



Pomperaug River Watershed Based Plan

prepared by FUSS & O'NEILL

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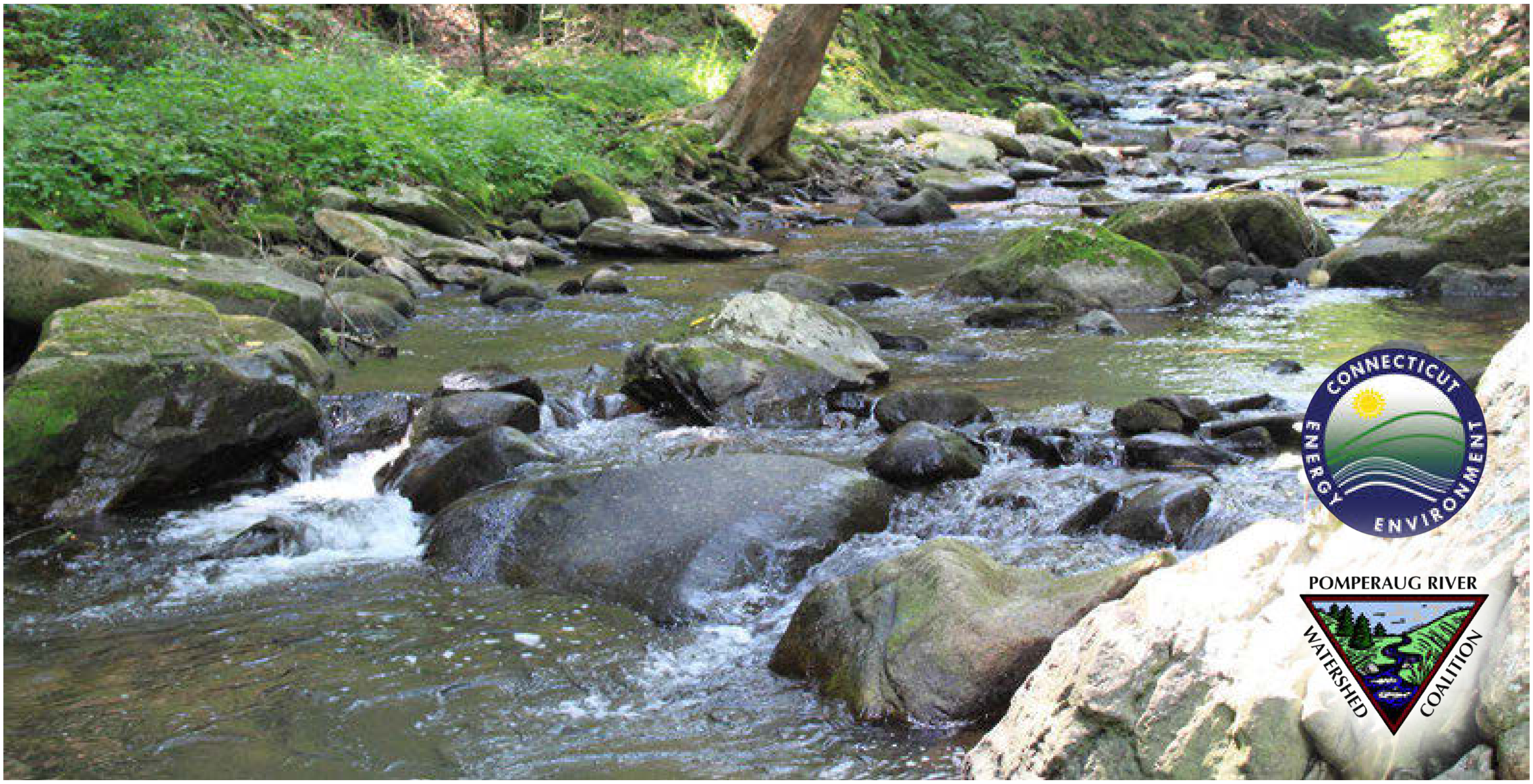

CONNECTICUT ENERGY ENVIRONMENT

POMPERAUG RIVER WATERSHED COALITION

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List of Acronyms

APA	Aquifer Protection Area
BMP	Best Management Practice
CFU	Colony Forming Units
CLEAR	Center for Land Use Education and Research
COGCNV	Council of Governments Central Naugatuck Valley (merged with Valley COG 2016 to form Naugatuck Valley COG)
CTDPH	Connecticut Department of Public Health
CT ECO	Connecticut Environmental Conditions Online
CTDEEP	Connecticut Department of Energy and Environmental Protection
CTDOT	Connecticut Department of Transportation
DCIA	Directly Connected Impervious Area
EQIP	Environmental Quality Incentives Program
EPA	U.S. Environmental Protection Agency
FLRP	Farmland Restoration Program
GI	Green Infrastructure
GIS	Geographic Information Systems
GPD	Gallons per Day
HVA	Housatonic Valley Association
IC	Impervious Cover
IDDE	Illicit Discharge Detection and Elimination
IWQR	Integrated Water Quality Report
LID	Low Impact Development
MGD	Million Gallons per Day
MS4	Municipal Separate Storm Sewer System
NEMO	Nonpoint Education for Municipal Officials
NFWF	National Fish and Wildlife Foundation
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
NRCS	USDA Natural Resource Conservation Service
NVCOG	Naugatuck Valley Council of Governments
NWQA	National Water Quality Assessment
NWQI	National Water Quality Inventory (EPA)
NWQI	National Water Quality Initiative (NRCS)
PDDH	Pomperaug District Department of Health
PRWC	Pomperaug River Watershed Coalition
QAPP	Quality Assurance Project Plan
ROW	Right-of-Way
TMDL	Total Maximum Daily Load
UCONN	University of Connecticut
USDA	United States Department of Agriculture
USGS	United States Geologic Survey
WTM	Watershed Treatment Model

1 Introduction

1.1 Background

The Pomperaug River and Its Watershed

The Pomperaug River watershed (also referred to as the Pomperaug River Regional Basin) (*Figure 1-1*) covers a 90-square mile area within the eight Connecticut towns of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown, Middlebury, and Morris in western Connecticut.

The Pomperaug River flows for approximately 13 miles from the confluence of the Weekeepeemee and Nonnewaug Rivers in Woodbury, south to the Housatonic River along the Southbury/Newtown border. Other major tributaries to the Pomperaug River include Transylvania Brook and Hesseky Brook, while Sprain Brook drains to the Weekeepeemee River and East Spring Brook feeds the Nonnewaug River (*Figure 1-2*).

What is a Watershed?

A watershed is the area of land that contributes runoff to a lake, river, stream, wetland, estuary, or bay. Land use activities within a watershed affect the water quality of the receiving waters.

Figure 1-1. Municipalities located within the Pomperaug River watershed (PRWC)

Land use in the southern part of the Pomperaug River watershed is dominated by suburban residential and commercial development, while the northern portion of the watershed is rural in character with primarily low-density residential land use and agricultural lands. Forested areas account for a third of the watershed, and approximately 16% of the watershed is protected open space. Major roads located in the watershed include Interstate 84, U.S. Route 6, and State Routes 61, 63, 64, 67, 172, 317, 47, and 132.

The waters of the Pomperaug River and its tributaries are connected to the groundwater aquifers within the watershed. The aquifers seasonally sustain streamflow and supply millions of gallons of drinking water daily to towns both in and outside of the Pomperaug watershed.

The existing physical, land use, and water quality characteristics of the Pomperaug River watershed are summarized in *Section 2* of this watershed based plan.

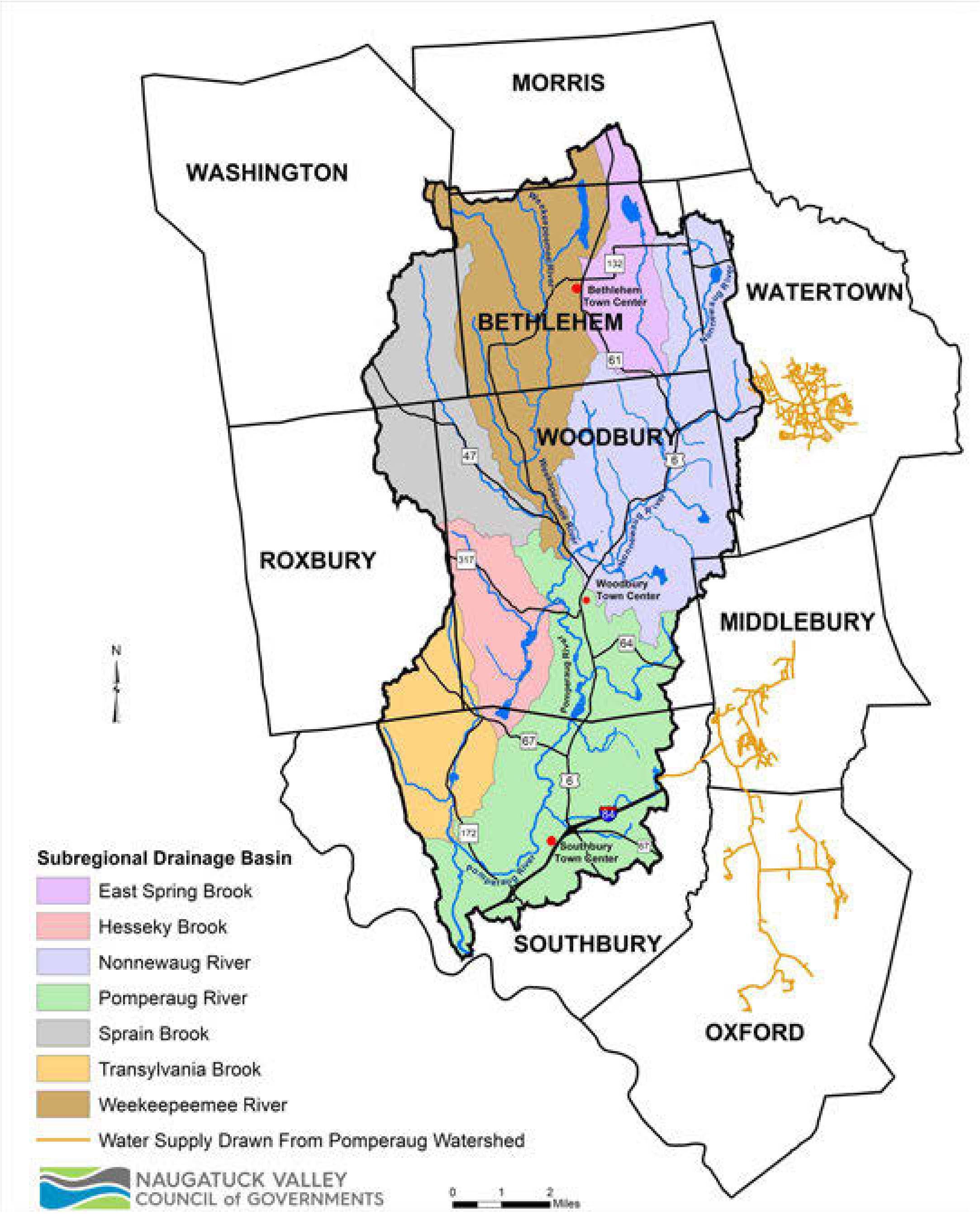


Figure 1-2. Watershed overview

Issues Facing the Pomperaug River Watershed

Impaired Recreational Use – Degraded Surface Water Quality

The Pomperaug River has been impacted by development and land use activities in its watershed. There are segments of the Pomperaug River, Weekeepeemee River, and Transylvania Brook where in-stream fecal indicator bacteria levels have been measured in excess of the State water quality standard for recreation.

Potential sources of bacteria in the watershed include "non-point sources" such as diffuse stormwater runoff, failing or malfunctioning septic systems, agricultural activities including but not limited to numerous farms in the northern part of the watershed, and waste from wildlife and pets. "Point sources" of bacteria include permitted discharges from Municipal Separate Storm Sewer Systems (MS4s), potential illicit discharges, and runoff from industrial and commercial facilities.

The Connecticut Department of Energy and Environmental Protection (CTDEEP) completed a "Statewide Bacteria Total Maximum Daily Load" (TMDL) for 176 impaired waterbody segments (CTDEEP, 2012) based on the 2010 Impaired Waters List. The TMDL sets target pollution levels and establishes a framework for restoring water quality of the impaired segments. Three of the bacteria-impaired segments in the Pomperaug River watershed are included in the TMDL (Pomperaug River-01 and -03 and Weekeepeemee River) based on past monitoring data. The pollution reduction goals specified in the Statewide Bacteria TMDL can be achieved by implementing actions that will reduce bacterial loads using a watershed framework. This watershed based plan therefore provides a framework for implementing the TMDL. Ultimately, the goal of both the watershed plan and the TMDL is to improve water quality in the Pomperaug River watershed, which will contribute to improved water quality in downstream receiving waters including Long Island Sound.

It is important to note that the data supporting the identified recreational impairments in the Pomperaug River watershed are extremely limited and based on data collected between 2006 and 2010, which underscores the need for additional water quality monitoring and analysis to support future plan implementation.

Physical Alterations

Physical alterations to stream channels (historic channelization), floodplains, and riparian corridors in the watershed have impacted water quality and the flow regime of the Pomperaug. Historically, gravel removal in the watershed has affected streamflow and altered the river floodplain. Potential future flow alterations, including permitted water withdrawals, have the potential to further impact habitat and limit other uses of the river.

Aquatic life has been impacted in some rivers and streams as a result of man-made impoundments such as dams, groundwater withdrawals for public water supply, and land development. These and other factors have contributed to reduced streamflow, causing some streams to run dry during periods of the year. A 0.25-mile long segment of Stiles Brook near its confluence with the Pomperaug River (Stiles Brook-01) is listed in the 2016 Connecticut Integrated Water Quality Report (IWQR) as impaired for aquatic life due to flow regime alterations.

The CTDEEP is working with the State Department of Public Health and stakeholders to refine proposed Stream Flow Classifications for the Housatonic, Hudson and Southwest Coastal River Basins, which includes the Pomperaug River watershed. Adoption of the Stream Flow Classifications is a key component in the effort to update standards for maintaining minimum flows in rivers and streams to balance river and stream ecology, wildlife, and recreation while providing for public health, flood control, industry, water supply, public safety, agriculture and other uses of water.

Threats to Groundwater Resources

There is an especially strong connection between groundwater and surface waters in the Pomperaug River watershed given the high percentage of stratified drift deposits in the basin (Markstrom et al., 2012). The groundwater in these stratified drift deposits is associated with high-yield sand and gravel aquifers, which formed in the typical New England glacial valley setting of the watershed. Groundwater in these aquifers provides drinking water both within the watershed and to surrounding communities. Water from the aquifer system also feeds the Pomperaug River and its tributaries, supplementing stream flows especially during periods of little precipitation, in which case it may be the only natural source of stream flow.

Given this close link between groundwater and surface water in the watershed and the coarse sand and gravel allowing for quick infiltration, the Pomperaug Aquifer is highly susceptible to contamination. The aquifers can also be depleted through overuse and disconnected from replenishing rainfall and snowmelt due to intensive land use development. Such development can also increase surface runoff and reduce the amount of precipitation that infiltrates into the ground and recharges groundwater levels. As development and the demand for water increases, so does the potential for groundwater contamination, depleted wells, lower river flows, and increased stress on fish and wildlife species that rely on aquatic habitat.

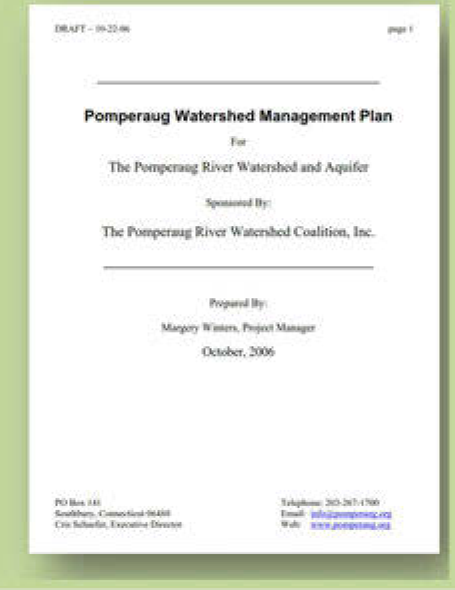
Preserving and protecting groundwater resources in the watershed – both groundwater quality and availability for various uses – continues to be a major focus of the watershed communities, the Pomperaug River Watershed Coalition (PRWC), resource agencies, and other stakeholders.

1.2 Prior Watershed Planning

The Pomperaug River watershed is one of the most studied watersheds in the country, with research dating back to 1898. The watershed has been the focus of grass-roots watershed management and water resource protection efforts over the years, led by the PRWC and its partners including university research groups, state and federal resource protection agencies, the watershed municipalities, land owners, and other local and regional groups. This work in the Pomperaug watershed has served as a model for other organizations and watersheds in the region and beyond. *Table 1-1* summarizes the existing plans and studies on water quality and related water resource issues within the Pomperaug River watershed. Many of these reports are available on the PRWC website: http://www.pomperaug.org/scientific-reports

In 2001, the Council of Governments of Central Naugatuck Valley and PRWC developed the "State of the Watershed Report," which was the first comprehensive overview of conditions in the Pomperaug River watershed. The report integrated the findings of numerous prior studies and research projects in the watershed as of 2001. In 2006, PRWC developed the first watershed management plan for the Pomperaug River watershed, called the "Pomperaug River Watershed Management Plan."

2006 Pomperaug River Watershed Management Plan



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Pomperaug Watershed Management Plan

For

The Pomperaug River Watershed and Aquifer

Sponsored By:

The Pomperaug River Watershed Coalition, Inc.

Prepared By:

Margery Winters, Project Manager

October, 2006

The 2006 Watershed Management Plan was developed prior to the establishment of the U.S. Environmental Protection Agency (EPA) Nine Elements criteria for watershed based plans for addressing impaired waters. The 2006 plan outlines data/information that was available at the time as well as data gaps and proposed actions for obtaining such data. Other action items within the plan are broad "programmatic" recommendations for efforts PRWC could undertake to further protect local rivers and streams. However, the 2006 plan does not identify site-specific recommendations or actions to improve or protect water quality.

Table 1-1. Existing plans and studies on the Pomperaug River watershed

Document/ Information Source	Author/Date	Notes
Connecticut Integrated Water Quality Report to Congress	CTDEEP (2014 and 2016)	In relation to the Pomperaug Watershed, this report identifies local stream segments that are classified as "impaired" relative to aquatic life support and/or recreational use based on water quality assessments conducted under CTDEEP's leadership. Report does not contain water quality data, just determinations made based on such data which can be obtained by contacting CTDEEP staff.
Restoring the Pomperaug River with Woody Debris – PowerPoint Presentation	Audubon Center at Bent of the River (2014)	Successful in-stream habitat restoration project constructed along a half-mile stretch of the lower Pomperaug River that flows through the Audubon at the Bent of the River (BOTR). Need for restoration initially identified in the 2007 UMASS Amherst study by the Instream Habitat Program
Water Allocation and Use Ordinance, Presentation to Town of Southbury Board of Selectmen	PRWC (2014)	Proposed model water use ordinance
CTDEEP River Bioassessment by Volunteers (RBV) Program, 2014 Annual Program Summary (Report #16)	CTDEEP (2014)	Annual macroinvertebrate survey report
CTDEEP River Bioassessment by Volunteers (RBV) Program, 2013 Annual Program Summary (Report #15)	CTDEEP (2013)	Annual macroinvertebrate survey report
Mapping Bedrock Surface Contours Using the Horizontal-to-Vertical Spectral Ratio (HVSR) Method Near the Middle Quarter Area, Woodbury, Connecticut	USGS (2013)	Bedrock mapping using novel non-invasive method. Relevance is to groundwater contamination in Woodbury
Impaired Stream Segments of the Pomperaug River	PRWC (2016)	PRWC summary of water quality impairments from CTDEEP's 2012 Integrated Water Quality Report. Superseded by the 2014 and 2016 IWQR information.

Table 1-1. Existing plans and studies on the Pomperaug River watershed

Document/ Information Source	Author/Date	Notes
Statewide Bacteria TMDL Core Document	CTDEEP (2012)	The purpose of a TMDL is to calculate the amount of a pollutant a waterbody can assimilate without exceeding water quality standards or impairing designated uses. This document provides (1) documentation for the impaired waters listing status and the need for a TMDL, (2) the water quality target that needs to be attained to restore the health of the waterbody, (3) details regarding sources of bacteria in the impaired waterbodies, and (4) estimated percent reductions, calculated from existing data, needed to meet the concentration-based water quality target.
Statewide Bacteria TMDL – Appendix A: Watershed Specific Bacteria Impairment Appendices for: Pomperaug River CT6800	CTDEEP (2012)	Sections of the statewide bacteria TMDL relevant to the Pomperaug River watershed. Includes general load reduction estimates and water quality data related to cause of impairment
Statewide Bacteria TMDL – Appendix A: Watershed Specific Bacteria Impairment Appendices for: Weekeepeemee River CT6804	CTDEEP (2012)	Sections of the statewide bacteria TMDL relevant to the Weekeepeemee River watershed. Includes general load reduction estimates and water quality data related to cause of impairment
Watershed Scale Response to Climate Change- Pomperaug River Watershed, Connecticut	USGS (2012)	Modeling to evaluate the climate change effects of various combinations of precipitation, temperature, and land use on streamflow and general basin hydrology.
Integrated Watershed-Scale Response to Climate Change for Selected Basins Across the United States	USGS (2011)	Modeling to evaluate the climate change effects of various combinations of precipitation, temperature, and land use on streamflow and general basin hydrology. Pomperaug Watershed is 1 of 14 basins included in the study, representing New England watersheds and regional climate characteristics.
Three Rivers Park and the Pomperaug River, A Management Analysis of River Stability and Riparian Buffers	Prepared for the River Processes and Restoration Course at the Yale School of Forestry and Environmental Studies (2010)	Riparian buffer and floodplain restoration recommendations for Three Rivers Park. Establishes baseline on the extent (length and width) and composition of the buffer. Provides stream profile/cross section data showing channel incision and bank steepness along the floodplain to the east of the river channel and potential flood storage area on the opposite bank
Assessing the Vulnerability of Public-Supply Wells to Contamination: Glacial Aquifer System in Woodbury, Connecticut	USGS (2010)	USGS National Water Quality Assessment

Table 1-1. Existing plans and studies on the Pomperaug River watershed

Document/ Information Source	Author/Date	Notes
Estimation of the Effects of Land Use and Groundwater Withdrawals on Streamflow for the Pomperaug River, Connecticut	USGS (2010)	USGS National Water Quality Assessment. Also known as "Precipitation-Runoff Model." Contains potentially useful water withdrawal and precipitation data. This model utilized precipitation, slope, soil, land cover, and other data to estimate the ratio of rainfall that runs off the landscape vs. soaks into the ground to recharge the aquifer. Different scenarios were run with increasing impervious cover and groundwater withdrawals to evaluate impact to in-stream flow.
Pomperaug River Watershed Streamwalk Summary Report	PRWC (2010)	Findings of PRWC volunteer streamwalk program. Includes findings from surveys conducted between 2005 and 2010. Survey areas are scattered spatially and temporally. Data is qualitative and subjective, and was not collected following a formalized QAPP.
Recharge Mapping: A GIS-based tool for identifying areas of land with significant groundwater recharge	PRWC, COGCNV, HVA (2009)	A simplified GIS tool to identify areas of land with significant groundwater recharge. Includes recharge estimates at the local basin scale. Simplified model based on USGS's Estimation of the Effects of Land Use and Groundwater Withdrawals on Streamflow for the Pomperaug River, Connecticut (when final report had not yet been released).
Pomperaug Water Allocation Planning Study (PWAPs) White Paper	PRWC (2009)	Identifies consensus actions to be taken by the major stakeholders in the Pomperaug Watershed about the allocation of water resources.
Aquifer Chemistry and Transport Processes in the Zone of Contribution to a Public-Supply Well in Woodbury, Connecticut, 2002–06	USGS (2009)	USGS National Water Quality Assessment
Draft After-Action Report Pomperaug River Watershed Extreme Drought Tabletop Exercise	Gradient Planning (2009)	Tabletop simulation exercise of response actions (by utilities; municipal offices, state agencies; local public health, safety and emergency response teams; and the public) to severe drought in the Pomperaug River watershed
Transylvania Pond Environmental Review Team Report	Eastern Connecticut Resource Conservation and Development Area, Inc. (2008)	Report examining the feasibility of options for addressing eutrophication problems in Transylvania Pond. Report also examines the increasing invasive aquatic plant infestation and degrading condition of the dams associated with the pond.
Hydrogeologic Setting and Ground-Water Flow Simulations of the Pomperaug River Basin Regional Study Area, Connecticut	USGS (2007)	USGS National Water Quality Assessment

Table 1-1. Existing plans and studies on the Pomperaug River watershed

Document/ Information Source	Author/Date	Notes
Simulations of Ground-Water Flow and Residence Time near Woodbury, Connecticut	USGS (2007)	USGS National Water Quality Assessment
Anthropogenic Organic Compounds in Source and Finished Water from Community Water System Wells in Western and Central Connecticut, 2002–2004	USGS (2007)	Study area includes water supply wells in Southbury and Woodbury. Particular interest was evaluating removal success for known contaminants in the Woodbury public water supply well area.
First Annual Water Quality Report Long Meadow Lake, Bethlehem, Connecticut	HydroEnvironmental Solutions, Inc. Environmental Consultants (2007)	Volunteer water quality monitoring report. Long Meadow Lake (also known as Long Meadow Pond) is one of the key headwaters to the Weekeepeemee River.
A Manual for Assessing Hydrologic Value of Land Parcels based on Physical Attributes	PWRC and Southbury Land Trust in cooperation with COGCNV and USGS (2007)	Modeling study to identify specific parcels in the Town of Southbury with significant hydrologic function (precursor to the GIS-tool for Recharge Mapping)
Assessment and Restoration of Instream Habitat for the Pomperaug, Nonnewaug, and Weekeepeemee Rivers of Connecticut	Northeast Instream Habitat Program, University of Massachusetts (2007)	Study to evaluate the low-flow related stresses to physical habitat and fish community and to determine ecologically viable objectives for a management plan for the Pomperaug River watershed. Study mapped existing instream habitat characteristics at varying levels of flow. Stresses determined by availability of certain habitat characteristics needed to support indicator fish species during different bioperiods (ex. spawning, overwintering, rearing and growth) under different flow scenarios. Report also known as the "MesoHABSIM" study.
Drugging the Waters (article)	Natural Resources Defense Council magazine OnEarth (2006)	Impacts of pharmaceutical products on water quality in the Pomperaug River. Only one waste water treatment plant discharges directly to the Pomperaug River, a plant that serves a community of residents all 55+ years old (high concentration of medication use). Article discusses research efforts of UCONN to understand the fate and transport of pharmaceuticals once they enter the river system.

Table 1-1. Existing plans and studies on the Pomperaug River watershed

Document/ Information Source	Author/Date	Notes
Pomperaug Watershed Management Plan	PRWC (2006)	Original watershed management plan developed prior to the establishment of the EPA 9-elements criteria for watershed-based plans for addressing impaired waters. This Plan outlines data/information that was available at the time as well as data gaps and proposed actions for obtaining such data. Other action items within the plan are broad "programmatic" recommendations for efforts PRWC could/should undertake to further protect local rivers and streams, but not specific remediation or on-the-ground pollution prevention actions to improve or protect water quality.
Volunteer Streamwalk Program – Summary Report and Proposed Action Plan	PRWC (2005)	Findings of ongoing PRWC volunteer streamwalk program. Includes findings from surveys conducted between 2000 and 2005. Survey areas are scattered spatially and temporally (i.e. not contiguously surveyed). Data is qualitative and subjective, and was not collected following a formalized QAPP.
Assessment of Bank Stabilization Options for a Streambank Erosion Site in Woodbury, Connecticut	Prepared for the River Processes and Restoration Course at the Yale School of Forestry and Environmental Studies (2002)	Study to address severe streambank erosion at a site along the Pomperaug River in Woodbury, CT (near Judson Avenue and Orton Lane)
Pomperaug River State of the Watershed Report	COGCNV and PRWC (2001)	Overview of conditions in the Pomperaug River watershed as of 2001. Points of interest include census / projected population, precipitation record, pumping rates for water supply wells, median August streamflow, land use maps, surface water quality classifications
Delineation and Analysis of Uncertainty of Contributing Areas to Wells at the Southbury Training School, Southbury, Connecticut	USGS (2000)	Contributing areas to public-supply wells at the Southbury Training School in Southbury, Connecticut, were mapped by simulating ground-water flow in stratified glacial deposits in the lower Transylvania Brook watershed
The Role of Agriculture In the Preservation of Open Space and the Protection of Water Resources: A Case Study of the Pomperaug River Watershed	COGCNV and PWRC Land Use Committee (undated)	Study to prioritize preservation of agricultural land in the watershed for water quality protection. Notes the hydrologic characteristics of farmland soils and general capacity for groundwater recharge in open farm fields with mid-level vegetative cover

1.3 Why Update the Watershed Plan?

EPA Nine Elements Watershed Plan Framework

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

Since the original Pomperaug River Watershed Management Plan was developed in 2006, EPA and CTDEEP have issued watershed planning guidance for impaired water bodies, placing greater emphasis on achieving quantifiable pollutant load reductions and water quality improvements through specific, measurable actions. The guidance outlines nine key elements (see the adjacent text box) 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.

Updating the watershed management plan is a critical first step to be eligible for future Federal funding for corrective-action projects to improve sections of river that do not fully support recreation or aquatic life because of water-quality or habitat limitations. Following the EPA Nine Elements framework will enable implementation projects under this plan to be considered for funding under the Section 319 nonpoint source program of the Clean Water Act and improve the chances for funding through other State and Federal sources. *Table 1-2* summarizes the nine elements and where they are addressed in this watershed based plan. This updated EPA and CTDEEP watershed planning process is also the recommended approach for achieving the pollutant load reductions for the Pomperaug watershed outlined in the Statewide Bacteria TMDL.

The PRWC, CTDEEP, and other partners recognize the need for an updated watershed management plan for the Pomperaug River to address the water quality issues within the Pomperaug. The updated plan will serve as a road map to return impaired waters to swimmable and fishable conditions and will be used to evaluate changes through time.

Specifically, the objectives of this plan update are to:

- Establish an up-to-date baseline of water quality and land use conditions in the watershed
- Evaluate contributing factors in areas of known impairments
- Identify water quality monitoring needs to support plan implementation
- Establish community buy-in through public engagement in the planning process
- Identify and prioritize actions to reduce pollutant inputs to impaired rivers and streams
- Incorporate proactive measures to protect/maintain high quality streams.

This Plan is a *guidance* document that seeks to resolve surface water quality impairments and related water resource issues within the Pomperaug watershed. This document is not intended to "point fingers" but is to help make all aware of how individual and collective actions are interconnected and can impact the Pomperaug's water resources. Unless identified as a required action under an existing local, State or federal regulation or permit, the recommendations in this Plan for specific projects/actions are intended to be *voluntary* undertakings, carried out with willing, cooperative partners, working together to protect and improve water quality. Towards this end, this Plan identifies potential partners and funding sources to assist with achieving the recommendations presented herein.

Table 1-2. How this watershed based plan addresses the EPA nine key elements

EPA Nine Elements	Description	Location in Watershed Based Plan
1. Impairment	Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and other goals identified in the watershed plan	• Section 2 (Watershed Characteristics) • Appendix B (Technical Memorandum – Visual Field Assessments)
2. Load Reduction	An estimate of the load reductions expected from management measures	• Section 5 (Management Measures and Pollutant Load Reductions) • Appendix C (Technical Memorandum – Pollutant Loading Model)
3. Management Measures	A description of the nonpoint source management measures that will need to be implemented to achieve load reductions, and a description of the critical areas in which those measures will be needed to implement this plan	• Section 3 (Management Recommendations) • Section 4 (Site-Specific BMP Concepts)
4. Technical and Financial Assistance	An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan	• Section 3 (Management Recommendations) recommendations tables • Section 4 (Site-Specific BMP Concepts) • Appendix E (Site-Specific BMP Concept Cost Estimates)
5. Public Information and Education	An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented	• Section 3.3 (Education and Outreach)
6. Schedule	A schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious	• Section 3 (Management Recommendations) recommendations tables
7. Milestones	A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented	• Section 3 (Management Recommendations) recommendations tables
8. Performance Criteria	A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards	• Section 3 (Management Recommendations) recommendations tables
9. Monitoring	A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the performance criteria established	• Section 3 (Management Recommendations) recommendations tables • Section 3.2 (Monitoring and Assessment)

1.4 Plan Development Process

PRWC and its partners, including the watershed municipalities, land owners, and regional, state, and federal agencies, worked collaboratively to develop an updated watershed based plan for the Pomperaug River watershed. Funding for this project was provided in part by CTDEEP through an EPA Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation. Fuss & O'Neill, Inc. was retained by PRWC to lead the development of the watershed based plan.

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

Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) was developed for this project to address data quality objectives associated with the field assessments (collection of direct measurements), manipulation of existing data (secondary data), and pollutant load modeling. The QAPP was approved by CTDEEP and EPA in May 2017. A copy of the approved QAPP is provided in *Appendix A*.

Project Steering Committee

PRWC's Land Use Committee provided guidance and oversight during the plan development process. The Land Use Committee consists of, but is not limited to, representatives from local conservation organizations, town land use departments, as well as regional, state, and federal agencies. Members of the Land Use Committee and other individuals involved in the plan development process are listed in the Acknowledgments section at the beginning of this document. A series of meetings were held with the Land Use Committee to discuss issues of concern in the watershed and provide critical input on planning recommendations. The Land Use Committee also provided review comments on draft deliverables. *Appendix F* contains meeting agenda, presentation materials, and notes from the Land Use Committee meetings held during the project.

Update of Existing Watershed Conditions

Water quality, land use, and other relevant characteristics of the Pomperaug River watershed were updated since the initial watershed management plan was developed in 2006. Updates incorporated information from CTDEEP water quality monitoring data that was collected in support of the Statewide Bacteria TMDL; information contained in the latest Connecticut Integrated Water Quality Report; updated land use, land cover, and impervious cover data; other GIS layers including open space, soils, ecological resources, riparian areas, wastewater, and water supply; and information from PRWC and local, state, and federal agencies regarding pollution sources in the watershed. *Section 2* of this plan summarizes existing water quality and land use conditions in the watershed.

Visual Field Assessments

Visual field assessments were performed by Fuss & O'Neill in September 2017 to further assess potential sources of water quality impairments in the Pomperaug River watershed and to identify possible restoration opportunities. The assessments focused on projects that would reduce bacteria loads in areas of the watershed with documented recreational impairments. Concepts for site-specific Best Management Practices (BMPs) were developed at priority sites throughout the watershed based on the results of the visual assessments and input from the PRWC Land Use Committee. The findings of the visual field assessments are documented in a technical memorandum, which is provided in *Appendix B*.

Watershed Pollutant Loading Model

A pollutant loading model was developed for the Pomperaug River watershed to estimate the quantity of pollutants that are delivered to rivers and streams in the watershed from various land uses and land use activities. The model is used to refine an understanding of relative sources of fecal indicator bacteria and other pollutants and to support the development of planning recommendations for the watershed. The results of the watershed pollutant loading model are described in a technical memorandum, which is provided as *Appendix C* to this plan. Estimated reductions in pollutant loads associated with the plan recommendations are addressed in *Section 5*.

Development of BMP Concepts

Potential site-specific restoration projects or actions to address elevated bacteria levels and flow regime alterations (referred to as Best Management Practices or BMPs) were initially identified based on the updated watershed conditions, results of the visual field assessments and pollutant load modeling, and input from the PRWC Land Use Committee. A matrix of potential BMPs was developed to help prioritize and select up to 15 site-specific project concepts based on consideration of bacteria removal, relative cost, maintenance requirements, and other factors. A copy of the BMP Prioritization matrix is included in *Appendix D*. Project concepts were then developed for 10 small BMP projects and 5 large BMP projects to serve as potential on-the-ground projects for future implementation. They also provide examples of the types of projects that could be implemented at similar sites throughout the watershed. The BMP project concepts are included in *Section 4* of this plan.

Management Plan Recommendations

In addition to site-specific BMP concepts, recommendations are also provided for other watershed-wide and non-structural BMPs with the goal of addressing elevated bacteria levels and alterations to the flow regime. *Section 3* of this plan outlines the management recommendations for the watershed, including responsible parties, timeframes, products and evaluation criteria, and estimated costs. *Section 6* of the plan identifies potential funding sources for implementation of the plan recommendations.

1.5 Public Participation and Outreach

Public participation and outreach was conducted as part of the watershed planning process to increase public understanding of issues affecting the watershed, to encourage participation in the development of the watershed plan, and to build support for implementation of the plan.

Early in the planning process, PRWC met with local elected officials and land use agencies to discuss the known impairments within the Pomperaug Watershed and the need to update the watershed management plan to a watershed based plan. This outreach includes a January 17, 2017 meeting with the First Selectman of Bethlehem; a January 18, 2017 presentation at the Joint Land Use Commission Meeting in the Town of Woodbury; a February 14, 2017 presentation during a joint meeting of the Inland Wetlands Agency and Conservation Commission in the Town of Bethlehem; an April 4, 2017 presentation at a Joint Land Use Commission Meeting in the Town of Southbury; and a progress report at the Joint Land Use Commission Meeting in the Town of Woodbury on January 17, 2018. Meeting presentations and notes are provided in *Appendix G*.

Three public information meetings were held on July 17 and 18, 2018 to present information on the Pomperaug River watershed, the watershed planning process, results of technical analyses, general recommendations for reducing pollutant loads to local rivers and streams, and to provide an opportunity for public feedback and input. The July 17 meeting was held in the evening at the Woodbury Municipal Complex. Two meetings were held on July 18, one in the afternoon at Southbury Town Hall and another in the evening at the Bethlehem Public Library. Meeting announcements, presentation materials, and notes are provided in *Appendix G*.

The draft watershed based plan was presented to the public on the evening of August 22, 2018 at the Woodbury Senior Center. Questions and comments were received during and following the meeting. Public comments have been incorporated into the final watershed management plan. The meeting announcement, presentation materials, and notes are also provided in *Appendix G*.

Throughout the planning process, outreach methods included press releases to area newspapers, news and blog posts on the PRWC website www.pomperaug.org, and articles featured in PRWC's semi-annual newsletter. These outreach materials are also provided in *Appendix G*.

2 Watershed Characteristics

2.1 Watershed Description

The Pomperaug River watershed (also referred to as the Pomperaug River Regional Basin) covers an area of approximately 90 square miles within the eight Connecticut towns of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown, Middlebury, and Morris in western Connecticut (*Table 2-1*). The Pomperaug River Regional Basin (#68)[1] consists of six Subregional Basins: Pomperaug River Subregional Basin (#6800), East Spring Brook Subregional Basin (#6801), Nonnewaug River Subregional Basin (#6802), Sprain Brook Subregional Basin (#6803), Weekeepeemee River Subregional Basin (#6804), Hesseky Brook Subregional Basin (#6805), and Transylvania Brook Subregional Basin (#6806) (*Figure 2-1*).

Table 2-1. Watershed composition by municipality

Municipality	Acres	Square Miles	Percent of Watershed
Woodbury	22,536	35.2	39.6
Southbury	12,624	19.7	22.2
Bethlehem	11,975	18.7	21.0
Washington	3,273	5.1	5.7
Roxbury	2,982	4.7	5.2
Watertown	2,492	3.9	4.4
Morris	895	1.4	1.6
Middlebury	185	0.3	0.3
Total	**56,960**	**89.0**	**100.0**

The main stem of the Pomperaug River is approximately 13.4 miles long, winding from the confluence of the Weekeepeemee and Nonnewaug Rivers in Woodbury, south to the Housatonic River between Southbury and Newtown where it flows into Lake Zoar. The Weekeepeemee and Nonnewaug Rivers are the largest tributaries to the Pomperaug River. Transylvania Brook and Hesseky Brook drain to the Pomperaug, while Sprain Brook drains to the Weekeepeemee River and East Spring Brook feeds the Nonnewaug River. Numerous smaller streams complete the network of waterbodies draining the Pomperaug River watershed. Major surface waterbodies in the watershed include Long Meadow Pond, Cat Swamp Pond, Judd Pond Reservoir, and Lockwood Reservoir.

The northern portion of the Pomperaug River watershed is rural in character with primarily low-density residential land use and agricultural lands, while land use in the southern part of the watershed is dominated by suburban residential and commercial development. Population density is 185 people per square mile in Bethlehem, 267 people per square mile in Woodbury, and 500 people per square mile in Southbury. Together, these three towns make up 83% of the watershed area. Major roads located in the watershed include Interstate 84, U.S. Route 6, and State Routes 61, 63, 64, 67, 172, 317, 47, and 132. Other landmarks in the watershed include Heritage Village, Audubon Center at Bent of the River, Southbury Training School, and Orenaug Park.

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[1] CTDEEP has established a statewide mapping system of natural drainage basins in Connecticut which classifies watersheds in a hierarchical order based on drainage size. Major basins are subdivided into smaller nested basins described, in turn, as regional, subregional and local drainage basins. Each basin has a unique code which reflects its relationship to the major basin in which it is nested.

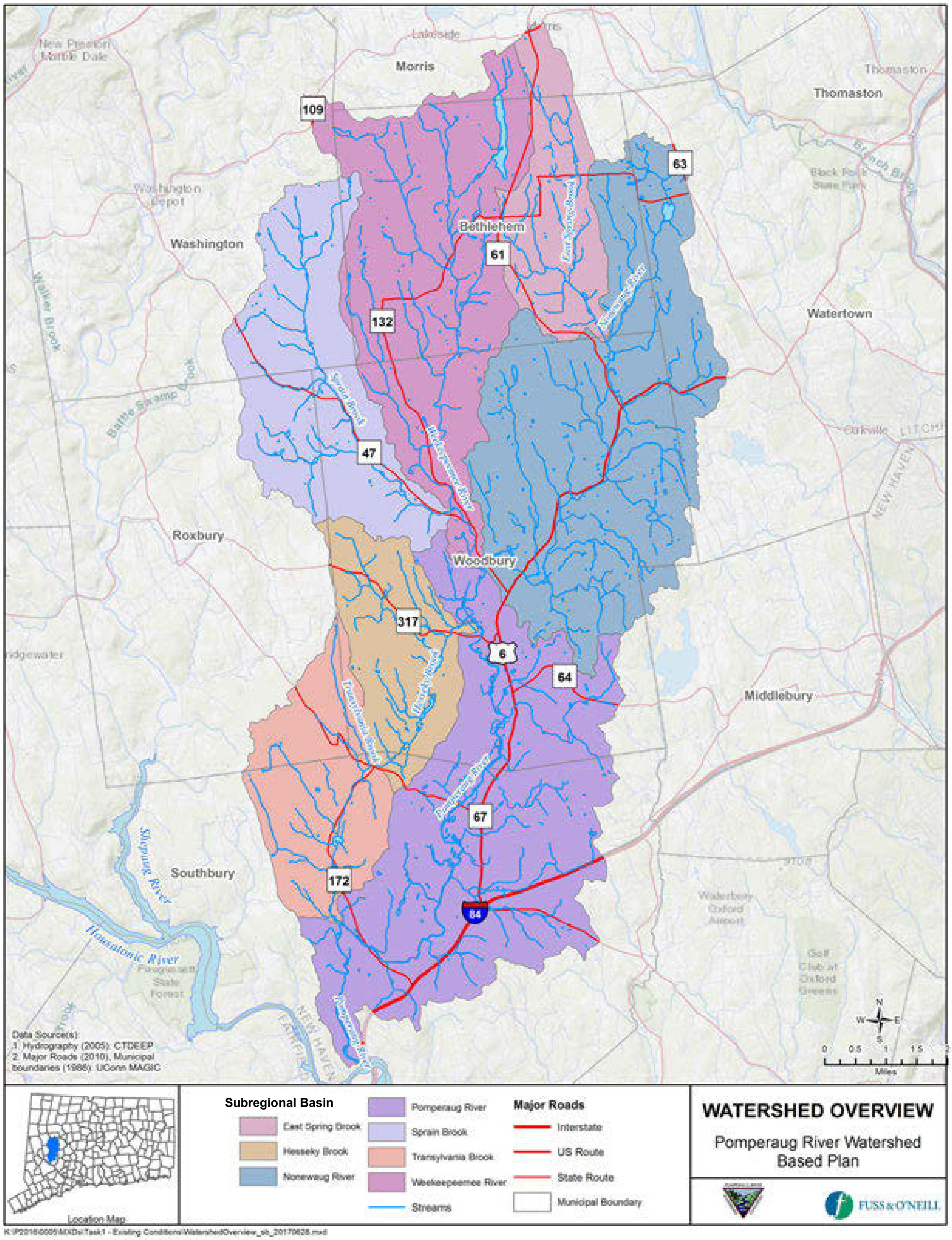

Figure 2-1. Pomperaug River Regional Basin and Subregional Basins

2.2 Water Quality

Water quality in the Pomperaug River and its tributaries is mixed. Some segments of the Pomperaug River have good water quality and support recreational activities (fishing, swimming, and boating) and healthy populations of resident fish species and benthic macroinvertebrates. Other segments of the Pomperaug and its tributaries have been impacted by historical development and land use activities, including portions of the Pomperaug River, Weekeepeemee River, and Transylvania Brook where in-stream fecal indicator bacteria (*Escherichia coli* or *E. coli*) levels have been measured in excess of the State water quality standard for recreation in non-designated swimming areas (410 colonies/100mL maximum for a single sample, and less than 126 colonies/100 mL for the geometric mean). Aquatic life has also been impacted in some rivers and streams as a result of man-made impoundments, groundwater withdrawals for public water supply, and land development, which has contributed to reduced streamflow, causing some streams to run dry in extreme drought conditions.

Nineteen river segments within the Pomperaug River Watershed were assessed in the 2016 Integrated Water Quality Report (IWQR). Of these, five river segments are impaired (i.e., do not meet water quality standards) for at least one designated use category (*Figure 2-2* and *Table 2-2*).

- **Pomperaug River.** Pomperaug River segment CT6800-00_01 ("Pomperaug River-01") is 2.74 miles long and extends from its mouth at the confluence with the Housatonic River, upstream to the confluence with Transylvania Brook in Southbury. Pomperaug River Segment CT6800-00_03 ("Pomperaug River-03") is 1.31 miles long and extends from Flood Bridge Road, upstream to the confluence with Bullet Hill Brook downstream of Heritage Road in Southbury. Both segments are fully supporting of aquatic life, but impaired for recreation. Two other Pomperaug River segments have been identified as fully supporting for aquatic life but not assessed for recreation.

- **Weekeepeemee River.** Weekeepeemee River segment CT6804-00_01 ("Weekeepeemee River-01") is 9.61 miles long and extends from its mouth at the confluence with the Nonnewaug River downstream of the Jacks Bridge Road crossing in Woodbury to its headwaters in a marsh just upstream of Bergman Hill Road crossing, east of the intersection with Todd Hill Road in Morris. The segment is fully supporting for aquatic life but is impaired for recreation.

- **Transylvania Brook.** Transylvania Brook segment CT6806-00_01 ("Transylvania Brook-01") is 1.6 miles long and extends from its mouth at the confluence with the Pomperaug River (just downstream of the East Flat Hill Road crossing), upstream to its confluence with Spruce Brook (just on the upstream side of the former Southbury Training School wastewater treatment facility) in Southbury, and is impaired for both aquatic life and recreation uses.

- **Stiles Brook.** Stiles Brook segment CT6800-03_01 ("Stiles Brook-01") is 0.25 miles long and extends from its mouth at the confluence with the Pomperaug River upstream to the Anna Stiles Pond outlet Dam adjacent to Route 6 in the northern portion of Southbury. This segment is listed in the 2016 IWQR as not assessed for recreation but impaired for aquatic life, due to flow regime alterations.

Potential sources of bacteria in the watershed include "non-point sources" such as diffuse stormwater runoff, failing or malfunctioning septic systems, agricultural activities including but not limited to numerous farms in the northern part of the watershed, and waste from wildlife and pets. "Point sources" of bacteria include discharges from Municipal Separate Storm Sewer Systems (MS4s), potential illicit discharges, and runoff from industrial and commercial facilities.

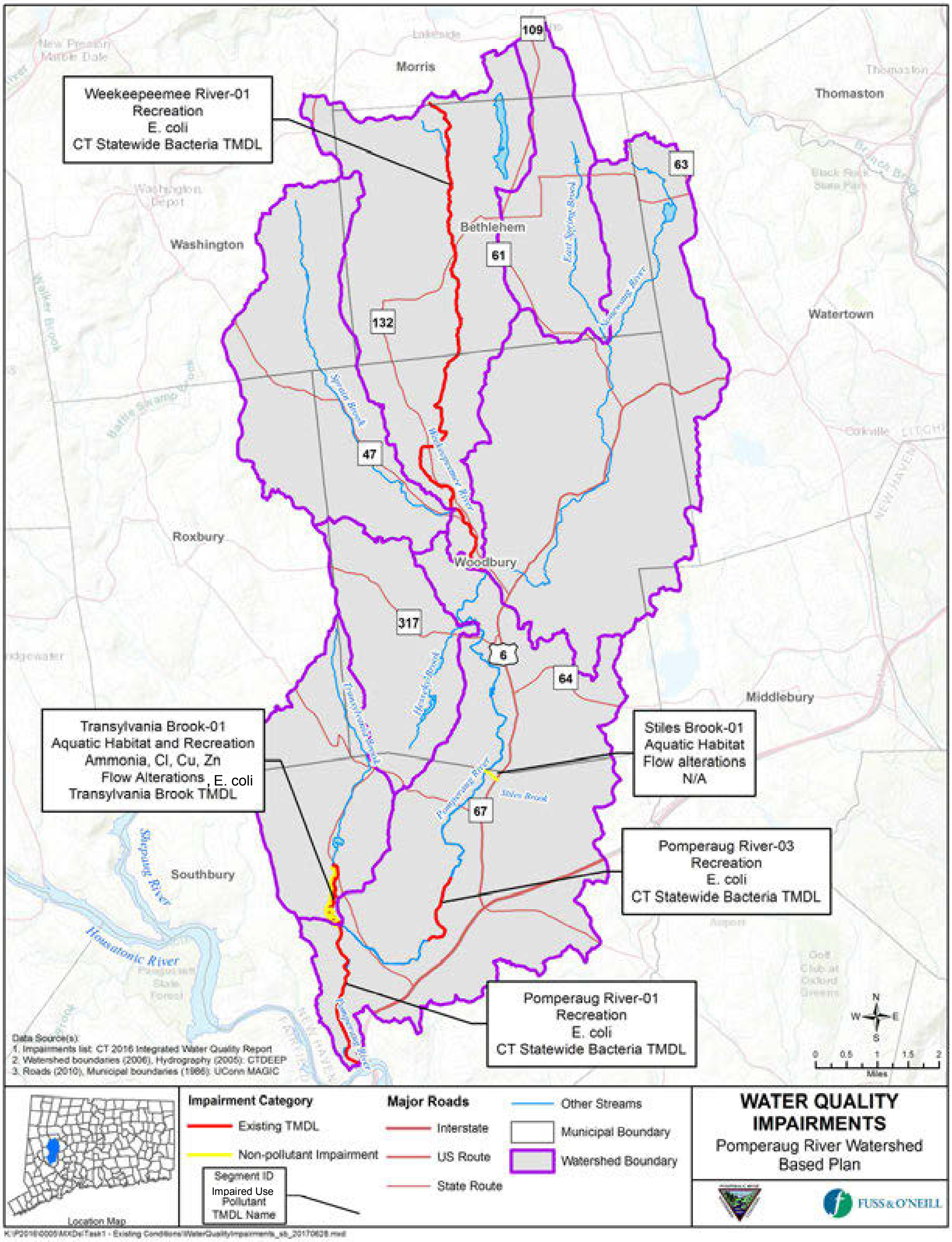

Figure 2-2. Water quality impairments in the Pomperaug River watershed

It is important to note that the data supporting the identified recreational impairments in the Pomperaug River watershed are extremely limited and based on data collected between 2006 and 2010.

Table 2-2. Impaired waterbody segments in the Pomperaug River watershed

Impaired Segment	Impaired Designated Use	Cause	TMDL Status
CT6800-00_01 Pomperaug River-01 Southbury	Recreation	*E. coli*	Included in Statewide Bacteria TMDL approved 2012
CT6800-00_03 Pomperaug River-03 Southbury, Woodbury	Recreation	*E. coli*	Included in Statewide Bacteria TMDL approved 2012
CT6804-00_01 Weekeepeemee River-01 Morris, Bethlehem, Woodbury	Recreation	*E. coli*	Included in Statewide Bacteria TMDL approved 2012
CT6806-00_01 Transylvania Brook-01 Southbury	Recreation Aquatic Life	*E. coli* Flow alterations, Ammonia, Chlorine, Copper, and Zinc	Proposed for bacteria reduction action plan development in 2018. Aquatic life impairment TMDL approved in 2001.
CT6800-03_01 Stiles Brook-01 Southbury	Aquatic Life	Flow alterations	Listed as category 4C: Non-pollutant impairment. No TMDL required

TMDL Analysis and Target Load Reductions

The Connecticut Department of Energy and Environmental Protection (CTDEEP) completed a "Statewide Bacteria Total Maximum Daily Load" (TMDL) for 176 impaired waterbody segments based on the 2010 Impaired Waters List (CTDEEP, 2012). The TMDL sets target pollution levels and establishes a framework for restoring water quality of the impaired segments. Three of the bacteria-impaired segments in the Pomperaug River watershed are included in the approved TMDL (Pomperaug River-01 and -03 and Weekeepeemee River-01) based on past monitoring data. The TMDL identifies percent reductions in geometric mean and single sample fecal indicator bacteria (*E. coli*) concentrations required to meet recreational water quality criteria.

Based on the 2010 data included in the TMDL, the Pomperaug River-01 segment requires a 65% reduction in geometric mean *E. coli* levels and a 90% single sample *E. coli* reduction to meet the TMDL targets. For the Pomperaug River-03 segment, the required percent reductions, based on data from 2006-2009, are 75% and 92%, respectively. The Weekeepeemee River-01 TMDL reduction targets are also derived from 2010 data, including 48% reduction in geometric mean and a 98% reduction in single sample bacteria levels. It is also important to note that these impairments and percent reductions are based on a very limited data set consisting of approximately 10 samples (wet and dry weather) collected at a single station in each river segment in 2010.

Potential sources of indicator bacteria identified in the TMDL include discharges from MS4s and industrial and commercial facilities. Additional non-point sources include stormwater runoff, failing septic systems, agricultural activities, and wastes from wildlife and pets. Stormwater discharges to MS4s and illicit discharges are two of the primary targets identified in the Statewide Bacteria TMDL for pollution reduction in freshwater segments. These items will be addressed through the regulatory requirements of the MS4 Permit program.

CTDEEP also completed a TMDL analysis in 2001 for the impaired segment of Transylvania Brook downstream of the Southbury Training School. This TMDL for copper, zinc, chlorine, and summer ammonia was developed for aquatic life habitat during low-flow conditions in the brook. As of June 2013, the discharge from the Southbury Training School to Transylvania Brook was eliminated and all flows are now conveyed to the

Heritage Village Water Pollution Control Facility for treatment and discharge. An action plan to address the recreation impairment is scheduled for development by CTDEEP in 2018.

Water Quality Monitoring

CTDEEP routinely monitors ambient water quality, macroinvertebrate diversity, and fisheries at three locations within the watershed (*Table 2-3*). These data are incorporated into the biannual IWQRs and TMDLs. Due to constrained resources, CTDEEP has a limited number of fixed stations across the state that are monitored on an annual basis. Additional assessments are conducted annually on a five-year rotating basis by major watershed throughout the state (i.e., one year the focus will be the Housatonic River Major Basin, and another it will be the Connecticut River Major Basin). As such, the TMDLs in the Pomperaug River watershed are based on limited water quality monitoring data. No water quality sampling for bacteria has occurred since 2010, as the State's priority for bacteria monitoring is focused on State-owned public swimming areas.

Table 2-3. CTDEEP Water Quality Monitoring Stations

Ambient Water Quality Station ID	TMDL Station ID	Waterbody	Location
15388	1313	Pomperaug-01	Off Flagg Swamp Road
15025	934	Pomperaug-03	Upstream of Poverty Road crossing
18874	6122	Weekeepeemee-01	Route 47 bridge across from Ruffin Road

2.3 Land Use and Land Cover

Land Cover

The distribution of land cover (physical land type) and land use (how people make use of land) within the watershed plays an important role in shaping spatial patterns and sources of nonpoint source pollution and surface water quality. *Figure 2-3* shows the distribution of land cover across the Pomperaug River watershed. Based on the National Land Cover Database (NLCD) land cover data[2], approximately 14% of the watershed falls into one of the four developed land cover categories (*Table 2-4*), while 16% is agricultural land cover and 60% is deciduous forest land. The Pomperaug River subregional basin is substantially more developed than the other subregional basins in the watershed, which have a greater proportion of agricultural and forested land. The southern part of the Pomperaug watershed is more developed, while the northern portion of the watershed is generally less developed and more agricultural.

Land Use

Where land cover characterizes the physical landscape, land use refers to the way that humans utilize the land. Land use data for the Pomperaug River watershed were obtained from the Naugatuck Valley Council of Governments (NVCOG) for the municipalities within their region. NVCOG last revised their land use data in 2017. Morris, Washington, and Roxbury are not within NVCOG's region and did not have digitized land use data. For this project, land use in these towns was manually assigned to the NVCOG land use categories,

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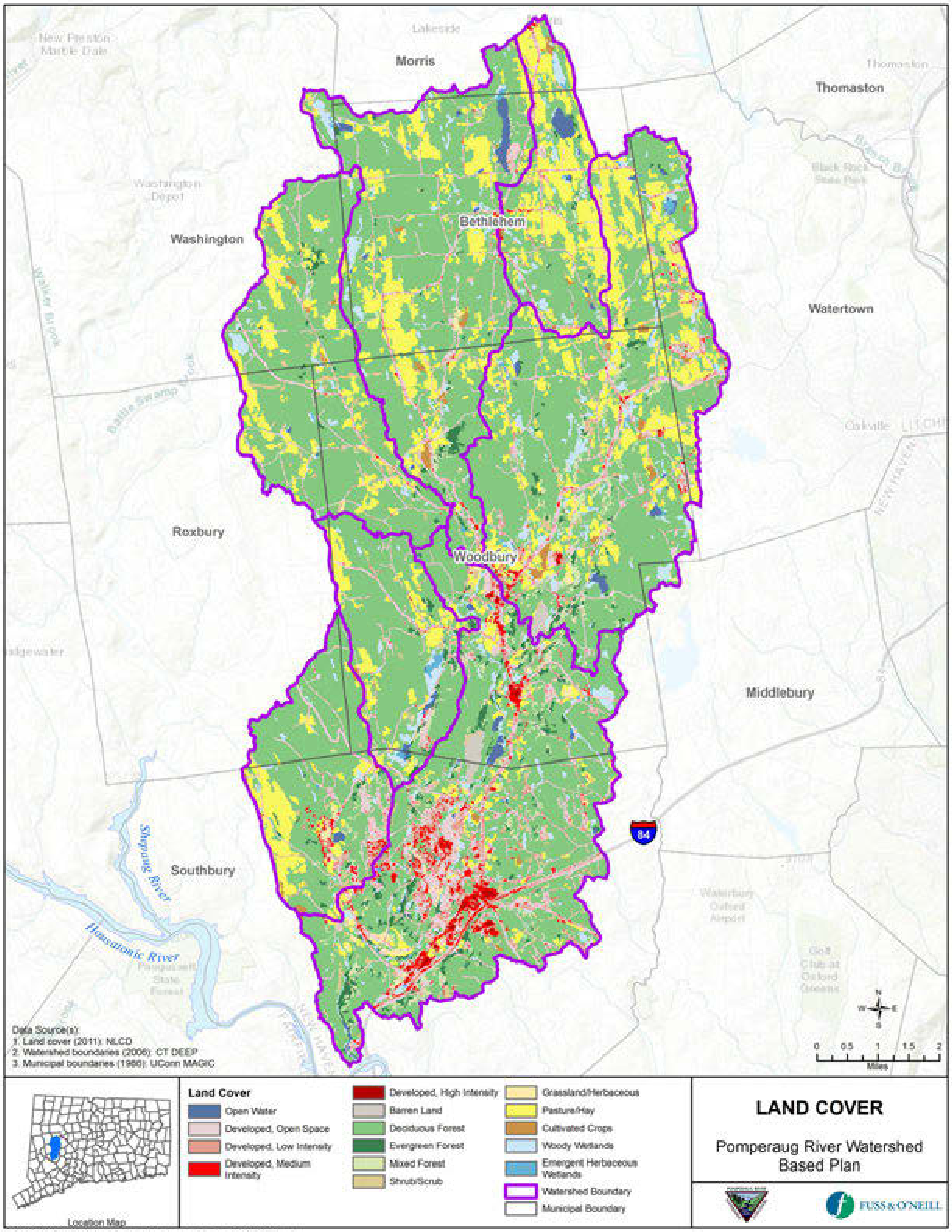
[2] The National Land Cover Database (NLCD) provides Landsat-based, 30-meter resolution land cover data for the entire nation. The most recent national data, presented here, are from 2011. The University of Connecticut Center for Land Use Education and Research (UCONN CLEAR) provides a more recent dataset (2015). However, the NLCD data are preferred as they disaggregate developed land into more precise categories based on density of development, and provide more detailed divisions for agricultural land and other habitat types.



Data Source(s):
1. Land cover (2011): NLCD
2. Watershed boundaries (2006): CT DEEP
3. Municipal boundaries (1986): UConn MAGIC

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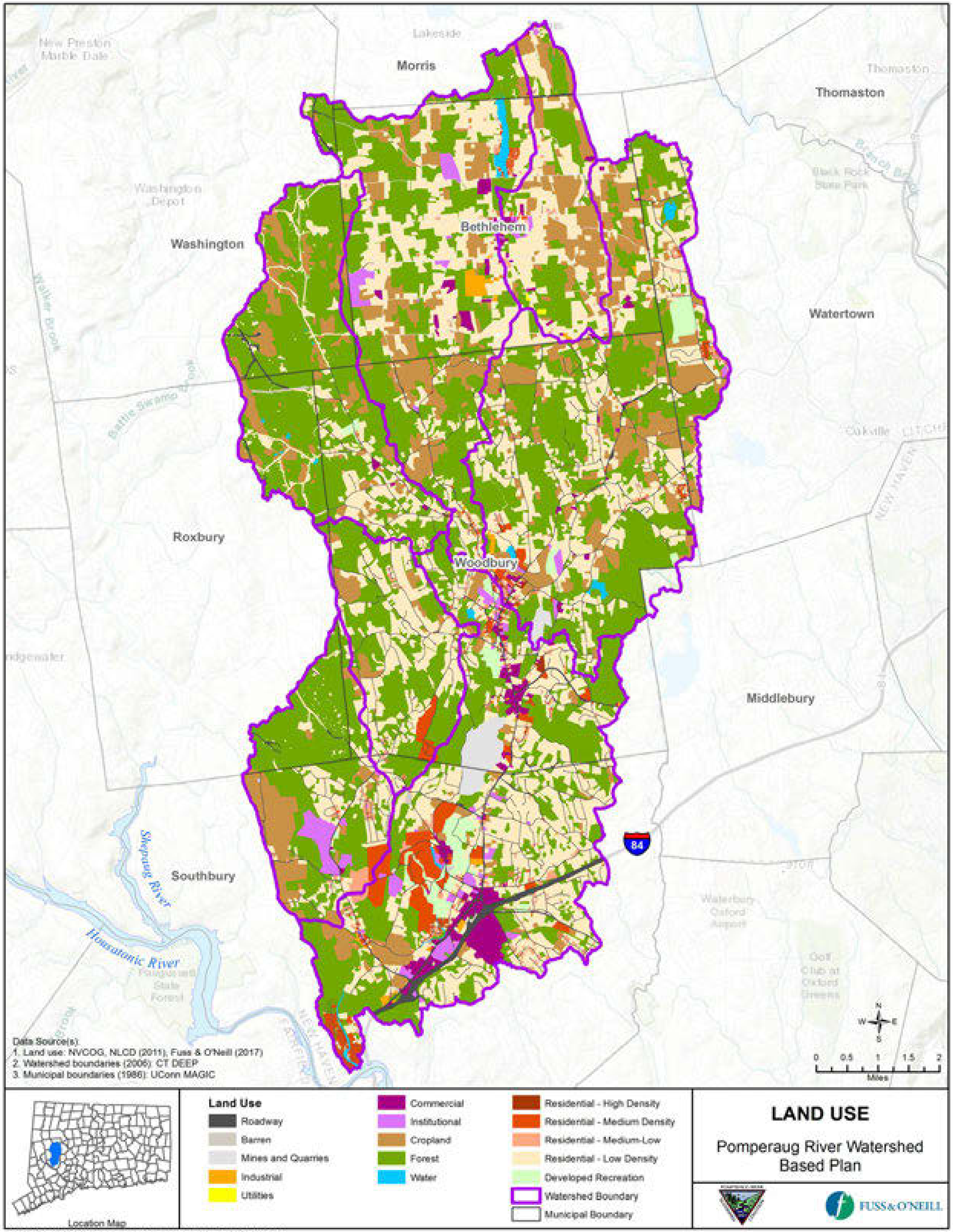
Figure 2-3. Land cover in the Pomperaug River watershed (NLCD, 2011)

Table 2-4. Distribution of land cover types by acres (and percent) in the Pomperaug River watershed (NLCD, 2011)

Land Cover	East Spring Brook		Weekeepeemee River		Nonnewaug River		Sprain Brook		Hesseky Brook		Pomperaug River		Transylvania Brook	
Open Water	90.3	(2.4)	142.3	(1.4)	84.3	(0.6)	9.1	(0.1)	31.1	(0.8)	95.4	(0.7)	15.8	(0.3)
Developed, Open Space	**223.9**	**(6.0)**	**655.7**	**(6.4)**	**946.1**	**(7.0)**	**375.5**	**(5.4)**	**257.5**	**(6.5)**	**1,724.2**	**(12.6)**	**415.1**	**(9.0)**
Developed, Low Intensity	**131.0**	**(3.5)**	**171.9**	**(1.7)**	**456.2**	**(3.4)**	**59.6**	**(0.8)**	**83.6**	**(2.1)**	**1,155.7**	**(8.4)**	**174.3**	**(3.8)**
Developed, Medium Intensity	22.5	(0.6)	21.8	(0.2)	88.7	(0.7)	4.7	(0.1)	5.6	(0.1)	506.5	(3.7)	57.8	(1.3)
Developed, High Intensity	2.0	(0.1)	2.0	(0.0)	9.1	(0.1)	0.0	(0.0)	0.0	(0.0)	94.3	(0.7)	2.9	(0.1)
Barren Land	1.8	(0.0)	2.2	(0.0)	75.4	(0.6)	3.1	(0.0)	2.9	(0.1)	118.7	(0.9)	2.2	(0.0)
Deciduous Forest	**1,559.7**	**(41.7)**	**6,794.0**	**(65.9)**	**7,643.6**	**(56.2)**	**5,094.0**	**(72.7)**	**2,675.4**	**(67.2)**	**7,535.5**	**(55.1)**	**3,012.9**	**(65.2)**
Evergreen Forest	24.2	(0.6)	107.2	(1.0)	166.8	(1.2)	56.5	(0.8)	84.7	(2.1)	505.6	(3.7)	40.5	(0.9)
Mixed Forest	27.8	(0.7)	67.1	(0.7)	315.3	(2.3)	21.3	(0.3)	34.2	(0.9)	352.4	(2.6)	42.7	(0.9)
Shrub/Scrub	38.2	(1.0)	126.7	(1.2)	290.4	(2.1)	179.4	(2.6)	61.1	(1.5)	301.7	(2.2)	40.0	(0.9)
Grassland-Herbaceous	9.3	(0.2)	45.1	(0.4)	46.5	(0.3)	13.3	(0.2)	13.8	(0.3)	147.6	(1.1)	41.4	(0.9)
Pasture/Hay	**1,404.3**	**(37.6)**	**1,746.0**	**(16.9)**	**2,739.2**	**(20.1)**	**1,027.4**	**(14.7)**	**522.3**	**(13.1)**	**598.5**	**(4.4)**	**685.0**	**(14.8)**
Cultivated Crops	35.4	(0.9)	71.1	(0.7)	118.3	(0.9)	29.1	(0.4)	8.9	(0.2)	28.7	(0.2)	30.0	(0.6)
Woody Wetlands	155.6	(4.2)	332.4	(3.2)	563.2	(4.1)	135.2	(1.9)	155.2	(3.9)	496.7	(3.6)	56.7	(1.2)
Emergent Herbaceous Wetlands	12.9	(0.3)	26.5	(0.3)	54.3	(0.4)	2.2	(0.0)	44.9	(1.1)	24.7	(0.2)	2.0	(0.0)
Total	**3,738.9**		**10,312.1**		**13,597.1**		**7,010.6**		**3,981.2**		**13,686.3**		**4,619.3**	



Data Source(s):
1. Land use: NVCOG, NLCD (2011); Fuss & O'Neill (2017)
2. Watershed boundaries (2006): CT DEEP
3. Municipal boundaries (1986): UConn MAGIC

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Figure 2-4. Land use in the Pomperaug River watershed (NVCOG, 2017)

Table 2-5. Land use composition by percent* in the Pomperaug River watershed (NVCOG, 2017)

Land Use	East Spring Brook	Hesseky Brook	Nonnewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River	Total Land Use Acres
Barren	0.0	0.0	0.0	0.2	0.3	0.1	0.0	**54.8**
Commercial	1.4	0.0	0.6	4.8	0.2	0.1	1.4	**699.0**
Cropland	**29.3**	**7.2**	**18.7**	5.1	**15.2**	**16.7**	**17.2**	**8,996.4**
Developed Recreation	0.0	0.0	1.5	3.3	0.4	0.1	0.1	**449.9**
Forest	**26.0**	**45.8**	**39.9**	**30.1**	**63.8**	**53.4**	**43.2**	**24,835.1**
Industrial	0.2	0.0	0.2	0.4	0.0	0.0	0.9	**137.4**
Institutional	1.2	0.1	0.4	2.2	0.0	5.1	2.0	**904.0**
Mines and Quarries	0.0	0.0	0.6	3.0	0.0	0.0	0.0	**297.9**
Residential - High Density	0.0	0.0	0.1	0.1	0.0	0.0	0.0	**19.8**
Residential - Low Density	**37.0**	**39.2**	**30.0**	**34.1**	**17.4**	**16.8**	**30.0**	**16,795.8**
Residential - Medium Density	0.4	2.9	0.9	6.4	0.0	1.7	0.5	**1,059.7**
Residential - Medium-Low	1.0	1.1	1.3	2.8	0.2	3.1	0.6	**826.8**
Roadway	0.3	3.9	3.3	**7.1**	2.0	2.8	1.0	**1,677.1**
Utilities	0.3	0.0	0.0	0.0	0.0	0.0	0.0	**25.3**
Water	0.0	0.0	0.5	0.4	0.2	0.0	1.1	**181.2**
Total (Acres)	**3,742**	**3,982**	**13,605**	**13,691**	**7,011**	**4,616**	**10,313**	**59,960**

*The top three most prevalent land uses within a subregional basin are shown in bold.

based on land cover data and aerial photography. Residential and agricultural uses are the dominant developed land uses across the entire watershed, comprising roughly half of the watershed land area (*Table 2-5*; *Figure 2-4*). Commercial and institutional uses make up a small proportion of land use in the subregional basins, but are more concentrated in the Pomperaug Subregional Basin and tend to cluster at the southern-most end of the watershed, in Southbury, near the I-84 corridor. Forest is the largest undeveloped category, making up 25-65% of the land area within each subregional basin.

2.4 Impervious Cover

Impervious cover (IC) refers to any surface that prevents natural infiltration of stormwater into the soil, most notably buildings and pavement. Urban stormwater runoff generated in developed areas from buildings, pavement, and other impervious surfaces is a significant source of pollutants to the Pomperaug River and its tributaries. Stormwater flowing off of impervious surfaces typically contains pollutants associated with atmospheric deposition, vehicles, industrial and commercial operations, lawns, construction sites, and human and animal activities. Without treatment, these pollutants may be conveyed during storm events from an impervious surface directly to a nearby waterbody or to a storm drainage system that eventually discharges to a waterbody. Impervious surfaces also prevent infiltration of rainfall and runoff into the ground which helps to filter out pollutants. In addition, impervious surfaces, especially those connected to traditional, piped storm drainage systems, increase the volume, peak flow rates, and velocity of stormwater runoff to receiving waters. This can contribute to higher flood risk, channel erosion, sedimentation, and reduced groundwater recharge and baseflow to streams, particularly during dry periods.

Research has documented the effects of urbanization on stream and watershed health. More specifically, studies by CTDEEP that have found a negative relationship between upstream impervious land cover and aquatic habitat in downstream, adjacent waters, with predictable, detrimental impacts to aquatic life when impervious cover exceeds 12% (CTDEEP, 2015a). However, impacts to streams can also occur before impervious cover reaches that level, particularly where sources other than piped stormwater discharges contribute to water quality impairments.

Figure 2-5 and *Table 2-6* summarize IC in the Pomperaug River watershed based on the 2012 high-resolution impervious cover data layer released by UCONN CLEAR in 2016. The map in *Figure 2-5* also includes estimates of IC for each local stream basin (smallest CTDEEP watershed unit) in the Pomperaug watershed. As a whole, the Pomperaug River watershed has an estimated 5.6% impervious cover. At 9.8%, impervious cover in the Pomperaug River subregional basin is below the 12% impacts threshold. However, at the local basin scale, 9 of the 57 local basins across the entire watershed exceed the 12% threshold. The highest impervious cover in the watershed is found in the local basins associated with the Pomperaug-03 river segment, where overall IC is estimated at 20-30%. IC in this basin is driven by the development along Main Street South and Heritage Village. Local basins that are predominantly rural and/or are less-developed tend to have impervious cover below 5%.

Table 2-6. Impervious Cover statistics (2012) for the Pomperaug River watershed (CTECO, 2017)

	Impervious Cover	
Subregional Basin	**Percent**	**Acres**
Pomperaug River	9.8	1,343.7
Transylvania Brook	5.5	255.0
East Spring Brook	5.3	199.3
Hesseky Brook	5.0	200.2
Nonnewaug River	4.6	619.8
Weekeepeemee River	3.6	372.4
Sprain Brook	2.9	204.4

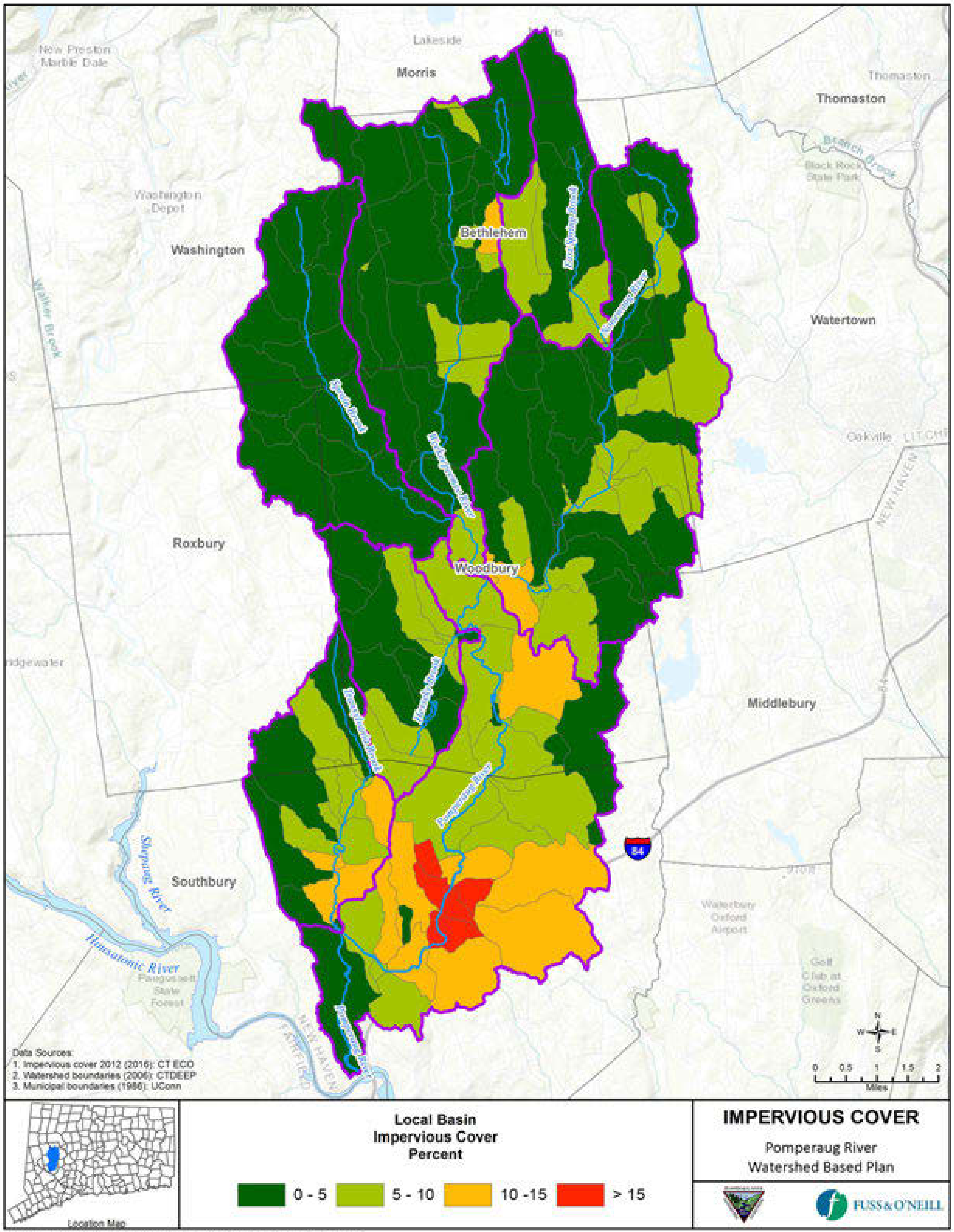

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Figure 2-5. Impervious cover by local stream basin (2012) in the Pomperaug River watershed (CTECO, 2017)

2.5 Open Space

Open space plays a critical role in protecting and preserving the health of a watershed by limiting development and impervious cover, preserving natural pollutant attenuation characteristics, and supporting other planning objectives such as farmland preservation, community preservation, passive recreation, habitat, and water supply. Open space includes public open space, which is land owned by the local, state, or federal government. Public open spaces are lands which may be used for recreation or other purposes and which may currently be lightly developed and potentially subject to future, more intensive development, if not protected. Permanently protected open space is land that has been set aside specifically to prevent future development through conservation easements, purchase, or other methods. Protecting open space from development, through these methods, is also an effective strategy for protecting the quantity and quality of local water resources.

Approximately 16 percent of the land area in the Pomperaug River watershed consists of protected open space (*Figure 2-6*). The permanently protected open space parcels in the Pomperaug watershed include Town-owned parks, recreation areas, and preserves; land trust properties; State of Connecticut properties that are undeveloped; farms where the development rights have been acquired (excluding Public Act 490 land); and Class A water company land. Major protected open space parcels in the Pomperaug River watershed include:

- Southbury Training School, Southbury (800 acres)
- Whittemore Sanctuary, Flanders Nature Center and Land Trust, Woodbury (700 acres)
- Audubon Center at Bent of the River, Southbury (450 acres)
- Bronson Lockwood Reservoir, Bethlehem (205 acres)
- Orenaug Park, Woodbury (182 acres)
- Baldridge Farm Preserve, Woodbury (145 acres)
- Aldo Leopold Wildlife Management Area, Southbury (135 acres)
- Swendsen Farm Preserve, Bethlehem (130 acres)
- Good Hill Farm Preserve, Roxbury Land Trust, Woodbury (127 acres)
- Young Farm, Watertown (118 acres)
- Van Vleck Sanctuary, Woodbury (111 acres)
- Platt Farm Preserve, Southbury (129 acres)
- Janie Pierce Park, Southbury/Woodbury (145 acres).

2.6 Geology and Soils

The Pomperaug River watershed has a unique geology, comparable to the Connecticut River Basin. Typical of watersheds in Connecticut, the topography of the Pomperaug watershed is quite variable, encompassing flat plains along the streams, with a mixture of rolling hills and steep slopes that run roughly north-to-south. The surficial geology of the watershed has been shaped by glaciation and is a major factor shaping topography, soils, and drainage characteristics within the watershed (USGS, 1929). Glacial advance and retreat carved rock ledges and removed existing soil, and deposited two types of glacial drift: unstratified drift, or till (e.g., hard-packed and jumbled mixture of unsorted glacial sediment smeared onto the bedrock by the glacier, often referred to colloquially as “hard pan”), and stratified drift, or glacial outwash (e.g., sorted layers of sand or gravel deposited by glacial meltwaters). Till was deposited directly by the ice, forming a till mantle of variable thickness, frequently interrupted by bedrock in the higher elevations of the watershed (Lyford et al., 2007). Stratified drift was deposited by glacial meltwater in the Pomperaug, Transylvania, and Hesseky Subregional Basins. The resulting alluvial plains formed terraces along the sides of valleys. These terraces are largely

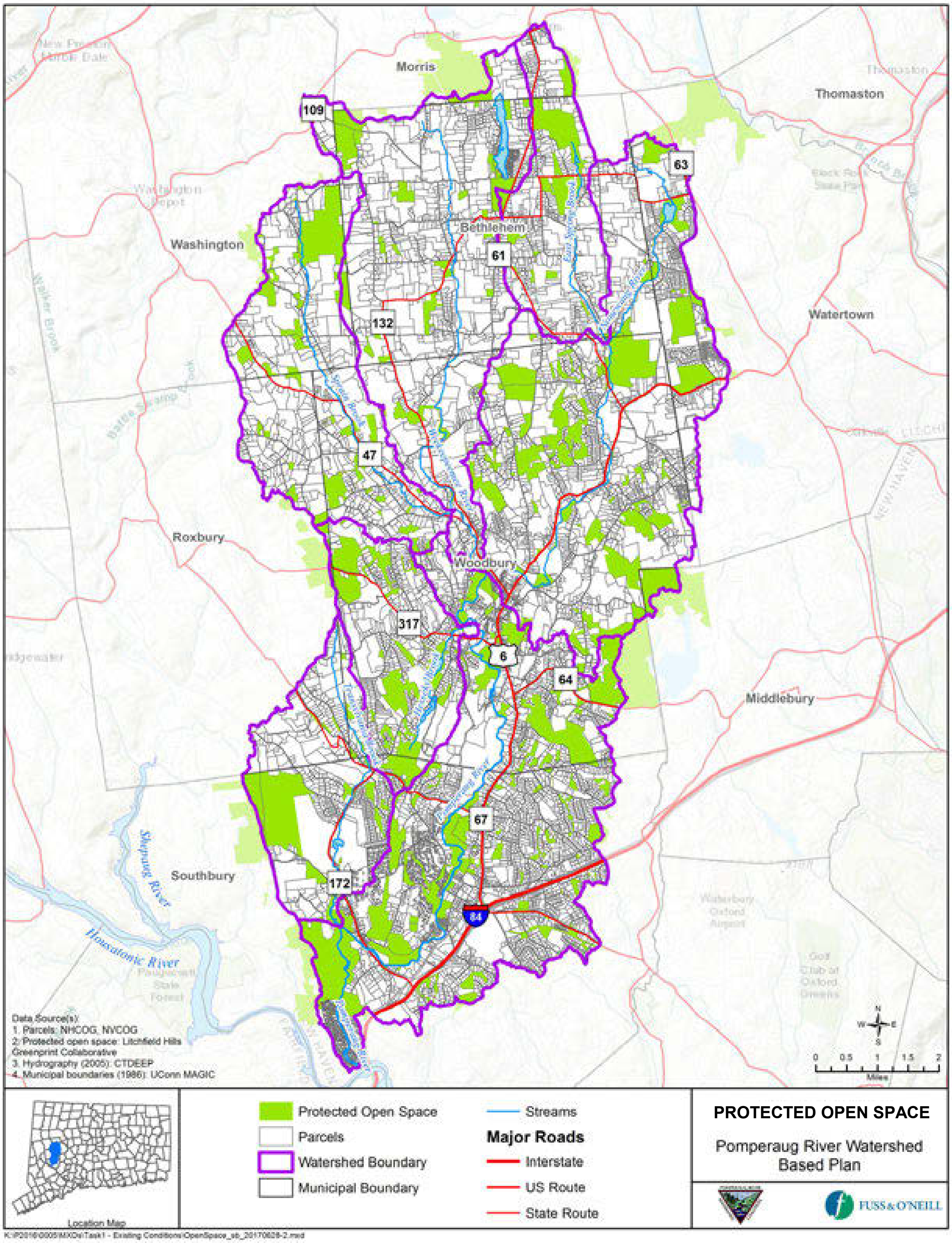

Figure 2-6. Protected open space parcels in the Pomperaug River watershed

smooth, with some kames and kettle holes[3]. At the northern reaches of the Pomperaug River watershed, the landscape rises to a maximum elevation of 1,150 feet above sea level in Morris, falling to just 100 feet above sea level at the confluence with the Housatonic River.

The U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS) classifies soils into Hydrologic Soil Groups that characterize a soil's runoff versus infiltration potential after prolonged wetting. Group A soils are the most well drained, meaning that they have low runoff potential and high infiltration potential. At the other extreme, Group D soils are the most poorly drained. Water movement through Group D soils is restricted, causing them to have high runoff potential and low infiltration potential. Group D soils are frequently either high in clay content or shallow soils over an impermeable layer (such as shallow bedrock or a dense glacial till) or a shallow water table. Group B and C soils complete the continuum between these extremes. Group B soils have moderately low runoff potential and unimpeded water transmission through the soil, while group C soils have moderately high runoff potential and are somewhat restrictive of water movement.

Figure 2-7 shows the distribution of Hydrologic Soil Groups in the Pomperaug watershed. Areas of the watershed at higher elevation and with a thin layer of till are generally classified as Group C or D soils, which are characterized by poor infiltration potential. Approximately 47% of the watershed is classified as either Group C or Group D soils. Conversely, approximately 52% of the watershed consists of areas with Group A or B soils, which have greater infiltration potential and are generally more conducive to infiltration-based Low Impact Development and green stormwater infrastructure. The Pomperaug, Weekeepeemee, Nonnewaug and Sprain Brook subregional basins have the largest percentage of Group A and B soils and are therefore expected to have better infiltration potential (*Table 2-7*). Additionally, some of the areas of Group A and B soils in the Pomperaug River subregional basin coincide with areas of denser development, making these areas potential targets for infiltration-based stormwater retrofits.

Table 2-7. Distribution of Hydrologic Soil Groups by Subregional Basin

Subregional Basin	Hydrologic Soil Group (Acres)				
	A	B	C	D	Water
Pomperaug River	1,392	7,108	1,987	3,023	181
Weekeepeemee River	426	5,382	2,671	1,689	146
Sprain Brook	193	4,185	1,282	1,336	15
Hesseky Brook	171	1,641	1,299	788	82
Nonnewaug River	1,416	4,611	3,642	3,820	117
East Spring Brook	97	889	2,155	516	86
Transylvania Brook	85	2,035	1,549	933	13
% of Watershed	6.6	45.4	25.6	21.3	1.1

*Soils labeled B/D or C/D are included in Group D
**Open water is not characterized into a HSG

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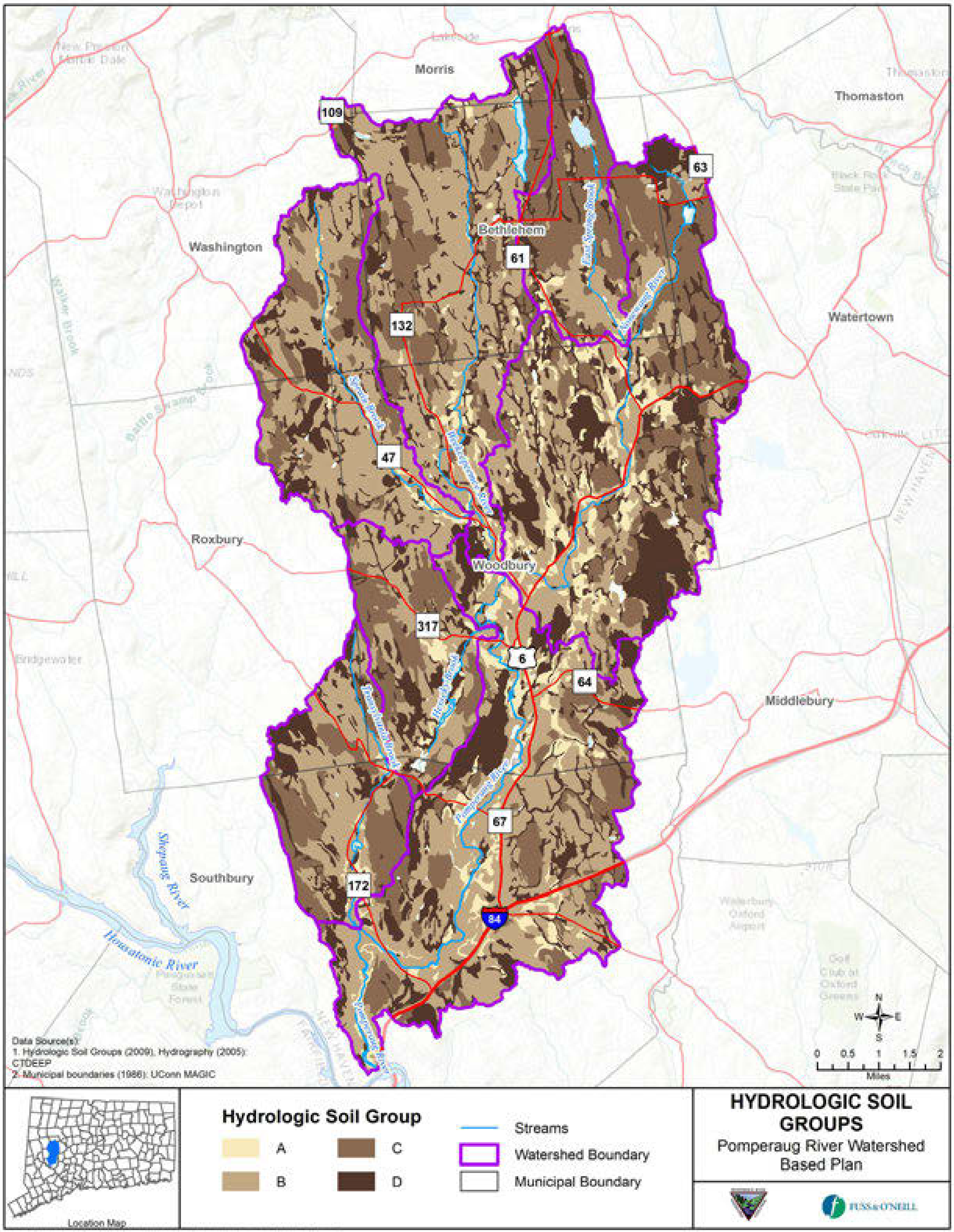
[3] A kame is an irregularly shaped hill or mound composed of sand, gravel and till that accumulates in a depression on a retreating glacier, and is then deposited on the land surface with further melting of the glacier. A kettle hole is a shallow, sediment-filled body of water formed when a block of ice from a retreating glacier becomes buried in sediment and melts slowly, leaving a basin that is usually shallow and may fill with water to create a pond or lake.



Data Source(s):
1. Hydrologic Soil Groups (2009), Hydrography (2005): CTDEEP
2. Municipal boundaries (1986): UConn MAGIC

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Figure 2-7. Distribution of Hydrologic Soil Groups in the Pomperaug River watershed

2.7 Wetlands, Riparian Areas, and Forested Areas

Wetlands

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and plant and animal communities living in the soil and on its surface. Wetlands can vary widely in type and characteristics, but are an important feature of a watershed, providing water quality benefits by removing pollutants and mitigating flooding. The extent and distribution of wetlands in the Pomperaug River watershed are shown in *Figure 2-8*. Wetlands make up approximately 12.5% of the watershed overall; 9.0% of the area consists of poorly drained and very poorly drained soils, with an additional 3.5% alluvial and floodplain soils. Wetlands comprise between 9% and 15% of the land area within the subregional basins making up the Pomperaug River watershed.

Riparian Areas

Riparian area refers to the interface between land and water. Healthy riparian areas are characterized by a vegetated area along a river or stream that provides habitat to a diverse array of plants and animals. Such areas, also referred to as vegetated or stream "buffers," can also slow stormwater runoff, trap sediment and other pollutants, provide shade to the stream, and a food source for wildlife. Conversely, riparian areas that are developed or that lack a dense stand of vegetation (e.g., paved or landscaped lawn areas or pasture and cropland right up to the water's edge) can be limited in their ability to filter stormwater and pollutants, leaving rivers and streams vulnerable to water quality issues. Slopes, soils, vegetation type and width all influence the effectiveness of buffers to protect water quality. Further, studies have found that minimum buffer widths required to accomplish different management goals and across jurisdictions are not uniform (Hawes and Smith 2005, Lee et al. 2004).

In 2006, UCONN CLEAR analyzed land cover within riparian areas in the Pomperaug River watershed, defined as 300 feet on both sides of mapped rivers and streams, including the areas of rivers and streams, which can be mapped as open water depending on their width. For this analysis, land cover types were grouped by their effectiveness as riparian buffer. Overall, approximately two-thirds of the riparian areas in the watershed are undeveloped (forest, wetland, and open water), with the percentage of undeveloped riparian land cover ranging from 60% to 75% across the subregional basins (*Table 2-8*). Agriculture, turf, and grass account for approximately 20% of the riparian land cover overall, while roughly 13% of the riparian areas in the watershed consist of developed land cover types. The Pomperaug River and Transylvania Brook subregional basins have the highest amounts of developed riparian land cover, while other subregional basins have higher amounts of agricultural land cover in the riparian area (*Figure 2-9*).

Table 2-8. Land cover composition (by percent) of riparian areas within the Pomperaug River watershed

	Land Cover Category		
Subregional Basin	**Developed, Other Grasses, Barren**	**Agriculture, Turf & Grass**	**Forest, Wetland, Water**
East Spring Brook	10.3	30.4	59.3
Hesseky Brook	10.3	14.9	74.8
Nonnewaug River	12.0	26.8	61.2
Pomperaug River	22.0	14.5	63.4
Sprain Brook	11.7	16.0	72.3
Transylvania Brook	17.6	20.1	62.2
Weekeepeemee River	9.9	19.4	70.7
Average	**13.4**	**20.3**	**66.3**

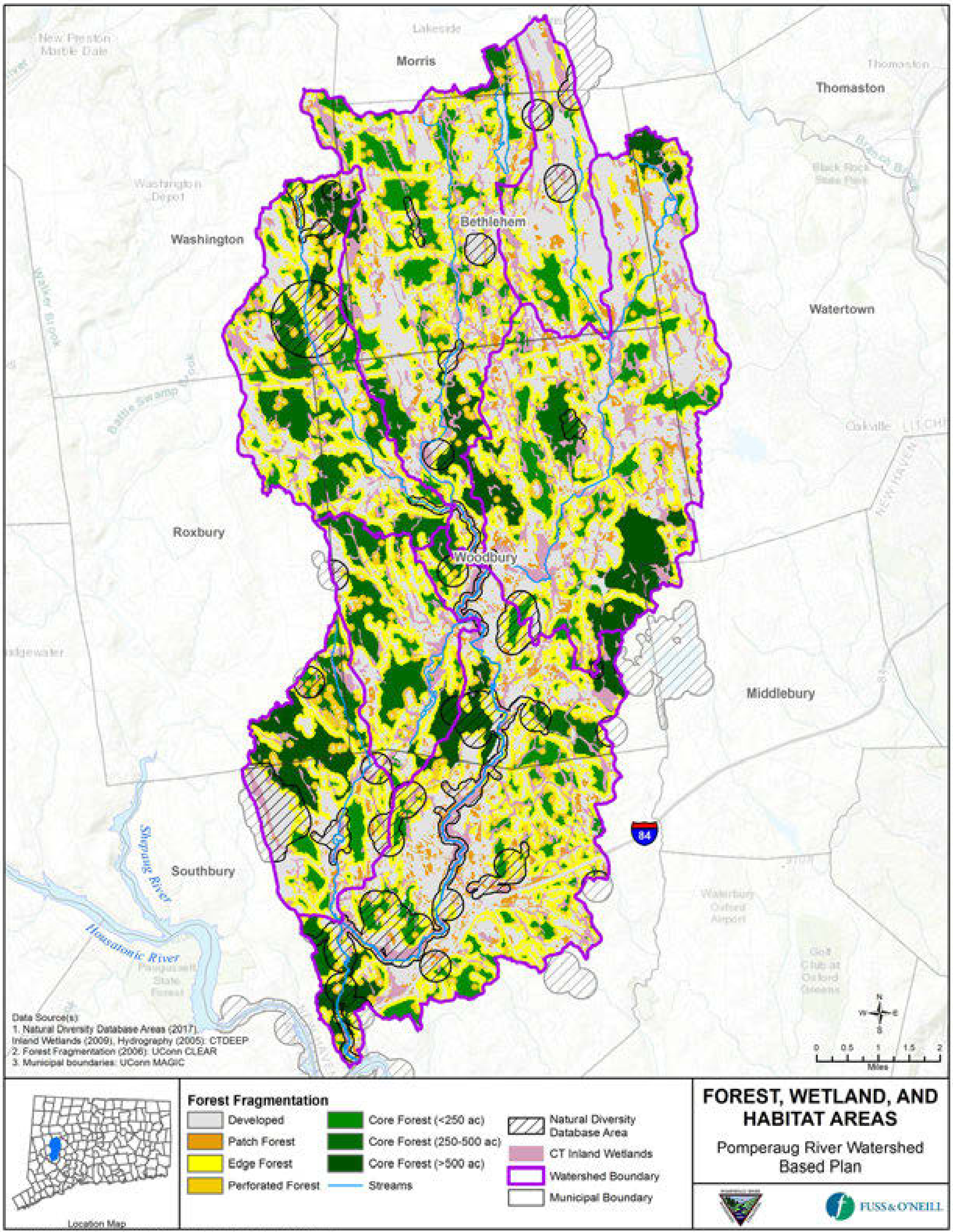

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Figure 2-8. Forest, wetlands, and habitat areas in the Pomperaug River watershed

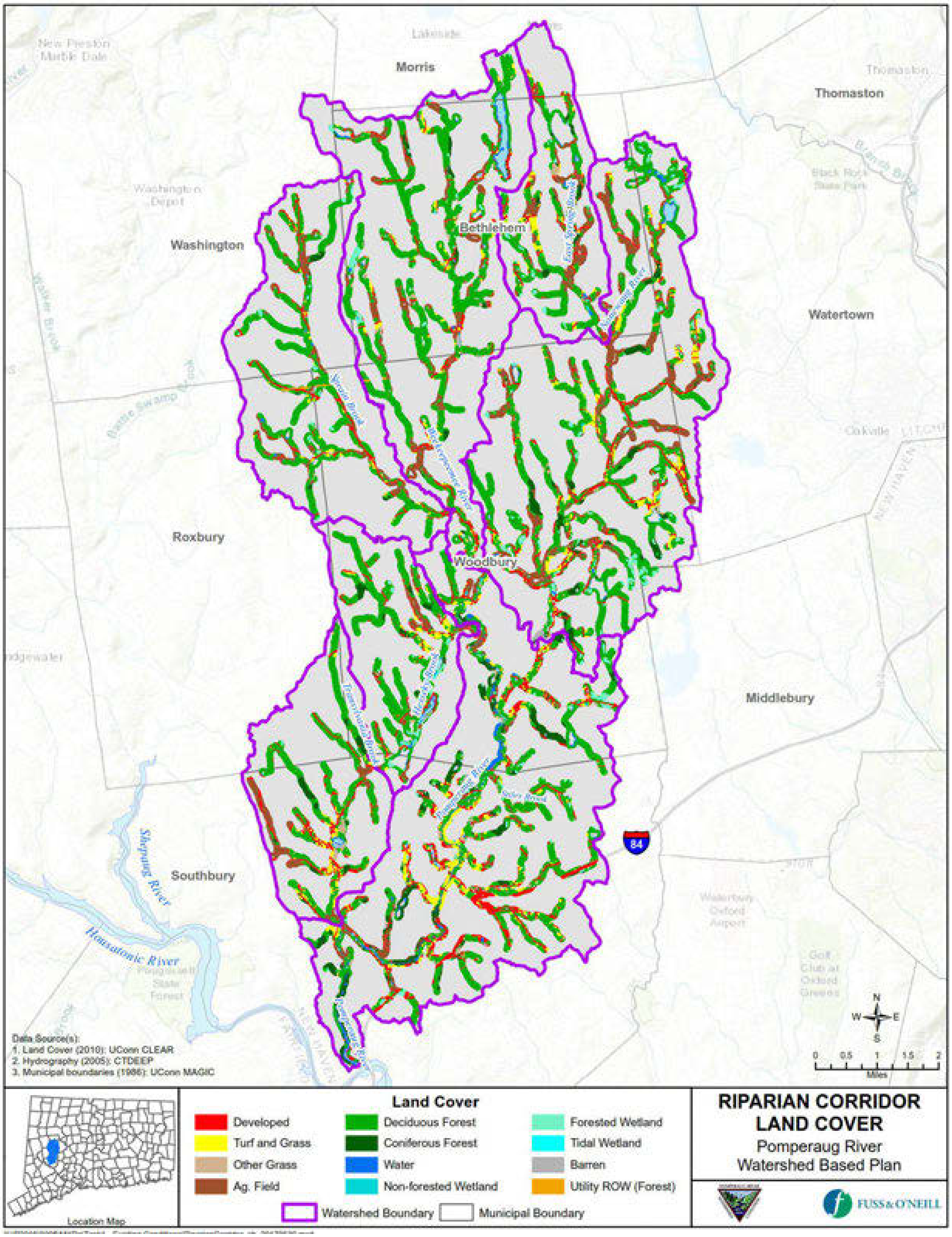


Figure 2-9. Riparian corridor land cover in the Pomperaug River watershed (UCONN CLEAR, 2015)

Forested Areas

Watershed forest cover provides numerous benefits including habitat for terrestrial and aquatic wildlife, improved soil and water quality, improved regional air quality, reduction in stormwater runoff, flooding, and stream channel erosion. Large, unfragmented forested areas play a critical role with regard to watershed integrity and the protection of water resources. Urbanization and fragmentation of forestland associated with land development have been shown to adversely affect stream water quality and ecological health.

Forested land cover varies between 43% and 74% across the subregional basins within the Pomperaug River watershed. Much of the larger tracts of unfragmented forestland within the Pomperaug River watershed (*Figure 2-8*) are protected (e.g., Audubon Center at Bent of the River and Whittemore Sanctuary). Others, such as the forested area west of O&G Industries' Southbury Quarry, are not protected from development. Across the watershed, core forest, defined as intact forest located over 300 feet from non-forested areas, typically comprises one-quarter to one-third of the total forest area. Edge forest, which make up the exterior periphery of core forest tracts where they meet with non-forested areas, also account for approximately one-third of the forest area in the watershed. Patch and perforated forest areas, which are highly fragmented and often associated with residential development and subdivisions, account for 7-11% of forest area (*Table 2-9*).

Table 2-9. Distribution of forest types in the Pomperaug River watershed

	Forest Type (%)				
Subregional Basin	Patch Forest	Perforated Forest	Edge Forest	Core Forest	Total Acres Core Forest
East Spring Brook	4.5	3.0	23.3	9.5	**353**
Weekeepeemee River	3.1	5.6	28.9	25.9	**2,669**
Nonnewaug River	5.0	3.9	25.0	24.0	**3,266**
Sprain Brook	1.5	6.5	31.3	32.5	**2,277**
Hesseky Brook	2.0	7.9	30.0	31.6	**1,259**
Pomperaug River	6.0	5.2	29.7	21.6	**2,952**
Transylvania Brook	2.5	7.4	25.7	31.4	**1,451**

2.8 Water Supply, Wastewater, and Stormwater

Water Supply

Groundwater serves as the sole water supply source for the Pomperaug River watershed. Water drawn from private and public wells supplies residents of all 8 municipalities in the watershed, as well as nearby Middlebury and Oxford. Depending on the location within the watershed, many homes rely on private wells drilled into bedrock aquifers for their water supply. Five large public wellfields in the watershed are located in and around areas of stratified drift (*Figure 2-10*). The Pomperaug Aquifer, made up of coarse sand and gravel materials, is highly susceptible to contamination. The aquifers can also be depleted through overuse and disconnected from replenishing rainfall and snowmelt due to intensive land use development which can increase surface runoff and reduce the amount of precipitation that infiltrates into the ground and recharges groundwater levels. As development and the demand for water increases, so does the potential for groundwater contamination, depleted wells, lower river flows, and increased stress on fish and wildlife species that rely on aquatic habitat.

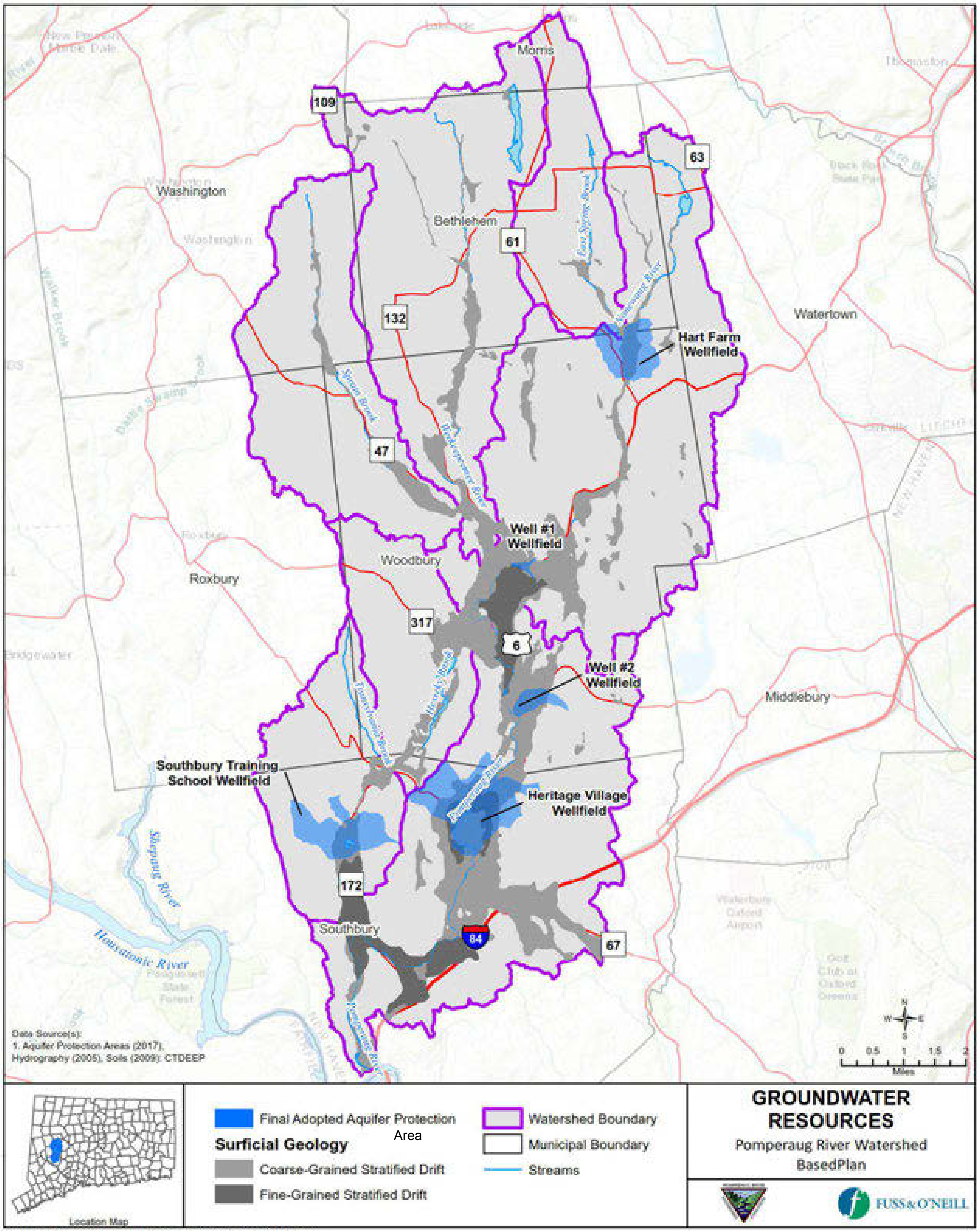


Figure 2-10. Groundwater resources in the Pomperaug River watershed

To protect major public water supply wells in stratified drift deposits that serve more than 1,000 people, CTDEEP requires water companies to map the boundaries for the area contributing groundwater to their well fields. These areas are called Aquifer Protection Areas (APAs). Municipalities are required, in turn, to delineate APA boundaries on local zoning (or inland wetland) maps and adopt aquifer protection regulations consistent with State regulations which restrict development of certain new land use activities involving hazardous materials and require existing regulated land uses to register and follow best management practices. Preserving and protecting groundwater resources in the watershed – both groundwater quality and availability for various uses – continues to be a major focus of the watershed communities, PRWC, resource agencies, and other stakeholders.

