in the watershed to maintain and increase the watershed's diversity of plant and animal species.

As described in *Technical Memorandum #1: The State of the Rooster River Watershed*, the Rooster River watershed is highly urbanized but provides habitat for a variety of fish and wildlife species, particularly along the river and stream corridors, in the forested areas of the watershed, in urban parklands, and in the ecologically-rich Ash Creek Estuary. Notable tracts of protected or preserved parkland in the watershed, and in particular along the river corridor, provide valuable habitat or unique natural resources in an otherwise developed suburban and urban watershed.

The following objectives and recommended actions are intended to protect and restore the various habitats that exist within the watershed.

3.3.1 Protect and Restore In-Stream and Riparian Habitat

The Ash Creek Estuary provides habitat for fish and shellfish. The Lower Creek provides the highest quality habitat for fish and shellfish. It provides the substrate for commercial and recreational

shellfishing, especially oystering. Oysters are commercially cultivated, seasonally harvested, and then moved into deeper waters of Long Island Sound for purification before being sold. The estuary does not currently meet water quality goals for commercial shellfishing due to elevated levels of indicator bacteria originating from point and nonpoint sources. The marine and aquatic life impairment is related to heavy metal contamination of the estuary sediments due to historical industrial uses along the creek.

The estuary also provides opportunities for recreational fishing. Ash Creek does meet designated uses for fish consumption and is evaluated on a regular basis by the CTDEEP. There is currently no specific advisory for the consumption of fish caught within Ash Creek or the remainder of the Rooster River watershed (Ash Creek Conservation Association, 2012).

A number of issues affecting fisheries exist throughout the watershed. Lack of shade along the stream banks results in increased stream temperature, which can affect dissolved oxygen concentrations and negatively impact many fish species. Sediment and pollutants introduced into the streams from stormwater runoff can harm fish and smother eggs and invertebrate larvae. Abnormally low stream flow during dry periods due to development and loss of groundwater recharge are common to many areas of the watershed. In addition, the numerous modifications of the rivers and streams in the watershed for flood control purposes (e.g., channelization, stream bank hardening, burying the streams in underground culverts) impede or limit fish migration upstream. Tide gates within Ash Creek also reduce the ecological connectivity of the creek with its tributaries (Turney and Riverside Creeks), and an underground section of the stream under Laurel Avenue beginning around Hughes Avenue and a manmade grade drop near the culvert severely restricts fish passage through this reach (personal communication, Steve Gephard, CTDEEP Fisheries Division, March 22, 2013).

The tide gates located along the major tributaries to Lower Ash Creek (Turney and Riverside Creeks) and the major road crossings in Upper Ash Creek (Interstate 95, Route 1) limit opportunities for anadromous[2] fish passage in the watershed. Although the CTDEEP or other organizations such as Trout Unlimited have not identified the Rooster River and Ash Creek as a high priority for anadromous fish restoration, opportunities still exist for improving fish passage for resident species and ecological connectivity throughout the watershed.

Recommended Actions

- Address areas of streambank erosion using appropriate bioengineering and habitat-sensitive measures.
- Implement priority stream restoration projects identified during stream walks and watershed field inventories. Many areas of the watershed include stream reaches that have been heavily impacted by encroaching development, including bank modifications resulting in significantly-reduced stream cross section, and heavily-impacted riparian buffer. In some cases, these areas may correspond with flooding issues that are a major concern in the watershed. To address these issues, identify and prioritize these areas and work with land owners to restore lost stream habitat and conveyance capacity.
- Several proposed stream restoration concepts are also presented in *Section 4* of this plan. Access to potential stream restoration sites may be limited; therefore, potential candidate sites should be

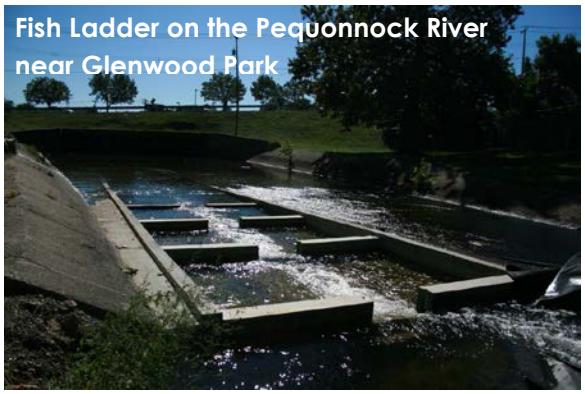
[2] Anadromous fish begin life in freshwater, migrate to the sea to reach maturity, and return to freshwater to spawn.

evaluated further for overall feasibility including land ownership, erosion severity, upstream and downstream conditions, infrastructure constraints, and construction access to the stream.

- Implement stream daylighting projects for priority culvertized segments in the watershed.
- As future progress is made on plan implementation, consider the feasibility of and potential options for providing fish passage at tide gates. For example, consider the desirability and feasibility of restoring migratory fish species such as river herring by providing a fish-pass design at the Lower and Upper Brooklawn Avenue flood relief culvert.
- In general, stream restoration and other habitat improvement projects should be implemented by identifying "seed" funding for the initial design phases, followed by the development of subwatershed plans with more detailed designs, which will increase the chances of state and federal funding for these projects.
- Revise local storm drainage design standards and regulations such that new or modified stream crossings are designed following the Connecticut Stream Crossing Guidelines.

Fish Passage Opportunities

The tide gates located along the major tributaries to Lower Ash Creek (Turney and Riverside Creeks) and the major road crossings in Upper Ash Creek (Interstate 95, Route 1) limit opportunities for anadromous fish passage in the watershed. As future progress is made on plan implementation, consider the feasibility of and potential options for providing fish passage at tide gates. For example, consider the desirability and feasibility of restoring migratory fish species such as river herring by providing a fish-pass design at the Lower and Upper Brooklawn Avenue flood relief culvert.



Fish Ladder on the Pequonnock River near Glenwood Park

3.3.2 Protect and Restore Forests and Watershed Tree Canopy

Forest cover provides numerous benefits at both the site and watershed scales. In addition to providing habitat for terrestrial and aquatic wildlife, watershed forest cover also reduces storm water runoff and flooding, improves regional air quality, reduces stream and channel erosion, improves soil and water quality, and reduces summer air and water temperatures (USDA Forest Service, 2005). Traditional approaches to restoring urban watersheds that have relied on structural solutions have failed to protect and restore urban streams. Through green infrastructure approaches, vegetation and natural systems are now considered a key tool in the protection and restoration of urban watersheds.

Approximately 20% of the Rooster River watershed consists of deciduous and coniferous forest cover. Most of the forested areas in the watershed are relatively small and fragmented. The following actions are recommended to protect and enhance forested areas and tree canopy within the watershed.

Recommended Actions

- Protect existing forests through land acquisition and conservation easements.
- Amend site development regulations and zoning to encourage tree retention and maintenance, restrict tree removal, and require landscaping and parking lot shading.
- Reforest public lands, beginning with priority sites.
- Encourage reforestation of private land by developing education, stewardship and incentive programs. For larger parcels, contact a state forester or private consulting forester to developing specific goals and objectives for that property.
- Consider developing a tree ordinance, especially for canopy protection along the river corridor.
- Establish municipally-based Urban Tree Canopy goals in the watershed and develop a plan to achieve those goals. Potential recommendations include:
    - Identify priority parcels for reforestation based on watershed field inventories and detailed tree canopy analysis results.
    - Identify areas where local regulations/ordinances pertaining to tree canopy may need to be strengthened.
    - Engage the tree wardens in the watershed municipalities, particularly as relates to tree health, tree retention and canopy cover goals.
    - Demonstrate the importance of trees and vegetation as a critical component of green infrastructure and the related water quality benefits through local tree canopy demonstration projects.

3.3.3 Manage Invasive Plant Species

Native vegetation plays an important role in ecosystem biodiversity. Invasive plants have displaced native species and threaten local biodiversity and ecosystem function in the watershed. Invasive plants and invasive aquatic plants have been identified in many areas of the watershed, including along the sides of highways, on lake shores and in tidal marsh areas. The most common and visible plant species include common reed (Phragmites), purple loostrife, and Japanese knotweed.

Tidal marsh habitat conditions in Upper Ash Creek are generally poor and contain significant stands of invasive plant species. Freshwater inputs from the Rooster River and stormwater runoff, accompanied by significant human disturbance, likely creates the low-saline waters in which Phragmites and other salt-tolerant species can thrive. In contrast, lower Ash Creek receives greater concentrations of salt water and as a result, contains a higher concentration of native vegetation (Ash Creek Conservation Association, 2012). The growth of Phragmites has been limited to a portion of Lower Ash Creek, at the end of Riverside Drive, near the tidal gates located in Fairfield and, near the stormwater outfalls along Gillman Drive in Bridgeport. These areas have experienced various forms of human disturbance. The tidal gates in Lower Ash Creek, which were originally installed for flood protection, also restrict tidal exchange, which has historically led to changes in salinity levels and the establishment of invasive plant species such as Phragmites. Replacement of the tide gates with newer self-regulating gates in the 1990s has improved water quality, although the presence of Phragmites in the vicinity of the gates suggests that flow might still be constricted to some degree (Ash Creek Conservation Association, 2012).

Invasive species management efforts should focus on site-specific and targeted stream corridor improvements, and properties that are actively maintained with opportunity and interest for control, given the impracticality of successfully controlling or eradicating invasive plant species on unmaintained sites.

Recommended Actions

- Implement priority invasive species management projects identified during stream walks and watershed field inventories.
- Develop an invasive species management plan for targeted and accessible areas of the watershed, including prevention and education efforts to preempt arrivals, early detection and citizen monitoring efforts, rapid response measures for successful eradication, and when a species cannot be eradicated, continued control efforts that are necessary to minimize ecological and economic impacts. The plan could identify prevention and education efforts to preempt arrivals, early detection and citizen monitoring efforts, response measures for successful eradication, and when a species cannot be eradicated, continued control efforts that are necessary to minimize ecological and economic impacts. The invasive species management plan should borrow from the successes of other local or regional invasive species control programs elsewhere in Connecticut. Information on invasive plant species planning and management can be obtained from:
    - U.S. Fish and Wildlife Service: (http://www.fws.gov/invasives/staffTrainingModule/planning/introduction.html),
    - The Connecticut Department of Environmental Protection
    - The Nature Conservancy (TNC)
    - Connecticut Invasive Plant Working Group (CIPWG)

- Educate residents, facility maintenance personnel, landscapers and local nurseries, and land use commissions about the negative effects of non-native invasive species, pathways of introduction, and alternatives to invasive ornamental plants.
- Involve volunteers and neighborhood groups in invasive species removal and stream corridor improvements.

3.3.4 Implement Ash Creek Estuary Master Plan Recommendations

The Rooster River Watershed Based Plan endorses the following water quality and habitat-related recommendations of the Ash Creek Estuary Master Plan:

- **Create a permanent bi-municipal entity (Fairfield/Bridgeport) focused on the Ash Creek Estuary.** This could be accomplished through the creation of a Conservation Commission in the City of Bridgeport, similar to that of Fairfield, and regular meetings and coordination between the two municipal Conservation Commissions to make joint recommendations on issues related to the estuary.

Ash Creek Estuary Master Plan

The Ash Creek Conservation Association, working with a project advisory committee consisting of representatives from the Town of Fairfield, the City of Bridgeport, and neighborhood groups, completed a comprehensive ecological restoration plan for the Ash Creek Estuary (http://www.ashcreekassoc.org/categories/ecological-master-plan) in 2012. The plan identifies specific recommendations for restoration of the Ash Creek Estuary.

- **Develop a Phase 2 Comprehensive Ecological Restoration Plan.** The master plan recommends developing a more comprehensive ecological restoration plan to guide future restoration and stewardship activities. Like this watershed-based plan for the entire Rooster River watershed, the plan ecological restoration plan for the Ash Creek Estuary should include additional scientific and regulatory analysis, design and cost estimates, stewardship budget, invasive species management recommendations, planting specifications, potential benefits, as well as goals, quantified objectives, and milestones.

- **Integrate recommendations with post-Hurricane Sandy recovery efforts.** As property and infrastructure damage from Hurricane Sandy is repaired, upgraded, and replaced, the recommendations of the Ash Creek Estuary Master Plan should be taken into consideration, including
    - Dune restoration efforts
    - Upgrading storm sewers
    - Dredging and sand placement activities
    - Forest management
    - Expansion of permanent oyster reefs
    - Creation of wetlands, uplands, and other flood control technologies
    - Integration of native plants into private and public properties
    - Improvement of buffer wetland systems

- **Investigate wetland mitigation opportunities.** Development related impacts to wetlands and other natural resources typically require mitigation in relatively close proximity to the location of the original impacts (i.e., on the same site). Rather than mitigating impacts on a site-by-site basis, the Ash Creek Estuary could provide a key role in satisfying future project-specific mitigation in coordination with the Fairfield and Bridgeport Wetland Agencies and/or state and federal wetland regulatory agencies. The Phase 2 restoration plan should identify site-specific restoration

projects within the estuary that may be implemented in-lieu of wetland mitigation on sites with less suitable conditions for high-value wetland creation or restoration.

- **Perform engineering review of tide gates to improve tidal flow in Turney Creek and Riverside Creek.** All tide gates in the estuary should be inspected to ensure they are operating according to their design requirements. Alternative types of tide gates should be considered to encourage greater tidal exchange and salinity within the tidal creeks.

- **Develop a Green Infrastructure Plan** (see the recommendations in *Section 3.2* and *Section 4* of this watershed plan).

- **Investigate restoration opportunities, especially for St. Mary's Spit and Turney Creek.** Restoration of the sand spit by the City of Bridgeport should follow the master plan recommendations. The headwaters of Turney Creek are not well-defined but appear to be on the west side of the Kings Highway exit on Interstate 95. The creek then appears to run primarily underground until emerging at the Old Post Road. It may be possible to enhance or restore the creek in certain sections. This could have important implications for water quality and habitat restoration (Ash Creek Conservation Association, 2012). Turney Creek should be included in the stream walks and follow up field assessments recommended in *Section 3.1.4* of this watershed plan.

- **Increase community outreach and education** (see the recommendations in *Section 3.5* of this watershed plan).

3.4 Sustainable Land Use and Open Space

Goal Statement: Promote sustainable growth and appropriate development in the watershed while preserving and improving the watershed's natural resources, providing public access to open space, and addressing current and future flooding problems.

3.4.1 Strengthen Land Use Regulations

Municipal land use plans and regulations help shape the development patterns within a watershed and can play a significant role in protecting water quality and other natural resources at the watershed scale. These commonly include municipal plans of conservation and development, zoning regulations, subdivision regulations, inland wetland and watercourses regulations, and stormwater regulations, all of which influence the type and density of development that can occur within a watershed. Local land use regulations often vary by municipality within a watershed, and regulations are periodically revised in response to development pressure, shifts in attitude toward natural resource protection, and political and socioeconomic factors.

Because a watershed management plan encompasses multiple municipalities, a watershed-based regulations review also provides an opportunity for towns or cities to compare their regulatory mechanisms to those of neighboring municipalities. By doing so, they can evaluate the relative merits of different approaches, adopt the best models, and improve region-wide consistency in how the common water resource is managed. This review of land use regulations and land use plans by municipality and other entities in the Rooster River watershed is, therefore, a tool that can be used to achieve several objectives.

A land use regulatory review was performed in 2010 for Bridgeport and Trumbull in support of the Pequonnock River Watershed Based Plan. The land use regulatory review identified areas for improvements in municipal local land use regulations and related land use planning documents to protect water resources throughout the watershed. The following sections summarize recommendations for Bridgeport and Trumbull, as well as general recommendations that could apply to all three watershed communities. These communities have expressed a desire for strengthened land use regulatory controls related to stormwater management, riparian buffers and riverfront development, and tree protection and preservation. Projects recently completed by a number of Connecticut communities to remove barriers to and implement Low Impact Development (LID) regulations can serve as a model for implementation of similar recommendations in the Rooster River watershed municipalities.

Implementation of Local LID Policy by Connecticut Municipalities

Many Connecticut communities are in the process of or have recently adopted Low Impact Development (LID) policy such as regulatory changes and design standards, including Newington, Greenwich, Vernon, Plainville, Avon, Torrington, Harwinton, and East Granby. These can serve as a model for implementation of similar LID policy recommendations for the Rooster River watershed municipalities.

Recommended Actions

General

- The Town of Fairfield should undertake a review of its land use regulations and policies comparable to the reviews performed for the City of Bridgeport and the Town of Trumbull.
- Bridgeport, Fairfield, and Trumbull should update their respective Plans of Conservation and Development (POCD) to make specific reference to and adopt the recommendations of the Rooster River Watershed Based Plan. The POCDs should emphasize that the various municipal land use agencies (i.e., inland wetlands and watercourses, planning and zoning, conservation) should consider the long-term protection and use of the watershed when implementing their statutory abilities to balance resource protection and development.

Bridgeport

The City of Bridgeport has embraced sustainability in its local planning efforts and through its land use regulations. The City is implementing an ambitious city-wide sustainability initiative through its BGreen 2020 sustainability master plan. The plan includes a number of water resource-related programs including the use of green infrastructure to address combined sewer overflows and stormwater management through stormwater retrofits at vacant or underutilized parcels, water conservation as well as stormwater harvesting and reuse, integration of stormwater management and public infrastructure improvements through the City's "complete streets" program, and an urban forestry initiative. The City of Bridgeport is also developing a comprehensive parks master plan and has begun waterfront revitalization efforts by redeveloping vacant or underutilized former industrial sites for passive recreation and other mixed-uses, such as the Knowlton Park project along the lower Pequonnock River.

Consistent with these initiatives, the City revised its zoning, subdivision and inland wetlands regulations in 2010 and its comprehensive master plan of conservation and development in 2008. The City's Engineering Department and Water Pollution Control Authority also developed a stormwater management manual in 2008, which outlines design standards and stormwater management criteria for projects that are subject to the local land use review and approval process. As indicated above, the City completed its BGreen 2020 sustainability plan in 2010.

Recommendations for additional improvements to Bridgeport's land use regulations and planning documents to further the goals of this watershed management plan include:

<u>River Corridor and Wetlands</u>

- Maintain comprehensive on-line mapping of critical water resources including, but not limited to, watercourses, wetlands, and flood hazard zones.
- Promote preservation and restoration of wetlands and watercourses in City plans and policies.
- Adopt local riparian buffer regulations, with the goal of establishing a contiguous vegetated riparian area on either side of the Rooster River and its tributaries (rivers and perennial streams). Recommended elements of a riparian buffer regulation include:
    - Establish regulated riparian zones, which may vary in width depending on the resource type (stream, pond, or wetlands) and nature of the land use. Larger buffer widths could be required for land uses with the potential to contribute significant pathogen and other

pollutant loads to receiving waters such as hot spot land uses. Refer to the CTDEEP's Upland Review Area Guide.
    - Establish maximum disturbance and include vegetation replacement and mitigation for various activities.
    - Limit the area of vegetation that can be disturbed for various regulated activities. A permit for activity involving disturbance of the riparian zone would be issued only if specific conditions are met, such as:
        - The basic purpose of the project cannot be accomplished on site without disturbing vegetation in the riparian zone.
        - Disturbance to the riparian zone is eliminated where possible and minimized where not possible by relocating the project, reducing the size of the project, or situating the project in portions of the riparian zone where previous development or disturbance has occurred.
        - Any temporarily cleared area of vegetation must be replanted with indigenous, non-invasive vegetation.
        - Limits on the amount of disturbance allowed for specific activities.
    - Limit disturbance within specified distances from the top of bank for certain activities.
    - Where the standards cannot be met, providing greater than 1:1 compensation in the form of re-vegetation and placing a deed restriction on the compensation area.
- Include standards for stream crossings which provide for consistency with the CTDEEP Stream Crossing Guidelines.
- Develop and implement appropriate waterfront zoning regulations through the Office of Planning and Economic Development that conform to the goals and objectives of this watershed management plans and the City's other land use planning documents. The regulations should address public access to the waterfront and other land use issues, while promoting resource protection.
- Establish a formal process to streamline review and enforcement of non-compliance and poor practices that are identified through field inventories and assessments.

<u>Stormwater Management</u>

- Consider incentives to promote the use of LID for private development such as increased development densities, reduced review time or expedited review, reduced application fees, and reduced property taxes.
- Consider relatively minor changes to the City's existing stormwater manual requirements, including:
    - Reference the LID addendum to the CTDEEP Stormwater Quality Manual. The addendum contains updated LID and green infrastructure standards and design guidance.
    - The City's existing stormwater manual allows an exemption from flow control (peak rate of runoff and runoff volume) for certain projects that discharge stormwater runoff directly into the Yellow Mill River, Rooster River, or Long Island Sound and have a surface area less than 5% of the watershed area upstream of the developed site. Pollution reduction requirements still apply to these projects. However, because pollutant loads are affected both by runoff pollutant concentrations and runoff volume, the City should consider revising the exemption such that runoff volume reduction is required for projects that discharge stormwater runoff directly into the Yellow Mill

River, Rooster River, or Long Island Sound. This would also better promote more consistent use of infiltration-based LID and green infrastructure techniques for projects within the Rooster River corridor.

- Consider the development of a stormwater utility district. A feasibility study is ongoing by the City of Bridgeport in conjunction with the Bridgeport Water Pollution Control Authority
- Review the municipal code and regulations for potential regulatory barriers to implementing downspout disconnection and revise the ordinances/regulations accordingly.
- Revise the City's Phase II Stormwater Management Plan for consistency with the MS4 Permit, when reissued in January 2015.
- In addition to the strategies discussed in the plan of conservation and development and BGreen 2020:
    - Review current setbacks and lot dimensions in subdivisions for potential to relax side yard setbacks and allow narrower frontages to reduce road length and site imperviousness, and to relax front setback requirements to reduce driveway length and lot imperviousness.
    - Review existing parking ratios to see if lower ratios are warranted and feasible. The required parking ratio for a particular land use (other than commercial retail) should be enforced as both a maximum and minimum to limit excess parking space construction and impervious cover.
    - Consider allowing the Commission to approve parking lots with more spaces than the allowed maximum provided all of the spaces above the maximum number are composed of a pervious surface, and where adequate stormwater management is provided.
    - Consider parking spaces held in reserve for phased developments, thereby avoiding the situation where unnecessary parking is not constructed if future phases of development do not occur.
    - Modify the parking area landscaped area requirements in the zoning regulations to promote parking lot bioretention and other LID practices.
- As discussed in the plan of conservation and development and BGreen 2020:
    - Encourage infill development and development of brownfield sites (contaminated sites) and greyfield sites (underutilized or abandoned sites) through such tools as density bonuses, tax incentives, and streamlined permitting.
    - Consider allowing offsite treatment of stormwater and wastewater at brownfield and greyfield sites to reduce overall development costs.

<u>Tree Protection</u>

- Strengthen the landscape provisions of the zoning and subdivision regulations by requiring maximum tree preservation, replacement and diversity of tree species; requiring that public trees damaged during construction are removed and replaced; and adopting tree protection rules for public trees during construction projects.
- Alternatively, adopt a stand-alone tree ordinance, informed by the results of the City's upcoming urban tree canopy study. The City of Hartford recently adopted a similar tree ordinance that could be used as a model. New York City also has an ambitious tree planting and preservation program ("Million Trees" initiative http://www.milliontreesnyc.org/html/home/home.shtml, elements of which could be adapted for the City of Bridgeport.

Other Issues

- Integrate the goals, objectives, and recommendations of this watershed management plan into the City's ongoing comprehensive parks master planning efforts. Consider establishing an administrative process or public funding to support open space planning and acquisition.
- Consider establishing an advisory Conservation Commission to focus on open space planning, park expansion, community gardens, urban forestry, green spaces master plan and linkages.
- Consider amending the zoning regulations to prohibit or restrict new USTs within the Rooster River watershed or river corridor.
- Adopt regulations or make specific recommendations concerning the use of pesticides such as discussed in the Plan of Conservation and Development.

Trumbull

The Town of Trumbull revised its inland wetlands regulations in 2010 for consistency with the CTDEEP model regulations. Trumbull also revised its zoning regulations in 2008 and again in 2010. The Town's subdivision regulations were last amended in 2000, and a recent revision of the Trumbull Plan of Conservation and Development is expected to be completed in September 2013. Trumbull also developed an administrative stormwater policy in 2007, which was subsequently revised in 2009. The policy outlines stormwater management and drainage design standards and is consistent with the stormwater management requirements in the Town zoning regulations. While the zoning regulations and stormwater policy address stormwater quality and quantity requirements, both could be revised to require or better promote the use of LID approaches and practices.

Specific land use regulatory and planning recommendations for Trumbull to further the goals of this watershed management plan include:

River Corridor and Wetlands

- Work with the Trumbull Inland Wetlands and Watercourses Commission to adopt local riparian buffer regulations, including application process, management practices, and enforcement mechanisms. Recommended elements of a riparian buffer regulation are described in similar recommendations for Bridgeport.
- Include standards for stream crossings which provide for consistency with the CTDEEP Stream Crossing Guidelines.
- Retain and maintain a maximum amount of natural vegetation on slopes over 15%, particularly those within the Upland Review Area of a watercourse or wetland. Prevent clear-cutting or tree removal beyond the established limits of disturbance.
- Establish no-build setback areas from wetlands and watercourses for new development of structures, pools, septic systems, etc.

Stormwater Management

- Revise the zoning, subdivision, inland wetlands regulations, and the Town's stormwater management and drainage design standards to place greater emphasis on the use of Low Impact Development. Consider incorporating elements of the LID addendum to the CTDEEP Stormwater Quality Manual.
    - Clarify the "Zero Incremental Runoff" requirement in the existing zoning regulations and stormwater management and drainage design standards to include peak runoff rate,

runoff volume, or both. A stormwater runoff volume control standard in addition to peak flow rate control for most new development and redevelopment projects.
    - Include a recommended process for incorporating LID site planning and design approaches.
    - Include a list of recommended LID stormwater practices such as bioretention, water quality swales, pervious pavement, downspout disconnection, amended soils, rain barrels and rain gardens, etc. and associated design guidance.
    - Create standards for retrofitting existing commercial properties for stormwater management adjacent to the wetlands and other environmentally sensitive areas.
- Consider incentives to promote the use of LID for private development such as increased development densities, reduced review time or expedited review, reduced application fees, and reduced property taxes.
- Consider the development of a stormwater utility district similar to and guided by the effort underway in Bridgeport.
- Revise the City's Phase II Stormwater Management Plan for consistency with the MS4 Permit, when reissued in January 2015.
- Review the zoning and subdivision regulations (particularly the older subdivision regulations) for potential opportunities to reduce impervious cover in new development and redevelopment projects.
    - Review current setbacks and lot dimensions in subdivisions for potential to relax side yard setbacks and allow narrower frontages to reduce road length and site imperviousness, and to relax front setback requirements to reduce driveway length and lot imperviousness.
    - Review existing parking ratios to see if lower ratios are warranted and feasible. The required parking ratio for a particular land use (other than commercial retail) should be enforced as both a maximum and minimum to limit excess parking space construction and impervious cover.
    - Consider allowing the Commission to approve parking lots with more spaces than the allowed maximum provided all of the spaces above the maximum number are composed of a pervious surface, and where adequate stormwater management is provided.
    - Modify the parking area landscaped area requirements in the zoning regulations to specifically promote parking lot bioretention and other LID practices.
    - Review Town road standards to reduce the amount of impervious surfaces by reducing road widths whenever appropriate and promote LID approaches in roadway design (i.e., green/complete streets).
- Update Town stormwater drainage maps for use by the Town Departments.
- Develop an illicit discharge ordinance that prohibits improper water discharges to the Town's regulated municipal storm drainage system (MS4), which is a requirement of the CTDEEP MS4 Permit.
- Encourage the use of pervious paving materials to the maximum extent practicable and minimize impervious surfaces in recreation and open space areas.
- Within subdivisions, design open areas to serve as filters, buffers, swales, wet and dry ponds, and detention and retention areas.
- Within public open areas such as parks and playgrounds, design for filtering polluted runoff from adjacent impervious areas.

Tree Protection

- Work with Trumbull officials, including Public Works Department, Tree Warden and related Commissions, to adopt a tree preservation, protection, and clearance ordinance, especially for canopy protection along the river corridor. See recommendation for Bridgeport.
- Consider revisions to the zoning and subdivision regulations to increase landscaping and tree canopy requirements for parking lots and other impervious surfaces.

Open Space

- Consider requiring conservation easements to be placed on Upland Review Areas of new subdivisions.
- Offer incentives to developers to protect open space and environmentally sensitive areas. Consider density or building height bonuses, tax incentives, streamlined permitting, and Transfer of Development Rights (TDR) to protect natural resources and encourage infill development in densely developed areas with appropriate existing infrastructure.

Other Issues

- Consider developing a steep slope ordinance and hillside protection ordinance.

3.4.2 Address Flooding Through a Watershed Approach

As described in *Technical Memorandum #1: State of the Rooster River Watershed*, the Rooster River watershed, like many coastal urban watersheds in Connecticut, has a long history of flooding as a result of historical development of the watershed. Urban flooding occurs when rain overwhelms drainage systems and waterways and makes its way into the basements, backyards, and streets of homes, businesses, and other properties. Urban flooding in the watershed occurs both as a result of overflow from the Rooster River and its tributaries and from the generation of excessive quantities of stormwater on properties and in public rights-of-way.

Urban Flooding in the Rooster River Watershed

Urban flooding in the watershed occurs both as a result of overflow from the Rooster River and its tributaries and from the generation of excessive quantities of stormwater on properties and in public rights-of-way. Despite the long history of flood control projects in the watershed, flooding still remains a significant issue for many areas of the watershed.

Flooding problems within the Rooster River watershed have been studied by various agencies and organizations since the 1950s. The State Legislature authorized funding for flood control along the Rooster River in 1967. Phase I and Phase II flood control improvements were constructed in the 1980s, focusing on the upper portions of the Rooster River and Ox Brook. Phase I and II flood control measures included reconstruction of the upper and lower Brooklawn Avenue bridges, channelization of the Rooster River from the upper Brooklawn Avenue bridge to upper Laurel Avenue and from lower Laurel Avenue to the lower Brooklawn Avenue bridge, relocation of the Rooster River to an underground conduit between upper Laurel Avenue and lower Laurel Avenue, and relocation of Ox Brook to an underground conduit that begins at Lincoln Boulevard and joins the Rooster River conduit. Small amounts of flow were allowed to remain in the original channels of the Rooster River and Ox

Brook for environmental reasons (FEMA, 2010 and 2013). Despite these flood control projects, flooding still remains a significant issue for many areas of the watershed.

Water quality is the primary focus of this watershed management plan, although water quality and quantity (i.e., flooding) issues are closely related in terms of watershed resource management. This watershed based plan, although not intended as a comprehensive flood mitigation plan, also addresses flooding due to the prevalence of flooding and significant attention that flood mitigation has received in all three watershed communities, particularly in the face of climate change and the potential for more frequent and intense storms in the future.