Regulated Wastewater Discharges

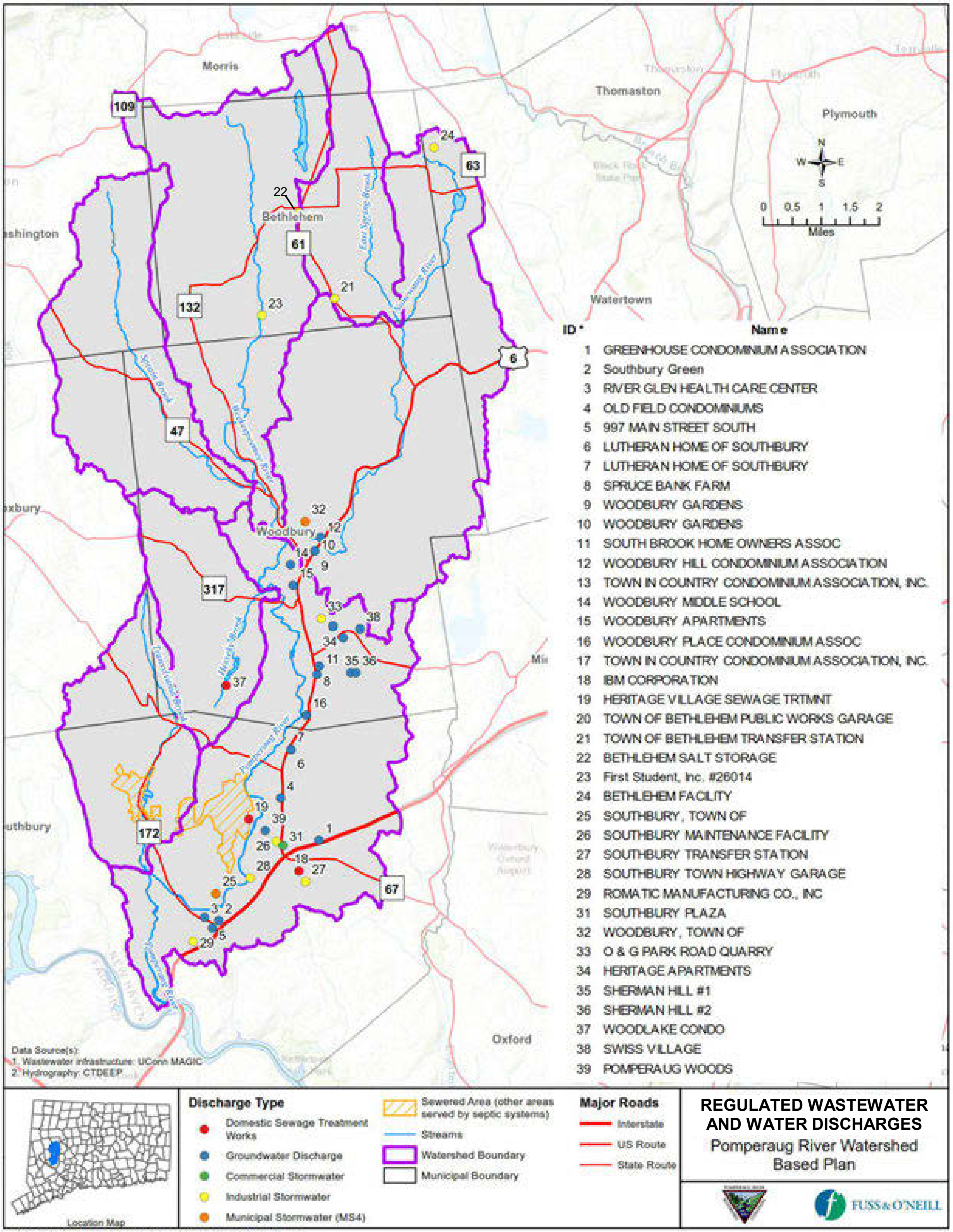
Only a small portion of the watershed is served by sanitary sewers (*Figure 2-11*). Wastewater treatment facilities in the watershed include those that serve Heritage Village (and Southbury Training School), Woodlake Condominium complexes, and the IBM Complex. The rest of the watershed is served by private subsurface sewage disposal systems, most of which are conventional septic systems. Larger subsurface disposal systems typically serve apartments, condominiums, restaurants, and other commercial buildings.

Subsurface disposal systems that are properly designed, installed, and maintained provide a safe and efficient way of disposing domestic sewage. Failing or older, sub-standard systems can impact surface water and groundwater quality and can expose the public to untreated sewage and be a source of bacteria, pathogens, and nutrients to the Pomperaug River and other surface waterbodies.

Septic systems on sites with design flows of 7,500 gallons per day (GPD) and less are under the jurisdiction of the Connecticut Department of Public Health (CTDPH) and the Local Director of Health. In general, systems of this size are permitted by local health directors and health districts, a process which includes: permit issuance, site investigation, plan review, approval to construct, system inspection, approval to discharge and enforcement of all newly constructed, repaired, altered or extended systems. However, plans for large septic systems serving buildings with design flows of 2,000 to 7,500 GPD must be approved by CTDPH. The Towns of Southbury and Woodbury are part of the Pomperaug District Department of Health (PDDH), the Town of Roxbury falls under the jurisdiction of Newtown Health District, and the remaining Towns (with the exception of Washington) form the southern part of the Torrington Area Health District. The Town of Washington has an independent part-time municipal health department. Disposal systems on sites with design flows exceeding 7,500 GPD, alternative sewage disposal systems, and community sewage systems are under the jurisdiction of CTDEEP.

According to discussions with the Pomperaug and Torrington Area Health Districts, failing or older, sub-standard residential septic systems are relatively isolated problems in the watershed, with annual failure rates of 1 percent or less in residential areas. Older residential neighborhoods with poor soils are most likely to experience failure or have substandard performance, and such systems in close proximity to rivers and streams can potentially impact surface water quality. Subsurface systems that serve apartment complexes, condos, and commercial businesses in the watershed are a potentially more significant source of water quality impacts. Facilities with new or existing subsurface systems (>7,500 GPD) are required to obtain a CTDEEP permit, which requires oversite/maintenance of the system by the facility owner. If the facility owner does not operate or maintain the system in accordance with their permit, it may take a while for CTDEEP to take action due to limited State resources for inspection and enforcement.

The accompanying map (*Figure 2-11*) identifies the locations of regulated wastewater and water discharges within the watershed that could potentially contribute bacteria and other pollutants. These include



ID *	Name
1	GREENHOUSE CONDOMINIUM ASSOCIATION
2	Southbury Green
3	RIVER GLEN HEALTH CARE CENTER
4	OLD FIELD CONDOMINIUMS
5	997 MAIN STREET SOUTH
6	LUTHERAN HOME OF SOUTHBURY
7	LUTHERAN HOME OF SOUTHBURY
8	SPRUCE BANK FARM
9	WOODBURY GARDENS
10	WOODBURY GARDENS
11	SOUTH BROOK HOME OWNERS ASSOC
12	WOODBURY HILL CONDOMINIUM ASSOCIATION
13	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC.
14	WOODBURY MIDDLE SCHOOL
15	WOODBURY APARTMENTS
16	WOODBURY PLACE CONDOMINIUM ASSOC
17	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC.
18	IBM CORPORATION
19	HERITAGE VILLAGE SEWAGE TRTMNT
20	TOWN OF BETHLEHEM PUBLIC WORKS GARAGE
21	TOWN OF BETHLEHEM TRANSFER STATION
22	BETHLEHEM SALT STORAGE
23	First Student, Inc. #26014
24	BETHLEHEM FACILITY
25	SOUTHBURY, TOWN OF
26	SOUTHBURY MAINTENANCE FACILITY
27	SOUTHBURY TRANSFER STATION
28	SOUTHBURY TOWN HIGHWAY GARAGE
29	ROMATIC MANUFACTURING CO., INC
31	SOUTHBURY PLAZA
32	WOODBURY, TOWN OF
33	O & G PARK ROAD QUARRY
34	HERITAGE APARTMENTS
35	SHERMAN HILL #1
36	SHERMAN HILL #2
37	WOODLAKE CONDO
38	SWISS VILLAGE
39	POMPERAUG WOODS

Data Source(s):
1. Wastewater infrastructure: UConn MAGIC
2. Hydrography: CTDEEP

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Figure 2-11. Regulated wastewater and water discharges in the Pomperaug River watershed discharges from industrial and commercial facilities in the watershed, subsurface sewage disposal systems permitted by CTDEEP, and regulated stormwater discharges, described in more detail below.

Regulated Stormwater Discharges

Two of the municipalities within the watershed, Southbury and Woodbury, are regulated under the CTDEEP General Permit for the Discharge of Small Municipal Separate Storm Sewer Systems (MS4 Permit). Although the regulated MS4 communities in the watershed (Woodbury and Southbury) are shown as discrete points (orange dots) on the map in *Figure 2-11*, the regulated stormwater discharges in both communities include numerous discrete outfall pipes and similar conveyances.

Communities subject to the MS4 Permit are required to develop, implement and enforce stormwater management plans centered around 6 minimum control measures, including: public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management in new development or redevelopment, and good housekeeping and pollution prevention. The last two measures include requirements to consider and utilize low impact development measures to reduce or disconnect impervious cover to infiltrate more runoff on site. The MS4 Permit also requires municipalities to address the source(s) of stormwater pollutants contributing to impaired water issues. For example, in this case, it means that both Southbury and Woodbury need to implement Best Management Practices (BMPs) that focus on reducing bacteria loads to waterbodies in the Pomperaug River watershed that are impaired for recreation. The Connecticut Department of Transportation is also required to address the quality of stormwater discharges from the state transportation system in the watershed through compliance with its own MS4 Permit, which becomes effective in July 2019.

Other regulated stormwater discharges in the watershed include industrial facilities that are registered under the CTDEEP General Permit for the Discharge of Stormwater Associated with Industrial Activity (“Industrial General Permit”) and commercial facilities registered under the CTDEEP General Permit for the Discharge of Stormwater Associated with Commercial Activity (“Commercial General Permit”). The Industrial General Permit regulates industrial facilities with point source stormwater discharges that are engaged in specific activities according to their Standard Industrial Classification code, while the Commercial General Permit requires operators of large paved commercial sites such as malls, movie theaters, and supermarkets to undertake actions such as parking lot sweeping and catch basin cleaning to keep stormwater clean before it reaches waterbodies. Construction activities in the watershed are also potentially subject to the CTDEEP General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities ("Construction General Permit"), which requires developers and builders to implement a Stormwater Pollution Control Plan to prevent the movement of sediments off construction sites into nearby waterbodies and to address the impacts of stormwater discharges from a project after construction is complete.

2.9 Pollutant Sources and Loads

The major anthropogenic sources of fecal indicator bacteria in the Pomperaug River watershed are summarized below. Individual sites and source areas are based on: 1) the findings of visual field assessments and pollutant load modeling conducted in support of this watershed plan update; 2) information from previous study reports and planning documents including the 2001 Pomperaug River State of the Watershed Report, the 2006 Pomperaug Watershed Management Plan, and the 2010 Pomperaug River Watershed Streamwalk Summary Report; and 3) input from the PRWC Land Use Committee on known or suspected pollutant sources in the watershed.

- **Agricultural Practices.** Hobby farms, equestrian facilities, and livestock farming practices are common throughout the watershed, with the greatest concentration of farms and agricultural uses in the central and northern portions of the watershed. While some farms maintain animal exclusion fencing to separate livestock from streams, other farms have livestock grazing or feeding areas that allow direct access to streams. Many sites have little or no vegetated buffers, and manure storage locations are sometimes located in close proximity to waterbodies.

- **Developed Land Use.** Residential, commercial, industrial and other developed land uses in the watershed generate stormwater runoff containing fecal indicator bacteria. Common sources of fecal indicator bacteria in these developed areas include pet waste, waterfowl (such as Canada geese), potential illicit discharges to the storm drainage systems, failing or malfunctioning septic systems, and bacteria growing in sediments and organic materials that collect in the storm drainage system. Stormwater runoff from developed areas includes both point discharges from municipal or privately-owned stormwater outfalls and diffuse nonpoint source runoff from lawns, roofs, driveways, and parking lots.

- **Wastewater Effluent.** Surface wastewater treatment facilities in the watershed discharge treated effluent to the Pomperaug River and its tributaries, including Heritage Village, IBM, and Woodlake Condominiums. Under normal operating conditions, these sources contribute relatively small amounts of fecal indicator bacteria to the receiving waterbodies.

Pollutant Source Assessments

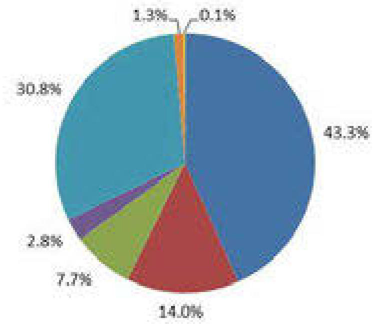
Visual field assessments were performed by Fuss & O'Neill in September 2017 to further assess possible sources of water quality impairments in the Pomperaug River watershed. Sites that were assessed were selected from an initial list of potential areas of concern in conjunction with the PRWC Land Use Committee. These included stream corridors and upland sites known or suspected of contributing to the impairments in the watershed.

A **pollutant loading model** was also developed for the Pomperaug River watershed to estimate the pollutant contribution from various land uses and land use activities. The model is used to refine an understanding of relative sources of fecal indicator bacteria and other pollutants and to support the development of planning recommendations for the watershed.

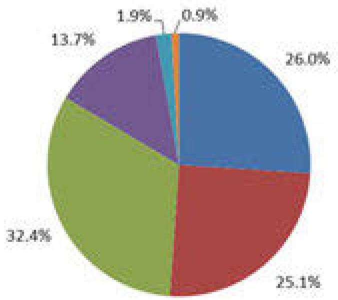
The relative contribution of bacteria from different land uses and activities is well illustrated by a comparison of the modeled loads in the various subregional basins (*Figure 2-12*). In the more-developed Pomperaug River subregional basin, modeled bacteria loads are dominated by stormwater runoff from urban land use (43%) and potential illicit connections associated with residential and commercial land use (31%), with agricultural sources estimated to contribute approximately 10% of the estimated annual load. By contrast, in the more rural Weekeepeemee River subregional basin, agricultural land uses (rural land and livestock) contribute an estimated 45% of the annual bacteria load, with stormwater runoff contributing approximately 25% of the annual load.

This comparison points out some of the opportunities and challenges in watersheds with mixed land use. The modeled bacteria loads in the Pomperaug River subregional basin illustrate the benefits of management measures that focus on sources of fecal indicator bacteria associated with urban stormwater runoff, including source controls, structural stormwater BMPs, education and outreach, and illicit discharge detection and elimination (IDDE). Even though the estimates of illicit connections are modest (0.1% of the population and 5% of the businesses served by sewer), the elimination of these discrete sources of bacteria could substantially reduce bacteria loadings where sanitary-related illicit connections are present (i.e., in areas served by sanitary sewers). Consequently, implementing an IDDE program in the more developed and/or sewered areas of the watershed can be effective at reducing bacteria loads.

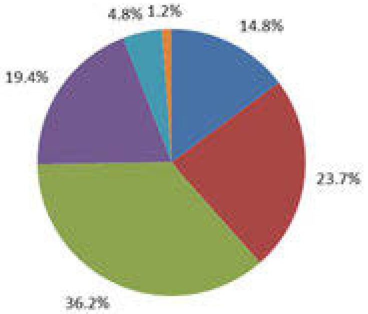
In contrast, in the more rural subregional basins such as the Weekeepeemee, livestock and agricultural practices are key drivers of bacteria loads, though pockets of residential and commercial development in these areas also contribute bacteria loads from urban runoff. Agricultural sources of bacteria typically require a combination of structural and non-structural best management practices (BMPs) to reduce loadings, including identification of “hot spot” bacteria sources and site-specific management strategies to achieve load reductions. Livestock in particular represent a considerable bacteria source in the Weekeepeemee River, Nonnewaug River, and Hesseky Brook subregional basins. Where practicable, load reduction in these basins should focus on agricultural BMPs such as exclusion fencing, vegetated buffers, alternative approaches to manure management, such as moving manure piles further away from streams, and other agricultural BMPs.



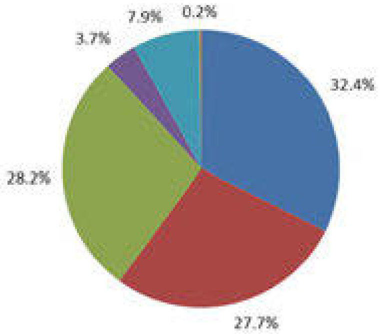
Pomperaug River Subregional Basin
Total annual load: 354,000 billion CFU (29% of watershed load)



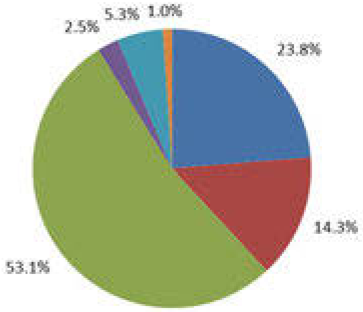
Weekeepeemee River Subregional Basin
Total annual load: 213,000 billion CFU (17%)



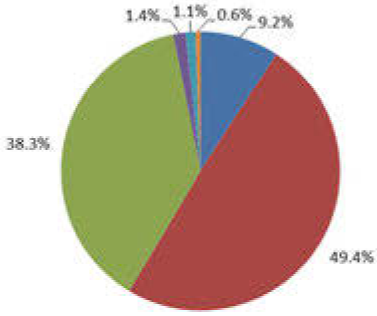
Nonnewaug River Subregional Basin
Total annual load: 275,000 billion CFU (23%)



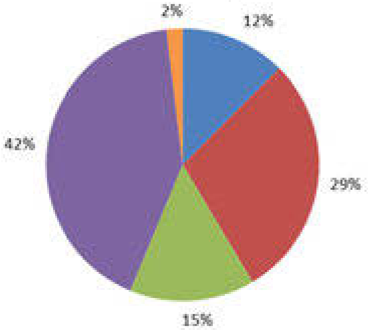
Transylvania Brook Subregional Basin
Total annual load: 107,000 billion CFU (9%)



East Spring Brook Subregional Basin
Total annual load: 81,000 billion CFU (7%)



Sprain Brook Subregional Basin
Total annual load: 109,000 billion CFU (9%)



Hesseky Brook Subregional Basin
Total annual load: 75,000 billion CFU (6%)

LEGEND:

- 🟦 Urban Land
- 🟥 Forest
- 🟩 Rural Land
- 🟪 Livestock
- 🟦 Illicit Connections
- 🟧 Septic Systems
- 🟨 Point Source Discharges

Figure 2-12. Relative contributions of bacteria sources in the Pomperaug River watershed

3 Management Recommendations

The primary management goals of the Pomperaug River watershed based plan are as follows:

- Strengthen and build local capacity and community support to implement the watershed plan
- Implement ongoing water quality monitoring and other assessments to support plan implementation
- Reduce fecal indicator bacteria and other pollutant inputs to impaired rivers and streams
- Incorporate proactive measures to protect/maintain high quality streams.

This section describes recommended actions to achieve these goals. The recommendations include watershed-wide and targeted actions:

- **Watershed-wide Recommendations** are recommendations that can be implemented throughout the Pomperaug River watershed. These basic measures can be implemented in most areas of the watershed and are intended to address nonpoint source pollution. The water quality benefits of these measures are primarily long-term and cumulative in nature resulting from runoff reduction, source control, pollution prevention, and improved stormwater management.

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

Given the large size of the Pomperaug River watershed, compressed timeline, and limited resources available for this initial watershed based planning process, it was challenging to conduct comprehensive field assessments of the entire regional basin. As a result, additional field investigations are recommended to further characterize pollutant sources and develop solutions. Supplementary field assessments, coupled with a strategic water quality monitoring plan, will help to identify and implement more site-specific projects and action plans which will be more effective at improving water quality on a subregional basin scale. This, in turn, will benefit the entire Pomperaug watershed.

The recommendations presented in this section are classified according to their timeframe and implementation priority. Recommendations include 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, fundraising, and education and outreach.

- **Short-Term Actions** are initial actions to be accomplished within the first 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.

- **Medium-Term Actions** involve continued programmatic and operational measures, delivery of educational and outreach materials, and construction of larger retrofit and/or restoration projects between two and five years after plan adoption.

- **Long-Term Actions** consist of continued implementation of watershed projects, as well as an evaluation of progress, accounting of successes and lessons learned, and an update of the watershed management plan. Long-term actions are intended to be completed between five and ten years or longer after plan adoption. The feasibility of long-term actions, many of which involve significant infrastructure improvements, depends upon the availability of sustainable funding mechanisms.

As discussed in *Section 1*, this Plan is a *guidance* document that seeks to resolve surface water quality impairments and related water resource issues within the Pomperaug watershed. Unless identified as a required action under an existing local, State or federal regulation or permit, the recommendations in this Plan for specific projects/actions are intended to be *voluntary* undertakings, carried out with willing, cooperative partners, working together to protect and improve water quality. This Plan identifies potential partners and funding sources to assist with achieving the recommendations presented herein. While some potential funding sources for specific management measures are suggested in the subsections and associated tables that follow, a more extensive list of potential funding opportunities is provided in *Appendix H*.

3.1 Capacity Building

The success of any watershed based plan depends on effective leadership, active participation by the watershed stakeholders, and local "buy-in" of the plan recommendations by the watershed communities, in addition to funding and technical assistance. Fortunately, significant local support and "capacity" for watershed protection and restoration already exists within the Pomperaug River watershed, through the leadership of the Pomperaug River Watershed Coalition and other stakeholders. Strengthening local capacity for implementing this watershed plan, by building on the existing network of volunteers and programs, is a critical early and ongoing part of the watershed plan implementation process. *Table 3-1* summarizes capacity building recommendations, which are described below in greater detail.

Recommended Actions

- Seek endorsement of the watershed based plan by the watershed municipalities to support the watershed planning effort through funding, staff, or other resources. Endorsement of the watershed management plan by the watershed municipalities is an important first step in implementing the plan recommendations.
- Review and prioritize potential funding sources that have been preliminarily identified in this watershed plan (see *Section 6*). High-priority funding sources that should be considered include:
    - CTDEEP/EPA Section 319 Nonpoint Source Grants
    - National Fish and Wildlife Foundation Long Island Sound Futures Fund
    - Connecticut Clean Water Fund (Green Infrastructure)
    - Private foundations
- Prepare and submit grant applications for projects identified in this plan on an ongoing basis.

3.2 Monitoring and Assessment

Additional monitoring and assessment is recommended to support implementation of the watershed based plan, including water quality monitoring, streamwalk assessments, and track down surveys. These additional assessments will help to establish an improved baseline of water quality conditions, further characterize pollutant sources and problem areas, and develop more detailed action plans and site-specific restoration projects. *Table 3-2* summarizes monitoring and assessment recommendations, which are described in the following sections.

Table 3-1. Capacity building recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. **Obtain municipal endorsement of the watershed plan** - Request letters of support	PRWC	0-2 years	Letter of support from each watershed municipality	$	
2. **Identify and pursue funding** - Review and prioritize funding sources - Prepare and submit grant applications	PRWC and other stakeholders in coordination with PRWC	0-2 years Ongoing	Funding sources pursued and funding obtained	$$	See *Section 5* and *Appendix H* of this plan for funding sources

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000
PRWC = Pomperaug River Watershed Coalition

Table 3-2. Monitoring and assessment recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. **Establish and implement fixed-station bacteria monitoring program** - Identify methodology - Prepare QAPP - Recruit and train volunteers - Conduct monitoring - Analyze samples - Compile and analyze data	PRWC with input from CTDEEP Monitoring & Assessment Program on site selection	Establish within 0-2 years Seasonal sampling (Apr - Oct)	- Approved QAPP - Volunteers trained - Monitoring results/reports	$$ (annually)	Local businesses, Argull Hull Foundation, National Fish and Wildlife Foundation, The Conservation Fund, Earthwatch Institute
2. **Prepare a periodic "Water Quality Report Card"** - Create and distribute report card	PRWC	2-5 years	- Report card disseminated to stakeholders including the public	$$$	
3. **Conduct streamwalk assessments and track down surveys** - Identify methodology - Prepare QAPP - Complete streamwalks - Compile and analyze data - Plan and conduct "track down" surveys	PRWC and volunteers	0-2 years (repeat streamwalks every 5 years)	- Approved QAPP - Streamwalks and track down surveys conducted - Streamwalk assessment results - Track down survey results and recommendations	$$$	

Table 3-2. Monitoring and assessment recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
• Analyze results and develop recommendations					
4. Prepare and implement subwatershed action plans • Identify site-specific and/or widespread issues • Develop and implement action plans	PRWC and consultant	2-5 years	• Subwatershed action plans prepared and implemented	$$$	

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000
PRWC = Pomperaug River Watershed Coalition   CTDEEP = Connecticut Department of Energy and Environmental Protection

3.2.1 Water Quality Monitoring

The identified recreational impairments in the Pomperaug River watershed are based on extremely limited water quality monitoring data (3 sampling locations) collected between 2006 and 2010. Additional, ongoing water quality monitoring is recommended for the Pomperaug River watershed to refine the understanding of water quality impacts from pollution sources in the watershed, to measure the progress toward meeting watershed management goals and TMDL pollutant load reductions, and ultimately support removal of the impaired segments of the Pomperaug River and its tributaries from the CTDEEP impaired waters list. Water quality monitoring recommendations are summarized in *Table 3-2*.

Recommended Actions

- Establish and implement a routine water quality monitoring program for the Pomperaug River watershed. Consistent with the bacteria TMDL for the Pomperaug and Weekeepeemee Rivers, the monitoring program should be designed to accomplish two objectives: (1) fixed station monitoring to track water quality improvements, and (2) source detection to identify specific sources of bacterial loading.
    - **Fixed Station Bacteria Monitoring.** Conduct routine bacteria (*E. coli*) monitoring at fixed stream locations in the Pomperaug River watershed to measure progress toward achieving the watershed plan and TMDL pollutant load reduction goals. The sampling sites should be located upstream and downstream of potential bacteria sources to bracket and isolate sources of pollution. *Figure 3-1* shows the locations of proposed bacteria monitoring sites. Sampling should be conducted monthly during the recreation season (April – October) under both wet and dry weather conditions.
    - **Bacteria Source Detection Monitoring.** Source detection monitoring may include 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. Source detection monitoring should be informed by the findings of streamwalk assessments and follow-up track down surveys. Source detection monitoring should also be implemented by Southbury and Woodbury as part of their "Illicit Discharge Detection and Elimination" efforts as required by the MS4 Permit.

Proposed Fixed-Station Bacteria Monitoring Sites in the Pomperaug River Watershed

1. Mill Road - USGS Gauge (Nonnewaug River, Woodbury)
2. Old Town Farm at North Gate Road (Nonnewaug River, Woodbury)
3. Route 47 Bridge (Nonnewaug River, Woodbury)
4. Route 61 Bridge (Nonnewaug River, Bethlehem/Woodbury line)
5. Audubon Center at Bent of the River (Pomperaug River, Southbury)
6. Heritage Road (Pomperaug River, Southbury)
7. Oakdale Manor (Pomperaug River, Southbury)
8. Poverty Road - Ewald Park - USGS Gauge (Pomperaug River, Southbury)
9. Route 67 - Bennett Park (Pomperaug River, Southbury)
10. The Gym - Flood Bridge Road (Pomperaug River, Southbury)
11. Wood Creek Road (Weekeepeemee River, Bethlehem)
12. Brushy Hill Road (Weekeepeemee River, Woodbury)
13. Chohees Trail (Weekeepeemee River, Woodbury/Bethlehem line)
14. Jacks Bridge Road (Weekeepeemee River, Woodbury)

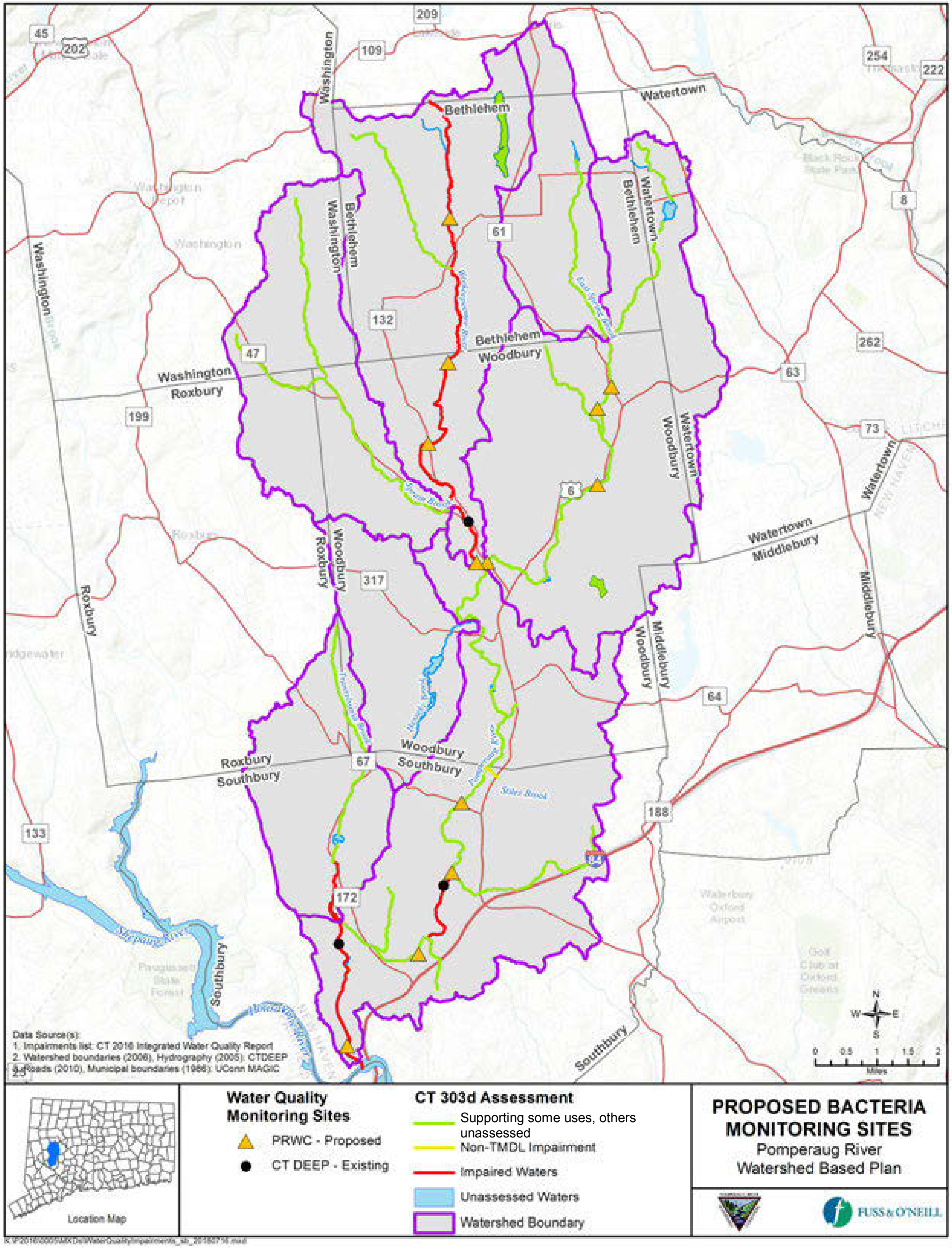


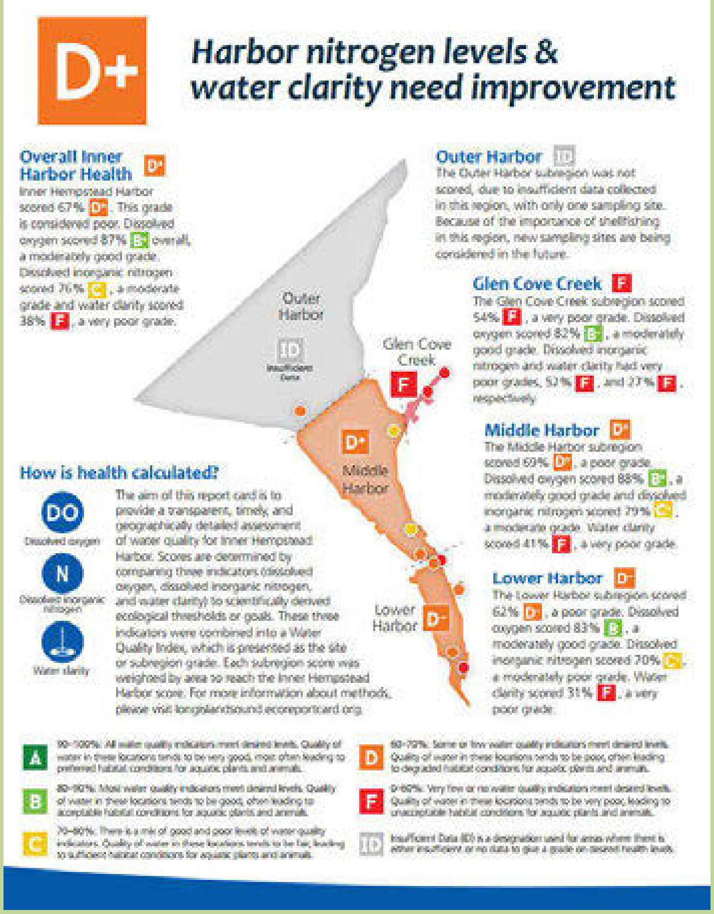
Figure 3-1. Proposed bacteria monitoring sites

- Pursue dedicated funding to finance an ongoing water quality monitoring program.

- Prepare a periodic "Water Quality Report Card" for the Pomperaug River and its tributaries, modeled after similar report cards that have been prepared for other rivers and embayments around Connecticut and elsewhere in the U.S. The report card would provide a transparent, timely, and geographically detailed assessment of water quality to inform the public of water quality conditions as well as actions that are occurring to improve and protect water quality in the river. Report card scores are determined by comparing water quality indicators to scientifically-derived ecological thresholds or goals. The report card for the Pomperaug River watershed would focus on: recreational water quality per the results of the proposed bacteria monitoring program; and aquatic habitat health per the results of continued, existing PRWC benthic macroinvertebrate survey and stream temperature monitoring programs. Results would be compared to Connecticut's Water Quality Standards to help determine watershed report card "grades".

Water Quality Report Card

An example of a water quality report card developed for Hempstead Harbor on the north shore of Long Island.
http://www.nfwf.org/whoweare/mediacenter/pr/Documents/hempstead-harbor-report-card.pdf



D+ **Harbor nitrogen levels & water clarity need improvement**

Overall Inner Harbor Health D+
Inner Hempstead Harbor scored 67% D+. This grade is considered poor. Dissolved oxygen scored 87% B+ overall, a moderately good grade. Dissolved inorganic nitrogen scored 76% C, a moderate grade and water clarity scored 38% F, a very poor grade.

Outer Harbor ID
The Outer Harbor subregion was not scored, due to insufficient data collected in this region, with only one sampling site. Because of the importance of shellfishing in this region, new sampling sites are being considered in the future.

Glen Cove Creek F
The Glen Cove Creek subregion scored 54% F, a very poor grade. Dissolved oxygen scored 82% B-, a moderately good grade. Dissolved inorganic nitrogen and water clarity had very poor grades, 52% F, and 27% F, respectively.

Middle Harbor D+
The Middle Harbor subregion scored 69% D+, a poor grade. Dissolved oxygen scored 88% B+, a moderately good grade and dissolved inorganic nitrogen scored 79% C+, a moderate grade. Water clarity scored 41% F, a very poor grade.

Lower Harbor D-
The Lower Harbor subregion scored 62% D-, a poor grade. Dissolved oxygen scored 83% B, a moderately good grade. Dissolved inorganic nitrogen scored 70% C-, a moderately poor grade. Water clarity scored 31% F, a very poor grade.

How is health calculated?

The aim of this report card is to provide a transparent, timely, and geographically detailed assessment of water quality for Inner Hempstead Harbor. Scores are determined by comparing three indicators (dissolved oxygen, dissolved inorganic nitrogen, and water clarity) to scientifically derived ecological thresholds or goals. These three indicators were combined into a Water Quality Index, which is presented as the site or subregion grade. Each subregion score was weighed by area to reach the Inner Hempstead Harbor score. For more information about methods, please visit longislandsound.ecoreportcard.org.

A 90–100%: All water quality indicators meet desired levels. Quality of water in these locations tends to be very good, most often leading to preferred habitat conditions for aquatic plants and animals.

B 80–90%: Most water quality indicators meet desired levels. Quality of water in these locations tends to be good, often leading to acceptable habitat conditions for aquatic plants and animals.

C 70–80%: There is a mix of good and poor levels of water quality indicators. Quality of water in these locations tends to be fair, leading to sufficient habitat conditions for aquatic plants and animals.

D 60–70%: Some or few water quality indicators meet desired levels. Quality of water in these locations tends to be poor, often leading to degraded habitat conditions for aquatic plants and animals.

F 0–60%: Very few or no water quality indicators meet desired levels. Quality of water in these locations tends to be very poor, leading to unacceptable habitat conditions for aquatic plants and animals.

ID Insufficient Data (ID) is a designation used for areas where there is either insufficient or no data to give a grade on desired health levels.

3.2.2 Streamwalk Assessments and Track Down Surveys

Streamwalk assessments, which were last performed in the Pomperaug in 2010, are recommended along with visual track down surveys of actual or suspected pollutant sources identified during the streamwalks.

Recommended Actions

- Conduct streamwalk assessments within the Pomperaug River watershed following previously established Connecticut NRCS streamwalk protocols or alternate methodology. PRWC began a Volunteer Streamwalk Program in the summer of 2000 to collect and analyze the data needed to make sound management decisions about the watershed and the future use of its water resources. This program has since become a long-term monitoring and assessment tool, allowing the PRWC to document and track changes in the watershed over time. The program's goals are to document the physical characteristics of the rivers and streams in the Pomperaug River watershed and to involve the community in river conservation stewardship. Future streamwalks should be conducted on a rotating subregional basin basis (i.e., concentrate on Sprain Brook one season and Weekeepeemee another season).

- Following the streamwalks and evaluation of the assessment results, plan and conduct subwatershed visual "track down" surveys of identified or suspected pollution sources, generally located in upland areas that drain to stream. Visual track down surveys are a tool commonly used by the Connecticut Conservation Districts to help identify conditions responsible for water quality impairments in streams. The goals of the track down survey are to collect information on the possible causes of impairment and recommend and implement solutions to address the identified issues of concern. Subregional watershed 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.

3.2.3 Subwatershed Action Plans

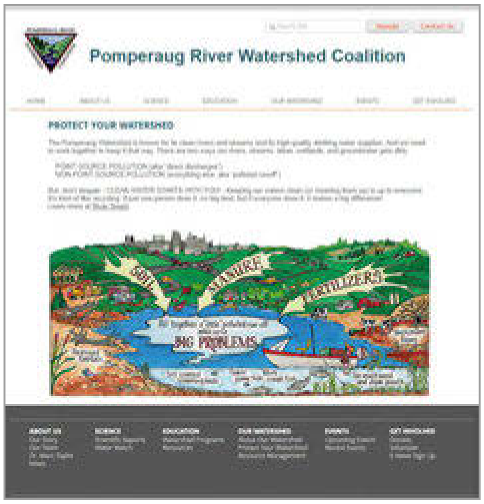
Development and implementation of site-specific restoration and protection strategies is most effective at the subregional watershed scale for larger, regional watersheds such as the Pomperaug River watershed. Although this watershed plan identifies a number of site-specific recommendations and BMP concepts that are examples of the types of projects that could be implemented elsewhere in the watershed, the limited scope of this watershed planning effort did not allow for comprehensive field assessments of the entire watershed.

Recommended Actions

- Prepare and implement more detailed action plans for priority subregional or local basins based on the findings of water quality monitoring, streamwalk assessments, and track down surveys (see recommendations in previous sections). Higher priority basins include those subregional and local basins associated with impaired segments of the Pomperaug River, Weekeepeemee River, and Transylvania Brook.
- Encourage the watershed municipalities and other stakeholders to participate in development and implementation of the respective subwatershed action plans.

- Subwatershed action plans could be added and maintained as appendices to the overall Pomperaug River Watershed Based Plan, relying on watershed background information, goals, and objectives contained in the larger watershed plan.

3.3 Education and Outreach



Pomperaug River Watershed Coalition

PROTECT YOUR WATERSHED

The public is often not aware of the critical role they have in protecting water resources. Under current law, municipalities and state agencies do not have statutory authority to mandate nonpoint source pollution reduction projects, other than those that violate land use regulations, on privately owned properties. Thus, inspiring residents and business owners to voluntarily implement practices that improve water quality on their own properties is critical to meeting water quality goals. Public education is vital 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. Increasing awareness and understanding is the first step in fostering support for watershed management efforts and cultivating a long-term, environmental and watershed stewardship ethic. While there are strong outreach and education programs already in place within the Pomperaug watershed, there is opportunity to expand and refine these activities, as staffing and funding resources allow.

3.3.1 Existing Education and Outreach Programs

Public outreach and education is a core component of PRWC's mission to ensure high quality water for future generations. The organization's existing outreach and education activities include but are not limited to:

- Online platforms including website, blog, and social media accounts which share an online resource center for water resource protection, directory of scientific reports and best practices, volunteer opportunities, and program and event announcements.
- Workshops, presentations, outings, and events such as drinking water and private well forums, *River Ramblers* hiking series, rain barrel workshops, participation in local farmers' markets and community fairs, and organizing Woodbury Earth Day (the largest Earth Day celebration in Connecticut)
- Print communications including a biannual newsletter, brochures, postcards, flyers, direct mailings, and articles in local newspapers
- Youth education programs in local classrooms and at summer camps
- Best management practice (BMP) demonstration sites including a native riparian buffer at Cedarland Park and a rain garden at Community House Park (both in Southbury)
- *Be RiverSmart* campaign focused on BMPs in and around the home related to landscaping, water conservation, septic care, and pet waste
- Volunteer projects including storm drain marking, trash clean-ups, invasive plant removal, and stream monitoring.

PRWC's outreach and education programs are aimed at informing residents, business owners, and municipal leaders about the link between personal property care choices and the health of water resources, and providing easy-to-implement, practical steps to make homes, businesses, and town properties watershed-friendly.

3.3.2 Future Goals and Core Outreach Messages

The overall goal of the recommendations described in this section of the plan is to promote stewardship of the Pomperaug River watershed through education and outreach messages tailored/personalized to diverse audiences, and to promote and offer stewardship opportunities through citizen involvement in science, conservation, and restoration activities.

Future or expanded education and outreach efforts should build upon the extensive programs that already exist in the watershed. Activities should be aimed at increasing awareness of watershed issues, establishing the link between one's personal choices and water resource quality, and encouraging easy-to-implement, low-cost, best management practices that benefit property owners and watershed residents. As such, the following messages were selected as "low-hanging fruit" for outreach based on their relative simplicity to implement, their importance to achieving watershed goals, and their cost effectiveness:

- **Investment in Green Infrastructure/Low Impact Development (GI/LID) practices** can help improve water quality and reduce flooding through improved infiltration in developed areas, pollutant control, and a decrease in erosive flows.
- **Riparian buffer** establishment and maintenance practices improve water quality, provide benefits to streamside property owners, and are simple and inexpensive to implement.
- **Improved landscape management practices** reduce pollutant loads, improve habitat, and reduce property management costs.
- **Proper management and disposal of animal waste** (livestock, pets, and waterfowl) is a relatively simple, inexpensive way to reduce bacterial loadings that can have sizeable impacts on water quality.
- **Rain barrels and rooftop disconnection** on residential properties can prevent roof runoff from discharging directly into the storm drainage system or directly into streams. Homeowners may use the collected rainwater for irrigation, outdoor washing, and other non-potable applications.
- **Inspection, maintenance, upgrade, and repair of residential septic systems** can significantly reduce bacterial and nutrient loading to streams.
- **Open space preservation** provides excellent habitat, recreational, and water quality benefits.

3.3.3 Primary Audiences, Media Formats, and Tailored Messages

Expanded outreach and educational activities should support the goals established in this Plan, and should be focused to reach five primary audience types, which have the greatest potential to affect long-term change and improve water resource conditions in the Pomperaug River watershed, namely:

- Residents and Landowners
- Municipalities
- Businesses
- Agricultural Operations
- Students (K-12)/higher education

Outreach messages and activities should be tailored and delivered in formats appropriate for the intended audience. A variety of media formats to consider include but are not limited to: direct mail, events, websites, social media, radio/television/print news, personal contact (events, presentations, classroom activities, volunteer engagement, etc.), and demonstration of best management practices.

Table 3-3 summarizes education and outreach recommendations for the Pomperaug River watershed.

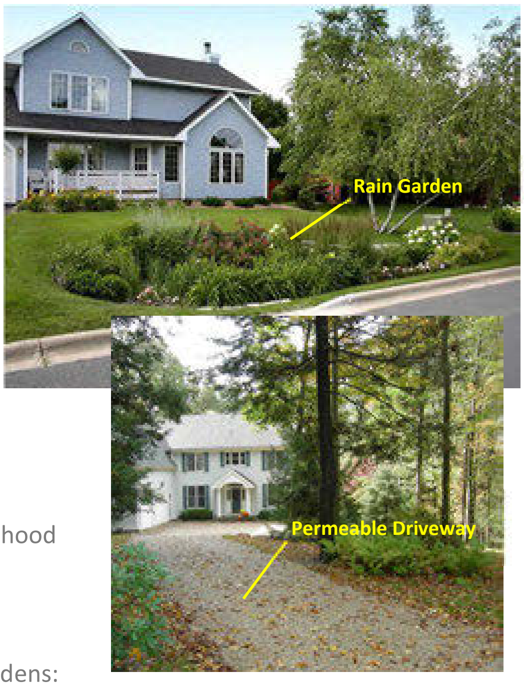
Resident and Landowner Outreach and Education

An objective of the watershed plan is to build awareness of land stewardship and management practices and reduce water quality impacts associated with residential land use, which comprises approximately 31% of the watershed land area. A successful homeowner outreach program, *Be RiverSmart* has already been established and implemented in the Pomperaug watershed. However, there is still great opportunity for refinement and expansion of this program. Currently, a number of educational brochures for homeowners are available on the *Be RiverSmart* website www.beriversmart.org with topics including LID practices, lawn care practices, in-home water conservation, pet waste disposal, septic care, and more. These brochures can be distributed (more widely) by themselves and/or used in conjunction with the outreach activities described below.

Looking forward, outreach messages to homeowners should focus on:

Encouraging the Use of Residential LID Practices

Homeowners should be encouraged to implement Green Infrastructure or Low Impact Development (LID) practices on their properties.



- Encourage reductions in impervious areas associated with driveways, walkways, and patios through use of permeable pavements/pavers which allow for infiltration of stormwater.
- Promote infiltration of run-off through use of rain gardens, vegetated swales, gravel-filled infiltration trenches, and dry wells in areas appropriate distances from drinking water wells, septic systems, and property boundaries.
- Provide education and outreach to homeowners, neighborhood groups, and roofing contractors on disconnecting roof downspouts and 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/raingardens/
- Provide residential LID incentive programs similar to that led by Save the Sound's *Reduce Runoff* initiative: http://ctenvironment.wixsite.com/reduce-runoff/raingardens-bioswales

Promoting Rooftop Disconnection

Residences in some areas of 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, rain gardens, or into rain barrels to store water for watering outdoor plants during dry periods. 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 provides a number of economic and environmental benefits to the municipality and the property owner. The major benefits include:

- Reduced volumes of flows and associated pollutant loads conveyed to watercourses
- Reduced volume of flow to the municipal storm drainage system (MS4)
- Increased infiltration and groundwater recharge
- Options to reuse rainwater for non-potable needs such as watering outdoor plants

Individual rooftop retrofits encompass 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/raingardens/.

- Continue to facilitate rain barrel workshops in coordination with River Network's "Project Rain Barrel" program which offers low-cost rain barrel conversion kits and up-cycled 55 gallon plastic drums to residents and other workshop participants.

Promoting Sustainable Lawn Care Practices and Creating Backyard Habitat

Although sustainable lawn care practices will not significantly reduce bacteria loadings, they will reduce nutrient loadings, the use of toxic chemicals, and promote water conservation. Since many homeowners hire landscaping companies to perform landscape care services, outreach to both property owners and landscape companies is important in driving wide-scale changes in practices.

Outreach to property owners and landscape professionals should:

- Emphasize the benefits of watershed-friendly landscaping practices in improving the health and quality of local streams and Long Island Sound
- Underscore responsible disposal of leaves and lawn clippings which includes not dumping them into a nearby waterbody, participating in municipal curbside leaf collection programs if offered and/or composting them on site
- Promote the use of soil testing to calibrate fertilizing requirements and eliminate excessive or unneeded fertilizer
- Encourage the use of slow-release fertilizers
- Highlight responsible application of fertilizers during dry weather periods
- Promote lawn aeration as a means to improve infiltration and improve turf health
- Emphasize the benefits of Integrated Pest Management (IPM) practices as an alternative to pesticide use
- Underscore appropriate mowing heights as a means to conserve water and improve turf health
- Encourage reductions in turf areas by promoting the replacement of lawn with low to no-mow grass, ground cover, or native flowering plant species as these may reduce property management costs by reducing the need for water, fertilizers and pesticides, and mowing.

Disposing of Pet Waste

Pet waste represents a small but manageable source of the overall bacterial load in the Pomperaug watershed. While solutions are simple and inexpensive—cleaning up after pets—the challenge for advocates lies in reaching the multitude of dog owners, and creating a message with enough social incentive to spur a change in behavior.

In public parks and along town sidewalks, availability of free baggies to pick up pet waste and trash receptacles for proper disposal of pet waste are a simple, inexpensive solution that can encourage pet owners to clean up after their pet. In addition, signage and print handouts placed near the baggies can be used to spread the message.

It may be more difficult to influence behavior on private property. In this case, a mass-media campaign using electronic and print media may be the most effective way to reach pet owners. Emphasizing the health and hygiene benefits of cleaning up pet waste within private properties and disposing of it properly can be an effective route to encouraging behavior change.

Establishing and Maintaining Riparian Buffers

Significant attention should be given to streamside property owners, as their land has a direct connection to runoff and water quality. Property owners who take steps to establish and maintain riparian buffers can create a measureable improvement in local in-stream conditions.

CEDARLAND PARK RIPARIAN BUFFER

What is a Riparian Buffer?

BENEFITS OF A NATIVE BUFFER

CAN YOU SPOT SOME OF THE NATIVE PLANTS GROWING HERE?

THE RIPARIAN BUFFER BEFORE YOU ACTS AS A LEARNING AND DEMONSTRATION SITE.

Tall grass, shrub, or forested riparian buffers along the stream corridor are a very efficient method of removing or reducing bacteria, nutrients, sediments and other pollutants carried in overland flow. In addition, riparian buffers help stabilize banks, deter geese from taking up permanent residence on nearby grassy areas, and reduce water temperatures by providing shade. Since a third of the land cover in riparian area is comprised of developed, agricultural, and turf or other grasses, outreach to streamside landowners and residents is an important vehicle for implementing riparian buffers on a large scale.

Outreach efforts should:

- Emphasize the relationship between water quality and overall quality of life
- Educate residents about the critical importance of riparian buffers, even relatively narrow buffers, in improving water quality and preventing potentially damaging stream bank erosion
- Highlight design details that can maintain views of and access to the stream
- Provide tips and advice for self-installation of riparian buffers including planting tips, contact information for local nurseries, and plantings lists
- Underscore the benefits of riparian buffers with regard to improving property values, beautifying property, and reducing property maintenance.

Maintaining Septic Systems

As described in *Section 2*, failing septic systems on residential property can cause significant loading of bacteria and nutrients. Adverse effects to water quality typically become more severe the closer those properties with problematic septic systems are located to waterbodies and storm drains. Since septic failure or potential failure rates can be difficult to quantify, preventative measures, including homeowner education, may be the best way to manage this problem.

Outreach and education for septic system owners should:

- Educate owners of septic systems about proper care and maintenance, and the benefits of a properly functioning system
- Encourage homeowners to have periodic inspections of their septic system to ensure proper functioning
- Identify common signs of malfunctioning septic systems
- Provide list of proper steps to take if a malfunction is suspected
- Communicate the potential water quality issues associated with leaking or malfunctioning septic systems.

What's in Your Yard?

When you flush your toilet, or pour something down your drain, do you know where it goes?

Ideally, educational materials would be distributed by the municipality or local health districts to all new homeowners and/or when a deed transfer occurs. A brochure created by PRWC and the North Atlantic States Rural Water Association should be updated, reprinted, and disseminated in coordination with local health, municipal land use and/or building officials. Distribution of outreach materials pertaining to septic system maintenance could also be used to meet the public outreach/education minimum control measure of the MS4 Permit and related municipal stormwater management plans.

Outreach to Municipal Staff and Volunteer Commissions

A key objective of this Plan and the MS4 General Permit, applicable to some of the watershed municipalities, is to advance local government awareness, understanding, and stewardship of the watershed through pollution prevention, best management practices education, regulatory enhancements, and involvement in watershed restoration activities. Municipal facilities and operations 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 water quality and environmental resources in the 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 and implementing illicit detection and elimination programs. 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. Suggested outreach topics include common municipal activities and operations that can reduce bacteria loads to the Pomperaug River including parks and open space maintenance, green infrastructure and LID implementation, storm sewer system and BMP maintenance, and identification and removal of illicit connections.

Outreach to municipalities should:

- Support municipalities with regard to providing 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 (municipal land use commissions and boards, planners, etc.) of land development projects and designers (developers, architects, engineers, contractors, etc.). Suggested training topics include riparian buffer protection; LID and green infrastructure; operation and maintenance, and testing/reporting requirements for larger, permitted wastewater treatment systems; and construction erosion and sediment controls. Training on these topics could be offered by:

    - Building on previous PRWC stream buffer outreach and educational programming (e.g., native riparian buffer demonstration site at Cedarland Park, Southbury and resources included in the *Be RiverSmart* campaign materials).
    - Providing targeted workshops for municipal parks and recreation employees on how to maintain riparian buffers on public property, invasive plant management, and organic lawn care practices. Include discussion of Connecticut's Greenway program as a mechanism for identifying and prioritizing riparian parcels for consideration in open space acquisitions, as many greenways follow river corridors.
    - Promoting and co-hosting topical training opportunities offered by Connecticut Sea Grant, UCONN Center for Land Use Education and Research (CLEAR), NEMO, CTDEEP, regional Councils of Governments, and partnering environmental organizations.
    - Collaborating with PDDH, CTDPH, and CTDEEP to provide outreach related to performance and compliance with large wastewater treatment system permits.

- Encourage building inspectors in each watershed municipality to receive regular training on stormwater and related topics. Building inspectors in Connecticut must earn a requisite amount of continuing education credits each year. Existing training programs may not address stormwater, LID, green infrastructure or erosion and sedimentation control methods. Training should also be encouraged on sanitary sewer and stormwater connection inspections.

- Continue the practice of inviting and involving municipal staff and land use commission members in ongoing and upcoming Pomperaug River restoration projects, outreach events, and clean-ups.

- Include the continued participation by PRWC in municipal stormwater management committees and provide ongoing assistance to municipalities in achieving the minimum control requirements of the MS4 permit program.

- Offer notification to municipal partners of funding opportunities for the implementation of LID and GI projects, riparian buffer enhancements, and other polluted runoff reduction initiatives that could be implemented on town-owned properties.

Outreach to Businesses, Commercial Landowners, and Institutions

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

- Conduct targeted outreach to residential builders in the watershed on environmental site design and LID methods that reduce and infiltrate runoff in new construction and redevelopment projects. (Note: Large properties or intensive development projects may already be subject to CTDEEP stormwater general permits; the MS4 Permit includes also provisions for onsite stormwater management in new construction and redevelopment projects).

- Provide targeted outreach for other 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, and restaurants). The education and outreach programs could consist of a variety of printed and electronic media, seminars and workshops, and training opportunities. Specific outreach topics could include:
  - Sustainable lawn care practices
  - Protection and restoration of vegetated buffer areas
  - Parking lot and road maintenance (deicing, snow management)
  - Drainage system inspection and maintenance (catch basins, storm drains, stormwater BMPs)
  - Water quantity and flooding issues
  - Low Impact Development and green infrastructure approaches
  - Dumpster and trash management issues

  - Wastewater system operation and maintenance, as well as testing and reporting requirements established by CTDPH and CTDEEP.

- Promote continued involvement of businesses in restoration efforts, outreach events, stream monitoring programs, and river clean-ups.

Outreach to Agricultural Operations

PRWC's outreach efforts to the agricultural community have been limited and represent a key area for increased collaboration. Agricultural operations, both large scale and hobby farm size, are common throughout the watershed and, according to the pollutant loading model results, represent key drivers of bacteria loads. In areas where livestock are present, poor manure management can allow bacteria, sediment, and nutrients to be transported to waterbodies via stormwater runoff. Presence of these pollutants may also increase when livestock have direct access to waterbodies.

As described in *Section 3.5*, outreach messages to the agricultural community should contain information about:

- Improving manure management practices, including stockpiling, placement, covering, timing for spreading and composting options
- Establishing and maintaining vegetated buffers, filter strips and exclusionary fencing near waterbodies
- Maintaining healthy soils (e.g. conducting soil tests and amending based on needs for selected crop production and/or rotating crops)
- Using integrated pest management techniques

These messages should be approached with great sensitivity, recognizing the multitude of challenges faced by the agricultural community, including size/scale of operation, financial resources and human resources, to name a few. It will be important to begin a dialogue with members of the local agricultural community to better understand their challenges before presenting potential BMP strategies. In this light, it will also be important to work closely with one or two local agricultural partners to establish demonstration projects that may also be suitable for other operations.

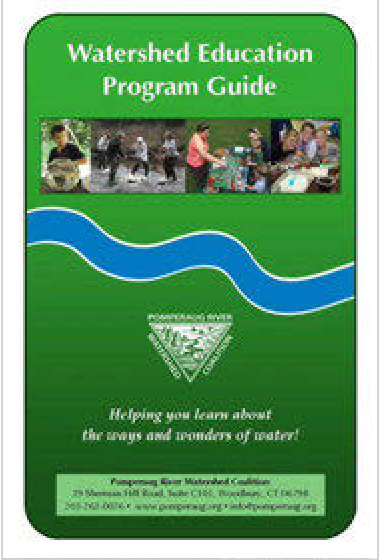
Education and outreach to the agricultural community should be done in collaboration with Northwest Conservation District and the local Natural Resource Conservation Service field office, as they have a long history of working with area farmers. They also represent a key funding partner for agricultural BMPs.

Outreach to Youth and Students

The Pomperaug River watershed and its surrounding area are home to numerous public and private primary and secondary schools, many of which offer environmental education and community service programs. The watershed is also home to two sizable nature centers, Audubon Center at Bent of the River and Flanders Nature Center & Land Trust, which both offer a wide variety of education programs for youth, including summer camps, after school programs and class field trip opportunities. These nature centers are not alone in their youth programs; they are complimented by town parks and recreation camps, church camps, scouts, and more. These existing programs and resources provide an excellent opportunity to promote youth education on issues related to watersheds, water quality, water conservation, and the Pomperaug River.

PRWC has already established a menu of educational activities that it brings into the classroom or facilitates outdoors, many of which are aligned to local public school curriculum requirements and the Next Generation Science Standards. These programs cover a wide variety of topics including stream ecology, water quality, water conservation, non-point source pollution, pollution prevention and the water cycle. Specific programs are outlined on the watershed education page of PRWC's website: http://www.pomperaug.org/watershed-education-programs.

Specific recommendations for program expansion include:



Watershed Education Program Guide

Helping you learn about the ways and wonders of water!

- Working with the local school districts (within the watershed, the surrounding towns and, nearby urban areas like Waterbury) to identify specific schools and grade levels that would benefit from new or expanded watershed or related environmental education programs.

- Establishing a formal program for local and nearby high school and college students to participate in volunteer watershed stewardship efforts such as stream and road-side cleanups, invasive species removal, trail and park maintenance, rain garden installations, and other ecological restoration projects.
    - Continue to provide similarly focused summer employment opportunities under the PRWC Youth Conservation Corps program established in 2017.

- Working with the local afterschool and summer camp programs to identify specific youth groups that would benefit from new or expanded watershed or related environmental education programs.

- Continuing to recruit student volunteers to participate in water quality and macroinvertebrate monitoring and streamwalk surveys in the Pomperaug River watershed.

- Marketing education program offerings to summer camp and scouting programs.

- Continuing to collaborate with college faculty and research staff on ongoing and future research activities focused on the Pomperaug River watershed, such as recent research conducted by hydrology students in the Yale School of Forestry.

3.3.4 Additional Education and Outreach Strategies

The education and outreach recommendations outlined above are just a brief sampling of strategies and messages to consider incorporating within the Pomperaug River watershed. Other strategies that reach multiple audiences at once could include:

- **Increased Watershed Stewardship Signage.** Such signage can increase public awareness and visibility of the Pomperaug River and the connection between the community, the watershed, and the river. Watershed signage can take the form of kiosks in public areas, storm drain markers or stencils (an ongoing local effort), 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 signs are already present in some areas of the watershed. PRWC and local partners should consider developing a more formal and consistent watershed sign program that could be implemented as a component of the recommended green infrastructure public outreach program. The signs should incorporate a simple, yet consistent message and logo. Watershed signs are recommended in highly-visible public areas of the watershed such as municipal facilities (schools, parks, libraries, other municipal properties, commercial areas, nature centers, land trust properties, etc.) and public access areas along the river. Examples of existing signage include interpretative signs placed at the Community House Park Rain Garden and the Cedarland Park Riparian Buffer, both in Southbury.

- **Increased Collaboration with Local Volunteer Groups and Civic Organizations.** Ongoing education and outreach to and collaboration with those that work as volunteers of local stewardship groups is also important. Partnerships with local, volunteer-based, nonprofit groups such as Friends of the Southbury Dog Park, Southbury Garden Club, Pomperaug Valley Garden Club, Woodbury Junior Women's Club, Southbury Women's Club, Scouts, Rotary, Lions and area land trusts may result in new and expanded opportunities for volunteers from these groups to participate in and/or assist with presentations and BMP implementation projects led by PRWC and/or watershed municipalities, working to comply with their MS4 Permit requirements.

- **Increased Participation in Community Events.** Promote, publicize, and support existing community engagement events where PRWC has an opportunity to interface with the general public including Woodbury Earth Day, Flanders' Farm Day, Bent Fest, Woodbury Fall Fest, Southbury Celebration, Bethlehem Garlic & Arts Festival, farmers' markets, and others yet to be identified. Events such as these also represent an opportunity to recruit volunteers as representatives of PRWC who could be trained as "Watershed Ambassadors".

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
Homeowner Outreach and Education					
Continue to implement the *Be RiverSmart* public outreach campaign, including: • Develop/refine and distribute outreach message(s) • Distribute and collect pledge forms • Develop a recognition program for river-friendly properties that integrate GI/LID, native buffers, rain gardens, downspout disconnection, etc.	PRWC, HVA, Rivers Alliance, Municipalities	2-5 years	• *Be RiverSmart* program implemented throughout watershed • Public outreach messages delivered through a variety of media • Number of pledges submitted • Number of properties recognized	$$$$	CTDEEP 319 NPS Grants, River Network, EPA EE Grants
Provide homeowner education and outreach on using LID • Develop outreach message(s) • Distribute outreach materials • Facilitate public education programs	PRWC, Municipalities, UCONN NEMO, NWCD, Long Meadow Pond Management Committee	Ongoing	• LID education program implemented throughout watershed • Number of people reached (website traffic, social media, email click rates, brochures distributed, print media readership metrics) • Number of program participants	$$	Municipal, grants
Evaluate and implement residential LID incentive programs • Identify and build upon existing programs (e.g., River Network's *Project Rain Barrel* program; Save the Sound's *Reduce Runoff* initiative) • Evaluate feasibility of alternative programs	PRWC, Municipalities, NWCD	2-5 years establish program Ongoing implementation thereafter	• LID incentive program implemented throughout watershed • Number of homeowners participating • Volume of water diverted from MS4 • Area of land utilized for LID retrofits	$$$$	Housatonic NRD Fund, future stormwater fees, NFWF Long Island Sound Futures Fund

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
Promote Rooftop Disconnection • Develop outreach message(s) • Distribute outreach materials • Facilitate public education programs	PRWC, Municipalities	2-5 years	• Rooftop disconnection program implemented throughout watershed • Number of people reached (website traffic, social media, email click rates, brochures distributed, print media readership metrics) • Volume of water diverted from MS4 • Number of rain barrel workshop participants • Number of rain gardens installed	$	Workshop fees; stormwater fees
Provide homeowner outreach on sustainable lawn care practices and backyard habitat • Develop outreach message(s) • Distribute outreach materials • Facilitate public education programs (tours, workshops, etc.)	PRWC, Municipalities, UCONN NEMO, NWCD, Long Meadow Lake Management Committee, Land Trusts, Audubon Center at Bent of the River	Ongoing	• Sustainable lawn care / backyard habitat outreach program implemented throughout watershed • Number of people reached (website traffic, social media, email click rates, brochures distributed, print media readership metrics, program participation) • Increased buffer widths • Decreased use of synthetic fertilizers and pesticides • Increased use of native plants in landscaping • Increased number of Audubon Backyard Habitat program recognitions	$$	Municipal, grants, business sponsors

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
Provide homeowner outreach on pet waste disposal • Develop outreach message(s) • Distribute outreach materials • Installation / maintenance of pet waste stations	PRWC, Municipalities, UCONN NEMO, NWCD, Long Meadow Lake Management Committee, Land Trusts, Audubon Center at Bent of the River	Ongoing	• Pet waste disposal program implemented throughout watershed • Number of people reached (website traffic, social media, email click rates, brochures distributed, other media metrics) • Increased availability of pet waste stations • Fewer observations of pet waste in public spaces	$$	Municipal, grants
Provide homeowner outreach on benefits of vegetated buffers • Develop outreach message(s) • Distribute outreach materials • Facilitate public education programs	PRWC, Land Trusts, Nature Center, Municipalities	Ongoing	• Vegetated buffer program implemented throughout watershed • Number of people reached (website traffic, social media, email click rates, brochures distributed, print media readership metrics, program participation) • Improved buffer conditions • Increased buffer widths • Increased use of native plants in landscaping	$	NFWF Long Island Sound Futures Fund, CTDEEP Supplemental Environmental Project Funds, CTDEEP 319 NPS Grants
Provide homeowner outreach on septic systems • Updated and refine outreach message(s) based on existing brochure • Distribute outreach materials • Implement voluntary inspection / repair incentive program in older neighborhoods along impaired stream segments	PRWC, PDDH, TAHD, Municipalities	Ongoing	• Septic systems program implemented throughout watershed • Number of people reached (website traffic, social media, email click rates, brochures distributed, print	$ - $$$$	NFWF Long Island Sound Futures Fund, CTDEEP Supplemental Environmental Project Funds, CTDEEP 319 NPS Grants

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
			media readership metrics, program participation) • Number of homeowners participating in incentive program		
Continue to recruit and train community volunteers to participate in water quality and benthic monitoring and streamwalks	PRWC	Ongoing	• Volunteer recruitment and orientation/training program implemented • Number of new and returning project volunteers	$	CTDEEP 319 NPS Grants, NFWF Long Island Sound Futures Fund
Advance Local Government Awareness					
Provide education and training for municipal employees and land use boards on: LID retrofit opportunities, septic systems, landscaping practices, invasive plant management, Connecticut's Greenway program, and stormwater "good housekeeping" practices • Develop topic-specific outreach message(s) • Distribute outreach materials • Facilitate education and training programs in conjunction with appropriate partners (listed at right)	Municipalities (as part of MS4 Permit Outreach), PRWC, UCONN NEMO / CLEAR, NVCOG, NWCD, CTNOFA, CIPWG	2-5 years	• Municipal outreach and education program implemented • Number of people reached (website traffic, social media, email click rates, brochures distributed, print media readership metrics, program participation) • Number of homeowners participating in incentive program • Continued MS4 compliance • Targeted acquisitions of land along the river corridors • Inclusion of LID and other BMPs in approved site designs	$$	NVCOG; CTDEEP Supplemental Environmental Project Funds; further stormwater fees;

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
Encourage pet waste stations at parks; popular walking paths; and enforcement of dog rules	PRWC, Municipalities	0-2 years	• Installation and regular restocking of pet waste stations • Regular waste removal from trash receptacles • Reduced incident of pet waste not cleaned up	$	Municipal
Provide municipal outreach on sustainable lawn care practices and riparian habitat • Develop outreach message(s) • Distribute outreach materials • Facilitate education and training programs in conjunction with appropriate partners (listed at right)	PRWC, UCONN CLEAR / NEMO, CTNOFA, CIPWG	2-5 years	• Municipal outreach and education program implemented • Increased buffer widths on municipal properties; • Decreased use of synthetic fertilizers and pesticides • Increased invasive plant removal efforts • Increased use of native plants in landscaping	$$	
Outreach to Business Community					
Conduct outreach to commercial and industrial property owners on LID retrofit opportunities, septic systems, and landscaping practices • Develop topic specific outreach message(s) • Assemble categorical list of business contacts • Distribute outreach materials • Facilitate education and training programs in conjunction with appropriate partners (listed at right)	PRWC, municipalities, NVCOG, UCONN CLEAR / NEMO, NWCD, CTDEEP	Ongoing through existing land use permitting processes; Implementation of a more formal outreach strategy 5-10 years	• Business outreach and education program implemented • Implementation of LID retrofits • Increased buffer widths • Decreased use of synthetic fertilizers and pesticides • Increased use of native plants in landscaping • Reduction in septic system back-ups or failures	$$$	CTDEEP Supplemental Environmental Project Funds

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
			• Compliance with reporting requirements in the case of DEEP permits for septic and or stormwater management		
Outreach to Agricultural Operations					
Conduct outreach to farm owners and operators on riparian buffer and manure management practices • Develop topic specific outreach message(s) • Assemble categorical list of farmer contacts • Distribute outreach materials • Facilitate education and training programs in conjunction with appropriate partners (listed at right)	PRWC, NRCS, CT Ag. Experiment Station, NWCD, UCONN Extension Service	2-5 years	• Hobby farm outreach and education program implemented • Number of direct interactions with farmers • Updated contacts list • Improved manure management • Increased buffer widths	$$	USDA, NRCS
Conduct outreach to equestrian facilities and farm owners/operators on vegetated buffers, manure storage and spreading practices, and exclusionary fencing • Develop topic specific outreach message(s) • Assemble categorical list of agricultural contacts • Distribute outreach materials • Facilitate education and training programs in conjunction with appropriate partners (listed at right)	PRWC, NRCS, CT Ag. Experiment Station, NWCD, UCONN Extension Service	0-2 years	• Agricultural outreach and education program implemented • Updated contacts list • Number of direct interactions and/or participants in workshops and/or demonstration project tours • Improved manure management • Installation or improved placement of exclusionary fencing	$$$	USDA, NRCS, CTDEEP

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
Youth Education, Community Service, and Stewardship Programs					
Expand existing relationships and educational programs with schools • Update list of academic contacts (curriculum coordinators, teachers, principals, PTOs by school/region) • Distribute educational program marketing materials • Facilitate school-based educational programs	PRWC, Region 14 Schools, Region 15 School, Oxford Public Schools, Region 12 Schools	Ongoing	• School based outreach and education programs implemented • Updated contacts list • Increased number of classroom visits and students reached • Increased knowledge of water, hydrologic systems, environmental impacts and corrective actions • Increased stewardship by area youth	$$	Program fees
Expand Pomperaug Watershed Youth Conservation Corps to implement and steward water quality-focused BMPs on publicly owned lands • Identify BMP project sites and secure permissions and funding for BMPs • Secure funding to hire YCC team members (4+ crew members with growth each year at/or greater than 24 hours per week for 6+ weeks) • Recruit, hire, and train crew members • Implement BMP projects • Provide crew enrichment / professional development opportunities	PRWC	0-2 years	• YCC program continuation and expansion • Increased hours of employment • Increased number of crew members hired • Increased knowledge of water, hydrologic systems, environmental impacts and corrective actions	$$$	EPA EE Grants, Foundation grants, program sponsorship
Continue to recruit student volunteers to participate in water quality and benthic monitoring and streamwalk surveys	PRWC, CTDEEP	Ongoing	• Volunteer recruitment and orientation/training program implemented	$$	

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
			• Number of new and returning project volunteers		
Expand existing relationships and educational program offerings with summer camp and after school programs • Update list of camp and after school program contacts • Distribute educational program marketing materials • Facilitate camp and after school educational programs	PRWC, parks and recreation departments, nature centers, land trusts	Ongoing	• Camp and after school outreach and education programs implemented • Updated contacts list • Number of programs conducted • Number of participants Updated contacts list, increased number of camp visits and youth reached • Increased knowledge of water, hydrologic systems, environmental impacts and corrective actions • Increased stewardship by area youth	$	Program fees
Additional Education and Outreach Strategies					
Watershed Stewardship Signage • Develop outreach message(s) and appropriate signage type (kiosk, road sign, interpretative sign, etc.) • Identify location(s) for signage (with or without associated demonstration project) • Secure necessary landowner permission for installation and/or sign permits • Install signage	PRWC, parks and recreation departments, nature centers, land trusts	2-5 years	• Increased signage and associated follow-up interaction with PRWC via phone and email inquiries and/or web visitation and social media followers	$$$	

Table 3-3. Education and outreach recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
Engage local, state, and regional organizations in the Pomperaug River watershed • Promote, publicize, and support existing events such as the annual Woodbury Earth Day Festival hosted by PRWC • Engage local organizations in volunteer monitoring and stewardship activities	PRWC	Ongoing	• Updated contacts list • Increased number of community organizations participating in PRWC sponsored events • Increased number of volunteers	$$	
Provide education and outreach to volunteers of local non-profit organizations (i.e., garden clubs, scouts, etc.) • Update list of community organization contacts • Distribute educational program marketing materials • Facilitate educational programs • Cultivate a team of "Watershed Ambassadors" to represent PRWC within other organizations and at community events ○ Develop volunteer training program ○ Recruit & train volunteers ○ Schedule volunteers for tabling at events	PRWC	Ongoing	• Increased number of education programs or presentations to community organizations • Increased number of volunteers • Increased participation or representation in area community events • Increased follow-up interaction with PRWC via phone and email inquiries and/or web visitation and social media followers • Increased watershed knowledge among volunteers	$$$	EPA EE grants

$ = $0 to $5,000
$$ = $5,000 to $10,000
$$$ = $10,000 to $50,000
$$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition
PDDH = Pomperaug District Department of Health
TAHD = Torrington Area Health District
NVCOG = Naugatuck Valley Council of Governments
CTNOFA = Connecticut Chapter Northeast Organic Farmers and Growers Association

CTDEEP = Connecticut Department of Energy and Environmental Protection
NWCD = Northwest Conservation District
NRCS = Natural Resource Conservation Service
HVA = Housatonic Valley Association
CPWIG = Connecticut Invasive Plant Working Group

3.4 Urban/Suburban BMPs

3.4.1 Green Infrastructure and Low Impact Development

Green infrastructure (GI) and Low Impact Development (LID) refer to systems and practices that reduce runoff through the use of vegetation, soils, and natural processes to manage and cleanse water and create healthier urban and suburban environments (EPA, 2014). GI/LID includes stormwater management practices such as rain gardens, permeable pavement, green and blue roofs, green streets, infiltration planters, trees and tree boxes, and rainwater harvesting. These practices capture, filter, manage, and/or reuse rainfall close to where it falls, to remove pollutants, reduce stormwater runoff volume, recharge ground water supplies, and control flows to receiving surface waters. GI/LID practices can remove bacteria in stormwater through filtration, sedimentation, and inactivation by exposure to sunlight.

Green Infrastructure (GI) can be defined as the natural and man-made landscapes and features that can be used to manage runoff. Examples of natural green infrastructure include forests, meadows and floodplains. Examples of man-made green infrastructure include green roofs, rain gardens and rainwater cisterns.

Low Impact Development (LID) is a land development approach that is intended to reduce development related impacts on water resources through the use of stormwater management practices that filter, infiltrate, evapotranspire, or harvest and use stormwater on the site where it falls.

In addition to reducing runoff and improving water quality, GI/LID has been shown to provide other social and economic benefits such as reduced energy consumption, decreased urban heat island effects, better air quality, increased carbon reduction and sequestration, higher property values, new recreational opportunities, improved economic vitality, greater adaptation to climate change, and enhanced human health and well-being (Center for Neighborhood Technology and American Rivers, 2010; EPA Green Infrastructure Website http://water.epa.gov/infrastructure/greeninfrastructure/gi_why.cfm; Oregon Health and Outdoors Initiative, 2018). For these reasons, many communities are exploring the use of and are adopting GI/LID within their municipal infrastructure programs.

Although conventional stormwater drainage systems are prevalent throughout the watershed, there are also several examples of GI/LID stormwater treatment practices in the watershed. One example is the use of permeable pavement in the lower parking lot behind the commercial plaza at 7 Garage Road in Southbury. Permeable pavement has also been used for the parking lot of the New Morning Market in Woodbury and Prime Publishing in Southbury. Underground infiltration practices are also located at the new Riverview Cinemas and Playhouse at 690 Main Street South in Southbury and at the Southbury Medical Building.

Regular maintenance is required for the successful operation of GI/LID practices, which is true for all stormwater management practices. Accumulated sediment and debris can reduce treatment effectiveness, hydraulic performance, and infiltration capacity. Some GI/LID practices such as infiltration and bioretention systems require more intensive or frequent maintenance. Below-ground practices such as subsurface infiltration systems are generally more susceptible to maintenance issues, as compared to surface practices such as bioretention systems, swales, and surface infiltration basins, since subsurface practices are less visible and may suffer from an "out-of-sight, out-of-mind" mentality by property owners.

There are many opportunities for GI/LID practices throughout the Pomperaug watershed given the available land area and relatively permeable soils in many parts of the watershed. Good candidates for GI/LID retrofits include public rights-of-way, municipal and commercial parking lots, and parking lots and roads associated with residential developments such as Heritage Village. Candidate stormwater retrofit sites exist in virtually all of the subregional basins but are most prevalent in the Pomperaug River subregional basin. *Table 3-4* contains GI/LID recommendations for the Pomperaug River watershed.

Care should be taken when siting and designing infiltration-based stormwater BMPs under the following conditions and settings:

- In mapped Aquifer Protection Areas (APAs) and other groundwater drinking supply areas to avoid inadvertent impacts to groundwater quality. Adequate separation distance between the bottom of the infiltration practice and seasonal high groundwater (typically 2 to 3 feet) is critical to allow for sufficient removal of pollutants from the infiltrated runoff before reaching the water table.

- Infiltration of stormwater from land uses or activities with potential for higher pollutant loads (also referred to as stormwater "hotspots"), such as industrial facilities, vehicle fueling facilities, commercial parking lots with high intensity use, etc., should include appropriate pretreatment designed to remove the stormwater pollutants of concern.

- In areas served by on-site sewage disposal (septic) systems, infiltration measures should be appropriately sized, located, and constructed in a manner consistent with the Connecticut Department of Health's Technical Standards for Subsurface Sewage Disposal Systems, Section 19-13-B100A of the Regulations of Connecticut State Agencies, and/or CTDEEP requirements for on-site sewage disposal systems.

- Infiltration of stormwater is not recommended in areas with soil or groundwater contamination.

Additional guidance on infiltration of stormwater under various conditions and settings is available in Appendix C of the CTDEEP MS4 General Permit.

Recommended Actions

- Pursue funding for and implement site-specific GI/LID retrofits on public lands based on the BMP concepts identified in *Section 4* of this plan. Other potential retrofit projects, such as those listed in *Appendix D*, should be identified through future streamwalks, track down surveys, and subwatershed action plans.

- The watershed municipalities should incorporate GI/LID into municipal projects, including parking lot upgrades and roadway projects using "green streets" approaches. Use of GI/LID in municipal projects will allow the MS4-regulated communities in the watershed (Southbury and Woodbury) to satisfy the stormwater retrofit and impervious area disconnection requirements of the MS4 Permit.

Table 3-4. Green Infrastructure and Low Impact Development recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. **Implement GI/LID retrofit projects on public lands** • Conduct retrofit inventory • Pursue and obtain funding • Design and construct projects	PRWC, municipalities, consultants	0-2 years (retrofit inventory) Ongoing implementation	• Inventory completed • Funding obtained • Projects designed and constructed	$$$$	Municipal funding, 319 NPS Grant, NFWF Long Island Sound Futures Fund
2. **Incorporate GI into municipal projects including parking lot upgrades and "green streets" projects** • Identify capital projects • Pursue and obtain funding • Design and construct projects	Municipalities	0-2 years (identify capital projects) Ongoing implementation	• Projects identified • Funding obtained • Projects designed and constructed	$$$$	Municipal funding, 319 NPS Grant, NFWF Long Island Sound Futures Fund, STEAP Grant
3. **Develop and implement a GI/LID master plan for the Main Street South corridor, Southbury** • Inventory GI/LID opportunities • Develop master plan and design concepts • Pursue and obtain funding • Design and construct projects	Town of Southbury	2-5 years (develop plan) 5-10 years (plan implementation)	• GI/LID opportunities identified • Master plan completed • Funding obtained • Projects designed and constructed	$$$$	Municipal funding, 319 NPS Grant
4. **Develop and implement a GI/LID master plan for Heritage Village** • Inventory GI/LID opportunities • Develop master plan and design concepts • Pursue and obtain funding • Design and construct projects	PRWC, Heritage Village Development Group	2-5 years (develop plan) 5-10 years (plan implementation)	• GI/LID opportunities identified • Master plan completed • Funding obtained • Projects designed and constructed	$$$$	319 NPS Grant
5. **Incorporate GI/LID into potential future re-use or redevelopment of the Southbury Training School**	State of Connecticut, Town of Southbury	5-10 years	• Redevelopment plan and completed projects	$$$$	

Table 3-4. Green Infrastructure and Low Impact Development recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
6. Pursue sustainable, long-term funding sources for large-scale GI implementation	PRWC, Regional Planning Agencies, Municipalities, NWCD	5-10 years	• Framework and action plan to evaluate and implement stormwater infrastructure financing	$$$$	Stormwater utilities, property tax credits and incentive rate structures, green bonds, public private partnerships, CWF

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition   CTDEEP = Connecticut Department of Energy and Environmental Protection   NWCD = Northwest Conservation District
CWF = Connecticut Clean Water Fund   STEAP = Connecticut Small Town Economic Assistance Program

- Develop and implement a GI/LID master plan for the Main Street South corridor in Southbury between Route 6/Southbury Plaza and South Britain Road (Route 172). The master plan could include GI/LID retrofits of municipal and commercial properties and within the municipal right-of-way. Potential municipal retrofit sites include:
    - Southbury Police, Fire, and Department of Public Works
    - Southbury Town Hall
    - Southbury Parks and Recreation / Senior Center
    - Rochambeau Middle School
    - Pomperaug Elementary School
    - Southbury Library
    - Roadway right-of-way.

- Develop and implement a GI/LID master plan for Heritage Village using the concepts identified in *Section 4* of this watershed plan. Stormwater infrastructure in Heritage Village is privately-owned and is not part of the Southbury municipal separate storm sewer system (MS4). The Heritage Village storm system is therefore not regulated under the statewide MS4 Permit. The Section 319 Nonpoint Source Grant program could potentially be used to fund GI/LID retrofits at Heritage Village.

- Incorporate GI/LID approaches into redevelopment projects, such as the potential future re-use or redevelopment of the Southbury Training School.

- Cost-effective, large-scale implementation of LID/GI will require non-traditional financing. Possible long-term funding sources including user fees, stormwater utilities, property tax credits or rebates, green bonds and community-based public-private partnerships.

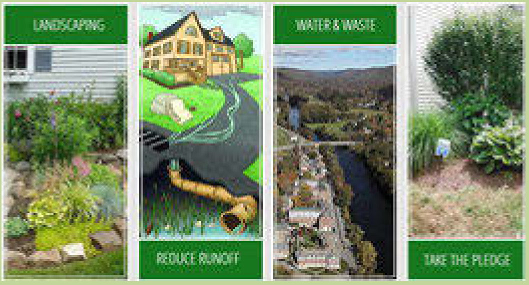
3.4.2 Homeowner Best Management Practices

Residential land use accounts for a large percentage of the developed land in the Pomperaug River watershed. Residential areas are a significant source of runoff and nonpoint source pollutant loads to the Pomperaug River and its tributaries. The actions of individual homeowners can also help to reduce runoff and pollutant loads that flow overland and directly into waterbodies or into the storm sewer systems in residential areas that, in turn, discharge at outfall pipes into waterbodies. The previous section describes larger-scale green infrastructure recommendations primarily targeted at the watershed municipalities, institutions, and private development. However, LID and other small-scale best practices can also be implemented by homeowners on individual residential lots.

Residential BMPs on individual lots target small areas, requiring the participation of many homeowners to make a measurable difference across a watershed. A coordinated effort is required for widespread

Best Practices for Homeowners – River Smart

River Smart is an education and outreach program that provides steps homeowners can take to reduce the impact of nonpoint source pollution from residential properties. The program is led cooperatively by Housatonic Valley Association, Pomperaug River Watershed Coalition, Kent Land Trust, Weantinoge Heritage Land Trust, Rivers Alliance of Connecticut, and the Farmington River Watershed Association. http://www.pomperaug.org/riversmart



participation in such a program, which typically includes a combination of targeted education, technical assistance, and financial subsidies to homeowners. Successful implementation of residential/small-scale practices therefore requires homeowner education and incentive programs.

Recommendations for implementation of homeowner BMPs in the Pomperaug River watershed are described below and summarized in *Table 3-5*.

Recommended Actions

- Continue to promote residential BMPs by homeowners, including practices promoted by the River Smart program:
    - Nurture native trees, shrubs, and flowers
    - Reduce the size of grass lawns
    - Limit the amount of paved areas and create natural places for the water to soak into the ground
    - Plant or grow natural buffers at the edges of rivers/streams, lakes/ponds, and wetlands
    - Reduce or eliminate use of fertilizers and pesticides
    - Dispose of pet waste in the trash or a pet-waste processor
    - Have your septic tank pumped and inspected regularly
    - Check and fix all the taps on sinks, baths, toilets, and hoses for leaks and drips
    - Dispose of unused and unwanted medications in the trash; do not flush them down the toilet.

- Encourage disconnection of rooftop runoff from the storm drainage system by redirecting exterior roof leaders to pervious lawn areas and through the use of dry wells, rain barrels or rain gardens. Downspout disconnection can be a cost-effective option for reducing the volume and cost of stormwater that requires public management. The use of pervious materials for patios, walkways and driveways, as well as pavement removal and planting new native and/or non-invasive trees, shrubs and herbaceous plants, can also reduce impervious surfaces on residential lots and the contribution of runoff and pollutant loads to waterbodies.

- In addition to the River Smart "pledge," consider other residential BMP incentive programs to encourage implementation of LID practices by homeowners, which will help reduce the burden on municipal stormwater infrastructure for managing runoff from residential lots. Other incentives to encourage residential property owners to use LID include:
    - Youth Conservation Corps – expanding the PRWC Youth Conservation Corps program to include residential landowner assistance creating rain gardens, planting riparian buffers, etc.
    - Stormwater Fee Discounts or Credits – reduced fees or utility bills by installing LID practices; requires a stormwater utility or similar fee-based system
    - Rebates and Installation Financing – funding, property tax credits (i.e., reduction in property taxes), or reimbursements to property owners who install green infrastructure
    - Workshop and Give-Away Programs - rain barrel workshops for homeowners that provide a free (or reduced cost) rain barrel to each participating household, along with training on how to install and maintain the rain barrel
    - Certification and Recognition Programs – certification of residential properties as watershed-friendly by implementing LID practices
    - Municipal sponsored public workshops on how to build rain gardens emphasizing the increase in property value and curb appeal of LID landscaping.

Incentive programs can also serve as a mode of public outreach. Several examples of successful residential BMP incentive programs are highlighted in the following text box.

Residential BMP Incentive Programs

Lake Champlain BLUE® Certification Program
Program developed by Lake Champlain International that certifies residential properties as watershed friendly, or BLUE®, if they follow simple, yet scientifically accepted, practices that reduce water pollution runoff starting on their properties. Certified homeowners receive a BLUE certification lawn sign, increased property values, and the satisfaction of improving local water quality.
http://www.mychamplain.net/blue-program

Montgomery County, MD Rainscapes Rewards
Montgomery County coordinates RainScapes Rewards, a rebate program used to meet part of its municipal separate storm sewer system (MS4) permit goals. The county provides rebates based on the amount of runoff captured. Residential properties are capped at $2,500.
https://www.montgomerycountymd.gov/DEP/water/rainscapes-rebates.html

Table 3-5. Homeowner recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Promote residential BMPs by homeowners, including River Smart practices (see Education and Outreach recommendations)	PRWC, municipalities	Ongoing	• Materials disseminated • Number of homeowners participating	$$	
2. Encourage disconnection of rooftop runoff • Integrate disconnection into River Smart materials (see Education and Outreach recommendations) • Incorporate disconnection as a BMP in local land use regulations	PRWC and River Smart partners Municipalities	0-2 years 2-5 years (land use regulations)	• Updated River Smart BMPs • Updated land use regulations • Volume of runoff diverted	$ $	
3. Evaluate and implement other residential BMP incentive programs • Build upon existing River Smart pledge • Evaluate feasibility of alternative programs • Implement program(s)	PRWC and River Smart partners	2-5 years establish program Ongoing implementation thereafter	• Program(s) identified, funding secured • Program established • Number of homeowners participating • Volume of runoff diverted	$$ (initial program implementation) $ (individual residential actions)	Grants, future stormwater fees, property tax credits

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition

3.4.3 Municipal Stormwater Management Programs

The stormwater collection and drainage systems within the watershed are owned and maintained by the watershed municipalities (with the exception of Heritage Village, which is privately-owned) and the Connecticut Department of Transportation. Stormwater discharges from the municipal storm drainage systems in the Town of Southbury and the Town of Woodbury (as well as the Town of Middlebury and Town of Watertown) are regulated under the CTDEEP General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 Permit).[1] Stormwater discharges associated with the state drainage system are regulated under a similar MS4 permit issued specifically to the Connecticut Department of Transportation (CTDOT), which will become effective July 1, 2019. Both permits establish requirements for implementing BMPs that will reduce pollutant discharges from municipal and state storm drainage systems.

Through their MS4 Permit stormwater management programs and other planning initiatives, the watershed municipalities have developed and are implementing a variety of BMPs to address stormwater quality issues associated with municipal activities as well as land development and redevelopment projects.

Compliance with MS4 Permits

Connecticut's revised MS4 General Permit went into effect on July 1, 2017. The watershed communities of Southbury and Woodbury are regulated under the MS4 General Permit. These communities have developed Stormwater Management Plans that outline steps that each town will take to comply with the 6 minimum control measures in the permit, which include public education, public involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, and pollution prevention and good housekeeping.

Stormwater discharges associated with the state drainage system are regulated under a similar MS4 permit issued specifically to the Connecticut Department of Transportation, which will become effective July 1, 2019.

Reduction of bacteria loads in stormwater discharges from the municipal and state storm drainage systems will be a focus of efforts by the Pomperaug River watershed municipalities and CTDOT in complying with their MS4 permits.

Compliance with the illicit discharge detection and elimination (IDDE) program requirements of the permit can help to significantly reduce bacteria loadings, where illicit connections are present and particularly where they contribute to the recreational impairments in the watershed. Outfall screening for bacteria is required where a MS4 discharges to an impaired water for which bacteria is the pollutant of concern. Other minimum control measures apply to municipal operations, such as reducing road sanding or increasing street sweeping. The permit also requires reduction in Directly Connected Impervious Area (DCIA) through the use of green infrastructure and Low Impact Development practices that retain/infiltrate stormwater runoff from impervious surfaces, either through private or municipal redevelopment projects or retrofits.

Municipal stormwater management recommendations are summarized in *Table 3-6*.

Recommended Actions

- The Town of Southbury and Town of Woodbury (and other MS4 watershed municipalities) should continue to implement municipal stormwater management programs for their regulated MS4s, as

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[1] The Town of Bethlehem is not a regulated MS4 community based on its population density.

required by the MS4 General Permit. Specific actions relevant to the recreational and aquatic life impairments in the Pomperaug River watershed include:

  - Dry weather screening of outfalls in "priority areas" (defined by the MS4 permit) for evidence of illicit discharges
  - Catchment investigations for outfalls known or suspected of having illicit discharges
  - Elimination of illicit discharges identified
  - Wet weather monitoring of stormwater outfalls that discharge directly to impaired waterbodies
  - Update of local land use regulations to reflect more stringent stormwater retention and treatment standards and promote the use of green infrastructure and LID practices
  - Development of a stormwater retrofit plan to identify opportunities for LID retrofits on municipal properties and within the municipal right-of-way, such as the site-specific BMP concepts presented in *Section 4* of this watershed plan
  - Tracking and disconnection of impervious area through private or municipal redevelopment projects and stormwater retrofits
  - Education and outreach on septic systems, sanitary cross connections, waterfowl, and pet waste targeted at homeowners, commercial businesses, and municipal staff
  - Education and outreach on manure management and vegetated buffers targeted at farm owners.

- CTDOT will be developing and implementing a Stormwater Management Plan to comply with its MS4 Permit. PRWC and watershed municipalities should review and comment on the draft Stormwater Management Plan during the public comment period, which is 90 days prior to the effective date of the MS4 Permit (July 1, 2019).

- PRWC should work collaboratively with the Town of Southbury, the Town of Woodbury (and other MS4 watershed municipalities), and CTDOT during implementation of their MS4 Stormwater Management Programs to share stormwater outfall screening and monitoring results, the results of streamwalks and track down surveys, the results of illicit discharge investigations, and opportunities for GI/LID retrofits in the Pomperaug River watershed.

- The Naugatuck Valley Council of Governments (NVCOG) should continue to explore the possibility of providing regional training and outreach materials to its member communities to facilitate sharing of resources and identify additional ways to comply more cost-effectively with the MS4 General Permit, borrowing from the successes of regional stormwater coalitions in Massachusetts such as the Central Massachusetts Regional Stormwater Coalition (http://centralmastormwater.org/Pages/index).

Table 3-6. Municipal stormwater management program recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Continue to implement municipal Stormwater Management Programs	Southbury, Woodbury and other watershed MS4 municipalities	Ongoing	• Compliance with permit deadlines for mapping, outfall monitoring, regulatory updates, etc.	$$$$	Municipal funds (permit requirements not eligible for federal 319 NPS Grant funding)
2. Develop and implement Transportation MS4 Stormwater Management Program	CTDOT	0-2 years (develop plan by July 1, 2019) Ongoing thereafter	• Draft and final Stormwater Management Program • Compliance with permit deadlines for mapping, outfall monitoring, regulatory updates, etc.	$$$$	State funds (CTDOT)
3. Review and comment on the CTDOT draft Stormwater Management Plan	PRWC Watershed municipalities	0-2 years (spring 2019)	• Review comments submitted	$	
4. Coordinate with watershed MS4 municipalities and CTDOT during implementation of MS4 Stormwater Management Programs • Stormwater outfall monitoring results • Illicit discharge investigation results • Opportunities for GI/LID retrofits	PRWC, Southbury, Woodbury, other watershed MS4 municipalities, and CTDOT	Ongoing	• Shared data and information	$	
5. Provide regional training and outreach materials for MS4 Permit • Develop training materials • Implement training	NVCOG UCONN CLEAR / NEMO	0-2 years	• Training materials developed • Training provided/number of municipalities receiving training	$$$	Member communities

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition   NVCOG = Naugatuck Valley Council of Governments   CTDOT = Connecticut Department of Transportation

3.4.4 Subsurface Sewage Disposal Systems

Most of the Pomperaug River watershed is served by on-site subsurface sewage disposal systems, also referred to as septic systems. Failing or older, sub-standard septic systems can impact surface water and groundwater quality and can be a source of bacteria to the Pomperaug River. Recommendations regarding subsurface sewage disposal systems are summarized in *Table 3-7*.

Recommended Actions

- Inventory and map the larger, State-regulated subsurface sewage disposal systems in the Pomperaug River watershed. Coordinate with CTDPH and/or CTDEEP to review system records related to system performance and corrective actions taken to resolve prior performance issues. Identify high-priority systems for ongoing oversight based on consideration of system size, soils, proximity to waterbodies, and performance history.

- Continue to encourage regular maintenance of septic systems by providing homeowner education and outreach (see the River Smart website http://www.pomperaug.org/riversmart) on how to identify improperly functioning systems and procedures to have systems inspected, cleaned, and repaired or upgraded. Septic system educational materials should be made available and disseminated to homeowners in the watershed, which could also be used to meet the public outreach/education minimum control measure of the MS4 Permit.
    - Explore options for offering group discounts to homeowners to pump and repair septic systems.

- Consider strengthening state and local regulations in the watershed to require regular septic system inspection and maintenance and upgrades to sub-standard systems, such as requiring systems to pass an inspection upon the sale of a property and be upgraded if necessary.

Subsurface Sewage Disposal Systems in the Pomperaug River Watershed

The **Pomperaug District Department of Health** has authority over most of the subsurface sewage disposal systems (also called septic systems) in the watershed, including system installation, site inspections, plan review, the issuing of permits and inspections of new, repair and replacement systems. The **Torrington Area Health District** serves most of the other watershed communities. Plans for septic systems serving buildings with design flows of 2,000 to 7,500 GPD must be approved by the **Connecticut Department of Public Health**. Disposal systems on sites with design flows exceeding 7,500 GPD, alternative sewage disposal systems, and community sewage systems are permitted by the **Connecticut Department of Energy and Environmental Protection**.

3.4.5 Illicit Discharges

Illicit discharges are non-stormwater flows that discharge or leak into the stormwater system and drain directly into surface waters. Wastewater connections to the storm drain system, sanitary sewer overflows, and illegal dumping or improper disposal of wastes down storm drains are among the types of illicit discharges that may exist in residential and commercial areas within the watershed. Identifying and eliminating these discharges is an important means of pollution source control for the watershed. Dry weather sources of bacteria such as illicit connections are the most likely to include human sources and need to be identified and effectively managed. Controlling dry weather sources of bacteria is typically more cost-effective than trying to address elevated bacteria in wet weather conditions.

The Town of Southbury and the Town of Woodbury (and other MS4 municipalities) are subject to the requirements of the CTDEEP MS4 Permit. The permit requires these 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 and implementing an Illicit Discharge Detection and Elimination (IDDE) program to systematically find and eliminate sources of non-stormwater discharges to the municipal separate storm sewer system and implement procedures to prevent such discharges. CTDOT is also subject to similar IDDE requirements under its own MS4 Permit, effective July 1, 2019. Although not currently subject to the CTDEEP MS4 Permit, the watershed municipalities of Bethlehem, Morris, Roxbury and Washington are also encouraged to set up a program to identify and address illicit discharges to stormwater systems in their communities.

Recommendations relative to illicit discharges in the Pomperaug River watershed are summarized in *Table 3-8*.

Recommended Actions

- Southbury, Woodbury, and the other watershed MS4 municipalities should continue to implement IDDE programs as required by the MS4 Permit, including an ordinance or other regulatory mechanism to effectively prohibit non-stormwater discharges into the MS4 and an IDDE program to detect and eliminate existing and future non-stormwater discharges, including illegal dumping.
    - Educate municipal staff and the public about illicit discharges and the importance of eliminating or avoiding such discharges.
    - Conduct follow-up illicit discharge investigations at priority outfalls identified during the towns' outfall screening processes and during streamwalks and track down surveys.

Table 3-7. Subsurface sewage disposal systems recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Inventory, review, and prioritize larger, State-regulated subsurface sewage disposal systems in the watershed	PRWC, PDDH, Torrington Area Health District	2-5 years	• List and map of high priority systems for additional oversight	$$	
2. Provide homeowner education and outreach on septic systems and explore options for group discounts to homeowners to pump and repair septic systems	PRWC, PDDH, Torrington Area Health District	0-2 years Ongoing	• Outreach materials provided or made available to homeowners	$	
3. Strengthen municipal regulations regarding septic system inspection, maintenance, and repair/upgrade	CTDPH/CTDEEP, municipalities	5-10 years	• Amended regulations	$$$$	CTDEEP Supplemental Environmental Project Funds, CTDEEP 319 NPS Grants

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition   CTDPH = Connecticut Department of Public Health   CTDEEP = Connecticut Department of Energy and Environmental Protection   PDDH = Pomperaug District Department of Health

Table 3-8. Illicit discharge recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Implement IDDE program consistent with MS4 Permit requirements • IDDE legal authority • Outfall mapping • IDDE Plan • Outfall screening and sampling • Catchment investigations and discharge removal projects • Education and outreach to municipal staff and the public	Southbury, Woodbury, other watershed MS4 municipalities, CTDOT	2017-2022 (5-year permit term)	• Compliance with permit deadlines for mapping, outfall monitoring, regulatory updates, etc. • Refined data for identifying BMP priority areas	$$$$	Municipal funds (permit requirements not eligible for federal 319 NPS Grant funding) State funds (CTDOT)
2. Encourage non-MS4 communities in the watershed to set up and implement a program to identify and address illicit discharges to stormwater systems in their communities	Bethlehem, Morris, Roxbury, and Washington	2-5 years	• Voluntary IDDE Program in place, number of illicit discharges identified and eliminated	$$$	Municipal funds. Non-MS4 communities in the watershed may be eligible for 319 NPS Grant funding.

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition   CTDOT = Connecticut Department of Transportation

3.4.6 Commercial Businesses and Industrial Facilities

Commercial and industrial land uses have the potential for higher pollutant loads due to the contaminant sources associated with these activities and the significant runoff generated from these often highly impervious sites. Much of the commercial development in the watershed is concentrated along the major transportation corridors in Southbury and Woodbury, with several industrial properties, such as the O&G quarry, also located in the southern part of the watershed. While many of these facilities may be subject to the CTDEEP General Permit for the Discharge of Stormwater associated with Commercial Activity (Commercial General Permit) or General Permit for the Discharge of Stormwater associated with Industrial Activity (Industrial General Permit), smaller facilities or certain activities may fall outside of these general permits. However, even entities that are not subject to these general permits should take stock of their facilities and activities to identify and address potential nonpoint pollutant sources. Recommendations related to reducing the impacts from commercial and industrial land uses are summarized in *Table 3-9*.

Recommended Actions

- Conduct outreach to commercial business owners in the watershed explaining how their activities can contribute to the water quality impairments of the Pomperaug River and its tributaries.

- Consider establishing or strengthening municipal ordinances requiring covered trash enclosures, setback distances from streams and catch basins, and frequent cleaning to reduce the bacteria load associated with dumpsters, consistent with the good housekeeping requirements in the CTDEEP industrial and commercial stormwater permit programs, which apply to certain categories of industrial facilities and to larger commercial sites such as shopping centers (e.g., Southbury Plaza, Southbury Green). Leaking dumpsters can be a major source of fecal indicator bacteria during wet weather. Include dumpster and trash management issues in commercial and industrial outreach.

- Review the commercial and industrial facilities in the watershed to identify sites that are subject to the CTDEEP industrial and commercial stormwater permit programs and the APA program, but that are not currently registered.

- Promote green infrastructure and vegetated buffer restoration during redevelopment of large commercial and industrial sites such as the proposed redevelopment of a portion of Southbury Plaza.

Table 3-9. Commercial business and industrial facility recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Conduct outreach to commercial and industrial business owners • See Education and Outreach recommendations	Municipalities (as part of MS4 Permit outreach)	2017-2022 (5-year permit term)	• Outreach completed as documented in MS4 annual Reports	$$	
2. Establish or strengthen municipal ordinances requiring covered trash enclosures and frequent cleaning • Review existing regulations/ordinances • Amend regulations or adopt new ordinances	Municipalities (as part of MS4 Permit IDDE Ordinance)	2016-2021 (5-year permit term)	• New or modified ordinance or other enforceable regulatory mechanism	$$	
3. Review commercial and industrial facilities to identify sites that need to be registered under the CTDEEP stormwater general permit programs • Develop list of facilities in watershed • Identify which facilities are not registered • Notify unregistered facilities of need for permit coverage	PRWC, CTDEEP	2-5 years	• Non-compliant sites identified and notified	$$	
4. Promote green infrastructure and vegetated buffer restoration for redevelopment of commercial sites	Municipalities	Ongoing	• Outreach to commercial property owners • Modified land use regulations to require GI/LID for commercial redevelopment	$$$	

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition CTDEEP = Connecticut Department of Energy and Environmental Protection

3.4.7 Wildlife and Pet Waste

Wildlife and domesticated animals within the Pomperaug River watershed are a source of fecal indicator bacteria that can impact stream water quality. Fecal material can be deposited directly into waterbodies, as well as from stormwater and dry-weather washing of feces deposited on the ground into storm sewers and receiving waters (ASCE, 2014). Domesticated animals (dogs and cats) and wildlife such as birds, raccoons, and rodents can be significant contributors, particularly in parks (including dog walking parks), golf courses, and commercial areas in the watershed. Several golf courses directly border the Pomperaug River, and waterfowl have been observed in these areas as well as public parks and playing fields close to watercourses.

Most of the watershed communities have existing bans on feeding of waterfowl and ordinances on pet waste (i.e., “pooper scooper” laws). However, enforcement of such regulatory controls is difficult. Furthermore, there are no easy solutions to nuisance waterfowl problems. Canada geese are persistent when they become habituated to an area (CTDEEP, 2015b).

A more effective nuisance waterfowl control strategy is needed, focusing on education and outreach and other proven control methods. Creation of a vegetated buffer, consisting of tall grasses, shrubs, or trees, along ponds or streams is a recommended form of habitat modification. Geese prefer to feed on short grass in areas that are open and within sight of a body of water. Tall grasses, shrubs, and trees can serve as a deterrent and cause them to relocate. Vegetated buffers can also reduce nonpoint source pollution. Recommendations related to wildlife and pet waste are summarized in *Table 3-10*.

Recommended Actions

- Continue nuisance waterfowl deterrent efforts – habitat modification, barriers/exclusion and other methods – to reduce feeding of waterfowl by the public, waterfowl nesting, and terrestrial waterfowl habitat in the watershed. Creation of vegetated buffers along ponds and streams as a form of habitat modification (to disrupt travel and sight lines) is the preferred deterrent method since it also provides water quality benefits.

- Existing regulatory controls prohibiting the feeding of waterfowl should be augmented through additional and/or more effective signage in public parks including the potential for fines. Signage should emphasize that feeding of waterfowl such as ducks, geese, and swans can be harmful to their health. People feed geese and other waterfowl because they love them; emphasizing protection of waterfowl health is often the most effective strategy.

- Provide pet waste bag dispensers and disposal cans at high-use areas and conveniently spaced intervals on trails, in open space areas, and along popular walking routes along Main Street areas in Woodbury and Southbury. Provide park and trail signs regarding pet waste disposal requirements and leash laws at the disposal cans. Consider allowing advertising on signs placed at pet waste bag dispensers and disposal cans to partially offset the cost. Provide educational materials regarding the impact of improperly disposed pet waste in pet stores, animal shelters, veterinary offices, and other sites frequented by pet owners.

Geese Deterrent Methods

Habitat Modification: As long as favorable habitat is available, geese will be attracted to an area. Plant unpalatable vegetation or allow grass to grow tall, which makes it unpalatable to the geese. Plant hedges, shrubs, or visual barriers between feeding areas and water. Be sure the geese are not being fed by people.

Barriers and Exclusion Methods: Low fences are very effective at keeping geese from lawns especially during June and July when geese have molted their flight feathers and are unable to fly. A 3-foot high chicken wire or weld wire fence should be used. Soft or hard nylon fences are also potential barriers.

Table 3-10. Wildlife and pet waste recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Continue waterfowl deterrent efforts • Physical barriers • Regulatory controls • Signage • Educational programs • Other	MS4 Municipalities (as part of MS4 Permit compliance) and non-MS4 municipalities on a voluntary basis Audubon Center at Bent of the River	2017-2022 (5-year permit term)	• Waterfowl programs implemented • Number of municipalities participating	$$	Municipal funds, NFWF
2. Implement and enforce pet waste programs • Provide bag dispensers and disposal cans at parks, trails, and dog parks • Provide park and trail signage • Provide educational materials	MS4 Municipalities (as part of MS4 Permit compliance) and non-MS4 municipalities on a voluntary basis Local veterinarians, pet stores, dog kennels, pet supply and feed stores, etc. to help educate the public and encourage participation	2017-2022 (5-year permit term)	• Pet waste programs implemented • Number of municipalities participating • Number of businesses and other partners participating	$$	Municipal funds, contributions from businesses

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

NFWF = National Fish and Wildlife Foundation

3.4.8 Vegetated Buffers

Vegetated buffers are vegetated areas adjacent to streams, ponds, lakes, and wetlands. Vegetated buffers help encourage infiltration of rainfall and runoff and reduce flooding. The buffer area provides a living "cushion" between upland land use and surface water resources, protecting water quality, the hydrologic regime of the waterway and stream structure. Vegetated buffers filter out pollutants, capture sediment, protect streambanks from erosion, regulate stream water temperature, and process many contaminants through vegetative uptake. Vegetated buffers can also provide habitat and travel corridors for animals, many of which are dependent on riparian features for survival. Changes to buffer width and vegetative cover can reduce the water quality and other benefits of vegetated buffers and contribute to water quality impairments. In general, vegetated buffers are more effective along small streams than large streams since most water delivered to stream channels from uplands enters along small streams.

The stream corridors in many areas of the Pomperaug River watershed are characterized by limited or no vegetated buffer due to residential and commercial development and farming practices. Residential lawns and some agricultural practices extend down to the banks of the stream in many areas.

Recommendations related to vegetated buffers in developed areas are summarized in *Table 3-11*. Recommendations for restoration of vegetated buffers and filter strips for agricultural operations are addressed later in this section.

Recommended Actions

- Encourage the creation and protection of backyard buffers in residential areas near stream corridors, including the importance of maintaining healthy vegetated buffers to streams, ponds, and wetlands, and recognize the efforts of homeowners and other land owners.
    - Educate homeowners about the value and importance of vegetated buffers by building on existing vegetated buffer outreach and educational programming (e.g., River Smart program, public recognition programs for cooperating landowners, *Streamside Landowners' Guide to the Quinnipiac Greenway,* Audubon's backyard program, and others).

- Implement priority buffer restoration projects based on streamwalks and track down surveys.
    - Focus efforts on publicly-owned, high-profile restoration sites such as the recent buffer restoration demonstration project in Cedarland Park in Southbury.
    - Potential buffer restoration approaches for the watershed include installation of new buffers, widening of existing buffers, invasive species removal/management, and tree planting/reforestation.
    - Target acquisition of riparian parcels to preserve vegetated buffers that provide public access to the Pomperaug River and its tributaries.
    - Engage the participation of volunteers in buffer implementation projects.
    - Further evaluate the feasibility of buffer restoration at specific sites based and consider site-specific factors including: site access, available land area, land ownership, soil conditions, slope, buffer width need to accomplish intended goal(s), and appropriate native plant species.

- Provide vegetated buffer protection through aggressive implementation and enforcement of setback zones in local Inland Wetlands and Watercourses regulations. Consider modifying existing land use regulations as part of the regulatory updates required by the MS4 Permit to incorporate incentives for developers to restore or establish vegetated buffers as part of new development or redevelopment.

Table 3-11. Vegetated buffer recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. **Encourage backyard vegetated buffers** • Provide homeowner education by building on existing materials and programs (see Education and Outreach recommendations)	Municipalities (as part of MS4 Permit compliance), PRWC	2017-2022 (5-year permit term)	• Educational materials disseminated	$$	Municipal funds
2. **Implement priority buffer restoration projects** • Conduct more detailed assessment to identify priority restoration project sites • Pursue and obtain funding • Design and construct projects	Municipalities, PRWC	Ongoing	• Priority projects identified • Funding secured • Projects designed and constructed	$$$	Section 319 NPS Grant Program and other grants NFWF; CT Open Space Grants (Greenway Program); Trout Unlimited; America the Beautiful tree grant program
3. **Implement and enforce setback zones in local Inland Wetlands and Watercourses regulations** • Review existing regulations • Amend regulations	Municipalities	Ongoing	• Modified or updated land use regulations	$$$	Municipal funds

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition   NFWF = National Fish and Wildlife Foundation

3.5 Agricultural BMPs

Agricultural operations can be a source of pollutants to surface waters and groundwater. Water quality contaminants associated with agricultural operations include excess nutrients (nitrogen and phosphorus primarily from fertilizers and animal wastes), bacteria/pathogens and organic materials (primarily from animal wastes), sediment (from field erosion), pesticides (applied to crops), salts (from evaporation of irrigation water), and petroleum products (from farm equipment). These pollutants enter watercourses through direct surface runoff or through seepage to groundwater that discharges to surface water.