The flooding-related recommendations in this watershed plan are intended to supplement previous and ongoing flood mitigation efforts in the watershed. These recommendations focus on an integrated, watershed-based approach to addressing flooding, water quality, and habitat restoration. The emphasis is on restoring the functions, and often the forms, of the resources provided by natural riverine, wetland, and estuarine systems, which is a change from past, conventional approaches to watershed development. The recommended approaches include elements of the traditional FEMA Flood Insurance programs for planning and restoration of riverine corridors (insurance claims, adaptation-avoidance by elevating structures, discouraging future development activities within flood prone areas, floodplain easements, etc.), as well as other approaches such as green infrastructure, which recognize that flooding damage in urban and suburban areas is not confined to floodplains (Center for Neighborhood Technology, 2013).

Recommended Actions

- The watershed communities should adopt a policy of no-net-loss of flood storage capacity or flood conveyance within the Rooster River watershed.
- The watershed communities should adopt the anticipated regional Natural Hazard Mitigation Plan prepared by the Greater Bridgeport Regional Council, which should incorporate reference to and recommendations of the Rooster River Watershed Based Plan.
- Restore floodplain storage in the lower watershed by excavating fill and removing flood-prone structures.
- In the upper watershed, emphasize infiltration using LID and green infrastructure techniques, restore detention capacity, no-net-loss of flood storage capacity or flood conveyance due to floodplain encroachment, and removal of fill and restoration of floodplain and natural channel meanders.
- Remove, redesign and reduce in-channel and in-floodway structures and restore channels, floodways and floodplains.
- Conduct a watershed-wide study of the river hydrology and geomorphology to better understand the urban river system and develop coordinated, watershed-wide water quality and flood

Use of Green Infrastructure and Other Innovative Approaches to Urban Flooding

Green infrastructure and other techniques are recommended to address urban flooding problems in the watershed. These recommendations focus on an integrated, watershed-based approach to addressing flooding, water quality, and habitat restoration. The emphasis is on restoring the functions, and often the forms, of the resources provided by natural riverine, wetland, and estuarine systems, which is a change from past, conventional approaches to watershed development.

mitigation recommendations, including consideration of green infrastructure approaches as an alternative to conventional flood mitigation measures.

- Incorporate updated design storm rainfall amounts into local land use regulations and policies to account for the influence of climate change.
- Ensure that future flood mitigation projects and designs include provisions for water quality and riparian/aquatic habitat restoration. Provide or maintain vegetated buffers around all watercourses and wetlands where feasible.
- Assess the vulnerability of public and private infrastructure (e.g., utilities, transportation, structures) to climate change and increased frequency of extreme storms, sea level rise, etc. Develop adaptation strategies for the watershed communities.
- Evaluate municipal policies, plans, and regulations that may adversely affect the river system, such as increased development and density without concomitant improvements in stormwater runoff and water quality, detention, groundwater recharge and flood mitigation.
- Engage federal and state agencies on available assistance and resources in order to develop and implement engineering solutions to address current flood problems.

Updated Design Storm Rainfall Amounts

The National Oceanic and Atmospheric Administration National Weather Service is updating precipitation frequency data (i.e., design storm rainfall amounts). A similar tool for updated extreme precipitation data was developed as a joint collaboration between the Northeast Regional Climate Center and the USDA Natural Resources Conservation Services, http://precip.eas.cornell.edu, for New York and New England. The design storm rainfall amounts provided by this web tool offer significant advantages over previous products (e.g., "Rainfall Frequency Atlas of the United States", Technical Paper No. 40, U.S. Department of Commerce, Weather Bureau and NOAA Technical Memorandum "NWS Hydro-35", June 1977, U.S. Department of Commerce, National Weather Service) since the design storm rainfall amounts are based on a much longer period of record, including future updates as new rainfall data is available.

3.4.3 Preserve and Protect Open Space

Open space plays a critical role in protecting and preserving the health of a watershed by limiting development and impervious coverage, preserving natural pollutant attenuation characteristics, and supporting other planning objectives such as farmland preservation, community preservation, and passive recreation. Open space includes preserved natural areas as well as lightly developed parks and playgrounds.

There are several common methods that undeveloped land can be preserved and protected as open space. These include outright purchase, conservation easements, restrictive covenants, purchase or transfer of development rights, tax lien procedures, and land donations. Regardless of the mechanism, critical to the success of protecting open space land is the ability to readily leverage financing when windows of opportunity arise to acquire or preserve significant parcels.

Approximately 12.5% of the Rooster River watershed consists of open space including municipally-owned parks, cemeteries, golf courses, and schools. Preserved open space that is protected against future

development or is unlikely to be developed in the future accounts for approximately 4.6% of the watershed. A key objective of this plan is to manage, maintain, and promote existing open space and continue to protect and acquire open space that meets resource protection and recreational goals in concert with development and redevelopment efforts within the watershed. The watershed communities have identified open space protection goals and priorities within the watershed primarily through their Plans of Conservation and Development.

Recommended Actions

- The watershed municipalities should work closely with land owners to protect and/or acquire unprotected open space as recommended in this watershed management plan, the municipal Plans of Conservation and Development, and related open space planning efforts.
- Plan and provide for public access to open space areas, and connect existing open spaces to avoid open space fragmentation. Obtain public access easements from property owners to link open space areas. For example, where the Town of Fairfield now has sanitary trunk sewer easements from Riverside Drive and Turney Creek across Post Road and extending up through the public 10-acre conservation/open space area at Metro Center, through the public creek-side access path along BJ's shopping area and linking up to the Railroad bridge foundation footpath to Commerce Drive/Rutland-Royal Avenue, and thence linking up with Fairchild Avenue and the sanitary sewer easement (after obtaining a public access easement) up to the Kings Highway East bridge; and/or a continuing public access extension along the Mount Grove Cemetery side of the Rooster River/Ash Creek up to North Avenue.
- Ensure that open spaces remain available for passive recreation.
- Assess, improve, and restore parcels already acquired. Develop management plans for the use of acquired parcels.
- Create a watershed-wide "green" map of environmental features and recreational amenities. Promote awareness and appropriate use of existing open space by publicizing parks, trails, community gardens, and historic landscapes as well as educational events on open space parcels.
- Update open space planning documents at least every five years.
- Work with property owners to permanently protect more sensitive portions of their properties with conservation easements and/or the purchase/donation of development rights.
- A variety of open space preservation techniques should be pursued. Financing for open space acquisitions should be leveraged through a coordinated effort between the public and private sectors. Seek alternative funding sources and approaches for open space acquisition such as state funding (e.g., Community Investment Act - Public Act 05-228), limited market rate development on a parcel to help fund the acquisition of the remainder of the parcel as open space, transferring development rights from sensitive locations to locations better suited for development.
- Proposed open space acquisitions should be evaluated based on a set of criteria that considers the environmental and physical characteristics of each property proposed for acquisition. In general, priority for open space protection should be given to properties that meet one or more of the following environmental criteria, in addition to multiple public benefits:
    - Size – Larger parcels provide greater opportunity for contiguous undeveloped areas to benefit wildlife, water quality and provide recreation.
    - Water Resources – Parcels that provide buffers for rivers and streams and associated riparian communities, headwater streams, and coastal areas.

- Wetlands and Wildlife Habitat – Parcels that provide upland buffers around high quality wetlands and habitat areas and that support, enhance or protect biodiversity.
- Floodplain Protection – Parcels in floodplain areas to provide habitat, protect or improve water quality, and preserve natural flood storage or function (to the 500-year flood level).
- Streamflow Protection – Parcels that provide protection of groundwater recharge areas and headwater streams or parcels whose protection would prevent fragmentation of large forest tracts.
- Recreation – Parcels that provide water and land-based recreational opportunities including swimming, fishing, boating, hunting, other water-access, or could accommodate multi-use trails as part of an existing or planned greenway, trail or linear park or provide connectivity of existing trail systems.

- Perform an evaluation of undeveloped and underdeveloped parcels in the watershed based upon the above factors to help identify open space protection priorities. Consider two types of open space protection – acquisition or protection through a conservation easement or restriction. Parcels that are currently undeveloped should be assigned higher priority for acquisition, while those parcels that are partially developed but have potential for future development should be assigned higher priority for a conservation restriction.

3.4.4 Increase Public Access to the River

An objective of this watershed management plan is to increase public access to the Rooster River/Ash Creek and their tributaries to enhance recreational opportunities as well as public appreciation and stewardship of the river and estuary, while balancing the interests of competing uses.

Recommended Actions

- Develop a public access area inventory for the Rooster River/Ash Creek and its tributaries that includes a map and listing of the areas summarizing location, size, current and potential uses, and ownership.
- Enhance or provide river access at existing public open spaces, focusing on areas where the river corridor is currently inaccessible.
- Target acquisition of new access points or areas at locations that are underserved by open space or access to the river and with dense residential development within walking distance.
- Public access areas should not adversely affect sensitive areas. Incorporate LID and other sensitive design elements into access area designs.
- Introduce educational signage, interpretive stations, maps and online resources in the design of new or modified public access to waterways and open space areas. Educational signage and informational resources should provide information about the history and natural environment, including water quality and ecological resources, of the Rooster River and its watershed.

3.5 Education and Stewardship

Goal Statement: Promote stewardship of the Rooster River watershed through education and outreach. Target appropriate messages to specific audiences, and promote stewardship opportunities through partnering with local educational institutions and citizen involvement in science, conservation, and restoration activities.

An overarching goal of this watershed management plan is to modify the behaviors of individuals and the public to affect a positive change in the watershed. Often, the public is not aware of the critical role they have in protecting water resources. Public education is critical to the long-term success of watershed management because it raises awareness of both personal responsibilities and the responsibilities of others relative to environmental protection and teaches people about individual actions they can take to protect and improve water resource conditions in their watershed. This increased understanding has the additional benefit of fostering support for watershed management efforts and cultivating a long-term environmental watershed stewardship ethic, particularly with respect to the benefits of green infrastructure.

Although the three watershed municipalities have unique watershed management issues, there are several education and outreach objectives that can be implemented in each. Each municipality could provide education for: a) the general public and youth in particular; b) municipal boards, commissions and employees; and c) business and landowners. A second common objective could be to promote public stewardship of the watershed by continuing engagement activities, such as clean-ups, stream walks and other field assessments, invasive plant removals, streambank buffer plantings, and river festivals/events. Another recommendation is to create an interactive website and social media tools to inform the public about watershed quality issues and accomplishments, and to advertise public stewardship opportunities.

Four primary target audiences have the greatest potential to affect long-term change and improve water resource conditions in the Rooster River watershed:

- Municipalities
- Businesses
- Homeowners and residential land use
- Students (K-12)/higher education

Education and outreach recommendations that are tailored to each of these audiences are described in the following sections. Watershed public outreach and educational programs will coordinate with existing education and outreach programming of the U.S. Environmental Protection Agency, Connecticut Department of Energy and Environmental Protection, Southwest Conservation District, Connecticut Nonpoint Education for Municipal Officials (NEMO), Connecticut Sea Grant, Trout Unlimited, Beardsley Zoo, The Discovery Museum and Planetarium, Groundwork Bridgeport, Bridgeport Conservation Corps, and other state and local non-profit education and outreach programming.

3.5.1 Develop and Maintain Website

An important objective of this watershed plan is to develop and maintain an interactive website in combination with the use of social media tools to inform the public about watershed issues, restoration activities and accomplishments, plus advertise public engagement and education opportunities.

Recommended Actions

- Develop and host a website for the Roster River Watershed Based Plan. The website should be completed within 6 months of the completion and acceptance of the watershed plan. The Greater Bridgeport Regional Council may consider developing and hosting the website similar to the website that exists for the Pequonnock River Watershed Initiative.
- Build a master list of volunteers, advocates, and interested followers. A database of names and e-mail addresses of people interested in the Rooster River Watershed has been created during the watershed planning process, including the members of the steering committee and the members of the public who attended the public meetings. The website will help garner additional public support and involvement in plan implementation. The website should have an application to allow people to sign-up for electronic newsletters and informational blasts.

3.5.2 Advance Local Government and Business Community Awareness

A variety of institutional land owners – i.e., local government and businesses community – are either located or maintain property within the Rooster River watershed. Examples of institutional land owners in the watershed include golf courses (Fairchild Wheeler Golf Course and Brooklawn Country Club); cemeteries; office/commercial/industrial parks; educational campuses; wildlife sanctuaries and open space owners; shopping centers, highways, parkways, railroads, and thruways with median-dividers and corridor land; cross-country utilities (gas, oil, electric, etc.) and their easement holders; and civic, community and fraternal organizations.

Recommended Actions – Outreach and Education for Local Government

A key objective of the this plan is to advance local government awareness, understanding, and stewardship of the Rooster River watershed through pollution prevention, best management practices education, regulatory enhancements, and involvement in watershed restoration activities. Municipal operations and facilities such as public works yards, street and bridge maintenance, winter road maintenance, stormwater system maintenance, vehicle and fleet maintenance, parks and open space maintenance, and municipal building maintenance can impact water quality by contributing pollutants to the storm drainage system or directly to surface waters or groundwater. Improving the awareness of municipal employees about the potential impact of their operations on the water quality and environmental resources of the Rooster River and its watershed is an important objective.

The science of watershed protection, including management and regulatory mechanisms that promote and protect watershed resources, has advanced significantly over the past decade. For example, many communities in Connecticut have adopted regulations promoting or requiring the use of LID and green infrastructure techniques. Volunteer members of land use commissions within the watershed should be provided educational opportunities to learn about advancements in watershed science and protection, and the regulatory enhancements being implemented in other communities in Connecticut. Recommendations include:

- **Develop Watershed-Wide Drainage Infrastructure Mapping** – Develop GIS mapping of the drainage infrastructure throughout the entire watershed. While each municipality is required to map their respective stormwater outfalls and associated drainage infrastructure to comply with the MS4 Permit, consistent drainage infrastructure mapping does not exist for the entire watershed. The mapping should identify municipal jurisdictions; MS4 versus non-MS4 areas; areas that drain directly into surface waters without stormwater controls; and areas that drain directly to sensitive resources, such as wetlands and unique habitat areas. The drainage infrastructure maps would provide a tool for enhanced inter-municipal coordination relative to the MS4 Permit stormwater management requirements. These efforts should be coordinated with the municipal WPCAs.

- **Provide Annual Municipal Pollution Prevention Training** – Municipalities should provide annual pollution prevention and good housekeeping training for all municipal employees whose activities potentially impact stormwater and water quality. The training should include municipal personnel with responsibility for public works, parks and recreation, building maintenance, lakes and pond management, and water/wastewater.

- **Provide Training for Municipal Reviewers and Designers** – Implementation of the proposed regulatory changes described under the Sustainable Land Use and Open Space goal of this plan requires effective education and outreach to both municipal reviewers (municipal land use commissions and boards, planners, etc.) of land development projects and designers (developers, architects, engineers, contractors, etc.). The focus of training topics will be different from municipality to municipality due to the differing characteristics of existing development, infrastructure, and natural resources in each community. Suggested training topics include riparian buffer protection, LID and green infrastructure, construction erosion and sediment control, and post-construction stormwater standards.

  Juliana Barrett of Connecticut Sea Grant (a program of the University of Connecticut and the National Oceanic and Atmospheric Administration) and other staff with the Connecticut Nonpoint Education for Municipal Officials (NEMO) program have developed municipal training materials on the importance of riparian buffers and their protecton. Juliana and the NEMO program are excellent local resources to provide training for land use commissioners in the watershed communities. Successful riparian corridor programming has also occurred in the Niantic River Watershed towns of Waterford, East Lyme, Salem and Montville.

  The Watershed Management Program of the CTDEEP has been recently involved with ten grant projects under the Municipal Land Use SEP fund from towns in the Farmington River Watershed. The final product for these grant projects are revisions to local land use regulations

and ordinances that incorporate and remove barriers to LID. Staff from the CTDEEP Watershed Management Program has led workshops for municipal public works and other staff on topics ranging from municipal facility pollution prevention to LID and green infrastructure. It is recommended that the watershed municipalities, through the future Rooster River watershed organization, coordinate a workshop inviting CTDEEP Watershed Management Program staff to provide a presentation for the land use commission members of the watershed municipalities, as well as designers from the greater watershed area.

Additionally, Michael Deitz, Connecticut NEMO Program Director, and Roman Mrozinski, Executive Director of the Southwest Conservation District, are available as excellent local resources to provide educational programming for municipal reviewers and designers.

- **Require Training for Municipal Building Inspectors** – Building inspectors in Connecticut must earn a requisite amount of continuing education credits each year. Existing training programs often do not address stormwater, LID, green infrastructure or erosion and sedimentation control methods. Building inspectors in each watershed municipality should be required to receive regular training on these topics. Additionally, training should also be required on sanitary sewer and stormwater connection inspections.

- **Involve Municipalities in Restoration Activities** – Continue to invite and involve the municipal staff and land use commission members in upcoming Rooster River restoration projects, outreach events, and clean-ups.

Recommended Actions – Outreach and Education for the Business Community

Various businesses are located within the Rooster River watershed. Whether located directly adjacent to the river or in upland areas of the watershed, all businesses contribute in some way to stormwater runoff that ultimately reaches the Rooster River. An objective is to advance local business awareness, understanding, and stewardship of the Rooster River watershed through pollution prevention and best management practices education, and involvement in watershed restoration activities. Recommendations include:

- **Conduct Outreach for Targeted Businesses** – Focus education and outreach efforts on the types of businesses in the watershed whose activities have the potential to impact water quality (e.g., heavy and light industry, commercial retail centers, landscaping companies, private golf courses, and restaurants). The education and outreach programs could consist of a variety of printed and electronic media, seminars and workshops, and training opportunities such as a training and certification program for local landscapers in the use of environmentally-sensitive lawn care practices. The City of Bridgeport provided training for area landscapers in 2010 using resources from the EPA GreenScapes program. It is recommended that this program be continued and broadened to reach landscapers and landscape designers throughout the watershed.

- **Involve Businesses in Restoration Activities** – Continue to invite and involve businesses in upcoming Rooster River restoration projects, outreach events, and clean-ups.

Recommended Actions – Outreach and Education for Institutional Land Owners

Management and maintenance practices at institutional facilities with large intensively managed lawn areas and expansive parking lots can have a significant impact on the water quality within the Rooster River watershed. Large institutional land owners, therefore, play an important collective role in protecting water quality. Recommendations include:

- **Develop and Host Workshops** – The future Rooster River watershed organization should develop and host workshops on best practices and local resources regarding management and maintenance practices at parks and institutional facilities. Topics could include:
    - Integrated Pest Management (IPM)
    - Turf management and low fertilizer usage
    - Grass clippings management and leaf/brush waste management
    - Restoration of riparian buffer areas
    - Parking lot and road maintenance (deicing, snow management)
    - Drainage system maintenance (catch basins, storm drains, stormwater BMPs)
    - Water quantity and flooding issues
    - Low Impact Development and green infrastructure approaches

  A wealth of local, state, and national resources and educational materials already exists on many of these topics. Workshop content should be developed in coordination with the Southwest Conservation District, Connecticut Sea Grant, Connecticut NEMO, Natural Resources Conservation Service, EPA-Long Island Sound Study, and the Connecticut Nursery and Landscape Association. Consideration should be given to provide funding and/or project assistance incentives for facility and park managers who complete the program.

3.5.3 Conduct Homeowner Outreach and Education

An objective of the watershed plan is to build awareness of land stewardship and management practices and reduce nonpoint source impacts associated with residential land use, which comprises approximately 58% of the watershed land area. Homeowner education and outreach efforts should be tailored to the most common types of residential activities in the watershed that pose a risk to water quality. These activities include lawn and landscape maintenance, fertilizer and pesticide use, alteration of backyard riparian areas, rooftop runoff connections to the storm drainage system, and pet waste.

Promote Rooftop Disconnection

Residential areas in the watershed contribute significant quantities of rooftop runoff to the storm drainage system. Opportunities exist to disconnect residential rooftop runoff from the storm drainage system and reduce the quantity of runoff by redirecting the runoff to pervious areas or through the use of rain barrels or rain gardens.

Downspout disconnection (also referred to as "roof leader disconnection") is a cost-effective on-site option for reducing the volume and cost of stormwater that requires public management. Downspout

disconnection has a number of economic and environmental benefits to the municipality and the property owner. The major benefits include:

- Reduces volumes of flows conveyed and resulting loads to watercourses
- Reduces the volume of flow to the municipal storm drainage system (MS4) and combined sewer systems
- Increases infiltration and groundwater recharge
- Provides options to reuse rainwater

Individual rooftop retrofits target a small area, requiring the participation of many homeowners to make a measurable difference across a watershed. As a result, a coordinated effort is required for widespread participation in such a program, which typically includes a combination of targeted education, technical assistance, and financial subsidies to homeowners or the business community. Examples of effective local downspout disconnection programs are presented in *Urban Stormwater Retrofit Practices* (CWP, 2007).

Recommended actions include:

- Encourage disconnection of rooftop runoff from the storm drainage system and impervious areas to reduce the quantity of runoff by redirecting the runoff to pervious areas, through the use of dry wells, compost-amended soils (in areas with poorly-drained soils), or through the use of rain barrels or rain gardens.
- Disseminate educational materials on designing, constructing or installing, and maintaining residential rain gardens and rain barrels. The Connecticut NEMO web site provides a wealth of information about residential rain gardens: http://nemo.uconn.edu/tools/stormwater/rain_garden.htm
- Consider rain barrel incentive program options for residents and business owners for those who purchase a rain barrel, such as monetary credit toward a utility bill or subsidized give-away programs, through grant funding or other revenue sources. The City of Bridgeport, through its BGreen initiative, has begun a free rain barrel roll-out program, using its Conservation Corps to disseminate information to City residents about the benefits of rain barrel installation. It is recommended that this program be continued and refined for potential replication throughout the watershed area.

Promote Sustainable Lawn and Landscape Maintenance

Promote sustainable lawn care and landscape maintenance practices. Educate homeowners about the impacts of lawn care practices on water quality and encourage the use of residential lawn care BMPs such as reducing or eliminating fertilizer and pesticide usage through the use of slow release fertilizers and fertilizer application timing; utilizing alternative landscaping that decreases maintenance; soil testing and non-chemical lawn care measures. Provide financial incentives for individual residences and local businesses to purchase and use non-harmful fertilizers and pesticides.

Extensive educational materials are available on these topics, including several brochures and resources that can be found on the Southwest Conservations District's web site: http://conservect.org/southwest/Education/tabid/267/itemid/121/Default.aspx

Connecticut's new law regulating the use of phosphorus on established lawns went into effect on January 1, 2013. Golf courses and agricultural land are exempt from this regulation. A law is summarized at: http://www.cga.ct.gov/2012/ACT/PA/2012PA-00155-R00SB-00440-PA.htm

Other resources include the EPA's GreenScape program, and more locally, the UCONN Cooperative Extension System's Home & Garden Education Center. The Home & Garden Education Center's web site, along with information on their soil testing services can be found at: http://www.ladybug.uconn.edu/index.html

Also work with and provide outreach to local landscapers regarding alternative landscaping and lawn care practices. Potential outreach programs, which can be developed in partnership with local land trusts and garden clubs, could include:

- Identifying and promoting sustainable landscape provider certification programs
- Developing a placard campaign to identify lawns that implement preferred practices
- Develop a sustainable lawn care and gardening recognition and incentive program, with landscapers and homeowners highlighted on a rotating basis, or institute an alternative landscape competition. The Environmental Concerns Coalition of Milford, Connecticut, has developed a very successful organic lawn care competition and incentive program called "Freedom Lawns", and their brochure and program can be found at: http://www.milfordecc.com/freedom_lawn/info.html. Another successful homeowner incentive program has been developed by Lake Champlain International called the BLUE® Certification Program, which can be found at: http://www.mychamplain.net/blue-program

Promote Backyard Habitat

Encourage the creation of backyard habitat in residential areas near stream corridors, including the importance of maintaining healthy vegetated buffers to streams, ponds, and wetlands, and recognize the efforts of the public. Take advantage of existing programs, such as Audubon's backyard program, and programs from the EPA- Long Island Sound Study and Connecticut Sea Grant.

Foster Neighborhood Stewardship

Foster a neighborhood "block-by-block" approach for the restoration and conservation of streams, ponds, and shoreline areas by providing educational materials and technical guidance. A neighborhood stewardship approach encourages neighbors to "self-organize" around shared interests, such as removing invasive species and restore native vegetation that serves as habitat for migratory birds. Homeowners are often willing to undertake environmental improvement projects – and assist with the labor – yet recognize the need for technical guidance.

Continue to promote public stewardship of the watershed by continuing public engagement activities, such as clean-ups, stream walks and other field assessments, invasive plant removals, streambank buffer plantings, and river festivals/events.

Increase Watershed Stewardship Signage

Stewardship signage can be an effective way of educating the public on the importance of preserving natural resources and common ways in which they may be impacting these resources. The general public is often unaware of the cumulative effects of their every-day activities. Signage can play an important role in making the connection between every-day activities and their sometimes harmful results. Educational signage can take the form of kiosks in public areas, storm drain markers or stencils, anti-dumping signs, proper pet waste management signs, and roadside/stream side signage (examples include "adopt a stream/roadway" programs).

Storm drain stenciling and other watershed stewardship signage is already present in many areas of the watershed. Storm drain stenciling or other forms of stewardship signage could be expanded to other areas of the watershed, targeting commercial and additional residential areas that are currently under-served. Interpretive educational signage is also recommended in highly-visible public areas of the watershed such as municipal facilities (schools, town offices, parks, libraries, etc.), in public access areas along the river, and along the existing and planned greenway/bike trails.

3.5.4 Enhance School Education and Stewardship Programs

The Mill River Watershed Association has been coordinating with Fairfield schools to teach a comprehensive watershed-based educational curriculum. Certain Connecticut magnet schools have also incorporated watershed-based programming into their curriculums. Such programs should be used as models for new or expanded educational programs for schools in the Rooster River watershed that don't currently provide watershed-based programs.

Identify Target Schools for Educational Programs

Work with the Bridgeport, Fairfield, and Trumbull school districts to identify specific schools and grade levels that would benefit from new or expanded watershed or related environmental education programs.

Develop a Watershed-Based Curriculum

Using existing educational materials available through the EPA-Long Island Sound Study, Connecticut Sea Grant, CTDEEP, Southwest Conservation District, the Mill River Watershed Association, and area colleges and universities, develop a watershed place-based K-12 curriculum that emphasizes the ecology of Long Island Sound, the Ash Creek estuary, and the Rooster River and the inter-relationship between the these water resources and their watershed(s). The curriculum could combine lessons, field activities, classroom experiments, and regional networking into learning activities that build shared scientific knowledge and stewardship experiences. Individual curricula could be tailored to specific age groups. The program should focus on issues of relevance in the watershed, such as the impacts of pathogens and other point and nonpoint source pollutants on water bodies and management/restoration techniques to address these problems.

Develop a Place-Based Toolkit to Accompany the Curriculum

Work with K-12 educators within the watershed as well as with area higher-education teacher training programs to build a place-based educational "toolkit" to accompany the watershed-based curriculum.

The "toolkit" could include recommendations for field research and documentation (photographs and GIS mapping) that can link into an online network, allowing for both internal and external (public) postings. Activities would provide opportunities for students to experience the watershed resources first-hand by getting their feet wet and hands dirty. Guidelines for learning activities would conform to state curriculum standards.

Establish a Stewardship Work Program

Establish a formal program for high school and college students to participate in watershed stewardship efforts such as beach and stream cleanups, invasive species removal, trail and park maintenance, and ecological restoration projects.

In Bridgeport, high school students have few job opportunities in the summer months and youth unemployment is high. Explore opportunities where youth job creation can be facilitated and focused on environmental stewardship and maintenance of the Rooster River watershed. A partnership with Groundwork Bridgeport could be created for this purpose.

4 Site-Specific Project Concepts

Site-specific restoration or retrofit concepts were developed for selected sites using a two-step approach. First, a desktop screening-level review was performed to initially identify potential areas of the watershed with the greatest feasibility for stormwater retrofits. This screening-level review considered watershed characteristics such as soils, land use, land ownership, and proximity to surface waters and identified impairments. Field inventories were then conducted in May 2013 within areas identified by the screening-level review, and retrofit concepts were developed for the most feasible sites.

The site-specific project concepts presented in this section are intended to serve as potential on-the-ground projects for future implementation. The locations of the potential projects described in this section are shown in the figure on the next page. They provide examples of the types of projects that could be implemented at similar sites throughout the watershed. It is important to note that the concepts presented in this section are examples of potential opportunities, yet do not reflect site-specific project designs. Property owners and other affected parties are responsible for evaluating the ultimate feasibility of these and similar site-specific concepts.

Preliminary, planning-level costs were estimated for the site-specific restoration concepts presented in this section. These estimates are based upon unit costs derived from published sources and the proposed concept designs. Capital (construction, design, permitting, and contingency) and operation and maintenance costs were included in the estimates, and total annualized costs are presented in 2013 dollars based on the anticipated design life of each restoration concept. A range of likely costs is presented for each concept, reflecting the inherent uncertainty in these planning-level cost estimates. A more detailed breakdown of the cost estimates is included in *Appendix C*.