A variety of agricultural BMPs are available to reduce the potential water quality impacts of agricultural nonpoint source runoff, including:

- Livestock exclusion fencing
- Manure collection and storage
- Nutrient management (remove, reuse, land application)
- Cover crops
- Contour planting
- Vegetated buffers, filter strips
- Filter berms
- Covered heavy use areas
- Diverting clean water
- Soil health management (disturbing the soil as little as possible, growing as many different species of plants as practical, keeping living plants in the soil as often as possible, and keeping the soil covered).

The following sections describe several of these agricultural BMPs that are more effective for reducing bacterial loads and are therefore recommended as part of the site-specific BMP concepts presented in *Section 4* of this plan. *Table 3-12* summarizes recommendations relative to agricultural operations in the Pomperaug River watershed.

3.5.1 Manure Management

Livestock waste is a source of bacteria (and associated pathogens) and excess nutrients, requiring ongoing management. Different types of livestock produce wastes that vary in bacteria and nutrient concentration (Ruddy et al. 2006, Wagner and Moench 2009). Poor manure management can allow bacteria, nutrients and sediment to be transported to waterbodies via stormwater runoff and when livestock have direct access to these waterbodies. Bacteria can also attach to soil particles that are washed into streams during a storm.

Manure management can take various forms depending on the type and scale of the agricultural operation. Dairy operations and equestrian facilities typically collect and store manure. In such cases, manure piles should, at minimum, be located away from streams and lakes and not drain toward catch basins. Where feasible, piles should be covered and stored in a containment structure (*Figure 3-2*). Covering piles reduces the exposure to rain. Containment structures also reduce the potential for bacteria and nutrients from impacting groundwater. The size and scope of management practices should be customized based on the scale of the operation.

Small farms and equestrian operations with few head appear to be common in the watershed and may not have the resources to implement the most stringent manure management practices. Educational outreach may provide better results in such instances, where the solutions offered can be tailored to the scale and situation of each operation.

Table 3-12. Agricultural operations recommendations

Actions & Milestones	Who	Timeframe	Products & Evaluation Criteria	Estimated Costs	Potential Funding Sources
1. Provide outreach to farm owners on the water quality impacts of agricultural operations and agricultural BMPs • See Education and Outreach recommendations	PRWC	0-2 years	• Outreach materials disseminated	$$	USDA/NRCS, USDA Farm Service Agency, Connecticut Department of Agriculture, University of Connecticut Cooperative Extension System, Connecticut Agricultural Experiment Station, Connecticut Conservation Districts
2. Work with farm owners and operators to implement site-specific agricultural BMPs (see BMP concepts in *Section 4*) • Reach out to owners and operators • Partner with owners and operators to identify projects and financial/technical assistance • Design and construct projects	PRWC, USDA/NRCS, land owners, Northwest Conservation District	2-5 years Ongoing	• Farm owners and operators contacted • Number of partners participating • Technical and financial assistance provided • Projects completed	$ to $$$$	USDA/NRCS, USDA Farm Service Agency, Connecticut Department of Agriculture, University of Connecticut Cooperative Extension System, Connecticut Agricultural Experiment Station, Connecticut Conservation Districts, CTDEEP 319 NPS Grants

$ = $0 to $5,000 $$ = $5,000 to $10,000 $$$ = $10,000 to $50,000 $$$$ = Greater than $50,000

PRWC = Pomperaug River Watershed Coalition USDA = U.S. Department of Agriculture NRCS = Natural Resources Conservation Service

Figure 3-2. Examples of covered manure storage facilities (left - Rutgers Equine Science Center, Rutgers University; right - Michigan State University Extension)

3.5.2 Vegetated Buffers and Filter Strips

As described in *Section 3.4.8*, vegetated buffers are vegetated areas adjacent to streams, ponds, and wetlands that can provide a variety of water quality and other benefits. Filter strips, similar to vegetated buffers, are small strips or areas of vegetated land, often used at the edges of fields, to reduce agriculture nonpoint source pollution (*Figure 3-3*).

In the Pomperaug River watershed, agricultural operations are commonly located close to streams and often have intermittent or perennial streams flowing through them. On these sites, providing vegetated buffers and filter strips can be effective at decreasing the velocity of water, trapping sediment, and allowing runoff and dissolved inorganic pollutants to infiltrate the soil for uptake by vegetation. Many operations in the watershed have animal grazing areas through which intermittent streams or drainage channels pass. In these cases, exclusion fencing should be used to keep animals out of the stream and out of the vegetated buffer or filter strip. In the Pomperaug watershed, space is often limited at farms located adjacent to rivers or streams and on smaller parcels, limiting the use or size of vegetated buffers or filter strips. As such, incentive programs should be considered to offset the cost of land taken out of active use or production, including exploring vegetated buffers that might also have an economic benefit to the land owner by providing a crop that could be harvested or sold for a profit for another use while still providing a water quality benefit.

Fencing vegetated buffers and filter strips from pastures is often necessary to protect water quality. Exclusion fencing (board, barbed, high tensile or electric wire) is commonly used to exclude livestock from streams and vegetated buffers and filter strips to improve or protect water quality and reduce soil erosion and sedimentation. Where a stream or pond serves as a source of drinking water for livestock, provisions for an alternative water supply for livestock (off-channel watering hole or groundwater well) may be necessary.

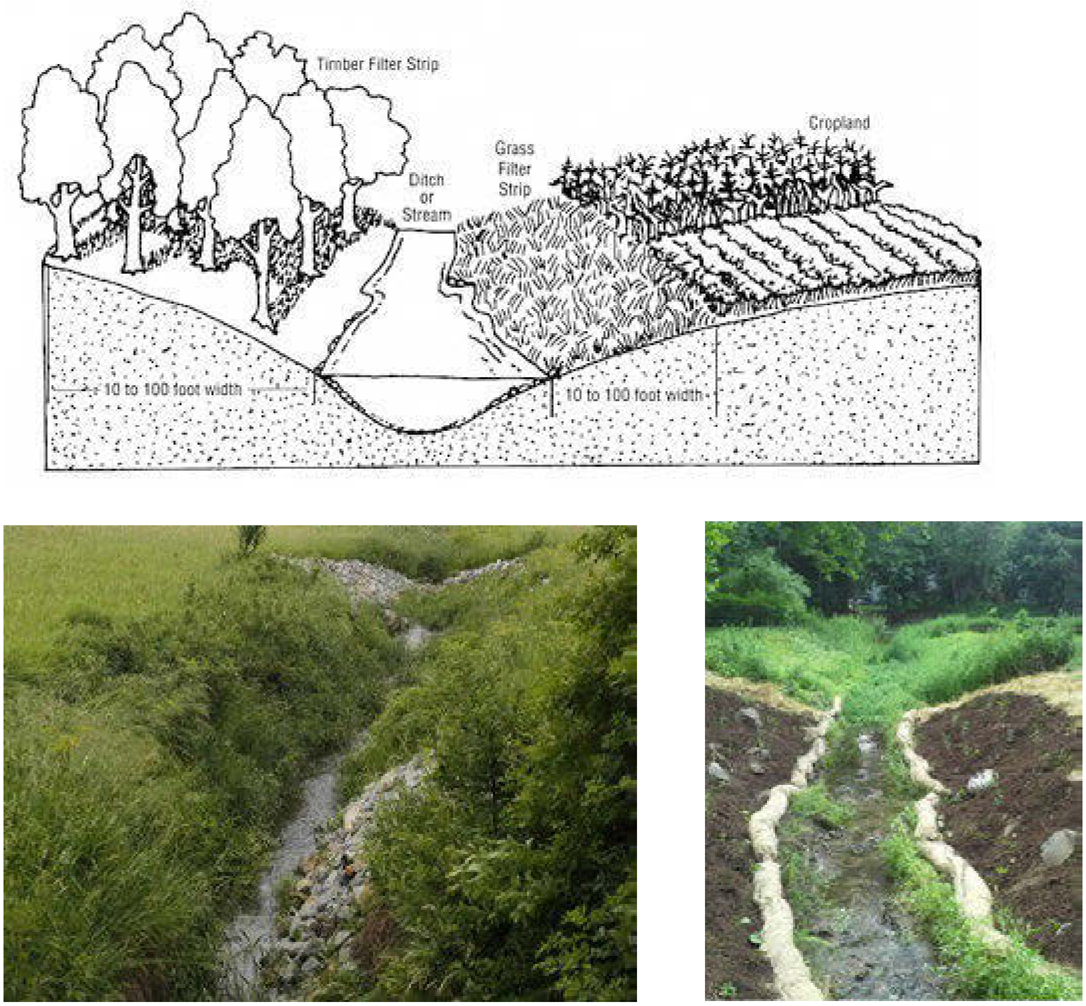


Figure 3-3. Vegetated buffer schematic (top, NRCS) and example vegetated buffers (bottom), including a model riparian buffer restoration project at Cedarland Park in Southbury (bottom right).

3.5.3 Filter Berms

Filter berms are structural BMPs that consist of a stable, permeable berm such as gravel or compost, placed at the downgradient edge of an agricultural field, manure storage and composting facilities, and areas with high livestock use. The filter media in the berm serves to both filter the runoff from the fields and provide some opportunity for cation exchange of dissolved pollutants. Filter berms are designed to follow an elevation contour and are turned up at the ends, resembling a horseshoe, to provide runoff storage (*Figure 3-4*). Runoff temporarily pools behind the berm, then filters through it and infiltrates into the ground. For that reason, berms are best located downgradient from sources of bacteria and nutrients. Filter berms are best suited to treating small, frequent storms, where water is captured and infiltrated. In larger storms, the berm stores stormwater, allowing sediment-bound pollutants to settle, before the treated stormwater is slowly released.

Filter berms typically have a small constructed footprint and represent simple and cost-effective solutions to runoff management and pollutant reduction. When properly designed and sited, they blend into the landscape. Maintenance requirements are also low: stored sediment must be periodically removed and the grass on the filter berm mowed, if desired.

Figure 3-4. Schematic and example of a filter berm (Guffey, 2012)

3.5.4 Farm Financial and Technical Assistance

Implementing improvements on farms requires some capital investment that is often beyond the means of the individual farmer. The State of Connecticut and U.S. Department of Agriculture both recognize this challenge and administer programs to support farmers in conservation efforts. Outreach and technical assistance programs provided by federal and state agencies include the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), USDA Farm Service Agency, Connecticut Department of Agriculture, University of Connecticut Cooperative Extension System, Connecticut Agricultural Experiment Station, Connecticut Conservation Districts, and CTDEEP.

Connecticut offers technical and financial support to farm businesses in their farm waste efforts through the "Partnership for Assistance on Agricultural Waste Management Systems." Through this partnership, a farm business may obtain waste management planning, facility design, and qualify for financial assistance as well as help in procuring required permits. Technical assistance is also available in selecting and implementing agricultural BMPs and soil erosion control methods and technologies.

As part of the National Water Quality Initiative (NWQI), the USDA NRCS offers financial and technical assistance to farmers and forest landowners interested in improving water quality and aquatic habitats in priority watersheds with impaired streams. The NWQI directs technical assistance to farmers as part of the Environmental Quality Incentives Program (EQIP). This is a voluntary conservation program to assist agricultural producers with implementing structural and management conservation practices to their farms that promote agricultural production and environmental quality as compatible goals. Through EQIP, agricultural producers receive financial and technical assistance to implement practices on working agricultural land.

The Connecticut Department of Agriculture further provides funding through its Farmland Restoration Program (FLRP) that may support the goals of this plan. Where BMP recommendations include relocating grazing areas, the voluntary FLRP provides funding opportunities to "enhance use of agricultural lands that are currently underutilized". This program provides support to projects that include installation of fencing to keep livestock in reclaimed pasture areas and/or out of riparian areas, as well as funding to clear and remove trees, stumps, stones and brush to create or restore agricultural use.

4 Site-Specific BMP Concepts

The site-specific BMP concepts presented in this section and indicated on the accompanying map (*Figure 4-1*) are intended to serve as potential on-the-ground projects for future implementation. They also 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. Individual project proponents (e.g., municipalities, private property owners, developers) are responsible for evaluating the ultimate feasibility of, as well as design, permitting, and maintenance of these and similar site-specific concepts.

Preliminary, planning-level costs were estimated for the site-specific concepts presented in this section, including operation and maintenance costs. These estimates are based upon unit costs derived from published sources, engineering experience, and the proposed concept designs. 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 estimated costs is included in *Appendix E*.

Visual Field Assessments

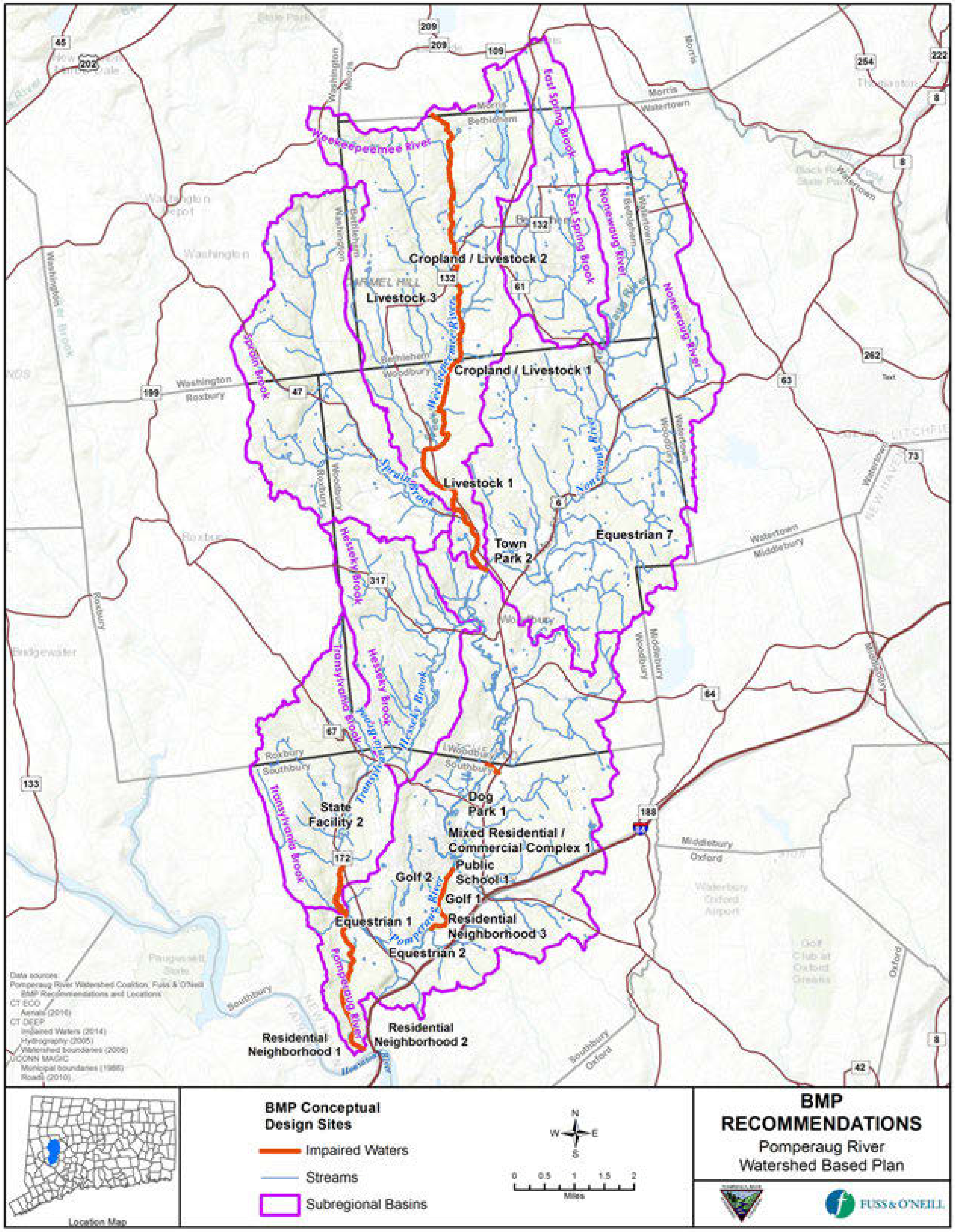
Visual field investigations were performed by Fuss & O'Neill in September 2017 to further assess potential sources of water quality impairments in the Pomperaug River watershed and to identify possible restoration opportunities. The assessments focused on identifying potential projects that would reduce bacteria loads in areas of the watershed with documented impairments. Concepts for site-specific Best Management Practices (BMPs) were developed at priority sites based on the results of the visual assessments and input from the PRWC Land Use Committee.

The table in *Appendix D* contains information on pollution sources and potential BMP opportunities for other sites visited during the field assessments.

4.1 Residential 1

This residential neighborhood sits on the side of a hill that slopes down to the Pomperaug River, near its confluence with the Housatonic River in Southbury. Two catch basins collect stormwater from the curbed road, which includes a paved cul-de-sac, and ultimately discharge to an impaired segment of the Pomperaug River. A number of single-family homes are located at the river's edge. These may once have been seasonal residences, but now may be occupied year-round. The proposed BMP concept for this neighborhood, shown in *Figure 4-2*, could be implemented by the Town of Southbury within the public right-of-way.

- **Stormwater Infiltration.** The paved cul-de-sac in this neighborhood presents an opportunity to reduce the amount of impervious surface, runoff, and pollutant loads to the Pomperaug River through a stormwater retrofit project. The soils at the site are believed to have good permeability (mapped as Hydrologic Soil Group A) and are conducive to stormwater infiltration. The proposed concept is to construct a subsurface infiltration system below the cul-de-sac, which would receive stormwater from the two upgradient catch basins on Pascoe Drive (see *Figure 4-3* for an example subsurface infiltration system). The existing downgradient catch basin on the eastern side of the cul-de-sac could serve as an overflow structure to allow excess stormwater to be conveyed to the storm drain system. As an alternative, a portion of the cul-de-sac could be converted to permeable or pervious pavement (see *Figure 4-4* for examples), which would serve to capture and infiltrate runoff from the cul-de-sac. The cul-de-sac isn't large enough to install a bioretention island in the middle of the cul-de-sac.



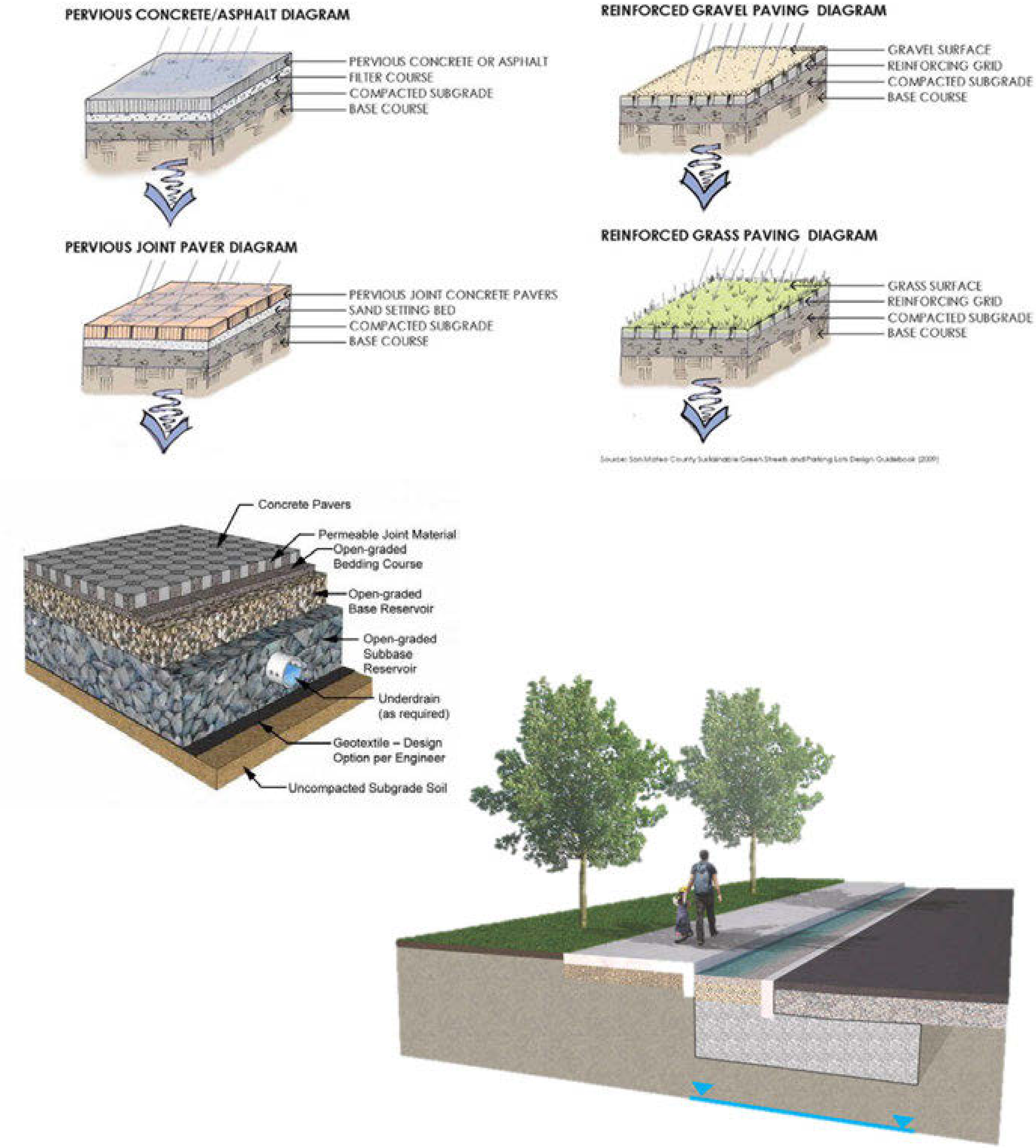
Data sources:
Pomperaug River Watershed Coalition, Fuss & O'Neill
BMP Recommendations and Locations
CT ECO
Aerials (2016)
CT DEEP
Impaired Waters (2014)
Hydrography (2005)
Watershed boundaries (2006)
UCONN MAGIC
Municipal boundaries (1986)
Roads (2010)

Figure 4-1. Locations of proposed site-specific BMP concepts in the Pomperaug River watershed

Figure 4-2. BMP Concept: Residential 1

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

Figure 4-3. Examples of subsurface infiltration systems for parking lots (top) and within the road right-of-way (middle and bottom)



Source: San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook (2009)

Figure 4-4. Examples of permeable pavement types (top) and use within the road right-of-way (bottom right)

4.2 Residential 2

Across the Pomperaug River from Residential 1, this approximately 78-acre residential neighborhood consists of houses on 1/8- to 1/4-acre lots. The neighborhood is characterized by greater than 15% impervious cover consisting of buildings, driveways, and streets. Most of the stormwater from this neighborhood drains to catch basins, which discharge to the same impaired segment of the lower Pomperaug River as the Residential 1 site. As with Residential 1, many of the homes in this neighborhood may once have been seasonal residences that may now be occupied year-round. Parcels along the river tend to have landscaped lawns that extend to the river's edge.

The public right-of-way is narrow in this neighborhood, limiting options for surface stormwater treatment practices. Streets along the river's edge have catch basins, but stormwater treatment options may be limited by the narrow right-of-way and minimal groundwater separation in these areas.

The proposed BMP concepts for this residential neighborhood are shown in *Figure 4-5*.

- **Subsurface Infiltration.** The limited area within the public right-of-way, typically only a few feet wide along the side streets, makes subsurface infiltration the most feasible BMP type given the underlying soils and space constraints. Given the location of existing catch basins, there exists approximately 400-feet of potential space for subsurface infiltration chambers. These chambers are typically 3 to 4 feet in width. Using existing catch basins as an inlet for stormwater, as well as an overflow for larger storms, represents the most efficient use of space and requires the least excavation. Subsurface infiltration systems could be located in the vicinity of 40 Oakdale Manor Road, 96 Oakdale Manor Road, 12 Hillside Road, and 63 Hillside Road. The proposed infiltration systems could be implemented by the Town of Southbury within the public right-of-way.

- **Infiltration Basins.**

    - An approximately 600-ft^2 infiltration basin is proposed southeast of the intersection of Oakdale Road and the Exit 13 on-ramp on State-owned property. At the intersection are 4 catch basins that discharge to an outfall in this location. A portion of the runoff from this drainage area, which consists of approximately 27,000 ft^2 of impervious surfaces, could be captured and treated by a proposed infiltration basin. An existing, but abandoned, single lane path near property owned by Oakdale Manor Water Users could potentially be repurposed as an access road for maintenance. Some tree clearing may be necessary to construct an infiltration basin at this location.

    - An approximately 2,200-ft^2 infiltration basin is proposed at the southern end of Oakdale Road, in a gravel pull-off area, on property owned by Eversource (formerly Connecticut Light & Power). The infiltration basin could be designed to infiltrate the water quality volume, i.e., the first one inch of runoff, from the approximately 24,000 ft^2 of impervious cover in this drainage area, including the area that drains to the three upgradient catch basins. The infiltration basin could be designed to overflow into the existing drainage system at the intersection of Oakdale Road and River Road.

Figure 4-5. BMP Concept: Residential 2

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

Figure 4-6. Examples of infiltration basin installations at an outfall (top), along a parking lot (middle), and in the road right-of-way (bottom)

4.3 Residential 3

Located north of the Flood Bridge Road crossing and on the west bank of the Pomperaug River in Southbury, this residential neighborhood contains several single-family houses on 1/4- to 1-acre lots. The total area of the neighborhood is approximately 40 acres, and the neighborhood has in excess of 15% impervious cover, including some 4 acres of buildings, driveways, and other impervious surfaces. Stormwater drains to two outfalls located near the intersection of Flood Bridge Road and Riverhill Road and the intersection of Riverhill Road and Branch Road.

As with the other residential areas, many of the homes in this neighborhood may once have been seasonal residences that may now be occupied year-round. Parcels along the river also tend to have landscaped lawns that extend to the river's edge.

Figure 4-7 shows the proposed BMP concepts for this residential neighborhood.

- **Bioretention.** Two bioretention cells with sediment forebays are proposed north and south of the intersection of Flood Bridge Road and Riverhill Road. This arrangement would capture stormwater flowing down Riverhill Road, as well as from the catch basins along Flood Bridge Road. These bioretention practices would have to be sited with consideration for flooding given their proximity to the river and location within the floodplain. Given their location in the floodplain, these could be flow-through, rather than infiltration, bioretention practices, and would have be designed to capture and treat runoff from small to medium-sized storms but also withstand periodic inundation during floods. Tree clearing within the floodplain would also be required, which would add cost and complicate the regulatory approval process.

    - The southern bioretention practice, located on several parcels owned by the Town of Southbury, would be installed near the existing outfall. It could be designed to capture flow from catch basins along Flood Bridge Road, draining approximately 1 acre of impervious cover. The proposed 1,000-ft^2 bioretention could treat the entire water quality volume from this catchment area.

    - The northern bioretention practice, located on a parcel owned by the Town of Southbury, would disconnect the existing catch basin from its current alignment, redirecting flow to a low-lying area to the east. It would capture approximately 10,000 ft^2 of impervious cover, which could be treated by an approximately 350-ft^2 bioretention area. This practice could also be designed as an infiltration basin.

- **Subsurface Infiltration.** A subsurface infiltration system is proposed near the intersection of Riverhill Road and Branch Road to capture stormwater runoff from portions of both roads. Stormwater would enter the infiltration system from the existing catch basins. Approximately 50,000 ft^2 of impervious cover could be infiltrated/treated by this practice. Flow in excess of the water quality volume would bypass the system and discharge to the existing stormwater outfall south of the intersection. Alternatively, road-side bioswales could be installed along Riverhill and Branch Roads upgradient of the catch basins at the intersection, which would be a less expensive option, but would capture runoff from a smaller drainage area and could face opposition from the neighboring homeowners. This proposed BMP concept could be implemented by the Town of Southbury within the public right-of-way.

Figure 4-7. BMP Concept: Residential 3

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

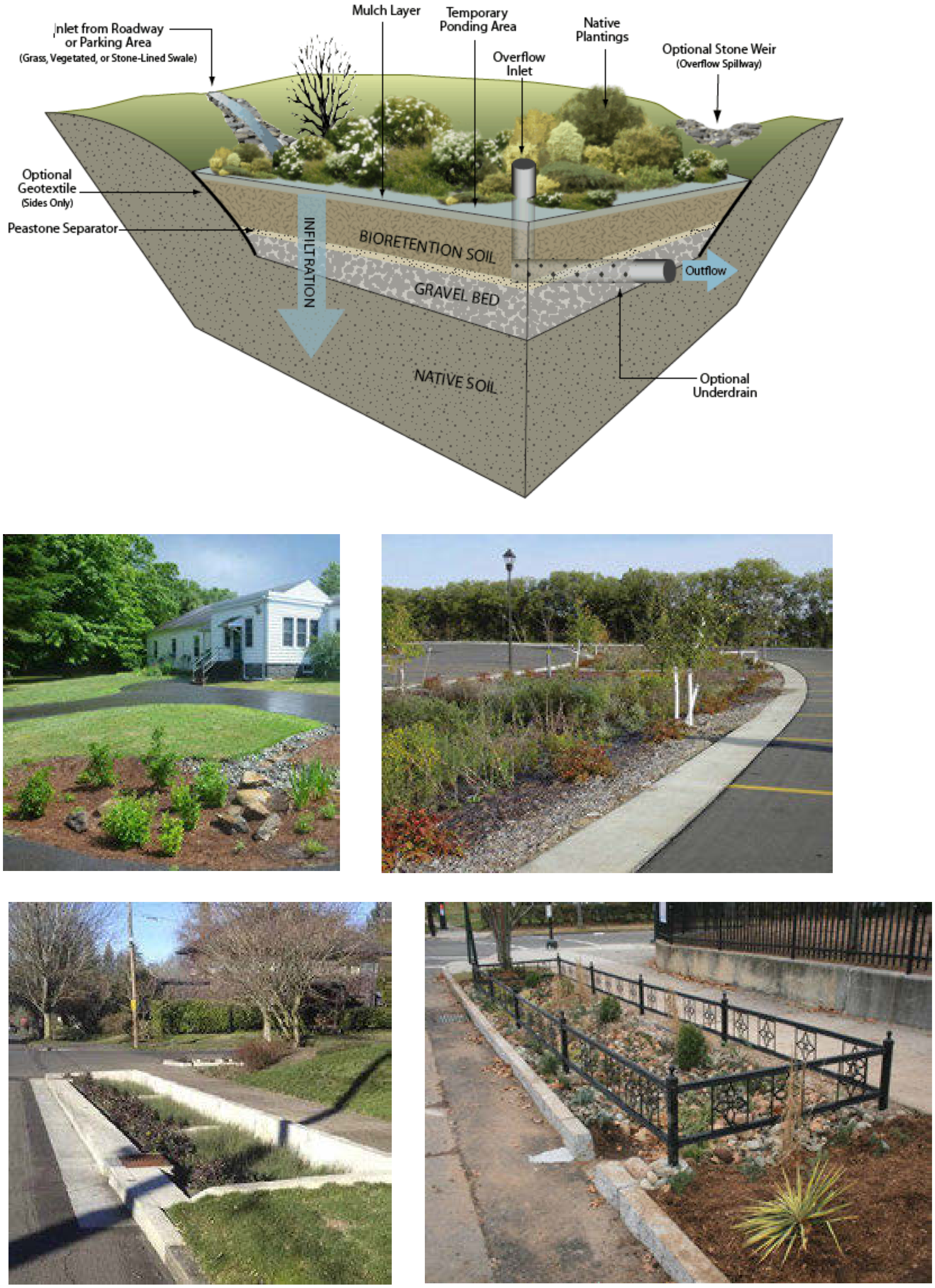


Figure 4-8. Examples of bioretention schematic (top), parking lot bioretention systems (middle), and road-side bioretention or bioswales (bottom)

4.4 Golf Course, Public School, and Town Park

Multiple golf courses, municipal properties, including a school and athletic fields, and some residential development are located near the Poverty Road crossing of the Pomperaug River in Southbury, along impaired segment Pomperaug-03. Stormwater runoff from impervious surfaces and waterfowl are potential sources of bacteria in this area. During the field assessments, numerous Canada geese were observed on the golf courses and in the field below Gainfield Elementary School.

Several large stormwater outfalls, some at least 36 inches in diameter, discharge to this segment of the Pomperaug River. Most of the stormwater runoff is conveyed by the municipal storm drainage system along Poverty Road and discharges near the Poverty Road Bridge. Runoff is generated from the residential development on the west side of the river, and from the elementary school on the east side. Additional catch basins are located in the unpaved parking lot at the athletic fields, which discharge directly to the Pomperaug River.

The proposed BMP concepts for these sites are shown in *Figure 4-9* and described below. The first three BMP concepts described below are located on property owned by the Town of Southbury or within the municipal right-of-way.

- **Bioretention.** A bioretention or infiltration practice is proposed in the triangular island in the parking lot of George Ewald Park. In this public park setting, the proposed BMP would be highly visible and could present an opportunity for public education. Some re-grading of the parking lot may be required to maximize surface runoff toward the bioretention area. Because the parking lot is unpaved, the bioretention system would likely receive a heavy sediment load. Filter strips are therefore proposed as pretreatment to reduce the frequency of required maintenance. Alternatively, the parking lot could be paved and the bioretention system constructed as part of the parking lot upgrades. The existing island configuration has approximately 1,400 ft^2 of available space for a potential bioretention area, which is sufficient to treat the water quality volume.

- **Subsurface Infiltration.** Subsurface infiltration is proposed along Poverty Road in-line with the existing stormwater infrastructure. Depending on the pipe connectivity at the intersection of Poverty Road and Old Field Road, the catchment includes a minimum of approximately 2 acres of impervious cover. West of Old Field Road on the north side of Poverty Road, subsurface infiltration chambers could be installed from approximately 204 Poverty Road to the entrance to George Ewald Park.

- **Permeable Pavement.** Parking stalls in the Gainfield Elementary School parking lot could be converted to permeable pavement, which would reduce runoff and pollutant loads from the site. Permeable pavement is a type of pavement that allows stormwater to pass through and infiltrate into the soil. A variety of permeable pavement types exist, including porous asphalt and concrete, interlocking pavers, grass pavers, and various grid systems.

- **Vegetated Buffer.** The riparian buffer along this segment of the Pomperaug is largely forested, though opportunities for buffer enhancement exist. At the eastern end of the driving range, enhancement of the existing vegetated buffer is proposed in an underutilized section of the golf course. A net is also proposed, since golf balls were found in the river, though this may shorten the driving range distance. Buffer enhancement is also proposed at the golf course on the east side of the river, by the water hazard on Hole 2. Both sites are located on privately-owned property.

- **Waterfowl Management Strategies.** Given the number of geese observed in the area, non-structural and non-lethal waterfowl management strategies are recommended, such as audio or visual repellants. Creation of a vegetated buffer, consisting of tall grasses, shrubs, or trees, along ponds or streams is a recommended form of habitat modification. Geese prefer to feed on short grass in areas that are open and within sight of a body of water. Tall grasses, shrubs, and trees can serve as a deterrent and cause them to relocate. Vegetated buffers can also reduce NPS pollution. Lethal control methods are also possible, but require regulatory approvals due to the goose's status as a migratory bird.

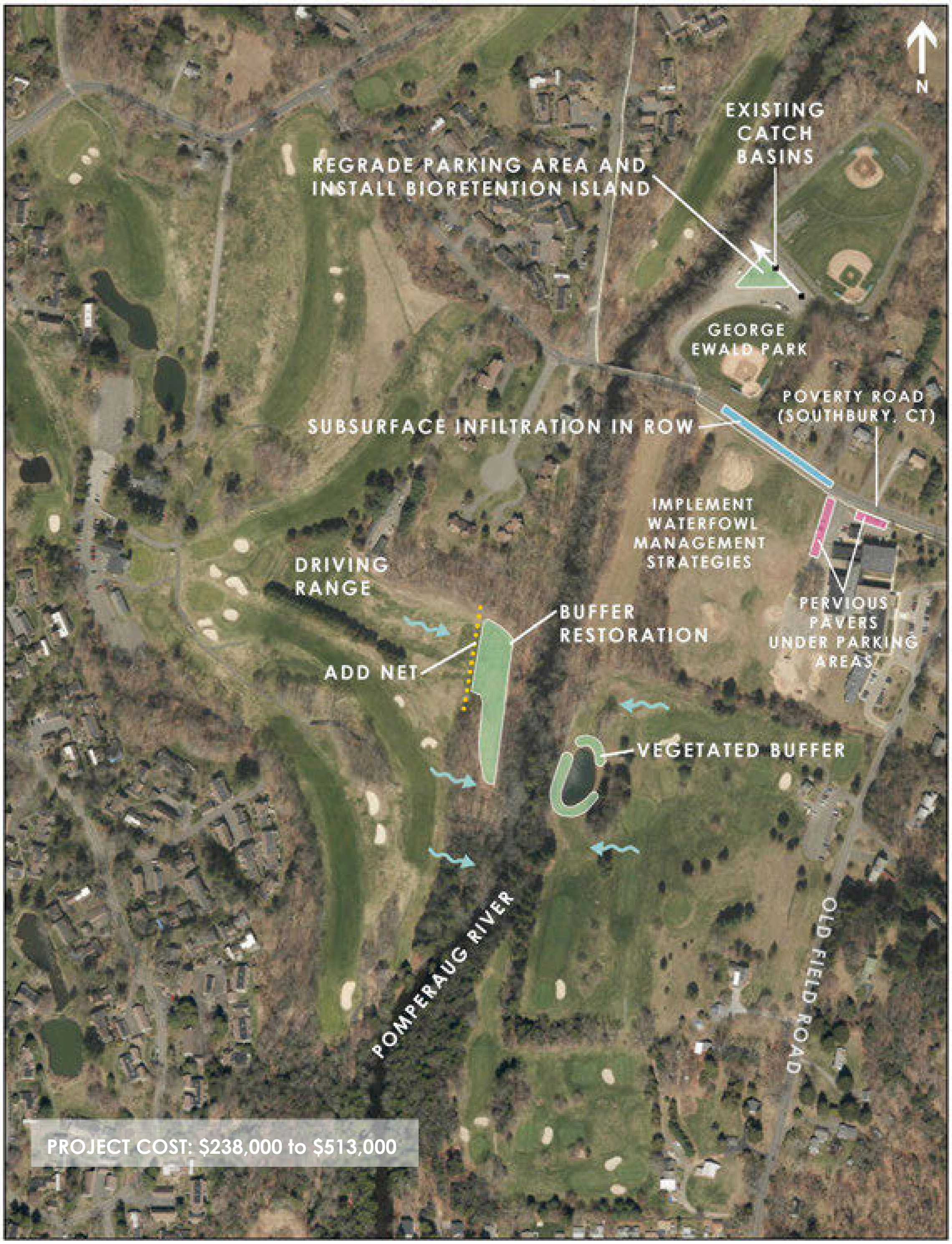


Figure 4-9. BMP Concept: Golf Course, Public School, and Town Park

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.5 Mixed Commercial/Residential 1

On the west side of the Pomperaug River-03 segment is a privately-owned planned retirement community containing nearly 2,600 residential units over approximately 2.3 square miles. The eastern end of this community houses commercial space, including a hotel, restaurants, stores, office space, and a library, along with more than 10 acres of impervious cover. Individual stormwater outfall catchments that serve this area have high levels of impervious cover. Some of the residential units are located on higher elevations over unconsolidated lodgment till, while others are located on melt-out till. The commercial area sits on top of sandy, glaciofluvial deposits. Unconsolidated till typically has a lower infiltration potential than glaciofluvial deposits, which can limit the potential for infiltration-based green infrastructure retrofits. The complex is entirely served by sanitary sewers, with its own wastewater treatment facility that discharges to the Pomperaug River near the upstream end of the impaired segment.

Stormwater runoff from this site is collected by catch basins and piped to the Pomperaug and its tributaries. Significant potential exists to disconnect impervious area and infiltrate stormwater runoff from this complex through green infrastructure and low impact development retrofits. The conceptual designs proposed here are those in and near the commercial area, which also have soils that are generally conducive to infiltration. This planned retirement community presents an ideal opportunity to showcase residential GI and LID retrofit techniques that could serve as demonstration projects for other residential and mixed-use neighborhoods in and outside of the watershed.

Proposed concepts for these sites are shown in *Figure 4-10* and *Figure 4-11*.

- **Infiltration Basin.** A 7,500-ft^2 surface infiltration basin with sediment forebay is proposed in an underutilized pervious area towards the rear of the Village Green area. Currently, it appears to serve as a short-cut to a golf course clubhouse. Upgradient of this area are two catchments draining approximately 100,000 ft^2 of impervious cover. The western catchment drains the majority of this area, while the northern catchment contains only a few catch basins. The infiltration basin could be designed to receive flow from the upgradient drainage areas to increase the impervious area that can be treated by the practice. The BMP would discharge to an existing water feature on the nearby golf course.

- **Subsurface Infiltration.** Opportunities for subsurface infiltration exist in front of a former bank and drugstore location on Heritage Road and under the parking lot for 460 Heritage Road.

    - Former Bank Site: Subsurface infiltration chambers could be installed under the sidewalk and parking stalls at this location. Capturing runoff from approximately 20,000 ft^2 of impervious area, there is sufficient area to infiltrate the entire water quality volume.

    - 460 Heritage Road parking: Four catch basins capture runoff from approximately 1 acre of impervious cover. Subsurface infiltration chambers are proposed under the parking area between 460 and 452 Heritage Road, where there is sufficient room to treat the entire water quality volume entering this catchment. Roof leaders from the surrounding buildings are buried at this location and likely drain to catch basins.

- **Permeable Pavement.** Permeable pavement is proposed to replace existing parking stalls near the library, Friendly's, meeting house, and office space. Overflow parking for the conference center is in need of repair, and represents the most feasible retrofit opportunity. If the overflow lot is substantially underutilized, then pavement removal and restoration to permeable surface would be more beneficial. Additionally, parking stalls in and around the Village Green could be replaced with pervious pavement to reduce the required size of the infiltration basin proposed above.

- **Bioretention.** A 750-ft^2 infiltrating bioretention practice or infiltration basin could be sited in an existing depression located north of the intersection of Heritage Road and Poverty Road. Capturing runoff from approximately 20,000 ft^2 of impervious cover from the meeting house and Poverty Road, the practice would require a sediment forebay and a filter strip for pretreatment of overland flow. Ample space exists to treat the entire water quality volume. The existing yard drain in this depression could be raised to function as an overflow structure.

- **Linear Bioretention.** Two rows of linear bioretention cells, also called "bioswales," are proposed at the southern approach to the intersection of Heritage Road and Village Street. Curb cuts from Heritage Road would allow water into the practice, with excess flow bypassing the bioretention cell and entering the existing catch basins and storm drainage system.

- **Water Quality Swale.** North of the intersection of Heritage Road and Poverty Road, east of the proposed pervious pavement and bioretention proposed above, a 275-foot dry water quality swale is proposed. A curb cut at the northern end would capture surface runoff along Heritage Road. A second curb cut is proposed to allow more runoff into the practice downstream of the first curb cut. This allows a greater amount of impervious cover to be disconnected and treated. Both curb cuts would first enter a pretreatment sediment forebay. In a limited-width ROW, it may be necessary to narrow the swale by the second curb cut to allow sufficient space for pretreatment. As proposed, this BMP would treat runoff from approximately 6,500 ft^2 of impervious cover, for which there is sufficient length in the ROW to infiltrate the water quality volume.

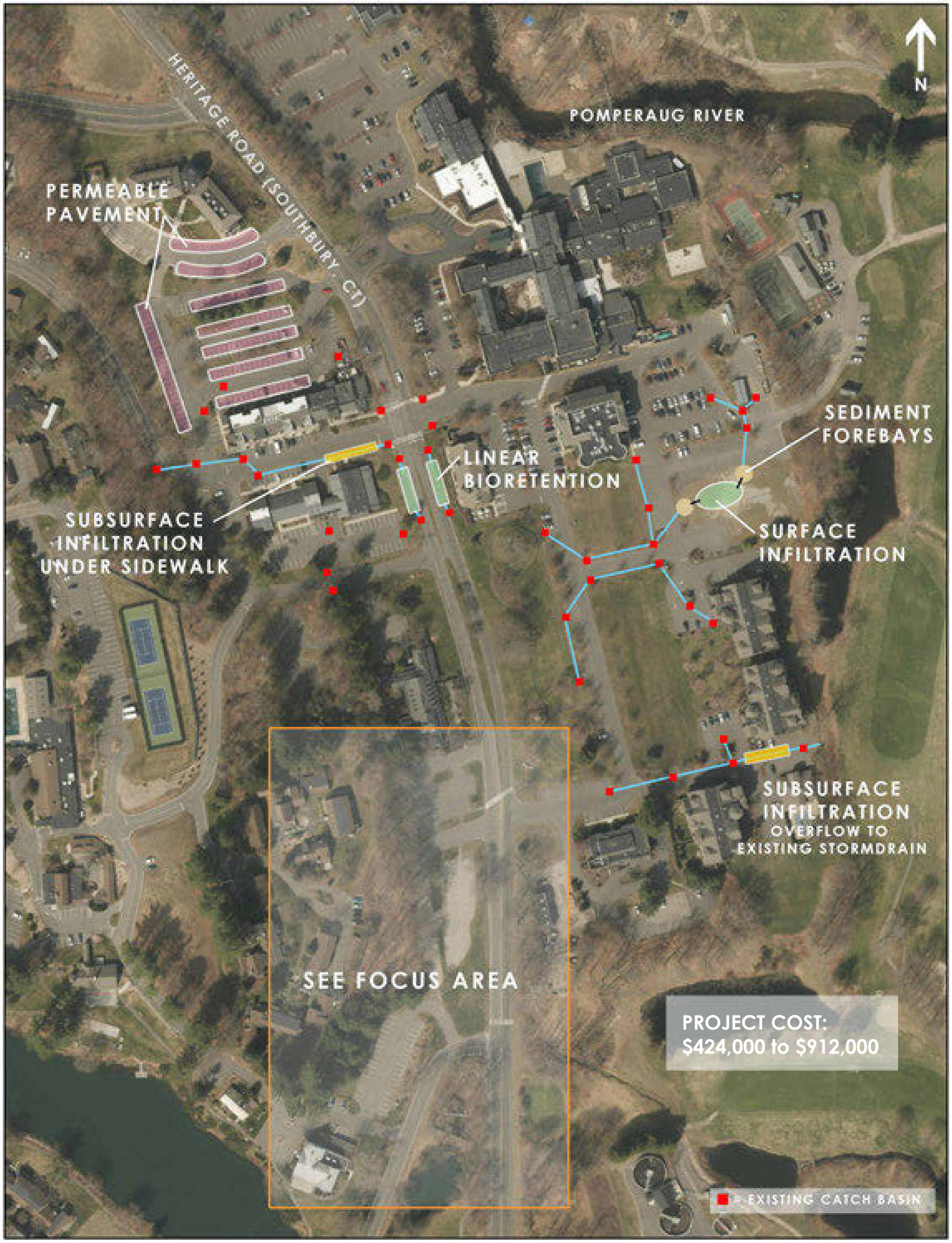


Figure 4-10. BMP Concept: Mixed Commercial/Residential 1

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

Figure 4-11. BMP Concept: Mixed Commercial/Residential 1 (focus area)

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.6 State Facility 2

This site is a 700-acre State-owned facility located on the west side of Transylvania Brook off of Route 172 (South Britain Road) in Southbury. Approximately 550 acres of the site are forested or used for agriculture, parts of which are conserved as protected open space. The remaining areas are developed with more than 35 acres of impervious cover. The developed areas of the site drain to Transylvania Brook and are characterized by over 20% impervious cover, including numerous outbuildings, access roads, and parking areas.

Most of the stormwater runoff from the site is collected by catch basins and eventually discharges directly to Transylvania Brook. Soils are typically good for infiltration, consisting of primarily Hydrologic Soil Group B soils, with some pockets of Group A soils. Some areas of locally-higher elevation are mapped as Group D soils, due to shallow bedrock. A perennial stream flows through the developed portion of the site, dividing it into roughly equal halves. Stormwater outfalls likely discharge into this tributary of Transylvania Brook. An impoundment creates Gravel Pond, which has recently been documented to host a significant inundation of invasive water chestnut plants, before Transylvania Brook continues south.

The State is currently phasing out use of the facility. Future uses of the site remain under discussion between the State, Town, and residents. The BMPs presented below, or similar LID/GI concepts could be implemented as part of a future redevelopment plan for the site, particularly in a residential, institutional, or recreational setting.

This site has been the subject of some environmental investigation in the past to assess the property for subsurface contamination associated with historical uses of the site, including underground storage tanks, maintenance shops, power generation facilities, and other potential pollution sources. As discussed in *Section 3.4.1* of this plan, infiltration of stormwater is not recommended in areas with soil or groundwater contamination. Further assessment and remediation of potential contamination will be necessary prior to implementing infiltration-based stormwater BMPs at this site.

Proposed BMP concepts for these sites are shown in *Figure 4-12*.

- **Permeable Pavement.** Multiple opportunities for permeable pavement exist across the site. Many parking areas have capacity for more than 10 vehicles. Parking is dispersed throughout the site, making larger practices less feasible.

- **Bioretention.** Three bioretention practices are proposed on Hartford Hill, Constitution Hill, and Liberty Lane.
    - Hartford Hill: A 1,000-ft^2 bioretention practice is proposed west of the intersection of Nutmeg Ave and Hartford Hill, capturing approximately 35,000 ft^2 of impervious cover from Hartford Hill and adjacent buildings. The concept includes a sediment forebay and bioretention area receiving runoff from the catch basins and storm drains on Hartford Hill. Ample space on the south side of the street exists to treat the entire water quality volume.

    - Constitution Hill: A 2,500-ft^2 bioretention practice is proposed in a lawn area northwest of the intersection of Yankee Drive and Constitution Hill, capturing approximately 88,000 ft^2 of impervious cover from Constitution Hill and adjacent buildings. The practice includes a sediment forebay and bioretention area receiving runoff from the catch basins and storm drains on Hartford Hill. While sufficient space exists to treat the water quality volume, this location is sloped, which would need to be addressed in the design.

  - Liberty Lane: A 1,200-ft^2 bioretention practice is proposed east of Liberty Lane. Catch basins on Liberty Lane capture runoff from approximately 35,000 ft^2 of impervious cover. The concept includes a sediment forebay and bioretention area receiving runoff from the catch basins and storm drains. Sufficient space exists within existing landscape features to treat the entire water quality volume.

- **Water Quality Swales.** Two roadside water quality swales are proposed in the wide ROW along South Britain Road, north and south of Transylvania Brook. Curb cuts would allow water to enter the swales. Sediment forebays or filter strips could be used as pretreatment options depending on the available ROW width.

  - Northern swale: Runoff from approximately 17,000 ft^2 of impervious cover could be treated by this proposed practice. Pervious pavement proposed elsewhere in the parking lots would help to reduce the amount of runoff that would otherwise drain to the BMP. A curb cut and filter strip is proposed here where existing utility poles limit the ROW width. The ROW widens closer to Transylvania Brook to approximately 20 feet.

  - Southern swale: Runoff from approximately 1 acre could be treated by this practice, including the drainage area that serves 5 catch basins along South Britain Road. Along the east side of the road, a local depression would receive runoff from the catch basins. This difference in elevation allows more opportunity to pass water through a sediment forebay prior to treatment in the swale.

- **Buffer restoration.** At the northern end of Gravel Pond, limited riparian buffer exists along Transylvania Brook, its tributary, and Gravel Pond. Bacteria sources in this area may include pet waste and nuisance wildlife. Educational signage encouraging pet owners to clean up after their pets is recommended. Vegetative buffer restoration is proposed along the water's edge to help deter waterfowl from occupying this area by restricting their access to water and to filter runoff and encourage infiltration.

Figure 4-12. BMP Concept: State Facility 2

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.7 Dog Park 1

On the west bank of the Pomperaug River in Southbury is a 14-acre off-leash dog park located on land owned by O&G Industries. A network of trails meanders through the forested portion of the dog park. A tributary to the Pomperaug River flows under the access road and along the southern edge of the site. A parking area for approximately 25 vehicles is located at the western edge of the site, by the access road. On the eastern side of the cleared area are an additional parking area and an access path. The owners of the park recognize that pet waste is a source of bacteria and a nuisance. They provide waste bags and trash cans at the main entrance and require that owners clean up after their pets. There are access paths to the Pomperaug River, which appear to be frequently used. Proposed BMP concepts for this site are shown in *Figure 4-13*.

- **Infiltration Basin.** A 300-ft^2 infiltration basin is proposed at the southern end of the main parking area. This area drains approximately 13,000 ft^2 of impervious cover, including the parking area and access road. A sediment forebay is proposed as pretreatment because the parking area is unpaved.

- **Buffer Restoration.** At the southeastern edge of the park, the existing riparian buffer is limited. Buffer restoration is therefore proposed along this narrow buffer area. Because the existing access path from the additional parking area is sited close to the Pomperaug River, realignment of the path is recommended to accommodate a wider buffer. A pet waste station is also recommended at the entrance from the additional parking. Recognizing that access to the Pomperaug is a popular feature of the park, river access is still recommended as part of the proposed buffer restoration project. The paths should be elevated relative to the surrounding area to prevent stormwater from short-circuiting the buffer. River access could be provided similar to the stairs installed at the Cedarland Park stream buffer demonstration project.

Figure 4-13. BMP Concept: Dog Park 1

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.8 Town Park 2

This site is a municipal park located on land owned by the Town of Woodbury at the confluence of the Weekeepeemee and Nonnewaug Rivers, which join to form the Pomperaug River. Athletic fields are located on the northern side of the river while a walking trail is to the south, surrounding a row crop field. Unpaved parking areas are located along Jacks Bridge Road. Wildlife and pet waste are the primary sources of bacteria in this location. The park provides waste bags and a trash receptacle at the main entrance. Access paths to the Pomperaug River appear to be frequently used. Proposed BMP concepts are shown in *Figure 4-14*.

- **Parking Reconfiguration and Additional Pet Waste Disposal.** The unpaved parking lot for the southern portion of the park has a maximum buffer width of 15 feet along the Weekeepeemee River. Moving the lot back from the river would allow widening and enhancement of the existing vegetative buffer in this area. Placement of another trash can at the halfway point of the trail is recommended as many pet owners leave their bagged pet waste on the trail for pick-up on their return to the car and often forget to pick it up.

- **Buffer Restoration.** The buffer width varies significantly across the northern and southern portions of the park. The vegetated buffer in the northern portion of the park ranges from 40 to 100 feet, averaging about 60 feet. While a wider buffer would be beneficial, expanding the existing buffer would result in the loss of parking, which may not be feasible given the popularity of the park. In the southern portion of the park, the vegetated buffer is much narrower, ranging from 10 to 60 feet. Buffer restoration is proposed along portions of the walking trail where it runs along the Weekeepeemee and Pomperaug Rivers (continuing along to Judson Avenue) to provide a more uniform width, which may require realignment of some trail segments. The park and the adjacent areas were the subject of a study conducted by the Yale School of Forestry and Environmental Studies in 2010 examining floodplain and geomorphic conditions and riparian buffer restoration.

Figure 4-14. BMP Concept: Town Park 2

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.9 Livestock 1

Between Weekeepeemee Road (South of Peter Road) and the Weekeepeemee River in Woodbury is a clustering of farm operations with several head of livestock, 17 acres of row crops, and two pasture areas. An intermittent stream passes between a fenced grazing area and the row crops. Further west, water is channelized in the row crop field, passes through the other pasture, and joins the Weekeepeemee River.

- **Buffer Restoration.** At 0.75 acres, the fenced grazing area represents the most significant source of bacteria. Several head of cattle are separated from the intermittent stream by no more than 10 feet of vegetated buffer. While available space is limited in this area, doubling the buffer width to at least 20 feet is recommended. The shade from a tree in the existing buffer area might be reduced by increasing the buffer width, so a new shelter/shade structure may also be needed.

- **Buffer Restoration.** The larger pasture area nearer the river contains a drainage channel from the upgradient row crops. Where this channel passes through the pasture area, a vegetated buffer is proposed on both sides to filter pollutants and promote infiltration. Moving the fence line to prevent grazing animals from accessing the buffer vegetation is also proposed. Proposed BMP concepts for this site are shown in *Figure 4-15*.

Figure 4-15. BMP Concept: Livestock 1

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.10 Livestock 3

Above Dowd Brook, a tributary to the Weekeepeemee River, a livestock farm maintains 10-20 head of cattle. The operation includes approximately 30 acres of hay fields and 2 acres of feeding and grazing areas. Both grazing areas represent the primary source of bacteria from this site.

- **Buffer Restoration/Filter Berm and Paddock Reconfiguration.** The feeding area passes through an intermittent tributary to Dowd Brook. Based on the observed lack of vegetative cover around bale feeders, livestock likely spend most of their time in the feeding lot. The paddock could be reconfigured to eliminate livestock access to the stream. If livestock currently use the tributary to Dowd Brook as a water source, then an alternative water supply may be required. Restoration of the existing vegetated buffer is also recommended to filter runoff. An optional filter berm could also be constructed to further retain agricultural runoff and enhance infiltration.

- **Buffer Restoration.** The grazing field slopes down toward a wetland and Dowd Brook. Livestock manure from grazing cattle could be washed down into the brook. Creation of a vegetated buffer along the eastern fence line is recommended to filter runoff and increase infiltration. Alternatively, rotating grazing between the areas could help to reduce the concentration of waste in a given area. Proposed BMP concepts for this site are shown in *Figure 4-16*.

Figure 4-16. BMP Concept: Livestock 3

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.11 Cropland/Livestock 1

This site is a 50-100 head livestock farm operated in close proximity to the water along the Weekeepeemee River in Woodbury. Exclusion fencing along the river appeared in good repair during the field visit, though dense buffer vegetation was minimal along part of the streambank. Adjacent to the river is a 2-acre feeding and grazing area. A 1-acre area of row crops and 11 acres of other hay and grazing fields are located uphill from the pasture area. Several intermittent streams flow down the hill and feed the Weekeepeemee River.

- **Buffer Restoration and Exclusion Fencing.** A vegetated buffer is proposed between the pasture and riverbank along the length of the existing fence line. The fence line would need to be reconfigured to provide enough space for the vegetated buffer. If the field surrounded by a fieldstone wall, located immediately north of the pasture area, is used for grazing, then additional exclusion fencing should be considered to restrict livestock access to the intermittent stream and to allow the buffer vegetation to regrow. An alternative water supply may also be needed if livestock rely on the stream for drinking water. Proposed BMP concepts for this site are shown in *Figure 4-17*.

Figure 4-17. BMP Concept: Cropland/Livestock 1

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.12 Cropland/Livestock 2

Located west of an unnamed tributary to the Weekeepeemee River in Bethlehem is a livestock farm with 50-100 head of beef cattle, sheep, and pigs. Livestock drink from several surface water bodies along the eastern edge of the farm, where there is also an approximately 4-acre grazing field. Direct livestock access to waterbodies can be a significant source of bacteria. A large feed lot is also located on the site. West of this area is an approximately 40-acre hay field. At the northern end of the hay field is a 1.5-acre pond. Proposed BMP concepts for this site are shown in *Figure 4-18*.

- **Buffer Restoration.** Restoration of a vegetated buffer is recommended between the existing fence line and the Weekeepeemee tributary that flows along the eastern edge of the site. A minimum 50-foot buffer is recommended in the grazing field. Using an existing fence line as exclusion fencing could allow a buffer greater than 100 feet wide. An additional buffer area is proposed between the hay field and the pond to the north.

- **Filter Berm.** Between the feeding area and the stream, a filter berm and optional bioreactor are proposed. The feeding area, which has minimal vegetative cover, would likely have higher loads of sediment, along with bacteria and nutrients attached to soil particles. Filter berms allow sediment loads to settle out of stormwater. The stormwater can then infiltrate into the soil, where further treatment can occur. A bioreactor is in essence a trench filled with wood chips that enhances nutrient removal, mainly by promoting denitrification.

Figure 4-18. BMP Concept: Cropland/Livestock 2

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.13 Equestrian 1

This site is an equestrian facility located west of the confluence of Transylvania Brook and the Pomperaug River. Two intermittent drainage channels pass through the paddocks and grazing areas on the facility. The southern-most drainage channel drains to the Audubon Center at Bent of the River and passes through a natural meadow. The northern drainage channel passes through a paddock and two grazing areas before spreading out and then entering an existing ditch and Transylvania Brook. The grazing area with the heaviest channelization (center) also appears to be used for horse trailer parking during equestrian events.

- **Buffer Restoration and Exclusion Fencing.** A vegetated buffer and exclusion fencing is proposed along the drainage channel that flows through the central portion of the property to filter runoff and reduce erosion. Some of the paddocks would need to be reconfigured to vegetated buffer and channel. New fencing and gates may also be needed for the reconfigured paddocks.

Proposed BMP concepts for this site are shown in *Figure 4-19*.

Figure 4-19. BMP Concept: Equestrian 1

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.14 Equestrian 2

This site is a large equestrian facility located along an impaired segment of the Pomperaug River in Southbury. An unnamed tributary splits the facility in two, draining from the north into a farm pond before passing through a culvert and entering the Pomperaug River. To the north along the unnamed tributary is a dairy farm.

Available space at the equestrian facility is limited and little buffer exists between paddocks and waterbodies. Good manure management practices are in place at this facility – paddocks are regularly cleaned and moved to a manure pile. At the time of the site visit, the manure pile was in close proximity to the Pomperaug River. Since then, the PRWC and Town of Southbury Inland Wetland Commission have worked with the owner of the facility to relocate the manure pile farther from the riverbank.

- **Paddock Relocation.** A paddock area is the primary bacteria source at this site, since the manure pile has been moved. This paddock is no more than 10 feet from the edge of the river, with little to no vegetative cover between the paddock and the river. Relocating this paddock to an area east of the stable should be considered, if feasible.

- **Buffer Restoration and Bank Stabilization.** Buffer restoration is proposed between the paddocks and the farm pond. A vegetated buffer is proposed to filter runoff from the paddock area. Bank erosion has also historically occurred along the Pomperaug River near the equestrian facility. Bank stabilization is also proposed.

- **Restriction of Livestock Access to Stream.** At the dairy farm to the north, it is unclear if livestock have direct access to the adjacent stream. The area on both sides of the stream appears to be fenced. Confirmation of livestock access to the unnamed tributary is recommended. If livestock access to the stream is confirmed, alternative approaches should be pursued to restrict livestock from this area.

Proposed BMP concepts for this site are shown in *Figure 4-20*.

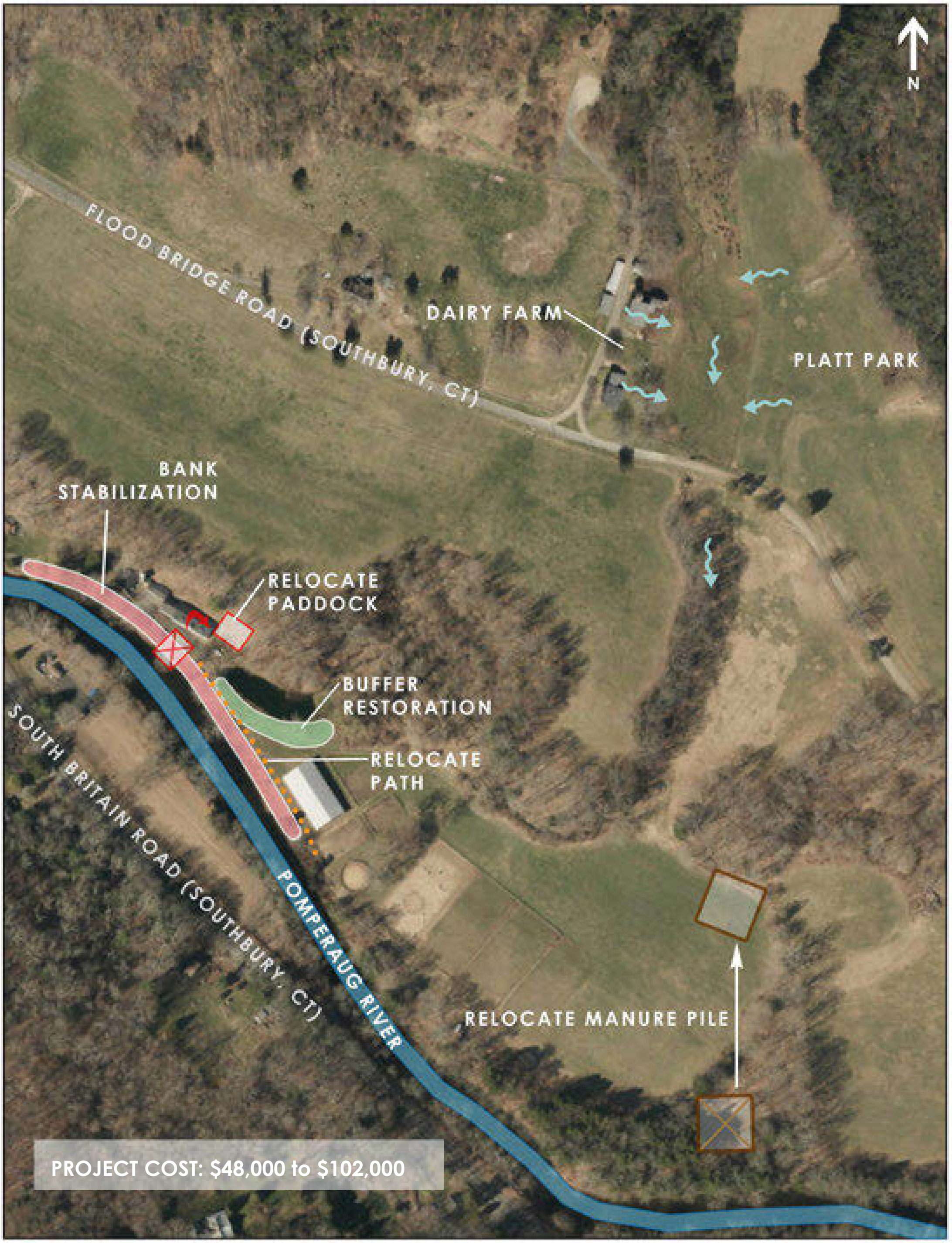


Figure 4-20. BMP Concept: Equestrian 2

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

4.15 Equestrian 7

This site is an equestrian facility with an estimated 50 horses located on Middle Road Turnpike in Woodbury. Covering approximately 60 acres, the facility includes several paddocks and fields. Three intermittent streams flow through the site, two merging in one field and flowing through a paddock and the rest of the farm before joining the third stream, which flows through the southern-most field. The stream continues to join the Nonnewaug River just north of Nonnewaug High School. Buffer widths are reasonable in some locations and manure management practices appear to be good.

- **Buffer Restoration.** Areas along portions of the on-site streams should be restored to create a relatively uniform 50-foot buffer.

- **Paddock Relocation and Exclusion Fencing.** Relocation of the paddock through which the two streams flow should be considered to accommodate an enhanced vegetated buffer. In the southern-most paddock, a reasonable buffer exists, but could be further protected from grazing by exclusion fencing. New fencing is also proposed along the proposed buffer to keep horses from grazing on the vegetation and limit access to the stream.

Proposed BMP concepts for this site are shown in *Figure 4-21*.

Figure 4-21. BMP Concept: Equestrian 7

The concepts presented in this figure illustrate potential measures that could be implemented at this and similar sites in the Pomperaug River watershed. Individual project proponents (e.g., municipalities, private property owners, developers) would be responsible for evaluating the ultimate feasibility of, as well as design and permitting for, the site-specific concepts. The measures depicted by these concepts are intended to be implemented voluntarily by willing, cooperative partners working together to protect and improve water quality. Financial and technical assistance towards the implementation of these measures may be available from sources like those listed in Appendix H.

5 Management Measures and Pollutant Load Reductions

Pollutant load reductions were estimated for the watershed plan recommendations for which pollutant loads can be reasonably quantified. Load reductions were calculated using the Watershed Treatment Model (WTM), a screening-level land use pollutant loading model described in the technical memorandum in *Appendix C*. Annual pollutant loads were modeled for existing baseline conditions (as presented in *Section 2.9* of this plan) and with the recommended management actions described below. Load reductions were calculated relative to the existing baseline pollutant loads, which are also presented in *Appendix C*. The types of management actions (and associated assumptions) evaluated for their ability to reduce pollutant loads to the Pomperaug River and its tributaries, emanating from various types of land uses and other activities/sources, include:

Pollutant Load refers to the quantity or mass of a pollutant originating from point sources (permitted outfalls) and nonpoint source runoff that is delivered to a surface waterbody in a specified amount of time. For this watershed plan, annual loads of bacteria, nutrients, and sediment were modeled for each subregional basin in the Pomperaug River watershed based on the land uses and activities/sources of pollutants in each subregional basin.

Pollutant Load Reductions are estimated reductions in pollutant loads than can be expected as a result of implementing structural controls and non-structural management practices in a watershed (collectively referred to as Best Management Practices or "BMPs"). For this watershed plan, pollutant load reductions were estimated based on modeled annual pollutant loads under existing conditions and with the recommended management actions described in this section.

- **Green Infrastructure/Low Impact Development.** Implementation of green infrastructure and Low Impact Development (GI/LID) practices is recommended throughout the watershed. GI/LID should continue to be implemented through retrofits of existing developed sites and roads (i.e., complete streets), and as part of new public and private development and redevelopment in the watershed, as required by existing and future land use regulations and policies. Potential pollutant load and runoff reductions were estimated under multiple scenarios to estimate the effect of varying levels of GI/LID implementation across the watershed, including estimates for retrofitting 10%, 25%, 50%, and 100% of the impervious area watershed-wide using stormwater infiltration treatment practices.

- **Vegetated Buffer Restoration.** Potential pollutant load reductions were estimated for restoration of impacted vegetated buffers in suburban areas and agricultural uses in the watershed. The total length of streams with impacted buffers was estimated from land cover data. Under the modeled restoration scenario, a 50-foot vegetative streamside buffer was assumed for 50% of those areas currently with impacted buffers (i.e., 50% restoration scenario).

- **Public Education.** Nonpoint source education programs can change behaviors that affect pollutant loads. Pollutant load reductions were estimated for pet waste education programs based on the number of dwellings, average fraction of pet-owners, pet-owners who already clean up after their pets, and an average fraction of those willing to change their behavior. Conservative model assumptions were used to avoid over-estimating the load reduction benefits of these programs.

- **Illicit Discharge Detection and Elimination.** Illicit connection removal was modeled based on the existing estimated number of illicit connections associated with commercial and residential land uses. The illicit connection removal scenario conservatively assumes that 15% of the existing illicit discharges are detected and eliminated.

- **Septic System Repairs.** Septic system repairs were modeled based on the existing estimated number of households served by septic systems. The septic system repair scenario assumes that 20% of failing or malfunctioning septic systems are repaired. This scenario reflects short- or mid-term recommendations to address existing failing or malfunctioning septic systems.

Other watershed management recommendations identified in this plan were not quantified due to the inherent limitations of screening-level pollutant load models and/or the lack of reliable information on the pollutant removal effectiveness of certain management measures.

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 overall Pomperaug River watershed (regional basin).

As indicated in *Table 5-1*, the watershed plan recommendations are predicted to result in an approximately 11% reduction[1] in annual fecal indicator bacteria loads for the entire Pomperaug River watershed assuming implementation of green infrastructure for 10% of the impervious area in the watershed. Of this 11% reduction, 6% is attributable to buffer restoration, approximately 2% to green infrastructure, approximately 1% to elimination of illicit discharges, and the remainder to other structural and non-structural nonpoint source pollution control measures.

Varying levels of GI/LID implementation across the watershed were modeled to manage runoff from 10%, 25%, 50%, and 100% of the impervious area in urbanized land uses. The results for the 10% scenario, which is considered a reasonable future scenario, are included in *Table 5-1*. The results for all four scenarios are presented in *Table 5-2*. The 10% retrofit scenario is predicted to result in an approximately 1.5% reduction in annual fecal indicator bacteria loads and 0.5% reduction in annual runoff volume. Higher bacteria load reductions (up to approximately 19%) could potentially be achieved by implementing GI/LID over a larger percentage of the watershed.

Illicit discharge detection and elimination (IDDE) is also predicted to result in annual bacteria load reductions comparable to a 10% GI/LID scenario. Even the modest 15% illicit discharge removal rate assumed in the model is predicted to achieve an approximately 1% reduction in annual fecal indicator bacteria loads. IDDE is generally more cost-effective than implementing structural stormwater retrofits. Dry weather sources of fecal indicator bacteria are the most likely to be identified and effectively managed and more likely to include human sources. Wet weather bacteria sources are often very challenging to identify and costly to address due to the contribution from large quantities of stormwater and other diffuse, nonpoint sources. Stream standards can also be difficult to attain during wet weather given the ubiquitous nature of wet weather bacteria sources. IDDE and other source controls focusing on dry weather bacteria sources should be aggressively implemented through municipal stormwater management programs (as required by the MS4 permit) in conjunction with green infrastructure to help address for wet weather bacteria sources.

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[1] A 10.5% "effective" reduction in annual fecal indicator bacteria loads is predicted. Effective load reductions are realistically-achievable reductions that account for the natural background pollutant load. 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.

Table 5-1. Modeled annual pollutant load reductions for the Pomperaug River watershed for proposed BMPs

Watershed Management Recommendation	Fecal Coliform (billion/year)	Fecal Coliform (%)	Runoff Volume (acre-feet/year)	Runoff Volume (%)
Green Infrastructure (10% of impervious area)	16,000 - 22,000	1.3 - 1.8	147 - 330	0.3 - 0.7
Riparian Buffer Restoration (50% of watershed, 50 foot width)	73,000	6.0	1,432	3.0
Livestock BMPs	13,000	1.1	--	--
Public Education	10,500	0.9	--	--
Illicit Discharge Detection and Elimination (IDDE)	11,000	0.9	--	--
Septic Repair	900	0.1	--	--
Total	**134,400 - 140,400**	**10.25 - 10.75**	**1,579 - 1,762**	**3.1 - 3.7**

Table 5-2. Modeled annual pollutant load reductions for varying levels of GI/LID implementation

Green Infrastructure Implementation Scenario	Fecal Coliform (billion/year)	Fecal Coliform (%)	Runoff Volume (acre-feet/year)	Runoff Volume (%)
Retrofit 10% of Impervious Area	16,000 - 22,000	1.3 - 1.8	147 - 330	0.3 - 0.7
Retrofit 25% of Impervious Area	40,000 - 56,000	3.3 - 4.6	367 - 826	0.8 - 1.7
Retrofit 50% of Impervious Area	79,000 - 112,000	6.6 - 9.2	734 - 1,652	1.5 - 3.4
Retrofit 100% of Impervious Area	159,000 - 224,000	13.1 - 18.5	1,468 - 3,304	3.1 - 6.9

Modeled Load Reductions and TMDL Load Reduction Targets

A Total Maximum Daily Load (TMDL) analysis for fecal indicator bacteria was completed for the Pomperaug and Weekeepeemee Rivers as part of CTDEEP's Statewide Bacteria TMDL. A TMDL is a "pollution budget" that identifies the reductions in point and nonpoint source pollution that are needed to meet Connecticut water quality standards for a particular waterbody and a strategy to implement those reductions to restore water quality. The Statewide Bacteria TMDL calls for a 48-65% reduction in fecal indicator bacteria loads (based on the geometric mean) to the various impaired segments within the Pomperaug watershed.

The pollutant load modeling results indicate that fecal indicator bacteria load reductions of roughly 11% are achievable with full implementation of the watershed management plan recommendations (under the 10% GI/LID implementation scenario). This suggests that additional controls or more aggressive control strategies are needed to fully achieve the load reductions specified in the TMDL. Additional load reductions may be achieved through implementation of GI/LID over a larger portion of the watershed, additional vegetated buffer restoration, increasing the public awareness in the watershed of certain best management practices and programs, and increased detection and elimination of illicit discharges.

It is important to note several limitations of both the TMDL load reduction estimates and the pollutant load reduction modeling. The TMDL is based on very limited wet and dry weather monitoring data for Pomperaug-01 and the Weekeepeemee River: fewer than five and ten samples were collected during wet and dry weather, respectively. Data collection efforts were more comprehensive for Pomperaug-03, biweekly samples collected during the summer between 2006 and 2009, but are a decade or more old.

Further, the TMDL and modeled load reductions are not directly comparable since the TMDL load reductions targets are daily, seasonal (i.e., worst-case) values, whereas the modeled pollutant loads are annual values. The modeled load reductions are also based on the use of fecal coliform rather than *E. coli*, the latter being a subset of fecal coliform which is more specific to humans and other warm-blooded animals. *E. coli* is the indicator bacteria for freshwater monitoring in Connecticut and was used in the TMDL.

As indicated in the TMDL, progress in achieving TMDL-established goals through implementation of this watershed plan may be most effectively gauged through continued fixed-station ambient water quality monitoring. A key recommendation of this watershed plan is to establish and implement a routine bacterial monitoring program at fixed stations in the watershed (refer to *Section 3.2* of this plan). The bacteria monitoring program will provide an updated baseline of recreational water quality in the watershed to support implementation of the watershed based plan and to measure progress toward achieving TMDL pollutant load reduction goals. Further coordination between PRWC and CTDEEP is also recommended to discuss the watershed based plan findings, recommendations, and modeled potential load reductions relative to the TMDL reduction goals and implications for proposed bacteria monitoring locations.

6 Funding Sources

A variety of local, state, and federal sources and private foundations are potentially available to provide funding for implementation of this watershed management plan, in addition to potential funds contributed by local grassroots organizations and concerned citizens. *Appendix H* contains a list of potential funding sources and mechanisms. 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 based plan. 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. Potential funding sources for specific recommendations are also listed in the tables in *Section 3* of this plan.

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Additional references for existing plans and studies on the Pomperaug River watershed are listed in Table 1-1 of this plan.

Appendix A

Quality Assurance Project Plan

Pomperaug River Watershed Based Plan

Quality Assurance Project Plan
Field Assessments, Modeling, and Analysis

In support of:

Pomperaug River Watershed Based Plan
CTDEEP No. 13-04b

Pomperaug River Watershed Coalition
Woodbury, Connecticut

May 3, 2017

FUSS & O'NEILL
146 Hartford Road
Manchester, CT 06040

Project No. 20160005.A10

FUSS & O'NEILL

Quality Assurance Project Plan
Field Assessments, Modeling, and Analysis
Pomperaug River Watershed Based Plan
May 3, 2017

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Date

William Guenther, Fuss & O'Neill, QA Manager

May 2, 2017
Date

Quality Assurance Project Plan
Field Assessments, Modeling, and Analysis
Pomperaug River Watershed Based Plan
May 3, 2017

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C	Watershed Treatment Model Manual
D	Model Input Data Needs and Sources

Distribution List (A3) – Quality Assurance Project Plan – Pomperaug River Watershed Based Plan

The approved Quality Assurance Project Plan (QAPP), and any subsequent updates, will be distributed to the following individuals by electronic mail:

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1 Section A – Project Management

1.1 Project Task Organization (A4)

The project that is the subject of this Quality Assurance Project Plan (QAPP) is being led by the Pomperaug River Watershed Coalition (PRWC). Fuss & O'Neill (F&O) is assisting with the development of a QAPP and the execution of the project. Key individuals and an organizational chart are presented in **Table 1** and **Figure 1**. All references to "Project Staff", "Project Managers", and "Project QA Managers" are associated with Fuss & O'Neil staff throughout the document.

Table 1. Project Team Responsibilities

Person/Entity	Project Title/Responsibility
Carol Haskins Pomperaug River Watershed Coalition	Project Manager – Overall manager leading the project for the Pomperaug River Watershed Coalition (PRWC), review/approval of final work products.
Steven Winnett US EPA – Region 1	EPA Project Manager– General project oversight.
Bryan Hogan US EPA – Region 1	EPA QA Manager – Reviews and approves QAPP and subsequent revisions.
Charles Lee CTDEEP	CTDEEP Project Manager – General oversight, final review/approval of all final work products.
Susan Peterson CTDEEP	CTDEEP Project Manager – General oversight, final review/approval of all final work products.
Christopher Bellucci CTDEEP	CTDEEP QA Manager – Reviews and approves QAPP and subsequent revisions.
Erik Mas Fuss & O'Neill	Project Manager/Principal-In-Charge – Project management, oversight of all visual assessments, modeling, and reporting activities. Maintains the official QAPP.
William Guenther Fuss & O'Neill	QA Manager – Quality assurance, data evaluation to ensure compliance with this QAPP.

Staff members within each organization will report to their project manager for technical and administrative direction. Each staff member is responsible for the performance of any assigned duties in the course of completing identified sub-tasks within the overall project. Quality control duties include:

- Completing assigned tasks on or before schedule.
- Completing assigned tasks in accordance with established procedures.
- Assuring that the work performed is technically correct and conforms to the applicable requirements of this QAPP.

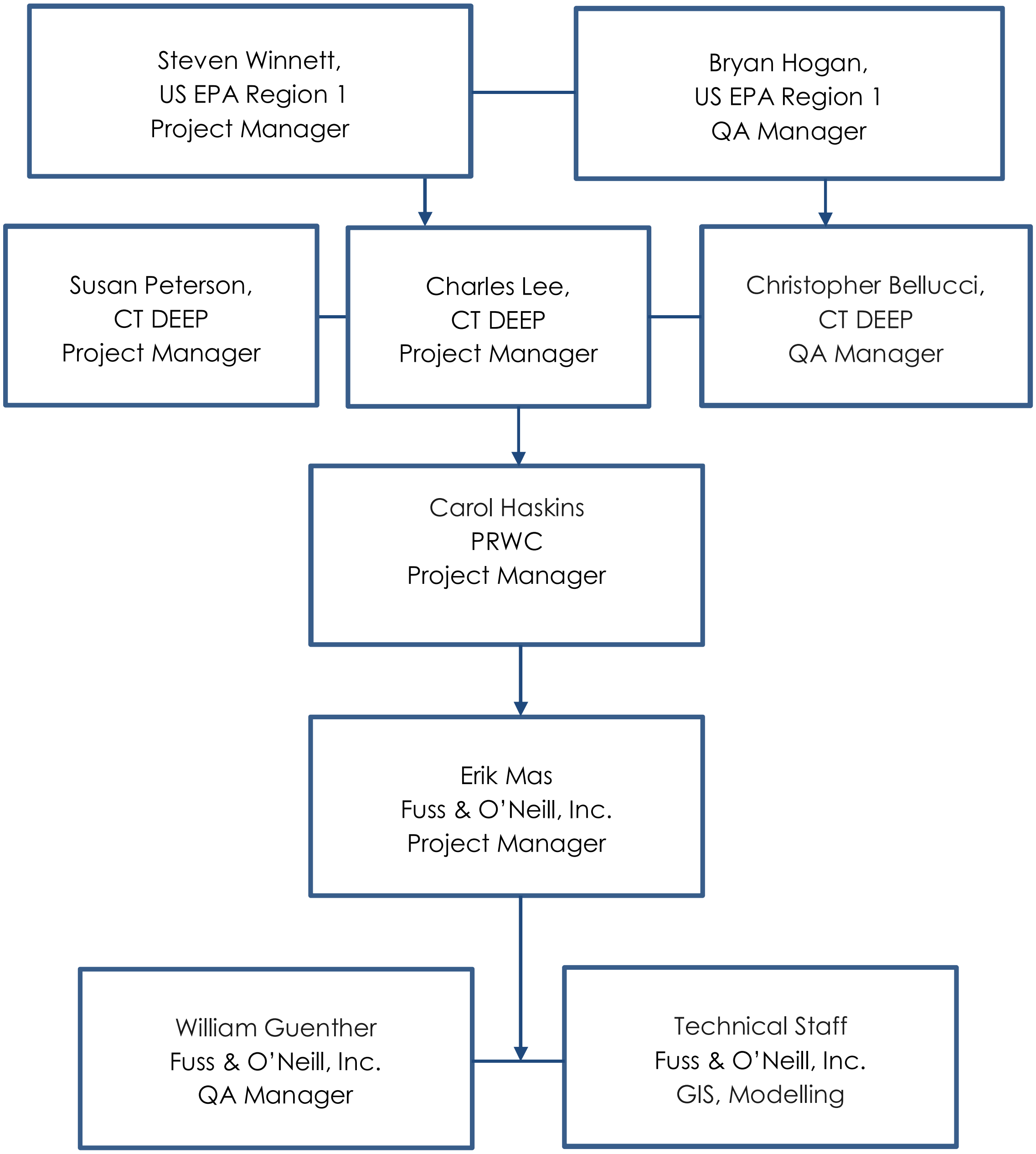


Figure 1. Project Organizational Chart

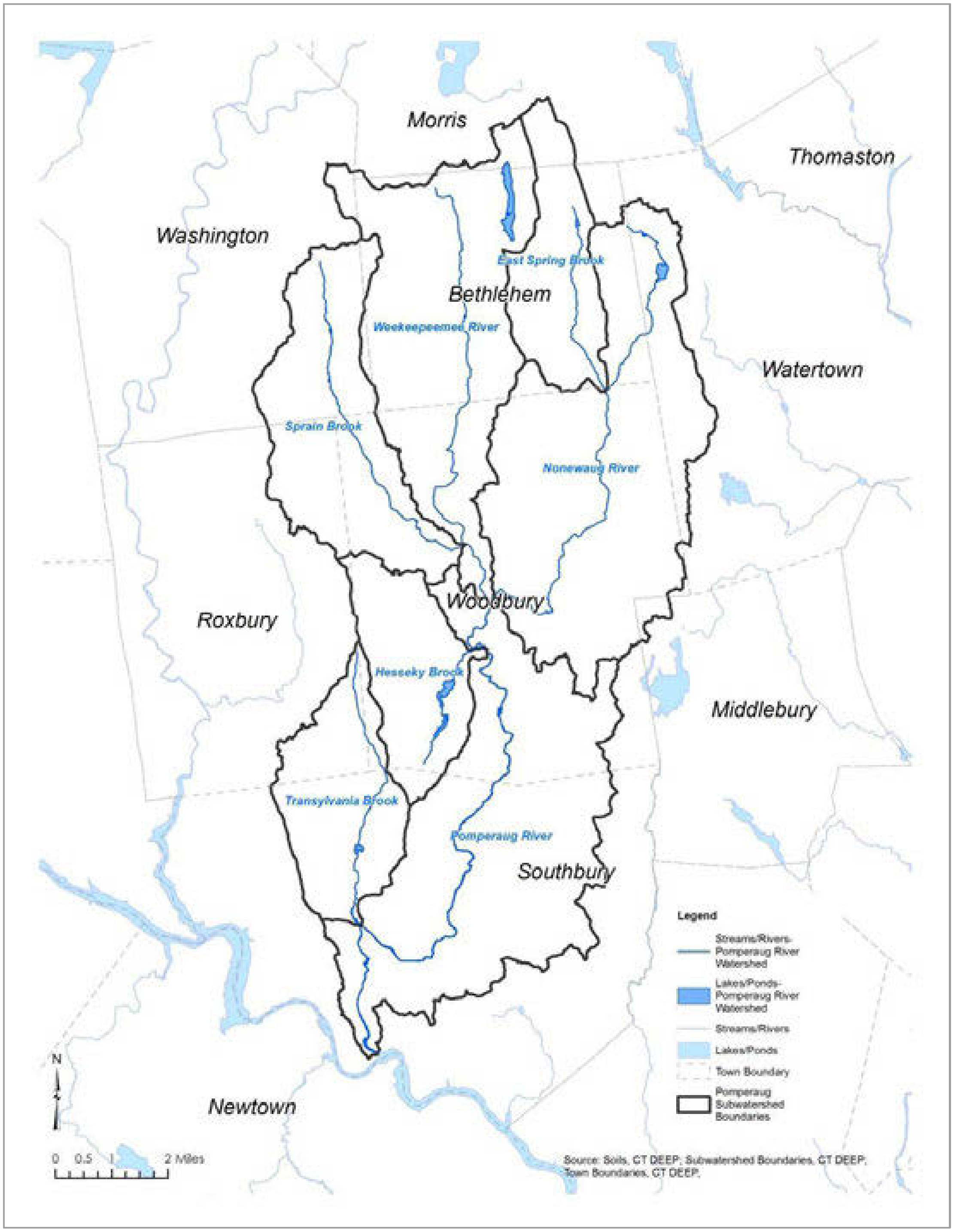
1.2 Problem Definition/Background (A5)

This QAPP provides a framework for assessing the quality of data obtained from visual assessment surveys and manipulation of existing data (i.e., secondary data/mapping and modeling) in support of the development of a watershed based plan for the Pomperaug River watershed consistent with the Connecticut Department of Energy and Environmental Protection (CTDEEP) and United States Environmental Protection Agency (EPA) criteria for a Nine-Element Watershed Based Plan. The plan will incorporate historical water quality data and statewide bacteria Total Maximum Daily Load (TMDL) information for the Pomperaug River and prioritize implementation projects to reduce pollutant loads. The ultimate goal of the watershed plan is to delist impaired segments of the Pomperaug River and its tributaries from the Impaired Water List. The watershed plan is funded in part by the CTDEEP and EPA through an EPA Clean Water Act Section 319 Nonpoint Source Grant.

The Pomperaug River Watershed is located in Western Connecticut in Litchfield and New Haven Counties. The 90-square mile regional basin includes parts of eight Connecticut towns in the lower central Housatonic Valley (**Figure 2**). Three segments of the Pomperaug River and two segments of other tributaries within the watershed (Weekeepeemee River and Transylvania Brook) are listed as impaired for recreation in the CTDEEP 2014 Integrated Water Quality Report. These impairments are the result of elevated bacteria levels. Specific sources of bacteria have not been identified, but are expected to include permitted discharges, illicit discharges, agriculture, failing septic systems, nuisance wildlife and pets, and stormwater runoff. Additional segments within the watershed have not been assessed, but may have similar water quality issues as the assessed segments, especially those with similar land uses.

Due to the documented bacterial impairments within the watershed, the CTDEEP has included the Pomperaug and Weekeepeemee Rivers in its statewide bacteria Total Maximum Daily Load (TMDL). The watershed has also been impacted by physical alterations to streamflow and alteration of the river floodplain. Potential future flow alterations, including permitted water withdrawals, may potentially impact habitat and interrupt other uses of the river.

In 2006, the PRWC prepared a Watershed Management Plan. Fuss & O'Neill will use the 2006 plan along with studies and models previously developed in the watershed to develop a new watershed plan that conforms to the EPA 9-element requirements. The effort will include collection and review of existing studies to characterize non-point source pollution in the watershed and identify load reduction goals. The plan will also identify potential sites for water quality Best Management Practices (BMPs) and develop implementation strategies for up to 15 priority projects.



Source: Soils, CT DEEP; Subwatershed Boundaries, CT DEEP; Town Boundaries, CT DEEP.

Figure 2. Pomperaug River Watershed

To effectively use the limited project funds available for the updated Pomperaug River Watershed Plan, Fuss & O'Neill will be focusing the watershed assessment and identification of BMPs on the impaired segments of the Pomperaug River and its tributaries, as well as the primary pollutant of concern for the watershed- indicator bacteria. The objective of the watershed plan update is to identify specific sources of bacteria within the subwatershed areas of the impaired stream segments of the Pomperaug River, Transylvania Brook, and Weekeepeemee River and develop management actions to address these sources. Recommended actions will include both structural and non-structural BMPs. In addition, the plan will emphasize the use of green stormwater infrastructure which has significant potential to address water quality and related issues in the Pomperaug River Watershed. Fuss & O'Neill will prioritize recommended actions to develop cost-effective implementation strategies, get early buy-in from watershed municipalities, identify short- and long-term funding sources for plan implementation, and produce a high quality finished product that is understandable to the general public. The data collection efforts described in this QAPP is needed to support this study and incorporate direct data collection (visual assessments) and secondary data collection, including modeling.

1.3 Project/Task Description (A6)

This QAPP addresses field assessments (collection of direct measurements), manipulation of existing data (secondary data), and pollutant load modeling to identify causes of water quality impairments and assist in targeting best management practices in the Pomperaug River watershed. A schedule for these tasks is provided in **Table 2**. Data collection efforts would begin following approval of the QAPP. Note that this schedule may be adjusted as the project progresses.

Table 2. Project Implementation Schedule

Task	Responsible Party	Estimated Start Date	Deliverables	Est. Completion Date
Field Assessments (See Section 1.3.3)	Fuss & O'Neill	June 2017	Field assessment forms and supporting maps/graphics – included in draft plan	July 2017
Manipulation of Secondary Data (See Section 1.3.2)	Fuss & O'Neill	May 2017	Prioritized locations for field assessments - included in draft plan	June 2017
Pollutant Load Modeling (See Section 1.3.3)	Fuss & O'Neill	May 2017	Pollutant loading by subwatershed - included in draft plan	June 2017

1.3.1 Field Assessments

Screening-level field investigations of the Pomperaug River watershed will be conducted by a two-person team using the Center for Watershed Protection (CWP) Unified Stream Assessment (USA) Unified Subwatershed and Site Reconnaissance (USSR) methods (Kitchell & Schueler, 2005; Wright et al., 2005). Areas to be assessed include stream corridors and upland areas that are known or suspected of contributing to the water quality impairments in the watershed. Areas to be assessed will be selected by the project team based on review of existing data and information on watershed land use, water quality impairments, and pollutant sources including the findings of previous volunteer streamwalk assessments in the watershed. The following CWP field assessment forms/procedures will be used (see the field data forms provided in **Appendix A** of this QAPP):

- Reach Level Assessment (stream corridor).
- Neighborhood Source Assessment (residential areas).
- Hotspot Site Investigation (commercial, industrial, agricultural, institutional land use).
- Pervious Area Assessment (schools, parks, vacant land).
- Streets and Storm Drains (drainage systems).

Locations of potential pollutant sources will be recorded with a Trimble GeoXT Sub-meter GPS receiver (“GPS”).

The field assessments will help identify pollutant sources, riparian impairments, and potential corrective actions, such as restoration, pollution prevention, and retrofit opportunities in the stream corridor and upland portions of the watershed to reduce watershed bacteria and pollutant loads to the impaired segments of the Pomperaug River, Transylvania Brook, and Weekeepeemee River.

1.3.2 Secondary Data Manipulation

Existing data and previous studies (i.e., secondary data) will be used as follows in support of this project:

- Baseline watershed conditions as described in the 2001 State of the Watershed Report and the 2006 Pomperaug River Watershed Management Plan will be updated to reflect current water and land use conditions.
- Areas to be investigated through the use of visual field assessments (see Section 1.3.1) will be selected by the project team based upon review of existing data and previous studies on watershed land use, water quality impairments, and pollutant sources, including identified data gaps.
- Inputs to the pollutant loading model described in Section 1.3.3 will be derived from available land use and land cover data and other watershed-specific information.

- The extent of impacted buffers along the impaired stream segments in the watershed will be conducted using existing GIS data from the UConn CLEAR program and land owner information available from the Naugatuck valley Council of Governments (NVCOG).

The secondary data and existing studies that will be used for this project include, but are not necessarily limited to:

- Existing data on water quality in the waterbodies, their tributary streams, and watersheds collected by other agencies including, but not limited to, PRWC, CTDEEP, University sponsored research studies and reports, Non-profit organization reports (Soil & Water Conservation District (SWCD), and Environmental Review Team (ERT), 2010 Streamwalk Assessment- Pomperaug River Watershed Volunteer Streamwalk Program, Monitoring data collected by the USGS, and other studies supported or commissioned by the PRWC, including instream habitat assessment completed by the University of Massachusetts.
- Land use and Land cover data (either parcel-based land use available from the Naugatuck Valley Council of Governments (NVCOG) or University of Connecticut Center for Land Use Education and Research (CLEAR) satellite-derived land cover data).
- Water Quality Monitoring Data – Data for the watershed and impaired segments collected by other agencies, institutions, and companies such as the CTDEEP and the U.S. Geological Survey. Data sources include published reports and databases. The data may be used in its entirety or limited to a specific time period. All data will be assessed for adequate quality prior to being used.
- Pollutant Loading and BMP Effectiveness – Data taken from peer-reviewed literature values will be used to support the modeling of watershed loads, load reductions from BMPs, and BMP cost-effectiveness.
- Watershed Mapping Data – CTDEEP's Environmental GIS Data Set, UConn MAGIC, and UConn CLEAR will serve as the primary sources of data for watershed mapping. The GIS data will be augmented by GIS mapping available from the watershed municipalities and the Naugatuck Valley Council of Governments (NV COG), as necessary.
- Data on the physical characteristics of impaired stream segments from CTDEEP, U.S. Geological Survey, and PRWC.

All data sources will be identified and fully referenced and all metadata, if applicable, will be included in the final report for the project.

1.3.3 Pollutant Load Modeling

A surface runoff pollutant loading model will be developed for the Pomperaug River watershed to help target the sources of impairments in the watershed, guide the selection of bacteria load reduction measures, and quantify the anticipated load reductions associated with the plan recommendations for structural and non-structural controls in the watershed. The model will be used to assist in identifying, prioritizing, and evaluating watershed pollution control strategies. The pollutant loading evaluation will simulate average annual surface runoff pollutants loads within the watershed by using existing and future loads calculated using the Watershed Treatment Model (WTM), Version 3.1 (or most recent available) developed by the Center for Watershed Protection. Existing pollutant loads will be calculated from available land use and land cover data and other watershed-specific information. Although bacteria is the focus of this study, the WTM also calculates pollutant loads for total phosphorus, total nitrogen, and sediment. Other pollutants can be included as custom additions to the WTM.

WTM calculates watershed pollutant loads primarily based on nonpoint source (NPS) runoff from various land uses. The model can also be used to estimate pollutant loads from other sources, including:

- Illicit Discharges.
- Septic Systems.
- Sanitary Sewer Overflows.
- Managed Turf.

Reductions in future pollutant loads in the watershed can be estimated using a range of treatment measures, such as structural and nonstructural best management practices, that are included in the WTM.

Other similar screening-level pollutant loading models were considered for use in this project, including the Spreadsheet Tool for the Estimation of Pollutant Load (STEPL), the Generalized Watershed Loading Function (GWLF) model, and other similar models. It was determined that the WTM is better suited for use with this project because it provides a larger suite of watershed best management practices. The ArcView GIS version of the GWLF model was also considered for use in the project, but the WTM model was determined to allow for more transparency and simplicity of use for this watershed.

The WTM uses the Simple Method to calculate nutrient, sediment, and bacteria loads from various land uses. The user specifies several model parameters for each land use in the watershed to estimate runoff quantity and pollutant levels. These parameters include Event Mean Concentrations (EMCs), which are literature values for the mean concentration of a pollutant in stormwater runoff for each land use, and an average impervious cover percentage for each land use. The Watershed Treatment Model manual is included in **Appendix C** of this QAPP.

A literature review will be conducted to determine EMC values and impervious percentage values for use in the evaluation. The default impervious cover coefficients in the WTM will be adapted as necessary to better reflect local conditions in the watersheds. All modeling methods will be documented as required in *Section 1.7.2*. Summaries of the specific model input parameters and identified sources of information for those parameters are included in **Appendix D**.

1.4 Quality Objectives and Acceptance Criteria (A7)

1.4.1 Direct Data Measurements

Data Quality Objectives (DQOs) for field assessments of watershed conditions rely on quasi-subjective assessments by field personnel. Accuracy, precision, completeness, representativeness, and comparability of visual assessments of watershed conditions will be assessed through the collaborative consensus of the staff performing those assessments consistent with the methodologies described in the Center for Watershed Protection Urban Subwatershed Restoration Manual Series (2005-2008). The Unified Stream Assessment (USA) and Unified Subwatershed and Site Reconnaissance (USSR) user's manuals and field data sheets are available for download at http://owl.cwp.org/. Field data sheets for visual assessments that are proposed as part of this project are provided in **Appendix A** of this QAPP.

1.4.2 Non-Direct Data (Secondary and Modeling) (A7; B9)

Assessing whether the DQOs have been achieved for secondary data collection and modeling is somewhat different than direct data collection. For indirect/secondary data, important features include documentation that the data meets the needs of the project and that data quality is high and data limitations are known. The usual data quality indicators (e.g., completeness, representativeness, comparability) can be met if metadata is available or data was collected under a QAPP or Standard Operating Procedure (SOP). For modeling, the data quality indicators are often difficult to apply and in many cases do not adequately characterize model output. The ultimate quality test for the model is whether the output sufficiently represents the natural system that is being simulated.

1.4.2.1 Secondary and Modeling Data Acceptance Criteria

The following criteria will be considered for acceptance of secondary data used in the project:

- Data generated by a reliable source, from a data generator that is generally trusted and respected, including federal, state, and local agencies, or research institutions, and data published in peer-reviewed articles or publications.
- All model input and parameterization (calibration) and corroboration (validation and simulation) data for the model will be of a known and documented quality.
- Data for modeling will be collected from as many sources as available, and provide the maximum temporal and spatial coverage of the watershed, if necessary and applicable.
- The data will be comparable with respect to previous studies.
- Modeling data will be representative of the parameters being measured with respect to time, location, and the conditions from which the data are obtained.

- Data have been collected for purposes similar to this project (i.e., to estimate BMP performance, etc.).
- Data was collected using a QAPP or similar plan.
- Data has been widely used and/or trusted by scientists and professionals in the subject area.

The following decision tree (**Figure 3**) will be used to assess the quality of secondary data. In general, the completeness of the data set will be assessed first, either by inspecting the metadata or the dataset itself.

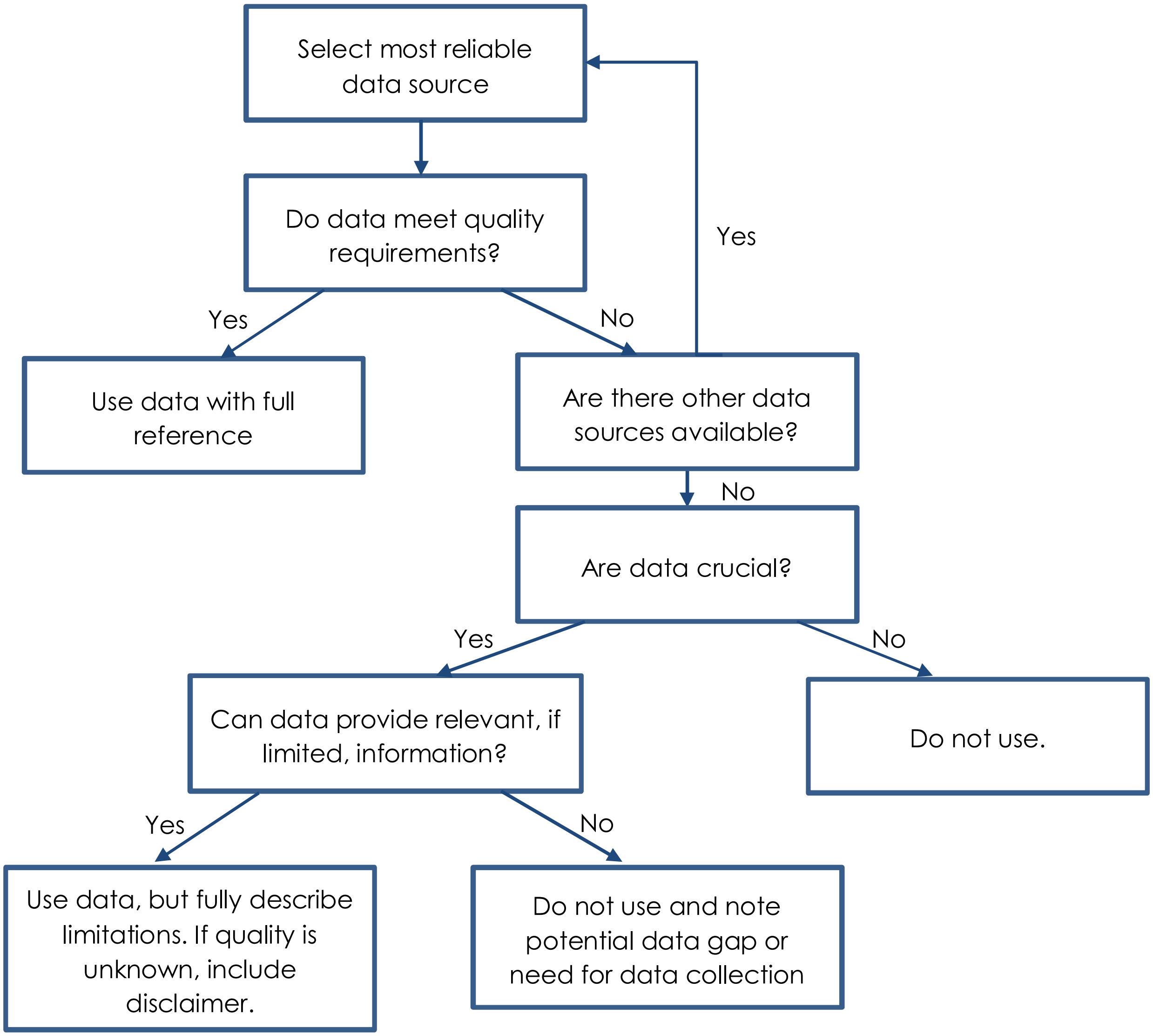


Figure 3. Data Decision Tree

If completeness is adequate, then other requirements will be assessed based on information available from the data providers or accompanying the dataset.

All project deliverables will reference the existence of this QAPP and limitations on known data quality will be fully disclosed as a disclaimer in the project deliverable.

1.4.2.2 Secondary and Modeling Data Reduction

Data alteration and reduction will be avoided to the maximum extent practicable. The types of data reduction/alteration anticipated for this project include the following:

- Data units may need to be changed for report consistency, to allow comparisons, or for use in model input.
- Certain data sets may be reduced and represented as percentages (i.e., percent of a land use type).
- Some data reduction may be used to display data in map form (i.e., average values at a site).
- Some data may be reduced for comparison with a water quality benchmark.

1.4.2.3 Secondary and Modeling Data Validation

The following measures will be taken to ensure the quality of secondary and modeling data:

- A copy of every secondary data set will be saved as a read-only, protected file to be used in the event that the integrity of the working dataset is compromised.
- Working data will be stored in a spreadsheet or ArcGIS format and will include relevant raw data, which will be locked for editing.
- Data manipulation will be minimized, but when necessary, data manipulation will start with raw data, and all formulas including units, conversion factors, and formulas will be shown in the spreadsheet.
- Prior to including in project deliverables, raw and reduced data will be displayed in graphic format and inspected to look for anomalous values. Any decision to eliminate anomalous values will be documented in the spreadsheets and will be noted in the project deliverables.

1.4.3 Modeling Data Quality Objectives

The use of existing data of known quality in modeling efforts is extremely important and helps ensure that the modeling yields accurate predictions with an acceptable level of model uncertainty. This modeling effort uses no water quality data for calibration or validation. Because of the type of data used for watershed pollutant loading and BMP efficiency modeling, the data to be used will consist of data previously collected by state and federal agencies. Data that has been collected in accordance with a QAPP or appropriate SOPs is generally appropriate for this study. Any data that does not have a QAPP or SOP, or data of unknown quality (i.e., collected without a documented QAPP or using SOPs not approved by state or federal agencies) will be flagged and noted as either conditionally acceptable for limited use or not acceptable for use at all.

The Data Quality Objectives (DQOs) can be further refined in order to define performance criteria that limit the probability of making decision-based errors. They address the data validity and reliability of the modeling effort and each is briefly described below in the context of completeness, representativeness, and comparability. The traditional context of precision and accuracy is not included due to the fact that, in most cases, the data has already been collected and analyzed through acceptable analytical procedures by state and federal agencies.

Completeness is a measure of the amount of valid input data obtained during a process. The target completeness for models will be 100 percent – e.g. all available sources included. Note that in this case, the available data is relatively limited, i.e., available from a single source. The actual completeness may vary depending on the intrinsic availability of monitoring data. Deficiencies in meteorological or stream flow data are outside of the control of the modeling effort and will be addressed as part of the data compilation and assessment effort. This modeling project proposes to use only data sources provided by federal, state and municipal agencies. Data that is intentionally excluded from use or analysis will be noted in the modeling journal and report.

Representativeness is a measure of how closely the input or parameterization (calibration) data will reflect the physical characteristics of the watershed over time. Standardized monitoring plan design and the use of Standard Operating Procedures (SOPs) for soils identification, land cover mapping, and acquisition of weather data are crucial to ensuring representative data quality. All applicable model input or parameterization data sources will have a QAPP in place or be of documented quality prior to use in the modeling effort. Data of unknown quality (i.e., collected without a QAPP or using SOPs not approved by state or federal agencies) will be flagged and noted as either conditionally acceptable for limited use or not acceptable for use at all.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability from external sources is very much tied to the individual project methodology and time at which it was collected. For the purpose of the modeling effort, comparability will be maintained by using consistent units, appropriate temporal scales, and reproducible methods. Unit conversions, datum transformations, and grid re-projections may be required to make data for the modeling comparable. Any required data transformations will be noted in the modeling journal and report. Information that exists outside a reasonable temporal scale, has been significantly changed, or will potentially diminish the modeling results are not comparable. Fuss & O'Neill will make these determinations using best professional judgment, as necessary. Comparability between other model indicators will be evaluated on a case-by-case basis. In most cases, data of a particular type will be obtained from a single source, reducing issues of comparability.

Acceptance Criteria for Model Parameterization (calibration)

Some models are "calibrated" to a set of specific parameters. Calibration is defined as the process of adjusting model parameters within defensible ranges until the resulting predictions give the best possible fit to the observed data. The acceptance criteria for model parameterization (calibration) define the procedures whereby the difference between the predicted and observed values of the model are within an acceptable range, or are optimized. This can occur either qualitatively or quantitatively and documented accordingly (USEPA 2009). Often parameterization is the only method to ensure that model predictions correlate with values observed in the field or within ranges documented in scientific studies. Parameterization uses observed data in a systematic search for parameters that yield an acceptable fit of computed results. This search is performed to find a reasonable best estimate that will yield the minimum value of an objective function, or variable that is critical in an application. In this modeling project, that variable is pollutant loading.

Parameterization has become increasingly important with the need for valid and defensible models. Each time a model is calibrated, it is potentially altered. Therefore, all calibrations will be documented in the modeling journal, including the approaches taken (e.g. qualitative versus quantitative) along with the acceptance criteria. Because of the nature of the modeling to be performed as part of this project, calibration will consist of use of engineering professional judgment in the comparison of modeled values with typical pollutant loading models for similar land use in southern New England. As such, no formal acceptance criteria are proposed for the modeling elements of the study.

All adjustments made to model parameters will be properly documented in the project modeling journal and modeling report, describing how the calibration was conducted and tested for acceptance.

Model Corroboration (Validation)

Corroboration (validation) is defined as the comparison of modeled results with independently derived numerical observations from the simulated environment. In this project, that would be a comparison of modeled pollutant loads and load reductions with observed loads and load reductions. Model corroboration is an extension of the parameterization (calibration) process. Its purpose is to assure that the calibrated model properly assesses the range of variables and conditions that are expected within the simulation.

Because of the nature of the modeling to be performed as part of this project, validation will consist of use of engineering professional judgment in the comparison of modeled values with typical pollutant loading for similar land use in southern New England. As such, no formal acceptance criteria are proposed for the modeling elements of the study.

Model Sensitivity

Sensitivity analysis determines the effect of a change in a model input parameter or variable on the model outcome. The sensitivity of a model parameter is typically expressed as a normalized sensitivity coefficient (Brown and Barnwell, 1987). One methodology for identifying the sensitivity of a model parameter is shown below.

$$\text{Normalized Sensitivity Coefficient (NSC)} = \frac{\Delta Y_o / Y_o}{\Delta X_I / X_I}$$

Where:

ΔY_o = Change in the output variable Y_o
ΔX_i = Change in the input variable X_i

Fuss & O'Neill will qualitatively assess the sensitivity of model parameters during manual parameterization (calibration) through parameter perturbation and will document the results in the modeling journal. A summary of model sensitivity will be included in the final modeling report. Details will include the variables modified for model parameterization (calibration), the percent modification (e.g. ± 10%), percent change in the modeling results, and the normalized sensitivity coefficient (NSC).

Model Uncertainty

Uncertainty is broadly defined as the lack of knowledge regarding model input parameters and the processes the model attempts to describe. Ability to define model uncertainty is marginalized by the limited ability to accurately describe complex processes. As a result, all engineering computations are subject to a degree of uncertainty due to the simplification of natural process and the limitations of input and parameterization (calibration) data. Computed values differ from observed ones, and the magnitude and frequency of these differences characterize the uncertainty of the best model estimate. Uncertainty analysis is the terminology associated with the examination of how the lack of knowledge in model parameters, variables, and processes propagates through the model structure as model output or forecast error. Sources of model uncertainty will be characterized by Fuss & O'Neill during the initial stages of planning in order to better understand how the model input data and parameters would potentially influence model output and prediction. Potential sources of model uncertainty include:

- Estimated model parameter values.
- Observed model input data.
- Model structure and forcing functions.
- Numerical solution algorithms.

Fuss & O'Neill will be responsible for documenting any areas of potentially significant uncertainty in the modeling journal and report.

1.5 Special Training/Certification (A8)

1.5.1 Project Staff

All staff referenced in this section is assumed to be project staff at Fuss & O'Neill. Staff from Fuss & O'Neill is responsible for all data collection and handling, and modeling tasks. Staff responsible for data collection from Fuss & O'Neill will be assigned duties based on their qualifications and ability to accomplish the task. All project staff is required to be familiar with this QAPP and relevant Standard Operating Procedures (SOPs) or methods associated with any assigned tasks. The Fuss & O'Neill Project Manager will be responsible for assigning staff to individual tasks and for either training staff or ensuring that staff has adequate prior training for the completion of all assigned tasks. The Project Manager will maintain a training and qualifications log listing the staff person, assigned duties, and dates and type of training or prior qualifications.

1.5.2 Field Staff

SOPs for field efforts will be distributed to Fuss & O'Neill project staff and will be available at all times throughout the project.

Staff performing visual assessments of the watershed will be trained in the use of methodologies described in the Center for Watershed Protection Urban Subwatershed Restoration Manual Series (2005-2008), and will be familiar with the field data forms in **Appendix A** and the assessment methodologies used to complete those forms in the field.

The Fuss & O'Neill Project Manager will be responsible assigning staff to individual tasks and for ensuring that staff has adequate prior training, as described above, for the completion of all assigned tasks. The Project Manager will maintain a training and qualifications log listing the staff person, assigned duties, and dates and type of training for the activities specific to this project.

1.6 Documents and Records (A9)

The approved QAPP, and any subsequent revisions, will be distributed to all individuals identified on the distribution list. Project-related documents and records will be accessible to the project members who need to obtain information or record and disseminate data. During data collection, deviations from the approved QAPP will be recorded and all recorded deviations will be compiled for final QA summary report. **Table 3** summarizes project documentation and records management procedures.

Table 3. Documentation and Records

Document/Record	Format	Location	Person Creating /Authorized to Update	Distribution List
Quality Assurance Project Plan (QAPP)	Hard-copy and digital copy	Fuss & O'Neill Project Manager	Fuss & O'Neill Project Manager/QA Manager (subject to CTDEEP and EPA review/approval)	All persons listed on master distribution list, All QA Managers
Standard Operating Procedures (SOPs)	Electronic	Fuss & O'Neill Project Manager	Fuss & O'Neill QA Manager	All field and data collection staff
Training Log	Electronic	Fuss & O'Neill Project Manager	Fuss & O'Neill Project Manager	Fuss & O'Neill QA Manager,
Field Notebooks and Digital Photography	Electronic or Hard-copy	Fuss & O'Neill Project Manager	Visual Assessment Team	Fuss & O'Neill QA Manager
Modeling Notebook	Electronic or Hard-copy	Fuss & O'Neill Project Manager	Project Staff assigned to Modeling	Fuss & O'Neill QA Manager
QA Summary Report	Electronic or Hard-copy	Fuss & O'Neill Project Manager	Fuss & O'Neill Project Manager	All persons listed on master distribution list

Electronic data and copies of hardcopy documents will be maintained as follows:

- Electronic files will be backed-up daily.
- Hard Copy Documents will be retained for a minimum of 5 years.

1.6.1 Field Assessment Documentation

Fuss & O'Neill field staff will complete watershed field assessment forms (**Appendix A**) and will maintain field notebooks recording other information obtained and field conditions. Crews may take digital photographs to document field conditions. Locations of potential pollutant sources will be recorded with a Trimble GeoXT Sub-meter GPS receiver ("GPS"). The field record will be held by the person recording the information, providing copies to the Project Manager.

1.6.2 Modeling Documentation

Documentation of the modeling process will be recorded in a modeling journal. The modeling journal will be kept by the Fuss & O'Neill Project Manager and technical staff responsible for running the model to identify the internal model parameters that were adjusted during the process. The journal documents all parameterization iterations made during the project along with the justification and professional reasoning behind the changes. For example, each time that a separate model parameterization run is completed, changes will be documented in the modeling journal. The level of detail in the modeling journal will be sufficient to allow another modeler to duplicate the parameterization method given the same data and model. The modeling journal will include complete recordkeeping of each step of the modeling process. The documentation will consist of information addressing the following items:

- Model assessments and selection with references.
- Model assumptions.
- Parameter values and sources.
- Input file notations.
- Output file notations and model runs.
- Parameterization (calibration) and corroboration (validation) procedures and results from the model.
- Intermediate results from iterative parameterization (calibration) runs.
- Changes and verification of changes made in code, if any.
- Summary of model sensitivity, as applicable.

The modeling journal, all data files, source codes, and executable versions of the computer software used in modeling studies will be retained for 5 years by the Pomperaug River Watershed Coalition and Fuss & O'Neill for auditing or post-project reuse. In addition, the modeling journal will be scanned and a PDF copy of the journal stored with other electronic files used in the project. These files will include:

- Version and source of the executable code used.
- Parameterization (calibration) input and output data.
- Corroboration (validation) input and output data.
- Model application input and output (i.e., for each scenario studied).
- Original source data used for model input and output development.

Fuss & O'Neill will conduct daily backup of all files stored electronically. At the conclusion of the project, electronic copies of all files will be written to CD and provided to the Pomperaug River Watershed Coalition for additional storage.

1.6.3 QAPP Modification

This section addresses procedures to be followed when modifications are needed to this QAPP. Examples of such modifications include changes in procedures, assessment and reporting.

Discussions involving changes to the QAPP may be initiated at any level. The scope of effect of the proposed change will determine the formality of the approval process. A formal QAPP revision will include reference to the section(s) of text being modified or added to, the reason why the revision is necessary and the actual replacement/additional language. It will be the responsibility of the Fuss & O'Neill QA Manager to seek review and approval of the revision of all signatories of the original QAPP. Individuals listed in the Distribution List will receive notification of revisions once updates have been approved by QAPP signatories. Notification may be by electronic mail.

1.6.4 QAPP Distribution

This QAPP will be implemented by Fuss & O'Neill, on behalf of the Pomperaug River Watershed Coalition, once the CTDEEP and US EPA have given approval. This QAPP is to be considered a "working document." The QAPP will be periodically revised as technology, policy and protocol change. All QAPP revisions will be distributed by the Fuss & O'Neill Project Manager according to the Distribution List.

Upon approval and implementation, the original QAPP shall be kept at Fuss & O'Neill's office in Manchester, Connecticut and the signed original QAPP should be distributed by email to all partners on the signature page and distribution list. All personnel responsible for implementation will be required to review the QAPP within 7 days of approval. As new field or modeling staff or managers are hired by Fuss & O'Neill, they will be required to review this QAPP within 14 days of their hiring date.

2 Section B – Data Generation and Acquisition

2.1 Field Assessments (B1)

Visual field assessments will be conducted by Fuss & O'Neil staff following Center for Watershed Protection watershed assessment, as described in Section 1.4 of this QAPP. Fuss & O'Neill staff performing visual assessments of the watershed will be trained in the use of methodologies described in the Center for Watershed Protection Urban Subwatershed Restoration Manual Series (2005-2008), and will be familiar with the field data forms in **Appendix A** and the assessment methodologies used to complete those forms in the field.

Locations of potential pollutant sources will be determined with a Trimble GeoXT Sub-meter GPS receiver ("GPS") and documented on appropriate field forms (**Appendix A**). Digital photographs may also be taken in the field to support the documentation process. Fuss & O'Neill field staff performing the assessments will also be familiar with the Field Activity Documentation and Site Etiquette provided in the Standard Operating Procedures (SOPs) in **Appendix B**.

Any problems encountered during the visual assessments will be reported to the Project Manager and noted in the field log book. Corrective actions will be discussed between the Project Manager, QA Manager, and field staff and documented.

As conditions in the field vary, it may become necessary to implement minor modifications to the visual assessment procedures and protocols described in the QAPP. If sites are inaccessible the day of visual assessments (due to inclement weather or other conditions) the field crew will return when access is easier. Other variations in the field may arise that deviate from the QAPP. If this becomes necessary, the field crews will notify the Project Manager or the QA Officer of the situation and obtain verbal approval prior to implementing any changes. The approval will be recorded on the field log book.

2.2 Sampling Methods (B2)

Not applicable. No environmental sampling will be conducted.

2.3 Sample Handling & Custody (B3)

Not applicable. No environmental sampling will be conducted.

2.4 Analytical Methods (B4)

Not applicable. No environmental sampling will be conducted.

2.5 Quality Control (B5)

Field assessments will consist of quasi-subjective evaluations by Fuss & O'Neill field personnel. Quality control of these field assessments will be performed in accordance with the method discussed in Section 1.4 (DQOs) of this QAPP.

2.5.1 Visual Assessment Control Requirements and Acceptability Criteria

The Fuss & O'Neill Project Manager and QA Manager will conduct an internal review of the field forms for compliance with quality assurance requirements. This will consist of verifying that field data forms have been filled out consistently and completely and that field personnel have followed the methodologies described in the Center for Watershed Protection Urban Subwatershed Restoration Manual Series (2005-2008). The visual assessment leader will also check these forms on a daily basis to make sure that they have been filled out properly.

2.5.2 Secondary Data Quality Control Requirements and Acceptability Criteria

Secondary and modeling data will be internally quality controlled by Fuss & O'Neill through in-house review. Anticipated review staff members responsible for this process include the Project Manager and QA Manager. The Fuss & O'Neill Project Manager will maintain overall responsibility for examining the work to ensure that methodologies and processes are consistent with the procedures outlined in the QAPP and the overall project goals. This will include monitoring secondary data formatting to ensure that the data are consistent and appropriate for the model and overseeing the selection of appropriate model parameters and review of the input files to ensure that the information is properly entered and formatted. The Project Manager will provide advice to the Fuss & O'Neill QA Manager of any deviations from the QAPP so that appropriate actions may be taken either to correct the problem, or amend the QAPP as needed. The QA Officer will monitor the extent to which the QAPP is supporting its intended use.

2.5.3 Failures in Quality Control and Corrective Action

The professional judgement of the Project Manager and technical staff will be relied upon to evaluate the visual assessments of watershed conditions. These assessments may be rejected based on whether the information contained in the field forms have been recorded accurately, completely, and in accordance with the methodology cited previously.

Similarly, the professional judgment of the Project Manager and technical staff will be relied upon in evaluating secondary data and modeling results. Rejecting secondary data or modeling results based on unreasonableness of the information (i.e., pollutant loading values unreasonably low or high, removal efficiencies significantly greater than reported literature values, etc.) is a possibility. Evaluation criteria noted previously in this section and in Section 1.4 will be used for data review. If the quality control review results in detection of unacceptable conditions or data, the Project Manager will be responsible for developing and initiating corrective action. Corrective response actions may include:

- Review of original secondary data and re-processing to maintain data integrity.
- Review or corroboration of modeling input and parameterization data.
- Re-definition of model extents or spatial distribution.
- Performing additional model runs.
- Editing and modifying report deliverables.

Notations of secondary data or modeling data failing to meet DQOs will be noted in the final deliverables.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance (B6)

The field assessment team leader will be responsible for noting and reporting issues or problems to the Project Manager or QA Officer. Any routine maintenance will be performed by the field assessment personnel. GPS equipment testing, inspection and maintenance will be performed according to manufacturer recommendations, as described in the equipment manuals. Outfall locations in impaired segments of the watershed will be collected during the study using a GPS unit, which will be inspected before each use for things such as battery life, etc. Digital cameras will be inspected before each use for battery life and sufficient storage.

Maintenance logs for field equipment will be submitted to and kept by the QA Manager. The log entry will include:

- Name of person maintaining the instrument/equipment.
- Date and description of maintenance procedure.
- Date and description of any instrument/equipment problems.
- Date and description of actions to correct problems.
- List of follow-up activities after maintenance.
- Date next maintenance will be needed.

2.7 Instrument/Equipment Calibration and Frequency (B7)

A Trimble Geo 7X Series handheld GPS unit will be used in the field to collect outfall locations in impaired segments of the Pomperaug River watershed. Operation and correct use of the GPS equipment will follow specifications in the product manual. Verification that the GPS unit is operating properly will be done prior to each visual assessment. Copies of the equipment manual will be maintained by the Visual Assessment Team and Visual Assessment Leader. The Operators Manual, including calibration information, is included in **Appendix B** of this QAPP.

2.8 Inspection of Supplies and Consumables (B8)

All supplies for field activities will be inspected by the field assessment team prior to use for compliance with the acceptance criteria. Supplies needed for visual assessments include:

- Field Data Forms.
- Maps.
- Tape measure.
- GPS unit.
- Log Books.
- Digital cameras.
- Data cards.
- Life preservers (PFDs).
- Waders.
- Pens/Pencils.

The field assessment team leader is responsible for maintaining the supplies needed for visual assessments. Supplies or consumables not meeting the acceptance criteria upon inspection will not be used. Any equipment determined to be in unacceptable condition will be replaced. The field supplies and replacement parts associated with the permanent field equipment may require replacement of wearable parts such as camera batteries. Any replacement parts for field equipment will be ordered and replaced by the Project Manager. Supplies and consumables will be stored in accordance with identified requirements of each item.

2.9 Data Acquisition Requirements (Non-Direct Measurements) (B9)

Available information on water quality and land use within the Pomperaug River Watershed will be compiled, reviewed and summarized by Fuss & O'Neill. Both mapping and tabular/narrative information summaries will be produced.

2.9.1 Data Sources

Non-direct data will be obtained primarily from federal and state agencies, regional authorities and municipalities to characterize historic and existing conditions in the watershed. Modeling efforts will also utilize peer-reviewed data related to water quality associated with particular land uses and effectiveness of various structural and non-structural management practices for bacteria and sediment load reduction. Data sources include, but are not limited to the following:

- Available water quality monitoring data for the watershed collected by PRWC, CTDEEP, United States Geological Survey (USGS) and non-profits.
- Impaired Waters Summary for Pomperaug Watershed (PRWC 2012).
- Statewide TMDL Bacteria for the Pomperaug and Weekeepeemee (CTDEEP).
- State of Watershed Report (PRWC 1999).
- Land use and Land cover data (either parcel-based land use available from the Naugatuck Valley Council of Governments (NVCOG) or UConn Center for Land Use Education and Research (CLEAR) satellite-derived land cover data).
- Riparian Land Cover Change Analysis, Agricultural Lands Analysis, Forest Fragmentation Analysis, and Land Cover Change Analysis (UConn CLEAR- 1985 to 2010).
- Land Use, Open Space, and Zoning Maps (NV COG).
- Information compiled by PRWC, NV COG, and other non-governmental organizations.
- Municipal planning documents.
- Published, peer-reviewed studies of pollutant loads from different land uses.

Summaries of the specific model input parameters and identified sources of information for those parameters are included in **Appendix D**.

CTDEEP's Environmental GIS Data Set, the University of Connecticut (UConn) Map and Geographic Information Center (MAGIC), and UConn CLEAR will serve as the primary sources of data for watershed mapping. The GIS data will be augmented by GIS mapping available from the watershed municipalities and NVCOG, as necessary.

All data sources will be fully referenced and documentation of data quality supplied in the final report and project deliverables, including links to web-based data, where appropriate.

2.9.2 Data Generators

Data generators are federal, state, and local agencies and other organizations that collect or have collected environmental data that is relevant and useful for this project and is of a sufficient quality for use.

2.9.3 Hierarchy of Data Sources

Secondary data sources preferred for use in the project will include existing data obtained from state and federal agencies, municipalities, and non-governmental organizations already conducting mapping and monitoring programs. Data sources with known and adequate quality control and quality assurance procedures will be preferred, including data from state and federal agencies and data collected or generated under a QAPP. Any known data limitations or gaps will be disclosed in the final project report and any other deliverables.

2.9.4 Rationale for Selecting Data Sources

Given the specific secondary data needs for this project (e.g., mapping of land use and land cover, water quality data, information about physical characteristics of the rivers, tributaries, and floodplains, literature sources of event mean concentrations (EMC's) for various land use types, estimates of BMP effectiveness for bacteria and sediment removal, etc.), there are, in some cases, only one or a limited number of data sources available. Where more than one data source is available, all available sources will be evaluated and the highest quality, most applicable data source will be used.

2.9.5 List of Sources of Secondary Data

The sources of all secondary data used will be listed and described in the final project report and any other deliverables. Where appropriate, links to web-based data will be provided.

2.10 Data Management (B10)

This section defines the specific policies, organization, and procedures related to data management. The data management system that will be used for the electronic data management is Microsoft Excel.

2.10.1 Field Data and Information Management

Items that require data management which are collected or generated in the field by the visual assessment team are field logbooks and field data forms.

Following watershed assessment activities, field data (including field data forms and field staff logbook copies) will be forwarded to the Project Manager and QA Manager, who are responsible for reviewing the field data for accuracy and completeness. If any field data forms are incorrect, incomplete, or missing, the package of data forms will be returned to field personnel for completion and/or correction.

Project personnel conducting the visual assessments will forward copies of the field data forms to the Project Manager. Field notebook copies will be forwarded to the Project Manager upon request.

Hard copies of all data and field forms will be retained by the Project Manager. Copies of this data will be available to team members upon request.

2.10.2 Visual Assessment Data and Information Management

Original field forms received from the visual assessment team by the Project Manager will be reviewed for accuracy and completeness. Accuracy and completeness, as defined herein, means that the requested information was collected appropriately and that the site IDs, date collected, etc. are correctly identified on the field forms.

The Project Manager will supervise the scanning of all field forms used for visual assessments in the field. The data will be reviewed and evaluated for completeness.

Hard-copy of all field forms will be retained by the Project Manager. Copies of this data will be available to team members upon request.

2.10.3 Non-Direct Data (Secondary and Modeling) Management

The following data handling equipment, hardware and software are anticipated to be used in model development and interpretation of results:

- Desktop computers using the Windows operating system.
- Microsoft Office Excel 2010 or later version.
- ArcGIS software v10 or later version.
- Watershed Treatment Model version 3.1 or later version (runs in Excel).

2.10.4 Electronic Data Management

The general approach to data storage and retrieval of electronic media is as follows:

- Data will be downloaded from the federal and state agencies websites directly or via FTP by Fuss & O'Neill. In some cases, data may have to be ordered for electronic delivery via email or FTP.
- Source data files, model input files, model executable files, and model output files will be stored in separate project subdirectories by Fuss & O'Neill.
- Fuss & O'Neill will conduct daily backup of all files stored electronically.
- At the conclusion of the project, electronic copies of all files will be written to CD and provided to the Pomperaug River Watershed Coalition for additional storage.

3 Section C – Assessment and Oversight

3.1 Assessment/Oversight and Response Action (C1)

The Fuss & O'Neill Project Manager and QA Manager are responsible for determining the need for and implementation of any corrective action measures to the visual assessments or modeling procedures. Corrective actions will be implemented upon the identification of problems discovered through system audits by field data sheet review or model oversight. If a problem is identified, the QA Manager will:

- Report the problem to the Project Manager.
- Evaluate the problem in accordance with data quality objectives.
- Determine whether implementation of corrective action is required.
- Assign and implement a corrective action.
- Evaluate the effectiveness of the corrective action.

The QA Manager will report the findings of any problems and corrective actions to the Project Manager. The following is a list of possible occurrences that may require corrective action and the corresponding action that would likely take place.

- If visual assessments of watershed conditions are not logged properly in the field data forms or do not follow the methodology outlined in the QAPP these forms will be flagged by the Visual Assessment Team Leader and Project Manager.
- If modeling results do not fall within the expected range, the model function as well as the input data will be reviewed for inaccuracies.

CTDEEP may implement, at their discretion, various audits or reviews of this project to assess conformance and compliance to the quality assurance project plan in accordance with the CTDEEP Quality Management Plan.

3.2 Reports to Management (C2)

Field data forms and/or modeling results that have passed preliminary quality control analysis may be submitted to the PRWC, CTDEEP and EPA. A caveat will accompany these or any data released on a preliminary basis, explaining that they are for review purposes only and subject to correction after completion of a full data review occurring at the end of the program.

All reports, preliminary or final, will include discussion of steps taken to assure data quality, findings on data quality, and decisions made on questionable data.

4 Section D – Data Validation and Usability

4.1 Data Review, Verification and Validation (D1)

4.1.1 Direct Data Measurements

Review, verification, and validation is a multi-step process to protect the integrity of the data collected during the visual assessments of watershed conditions and will reduce the number of field data forms that do not meet the DQOs. Verification of the visual assessments will occur at the field level.

The field data forms will be reviewed after the visual assessment date by the QA officer and Project Manager using all available QC data. Deviations will be flagged. Incomplete data will be noted, as necessary. QC results that deviate from the data quality objectives will call into question the validity of the individual field data form or all related field data forms.

The final decision on whether to include or reject the field data forms should be made by the Project Manager and QA Officer.

4.1.2 Non-Direct Measurement Data (Secondary and Modeling)

The Project Manager and QA Manager will be responsible for review, verification and validation of secondary and modeling data. The review will be conducted to both protect the integrity of the data and make sure that data was used appropriately to support the goals of the project. The review of secondary data will be conducted at the end of the existing conditions background data collection process. The Project Manager and/or QA Manager will confirm that secondary data was collected consistent with the data decision process described in this QAPP. Any data not meeting the criteria will be reviewed by the Project Manager and QA Manager and either removed from use or flagged in the dataset, with the appropriate qualifying description, for use in the report deliverables.

Similarly, modeling data will be reviewed by the Project Manager and/or QA Manager relative to the DQOs described in Section 1.4. Modeling data or results that deviate from the DQOs will be reviewed by the Project Manager and QA Manager and either removed from use or flagged in the dataset, with appropriate qualifying description, for use in the report deliverables.

4.2 Verification and Validation Methods (D2)

4.2.1 Direct Data Measurements

Data quality measures for visual field assessments will be compared to applicable data quality objectives. The verification process for the compiled field data forms of all visual assessments will involve the Project Manager visually comparing a hard copy of field data forms with the information scanned electronically into PDF format. This process will ensure that data has been accurately scanned into the Fuss & O'Neill computer system.

4.2.2 Non-Direct Data Measurements (Secondary and Modeling)

The Project Manager and QA Manager will perform visual inspection of data before including it in deliverables. The following will be observed for secondary data validation:

- A copy of every secondary data set will be saved as a read-only, protected file to be used in the event that the integrity of the working dataset is compromised.
- Working data will be stored in a spreadsheet or ArcGIS format and will include relevant raw data, which will be locked for editing.
- Data manipulation will be minimized, but when necessary, data manipulation will start with raw data, and all calculations, including units, conversion factors, and formulas will be shown in the spreadsheet.
- Prior to including in project deliverables, raw and reduced data will be displayed in graphic format and inspected to look for anomalous values. Any decision to eliminate anomalous values will be documented in the spreadsheets and will be noted in the project deliverables.

Verification and validation of modeling data will be performed by the Project Manager and will include:

- Review of modeling parameters inputs and assumption to confirm the reasonableness of those assumptions.
- Comparison of model output with similar, acceptable quality data from other studies prepared by either reliable sources (e.g., USGS, CTDEEP, EPA) or through a peer-reviewed process to assess the reasonableness of modeling results.

Any concerns regarding secondary or modeling data will be communicated to the project team. If necessary, modifications to the modeling process may be required and will be documented in accordance with this QAPP. If necessary, data qualifiers for either the secondary or modeling data will be assigned and noted in the project database, modeling notebook, and limitations identified, as appropriate, in project deliverables.

4.3 Reconciliation with User Requirements (D3)

4.3.1 Direct Measurements Data

After reviewing the DQOs outlined in Section 1.4 related to visual assessments the Project Manager and QA Manager will evaluate overall program attainment for the direct data acquisition.

4.3.2 Non-Direct Measurements (Secondary and Modeling)

Once secondary data collection and modeling are complete, the resulting data sets will be compared with the DQOs for secondary and modeling data outlined in Section 1.4. This will include an assessment of the secondary data characteristics relative to the data decision tree in Section 1.4 and will include a narrative summary of the following:

- Number of data sets used that had full references.
- Number of data sets used with disclaimers.

It should be noted that all models are a simplification of the environmental processes they intend to represent. Although there is no consensus on model performance criteria in the literature, a number of basic statements are likely to be accepted by most professional modelers including:

- Models are approximations of reality and cannot precisely represent natural systems.
- There is no single, accepted test that determines whether or not a model is valid.
- Models cannot be expected to be more accurate than the sampling and statistical error (e.g., confidence intervals) in the input and observed data.

These considerations must be included in the development of appropriate procedures for quality assurance of the models. Despite a lack of agreement on how models should be evaluated, the following principles provide a final set of evaluation criteria for the modeling projects:

- Exact duplication of observed data is not possible, nor is it a performance criterion for projects, and in fact, for some models it may indicate a lack of ability to generalize when given new input data. The model validation process will measure the ability of the model to simulate measured values.

- No single procedure or statistic is widely accepted as measuring, or capable of establishing, acceptable model performance. Therefore the combination of graphical comparisons, statistical tests and professional judgment are proposed to provide sufficient evidence upon which to base a decision of model acceptance or rejection.
- All model and observed data comparisons must recognize, either qualitatively or quantitatively, the inherent error and uncertainty in both the model and the observations. Model sensitivity and uncertainty will be documented, where possible, as part of the modeling study.

The uncertainty in the modeling process and its impact on the usability of the results toward decision-based management will be addressed in the final project deliverable. After the review of secondary data DQO and modeling performance, the Project Manager and QA Manager will evaluate overall program attainment for the secondary data and modeling data.

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Quality Assurance Project Plan
Field Assessments, Modeling, and Analysis
Pomperaug River Watershed Based Plan
May 3, 2017

Appendix A

Field Data Forms

Reach Level Assessment

RCH

SURVEY REACH ID: ______	**WTRSHD/SUBSHD:**	**DATE:** ___/_____/___	**ASSESSED BY:**

START **TIME:**____:____AM/PM **LMK:** ______ **LAT**___°______'______" **LONG** ___°______'______" **DESCRIPTION:**	*END* **TIME:**____:____AM/PM **LMK:** ______ **LAT**___°______'______" **LONG** ___°______'______" **DESCRIPTION:**	**GPS ID:**

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM
(Evidence of)
☐ Fish ☐ Beaver ☐ Deer
☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown
☐ Downcutting ☐ Bed scour
☐ Widening ☐ Bank failure
☐ Headcutting ☐ Bank scour
☐ Aggrading ☐ Slope failure
☐ Sed. deposition ☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank ___________(ft)
RT bank ___________(ft)
Width: Bottom ___________(ft)
Top ___________(ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.

5 4 3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

REPORTED TO AUTHORITIES ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION **(**facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: _____ **/80** + Buffer/Floodplain: _____ **/80** = **Total** Survey Reach ______ **/160**

Neighborhood Source Assessment **NSA**

WATERSHED:	**SUBWATERSHED:**	**UNIQUE SITE ID:**	
DATE: ___/___/_____	**ASSESSED BY:**	**CAMERA ID:**	**PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ____ Neighborhood Area (acres) _______

If unknown, address (or streets) surveyed:

____

Homeowners Association? ☐ Y ☐ N ☐ Unknown If yes, name and contact information: __________________________

Residential *(circle average single family lot size):* __________________________

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☐ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

		INDEX*
Estimated Age of Neighborhood: _____ years	Percent of Homes with Garages: _____% With Basements ____%	
Sewer Service? ☐ Y ☐ N		○
Index of Infill, Redevelopment, and Remodeling ☐ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	**Percentage**	**Comments/Notes**	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover			
B2. % of lot with grass cover			○
B3. % of lot with landscaping (e.g., mulched bed areas)			◇
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy			◇
B6. Evidence of permanent irrigation or "non-target" irrigation			○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: ____		○
	Med: ____		
	Low: ____		
B8. Outdoor swimming pools? ☐Y ☐N ☐ Can't Tell Estimated # ____			○
B9. Junk or trash in yards? ☐ Y ☐ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A			
C2. Driveway Condition ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☐ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☐ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer			◇ ○
D2. Downspouts are directed to impervious surface			
D3. Downspouts discharge to pervious area			
D4. Downspouts discharge to a cistern, rain barrel, etc.			
*Note: C1 through C4 should total 100%			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☐ N			◇
E. COMMON AREAS			
E1. Storm drain inlets? ☐ Y ☐ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ________________			○
E2. Storm water pond? ☐ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre			◇
E3. Open Space? ☐ Y ☐ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☐ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other __________________			○

Recommended Actions

Specific Action

- ☐ Onsite retrofit potential?
- ☐ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) __________________________

Describe Recommended Actions:

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

Hotspot Site Investigation **HSI**

WATERSHED:	**SUBWATERSHED:**		**UNIQUE SITE ID:**
DATE: ___/___/_____	**ASSESSED BY:**	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___°_____'_____" **LONG** ___°_____'____"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: ___________________

____

____

SIC code (if available): ___________

NPDES Status: ☐ Regulated
☐ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial Miscellaneous
☐ Institutional ☐ Municipal ☐ Golf Course
☐ Transport-Related ☐ Marina
☐ Animal Facility

Basic Description of Operation:

____

INDEX*

B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ____________

B2. Approximate number of vehicles: _______

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: _______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ________ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)*

Observed Pollution Source? ☐

F1. % of site with: Forest canopy ____% Turf grass _____ % Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: _________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: _________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☐ Schedule a review of storm water pollution prevention plan

Notes:

Pervious Area Assessment **PAA**

WATERSHED: **SUBWATERSHED:** **UNIQUE SITE ID:**

DATE: ___/___/_____ **ASSESSED BY:** **CAMERA ID:** **PIC #:**

MAP GRID: **LAT** ___°_____'_____" **LONG** ___°_____'_____" **LMK #**

A. PARCEL DESCRIPTION

Size: ___acre(s) Access to site (*check all that apply)*: ☐ Foot access ☐ Vehicle access ☐ Heavy equipment access

Ownership: ☐ Private ☐ Public Current Management: ☐ School ☐ Park ☐ Right-of-way ☐ Vacant land

☐ Other (please describe) ______________________________

Contact Information: ______________________________

Connected to other pervious area? ☐ Y ☐ N If yes, what type? ☐ Forest ☐ Wetland ☐ Other ____________

Estimated size of connected pervious area: ____ acre(s) Record Unique Site ID of connected fragment: ____________

PART I. NATURAL AREA REMNANT

FOREST

B. CURRENT VEGETATIVE COVER

B1. Percent of forest with the following canopy coverage:

Open _____% Partly shaded _____% Shaded _____%

**Note – these should total 100%*

B2. Dominant tree species: ______________________________

B3. Understory species: ______________________________

B4. Are invasive species present? ☐ Y ☐ N ☐ Unknown

If yes, % of forest with invasives: _______

Species: ______________________________

C. FOREST IMPACTS

C1. Observed Impacts (*check all that apply*): ☐ Animals ☐ Clearing/encroachment ☐ Trash and dumping ☐ Storm water runoff ☐ Other

D. NOTES

WETLAND

B. CURRENT VEGETATIVE COVER

B1. % of wetland with following vegetative zones:

Aquatic: __________

Emergent: __________

Forested: __________

**Note – these should total 100%*

B2. Dominant species: ______________________________

B3. Are invasive species present? ☐ Y ☐ N ☐ Unknown

If yes, % of wetland with invasives: _______

Species: ______________________________

C. WETLAND IMPACTS

C1. Observed Impacts (*check all that apply*): ☐ Animals ☐ Clearing/encroachment ☐ Trash and dumping ☐ Storm water runoff ☐ Hydrologic impacts ☐ Other

D. NOTES

E. INITIAL RECOMMENDATION

☐ Good candidate for conservation/protection

☐ Potential restoration candidate

☐ Poor restoration or conservation candidate

PART II. OPEN PERVIOUS AREAS

A. CURRENT VEGETATIVE COVER

A1. Percent of assessed surface with:
Turf _____% Other Herbaceous _____% None (bare soil) _____% Trees _____% Shrubs ____ % Other _____%
(please describe): ____ **Note – these should total 100%*

A2. Turf: Height: _____ inches Apparent Mowing Frequency: ☐ Frequent ☐ Infrequent ☐No-Mow ☐ Unknown
Condition (*check all that apply*): ☐ Thick/Dense ☐ Thin/Sparse ☐ Clumpy/Bunchy ☐ Continuous Cover

A3. Thickness of organic matter at surface: _______ inches

A4. Are invasive species present? ☐ Y ☐ N ☐ Unknown If yes, % of site with invasives: _____
Species:____

B. IMPACTS

B1. Observed Impacts (*check all that apply*): ☐ Soil Compaction ☐ Erosion ☐ Trash and Dumping
☐ Poor Vegetative Health ☐ Other (describe): _____________________________________

C. REFORESTATION CONSTRAINTS

C1. Sun exposure: ☐ Full sun ☐ Partial sun ☐ Shade ☐ Unknown

C2. Nearby water source? ☐ Y ☐ N ☐ Unknown

C3. Other constraints: ☐ Overhead wires ☐ Underground Utilities ☐ Pavement ☐ Buildings
☐ Other (please describe): ___________________

D. NOTES

E. INITIAL RECOMMENDATION

☐ Good candidate for natural regeneration
☐ May be reforested with minimal site preparation
☐ May be reforested with extensive site preparation
☐ Poor reforestation or regeneration site

PART III. SKETCH

Streets and Storm Drains **SSD**

WATERSHED:	**SUBWATERSHED:**	**UNIQUE SITE ID:**
DATE: ___/___/_____	**ASSESSED BY:**	**CAMERA ID:**
MAP GRID	**RAIN IN LAST 24 HOURS** ☐ Y ☐ N	**PIC #**

A. LOCATION

A1. Street names or neighborhood surveyed:

____

A2. Adjacent land use: ☐ Residential ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

A3. Corresponding HSI or NSA field sheet? If so, circle HSI or NSA and record its Unique Site ID here _____________

B. STREET CONDITIONS

B1. Road Type: ☐ Arterial ☐ Collector ☐ Local ☐ Alley ☐ Other: _________

B2. Condition of Pavement: ☐ New ☐ Good ☐ Cracked ☐ Broken

B3. Is on-street parking permitted ☐ Y ☐ N If yes, approximate number of cars per block: ________

B4. Are large cul-de-sacs present? ☐ Y ☐ N

B5. Is trash present in curb and gutter? If so, use the index to the right to record amount.	Index Rating for Accumulation in Gutters				
	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic Material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

C. STORM DRAIN INLETS AND CATCH BASINS

C1. Type of storm drain conveyance: ☐ open ☐ enclosed ☐ mixed

C2. Percentage of inlets with catch basin storage: ________ ☐ N/A

Sample 1-2 catch basins per NSA/HSI	**C3.** Catch basin #1	**C4.** Catch basin #2
Latitude	___°_____'_____"	___°_____'_____"
Longitude	___°_____'_____"	___°_____'_____"
LMK #		
Picture #		
Current Condition	☐ Wet ☐ Dry	☐ Wet ☐ Dry
Condition of Inlet	☐ Clear ☐ Obstructed	☐ Clear ☐ Obstructed
Litter Accumulation	☐ Y ☐ N	☐ Y ☐ N
Organics Accumulation	☐ Y ☐ N	☐ Y ☐ N
Sediment Accumulation	☐ Y ☐ N	☐ Y ☐ N
Sediment Depth (in feet)	__________ ft.	__________ ft.
Water Depth	__________ ft.	__________ ft.
Evidence of oil and grease	☐ Y ☐ N	☐ Y ☐ N
Sulfur smell	☐ Y ☐ N	☐ Y ☐ N
Accessible to vacuum truck	☐ Y ☐ N	☐ Y ☐ N

D. NON-RESIDENTIAL PARKING LOT (>2 acres)

D1. Approximate size: _________ acres

D2. Lot Utilization: ☐ Full ☐ About half full ☐ Empty

D3. Overall condition of Pavement: ☐ Smooth (no cracks) ☐ Medium (few cracks) ☐ Rough (many cracks) ☐ Very Rough (numerous cracks and depressions)

D4. Is lot served by a storm water treatment practice? ☐ Y ☐ N If yes, describe: ______________________

D5. On-site retrofit potential: ☐ Excellent ☐ Good ☐ Poor

E. MUNICIPAL POLLUTANT REDUCTION STRATEGIES

E1. Degree of pollutant accumulation in the system: ☐ High ☐ Medium ☐ Low ☐ None

E2. Rate the feasibility of the following pollution prevention strategies:

Street Sweeping:	☐ High	☐ Moderate	☐ Low
Storm Drain Stenciling:	☐ High	☐ Moderate	☐ Low
Catch Basin Clean-outs:	☐ High	☐ Moderate	☐ Low
Parking Lot Retrofit Potential:	☐ High	☐ Moderate	☐ Low

CATCH BASIN SKETCHES

#1

#2

Notes:

Appendix B

SOPs, Methods, Equipment Manuals

1. Field Activity Documentation
2. Site Etiquette
3. Trimble GEO 7X Calibration

FIELD NOTEBOOKS

All field personnel will carry a bound field notebook. All field activities will be documented in the field notebook, regardless of whether or not those activities involve sample collection. Each employee's book will be numbered sequentially with the format of the employee number followed by the book number (i.e. **156-01**) and will be labeled on the cover as such with the range of dates covered by the book (i.e. 10/23/03 to 8/17/04). Each page of the field notebook book will be numbered with the employee number, the book number, and the page number (i.e. **156-01-01, 156-01-02, 156-01-03**, etc.). The field notebook will document site-specific information such as:

- Project name and location
- Names of other Fuss & O'Neill personnel involved in field activities
- Time and date of arrival at the site
- Weather conditions
- Sampling locations and corresponding sample numbers
- Documentation of field calibration of instruments
- Conversations with individuals on site
- Any unusual events or observations
- All information not recorded on field data sheets
- Time of departure from the site

For field investigations that involve the collection of samples, additional forms of documentation are required. See SOPs 020100, 020200, 020300, 020400, and 020500.

Upon arrival on-site, all Fuss & O'Neill field personnel will follow the following guidelines:

1. The client/owner will be notified of site visits.

2. Field personnel will always carry their business cards for identification purposes.

3. Field personnel will strictly adhere to policies in effect at the client's facilities. An example of such a policy is signing in and out of buildings or offices and wearing facility specified safety gear (hard hats, eyeglasses).

4. The client/owner's property will be respected at all times.

5. Field personnel will not discuss specifics of sampling or contaminants with any site employees or passers-by without authorization from project management and the client.

6. Field personnel will not be permitted to smoke in the client's presence or while in indoor facilities. **In addition, no smoking will be permitted in the vicinity of sample collection.**

7. All field activities will be conducted following the established sampling plan and the site health and safety plan for the site.

8. Wells will be locked and maintained in good condition between sampling events.

9. The homeowner will be notified prior to any domestic well sampling. If no one is home and a sample cannot be obtained, field personnel will leave a note to inform the resident of the sampling attempt and the name of a contact person with whom to reschedule. A business card should always accompany this note.

10. When domestic wells are purged from an outside tap, a hose will be attached whenever possible to direct the water away from the building.

11. Contaminated and/or dirty protective gear will be properly decontaminated and removed prior to entering on-site buildings and offices.

12. No discarded materials will be left at sample locations. All trash, which has accumulated at a site as a result of field activities, will be collected disposed of according to site guidelines and waste disposal plans.

13. Field Staff will keep company vehicles clean and in presentable condition while conducting field activities.

Trimble Handheld GEO 7x Calibration

Note: The User's Guide for the Trimble Handheld Geo 7x is a protected document, available on-line at the link below. Calibration procedures for the ***Global Navigation Satellite System*** (GNSS) are found on Page 98. Calibration procedures are given for both fast calibration and full calibration.

https://www.neigps.com/wp-content/uploads/2013/12/Geo7Series_UserGuide.pdf\

Appendix B

Technical Memorandum – Visual Field Assessments

Pomperaug River Watershed Based Plan

FUSS & O'NEILL

MEMORANDUM

TO: Pomperaug River Watershed Coalition

FROM: Erik Mas, P.E, Stefan Bengtson, MSc, William Guenther, MS

DATE: December 1, 2017

RE: **Visual Field Assessments**
Pomperaug Watershed Based Plan

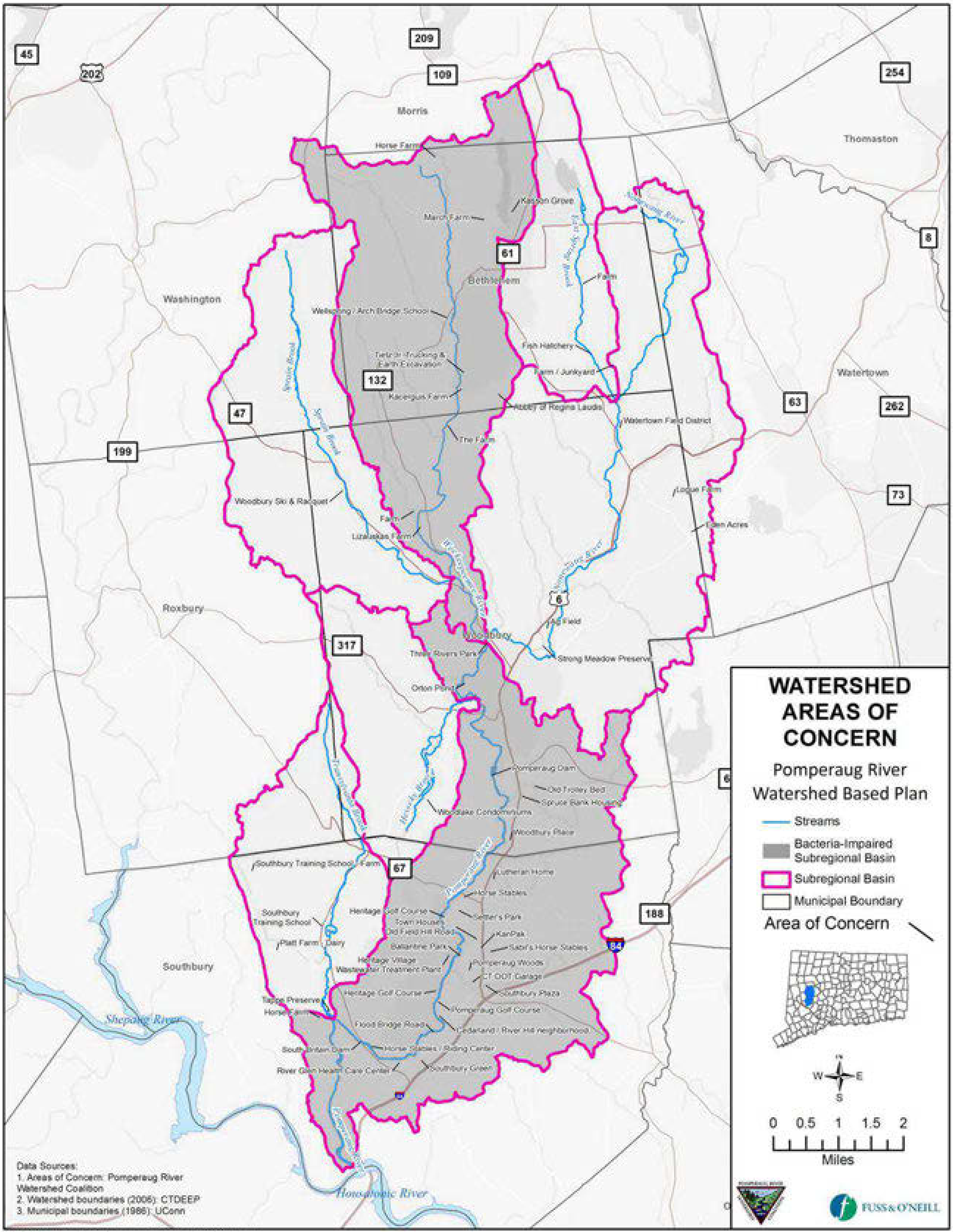
Visual field investigations were performed by the Fuss & O'Neill project team to further assess potential sources of water quality impairments in the Pomperaug River watershed. The field assessments are a screening-level tool for locating potential pollutant sources in a watershed and identifying possible locations where restoration opportunities and mitigation measures could be implemented. This memorandum describes the field assessment methods and findings.

1. Field Assessment Methods

Areas of concern (i.e., potential pollutant sources contributing to water quality impairments in the watershed) were initially identified based on a review of existing data and information including the 2001 State of the Watershed Report, the 2006 Pomperaug Watershed Management Plan, the 2010 Pomperaug River Watershed Streamwalk Summary Report, updated watershed mapping, and recommendations from the PRWC Land use Committee. **Figure 1** shows the initial areas of concern, which are generally located within the Pomperaug River and Weekeepeemee River subregional basins – the two primary subwatershed areas associated with the bacterial impairments in the watershed.

The areas to be assessed during the field assessments were selected from this initial list of areas of concern in conjunction with the PRWC Land Use Committee. Final areas selected for field assessments include stream corridors and upland areas that are known or suspected of contributing to the bacterial impairments in the watershed.

A two-person field team conducted field assessments on September 5 and 6, 2017, including reach level stream corridor assessments (i.e., stream walks) in impaired segments and upland source assessments in selected neighborhoods following the Center for Watershed Protection (CWP) Unified Stream Assessment and Unified Subwatershed and Site reconnaissance methods (Kitchell & Schueler, 2005; Wright et al., 2005). The upland assessments included inventories of selected representative residential neighborhoods, streets and storm drainage systems, and land uses with higher potential pollutant loads (i.e., "hotspot" land uses). The field assessment protocols are also documented in the Quality Assurance Project Plan (QAPP) (approved March 27, 2017) for this Section 319-funded project.



Data Sources:
1. Areas of Concern: Pomperaug River Watershed Coalition
2. Watershed boundaries (2006): CTDEEP
3. Municipal boundaries (1986): UConn

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Figure 1: Areas of concern in the Pomperaug River Watershed.

Field personnel visited each location and documented potential sources of bacteria on field forms and through photographs. During each visit, particular note was made of potential structural and non-structural Best Management Practices (BMPs) that could be implemented at a particular site or more broadly throughout the watershed to reduce loadings of bacteria and other pollutants. Completed field assessment forms are provided in *Attachment A*.

2. Summary of Findings

Tables 1, 2, and 3 summarize the field assessment results for each site visited, including possible bacteria sources, potential BMPs, and other preliminary recommendations. Major findings of the field assessments are also summarized below. The field assessment findings will be used to guide the development of recommendations for the Watershed Based Plan.

- **Agricultural Land Use –** Hobby farms, equestrian centers, and more intensive livestock farming practices were frequently observed in the watershed. While some farms maintain animal exclusion fencing to separate livestock from streams, other locations, such as Logue Farms on Artillery Road, Mountain Valley Equestrian Center (**Figure 2**), and Percy Thomson Meadows on Thomson Road all have grazing or feeding areas with apparent channelization or full access to streams and discharges to streams. Exclusion fencing, alternative approaches to manure management, such as moving manure piles further away from streams, and other agricultural BMPs can yield water quality improvements.

Figure 2: View of equestrian center adjacent to the start of reach Pomperaug-01. Runoff from paddock areas appears to channelize in several places and ultimately discharge to both Transylvania Brook and the Pomperaug River.

- **Urban Land Use** – Land uses with high impervious cover, typical of more-developed areas of the Pomperaug River subwatershed generate large amounts of stormwater runoff containing fecal indicator bacteria from various sources (pet waste, nuisance wildlife, bacteria attached to sediment inside catch basins, bacteria growth in storm drains, illicit connections, failing septic systems, etc.) (**Figures 3 and 4**). Neighborhoods with houses adjacent to streams, such as Berkshire Estates and Oakdale Manor, Cedarland and River Hill may have homes with failing septic systems and little separation distance from impaired segments of the Pomperaug River. The use of stormwater treatment practices (Low Impact Development or green infrastructure) is limited throughout the watershed, including in areas with significant impervious surfaces such as parking lots and roadways. Roof downspouts were also typically observed to be directed toward impervious surfaces or piped underground and ultimately discharge to storm drainage systems.

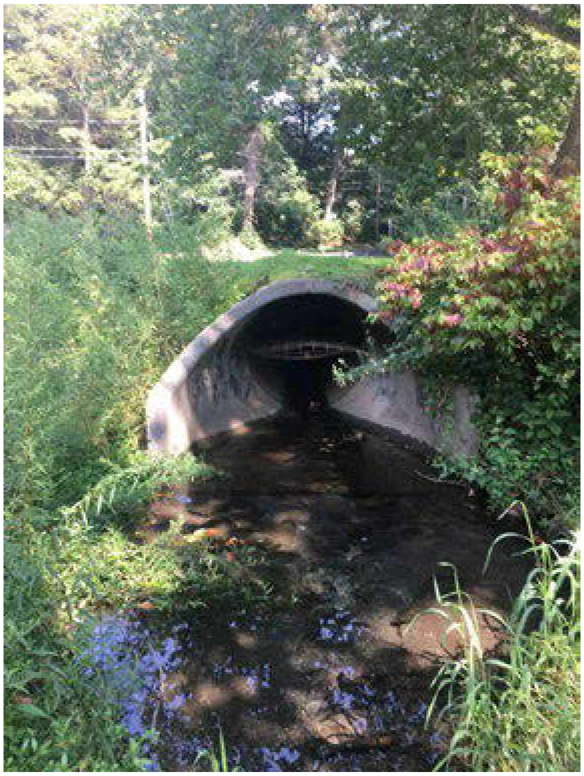


Figure 3: Stormwater outfall at Cedarland Park off of River Trail Road.

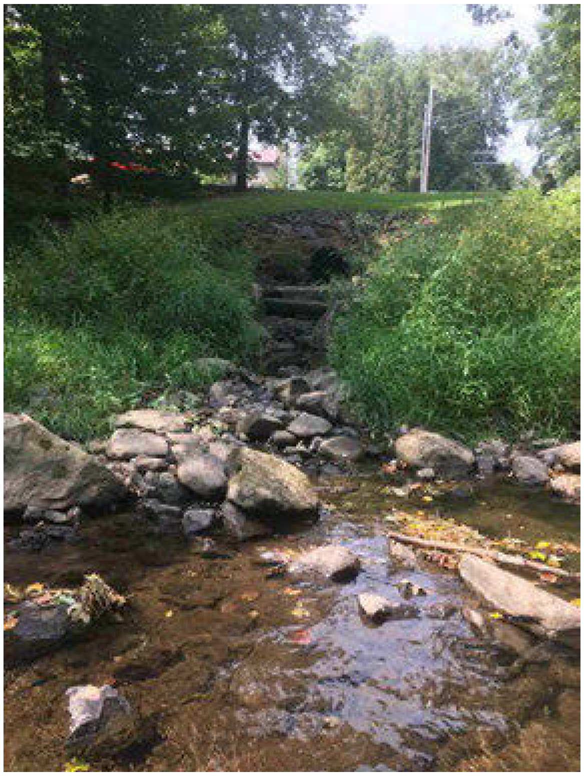


Figure 4: Stormwater outfall at head of reach Pomperaug-03.

- **Lack of Stream Buffer** – Stream buffer encroachments are prevalent along stream corridors in many areas of the Pomperaug River watershed and are most often associated with residential and commercial development and farms. Residential lawns and some agricultural practices extend down to the banks of the stream in many areas (**Figures 5 to 7**).

  The high level of stream buffer encroachment along the streams in the Pomperaug River watershed has a significant impact on overall stream and habitat conditions. In general, larger natural buffers are associated with better stream health, including improved water quality by filtering sediment and other runoff pollutants, cooler water temperatures as a result of stream shading, greater in-stream oxygen levels due to cooler waters, and enhanced habitat for a variety of wildlife resulting from deposited large woody debris and leaf litter.

Figure 5: View of pastures along the Weekeepeemee River in Woodbury, CT. The river runs along the tree line, with limited buffer to pasture and feeding areas. Animal fencing appeared well maintained at this location.

Figure 6: House with limited buffer to Pomperaug River encountered during stream walk.

- **Low Impact Development (LID) Opportunities** – There are many opportunities for infiltration practices throughout the watershed. Good candidates for LID retrofits include public rights-of-way (**Figure 8**), municipal and commercial parking lots, and parking lots and roads associated with Heritage Village. LID stormwater retrofits work to reduce site runoff and improve water quality through the use of bioretention, water quality swales, buffer strips/level spreaders, and other small-scale LID and green infrastructure approaches. Candidate stormwater retrofit sites exist in virtually all of the assessed subwatersheds but are most prevalent in the Pomperaug River subwatershed.

  Although conventional stormwater drainage systems with no treatment capability are prevalent throughout the watershed, there are also several examples of LID stormwater treatment practices in the watershed. One example of LID site design practices was observed in the lower parking lot behind the commercial plaza at 7 Garage Road, which included permeable pavement (**Figure 9**). Pervious pavement has also been used for the parking lot of the New Morning Market in Woodbury. Underground infiltration practices are also located at the new Riverview Cinemas and Playhouse at 690 Main Street South in Southbury and at the Southbury Medical Building.

Figure 7: View from Oakdale Manor looking towards the Pomperaug River depicting areas of limited buffer. Homes in close proximity to the river may also have issues with failing septic systems.

Figure 8: View of Pascoe Drive from the cul-de-sac looking up the hill. Potential opportunity for stormwater BMPs in the cul-de-sac or beneath it.

Figure 9: Example of pervious parking surface behind commercial plaza at 7 Garage Road, Southbury.

Table 1: Stream segment assessment results

Reach	Possible Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes
Pomperaug-01	Mountain Valley Equestrian Center	· Bioretention in drainage ditch adjacent to Audubon Property · Filter berms · Improved buffer around intermittent streams on equestrian property or reconfigured paddocks/runs/training areas	· Conduct additional ambient water quality monitoring at new sampling locations to determine extent of impairment and possible source(s) of bacteria
	Horse Fence Hill Road: Stormwater	· Limited potential for BMPs · Road recently repaved, catch basins already stenciled	
Pomperaug-03	Geese on adjacent golf courses and field of elementary school	· Increase vegetated buffer around water hazards and adjacent to streams/river · Implement other waterfowl deterrent strategies	· Golf Course Canada Geese Management strategies · CTDEEP Canada Geese Management Fact Sheet
	Stormwater outfalls	· Infiltration in ROW or underground (see also Heritage Village Neighborhood) · River Trail et al.: additional neighborhood assessment. IDDE investigation of drainage discharging at Cedarland Park · Reduce road sanding by municipalities · Septic survey of Branch Rd./Riverhill Rd. neighborhood	
	Heritage Village Wastewater Treatment Facility (upstream of reach)		· Conduct additional ambient water quality monitoring at new sampling locations to determine extent of impairment and possible source(s) of bacteria
	Failing or malfunctioning septic systems. Raw sewage smell noted during stream walk near River Trail		· Encourage septic system inspections · Investigate septic smell · Educate homeowners and homebuyers about proper use and maintenance of septic systems
Weekeepeemee-01	Run-off from livestock pasture and feeding paddocks at the farms north and south of Chohees Trail	· Filter berms along pasture · Increased vegetated buffer	

Table 2: Neighborhood assessment results

Neighborhood *Subwatershed*	Possible Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes
Berkshire Estates ***Pomperaug***	Stormwater	· Infiltration below roadway, especially cul-de-sac at Pascoe Dr. and Pomperaug Trail and at Pascoe Dr. and Berkshire Rd. intersection	· Increase buffer along river · More frequent catch basin cleaning
	Failing or malfunctioning septic systems	· Advanced subsurface sewage disposal systems (sand filter or similar) in riverside lots	· Inspect septic systems for failure · Ledge/bedrock could be a constraint · Educate homeowners and homebuyers about proper use and maintenance of septic systems
Oakdale Manor Road and associated Streets ***Pomperaug***	Stormwater	· Underground infiltration only, limited ROW space	· Septic system inspection and outreach · Turf management · Grass clippings – outreach or establish collection for disposal
Wellspring/Arch Bridge ***Weekeepeemee***	Failing or malfunctioning septic systems (noted by LUC)		· Assess septic system size for school buildings · If undersized, consider replacement or advanced subsurface sewage disposal systems (e.g. sand filter) · Education about proper use and maintenance of septic systems
Heritage Village ***Pomperaug***	Stormwater	· Underground infiltration in ROW · Bioretention cells where feasible · Pervious pavement at older parking lots (e.g. Meeting House) needing maintenance	· Heritage Village should be included as a priority area in the Town of Southbury's MS4 Stormwater Management Program, including IDDE program implementation · Conduct a stormwater BMP retrofit inventory/feasibility study for Heritage Village, which would support Southbury's efforts to reduce and disconnect DCIA as required by the MS4 Permit
	Wastewater treatment plant		· Conduct further sampling with increased sample spatial density

Table 3: Hotspot assessment results

Hotspot *Subwatershed*	Possible Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes
Mountain Valley Equestrian Center ***Pomperaug and Transylvania Brook***	Horse manure in paddocks Two drainage paths: One flows through Audubon old pasture, excellent buffer Other flows out drainage ditch to Transylvania Brook	· Bioretention in drainage ditch · Filter berm at bottom of paddock · Move drainage away from the center of paddocks/pasture	· Outreach for manure management best practices · Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program
The Farm – north and south of Chohees Trail ***Weekeepeemee***	Livestock manure in pasture and feed lot Livestock access to intermittent stream Row crops	· Filter berms along Weekeepeemee · Increased buffer width · Infiltration BMP on north farm next to road · Remove stream access through buffer and/or fencing	· Fencing in good repair, encourage maintenance · Encourage effective manure application (e.g. not before rain storm)

Hotspot *Subwatershed*	Possible Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes
Another Farm – Weekeepeemee Road ***Weekeepeemee***	Livestock (horses, goats, alpaca) manure	· Filter berms along intermittent stream · Increase buffer width	· Fencing in good repair, encourage maintenance · Outreach for manure management best practices
Quick Water Farm – Weekeepeemee Road and Peter Road ***Weekeepeemee***	Livestock (few head); Row crops	· Filter berms along Carmel Hill Brook · Increase buffer width	· Encourage effective manure application (e.g. not before rain storm) · Outreach for manure management best practices
Parmalee Farm – Guilds Hollow Road ***Weekeepeemee***	Livestock grazing and feed lot	· Filter berm along Dowd Brook	· Feeding appears to occur in a local depression, ensure that it does not drain under road
Southbury Plaza – Rt 6 ***Pomperaug***	Stormwater; Waste management	· Incorporate LID retrofits into site redevelopment · Underground infiltration, permeable pavement	· Cover dumpsters with roof · Review stormwater control plan, if exists · Heavily channelized stream · Conduct survey for potential illicit discharges from businesses in plaza
Medical Office Building - 10 Main St. South, Southbury ***Pomperaug***	Dry weather discharge requiring further investigation		· Pavement stained · Follow up sampling of dry weather discharge and removal of illicit connections
Stonecrest Farm – Rt 172 ***Pomperaug***	Manure piles; Paddock	· Move manure piles to alternative site with filter berms or drainage away from Pomperaug · Filter berms or increased buffer to pond · Move paddock at front barn area to alternative location or make smaller with a buffer strip adjacent to the river · Bank stabilization and buffer improvement along river edge · Evaluate need for farm pond · Move and regrade paddock/training areas to improve buffer	· Manure management in place · Most paddocks drain away from Pomperaug and toward a pond with algal mats · Farm to the north allows access to trib. Add buffer and fencing around stream · Outreach for manure management best practices
Berry Farm – Settler's Field and Stables ***Pomperaug***	Manure in open dumpsters	· Cover dumpsters or ensure drainage away from river	· Outreach for manure management best practices
Frazier Farm Training Center – Middle Road Turnpike ***Nonnewaug***	Horse access to tributary stream	· Filter berms and/or increased buffer in pasture · Reconfigure paddocks to avoid stream	· Some buffer exists in parts of pasture land · Outreach for manure management best practices · Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program
Logue Farm – Artillery Road ***Nonnewaug***	Livestock access to tributary Incomplete coverage of manure storage	· Filter berms or fencing and increased buffer around stream to prevent livestock access	· Reconfigure manure composting to divert runoff away from catch basins · Encourage more complete coverage (e.g. roofing) of manure composting
Percy Thomson Meadows – Thomson Road ***Weekeepeemee***	Livestock access to tributary	· Increased buffer and fencing or filter berms	
Fox Crossing Equestrian – Rt 61 ***East Spring Brook***	Manure storage	· Increase buffer to stream	· Manure management measures appear to be in place · Outreach for manure management best practices · Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program

3. Potential BMPs

Tables 1, 2, and 3 identify preliminary site-specific recommendations for Best Management Practices (BMPs) to address the bacteria sources that were identified during the field assessments. These preliminary BMP recommendations generally fall into the following categories:

- **Water Quality Monitoring** – The bacteria TMDL indicates impairments based on relatively few sampling stations. While this may be sufficient for identification of an impaired segment, additional water quality monitoring can be effective in tracing the source of the impairment. Particularly in the Weekeepeemee River watershed where only one bacteria monitoring station is indicated, increased water quality sampling at a higher spatial resolution should provide the information necessary to identify locations with the highest bacterial loads and help target management strategies. Flow monitoring is also recommended at these locations at the time of sampling to allow direct calculation of bacteria loads (pollutant concentration times flow rate). Pollutant loads, as opposed to concentration data alone, provide greater insight into potential sources since a highly concentrated wastewater discharge that occurs as a continuous "trickle" may have a greater impact on water quality than an intermittent, low-concentration discharge with a higher flow rate.

- **Stormwater Retrofits** – Existing impervious areas such as parking lots and roads may be good candidates for Low Impact Development (LID) or "green stormwater infrastructure" retrofits such as bioretention or underground infiltration, given the relatively permeable nature of the soils in the watershed. Underground infiltration practices located beneath existing parking lots provide stormwater treatment without eliminating parking. Parking availability can be further preserved by retrofitting lots to permeable pavement, similar to plans recently submitted to the Southbury Inland Wetlands Commission for redevelopment of a portion of Southbury Plaza. Practices under roads can be useful where right-of-way space is limited. Where parking and ROW space are not limitations, bioretention cells and wet vegetated treatment systems can also provide stormwater treatment to remove bacteria. Areas with good potential for LID retrofits include along Main Street South in Southbury, the under-utilized parking lot and adjacent depression at the intersection of Heritage Road and Hillhouse Road in Heritage Village, and Southbury Plaza. Regular maintenance of LID/GI practices is critical for these systems to function as designed. Regular maintenance, following written O&M procedures, is particularly important for underground infiltration practices, which can be "out of sight, out of mind."

- **Downspout Disconnection** – Disconnection of roof downspouts from the storm drainage system by directing roof runoff to pervious areas or LID practices such as rain gardens can reduce runoff volumes and bacteria loads originating from roosting birds. This relatively inexpensive retrofit strategy can be effective in residential and commercial settings.

- **MS4 Program Implementation** – Connecticut's revised MS4 General Permit went into effect on July 1, 2017. The watershed communities of Southbury and Woodbury are regulated under the MS4 General Permit. Both communities have developed Stormwater Management Plans that outline various activities that each town will conduct to comply with the 6 minimum control measures outlined in the permit. Compliance with the illicit discharge detection and elimination (IDDE) program requirements of the permit can help to significantly reduce bacteria loadings, where illicit connections are present and particularly where they contribute to the impaired segments of the Pomperaug and Weekeepeemee Rivers. Outfall screening for bacteria is required where a MS4 discharges to an impaired water for which bacteria is the pollutant of concern. Other minimum control measures apply to municipal operations, such as reducing road sanding or increasing street sweeping. The permit also requires reduction in Directly Connected Impervious Area (DCIA) through the use of LID practices that retain/infiltrate stormwater runoff from impervious surfaces, either through private or municipal redevelopment projects or retrofits.

- **Manure/Nutrient Management** – Livestock waste in agricultural operations can represent a potent source of bacteria when poorly managed. Often, larger livestock and equestrian operations maintain good manure management. Smaller operations may have fewer resources available for manure management. One key location for improved manure management practices is Stonecrest Farm, where an uncovered manure pile is located in close proximity to the Pomperaug River. Existing site grading at this farm is conducive to implementing improved manure management practices. Reconfiguring the manure management facility at Logue Farm away from existing storm drains may also be useful. In addition, identification of and outreach to 1- to 5-horse equestrian operations throughout the watershed can help assess and reduce their contribution to bacteria loads.

  Development and implementation of Comprehensive Nutrient Management Plans (CNMP) by the farming operations in the watershed – e.g., ensuring adequate storage of manure and wastewaters, diverting clean water from production areas, and methods for safe land application of manure and wastewaters – can reduce the potential water quality impacts. Other agricultural BMPs that could be implemented for large and small-scale farming operations include livestock exclusion fencing, cover crops, vegetated buffers/filter strips and filter berms (see below), covering heavy use areas, diverting clean water, and soil health.

- **Filter Berms** – Filter berms provide a relatively inexpensive option for treating agricultural nonpoint source runoff where drainage of pasture, paddocks, or feeding areas is directed toward a stream. Filter berms are nearly identical to more common stormwater filtration practices like sand filters and bioretention. They function by filtering stormwater runoff through soil media where microbial and plant communities can treat the runoff as it passes through the filter. Nearly all assessed farms where livestock are in close proximity to streams are potential candidates for filter berms. Additional funding opportunities may exist for agricultural producers through the Environmental Quality Incentives Program (EQIP) through USDA's Natural Resources Conservation Service.

- **Vegetated Buffers** – Increased vegetated buffer widths are recommended along streams where development or agricultural operations border the waterbody. Riparian buffers slow and absorb runoff, acting as a natural filter in both residential and agricultural settings. Their root structure can also help limit erosion. A properly maintained vegetated buffer can also limit livestock access to streams when used in conjunction with exclusion fencing. As with filter berms, funding from EQIP may be available to agricultural producers to restore vegetative buffers.

- **Septic System Inspection, Maintenance, and Outreach** – Septic system management appears limited in the watershed. Working with the Pomperaug Health District to strengthen inspection and maintenance guidelines, at least of those systems near impaired waterbodies, may help identify and mitigate failing or malfunctioning septic systems, which can be a significant source of bacteria loadings to the impaired stream segments in the watershed. Outreach programs to residents, especially those in close proximity to waterbodies, should encourage best practices in terms of septic system management, inspection, and routine maintenance.

- **Waterfowl Management** – Several golf courses directly border the Pomperaug River. Waterfowl such as Canada geese favor golf courses for feeding. Resident populations of waterfowl have increased in the past half-century. Their wastes are sources of bacteria that can drain directly or indirectly to water bodies. Reducing waterfowl nuisance populations can restore water quality by reducing bacterial and nutrient loadings, particularly in public parks, golf courses, and commercial areas along rivers, streams, and shoreline areas. Many communities also have existing bans on feeding of waterfowl. However, there are no easy solutions to nuisance waterfowl problems. CTDEEP provides some resources for Canada geese management strategies. Hunting is limited in such urban settings, so other strategies, such as egg-oiling may be a practice for further investigation. Creation of a vegetated buffer, consisting of tall grasses, shrubs, or trees, along ponds or streams is a recommended form of habitat modification. Geese prefer to feed on short grass in areas that are open and within sight of a body of water. Tall grasses, shrubs, and trees can serve as a deterrent and cause them to relocate. Vegetated buffers can also reduce NPS pollution.

References

Kitchell, A and T Schueler. 2004. Unified Stream Assessment: A User's Manual. Center for Watershed Protection. Ellicott City, MD.

Wright, T, C Swann, K Cappiella, and T Schueler. 2004. Unified Subwatershed and Site Reconnaissance: A User's Manual. Center for Watershed Protection. Ellicott City, MD.

Attachment A

Field Assessment Forms

Reach Level Assessment **RCH**

SURVEY REACH ID: 1 **WTRSHD/SUBSHD:** Pomp Lower **DATE:** 9/5/17 **ASSESSED BY:** SB BG

START **TIME:** 10:00 [✓ AM]/PM **LMK:** ____
LAT ___° ___' ___" **LONG** ___° ___' ___"
DESCRIPTION: AUDUBON BENT OF RIVER

END **TIME:** ___:___ AM/PM **LMK:** ____
LAT ___° ___' ___" **LONG** ___° ___' ___"
DESCRIPTION: SAME

GPS ID: FLD R1

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☒ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☒ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☒ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☒ Other: Protected Land

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐ 25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☒ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☒ Fish ☐ Beaver ☐ Deer
☐ Snails ☐ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown
☐ Downcutting ☐ Bed scour
☐ Widening ☐ Bank failure
☐ Headcutting ☒ Bank scour
☐ Aggrading ☐ Slope failure
☐ Sed. deposition ☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank ________ (ft)
RT bank ________ (ft)
Width: Bottom ________ (ft)
Top ________ (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair:** Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.

[✓ 5] 4 3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

River examined from bank, along Audubon Society Trail.

Many riffles, protected land on both banks to neighborhoods assessed @ mouth of Pomperaug

Horse Fence Hill Rd Neighborhood
2 outfalls f/ storm drain network at top of hill discharge to impaired segment
stencils on ~~storm~~ catch basins.

NOTES: *(biggest problem you see in survey reach)*
Mountain Valley Equestrian Hotspot
outfalls

REPORTED TO AUTHORITIES ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 [✓ 19] 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank [✓ 10] ~~9~~	8 7 6	5 4 3	2 1 0
	Right Bank [✓ 10] ~~9~~	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
	Left Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
	Right Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
	20 19 18 17 16	[✓ 15] 14 13 12 11	~~10~~ 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
	Left Bank [✓ 10] 9	8 7 6	5 4 3	2 1 0
	Right Bank [✓ 10] 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
	20 19 18 17 16	15 14 [✓ 13] 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
	20 19 18 17 16	[✓ 15] 14 13 ~~12~~ 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: ~~60~~ 62 /80 + Buffer/Floodplain: ~~59~~ 62 /80 = **Total** Survey Reach ~~119~~ 124 /160

Reach Level Assessment **RCH**

SURVEY REACH ID: 2 | **WTRSHD/SUBSHD:** Pomp Upper | **DATE:** 09/05/17 | **ASSESSED BY:** SB BG

START **TIME:** 12 : 52 AM/[✓ PM] **LMK:** ____
LAT 41 ° 28 . 853 " **LONG** 73 ° 13 . 523 "
DESCRIPTION: Poverty RD Bridge

END **TIME:** ___ : ___ AM/PM **LMK:** ____
LAT 41 ° ___ ' ___ " **LONG** ___ ° ___ ' ___ "
DESCRIPTION: Flood Bridge RD

GPS ID: FLD RI

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☒ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☒ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☒ Commercial ☒ Urban/Residential ☒ Suburban/Res ☒ Forested ☐ Institutional ☒ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 25-50 % ☐ 50%-75% ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☒ Cobble (2.5 –10")
☒ Sand (gritty) ☒ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)* ☒ Stained *(clear, naturally colored)* ☐ Opaque *(milky)* ☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☐ none ☒ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of) ☒ Fish ☐ Beaver ☐ Deer ☐ Snails ☒ Other: Hawk Duck

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Downcutting ☒ Bed scour
☐ Widening ☐ Bank failure
☐ Headcutting ☒ Bank scour
☐ Aggrading ☐ Slope failure
☑ Sed. deposition ☐ Channelized
☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank >12 (ft)
RT bank >12 (ft)
Width: Bottom ____ (ft)
Top ____ (ft)

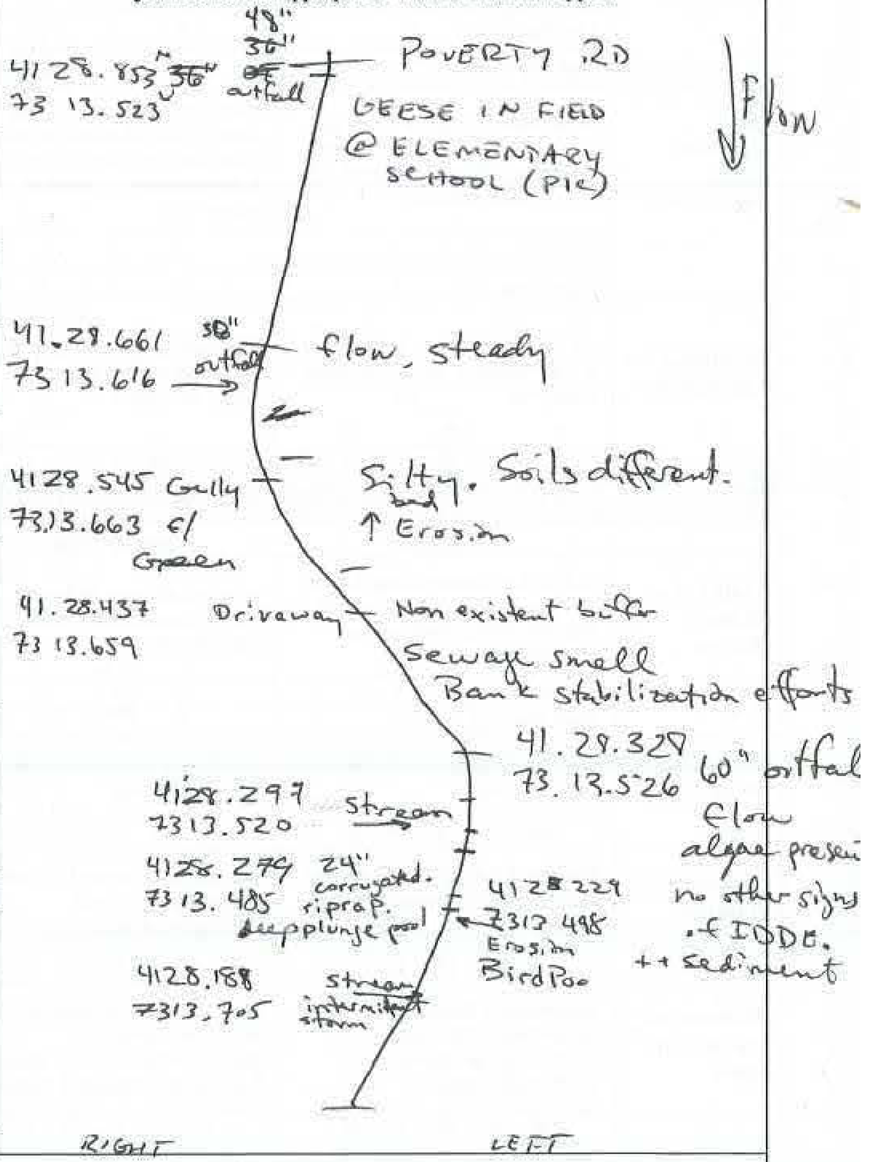
REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair:** Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.

5 4 [✓ 3] [✓ 2] 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow



NOTES: *(biggest problem you see in survey reach)*
understory mgmt golf course
lots of sand. stormwater mgmt in tributary + direct stormwater discharge. Septic smell

REPORTED TO AUTHORITIES ☐ YES ☐ NO

OVERALL STREAM CONDITION				
	Optimal	**Suboptimal**	**Marginal**	**Poor**
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0
	Right Bank 10 9	8 7 [✓ 6]	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
	Left Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
	Right Bank 10 9	8 7 6	5 [✓ 4] 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
	20 19 18 17 16	15 [✓ 14] 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION				
	Optimal	**Suboptimal**	**Marginal**	**Poor**
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
	Left Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
	Right Bank 10 9	8 [✓ 7] 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
	20 19 18 17 16	15 14 13 [✓ 12] 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 [✓ 4] 3 2 1 0
FLOODPLAIN ENCROACHMENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	[✓ 5] 4 3 2 1 0

Sub Total In-stream: 48 /80 + Buffer/Floodplain: 35 /80 = **Total** Survey Reach 83 /160

Reach Level Assessment **RCH**

SURVEY REACH ID: 3 **WTRSHD/SUBSHD:** WEEKEEPEEMEE **DATE:** 9/5/17 **ASSESSED BY:** SB BG

START **TIME:** ___:___ AM/PM **LMK:** ___
LAT ___° ___' ___" **LONG** ___° ___' ___"
DESCRIPTION: CHOHEES TR.

END **TIME:** ___:___ AM/PM **LMK:** ___
LAT ___° ___' ___" **LONG** ___° ___' ___"
DESCRIPTION:

GPS ID:

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☒ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 25-50 % ☐ 50%-75% ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☒ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)* ☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)* ☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)* ☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Downcutting ☐ Bed scour
☐ Widening ☐ Bank failure
☐ Headcutting ☐ Bank scour
☐ Aggrading ☐ Slope failure
☐ Sed. deposition ☐ Channelized
☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank ______ (ft)
RT bank ______ (ft)
Width: Bottom ______ (ft)
Top ______ (ft)

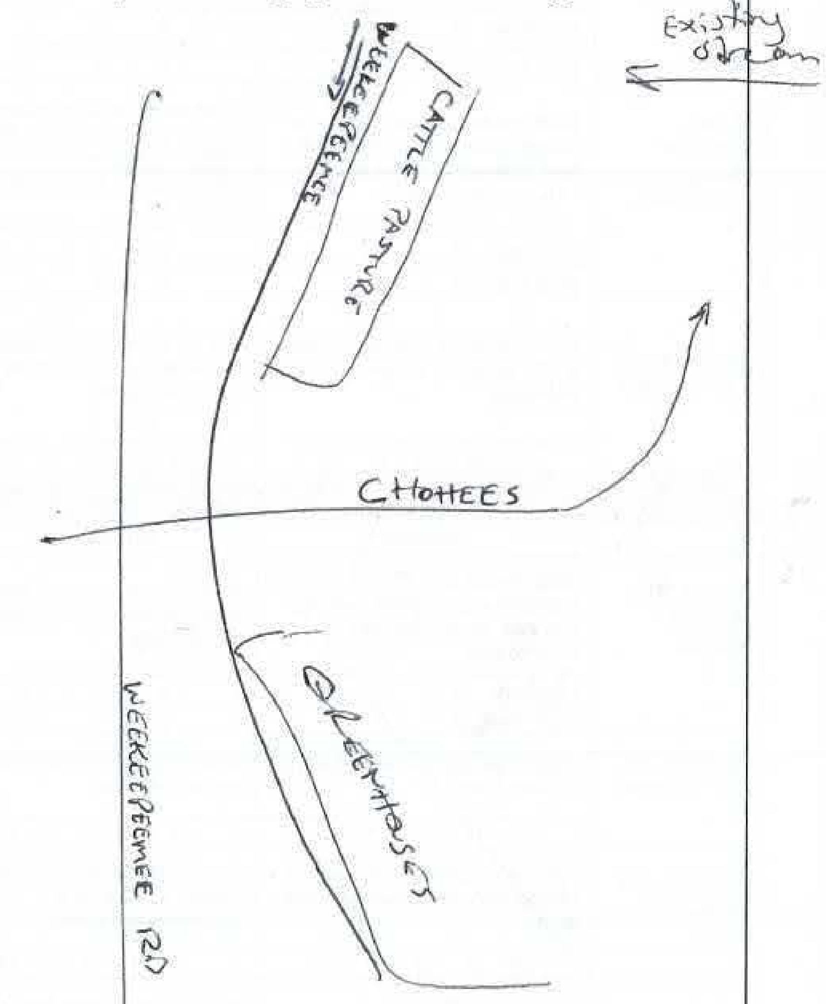
REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair:** Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.

5 4 3 [✓ 2] 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow



NOTES: *(biggest problem you see in survey reach)* Stream walk not completed. Poor streambed access from roadway. Animal exclusion fencing visible from Weekeepeemee Rd and appears in good repair.
Recommend buffer on farm around existing stream.

REPORTED TO AUTHORITIES ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACHMENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: _____ /80 + Buffer/Floodplain: _____ /80 = **Total** Survey Reach _____ /160

Neighborhood Source Assessment **NSA**

WATERSHED: Pomparaug	**SUBWATERSHED:** Lower	**UNIQUE SITE ID:** N – 01
DATE: 09/05/2012	**ASSESSED BY:** SB BG	**CAMERA ID:** BILL PHONE **PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: BERKSHIRE ESTATES Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed:
PASCOE TR, POMPERAUG TR

Homeowners Association? ☐ Y ☐ N ☒ Unknown If yes, name and contact information: ______

Residential *(circle average single family lot size):* 65

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ [✓ ¼] ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached [✓ <¼] [✓ ¼] ½ 1 >1 acre ☐ Mobile Home Park

		INDEX*
Estimated Age of Neighborhood: 70 years	Percent of Homes with Garages: >75 % With Basements ___ %	
Sewer Service? ☐ Y ☒ N		○
Index of Infill, Redevelopment, and Remodeling ☐ No Evidence ☐ <5% of units ☐ 5-10% ☒ >10% 20%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	Percentage	Comments/Notes	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	40-50%	Incl House + Driveway	
B2. % of lot with grass cover	50%		○
B3. % of lot with landscaping (e.g., mulched bed areas)			◇
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy			◇
B6. Evidence of permanent irrigation or "non-target" irrigation			○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 20		○
	Med: 40		
	Low: 40		
B8. Outdoor swimming pools? ☐ Y ☒ N ☐ Can't Tell Estimated # ___			○
B9. Junk or trash in yards? ☐ Y ☐ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	~~75~~ 50%	OTHERS COMPACTED GRAVEL	
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☐ N If yes, check all that apply: UPPER ELEV			
☒ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☒ Sediment			○
☒ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer	FEW		◇ ○
D2. Downspouts are directed to impervious surface			
D3. Downspouts discharge to pervious area	MOST		
D4. Downspouts discharge to a cistern, rain barrel, etc.			
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☐ N			◇

E. COMMON AREAS	
E1. Storm drain inlets? ☒ Y ☐ N If yes, are they stenciled? ☒ Y ☐ N Condition: ☒ Clean ☒ Dirty	◇
Catch basins inspected? ☐ Y ☒ N If yes, include Unique Site ID from SSD sheet: ______	○
E2. Storm water pond? ☐ Y ☒ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre	◇
E3. Open Space? ☒ Y ☐ N If yes, is pet waste present? ☐ Y ☒ N dumping? ☐ Y ☒ N	○
Buffers/floodplain present: ☒ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N	
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS	
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply)* ☐ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☒ Bacteria ☒ Sediment ☐ Other ______	○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice? — leaving buffer of 6" grass for 3-4' along river
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ______

Describe Recommended Actions:

Inspect Septic Systems for failure, esp. along river

Catch Basin Cleaning

Pascoe + Berkshire cul-de-sacs

↳ verify soils, limited utility conflict.

Underground infiltration

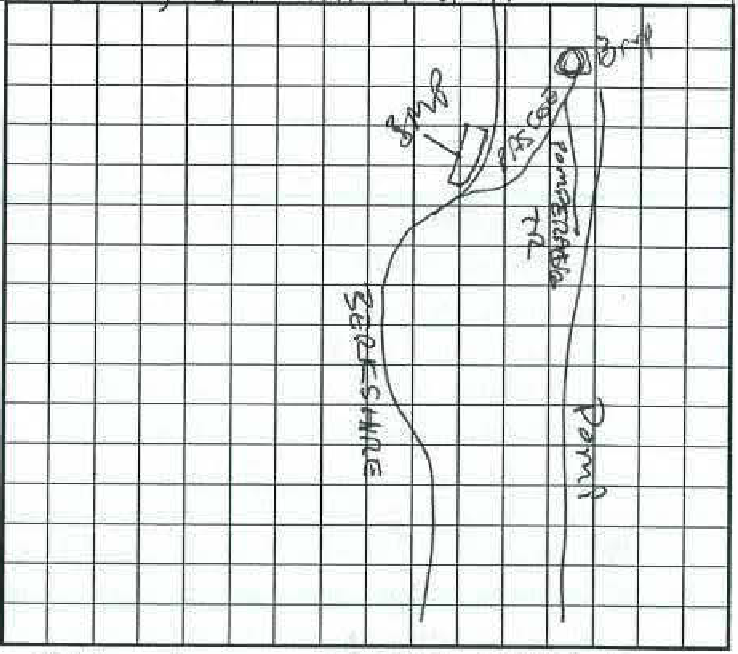
Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)



NOTES: 97+188 Berkshire Rd Have severe erosion issues to

Neighborhood Source Assessment **NSA**

WATERSHED: POMPERAUG	**SUBWATERSHED:** ~~B~~ LOWER	**UNIQUE SITE ID:** N-02
DATE: 09/05/2017	**ASSESSED BY:** SB BL	**CAMERA ID:** BILL CELL **PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: OAKDALE DR   Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed: ______

Homeowners Association? ☐ Y ☐ N ☒ Unknown If yes, name and contact information: ______

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached [✓ <¼] ¼ ½ 1 >1 acre ☐ Mobile Home Park

	INDEX*
Estimated Age of Neighborhood: 70 years | Percent of Homes with Garages: ____% With Basements 0 %	
Sewer Service? ☐ Y ☒ N	○
Index of Infill, Redevelopment, and Remodeling ☐ No Evidence ☐ <5% of units ☒ 5-10% ☒ >10%	○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	Percentage	Comments/Notes	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	50%		
B2. % of lot with grass cover	50%		○
B3. % of lot with landscaping (e.g., mulched bed areas)			◇
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy			◇
B6. Evidence of permanent irrigation or "non-target" irrigation	minimal		○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: ~~20~~ 10		○
	Med: ~~70~~ 30		
	Low: ~~40~~ ~~50~~ 60		
B8. Outdoor swimming pools? ☐ Y ☒ N ☐ Can't Tell Estimated # ____			○
B9. Junk or trash in yards? ☒ Y ☐ N ☐ Can't Tell	5%	cars	⊗
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	50%	compacted gravel 50%	
C2. Driveway Condition ☐ Clean ☒ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? ____ ft.			◇
Is pet waste present in this area? ☒ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☒ Y ☐ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☒ Long-term car parking ☐ Sediment			○
☒ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer			◇ ○
D2. Downspouts are directed to impervious surface	Some		
D3. Downspouts discharge to pervious area	most		
D4. Downspouts discharge to a cistern, rain barrel, etc.			
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☒ N		insufficient space for rain garden	◇

E. COMMON AREAS

E1. Storm drain inlets? ☒ Y ☐ N If yes, are they stenciled? ☐ Y ☒ N Condition: ☒ Clean ☐ Dirty ◇

Catch basins inspected? ☐ Y ☒ N If yes, include Unique Site ID from SSD sheet: ______ ○

E2. Storm water pond? ☐ Y ☒ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N
What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre ◇

E3. Open Space? ☒ Y ☒ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N ○

Buffers/floodplain present: ☒ Y ☐ N If yes, is encroachment evident? ☒ Y ☐ N

F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS

Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply)*
☒ Nutrients ☒ Oil and Grease ☐ Trash/Litter ☒ Bacteria ☒ Sediment ☐ Other ______ ○

Recommended Actions

Specific Action

- ☐ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice?
- ☒ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☒ Other action(s) Remove old vehicles

Describe Recommended Actions:

Turf mgmt, grass clippings outreach → where take grass clipp
collection?
Septic education + monitoring
Stormwater mgmt
More ambient water quality stations.

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES: No room in BMPs in ROW, underground infil as an option.

Neighborhood Source Assessment **NSA**

WATERSHED: WEEKEEPEEMEE	**SUBWATERSHED:**	**UNIQUE SITE ID:** NSA-03
DATE: 9/5/17	**ASSESSED BY:** SB BG	**CAMERA ID:** **PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: WELLSPRING / ARCH BRIDGE Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed: ______

Homeowners Association? ☐ Y ☐ N ☐ Unknown If yes, name and contact information: ______

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☐ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

		INDEX*
Estimated Age of Neighborhood: _____ years	Percent of Homes with Garages: _____% With Basements ___%	
Sewer Service? ☐ Y ☐ N		○
Index of Infill, Redevelopment, and Remodeling ☐ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	Percentage	Comments/Notes	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	30%		
B2. % of lot with grass cover	~~40~~ 50%		○
B3. % of lot with landscaping (e.g., mulched bed areas)	5%		◇
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy	15%		◇
B6. Evidence of permanent irrigation or "non-target" irrigation			○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 20		○
	Med: 60		
	Low: 20		
B8. Outdoor swimming pools? ☐ Y ☐ N ☒ Can't Tell Estimated # ___			○
B9. Junk or trash in yards? ☐ Y ☒ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	100		
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☒ Y ☐ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☒ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☒ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer			◇ ○
D2. Downspouts are directed to impervious surface			
D3. Downspouts discharge to pervious area	100%		
D4. Downspouts discharge to a cistern, rain barrel, etc.			
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☐ N			◇

E. COMMON AREAS	
E1. Storm drain inlets? ☒ Y ☐ N If yes, are they stenciled? ☐ Y ☒ N Condition: ☒ Clean ☐ Dirty	◇
Catch basins inspected? ☐ Y ☒ N If yes, include Unique Site ID from SSD sheet: ________	○
E2. Storm water pond? ☐ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre	◇
E3. Open Space? ☐ Y ☐ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N	○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N	
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS	
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☐ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other ________	○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☐ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ________

Describe Recommended Actions:

ASSESS SEPTIC SYSTEM SIZE FOR SCHOOL IF IT IS PROBLEM SEPTIC RETROFIT POTENTIAL FOR UPGRADED OR SAND FILTER OR OTHER ADVANCED OWTS

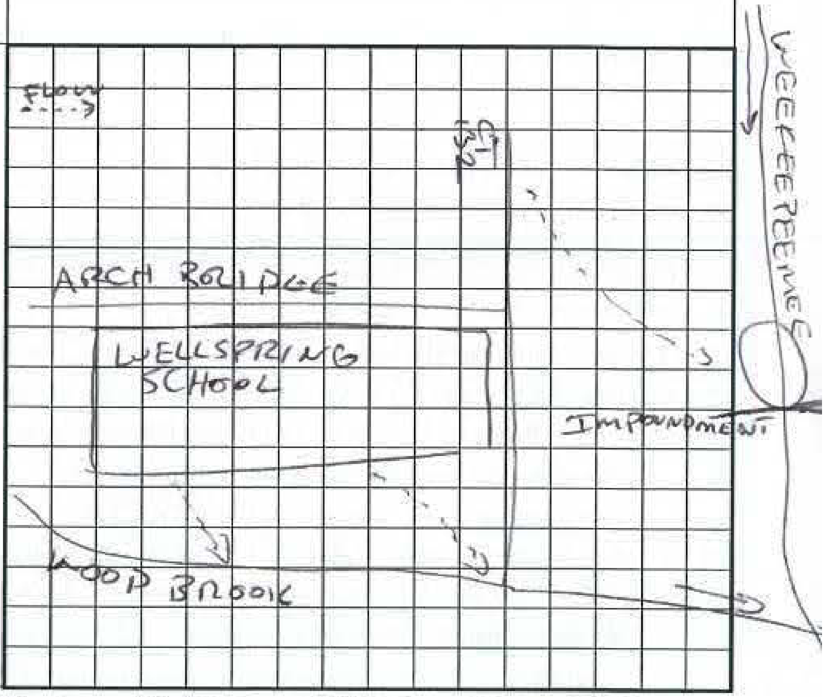
Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)



NOTES: ~~THE~~ NEIGHBORHOOD DESCRIBED AS PROBLEM SEPTIC, RECOMMEND

CT 132 CONTINUES S TOWARD A HILL W/ A 9% GRADE

Neighborhood Source Assessment **NSA**

WATERSHED: POMPERAUG | **SUBWATERSHED:** UPPER | **UNIQUE SITE ID:** NSA-01

DATE: 09/06/2017 | **ASSESSED BY:** SB BG | **CAMERA ID:** BG CELL | **PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: HERITAGE VILLAGE Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed: ______

Homeowners Association? ☐ Y ☐ N ☒ Unknown If yes, name and contact information: ______

Residential *(circle average single family lot size):*

☒ Single Family Attached (Duplexes, Row Homes) [✓ <⅛] ⅛ ¼ ⅓ ⅓ acre ☒ Multifamily (Apts, Townhomes, Condos)

☐ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

	INDEX*
Estimated Age of Neighborhood: 30 years | Percent of Homes with Garages: 0 % With Basements ? %	
Sewer Service? ☒ Y ☐ N ↳ ALL PARKING IN COMMUNAL LOTS	○
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%	○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity	Percentage	Comments/Notes	INDEX*
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover	~~75%~~ 70%		
B2. % of lot with grass cover	25%		○
B3. % of lot with landscaping (e.g., mulched bed areas)	5		◇
B4. % of lot with bare soil			○
**Note: B1 through B4 must total 100%*			
B5. % of lot with forest canopy	0		◇
B6. Evidence of permanent irrigation or "non-target" irrigation			○
B7. Proportion of *total neighborhood* turf lawns with following management status:	High: 100		○
	Med: ___		
	Low: ___		
B8. Outdoor swimming pools? ☒ Y ☐ N ☐ Can't Tell Estimated # 3 communal			○
B9. Junk or trash in yards? ☐ Y ☒ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A	100	parking lots	
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☒ Y ☐ N If yes, are they on one side of street ☐ or along both sides ☐			
☒ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? 3 ft.			◇
Is pet waste present in this area? ☒ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☒ Y ☐ N If yes, check all that apply:			
☒ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer			◇ ○
D2. Downspouts are directed to impervious surface			
D3. Downspouts discharge to pervious area			
D4. Downspouts discharge to a cistern, rain barrel, etc.			
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☐ N			◇
E. COMMON AREAS			
E1. Storm drain inlets? ☒ Y ☐ N If yes, are they stenciled? ☐ Y ☒ N Condition: ☒ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☒ N If yes, include Unique Site ID from SSD sheet: ________			○
E2. Storm water pond? ☒ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre			◇
E3. Open Space? ☒ Y ☐ N If yes, is pet waste present? ☐ Y ☒ N dumping? ☐ Y ☒ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☒ Bacteria ☐ Sediment ☐ Other ________			○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ________

Describe Recommended Actions:

ENGage Village
Sampling outfalls + trt plant - what is contribution
consider MS4 status
disconnect parking areas, replace w/ pervious pavers,
need to start treating stormwater

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☒ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☒ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

LOTS OF SPACE FOR BMPS.
THERE IS A LOT OF SCOPE FOR WORK ON STORMWATER QUALITY + WASTEWATER TREATMENT

NOTES: OVERFLOW PARKING FOR MTG HOUSE CAN BE RETROFITTED W/ PERVIOUS PAVEMENT, BIORETENTION

PIPED STORMWATER → INFIL PROJECT

REVIEW STORMWATER PLAN - ANY CURRENT INFILTRATION PRACTICES

Return Wed. for Follow up

Hotspot Site Investigation **HSI**

WATERSHED: Pomperaug	**SUBWATERSHED:** Lower		**UNIQUE SITE ID:** HSI-01
DATE: 9/6/17	**ASSESSED BY:** SB BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __° __' __" **LONG** __° __' __"		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: Mountain Valley Equestrian Ctr E. Flat Hill Rd. Southbury

SIC code (if available): ———

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

Basic Description of Operation: Horse training facility

	INDEX*
B. VEHICLE OPERATIONS ☒ **N/A** *(Skip to part C)* **Observed Pollution Source?**	☐
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ______	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ **N/A** *(Skip to part D)* **Observed Pollution Source?**	☐
C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☒ Can't Tell If yes, are they ☐ Liquid ☒ Solid Description: Animal ~~#~~Wask Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☒ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☒ N ☒ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☒ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☒ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☒ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ **N/A** *(Skip to part E)* **Observed Pollution Source?**	☐
D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ **N/A** *(Skip to part F)* **Observed Pollution Source?**	☐
E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ **N/A** *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ **N/A** *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

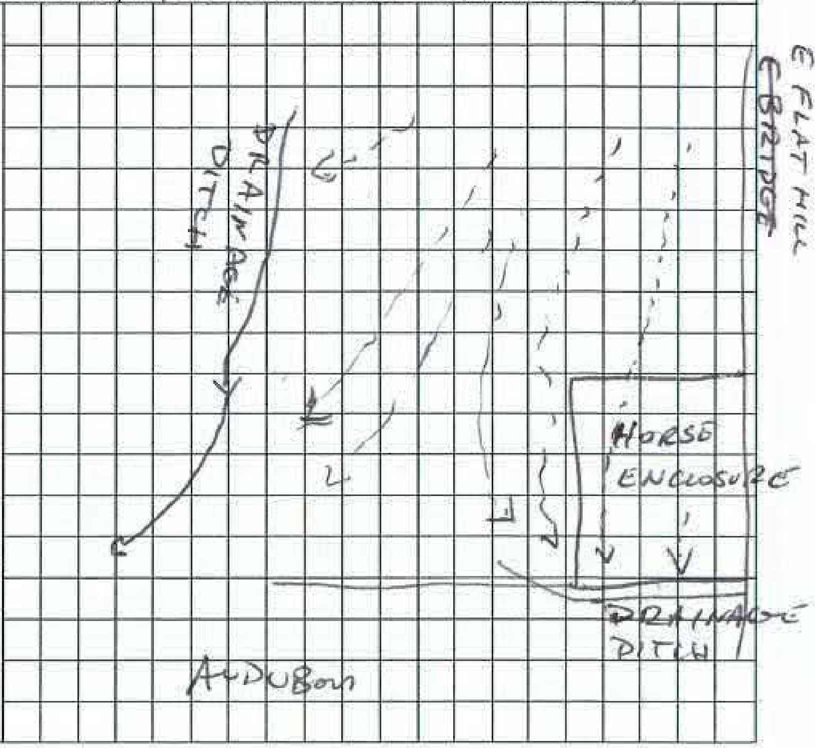
H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☒ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☐ Schedule a review of storm water pollution prevention plan

Notes: ~~Unlikely hotspot.~~
Drainage noted on aerial to South
passes through wetland



Hotspot Site Investigation **HSI**

WATERSHED: WEEKEPEEMEE	**SUBWATERSHED:**		**UNIQUE SITE ID:** HSI-# 02
DATE: 9/5/17	**ASSESSED BY:** SB BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __°___'___" **LONG** __°___'___"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: THE FARM
646 HEES TR

Category: ☐ Commercial ☐ Industrial Miscellaneous
☐ Institutional ☐ Municipal ☐ Golf Course
☐ Transport-Related ☐ Marina
☒ Animal Facility

SIC code (if available): ________

Basic Description of Operation: LIVESTOCK OPERATION, POT ACCESS TO STREAM

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

INDEX*

B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)* — Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: ________

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)* — Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☒ N/A *(Skip to part E)* — Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☒ N/A *(Skip to part F)* — Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☒ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☒ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

	Index Rating for Accumulation in Gutters				
	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

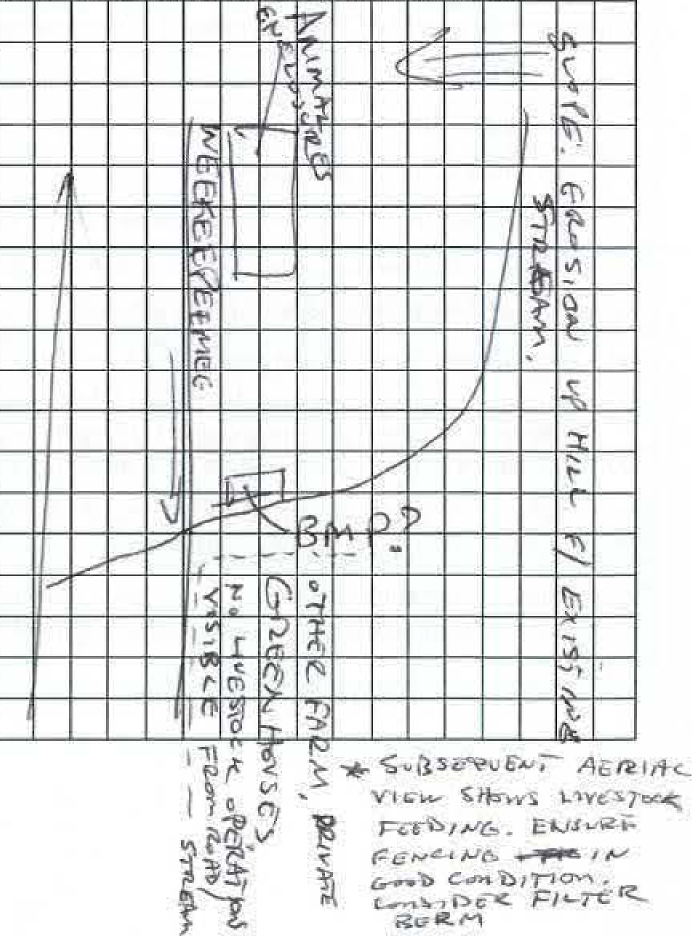
☒ Not a hotspot (fewer than 5 circles and no boxes checked) ☒ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☐ Schedule a review of storm water pollution prevention plan

Notes:

POSSIBLE BUFFER RESTORATION ALONG RIVER. FENCING IN GOOD REPAIR.
FILTER BERM POTENTIAL TO PREVENT MANURE RUNOFF.
CROP BUFFER IF ROTATIONAL
BMP FOR STORMWATER RUNOFF(?) ON THE FARM.

ADD BUFFER AROUND STREAM PASSING THROUGH FARM.



* SUBSEQUENT AERIAL VIEW SHOWS LIVESTOCK FEEDING. ENSURE FENCING ~~[illegible]~~ IN GOOD CONDITION. CONSIDER FILTER BERM

Hotspot Site Investigation **HSI**

WATERSHED: WEEKEEPEEMEE	**SUBWATERSHED:**		**UNIQUE SITE ID:** HSI-03
DATE: 9/5/17	**ASSESSED BY:**	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** 41 ° 35.126 " **LONG** 73° 13.933 "		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: QUICK WATERS FARM, 233 WEEKEEPEEMEE RD WOODBURY

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

SIC code (if available): ____

Basic Description of Operation: ROW CROPS, LIVESTOCK

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

INDEX*

B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ____

B2. Approximate number of vehicles: ____

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☒ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ____
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☑ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ____ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

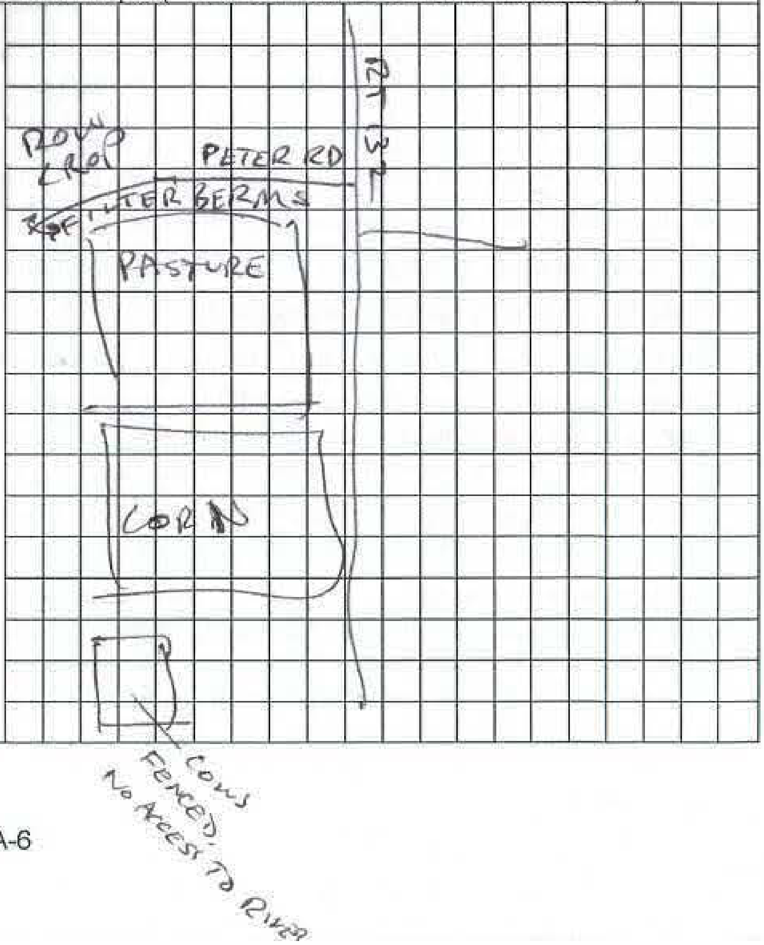
H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☒ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
- ☐ Refer for immediate enforcement
- ☐ Suggest follow-up on-site inspection
- ☐ Test for illicit discharge
- ☐ Include in future education effort
- ☐ Check to see if hotspot is an NPDES non-filer
- ☐ Onsite non-residential retrofit
- ☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: ____________________
- ☐ Schedule a review of storm water pollution prevention plan

Notes: FILTER BERMS ALONG CARMEL HILL BROOK,

FILTER BERMS ~~ALONG~~ FOR COWS



Hotspot Site Investigation **HSI**

WATERSHED: Pmi	**SUBWATERSHED:** VR7ER		**UNIQUE SITE ID:** HSI 04
DATE: 9/5/17	**ASSESSED BY:** SB RG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __°___'___" **LONG** __°___'___"		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: SOUTHBURY PLAZA

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

SIC code (if available): ______

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

Basic Description of Operation: RETAIL OPERATIONS, PARKING LOT CHANNELIZED STREAM

INDEX*

B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ______

B2. Approximate number of vehicles: ______

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☒ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☒ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☒ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☒ Solid Description: ______
Where are they stored? ☐ grass/dirt area ☒ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☒ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☒ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☒ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☒ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☒ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☒ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☒ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☒ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age 5 yrs. Condition: ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☒ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☒ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☒ N/A *(skip to part G)*

Observed Pollution Source? ☐

F1. % of site with: Forest canopy ____% Turf grass ____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☒ Unknown If yes, please describe: ____________ ○

G2. Are private storm drains located at the facility? ☒ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

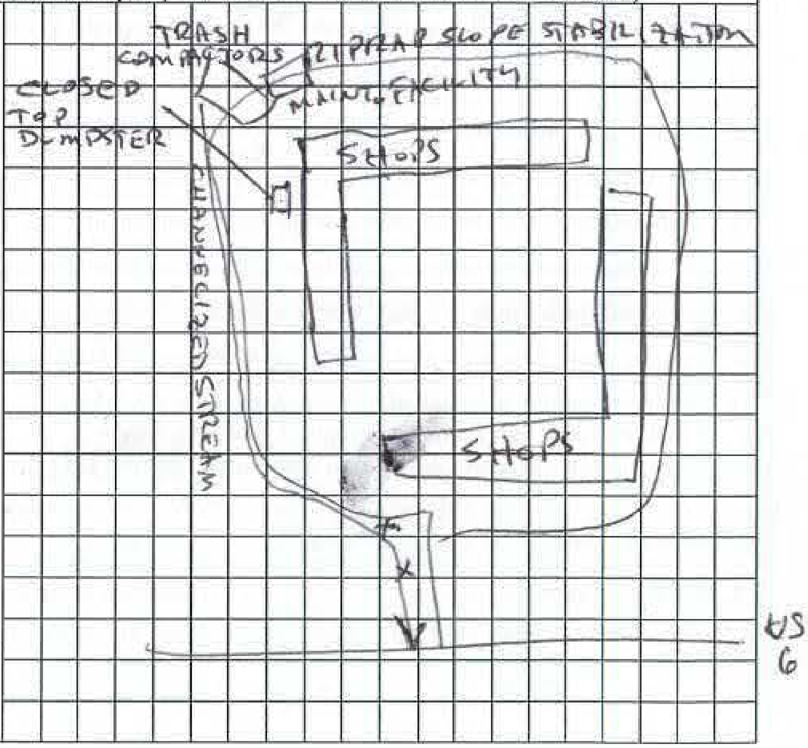
- ☐ Refer for immediate enforcement
- ☐ Suggest follow-up on-site inspection
- ☐ Test for illicit discharge
- ☐ Include in future education effort
- ☐ Check to see if hotspot is an NPDES non-filer
- ☒ Onsite non-residential retrofit
- ☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: ____________
- ☒ Schedule a review of storm water pollution prevention plan

Notes:

POSSIBLE/LIKELY THAT A STORMWATER CONTROL PLAN EXISTS FOR THIS FACILITY RECOMMEND REVIEW.

UNDERGROUND INFILTRATION POTENTIAL SOME OUTFALLS EXIST.