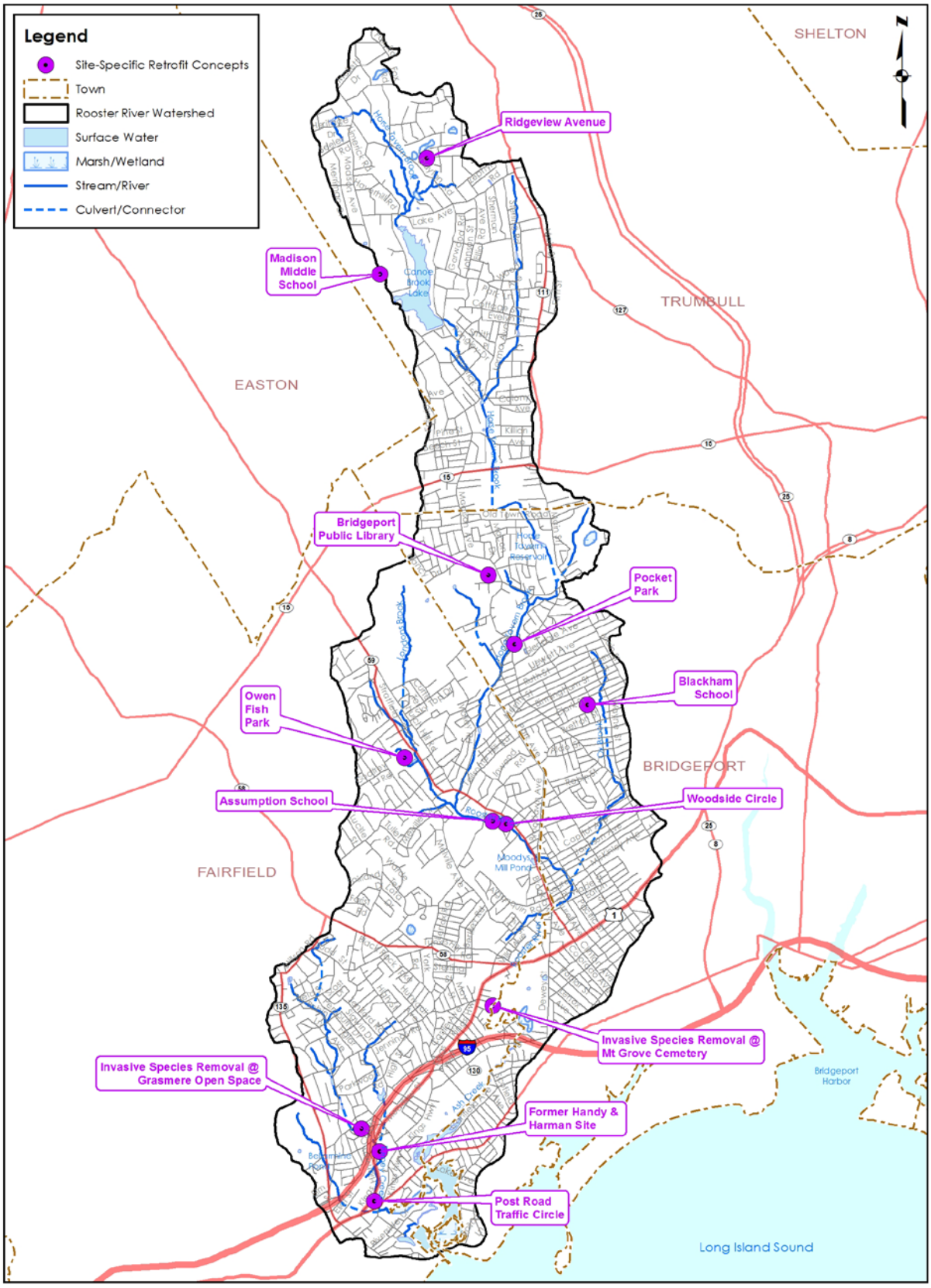


Figure 4-1 Site-Specific Project Locations

4.1 Assumption School Parking Lot Retrofit

Assumption School Parking Lot Retrofit

Location:
Stratfield Avenue, Fairfield
Objectives:
Reduce parking lot runoff via infiltration and bioretention; repair erosion in outflow channel to stream; restore the stream channel behind the school; provide educational elements for students and the public.
Essential Elements:
Bioretention, pervious pavers, vegetated swale, armored outflow channel
Estimated Cost: $76,000 –$164,000

Our Lady of the Assumption School ("Assumption School") is located in Fairfield along Stratfield Avenue. The school is an ideal candidate for green infrastructure retrofits since it is located in close proximity to the Rooster River, which flows adjacent to the school in the rear of the property. There is a large parking area in front of the school that is shared with the church. This is a representative institutional property LID retrofit that could be applied at similar schools, civic buildings, hospitals or other properties with large parking areas throughout the watershed.

Stormwater runoff from approximately half of the paved parking lot drains toward a leak-off that discharges directly to the Rooster River on the western side of the school. The other half of the parking lot drains to the eastern side of the school and also discharges directly to the river. Site drainage is conveyed via sheet flow since there are no catch basins or piped drainage on the site.

The proposed concept for this site, shown in *Figure 4-2,* incorporates LID retrofits without removing any parking spaces by using the existing vegetated areas around the site and by converting a paved area next to the school that is not used for parking into a bioretention basin. The concept also includes stream restoration in back of the school building. The proposed concept includes the following elements:

Pervious Pavement in Parking Stalls with a Vegetated Swale. The existing conventional asphalt pavement within the parking stalls on the western side of the parking lot could be retrofitted with pervious pavement, pervious concrete, or open-jointed block pavers to reduce effective impervious cover and provide stormwater treatment. A vegetate swale would collect runoff that does not infiltrate in the pervious parking area and treat stormwater prior to discharging to the river. A typical pervious parking stall is shown in *Figure 4-3*. Different types of pervious pavement are discussed in *Section 4.2*.

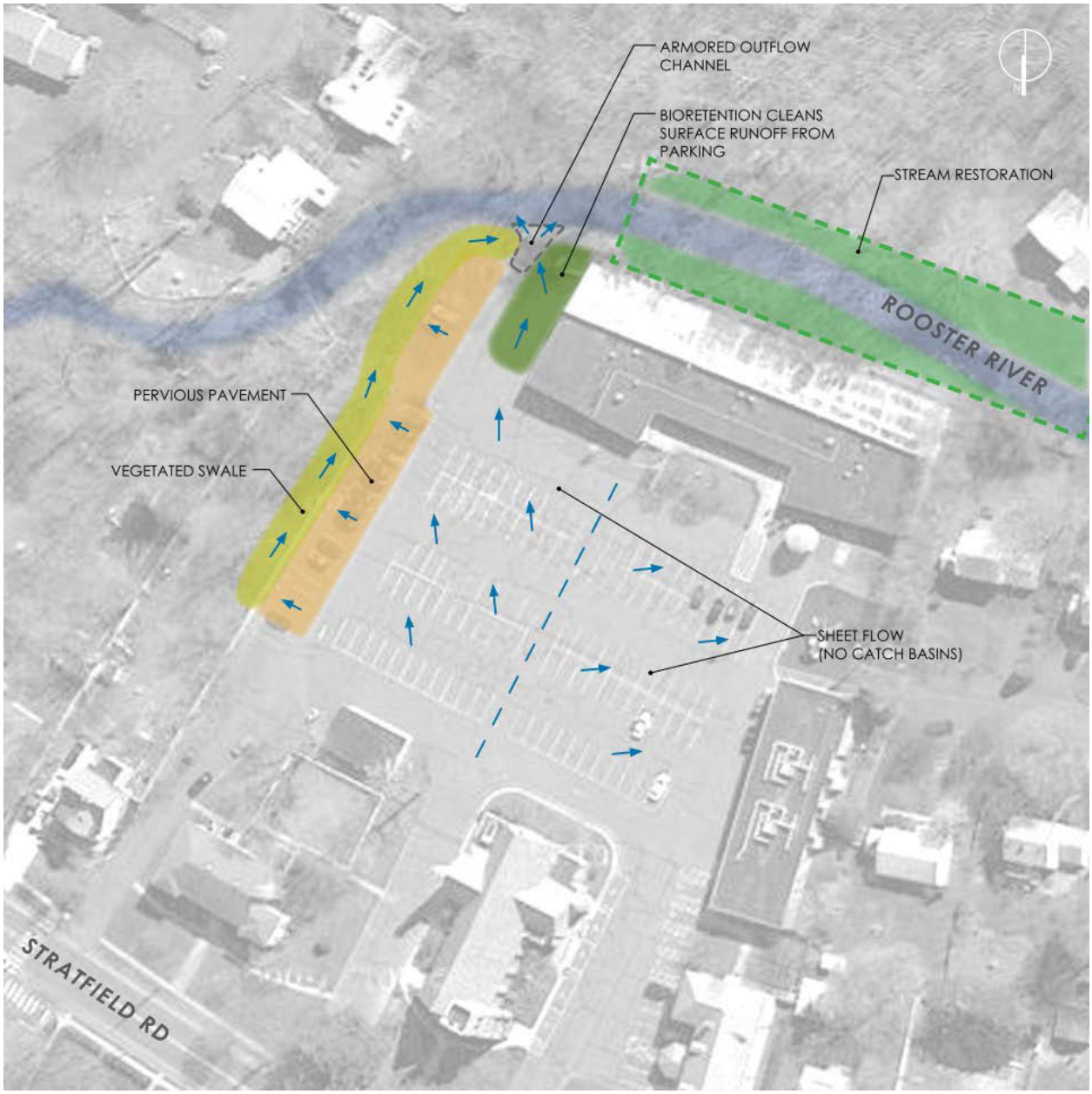


Figure 4-2. Retrofit Concept Plan for Assumption School

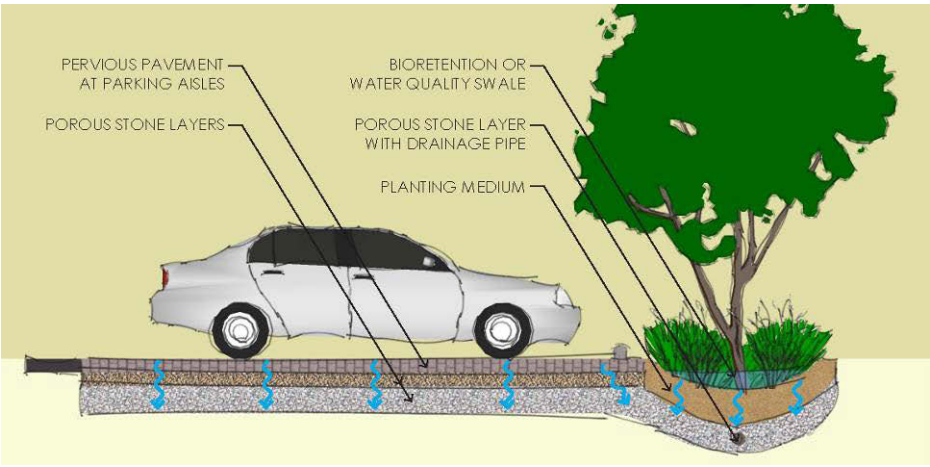
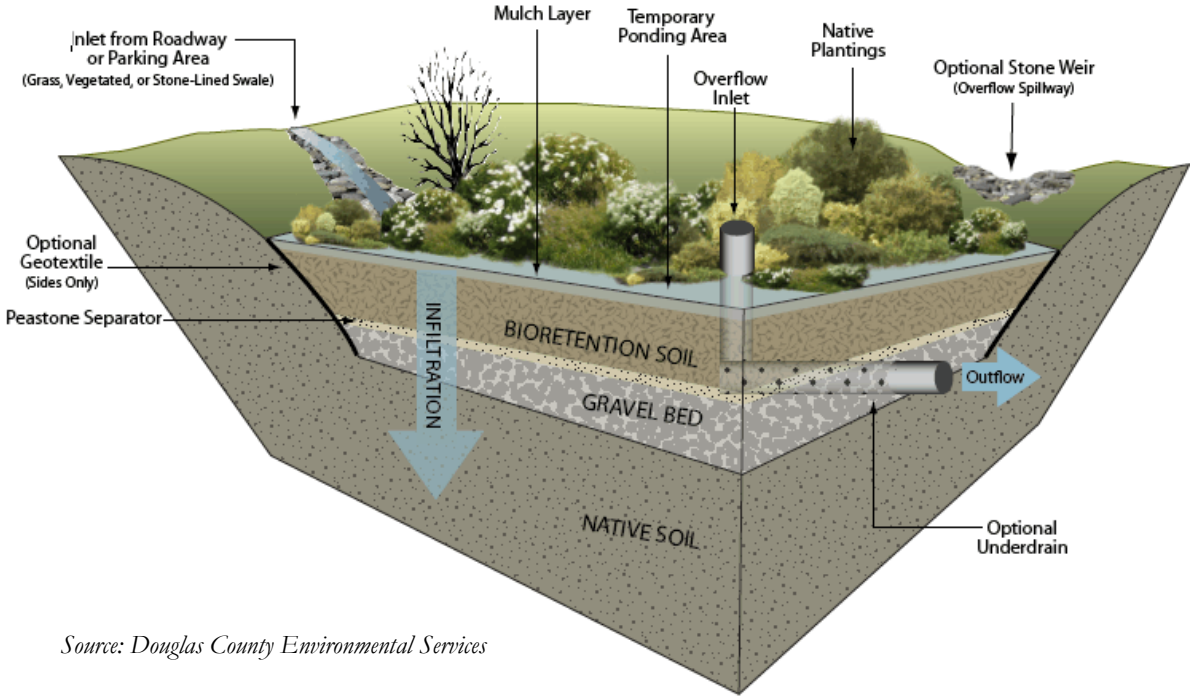


Figure 4-3. Typical Pervious Parking Stalls with Vegetated Swale

Bioretention Area and Armored Outflow Channel. A bioretention area could be installed to treat stormwater from approximately half of the paved lot. This area would capture, treat, and infiltrate runoff prior to discharging it through an armored channel to the river. A schematic of a typical bioretention area is shown in *Figure 4-4*.



Source: Douglas County Environmental Services

Figure 4-4. Typical Bioretention Design

Stream Restoration. The segment of the Rooster River that runs along the rear of the school could be restored to its original channel. Historical fill had been placed in this location and the restoration of this site could include removal of this fill behind the school building and restoration of the original stream channel location.

4.2 Blackham School LID Retrofit

Blackham School is situated in a densely developed urban neighborhood in Bridgeport at the corner of Thorme Street and Amsterdam Avenue. The school grounds contain two baseball fields, a playground, the school building, and associated parking and landscaping. *Figure 4-5* shows the school building and the significant impervious area of the roofs and parking areas around the site. The northern side of the site has plenty of available underutilized lawn area that could accommodate bioretention retrofits; however, the parking lots drain predominantly from north to south, limiting the ability of the northern side of the property to capture and treat on-site runoff. The site drainage is predominantly toward the intersection of Amsterdam and Bretton Street, as evidenced by ponded water and accumulated sediment in the parking lot. The corner of the parking lot was observed to be covered with sediment. However, it may not be possible to eliminate parking spaces for LID retrofits if parking at the school is at capacity.

Blackham School LID Retrofit

Location:
Thorme Street and Amsterdam Avenue, Bridgeport

Objectives:
Reduce parking lot runoff and improve water quality using bioretention areas, permeable pavers, and subsurface infiltration; reduce roof runoff using a green roof; provide educational benefits to school children and the public.

Essential Elements:
Green Roof, Permeable Paver, Bioretention, and Subsurface Infiltration

Estimated Costs:

Green Roof	$213,000 – $456,000
Permeable Pavers	$70,000 - $150,000
Bioretention Areas	$39,000 - $83,000
Subsurface Infiltration Chambers	$76,000 – $162,000
Total Cost:	$398,000 – $851,000

The proposed LID retrofit design for Blackham School involves bioretention basins in existing grass medians or lawn areas that have some impervious areas draining toward them, permeable pavers in the rear lot, and a green or blue roof. Specific elements of the design include:

Green or Blue Roof. Public buildings with large flat roofs are potential candidates for green or blue roof retrofits. Green roofs are engineered planting systems that can be installed on buildings to absorb and retain rainwater, reducing peak stormwater flows and runoff volumes. Green roofs are more costly than conventional roofs but they are capable of absorbing and retaining large amounts of stormwater. In addition, green roofs provide sustainability benefits such as absorbing air and noise pollution, rooftop cooling by reducing ultraviolet radiation absorption, creating living environments for birds, and increasing the quality-of-life for residents.

Blue roofs are non-vegetated rooftop source controls that detain stormwater. Weirs at the roof drain inlets and along the roof can create temporary ponding and gradual release of stormwater. Blue roofs are less costly than green roofs. Coupled with light colored roofing material they can provide sustainability benefits through rooftop cooling. New York City has begun to use blue roofs as part of its green infrastructure strategy for addressing CSOs and stormwater management.

A portion of the school building's roof could be converted to a blue roof or a green roof, as shown in *Figure 4-6 and 4-7*.

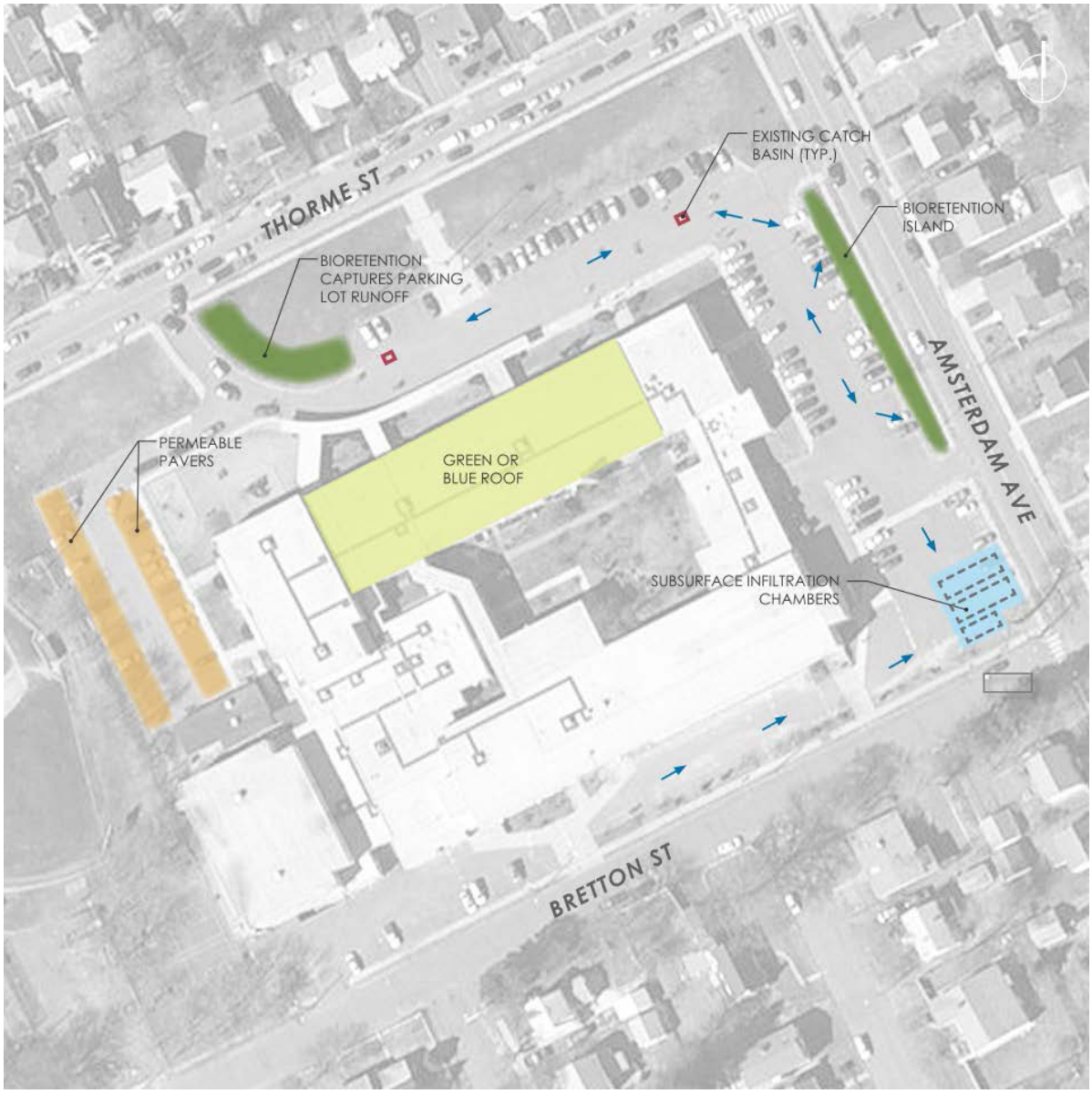


Figure 4-5. Blackham School LID Retrofit Concept

Figure 4-6. Modular Green Roof System Installation

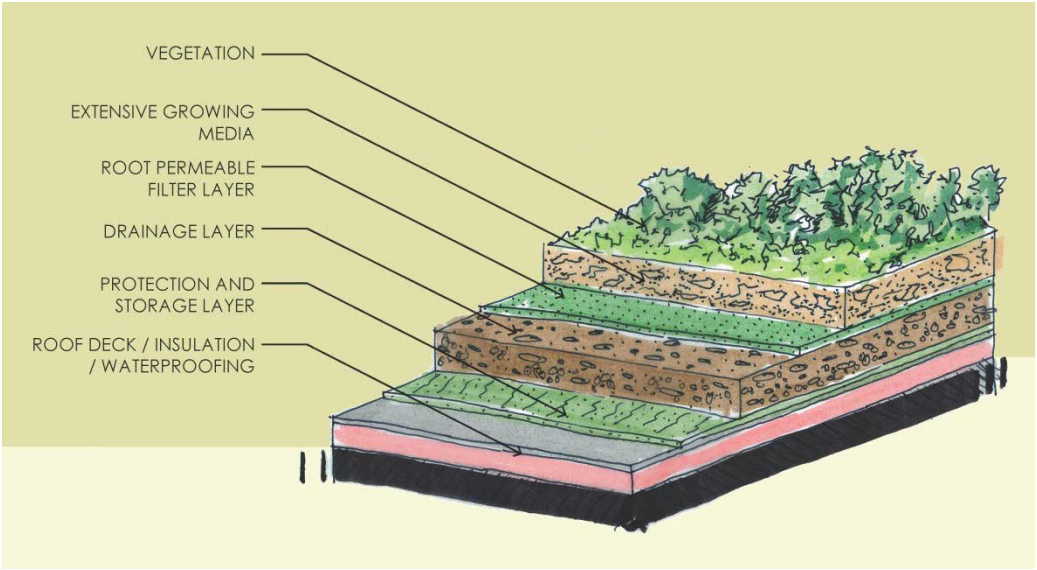


Figure 4-7. Typical Green Roof Design

Bioretention Island. The building's rear entrance along Amsterdam Avenue has a small grass island between the roadway and parking lot that could be converted to a bioretention area to capture, treat, and infiltration runoff from the adjacent parking area during small storms. Additional rain gardens could be created adjacent to the building to treat roof runoff.

Figure 4-8. Before and After Concept Design for a Bioretention Area for the Parking Lot

Source: StormTech Product Manual

Subsurface Infiltrators. A subsurface infiltration system is proposed to receive stormwater runoff from the parking area and infiltrate it through a subsurface galley such as the one shown in the picture to the left. The stormwater infiltrates through the stone bottom. The outlet would tie into the existing piped drainage system along Amsterdam Avenue to avoid water backup into the parking area.

Pervious Pavement. A variety of materials are available to replace conventional paved surfaces (roadway, driveway, and parking) with pervious pavement *(Figure 4-9)*. Pervious pavement material should be selected based on the characteristics of the application. The block pavers are easy to install and relatively inexpensive, but are suitable for applications where vehicle traffic is relatively light.

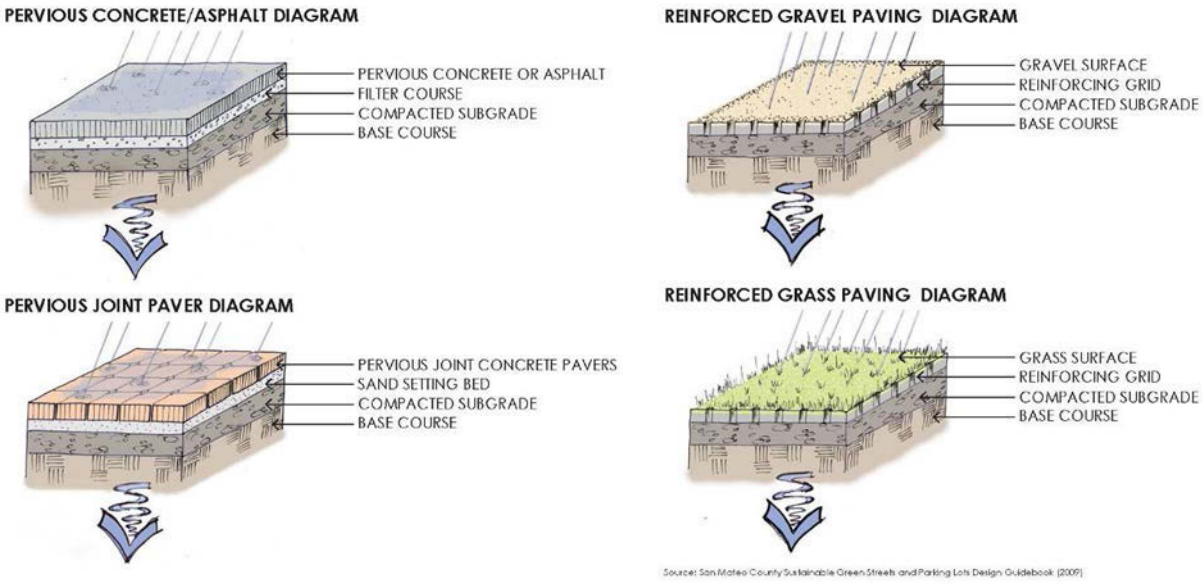


Figure 4-9. Diagrams of Selected Permeable Pavement Systems

Parking spaces in urban areas can be paved with open-jointed block pavers, which are more attractive than pervious asphalt or concrete, but provide a smoother surface and are somewhat more suited to constant vehicle use, although at slow speeds. For areas where heavier traffic loads are anticipated, pervious asphalt or pervious concrete may be more appropriate. These pavements are similar to common asphalt and concrete but are much more permeable and can be used for roadway surfaces.

4.3 Former Handy & Harman Site Flood Storage and Tidal Wetland Restoration

Flood Storage and Tidal Wetland Restoration

Location:
Grasmere Avenue and Kings Highway, Fairfield

Objectives:
Tidal wetland restoration, flood storage, riparian restoration, and pollutant reduction

Essential Elements:
Detention basin for flood storage, and tidal wetland restoration.

Estimated Cost: $56,000 –$120,000

The former Handy & Harman site is located at the corner of Grasmere Avenue and Kings Highway in Fairfield, which was a precious metals refining factory that manufactured sheets, bars, wire and anodes for electroplating and recycled precious metals from scrap. At one time, the facility employed about 430 workers, although it closed in 2002. The site was designated as an EPA Superfund site due to elevated levels of cadmium, arsenic and lead in soil, and dissolved arsenic and mercury in surface water. The portion of the site to the east of Grasmere Avenue was remediated and redeveloped into the "Kings Crossing" retail complex.

The portion of the site that was the former employee lot on the western side of Grasmere Avenue is still vacant and is in need of remediation for hazardous materials. The pavement from the former employee lot is badly deteriorating and is sinking into the encroaching wetland area. The area near Grasmere Avenue, and the western side of the parcel where the Rooster River daylights after flowing through a culvert beneath I-95 and the Route 1 interchange ramps, is

reverting back to tidal wetlands. Restoration of the site could occur after the site is fully remediated for any hazardous materials. A potential restoration concept involves the following elements *(Figure 4-10)*:

Tidal Wetland Restoration. Enhance the tidal wetland area around the existing stream reach between Route 1 and the railroad.

Creation of Detention Area. A proposed outlet structure with a low-flow orifice would allow flood waters to be stored for a short period within a proposed detention area to improve flooding downstream. The proposed forebay at the inlet would provide some water quality benefits at both low and high flows. Lows flows would be conveyed in essentially the same channel as existing conditions.

Figure 4-10. Flood Storage and Tidal Wetland Restoration at the Former Handy & Harman Site

4.4 Invasive Species Removal

Japanese knotweed (*Fallopia japonica*) was identified in many areas of the Rooster River watershed and has displaced native species and threatens local biodiversity and ecosystem function in the watershed. The plant has hollow stems with distinct raised nodes that give it the appearance of bamboo, as shown in *Figure 4-11*, taken along the Rooster River and Turney Creek in the Mt. Grove Cemetery and the Grasmere Open Space Area, respectively. An invasive species management plan could be developed for eradication and control methods within the watershed including planting plans for native vegetation. The Grasmere Open Space Area and the Mt. Grove Cemetery were preliminarily identified and other areas may be identified following a vegetation survey of the watershed.

Invasive Species Removal

Location: Mt. Grove Cemetery, Grasmere Open Space Area, and others
Objectives:
Habitat improvement and public outreach
Essential Elements:
Removal of Japanese knotweed
Estimated Cost:
Mt. Grove Cemetery: $6,000 - $14,000
Grasmere Brook: $6,000 –$12,000

Japanese knotweed in Mt Grove Cemetery

Japanese knotweed in Grasmere Open Space Area

Figure 4-11. Photos of Japanese knotweed in the Rooster River Watershed

4.5 Green Infrastructure Retrofit at Madison Middle School

Madison Middle School is located along Madison Avenue in Trumbull. The school property is located partially within the adjacent Mill River watershed; however, the site is an excellent candidate for a demonstration LID retrofit due to the public exposure, site drainage, and available open space on the site. The school has a three-tiered parking lot that drains stormwater from the school and upper lots into a tributary of the Mill River along Madison Avenue.

Green Infrastructure Retrofit at Madison Middle School

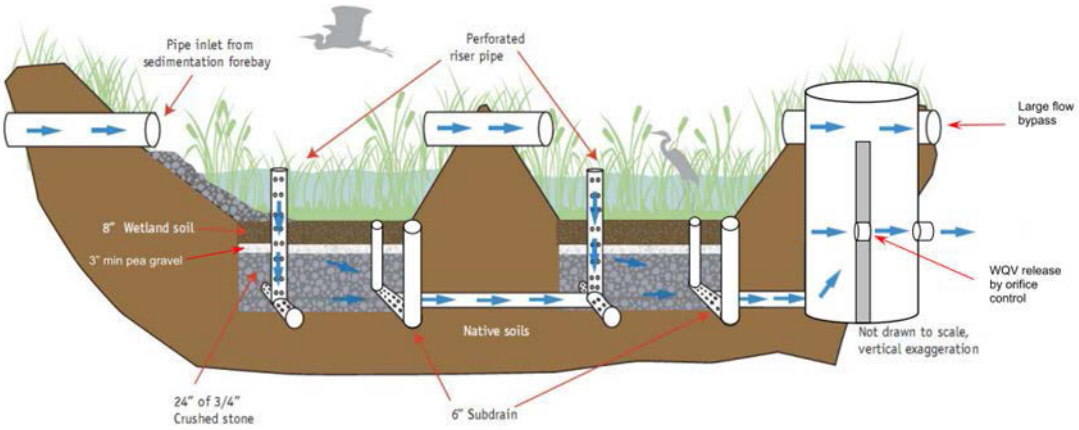
Location: Madison Avenue, Trumbull
Objectives:
Reduce parking lot runoff and remove pollutants with bioretention islands and a subsurface gravel wetland; reduce runoff using permeable pavement on isolated parking lots; install a green roof to reduce roof runoff; and install a rain garden in the front of the school for educational purposes.
Essential Elements: Bioretention, subsurface gravel wetland, and porous asphalt.
Estimated Cost: $204,000 - $348,000

A proposed concept for improving stormwater management at the school is shown in *Figure 4-12* and includes the following elements:

Figure 4-12. School Greening Concept

Bioretention. Construct bioretention areas in traffic islands between parking areas and the student drop-off loop in the back of the school to capture, treat, and infiltrate stormwater. Construct water quality swales or filter strips along the perimeter of the parking area on the south side of the school to capture runoff and sediment from the parking lot. Trees could also be planted along the strip to increase shading of the parking lot.

Subsurface Gravel Wetland. A subsurface gravel wetland is proposed for treating the runoff from the parking areas that does not infiltrate in the bioretention island. The subsurface gravel wetland uses a series of horizontal flow-through treatment cells, preceded by a sedimentation forebay and provides sedimentation, filtration, physical and chemical sorption, and treatment of bacteria (UNHSC, 2009).



Source: University of New Hampshire Stormwater Center (UNHSC), 2009, Subsurface Gravel Wetland Design Specifications.

Figure 4-13. Typical Subsurface Gravel Wetland Design

Pervious Pavement. The two smaller rear parking lots are good candidates for pervious pavement such as porous asphalt or pavers since they do not receive any stormwater run-on and do not have heavy traffic.

4.6 Green Infrastructure Retrofit at Bridgeport Public Library

The North Branch Bridgeport Public Library is located on Madison Avenue in Bridgeport adjacent to Veteran's Memorial Park. The site has a moderate amount of impervious areas associated with the tennis courts, the parking lots and the library roof.