SAND USED FOR WINTER MAINTENANCE. STORAGE AREA COVERED



X - OUTFALL

Hotspot Site Investigation **HSI**

WATERSHED: WEEKEEPEEMEE	**SUBWATERSHED:**		**UNIQUE SITE ID:** HSI-05
DATE: 9/5/17	**ASSESSED BY:**	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __° __' __" **LONG** __° __' __"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: PARMALEE FARM
426 GUILDS HOLLOW RD
BETHLEHEM

SIC code (if available): ________

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

Basic Description of Operation: LIVESTOCK GRAZING

INDEX*

B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: ________

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* — Observed Pollution Source? ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* — Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☐ Schedule a review of storm water pollution prevention plan

Notes: LIVESTOCK FEEDING APPEARS TO
OCCUR IN A LOCAL DEPRESSION,

RECOMMEND INCREASING BUFFER
OR FILTER BERM TO STREAM.
TRIB TO DOWD BROOK MAY GO THROUGH
GRAZING AREA SOUTH OF CT 132.
RECOMMEND FILTER BERMS

Hotspot Site Investigation **HSI**

WATERSHED: Weekeepeemee	**SUBWATERSHED:**		**UNIQUE SITE ID:** HSI-06
DATE: 9/5/17	**ASSESSED BY:** SB BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __° __' __" **LONG** __° __' __"		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: ANOTHER FARM
Weekeepeemee Rd
Woodbury

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

SIC code (if available): ________

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Basic Description of Operation: EQUESTRIAN + OTHER ANIMALS

INDEX*

B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: ______

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: _______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: _______________
☐ Schedule a review of storm water pollution prevention plan

Notes: GOATS, ALPACAS, MULES, HORSES
FILTER BERM TO TRIB OF WEEREEMEE

Hotspot Site Investigation **HSI**

WATERSHED: POMPERAUG	**SUBWATERSHED:** UPPER		**UNIQUE SITE ID:** HSI - 07
DATE: 9/5/17	**ASSESSED BY:** SB BG	**CAMERA ID:** BILL CELL	**PIC#:**
MAP GRID:	**LAT** ___° _____' _____" **LONG** ___° _____' ____"		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: MEDICAL OFFICE BUILDING, 10 MAIN ST S. SOUTHBURY

SIC code (if available): ____________

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

Category: ☒ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☐ Animal Facility

Basic Description of Operation: MEDICAL OFFICES

INDEX*

B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)* — Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ____________

B2. Approximate number of vehicles: ________

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☑ N/A *(Skip to part D)* — Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: _______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☒ N/A *(Skip to part E)* — Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☒ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)* — Observed Pollution Source? ☐

E1. Building: Approximate age: ________ yrs. Condition of surfaces: ☐ Clean ☒ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☒ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☒ Stained ☐ Dirty ☐ Breaking up
Surface material ☑ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☒ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☒ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☒ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☒ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☒ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☒ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☒ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: __________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

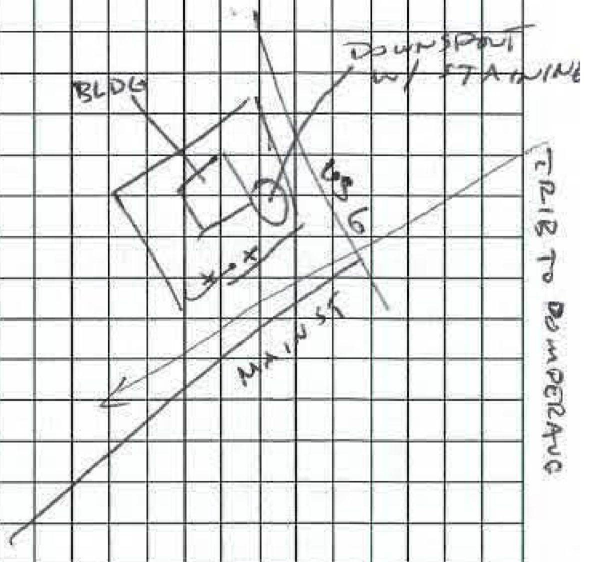
☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☒ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☐ Schedule a review of storm water pollution prevention plan

Notes: DRY WEATHER DISCHARGE OBSERVED
STAINING ON PAVEMENT FROM
DISCHARGE. PIPE ALSO STAINED

POSSIBLY FROM SUMP



× CATCHBASINS RECEIVING DISCHARG

Hotspot Site Investigation **HSI**

WATERSHED: POMPERAUG	**SUBWATERSHED:** LOWER	**UNIQUE SITE ID:**	
DATE: 9/6/17	**ASSESSED BY:** SB BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___° ___' ___" **LONG** ___° ___' ___"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: STONECREST EQUESTRIAN

SIC code (if available): ___________

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous: ☐ Golf Course ☐ Marina ☐ Animal Facility

Basic Description of Operation: HORSE STABLE

INDEX*

B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______ Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell	○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged	○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)*

Observed Pollution Source? ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)*

Observed Pollution Source? ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

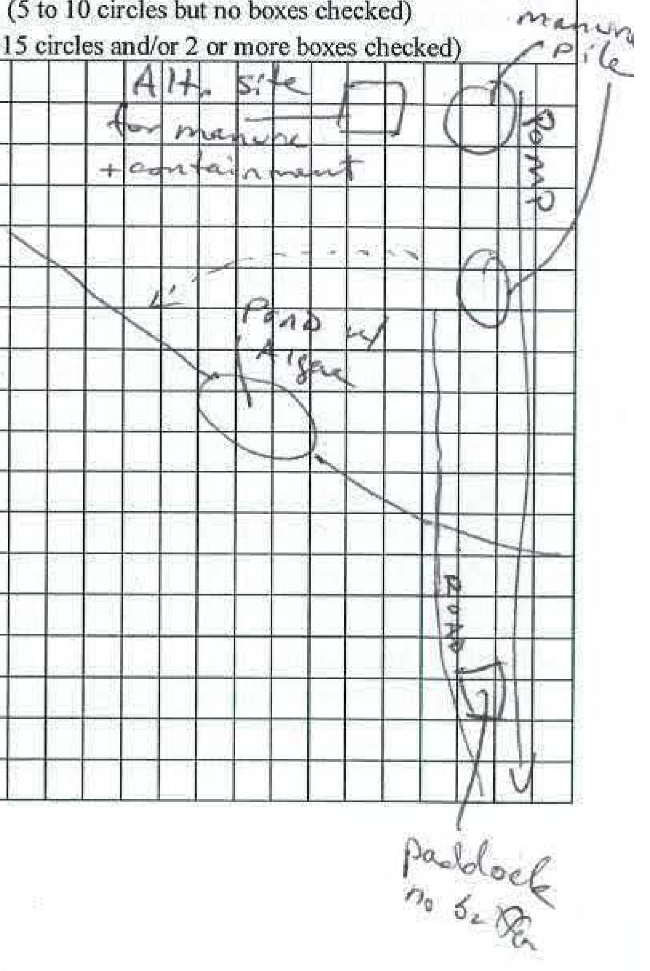
G3. Catch basin inspection – Record SSD Unique Site ID here: __________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
- ☐ Refer for immediate enforcement
- ☐ Suggest follow-up on-site inspection
- ☐ Test for illicit discharge
- ☒ Include in future education effort
- ☐ Check to see if hotspot is an NPDES non-filer
- ☒ Onsite non-residential retrofit
- ☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: ______________
- ☐ Schedule a review of storm water pollution prevention plan

Notes: OWNER EAMON [redacted]
MANURE PILES
slope away f/ river
manure mgmt in place
~~ct~~ at paddocks



Hotspot Site Investigation **HSI**

WATERSHED: POMPERAUG	**SUBWATERSHED:** UPPER		**UNIQUE SITE ID:**
DATE: 9/6/17	**ASSESSED BY:** SR BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** ___ ° ___ ' ___ " **LONG** ___ ° ___ ' ___ "		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: BERRY FARM
SETTLERS FIELD + STABLES

SIC code (if available): ________

NPDES Status: ☐ Regulated ☒ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

Basic Description of Operation: EQUESTRIAN

INDEX*

B. VEHICLE OPERATIONS ☒ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: ______

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☒ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☒ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ____________________
☐ Schedule a review of storm water pollution prevention plan

Notes: MANURE MGMT APPEARS TO BE IN PLACE. MANURE STORED UNCOVERED IN DUMPSTERS. PADDOCKS WELL MAINTAINED, MINIMAL MANURE.

Hotspot Site Investigation **HSI**

WATERSHED: NONNEWAUG
SUBWATERSHED:
UNIQUE SITE ID:
DATE: 9/6/17
ASSESSED BY: SB BG
CAMERA ID:
PIC#:
MAP GRID:
LAT __°____'____" **LONG** __°____'____"
LMK#

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: FRASIER FARM TRAINING CENTER

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related
Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

SIC code (if available): ________
NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Basic Description of Operation: EQUESTRIAN

	INDEX*
B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)* — **Observed Pollution Source?**	☐
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)* — **Observed Pollution Source?**	☐
C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______ Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)* — **Observed Pollution Source?**	☐
D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ N/A *(Skip to part F)* — **Observed Pollution Source?**	☐
E1. Building: Approximate age: _______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ **N/A** *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ **N/A** *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)

☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☒ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☒ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: ________________
☐ Schedule a review of storm water pollution prevention plan

Notes: RECONFIGURE PADDOCKS TO
AVOID STREAM.
BUFFER + FILTER BERM
MANURE MGMT OUTREACH

Hotspot Site Investigation **HSI**

WATERSHED: NONNEWAUG	**SUBWATERSHED:** TRIB		**UNIQUE SITE ID:**
DATE: 9/6/17	**ASSESSED BY:** SB BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __ ° __ ' __ " **LONG** __ ° __ ' __ "		**LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: LOGUE FARM
ARTILLERY RD

SIC code (if available): ________

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

Basic Description of Operation: DAIRY ~350 HEAD

INDEX*

B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☒ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: 10-15

B3. Vehicle activities *(circle all that apply)*: [✓ Maintained] Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☒ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☒ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☒ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☒ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☒ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☒ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☒ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☒ Solid Description: MANURE
Where are they stored? ☐ grass/dirt area ☒ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☒ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☒ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☒ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☒ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☒ Can't Tell ○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☐ Paved/Concrete ☐ Gravel ☒ Permeable ☐ Don't know MUD

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☒ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☒ Y ☒ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☒ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: Condition: ☒ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☒ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:
- ☐ Refer for immediate enforcement
- ☐ Suggest follow-up on-site inspection
- ☐ Test for illicit discharge
- ☒ Include in future education effort
- ☐ Check to see if hotspot is an NPDES non-filer
- ☒ Onsite non-residential retrofit
- ☐ Pervious area restoration; complete PAA sheet and record Unique Site ID here: ________________
- ☐ Schedule a review of storm water pollution prevention plan

Notes: PRACTICE OF NOT EXCLUDING LIVESTOCK FROM INTERMITENT STREAM SHOULD BE AN OUTREACH TARGET.

Recommend initial 25' vegetated buffer. Reconfigure pastures to avoid stream.

Reconfigure manure composting to ensure complete coverage divert away from roadway ⇒ Reverse alignment so loading happens on farm property, not roadway. runs off to catch basin

Free range goats

Hotspot Site Investigation **HSI**

WATERSHED: WEEKEEPEEMEE | **SUBWATERSHED:** | **UNIQUE SITE ID:**

DATE: __/__/____ | **ASSESSED BY:** SB BG | **CAMERA ID:** | **PIC#:**

MAP GRID: | **LAT** __°__'__" **LONG** __°__'__" | **LMK#**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: PERCY THOMSON
MEADOWS. THOMSON RD
BETHLEHEM

SIC code (if available): __________

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

Basic Description of Operation: LIVESTOCK

INDEX*

B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)*

Observed Pollution Source? ☐

B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________

B2. Approximate number of vehicles: ______

B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored ○

B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell
Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell ○

B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell ○

B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell ○

B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell ○

B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell
Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell ○

C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)*

Observed Pollution Source? ☐

C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell
If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell ○

C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______
Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area ○

C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell ○

C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell ○

C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell ○

C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell ○

C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell ○

D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)*

Observed Pollution Source? ☐

D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials ○

D2. Dumpster condition (*check all that apply*): ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing ○

D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell
If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell ○

E. PHYSICAL PLANT ☐ N/A *(Skip to part F)*

Observed Pollution Source? ☐

E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged ○
Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up
Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know ○

E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know ○

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping ____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ________________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown
Is trash present in gutters leading to storm drains? If so, complete the index below. ○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ____________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☒ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☒ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☒ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ________________
☐ Schedule a review of storm water pollution prevention plan

Notes: NO ACCESS POSSIBLE.
AERIALS SHOW LIVESTOCK ACCESS TO
weekeepeenee trib. Remove
access through fencing. Add filter berms
to treat water coming off field.
Increase vegetated buffer to stream

Hotspot Site Investigation **HSI**

WATERSHED: E SPRING	**SUBWATERSHED:**		**UNIQUE SITE ID:**
DATE: 9/6/17	**ASSESSED BY:** SB BG	**CAMERA ID:**	**PIC#:**
MAP GRID:	**LAT** __° ___' ___" **LONG** __° ___' ___"		**LMK #**

A. SITE DATA AND BASIC CLASSIFICATION

Name and Address: SOUTHWIND FARMS
RT 61 MORRIS

Category: ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related
Miscellaneous ☐ Golf Course ☐ Marina ☒ Animal Facility

SIC code (if available): ________

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Basic Description of Operation: EQUESTRIAN

	INDEX*
B. VEHICLE OPERATIONS ☐ N/A *(Skip to part C)* **Observed Pollution Source?**	☐
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Other: ________	
B2. Approximate number of vehicles: ______	
B3. Vehicle activities *(circle all that apply)*: Maintained Repaired Recycled Fueled Washed Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. OUTDOOR MATERIALS ☐ N/A *(Skip to part D)* **Observed Pollution Source?**	☐
C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: ______ Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell	○
D. WASTE MANAGEMENT ☐ N/A *(Skip to part E)* **Observed Pollution Source?**	☐
D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition *(check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. PHYSICAL PLANT ☐ N/A *(Skip to part F)* **Observed Pollution Source?**	☐
E1. Building: Approximate age: ______ yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age _____ yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up ○
Surface material ☐ Paved/Concrete ☐ Gravel ☒ Permeable ☐ Don't know

E3. Do downspouts discharge to impervious surface? ☐ Y ☒ N ☐ Don't know ☐ None visible ○
Are downspouts directly connected to storm drains? ☐ Y ☐ N ☒ Don't know → LIKELY DRY WELLS. ON HILL

E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell ○

F. TURF/LANDSCAPING AREAS ☐ N/A *(skip to part G)* **Observed Pollution Source?** ☐

F1. % of site with: Forest canopy ____% Turf grass _____% Landscaping _____% Bare Soil ____% ○

F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low ○

F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell ○

F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell ○

F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell ○

G. STORM WATER INFRASTRUCTURE ☐ N/A *(skip to part H)* **Observed Pollution Source?** ☐

G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe: ______________ ○

G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown ○
Is trash present in gutters leading to storm drains? If so, complete the index below.

	Index Rating for Accumulation in Gutters				
	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: ____________ Condition: ☐ Dirty ☐ Clean

H. INITIAL HOTSPOT STATUS - INDEX RESULTS

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☑ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: ________________
☐ Schedule a review of storm water pollution prevention plan

Notes: MANURE MGMT PROGRAM APPEARS TO BE ONGOING.

LIMITED MANURE IN PADDOCKS SLOPING TOWARD BROOK. COULD INCREASE BUFFER.

Appendix C

Watershed Treatment Model Manual

Watershed Treatment Model (WTM)
2013 User's Guide

Funding Provided By:
US EPA Office of Wetlands Oceans and Watersheds
Altria Foundation
Cooperative Institute for Coastal and Estuarine
Environmental Technology

June, 2013

Deb Caraco, P.E.
Center for Watershed Protection, Inc.

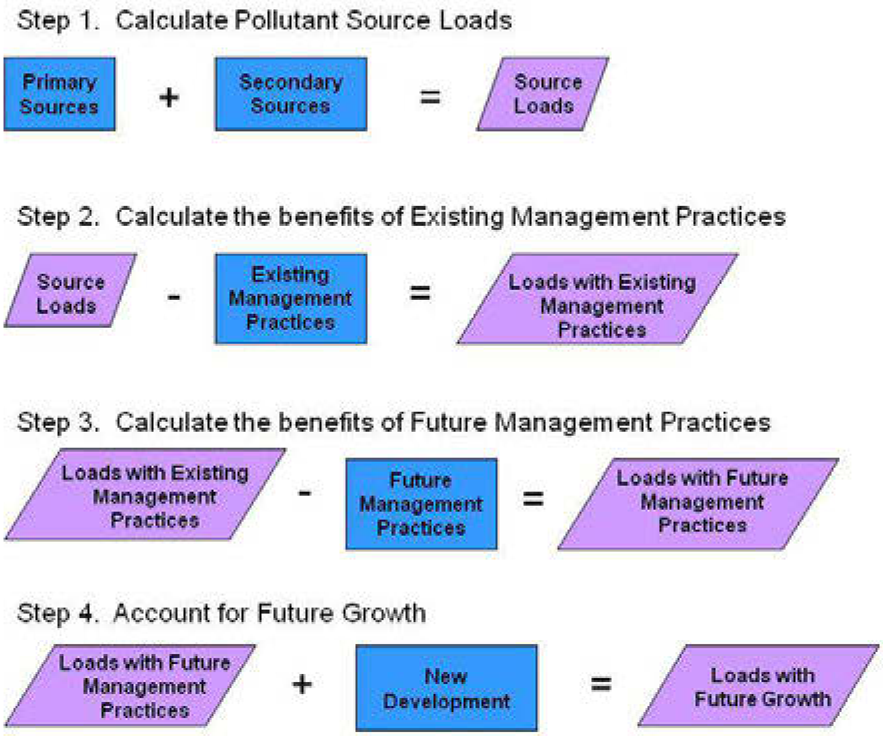


Figure 1. WTM Model Structure

Primary Sources

This worksheet summarizes the loads from sources that can be determined solely by land use. It requires basic land use information and calculates surface runoff loads. In addition, it requires basic watershed data, such as annual rainfall, stream length, and soils distribution. The loads calculated in this worksheet incorporate data from the "turf management" section of the "existing management practices" tab (see page 6), and model default values reflect typical lawn care practices.

Secondary Sources

Secondary sources are pollutant sources that cannot be calculated based on land use information alone. Many of these sources, such as CSOs and SSOs, are at least partially composed of wastewater.

Existing Management Practices

This sheet reflects programs currently in place to control loads from urban land. Users need to input information about the effectiveness and level of implementation of various programs and practices.

This sheet, and other sheets in the WTM that quantify program implementation, ask the user to input "discount factors" for each practice. "Discount factors" are used to reduce the ideal (i.e., literature value) load reductions for a practice that can rarely be achieved. For example, structural practices may lack space or have poor maintenance that can hamper practice effectiveness over time. For programmatic practices, such as lawn care education, only a fraction of the population may implement the recommendations put forward in the educational program. In both of these cases, specific design features for structural practices, or marketing approaches for education and outreach techniques can make the practice more effective. While some discount factors have default values, the WTM asks the user to input values for others In each case, the model provides guidance to select appropriate values.

Future Management Practices

This sheet reflects the planned extent of programs to control loads from urban land. By default, the model populates this sheet with values from the "Existing Management Practices" sheet. The user then enters data that describe proposed or "future" management practices given the same existing land use.

Retrofit Worksheet

Stormwater retrofits are BMP put in place after development has occurred. The retrofit worksheet allows the user to input individual stormwater retrofit practices. These are then reported in the "Future Management Practices" sheet.

Future Land Use

In this sheet, the user enters the projected future land use in the watershed. Land use can be determined from comprehensive planning or zoning documents, or forecasted using other methods. If no data are entered in this tab, the model default is to assume no growth in the watershed.

New Development

This sheet calculates the loads from future development, based on future development in the watershed, and proposed future treatment. The sheet calculates new "primary source" loadings based on the increase in area of certain land uses, then asks the user to describe the types of stormwater controls on new development. Next, it adds secondary sources, such as loads from new OSDS customers and wastewater treatment plant loads. Finally, it calculates the loads from active construction as land is developed.

Display Sheets

Three sheets display final loads and runoff volumes: *Existing Loads, Loads with Future Practices*, *Loads Including Growth*. These sheets simply sum up the loading from other sheets, and partition them into surface (both storm- and non-storm) and groundwater loads.

SECTION 2. DATA ENTRY OVERVIEW

Although the WTM is a simple model, it requires significant data input. In addition, no part of the spreadsheet is write protected, in order to allow for maximum flexibility. These decisions put a great deal of responsibility on the user, and some guidelines need to be followed to prevent errors in algorithms. This section describes some components of the WTM designed to facilitate the data input process, as well as some tips for tracking down and avoiding errors in the model.

Color Coding

In order to make data entry easier, cells are coded in four colors: green, blue, grey and purple.

BLUE CELLS must be filled out, unless a pollutant source or treatment option is not being considered. For example, the acres of commercial land only need to be filled out only if commercial land is in the watershed.

YELLOW CELLS represent model defaults that a user may want to modify. Examples include pollutant concentrations and practice efficiencies.

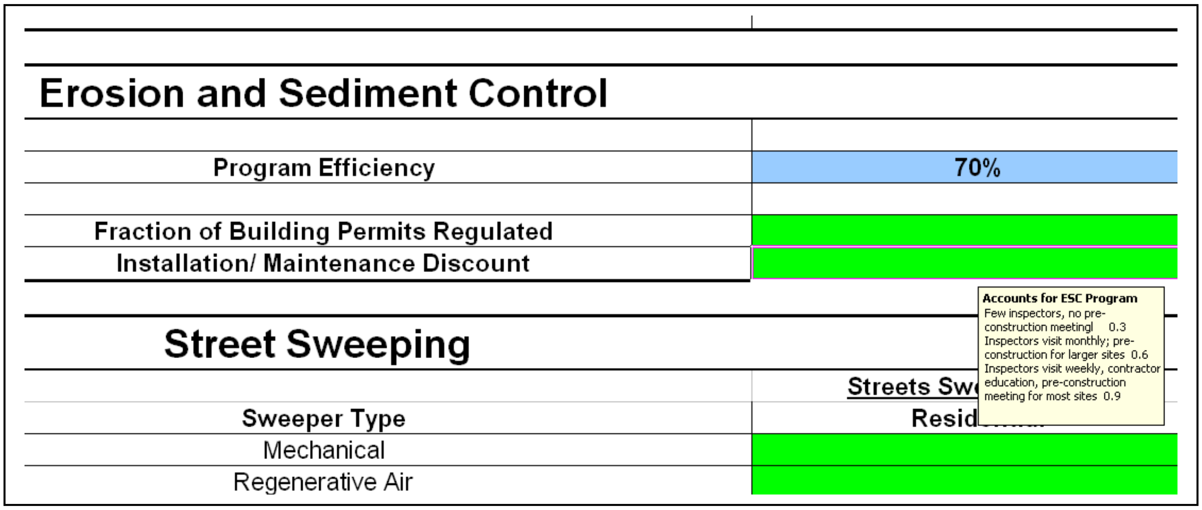
GREY CELLS have been calculated, and typically should not be overridden. Examples include practice load reductions.

PURPLE CELLS represent "bottom line" calculations, such as load reductions or final loads.

The worksheets of the WTM are also color coded. Of the ten tabs of the WTM, three are strictly for output, and have a purple tab color, while the remainder are green to indicate that data entry is needed.

"Pop-Up" Guidance and Comments

Many pieces of input data require some judgment on the part of the user. By clicking on many of the green cells (particularly those for discount factors), a "popup" message will appear with guidance for data values (Figure 2).



Erosion and Sediment Control

Program Efficiency 70%

Fraction of Building Permits Regulated

Installation/ Maintenance Discount

Accounts for ESC Program
Few inspectors, no pre-construction meetingl 0.3
Inspectors visit monthly; pre-construction for larger sites 0.6
Inspectors visit weekly, contractor education, pre-construction meeting for most sites 0.9

Street Sweeping

Streets Sw

Sweeper Type

Resid

Mechanical

Regenerative Air

Figure 2. Example Pop-Up Guidance for the Installation/Maintenance Discount for ESC programs

Pull-Down Menus

While many of the data in the WTM require a number value, some of the inputs are multiple choice (e.g., type of practice) or "yes/no" (e.g., Do you have a program for…") questions. The WTM uses "pull down menus" for these questions. For these cells, the user should not (and cannot) select an option that does not appear in the menu.

.

SECTION 3. DATA ENTRY DETAILS

This section describes in detail the data entry requirements of each worksheet of the WTM. It separates the discussion by worksheet (for each calculation sheet), but "Existing Management Practices" and "Future Management Practices" are discussed together because of the overlap between the two.

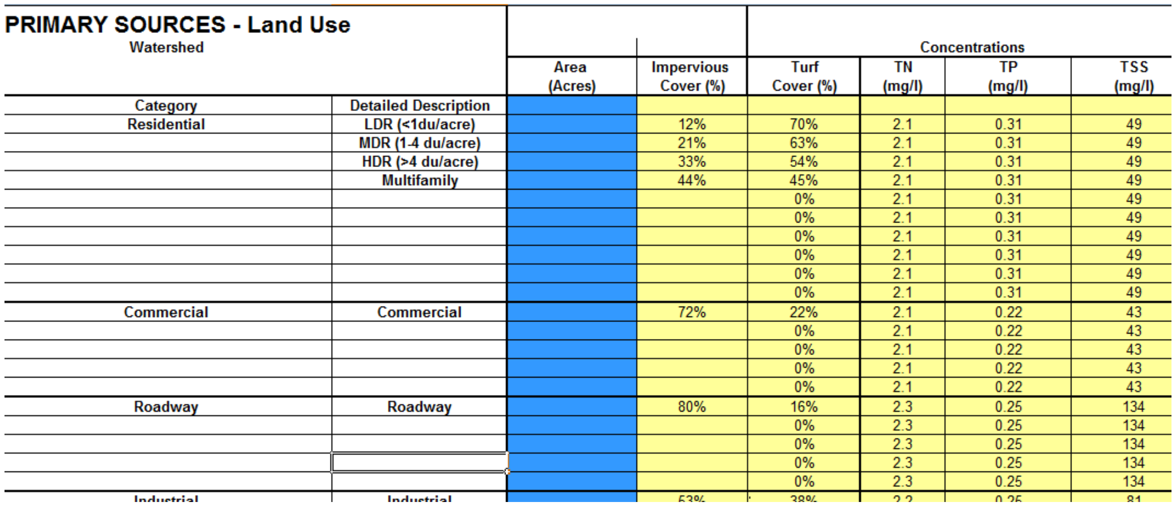
Primary Sources

This worksheet has four major sections: *Land Use*, *Partitioning Coefficients for Rural and Forest Land*, *Watershed Data*, and *Soils Information*. Data Requirements for each are as follows:

Land Use

The user is required to enter the area of each land use category. If there is a land use that is not in included the model but it is present in the watershed, the user should type in the land use category (Figure 4) and enter in appropriate values to characterize the land use in the blue cells listed below. In addition, users may override model defaults for land uses included in the model for the following data (blue cells):

- Impervious Cover %
- Turf %
- Pollutant Concentrations
- Pollutant Loading rates/R1:49:38 PMunoff Rates (lbs/acre, billion/acre or in/year). Note that, for rural and agricultural land uses, loading rates should be entered directly, since they are not determined from concentrations and runoff calculations for these land uses.



PRIMARY SOURCES - Land Use
Watershed

				Concentrations			
		Area (Acres)	Impervious Cover (%)	Turf Cover (%)	TN (mg/l)	TP (mg/l)	TSS (mg/l)
Category	Detailed Description						
Residential	LDR (<1du/acre)		12%	70%	2.1	0.31	49
	MDR (1-4 du/acre)		21%	63%	2.1	0.31	49
	HDR (>4 du/acre)		33%	54%	2.1	0.31	49
	Multifamily		44%	45%	2.1	0.31	49
				0%	2.1	0.31	49
				0%	2.1	0.31	49
				0%	2.1	0.31	49
				0%	2.1	0.31	49
				0%	2.1	0.31	49
				0%	2.1	0.31	49
Commercial	Commercial		72%	22%	2.1	0.22	43
				0%	2.1	0.22	43
				0%	2.1	0.22	43
				0%	2.1	0.22	43
				0%	2.1	0.22	43
Roadway	Roadway		80%	16%	2.3	0.25	134
				0%	2.3	0.25	134
				0%	2.3	0.25	134
				0%	2.3	0.25	134
				0%	2.3	0.25	134
Industrial	Industrial		53%	38%	2.2	0.25	81

Figure 3. Land Use Data in the Primary Sources tab. The user needs to enter land areas (green) and may override turf and impervious cover, and pollutant concentration values.

Partitioning Coefficients for Rural and Forest Land

This section includes model defaults determining the fraction of the load from forest and rural land that occurs during storm events, versus as extended baseflow. These can be overridden if better information is available for your watershed.

Watershed Data

This section requires entry for annual rainfall and total stream length. The WTM will return errors if these values are not entered.

Soils Information
This section asks the user to describe the soils in terms of Hydrologic Soils Group (A, B, C or D) by entering the percent of the watershed soils in each category. It also asks the user to enter the break-down of soil type based on depth to groundwater (again, describing the percent of the watershed in each category).

Model defaults in this section include runoff coefficients for each land cover category (Turf, Forest, and Rural). For other land covers, the user may enter runoff coefficients in the green cells (columns I through M). Note that the runoff coefficient for turf also takes into account information provided in the *Turf Management* practice on the "Existing Management Practices" sheet.

Secondary Sources
The secondary sources worksheet sums the loads from sources that cannot be determined by land use alone, such as channel erosion or illicit discharges. The data sheet is structured so that data are entered in smaller tables, or sections of the sheet. With the exception of the general sewage use data and channel nutrient concentration provided at the top of the sheet, each section corresponds to a specific secondary source. The required data for this sheet is summarized in Table 1.

TABLE 1. SECONDARY SOURCE DATA REQUIREMENTS

Source or Data Area	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
General Sewage Use Data	Number of single-family, detached dwelling units	• Individuals/unit • Water use/individual • Wastewater pollutant concentrations	These data are needed to compute loads from OSDSs, SSOs, CSOs, Illicit Connections
Nutrient Concentrations in Stream Channels	Concentrations	Enrichment Factor	Figure 5 provides one source for these data. Used in combination with Channel Erosion data to calculate the nutrient loads from channel erosion.
On-Site Sewage Disposal Systems (OSDSs)	• % of Dwelling Units Unsewered • % of OSDSs <100' from waterway • Soils (from pull-down menu) • System type (% of each type of system) • Description of Management (inspection and maintenance) from pull-down menu • Separation distance from groundwater • Density (#/acre)	• Failure rates (calculated from other factors) • Decay of bacteria (% reaching the surface waterway) • Delivery ratio for nutrients • Efficiencies for each OSDS type	Required data are often available from the health department or other agency responsible for OSDS management. If the user enters "other" for a system type, the efficiency ***must*** be entered.

TABLE 1. SECONDARY SOURCE DATA REQUIREMENTS

Source or Data Area	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
SSOs	• Miles of sanitary sewer	• Overflows/1,000 miles • Volume per overflow • Fraction of load as storm flow (to partition between storm and non-storm loads)	These sections are a broad estimate of diffuse wastewater sources. If available (e.g., from an SSO/CSO or IDDE study) these data may be directly entered in the Summary table (purple cells) at the bottom of the Secondary Sources worksheet.
CSOs	• Median storm event (inches) • Sewershed area (acres) • Sewershed Impervious Cover (%)	• # CSOs/year (calculated) • Capacity of CS System (rainfall depth in inches) • CSO pollutant concentrations.	
Illicit Connections	• Fraction of watershed population illicitly connected • Number of businesses	• Fraction of businesses with illicit connections. • Characterization of businesses wash water • Business wastewater flow in gpd.	
Urban Channel Erosion	Method of calculation (Methods 1-3) from pull-down menu. All data inputs described are required data. **Method 1. Estimate based on typical estimates:** General Assessment of Channel Erosion (Low, Medium, High) **Method 2. Back calculate based on known sediment loading.** Total watershed loading (lbs TSS/year) based on monitoring data. **Method 3. Estimate based on other study results.** Sediment Load from Channel Erosion (tons/year)		The WTM offers three options for calculating urban channel erosion. Data required varies depending on the method used. Each method requires progressively more data, and provides a more accurate representation of the watershed.

TABLE 1. SECONDARY SOURCE DATA REQUIREMENTS

Source or Data Area	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
Livestock	# of animals in each category	• % of animals exposed to runoff • Load (lbs/animal/year or billion/animal/year) • Delivery ratios of nutrients and bacteria	
Marinas	• Berths • Length of season (days)	• Occupancy (fraction of the season) • Flow rates (gallons/capita/day) • Individuals/boat	This "untreated" estimate can be significantly lowered by the "marina pumpout station" practice in Existing Management Practices.
Road Sanding	• Sand application (lbs/year) • Fraction of roads open section	• Delivery ratio (sand to the receiving water) for closed section roads. • Delivery ratio for open section roads.	This untreated estimate can be partially remedied by street sweeping.
Non-Stormwater Point Sources	• Flow (Millions of gallons/day) • Concentrations (mg/l or MPN/100 ml)	• Loads (lbs/year or billion/year)	Data can be gathered from Discharge Monitoring Reports (DMRs) for NPDES discharges

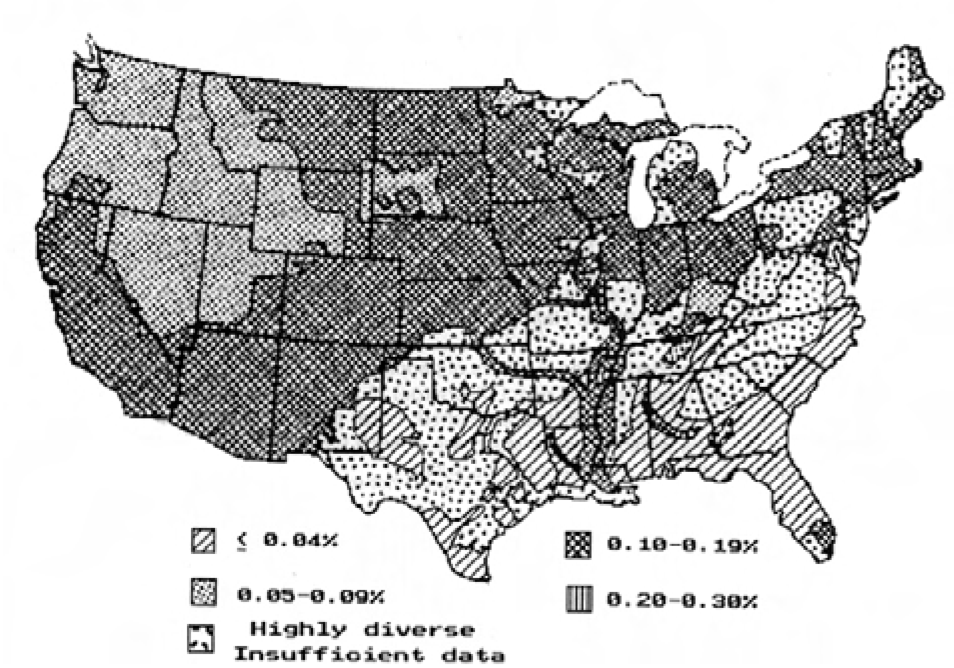


Figure 4. Soil N/P concentrations (by % mass in soil). From Haith et al., 1992

Existing and Future Management Practices
These two worksheets calculate the benefits of practices and programs in the watershed. Current land use conditions are used for the Existing and Future Management Practices worksheet (e.g. does not consider future changes in land use within the watershed). The practices entered into the Existing Management Practices worksheet are carried over to the Future Management Practices. However, additional practices and program options for non-structural practices are included in the "Future Management Practices" section. A description of the practice types and their data input is provided in Table 2. While the specific data for each practice varies, some of the discount factors appear for several practices, including the following:

- **Awareness Factor:** Applied to all educational programs, the awareness factor reflects the % of people who remember an educational message.
- **Maintenance Factor:** Typically applied to structural practices, this factor reflects the maintenance of practices over the long term.
- **Design or Technique Factor:** Reflects the quality of the practice design
- **Implementation**. Reflects the fraction of long-term capitol projects identified (e.g., SSO removal) that are implemented.

By default, the WTM will use the values from the "Existing Management Practices" worksheet for the "Future Management Practices" values. If expanded coverage of a particular practice is proposed, the user should enter values for the future condition. For example, if the watershed currently has 5 miles of riparian buffer, and a management plan proposes is to expand this by one mile, the data on the "Future Management Practices" tab should be edited by the user to include 6 miles of buffer.

TABLE 2. DATA REQUIREMENTS FOR EXISTING/FUTURE MANAGEMENT PRACTICES

Practice	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
Practices on the Existing Management Practices Sheet Only			
Turf Condition and Management Practices - Residential	• % of lawns bare/compacted • % of homes <10 years old • % off lawn area "highly managed" (high input)	• Residential turf area (calculated from Primary Sources) • Typical fertilizer applications/year • Fertilizer rate (lbs N/acre) • Distribution of fertilizer type (by %) • N and P analysis of fertilizers	Data for bare and compacted lawns and "highly managed" lawns can be gathered from field surveys. Fertilizer use and application rates are default values but can be replaced with survey or fertilizer sales data. Fertilizer losses are incorporated as a primary source (in loading rates) and as a secondary groundwater source. The turf runoff coefficient (on the primary sources tab) is modified based on the % if bare/compacted lawns.
Turf Condition and Management Practices – Other	• Management compared to residential turf (pull-down menu). Choices are "Same", "Comparatively High Management/Input", or "Better management/ nutrient management"	• Turf area calculated from Primary Sources	The simplified approach for this source "scales" loading compared with residential lawns rather than asking users for a separate assessment.
Structural Stormwater Practices	• Drainage areas to each practice • Impervious Area draining to each practice • Capture Discount (annual rainfall captured) • Design Discount • Maintenance Discount	• Turf area draining to each practice • Efficiencies and runoff reduction (%)	Although structural stormwater practices can be modified or added in the future condition, these practices are considered "Stormwater Retrofits" and accounted for separately. The model includes pop-up guidance for each discount factor.

TABLE 2. DATA REQUIREMENTS FOR EXISTING/FUTURE MANAGEMENT PRACTICES			
Practice	**Required Data (Green Cells)**	**Model Default Data (Blue Cells)**	**Notes**
Practices on Both Sheets			
Pet Waste Education*	• Program in Place (yes/no pull-down) • Number of dwelling units (unless already entered on the "Secondary Sources" worksheet) • Awareness of the Message	• Characteristics of the population (dog owners, fraction who clean up) • Fraction of the population willing to change their behavior. • Dog waste characteristics (waste production and pollutant concentrations) • Delivery factors (fraction of pollutants that reach the receiving water)	Concentrations in the "Primary Sources" tab include loads from pets. Consequently, the benefits of these programs will be subtracted from the "base loads" calculated in the primary and secondary sources tabs.
Erosion and Sediment Control	• Fraction of building permits regulated • Installation/ Maintenance discount	• Program efficiency	The model defaults and the recommended discounts can be refined based on field experience of ESC inspectors.
Street Sweeping	• Area Swept for residential streets, other streets, and parking lots. • Type of sweeper used • Sweeping frequency • Technique discount	• Sweeper efficiencies for TSS and nutrients	
Riparian Buffers	• Buffer length (miles) • Buffer width (feet) • Maintenance factor	• Buffer efficiencies • Treatability (fraction of the watershed captured). Calculated from other values.	Collect original buffer data from aerial photographs and field surveys. For the future condition, consider proposals to reforest the buffer, or to expand buffer protection.
Catch basin cleanouts	• Area captured (imperious cover) • Cleaning frequency • Disposal discount	• Efficiencies	
Marina Pumpouts	• Number of pumpouts	• Total number of berths (same as the value from "marinas" on the secondary source sheet) • Boats served per station • Fraction of owners willing to use	

Note: Cells in red font will show an "Enter Value" message if data entry is needed. If no data are entered, an error will result.

TABLE 2. DATA REQUIREMENTS FOR EXISTING/FUTURE MANAGEMENT PRACTICES

Practice	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
Practices on the Future Management Practices Sheet Only			
Residential Lawn Care Education	• Awareness of the Message • Yes/No pull-down menus to ask if several specific lawn care education programs are in place	• Turf area • Additional forest area (from turf conversion) • Revised fertilizer application rate • Distribution of fertilizer type (by %) • N and P analysis of fertilizers • Ease of implementation for each education program type	The WTM uses the same calculations to calculate Nitrogen and Phosphorus loss, but uses the forecasted results of a future education program to revise fertilizer application rates. One program goal (Add soil amendments to lawn) is actually recorded on the "Retrofit Worksheet" described on the following pages.
Residential Impervious Cover Disconnection	• Program in place (yes/no from pull down menu) • Fraction of land where applicable • Fraction of population reached by the message	• Roof area (square feet) • Fraction willing to participate	The area of disconnection produced from this program is recorded as a stormwater retrofit, and appears in the stormwater retrofit worksheet.
Urban Downsizing	• Fraction Implemented (i.e., % of planned land conversion that happens) • Acres of urban land (in each land category) converted to another use • Acres of other land use created	• Loading and runoff rates for each land use	This practice applies only to a planned urban downsizing. If another land use is created or converted, the user will need to override the land use categories and loading rates.
Redevelopment with Improvements	• Land to be redeveloped (acres) • Impervious cover reduction (%) • Turf reduction (%)	N/A	
Stormwater Retrofits	N/A	N/A	Retrofit benefits are summarized on the Future Management Practices Worksheet, but data entry are in the Retrofit Worksheet

TABLE 2. DATA REQUIREMENTS FOR EXISTING/FUTURE MANAGEMENT PRACTICES

Practice	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
Channel Protection	• Assessment option (from pull-down menu) **No Channel Protection** **Option 1: Estimate based on miles of stream stabilized** • Portion of stream channel unstable • Miles of stream channel stabilized • Fraction of watershed with flow control for the 1-year storm event. **Option 2: Enter Total Anticipated Removal** • Sediment removal (tons/year) • Phosphorus and Nitrogen Removal (lbs/year)	• For option 1, miles of unstable channel is calculated	Channel protection refers to in-stream channel protection measures. The model allows separate options to allow the user to input local values from a detailed stream study that may have resulted in estimated removals that may differ from the model default. The model default values are considered conservative,
Illicit connection removal	• Fraction of system surveyed • Fraction of repairs made	N/A	These wastewater source reduction measures all calculated reductions by multiplying the user defined fraction or reduction in events by the fraction completed over the planning horizon timeline times the load from the original secondary source load.
CSO Repair/Abatement	• CSO Events after Repairs • Fraction complete		
SSO Repair/Abatement	• Goal (% reduction) • Fraction complete		
OSDS Education	• Program (yes/no pull down menu) • Awareness of the message • Fraction willing to change behavior		OSDS education and repair measures are combined to change the characteristics of the "OSDS" load. The WWTP load resulting from retiring OSDSs is subtracted from the "point source reduction" benefit. If the retired systems are directed to a
OSDS Repair	• Program (yes/no pull down menu) • Fraction inspected • Percent willing to repair		

TABLE 2. DATA REQUIREMENTS FOR EXISTING/FUTURE MANAGEMENT PRACTICES

Practice	Required Data (Green Cells)	Model Default Data (Blue Cells)	Notes
OSDS Upgrade	• Program (yes/no pull down menu) • Fraction inspected • Fraction willing to upgrade • Type of upgrade system • System efficiencies (if "other" selected as system type)	• System efficiencies (except for "other")	treatment plant in another watershed, override the WWTP loads and change them to 0.
OSDS Retirement (convert to WWTP)	• Fraction of systems inspected • % failing among retired systems • % w/in 100' of a waterway among retired systems • WWTP Efficiencies	• WWTP loads	
Point Source Reduction	• Reduction (lbs/year of billion/year)	• WWTP load (negative) from OSDS retirement	

Retrofit Worksheet

The retrofit worksheet is a worksheet to enter individual stormwater retrofit practices. Stormwater retrofits are a type of future management practice. The Retrofit Worksheet allows the user to enter detailed design information for each practice. The worksheet asks for general practice information (and data entry options) at the top of the sheet, and then asks for individual practice information in the main section of the worksheet in the "Basic Site Information" table. (Figure 6)

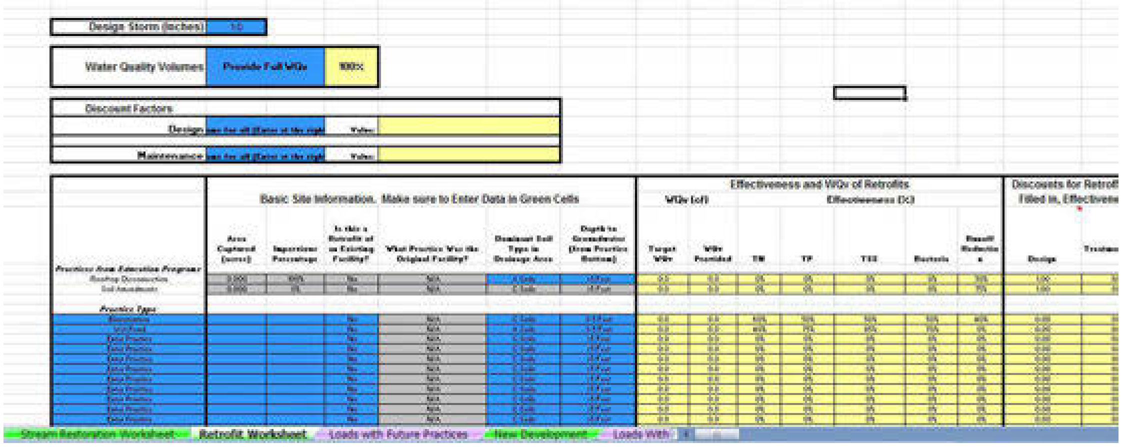


Figure 5. The Retrofit Worksheet, showing the generalized information at the top and individual practice data at the bottom (main section).

Design Storm:

The top of the retrofit worksheet asks the user for the design storm (in inches). This value should reflect the water quality design storm (typically about 1"). This is a critical value that needs to be entered.

Water Quality Volume (WQv)
The target WQv for each practice is the runoff volume from the design storm. Ideally, practices would be sized to capture this volume, but in some cases (particularly for retrofits) the practice cannot be sized to capture the entire volume. In the upper portion of the retrofit worksheet, the user selects from a pull-down menu to determine how to enter the water quality volume, among three choices:

Option 1. Provide the full water quality volume at all practices
If the user chooses this option, no further data entry is required.

Option 2. Provide a consistent fraction of the water quality volume (e.g., 80% of the Target WQv for all practices)
For this option, the user needs to enter the % of the WQv provided in all sites. The value will be entered in cell E5. When this data entry option is selected, an "Enter Value" value appears in this cell.

Option 3. Provide a different water quality volume at each site.
If this option is selected, the user needs to enter the WQv for each practice (in Column J) under the "WQv Provided" heading.

The third option provides the most flexibility, so it is the best choice when a detailed retrofit inventory has been conducted and design information is available. The other options presented represented a way to evaluate "what if" scenarios across a wide range of practices.

Discount Factors
For the design and maintenance factors, the user may either select a single value for all practices (entered in Column F), or to enter a different value for each practice. Note that, if the "Varies" option is selected, the discount factors need to be entered for each practice, in columns P and R. (Scroll over to enter these data).

Basic Site Information
For each practice, select the practice type from the pull-down menu. For each practice, the basic required data includes the following:

- Area captured (acres)
- Impervious Percentage
- Soil in the drainage area
- Depth to groundwater (from practice bottom)

This section also asks the user if this is a "new" retrofit or a retrofit of an existing facility. If the practice is a retrofit of an existing facility, such as a conversion of a dry pond to a wet pond, the user selects the type of *original* practice from a pull-down list.

Effectiveness and WQv of Retrofits
This section of the retrofit worksheet provides the target water quality volume. If the WQv needs to be input, an "Enter Value" will appear in the cells in Column J. Effectiveness (%) will be derived from a look-up table, depending on the practice type, but the user will need to input values if "Other" is selected as a practice option.

Effects of the Original Practice
The WTM reports the pollutant removal of the original practice (if this practice is a retrofit of an existing practice). In general, these cells should not be modified, but may be overridden if the user has detailed data about the effectiveness of a particular existing practice.

Practices from Education Programs
Data for rooftop disconnection and soil amendments are imported into the retrofit worksheet from the "Future Management Practices" sheet. The user does not need to enter data in these sections, although the soil type or other practice features can be modified as needed.

Future Land Use

This tab is simply a forecast of future land use or land cover in the watershed. The only caveat for this portion of the WTM is that the land use categories **must be the same** as those reported in the Primary Sources tab, or errors will occur. Another potential error on this sheet results when total land area either exceeds or is less than the original watershed area. The value under "Total Acres" will report an error if the areas are not the same.

New Development

This sheet includes four sections of data input: New Development, Controls on New Development, Data to Quantify Wastewater Loads, and Active Construction. Data requirements for each section are as follows:

New Development
This section sums the uncontrolled pollutant loads from new development. No data entry is needed, but the user can modify the characteristics of each land use category by adjusting pollutant concentrations, impervious cover and turf cover for each land use type.

Stormwater Controls on New Development
This section describes and quantifies the benefits of stormwater controls to be implemented on new development. The WTM allows three different program options. Each of these options reflects stormwater regulations that are used throughout the United States.

> Option 1: Meet a specific pollutant removal target
> If this option is selected, the user needs to enter the removal efficiencies in cells marked "Enter Value" next to the "Target % Removal" row.
>
> Option 2: Meet a target load
> If this option is selected, the user needs to enter the target load in lbs/acre/year, billion/acre/year inches/year (for runoff volume).
>
> Option 3: Show no net increase in load on each parcel
> If this option is selected, no further data are needed.

Discount Factors

Four discount factors (% regulated, capture discount, design discount, and maintenance discount) are applied to the target removals. By default, the data in these cells is derived from data in the "Existing Management Practices" and "Future Management Practices" sheets. While no data are required in this section, the user may override these default values to reflect different levels of program implementation in the future.

Channel Protection

Enter "yes" to answer the question, "Is channel protection required?" if there is some requirement in place to control small (1-year) storms either through detention or runoff reduction, in order to protect stream channels.

Data to Quantify Wastewater Loads

This section requires data to quantify the loads from future wastewater sources, including OSDSs, SSOs, CSOs, Illicit Connections, and WWTP Dischargers. This section uses simplified calculations to forecast loads from these sources. Data required are summarized in Table 3.

TABLE 3. DATA REQUIRED TO CALCULATE FUTURE WASTEWATER LOADS

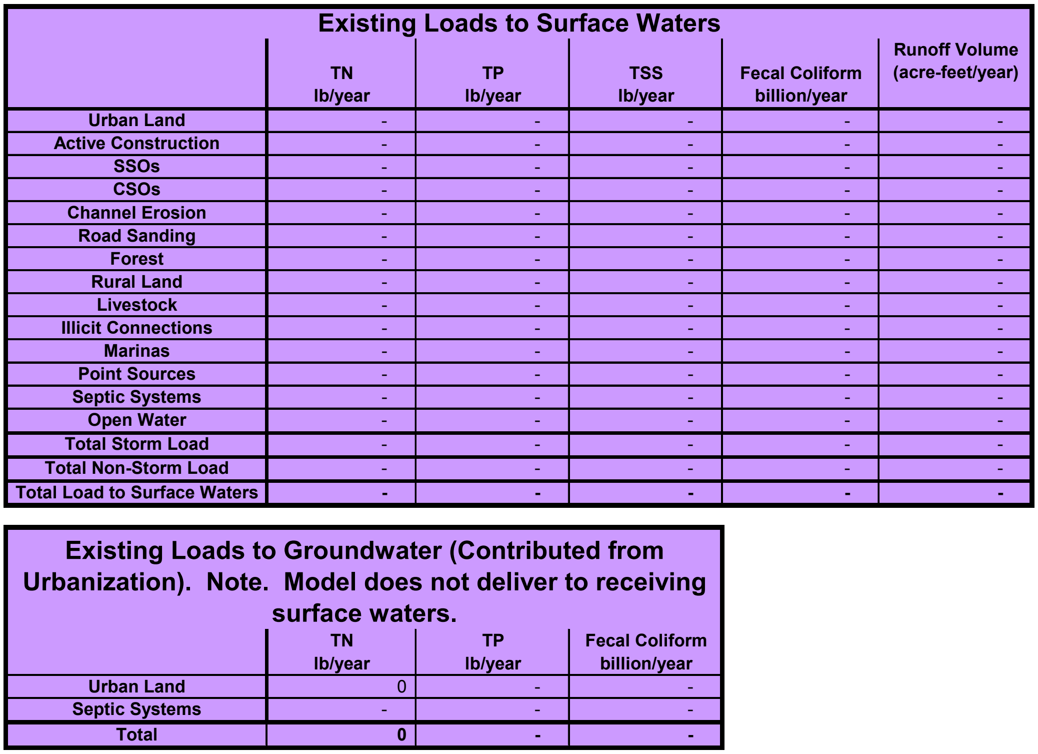
Source	Data Required
OSDS	• New OSDS customers • OSDS failure rate • OSDS efficiency (High/medium low) compared to the current systems.
SSOs	• Miles of sewer constructed • SSOs/mile
Illicit Connections	• Percent of population illicitly connected
WWTP Discharges	• New wastewater customers (households) • WWTP Efficiency

Active Construction

The WTM calculates loads from active construction based on three user inputs: the program efficiency, % of new development regulated, and the "Maintenance Discount." By default the WTM imports data from the "Future Management Practices" worksheet, but these data may be adjusted by the user.

SECTION 4. INTERPRETING OUTPUT DATA

Final model results are reported in three summary sheets: Loads with Existing Practices, Loads with Future Practices, and Loads with New Growth. Each of these sheets uses exactly the same format (See Figure 6). The summary output sheets divide the load into two categories: Loads to Surface Waters, and Loads to Groundwater. The loads to Surface Waters are then further subdivided into Storm Loads (e.g., urban runoff) and Non-Storm Loads (e.g., Illicit Discharges).



Existing Loads to Surface Waters

	TN lb/year	TP lb/year	TSS lb/year	Fecal Coliform billion/year	Runoff Volume (acre-feet/year)
Urban Land	-	-	-	-	-
Active Construction	-	-	-	-	-
SSOs	-	-	-	-	-
CSOs	-	-	-	-	-
Channel Erosion	-	-	-	-	-
Road Sanding	-	-	-	-	-
Forest	-	-	-	-	-
Rural Land	-	-	-	-	-
Livestock	-	-	-	-	-
Illicit Connections	-	-	-	-	-
Marinas	-	-	-	-	-
Point Sources	-	-	-	-	-
Septic Systems	-	-	-	-	-
Open Water	-	-	-	-	-
Total Storm Load	-	-	-	-	-
Total Non-Storm Load	-	-	-	-	-
Total Load to Surface Waters	**-**	**-**	**-**	**-**	**-**

Existing Loads to Groundwater (Contributed from Urbanization). Note. Model does not deliver to receiving surface waters.

	TN lb/year	TP lb/year	Fecal Coliform billion/year
Urban Land	0	-	-
Septic Systems	-	-	-
Total	**0**	**-**	**-**

Figure 6. Output from the "Loads with Existing Practices" Worksheet

Surface Loads

While the WTM is not a continuous model, some users find it useful to separate "storm loads" from "non-storm loads." This is particularly true for bacteria loads, where violations typically occur during storm events.

Loads to Groundwater

Although the WTM is not a groundwater model, it does estimate the loads (from urban land and OSDSs) delivered to the groundwater. It is important to note that the WTM *does not* estimate the amount of this load that is ultimately delivered to the surface water. However, it *does* account for soil infiltration, so it reflects expected delivery to the groundwater system, rather than the entire mass of pollutants infiltrated.

Summaries on Other Sheets

Many of the calculation sheets also offer some summary data that may be useful for comparing practice options. These data are summarized in Table 4.

TABLE 4. DATA REQUIRED TO CALCULATE FUTURE WASTEWATER LOADS

Sheet	Summary Data	Notes
Primary Sources	Annual Surface Loads (pre-BMP) for each land use and summed in Columns P through U Total loads are divided into *storm* and *non-storm* components	The summary data on this sheet are coded grey because they are not highly useful. Although these summaries compare the contributions from each land use, the data can be deceptive because they do not include BMP implementation.
Secondary Sources	The purple cells at the bottom of the sheet report pollutant loads from each secondary source. These loads are then summed and divided into storm load, non-storm load, and loads to groundwater.	These data can be useful, but also do not include BMP implementation.
Existing Management Practices	The summary sheet at the bottom of the page (purple cells) tabulates the load reduction (or runoff reduction), from each practice The summary the divides the total load into storm, non-storm and groundwater components.	Some load reductions may be negative. This *negative reduction* actually represents an *increased load* resulting from a management practice. One example of this is the load from infiltration practices to the groundwater. The purple cells in the Future Management Practices sheet are the most useful, since they reflect the benefit of the proposed practices.
Future Management Practices	These load reductions are summarized in two sections. Grey cells reflect the load reductions from *all practices* (both existing and future). Purple cells reflect the *net reduction* from future management practices.	
Retrofit Worksheet	The benefits, and loads to groundwater, of each practice are summed in the purple cells to the right. In addition, the model sums the total benefits from each practice.	All of these data are transferred to the Future Management Practices sheet, and aggregated by practice type.
New Development	The net additional load from each source is summed at the bottom of this sheet in purple cells.	

REFERENCES

Haith, D., R. Mandel and R. Wu. 1992. *Generalized Watershed Loading Functions, Users's Manual.* Daprtment of Agricultural and Biological Engineering. Cornell University. Ithaca, NY

Appendix D

Model Input Data Needs and Sources

Watershed Treatment Model – Input Parameters and Sources

Data	**Type**	**Need**	**Data Source**
Watershed/ subwatershed boundary	ArcGIS FileGDB	Required for delineating watershed and subwatershed areas	CT DEEP http://www.ct.gov/deep/cwp/view.asp?a=2698&q=322898&depNav_GID=1707&depNav=| Watershed and Drainage Basins- 2006 Edition.
Land use and Land Cover	Raster dataset ESRI Shapefile	Required for defining land use distribution	UConn CLEAR 2010 Land Cover Data http://clear.uconn.edu/projects/landscapeLIS/galleryLC/map.html?webmap=a1ab06fea59149cebef945d28b32a2bb November 2012 Naugatuck Valley Council of Governments (NV COG) http://www.nvcogct.org/content/map-gallery-0 released October 2016
Hydrologic Soil Group	ESRI Shapefile	Required for drainage characteristics	CT DEEP http://www.ct.gov/deep/cwp/view.asp?a=2698&q=322898&depNav_GID=1707&depNav=| SSURGO database for State of Connecticut- March 2007
Rivers/ Streams	ArcGIS File GDB	Required for stream channel erosion calculations, riparian buffer locations, and proximity of on-site sewage disposal systems.	CT DEEP http://www.ct.gov/deep/cwp/view.asp?a=2698&q=322898&depNav_GID=1707&depNav=| Hydrography: Connecticut Hydrography (Line and Polygon)- 2005 Edition.
Surface waters	ESRI Shapefile	Required for defining land use distribution, and determining proximity of on-site disposal systems to water bodies.	CT DEEP http://www.ct.gov/deep/cwp/view.asp?a=2698&q=322898&depNav_GID=1707&depNav=| Connecticut Named Waterbody (Line and Polygon)- 2005 Edition.

Data	**Type**	**Need**	**Data Source**
EMCs	Literature values	Required for defining pollutant concentrations associated with land use	McCarthy, Jillian, 2008. *New Hampshire Stormwater Manual Volume 1: Stormwater and Antidegradation, December 2008*. http://des.nh.gov/organization/divisions/water/stormwater/documents/wd-08-20a_apxd.pdf. New York State Department of Environmental Conservation, 2001. *New York State Stormwater Management Manual. Appendix A: The Simple Method to calculate Urban Stormwater Loads.* http://www.dec.ny.gov/docs/water_pdf/simple.pdf Beta Group, Inc, 2006, *Quality Assurance Project Plan. Development of a Watershed Based Plan for Massachusetts.*
Impervious cover	Literature values; Raster data	Required for defining percent of impervious cover and subsequent runoff contribution pertaining to each land use.	Multi-Resolution Land Characteristic Consortium (MRLC) http://www.mrlc.gov/ National Land Cover Database- 2011 NLCD impervious. October 10, 2014 Edition.
Annual Rainfall	Data table	Required for runoff calculations	NOAA National weather service. http://water.weather.gov/precip/
Dwelling units and population data	ESRI Shapefile	Required for sewage use calculations	MAGIC. http://magic.lib.uconn.edu/connecticut_data.html- 2010 Census Data-released in 2010.
Nutrient concentration in stream channels	Literature values	Required for pollutant loading from stream channel erosion	Haith, D., R. Mandel, and R. Wu. 1992. Generalized Watershed Loading Functions, User's Manual.

Data	**Type**	**Need**	**Data Source**
Septic System Maintenance	Septic system records	To determine if there are failing septic systems in the study area	Pomperaug Health District Information/data
Sewage Treatment Plants	ESRI Shapefile	Indicates where sewage treatment plants are located along Rivers	MAGIC. http://magic.lib.uconn.edu/connecticut_data.html. Connecticut Sewage Treatment Plants- released in 1999.
Sewer Service Areas	ESRI Shapefile	Helps to define areas that have public-disposal of septic vs. septic systems	MAGIC. http://magic.lib.uconn.edu/connecticut_data.html. Connecticut Sewer Service Areas- released in 1998.
Bank stability/ channel erosion	Field assessments	Required for pollutants associated with stream degradation	Field assessments
Livestock	Field assessments	Required for pollutant load calculation from livestock	Field assessments
Road sanding application	Literature values; Town information	Required for pollutant load calculation from road sanding	Relevant municipalities; National Research Council, 1991. *Highway Deicing Comparing Salt and Calcium Magnesium Acetate* -- Special Report 235.
Acres and length of roads	ESRI Shapefile	Road sanding, catch basin clean out calculations	MAGIC, http://magic.lib.uconn.edu/connecticut_data.html Connecticut Roads, released 1984 or OpenStreetMap, http://www.openstreetmap.org/#map=6/51.255/-4.526 Released October 2016
Catch basin clean out schedule	Town information	Required to calculate benefit from catch basin cleaning BMP	Relevant municipalities
Street sweeping schedule	Town information	Required to calculate benefit from street sweeping BMP	Relevant municipalities

Data	Type	Need	Data Source
Aerial photography	Photography	Required for desktop assessment and data checking	CT ECO http://www.cteco.uconn.edu/help/info_orthos2012.htm February 2013.
Storm water drainage information	Field assessments	Required for pollutant delivery ratios for road sanding and catch basin cleanouts	Field assessments, relevant municipalities
Parcel information	ESRI Shapefile	Required for determining proximity of land use disposal systems to water bodies	Relevant municipalities
Marinas - berths and pumpouts	Field assessments/ desktop assessment	Required if watershed contains marinas for pollutant source calculations	Aerial photography, business websites
Turf Area	Raster dataset ESRI Shapefile	Required for area of turf management practices	UConn CLEAR 2010 Land Cover Data http://clear.uconn.edu/projects/landscapeLIS/galleryLC/map.html?webmap=a1ab06fea59149cebef945d28b32a2bb November 2012 Naugatuck Valley Council of Governments (NV COG) http://www.nvcogct.org/content/map-gallery-0 released October 2016
Fertilizer Use	Survey/ Field Assessment	Required for area of turf management practices	Survey, field assessment, relevant municipalities.
Practices of households with dogs	Survey	Required for pet waste contributions	Survey

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Appendix C

Technical Memorandum – Pollutant Loading Model

Pomperaug River Watershed Based Plan

MEMORANDUM

TO: Pomperaug River Watershed Coalition (PRWC)

FROM: Erik Mas, P.E, Stefan Bengtson, MSc

DATE: March 5, 2018; **Revised September 27, 2018**

RE: **Pollutant Loading Model**
Pomperaug River Watershed Based Plan

This memorandum summarizes the methods and results of a pollutant loading model that was developed for the Pomperaug River Watershed. The model is used to support the development of a watershed-based plan for the Pomperaug River watershed.

1. Introduction

The Watershed Treatment Model (WTM), developed by the Center for Watershed Protection, was used to estimate annual pollutant loads from the following Connecticut Subregional Drainage Basins (also referred to as "subwatersheds" in this document) located within the larger Pomperaug River Regional Basin watershed (**Figure 1**):

- East Spring Brook
- Hesseky Brook
- Nonnewaug River
- Pomperaug River
- Sprain Brook
- Transylvania Brook
- Weekeepeemee River.

The WTM is a screening-level model that can be used to estimate the loading of pollutants to a waterbody based on land use and other activities within a watershed. Based on user-specified input describing characteristics of the watershed, the WTM estimates pollutant loads from various land uses and activities, as well as load reductions associated with structural and non-structural best management practices. While fecal indicator bacteria impairments are the primary focus of the watershed based plan, the WTM also provides loading estimates for other pollutants including total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). BMPs that will be recommended in the watershed based plan will not only help to reduce bacteria but may also help to reduce these other pollutants.

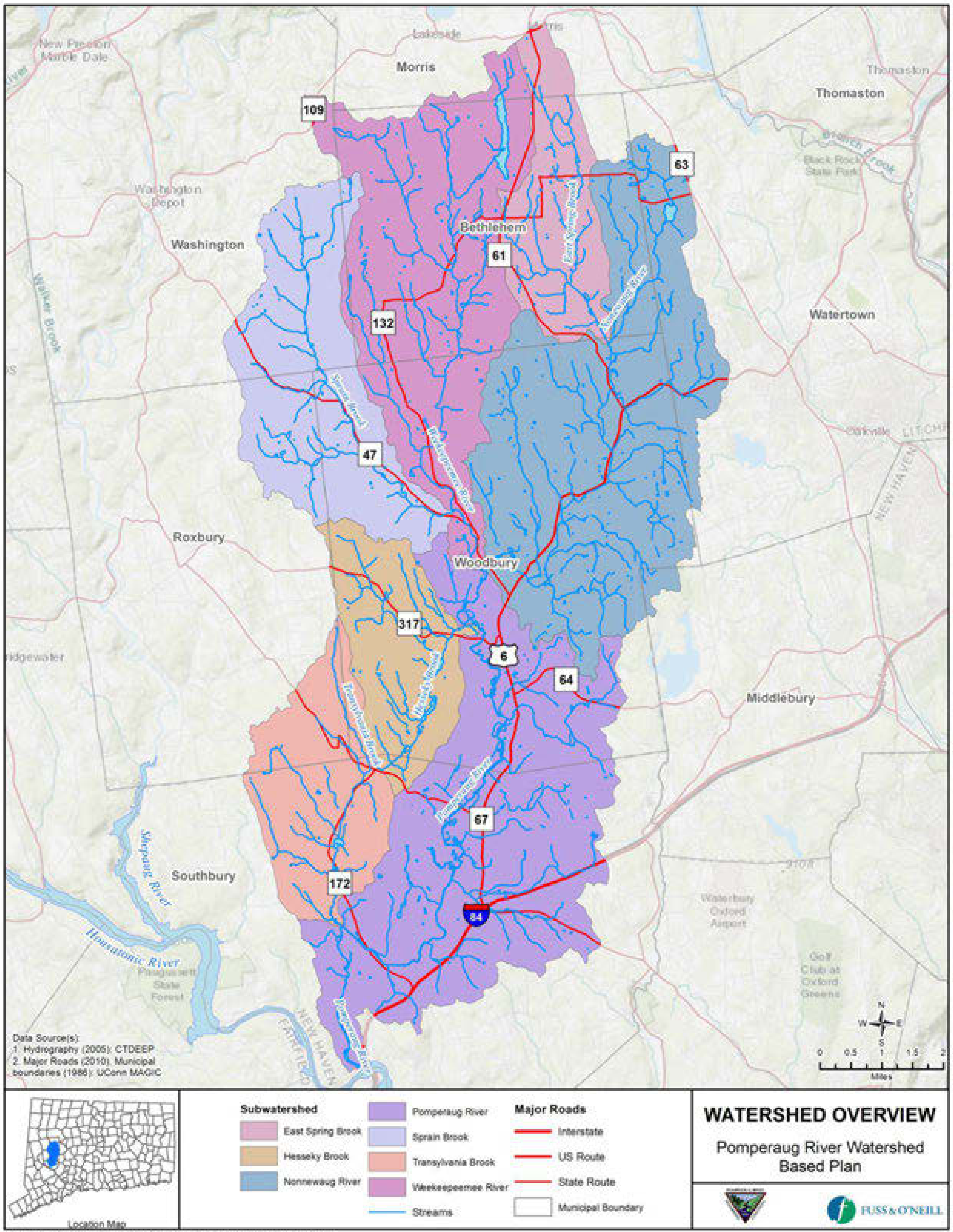

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Figure 1: Subregional Drainage Basins in the Pomperaug River Regional Basin Watershed

2. Model Inputs

Primary Sources (Land Use)

Land use is considered a primary source of runoff pollutant loads in the WTM, which uses the Simple Method (Schueler, 1987) to calculate loads from urban land uses, and area loading factors to calculate loads from non-urban land uses. 2016 parcel-based land use data available from the Naugatuck Valley Council of Governments (NVCOG) were adapted for use with the WTM. Impervious area for each land use category was calculated from the National Land Cover Database (NLCD) 2011 impervious cover dataset. **Table 1** in *Attachment A* summarizes the modeled land use category and impervious area for each land use classification. **Table 2** provides a breakdown of existing modeled land use by subregional drainage basin.

Model inputs were specified for each land use category, including area, impervious cover, runoff coefficient, and runoff pollutant concentrations or export coefficients. Literature-based event mean concentration (EMC) values were used for all developed land use categories, while selected regional export coefficients were used for non-urban land uses. WTM default export coefficients were used for rural, powerline, and open water land use categories. The cropland land use category included both row crops and pasture land. The export coefficients for this land use category were approximated as the area-weighted average of the export coefficients of the two sub-categories. Discussions with the PRWC Land Use Committee revealed that some farmers in the watershed apply manure to their hay fields to increase yields, which was also considered when selecting an appropriate export coefficient for cropland. Tables 3 and 4 in Attachment A summarize the selected EMC and export coefficient values and associated references. Average annual precipitation for the watershed (51.09 inches) was estimated from the average precipitation recorded at the Woodbury station over the period of record (1967-2008) (Northeast Regional Climate Center http://www.nrcc.cornell.edu/).

Secondary Sources

In addition to pollutants generated from land uses, the WTM estimates pollutant loads from other activities or sources (secondary sources) that may be present, but are not necessarily associated with a particular land use. The following secondary sources were included in the WTM for the Pomperaug River watershed:

- **Failing or Malfunctioning Septic Systems** – Most of the Pomperaug River watershed is served by individual septic systems. A septic system failure rate of 1% was assumed for residential areas throughout the watershed. This rate represents an estimate based on regional failure rates and information provided by Pomperaug and Torrington Health Districts. Based on a review of aerial imagery, tax assessor's database information, and parcel land use mapping, an estimated 3.25% of septic systems in the watershed are within 100 feet of surface water bodies.

- **Stream Channel Erosion** – Due to the limited data available on stream channel erosion loads in the watershed, a simplified approach was used in which stream channel erosion sediment loads were estimated as a fraction of total watershed sediment load, based on overall stream channel stability. Stream channel erosion sediment loads were assumed to be 50% of the total sediment load for the watershed (reflecting "medium" stream channel degradation and stability), consistent with the model guidance.

- **Livestock** – This secondary source accounts for pollutant loads from animals that are confined (e.g., feedlots, stables). In the model, pollutant loads associated with pastured animals are simulated as Primary Sources (i.e., cropland land use). Hobby farms with a few horses are common throughout the watershed. Equestrian centers, including stables or boarding, are also prevalent. There are small and large farm operations for cattle, goats, sheep, and alpacas ranging from 10 to more than 300 head. Estimates of head per subregional drainage basin were based on information provided by Sarah Turoczi, a local resident and farmer in the watershed with first-hand knowledge of livestock head counts. Further site-specific information was derived from observations by Fuss & O'Neill personnel during field assessments and from aerial imagery. **Tables 7 and 8** in *Attachment A* summarize livestock head counts and other model inputs for the Livestock Secondary Source.

- **Road Sanding** – Sediment loads from road sanding were calculated based on a 2015 CTDOT report entitled Winter Highway Maintenance Operations. The report includes a survey of 31 municipal public works operations and reveals an average annual application rate of 6.1 tons of sand per lane mile between 2009 and 2014. This was assumed to be uniform over municipally-maintained roads in the watershed. The Connecticut Department of Transportation does not apply sand to state roads, so state-maintained roads were not included in the calculation of lane miles.

- **Potential Illicit Connections** – In areas served by sanitary sewers, illicit connections were assumed for one in every 1,000 sewered connections and 5% of businesses, consistent with values reported in several national studies, modified to account for local conditions. Model default pollutant concentrations and daily flow values were used.

- **Wastewater Treatment Plants** – Average daily flow and effluent concentrations reported in Discharge Monitoring Reports obtained from the EPA's Integrated Compliance Information System (ICIS) website were used for estimating pollutant loads from the wastewater treatment plants in the watershed, including Heritage Village, IBM Southbury, and Woodlake Condos.

Refer to **Tables 5 and 6** in *Attachment A* for a detailed description of the model inputs and assumptions.

3. Model Results

Existing Pollutant Loads

Annual loads of bacteria, TP, TN, and TSS were estimated for each subregional drainage basin (**Figures 2, 3, and 4**). Existing modeled pollutant loads are provided in **Tables 9.1 – 9.7** in *Attachment A*. The model results indicate that the Pomperaug, Nonnewaug, and Weekeepeemee River subregional drainage basins have the highest annual pollutant loads. This result is not surprising since these are the largest subregional drainage basins by land area. In addition, the primary land uses and activities in these subregional drainage basins have higher EMCs and pollutant loading factors (e.g., residential areas, agriculture, road sanding, and septic systems).

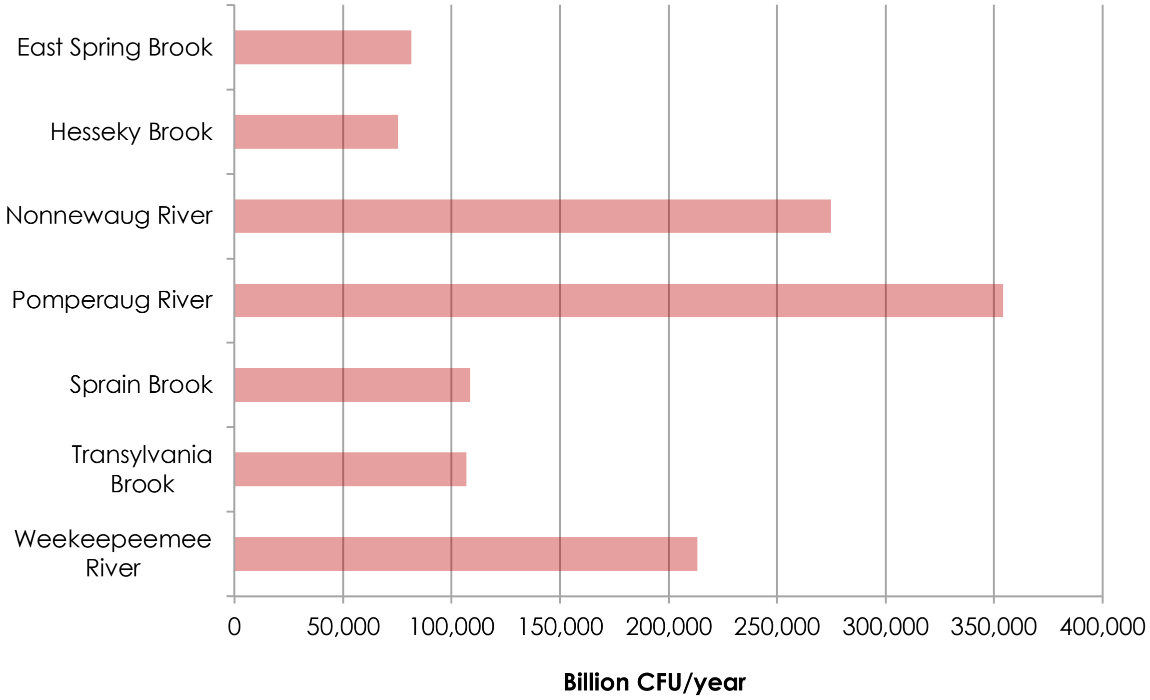


Figure 2: Modeled bacteria loads by subregional drainage basin

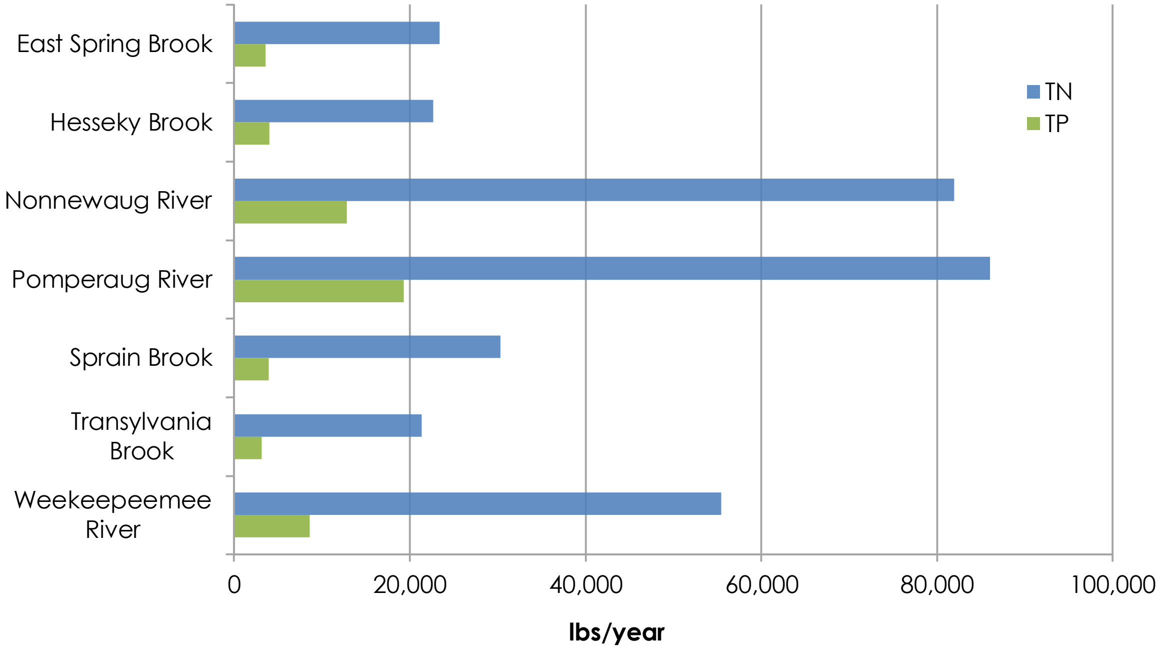


Figure 3: Modeled Total Nitrogen (TN) and Total Phosphorus (TP) loads by subregional drainage basin

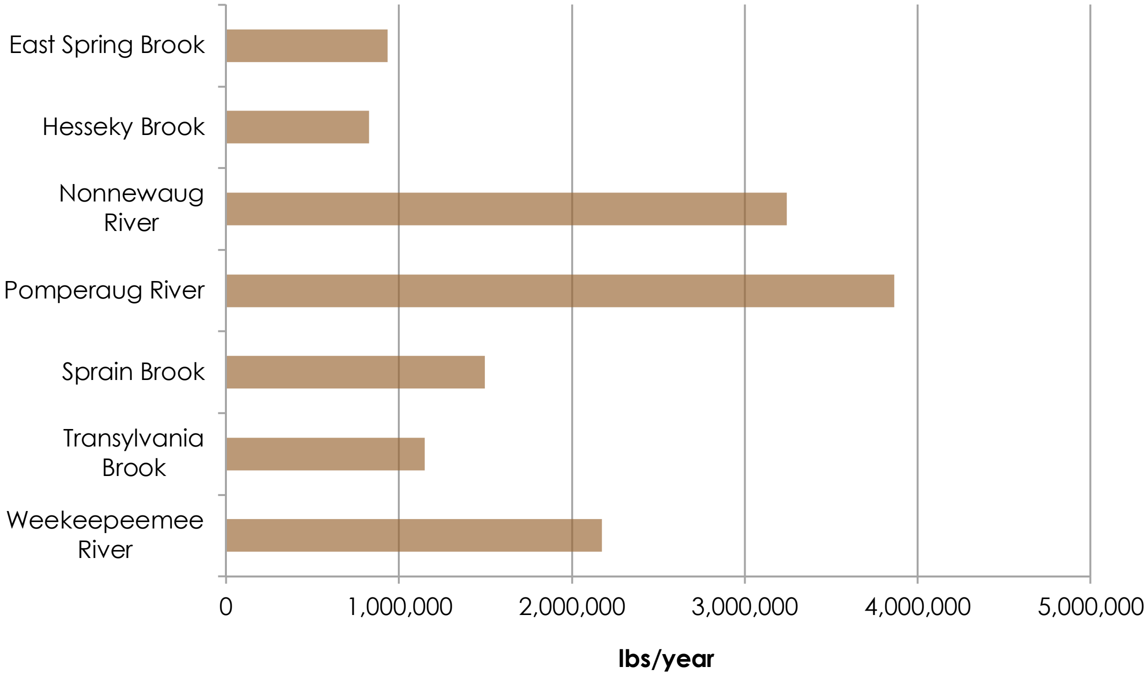


Figure 4: Modeled total suspended solids (TSS) loads by subregional drainage basin

Existing Pollutant Yields

Watersheds differ in area, which directly influences pollutant loads – a larger watershed may have a higher load than a smaller watershed simply because it has a larger area. To remove this effect, pollutant loads were divided by the subwatershed area to derive a per-acre pollutant "yield," which provides a better comparison of pollutant contributions among subwatersheds of varying sizes.

In addition to the highest annual loads, the Pomperaug River subregional drainage basin also has the highest modeled TP, TSS, and bacteria yields and among the highest TN yields (**Figures 5, 6, 7**). The Pomperaug River subregional drainage basin is characterized by a greater intensity of development and land use activities, namely larger percentages of developed land uses with higher EMCs, larger numbers of septic systems in proximity to mapped streams, greater commercial development with potential for illicit connections, and higher numbers of road lane miles subject to sanding, as well as point source discharges from wastewater treatment facilities. In contrast, the Sprain Brook subregional drainage basin, the fourth largest of the 7 subregional drainage basins considered in this study, has among the lowest annual loads and yields for all pollutants considered. This reflects the predominantly forested nature (approximately 64%) and relatively limited development and agricultural practices within this basin.

In order to assess the reasonableness of the WTM results, the modeled pollutant yields were compared with those of the U.S. Geological Survey (USGS) SPAtially Referenced Regressions On Watershed attributes model (SPARROW) for TN and TP for the overall Pomperaug River watershed. Comparison of the yields in **Table 1** shows that there is relatively good agreement between the two models. Notably, WTM results are within the same order-of-magnitude but slightly above the range of SPARROW values.

This result is not very surprising since the SPARROW results are based on data from 1993 and the patterns and intensity of development in the watershed have changed.

Table 1: Comparison of TN and TP estimates

Parameter	TN	TP
WTM (lbs/acre/yr)	4.3 – 6.4	0.6 – 1.4
SPARROW (lbs/acre/yr)	0.9 – 5.9	0.1 – 0.9

Figures 6 and 7 show that most subregional drainage basins have similar modeled nutrient and TSS yields. Despite this similarity, the sources of these pollutants in each subregional drainage basin vary. For example, in the Pomperaug subregional drainage basin, developed land use and residential turf management dominate. In the less developed East Spring Brook subregional drainage basin, agricultural land use more strongly influences pollutant yields. While there are distinct locations in every subregional drainage basin where opportunities for bacteria source reduction could be pursued, the more developed areas and areas with higher concentrations of livestock in the watershed are the dominant sources of existing modeled bacteria loads in the watershed.

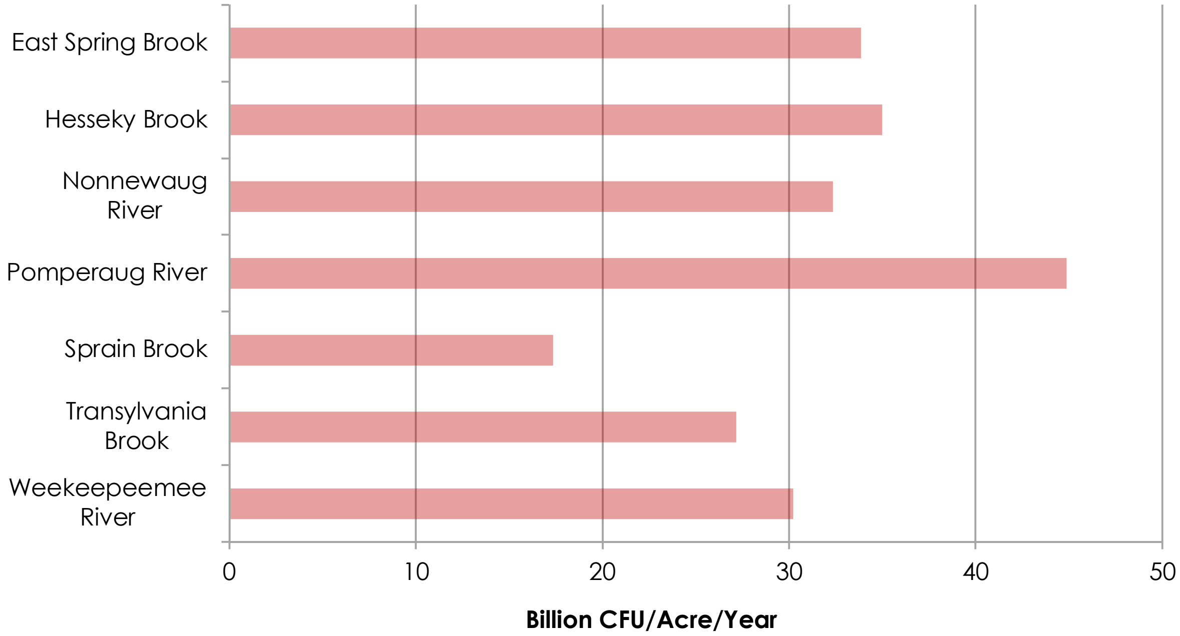


Figure 5: Modeled bacteria yields by subregional drainage basin

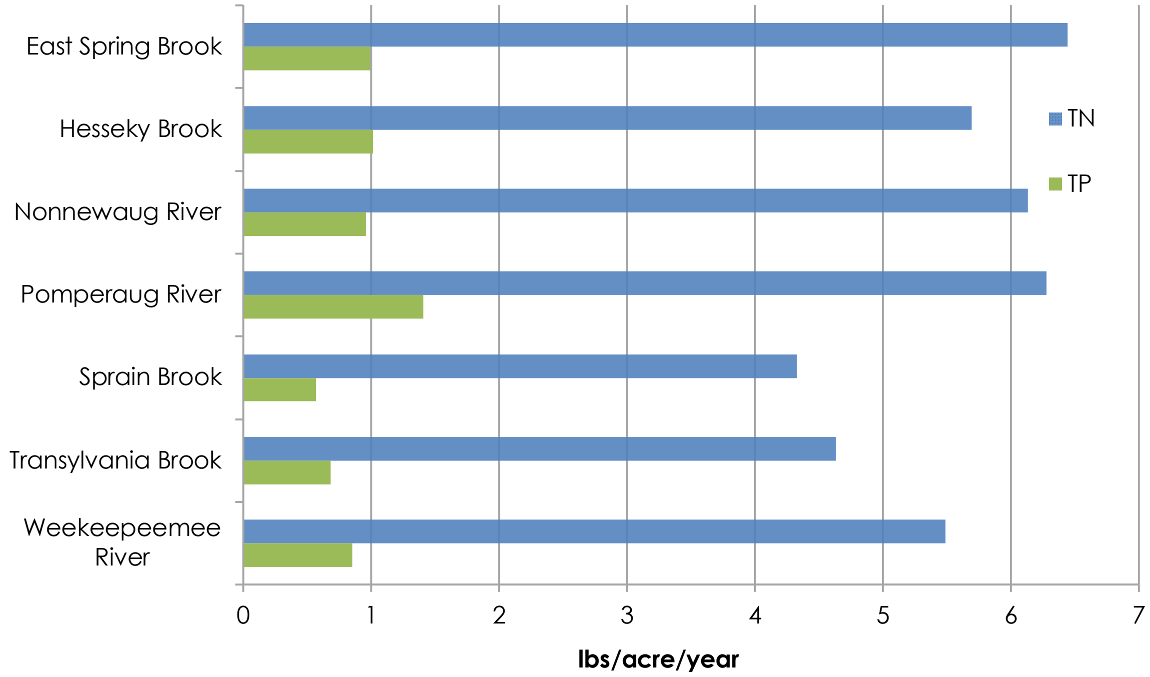


Figure 6: Modeled Total Nitrogen (TN) and Total Phosphorus (TP) yields by subregional drainage basin

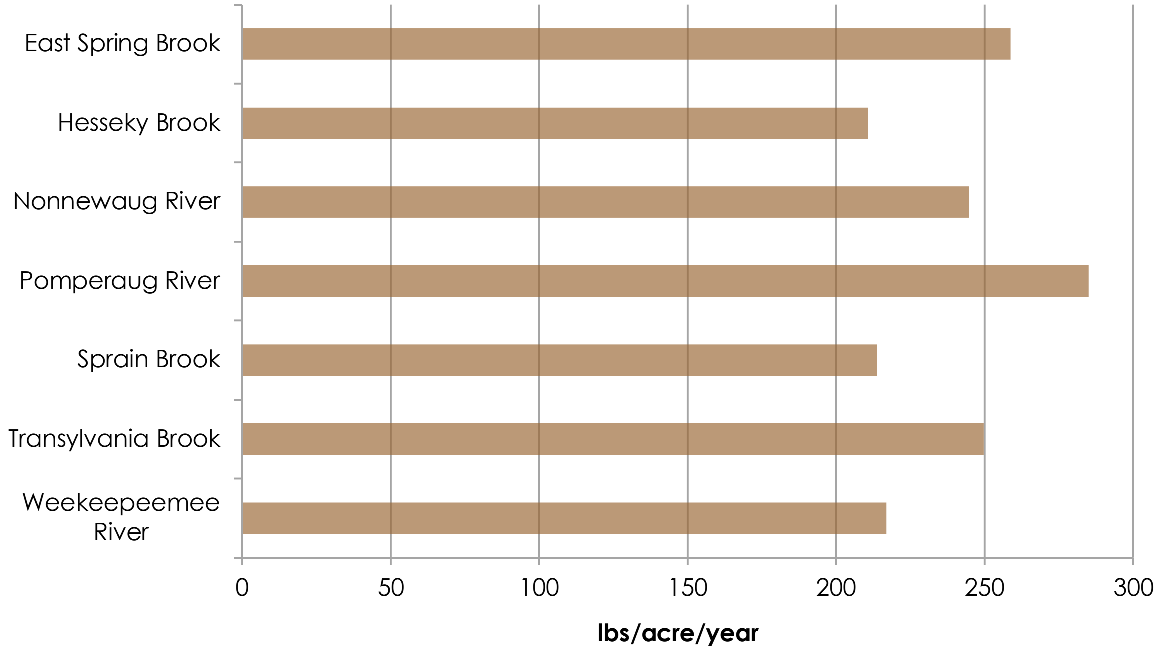


Figure 7: Modeled total suspended solids (TSS) yields by subregional drainage basin

Discussion

Bacteria sources in the watershed reflect both the underlying land use (i.e., agriculture, forest, residential, etc.) and specific activities that can result in bacteria loading to streams (e.g., livestock, septic system failures, illicit discharges). The relative contribution of bacteria from different land uses and activities is well illustrated by a comparison of the modeled loads in the various subregional drainage basins (**Figures 8-14**). In the more-developed Pomperaug River subregional drainage basin, modeled bacteria loads are dominated by stormwater runoff from urban land use (43%) and potential illicit connections associated with residential and commercial land use (31%), with agricultural sources estimated to contribute approximately 10% of the estimated annual 354,000 billion CFU load (**Figure 8**). By contrast, in the more rural Weekeepeemee River subregional drainage basin, agricultural land uses (rural land and livestock), contribute an estimated 45% of the annual bacteria load, with stormwater runoff contributing approximately one-quarter of the 213,000 billion CFU annual load (**Figure 9**).

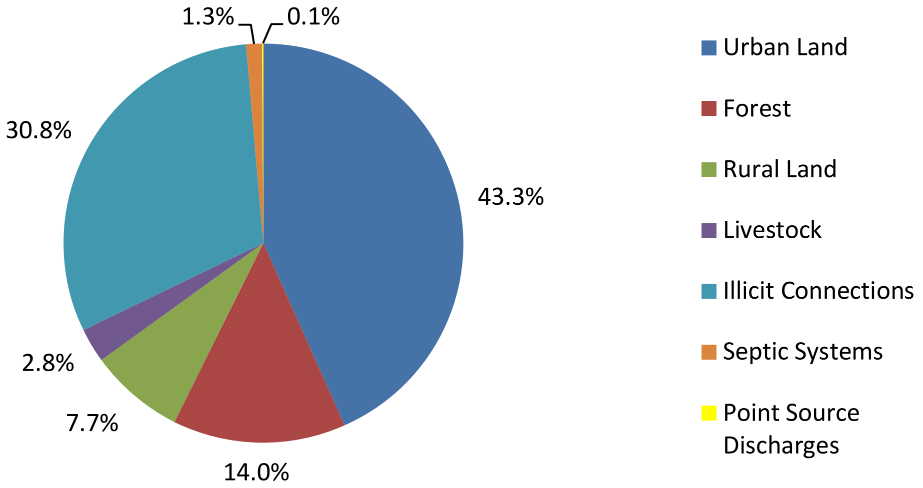


Figure 8: Relative contributions of various bacteria sources in the Pomperaug River subregional drainage basin. Total annual load: 354,000 billion CFU

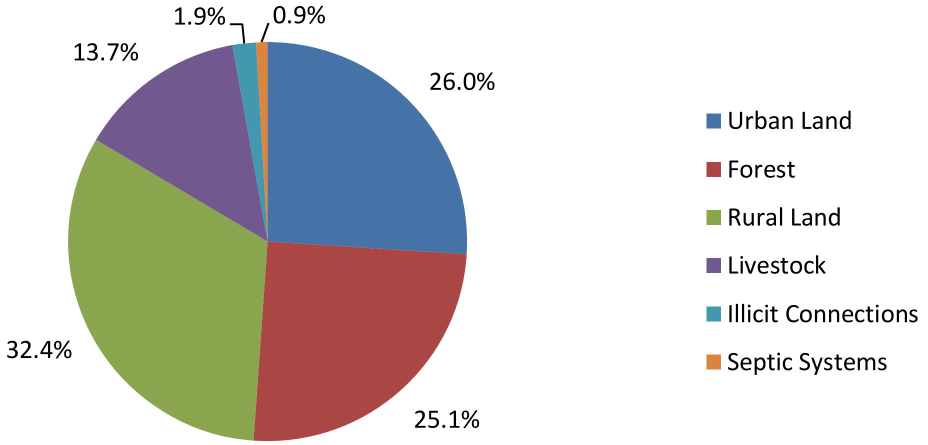


Figure 9: Relative contributions of various bacteria sources in the Weekeepeemee River subregional drainage basin. Total annual load: 213,000 billion CFU

The comparison points out some of the opportunities and challenges in watersheds with mixed land use. The modeled bacteria loads in the Pomperaug River subregional drainage basin illustrate the benefits of management measures that focus on sources of fecal indicator bacteria associated with urban stormwater runoff, including source controls, structural stormwater BMPs, education and outreach, and illicit discharge detection and elimination (IDDE). Even though the estimates of illicit connections are modest (0.1% of the subwatershed population and 5% of the businesses served by sewer), the elimination of these discrete sources of bacteria could substantially reduce bacteria loadings where sanitary-related illicit connections are present (i.e., in areas served by sanitary sewers). Consequently, implementing an IDDE program in the more developed and/or sewered areas of the watershed can be effective at reducing bacteria loads.

In contrast, in the more rural subregional drainage basins, livestock and agricultural practices are key drivers of bacteria loads, though pockets of residential and commercial development in these areas also contribute bacteria loads from urban runoff (**Figures 10-14**). Agricultural sources of bacteria typically require a combination of structural and non-structural best management practices to reduce loadings, including identification of "hot spot" bacteria sources and site-specific management strategies to achieve load reductions. Livestock in particular represent a considerable bacteria source in the Weekeepeemee River, Nonnewaug River, and Hesseky Brook subregional drainage basins. Where practicable, load reduction in these basins should focus on agricultural best management practices.

The impaired segments of the Pomperaug and Weekeepeemee Rivers are included in the Connecticut Statewide Bacteria TMDL (2012). The TMDL identifies percent reductions (**Table 2**) in geometric mean and single sample fecal indicator bacteria (*E. coli*) concentrations required to meet recreational water quality criteria. These percentages are for reducing fecal indicator bacteria concentrations at ambient monitoring locations in each river segment, not at the end of stormwater outfalls or other pollutant loads to the river. It is also important to note that these impairments and percent reductions are based on a very limited data set consisting of approximately 10 samples (wet and dry weather) collected at a single station in each river segment in 2010.

Table 2: Bacteria (E. coli) Percent Reductions to Meet TMDL

Impaired River Segment	Geometric Mean	Single Sample
Pomperaug River (CT-6800-00_01)	65%	90%
Pomperaug River (CT6800-00_03)	75%	92%
Weekeepeemee River (CT6804-00_01)	48%[1]	98%[1]

[1] The required percent reductions in *E. coli* concentrations are incorrectly reported (geometric mean and single sample percent reductions are switched) in the Weekeepeemee River Watershed Summary document for the statewide Bacteria TMDL.

Further, the TMDL and modeled load reductions are not directly comparable since the TMDL load reductions targets are daily, seasonal (i.e., worst-case) values, whereas the modeled pollutant loads are annual values. The modeled load reductions are also based on the use of fecal coliform rather than *E. coli*, the latter being a subset of fecal coliform which is more specific to humans and other warm-blooded animals. *E. coli* is the indicator bacteria for freshwater monitoring in Connecticut and was used in the TMDL. Additional bacterial monitoring is recommended, as well as further coordination between PRWC and CTDEEP to discuss the watershed based plan findings, recommendations, and modeled potential load reductions relative to the TMDL reduction goals and implications for proposed bacteria monitoring locations.

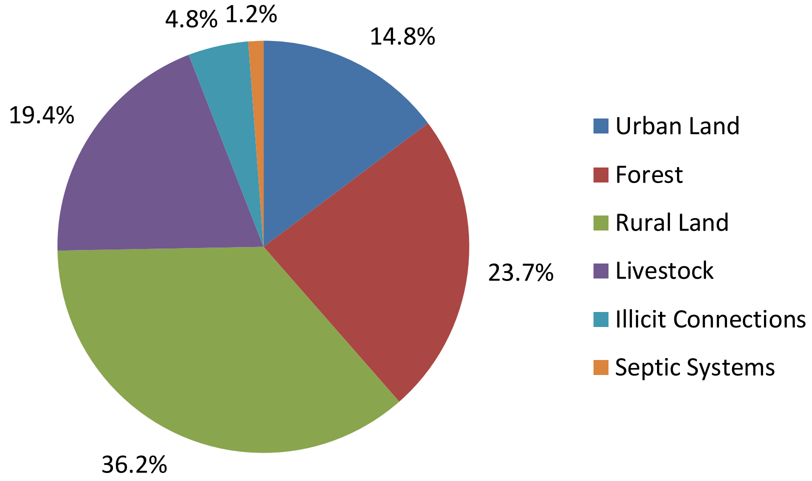


Figure 10: Relative contributions of various bacteria sources in the Nonnewaug River subregional drainage basin. Total annual load: 275,000 billion CFU

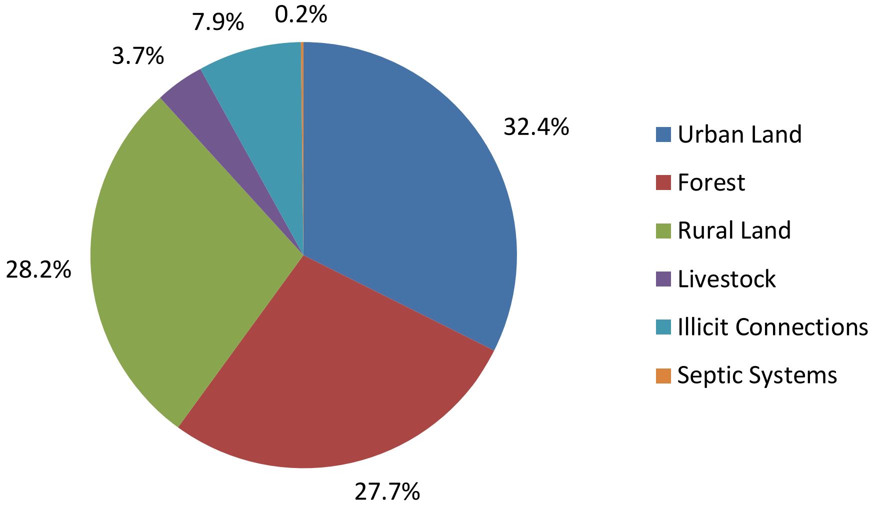


Figure 11: Relative contributions of various bacteria sources in Transylvania Brook subregional drainage basin. Total annual load: 107,000 billion CFU

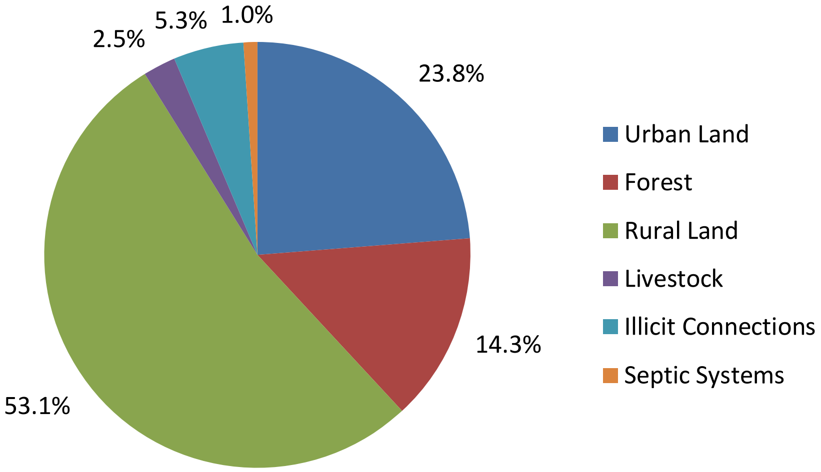


Figure 12: Relative contributions of various bacteria sources in East Spring Brook subregional drainage basin. Total annual load: 81,000 billion CFU

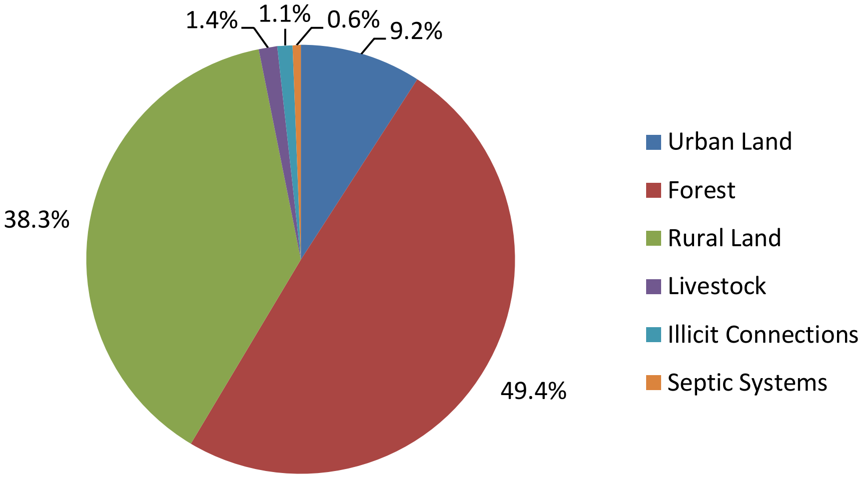


Figure 13: Relative contributions of various bacteria sources in Sprain Brook subregional drainage basin. Total annual load: 109,000 billion CFU

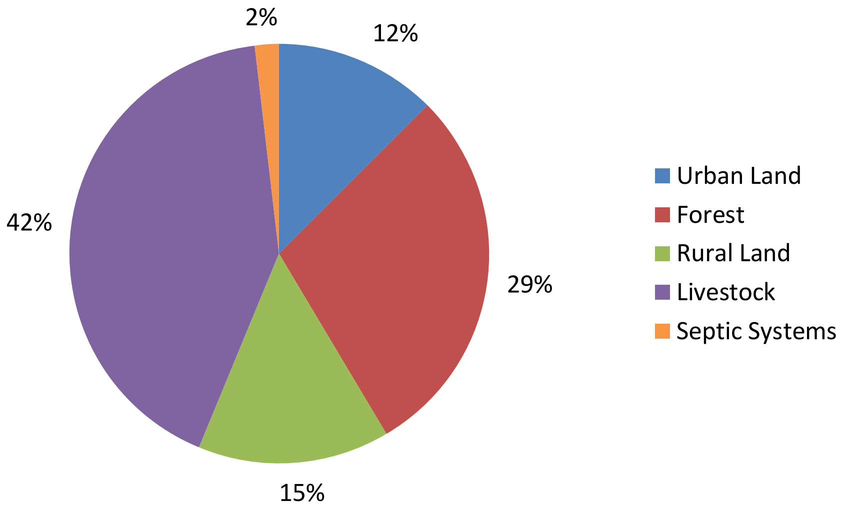


Figure 14: Relative contributions of various bacteria sources in Hesseky Brook subregional drainage basin. Total annual load: 75,000 billion CFU

Attachment A

Watershed Treatment Model
Model Parameter Values, Input Data, and Model Results

Table 1
Land Use and Impervious Cover in the Pomperaug River Watershed (acres)

	Land Use	Percent Impervious	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River	Watershed Total
Developed	Residential - High Density	13.5	0	0.1	9.6	18.8	0	0	3.2	31.7
	Residential - Medium Density	17.9	16.6	116	126.2	876.6	1.8	78.7	48.9	1,264.90
	Residential - Medium-Low	9.4	37.3	41.9	179.4	381.3	14.9	141.1	65.4	861.5
	Residential - Low Density	2.0	1,383.60	1,561.00	4,082.20	4,664.60	1,217.30	774.9	3,089.40	16,773.00
	Developed Recreation	5.6	0.5	0	206	453.5	30.7	6.1	6.5	703.4
	Commercial	23.1	50.6	0	84.7	659.8	15.5	5	142.7	958.2
	Industrial	7.5	5.8	0	24.8	53.5	0	0	97.4	181.5
	Institutional	15.7	44	2.9	60.2	304.2	0	234.7	206.3	852.3
	Mining	0.1	0	0	87.2	408.4	0	0	0	495.6
	Roadway	17.5	13	153.8	444.8	978.9	140.4	129.7	99.4	1,960.00
	Utilities	3.0	11.5	0	0	0	0	0	0	11.5
Rural	Barren	12.0	0	0	0.2	28.4	21.2	6.5	1.4	57.7
	Cropland	1.0	1,096.20	285.6	2,550.30	699.6	1,066.60	773	1,771.80	8,243.10
	Forest	0.2	971.9	1,823.60	5,432.40	4,123.90	4,472.60	2,462.90	4,455.70	23,743.00
	Water	0.4	0.7	0	72	51.7	13.6	0	111.8	249.9
	Sub-watershed Total		**3,631.80**	**3,985.00**	**13,360.00**	**13,703.30**	**6,994.60**	**4,612.60**	**10,099.90**	**56,387.10**

Table 2
Pomperaug Watershed Land Use Map to Modeled Land Uses

	Land Use	Modeled Land Use	Notes
Developed	Residential - High Density	High Density Residential	
	Residential - Medium Density	Medium Density Residential	
	Residential - Medium-Low	N/A	Assigned equally to Medium and Low Density Residential
	Residential - Low Density	Low Density Residential	
	Developed Recreation	Barren	Modeled as barren land use, but with FC value below Low Density Residential
	Commercial	Commercial	
	Industrial	Industrial	
	Institutional	Commercial	Assumed to be same as commercial
	Mining	Mining	
	Roadway	Highway	
	Utilities	Rural	
Rural	Barren	Barren	
	Cropland	Cropland	Combined Pasture, Hay Fields, and Row Crops
	Forest	Forest	
	Water	Open Water	

Table 3
Developed Land Uses - Event Mean Concentrations
(TN, TP, TSS in mg/L and Fecal Coliform in MPN/100ml)

Land Use	WTM Default Values				Regional Values				Selected Values			
	TN	TP	TSS	FC	TN	TP	TSS	FC	TN	TP	TSS	FC
Low Density Residential	2.1	0.31	49	20,000	3.18	0.27	34	2,950	3.18	0.27	34	2,950
Medium Density Residential	2.1	0.31	49	20,000	3.5	0.41	49	12,360	3.5	0.41	49	12,360
High Density Residential	2.1	0.31	49	20,000	3.81	0.64	102	16,901	3.81	0.64	102	16,901
Highway	-	-	-	-	2.65	0.43	141	600	2.65	0.43	141	600
Commercial	2.1	0.22	43	20,000	1.85	0.15	44	9,306	1.85	0.15	44	9,306
Institutional	2.1	0.22	43	20,000	1.85	0.15	44	9,306	1.85	0.15	44	9,306
Industrial	2.2	0.25	81	20,000	4	0.11	42	1,467	4	0.11	42	1,467
Mining	-	-	-	-	1.18	0.15	94	300	1.18	0.15	94	300
Barren	-	-	-	-	1.74	0.11	51	5,000	1.74	0.11	51	300

Notes:

TN = Total Nitrogen; TP = Total Phosphorus; TSS = Total Suspended Solids; FC = Fecal Coliform

Sources:

BETA Group, Inc. (2006). Quality Assurance Project Plan. Development of a Watershed Based Plan for Massachusetts.

Caraco, D. and Center for Watershed Protection, Inc. (2013). Watershed Treatment Model (WTM) 2013 Documentation.

Table 4
Rural Land Uses - Export Coefficients
(TN, TP, and TSS in lb/ac/yr and Fecal Coliform in billion/ac/yr)

Land Use	WTM Default Values				Regional Values				Selected Values				Comments
	TN	TP	TSS	FC	TN	TP	TSS	FC	TN	TP	TSS	FC	
Forest	2.0	0.2	100	12	2.5	0.2	100	12	2.5	0.2	100	12	Selected regional values
Rural	4.6	0.7	100	39	-	-	-	-	4.6	0.7	100	39	Selected WTM Default values
Power Lines	4.6	0.7	100	39	-	-	-	-	4.6	0.7	100	39	Selected WTM Default values
Open Water	12.8	0.5	155	-	0.4 (2)	0.03 (2)	2 (2)	0.4 (2)	0.4	0.03	2	0.4	Selected regional values
Cropland	-	-	-	-	Pasture 1.9 (2) 7.7 (3) 5.6 (4) Row Crops 14.4 (3) 15.7 (4)	Pasture 0.1 (2) 1.3 (3) 0.5 (4) Row Crops 4.0 (3) 0.94 (4)	Pasture 47 (2) 591 (4) Row Crops 1997 (4)	Pasture 7 (2) Row Crops -	10	0.8	300	39	Selected TN, TP, and TSS based on regional sources for pasture and row crops; FC assumed same as Rural land use

Notes:

TN = Total Nitrogen; TP = Total Phosphorus; TSS = Total Suspended Solids; FC = Fecal Coliform

Conversion equation used for Pasture/Orchard

NSQD (2005) and MA DEP QAPP do not provide rural land use data.