A proposed retrofit concept includes the following features *(Figure 4-14)*:

Green Infrastructure Retrofit at Bridgeport Public Library

Location: Madison Avenue, Bridgeport
Objectives:
Runoff reduction, infiltration, pollutant reduction, and public outreach
Essential Elements:
Infiltration Trenches
Bioretention Islands and Tree Boxes
Sidewalk tree box filters
Rain Garden
Bioretention Area Retrofit.
Estimated Cost: $133,000 –$286,000

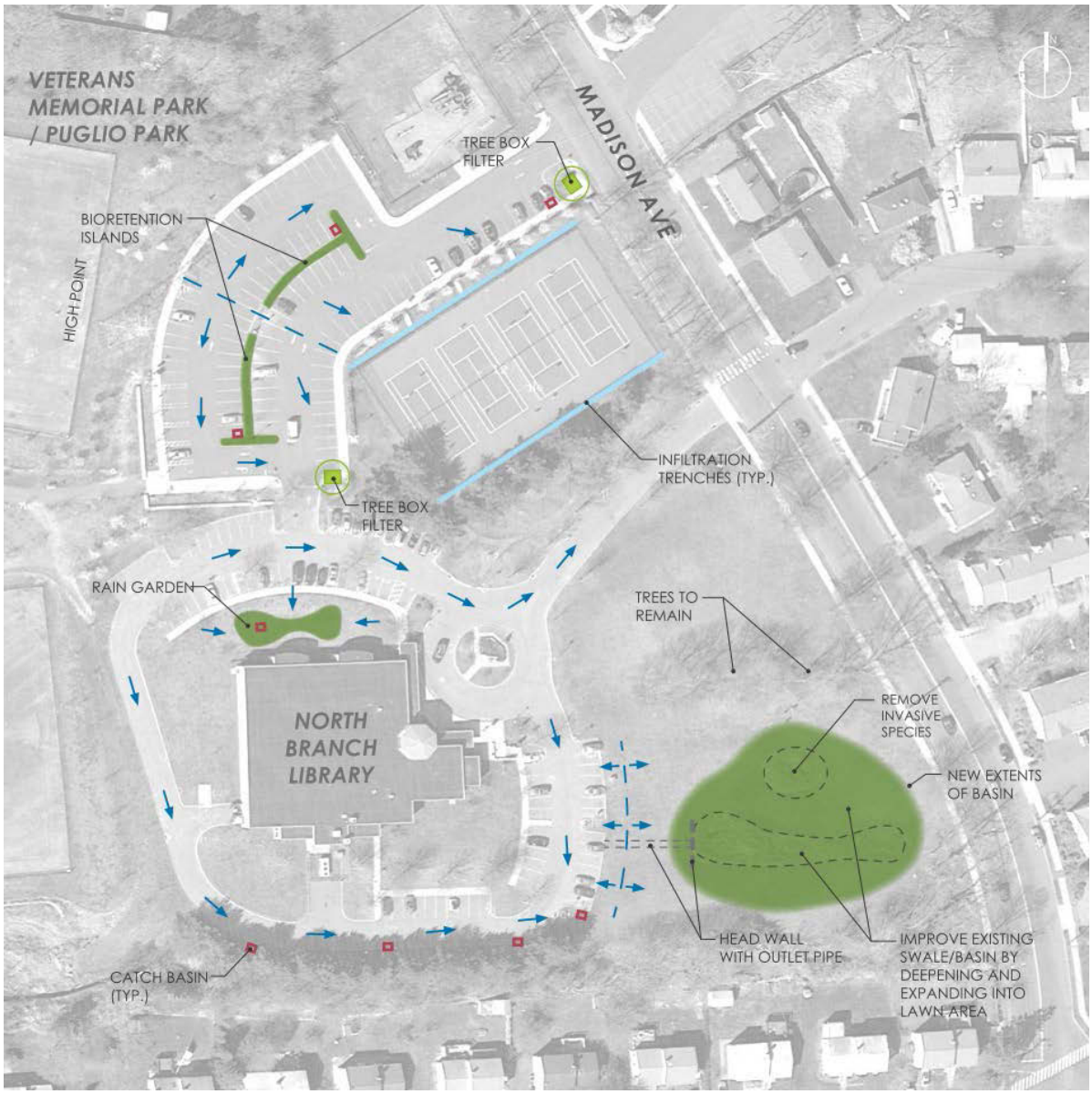


Figure 4-14. North Branch Public Library LID Concept

Infiltration – Tennis Courts. The site appears to have some existing LID features. Linear strips of pea stone or gravel are located around the tennis courts, although they could be enhanced or expanded into infiltration trenches to increase infiltration of runoff from the tennis courts.

Bioretention Islands and Tree Boxes. The stormwater runoff from the parking area adjacent to the tennis courts and playground drains into catch basins at the edges of the parking stalls. The proposed concept includes bioretention islands in the middle of the parking area for the upper parking tier.

Sidewalk Tree Box Filters. Tree box filters could be installed to capture and treat the runoff from the lower parking area during small storms. Tree box filters are a form of bioretention, consisting of precast concrete planters with tops that install flush with the curb. The majority of the device is below ground and includes a soil media to support tree growth and for pollutant removal via filtration. The curb inlet allows stormwater to enter the tree box filter. Trash and debris is deposited on top of the soil media and can be removed, while stormwater is treated as it passes through the soil media. The system can be configured to infiltrate the treated stormwater depending on soil and groundwater conditions. A typical schematic of a tree box filter is shown in *Figure 4-15*.

Existing pea stone/gravel along the tennis courts.

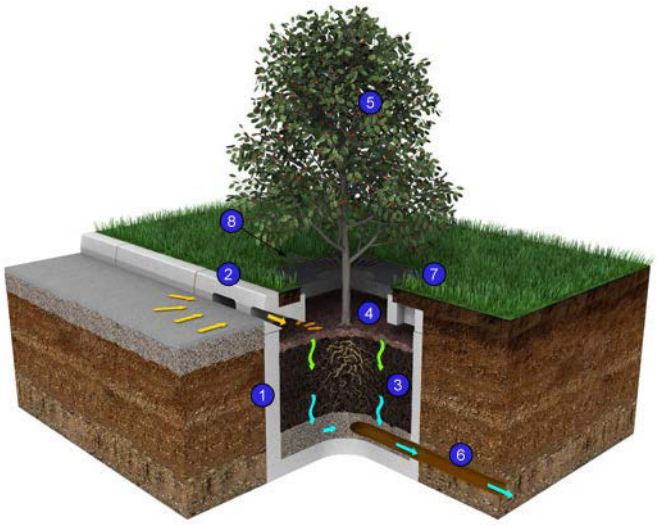


Figure 4-15. Typical Tree Box Filter (Source: Hydro International, Inc.)

Rain Garden. A rain garden is proposed in front of the library, where there is a depressed area in the grass with an existing catch basin, making the area ideal for conversion to a LID feature, which is believed to capture mostly roof runoff.

Bioretention Area Retrofit. The other impervious parking areas around the library generally drain to the east to a common outfall which discharges into an existing bioretention area in the lawn before being conveyed offsite. The existing bioretention area is relatively shallow and could be retrofitted to widen and deepen the basin to enhance the water quality and runoff reduction benefits. Additional benefits of the bioretention area at the library may include benches and picnic areas for outdoor reading or library programming.

Figure 4-16. Existing and Proposed Bioretention Basin at the Bridgeport Public Library

4.7 Green Infrastructure at Owen Fish Park

Owen Fish Park, also called Lilalyn Park, is a recreational field and pond area located along Stratfield Road in Fairfield. The parking area is located in the rear of the parcel adjacent to a tributary to Londons Brook. In this area, London Brook flows north to south along Stratfield Avenue and flows in an underground culvert or a channelized daylighted culvert. The tributary that flows behind Owen Fish Park discharges to the on-site pond and then flows over a dam into Londons Brook prior to reaching the confluence with Horse Tavern Brook and forming the Rooster River.

Green Infrastructure at Owen Fish Park

Location: Stratfield Road in Fairfield
Objectives:
Retrofit the parking lot to provide water quality treatment prior to discharge to the tributary stream and riparian buffer restoration along a highly visible area within the park.
Essential Elements:
Parking Lot Retrofit and Riparian Buffer Restoration
Estimated Cost: $14,000 –$30,000

A proposed retrofit concept for Owen Fish Park consists of the following elements *(Figure 4-17)*:

Parking Lot Retrofit and Riparian Buffer Restoration. The parking lot at the site is dilapidated. Runoff from the eastern half of the lot flows toward a catch basin, which pipes water into the pond on the southeast side of the site. The western half of the parking lot flows via sheet flow into the tributary. There is space at the edge of the parking lot to construct a vegetative swale to treat the parking lot runoff and to create a riparian buffer. Decreasing direct runoff to the stream would help lower a potential source of bacteria and other pollutants to the pond and Londons Brook.

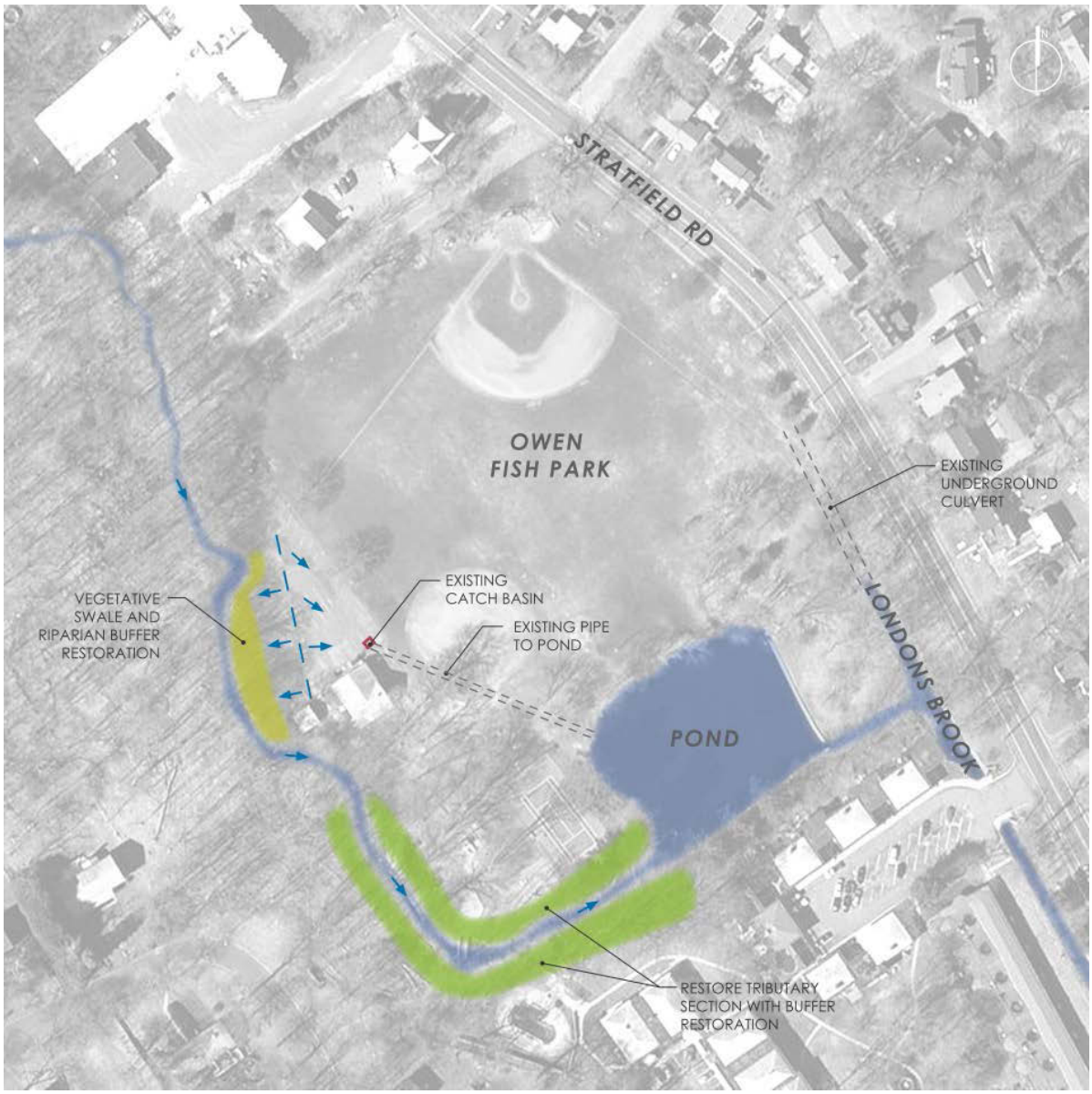


Figure 4-17. Green Infrastructure and Buffer Restoration Concept at Owen Fish Park

Figure 4-18. Existing Stream and Proposed Stream Restoration Concept (Typical)

4.8 Pocket Park at Madison Avenue and Vincellette Street

The Mayor of Bridgeport has identified the parcel located at the corner of Madison Avenue and Vincellette Street as a priority for acquisition for the creation of a "pocket park" along Horse Tavern Brook. The proposed park would be situated between condominium complexes, single family residences and a Stop & Shop grocery store in an under-served community.

Pocket Park at Madison Avenue and Vincellette Street

Location:
Madison Avenue and Vincellette Street, Bridgeport
Objectives:
Stream restoration, public education, riparian restoration, and public open space
Essential Elements:
Restore riparian buffer and create a pocket park with a gravel trail and picnic tables.
Estimated Cost: $195,000 –$417,000
Note: The estimated appraisal value of the parcel is $256,000, which is included in the total cost estimate.

The park is small, only approximately 0.5-acres; however it is highly visible from Madison Avenue, and Horse Tavern Brook runs through the middle of the parcel, providing residents who live in walking distance easy access to the river. The proposed pocket park concept is to create a short trail along the stream that would allow people to have easy access to view the stream and to provide a few picnic tables. Riparian buffer restoration is proposed throughout the entire park to remove invasive species and replant the stream banks. Armoring may be required to stabilize the banks. Educational signage and interpretive stations could be provided at the park describing the history, natural environment, water quality, and ecological resources of the Rooster River and its watershed. The cost of the pocket park includes the estimated cost to acquire the parcel, which is estimated at approximately $256,000.

Figure 4-19. Pocket Park at Madison Avenue and Vincellette Street Concept

4.9 Green Streets Design for Ridgeview Avenue

A "green street" retrofit of Ridgeview Avenue in Trumbull would address stormwater management and streetscape improvement objectives. Ridgeview Avenue is typical of residential streets within single-family neighborhoods in Trumbull; it is wider than necessary, terminating in a large cul-de-sac, and provides for parking on both sides of the street, which is unnecessary since most homes have two-car driveways and garages. Many urban and suburban streets, sized to meet code requirements for emergency service vehicles and provide a free flow of traffic, are oversized for their typical everyday functions. The Uniform Fire Code requires that streets have a minimum 20 feet of unobstructed width. The width on Ridgeview is approximately 30 feet.

Green Streets Design for Ridgeview Avenue

Location: Ridgeview Avenue in Trumbull
Objectives:
Reduce runoff volumes, pollutant loads, and peak flow rates, as well as infiltrating and treating stormwater through the use of green infrastructure practices.
Essential Elements:
Pervious pavement in on-street parking stalls and bioretention bulb-outs at intersections
Estimated Cost: $83,000 –$180,000

One potential concept (*Figure 4-20)* consists of reducing the amount of effective impervious cover along Ridgeview Avenue to reduce runoff volumes, pollutant loads, and peak flow rates, as well as infiltrating and treating stormwater through the use of other green infrastructure practices. This concept maintains on-street parking and integrates stormwater management and streetscape improvements using green infrastructure approaches within the right-of-way, while providing an aesthetic benefit and traffic calming. This concept could be applied to many residential streets within the watershed. The City of Bridgeport is undertaking several green streets projects within the city.

Figure 4-20. Ridgeview Avenue Green Street Retrofit Concept Visualization

The proposed concept for Ridgeview Avenue includes the following elements, which can be implemented on other low-traffic volume residential streets:

Pervious pavement in on-street parking stalls. Ridgeview Avenue is approximately 30 feet wide with one travel lane in each direction and the remainder used for on-street parking. On-street parking could be limited to one side, which would allow more area to construct pervious pavement, such as pervious concrete, pervious asphalt, or open-jointed block pavers. These areas would be available for parking but, unlike conventional asphalt pavement, would reduce infiltrate stormwater and reduce roadway runoff volumes and pollutant loads. *Figure 4-21* shows a typical detail of a green street parking bay.

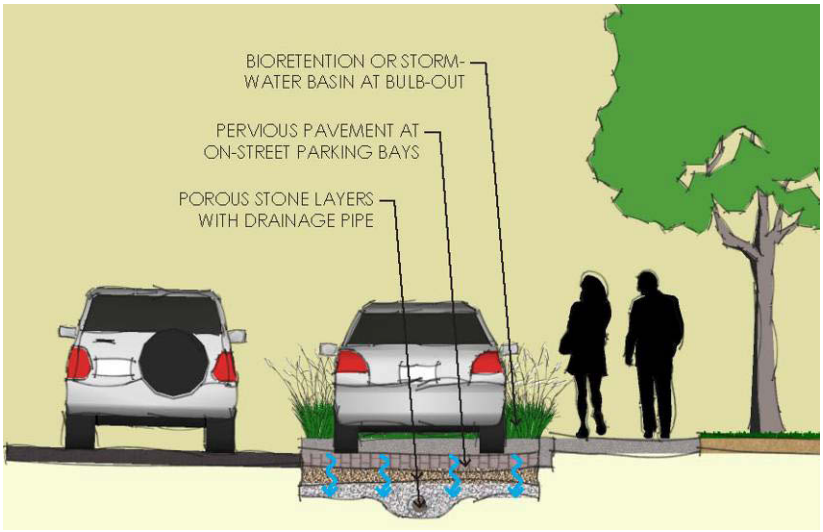


Figure 4-21. Typical Green Street Parking Bay

Bioretention bulb-outs at intersections. Near intersections, where on-street parking is discouraged to maintain site distance for turning vehicles, bioretention bulb-outs could be used to capture, treat, and infiltrate or filter stormwater. Bulb-outs at intersections can also serve to provide traffic calming. A typical bioretention bulb-out detail is presented in *Figure 4-22*. These bioretention areas would have a soil media layer to temporarily store and treat runoff prior to infiltration into underlying soils or discharge to the storm drainage system in areas with high groundwater or poor soils. The bulb-outs could be planted with attractive, low-growing and low-maintenance native landscape plants with a mulch layer.

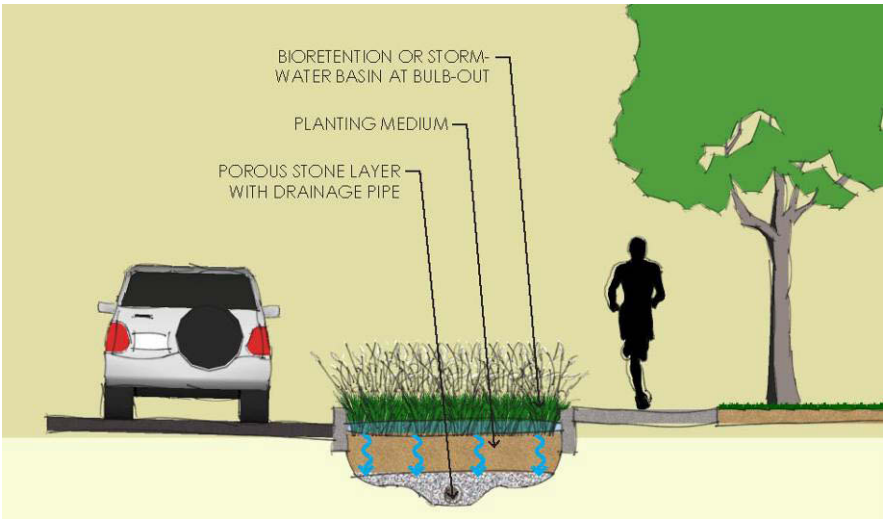


Figure 4-22. Typical Bioretention Bulb-out

4.10 Green Infrastructure Retrofit at Post Road Traffic Circle

Turney Creek flows parallel to Route 1 from north to south in a trapezoidal concrete channel, then goes underground in an approximately 865-foot culvert beneath the Post Road traffic circle, and daylights south of Post Road (Route 130) in Fairfield. There is an approximately 1-acre semi-circular grass area adjacent to the McDonald's parking lot. The grass area contains several catch basins to collect stormwater and convey it into the culvert, as well as manholes for access to the underground culvert. The existing topography of the grass area slopes toward the center of the area, and runoff from the McDonald's parking lot flows toward the grass to the northeast. The retrofit concept for the Post Road traffic circle consists of the following elements:

Green Infrastructure Retrofit at Post Road Traffic Circle

Location: Post Road (Route 130), Fairfield
Objectives:
Daylight Turney Creek for approx. 200 feet and create a constructed wetland and green infrastructure for the parking lot runoff.
Essential Elements:
Stream daylighting, constructed wetland area, and parking lot improvements including filter strips and infiltration trenches.
Estimated Cost: $197,000 –$421,000

Stream Daylighting and Constructed Wetland Area. The approximately 200-foot section of culvert below the grass area could be removed to its end and replaced with a restored stream channel to carry Turney Creek. The channel could be created from a combination of boulders, cobbles, and gravel, with deep pools at intervals for habitat. Due to concerns with traffic sight distances, a restored riparian area with high plantings should not be used.

Parking Lot Improvements. The existing McDonald's parking lot could be retrofitted with a filter strip and infiltration trench to capture, treat, and infiltrate stormwater prior to discharging into the wetland area. These improvements could effectively eliminate the stormwater contribution of this parking lot to Turney Creek during most storms.

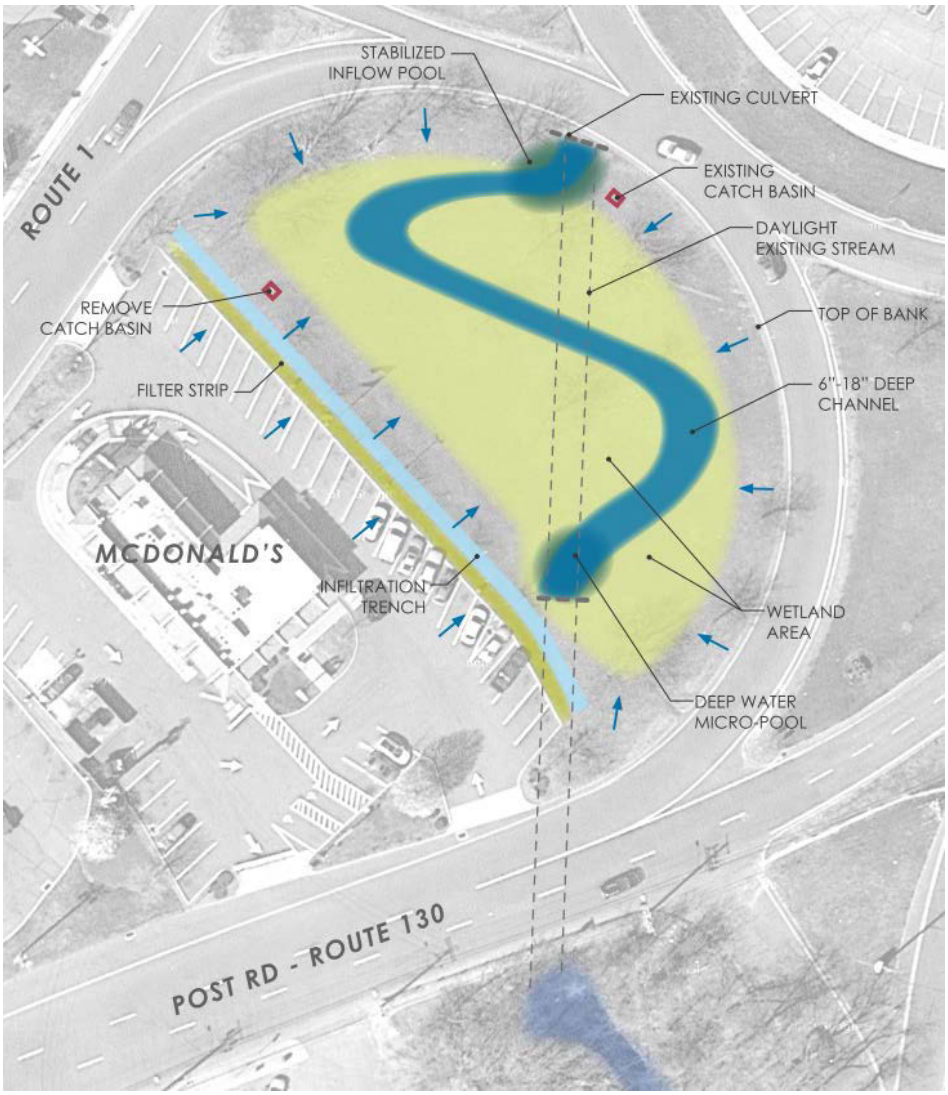


Figure 4-23. Turney Creek Restoration Concept at the Post Road Traffic Circle

4.11 Woodside Circle Open Space Stream Restoration

Woodside Circle Open Space Stream Restoration

Location: Woodside Circle, Fairfield
Objectives:
Stream bank and riparian restoration
Essential Elements:
Stream restoration and drainage swale armoring
Estimated Cost: $111,000 –$239,000

The Woodside Circle Open Space is located approximately 2,500 feet downstream of the confluence of Londons Brook and Horse Tavern Brook, where the Rooster River begins. The Rooster River has severely impacted buffers along this entire reach of river due to riparian buffer encroachment at the Brooklawn Country Club and dense residential development. The Woodside Circle Open Space area provides an opportunity to restore a portion of the riparian buffer since it is publicly-owned. The banks of the river within Woodside Circle are severely eroded due to turf being planted right to the

bank of the river, which is not stabilizing the bank. In addition, impervious areas upstream of the park are increasing runoff volume, peak flows and velocities to the river, exacerbating the problems.

A study was recently conducted by Tighe & Bond for the Town of Fairfield Engineering Department called "Woodside Circle Velocity Distribution Study for Rooster River in the vicinity of Assumption School and Woodside Circle" to examine potential restoration of the bank to alleviate erosion. The study recommended hard armoring of the banks due to the high flows in the stream reach.

Surface stabilization could consist of a layered series of bioengineered stabilization and planting techniques, based on potential for river inundation and erosive forces. Where flow velocities are expected to exert highest shear forces, riprap could be installed with root wads providing additional interlocking and habitat. Varying vegetated surfaces could transition from the top of the riprap layer to the top of slope as the potential for inundation and erosion decreases. Upslope from the bank, a riparian buffer of native trees and shrubs could replace the existing grass to better slow direct stormwater runoff and provide improved stormwater treatment and infiltration *(Figure 4-24)*.

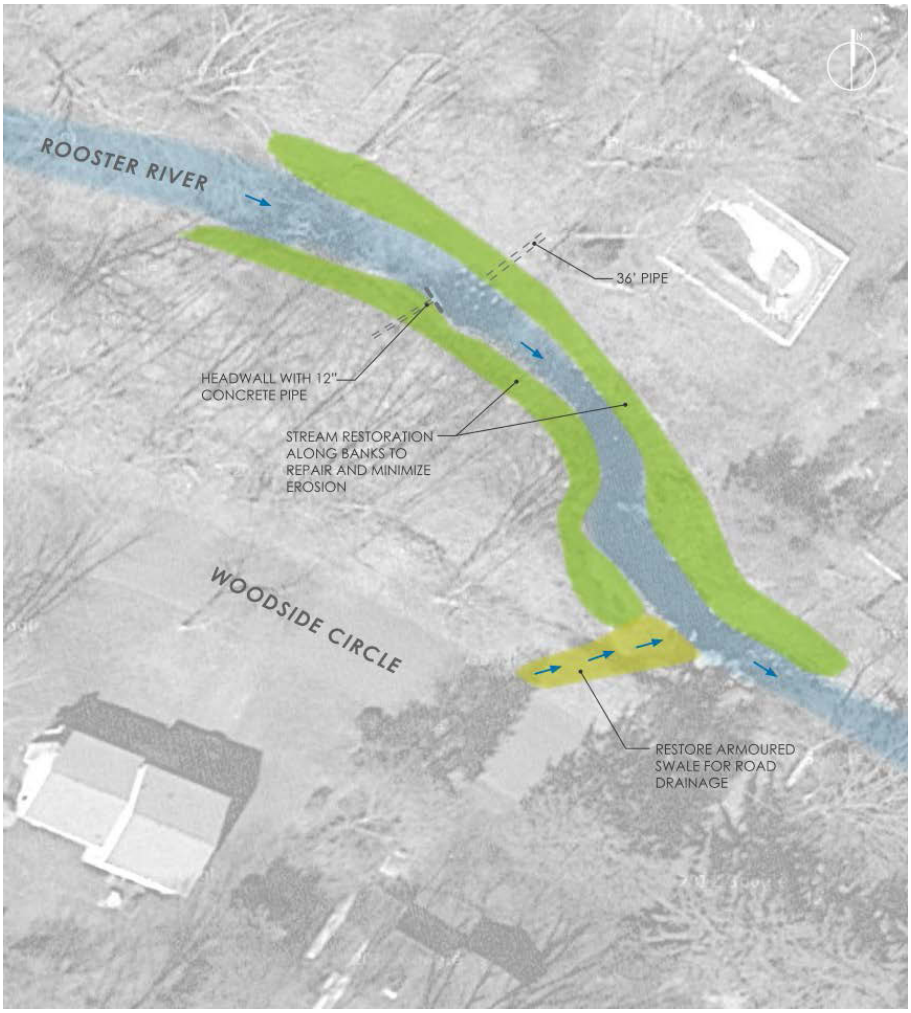


Figure 4-24. Woodside Circle Open Space Stream Restoration Concept

4.12 Other Potential Green Infrastructure Retrofits

Opportunities for stormwater retrofits exist throughout the Rooster River watershed, in addition to the site-specific retrofits that are presented in the previous section. The most promising retrofit opportunities are generally located on publicly-owned land and include:

- Parking lot upgrades (bioretention, pervious pavement, vegetated buffers, water quality swales)
- Municipal and institutional properties (bioretention, pervious pavement green roofs, blue roofs, tree planting, stormwater harvesting)
- Athletic fields at parks and educational institutions (water quality swales, vegetated buffers, infiltration, bioretention, stormwater reuse for irrigation)
- Road repair/upgrades (green or "complete" streets – bioretention, water quality swales, tree planters, below-ground infiltration chambers)
- Roadway stormwater outfalls, particularly at or near roadway stream crossings
- Vacant or underutilized parcels owned by the watershed municipalities

Potential target areas for retrofits on public land (e.g., golf courses, schools and other institutional uses, and cemeteries) are shown in *Figure 4-25*.

Residential lots offer opportunities for small-scale LID retrofits such as roof leader and downspout disconnection, rain barrels, and rain gardens, but typically require homeowner incentives and outreach/education for widespread implementation. Commercial and industrial facility retrofits can also be effective as these sites are typically characterized by high impervious cover and pollutant sources. However, commercial and industrial retrofits also require incentives and cooperation of private land owners if they are not regulated through a local, state, or federal permit program. Target areas in the watershed for residential, commercial and industrial retrofits are shown in *Figure 4-26*.

Two community workshops were held at the Discovery Museum and Planetarium in Bridgeport on May 8, 2013. The workshops focused on soliciting input from residents, municipal staff, and land use commissions in the major watershed communities of Bridgeport, Fairfield, and Trumbull. *Table 4-1* summarizes potential green infrastructure retrofit sites that were identified during the desktop screening-level review, field inventories, and community workshops, in addition to the site-specific retrofits that are presented in this document.

Table 4-1. Other Potential Green Infrastructure Retrofits

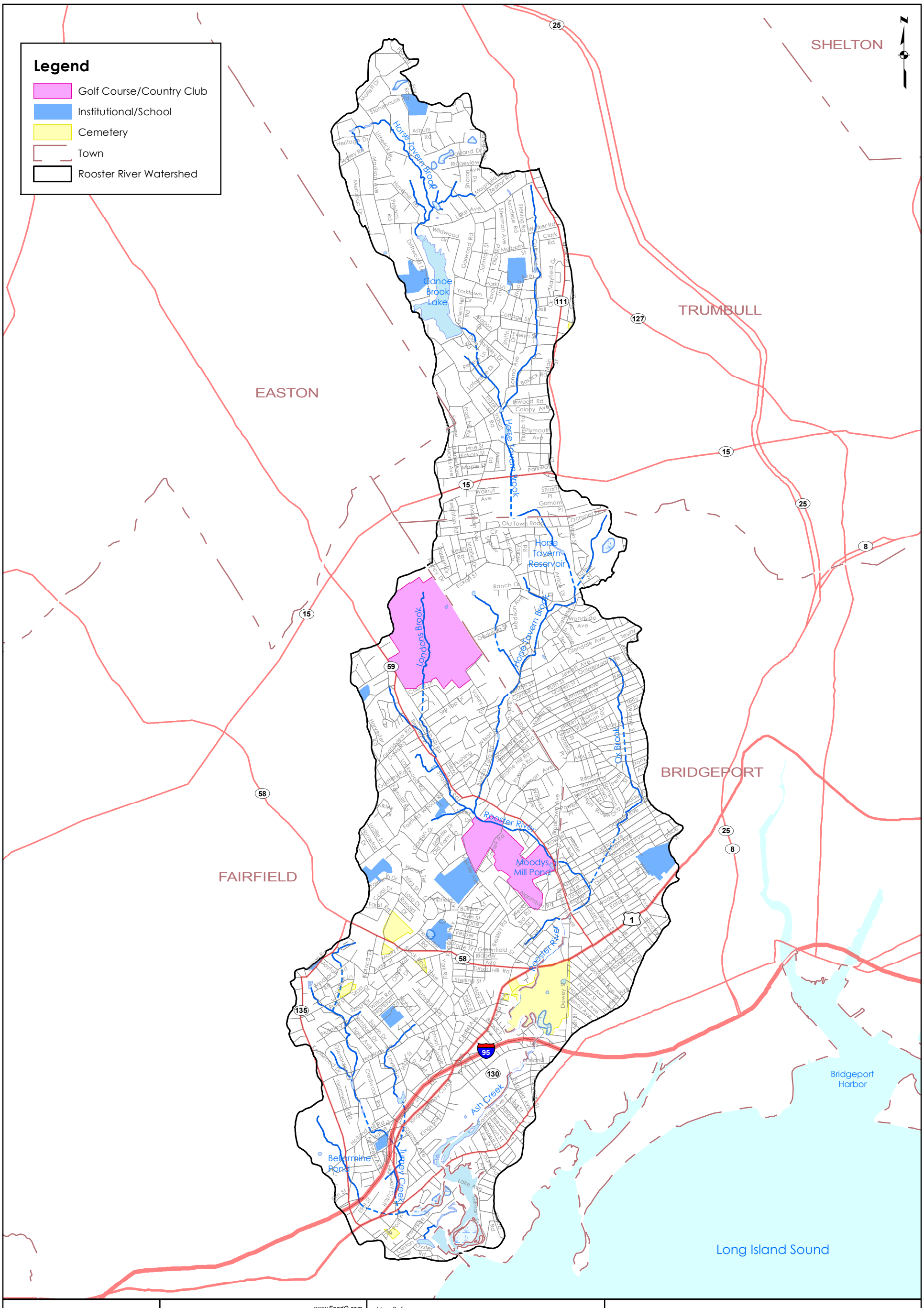
Site	Land Use	Town	Potential Retrofits
Tashua School	Institutional	Trumbull	Potential retrofits include bioretention, pervious pavement, green roofs, blue roofs, tree planting, and stormwater harvesting.
Westfield Shopping Center (Trumbull Shopping Mall)	Commercial	Trumbull	Horse Tavern Brook is culverted under the mall. Stormwater retrofit opportunities exist on the southern side of the mall to reduce peak flows and infiltrate runoff from the mostly impervious site.
Jane Ryan School	Institutional	Trumbull	Potential site for a demonstration project using stormwater retrofits to treat parking lot or athletic field runoff.
Fairchild/Wheeler Golf Course	Recreation	Fairfield	The golf course is owned by the City of Bridgeport. Potential projects may include: • Improving water quality • Improve plant and animal habitats • Restore wetlands around the golf course • Restore the natural floodplain • Construct a detention basin at the golf course discharge pipe (along the southern side of the course) to improve stormwater detention and attenuate downstream flooding
Tunxis Hill Park	Recreation	Fairfield	Opportunity to construct a bioretention or detention area to reduce runoff and flooding potential in a forested area northwest of Nordstrom Avenue along the western edge of Tunxis Hill Park where the discharge from the park in coveyed.
Stratfield Elementary	Institutional	Fairfield	Potential retrofits include bioretention, pervious pavement, green roofs, blue roofs, tree planting, and stormwater harvesting.
Brooklawn Country Club	Recreation	Fairfield	Improve water quality and provide flood relief by restoring the floodplain and natural channel along the river at Brooklawn Avenue and north of Cornell Road. This course is privately-owned.
Fairfield Metro Center	Transportation	Fairfield	Follow-up inspections for the embankment rehabilitation project at the new Metro Station.
Grasmere Brook Open Space	Open Space	Fairfield	Provide public access by restoring the inland wetland by removing accumulated fill and debris while providing an access trail and sound attenuator berm to reduce traffic noise form I-95. Restore the floodplain from historical fill.

Table 4-1. Other Potential Green Infrastructure Retrofits

Site	Land Use	Town	Potential Retrofits
Turney Creek Trapezoidal Channel near Post Road Traffic Circle	Transportation	Fairfield	Relieve flooding by redesigning and removing all or a portion of the State's open concrete trapezoidal channel of Turney Creek between the Circle and the Railroad right-of-way.
Stratfield Elementary	Institutional	Fairfield	Potential retrofits include bioretention, pervious pavement, green roofs, blue roofs, tree planting, and stormwater harvesting.
Scofield Avenue Extension Bridge	Transportation	Fairfield & Bridgeport	The Rooster River Hydrologic Study performed by Vollmer Associates (now Stantec) recommended the demolition of the two bridges over the Rooster River at Scofield Avenue and replace them with a single bridge to improve the stream hydraulics. As a part of this project, the stream could be restored and riparian buffers improved.
Rooster River between North Avenue Bridge and Brewster Street Bridge	Various	Bridgeport	Stream restoration along this approximately 1.75 mile stream segment to restore wetlands and channel widths
Laurel Avenue between Hughes and Capital Avenues	Residential	Bridgeport	Alleviate flooding issues by encouraging small-scale residential retrofits in this neighborhood or incorporation of LID within the public right-of way (i.e., green streets). Evaluate the feasibility of fish passage past the Lower and Upper Brooklawn Avenue flood relief culverts.
Rooster River upstream of I-95 Road Crossing	Transportation	Bridgeport	Sediment is filling in the area causing a significant loss of floodplain storage volume, increased flood elevations, and has caused debris dams of floating trash, expansion of the flooded area into new areas, and increased mosquito breeding. In-filling has also resulted in the elimination of natural salt marsh plant and animal habitats. Restore the floodplain and tidal wetland habitat by excavating the accumulated sediment and restoring the wetlands.
Brookside Shopping Center	Commercial	Bridgeport	Horse Tavern Brook is culverted under the shopping center. Daylight stream and provide water quality treatment for stormwater runoff from the site.

Table 4-1. Other Potential Green Infrastructure Retrofits

Site	Land Use	Town	Potential Retrofits
Ox Brook Buffer Restoration	Residential	Bridgeport	Restore stream buffer and daylight stream, especially in the vicinity of Wayne Street, Amsterdam Avenue from Madison Ave to Thorme Street
John Winthrop Middle School	Institutional	Bridgeport	Potential retrofits include bioretention, pervious pavement, green roofs, blue roofs, tree planting, and stormwater harvesting.
St. Mary's Sand Spit	Open Space	Bridgeport	Restore dunes from damage caused by Tropical Storm Sandy
Various tidally-influenced stream locations	Various	Fairfield & Bridgeport	Improve tidal gate flow along Turney Creek and Riverside Creek
Park Avenue near Plankton Street	Transportation	Bridgeport	Eroding bridge abutments



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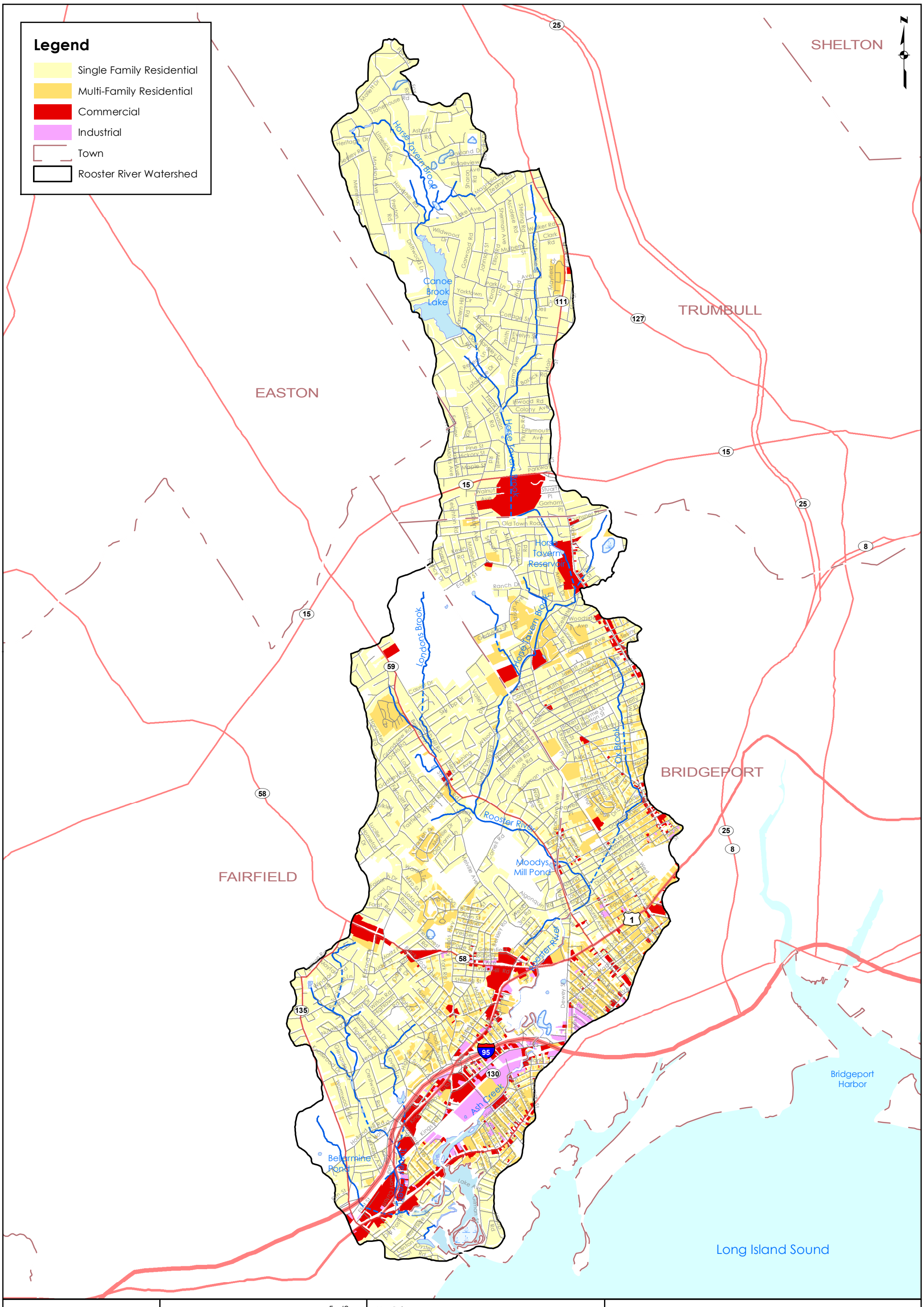
Map References:
Land use based on GIS data from City of Bridgeport (2008), Town of Fairfield (2012), and Greater Bridgeport Regional Planning Agency (GBRPA) (2000) for Trumbull; Water based on National Hygrography Dataset (NHD); Recreation/Open Space and Roadways adjusted using Connecticut Department of Energy & Environmental Protection (CTDEEP) data. Land use data verified using Ortho_2010_4Band_Color_NAIP.

ROOSTER RIVER WATERSHED BASED PLAN

FIGURE 4-25
HIGHER-PRIORITY TARGET RETROFIT AREAS



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ROOSTER RIVER WATERSHED BASED PLAN

FIGURE 4-26
LOWER-PRIORITY TARGET RETROFIT AREAS

5 Pollutant Load Reductions

Pollutant load reductions were estimated using the Watershed Treatment Model (WTM) pollutant loading model described in *Technical Memorandum #1: State of the Rooster River Watershed.* Anticipated pollutant load reductions were modeled using WTM for the following watershed management plan recommendations. Other recommended actions identified in this plan could not be quantified due to inherent limitations of WTM and/or the lack of reliable input data or information on the pollutant removal effectiveness of certain practices.

1. **CSO Abatement.** The City of Bridgeport Water Pollution Control Authority (WPCA) is implementing a Long-Term Control Plan that will eliminate the last remaining active CSO discharge location in the Rooster River watershed, which is located at State Street and Dewey Street in the upper portion of Ash Creek.

2. **Green Infrastructure/Low Impact Development (LID) Retrofits.** Stormwater retrofits are recommended throughout the watershed on public land (municipal, institutional, and transportation land uses), identified or potential hotspots (commercial and industrial land uses), and residential properties. Potential pollutant load and runoff reductions were estimated for a variety of green infrastructure and LID retrofit practices, including:

    - Bioretention, infiltration practices, and green roofs on public and institutional land
    - Vegetated filter strips and bioretention for transportation land use (roadways)
    - Roof disconnection and bioretention on commercial & industrial land
    - Rain barrels and roof disconnection on residential properties

    Multiple scenarios were modeled to estimate the effect of varying levels of retrofit implementation across the watershed, including estimates for retrofitting 5%, 10%, 50%, and 100% of the watershed impervious area. The modeled effectiveness of the proposed retrofits was reduced to reflect system maintenance and design (system bypass during larger storms) factors. These scenarios assume that the retrofits in the watershed would most likely be implemented as the watershed is redeveloped over time. The watershed management plan promotes effective stormwater management for future development and redevelopment throughout the watershed through land use regulatory mechanisms and the local site plan review process.

3. **Riparian Buffer Restoration.** Potential pollutant load reductions were estimated for restoration of impacted riparian buffers in the watershed. The total length of streams within each subwatershed with impacted buffers was estimated from aerial photography. Under the modeled restoration scenario, a 100-foot vegetative riparian buffer was assumed for those areas currently with impacted buffers.

4. **Reforestation.** The watershed management plan promotes preservation and enhancement of tree canopy through various urban watershed forestry approaches. Potential pollutant load reduction benefits were estimated for a watershed reforestation scenario using recommended tree canopy goals. Based on a recommendation of American Forests, 40% forest cover is a

reasonable overall threshold goal for urban areas. The recommended tree canopy goal in suburban residential zones is 50%; the recommended goal for urban residential zones is 25%; and the recommended goal for central business districts is 15% due to constraints on open space typical of the urban environment (American Forests, 2009). Since the overall existing forest cover in the watershed is low, less than 3%, a more realistic goal of 15% was modeled. The amount of land conversion required to achieve the recommended tree canopy goal was modeled by converting existing developed land uses to a forested condition.

5. **Public Education.** Pet waste, lawn care, and other nonpoint source education programs can change behaviors that affect pollutant loads. Pollutant load reductions were estimated for pet waste and lawn care education programs based on the number of dwellings, average fraction of pet-owners, pet-owners who already clean up after their pets, and average fraction willing to change their behavior. Conservative model assumptions were used to avoid over-estimating the load reduction benefits of these programs. Residential lawn care education accounts for fertilizer reduction, using organic fertilizers, and adherence to the recent Connecticut law restricting the application of fertilizers that contain phosphate.

6. **Illicit Discharge Detection and Elimination.** Illicit stormwater connection removal was considered in each subwatershed based on the existing estimated number of illicit connections associated with commercial and residential land uses. The illicit connection removal scenario assumes that 15% of the existing illicit discharges are detected and eliminated.

7. **Street Sweeping and Catch Basin Cleaning.** Municipalities are required to sweep all streets and clean catch basins and other stormwater structures that accumulate sediment at least once a year in accordance with the *General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems*. A revised General Permit is anticipated in 2014, which may include more stringent requirements for street sweeping and catch basin cleaning. In anticipation of these requirements, future street sweeping and catch basin cleanouts are modeled semi-annually.

Existing Pollutant Loads

Annual average pollutant loads for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), total fecal coliform (FC) bacteria and average annual runoff volume were estimated for existing conditions and future conditions assuming implementation of the proposed watershed management plan recommendations described in the above scenarios. Existing conditions pollutant loads are described in *Technical Memorandum #1: State of the Rooster River Watershed*, a copy of which is provided as *Appendix A* of this plan.

Existing annual pollutant loads are dominated by nonpoint sources, with the exception of indicator bacteria, which has a significant point source contribution from CSOs and illicit discharges. Nonpoint source runoff accounts for approximately 95% of the TN load, 79% of the TP load, 38% of the TSS load, and 42% of the FC load for the entire watershed. Channel erosion accounts for approximately 18% and 19% of the total TP and TSS loads, respectively. Road sanding accounts for approximately 43% of the TSS load, while illicit discharges and CSOs contribute approximately 58% of the FC load for the watershed.

Pollutant Load Reductions

Table 5-1 summarizes the anticipated pollutant load reductions for the plan recommendations for which pollutant loads can be reasonably quantified. The load reduction values presented in *Table 5-1* are for the entire Rooster River watershed. Load reduction summaries by subwatershed are provided in *Appendix D*.

As indicated in *Table 5-1*, eliminating the last remaining CSO in the watershed under the City of Bridgeport's CSO Long Term Control Plan is estimated to result in an approximately 14% reduction in fecal coliform loading to the Rooster River, compared to existing conditions.

Varying levels of stormwater retrofit implementation across the watershed were modeled, including estimates for retrofitting 5%, 10%, 50%, and 100% of the impervious area in residential, industrial, commercial, mixed use, institutional, and transportation land uses. The results for the 5% scenario, which is considered a reasonable likely scenario, are included in *Table 5-1*. The results for all four scenarios are presented in *Table 5-2*. The 5% retrofit scenario is predicted to result in approximately 0.7 to 1.7% reductions in annual TN, TP, TSS, FC, and runoff volume watershed-wide. Significantly higher reductions (14% to 30%) could potentially be achieved by retrofitting a much greater percentage of the watershed, although the level of retrofits required to achieve these reductions would likely be cost-prohibitive. Estimated costs for each of the four retrofit scenarios are provided in *Appendix C*.

CSO abatement, public education, IDDE, and reforestation and riparian buffer restoration are the most effective management plan recommendations for reducing bacteria loads. The effectiveness of the watershed management recommendations varies by pollutant, although fecal coliform load reductions are anticipated to yield the greatest load reduction, approximately 42%, through the implementation of stormwater controls. In addition, nitrogen and phosphorus loads are anticipated to be reduced by approximately 23% and 16%, respectively. Runoff volume is anticipated to decrease by approximately 11% overall, with reforestation, riparian buffer restoration, and green infrastructure practices predicted to provide the greatest potential reductions in runoff volume.

Table 5-1. Anticipated Annual Pollutant Load Reductions

Watershed Management Recommendation	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	FC (billion/yr)	Runoff Volume (ac-ft/yr)	TN (%)	TP (%)	TSS (%)	FC (%)	Runoff Volume (%)
CSO Abatement	636	127	2,096	305,711	0	0.4%	0.5%	0.0%	14.4%	0.0%
Green Infrastructure/ LID Retrofits (Retrofit 5% of impervious area)	2,599	384	90,727	14,878	188	1.7%	1.5%	1.3%	0.7%	1.3%
Riparian Buffer Restoration	7,017	1,053	242,373	30,157	481	4.7%	4.0%	3.3%	1.4%	3.3%
Reforestation	15,771	1,914	399,820	144,354	858	10.6%	7.3%	5.5%	6.8%	5.9%
Public Education	4,312	66	0	236,089	0	2.9%	0.3%	0.0%	11.1%	0.0%
Illicit Discharge Detection and Elimination (IDDE)	239	71	1,798	133,160	0	0.2%	0.3%	0.0%	6.3%	0.0%
Street Sweeping and Catch Basin Cleaning	2,713	474	348,553	0	0	1.8%	1.8%	4.8%	0.0%	0.0%
Total	**33,287**	**4,089**	**1,085,368**	**864,348**	**1,527**	**22.3%**	**15.6%**	**15.0%**	**40.8%**	**10.5%**

Table 5-2. Anticipated Annual Pollutant Load Reductions for Varying Levels of Green Infrastructure/LID Retrofits

Green Infrastructure/LID Retrofits	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	FC (billion/yr)	Runoff Volume (ac-ft/yr)	TN (%)	TP (%)	TSS (%)	FC (%)	Runoff Volume (%)
Retrofit 5% of Impervious Area	2,599	384	90,727	14,878	188	1.7%	1.5%	1.3%	0.7%	1.3%
Retrofit 10% of Impervious Area	5,199	768	181,455	29,755	376	3.5%	2.9%	2.5%	1.4%	2.6%
Retrofit 50% of Impervious Area	25,993	3,838	907,273	148,775	1,878	17.4%	14.7%	12.5%	7.0%	12.9%
Retrofit 100% of Impervious Area	51,986	7,676	1,814,546	297,550	3,756	34.8%	29.3%	25.0%	14.0%	25.7%

Table 5-3 summarizes the anticipated combined effectiveness for all of the watershed management recommendations considered. The pollutant loadings and load reductions presented in *Table 5-3* reflect a comparison of modeled natural background conditions, existing conditions, and future pollutant loadings with implementation of the watershed management recommendations for the entire Rooster River watershed. The natural background pollutant loads reflect a fully-forested condition in the entire watershed, which represents the lowest, realistically-achievable pollutant loads for the watershed. The last column in *Table 5-3* contains anticipated "effective load reductions" with implementation of the watershed management recommendations. These effective load reductions are realistically-achievable reductions that account for the natural background pollutant load. Overall, a 41.6% reduction in bacteria loads is anticipated, with smaller reductions anticipated for nitrogen (28.4%), phosphorus (25.3%), total suspended solids (18.1%), and runoff volume (19.6%).

Table 5-3. Summary of Modeled Pollutant Loads and Load Reductions

Pollutant	Natural Background Conditions	Existing Conditions	Future Conditions with Controls	Load Reduction with Controls (From Existing Conditions)	Effective Load Reduction with Controls (Accounting for Natural Background Load)
Nitrogen (lb/yr)	31,922	149,208	115,920	22.3%	28.4%
Phosphorus (lb/yr)	10,026	26,161	22,071	15.6%	25.3%
TSS (lb/yr)	1,251,918	7,244,999	6,159,631	15.0%	18.1%
Fecal Coliform (billion/yr)	42,095	2,119,083	1,254,734	40.8%	41.6%
Runoff Volume (acre-ft/year)	6,811	14,605	13,078	10.5%	19.6%

Figures 5-1 through *5-5* depict the existing and anticipated future pollutant loads for the watershed, with and without implementation of the watershed management plan recommendations. The pie charts in *Figures 5-1* through *5-5* show the relative contribution of the management plan recommendations to the predicted effective load reductions.

Pollutant Load Reductions and Water Quality Impairment Status

The primary objective of this watershed management plan is to address the water quality impairments in the Rooster River in order to restore the recreation and habitat uses that have been lost due to degraded water quality. The pollutant load evaluation suggests that significant pollutant load and runoff reductions could be achieved by implementing the plan recommendations. Implementation of the watershed management recommendations included in *Table 5-1* is predicted to result in an approximately 42% reduction in annual bacteria loads to the Rooster River. Additional loads reductions may be achieved by implementation of stormwater controls over a larger portion of the watershed, as shown in *Table 5-2*, additional tree cover and reforestation, increasing the awareness in the watershed of certain programs, such as the pet waste pickup program or increased detection and elimination of illicit discharges.

However, a key question that arises from this evaluation is – will the pollutant load reductions that are anticipated to result from the watershed plan recommendations enable the impaired water bodies to meet their designated uses?

A TMDL analysis was completed for indicator bacteria in the Mill River, Rooster River and Sasco Brook in 2005. The TMDL calls for overall reductions in indicator bacteria in the Rooster River of 91% (CTDEEP, 2005). The occurrence of combined sewer overflows (CSOs) during wet conditions may be contributing to such a high percent reduction. The wet weather bacteria monitoring data, which are the basis for the TMDL, were collected at the Route 1 Rooster River monitoring station between August 1999 and May 2002. Although only one active CSO discharge to the Rooster River currently remains, located at State Street and Dewey Street downstream of Route 1, several other CSO discharges existed in the vicinity of the Route 1 monitoring location during the period of wet weather data collection for the TMDL in the late 1990s and early 2000s. These other CSO discharges have since been eliminated by the City of Bridgeport, including a former CSO discharge located at the Mt. Grove Cemetery and Dewey Square, which was closed in December 2012. Additionally, wet weather bacteria concentrations at the Route 1 Rooster River monitoring location were consistently higher than at the two upstream Rooster River monitoring locations during the 1999-2002 monitoring events, further suggesting that the TMDL monitoring data were influenced by CSO discharges. The 91% reduction in bacteria loads required by the TMDL is likely overly conservative for nonpoint sources.

As indicated in the 2005 TMDL, progress in achieving TMDL established goals through implementation of this watershed plan may be most effectively gauged through implementing a fixed-station ambient monitoring program. Routine monitoring should be performed at the same site(s) used to generate the data used to perform the TMDL calculations (see the water quality monitoring recommendations in *Section 3.2* of this plan). Sampling should be scheduled at regularly spaced intervals during the recreational season. Therefore, the data set at the end of each season will include ambient values for both "wet" and "dry" conditions in relative proportion to the number of "wet" and "dry" days that occurred during the monitoring period. The TMDL calculations can be updated over time to compare the percent reductions needed under "dry" and "wet" conditions to the percent reductions that were needed at the time of TMDL adoption in 2005.