Cropland export coefficients are based on regional values. This category includes both pasture and crop land. Pasture land and hay fields are more prevalent in the Pomperaug River Watershed, so the selected coefficients tend towards those values. Information from the Pomperaug River Watershed Coalition Land Use Committee indicates that some farmers apply manure to hay fields, which is reflected in the choice of coefficients.

Sources:

Maestre & Pitt and Center for Watershed Protection (2005). The National Stormwater Quality Database, Version 1.1.

Caraco, D. and Center for Watershed Protection, Inc. (2013). Watershed Treatment Model (WTM) 2013 Documentation.

Regional values identified by number:

1. CDM (2004). Merrimack River Watershed Assessment Study - Screening Level Model.
2. BETA Group, Inc. (2006). Quality Assurance Project Plan. Development of a Watershed Based Plan for Massachusetts. Converted values presented in mg/L into lb/ac/yr assuming 0% impervious area for Forest and 2% impervious area, 46 inches of rain per year, for agricultural land uses.
3. Reckhow et al. (1980): "Modeling Phosphorus Loading and Lake Response under Uncertainty: A Manual and Compilation of Export Coefficients." From Lin, J. (2005) Review of Published Export Coefficient and Event Mean Concentration (EMC) Data. Converted values from kg/ha/yr to lb/ac/yr.
4. CH2M HILL (2001). PLOAD version 3.0, An ArcView GIS Tool to Calculate Nonpoint Sources of Pollution in Watershed and Stormwater Projects: User's Manual.

Table 5
Sources and Model Assumptions

Parameter	Sources	Model Assumptions & Notes
Primary Sources		
Watershed Boundary	CTDEEP – Subregional basins	The Watershed Boundary for the subregional basins within the Pomperaug River watershed.
Land Cover and Land Use	NVCOG – Land Use 2016 NLCD 2011 CTECO – 2016 Orthophotography	NVCOG land use classifications were simplified for input into WTM. Acreage for various classifications was determined in ArcGIS by intersecting the land use with the Sub Watersheds. NVCOG land use classifications include Medium-Low Density Residential, which was equally divided and assigned to both Medium Density and Low Density Residential. Because NVCOG does not include Morris, Washington, and Roxbury, their land uses were converted from raster to vector from national land cover data and manually assigned to NVCOG land use categories based on 2016 CT aerial imagery (3-inch resolution).
Pollutant Event Mean Concentrations (EMCs) and Export Coefficients	WTM Default Values, Selected Regional Values used in MA Watershed Based Plan (2006)	Selected regional EMCs used for residential, transitional, commercial, highway, and industrial land use categories. WTM default values used for rural, powerlines, and open water land use categories.
Impervious %	NLCD, 2011	The impervious surface data set available from USGS NLCD as a nationwide dataset representing impervious surfaces in 2011. The percent impervious for land use classes in each subwatershed was determined by intersecting the raster with the 2016 land use data.
Annual Rainfall	Northeast Regional Climate Center	Weather station on Saw Pitt Hill Rd, Woodbury. Period of record 1967-2008.
Stream Length	CTDEEP Hydrography Line	Stream lengths in each subwatershed were calculated based on intersecting the CTDEEP Hydrography Line data layer with the Sub Watershed boundaries.
Soils Information	CTDEEP Soils Data – NRCS SSURGO-Certified Soils 2009	Hydrologic Soils Group data were available from SSURGO and matched to CTDEEP soils data based on the Soil Map Unit Key (MUKey) field An estimate of the depth to groundwater was made by converting USDA drainage classes, which are essentially an estimate of seasonal high water table. Depth to groundwater was estimated at 3-5 ft across the watershed.
Runoff Coefficients	Virginia Erosion & Sediment Control Handbook, 1980.	Runoff coefficients for Rural Land Uses were selected from a range of values listed in the Virginia Erosion & Sediment Control Handbook. Values for Cropland ranged from 0.15 to 0.4 and for Pasture/Orchard, etc. values ranged from 0.12 to 0.35.

Parameter	Sources	Model Assumptions & Notes
Secondary Sources		
General Sewage Data	UConn MAGIC, NVCOG parcel-based land use and WTM defaults	Parcel-based land use in NVCOG area includes dwelling units. The sum of these within the sewered area delineated by UConn MAGIC data was used.
Nutrient Concentration in Stream Channels	Haith et al. 1992	A mid- range value of 0.15 was used for Soil P (%) and Soil TN (%). See figures 4.1 and 4.2 in the WTM 2013 Documentation.
On-Site Sewage Disposal (OSDS)	UConn MAGIC Sewered Areas, NVCOG land use and WTM defaults	All dwelling units assumed to be served by OSDS unless the parcel is within an area served by sanitary sewers. Unsewered areas were set to Clay/Mixed Soils. The default failure rate of 10% was assumed. System type was set to 100% conventional, with medium maintenance. Typical separation from groundwater was assumed to be 3-5 ft. The OSDS density was set at 1-2 per acre based on calculated dwelling unit density in unsewered areas.
SSOs, CSOs,	NA	It was assumed that neither SSOs nor CSOs exist in the study area based on the typical design of sanitary systems in the region.
Illicit Connections	NVCOG Parcel-based land use 2016	In sewered areas, 1/1000 residential connections and 5% of business connections assumed to be illicit. Defaults used for pollutant concentrations and percent wash water.
Stream Channel Erosion	NA to Non-urban watersheds.	Method 1 was selected as the method to estimate channel erosion which is assumed that some fraction of the total watershed load comes from stream channel erosion. A stream degradation value of "medium" (50% of the total sediment load) was applied to each sub watershed.
Livestock	Sarah Turoczi, aerial imagery, Fuss & O'Neill watershed survey	Livestock head counts based on information from Sarah Turoczi, a farmer who has first-hand knowledge of many farm operations in the watershed. Other farms were identified by aerial imagery and head counts inferred based on observations made by Fuss & O'Neill personnel during a watershed assessment. Nutrient loads converted from daily loads in kilograms (Ruddy et al., 2006). E. coli loads converted from daily loads reported by Borel et al. (2015), which are based on those from Wagner and Moench (2009), who incorporated daily fecal production and fecal coliform concentration into their load estimates. These loads are based on the concept of an animal unit (AU), which standardizes animals based on unit forage intake, relative to cows (Scarnecchia 1985).

Parameter	Sources	Model Assumptions & Notes
Road Sanding	Winter Highway Maintenance Operations, 2015 UConn MAGIC – Connecticut Roads (2010)	Based on the CTDOT report, state agencies switched from sand to sodium chloride. An anonymous survey of 31 municipalities in Connecticut showed that 6.143 tons/lane mile of sand was used. This rate was multiplied by the lane miles under municipal jurisdiction to determine the amount of road sand applied per HUC12 Sub Watershed/WTM Area. Road miles were determined by intersection of the Connecticut Roads layer with the shape file containing the respective HUC12 Sub Watershed/WTM Area. Lane miles were double, because all municipal roads are two-lane. The fraction of roads that are open is determined by dividing the amount of roadway that is open by the amount of road that drains to catch basins. Open sections do not have catch basins. Based on the rural/suburban nature of the study area, the length of road within the Municipal Separate Storm Sewer System (MS4) regulated area was used to estimate that 60% of roads were classified as open, on the assumption that urbanized areas are more likely to have closed section roads than more rural areas.
Non-Stormwater Point Sources	EPAs ICIS web data service	Daily discharge values of reported effluent concentrations on the EPA ICIS website were used for evaluating the contributing load from this source. The two treatment facilities with data available through this website were Heritage Village and IBM.

Haith, DA, R Mandel, and RS Wu. 1992. Generalized Watershed Loading Functions, Version 2.0 User's Manual. Department of Agricultural and Biological Engineering, Cornell University, Ithaca, NY.

Northeast Regional Climate Center. 2015. CLIMOD2: Woodbury, CT Precipitation Record 1967 – 2008.

USGS. 2011. National Land Cover Dataset.

Virginia Erosion and Sediment Control Handbook, 1980. Virginia Soil and Water Conservation Committee.

Winter Highway Maintenance Operations, 2015. Connecticut Academy of Science and Engineering report to the Connecticut Department of Transportation.

Table 6
Additional Model Inputs

	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Road Sanding (lbs/yr) - Entire Watershed	558,563	614,684	1,861,852	2,778,710	752,034	768,705	1,258,228
% With storm drains	20	20	20	40	20	20	20
% Without storm drains	80	80	80	60	80	80	80
Total length of streams (miles)	16.1	17.0	58.2	46.3	22.2	17.8	38.0
Dwelling units	611	1,050	2,368	5,807	466	761	1,446
Percentage of dwelling units un-sewered	100	100	100	58.3	100	21.7	100
Percentage of dwelling units with onsite septic within 100 ft of surface water[1]	10	10	10	10	10	10	10
Residential Sewered units	0	0	0	2,422	0	596	0
Commercial/Business Sewered units	0	0	0	161	0	2	0
Hydrologic Soil Group (Percent)							
A	2.6	4.3	10.4	10.2	2.8	1.8	4.1
B	23.8	41.2	33.9	51.9	59.7	44.1	52.2
C	57.6	32.6	26.8	14.5	18.3	33.6	25.9
D[2]	16.1	21.9	28.9	23.4	19.3	20.5	17.8

[1] An estimated 10% of dwelling units with septic systems are assumed to be located within 100 feet of a waterbody based on a review of aerial imagery and parcel land use mapping.

[2] Hydrologic soil group designation does not consider surface water. This area has been included under Group D which has the most similar infiltrative properties.

Table 7
Livestock Pollutant Loading Rates/Export Coefficients

Livestock	Nitrogen[1] (lbs/animal/year)	Phosphorus[1] (lbs/animal/year)	E. coli[2] (billion cfu/AU/year)
Bovine	164	26	1,966
Equine	102	18	84
Ovine	18.5	3.2	7,165
Poultry	1.1	0.4	85

[1] Ruddy et al (2006). Loads converted from daily loads in kilograms.

[2] E. coli loads converted from daily loads reported by Borel et al. (2015), which are based on those from Wagner and Moench (2009), who incorporated daily fecal production and fecal coliform concentration into their load estimates. These loads are based on the concept of an animal unit (AU), which standardizes animals based on unit forage intake, relative to cows (Scarnecchia 1985).

Table 8
Estimated Head of Livestock by Subregional Drainage Basin

Livestock	East Spring Brook	Hesseky Brook	Nonnewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Bovine	20	175	450	100	15	40	150
Equine	60	40	50	100	15	25	40
Ovine	25	40	25	15	0	0	40
Poultry	30	75	50	50	250	25	50

Notes:

Livestock head counts based on information from Sarah Turoczi, a local resident and farmer who has first-hand knowledge of farming practices in the watershed. Other farms were identified by aerial imagery and head counts inferred based on observations made by Fuss & O'Neill personnel during field assessments.

Table 9. 1
Modeled Pollutant Loads in the East Spring Brook Subregional Basin

	Existing Loads to Surface Waters					Percent of total load				
Source	FC (billion/year)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Runoff Volume (acre-feet/yr)	FC (%)	TN (%)	TP (%)	TSS (%)	Runoff Volume (%)
Urban Land	19,335	8,125	2,241	78,182	2,146	15.72	34.72	62.31	8.32	61.85
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	5	5	168,847	-	-	0.02	0.14	17.98	-
Road Sanding	-	-	-	256,939	-	-	-	-	27.36	-
Forest	11,663	2,430	194	97,190	140	9.48	10.38	5.40	10.35	4.03
Rural Land	43,200	11,015	885	330,010	1,184	35.12	47.07	24.61	35.14	34.12
Livestock	2,010	630	68	-	-	1.63	2.69	1.90	-	-
Illicit Connections	24,633	39	10	277	-	20.03	0.17	0.27	0.03	-
Point Source Discharges	-	-	-	-	-	-	-	-	-	-
OSDS/Septic	22,151	1,158	193	7,723	-	18.01	4.95	5.37	0.82	-
Open Water	0.28	0.28	0.02	1.40	-	0.00	0.00	0.00	0.00	-
Total Storm Load	76,209	15,482	3,070	888,448	3,470	61.96	66.16	85.36	94.60	100.00
Total Non-Storm Load	46,785	7,920	527	50,720	-	38.04	33.84	14.64	5.40	-
Total Load to Surface Waters	122,993	23,402	3,596	939,168	3,470	100.00	100.00	100.00	100.00	100.00

Table 9.2
Modeled Pollutant Loads in the Hesseky Brook Subregional Basin

	Existing Loads to Surface Waters					Percent of total load				
Source	**FC (billion/year)**	**TN (lb/yr)**	**TP (lb/yr)**	**TSS (lb/yr)**	**Runoff Volume (acre-feet/yr)**	**FC (%)**	**TN (%)**	**TP (%)**	**TSS (%)**	**Runoff Volume (%)**
Urban Land	9,396	8,734	2,623	128,496	2,624	6.74	38.49	64.97	15.30	82.83
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	4	4	146,900	-	-	0.02	0.11	17.49	-
Road Sanding	-	-	-	282,755	-	-	-	-	33.67	-
Forest	21,883	4,559	365	182,360	253	15.69	20.09	9.03	21.72	7.98
Rural Land	11,138	2,856	228	85,680	291	7.99	12.59	5.66	10.20	9.19
Livestock	31,574	4,508	479	-	-	22.64	19.87	11.86	-	-
Illicit Connections	27,380	36	6	241	-	19.64	0.16	0.15	0.03	-
Point Source Discharges	-	-	-	-	-	-	-	-	-	-
OSDS/Septic	38,067	1,991	332	13,272	-	27.30	8.77	8.22	1.58	-
Open Water	-	-	-	-	-	-	-	-	-	-
Total Storm Load	73,992	16,954	3,521	799,387	3,167	53.06	74.73	87.22	95.20	100.00
Total Non-Storm Load	65,447	5,735	516	40,318	-	46.94	25.27	12.78	4.80	-
Total Load to Surface Waters	139,439	22,689	4,037	839,705	3,167	100.00	100.00	100.00	100.00	100.00

Table 9. 3
Modeled Pollutant Loads in the Nonnewaug River Subregional Basin

	Existing Loads to Surface Waters					Percent of total				
Source	FC load (billion/year)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Runoff Volume (acre-feet/yr)	FC (%)	TN (%)	TP (%)	TSS (%)	Runoff Volume (%)
Urban Land	40,606	26,931	7,672	382,699	7,432	9.39	32.87	59.98	11.70	68.19
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	18	18	589,396	-	-	0.02	0.14	18.02	-
Road Sanding	-	-	-	958,854	-	-	-	-	29.32	-
Forest	65,189	13,581	1,086	543,240	770	15.08	16.57	8.49	16.61	7.07
Rural Land	99,462	25,503	2,040	765,090	2,697	23.01	31.12	15.95	23.40	24.75
Livestock	53,224	11,254	1,192	-	-	12.31	13.73	9.32	-	-
Illicit Connections	87,851	136	32	953	-	20.33	0.17	0.25	0.03	-
Point Source Discharges	-	-	-	-	-	-	-	-	-	-
OSDS/Septic	85,849	4,490	748	29,932	-	19.86	5.48	5.85	0.92	-
Open Water	29	29	2	144	-	0.01	0.04	0.02	0.00	-
Total Storm Load	258,510	57,774	11,072	3,108,590	10,899	59.81	70.51	86.56	95.05	100.00
Total Non-Storm Load	173,701	24,167	1,718	161,719	-	40.19	29.49	13.44	4.95	-
Total Load to Surface Waters	432,210	81,941	12,791	3,270,308	10,899	100.00	100.00	100.00	100.00	100.00

Table 9. 4
Modeled Pollutant Loads in the Pomperaug River Subregional Basin

	Existing Loads to Surface Waters					Percent of total load				
Source	**FC (billion/year)**	**TN (lb/yr)**	**TP (lb/yr)**	**TSS (lb/yr)**	**Runoff Volume (acre-feet/yr)**	**FC (%)**	**TN (%)**	**TP (%)**	**TSS (%)**	**Runoff Volume (%)**
Urban Land	153,444	55,974	15,925	1,056,415	14,799	24.96	65.06	82.45	27.06	92.40
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	18	18	592,836	-	-	0.02	0.09	15.19	-
Road Sanding	-	-	-	1,583,865	-	-	-	-	40.57	-
Forest	49,487	10,310	825	412,390	544	8.05	11.98	4.27	10.56	3.40
Rural Land	27,284	6,996	560	209,880	673	4.44	8.13	2.90	5.38	4.20
Livestock	9,893	2,690	287	-	-	1.61	3.13	1.49	-	-
Illicit Connections	251,484	407	105	2,903	-	40.91	0.47	0.54	0.07	-
Point Source Discharges	352	3,204	524	2,764	-	0.06	3.72	2.71	0.07	-
OSDS/Septic	122,737	6,419	1,070	42,794	-	19.97	7.46	5.54	1.10	-
Open Water	21	21	2	103	-	0.00	0.02	0.01	0.00	-
Total Storm Load	240,129	67,355	17,200	3,793,263	16,016	39.06	78.29	89.06	97.16	100.00
Total Non-Storm Load	374,574	18,682	2,114	110,687	-	60.94	21.71	10.94	2.84	-
Total Load to Surface Waters	614,703	86,038	19,314	3,903,950	16,016	100.00	100.00	100.00	100.00	100.00

Table 9. 5
Modeled Pollutant Loads in the Sprain Brook Subregional Basin

	Existing Loads to Surface Waters					Percent of total load				
Source	FC (billion/year)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Runoff Volume (acre-feet/yr)	FC (%)	TN (%)	TP (%)	TSS (%)	Runoff Volume (%)
Urban Land	9,951	8,003	2,170	99,613	1,976	8.20	26.42	54.59	6.66	54.56
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	8	8	281,857	-	-	0.03	0.21	18.86	-
Road Sanding	-	-	-	345,936	-	-	-	-	23.14	-
Forest	53,671	11,182	895	447,260	605	44.21	36.91	22.51	29.92	16.71
Rural Land	41,597	10,666	853	319,980	1,040	34.26	35.21	21.47	21.41	28.73
Livestock	1,537	405	44	-	-	1.27	1.34	1.10	-	-
Illicit Connections	14,638	21	4	146	-	12.06	0.07	0.11	0.01	-
Point Source Discharges	-	-	-	-	-	-	-	-	-	-
OSDS/Septic	-	-	-	-	-	-	-	-	-	-
Open Water	5	5	0.41	27	-	0.00	0.02	0.01	0.00	-
Total Storm Load	106,762	19,346	3,446	1,417,949	3,621	87.94	63.87	86.70	94.86	100.00
Total Non-Storm Load	14,638	10,945	529	76,870	-	12.06	36.13	13.30	5.14	-
Total Load to Surface Waters	121,400	30,291	3,974	1,494,819	3,621	100.00	100.00	100.00	100.00	100.00

Table 9. 6
Modeled Pollutant Loads in the Transylvania Brook Subregional Basin

	Existing Loads to Surface Waters					Percent of total load				
Source	FC (billion/year)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Runoff Volume (acre-feet/yr)	FC (%)	TN (%)	TP (%)	TSS (%)	Runoff Volume (%)
Urban Land	34,588	6,096	1,849	114,373	1,991	27.60	28.52	59.00	9.94	63.23
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	6	6	202,703	-	-	0.03	0.19	17.61	-
Road Sanding	-	-	-	353,604	-	-	-	-	30.72	-
Forest	29,555	6,157	493	246,290	350	23.59	28.81	15.71	21.40	11.13
Rural Land	30,147	7,730	618	231,900	807	24.06	36.17	19.73	20.15	25.64
Livestock	3,948	1,041	111	-	-	3.15	4.87	3.53	-	-
Illicit Connections	21,087	29	5	194	-	16.83	0.13	0.17	0.02	-
Point Source Discharges	-	-	-	-	-	-	-	-	-	-
OSDS/Septic	5,987	313	52	2,087	-	4.78	1.46	1.66	0.18	-
Open Water	-	-	-	-	-	-	-	-	-	-
Total Storm Load	98,237	14,087	2,744	1,101,051	3,148	78.39	65.91	87.53	95.65	100.00
Total Non-Storm Load	27,074	7,286	391	50,101	-	21.61	34.09	12.47	4.35	-
Total Load to Surface Waters	125,311	21,373	3,135	1,151,152	3,148	100.00	100.00	100.00	100.00	100.00

Table 9. 7
Modeled Pollutant Loads in the Weekeepeemee River Subregional Basin

	Existing Loads to Surface Waters					Percent of total load				
Source	FC (billion/year)	TN (lb/yr)	TP (lb/yr)	TSS (lb/yr)	Runoff Volume (acre-feet/yr)	FC (%)	TN (%)	TP (%)	TSS (%)	Runoff Volume (%)
Urban Land	55,460	19,820	5,399	212,994	5,254	18.16	35.75	62.72	9.72	69.36
SSOs	-	-	-	-	-	-	-	-	-	-
Channel Erosion	-	12	12	403,028	-	-	0.02	0.14	18.40	-
Road Sanding	-	-	-	578,785	-	-	-	-	26.42	-
Forest	53,468	11,139	891	445,570	598	17.51	20.09	10.35	20.34	7.89
Rural Land	69,100	17,718	1,417	531,540	1,723	22.63	31.96	16.47	24.26	22.74
Livestock	29,111	3,893	414	-	-	9.53	7.02	4.81	-	-
Illicit Connections	45,786	67	14	459	-	14.99	0.12	0.16	0.02	-
Point Source Discharges	-	-	-	-	-	-	-	-	-	-
OSDS/Septic	52,423	2,742	457	18,278	-	17.17	4.95	5.31	0.83	-
Open Water	45	45	3	224	-	0.01	0.08	0.04	0.01	-
Total Storm Load	207,185	38,198	7,444	2,074,430	7,575	67.84	68.91	86.48	94.68	100.00
Total Non-Storm Load	98,209	17,237	1,164	116,448	-	32.16	31.09	13.52	5.32	-
Total Load to Surface Waters	305,393	55,435	8,608	2,190,878	7,575	100.00	100.00	100.00	100.00	100.00

Appendix D

Structural BMP Prioritization Matrix

Pomperaug River Watershed Based Plan

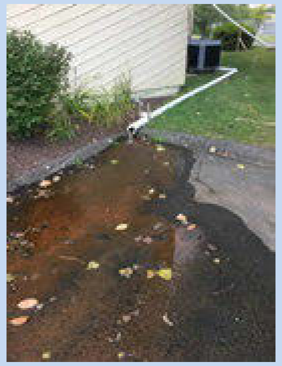
BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
POMPERAUG RIVER SUBWATERSHED										
Equestrian 1 (Pomperaug-01 and Transylvania Brook)	East Flat Hill Road, Southbury	Horse manure in paddocks Two drainage paths - one flows through Audubon old pasture, excellent buffer; another flows out drainage ditch to Transylvania Brook.	• Bioretention in drainage ditch adjacent to Audubon Property • Filter berm at bottom of paddock • Improved buffer around intermittent streams on equestrian property or reconfigured paddocks/runs/training areas • Move drainage away from the center of paddocks/pasture	• Outreach for manure management best practices • Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program	Medium (bioretention) High (filter berm/buffer)	Medium Medium	Medium Low	Yes	YES - LARGE	
Public School 1, Golf 1, Golf 2, Golf 3 (Pomperaug-03)	Old Field Road & Poverty Road, Southbury	Geese observed at both golf courses and in field adjacent to river at elementary school.	• Increase vegetated buffer around water hazards and adjacent to streams/river • Implement other waterfowl deterrent strategies		Medium (buffer) Low (other deterrent strategies)	Low Medium	Low High	Yes	YES - SMALL	
Residential Neighborhood 3 (Pomperaug-03)	Flood Bridge / River Hill neighborhood, Southbury	Failing or malfunctioning septic systems. Stormwater runoff.	• Sanitary/septic survey of Branch Road/Riverhill Road neighborhood • Infiltration in ROW or underground • Inspect Flood Bridge Road houses along riverbank for proper septic system sizing and function		Medium (IDDE/Septic investigation) High (infiltration BMP)	Medium High	N/A High	Yes	YES – LARGE Combine with Residential Neighborhood 2	
Residential Neighborhood 4 (Pomperaug-03)	River Trail, Spring Road, Middle Road ("Cedarlands"), Southbury	Failing or malfunctioning septic systems. Raw sewage odor noted during stream walk near River Trail.	• Investigate septic odor • Encourage septic system inspections • Educate homeowners and homebuyers about proper use and maintenance of septic systems • IDDE investigation of drainage discharging at Cedarland Park		High	Low	Low	Yes		
Residential Neighborhood 1 (Pomperaug-01)	Western side of Pomperaug River outlet to the Housatonic, North of River Road	Stormwater runoff	• Infiltration below roadway, especially cul-de-sac at Pascoe Drive and Pomperaug Trail and at Pascoe Drive and Berkshire Road intersection • Increase buffer along river • More frequent catch basin cleaning		High	High	High	Yes	YES - LARGE	
Residential Neighborhood 1 (Pomperaug-01)	Western side of Pomperaug River outlet to the Housatonic, North of River Road	Failing or malfunctioning septic systems	• Advanced subsurface sewage disposal systems (sand filter or similar) in riverside lots • Inspect septic systems for failure • Ledge/bedrock could be a constraint • Educate homeowners and homebuyers about proper use and maintenance of septic systems		High	High	High	Yes		
Residential Neighborhood 2 (Pomperaug-01)	Eastern side of Pomperaug River outlet to the Housatonic, North of River Road	Stormwater runoff	• Underground infiltration (limited space in ROW)	• Septic system inspection and outreach • Turf management • Grass clippings – outreach or establish collection for disposal	High	High	High	Yes	YES – LARGE Combine with Residential Neighborhood 3	

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Mixed Residential / Commercial Complex 1 (Pomperaug-03)	Heritage Road, Southbury	Stormwater runoff	• Underground infiltration in ROW • Bioretention cells where feasible • Pervious pavement at older parking lots (e.g. Meeting House) needing maintenance	• Heritage Village should be included as a priority area in the Town of Southbury's MS4 Stormwater Management Program, including IDDE program implementation • Conduct a stormwater BMP retrofit inventory/feasibility study for Heritage Village, which would support Southbury's efforts to reduce and disconnect DCIA as required by the MS4 Permit	High	High	High	Yes	YES - LARGE	
Wastewater Treatment Facility 1 (Pomperaug-03)	Heritage Road, Southbury	Wastewater treatment plant	• Conduct additional ambient water quality monitoring at new sampling locations to determine extent of impairment and possible source(s) of bacteria		N/A	Low	N/A	Yes		
Commercial Complex 1 (tributary to Pomperaug-03)	East side of intersection of Route 6 and Main Street South, Southbury (South of Bullet Hill Brook)	Stormwater runoff, waste management, past septic issues	• Incorporate LID retrofits into site redevelopment • Underground infiltration, permeable pavement • Inspect septic systems for failure (due to size this falls under DPH or DEEP jurisdiction)	• Cover dumpsters with roof • Review stormwater control plan, if exists • Heavily channelized stream • Conduct survey for potential illicit discharges from businesses in plaza	High	High	High	Yes		
Business District 1 (Pomperaug-03)	Main Street South Corridor, Southbury (particularly concentrated at Municipal Complex west of the intersection with Peter Road	Stormwater runoff	• Develop and implement GI/LID "master plan" for Main Street South corridor • LID retrofits of municipal and commercial properties and within the municipal ROW between Route 6/Southbury Plaza and South Britain Road (Route 172) • Potential municipal sites include: ○ Southbury Police, Fire, and DPW ○ Southbury Town Hall ○ Southbury Park and Recreation ○ Rochambeau Middle School ○ Pomperaug Elementary School ○ Southbury Library ○ Municipal ROW • Numerous commercial redevelopment sites along the corridor		High	High	High	Yes		
Health Care 2 (tributary to Pomperaug-03)	Intersection of Main Street South and Garage Road	Dry weather discharge (pavement stained)	• Follow up sampling of dry weather discharge and removal of any illicit connections found		Medium	Low	Low	Yes		

BMP Prioritization Matrix for Potential Areas of Concern
Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Equestrian 2	Pomperaug River Crossing on Route 172, South Britain	Equestrian facility, manure piles, paddock	• Move manure piles to alternative site with filter berms or drainage away from Pomperaug • Filter berms or increased buffer to pond • Bank stabilization and buffer improvement along river edge • Evaluate need for farm pond • Move and regrade paddock/training areas to improve buffer	• Manure management in place • Most paddocks drain away from Pomperaug and toward a pond with algal mats that drains to Pomperaug • Farm to the north allows cows/cattle access to tributary. Add buffer and fencing around stream. • Outreach for manure management best practices • Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program	High	Medium	Low	Yes	YES - SMALL	
Equestrian 4	Intersection of Route 67 and Crook Horn Drive	Manure in open dumpsters	• Cover dumpsters or ensure drainage away from river	• Outreach for manure management best practices	High	Low	Low	Yes		
State Facility 1	Garage Road, Southbury	Stormwater runoff, potential illicit discharges (buried stream)	• Good housekeeping/pollution prevention • Infiltration where possible					No		
Town Park 2	Judson Avenue / Jack's Bridge Road, Woodbury	Pet and wildlife waste	• Pet waste management • Increase buffer width					No	YES – SMALL	
Earthworks / Quarry 1	Route 67, Southbury	Sedimentation ponds, dynamic river channel, non-bacterial	• N/A					No		
Town Park 1		Pet and wildlife waste	• Pet waste management					No		
Dog Park 1	Route 67 along the north bank of the Pomperaug River, Southbury	Pet waste, bank erosion	• Increase buffer width, already slated for bank stabilization project					No	YES - SMALL	
Residential Complex 2	Main Street South, Woodbury just north of the Southbury Town Line	Concerns about large residential septic system	• Inspect septic system for proper function					No		

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Equestrian 3	Route 67 along South Branch of Bullet Hill Brook	Stream running through paddock	• Encourage sufficient buffer • Animal exclusion fencing					No		
Residential Complex 3	Route 6 across intersection from South Pomperaug Avenue, Middle Quarter, Woodbury	Past septic issues	• Inspect septic system for proper function					No		
Commercial Complex 2	West side of Route 6; south of intersection with Route 64, Middle Quarter Woodbury	Historical groundwater contamination Septic failure issues	• Inspect septic system for proper function					No		
Health Care 1	North of intersection of Route 172 and Main Street South, Southbury adjacent to Pomperaug River	Past septic issues	• Inspect septic system for proper function					No		
WEEKEEPEEMEE RIVER SUBWATERSHED										
Cropland / Livestock 1 (Weekeepeemee-01)	Intersection of Chohees Trail & Weekeepeemee Road	Run-off from livestock pasture and feeding paddocks. Livestock access to intermittent stream. Row crops.	• Filter berms along pasture and Weekeepeemee • Increased vegetated buffer width • Infiltration BMP on north farm next to road • Remove stream access through buffer and/or fencing	• Fencing in good repair, encourage maintenance • Encourage effective manure application (e.g., not before rain storm)	High	Medium	Low	Yes	YES - SMALL	

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Equestrian 5 (Weekeepeemee-01)	Weekeepeemee Road Woodbury, just south of the Bethlehem town line	Livestock (horses, goats, alpaca) manure	• Filter berms along intermittent stream • Increase buffer width	• Fencing in good repair, encourage maintenance • Outreach for manure management best practices	High	Medium	Low	Yes		
Cropland 1 (Weekeepeemee-01)	Weekeepeemee Road South of Peter Road, Woodbury	Row crops	• Increase buffer width	Timing relevant to application of manure / fertilizer on the fields	High	Medium	Low	Yes		
Livestock (Weekeepeemee-01)	Weekeepeemee Road South of Peter Road, Woodbury	Livestock (few head);	• Filter berms along Weekeepeemee • Increase buffer width	• Encourage effective manure application (e.g., not before rain storm) • Outreach for manure management best practices	High	Medium	Low	Yes	YES - SMALL	
Cropland 2 (tributary to Weekeepeemee-01)	North of Peter Road, adjacent to Carmel Hill Brook	Row crops / vegetable	• Increase buffer width		High	Medium	Low	Yes		
Livestock 3	Guilds Hollow Road	Livestock grazing and feed lot	• Filter berm along Dowd Brook	• Feeding appears to occur in a local depression, ensure that it does not drain under road	High	Medium	Low	Yes	YES – SMALL	
Cropland / Livestock 2	Thomson Road, Bethlehem	Livestock access to tributary	• Increased buffer and fencing or filter berms	• Evaluate manure storage • Outreach for manure management best practices	High	Low	Low	Yes	YES - SMALL	

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Livestock 2	Robert Leather Road, Bethlehem	Convent with active farm operation. Past grant recipient for cattle management to get cows out of a wetland area.	• Encourage effective manure management					Yes		
Earthworks 2 (Weekeepeemee-01)	North of Crane Hollow Road, east of Weekeepeemee River	Earth excavation and school bus yard	• Encourage effective sediment and erosion controls, runoff infiltration					No		
Residential Neighborhood 6	Kasson Grove, Bethlehem	Lake side housing community -- old seasonal camps, many now year round residences	• Inspect septic system for proper function and sizing					No		
Residential Neighborhood 5	Lake Drive	Lake side housing community -- old seasonal camps, many now year round residences	• Inspect septic system for proper function and sizing					No		
Dairy Farm 1	West of Todd Hill Road, north of intersection with Wood Creek Road, Bethlehem	Manure storage	• Encourage effective manure management	• Evaluate manure storage • Outreach for manure management best practices				No		

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Equestrian 6	east of Todd Hill Road, south of Bergman Hill Road, Bethlehem	Manure storage	• Encourage effective manure management	• Evaluate manure storage • Outreach for manure management best practices				No		
Equestrian 7	Middle Road Turnpike, Woodbury	Horse access to tributary stream	• Filter berms and/or increased buffer in pasture • Reconfigure paddocks to avoid stream	• Some buffer exists in parts of pasture land • Outreach for manure management best practices • Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program	High	Medium	Low	Yes	YES - SMALL	
Dairy Farm 2	Artillery Road, Woodbury	Livestock access to tributary. Incomplete coverage of manure storage.	• Filter berms or fencing and increased buffer around stream to prevent livestock access • Reconfigure manure composting to divert runoff away from catch basins • Consider covered manure storage or manure composting		High	Medium	Low	Yes		

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Residential Neighborhood 7	Quassapaug Road at Soucy Road, Woodbury	Impacts to wetland areas Historic (chronic) septic failures	• Ensure wetland limits have been respected • Septic inspections					No		
Livestock 4	Hard Hill Road South, approximately 1/4 mile north of intersection with Nonnewaug Road, Bethlehem	Livestock paddock near farm pond Possible junkyard	• Encourage adequate buffer to water body • Ensure proper waste storage and disposal					No		
Plant Nursery 1	North of Washington Road (Route 47 Bridge), Woodbury	Fertilizer and pesticide applications	• Encourage effective application (and storage) strategies and timing					No		

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Livestock 7	West side of Flanders Road near intersection with Church Hill Road, Woodbury	Cattle	• Encourage effective manure management	• Outreach for manure management best practices				No		
Livestock 6	West side of Flanders Road near intersection with Church Hill Road, Woodbury	Cattle, chickens, pigs, etc	• Encourage effective manure management	• Outreach for manure management best practices				No		
Livestock 5	Route 6 near Guernseytown Road on the Woodbury/Watertown townline	Cattle, chickens, pigs, etc	• Encourage effective manure management	• Outreach for manure management best practices				No		
Cropland 3	East of Main Street North (Route 6), north of Scratchville Road along Nonnewaug River	Cornfield – application of manure as fertilizer	• Encourage effective application strategies and timing • Enhance width of riparian buffer					No		

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
EAST SPRING BROOK SUBWATERSHED										
Equestrian 7	Route 61, Morris north of fairgrounds	Manure storage	• Increase buffer to stream	• Manure management measures appear to be in place • Outreach for manure management best practices • Connecticut Horse Environmental Awareness Program (HEAP) and Connecticut Horse Farm of Environmental Distinction Program	High	Low	Low	Yes		
Fish Hatchery 1	Nonnewaug Road, Bethlehem	Nutrients	• If still active, encourage effective waste management, possibly through multi-trophic aquaculture					No		
Dairy Farm 3	Magnolia Hill Road and Hard Hill Road South, Bethlehem	Livestock access to tributary. Manure storage	• Filter berms or fencing and increased buffer around stream to prevent livestock access • Evaluate manure storage practices	• Outreach for manure management best practices				No		
TRANSYLVANIA BROOK SUBWATERSHED										
State Facility 2	Route 172, Southbury north of South Britain Historic District	Ag easement, including leases to local farming operations	• Encourage effective manure management and timing for spread of fertilizer/manure on cropland areas	Outreach for manure management best practices				No		
State Facility 2	Route 172, Southbury north of South Britain Historic District	Waterfowl	• Establish / increase riparian buffer width to filter runoff from fields where geese graze	Pond infested with water chestnut				No	YES - SMALL	

BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Dairy Farm 4	Spruce Brook Road, Southbury	Manure storage	• Encourage effective manure management	• Outreach for manure management best practices				No		
HESSEKEY BROOK SUBWATERSHED										
Residential Complex 4	Transylvania Road & Woodlake Road	Private sewage treatment plant	• Ensure correct sizing and effective monitoring for failures					No		
Dairy Farm 5	north of intersection of Grassy Hill Road and North Road, Woodbury	Manure storage / Cattle pastured on slope draining to pond with minimal buffer width	• Filter berms or fencing and increased buffer around stream to prevent livestock access	• Outreach for manure management best practices				No		

Appendix E

Site-Specific BMP Concept Cost Estimates

Pomperaug River Watershed Based Plan

Pomperaug River Watershed Based Plan
Planning-Level Costs for Site-Specific BMP Concepts

Order of Magnitude Cost Range															
Location and Element		Construction				Planning and Design		Cost Range			Life Cycle				
		Unit Cost	Unit	Quantity	Cost (2018$)	Allowance	Cost	Total Cost	-30%	50%	Lifespan (yrs)	Annual Cost over Lifespan	O&M (% Cost)	O&M ($/yr)	Total Capitalized Cost/yr over lifespan
Residential 1															
1	Subsurface Infiltration	$20.00	cf runoff treated	2,700	$54,000	30%	$16,200	$71,000	$50,000	$107,000	20	$5,220	10%	$520	$5,740
Add-on	Permeable Pavement - Replace cul-de-sac	$3.07	sf	4,300	$13,201	30%	$3,960	$18,000	$13,000	$27,000	20	$1,320	10%	$130	$1,450
							Total	**$89,000**	**$63,000**	**$134,000**					
Residential 2															
1	Subsurface Infiltration	$20.00	cf runoff treated	4,400	$88,000	30%	$26,400	$115,000	$81,000	$173,000	20	$8,460	10%	$850	$9,310
2	Infiltration Basin, I-84 On-Ramp	$18.72	cf runoff treated	600	$11,232	30%	$3,370	$15,000	$11,000	$23,000	20	$1,100	10%	$110	$1,210
3	Infiltration Basin, Oakdale Road	$18.72	cf runoff treated	2,200	$41,184	30%	$12,360	$54,000	$38,000	$81,000	20	$3,970	10%	$400	$4,370
							Total	**$184,000**	**$130,000**	**$277,000**					
Residential 3															
1	Bioretention Area, north	$35.62	sf	350	$12,467	30%	$3,740	$17,000	$12,000	$26,000	20	$1,250	10%	$130	$1,380
2	Bioretention Area, south	$35.62	sf	1,000	$35,620	30%	$10,690	$47,000	$33,000	$71,000	20	$3,460	10%	$350	$3,810
3	Subsurface Infiltration	$20.00	cf runoff treated	4,000	$80,000	30%	$24,000	$104,000	$73,000	$156,000	20	$7,650	10%	$770	$8,420
							Total	**$168,000**	**$118,000**	**$253,000**					
Residential/Commercial Mixed 1															
1	Linear Bioretention	$35.62	sf	900	$32,058	30%	$9,620	$42,000	$29,000	$63,000	20	$3,090	10%	$310	$3,400
2	Subsurface Infiltration, Bank	$20.00	cf runoff treated	1,700	$34,000	30%	$10,200	$45,000	$32,000	$68,000	20	$3,310	10%	$330	$3,640
3	Subsurface Infiltration, 460 Heritage Road	$20.00	cf runoff treated	3,600	$72,000	30%	$21,600	$94,000	$66,000	$141,000	20	$6,920	10%	$690	$7,610
4	Infiltration Basin, Village Green	$18.72	cf runoff treated	8,300	$155,376	30%	$46,610	$202,000	$141,000	$303,000	20	$14,860	10%	$1,490	$16,350
5	Infiltration Basin, Heritage and Poverty Roads	$18.72	cf runoff treated	1,700	$31,824	30%	$9,550	$42,000	$29,000	$63,000	20	$3,090	10%	$310	$3,400
6	Vegetated Water Quality Swale	$10.96	sf	1,600	$17,536	30%	$5,260	$23,000	$16,000	$35,000	16	$1,970	10%	$200	$2,170
7	Permeable Pavement	$3.07	sf	39,750	$122,033	30%	$36,610	$159,000	$111,000	$239,000	20	$11,700	10%	$1,170	$12,870
							Total	**$607,000**	**$424,000**	**$912,000**					
State Facility 2															
1	Permeable Pavement	$3.07	sf	59,200	$181,744	30%	$54,520	$237,000	$166,000	$356,000	20	$17,440	10%	$1,740	$19,180
2	Bioretention Area, Hartford Hill	$35.62	sf	1,000	$35,620	30%	$10,690	$47,000	$33,000	$71,000	20	$3,460	10%	$350	$3,810
3	Bioretention Area, Constitution Hill	$35.62	sf	2,500	$89,050	30%	$26,720	$116,000	$81,000	$174,000	20	$8,540	10%	$850	$9,390
4	Bioretention Area, Liberty Lane	$35.62	sf	1,200	$42,744	30%	$12,820	$56,000	$39,000	$84,000	20	$4,120	10%	$410	$4,530
5	Vegetated Water Quality Swale, north	$10.96	sf	1,400	$15,344	30%	$4,600	$20,000	$14,000	$30,000	16	$1,720	10%	$170	$1,890
6	Vegetated Water Quality Swale, south	$10.96	sf	4,500	$49,320	30%	$14,800	$65,000	$46,000	$98,000	16	$5,580	10%	$560	$6,140
7	Buffer Restoration	$12,166.62	acre	1.06	$12,848	30%	$3,850	$17,000	$12,000	$26,000	20	$1,250	10%	$130	$1,380
							Total	**$558,000**	**$391,000**	**$839,000**					
Golf Course, Public School, and Town Park															
1	Bioretention Areas	$19.97	sf	1,400	$27,955	30%	$8,390	$37,000	$26,000	$56,000	20	$2,720	10%	$270	$2,990
2	Subsurface Infiltration	$20.00	cf runoff treated	9,539	$190,780	30%	$57,230	$249,000	$174,000	$374,000	20	$18,320	10%	$1,830	$20,150
3	Permeable Pavement	$3.07	sf	4,700	$14,429	30%	$4,330	$19,000	$13,000	$29,000	20	$1,400	10%	$140	$1,540
4	Buffer Restoration	$12,166.62	acre	0.75	$9,105	30%	$2,730	$12,000	$8,000	$18,000	20	$880	10%	$90	$970
Add-on	Permeable Pavement - front parking rows	$3.07	sf	5,800	$17,806	30%	$5,340	$24,000	$17,000	$36,000	20	$1,770	10%	$180	$1,950
							Total	**$341,000**	**$238,000**	**$513,000**					

Pomperaug River Watershed Based Plan
Planning-Level Costs for Site-Specific BMP Concepts

Order of Magnitude Cost Range															
Location and Element		Construction				Planning and Design		Cost Range			Life Cycle				
		Unit Cost	Unit	Quantity	Cost (2018$)	Allowance	Cost	Total Cost	-30%	50%	Lifespan (yrs)	Annual Cost over Lifespan	O&M (% Cost)	O&M ($/yr)	Total Capitalized Cost/yr over lifespan
Dog Park 1															
1	Infiltration Basin	$18.72	cf runoff treated	1,100	$20,592	30%	$6,180	$27,000	$19,000	$41,000	20	$1,990	10%	$200	$2,190
2	Buffer Restoration	$12,166.62	acre	0.25	$3,017	30%	$900	$4,000	$3,000	$6,000	20	$290	10%	$30	$320
							Total	**$31,000**	**$22,000**	**$47,000**					
Town Park 2															
1	Buffer Restoration	$12,166.62	acre	3.70	$45,016	30%	$13,500	$59,000	$41,000	$89,000	20	$4,340	10%	$430	$4,770
							Total	**$59,000**	**$41,000**	**$89,000**					
Livestock 1															
1	Buffer Restoration, grazing area	$12,166.62	acre	0.11	$1,397	30%	$420	$2,000	$1,000	$3,000	20	$150	10%	$20	$170
2	Buffer Restoration, pasture	$12,166.62	acre	0.51	$6,145	30%	$1,840	$8,000	$6,000	$12,000	20	$590	10%	$60	$650
3	Shade Structure	$1.60	sf	300	$480	30%	$140	$1,000	$1,000	$2,000	15	$90	10%	$10	$100
							Total	**$11,000**	**$8,000**	**$17,000**					
Livestock 3															
1	Buffer Restoration, feeding area	$12,166.62	acre	0.37	$4,469	30%	$1,340	$6,000	$4,000	$9,000	20	$440	10%	$40	$480
2	Buffer Restoration, hay and grazing	$12,166.62	acre	1.91	$23,182	30%	$6,950	$31,000	$22,000	$47,000	20	$2,280	10%	$230	$2,510
Add-on	Filter Berm	$13.86	ft	375	$5,198	30%	$1,560	$7,000	$5,000	$11,000	15	$630	10%	$60	$690
							Total	**$44,000**	**$31,000**	**$67,000**					
Cropland/Livestock 1															
1	Buffer Restoration	$12,166.62	acre	0.69	$8,379	30%	$2,510	$11,000	$8,000	$17,000	20	$810	10%	$80	$890
2	Exclusion Fencing	$15.00	linear foot	1,250.00	$18,750	30%	$5,630	$25,000	$18,000	$38,000	20	$1,840	10%	$180	$2,020
							Total	**$36,000**	**$26,000**	**$55,000**					
Cropland/Livestock 2															
1	Buffer Restoration 1	$12,166.62	acre	2.66	$32,400	30%	$9,720	$43,000	$30,000	$65,000	20	$3,160	10%	$320	$3,480
2	Buffer Restoration 2	$12,166.62	acre	0.19	$2,346	30%	$700	$4,000	$3,000	$6,000	20	$290	10%	$30	$320
3	Filter Berm	$13.86	ft	325	$4,505	30%	$1,350	$6,000	$4,000	$9,000	15	$540	10%	$50	$590
							Total	**$53,000**	**$37,000**	**$80,000**					
Equestrian 1															
1	Buffer Restoration	$12,166.62	acre	0.75	$9,125	30%	$2,740	$12,000	$8,000	$18,000	15	$1,080	10%	$110	$1,190
2	Exclusion Fencing	$20.00	foot	1,300.00	$26,000	30%	$7,800	$34,000	$24,000	$51,000	15	$3,060	10%	$310	$3,370
							Total	**$46,000**	**$32,000**	**$69,000**					
Equestrian 2															
1	Buffer Restoration, Equestrian	$12,166.62	sf	0.20	$2,430	30%	$730	$4,000	$3,000	$6,000	15	$360	10%	$40	$400
Add-on	Bank Stabilization	$57.70	linear foot	850.00	$49,045	30%	$14,710	$64,000	$45,000	$96,000	20	$4,710	10%	$470	$5,180
							Total	**$68,000**	**$48,000**	**$102,000**					
Equestrian 7															
1	Buffer Restoration	$12,166.62	acre	0.73	$8,938	30%	$2,680	$12,000	$8,000	$18,000	15	$1,080	10%	$110	$1,190
2	Exclusion Fencing	$20.00	foot	900.00	$18,000	30%	$5,400	$24,000	$17,000	$36,000	15	$2,160	10%	$220	$2,380
							Total	**$36,000**	**$25,000**	**$54,000**					
							All Projects:	**$2,331,000**							

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 screening-level evaluations of site characteristics. Construction costs could vary significantly.

Unit Costs

Element	2018 Adjusted Cost	Unit	Cost	$YEAR	Source
Low Impact Development/Green Infrastructure Practices					
Curbside Bioswale	$ 15,000.00	ea			Recent bids for New Haven West River Bioswales, Fuss & O'Neill.
Large Bioretention Retrofit	$ 13.10	cf 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)	$ 35.62	sf	$ 32.50	2012	District of Columbia Water and Sewer Authority, George S. Hawkins, General Manager, Green Infrastructure Summit 2012, February 29, 2012.
Rain Garden	$ 7.98	sf	$ 7.28	2012	Woodard & Curran - Route 1 Falmouth Commercial District Stormwater Management, 2012
Water Quality Swale	$ 10.96	sf	$ 10.00	2012	District of Columbia Water and Sewer Authority, George S. Hawkins, General Manager, Green Infrastructure Summit 2012, February 29, 2012.
Porous Asphalt	$ 3.07	sf	$ 2.80	2012	UNH Stormwater Center 2012 Biennial Report. Page 12
Permeable Pavers	$ 10.96	sf	$ 10.00	2012	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, Page E-5
Reinforced Gravel Parking	$ 5.07	sf	$ 5.07	2013	http://www.boddingtonsonline.com/products/grass-ground-reinforcement/grass-reinforcement-protection/bodpave-85-permeable-gravel-pavers.php; Added $2/sf for installation
Subsurface Infiltration	$ 20.00	cf runoff treated	$ 20.00	2018	Fuss & O'Neill, City of Pawtucket Grant Application, 2018.
Green Roof	$ 25.21	sf	$ 23.00	2012	District of Columbia Water and Sewer Authority, George S. Hawkins, General Manager, Green Infrastructure Summit 2012, February 29, 2012.
Blue Roof	$ 5.48	sf	$ 5.00	2012	NYC Department of Environmental Protection (2012), Rooftop Detention: A Low-Cost Alternative for Complying with New York City's Stormwater Detention Requirements and Reducing Urban Runoff.
Subsurface Gravel Wetland	$ 23.93	cf runoff treated	$ 21.83	2012	Woodard & Curran - Route 1 Falmouth Commercial District Stormwater Management, 2012
Pond Retrofit	$ 13,852.80	impervious acre of runoff treated	$ 11,100.00	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, page E-2
French Drain/Infiltration Trench	$ 19.97	lf	$ 16.00	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, page E-11
Tree Box	$ 6,576.00	ea	$ 6,000.00	2012	UNH Stormwater Center 2012 Biennial Report, adjusted based on professional judgement, inflation, and materials cost.
Infiltration Basin	$ 18.72	cf runoff treated	$ 15.00	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted
Constructed Wetland	$ 5.08	sf	$ 4.07	2006	Center for Watershed Protection Urban Subwatershed Retrofit Manual 3 (2007), cost adjusted, page E-11
Restoration Practices					
Vegetated Buffer Restoration	$ 12,166.62	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	$ 14,232.28	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
Remove Invasive Species	$ 3,692.80	acre	$ 3,200	2010	Professional Engineering Experience
Tree Planting	$ 500.00	ea			Street tree cost
Bank stabilization	$ 57.70	river mile	$ 50.00	2010	Professional Engineering Experience
Educational Signage	$ 1,200	ea	$ 1,200	2013	Professional Engineering Experience
Agricultural Practices					
Filter Berm	$ 13.86	linear foot	$ 12.65	2013	Warner et al. (2013) Designing Contour Weep Berms to Reduce Agricultural Nonpoint Source Pollution. Applied Engineering in Agriculture 29: 521-528. $41.50 per linear meter. Converted to linear feet.

Inflation Rates

Inflation from	Inflation to	Percent
2004	2018	33.40%
2006	2018	24.80%
2010	2018	15.40%
2011	2018	11.80%
2012	2018	9.6%
2013	2018	8.0%

http://www.usinflationcalculator.com/

Appendix F

PRWC Land Use Committee Meetings

Pomperaug River Watershed Based Plan

PRWC Land Use Committee

Monday October 31, 2016 at 1:00 PM-2:30PM
Southbury Town Hall, Room 205
501 Main Street South, Southbury

MEETING NOTES

1. Welcome / Sign-In

Reminder: This ties in with the matching funds requirements of the grant.

Present: Vince McDermott, Gail McTaggart, Ingrid Davis, Arthur Milnor, Dick Leavenworth, Neal Lustig, Petra Volinski, Aaron Budris, Chris Wood, DeLoris Curtis, Leslie Kane, Carol Haskins, David Askew
Absent: Susan Peterson, Norma Carey, Kyle Turoczi

2. Introduce Consulting Team from Fuss & O'Neill

David Askew, Project Manager, from Fuss & O'Neill was introduced and provided a brief background of experience developing watershed plans both from the non-profit perspective and, more recently, the consulting perspective. Fuss & O'Neill was selected through the RFP process to serve on this project. F&O's team for this project is made up of six staff where David serves as the Project Scientist. He will lead the watershed assessment process including the field assessments, BMP site selection, implementation strategy, and plan development.

3. Existing Information / Data

a. Review attached list
b. Committee input on missing items to add to the list*

Potential Additional Sources of Data to Consider

- Waste Water Treatment System Reports (from DEEP and/or DPH)
- NV COG will have 2016 updates to Land Use Maps
- CLEAR is expected to have 2015 Land Cover Data available soon
- Pomperaug MesoHABSIM report (Piotr Parasiewicz) – Instream habitat availability
    - especially sections relating to Orton Pond / Three Rivers

- Large Sewage Systems – DEEP Map or Site List
    - Lutheran Home, Route 6 and Dublin Hill Road, Southbury (17,000 gals)
    - Southbury Green, 700 Main Street South, Southbury (15-20,000 gals)
    - Woodlake Condominiums, Transylvania Road, Woodbury
- Municipal Zoning Regs – density concerns / build-out model
- Wetlands Enforcement Records – help identify areas of concern
- Water Quality Data from CT DEEP
    - data since the most recent Water Quality Report to Congress)
- Missing Data / Gaps -- identify need for monitoring program potential?

4. Hot Spots / Areas of Concern

a. Committee input on sites of concern to consider in the Plan development

HOT SPOTS identified during the meeting

- Above/Below Waste Water Treatment Plant
  (Heritage Village), Heritage Road, Southbury
- Three Rivers Park, Woodbury
  Jacks Bridge Road (Weekeepeemee) / Judson Avenue (Pomperaug)
- Orton Pond, Orton Lane, Woodbury
- East Meadow Brook?
    - Dry channel – at Strong Meadow Preserve, Scratchville Road, Woodbury
    - headwaters to Brook is the pond at Flanders Nature Center, Church Hill Road, Woodbury
- Blow out near State Garage, Bullet Hill Brook, Garage Road, Southbury
- Old Trolley Bed, Woodbury Reservoir Property, South Brook, Erosion of trail off Scuppo Road, Woodbury
- Horse Farm (?) along headwaters area of Weekeepeemee River, Todd Hill Road/Bergemann Hill Road, Bethlehem
- Kasson Grove (Long Meadow Lake), Bethlehem
- March Farms, Munger Hill Road, Bethlehem
- Newport Academy, Double Hill Road, Bethlehem
- Arch Bridge School / Wellspring, Arch Bridge Road, Bethlehem
- Pabst Farm / Blue Ribbon Farm (Woodbury?) – Tim Pabst Property
- Kasergus Farm, Crane Hollow Road, Bethlehem/Woodbury Line
- The Farm
    - Weekeepeemee River, Chohees Road, Woodbury (Beef Cattle)
    - Carmel Hill Brook, Peter Road, Woodbury (Crops)
- Logue Farm (Dairy – No Manure Management)
    - Quassapaug Road / Artillery Road, Woodbury

- Woodbury Ski & Racket, Spring Brook, Route 47, Woodbury
- Old Water Mill on Route 47 upstream from Woodbury Ski
    - (which way does it flow... Pomperaug or Shepaug?)
- O& G Industries, Pomperaug River, off Route 67, Woodbury/Southbury line
- Southbury Training School, Cassidy Road / Constitution Hill, Southbury
    - Farm Pumps?
    - Upper ag fields with new farming leases
    - Spruce Brook feeding Transylvania
- Abbey of Regina Laudis (cattle and other livestock), Flanders Road, Bethlehem
        - How's the septic?
- Sabil's Horse Stable, Bullet Hill Brook, Route 6, Southbury
- Eden Acres, Quassapaug Road / McVeigh Road / Middle Road Tpke, Woodbury
- Middle Quarter Mall, Route 6 / South Pomperaug Ave, Woodbury
    - Groundwater contamination - VOCs
    - Septic issues in commercial area
- Tappe Preserve, Transylvania Brook (severe bank erosion), East Flat Hill Road, Southbury
- Large Sewage Systems – DEEP Map or Site List?
    - Lutheran Home, Route 6 and Dublin Hill Road, Southbury (17,000 gals)
    - Southbury Green, 700 Main Street South, Southbury (15-20,000 gals)
    - Woodlake Condominiums, Transylvania Road, Woodbury

Additional "HOT SPOTS" identified post LUC meeting by PRWC Staff/ Board/LUC Members

- Flood Bridge Road and Cedarland Neighborhoods along Pomperaug River, Southbury
  Old fishing camps converted to year round residences, potential septic issues
- Southbury Training School, Route 172, Southbury
  Large population of Canada geese on lawn sloping to Stibbs Pond / Transylvania Brook
- Horse Stables located at Crook Horn Road and Route 67, Southbury
- Horse Stables on East Flat Hill Road (Pomperaug River/Transylvania Brook) near Audubon at Bent of the River
- Horse Stables on Route 172 in Southbury, just upstream of the South Britain Dam
- Southbury Dog Park, O&G Property of Route 67 Southbury
- Tietz earthmoving operation, Weekeepeemee River, Crane Hollow Road, Woodbury
- Platt Farm, Spruce Brook Road, Southbury (along Spruce Brook feeding Transylvania Brook)
- River Glen Health & Rehabilitation Center, Route 172, Southbury (Septic issues)
- Pomperaug Woods, retirement facility, Hertiage Road, Southbury
- Former Baskin Robbins facility (KanPak now), Route 6 (Main Street North), Southbury
- Condo / Townhouse Complex, Old Field Hill Road, Southbury
- Townhouses / Apartments, 1080 Main Street South, Woodbury (large septic? Pomperaug River frontage)

- Spruce Bank state subsidized senior housing, Main Street South, Woodbury (Septic)
- Fish Hatchery, East Spring Brook, Nonnewaug Road, Bethlehem
- Farm / Junkyard, Hard Hill Road South, Bethlehem (extends to Nonnewaug Road)
    - Contributor to both East Spring Brook and Nonnewaug River?
- Cattle Farm, Magnolia Hill Road, Bethlehem, East Spring Brook
- Southbury Plaza (K-mart/Stop & Shop), Route 6, Southbury (Septic)

5. Vision / Goals for Plan

a. Committee input to draft “Vision Statement and Goals” for Plan*

DRAFT VISION STATEMENT

PRWC’s vision is that this Plan will be used as a road map to return impaired waters to swimmable and fishable conditions and that this document can be used to evaluate changes through time. PRWC’s goal for the Pomperaug Watershed Based Plan is develop a document that:

- establishes an up-to-date baseline of conditions in the watershed;
- evaluates contributing factors in areas of known impairments;
- identifies water quality monitoring needs;
- identifies and prioritizes steps to reduce pollutant inputs to impaired rivers and streams;
- incorporates proactive measures to protect/maintain high quality streams; and,
- establishes community buy-in through public engagement in the planning process.

6. Next steps

a. Overview of General Timeline of Tasks Ahead

b. Next committee meeting

Immediate tasks that lay ahead are to:

- Develop a Quality Assurance Project Plan (QAPP), which the team from Fuss & O’Neill has already begun drafting. Once the QAPP is approved, they will begin assembling GIS and other related data to begin assessing Land Use and Land Cover factors associated with impairments. From that and the list of “hot spots” identified by the LUC, they will then conduct an on the ground Visual Assessment Survey in the impaired stream segments and determine
- Provide Fuss & O’Neill with a more organized list of potential hot spots – i.e. group them by stream corridor and progression from mouth to headwaters (possibly in map form).
- Update “List of Existing Data Sources” with LUC input. Begin annotating that list with key information pulled from each report.
- Start developing a communications strategy to notify riparian landowners about forthcoming Visual Assessment Surveys and the overall WMP project.

Next Committee Meeting will be scheduled for mid-January. Please expect emails to the full committee and to specific members asking for input and participation in the interim.

Agenda
Land Use Committee Meeting

Pomperaug River Watershed Based Plan

July 20, 2017

1. Introductions
2. Quality Assurance Project Plan (QAPP)
3. Compilation and Review of Existing Data, Plans & Studies
4. Existing Watershed Conditions Mapping
5. Watershed Assessments
6. Next Steps
7. Additional Discussion

POMPERAUG RIVER WATERSHED COALITION

Land Use Committee Meeting Notes
Southbury Town Hall, Room 205

July 20, 2017 ~ 9:00 to 11:00 am

1. **Introductions & Sign-in**

Begin presentation by Erik Mas of Fuss & O'Neill

2. **QAPP Update – no comments**

3. **Existing Data Gaps – no comments**

4. **Existing Conditions mapping – discussion notes follow**

Impervious Cover

- We will also estimate impervious cover at the CT DEEP Local Basin scale
- Note: Anything below 5% on the subregional watershed scale is considered very low (11% is usually the tipping point for degradation and 25% for "impacted" streams and urban drainage). If you were looking at the DEEP local basin scale, the % would be higher. However, when setting water quality goals and impervious cover limits, the subregional watershed is really the scale that should be used.Question about NLCD picking up low density residential impervious cover and whether or not that should be incorporated into the pollutant load modeling?

Land Use

- NVCOG dataset shows how land is used on a parcel level, which may help refine coefficients in the pollutant load modeling which will otherwise be based on the land cover dataset.

Land Cover

- UConn CLEAR may have more detail in the developed land cover class with the 2015 version. They are also developing an update to impervious cover for the new CT MS4 Permit, including a 2012 baseline to account for the 5-year "look back" for impervious cover reductions that are required in Years 4 and 5 of the CT MS4 Permit. Where does it stand? Fuss & O'Neill to check on both.
- Fuss & O'Neill to compare the 2010 and 2015 CLEAR land cover data to see what changes have occurred in this timeframe, which will provide some indication of the reliability of the 2011 National Land Cover Data to represent current conditions.
- Comment: Cows in Weekeepeemee River. Some farmers are applying fertilizer to pasture/hay fields. Can/should the Pasture/Hay land cover category be teased apart from a bacteria loading perspective? Similar discussion for Table 12 that lumps Agriculture, Turf, and Grass into a broad categories found within the riparian corridors.

Riparian zone

- Riparian zone development analysis – Check the date of the land cover data used by UConn CLEAR in the analysis (2006 versus 2010)
- Overlay riparian zone and protected open space for restoration/conservation opportunities analysis

Forest fragmentation

- Check the date of the land cover data used by UConn CLEAR in the analysis (2006 versus 2010)
- Overlay forest fragmentation and protected open space for conservation opportunities analysis

Open Space

- AREA OF CAUTION - Land preservation is a hot button issue in the towns.
    - Committee will come up with a single definition and criteria about what will be considered with a focus on permanently protected open space parcels (e.g. not CT Public Act 490 or 4742A land, which is <u>not</u> permanently protected from development).
    - NVCOG to update and share their parcel-based protected land information.
    - It would be helpful for Fuss & O'Neill to separate protected open space by use and/or mechanism of protection
    - Fuss & O'Neill to share protected land attribute tables to get committee input on the permanence of protection mechanisms
    - NVCOG to provide available open space data for their watershed communities, which is based on legacy data (collected and tracked by COGCNV over several decades), municipal parcels, and discussion with town officials and land trusts.
    - Roxbury conservation commission has some protected open space mapping
        - Barbara Henry First Selectman at 860-354-3478 is a resource
    - Note: Open Space map will not be used in the pollutant load model. However, this map may factor into BMP recommendations and help prioritize recommendations for future open space acquisitions.

Groundwater resources

- Are the aquifer protection areas all level A or some level A/B? A few committee members commented that the APA areas shown on the map look larger than they had remembered, possibly indicating that they may reflect earlier Level B mapping. Fuss & O'Neill will confirm.
- Surficial geology or USGS mapping. Vince McDermott suggested reviewing the available surficial materials mapping produced by USGS for the lower Housatonic Valley. He can also provide a hard copy for reference.

Hydrologic soil groups

- Town centers are a focus for development in the Statewide Conservation and Development Policies Plan for Connecticut, rather than scattershot. It therefore makes sense to tie into community septic systems. Hydrologic soil groups and other soils information may help suggest possible locations.
- Soil group categorizes the runoff / infiltration potential in an area and will be used broadly to help identify areas suitable for infiltration best management practices. Soils are also a factor related to on-site sewage treatment systems.
- Note: A and B soils = infiltration. C and D soils = runoff.

Water quality impairments

- Add CT DEEP ambient water quality and benthic macroinvertebrate monitoring locations to the map (other monitoring data?)
- Revise map to differentiate between assessed stream segments (green lines) that meet water quality standards and unassessed segments (blue lines).
- Recommendation in watershed plan: additional monitoring locations to help determine source(s) of impairments.
- Wastewater These data will be used in the pollutant load model that will estimate TSS, N, P, and Bacteria inputs from the watershed based on existing conditions.
- Need additional on septic systems (i.e., areas of failing septic systems) for pollutant load modeling
    - Map presented shows permitted discharges >5000 gallons per day
    - Fuss & O'Neill to contact CT DPH to for information on septic systems in the watershed that are regulated by CT DPH (2,000-4,999 GPD systems) – Wellspring and/or Newport Academy in Bethlehem may fall in this category (not on map provided)
        - Len DeJong may be a good resource, knows people at DPH from his time in drinking water
    - For locally-regulated septic systems, need failure rate information from Pomperaug (Woodbury, Southbury), Torrington (Watertown, Bethlehem, Middlebury, Morris), and Newtown (Roxbury) health districts
- Indicate permitted discharge type (by color) in discharge list/table
- CT Water Company may have updated sewer service area information
- Woodlake Condos has a treatment plant with a surface discharge

Areas of Concern

- Kyle Turoczi's daughter will compile a list for the committee to share with Fuss & O'Neill detailing farm locations, and crops grown/animals raised

5. Watershed Assessments

Pollutant load modeling

- Fuss & O'Neill to create and circulate a table of EMCs and loading factors used in each watershed to get coalition input

Visual field assessments

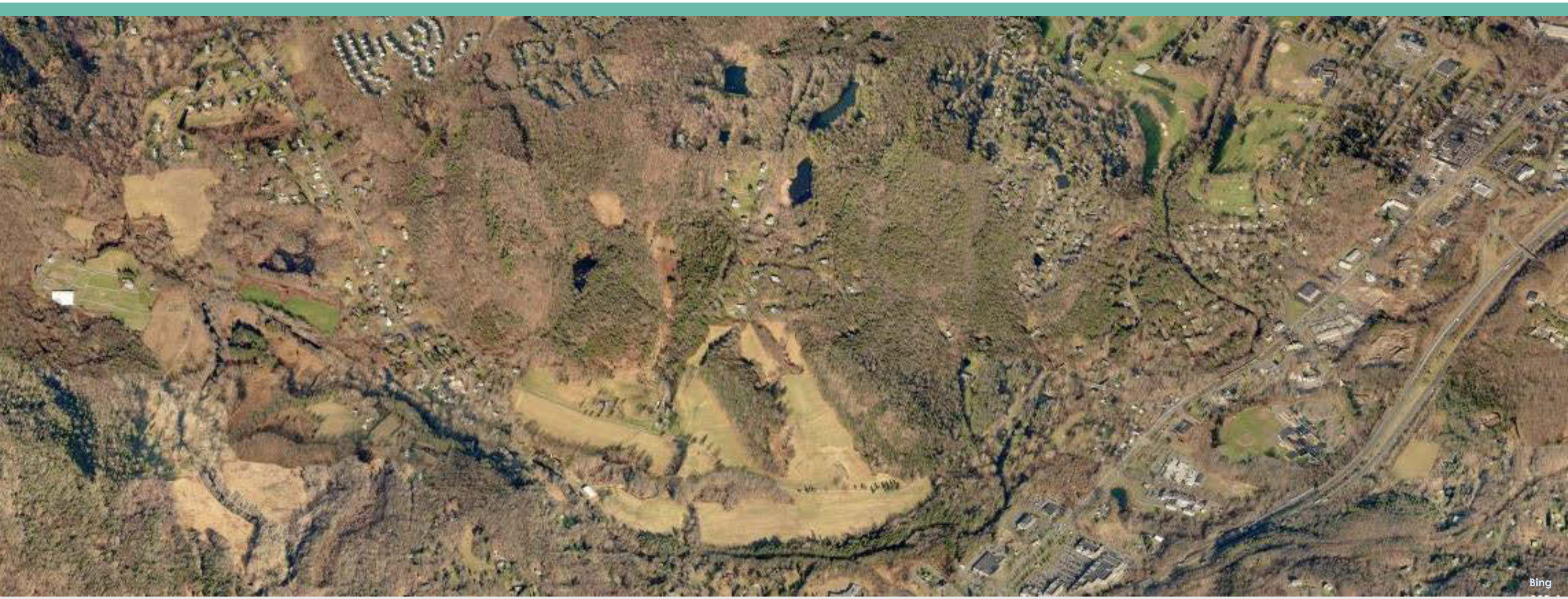
- Committee has a field work notification letter used by USGS for their sampling. Fuss & O'Neill needs something similar. We should also contact selectmen and local PDs prior to field work. PRWC can facilitate the notification process.

6. Next Steps

Fuss & O'Neill to provide updated link for latest set of maps.
https://fando.filetransfers.net/downloadPublic/o0anpku7so

Next meeting to likely occur in September, with public meetings following in October/November

FUSS & O'NEILL



PRWC Land Use Committee Meeting

Pomperaug River Watershed Based Plan

July 20, 2017

POMPERAUG RIVER WATERSHED COALITION

Presentation Outline

1. Quality Assurance Project Plan (QAPP)
2. Compilation and Review of Existing Data, Plans & Studies
3. Existing Watershed Conditions Mapping
4. Watershed Assessments
5. Next Steps
6. Additional Discussion

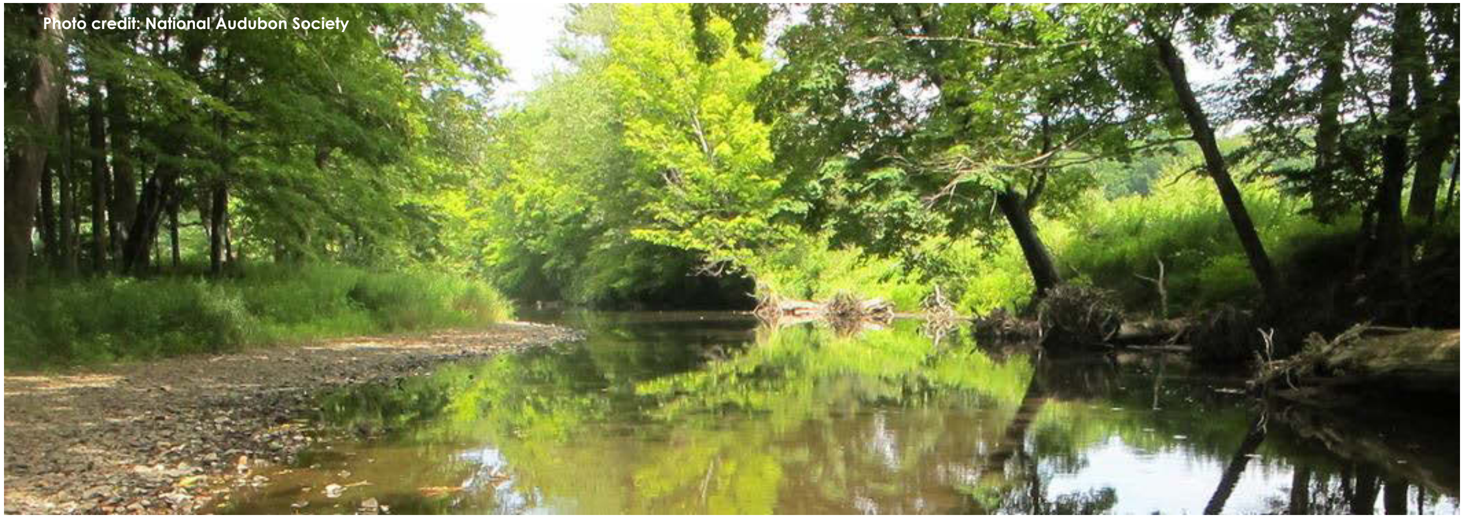


Photo credit: National Audubon Society

POMPERAUG RIVER WATERSHED COALITION

FUSS & O'NEILL

Quality Assurance Project Plan (QAPP)

- Includes
  - Field assessments
  - Pollutant load modeling
  - Secondary data usage
- Approved May 3, 2017

Quality Assurance Project Plan
Field Assessments, Modeling, and Analysis

In support of:

Pomperaug River Watershed Based Plan
CTDEEP No. 13-04b

Pomperaug River Watershed Coalition
Woodbury, Connecticut

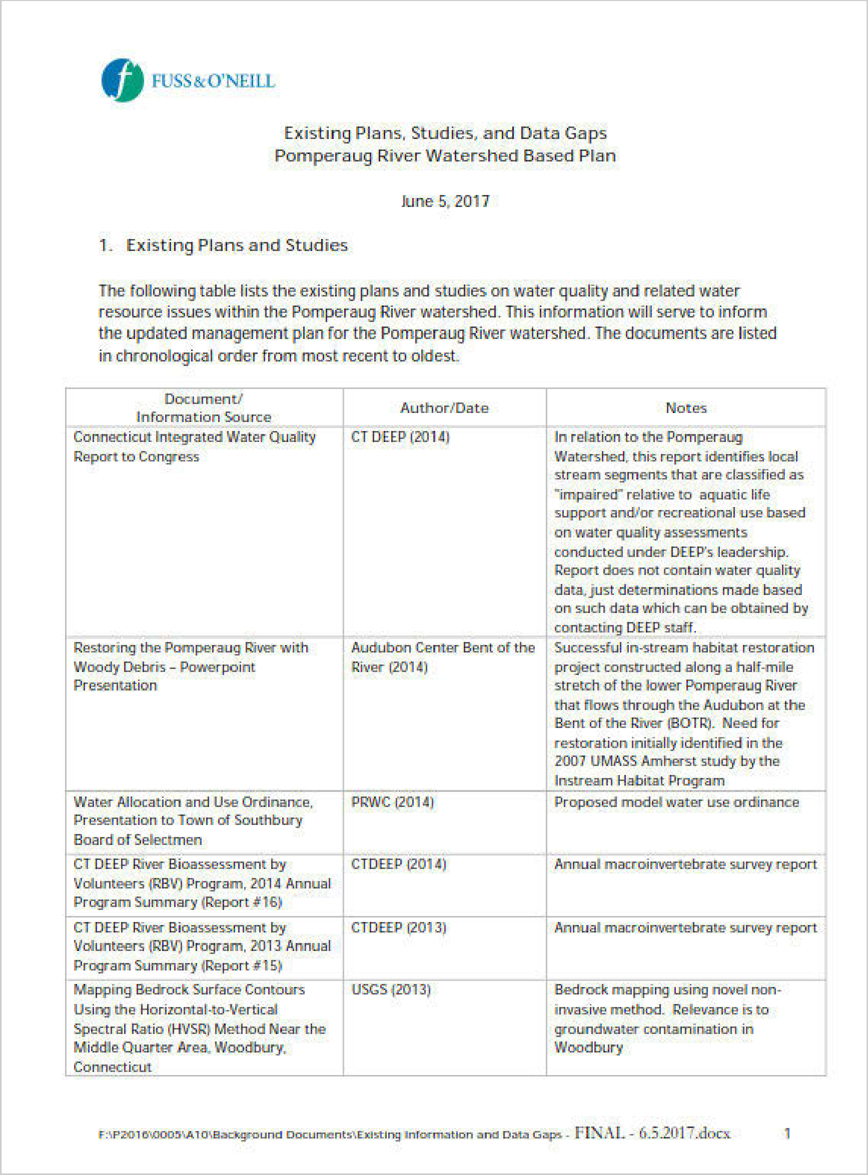
May 3, 2017

FUSS & O'NEILL
146 Hartford Road
Manchester, CT 06040

Project No. 20160005.A10

Existing Data, Plans & Studies

- Completed June 5, 2017
- Existing plans and studies
  - 34 documents identified
- Data gaps
  - Update existing conditions
  - Sources of Impairments
  - Pollutant Loads
  - Site-specific recommendations



FUSS & O'NEILL

Existing Plans, Studies, and Data Gaps
Pomperaug River Watershed Based Plan

June 5, 2017

1. Existing Plans and Studies

The following table lists the existing plans and studies on water quality and related water resource issues within the Pomperaug River watershed. This information will serve to inform the updated management plan for the Pomperaug River watershed. The documents are listed in chronological order from most recent to oldest.

Document/ Information Source	Author/Date	Notes
Connecticut Integrated Water Quality Report to Congress	CT DEEP (2014)	In relation to the Pomperaug Watershed, this report identifies local stream segments that are classified as "impaired" relative to aquatic life support and/or recreational use based on water quality assessments conducted under DEEP's leadership. Report does not contain water quality data, just determinations made based on such data which can be obtained by contacting DEEP staff.
Restoring the Pomperaug River with Woody Debris – Powerpoint Presentation	Audubon Center Bent of the River (2014)	Successful in-stream habitat restoration project constructed along a half-mile stretch of the lower Pomperaug River that flows through the Audubon at the Bent of the River (BOTR). Need for restoration initially identified in the 2007 UMASS Amherst study by the Instream Habitat Program
Water Allocation and Use Ordinance, Presentation to Town of Southbury Board of Selectmen	PRWC (2014)	Proposed model water use ordinance
CT DEEP River Bioassessment by Volunteers (RBV) Program, 2014 Annual Program Summary (Report #16)	CTDEEP (2014)	Annual macroinvertebrate survey report
CT DEEP River Bioassessment by Volunteers (RBV) Program, 2013 Annual Program Summary (Report #15)	CTDEEP (2013)	Annual macroinvertebrate survey report
Mapping Bedrock Surface Contours Using the Horizontal-to-Vertical Spectral Ratio (HVSR) Method Near the Middle Quarter Area, Woodbury, Connecticut	USGS (2013)	Bedrock mapping using novel non-invasive method. Relevance is to groundwater contamination in Woodbury

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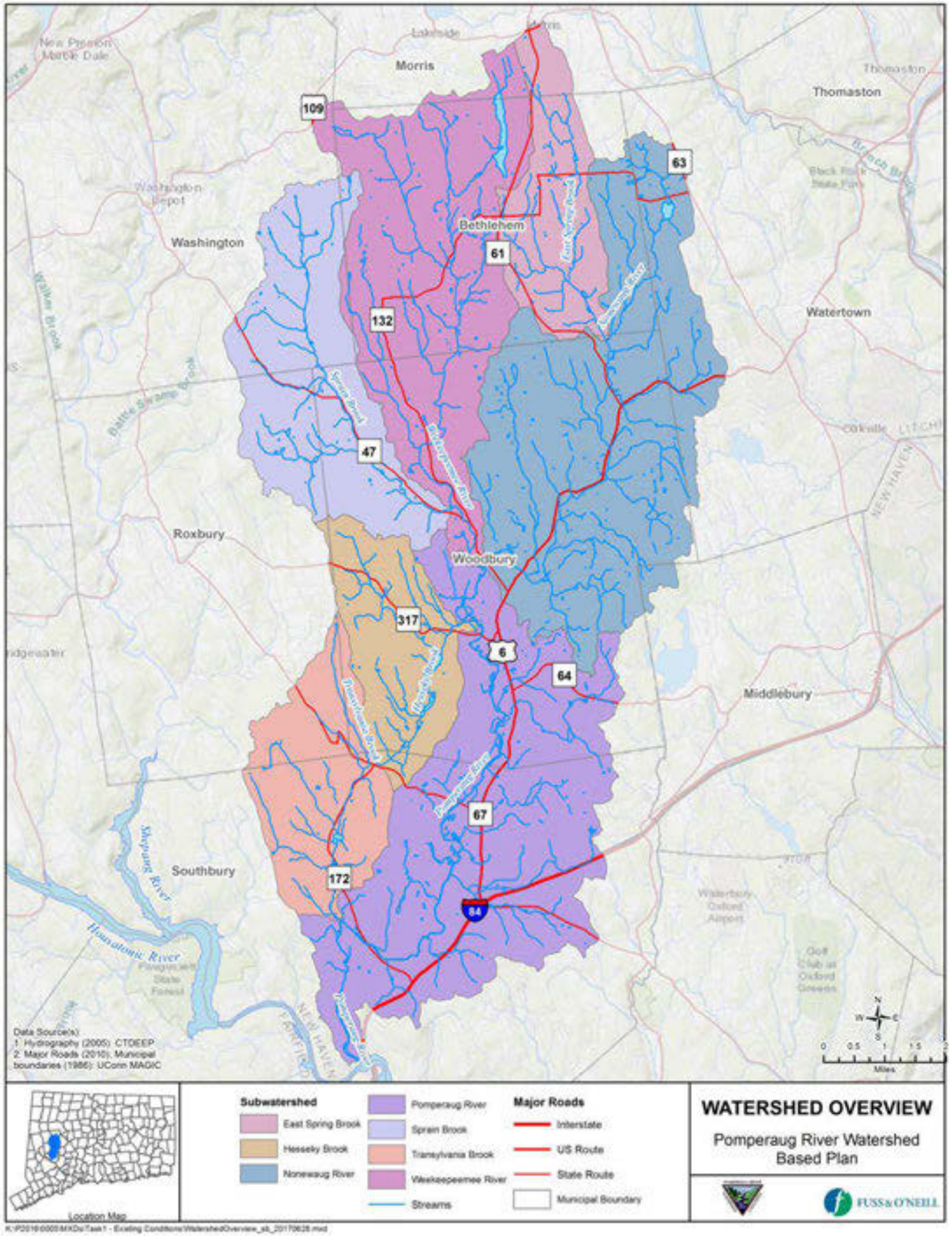
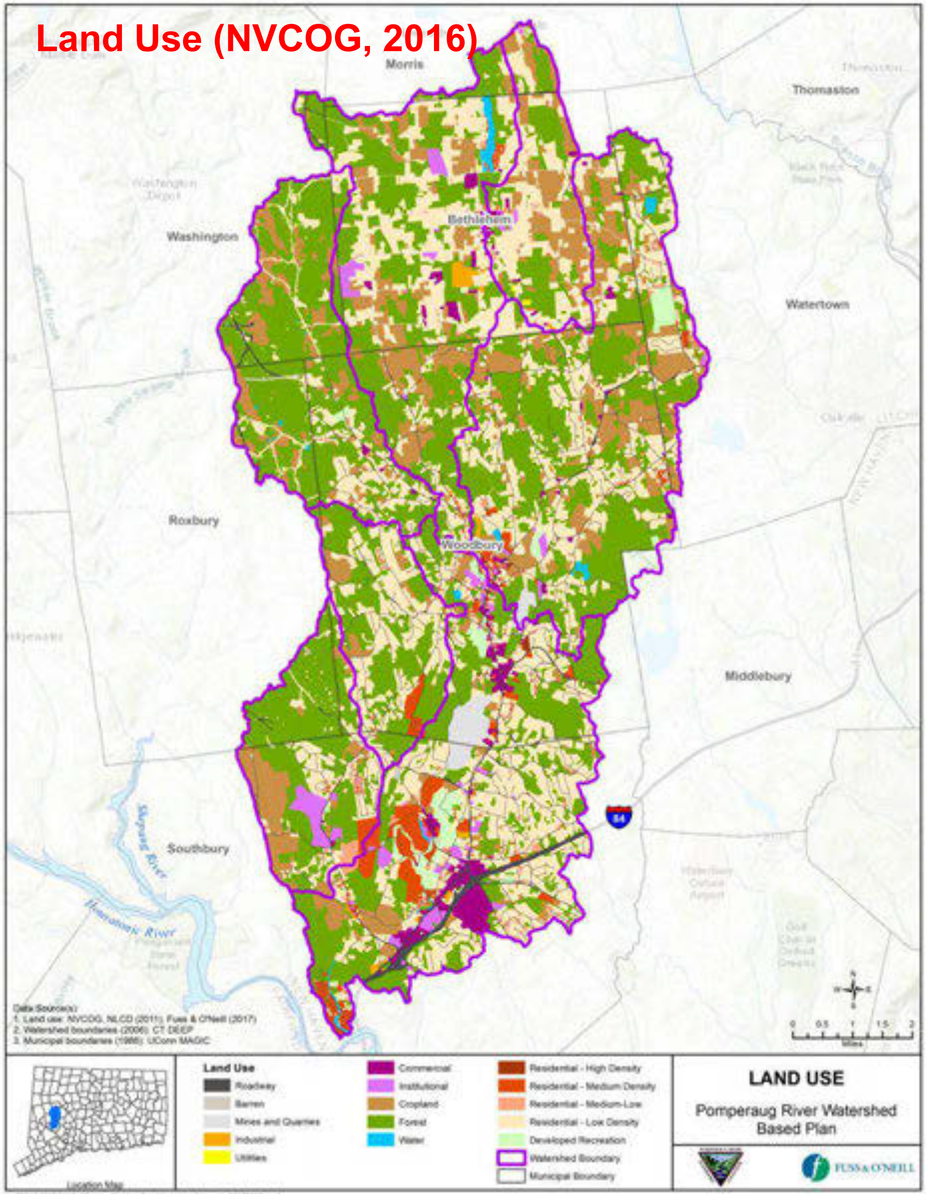
Watershed Mapping

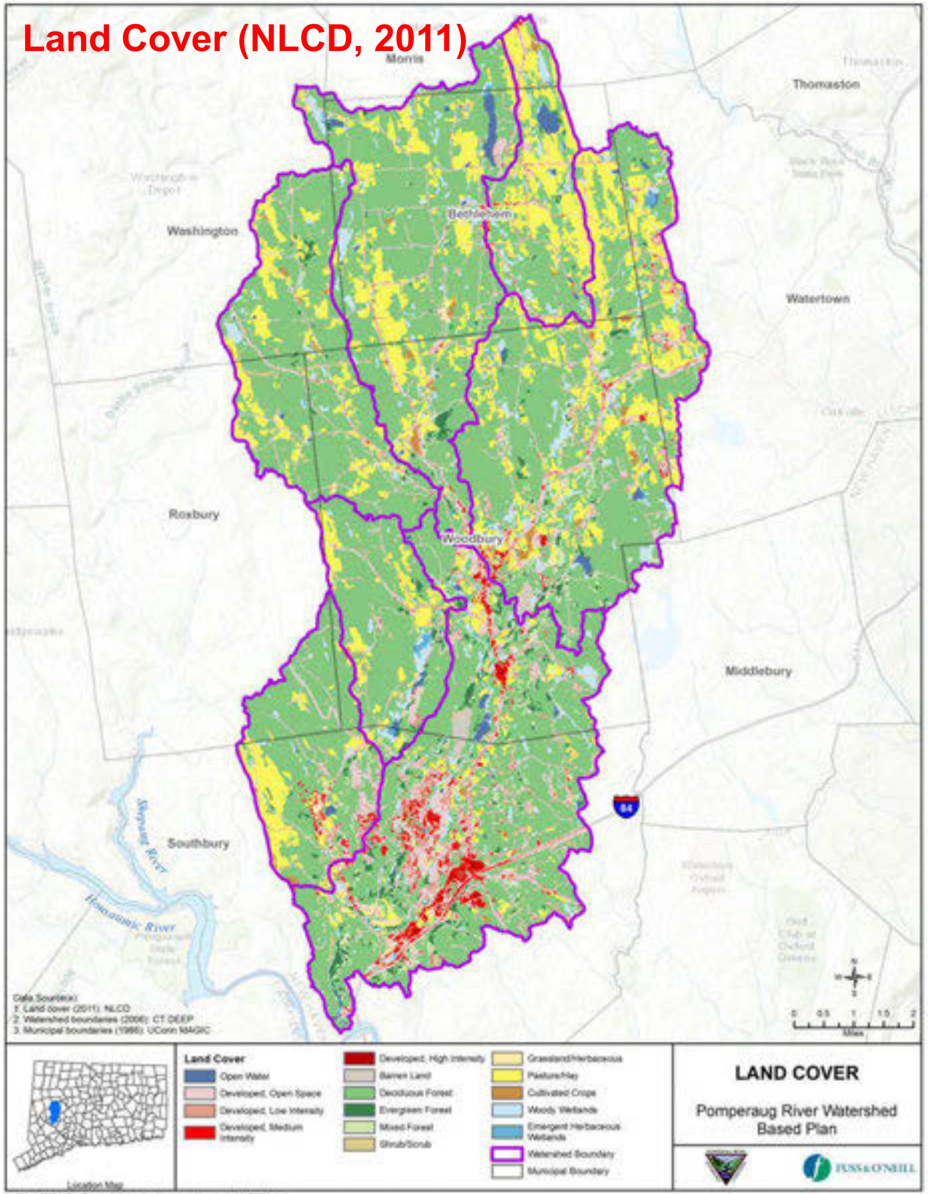
- Draft watershed mapping completed
- Subwatersheds defined at DEEP Sub-regional Basin Scale
- Looking for feedback from PRWC and LUC
- Updated existing conditions narrative to be developed from mapping



Land Use / Land Cover

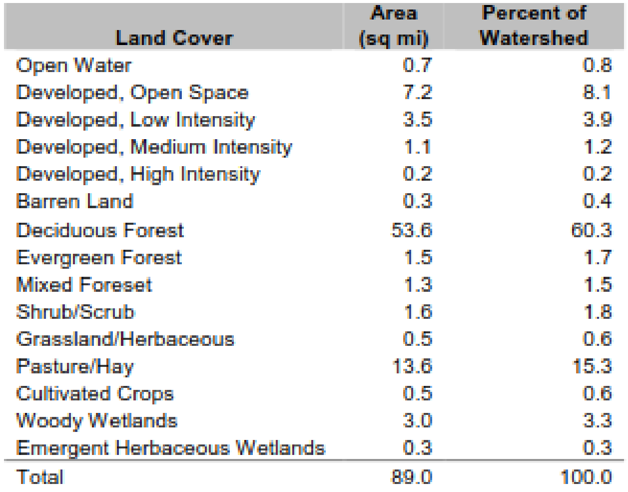


Land Use (NVCOG, 2016)



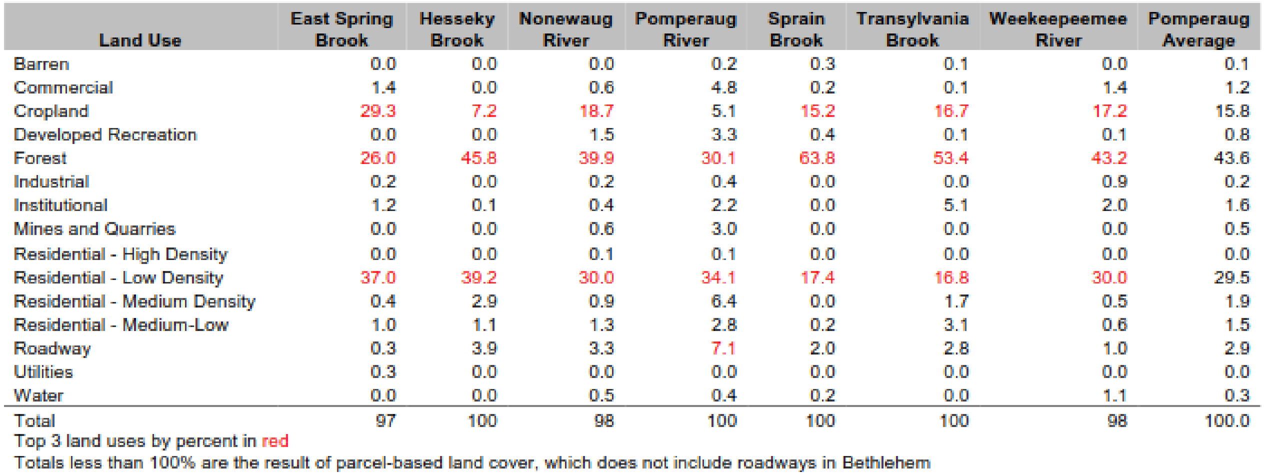
Land Cover (NLCD, 2011)

Land Use / Land Cover



Land Cover	Area (sq mi)	Percent of Watershed
Open Water	0.7	0.8
Developed, Open Space	7.2	8.1
Developed, Low Intensity	3.5	3.9
Developed, Medium Intensity	1.1	1.2
Developed, High Intensity	0.2	0.2
Barren Land	0.3	0.4
Deciduous Forest	53.6	60.3
Evergreen Forest	1.5	1.7
Mixed Foreset	1.3	1.5
Shrub/Scrub	1.6	1.8
Grassland/Herbaceous	0.5	0.6
Pasture/Hay	13.6	15.3
Cultivated Crops	0.5	0.6
Woody Wetlands	3.0	3.3
Emergent Herbaceous Wetlands	0.3	0.3
Total	89.0	100.0

- Top three land cover types:
  - Forest, Pasture/Hay, Developed
- Top three land uses:
  - Forest, Cropland, Low-density residential

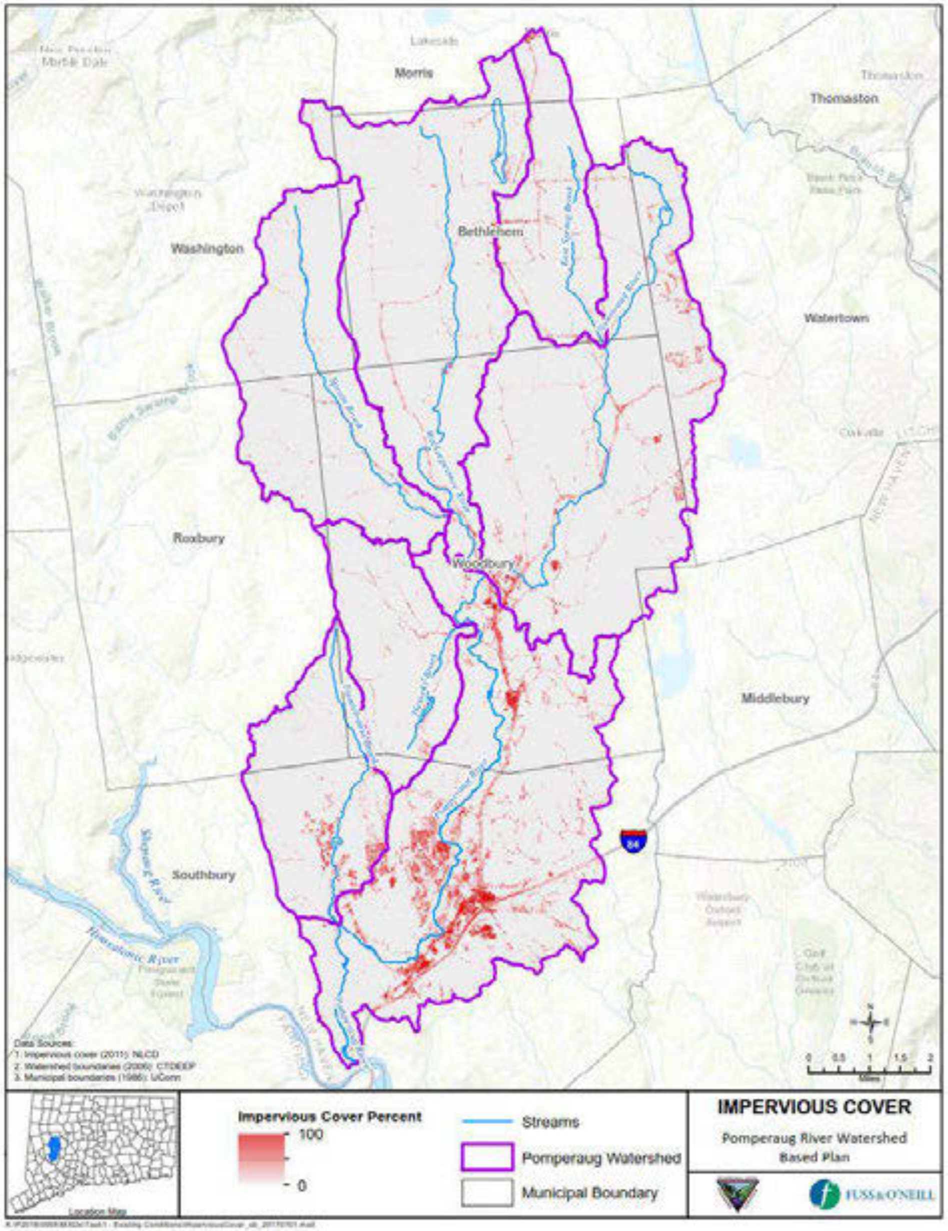


Land Use	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River	Pomperaug Average
Barren	0.0	0.0	0.0	0.2	0.3	0.1	0.0	0.1
Commercial	1.4	0.0	0.6	4.8	0.2	0.1	1.4	1.2
Cropland	29.3	7.2	18.7	5.1	15.2	16.7	17.2	15.8
Developed Recreation	0.0	0.0	1.5	3.3	0.4	0.1	0.1	0.8
Forest	26.0	45.8	39.9	30.1	63.8	53.4	43.2	43.6
Industrial	0.2	0.0	0.2	0.4	0.0	0.0	0.9	0.2
Institutional	1.2	0.1	0.4	2.2	0.0	5.1	2.0	1.6
Mines and Quarries	0.0	0.0	0.6	3.0	0.0	0.0	0.0	0.5
Residential - High Density	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Residential - Low Density	37.0	39.2	30.0	34.1	17.4	16.8	30.0	29.5
Residential - Medium Density	0.4	2.9	0.9	6.4	0.0	1.7	0.5	1.9
Residential - Medium-Low	1.0	1.1	1.3	2.8	0.2	3.1	0.6	1.5
Roadway	0.3	3.9	3.3	7.1	2.0	2.8	1.0	2.9
Utilities	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water	0.0	0.0	0.5	0.4	0.2	0.0	1.1	0.3
Total	97	100	98	100	100	100	98	100.0

Top 3 land uses by percent in red

Totals less than 100% are the result of parcel-based land cover, which does not include roadways in Bethlehem

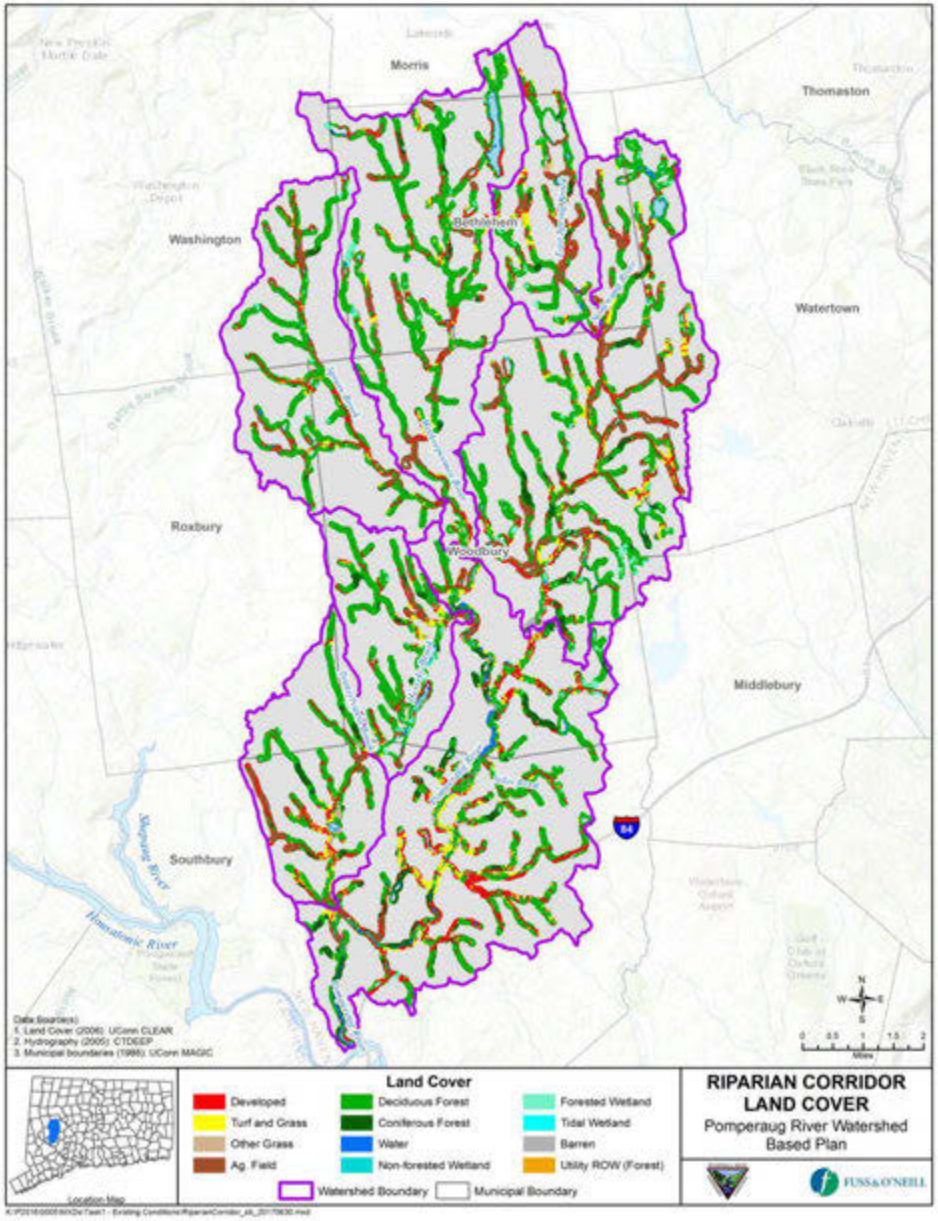
Impervious Cover



Subwatershed	Impervious Cover Percent
East Spring Brook	2.04
Weekeepeemee River	1.06
Nonewaug River	2.04
Sprain Brook	0.64
Hesseky Brook	1.17
Pomperaug River	6.64
Transylvania Brook	2.60
Watershed	2.78

- Sub-regional Basin analysis
- Pomperaug River sub-watershed has highest impervious cover
- None above 10% threshold
- Also evaluating DEEP Local Basins

Riparian Corridor Land Cover



- UConn Center for Land Use Education And Research (CLEAR), 2006 Statewide Analysis
- 300-foot buffer either side of stream centerline
- All mapped perennial and intermittent streams in watershed

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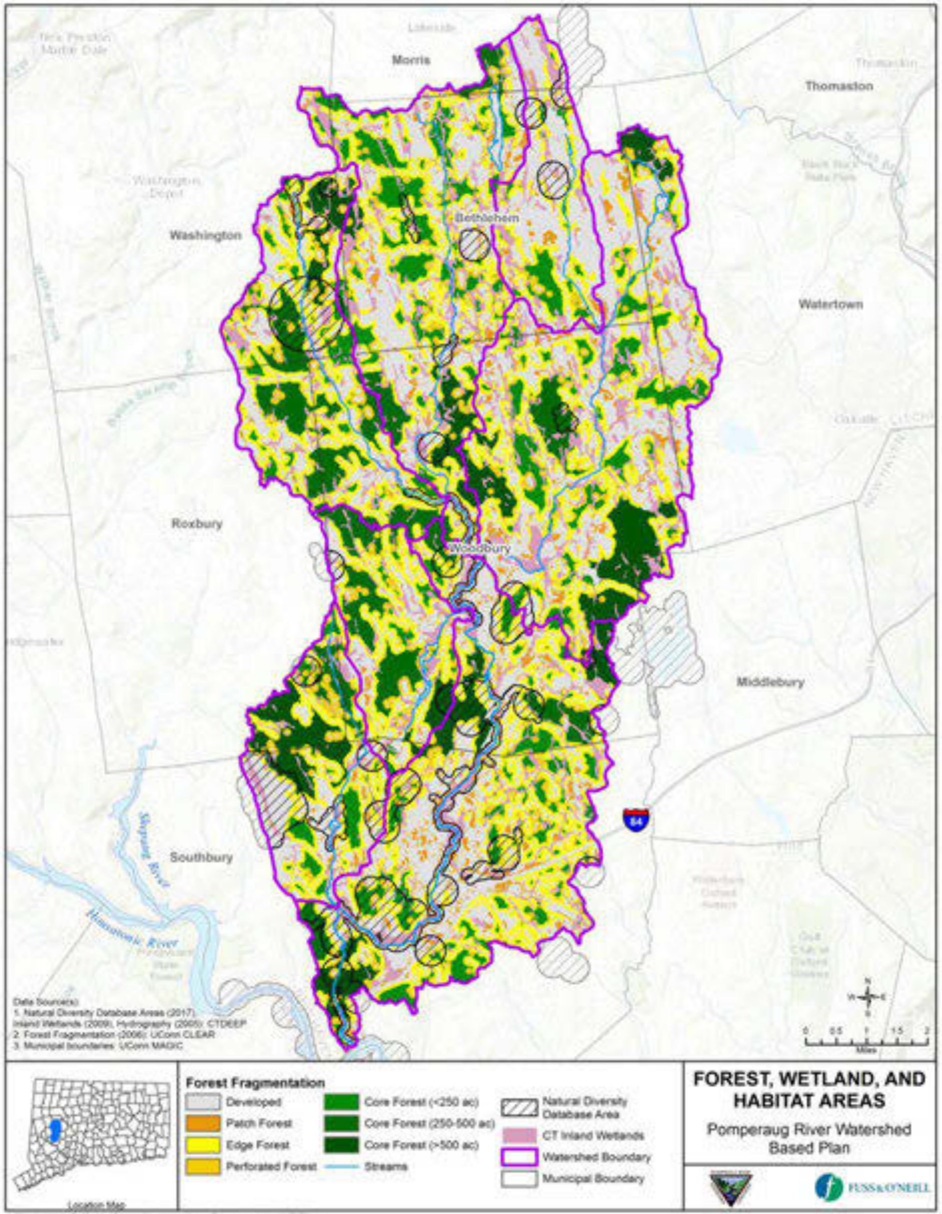
Riparian Corridor Land Cover

- Mostly forest and wetland
- Pomperaug River subwatershed more developed than agricultural
- Other subwatersheds show the opposite pattern

Land Cover Category	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Developed, Other Grasses, Barren	10.33	10.33	12.05	22.05	11.74	17.63	9.89
Agriculture, Turf & Grass	30.38	14.91	26.76	14.54	15.98	20.13	19.36
Forest, Wetland, Water	59.29	74.76	61.20	63.41	72.28	62.24	70.74
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Forests, Wetlands, Critical Habitat



- UConn CLEAR
  - Forest fragmentation analysis, 2006
- CT DEEP
  - Wetlands (soil-based determination), 2009
  - National Diversity Database (NDDB), June 2017

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Forests, Wetlands, Critical Habitat

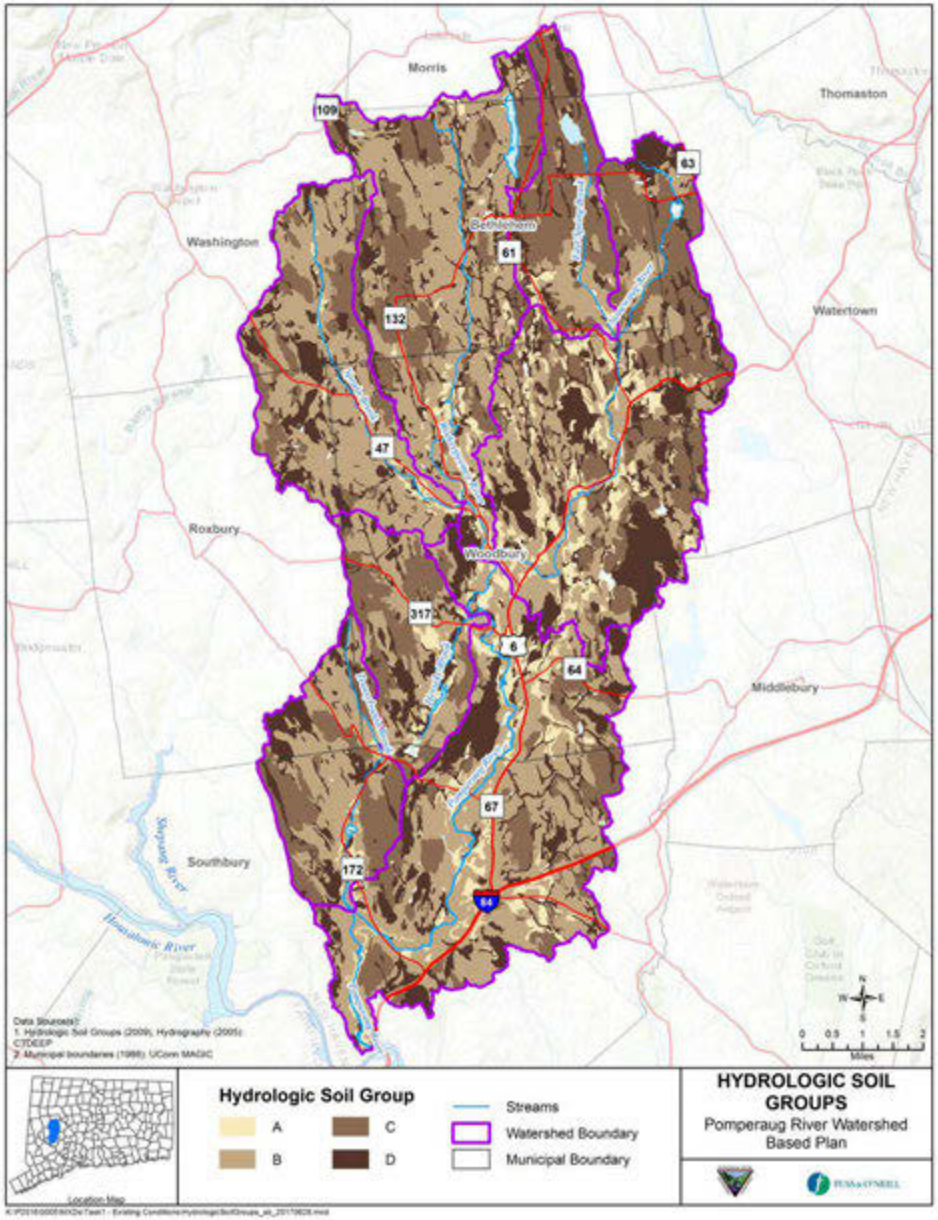
Subwatershed	Percent Core Forest
East Spring Brook	9.5
Weekeepeemee River	25.9
Nonewaug River	24.0
Sprain Brook	32.5
Hesseky Brook	31.6
Pomperaug River	21.6
Transylvania Brook	31.4
Average	25.2

- 25-30% Core Forest
  - East Spring Brook
- 9-15% Wetland
- 2-25% Critical Habitat

Subwatershed	Percent Wetland
East Spring Brook	12.6
Hesseky Brook	10.0
Nonewaug River	14.6
Pomperaug River	11.7
Sprain Brook	9.8
Transylvania Brook	8.9
Weekeepeemee River	15.0
Average	11.8

Subwatershed	Percent NDDB Area
East Spring Brook	8.6
Hesseky Brook	4.9
Nonewaug River	1.7
Pomperaug River	25.4
Sprain Brook	13.7
Transylvania Brook	24.9
Weekeepeemee River	4.5
Average	12.0

NRCS Hydrologic Soil Groups



- CTDEEP (NRCS)
  - Soils, 2009
- Infiltration capacity higher in A&B soils
- Impacts the feasibility and design of infiltration-based GI/LID and septic systems

NRCS Hydrologic Soil Groups

- Approximately even distribution of soil groups across the watershed
- Variability at the subwatershed scale

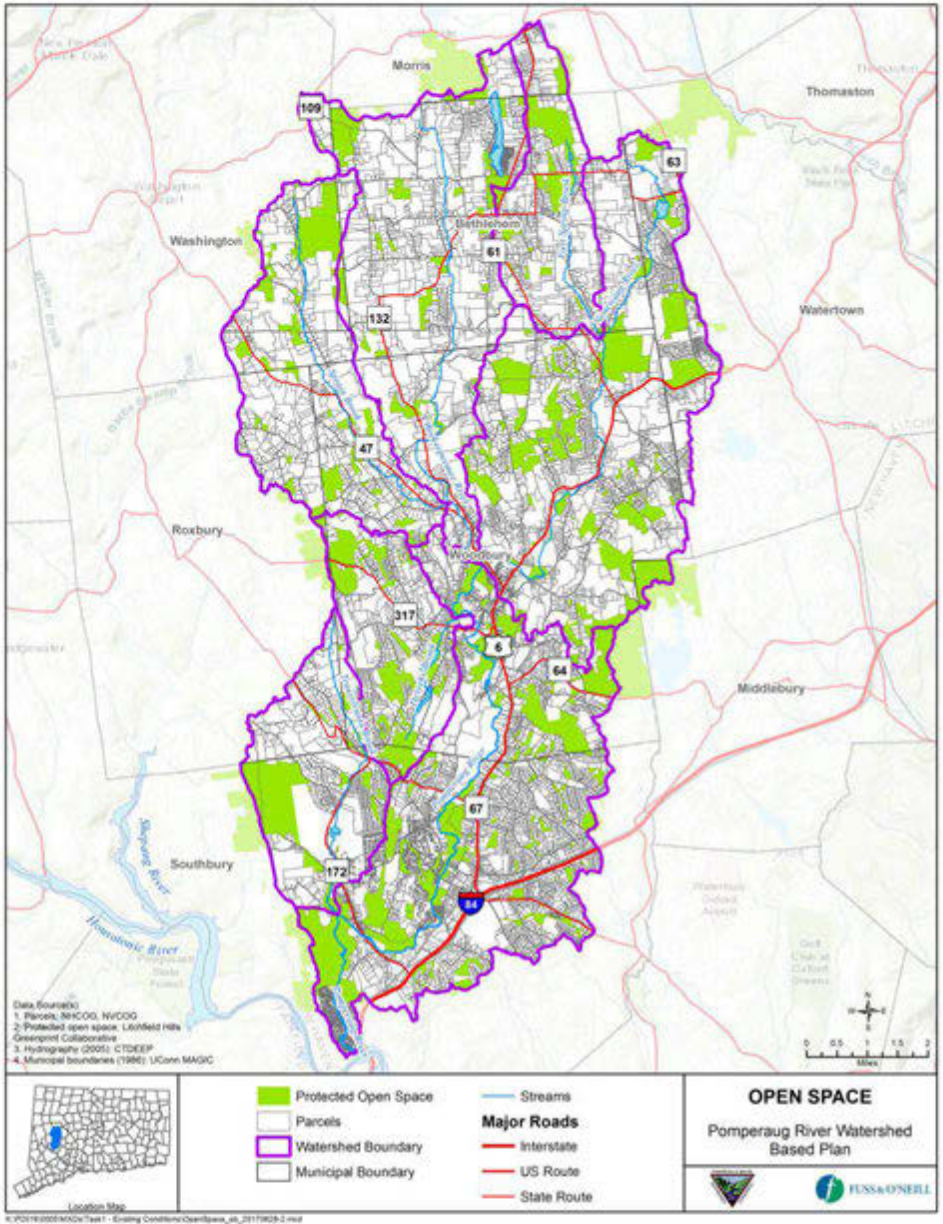
Total Area

Hydrologic Soil Group	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River	Total Area (sq mi)
A & B	1.5	2.8	9.4	13.3	6.8	3.3	9.1	46.3
C & D	4.2	3.3	11.7	7.8	4.1	3.9	6.8	41.7
Water	0.1	0.1	0.2	0.3	0.0	0.0	0.2	1.0
Total	5.8	6.2	21.3	21.4	11.0	7.2	16.1	89.0

Percent

Hydrologic Soil Group	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
A & B	26.3	45.5	44.3	62.1	62.4	45.9	56.3
C & D	71.4	52.4	54.8	36.6	37.3	53.8	42.3
Water	2.3	2.1	0.9	1.3	0.2	0.3	1.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Protected Open Space



- Open space data from Litchfield Hills Greenprint Collaborative
- Parcels from NVCOG and NHCOG

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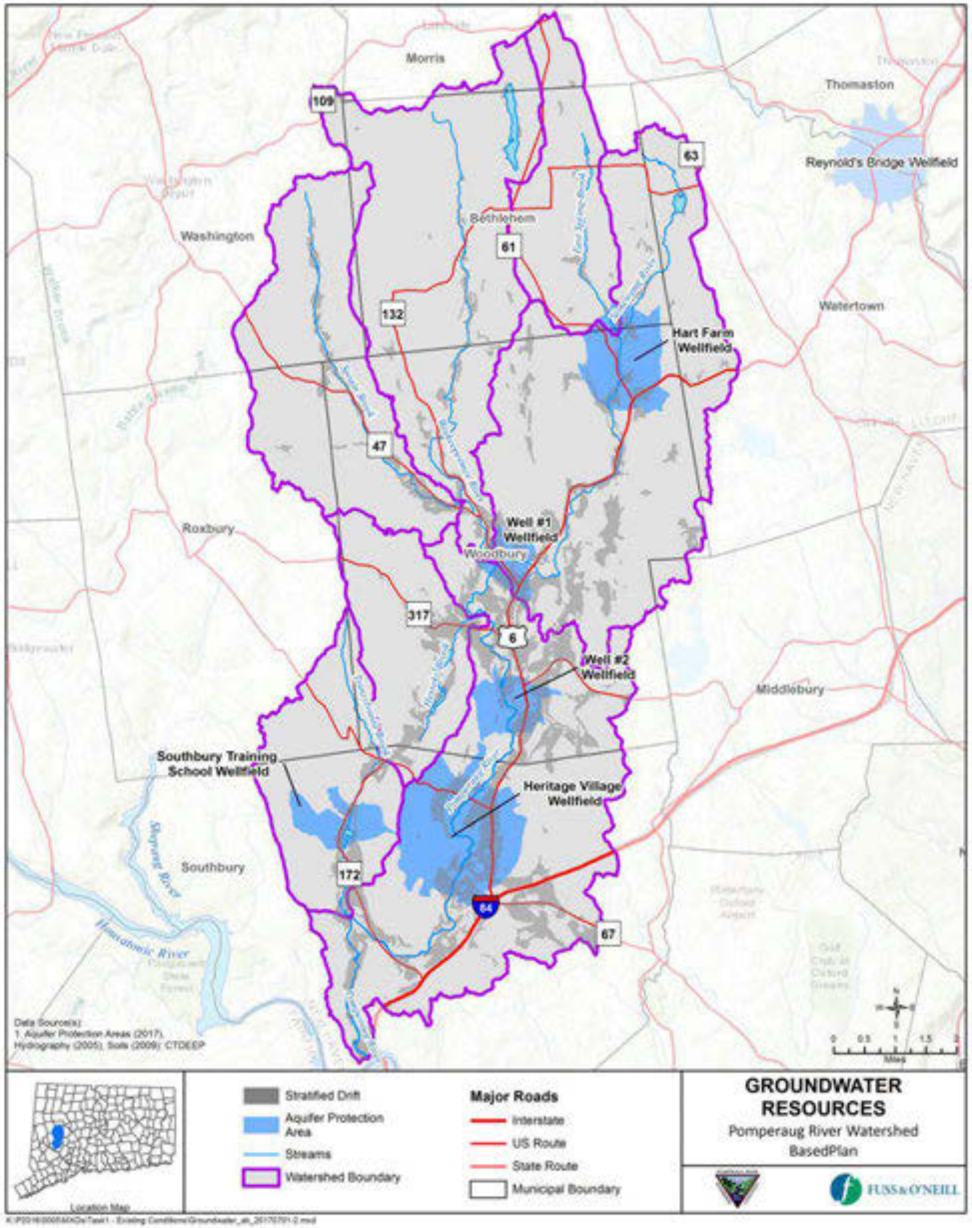
Protected Open Space

- Mix of publicly-owned, land trust, and private easement land
- Variety of protection mechanisms
- Most large, undeveloped tracts already protected

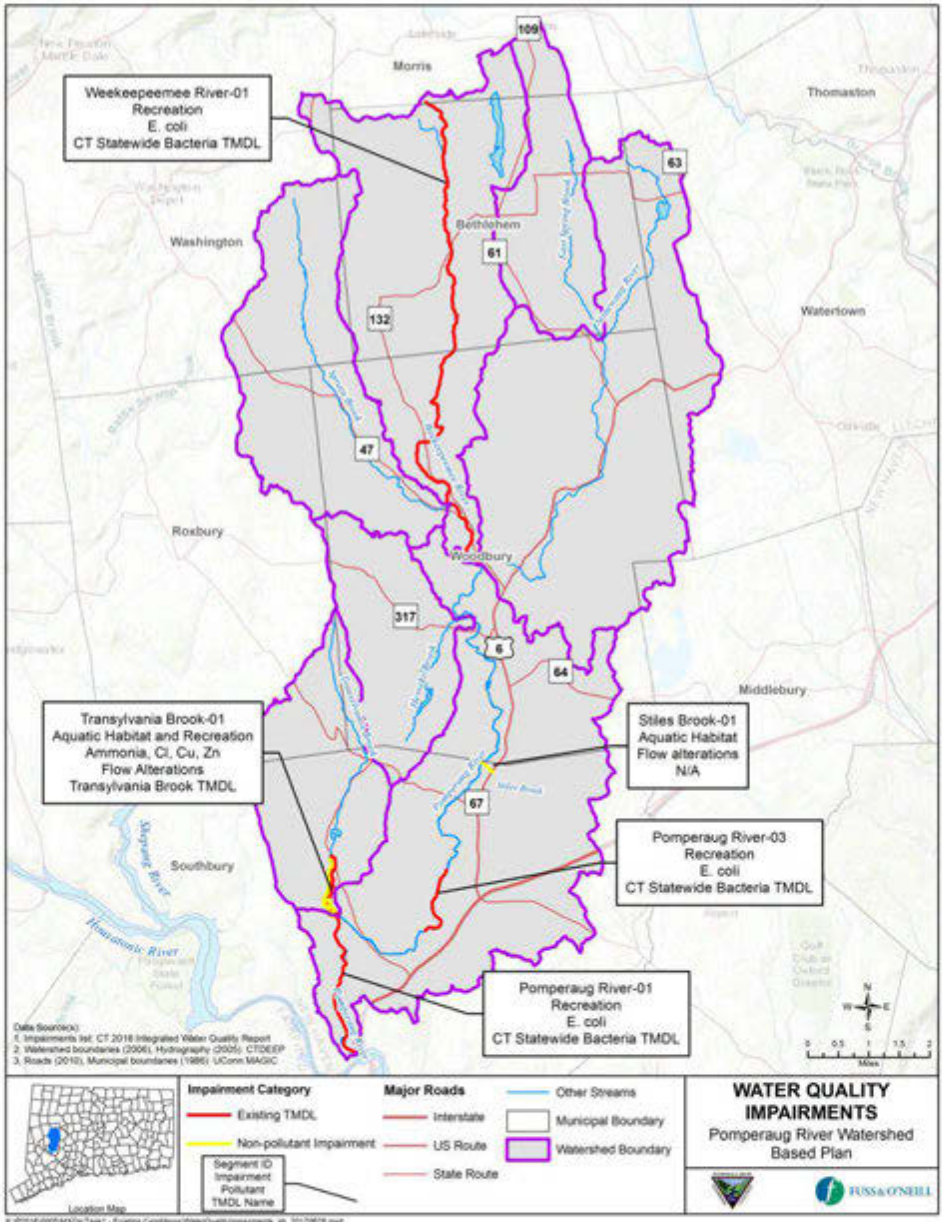
Subwatershed	Protected Open Space (sq mi)	Protected Open Space (percent)
East Spring Brook	0.92	15.8
Hesseky Brook	1.40	22.5
Nonewaug River	3.90	18.3
Pomperaug River	4.26	19.9
Sprain Brook	1.56	14.3
Transylvania Brook	1.25	17.4
Weekeepeemee River	1.25	7.8
Total	14.54	16.3

Groundwater Resources



- CTDEEP
  - Aquifer protection areas, 2017
  - Stratified drift soils, 2009
- Significant prior study of groundwater resources in the watershed

Water Quality Impairments



- CT 2016 Integrated Water Quality Report
- Designation based on impaired uses
  - Recreation (swimming and boating)
  - Aquatic habitat
  - Fish consumption
  - Drinking water supply

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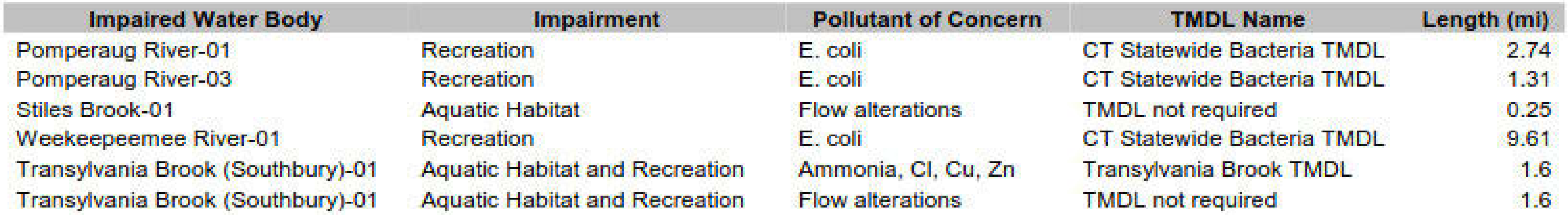
Water Quality Impairments

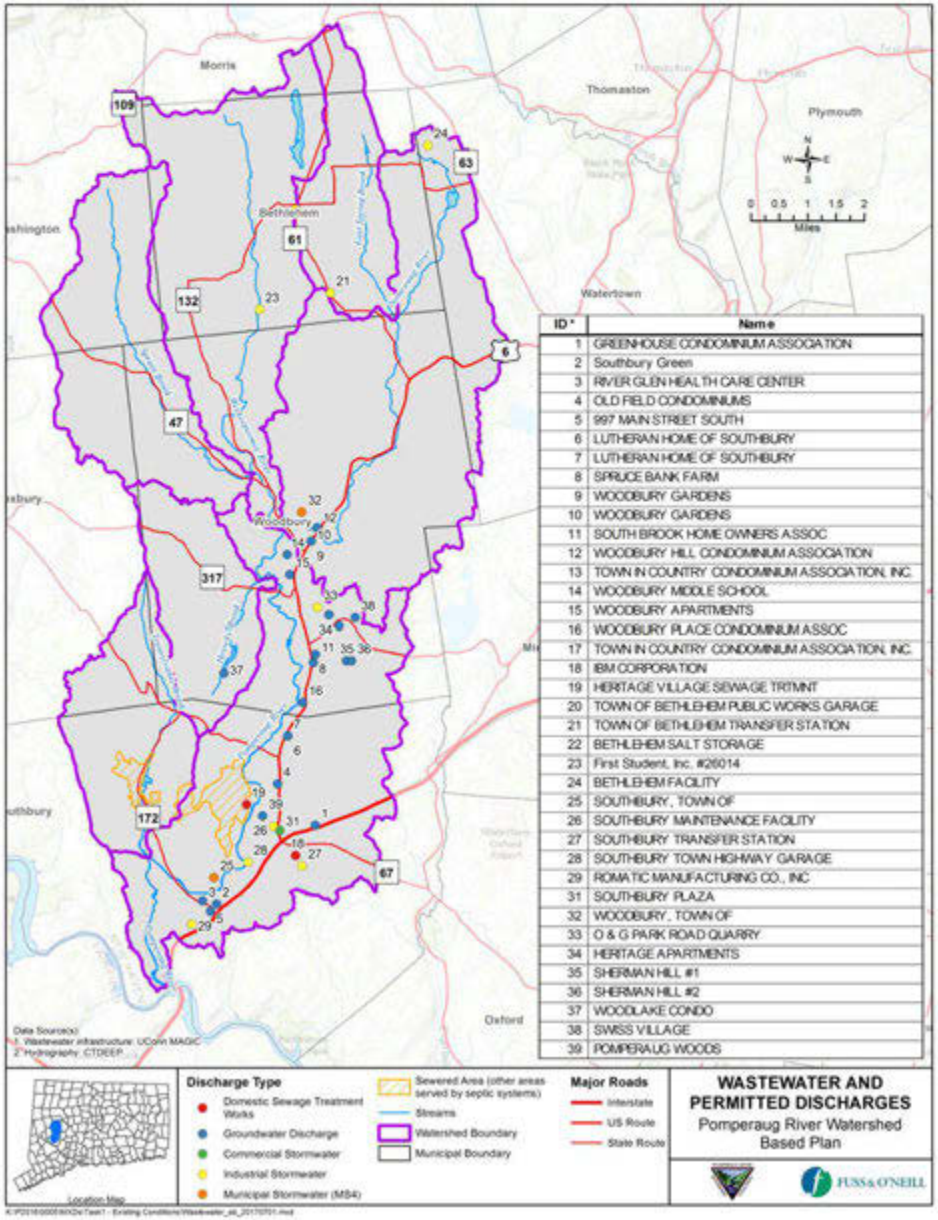
- Five impaired segments
  - Pomperaug River
  - Weekeepeemee River
  - Transylvania Brook (2)
  - Stiles Brook

- State-wide Bacteria TMDL
  - Pomperaug River
  - Weekeepeemee River
- Transylvania Brook TMDL
- Flow Alterations
  - Water withdrawals?



Impaired Water Body	Impairment	Pollutant of Concern	TMDL Name	Length (mi)
Pomperaug River-01	Recreation	E. coli	CT Statewide Bacteria TMDL	2.74
Pomperaug River-03	Recreation	E. coli	CT Statewide Bacteria TMDL	1.31
Stiles Brook-01	Aquatic Habitat	Flow alterations	TMDL not required	0.25
Weekeepeemee River-01	Recreation	E. coli	CT Statewide Bacteria TMDL	9.61
Transylvania Brook (Southbury)-01	Aquatic Habitat and Recreation	Ammonia, Cl, Cu, Zn	Transylvania Brook TMDL	1.6
Transylvania Brook (Southbury)-01	Aquatic Habitat and Recreation	Flow alterations	TMDL not required	1.6

Wastewater and Other Permitted Discharges



ID*	Name
1	GREENHOUSE CONDOMINIUM ASSOCIATION
2	Southbury Green
3	RIVER GLEN HEALTH CARE CENTER
4	OLD FIELD CONDOMINIUMS
5	997 MAIN STREET SOUTH
6	LUTHERAN HOME OF SOUTHBURY
7	LUTHERAN HOME OF SOUTHBURY
8	SPRUCE BANK FARM
9	WOODBURY GARDENS
10	WOODBURY GARDENS
11	SOUTH BROOK HOME OWNERS ASSOC
12	WOODBURY HILL CONDOMINIUM ASSOCIATION
13	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC
14	WOODBURY MIDDLE SCHOOL
15	WOODBURY APARTMENTS
16	WOODBURY PLACE CONDOMINIUM ASSOC
17	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC
18	IBM CORPORATION
19	HERITAGE VILLAGE SEWAGE TRTMNT
20	TOWN OF BETHLEHEM PUBLIC WORKS GARAGE
21	TOWN OF BETHLEHEM TRANSFER STATION
22	BETHLEHEM SALT STORAGE
23	First Student, Inc. #26014
24	BETHLEHEM FACILITY
25	SOUTHBURY, TOWN OF
26	SOUTHBURY MAINTENANCE FACILITY
27	SOUTHBURY TRANSFER STATION
28	SOUTHBURY TOWN HIGHWAY GARAGE
29	ROMATIC MANUFACTURING CO., INC
31	SOUTHBURY PLAZA
32	WOODBURY, TOWN OF
33	O & G PARK ROAD QUARRY
34	HERITAGE APARTMENTS
35	SHERMAN HILL #1
36	SHERMAN HILL #2
37	WOODLAKE CONDO
38	SWISS VILLAGE
39	POMPERAUG WOODS

Data Source(s):
1. Wastewater infrastructure: UConn MAGIC
2. Hydrography: CTDEEP

WASTEWATER AND PERMITTED DISCHARGES
Pomperaug River Watershed Based Plan

- CTDEEP
  - Discharge permits database, 2016
  - Sewered area, 1997

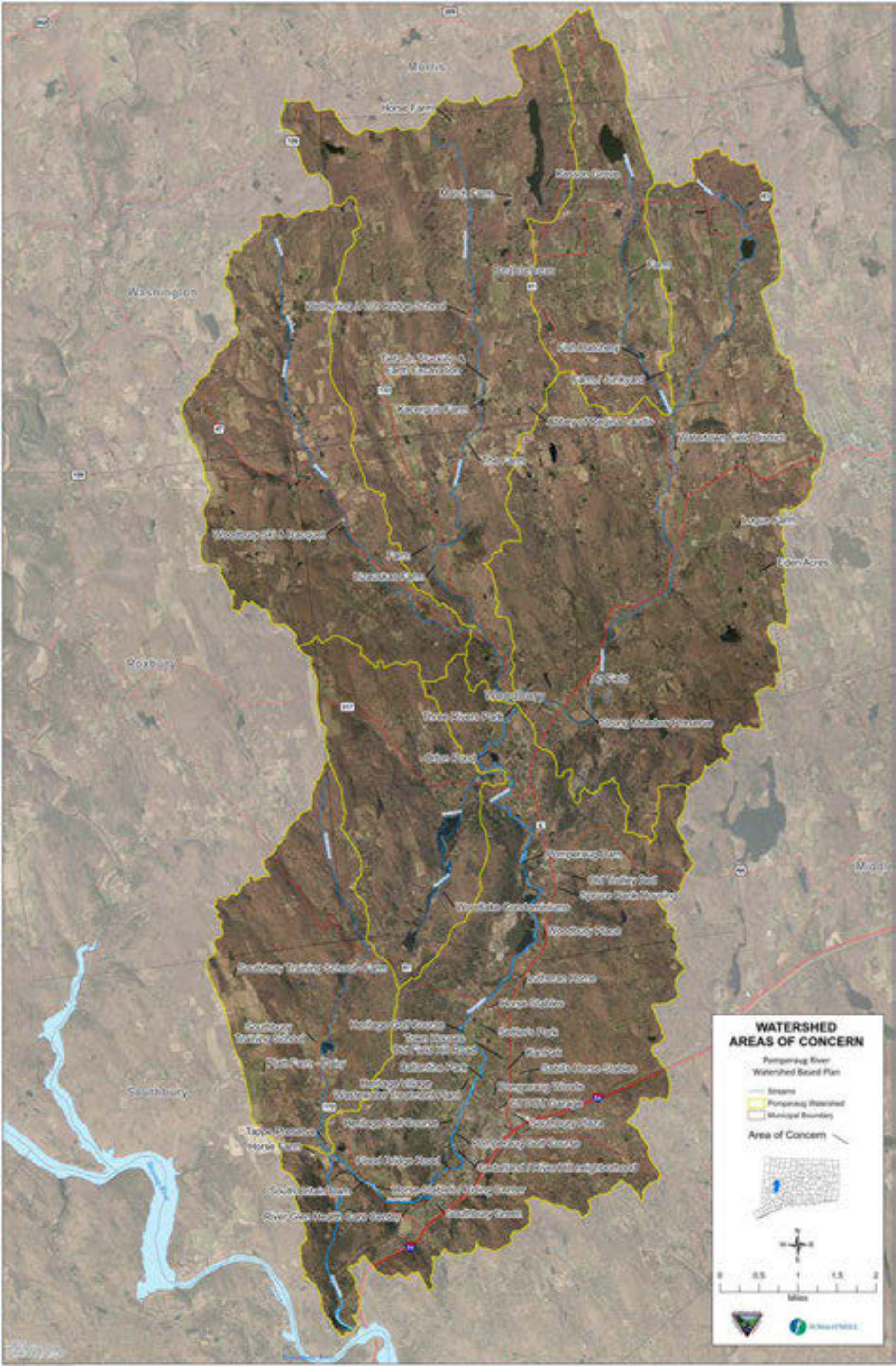
Wastewater and Other Permitted Discharges

- 39 permitted dischargers
  - Sewage treatment plants
  - Subsurface sewage disposal (septic) systems
  - Commercial, industrial, municipal stormwater discharges

- 2 sewage treatment plants
  - Heritage Village
  - IBM Campus
- Several apartments/condos with large septic systems
- Quarries

Pollution Hotspots/ Areas of Concern

- Identified by LUC and PRWC
- Roughly 60 sites identified (see board)
- Potential bacteria sources
  - Streambank erosion
  - Agricultural land adjacent to streams
  - Manure management
  - Septic system issues
  - Significant point discharges
  - Waterfowl, pet waste



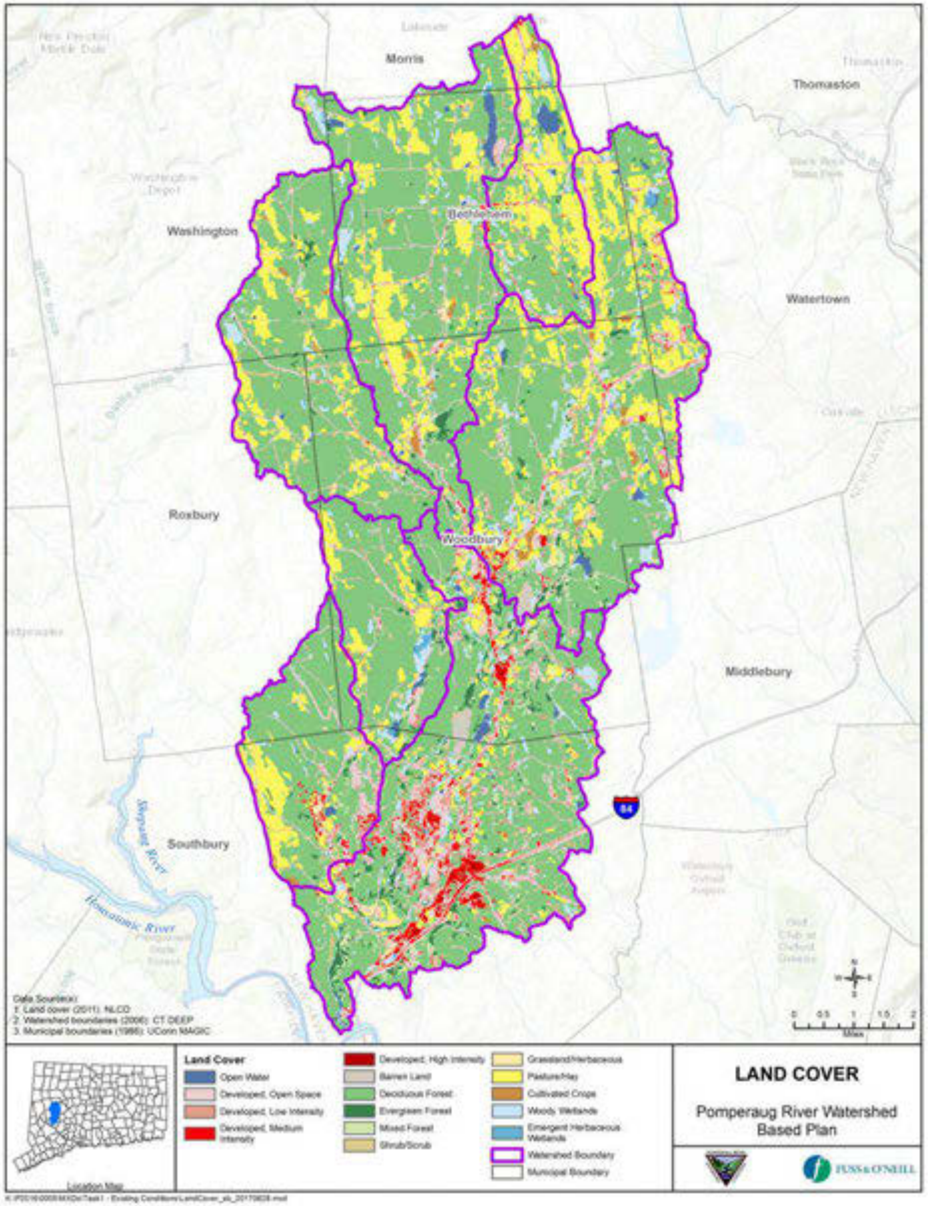
POMPERAUG RIVER WATERSHED COALITION

Watershed Assessments

- Pollutant Loading Model
- Riparian Cover Analysis
- Visual Field Assessments

Pollutant Loading Model

- Watershed Treatment Model (WTM) – surface runoff pollutant loads
- Annual loadings of bacteria, nutrients, and sediment
- Primary sources – land cover (NLCD, 2011)
- Secondary sources – point sources, septic systems, urban stream erosion, etc.
- Model development in progress

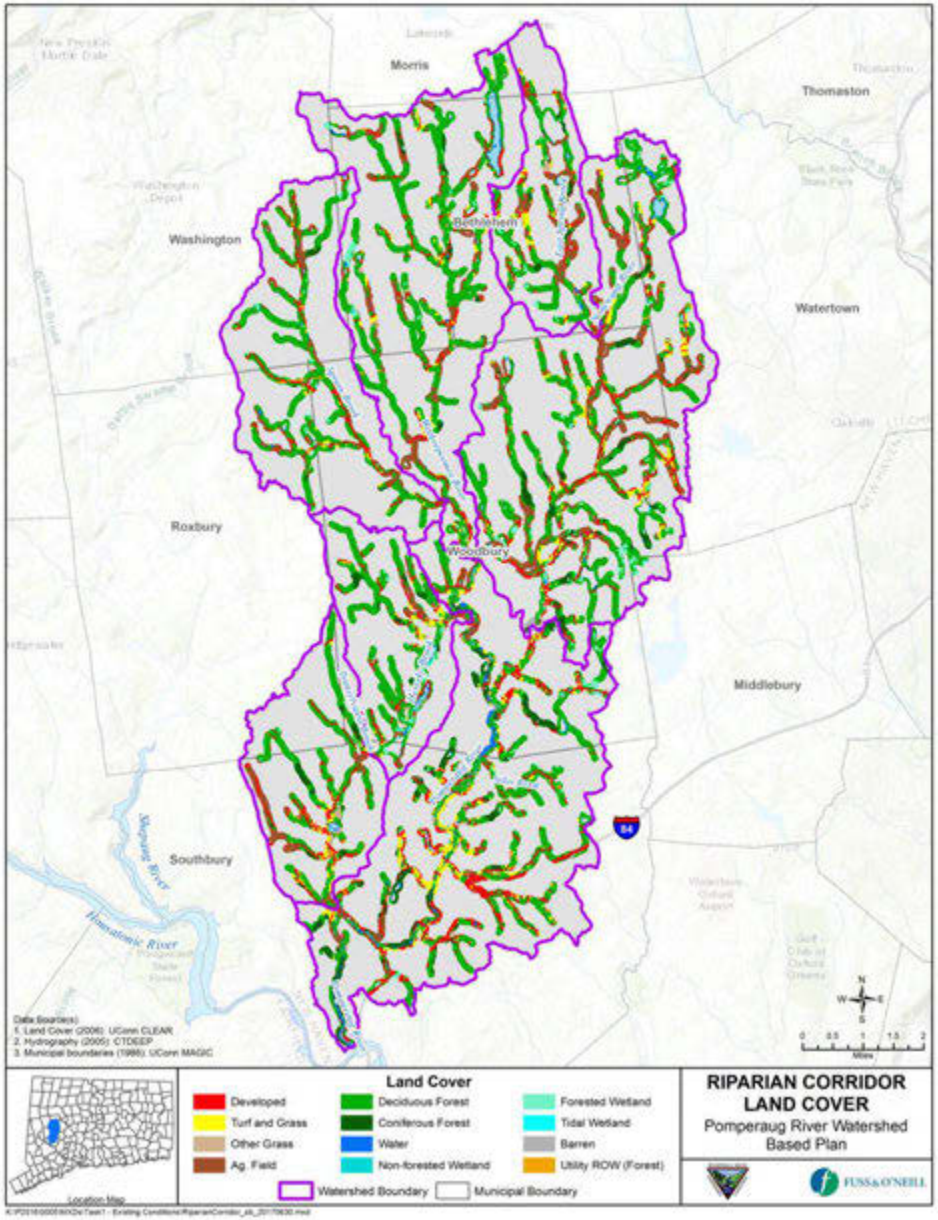


Visual Field Assessments

- Identify site-specific restoration, pollution prevention, and retrofit opportunities
- Prioritize locations for field assessments based on existing information and other watershed assessments
- 2-4 field days, using standardized protocols

Riparian Cover Analysis

- Combine CLEAR riparian analysis with NVCOG parcels and protected open space
- Buffer restoration opportunities
- Additional land conservation opportunities



POMPERAUG RIVER WATERSHED COALITION

Next Steps

- July
  - Finalize watershed maps
  - Complete existing conditions pollutant load modeling
  - Complete riparian cover analysis
- July/August
  - Develop updated existing conditions narrative to support WBP
- August
  - Conduct visual field assessments

Additional Discussion/Questions

POMPERAUG RIVER WATERSHED COALITION

FUSS & O'NEILL

MEETING NOTES

PRWC Land Use Committee
Thursday, October 5, 2017
3:00 PM – 4:30 PM
Southbury Town Hall, Room 201
501 Main Street South, Southbury

Attendees: Carol Haskins, Len DeJong, Chris Wood, Gail McTaggart, Leslie Kane, Norma Carey, DeLoris Curtis, Arthur Milnor, Curtis Jones, Petra Volinski, Susan Peterson, Erik Mas, Bill Guenther

1. Introductions

2. Presentation by Fuss & O'Neill and Discussion

Watershed Mapping Updates Since Previous LUC Meeting

- Erik Mas reviewed watershed mapping updates that were completed based on comments received during and following LUC Meeting #2
- Additional CTDEEP water quality monitoring stations (if any) should be added to the Water Quality Impairments map, including fish survey and macroinvertebrate survey data, if available
- Susan Peterson and others discussed clarifying the Water Quality Impairments map to distinguish between waters that are supporting for some uses (e.g., aquatic habitat) and not assessed for others (e.g., recreation). There was also a suggestion to re-color the reaches (red, yellow green) to avoid confusion and to clarify the impairment status for a general audience. For example, green implies "good water quality," although some of the segments that are colored green on the map may be unassessed for recreation/bacteria and therefore could have similar bacteria issues as the assessed/impaired segments.

Pollutant Loading Model

- Erik Mas presented draft results of the pollutant loading model that was developed for the Pomperaug River watershed. A draft technical memorandum dated October 4, 2017 was distributed to the PRWC LUC prior to the meeting.
- There was discussion about the assumptions and results of the illicit discharge and septic system secondary pollutant source categories in the model.
- How are illicit discharges quantified in the model? The model assumes 1 illicit connection per 1,000 residences and 5% of businesses having illicit connections. These estimates may be conservatively high given the type of development and very limited area of sanitary sewers in the Pomperaug. The loads resulting from illicit connections are likely overstated and should be revisited based on additional input from the Southbury and Woodbury DPW and the regional health district.
- How are septic system failure/malfunction rates quantified in the model? The model assumes a 10% failure rate. This estimate may also be conservatively high and may not reflect actual septic system failure issues in the watershed. The model also assumes that 10% of septic systems are within 100 feet of a surface water body, which may be overly conservative considering that many septic systems in the watershed were constructed or replaced following the adoption of minimum setbacks for septic systems in the local land use regulations.

- PRWC will discuss these issues with the regional health district to provide some additional feedback on appropriate local values for illicit connection and septic system failure rates. Fuss & O'Neill will update the model accordingly.
- In the context of the pollutant loading model, make sure to refer to the modeled Pomperaug River subwatershed as the "Pomperaug Subregional Basin," consistent with CT DEEP terminology, to avoid confusion with the overall Pomperaug River watershed.

Field Assessments and Preliminary BMPs

- Bill Guenther presented major findings from the watershed field assessments, including preliminary ideas for site-specific Best Management Practices to address observed issues relative to bacterial water quality impairments. A draft technical memorandum dated October 5, 2017 was distributed to the PRWC LUC prior to the meeting.
- Canada geese are an issue and source of bacteria in the watershed. Management of geese and other waterfowl populations is very challenging. The focus should be on resident as opposed to migratory geese. The close proximity of corn fields (food source), golf courses, other manicured lawns, and open water bodies are key ingredients that contribute to resident geese populations in the watershed. Golf courses typically discourage geese, although vegetated buffers may be in conflict with the use of the golf course. Southbury Training School and other municipal/state properties have issues with geese populations.
- Manure management, lack of vegetated buffers, and livestock access were identified as common issues at several of the farms that were assessed. Note, many farms observed during the field assessment survey were viewed from the road. There was discussion of how to raise site-specific issues with particular farms without "pointing fingers" unfairly at specific property owners, whose support and cooperation are critical for address water quality issues. The discussion also pointed out that many farmers may be more willing to pursue BMP implementation if there are additional local avenues to cost share or match federal funds. In some cases, farmers might like to pursue BMPs but may not have the funding or have it as a priority, or may not have the landowner rights (in the case of leased land) to make a long-term commitment to maintaining the BMP for its lifespan. Using riparian buffers to keep livestock out of streams was discussed, noting that while 200 foot widths are ideal, any buffer width is better than none given the perception challenges that such areas are removed from pasture land and or crop production land.
- Discussion of Berkshire Estates and the various issues associated with the "T lots" – particularly related to property lines, landownership, and how to proceed with developing BMP plans for this area that would be reasonably feasible to implement.
- Heritage Village was identified as a potential candidate for retrofitting existing connected impervious surfaces (i.e., roads, parking lots) with stormwater quality BMPs given the available land and limited, if any, existing stormwater quality BMPs. The Heritage Village housing units were the first condos developed in Connecticut (initially developed in 1966-1974), with later phases constructed in 1978 and 1982.
- There are several examples of Low Impact Development practices throughout the watershed. The watershed communities have promoted the use of LID for many years, although the municipal land use regulations may not require the use of LID and may need to be modified, either through compliance with the new MS4 Permit (Southbury and Woodbury) or separate land use regulatory updates by the non-MS4 communities in the watershed.

- New Morning Market and Prime Publishing are examples of recently installed pervious parking lots. The new movie theater that is under construction along Main Street South in Southbury is also implementing underground infiltration systems.
- Per recent feedback from EPA, CTDEEP indicated that watershed based plans should identify as many site-specific projects as possible, even if they are limited in their level of detail, to increase the chance of success with future grant applications. Inclusion of a table naming the site and most suitable BMP without detailed plans may be sufficient in this regard.

3. Next Steps

- PRWC will provide feedback from the LUC on both draft technical memoranda – pollutant loading model and watershed field assessments.
- Fuss & O'Neill will revise and finalize the pollutant loading model based on feedback from the LUC, town staff, and/or regional health district
- The next phase of work will focus on finalizing selection of BMPs, developing site-specific BMP concepts, and preparing the draft watershed based plan.

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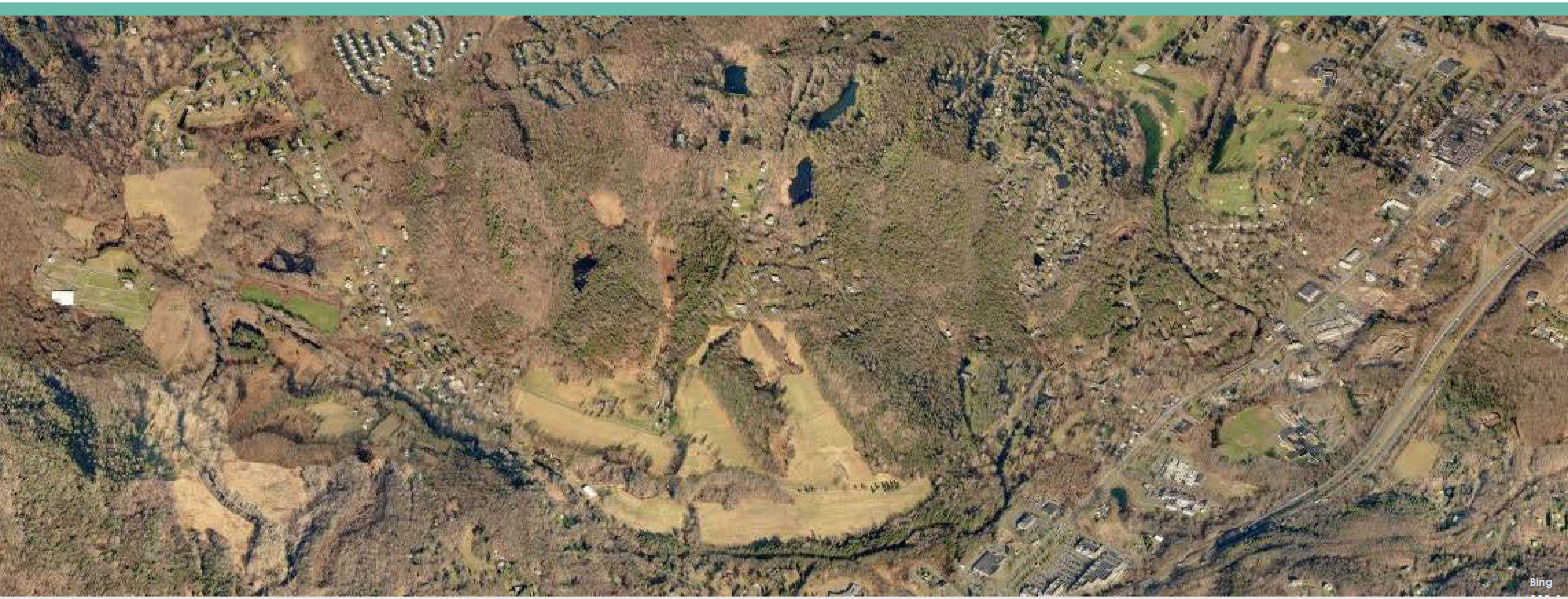


PRWC Land Use Committee Meeting

Pomperaug River Watershed Based Plan

October 5, 2017

POMPERAUG RIVER WATERSHED COALITION

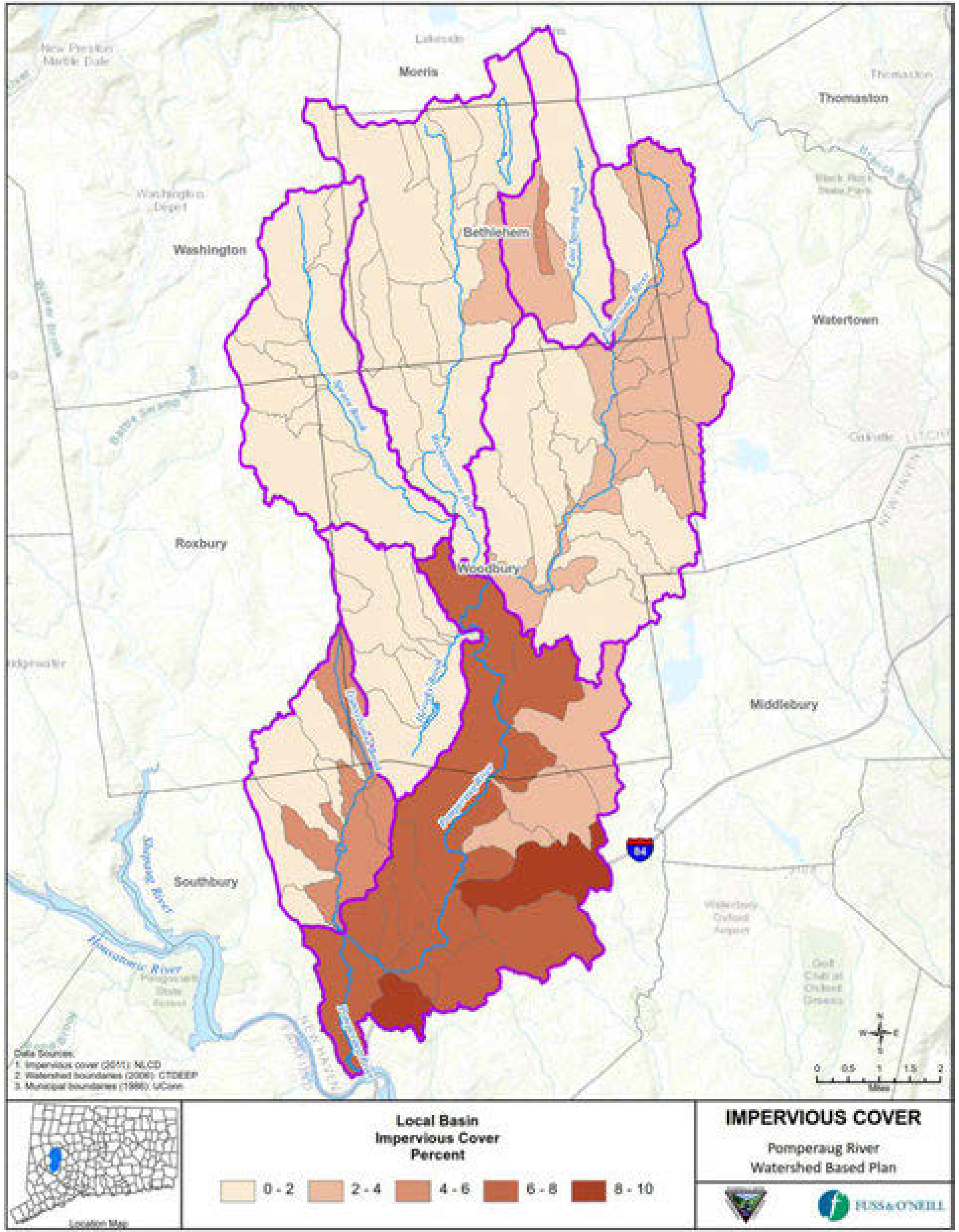
Meeting Agenda

1. Introductions
2. Updates from Previous LUC Meeting
3. Pollutant Loading Model
4. Field Assessments and Potential BMPs
5. Next Steps
6. Discussion

Photo credit: National Audubon Society

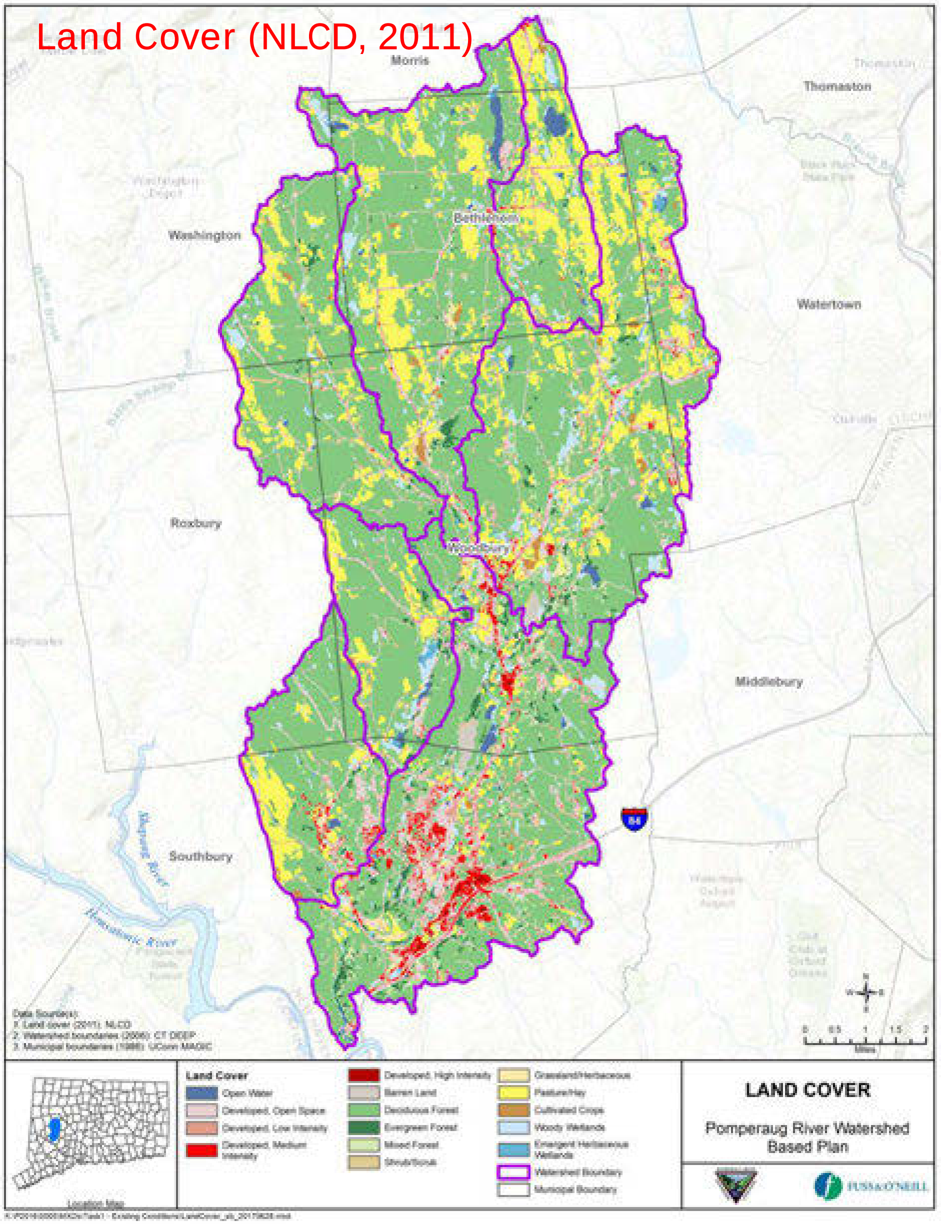
Mapping Updates

- Impervious Cover
  - CT Local Basins
  - All basins below 10% IC threshold
  - Most of Pomperaug basin in 6-10% range
  - Several Pomperaug sub-basins in 8-10% range



Mapping Updates

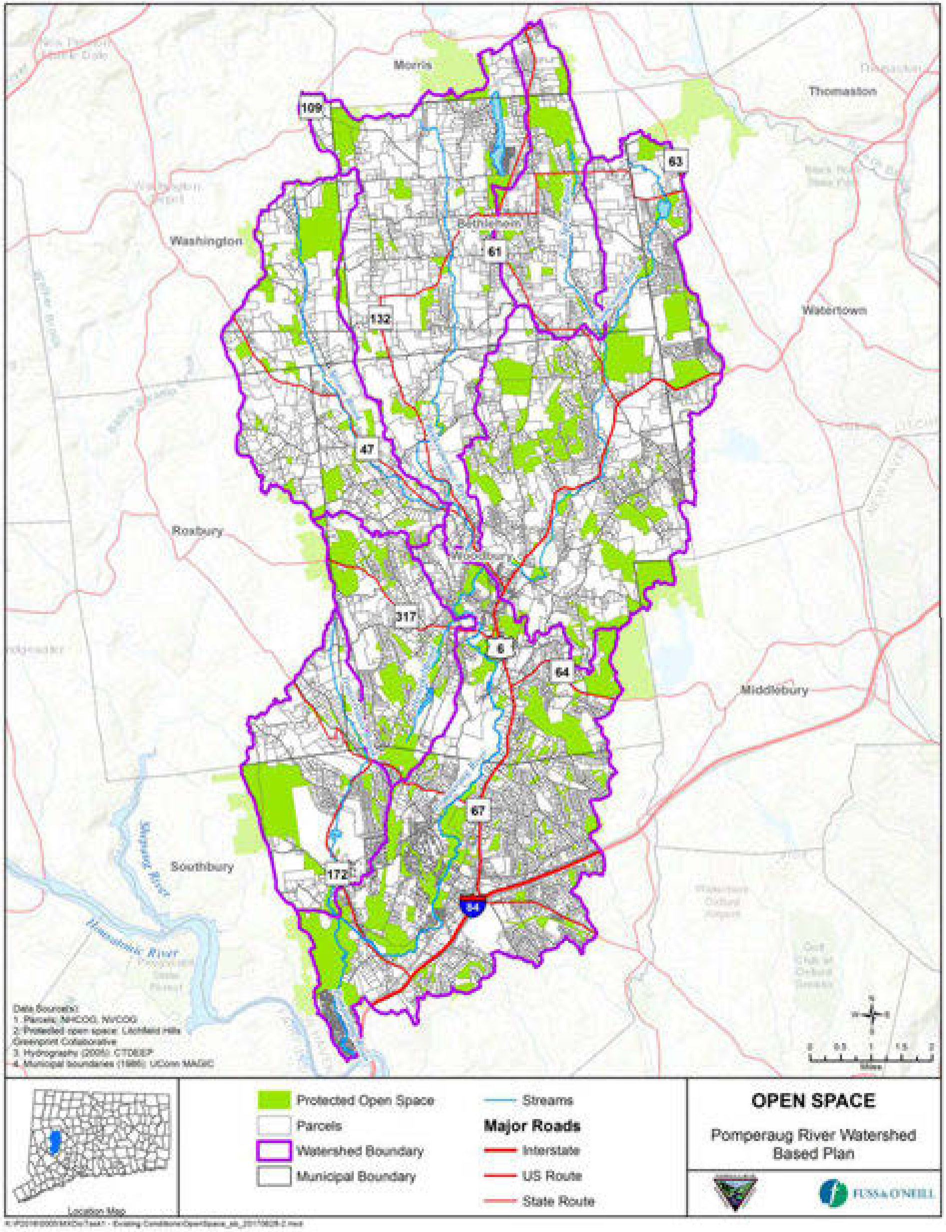
- Land Cover
  - CLEAR 2015 land cover (same classes as 2010 data)
  - Compared 2010 and 2015 CLEAR land cover data (no significant differences)
  - NLCD 2011 land cover still valid



Land Cover (NLCD, 2011)

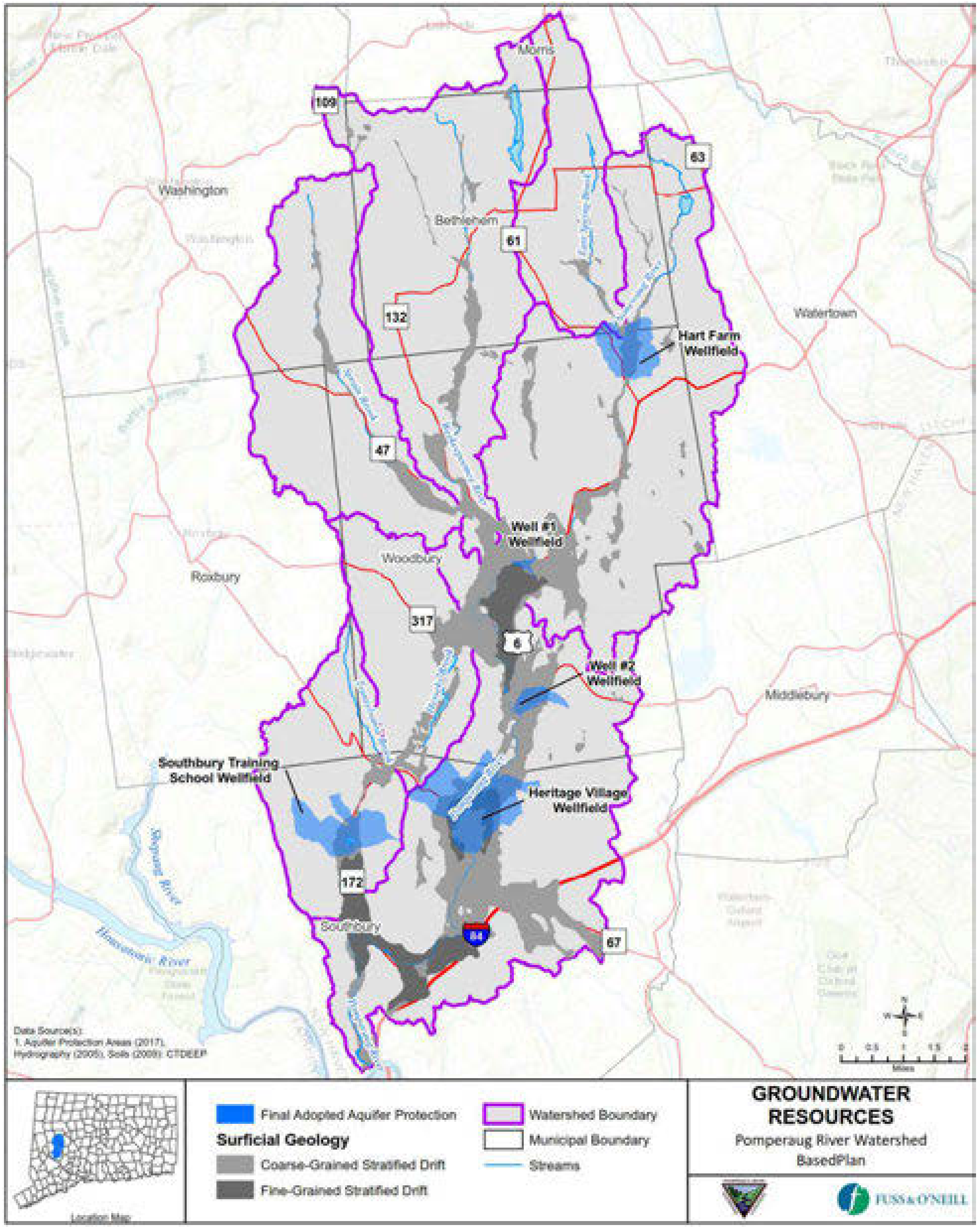
Mapping Updates

- Committed Open Space
  - Town owned parks, recreation areas, preserves
  - Land trust properties with legal protections
  - State of Connecticut properties that are undeveloped
  - Farms where the development rights have been acquired
  - Excludes Public Act 490 land
  - Class A water company property



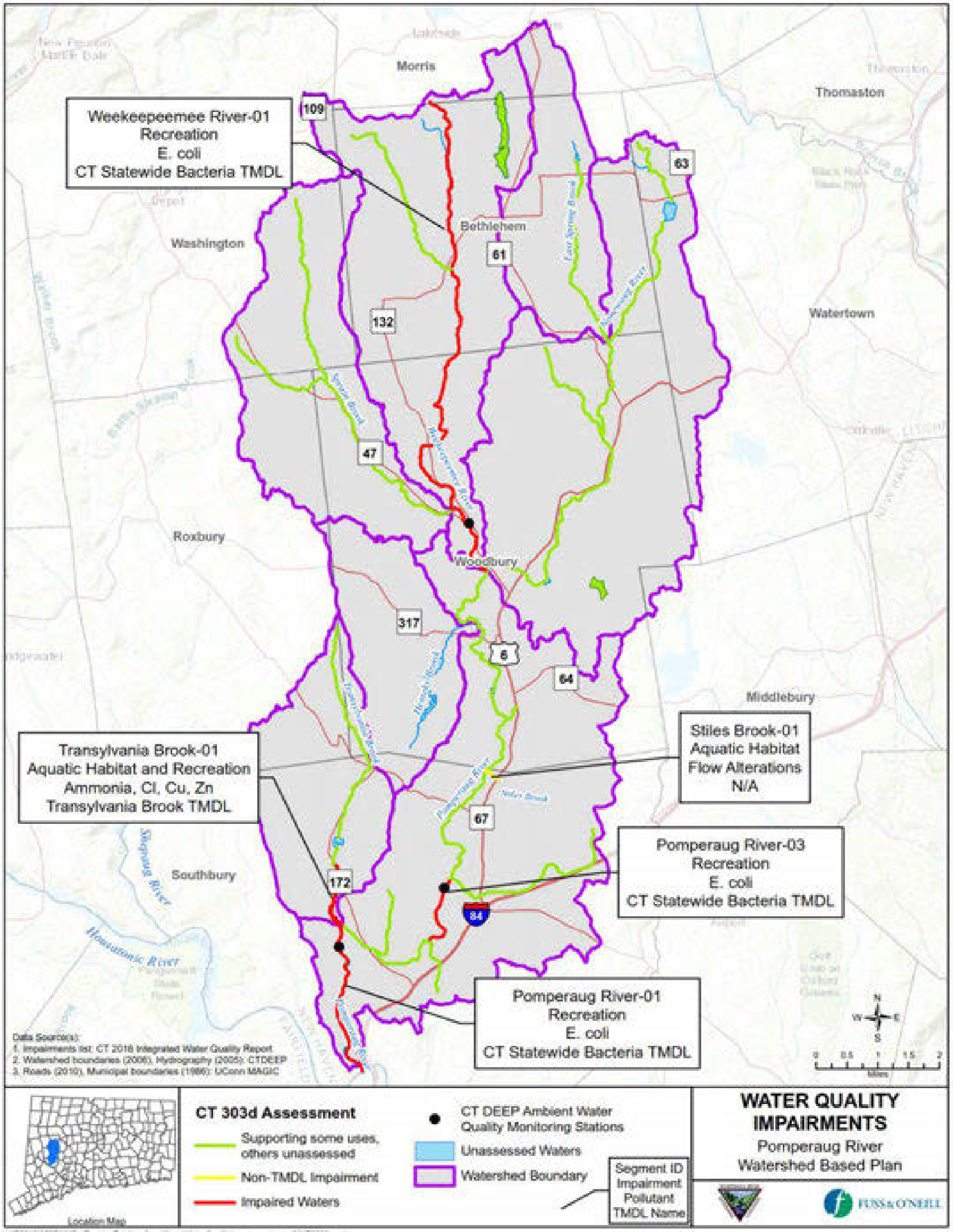
Mapping Updates

- Groundwater Resources
  - Final adopted Aquifer Protection Areas only
  - Surficial geology



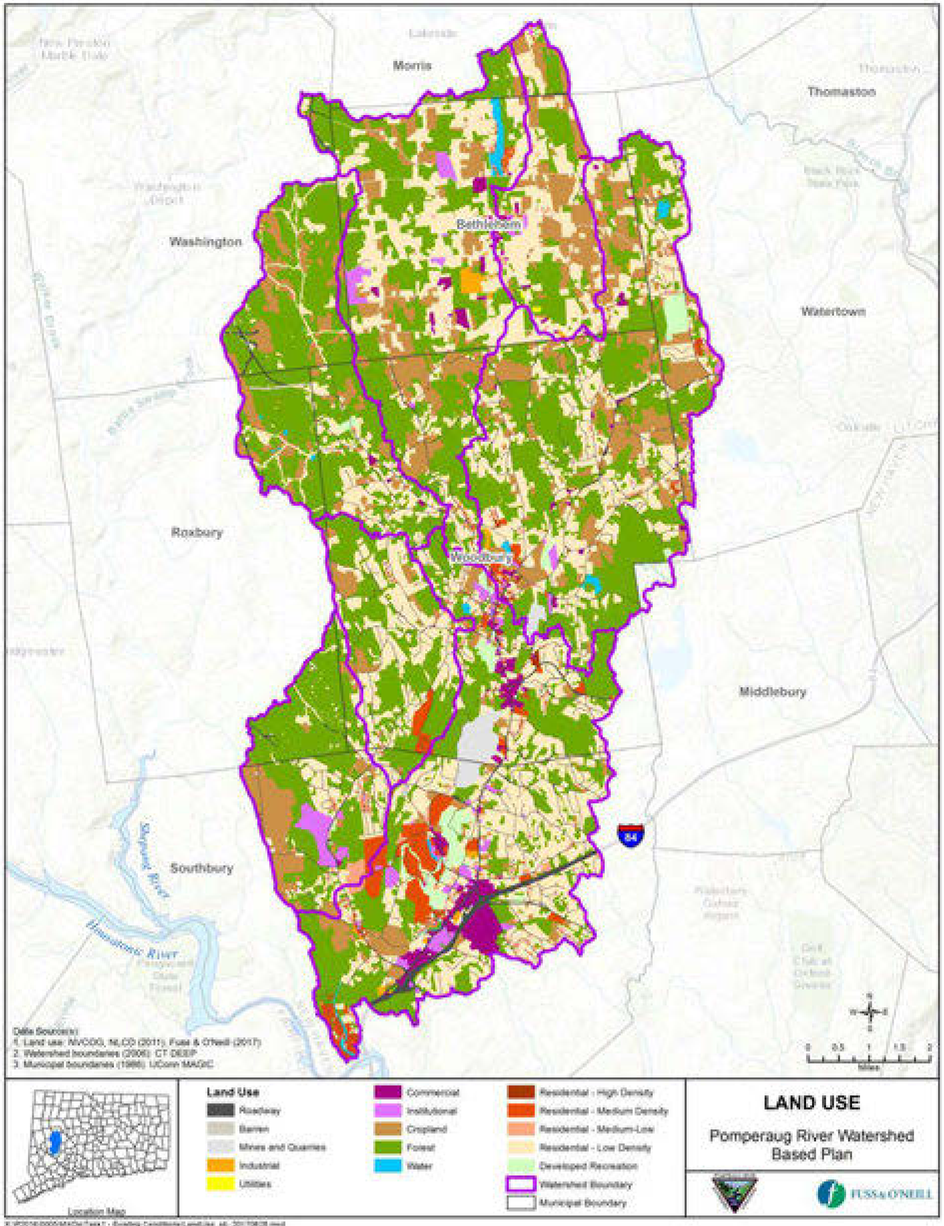
Mapping Updates

- Water Quality Impairments
  - Updated to show supporting and unassessed waters
  - CTDEEP ambient water quality monitoring locations added



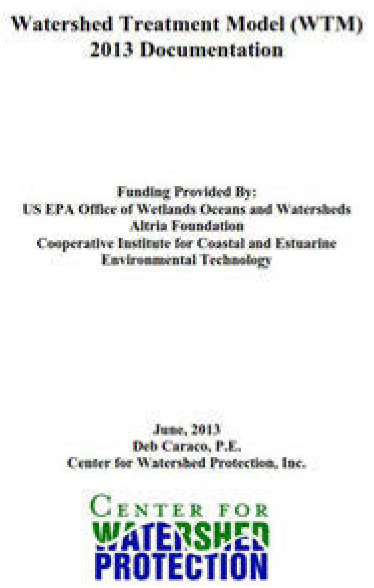
Pollutant Loading Model

- Watershed Treatment Model (WTM) – surface runoff pollutant loads
- Annual loadings of bacteria, nutrients, and sediment to surface waters
- Primary sources – land use
- Secondary sources – point sources, septic systems, illicit discharges, etc.



Model Inputs

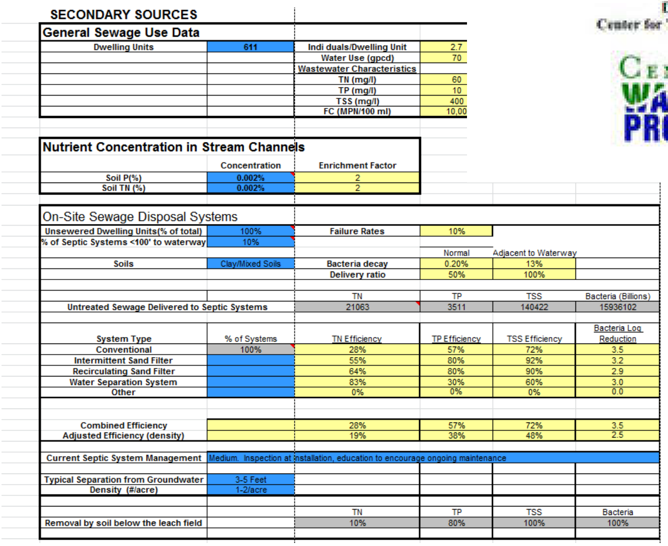
- Land Use and Impervious Cover
- Event Mean Concentrations (Developed Land Use)
- Export Coefficients (Rural Land Use)
- Annual Rainfall
- Hydrologic Soil Groups
- Runoff Coefficients
- Sewer Service Information
- Septic System Information
- Illicit Connections
- Road Sanding
- Livestock



Watershed Treatment Model (WTM)
2013 Documentation

Funding Provided By:
US EPA Office of Wetlands Oceans and Watersheds
Altria Foundation
Cooperative Institute for Coastal and Estuarine
Environmental Technology

June, 2013
Deb Caraco, P.E.
Center for Watershed Protection, Inc.



SECONDARY SOURCES

General Sewage Use Data

Dwelling Units	611	Indi duals/Dwelling Unit	2.7
		Water Use (gpcd)	70
		Wastewater Characteristics	
		TN (mg/l)	60
		TP (mg/l)	10
		TSS (mg/l)	400
		FC (MPN/100 ml)	10,00

Nutrient Concentration in Stream Channels

	Concentration	Enrichment Factor
Soil P(%)	0.002%	2
Soil TN (%)	0.002%	2

On-Site Sewage Disposal Systems

Unsewered Dwelling Units(% of total)	100%	Failure Rates	10%		
% of Septic Systems <100' to waterway	10%				
			Normal	Adjacent to Waterway	
Soils	Clay/Mixed Soils	Bacteria decay	0.20%	13%	
		Delivery ratio	50%	100%	
		TN	TP	TSS	Bacteria (Billions)
Untreated Sewage Delivered to Septic Systems		21063	3511	140422	15936102
System Type	% of Systems	TN Efficiency	TP Efficiency	TSS Efficiency	Bacteria Log Reduction
Conventional	100%	28%	57%	72%	3.5
Intermittent Sand Filter		55%	80%	92%	3.2
Recirculating Sand Filter		64%	80%	90%	2.9
Water Separation System		83%	30%	60%	3.0
Other		0%	0%	0%	0.0
Combined Efficiency		28%	57%	72%	3.5
Adjusted Efficiency (density)		19%	38%	48%	2.5
Current Septic System Management	Medium. Inspection at installation, education to encourage ongoing maintenance				
Typical Separation from Groundwater	3-5 Feet				
Density (#/acre)	1-2/acre				
		TN	TP	TSS	Bacteria
Removal by soil below the leach field		10%	80%	100%	100%

Event Mean Concentrations

- **Developed Land Use**

Land Use	WTM Default Values				Regional Values				Selected Values			
	TN	TP	TSS	FC	TN	TP	TSS	FC	TN	TP	TSS	FC
Low Density Residential	2.1	0.31	49	20,000	3.18	0.27	34	2,950	3.18	0.27	34	2,950
Medium Density Residential	2.1	0.31	49	20,000	3.5	0.41	49	12,360	3.5	0.41	49	12,360
High Density Residential	2.1	0.31	49	20,000	3.81	0.64	102	16,901	3.81	0.64	102	16,901
Highway	-	-	-	-	2.65	0.43	141	600	2.65	0.43	141	600
Commercial	2.1	0.22	43	20,000	1.85	0.15	44	9,306	1.85	0.15	44	9,306
Institutional	2.1	0.22	43	20,000	1.85	0.15	44	9,306	1.85	0.15	44	9,306
Industrial	2.2	0.25	81	20,000	4	0.11	42	1,467	4	0.11	42	1,467
Mining	-	-	-	-	1.18	0.15	94	300	1.18	0.15	94	300

Export Coefficients

- **Rural Land Use**

Land Use	WTM Default Values				Regional Values				Selected Values				Comments
	TN	TP	TSS	FC	TN	TP	TSS	FC	TN	TP	TSS	FC	
Forest	2.0	0.2	100	12	2.5	0.2	100	12	2.5	0.2	100	12	Selected regional values
Rural	4.6	0.7	100	39	-	-	-	-	4.6	0.7	100	39	Selected WTM Default values
Power Lines	4.6	0.7	100	39	-	-	-	-	4.6	0.7	100	39	Selected WTM Default values
Open Water	12.8	0.5	155	-	0.4 (2)	0.03 (2)	2 (2)	0.4 (2)	0.4	0.03	2	0.4	Selected regional values
Cropland	-	-	-	-	Pasture 1.9 (2) 7.7 (3) 5.6 (4) Row Crops 14.4 (3) 15.7 (4)	Pasture 0.1 (2) 1.3 (3) 0.5 (4) Row Crops 4.0 (3) 0.94 (4)	Pasture 47 (2) 591 (4) Row Crops 1997 (4)	Pasture 7 (2) Row Crops -	10	0.8	300	39	Selected TN, TP, and TSS based on regional sources for pasture and row crops; FC assumed same as Rural land use

Livestock Pollutant Source

- ## Export Coefficients

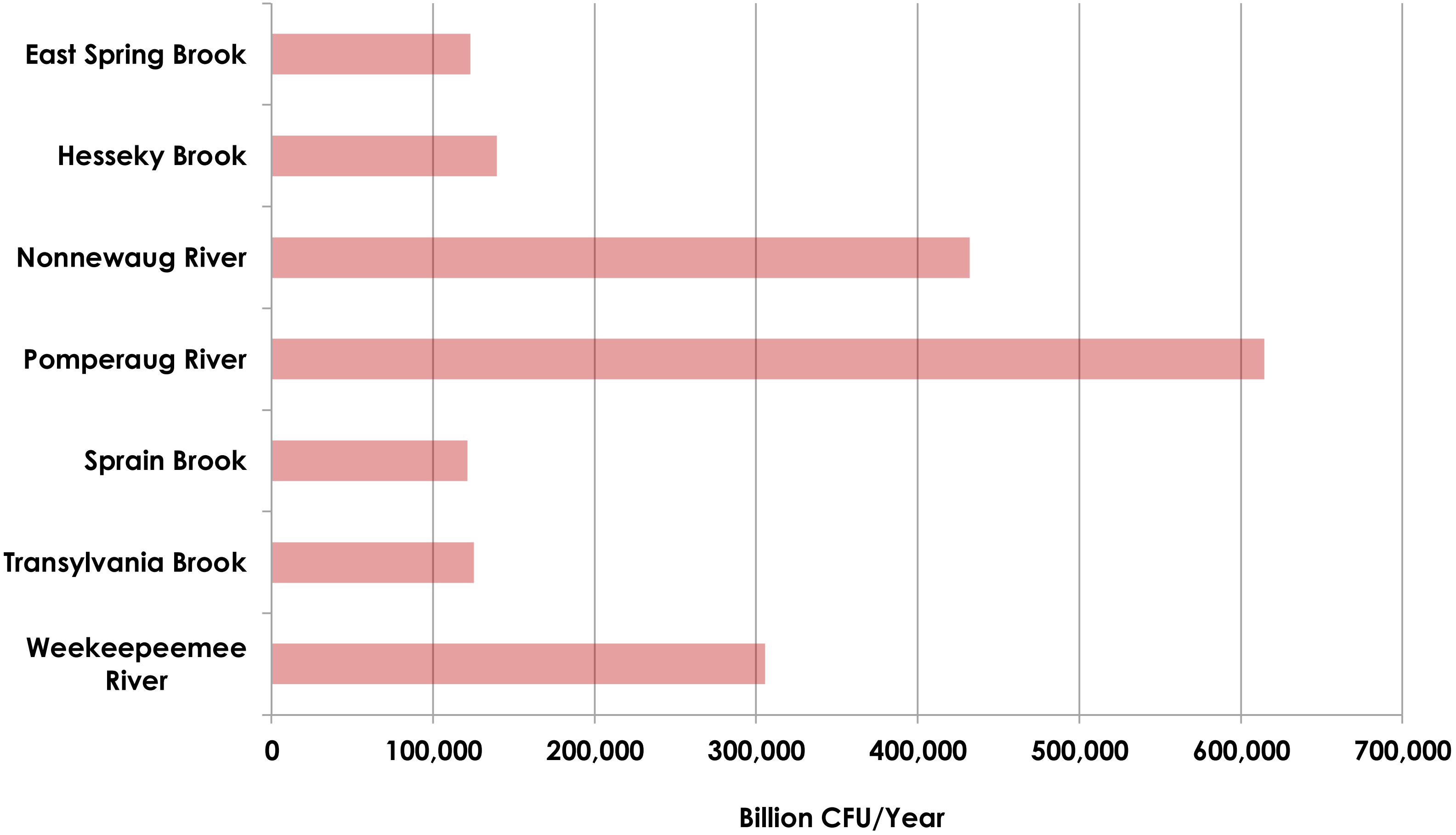
Livestock Type	Nitrogen[1] (lbs/animal/year)	Phosphorus[1] (lbs/animal/year)	E. coli (billion cfu/AU/year)
Cows	164	26	1,966
Horses	102	18	84
Sheep	18.5	3.2	7,165
Poultry	1.1	0.4	85

- ## Estimated Number of Livestock

Livestock Type	East Spring Brook	Hesseky Brook	Nonnewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Cows	20	175	450	100	15	40	150
Horses	60	40	50	100	15	25	40
Sheep	25	40	25	15	0	0	40
Poultry	30	75	50	50	250	25	50

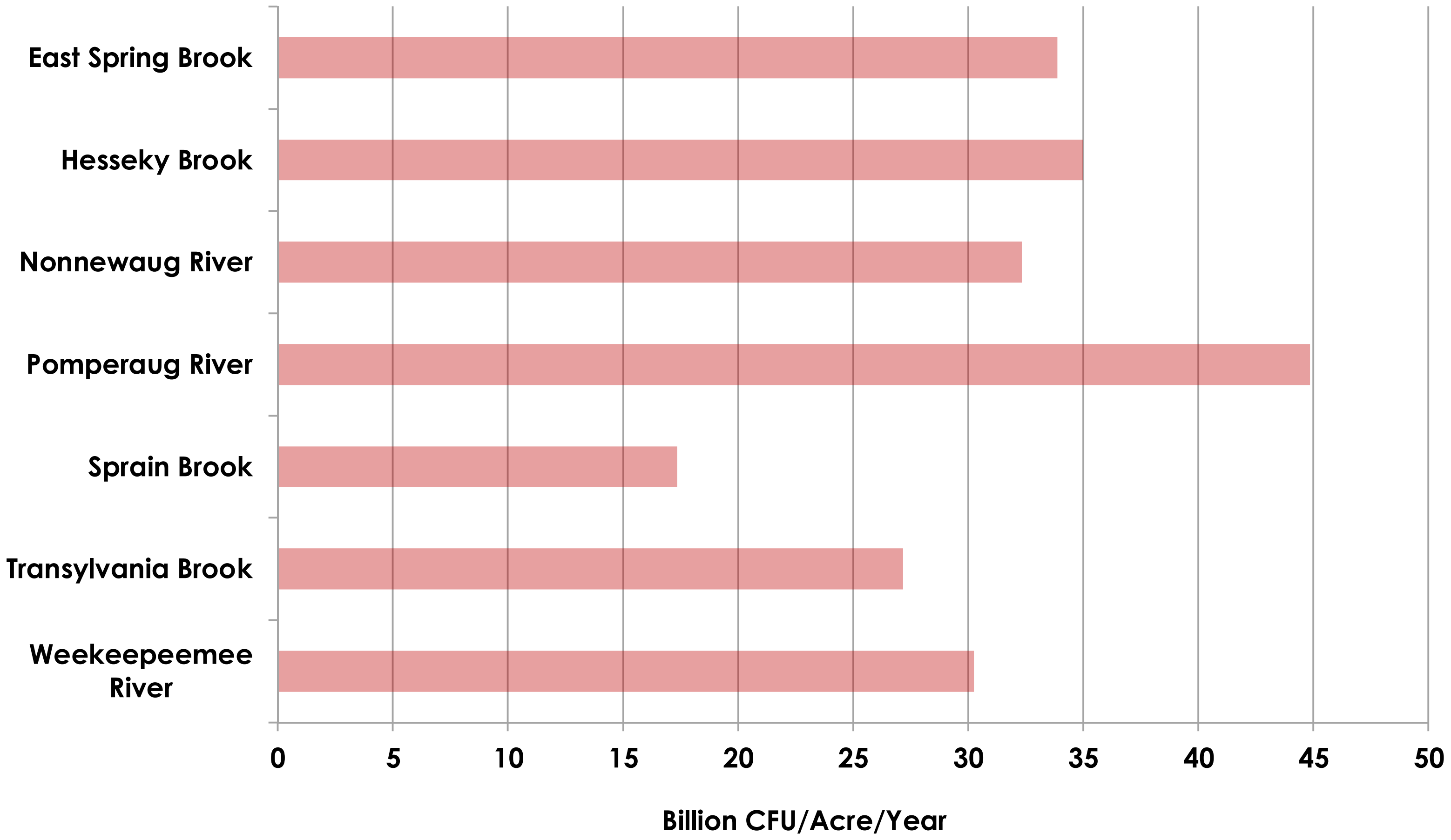
Model Results – Bacteria

- **Pollutant Loads**



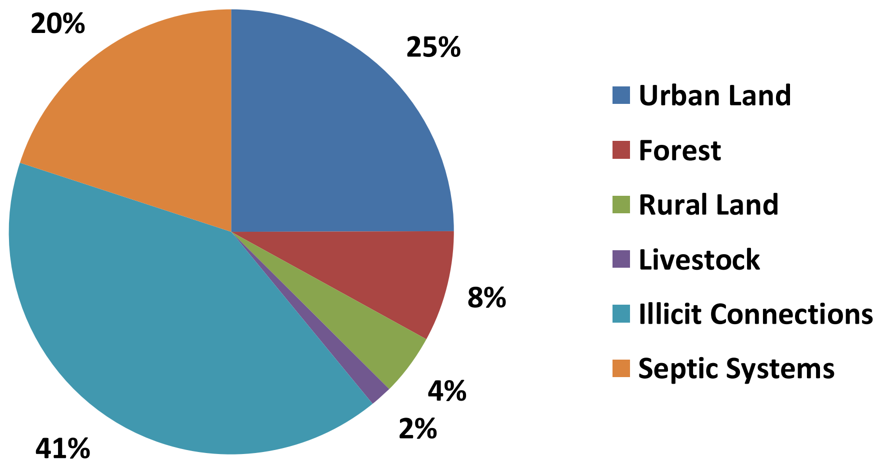
Model Results – Bacteria

- Pollutant Yields

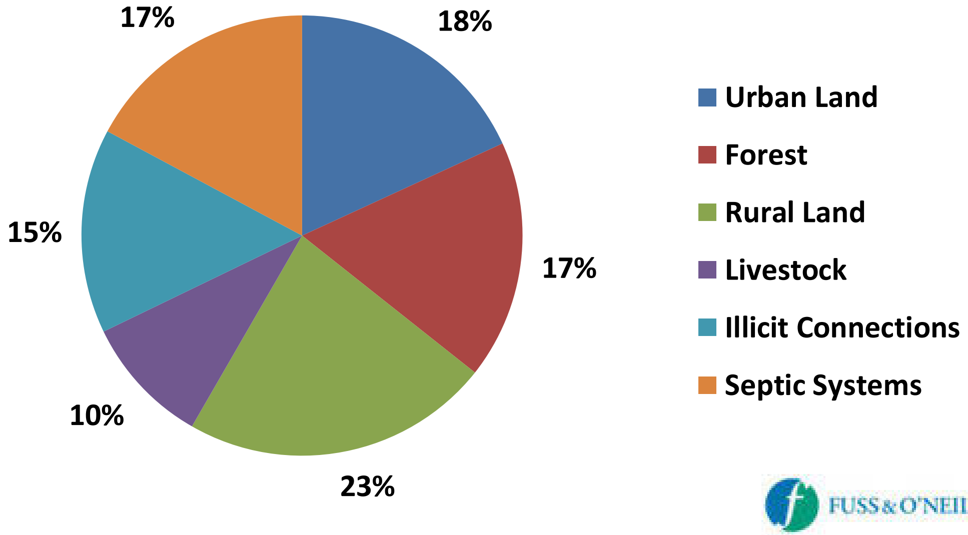


Relative Bacteria Sources

- Pomperaug River Subwatershed

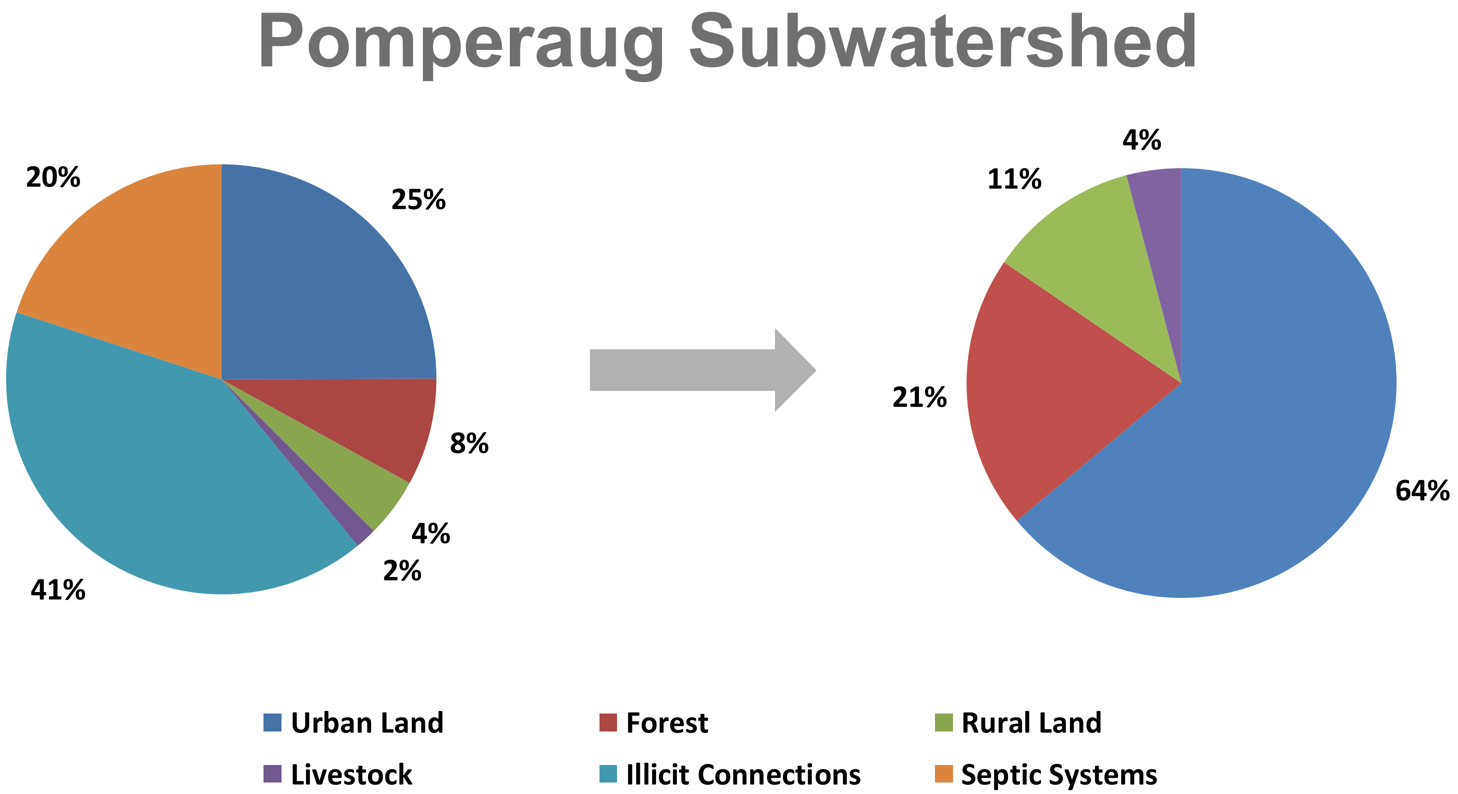


- Weekeepeemee River Subwatershed



Relative Bacteria Sources

- What if we could eliminate illicit discharges and septic system issues?



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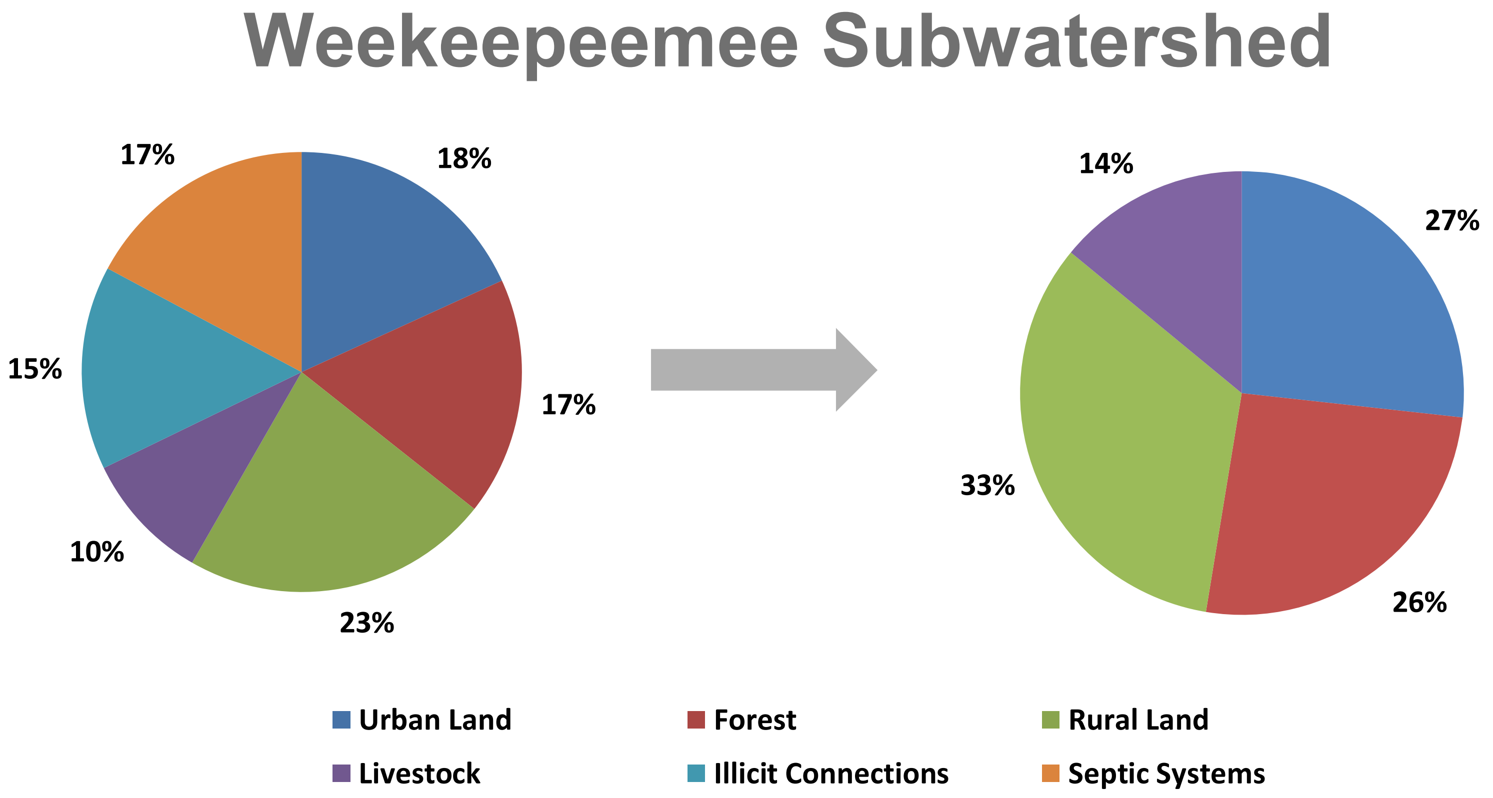

Visual Field Assessments

- Investigate suspected bacteria sources in areas with impairments
- Identify restoration, pollution prevention, and retrofit opportunities
- Standardized field protocols
  - Stream reaches
  - Neighborhoods
  - Hotspots

Pollution Hotspots/ Areas of Concern

- **Identified by LUC and PRWC**
- **Roughly 60 sites identified**
- **Potential bacteria sources**
  - Urban runoff
  - Agricultural land adjacent to streams
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  - Septic system issues
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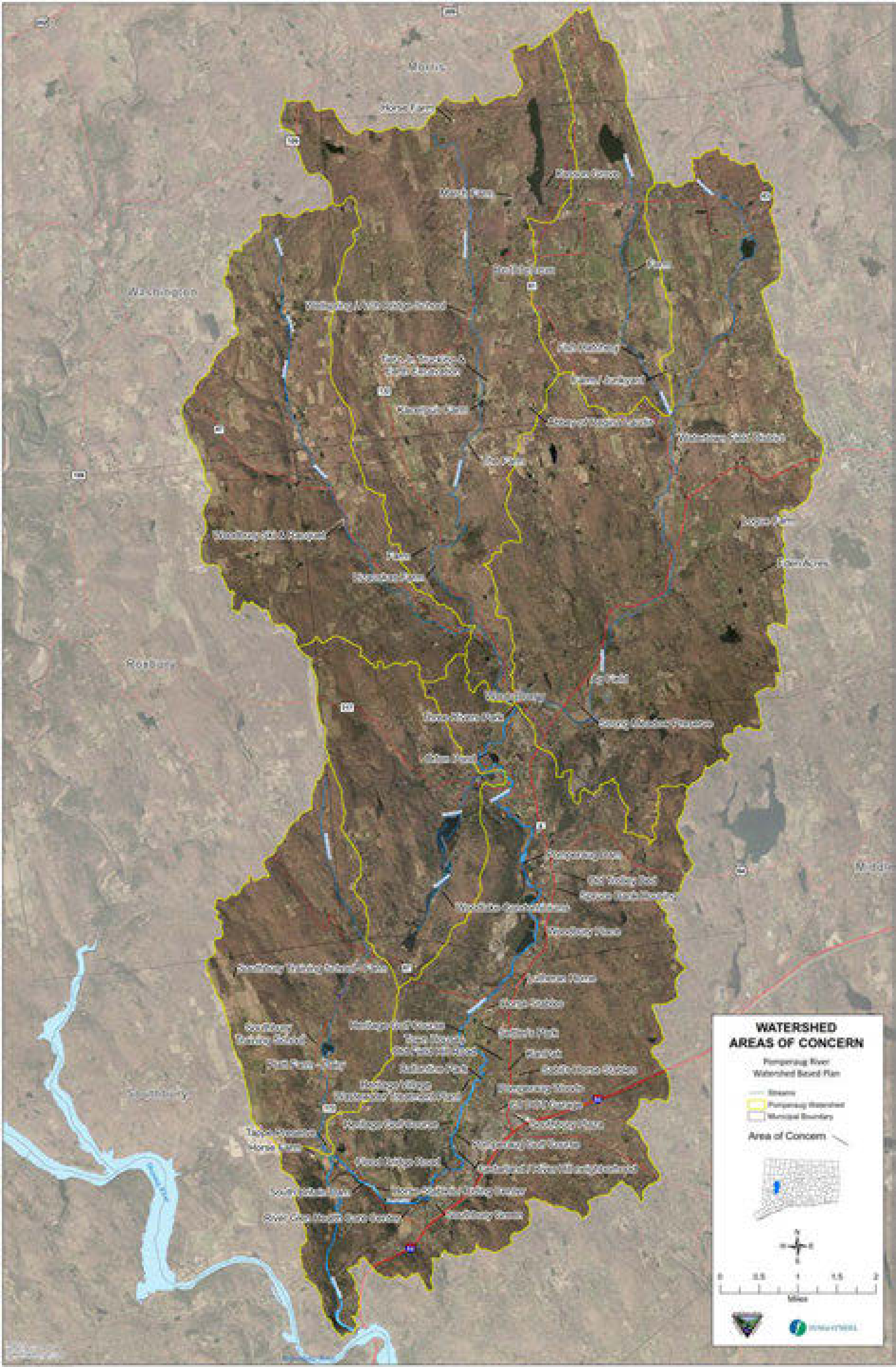
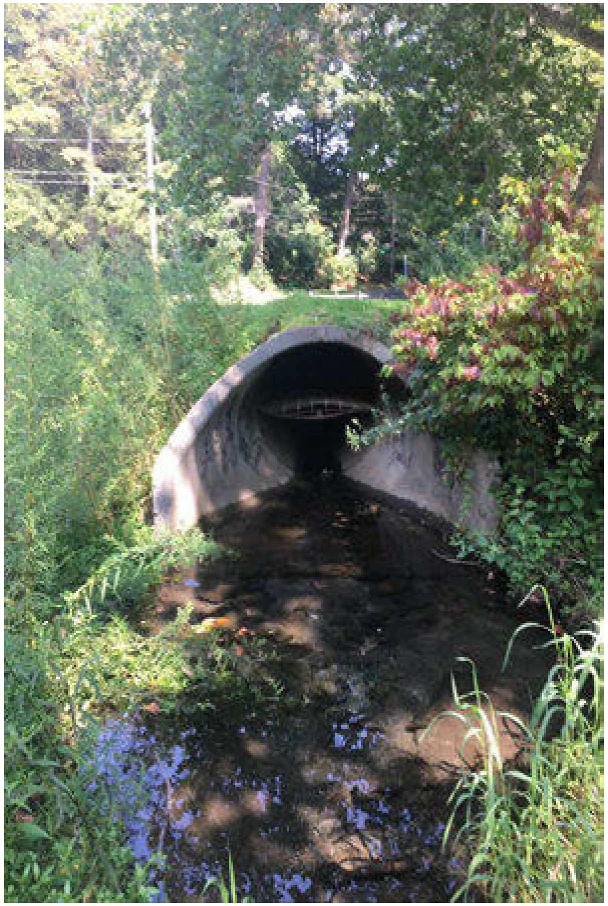


Reach Assessment Results

- **Pomperaug-01**
  - Potential sources
    - *Equestrian Center*
    - *Stormwater*

Reach Assessment Results

- **Pomperaug-03**
  - Potential sources
    - *Geese*
    - *Stormwater*
    - *WWTP*
    - *Septic*



Reach Assessment Results

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  - Runoff from pastures and Paddocks

Neighborhood Assessment Results

- **Berkshire Estates/Oakdale Manor**
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Neighborhood Assessment Results

- Heritage Village
  - Stormwater
  - WWTP
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- Stonecrest Farm
  - Manure piles
  - Front Paddock Area
  - Farm Pond

Hotspot Assessment Results

- **Stonecrest Farm**

Hotspot Assessment Results

- Logue Farms
  - Direct livestock access to tributaries
  - Buffer
  - Manure handling

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- Logue Farms
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Hotspot Assessment Results

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  - Dry weather flows

Best Management Practices (BMPs)

- Filter berms
- Increased riparian buffer
- Structural stormwater BMPs
  - Infiltration systems
  - Bioretention systems
  - Underground solutions
- Non-structural BMPs
  - Goose abatement
  - Septic system management and outreach
  - Illicit discharge detection and elimination (IDDE)
  - Manure/nutrient management
  - Land use regulatory controls

Illicit Discharge Detection and Elimination (IDDE)

- **Requirements for MS4 regulated communities**
- **Encourage IDDE program implementation outside of regulated areas and in unregulated communities**
- **“Priority Areas” should include discharges to impaired segments**

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- Target equestrian facilities and livestock owners
  - Many likely doing a good job but could be better
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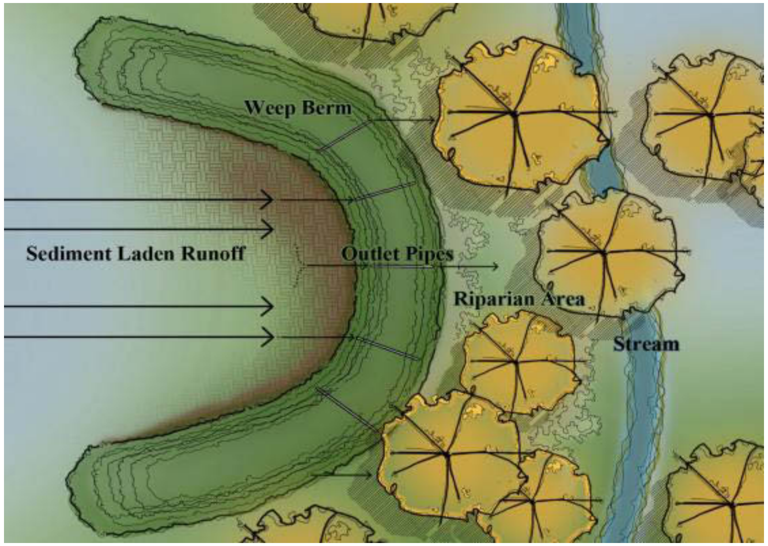
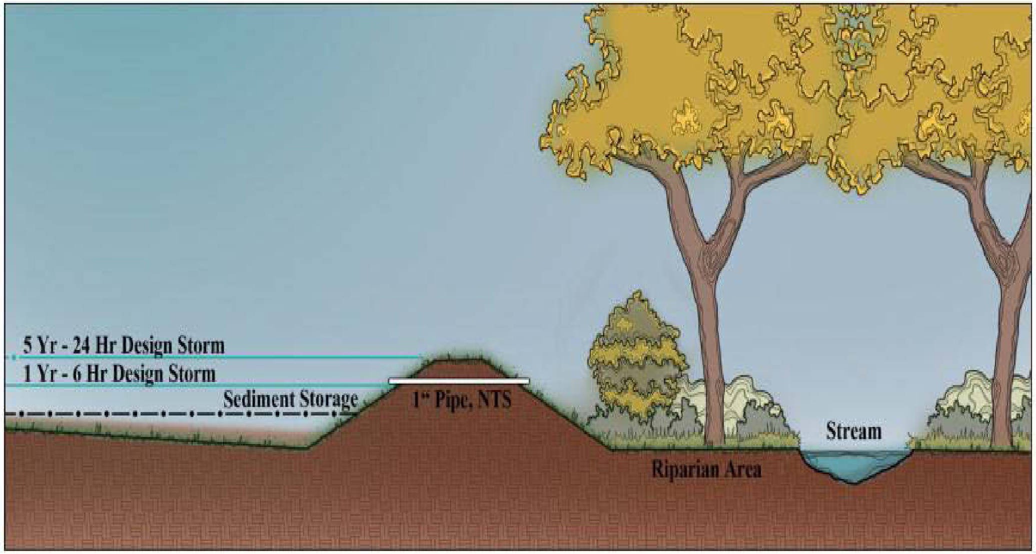
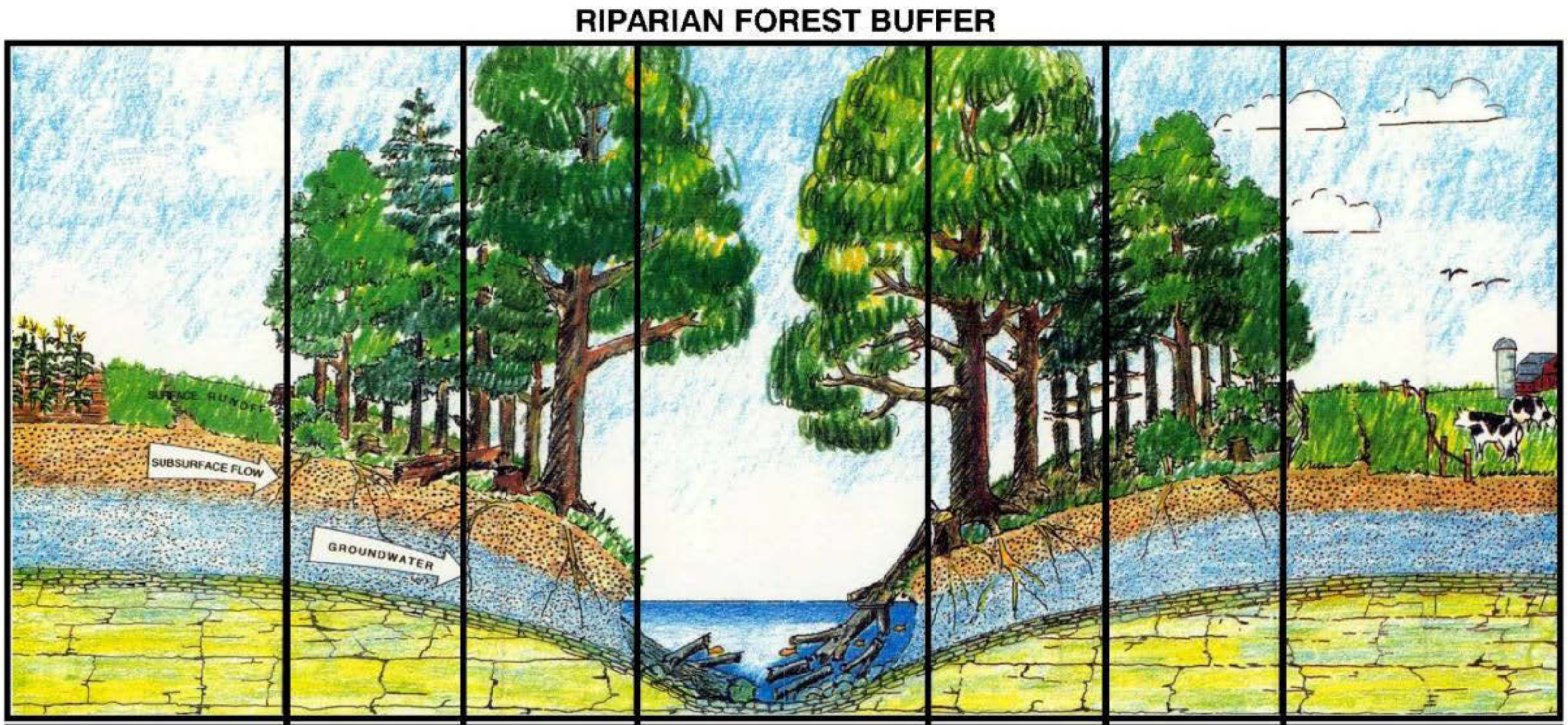




Increased Riparian Buffer



	Minimum ← 50 - 100' →	Minimum ← 50' →		Minimum ← 50' →	Minimum ← 50 - 100' →	
Concentrated flow along with accelerated erosion and sedimentation is controlled in this area.	**Zone 2** **Managed Forest** **Trees and Shrubs** Removes, transforms or stores sediment, nutrients and other pollutants. Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through rapid tree growth.	**Zone 1** **Undisturbed Forest** **Trees** Creates a stable ecosystem adjacent to the water's edge, provides soil/water contact area to facilitate nutrient buffering processes, and provides shade to moderate and stabilize water temperature.	**Streambottom** Debris dams hold detritus, nutrients and other pollutants for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.	**Zone 1** **Undisturbed Forest** **Trees** Stabilizes stream banks and reduces flooding impacts by providing a wider, more natural stream channel. Tree removal is not permitted in this area.	**Zone 2** **Managed Forest** **Trees and Shrubs** Provides long term storage of nutrients in the biomass of trees and shrubs and economic benefits to the landowner if the forest resource is sustainably harvested.	Runoff enters Zone 2 as sheet flow or shallow concentrated flow over natural terrains.

Adapted from Welsch (*Riparian*)

Structural Stormwater BMPs

- Permeable Pavers

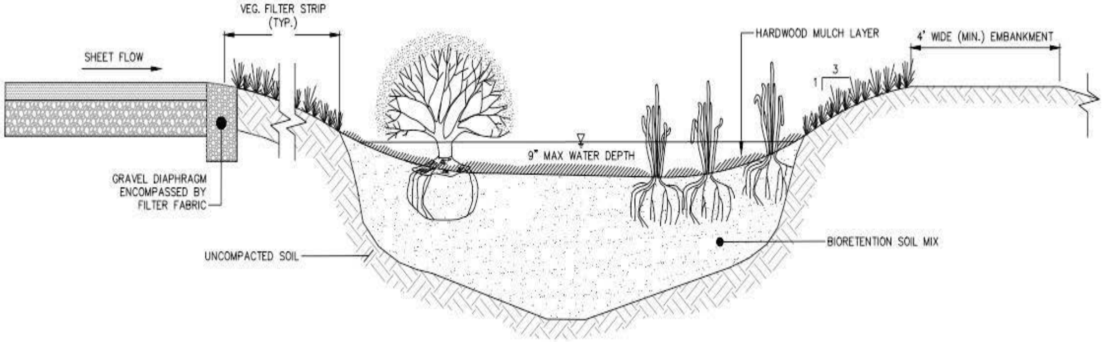
Slide 36

EM2 Somewhere in these stormwater BMP slides, discuss the potential for stormwater retrofits at Southbury Plaza (recall our discussion with Carol and Chris?) and Heritage Village.