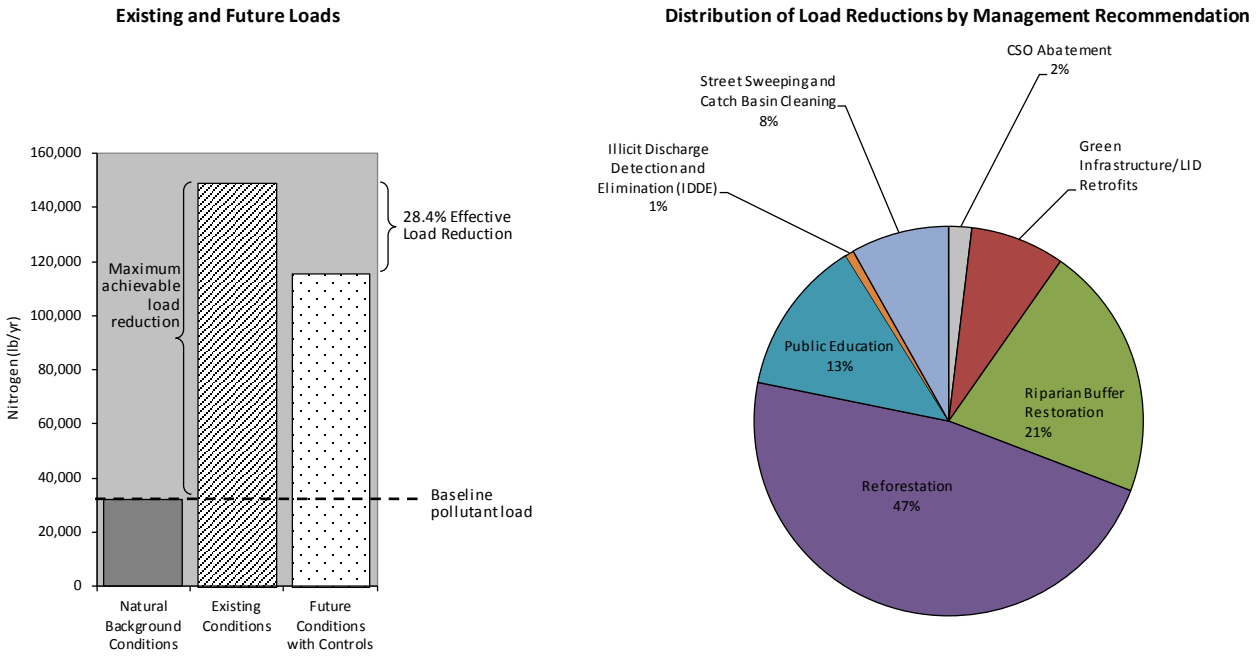

Figure 5-1. Anticipated Nitrogen Loads and Load Reductions

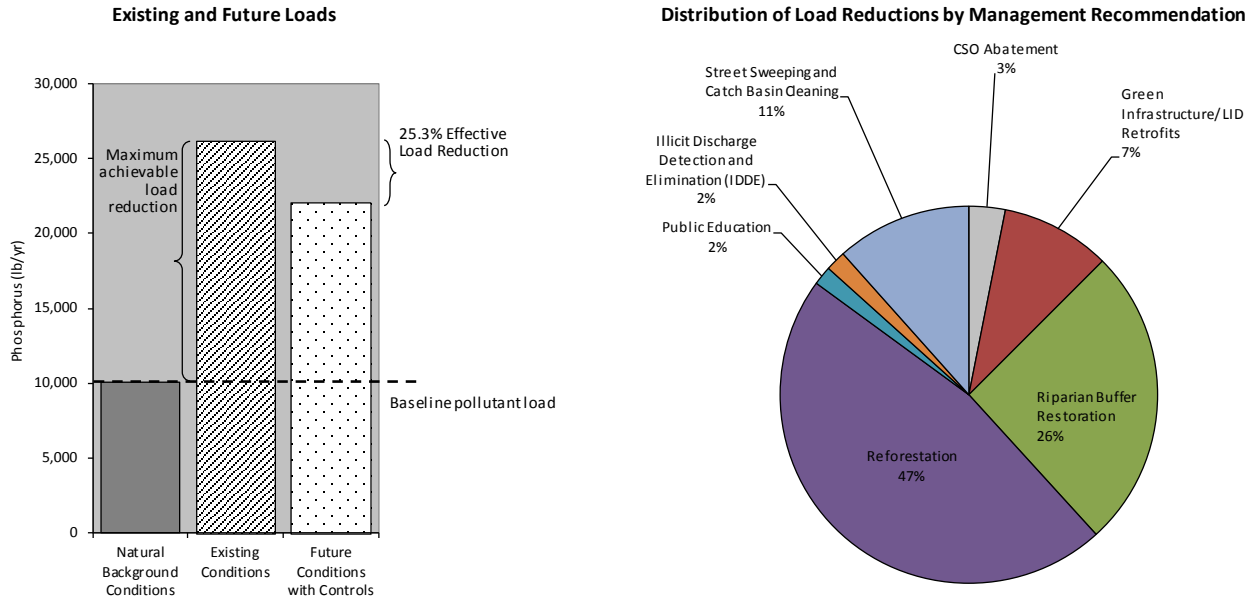

Figure 5-2. Anticipated Phosphorus Loads and Load Reductions

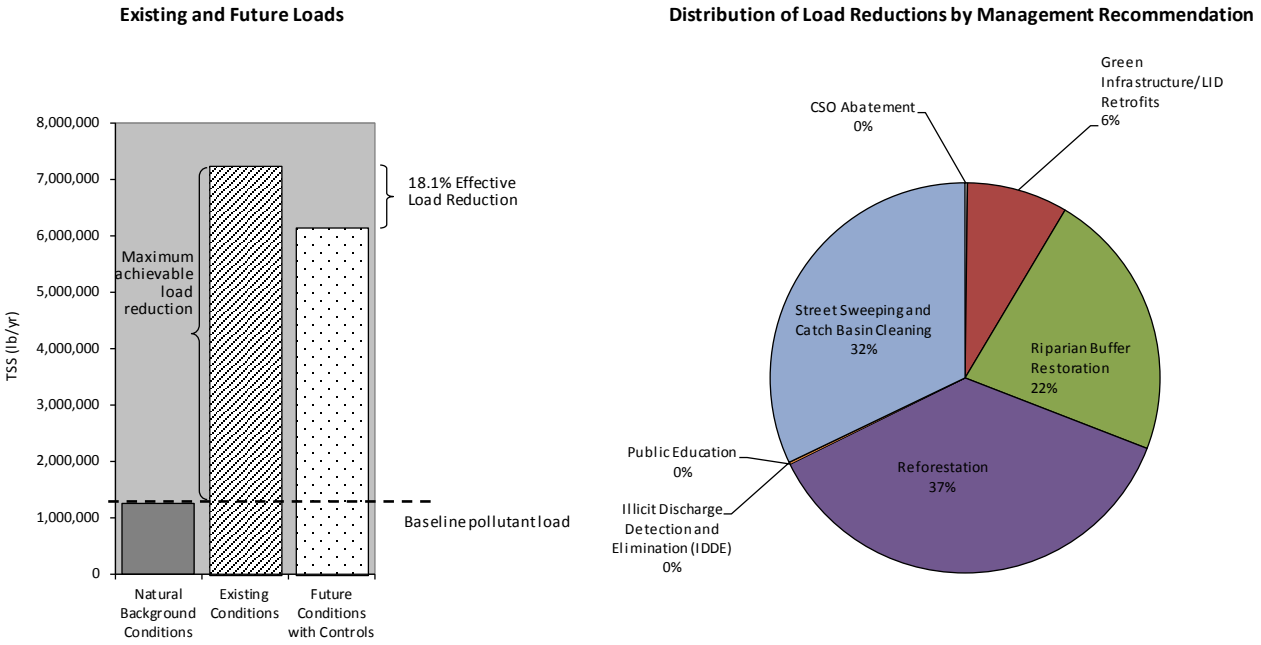

Figure 5-3. Anticipated Sediment (TSS) Loads and Load Reductions

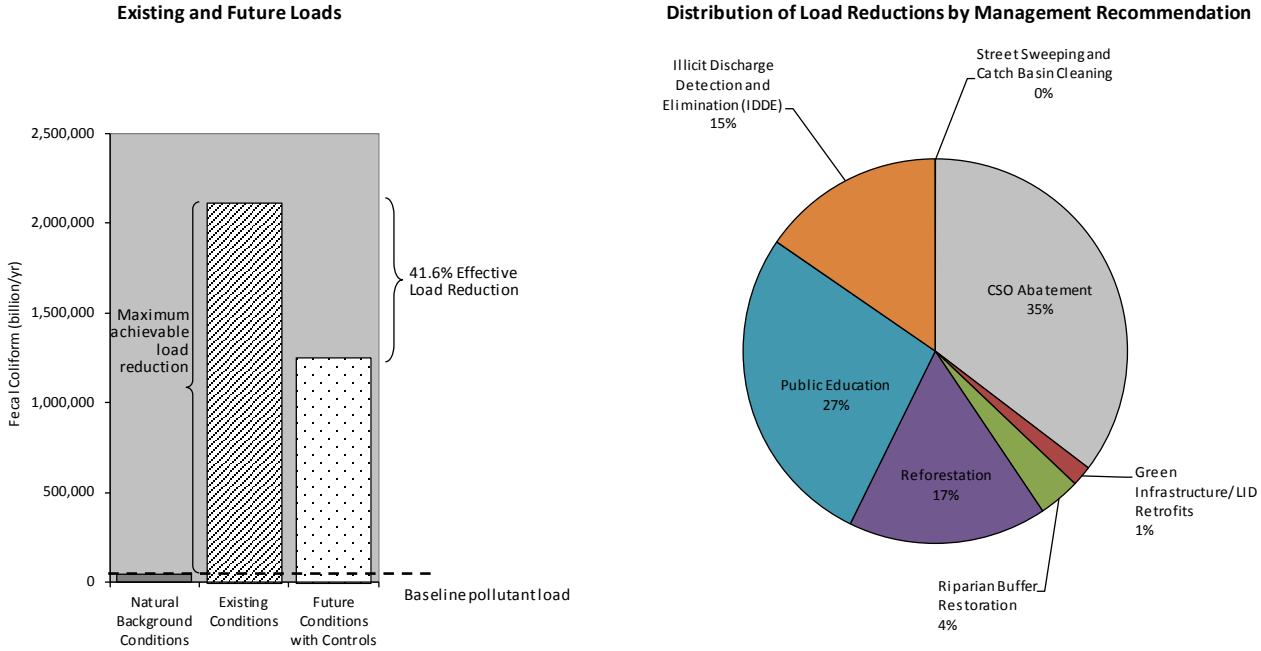

Figure 5-4. Anticipated Fecal Coliform Loads and Load Reductions

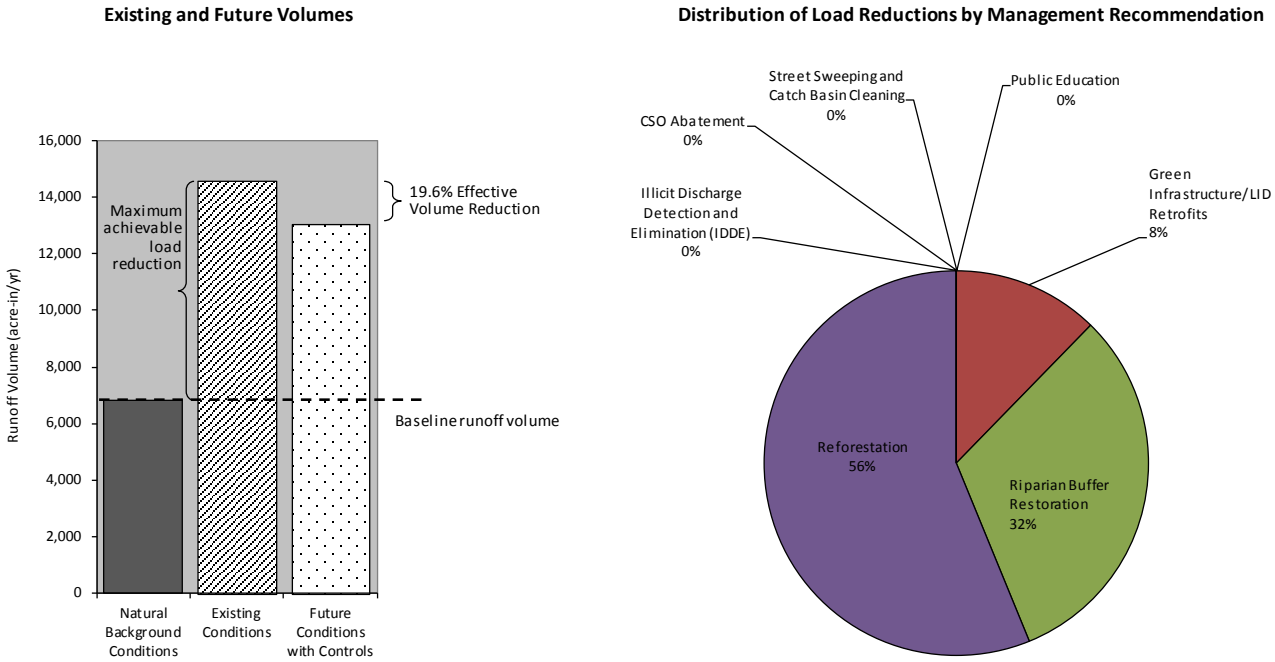

Figure 5-5. Anticipated Runoff Volumes and Volume Reductions

6 Schedule, Milestones, and Evaluation Criteria

Appendix E contains a proposed implementation schedule, including action items and associated lead entity, timelines, products, and evaluation criteria. This table should be revised as necessary to reflect future changes to the watershed plan and implementation activities.

Many different groups will need to participate and collaborate to successfully implement the recommendations identified in this plan. The table in *Appendix E* identifies a designated lead group(s), which will initiate, obtain the necessary funding for, and organize the necessary resources to implement an action. The lead group is assigned based on the organization or entity whose mission or responsibilities best align with the action and, in the case of a government entity, have jurisdiction over the action or associated geographic area.

7 Funding Sources

A variety of local, state, and federal sources are potentially available to provide funding for the implementation of this watershed management plan, in addition to potential funds contributed by local grassroots organizations and concerned citizens. *Appendix F* contains a list of potential funding sources that has been developed by the CTDEEP and Natural Resources Conservation Service, and further refined through this planning process. The table is not intended to be an exhaustive list but can be used as a starting point to seek funding opportunities for implementation of the recommendations in this watershed plan. The information presented in this watershed management plan and the supporting study documentation will support future grant proposals by demonstrating a comprehensive, scientifically-based approach for addressing identified concerns consistent with the recommended watershed-based approach. The table of potential funding sources is intended to be a living document that should be updated periodically to reflect the availability of funding or changes to the funding cycle, and to include other funding entities or grant programs.

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Appendix A

Technical Memorandum #1: State of the Rooster River Watershed (on CD)

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Appendix B

Technical Memorandum #2: Low Impact Development & Green Infrastructure Assessment (on CD)

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Appendix C

Site-Specific Project Cost Estimates

	Location and Element	Order of Magniude Cost Range: Construction: Unit Cost	Unit	Quantity	Cost (2013$)	Design and Planning: Allowance	Cost	Cost Range: Total Cost	-30%	50%	Life Cycle: Lifespan (yrs)	Annual Cost over Lifespan	O&M (% Cost)	O&M ($/yr)	Total Capitalized Cost/yr over lifespan
Assumption School Parking Lot Retrofit															
1	Pervious Pavement	$ 2.84	sf	5,200	$ 14,793	30%	$4,000	$19,000	$13,000	$29,000	20	$1,400	4%	$60	$1,460
2	Vegetated Swale	$ 10.16	sf	900	$ 9,144	30%	$3,000	$13,000	$9,000	$20,000	15	$1,170	4%	$50	$1,220
3	Rip Rap at Leakoff	$ 45.72	CY	19	$ 847	30%	$0	$1,000	$1,000	$2,000	20	$70	4%	$0	$70
4	Bioretention Area	$ 33.02	sf	1,280	$ 42,266	30%	$13,000	$56,000	$39,000	$84,000	15	$5,040	4%	$200	$5,240
5	Stream Restoration	$ 13,106.28	ac	1.00	$ 13,106	30%	$4,000	$18,000	$13,000	$27,000	15	$1,620	4%	$60	$1,680
6	Remove fill	$ 7.62	CY	50	$ 381	30%	$0	$1,000	$1,000	$2,000	15	$90	4%	$0	$90
							Total	**$108,000**	**$76,000**	**$164,000**					
Blackham School LID Retrofit															
1	Green Roof	$ 23.37	sf	10,000	$ 233,680	30%	$70,000	$304,000	$213,000	$456,000	15	$27,340	4%	$1,090	$28,430
2	Permeable Pavers	$ 10.16	sf	7,500	$ 76,200	30%	$23,000	$100,000	$70,000	$150,000	20	$7,360	4%	$290	$7,650
3	Bioretention Areas	$ 33.02	sf	1,270	$ 41,935	30%	$13,000	$55,000	$39,000	$83,000	15	$4,950	4%	$200	$5,150
4	Subsurface Infiltration Chambers	$ 36.73	cf of runoff treated	2,240	$ 82,272	30%	$25,000	$108,000	$76,000	$162,000	20	$7,950	4%	$320	$8,270
							Total	**$567,000**	**$398,000**	**$851,000**					
Former Handy & Harman Site Flood Storage and Tidal Wetland Restoration															
1	Rip Rap Low Flow Channel	$ 46	CY	509	$23,283	30%	$7,000	$31,000	$22,000	$47,000	20	$2,280	4%	$90	$2,370
2	Forebay	$ 46	CY	241	$11,007	30%	$3,000	$15,000	$11,000	$23,000	20	$1,100	4%	$40	$1,140
3	Precast Concrete Outlet Structure (8 x 12 x 16' high)	$ 25,000	ea	1	$25,000	30%	$8,000	$33,000	$23,000	$50,000	20	$2,430	4%	$100	$2,530
4	Tidal Wetland Restoration	$ 2.03	SY	2256	$4,583	30%	$1,000	$6,000	$4,000	$9,000	20	$440	4%	$20	$460
							Total	**$79,000**	**$56,000**	**$120,000**					
Invasive Species Restoration															
1	Remove Invasive Species @ Grasmere Brook	$ 3,401	acre	1.7	$ 5,781	30%	$2,000	$8,000	$6,000	$12,000	2	$4,240	4%	$170	$4,410
1	Remove Invasive Species @ Mt Grove Cemetery	$ 3,401	acre	2.0	$ 6,801	30%	$2,000	$9,000	$6,000	$14,000	2	$4,770	4%	$190	$4,960
							Total	**$17,000**	**$12,000**	**$26,000**					
Green Infrastructure Retrofit at Madison Middle School															
1	Pervious Pavement	$ 2.84	sf	12,300	$ 34,991	30%	$10,000	$45,000	$32,000	$68,000	20	$3,310	4%	$130	$3,440
2	Subsurface Gravel Wetland	$ 22	cf of runoff treated	1,980	$ 43,915	30%	$13,000	$57,000	$40,000	$86,000	15	$5,130	4%	$210	$5,340
3	Rain Gardens	$ 7.40	sf	1,000	$ 7,396	30%	$2,000	$10,000	$7,000	$15,000	15	$900	4%	$40	$940
4	Bioretention Areas	$ 33.02	sf	4,150	$ 137,033	30%	$41,000	$179,000	$125,000	$269,000	15	$16,100	4%	$640	$16,740
							Total	**$291,000**	**$204,000**	**$438,000**					

	Location and Element	Order of Magniude Cost Range: Construction Unit Cost	Unit	Quantity	Cost (2013$)	Design and Planning Allowance	Cost	Cost Range Total Cost	-30%	50%	Life Cycle Lifespan (yrs)	Annual Cost over Lifespan	O&M (% Cost)	O&M ($/yr)	Total Capitalized Cost/yr over lifespan
Green Infrastructure Retrofit at Bridgeport Public Library															
1	Large Bioretention Area (Rain Garden)	$ 7.40	sf	12,000	$ 88,758	30%	$27,000	$116,000	$81,000	$174,000	15	$10,430	4%	$420	$10,850
2	Rain Garden	$ 7.40	sf	1,300	$ 9,615	30%	$3,000	$13,000	$9,000	$20,000	15	$1,170	4%	$50	$1,220
3	Parking Island Bioretention	$ 33.02	sf	680	$ 22,454	30%	$7,000	$30,000	$21,000	$45,000	15	$2,700	4%	$110	$2,810
4	Tree Box Filters	$ 6,096	ea	2	$ 12,192	30%	$4,000	$17,000	$12,000	$26,000	15	$1,530	4%	$60	$1,590
5	Infiltration Trenches	$ 18.58	lf	580	$ 10,777	30%	$3,000	$14,000	$10,000	$21,000	20	$1,030	4%	$40	$1,070
							Total	**$190,000**	**$133,000**	**$286,000**					
Green Infrastructure at Owen Fish Park															
1	Vegetated Swale	$ 10.16	sf	1,000	$ 10,160	30%	$3,000	$14,000	$10,000	$21,000	15	$1,260	4%	$50	$1,310
2	Riparian Buffer Restoration	$ 11,204	ac	0.39	$ 4,398	30%	$1,000	$6,000	$4,000	$9,000	15	$540	4%	$20	$560
							Total	**$20,000**	**$14,000**	**$30,000**					
Pocket Park at Madison Avenue and Vincellette Street															
	Riparian Buffer Restoration	$ 11,204	ac	0.32	$ 3,601	30%	$1,000	$5,000	$4,000	$8,000	15	$450	4%	$20	$470
	Gravel Trail	$ 30.48	CY	18.5	$ 564	30%	$170	$1,000	$1,000	$2,000	20	$70	4%	$0	$70
	Picnic Tables	$ 200.00	ea	3	$ 600	30%	$180	$1,000	$1,000	$2,000	10	$120	4%	$0	$120
	Parcel Acquisition	$ 256,209	ea	1	$ 256,209	5%	$13,000	$270,000	$189,000	$405,000	100	$11,020	4%	$440	$11,460
							Total	**$277,000**	**$195,000**	**$417,000**					
Green Streets Design for Ridgeview Avenue															
1	Pervious Pavement (20 spaces)	$ 2.84	sf	2,240	$ 6,372	30%	$2,000	$9,000	$6,000	$14,000	20	$660	4%	$30	$690
2	Bioretention Areas	$ 33.02	sf	700	$ 23,114	30%	$7,000	$31,000	$22,000	$47,000	15	$2,790	4%	$110	$2,900
3	Tree Box	$ 6,096	ea	10	$ 60,960	30%	$18,000	$79,000	$55,000	$119,000	15	$7,110	4%	$280	$7,390
							Total	**$119,000**	**$83,000**	**$180,000**					
Green Infrastructure Retrofit at Post Road Traffic Circle															
1	Constructed Wetland Area	$4.38	sf	38,000	$ 166,368	30%	$50,000	$217,000	$152,000	$326,000	15	$19,520	4%	$780	$20,300
2	Stream Daylighting	$25,000	ea	1	$ 25,000	50%	$13,000	$38,000	$27,000	$57,000	100	$1,550	4%	$60	$1,610
3	Filter Strip	$10.16	sf	875	$ 8,890	30%	$3,000	$12,000	$8,000	$18,000	15	$1,080	4%	$40	$1,120
4	Infiltration Trench	$18.58	lf	292	$ 5,419	30%	$2,000	$8,000	$6,000	$12,000	20	$590	4%	$20	$610
5	Excavation/Earthwork	$7.62	CY	500	$ 3,810	30%	$1,000	$5,000	$4,000	$8,000	20	$370	4%	$10	$380
							Total	**$280,000**	**$197,000**	**$421,000**					
Woodside Circle Open Space Stream Restoration															
1	Stream Restoration	$ 13,106	ac	0.50	$ 6,553	30%	$2,000	$9,000	$6,000	$14,000	15	$810	4%	$30	$840
2	Streambank Stabilization	$ 100,000	ea	1	$ 100,000	50%	$50,000	$150,000	$105,000	$225,000	15	$13,490	4%	$540	$14,030
							Total	**$159,000**	**$111,000**	**$239,000**					

Notes:
Rate of Inflation used = 2%
Interest (discount) rate used = 6%
*Projects are proposed for these locations already. Costs estimated in this table are for adding ecological and water quality elements to the assumed original purpose of the proposed projects.
Costs should be used for planning purposes only based on cursory evaluations of site characteristics. Construction costs could vary significantly.

Unit Costs Table

Element	2013 Adjusted Cost	Unit	Cost	$YEAR	Source
Large Bioretention Retrofit	$ 12.19	cf of runoff treated	$ 10.50	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, Page E-3
Small Bioretention Retrofit (<0.5 acre)	$ 33.02	sf	$ 32.50	2012	District of Columbia Water and Sewer Authority, George S. Hawkins, General Manager, Green Infrastructure Summit 2012, February 29, 2012.
Water Quality Swale	$ 10.16	sf	$ 10.00	2012	District of Columbia Water and Sewer Authority, George S. Hawkins, General Manager, Green Infrastructure Summit 2012, February 29, 2012.
Rain Garden	$ 7.40	sf	$ 7.28	2012	Woodard & Curran - Route 1 Falmouth Commercial District Stormwater Management, 2012
French Drain	$ 18.58	lf	$ 16.00	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, page E-11
Subsurface Infiltration Chambers	$ 36.73	cf of runoff treated	$ 36.15	2012	Woodard & Curran - Route 1 Falmouth Commercial District Stormwater Management, 2012
Green Roof	$ 23.37	sf	$ 23.00	2012	District of Columbia Water and Sewer Authority, George S. Hawkins, General Manager, Green Infrastructure Summit 2012, February 29, 2012.
Subsurface Gravel Wetland	$ 22.18	cf of runoff treated	$ 21.83	2012	Woodard & Curran - Route 1 Falmouth Commercial District Stormwater Management, 2012
Constructed Wetland	$ 4.38	sf	$ 3.77	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, page E-11
Tree Box	$ 6,096	ea	$ 6,000	2012	UNH Stormwater Center 2012 Biennial Report
Porous Asphalt	$ 2.84	sf	$ 2.80	2012	UNH Stormwater Center 2012 Biennial Report. Page 12
Permeable Pavers	$ 10.16	sf	$ 10.00	2012	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, Page E-5
Remove Invasive Species	$ 3,400.64	acre	$ 3,200	2010	Professional Engineering Experience
Riparian Buffer Restoration	$ 11,204.05	ac	$ 10,543	2010	Oregon Department of Environmental Quality, 2010, Cost Estimate to Restore Riparian Forest Buffers and Improve Stream Habitat in the Willamette Basin, Oregon. Page 20
Stream Channel Restoration	$ 13,106.28	ac	$ 12,333	2010	Oregon Department of Environmental Quality, 2010, Cost Estimate to Restore Riparian Forest Buffers and Improve Stream Habitat in the Willamette Basin, Oregon. Page 20
6" to 12" Rip Rap	$ 45.72	CY	$ 45.00	2012	Professional Engineering Experience
Gravel Borrow	$ 30.48	CY	$ 30.00	2012	Professional Engineering Experience
Seeding	$ 2.03	SY	$ 2.00	2012	Professional Engineering Experience
Earth Excavation	$ 7.62	CY	$ 7.50	2012	Professional Engineering Experience

Inflation Rates Table

Inflation from	Inflation to	Percent
2006	2013	16.13%
2010	2013	6.27%
2011	2013	4.57%
2012	2013	1.6%

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Appendix D

Pollutant Load Reduction Model Results

Table 5-1. Anticipated Annual Pollutant Load Reductions

Watershed Management Recommendation	TN lb/yr	TP lb/yr	TSS lb/yr	FC billion/yr	Runoff Volume acre-ft/year	TN %	TP %	TSS %	FC %	Runoff Volume %
CSO Abatement	636	127	2,096	305,711	0	0.4%	0.5%	0.0%	14.4%	0.0%
Green Infrastructure/ LID Retrofits (Retrofit 5% of residential, industrial, commercial, and transportation land uses)	2,599	384	90,727	14,878	188	1.7%	1.5%	1.3%	0.7%	1.3%
Riparian Buffer Restoration	7,017	1,053	242,373	30,157	481	4.7%	4.0%	3.3%	1.4%	3.3%
Reforestation	15,771	1,914	399,820	144,354	858	10.6%	7.3%	5.5%	6.8%	5.9%
Public Education	4,312	66	0	236,089	0	2.9%	0.3%	0.0%	11.1%	0.0%
Illicit Discharge Detection and Elimination (IDDE)	239	71	1,798	133,160	0	0.2%	0.3%	0.0%	6.3%	0.0%
Street Sweeping and Catch Basin Cleaning	2,713	474	348,553	0	0	1.8%	1.8%	4.8%	0.0%	0.0%
Total	***33,287***	***4,089***	***1,085,368***	***864,348***	***1,527***	**22.3%**	**15.6%**	**15.0%**	**40.8%**	**10.5%**

Table 5-3. Summary of Modeled Pollutant Loads and Load Reductions

	Natural Background Conditions	Existing Conditions	Future Conditions with Controls	Load Reduction with Controls	Effective Load Reduction with Controls
Nitrogen (lb/yr)	31,922	149,208	115,920	22.3%	28.4%
Phosphorus (lb/yr)	10,026	26,161	22,071	15.6%	25.3%
TSS (lb/yr)	1,251,918	7,244,999	6,159,631	15.0%	18.1%
Fecal Coliform (billion/yr)	42,095	2,119,083	1,254,734	40.8%	41.6%
Runoff Volume (acre-ft/year)	6,811	14,605	13,078	10.5%	19.6%

Nitrogen Load Reductions with Watershed Management Recommendations

Watershed Management Recommendation	Existing Conditions (lb/yr)	Future Conditions with Contols (lb/yr)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	10,513	9,876	10,347	9,662	10,002	10,248	10,472	10,295
Horse Tavern Brook (3,196 acres)	48,812	48,812	48,010	46,983	43,769	47,820	48,773	47,991
Londons Brook (1,002 acres)	13,395	13,395	13,158	12,506	11,583	13,126	13,384	13,169
Long Hill (518 acres)	8,586	8,586	8,442	8,298	7,587	8,452	8,581	8,446
Rooster River (2,769 acres)	42,215	42,215	41,499	40,826	37,568	40,056	42,095	41,313
Turney Creek (1,523 acres)	25,688	25,688	25,153	23,915	22,928	25,194	25,664	25,281
Watershed Total (9,813 acres)	149,208	148,571	146,608	142,191	133,437	144,895	148,969	146,495

Watershed Management Recommendation	Existing Conditions (lb/yr)	Load Reduction due to Contols (%)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	10,513	6.1%	1.6%	8.1%	4.9%	2.5%	0.4%	2.1%
Horse Tavern Brook (3,196 acres)	48,812	0.0%	1.6%	3.7%	10.3%	2.0%	0.1%	1.7%
Londons Brook (1,002 acres)	13,395	0.0%	1.8%	6.6%	13.5%	2.0%	0.1%	1.7%
Long Hill (518 acres)	8,586	0.0%	1.7%	3.4%	11.6%	1.6%	0.1%	1.6%
Rooster River (2,769 acres)	42,215	0.0%	1.7%	3.3%	11.0%	5.1%	0.3%	2.1%
Turney Creek (1,523 acres)	25,688	0.0%	2.1%	6.9%	10.7%	1.9%	0.1%	1.6%
Watershed Total (9,813 acres)	149,208	0.4%	1.7%	4.7%	10.6%	2.9%	0.2%	1.8%

Phosphorus Load Reductions with Watershed Management Recommendations

Watershed Management Recommendation	Existing Conditions (lb/yr)	Future Conditions with Contols (lb/yr)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	2,051	1,924	2,025	1,915	1,983	2,047	2,036	2,013
Horse Tavern Brook (3,196 acres)	8,284	8,284	8,166	8,012	7,701	8,269	8,276	8,142
Londons Brook (1,002 acres)	2,401	2,401	2,365	2,262	2,184	2,398	2,399	2,362
Long Hill (518 acres)	1,425	1,425	1,404	1,383	1,310	1,423	1,424	1,401
Rooster River (2,769 acres)	7,931	7,931	7,819	7,710	7,328	7,900	7,893	7,774
Turney Creek (1,523 acres)	4,068	4,068	3,997	3,827	3,742	4,058	4,061	3,994
Watershed Total (9,813 acres)	26,161	26,033	25,777	25,108	24,246	26,095	26,089	25,687

Watershed Management Recommendation	Existing Conditions (lb/yr)	Load Reduction due to Contols (%)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	2,051	6.2%	1.3%	6.6%	3.3%	0.2%	0.7%	1.9%
Horse Tavern Brook (3,196 acres)	8,284	0.0%	1.4%	3.3%	7.0%	0.2%	0.1%	1.7%
Londons Brook (1,002 acres)	2,401	0.0%	1.5%	5.8%	9.1%	0.2%	0.1%	1.6%
Long Hill (518 acres)	1,425	0.0%	1.5%	2.9%	8.1%	0.1%	0.1%	1.7%
Rooster River (2,769 acres)	7,931	0.0%	1.4%	2.8%	7.6%	0.4%	0.5%	2.0%
Turney Creek (1,523 acres)	4,068	0.0%	1.8%	5.9%	8.0%	0.3%	0.2%	1.8%
Watershed Total (9,813 acres)	26,161	0.5%	1.5%	4.0%	7.3%	0.3%	0.3%	1.8%

Sediment (TSS) Load Reductions with Watershed Management Recommendations

Watershed Management Recommendation	Existing Conditions (lb/yr)	Future Conditions with Contols (lb/yr)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	600,670	598,574	593,331	562,633	581,628	600,670	600,345	572,769
Horse Tavern Brook (3,196 acres)	2,115,023	2,115,023	2,089,587	2,058,487	2,010,799	2,115,023	2,114,752	2,014,952
Londons Brook (1,002 acres)	614,260	614,260	606,475	585,109	574,022	614,260	614,190	585,804
Long Hill (518 acres)	368,121	368,121	363,726	359,641	348,533	368,121	368,088	350,374
Rooster River (2,769 acres)	2,405,413	2,405,413	2,376,859	2,350,410	2,274,009	2,405,413	2,404,497	2,286,261
Turney Creek (1,523 acres)	1,141,513	1,141,513	1,124,294	1,086,346	1,056,189	1,141,513	1,141,329	1,086,287
Watershed Total (9,813 acres)	7,244,999	7,242,903	7,154,272	7,002,626	6,845,180	7,244,999	7,243,201	6,896,446

Watershed Management Recommendation	Existing Conditions (lb/yr)	Load Reduction due to Contols (%)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	600,670	0.3%	1.2%	6.3%	3.2%	0.0%	0.1%	4.6%
Horse Tavern Brook (3,196 acres)	2,115,023	0.0%	1.2%	2.7%	4.9%	0.0%	0.0%	4.7%
Londons Brook (1,002 acres)	614,260	0.0%	1.3%	4.7%	6.6%	0.0%	0.0%	4.6%
Long Hill (518 acres)	368,121	0.0%	1.2%	2.3%	5.3%	0.0%	0.0%	4.8%
Rooster River (2,769 acres)	2,405,413	0.0%	1.2%	2.3%	5.5%	0.0%	0.0%	5.0%
Turney Creek (1,523 acres)	1,141,513	0.0%	1.5%	4.8%	7.5%	0.0%	0.0%	4.8%
Watershed Total (9,813 acres)	7,244,999	0.0%	1.3%	3.3%	5.5%	0.0%	0.0%	4.8%

Fecal Coliform Load Reductions with Watershed Management Recommendations

Watershed Management Recommendation	Existing Conditions (lb/yr)	Future Conditions with Contols (billion/yr)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	478,186	172,475	477,302	474,901	473,440	463,627	460,371	478,186
Horse Tavern Brook (3,196 acres)	487,360	487,360	482,915	479,468	442,273	432,739	460,157	487,360
Londons Brook (1,002 acres)	132,534	132,534	131,181	128,712	115,403	117,762	125,219	132,534
Long Hill (518 acres)	81,088	81,088	80,271	79,782	71,942	73,706	77,453	81,088
Rooster River (2,769 acres)	683,773	683,773	679,651	677,762	637,010	564,942	620,226	683,773
Turney Creek (1,523 acres)	256,142	256,142	252,885	248,300	234,661	230,218	242,497	256,142
Watershed Total (9,813 acres)	2,119,083	1,813,372	2,104,205	2,088,926	1,974,728	1,882,994	1,985,923	2,119,083

Watershed Management Recommendation	Existing Conditions (lb/yr)	Load Reduction due to Contols (%)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	478,186	63.9%	0.2%	0.7%	1.0%	3.0%	3.7%	0.0%
Horse Tavern Brook (3,196 acres)	487,360	0.0%	0.9%	1.6%	9.3%	11.2%	5.6%	0.0%
Londons Brook (1,002 acres)	132,534	0.0%	1.0%	2.9%	12.9%	11.1%	5.5%	0.0%
Long Hill (518 acres)	81,088	0.0%	1.0%	1.6%	11.3%	9.1%	4.5%	0.0%
Rooster River (2,769 acres)	683,773	0.0%	0.6%	0.9%	6.8%	17.4%	9.3%	0.0%
Turney Creek (1,523 acres)	256,142	0.0%	1.3%	3.1%	8.4%	10.1%	5.3%	0.0%
Watershed Total (9,813 acres)	2,119,083	14.4%	0.7%	1.4%	6.8%	11.1%	6.3%	0.0%

Runoff Volume Reductions with Watershed Management Recommendations

Watershed Management Recommendation	Existing Conditions (acre-ft/yr)	Future Conditions with Contols (acre-ft/yr)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	1,147	1,147	1,133	1,077	1,109	1,147	1,147	1,147
Horse Tavern Brook (3,196 acres)	4,495	4,495	4,441	4,379	4,264	4,495	4,495	4,495
Londons Brook (1,002 acres)	1,351	1,351	1,333	1,290	1,264	1,351	1,351	1,351
Long Hill (518 acres)	743	743	733	725	701	743	743	743
Rooster River (2,769 acres)	4,503	4,503	4,447	4,399	4,216	4,503	4,503	4,503
Turney Creek (1,523 acres)	2,366	2,366	2,330	2,254	2,193	2,366	2,366	2,366
Watershed Total (9,813 acres)	14,605	14,605	14,417	14,124	13,747	14,605	14,605	14,605

Watershed Management Recommendation	Existing Conditions (lb/yr)	Load Reduction due to Contols (%)						
		CSO Abatement	Green Infrastructure/ LID Retrofits (Retrofit 5% of Impervious Area)	Riparian Buffer Restoration	Reforestation	Public Education	Illicit Discharge Detection and Elimination (IDDE)	Street Sweeping and Catch Basin Cleaning
Ash Creek (805 acres)	1,147	0.0%	1.2%	6.1%	3.3%	0.0%	0.0%	0.0%
Horse Tavern Brook (3,196 acres)	4,495	0.0%	1.2%	2.6%	5.2%	0.0%	0.0%	0.0%
Londons Brook (1,002 acres)	1,351	0.0%	1.3%	4.6%	6.5%	0.0%	0.0%	0.0%
Long Hill (518 acres)	743	0.0%	1.2%	2.3%	5.6%	0.0%	0.0%	0.0%
Rooster River (2,769 acres)	4,503	0.0%	1.3%	2.3%	6.4%	0.0%	0.0%	0.0%
Turney Creek (1,523 acres)	2,366	0.0%	1.5%	4.7%	7.3%	0.0%	0.0%	0.0%
Watershed Total (9,813 acres)	14,605	0.0%	1.3%	3.3%	5.9%	0.0%	0.0%	0.0%

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Appendix E

Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

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Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Objective 1-1. Endorse the Plan and Establish a Watershed Organization				
Steering Committee endorse the Plan	Steering Committee	3 mos	Plan endorsed	Endorsement
Bridgeport, Fairfield, and Trumbull endorse plan formally	Municipalities	3 mos	Memorandum of Agreement (MOA), inter-municipal agreement, compact or similar mechanism	Municipal adoption of plan
Formation of Watershed Organization	Steering Committee, Greater Bridgeport Regional Council	6 mos	Watershed Organization members identified	
Appoint representatives from each of the municipalities as town liaisons	Watershed Organization	6 mos	Representatives appointed	
Hire a long-term Watershed Coordinator	Watershed Organization	6 mos	Watershed Coordinator position funded and filled	Develop and track annual work plan; leading outreach activities
Establish subcommittees for implementation of the watershed plan	Watershed Organization and Watershed Coordinator	6 mos	Subcommittee members identified	
Develop a work plan	Watershed Organization and Watershed Coordinator	1 yr	Work plan	
Lead public outreach activities	Watershed Organization and Watershed Coordinator	Ongoing	Host periodic public meetings	Number of meetings held
Objective 1-2. Identify and Secure Funding				
Submit grant applications for projects identified in the Watershed Management Plan	Watershed Organization	Ongoing	Grant applications	Amount of funding secured and grant applications submitted
Pursue funding for an ongoing, long-term water quality monitoring program	Watershed Organization	1 yr	Grant applications	Amount of funding secured and grant applications submitted
Actively advocate for state and federal funding	Watershed Organization and other interested organizations in Connecticut	Ongoing	Grant applications	Amount of funding secured and grant applications submitted
Objective 1-3. Promote Regional Collaboration				
Coordinate with the Pequonnock River Initiative and the Greater Bridgeport Regional Council	Watershed Organization	Ongoing	Periodic Meeting series with groups	
Coordinate with other watershed organizations in Connecticut and on Long Island	Watershed Organization	Ongoing	Collaborate on ongoing activities, outreach materials, and information	
Initiate contact with other municipalities, agencies, organizations and communities	Watershed Organization	1 yr	Support from private and public economic and business sectors	

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Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Objective 1-4. Conduct Stream Walks				
Conduct stream walks	Watershed Organization, NRCS, Southwest Conservation District	1-2 yrs	Assessment findings	Number of reaches and areas assessed
Ongoing field assessments and track-down surveys	Watershed Organization	Ongoing	Annual field assessments on rotating subwatersheds	Number of reaches and areas assessed
Objective 2-1. Conduct Water Quality Monitoring				
Establish an ongoing water quality (chemical and biological) monitoring program	Watershed Organization	1-2 yrs	QAPP, monitoring data, reporting	Monitoring results, findings
Conduct benthic macroinvertebrate monitoring using Rapid Bioassessment in Wadeable Streams & Rivers by Volunteer Monitors (RBV) program	Watershed Organization, NRCS, Trout Unlimited, and the Southwest Conservation District.	1-2 yrs	Monitoring data, reporting	Monitoring results, findings
Establish 1 or 2 routine, fixed-station monitoring sites within Ash Creek for routine analysis of bacteria (Enterococcus)	Watershed Organization	1-2 yrs	Monitoring data, reporting	Monitoring results, findings
Objective 2-2. Promote LID and Green Infrastructure				
Implement LID and green infrastructure demonstration projects	Watershed Organization, Municipalities	1-5 yrs	Completed projects	Number of projects, photos, monitoring
Provide education and outreach programs on green infrastructure and LID stormwater management approaches	Watershed Organization	Ongoing	Education events and materials	Number of participants and audience reached
Incorporate LID and green infrastructure requirements into local land use regulations	Municipalities	1-5 yrs	Regulatory review and revised land use regulations	
Implement CSO Long Term Control Plan	Bridgeport	Ongoing	Long Term Control Plan projects completed	Number of CSO discharges removed
Pursue sustainable, long-term funding sources to create a comprehensive green infrastructure program	Watershed Organization, Municipalities	1-5 yrs	Alternative funding sources for green infrastructure projects (i.e. user fees, stormwater utility districts, infrastructure banking, public-private partnerships, etc.)	Funding secured
City of Bridgeport should continue its city-wide green infrastructure initiatives, as identified in its BGreen 2020	Bridgeport	1-10 yrs		
Implement recommendations of the Bridgeport green infrastructure feasibility scan	Bridgeport	1-10 yrs		

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Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Implement the recommendations of the ongoing stormwater authority feasibility study	Bridgeport	1-5 yrs	Stormwater Authority initiated	Stormwater fees collected
Objective 2-3. Implement Stormwater Retrofits				
Implement stormwater retrofits identified in watershed plan	Watershed Organization and Municipalities	2-10 yrs	Completed projects	Number of projects, photos
Identify additional retrofit opportunities	Watershed Organization	5-10 yrs	Completed projects	Number of projects, photos
Encourage commercial stewardship	Municipalities	2-20 yrs	Completed projects	Number of projects, photos
Objective 2-4. Implement Municipal Stormwater Management Programs				
Work cooperatively to implement MS4 programs	Municipalities	1-5 yrs	Cost savings for public education and outreach, monitoring, mapping, and IDDE requirements	
Obtain alternative MS4 Permit monitoring program from CTDEEP to more effectively address the bacteria impairments in the Rooster River	Municipalities	1-5 yrs	alternative MS4 Permit for Bridgeport, Fairfield, and Trumbull	
Objective 2-5. Protect Existing and Restore Degraded Riparian Buffers				
Implement priority buffer restoration projects	Watershed Organization, Municipalities, Southwest Conservation District	2-10 yrs	Completed projects	Number of projects, photos, monitoring
Preserve and enhance riparian buffers for projects that provide public access	Watershed Organization	2-10 yrs	Completed projects	Number of projects, photos, monitoring
Strengthen riparian buffer regulations	Municipalities	2-5 yrs	Revised regulations	
Engage volunteers in buffer restoration projects	Watershed Organization, Municipalities, Southwest Conservation District	Ongoing	Completed projects	Number of projects, photos, monitoring, and number of volunteers
Provide buffer restoration workshops for municipal officials	UConn, CT Sea Grant and Dept. of Extension, Watershed Organization	1-2 yrs	Education events and materials	Number of participants and audience reached
Objective 2-6. Remove Combined and Sanitary Sewer Overflows				
Eliminate the CSO located at State Street and Dewey Street	Bridgeport	1-5 yrs	CSO Eliminated	
Eliminate the Sanitary Sewer Overflow (SSO) along the East Trunk Sanitary Sewer	Fairfield	1-10 yrs	SSO Eliminated	
Objective 2-7. Reduce Nuisance Waterfowl				
Augmented existing regulatory controls prohibiting the feeding of waterfowl	Municipalities	1-2 yrs	Revised regulations	
Develop a comprehensive strategy to control and reduce populations of nuisance waterfowl in the watershed	Watershed Organization and Municipalities	1-2 yrs	Management plan	

Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Objective 2-8. Identify and Eliminate Illicit Discharges				
Review and update municipal stormwater management plans	Municipalities	2-5 yrs	Revised stormwater management plans	Meets requirements of MS4 Permit
Implement priority stream cleanup projects	Watershed Organization	2-10 yrs	Completed cleanups	Number of cleanups, photos, amount of waste cleaned up
Educate municipal staff and the public on the topic of illicit discharges	Watershed Organization	Ongoing	Education events and materials	Number of participants and audience reached
Conduct follow-up illicit discharge investigations at priority outfall locations identified during stream walks	Watershed Organization and Municipalities	1-2 yrs	Completed follow-up and action taken to rectify illicit discharges	Number of potential identified illicit discharges investigated; number of illicit discharges rectified
Objective 2-9. Reduce Impacts from Hotspot Land Uses				
Review the current compliance of their respective facilities (public works/maintenance facilities, parks, schools, public safety facilities, etc.)	Municipalities	1-2 yrs	Compliance review completed	Compliance with respect to NPDES and MS4 Permits
Develop outreach program to dovetail with CTDEEP industrial stormwater permitting requirements for facility operators	Municipalities	1-2 yrs	Outreach with industrial facilities	Number of facilities visited
Ensure that reissued NPDES industrial water discharge permits contain provisions for TMDL implementation, LID, runoff volume reduction, and water quality protection	Municipalities	1-2 yrs	Reviewed/revised NPDES permits	Number of NPDES permits reviewed
Incorporate source controls, green infrastructure, and LID practices into brownfield redevelopment projects to reduce pollutant loads and runoff volumes	Municipalities	1-2 yrs	Improved stormwater controls at redevelopment sites	Number of redevelopment projects
Objective 3-1. Protect and Restore In-Stream and Riparian Habitat				
Address streambank erosion	Watershed Organization, Municipalities	2-10 yrs	Completed projects	Number of projects, photos, monitoring
Implement priority stream restoration projects	Watershed Organization, Municipalities, Southwest Conservation District	2-10 yrs	Completed projects	Number of projects, photos, monitoring
Implement stream daylighting projects for priority culvertized segments in the watershed	Watershed Organization, Municipalities, Southwest Conservation District	5-10 yrs	Completed projects	Number of projects, photos, monitoring
Conduct feasibility assessment for providing fish passage at tide gates	Watershed Organization, Municipalities, Southwest Conservation District	2-5 yrs	Feasibility assessment	
Revise local storm drainage design standards and regulations so future stream crossings are designed following the Connecticut Stream Crossing Guidelines	Municipalities	2-5 yrs	Revised local storm drainage design standards	

Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Objective 3-2. Protect and Restore Forests and Watershed Tree Canopy				
Protect existing forests through land acquisition and conservation easements	Municipalities	Ongoing	Completed projects	Area of forest land preserved
Strengthen local tree removal regulations and enforcement	Municipalities	1-5 yrs	Adopted/amended regulations	
Encourage reforestation of private land with native species	Municipalities	Ongoing	Completed projects	Area of reforested private land
Engage the tree wardens in the watershed municipalities	Municipalities	1-5 yrs	Meetings and discussions with tree wardens	Participation be tree wardens in urban forestry efforts
Conduct a detailed Urban Tree Canopy analysis	Watershed Organization and Bridgeport	2-5 yrs	Completed Urban Tree Canopy analysis	
Consider developing a tree ordinance	Municipalities	1-5 yrs	Adopted ordinance	
Implement local tree planting demonstration projects	Municipalities	2-10 yrs	Completed projects	Number of projects, photos
Objective 3-3. Manage Invasive Plant Species				
Implement priority invasive species management projects identified during the watershed field inventories	Watershed Organization, Municipalities, Universities and Schools	2-10 yrs	Completed projects	Number of projects, photos, monitoring
Develop an invasive species management plan	Watershed Organization, Municipalities, CT DEEP, The Nature Conservancy, Southwest Conservation District	2-5 yrs	Management plan	
Educate residents, facility maintenance personnel, landscapers and local nurseries, and land use commissions about non-native invasive species	Watershed Organization	1-2 yrs	Education events and materials	number of participants and audience reached
Involve volunteers and neighborhood groups in invasive species removal	Watershed Organization, Municipalities, CT DEEP, The Nature Conservancy, Southwest Conservation District	Ongoing	Invasive species removal	Number of sites or areas restored
Objective 3-4. Implement Ash Creek Estuary Master Plan Recommendations				
Create a permanent bi-municipal entity (Fairfield/Bridgeport) focused on the Ash Creek Estuary	Watershed Organization, Ash Creek Conservation Association	2-5 yrs	Creation of a Conservation Commission in the City of Bridgeport	and regular meetings and coordination between the two municipal Conservation Commissions
Develop a Phase 2 Comprehensive Ecological Restoration Plan (including investigations of wetland mitigation opportunities)	Watershed Organization, Ash Creek Conservation Association	1-5 yrs	Phase 2 Comprehensive Ecological Restoration Plan	

Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Integrate recommendations with post-Hurricane Sandy recovery efforts	Watershed Organization, Ash Creek Conservation Association	1-10 yrs	Restoration and improvements so the estuary for redevelopment projects	
Perform engineering review of tide gates to improve tidal flow in Turney Creek and Riverside Creek	Watershed Organization, Ash Creek Conservation Association	2-5 yrs	Engineering Study	
Investigate restoration opportunities, especially for St. Mary's Spit and Turney Creek	Watershed Organization, Ash Creek Conservation Association	2-5 yrs	Follow Ash Creek Master Plan	
Objective 4-1. Strengthen Land Use Regulations and Promote Sustainable Development				
Review and update land use regulations and planning documents to promote LID and green infrastructure	Town of Fairfield	1-2 yrs	Revised development codes, ordinances, and/or land use plans	
Adopt watershed management plan in local Plan of Conservation and Development	Municipalities	1 yr	Amended plan	
Adopt local riparian buffer regulations	Municipalities	1-2 yrs	New regulations	
Adopt tree ordinance or regulations	Municipalities	1-2 yrs	New ordinance or regulations	
Objective 4-2. Address Flooding Through a Watershed Approach				
adopt a policy of no-net-loss of flood storage capacity or flood conveyance	Municipalities	1-5 yrs	Revised floodplain management codes	
Update their natural hazard mitigation plans	Municipalities	2-5 yrs	updated plans	
Restore floodplain storage in the lower watershed by excavating fill and removing flood-prone structures	CTDEEP, municipalities	2-10 yrs	Excavating or dredging project completed	
Remove, redesign and reduce in-channel and in-floodway structures and restore channels, floodways and floodplains	Municipalities	2-10yrs	Structures removed from floodplains	Number of structures removed and channels restored
Conduct a watershed-wide flood management study	Municipalities	1-5 yrs	Completed flood management study	
Prepare for climate change by updating the design storm rainfall amounts and assessing the vulnerability of public and private infrastructure (e.g., utilities, transportation, structures)	Municipalities	2-10 yrs	Design storm amount changes in regulations; climate change impact study	
Address current flood problems using federal and state agency assistance and resources	Watershed Organization and Municipalities	1-2 yrs	Contact federal and state agencies	
Objective 4-3. Preserve and Protect Open Space				
Acquire unprotected open space	Watershed Organization and Municipalities	1-5 yrs	Protected land	Number of sites and acres protected

Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Provide for public access to open space areas	Municipalities	Ongoing	Completed projects	Number of sites
Create a watershed-wide "green" map of environmental features	Watershed Organization and Municipalities	1-2 yrs	Watershed-wide mapping	
Update open space planning documents at least every five years	Municipalities	1-5 yrs	Open space planning documents updates	
Objective 4-4. Increase Public Access to the River				
Develop a public access area inventory	Watershed Organization and Municipalities	1-2 yrs	Inventory mapping	Map and listing of the areas summarizing location, size, current and potential uses, and ownership
Enhance or provide river access at existing public open spaces	Watershed Organization and Municipalities	5-10 yrs	Completed projects	Number of sites
Target acquisition of new access points or areas	Watershed Organization and Municipalities	5-10 yrs	Projects identifies	Number of sites identifies
Objective 5-1. Develop and Maintain Website				
Develop an operational website	Watershed Organization	6 mos	Completed website	Number of hits on the website
Build Master List of Volunteers, Advocates, and Interested Followers	Watershed Organization	Ongoing	Ongoing email	Number of volunteers and advocates on mailing list; Number of followers on social media sites
Objective 5-2. Advance Local Government and Business Community Awareness				
Develop Watershed-Wide Drainage Infrastructure Mapping	Municipalities	2-5 yrs	Drainage infrastructure map	Completeness of map coverage
Provide Annual Municipal Pollution Prevention Training	Municipalities, NEMO	1-2 yrs	Training materials	Number of training sessions provided, number of participants
Provide Training for Municipal Reviewers, and Designers	Municipalities, NEMO	1-2 yrs	Training materials	Number of participants
Provide Training for Municipal Building Inspectors	Municipalities, NEMO	1-2 yrs	Training materials	Number of participants
Involve Municipalities in Restoration Activities	Municipalities, Watershed Organization	Ongoing		
Conduct Outreach for Targeted Businesses	Watershed Organization, Southwest Conservation District, CT Sea Grant, NEMO, NRCS	1-2 yrs	Education materials	Number of businesses contacted
Involve Businesses in Restoration Activities	Watershed Organization and Municipalities, Southwest Conservation District	Ongoing	Education materials	Number of businesses included in restoration activities

Pequonnock River Watershed Based Plan – Implementation Roadmap - Schedule, Milestones, and Evaluation Criteria

Action Items	Lead Entity	Timeline	Products	Evaluation Criteria
Develop and Host Workshop Series	Watershed Organization, Southwest Conservation District, CT Sea Grant, NEMO, NRCS	1-2 yrs	Education materials	Number of workshops and number of attendees
Objective 5-3. Conduct Homeowner Outreach and Education				
Promote Rooftop Disconnection	Watershed Organization	Ongoing	Education materials on the use of rain barrels/cisterns and rain gardens for rooftop disconnection	Number of roof leaders disconnected
Promote Sustainable Lawn and Landscape Maintenance and Backyard Habitat	Watershed Organization	Ongoing	Education materials	Number of workshops and number of attendees
Increase Watershed Stewardship Signage	Watershed Organization	Ongoing	New signage	Number of signs and participants
Objective 5-4. Enhance School Education and Stewardship Programs				
Identify Target Schools for Educational Programs	Watershed Organization and Municipalities	1-2 yrs	Schools identified	Number of schools identified, number of students
Develop a Watershed-Based Curriculum	Watershed Organization and Municipalities	2-5 yrs	Complete curriculum	
Develop a Place-Based Toolkit to Accompany the Curriculum	Watershed Organization and Municipalities	2-5 yrs	Complete toolkit	
Establish a Stewardship Work Program	Watershed Organization and Municipalities	1-5 yrs	Establish work program	Number of participating schools, teachers, and students

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Appendix F

Potential Funding Sources

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
CTDEEP Watershed and Stormwater Funding Website Index of many potential funding sources for funding watershed-based planning projects. http://www.ct.gov/dep/cwp/view.asp?a=2719&q=335494&depNav_GID=1654&pp=12&n=1					Varies
EPA Green Infrastructure Funding Website http://cfpub.epa.gov/npdes/greeninfrastructure/fundingopportunities.cfm Region 1 contact – Cathy Haas (631) 444-0427					October
CTDEEP Landowner Incentive Program http://www.ct.gov/dep/cwp/view.asp?a=2723&q=325734&depNav_GID=1655 Contact 860-295-9523 judy.wilson@ct.gov	$25,000		25% of project cost	April (last opened in 2011)	May
CTDEEP Long Island Sound License Plate Program http://www.ct.gov/dep/cwp/view.asp?a=2705&q=323782&depNav_GID=1635 Contact: 860-424-3034 kate.brown@po.state.ct.us	$25,000			Typically January (did not open in 2010 or 2011)	Typically March
CTDEEP Open Space and Watershed Land Acquisition http://www.ct.gov/dep/cwp/view.asp?a=2706&q=323834&depNav_GID=1641 Bridgeport has special status as a distressed and targeted investment community with priority under this program Contact: 860-424-3016 david.stygar@ct.gov			Grant pays 50-75% of fair market value or project cost	March (did not open in 2011)	June

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
CTDEEP Recreation and Natural Heritage Trust Program http://www.ct.gov/dep/cwp/view.asp?a=2706&q=323840&depNav_GID=1641					
America the Beautiful Grant Program http://www.ct.gov/dep/cwp/view.asp?a=2697&q=322872&depNav_GID=1631&depNav=| Contact: 860-424-3178 or 860-424-3635 chris.donnelly@po.state.ct.us	$8000		50%	May	June
Eastman Kodak / Nat'l Geographic American Greenways Awards optional Program http://www.conservationfund.org/kodak_awards jwhite@conservationfund.org, Jen White kodakawards@conservationfund.org	$2500	$300	Optional	April	June
EPA Healthy Communities Grant Program http://www.epa.gov/region1/grants/healthycommunities.html Padula.sandra@epa.gov 617-918-1797	$35,000	$5,000	Optional, up to 5%	March	May
EPA Targeted Watershed Grants Program http://www.epa.gov/twg/ Requires Governor nomination. No Connecticut groups have ever received a grant under this program			25% of total project costs (non-federal)		

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
Northeast Utilities Environmental Community Grant Program http://www.nu.com/environmental/grant.asp Contact: Patricia Baxa 860-665-2827 Brian Benito at 860-665-5033	$1,000	$250			April 15 October 15
CT DEEP CWA Section 319 NPS Nonpoint Source Management program Contact : stanley.zaremba@ct.gov 860-424-3730			40% of total project costs (non-federal)		September 15, 2011
CTDEEP Section 6217 Coastal NPS http://www.ct.gov/dep/cwp/view.asp?a=2705&q=323554&depNav_GID=1709 Section 6217 of the CZARA of 1990 requires the State of Connecticut to implement specific management measures to control NPS pollution in coastal waters. Management measures are economically achievable measures that reflect the best available technology for reducing nonpoint source pollution.			**N/A**		
CTDEEP Hazard Mitigation Grant Program http://www.ct.gov/dep/cwp/view.asp?a=2720&q=325654&depNav_GID=1654 Provides financial assistance to state and local governments for projects that reduce or eliminate the long-term risk to human life and property from the effects from natural hazards.			75% Federal / 25% Local		

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
NRCS Conservation Stewardship Program http://www.nrcs.usda.gov/programs/csp/ This program is available to producers to address resource concerns in a comprehensive manner by improving existing conservation activities and undertaking new conservation activities. Contact: Joyce Purcell, 860-871-4028					Rolling
NRCS Conservation Reserve Program http://www.nrcs.usda.gov/programs/crp/ This program is to provide technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally-beneficial and cost-effective manner. Contact: Joyce Purcell, 860-871-4028					Rolling
NRCS Floodplain Easement Program http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ct/home/?cid=stelprdb1143958 NRCS is providing up to $124.8 million in Emergency Watershed Protection Program-Floodplain Easement funding to help prevent damages from future storm events in Connecticut and other states affected by Hurricane Sandy. NRCS purchases the permanent easements on eligible lands and restores the area to natural conditions. The program complements traditional disaster recovery funding and allows NRCS to purchase a permanent easement on lands within floodplains that sustained damage from Sandy.					September 2013

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
American Rivers – NOAA Community-Based Restoration Program Partnership http://www.americanrivers.org/our-work/restoring-rivers/dams/noaa-grants-program.html These grants are designed to provide support for local communities that are utilizing dam removal or fish passage to restore and protect the ecological integrity of their rivers and improve freshwater habitats important to migratory fish.					
FishAmerica Foundation Conservation Grants 703-519-9691 x247 fishamerica@asafishing.org	Average $7,500				
NOAA Open Rivers Initiative http://www.habitat.noaa.gov/funding/ori.html Tisa Shostik (Tisa.Shostik@noaa.gov) 301-713-0174 x184 Cathy Bozek (Cathy.Bozek@noaa.gov) 301-713-0174 x150	$3,000,000	$100,000	Optional 1:1 non-federal		Fall/Winter
NFWF Long Island Sound Futures Fund Small Grants	$6,000	$1,000	Optional (non-federal)	Fall/Winter	Spring/ Summer
NFWF Long Island Sound Futures Fund Large Grants 631-289-0150 Lynn Dwyer Lynn.Dwyer@nfwf.org	$150,000	$10,000	Optional (non-federal)	Fall/Winter	Spring/ Summer

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
NRCS Wildlife Habitat Incentives Program (WHIP) http://www.nrcs.usda.gov/programs/whip/ For creation, enhancement, maintenance of wildlife habitat; for privately owned lands.	$50,000/year	$1,000	25%		
NRCS Environmental Quality Incentives Program (EQIP) http://www.ct.nrcs.usda.gov/programs/eqip/eqip.html For implementation of conservation measures on agricultural lands.	$50,000/year		25-50%		
NRCS Healthy Forests Reserve Program http://www.nrcs.usda.gov/programs/hfrp/proginfo/index.html For restoring and enhancing forest ecosystems					
NRCS Wetlands Reserve Program http://www.nrcs.usda.gov/programs/wrp/ For protection, restoration and enhancement of wetlands					
USFS Watershed and Clean Water Action and Forestry Innovation Grants http://www.na.fs.fed.us/watershed/gp_innovation.shtm This effort between USDA FS-Northeastern Area and State Foresters is to implement a challenge grant program to promote watershed health through support of state and local restoration and protection efforts.					Does not appear to have been open since 2005

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
Corporate Wetlands Restoration Partnership (CWRP) http://www.ctcwrp.org/9/ Can also apply for in-kind services, e.g. surveying, etc.	Typically $20,000	Typically $5,000	3 to 1	April and August	
Trout Unlimited Embrace A Stream http://www.tu.org/conservation/watershed-restoration-home-rivers-initiative/embrace-a-stream	$5,000				
USFWS National Coastal Wetlands Conservation Grant Program Ken Burton 703-358-2229 Only states can apply.	$1 million		50%		
YSI Foundation 937-767-7241 x406 Susan Miller Susan Miller smiller@ysi.com	$60,000		Optional	March	April
Other Financial Opportunities					
Private Foundation Grants and Awards Private foundations are potential sources of funding to support watershed management activities. Many private foundations post grant guidelines on websites (e.g., Fairfield County Community Foundation). http://www.rivernetwork.org/resource-library?tid=All					
Congressional Appropriation - Direct Federal Funding					
State Appropriations - Direct State Funding					

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
Membership Drives Membership drives can provide a stable source of income to support watershed management programs.					
Donations Donations can be a major source of revenue for supporting watershed activities, and can be received in a variety of ways.					
User Fees, Taxes, and Assessments Taxes are used to fund activities that do not provide a specific benefit, but provide a more general benefit to the community.					
Rates and Charges State law authorizes some public utilities to collect rates and charges for the services they provide.					
Stormwater Utility Districts A stormwater utility district is a legal construction that allows municipalities to designated management districts where storm sewers are maintained in order to the quality of local waters. Once the district is established, the municipality may assess a fee to all property owners.					
Impact Fees Impact fees are also known as capital contribution, facilities fees, or system development charges, among other names.					
Special Assessments Special assessments are created for the specific purpose of financing capital improvements, such as provisions, to serve a specific area.					
Property Tax These taxes generally support a significant portion of a county's or municipality's non-public enterprise activities.					
Excise Taxes These taxes require special legislation, and the funds generated through the tax are limited to specific uses: lodging, food, etc.					

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Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
Bonds and Loans Bonds and loans can be used to finance capital improvements. These programs are appropriate for local governments and utilities to support capital projects.					
Investment Income Some organizations have elected to establish their own foundations or endowment funds to provide long-term funding stability. Endowment funds can be established and managed by a single organization-specific foundation or an organization may elect to have a community foundation to hold and administer its endowment. With an endowment fund, the principal or actual cash raised is invested. The organization may elect to tap into the principal under certain established circumstances.					
Emerging Opportunities for Program Support Water Quality Trading Allows regulated entities to purchase credits for pollutant reductions in the watershed or a specified part of the watershed to meet or exceed regulatory or voluntary goals. There are a number of variations for water quality credit trading frameworks. Credits can be traded, or bought and sold, between point sources only, between NPSs only, or between point sources and NPSs.					
Mitigation and Conservation Banks Created by property owners who restore and/or preserve their land in its natural condition. Such banks have been developed by public, nonprofit, and private entities. In exchange for preserving the land, the "bankers" get permission from appropriate state and federal agencies to sell mitigation banking credits to developers wanting to mitigate the impacts of proposed development. By purchasing the mitigation bank credits, the developer avoids having to mitigate the impacts of their development on site. Public and nonprofit mitigation banks may use the funds generated from the sale of the credits to fund the purchase of additional land for preservation and/or for the restoration of the lands to a natural state.					

Rooster River Watershed Based Plan - Potential Funding Sources

Funding Source	Maximum Dollar Amount	Minimum Dollar Amount	Required Match	Applications Open	Deadline
Public Private Partnerships (P3s) Innovative financing mechanisms are being explored at the national level, particularly tapping into the resources of the private sector through public–private partnerships (P3s). Traditionally, water and wastewater infrastructure has been funded through municipal bonds, with help from EPA State Revolving Loan funds, while stormwater is typically funded either through its limited share of local general funds or stormwater utilities. The Chesapeake Bay states are exploring P3s to meet TMDL obligations for nutrients and sediment. A P3 is an arrangement between government and the private sector in which the private sector assumes a large share of the risk in terms of financing, constructing, and maintaining the infrastructure. Government repays the private sector over the long term if the infrastructure is built and maintained according to specifications. Prince George's County is launching a P3 pilot program in the fall of 2013 to retrofit 2000 acres of impervious surfaces in the public right of way. Private funds will finance 30% to 40% of the program costs upfront, enabling project construction to begin sooner and proceed more quickly. This program is part of the County's Watershed Protection and Restoration Program.					

Appendix G

Steering Committee Questionnaire Responses

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7
	Top Concerns/Issues/Priorities regarding the Rooster River Watershed	**What Would you Most like to see as Outcomes of the Rooster River Watershed Action Plan?**	**If you represent a Municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Specific examples?**	**What can you or your organization provide to the Watershed Action Plan?**	**Are you interested in becoming a member of the Steering Committee? Volunteering in Watershed Activities? Comments?**	**What other Organizations, Businesses, or Individuals might be interested in providing input to the Rooster River Watershed Action Plan?**	**Do you have any other ideas, advice or words of wisdom that might be helpful?**
Annette Jacobson-Fairfield Conservation Department	Significantly Improve Water Quality	Recognition that poor water quality did not result from only one project or development, but was result of each individually insignificant action that added up to a sig problem. The way to fix it is to chip away, one project at a time, every time, every opportunity	Fairfield has been requiring stormwater detention, water quality improvement & buffers for decades under it's Inland Wetland Agency permit review. This has been expanded by P&Z for detention(which also helps improve water quality). This should be required in Bridgeport and other watershed areas.	Expertise and Advice		Neighborhood Associations within the watersheds, Melville Village Association,	
	Eliminate all Combined Sewers	Improved buffers	Example-Fairfield Black Rock Tpke/Bridgeport Brewster Street, BJs/Cinemas on Fairfield side, Cinemas on Bpt side, Fairfield required permits for substantial development widening of flood plain by removal of wall along river for flood control and created islands and buffers. Bpt has no buffer to river.			Stratfield Improvement Association-Sam Boyarsky (President) 200 Autumn Ridge Rd, Fairfield CT 06825, 203-374-5143	
	Eliminate Sanitary Sewer Treatment Plan by-pass	Improved Citizen Awareness				Stratfield Village Association-PO Box 320232, Fairfield CT 06825, stratfieldvillage@yahoo.com	
	All Municipalities require stormwater detention & water quality improvement when applying for any permit						
	Increase Buffers						
Jim Sullivan-Trumbull Conservation Commission	Collection of Road Sand	River needs all WQ Standards	Trumbull Conservation Commission is advisory only, but we wish to help however we can				
	Loss of Wetlands to Development	Public recreated on River					
	No Funding for Valid Sampling	Habitat for Wildlife					
	Real Enforcement against Violators						
Gail Robinson- Ash Creek Conservation Assoc.	Restoration of Sand Dunes & Plantings destroyed by Sandy on St Mary's Sand Spit	Fairfield and Bridgeport working together in an ongoing way to improve & protect the entire watershed, including Ash Creek		We can provide our recently published scientific study of Ash Creek. We also have 8+ years of information gathered on Ash Creek.	Yes, Yes-Our organization has a number of people with specialized skills in presenting, teaching, environmental knowledge, etc.	We would like our VP, Steffen to serve on the Steering Committee as well as myself due to knowledge and interest on the Rooster River Watershed. Phone-203-254-4000 x2254	Although the grant doesn't cover the Ash Creek tidal estuary, it is part of the watershed ecosystem and needs to be included in the discussion and public presentations. Watershed needs to be considered as a whole. Also, water quality is only on measure of the health of a watershed, biodiversity & habitat are equally important
	Improving Tidal Gate Flow-Turney Creek and Riverside Creek	Development of Green Infrastructure plan to address CSOs and stormwater runoff		We can help with the public forums-we have done forums in the past to educate on the Rooster River Watershed.			
	Completion of Remediation of 2800 foot embankment(no plantings) at Fairfield Metro Center			We have access to university level expertise through out VP(L.Kraig Steffen, who teaches organic chemistry, chemistry, energy & environment.			
	Create a permanent bi-municipal entity(Fairfield/Bridgeport)to make joint decisions about Ash Creek						
Don Watson-Trumbull Conservation Commission	Promote Lawn Property Maintenance	De-list	Yes, Trumbull Conservation Commission will support & promote	Yes, Trumbull Conservation Commission will help	Yes, but also want an alternate. No		Education and Outreach
	Flooding	More recreational access	Trumbull Natural Resource Inventory				
	Promote Green Infrastructure	Improved species values					
	Opportunity for Public Education						

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7
	Top Concerns/Issues/Priorities regarding the Rooster River Watershed	**What Would you Most like to see as Outcomes of the Rooster River Watershed Action Plan?**	**If you represent a Municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Specific examples?**	**What can you or your organization provide to the Watershed Action Plan?**	**Are you interested in becoming a member of the Steering Committee? Volunteering in Watershed Activities? Comments?**	**What other Organizations, Businesses, or Individuals might be interested in providing input to the Rooster River Watershed Action Plan?**	**Do you have any other ideas, advice or words of wisdom that might be helpful?**
Brian Lindquist-Ash Creek Conservation Assoc	Sewage Overflow						
	Restoration of Ash Creek, especially by Metro Station						
Tom Zimmerman- Bpt Resident	Removal of dishwasher that neighbors dumped into the River between Stratfield Rd, Hughes St and Unqoua Hill St						
Frank Rice-Fairfield Wetland Agency	The large number of homes on the bank of Rooster River						
Robert Halstead-Bpt Community Land Trust	Tap into CIA state DEEP PA 228	Synergy with other interest groups(quality of life, bike advocacy, Community Development)		Grant Writing through 501C3 for open space acquisition	Yes, Yes- I can organize BPT residents in proximity to Commerce Park(Main St Bpt)	Bike Friendly Bridgeport, Connecticut Community Gardening, North End Association	Please direct the scope to include automobile, runoff, silt and cancer causing chemicals
	Acquisition Funding			CIA PA 228 DEEP			
	Acquire at Risk Wetland						
Tom Steinke-Fairfield Conservation Dept	Restore floodwater storage in low-lying floodplain in lower watershed by escavating fill and removing flood-prone structures, adopt no netloss policy of flood storage capacity. Upper watershed-emphasize restoration of infiltration and bio-filtration, restore detention capacity, no net-loss of capacity due to floodplain encroachment and removal of fill and restoration of floodplain and natural channel meanders	A comprehensive water quality planning document that will support an inter-municipal agreement that will be integrated with municipal and state land-use planning goals directed toward implementing the plan and achieving its objectives.	The Watershed Action Plan could be used to guide decision making with respect to planning, budgets, and investment priorities in municipal CSOs and correcting and repairing SSOs; in flood and erosion control plans; open space acquisition and development, public works, and highway plans and investments for related improvements;	I am not familiar with the WAP contributions needed, also depends on available time and priorities set by the town of Fairfield.		1. The Kings Highway East Neighborhood Association (unknown status of the organization as it is action-oriented following a large flood event and there has not been a significant flood event in the recent past.)	Patience
	Study hydro-geomorphology of river to understand urban system and plan for future water quality improvement and food relief.					2. Grasmere Neighborhood Association	
	Remove, redesign and reduce in-channel and in-floodway structures and restore channels, floodways and floodplains.						
	Examine public and private utlity systems for potential to be damaged in storms						
	Reevaluate municipal policies, plans, and regulations that may adversely affect the river system, such as “Channel Lines”, increased development and density without concomitant improvements in stormwater runoff water quality, detention, groundwater recharge and flood relief						
	Evaluate potential watershed and runoff changes related to climate change for their significance to water quality and river system dynamics						
	Provide vegetated buffers around all watercourses and wetlands where feasible						

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7
	Top Concerns/Issues/Priorities regarding the Rooster River Watershed	**What Would you Most like to see as Outcomes of the Rooster River Watershed Action Plan?**	**If you represent a Municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Specific examples?**	**What can you or your organization provide to the Watershed Action Plan?**	**Are you interested in becoming a member of the Steering Committee? Volunteering in Watershed Activities? Comments?**	**What other Organizations, Businesses, or Individuals might be interested in providing input to the Rooster River Watershed Action Plan?**	**Do you have any other ideas, advice or words of wisdom that might be helpful?**
	River wetlands area at kings highway behind mountain grove cemetary-restore acres of Ash Creek tidal wetlands through excavation of accumulated sediment upstram of I-95 wetland crossing. Tidal flushing and discharge through restored channel widths and lateral wetlands btw Kings Hwy East/North Ave Bridge and Black Rock Tpke/Brewster St Bridge.						
	Public access to Fairfield and Bridgeport communiteis from Kings Hwy East downstream to Fairchild Ave-contruct pedestrian walkway along raised eastment of the Fairfield East trunk sanitary sewer through the wetland						
	Consider pedestrian bridge over Ash Creek to connect westerly section of Black Rock to Metro center						
	Evaluate flow condition to eliminate CSOs in Brigeport and SSOs in Fairfield						
	Grasmere Subwatershed-improve water quality, relieve flooding, restore habitat, public access						
	Middle Watershed from Upper Brooklawn Ave Bridge-improve water quality by restoring floodplain and natural channel meanders						
	Upper Watershed-improve water quality, habitat restoration , relieve flooding by engaging with Fairchild Golf Course, restore natural overbank floodplain of drainage network, water control for course, engage public and private groups to provide bio-filtration and SW detention						

Rooster River Watershed Action Plan Questionnaire

Name: DON WATSON Organization: Trumbull CC

Position: TRUMBULL CC E-mail: EarthRise001@SBCglobal.net

Phone: 203 459 0332 Cell Phone: /

Street Address (for mailings): 54 LARKSPUR DR

TRUMBULL CT 06611

1. What are your top five (or more) concerns/issues/priorities regarding the Rooster River Watershed?

1. buffers - promote lawn property maintenance
2. flooding
3. promote green infrastructure
4. opportunity for public education
5.

2. What would you most like to see as outcomes of the Rooster River Watershed Action Plan?

Delist
more recreational access
Improved species values

3. If you represent a municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Can you give specific examples?

Yes
Trumbull Conservation Commission will support + promote also Trumbull Natural Resource Inventory.

4. What can you or your organization provide to the Watershed Action Plan? (expertise,advice, in-kind services, etc.)

Yes Trumbull
Conservation Commission
will help

5. Are you interested in:

becoming a member of the Steering Committee ✓ Yes ___ No but also want an alternate
volunteering in watershed activities ___ Yes ___ No

Comments:

6. What other organizations, businesses, or individuals might be interested in providing input to the Rooster River Watershed Action Plan? (Please provide contact info if you have it – Thanks!)

7. Do you have any other ideas, advice or words of wisdom that might be helpful?

educat in
outreach

THANK YOU FOR YOUR TIME!

Rooster River Watershed Action Plan Questionnaire

Name: Gail Robinson

Organization: Ash Creek Conservation Association, Inc.

Position: President

E-mail: ashcreekassoc@optonline.net

Phone: 203-521-0768

Cell Phone: 203-521-0768

Street Address (for mailings): 247 Harborview Avenue, Bridgeport, CT 06605

1. What are your top five (or more) concerns/issues/priorities regarding the Rooster River Watershed?

1. Improving water quality
2. Restoration of sand dunes & plantings destroyed by Sandy on St. Marys sand spit
3. Improving tidal gate flow - Turney Creek & Riverside Creek
4. Completion of Remediation of 3800 foot embankment (no plantings) - Fairfield Metro Center
5. Creating a permanent ~~group~~ bi-municipal entity (Fairfield/Bridgeport) to make joint decisions about Ash Creek

2. What would you most like to see as outcomes of the Rooster River Watershed Action Plan?

Fairfield and Bridgeport working together in an ongoing way to improve & protect the entire watershed, including the Ash Creek Tidal Estuary

Development of green infrastructure plan to address CSOs, stormwater runoff

3. If you represent a municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Can you give specific examples?

N/A

4. What can you or your organization provide to the Watershed Action Plan? (expertise, advice, in-kind services, etc.)

We can provide our recently published scientific study of Ash Creek. We also have 8+ years of information gathered on Ash Creek. We can help with the public forums. We have done public forums to educate on the Rooster River Watershed and have a projector. We have access to university-level expertise through our Vice President, L. Kraig Steffen, who teaches Organic Chemistry as well as Chemistry, Energy, & Environment

5. Are you interested in:

becoming a member of the Steering Committee ✓ Yes ___ No
volunteering in watershed activities ✓ Yes ___ No

Comments:

Our organization has a number of people with specialized skills in presenting, teaching, environmental knowledge, etc.

6. What other organizations, businesses, or individuals might be interested in providing input to the Rooster River Watershed Action Plan? (Please provide contact info if you have it – Thanks!)

We would like our Vice President, L. Kraig Steffen to serve on the Steering Committee as well as myself due to his knowledge and interest in the Rooster River Watershed.

Phone: 203-254-4000 X2254

Kraig is a professor of Organic Chemistry at Fairfield University.

7. Do you have any other ideas, advice or words of wisdom that might be helpful?

Although the grant doesn't cover the Ash Creek tidal estuary, it is part of the watershed ecosystem and needs to be included in the discussions and public presentations. A watershed needs to be considered as a whole. Also, water quality is only one measure of the health of a watershed, biodiversity & habitat are equally important.

THANK YOU FOR YOUR TIME!

Rooster River Watershed Action Plan Questionnaire

Name: Annette Jacobson Organization: Fairfield Conservation Dept.

Position: Conservation Administrator E-mail: ajacobson@town.fairfield.ct.us

Phone: 203 256-3071 Cell Phone: _____

Street Address (for mailings): 725 Old Post Road

Fairfield, CT 06824

1. What are your top five (or more) concerns/issues/priorities regarding the Rooster River Watershed?

1. To significantly improve water quality
2. Eliminate all combined sewers
3. Eliminate Sanitary Sewer Treatment Plant (STP) by-passes.
4. To have each municipality on Every Proposed addition, house, driveway or driveway expansion, parking lot, etc by P+Z or Inland Wetlands, Require
5. stormwater detention & water quality improvement. (Even if replacing existing impervious surface — to make-up for historical non-detention.)
   → Increase buffers

2. What would you most like to see as outcomes of the Rooster River Watershed Action Plan?

- Recognition that poor water quality did not result from only one project or development but was a result of each individually in-significant action that added-up to a significant problem. The way to fix it is to chip-away, one project or one modification at a time, every time, every opportunity.
- Improved buffers
- Improved citizen awareness

3. If you represent a municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Can you give specific examples?

Fairfield has been requiring stormwater detention, water quality improvement + buffers for decades under its Inland Wetland Agency permit review. This has been expanded by P+Z for detention (which also helps improve water quality).

These efforts should be required in Bridgeport + other watershed areas as well.

Example: Fairfield Black Rock Tpk/Bridgeport Brewster Street.

BJ's/Cinemas on Fairfield side, Cinemas on Bpt side. Fairfield required in permits for substantial development widening of floodplain by removal of wall along river for flood control, + created islands + buffers. Bpt has no (zero) buffer to river.

4. What can you or your organization provide to the Watershed Action Plan? (expertise, advice, ~~in-kind services, etc.~~) Yes

5. Are you interested in:

becoming a member of the Steering Committee ___ Yes ___ No
volunteering in watershed activities ___ Yes ___ No

Comments:

6. What other organizations, businesses, or individuals might be interested in providing input to the Rooster River Watershed Action Plan? (Please provide contact info if you have it – Thanks!)

Neighborhood Associations within the watershed?

Stratfield Improvement Association – Sam Boyarsky President
200 Autumn Ridge Rd Fairfield CT 06825
203-374-5143

Melville Village Association ?

Stratfield Village Association – P.O. Box 320232 Fairfield, CT 06825
Stratfieldvillage@yahoo.com

7. Do you have any other ideas, advice or words of wisdom that might be helpful?

THANK YOU FOR YOUR TIME!

1/18/13

Rooster River Watershed Action Plan Questionnaire

Name: Thomas J. Steinke Organization: Fairfield Conservation Dept.

Position: Conservation Director; E-mail: tsteinke@town.fairfield.ct.us

Phone: 203-371-5695 Cell Phone: _____

Street Address (for mailings): John J. Sullivan Independence Hall
725 Old Post Road
Fairfield, CT 06824

1. What are your top five (or more) concerns/issues/priorities regarding the Rooster River Watershed?

1. In the lower watershed, consider restoring floodwater storage in low-lying floodplain areas by excavating fill and removing flood-prone structures; adopt a policy of no net-loss of flood storage capacity when property is developed or re-purposed. In upper watershed areas, emphasize restoration of infiltration and bio-filtration; restore detention capacity; no net loss of capacity due to floodplain encroachment; removal of fill and restoration of floodplain and natural channel meanders.

2. Study the river's hydro-geomorphology to understand how this urban river system works and how to plan for it in the future so as to improve water quality and food relief.

3. Remove, redesign, and through condemnation proceedings or otherwise, reduce "in-channel" and "in-floodway" structures and restore the channels, floodways , and floodplains to the extent possible.

4. Examine public and private utility systems that contact the river channel, for their potential to be damaged or destroyed in storm events thus posing significant impacts to water quality or the riverine system, e.g., are sanitary sewer trunk lines in danger of structural damage and failure due to 'down-cutting' of the channel due to increased runoff and storm discharge and scour?

5. Reevaluate municipal policies, plans, and regulations that may adversely affect the river system, such as "Channel Lines", increased development and density without concomitant improvements in stormwater runoff water quality, detention, groundwater recharge and flood relief.

6. Evaluate potential watershed and runoff changes related to climate change for their significance to water quality and river system dynamics.

7. Provide vegetated buffers around all watercourses and wetlands where feasible.

I. Lower Watershed:

A. Rooster River wetlands area at Kings Highway East behind the Mountain Grove Cemetery:

1. Look at the potential for improved water quality and flood relief in this area by restoring acres of the Ash Creek tidal wetlands through the excavation of accumulated sediment upstream of the I-95 wetland crossing where the I-95 embankment has caused the upper wetland basin complex to act as a stilling basin to accrete several feet of sediment that eroded from the upper watershed.

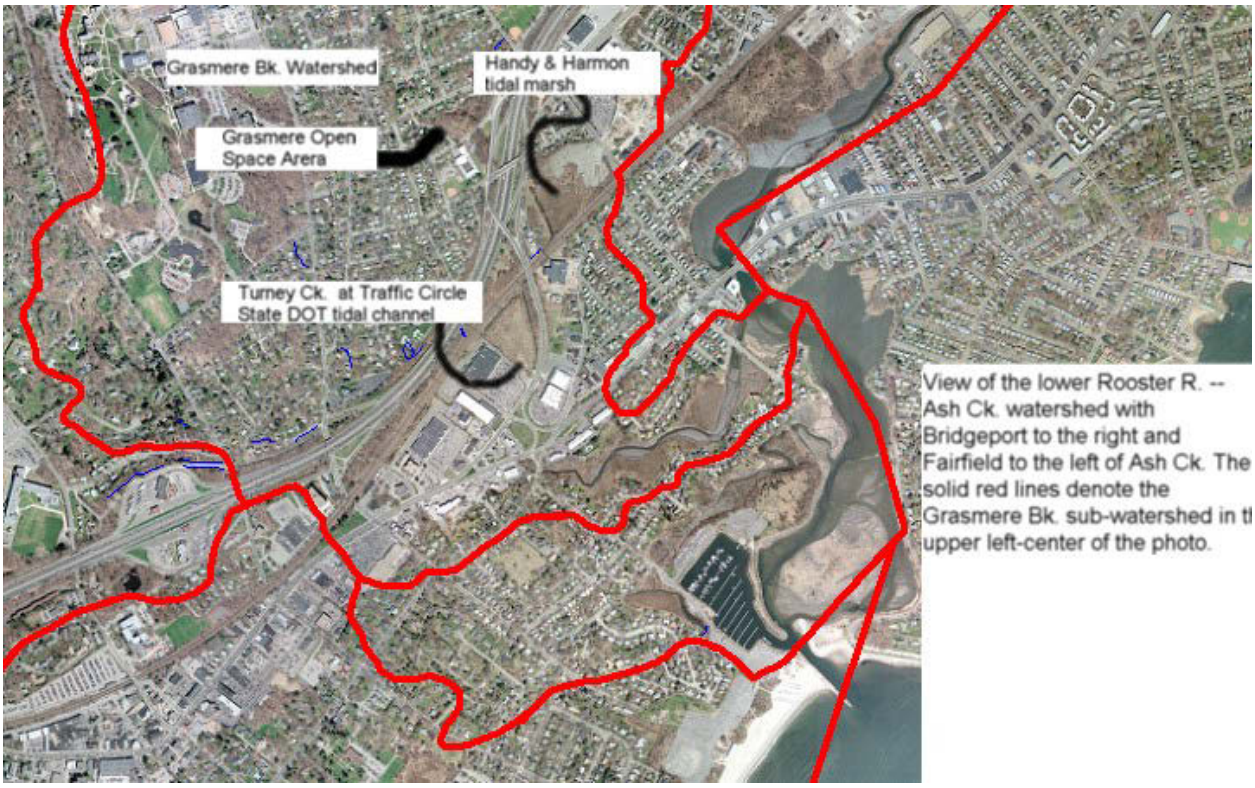
2. Provide improved water quality and flood relief in this area through tidal flushing and discharge through restored channel widths and lateral wetlands between the Kings Highway East/North Avenue Bridge and the Black Rock turnpike / Brewster Street Bridge.

3. Provide public access to the Fairfield and Bridgeport communities to experience a remarkable tidal freshwater wetland habitat complex from Kings Highway East downstream to Fairchild Avenue by constructing a pedestrian walkway along the raised easement of the Fairfield east trunk sanitary sewer through the wetland.

4. Consider a pedestrian bridge over Ash Creek to connect the westerly section of Black Rock to the Metro Center complex.

5. Improve water quality by evaluating flow conditions for the purpose of eliminating the CSOs in Bridgeport and the SSOs in Fairfield that intermittently discharge sewage to Rooster River/Ash Creek below the Kings Highway East—North Avenue Bridge.

B. Grasmere Subwatershed in the Kings Highway Holland Hill Road and Home Street area



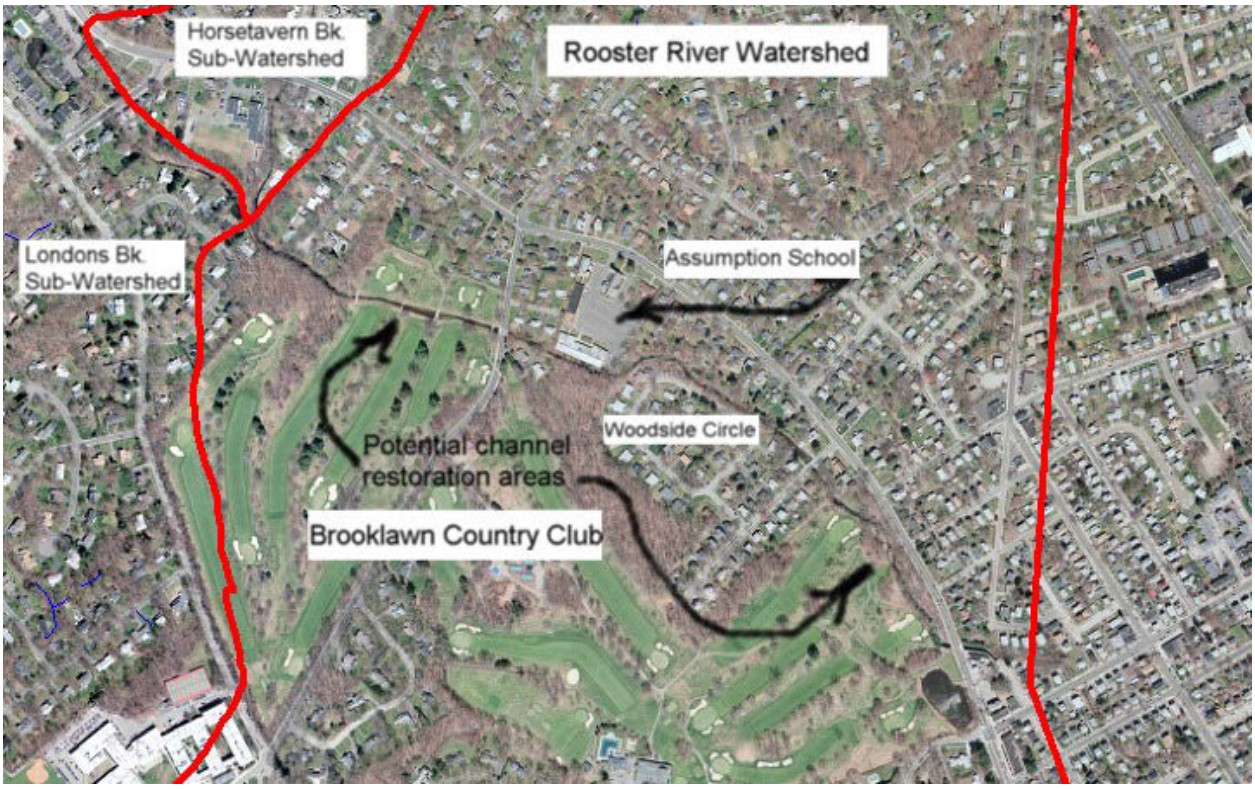
(photo)

1. At the Grasmere Brook Open Space property: Improve water quality, relieve flooding downstream in the traffic circle area to Turney Creek neighborhood, restore plant and animal habitats, and provide public access by restoring the inland wetland by removing accumulated fill and debris while providing an access trail and sound attenuator berm to reduce traffic noise form I-95.

2. In Turney Creek (Grasmere Brook Watershed) NE of the Post Road Traffic Circle immediately east of the Stop & Shop Supermarket: Improve water quality, provide salt marsh plant and animal habitat, and relieve flooding by redesigning and removing all or a portion of the State's open concrete trapezoidal channel of Turney Creek between the Circle and the Railroad right-of-way.

3. In Turney Creek, pursue restoration of water quality by remediating the tidal marsh with the significant industrial oil and heavy metal contamination resulting from the Grasmere Avenue former Handy & Hamon metals processing factory.

II. Middle Watershed of Rooster River from Upper Brooklawn Avenue Bridge to the convergence of Horsetavern Brook and London Brook



1. Improve water quality and provide flood relief by engaging the Brooklawn Country Club in a cooperative program to restore the floodplain and natural channel meanders in the low areas of the golf course along the river at Brooklawn Avenue and above Cornell Road.

2. Improve water quality in the actively eroding Woodside Circle – Assumption School channel area on public and private property where the Rooster River is down-cutting and widening its channel by eroding large amounts of soil and washing suspended sediment into the river.

III. Upper Watershed (Fairfield, Bridgeport, Trumbull)

(photo)

A. London Brook

1. Improve water quality, plant and animal habitats, and relieve flooding by engaging the Fairchild Wheeler Golf Course in a cooperative effort to restore wetlands around the golf course, restore the natural overbank floodplain of the primary drainage network, and provide a water-control structure at the golf course discharge pipe along the southerly side of the course to improve stormwater detention and attenuate downstream flooding.

2. Improve water quality and provide flood relief by engaging public and private institutional, educational, commercial, and recreational facilities and property owners to provide bio-filtration and storm water detention to compensate for impermeable surfaces associated with their facilities.

B. Horsetavern Brook

1. Improve water quality and provide flood relief by engaging public and private institutional, educational, commercial, and recreational facilities and property owners to provide bio-filtration and storm water detention to compensate for impermeable surfaces associated with their facilities.
2.

2. What would you most like to see as outcomes of the Rooster River Watershed Action Plan?

Ans.: A comprehensive water quality planning document that will support an inter-municipal agreement that will be integrated with municipal and state land-use planning goals directed toward implementing the plan and achieving its objectives.

3. If you represent a municipality, do you see opportunities for the Watershed Action Plan to complement your efforts to improve the Rooster River water quality? Can you give specific examples?

Ans. The Watershed Action Plan could be used to guide decision making with respect to planning, budgets, and investment priorities in municipal CSOs and correcting and repairing SSOs; in flood and erosion control plans; open space acquisition and development, public works, and highway plans and investments for related improvements;

4. What can you or your organization provide to the Watershed Action Plan? (expertise,advice, in-kind services, etc.)

Ans. I am not familiar with the WAP contributions needed, also depends on available time and priorities set by the town of Fairfield.

5. Are you interested in:

becoming a member of the Steering Committee ___ Yes ___ No
volunteering in watershed activities ___ Yes ___ No

Comments:

6. What other organizations, businesses, or individuals might be interested in providing input to the Rooster River Watershed Action Plan? (Please provide contact info if you have it – Thanks!)

Ans. (tentative)

1. The Kings Highway East Neighborhood Association (unknown status of the organization as it is action-oriented following a large flood event and there has not been a significant flood event in the recent past.)
2. Grasmere Neighborhood Association
3.

7. Do you have any other ideas, advice or words of wisdom that might be helpful?

Patience

THANK YOU FOR YOUR TIME!

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