Erik Mas, 10/4/2017

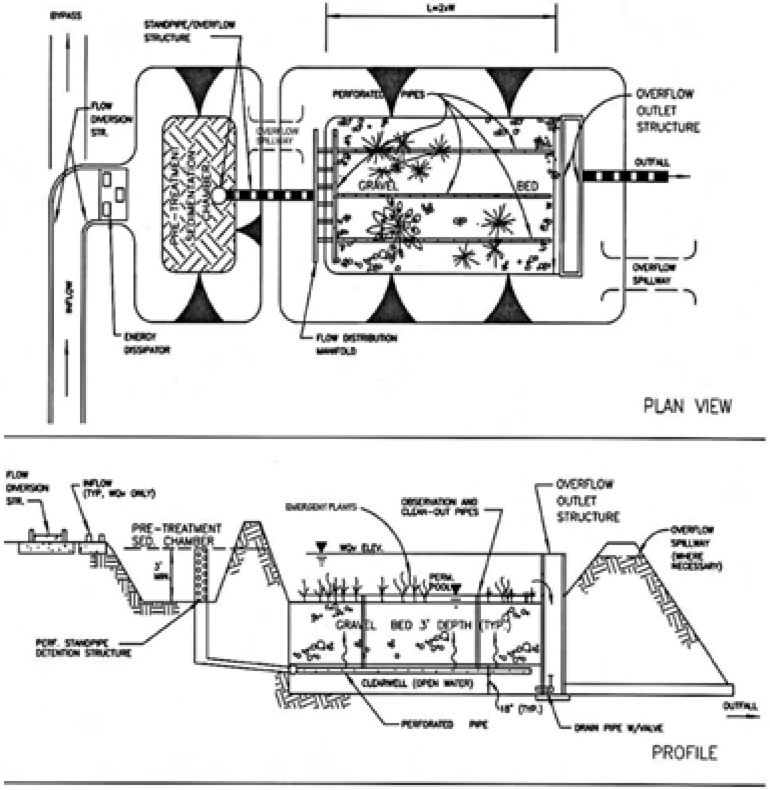
Structural Stormwater BMPs

- **Bioretention/Infiltration**



Structural Stormwater BMPs

- **WVTS**



Structural Stormwater BMPs

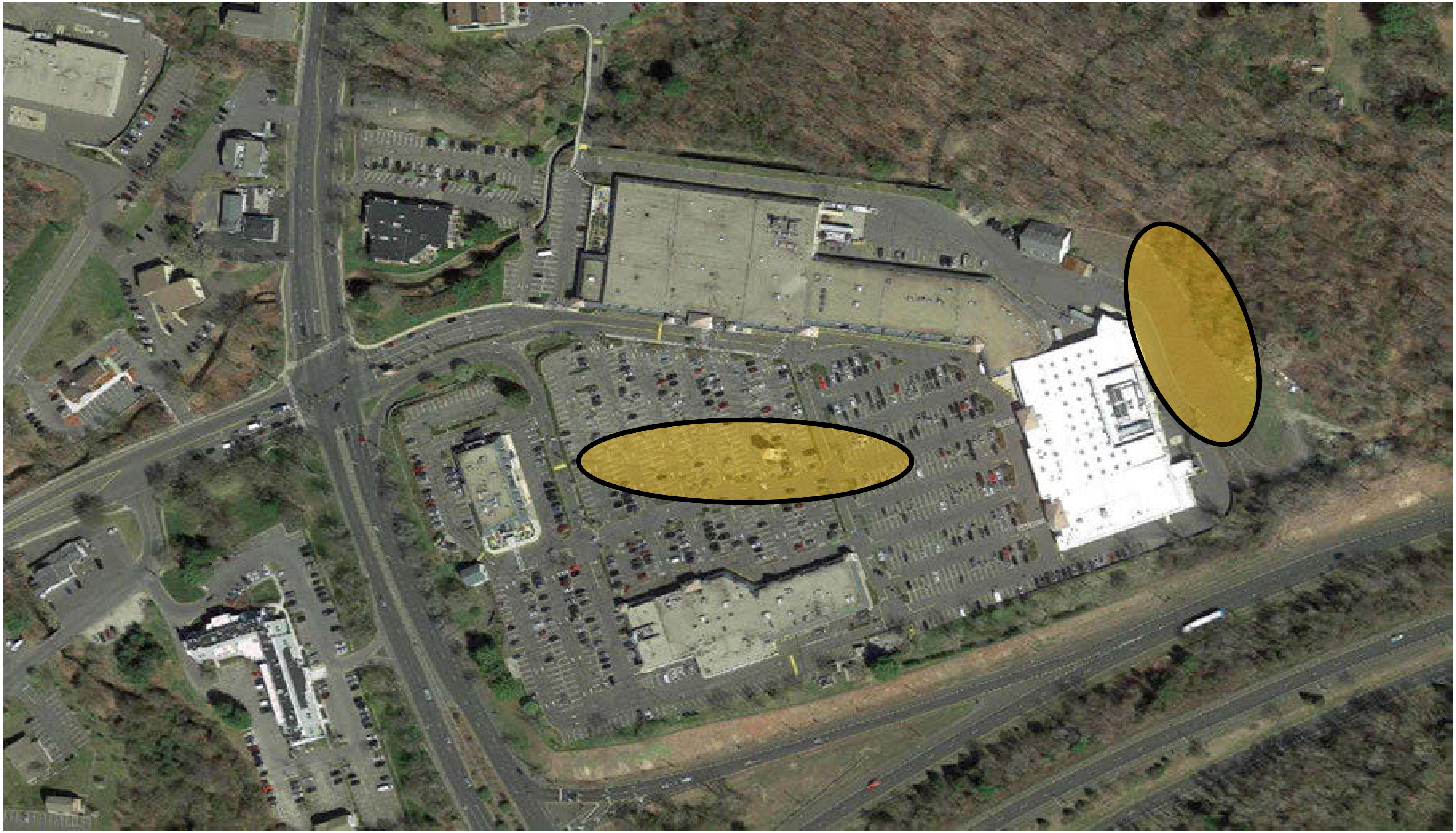
- Underground solutions
  - Parking lots
  - Public right-of-way

Structural BMP Opportunities

- **Southbury Plaza**
- **Heritage Village**

Southbury Plaza

Southbury Plaza cont.



Heritage Village

Heritage Village cont.

Next Steps

- BMP site selection and prioritization
- BMP concept designs
- Public meetings
- Draft and final watershed plan

Discussion/Questions

Pomperaug River Watershed Coalition
Land Use Committee Meeting
June 12, 2018 from 3:00 PM – 5:00 PM
Shove Building, Municipal Office Complex, Woodbury

AGENDA

1. Revisit pollutant loading model results

2. Revisit field assessment survey findings

3. Revisit general recommendations for structural and non-structural BMPs

4. Review BMP Matrix for site specific BMP recommendations
    a. Add/subtract and make corrections to list

5. Prioritize projects/sites from BMP matrix for conceptual project design development
    a. Select 5 large projects for conceptual project design development
    b. Select 10 small projects for conceptual project design development

6. Review and revise draft outline for Watershed Based Plan document

7. Next steps

Pomperaug River Watershed Coalition
Land Use Committee Meeting
June 12, 2018 from 3:00 PM – 5:00 PM
Shove Building, Municipal Office Complex, Woodbury

Meeting Notes

Attendees: Neil Lustig, Amy Fisher, Erik Mas, Susan Peterson, Chris Wood, Maryellen Edwards, Janel Chap, Carol Haskins, Norma Carey, Curt Jones, Gail McTaggart, Aaron Budris

1. **Revisit pollutant loading model results**
   Erik Mas (Fuss & O'Neill) presented slides previously shared at the Land Use Committee (LUC) meeting in October to refresh the committee's memory of the pollutant load modeling results. He began by sharing the water quality impairment map that highlights the locations of the stream reaches that are listed as impaired for elevated levels of bacteria, which are the focus of the Watershed Based Plan development. Viewing the pie charts of the relative sources of bacteria loading model, the following land cover types were noted as the main contributing sources in their respective subwatershed areas:
   A. Pomperaug Subwatershed
      - Primary: Runoff from the urbanized area (i.e. stormwater input)
      - Secondary: Illicit Discharges (not necessarily a large number of these discharges, but a few could count account for a large contribution of bacteria from residential, commercial, or other land uses).
      - Priority Area for Load Reduction: Mitigating stormwater runoff through implementation of LID and BMP practices on new and redevelopment projects; conducting illicit discharge detection and elimination surveys (requirement of MS4 permit in Southbury and Woodbury)

   B. Weekeepeemee Subwatershed – almost the inverse of the Pomperaug as the relative bacteria sources go
      - Primary: Rural land cover and livestock
      - Secondary: Urban and forested land cover areas
      - Priority Areas for Load Reduction: Manage for agricultural inputs associated with livestock near waterways

   C. Transylvania Subwatershed
      - Modeled bacteria inputs are a mix of those reflected in the Pomperaug and Weekeepeemee Subwatersheds and the reductions priorities should be a mix of urban and rural
      - Question raised about the geese population on Southbury Training School site and their contribution to the bacteria load

2. **Revisit field assessment survey findings**

   Erik continued his slide presentation to highlight the findings of the Field Assessment Surveys, showing slides shared previously at the October 2017 meeting. He reminded the committee that about 35 sites were visited of the list of sixty or more identified as potential areas of concern by the Land Use Committee. The sites visited represented a mix of public and private residential, municipal, agricultural, and commercial activities. The field team looked at equestrian facilities, farms with other livestock, urban and rural residential areas, roads, storm drains, paddocks, manure management practices, and more. The field investigations were intended to serve as a way to ground-truth the types of potential concerns and to identify areas where LID retrofits and other BMPs could potentially be implemented.

3. **Revisit general recommendations for structural and non-structural BMPs**

   Based on the observations made during the field assessment surveys, Erik's team generated a broad list of BMP types that may be suitable for reducing bacteria inputs to the Pomperaug and Weekeepeemee Rivers and Transylvania Brook.

   A. BMPs include filter berms, increased buffer widths, structural stormwater BMPs (infiltration systems, bio-retention); non-structural BMPs (education, geese deterrents); livestock fencing, and more with the main focus generally being practices that will infiltrate runoff into the soil for natural filtration. Additional notes for specific BMP types are as follows:
      - Stormwater reductions – already focus via MS4 – IDDE (big bang for the buck)
      - Manure Management – generally cost effective, but could be challenging in working with private landowners
      - Filter Berms – structural element to filter overland flow around paddocks and manure storage areas (materials, soils w/ amendments)
      - Riparian Buffers – farms especially; barrier to livestock access to water
      - Permeable Pavers – low traffic, low volume overflow parking
      - Bioretention – permeable soils make Pomp Watershed generally viable for rain gardens, linear bioswales, infiltration and/or underdrain systems
      - WVTS – Wet vegetated treatment systems
      - Underground solutions – parking lots and public right of ways

   B. Sites highlighted as opportunities for structural BMP retrofits included –
      - Southbury Plaza – areas for infiltration, need to design around existing septic systems below parking lot
      - Main Street South – Exit 15 end – office buildings and retail areas
      - Main Street South – Exit 14 end – town offices, Southbury Green, Sacred Heart Church
      - Heritage Village – potential parking areas and roadway areas

4. **Review BMP Matrix for site specific BMP recommendations; add/subtract and make corrections to list**

   Erik passed out copies of the BMP Matrix along with maps of the subwatershed areas showing the potential areas of concern for reference. He walked the committee through the data captured in the matrix and how it is presented while noting the breakdown of subwatersheds, the area of concern, notes regarding the potential for bacteria input, potential BMPs for the specific site along with associated project scale, relative costs, maintenance requirements, whether a field visit was conducted, and a recommendation if a BMP conceptual plan should be developed for that site.

   In reviewing this document, the committee flagged a key question related to the datasets and thresholds used to identify the impaired stream segments and how that factors into understanding potential bacteria sources contributing to those stream segments. In the discussion that followed, the committee recognized the limitation of the dataset and that further temporal and spatial data collection is needed to refine our understanding of the extent of the impaired areas and that this is something that should be included among the non-structural BMP recommendations in the draft Watershed Based Plan. Carol noted that she would follow-up with CT DEEP's Monitoring & Assessment Division staff to learn more about the scope of data needed to have an impaired stream segment removed from EPA' 303(d) impaired waters list (established based on finding of DEEP's monitoring and assessment work).

   A couple of questions were raised about the inclusion of a couple of sites that have already made modifications that would alleviate bacteria inputs. These included Pomperaug Woods having connected to the Heritage Village Wastewater Treatment Plant and Wellspring installing a new septic system. The committee was asked to look carefully through the list to see if there are other sites that should be taken out and to share that feedback with Carol by June 20, 2018. Similarly, are there any sites that should be added to the list?

   In regards to residential septic concerns in certain neighborhoods, we recognized that staffing availability of the local health department currently precludes neighborhood-wide track down surveys to identify specific instances of failure based on unsolicited reports. We also recognized that seeking funding for additional staffing or interns to aide in this type of activity could be considered as a non-structural BMP recommendation to include in the WBP.

   A question was also raised regarding the facility discharge from the Heritage Village Wastewater Treatment Plant as it relates to the volume of wastewater they are treating compared to their overall capacity. Carol seemed to recall their influent volume is only about half of their full capacity of 750,000 gallons per day. As for the quality of the effluent, Erik noted his team did use the plants quarterly reporting data submitted to DEEP in the pollutant loading model. Thus, that wedge of the pie in the relative bacteria sources chart reflects the actual discharge from the plant.

In consideration for manure management practices, Amy suggested that livestock fencing and buffer practices be used for keeping livestock away from stream areas if that is a component of the bacteria concern. She noted the strict technical guidelines NRCS has for other manure containment measures when funded through their agency. Amy also noted that her program is non-regulatory in nature and focuses heavily on sharing innovated practices and providing technical assistance to help farmers implement BMPs; but again underscored that certain programs and funding mechanisms through the agency have strict technical guidelines for certain BMPs. This lead the LUC to consider more educational outreach based approaches for working with smaller farming operations (hobby farms) on topics of manure management and livestock containment as a non-structural BMP recommendation for inclusion in the WBP.

5. **Prioritize projects/sites from BMP matrix for conceptual project design development**

   Taking the above discussion into consideration, the committee members were asked to more closely review the BMP matrix and to provide input back to Carol by June 20, 2018. PRWC is looking for input specific to:

   - verification (addition / subtraction) of sites on the list
   - flagging sites deemed as "low-hanging fruit" for BMP implementation
     - basis of project scale and/or willingness of landowner to support a project
     - basis of project type; ability to replicate at other sites
   - Goal is to collectively select 5 large projects and 10 small projects for conceptual project design and then to identify approximate project cost and potential funding sources and a timeline for implementation.

6. **Review and revise draft outline for Watershed Based Plan document**

   Erik provided a draft outline for the Watershed Based Plan. Upon review, committee suggestions were:

   - Include discussion of the limited datasets that were used in establishing the "impaired" rankings in the Introduction section.
   - Include examples of sites where BMPs and LID practices have already been implemented in the watershed
   - Include a glossary of acronyms and definitions of technical terms
   - Include additional monitoring needs within the Management Recommendations section
   - Call out / reference the EPA's required 9-elements within the table of contents to ease DEEP and EPA review and approval of the document

7. **Next steps**

   A. Carol will collect LUC input on BMP prioritization and draft outline for the Watershed Based Plan. Please share input with Carol by Wednesday June 20, 2018.

   B. Fuss & O'Neill will then begin drafting conceptual BMP plans

   C. In the meantime, Fuss & O'Neill will also begin drafting sections of the Watershed Based Plan document

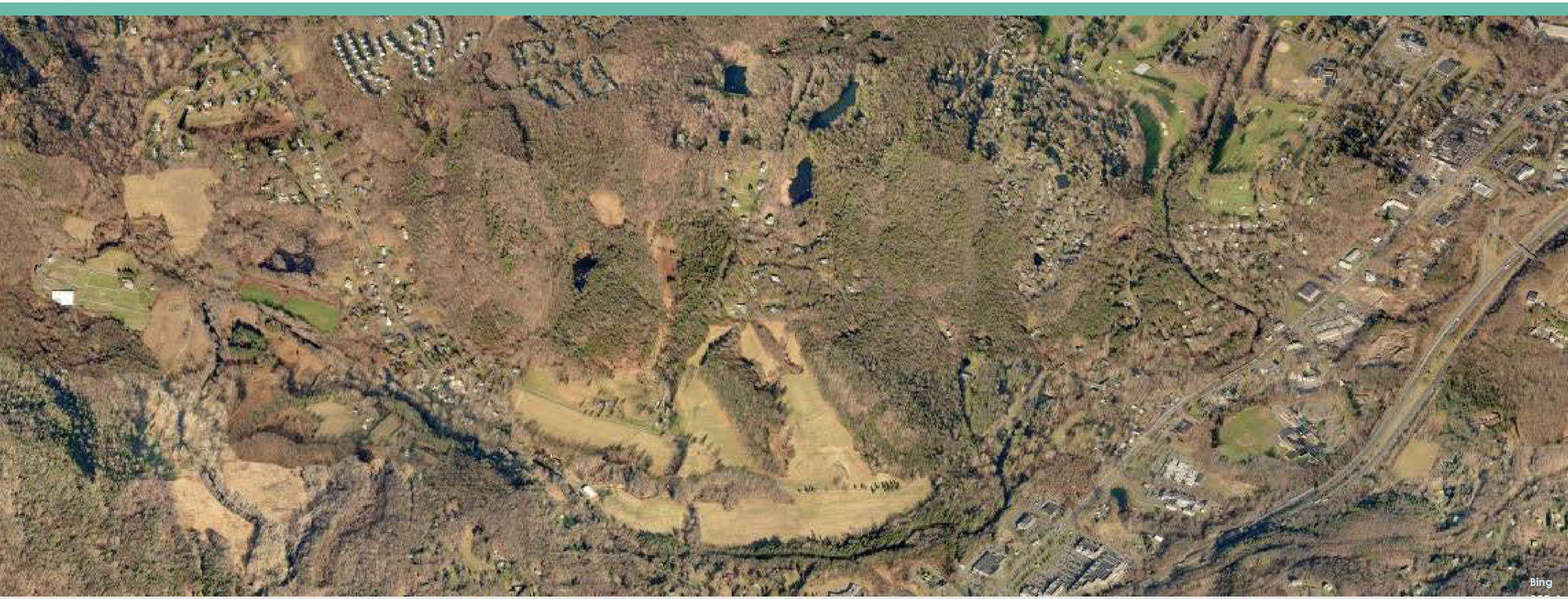
D. Public information sessions still need to be held in Southbury, Woodbury, and Bethlehem to capture community input. Timing = July
    a. After the meeting, Carol and Erik identified July 18 & 19 as dates for these sessions pending availability of meeting space.

E. After the draft plan is completed and reviewed, a final presentation of the Watershed Based Plan will be held somewhere central in the watershed. Timing = August

F. After the meeting, Carol and Erik identified August 15 or August 22 as possible dates for the final presentation pending availability of meeting space and completeness of the Plan.

G. The Final Draft of the Watershed Based Plan needs to be submitted by August 31 to ensure adequate time for DEEP and EPA review/approval of the document before the grant contract expires.

FUSS & O'NEILL



PRWC Land Use Committee Meeting

Pomperaug River Watershed Based Plan

June 12, 2018

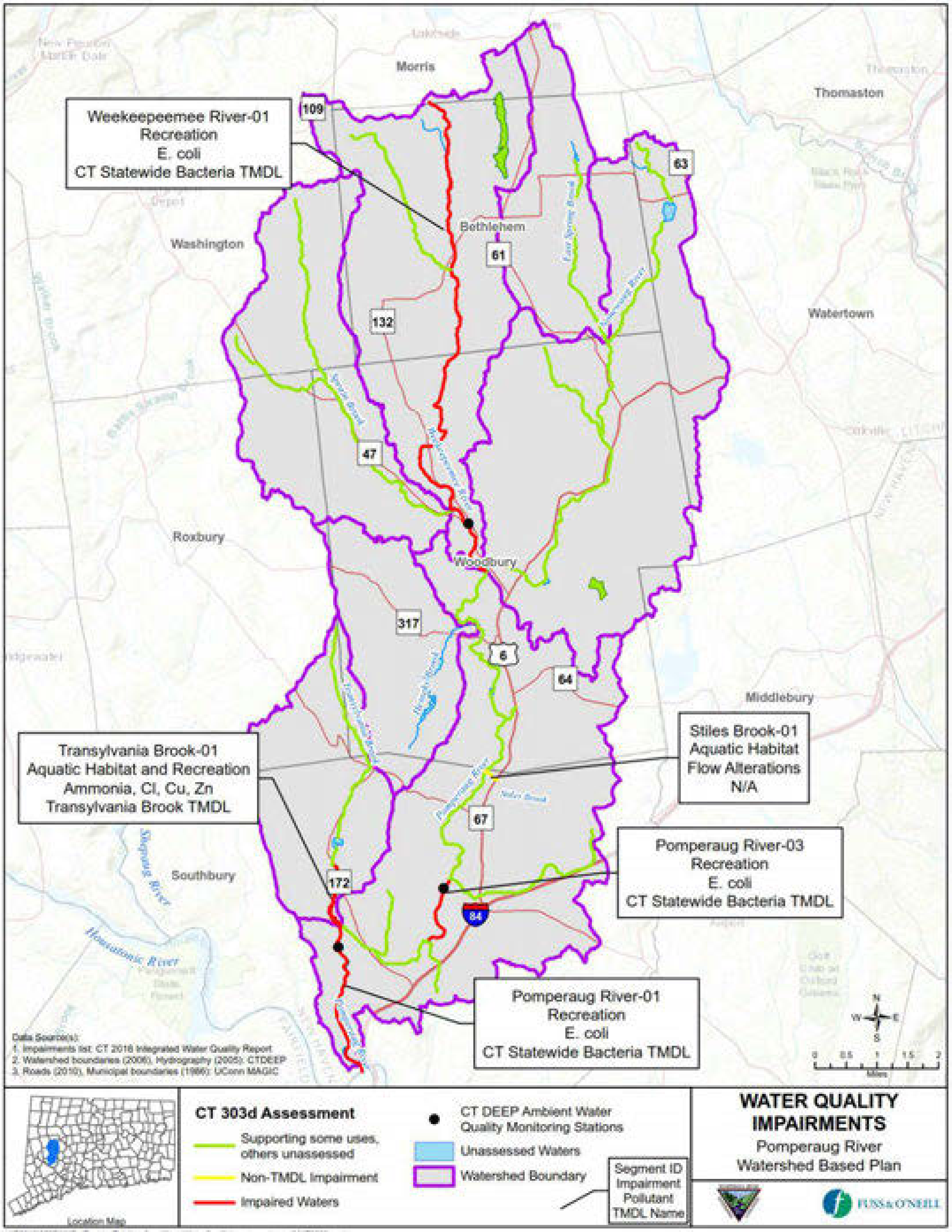
POMPERAUG RIVER WATERSHED COALITION

Meeting Agenda

1. Introductions
2. Summary of Findings from Previous LUC Meeting
   - Pollutant Loading Model
   - Field Assessments and Potential BMPs
3. BMP Project Selection
4. Next Steps
5. Discussion

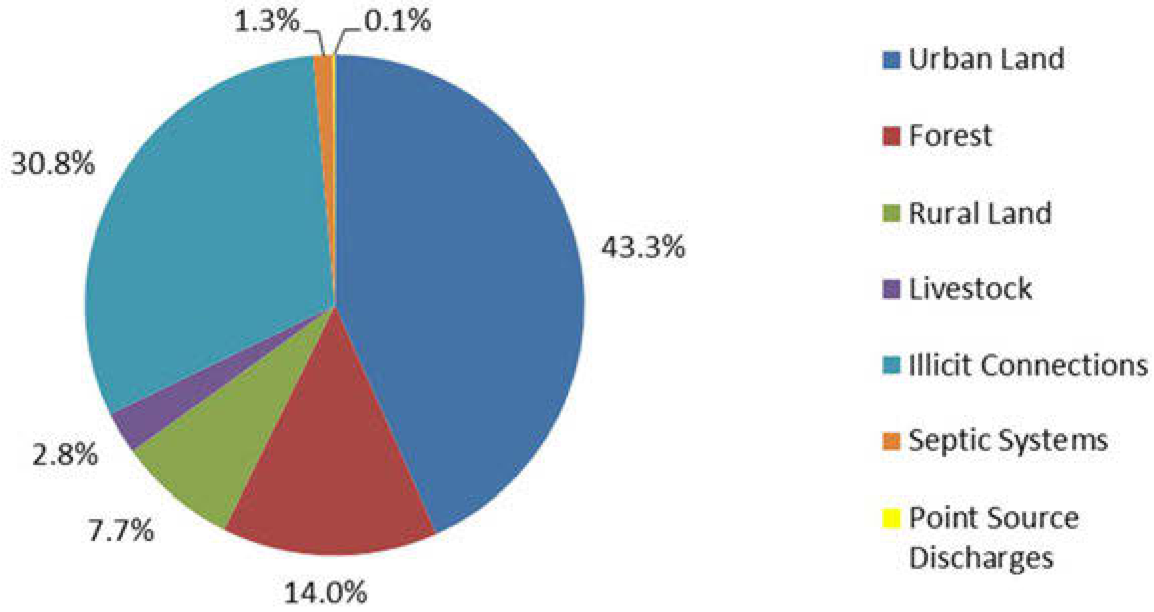
Impairments

- Pomperaug River
- Weekeepeemee River
- Transylvania Brook



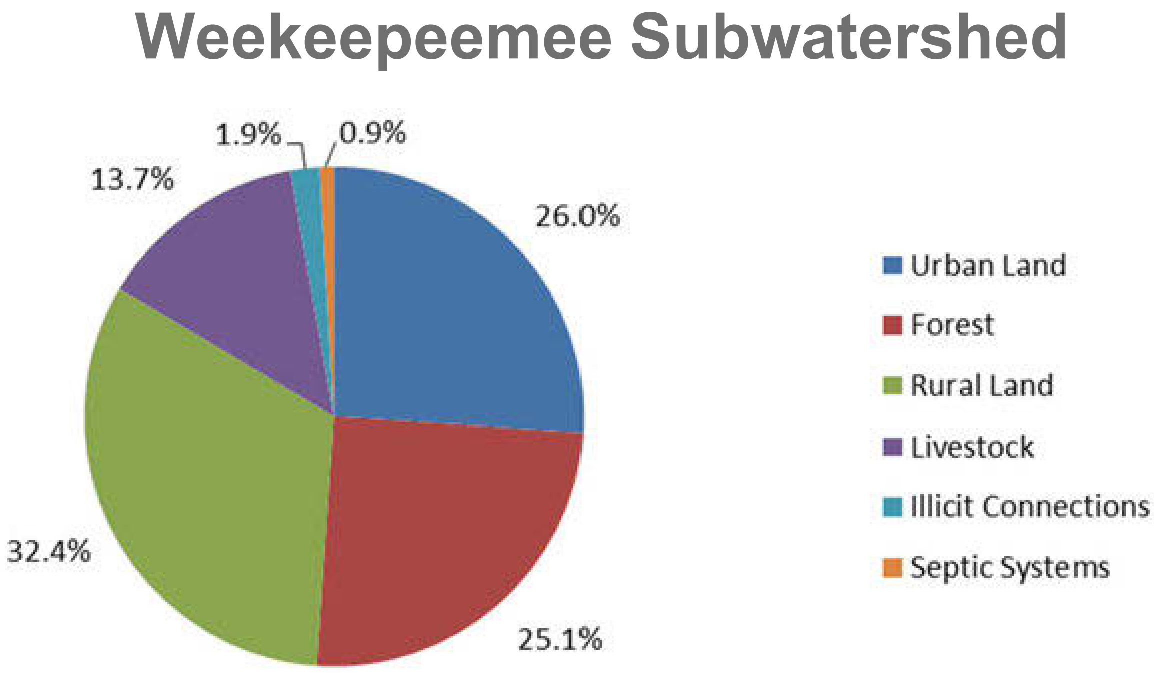
Modeled Relative Bacteria Sources

Pomperaug Subwatershed



- Stormwater runoff from developed land
- Illicit connections from residential and commercial land use
- Source controls, structural stormwater BMPs, education and outreach, illicit discharge detection and elimination

Modeled Relative Bacteria Sources



- Stormwater runoff from agricultural land use and some developed land use
- Agricultural BMPs (livestock and manure management)

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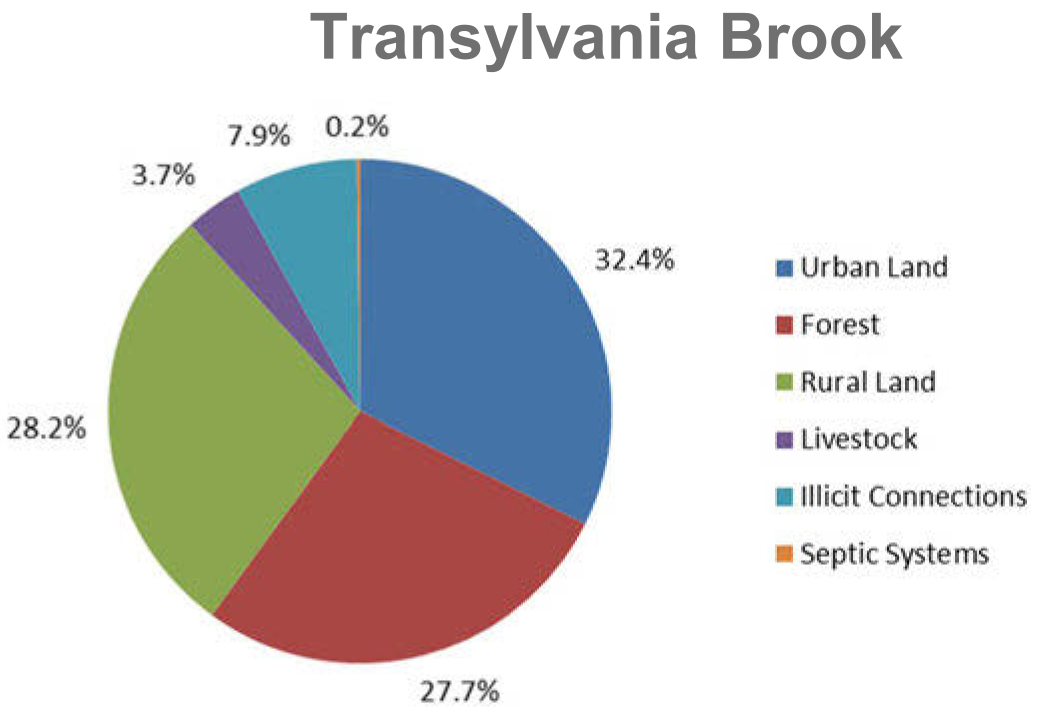

- Stormwater runoff from mix of agricultural and developed land uses

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- Investigate suspected bacteria sources in areas with impairments
- Identify restoration, pollution prevention, and retrofit opportunities
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  - Stream reaches
  - Neighborhoods
  - Hotspots

Pollution Hotspots/ Areas of Concern

- Identified by LUC and PRWC
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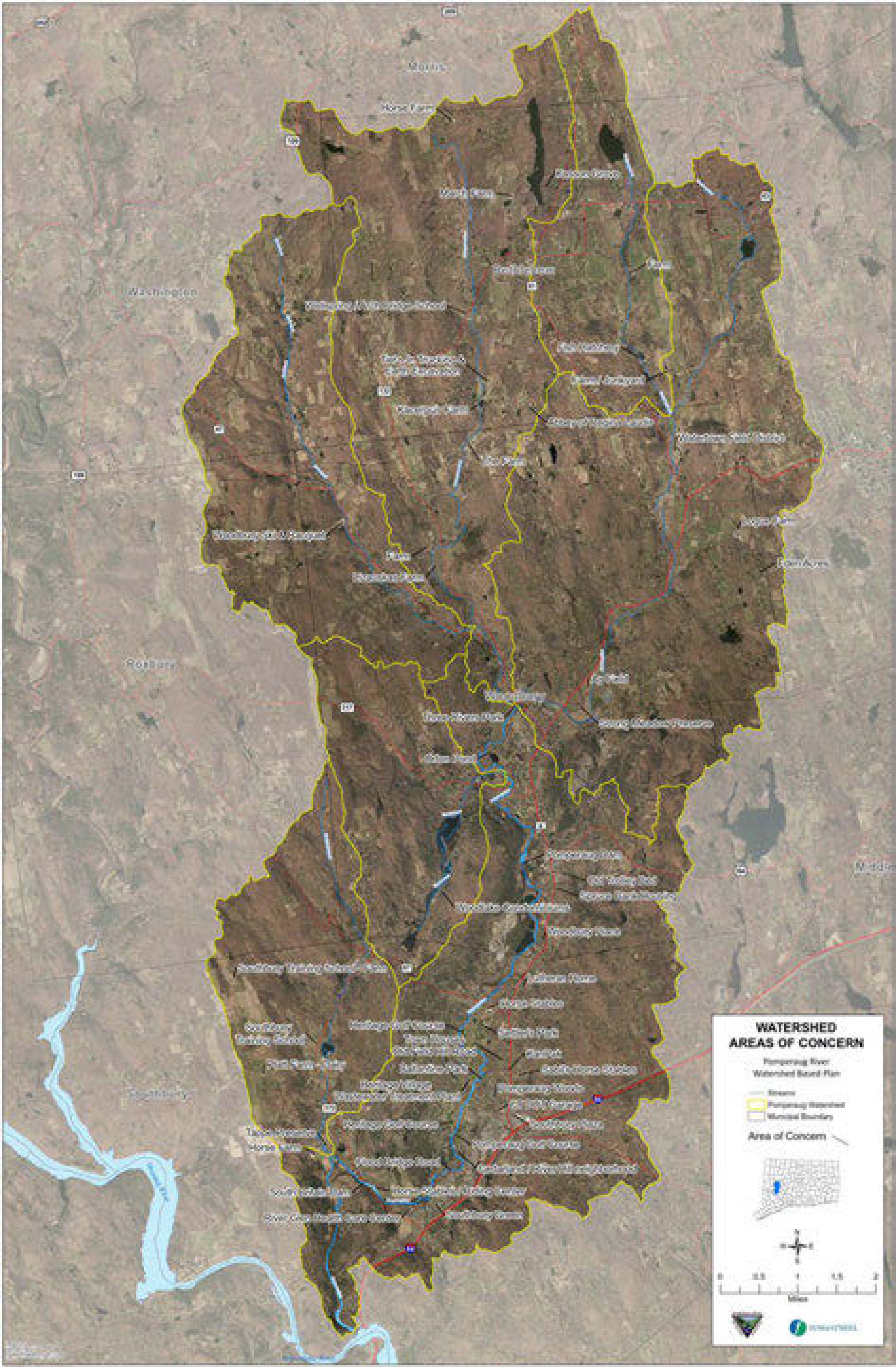

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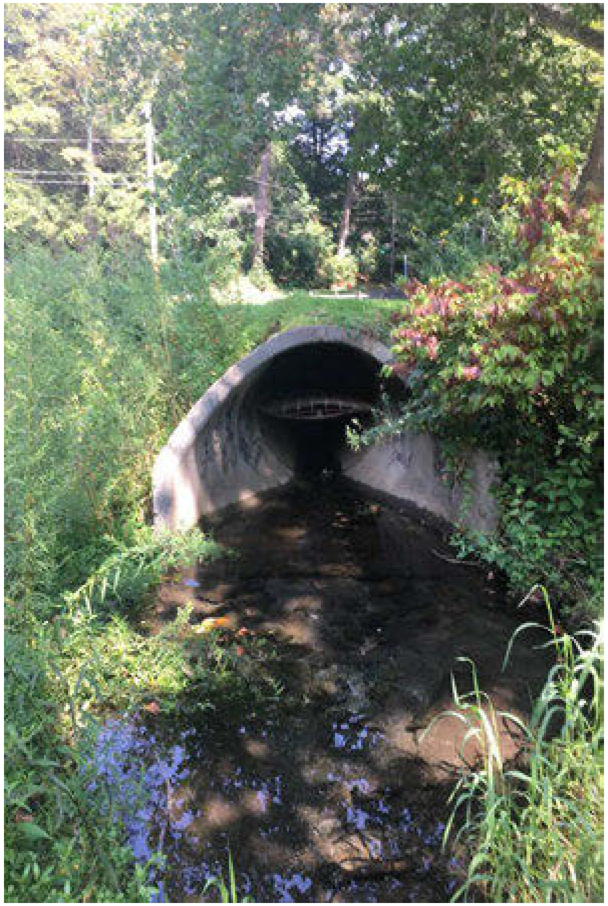

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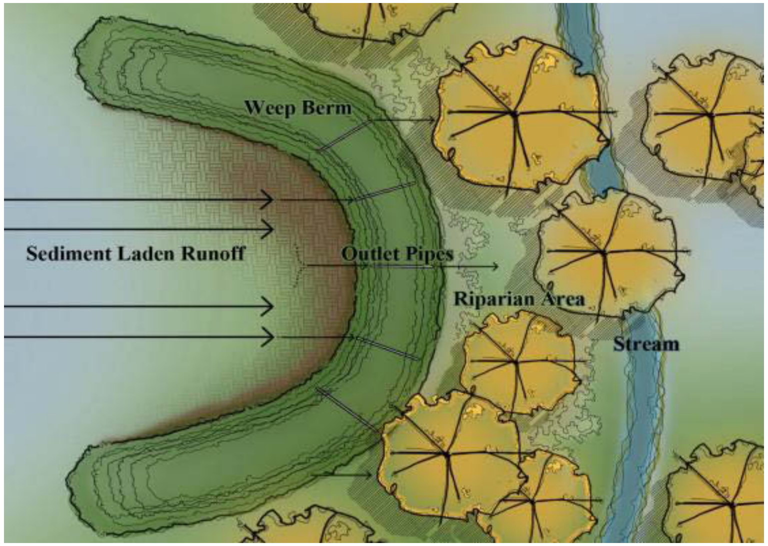
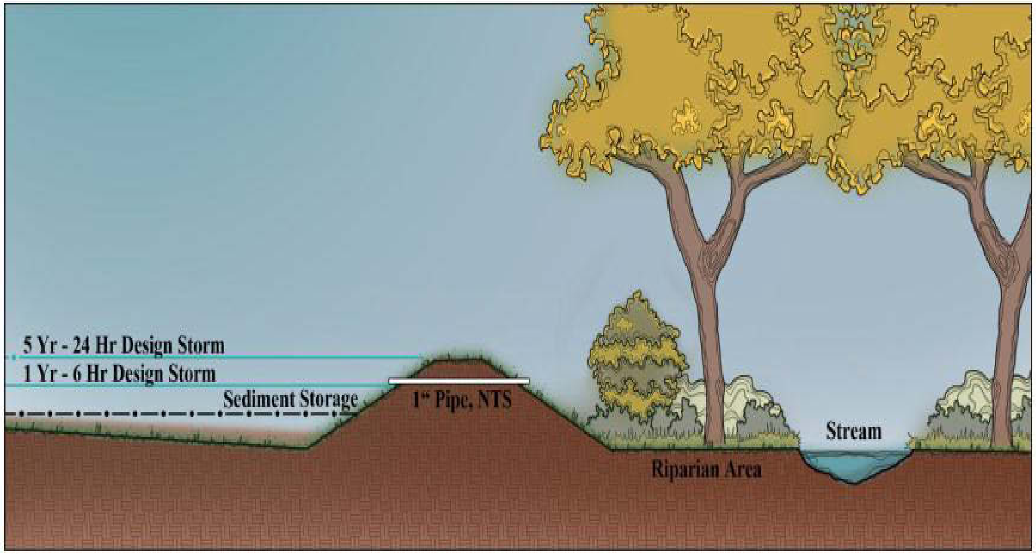
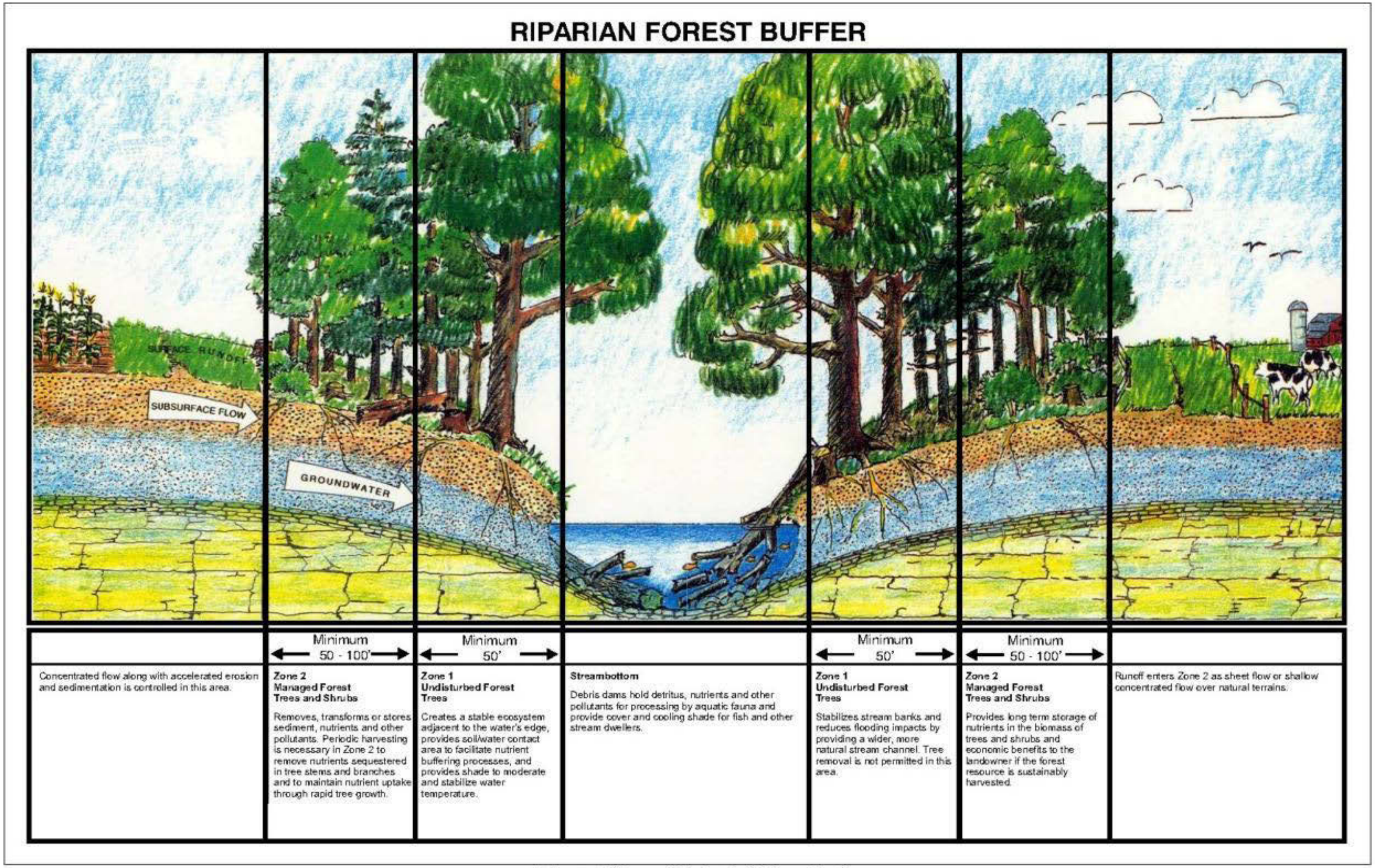
- Focus on pastures as well as paddocks, barns, and storage areas

Filter Berms





Increased Riparian Buffer



RIPARIAN FOREST BUFFER

	Minimum ← 50 - 100' →	Minimum ← 50' →		Minimum ← 50' →	Minimum ← 50 - 100' →	
Concentrated flow along with accelerated erosion and sedimentation is controlled in this area.	**Zone 2** **Managed Forest** **Trees and Shrubs** Removes, transforms or stores sediment, nutrients and other pollutants. Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through rapid tree growth.	**Zone 1** **Undisturbed Forest** **Trees** Creates a stable ecosystem adjacent to the water's edge, provides soil/water contact area to facilitate nutrient buffering processes, and provides shade to moderate and stabilize water temperature.	**Streambottom** Debris dams hold detritus, nutrients and other pollutants for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.	**Zone 1** **Undisturbed Forest** **Trees** Stabilizes stream banks and reduces flooding impacts by providing a wider, more natural stream channel. Tree removal is not permitted in this area.	**Zone 2** **Managed Forest** **Trees and Shrubs** Provides long term storage of nutrients in the biomass of trees and shrubs and economic benefits to the landowner if the forest resource is sustainably harvested.	Runoff enters Zone 2 as sheet flow or shallow concentrated flow over natural terrains.

Adapted from Welsch (*Riparian*)

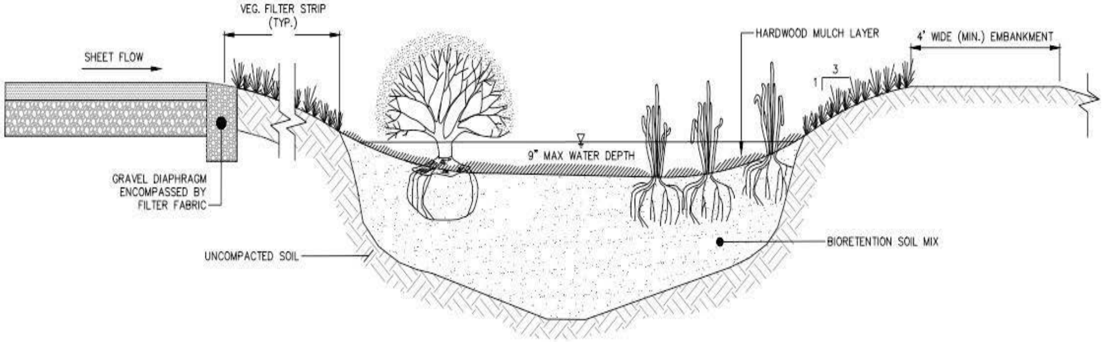
Structural Stormwater BMPs

EM2

- Permeable Pavers

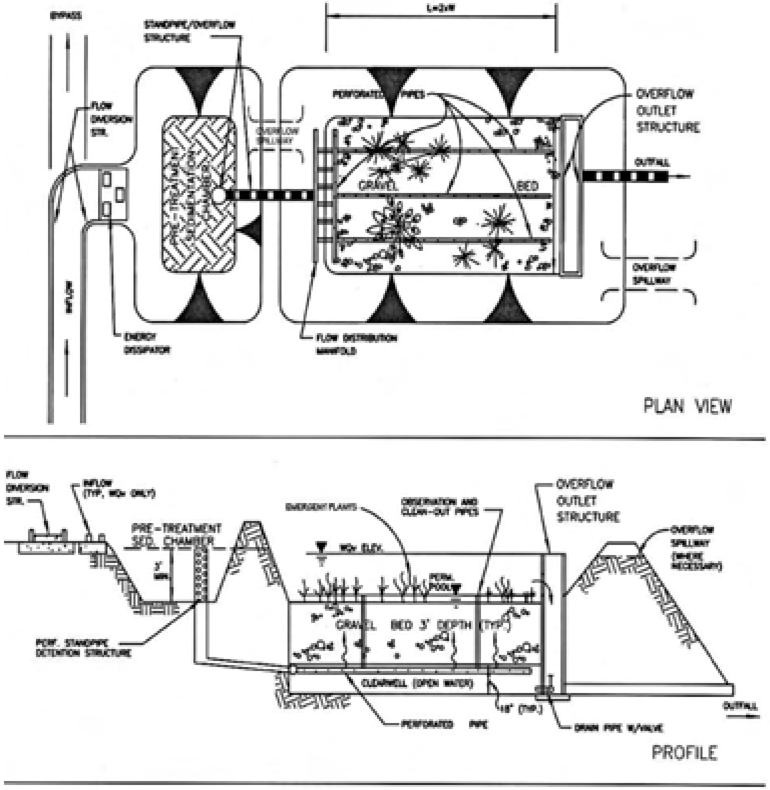
Structural Stormwater BMPs

- **Bioretention/Infiltration**



Structural Stormwater BMPs

- **WVTS**



Structural Stormwater BMPs

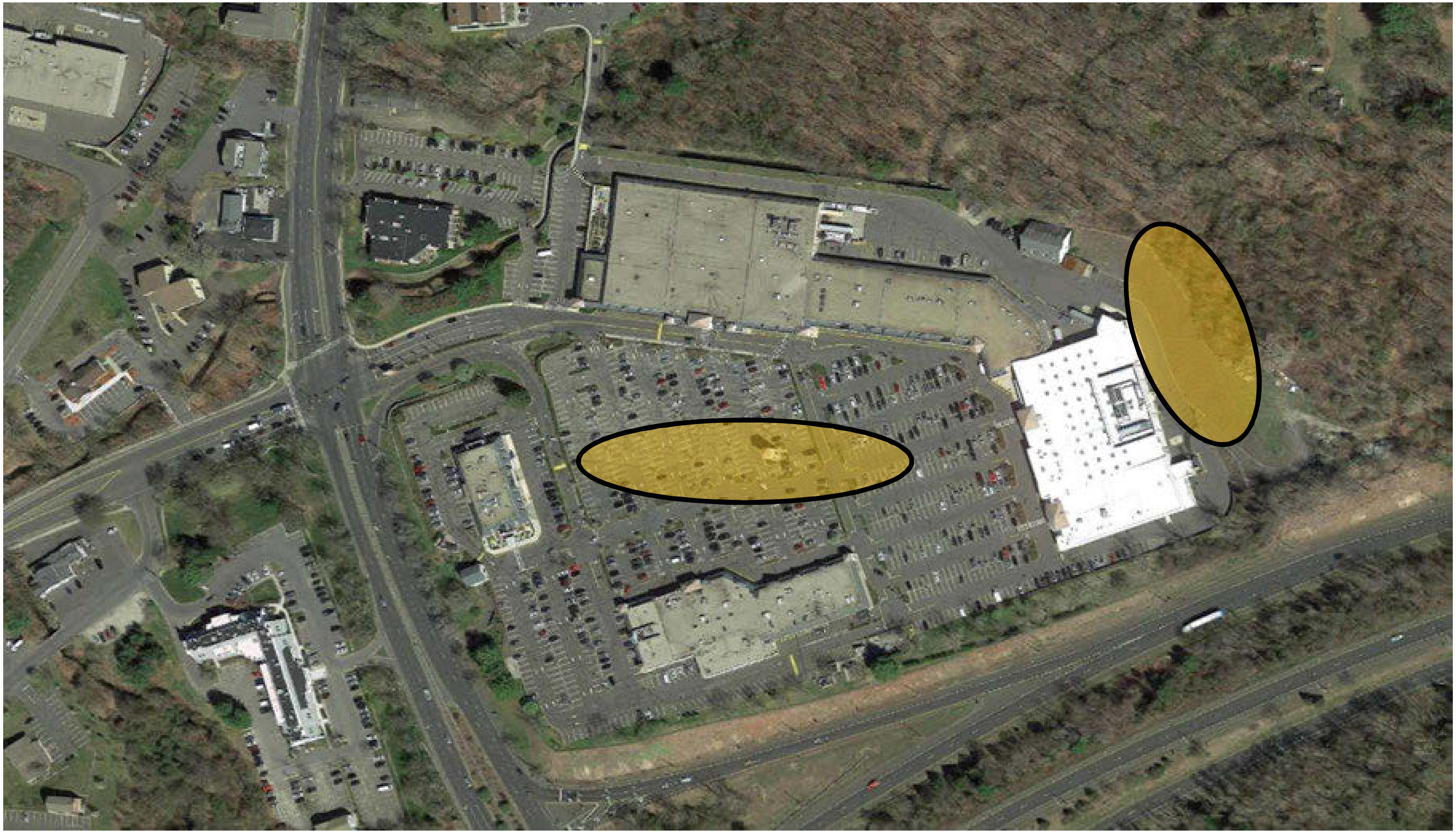
- Underground solutions
  - Parking lots
  - Public right-of-way

Structural BMP Opportunities

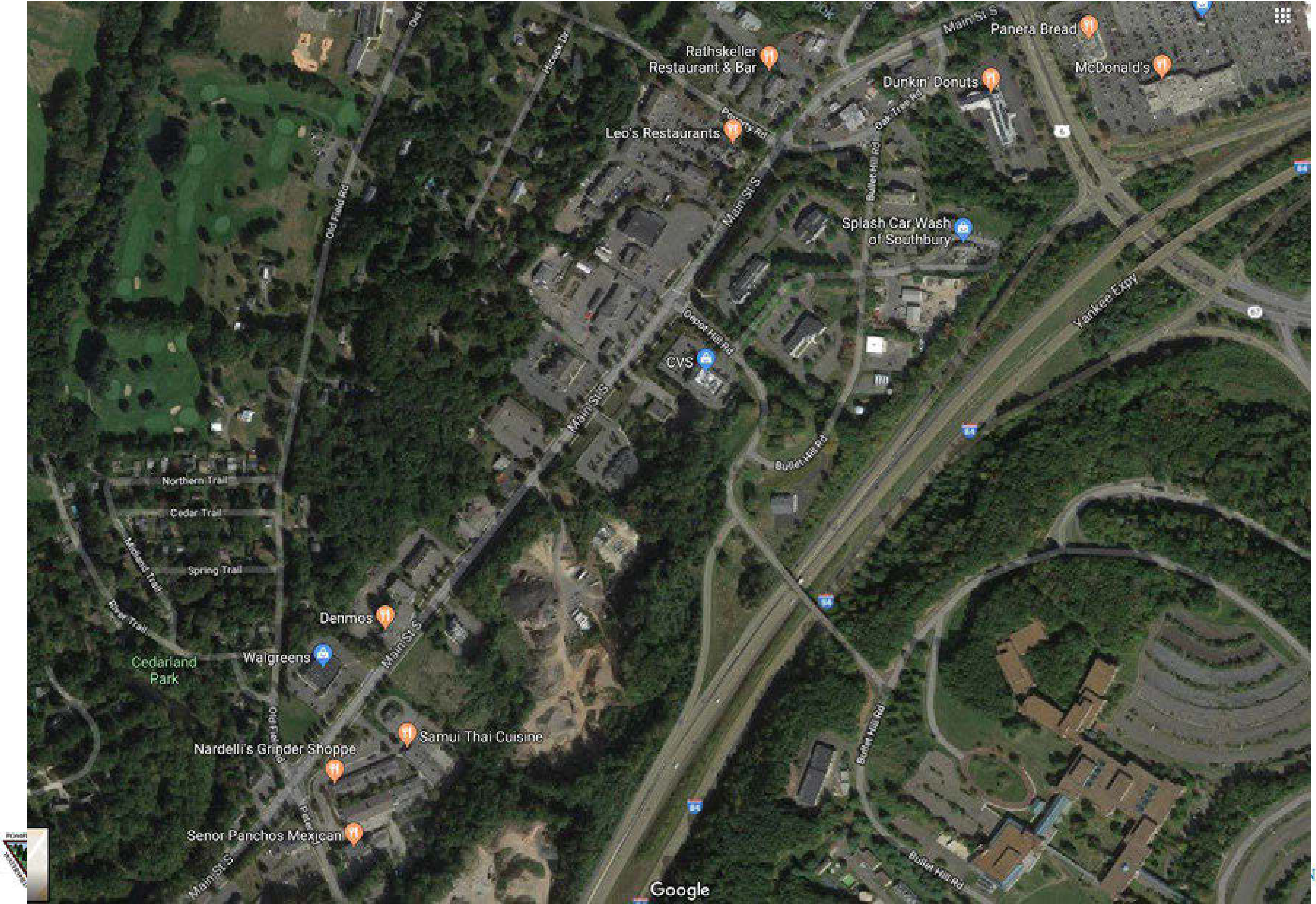
- Southbury Plaza
- Heritage Village
- Main Street South Corridor, Southbury

Southbury Plaza

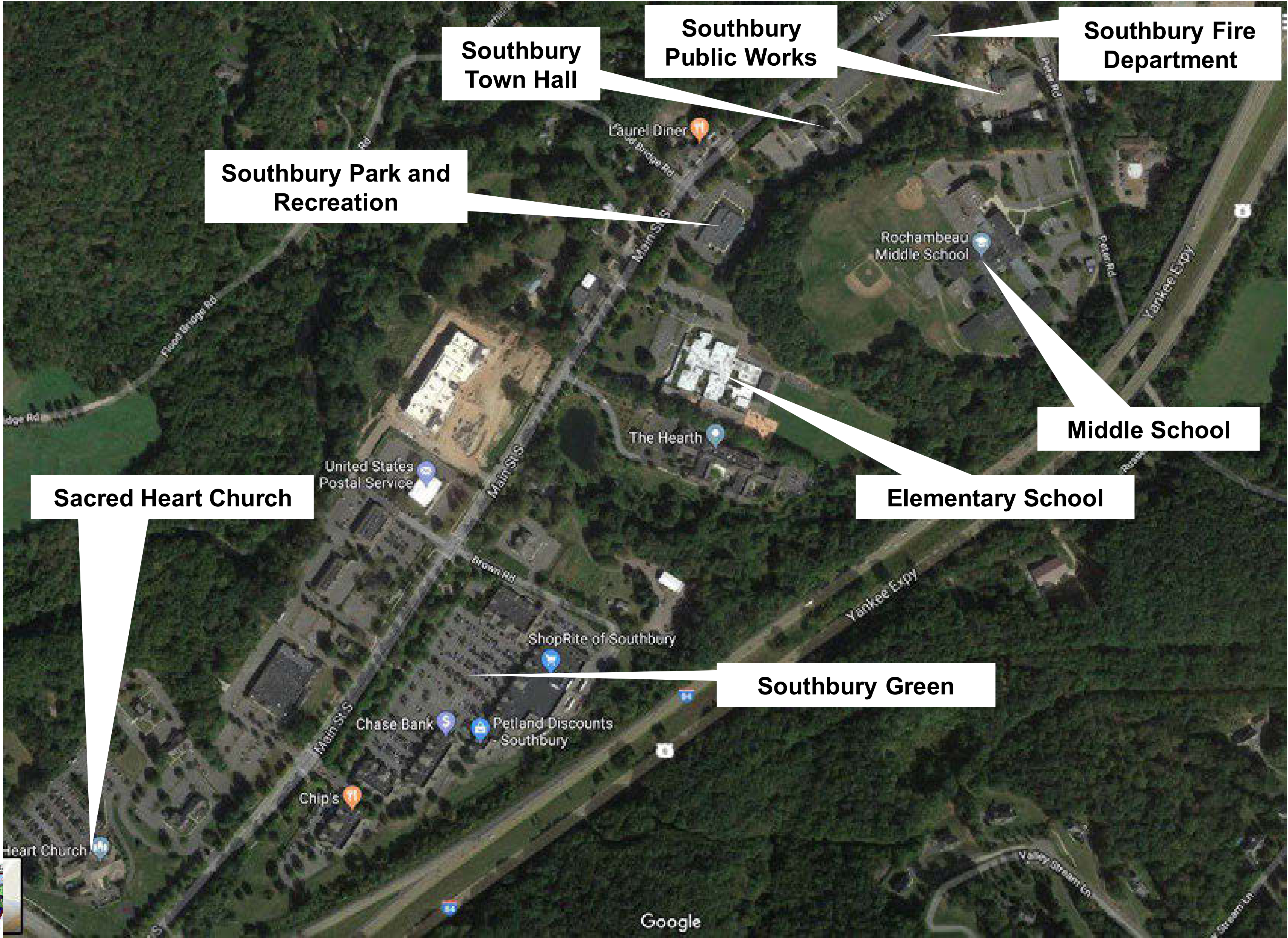
Southbury Plaza cont.



Main Street South Corridor – North



Main Street South Corridor – South



Heritage Village

Heritage Village cont.

Site-Specific BMP Project Selection

- 10 small BMP projects
- 5 large BMP projects
- See BMP Prioritization Matrix
  - Relative bacteria removal
  - Relative cost
  - Level of maintenance required

Next Steps

- Develop BMP project concepts – June/July
- Hold 2 public meetings – July
- Prepare watershed plan – July/August

Discussion/Questions

Appendix G

Public Participation and Outreach Meetings

Pomperaug River Watershed Based Plan

COMMUNITY INFORMATION SESSIONS

Watershed Based Plan Project Introduction
Meeting with First Selectman of Bethlehem
Date: January 17, 2017

Watershed Based Plan Project Introduction
Joint Land Use Commission Meeting, Town of Woodbury
w/ representatives of Planning, Zoning, Wetlands, Conservation, Historic District Commission, ZBA
Date: January 18, 2017

Updating the Pomperaug Watershed Management Plan
Joint Meeting Inland Wetlands & Conservation Commission, Town of Bethlehem
Date: February 14, 2017

Updating the Pomperaug Watershed Management Plan
Joint Land Use Commission Meeting, Town of Southbury
w/ representatives of Planning, Zoning, Wetlands, Conservation, Public Works
Date: April 4, 2017

Watershed Based Plan Project Update
Joint Land Use Commission Meeting, Town of Woodbury
w/ representatives of Planning, Zoning, Wetlands, Conservation, Historic District Commission, ZBA
Date: January 17, 2018

Public Information Session: Pomperaug Watershed Based Plan*
Woodbury Community
Date: July 17, 2018 (7:00 PM)

Public Information Session: Pomperaug Watershed Based Plan*
Southbury Community
Date: July 18, 2018 (2:00 PM)

Public Information Session: Pomperaug Watershed Based Plan*
Bethlehem Community
Date: July 18, 2018 (6:30 PM)

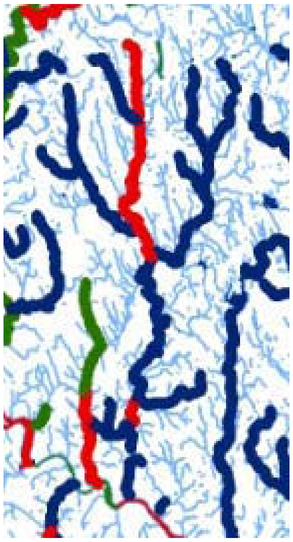
Handout from 1/17/17 meeting with Bethlehem First Selectman

POMPERAUG WATERSHED BASED PLAN

VISION STATEMENT & GOALS

PRWC's vision is that this Plan will be used as a road map to return impaired waters to swimmable and fishable conditions and that this document will be used as a guide to evaluate changes through time. PRWC's goal for the Pomperaug Watershed Based Plan is develop a document that:

- establishes an up-to-date baseline of conditions in the watershed;
- evaluates contributing causes of known water quality impairments;
- identifies water quality monitoring needs;
- identifies and prioritizes steps to reduce pollutant inputs to impaired rivers and streams;
- incorporates proactive measures to protect/maintain high quality streams; and,
- establishes community buy-in through public engagement in the planning and implementation process.



Pomperaug Recreational Impairments
due to elevated bacteria levels:

Weekeepeemee River (entire)
Pomperaug River (2 segments)
Transylvania Brook (lower section)

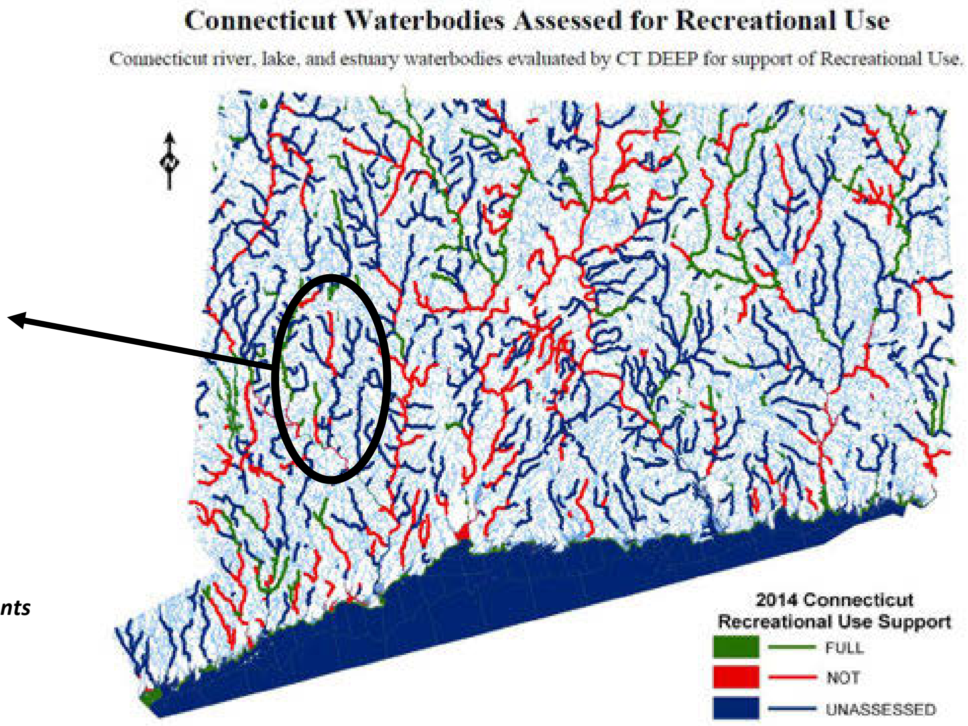


Figure 2-6. Waterbody segments assessed for Recreational Use Support (REC)

Woodbury
First land deed from the Indians
April 12th 1659

TOWN OF WOODBURY
Selectmen's Office
281 Main Street South
Woodbury, Connecticut 06798

TELEPHONE: (203) 263-2141
FAX: (203) 263-4755

Board of Selectmen Annual Joint Land Use Meeting
Wednesday, January 18, 2017
7:00 p.m.
Senior/Community Center

AGENDA

1. Call to Order
2. Introduction - First Selectman Bill Butterly
3. Guest Speaker – Sean Hayden, Executive Director,
   Northwest Conservation District

   Discussion of a Low Impact Development (LID) Design Manual for the Town of Woodbury to guide the land use office, municipal commissions, and the design/build community to create more sustainable projects in town. Meeting attendees will be introduced to the steps needed to create and implement the LID Manual.

4. Carol Haskins, Pomperaug River Watershed Coalition - Update on
   Watershed Management Plan
5. Brief Overview of Successes and Challenges – Commission Chairs or their Designees
   a. Planning Commission
   b. Zoning Commission
   c. Inland Wetlands & Watercourses Agency
   d. Zoning Board of Appeals
   e. Historic District Commission
   f. Conservation Commission
6. Introduction of Woodbury Town Planner – Mr. Butterly
   (Please stay for light refreshments following adjournment)
7. Adjournment

Respectfully Submitted,

Debra W. Carlton
Assistant to the First Selectman

RECEIVED & FILED
IN WOODBURY, CT
This 17th day of Jan 2017
at 9:58 o'clock A M
Town Clerk

TOWN OF WOODBURY

281 Main Street South
Woodbury, Connecticut 06798-0369

Woodbury
First land deed from the Indians
April 12th 1659

Board of Selectmen Joint Land Use Meeting

Wednesday, January 18, 2017 ♦ 7:00 p.m.
Senior/Community Center

MINUTES

Present: First Selectman Butterly, Maryellen Edwards, Sean Hayden, Carol Haskins, Len DeJong, Various Members of the Land Use Boards/Commissions/Agencies, Members of the Public and Press

Call to Order

First Selectman William Butterly convened the meeting at 7:05 p.m.

Introduction – First Selectman

First Selectman Butterly introduced Maryellen Edwards, the new Town Planner. He briefly mentioned the upcoming permitting software. He expressed his desire to have clerks keep track of the digital recorder times on each application to make it easier to find applications when listening to recordings. He stated that the "Sherwood Property" has not been approved; the BOS is sending it to the Conservation Commission for comment. Mr. Butterly suggested that the Zoning Commission post-pone their meeting on the Regulation Changes.

Guest Speaker – Sean Hayden, Executive Director, Northwest Conservation District

Mr. Hayden discussed the concept of creating a Low Impact Development (LID) Design Manual for the Town of Woodbury to guide the Land Use office, Town commissions, and the design/build community to create more sustainable projects in Town. An example of a LID project was shown for the Town of Morris. LID is a way to develop land working with it, not against it. There are concerns over the water supply; this is a protective measure for the water supply. He described the process as a giant filter; water is moved at the surface. There's no downside to implementing LID, including cost. He handed out a conceptual LID manual to the Chairmen of certain commissions to review. Mr. Hayden has a grant to get a design manual specific for Woodbury. Regulations do not need to change; this manual can be attached to the regulations as a "living document." The design manual meshes with the regulations, it does not conflict with them. There are about 4-5 towns in Connecticut that have a manual including Guilford, Tolland, Granby Plainville and Harwington. It was noted that this can be applied to the MS4 permit, addressing some of those requirements.

Guest Speaker - Carol Haskins, Pomperaug River Watershed Coalition

Ms. Haskins discussed the PRWC Watershed Management Plan and their goals. This plan will be used as a guide to evaluate changes through time. It includes establishing current conditions in the watershed, evaluating contributing causes of known water quality impairments, identifying monitoring needs, prioritizing steps to reduce pollutant inputs to waterways, incorporating measures to protect and maintain high quality streams and establishing community involvement. Land Use commissions can have an important role in developing the plan by sharing their knowledge of and assisting in identifying potential sources related to stream impairments. They can help with the prioritization of best management practices to implement, when and by whom. They can get the public together for informational sessions. Commissions can also communicate directly with the Pomperaug River Waterhsed Coalition and proactively pass information related to concerning sites for the inclusion in visual assessment surveys.

Brief Overview of Successes and Challenges – Commission Chairs (or designees):

Planning Commission – *Mary Connolly:* The Planning Commission is currently working on redoing the POCD, which needs to be done by 2020. They are hoping to tie into the AIA/SDAT plan and have asked to include funding for the upcoming budget.

Zoning Commission – *Bob Clarke*: The Zoning Commission is continuing revision of the regulations and will continue to do so.

Inland Wetlands & Watercourses Agency – *Mary Tyrrell*: Thanked the Board members. She noted that they are the first Board people have to go to. The Agency tries to educate applicants with regards to the wetlands. Sean Hayden was thanked for his extra help on recent applications.

Historic District Commission – *Susan Cheatham:* The Historic District Commission has worked on regulations. One was to change the responsibility for sending abutter notifications and the other being the COG maps to replace the text description of the boundaries. They are still concerned with the conditions of the Telephone Company Buildings. They issued a Cease & Desist for 76 Main Street South for not applying for a Certificate of Appropriateness. They are working on recommendations from the SDAT committee, specifically looking at the Bicentennial Green. The Commission presented three Historic Preservation Awards this year. Ms. Cheatham reminded everyone that the purpose of the Historic District Commission is "promoting the educational, cultural, economic and general welfare of the public through the preservation and protection of buildings, places and districts of historic interest by the maintenance of such landmarks in the history of architecture of the town, state or nation; and through the promotion and development of appropriate settings for such buildings, places and districts."

Conservation Commission – *David Taylor:* The Conservation Commission promotes and encourages conservation activities. They are a bit of a "conscience" to the Board of Selectmen and other groups. They participated with the Trolley Bed Committee, continue to hold Town Wide Clean Up days and participated in the Earth Day Celebration. They will be contributing to the POCD and hope to promote LID. Woodbury has 14% of protected Open Space, State Guidelines state it should be 23%, they are looking at ways to increase this percentage. They have also found that some properties they thought were protected are not.

Zoning Board of Appeals – *Michael Novak:* The ZBA had 7 Variance Requests and 2 Special Exceptions for Change of Use and all applications were approved. He thanked his Board and their dedication to look for the best possible solutions, which is challenging when it comes to determining hardships. They try to look past the "self-imposed hardship," where they can simply say you could choose not to do it. They've had to determine if applications are in harmony with the neighborhood and challenges with regards signage. He ended by stating that he thinks the Main Street Design Exception for Variances is in conflict with the Connecticut General Statutes.

First Selectman Butterly thanked everyone for coming and ended the meeting at 8:25 p.m.

Respectfully submitted,

Anne Firlings
Administrative Assistant, Land Use Office

Handout from 1/18/17 Woodbury's Joint Land Use Committees Meeting

POMPERAUG RIVER WATERSHED COALITION

POMPERAUG WATERSHED BASED PLAN

VISION STATEMENT & GOALS

PRWC's vision is that this Plan will be used as a road map to return impaired waters to swimmable and fishable conditions and that this document will be used as a guide to evaluate changes through time. PRWC's goal for the Pomperaug Watershed Based Plan is develop a document that:

- establishes an up-to-date baseline of conditions in the watershed;
- evaluates contributing causes of known water quality impairments;
- identifies water quality monitoring needs;
- identifies and prioritizes steps to reduce pollutant inputs to impaired rivers and streams;
- incorporates proactive measures to protect/maintain high quality streams; and,
- establishes community buy-in through public engagement in the planning and implementation process.

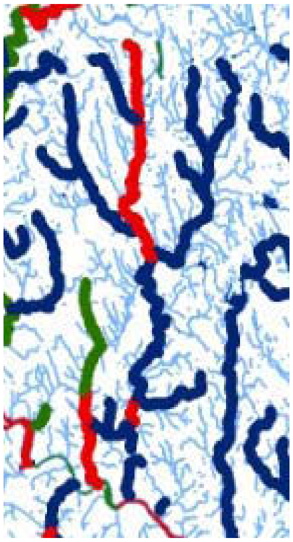
WHAT ROLE DO TOWN LAND USE COMMISSIONS SERVE IN THE PLAN DEVELOPMENT PROCESS?

- Share local land use knowledge and observations (priority: impaired stream areas)
- Identify potential sources related to stream impairments
- Help convene residents at public informational forums
- Identify sites for best practices to be implemented
- Help prioritize what BMP's to implement, when, and by whom
- Pass along information to PRWC related to sites of concern for inclusion in visual assessment surveys (priority on impaired streams):

Contact: Carol Haskins, Outreach Director, at chaskins@pomperaug.org or 203-263-0076

The project of updating the Pomperaug Watershed Management Plan to an EPA Approved 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.

WHAT / WHERE ARE OUR LOCALLY IMPAIRED STREAM SEGMENTS?



Pomperaug Recreational Impairments

due to elevated bacteria levels:

Weekeepeemee River (entire)
Pomperaug River (2 segments)
Transylvania Brook (lower section)

Connecticut Waterbodies Assessed for Recreational Use

Connecticut river, lake, and estuary waterbodies evaluated by CT DEEP for support of Recreational Use.

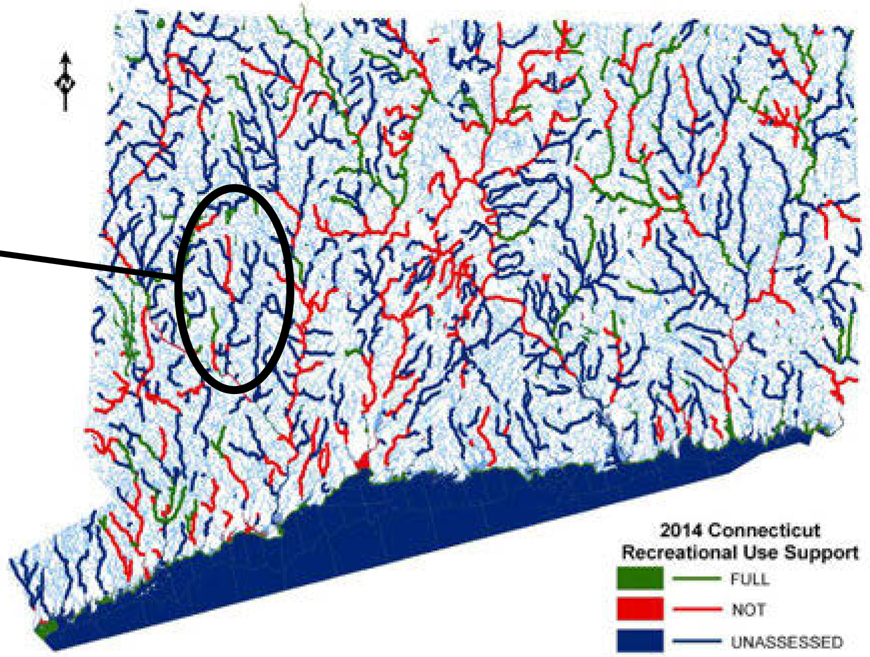
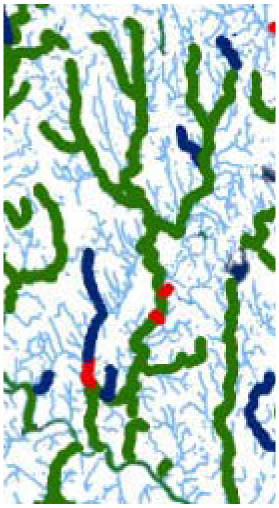


Figure 2-6. Waterbody segments assessed for Recreational Use Support (REC)



Pomperaug Aquatic Life Use Impairments

due to flow regime alteration:
Stiles Brook (below dam)
South Brook (previously listed)

Due to ammonia, chlorine, copper, zinc:
Transylvania Brook (lower section)

Connecticut Waterbodies Assessed for Aquatic Life Use

Connecticut river, lake, and estuary waterbodies evaluated by CT DEEP for support of Aquatic Life Use.

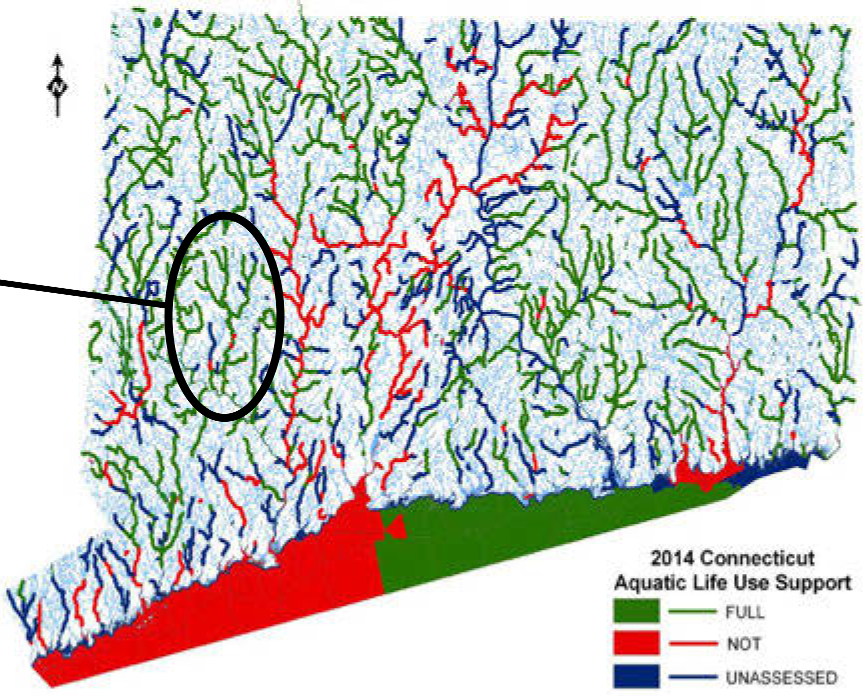


Figure 2-2. Waterbody segments assessed for Aquatic Life Use Support (ALUS)

BETHLEHEM CONSERVATION COMMISSION

Tuesday, February 14, 2017
7:00 pm, Leever Room

Members Present: Cassandra Beauvais, Jane Pittari, Nancy Stein, Trish Traver (Acting Chair). Guests Carol Haskins and Vince McDermott of the PRWC

Meeting call to order: 7:10 pm

Joint Meeting with PRWC: The Pomperaug River Watershed Coalition presented a project they are undertaking. They want the input of the Conservation Commission and Inland Wetlands on areas in Bethlehem that might be of concern for water conditions for swimming and fishing, drainage, erosion, septic issues, drought, runoff and other issues. They have a grant to identify, test, establish baselines and work on remediation for the watershed areas. They will also have a work crew funded by the CT Community Foundation available for projects we can suggest – boardwalk, tree removal, invasive removal, etc. Their presentation ended at 8 pm and we continued with our regular meeting.

Review of Previous Minutes: NS moved to accept the January minutes. CB 2nd'd. Motion passed.

Treasurer's Report: The $1000 was finally sent to PRWC. We have $1369.41. NS moved to approve the treasurer's report. CB 2nd'd. Motion passed.

Budget – BofF Letter: TT will put together a letter for our budget request to get it in by Feb. 24.

Website update: TT still waiting for pic from Bethlehem Fair Garden. We will firm up more dates for our spring programs to put on the website and look for other sites we can get our link on.

Weird Email: We deleted the weird email sent to our town email address without opening it.

Garlic Festival Application: We'll decide at the next meeting whether we're able to commit to attending this year.

Swendsen Farm / Community Garden: We will get together on March 1 at TT's to brainstorm about future possibilities for the Swendsen Preserve.

We have scheduled as part of our spring programs a ravine trail walk on May 13th at 10am. CB with look into scheduling the migratory spring bird walk. Perhaps a weekday evening or Saturday or Sunday in May. She will check the guide's availability.

JP moved to pay all expenditures by the Garden. CB 2nd'd. Motion passed.

Library Programs: We are scheduled for April 17th with Nora Hulton. JP will check what her fee is. CB will check with the library to see if April 24 is open for the Climate

Reality talk. Then JP will confirm with the presenter about that night. CB will check to see if the library is available for the movie (whichever Dirt one we decide on) on May 1.

Land Use Guide edit and reprint: TT is finishing up corrections. She will look up what it cost to print the last one.

NS moved to adjourn, CB 2nd’d. Motion passed. Meeting adjourned at 9:20 pm.

Respectfully submitted,

Jane Pittari, Secretary

NEXT MEETING Tuesday, March 14, 2017

Trish Traver will be the acting chair for the February meeting.
We should have our agenda in by the Thursday before the meeting.

Committee Chair Schedule for 2017: **Jan & Feb/C.Rabinowitz**, **Mar & Apr/T.Traver**, **May & June/N.Stein**, **July & Aug/J.Pittari**, **Sept & Oct/N.Carey**, SEPT&OCT WE NEED TO DO CACIWC **Nov WE NEED TO DO ANNUAL REPORT & Dec/C.Beauvais**

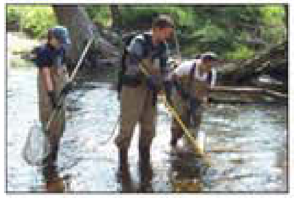
Updating the Pomperaug Watershed Management Plan*

Town of Bethlehem
Inland Wetlands and Conservation Commission Joint Meeting
Tuesday February 14, 2017

Carol Haskins, Outreach Director
Pomperaug River Watershed Coalition

* *The project of updating the Pomperaug Watershed Management Plan to an EPA 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.*

SCIENCE



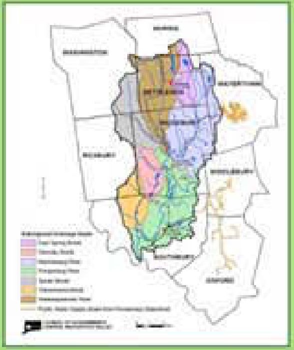
Science is our first priority. We carry out studies that examine the river water, the groundwater, and the landscape to better understand and steward the health of our watershed. We want to ensure that our rivers, streams, and aquifer will be a trusted drinking water source, a vital habitat for aquatic wildlife, and a vibrant recreational resource for generations.

For more information:

(203) 263-0076
www.pomperaug.org
39 Sherman Hill Rd, Woodbury, CT

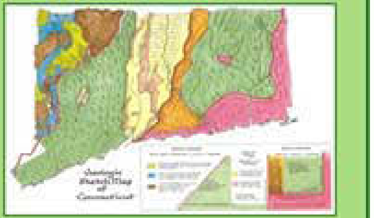
THE POMPERAUG RIVER WATERSHED: A TREASURE IN OUR MIDST.

What is a watershed?
It is all the water in our rivers, streams, lakes, wetlands and underground aquifers.
It is also the landscape that surrounds these waters.



A watershed is the land that stretches from water's edge to the tops of nearby hills. Rain that falls here is either absorbed into the ground, replenishing the aquifer, or flows downhill as runoff until it reaches a river, stream, lake, or wetland.

The Pomperaug River Watershed is a 90-square mile watershed that drains to the Housatonic River Watershed in western Connecticut and that has geology mimicking the Connecticut River Watershed.



EDUCATION

Education is an essential service to our community. We teach school children about the way and wonder of the watershed. We also teach our neighbors how they can protect this precious resource we all share. We provide information to governments and businesses that make critical decisions about how communities use our water.

Your stewardship matters!

Learn more about the watershed.
Become a Member. Make a donation.
Volunteer to help. Like us on Facebook.

PRWC Team

Board of Directors

Vincent McDermott, Chair
Joseph Eisenberg, Vice-Chair
Gail McTaggart, Vice-Chair
John Lacadie, Treas. & Sec.
Marianne Bette
Christopher Wood
J. Lawrence Pond - *Emeritus*
Anne Delo
Ann Merriam Feinberg
Frederick R. Leavenworth
Frank Sherer, Jr.
Dan Slywka

Staff

Len DeJong, Executive Director
Carol Haskins, Outreach Director
Anne Urkawich, Manager of Administration & Development

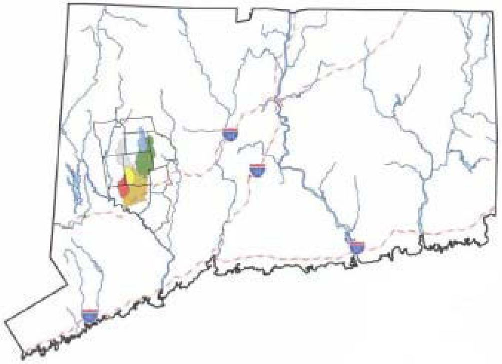
Advisory Council

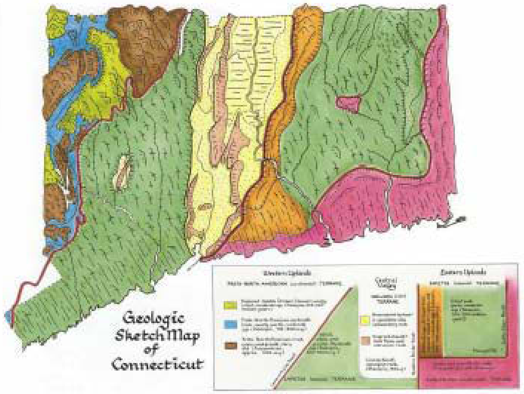
Barbara Ajello
Leslie Kane
Justin Bette
Neal Lustig
David Bjerklie
Susan Peterson
Aaron Budris
Karen Reddington-Hughes
DeLoris Curtis
Bob Travers
Kenneth Faroni
Kyle Turoczi
Karen A. Huber
Anne Westerman

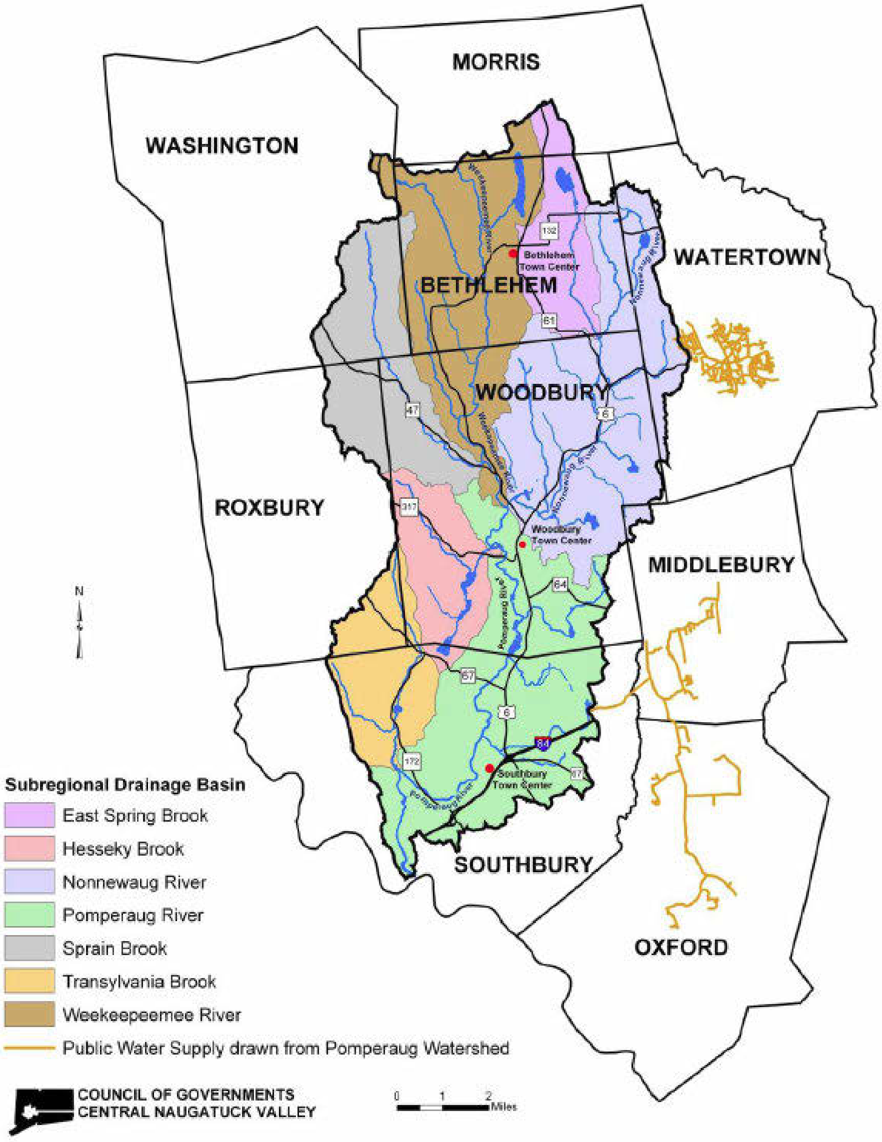
Volunteers

Pomperaug River Watershed

A 90-square mile watershed that drains to the Housatonic River Watershed in western Connecticut and that has geology mimicking the centrally located Connecticut River Watershed.







Need for Updated Watershed Plan

- Out of date Watershed Management Plan (2006)
  - New Data (Increased Number of Impaired Areas)
  - New prescribed format required by EPA
- Current identified solutions (i.e. TMDL plans) are generalized
- Need to identify and prioritize site specific solutions
- Provides mechanism for funding corrective actions

Watershed Plan Elements

Watershed Based Management Plan

(EPA's 9 Required Elements)

MONITORING

A monitoring component to evaluate the effectiveness of the implementation efforts over time.

IMPAIRMENT

An identification of the causes and sources of pollution, that will need to be controlled to achieve the load reductions estimated to fix the impairment.

LOAD REDUCTION

An estimate of the load reductions expected for the management measures described.

MANAGEMENT MEASURES

A description of the NPS management measures that will need to be implemented to achieve the estimated load reductions.

TECHNICAL & FINANCIAL ASSISTANCE

An estimate of the amounts of technical and financial assistance needed.

PUBLIC INFORMATION & EDUCATION

An information/education component that will be used to enhance public understanding and engagement with the project.

SCHEDULE

An expedited schedule for implementing NPS management measures identified.

MILESTONES

A description of interim, measurable milestones for determining whether NPS management measures or other controls are being implemented.

PERFORMANCE

Criteria to determine whether loading reductions are being achieved over time.

WBP VISION STATEMENT & GOALS

PRWC's vision is that this Plan will be used as a road map to return impaired waters to swimmable and fishable conditions and that this document will be used as a guide to evaluate changes through time. PRWC's goal for the Pomperaug Watershed Based Plan is develop a document that:

- establishes an up-to-date baseline of conditions in the watershed;
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- identifies water quality monitoring needs;
- identifies and prioritizes steps to reduce pollutant inputs to impaired rivers and streams;
- incorporates proactive measures to protect/maintain high quality streams; and,
- establishes community buy-in through public engagement in the planning and implementation process.

What role do town land use commissions serve in the process?

- Become familiar with stream impairments*
- Share local land use knowledge and observations
- Identify potential sources related to impairment
- Help convene residents at public informational forums
- Identify sites for best practices to be implemented
- Help prioritize what BMP’s to implement, when, and by whom

Impaired Waters

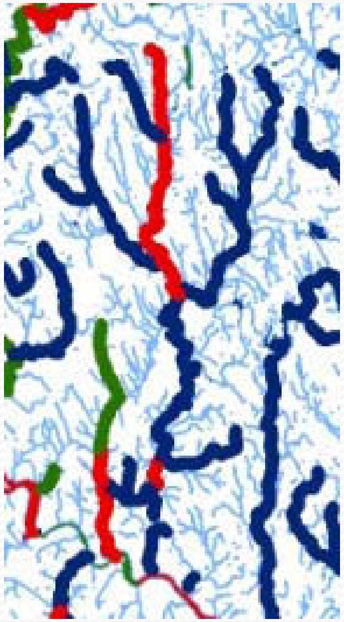
What are impaired waters?

- An impaired or threatened waterbody is any waterbody that is listed according to section 303(d) of the Clean Water Act.

  A waterbody is considered impaired if it does not attain water quality standards.

- For biologically impaired river segments, often multiple potential sources exist and determination of the definitive cause(s) and source(s) requires further investigative work.

What/Where are our locally impaired waters?



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<u>due to elevated bacteria levels:</u>

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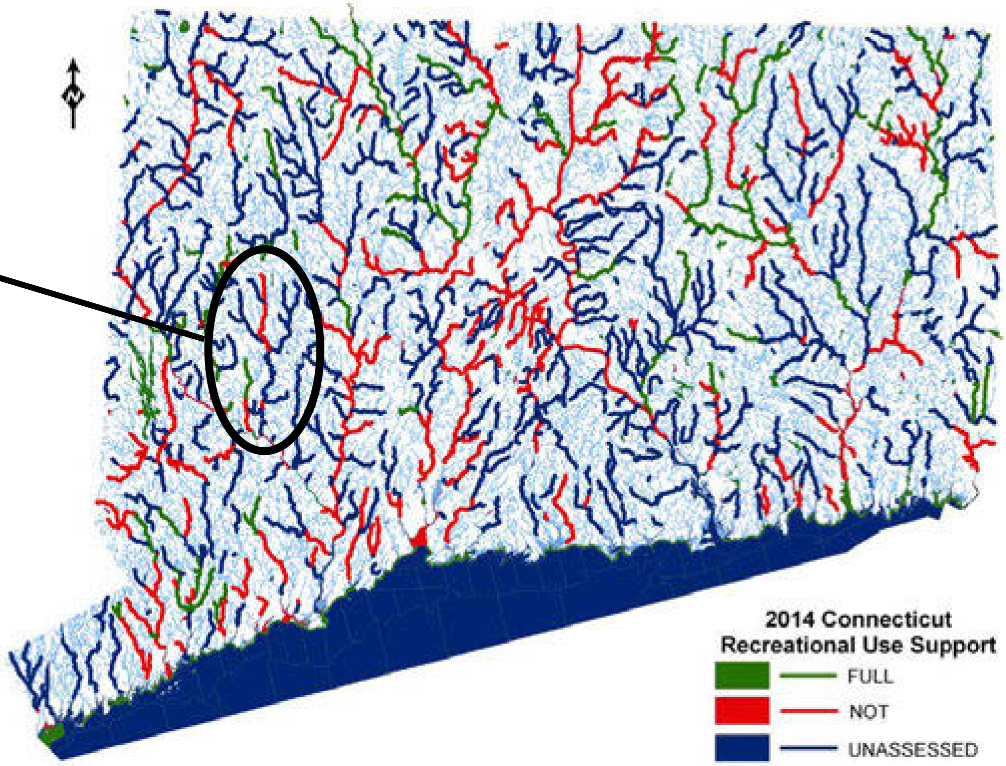

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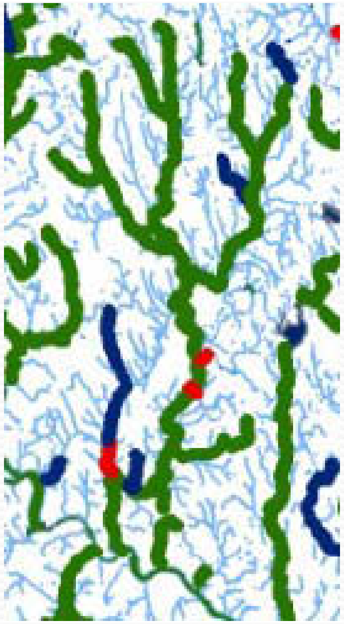

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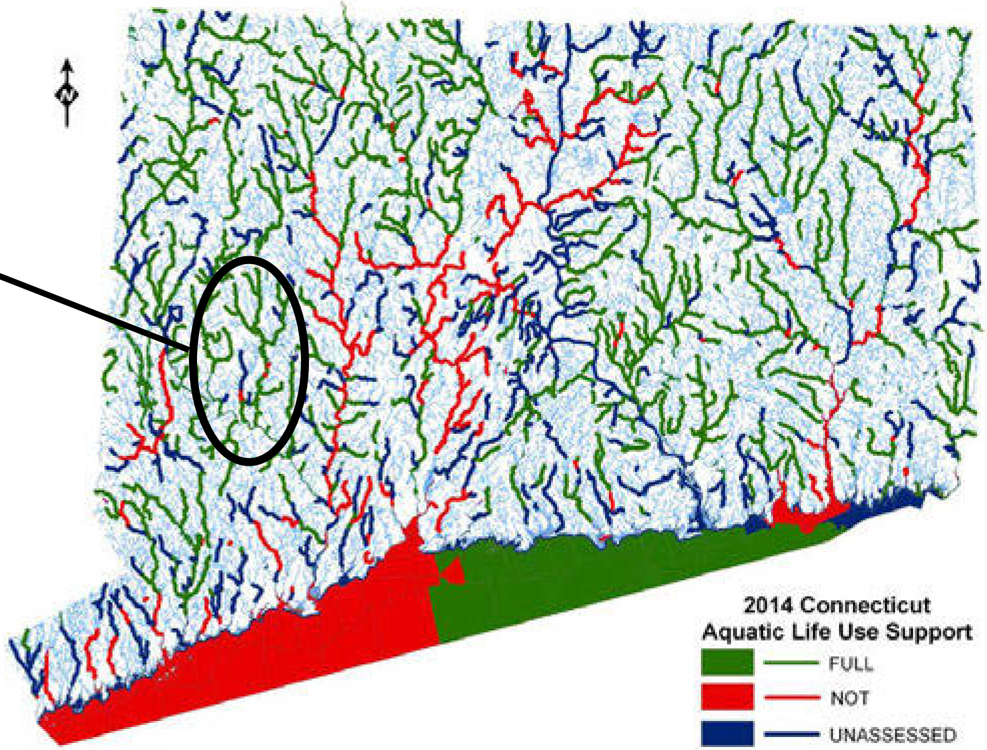

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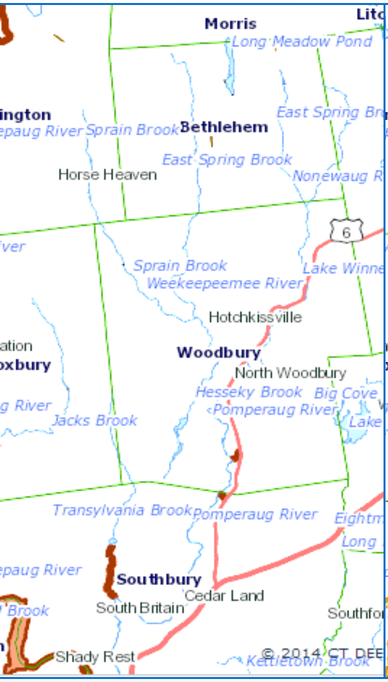

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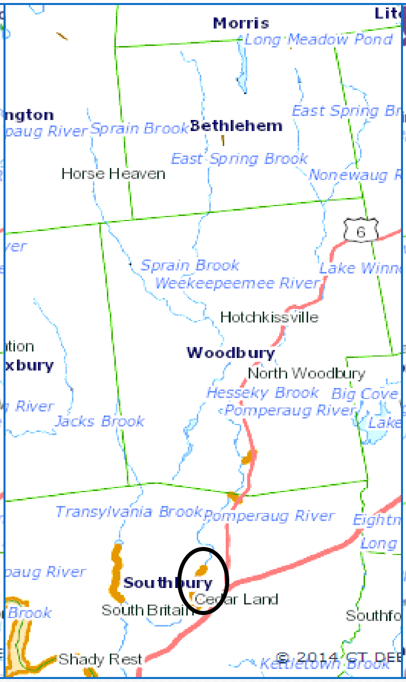

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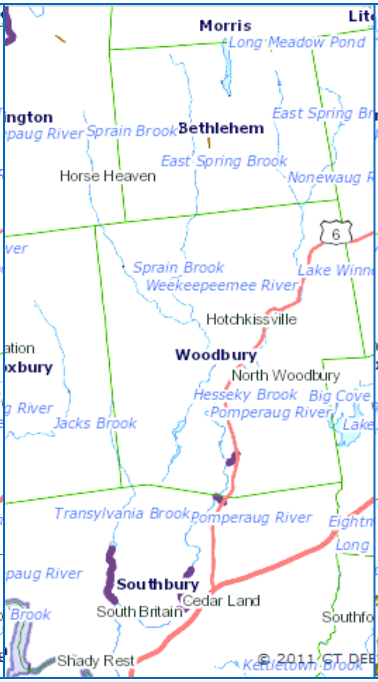

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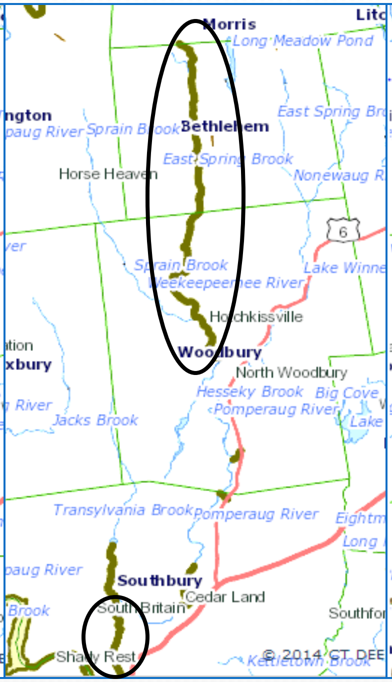

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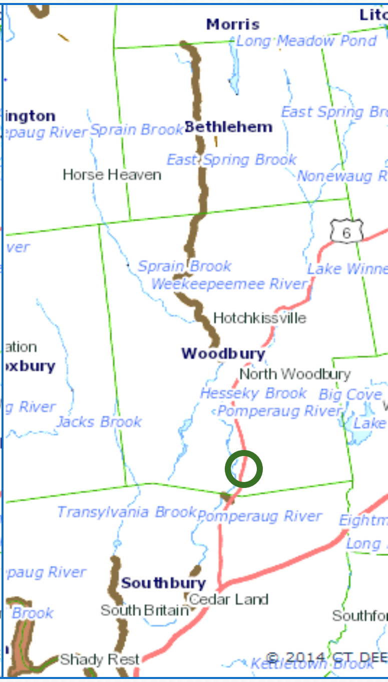

Next Steps

- Consider local land use issues (particularly adjacent to streams)
- Pass along information to PRWC related to sites of concern for inclusion in visual assessment surveys (priority on impaired streams)



Share Your Knowledge & Observations

Pomperaug River Watershed Coalition
39 Sherman Hill Road, C103
Woodbury, CT 06798

203-263-0076
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POMPERAUG RIVER WATERSHED COALITION

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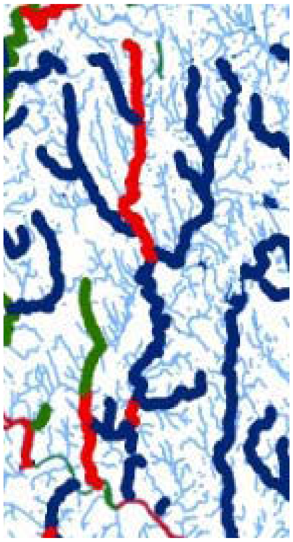

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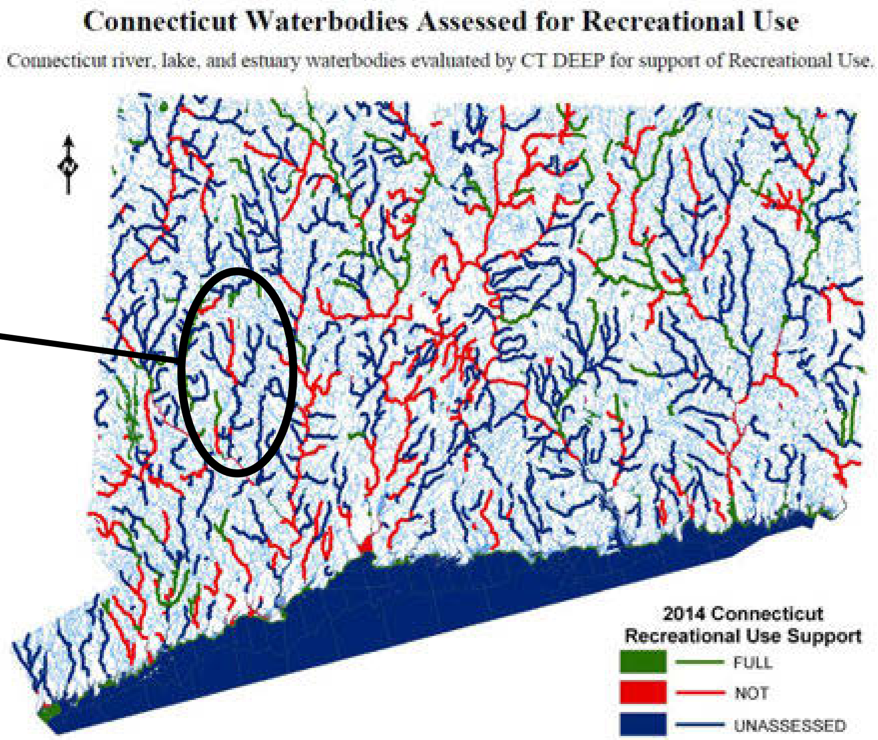

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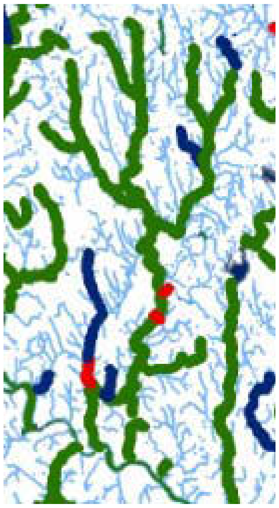

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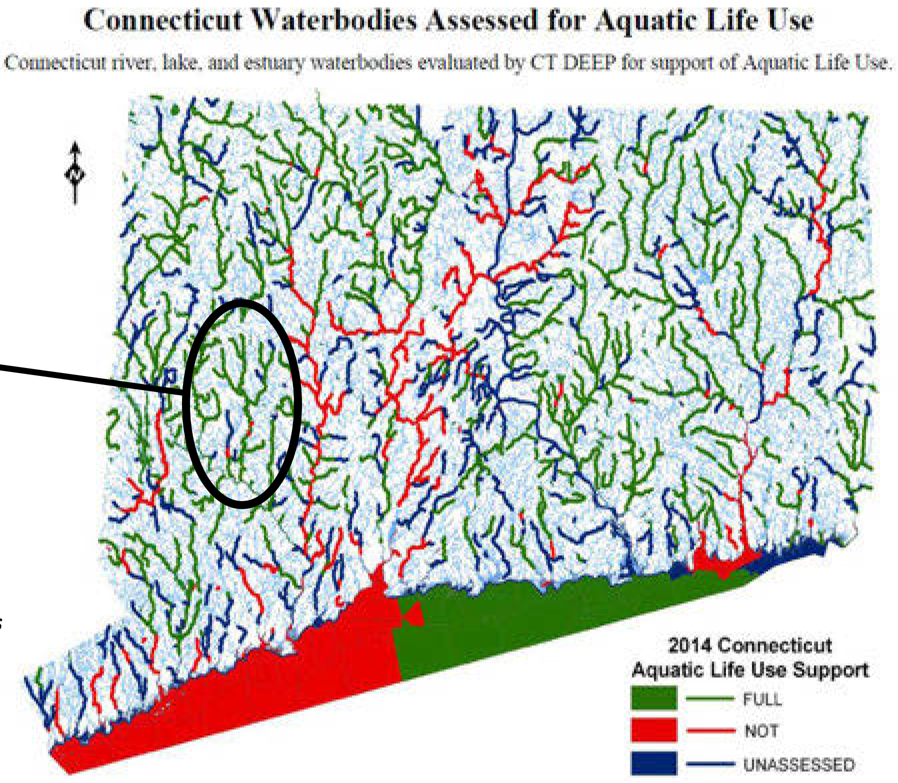

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Updating the Pomperaug Watershed Management Plan*

Town of Southbury
Conversation with Representatives of Town Land Use Commissions
Thursday April 4, 2017

Carol Haskins, Outreach Director
Pomperaug River Watershed Coalition

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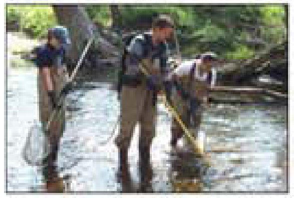
SCIENCE



Science is our first priority. We carry out studies that examine the river water, the groundwater, and the landscape to better understand and steward the health of our watershed. We want to ensure that our rivers, streams, and aquifer will be a trusted drinking water source, a vital habitat for aquatic wildlife, and a vibrant recreational resource for generations.

POMPERAUG RIVER WATERSHED COALITION

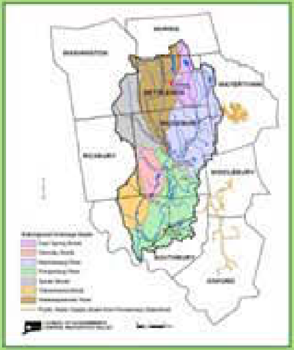
For more information:

(203) 263-0076
www.pomperaug.org
39 Sherman Hill Rd, Woodbury, CT

THE POMPERAUG RIVER WATERSHED: A TREASURE IN OUR MIDST.

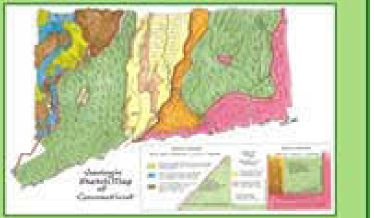
What is a watershed?

It is all the water in our rivers, streams, lakes, wetlands and underground aquifers.
It is also the landscape that surrounds these waters.



A watershed is the land that stretches from water's edge to the tops of nearby hills. Rain that falls here is either absorbed into the ground, replenishing the aquifer, or flows downhill as runoff until it reaches a river, stream, lake, or wetland.

The Pomperaug River Watershed is a 90-square mile watershed that drains to the Housatonic River Watershed in western Connecticut and that has geology mimicking the Connecticut River Watershed.



EDUCATION

Education is an essential service to our community.
We teach school children about the way and wonder of the watershed. We also teach our neighbors how they can protect this precious resource we all share. We provide information to governments and businesses that make critical decisions about how communities use our water.

Your stewardship matters!

Learn more about the watershed.
Become a Member. Make a donation.
Volunteer to help. Like us on Facebook.

PRWC Team

Board of Directors

Vincent McDermott, Chair
Joseph Eisenberg, Vice-Chair
Gail McTaggart, Vice-Chair
John Lacadie, Treas. & Sec.
Marianne Bette
Christopher Wood
J. Lawrence Pond - *Emeritus*

Anne Delo
Ann Merriam Feinberg
Frederick R. Leavenworth
Frank Sherer, Jr.
Dan Slywka

Staff

Len DeJong, Executive Director
Carol Haskins, Outreach Director
Anne Urkawich, Manager of Administration & Development

Advisory Council

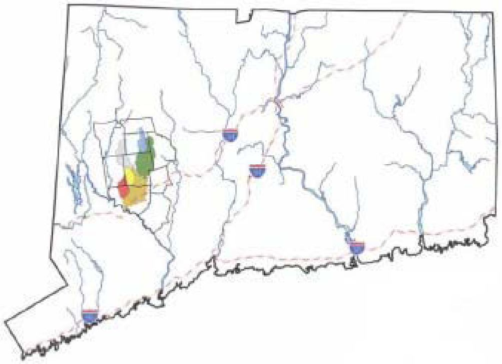
Barbara Ajello
Leslie Kane
Justin Bette
Neal Lustig
David Bjerklie
Susan Peterson
Aaron Budris

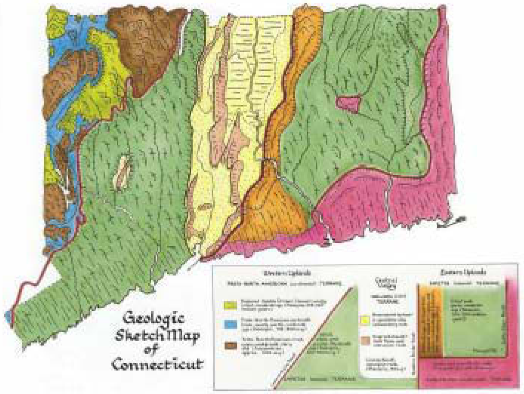
Karen Reddington-Hughes
DeLoris Curtis
Bob Travers
Kenneth Faroni
Kyle Turoczi
Karen A. Huber
Anne Westerman

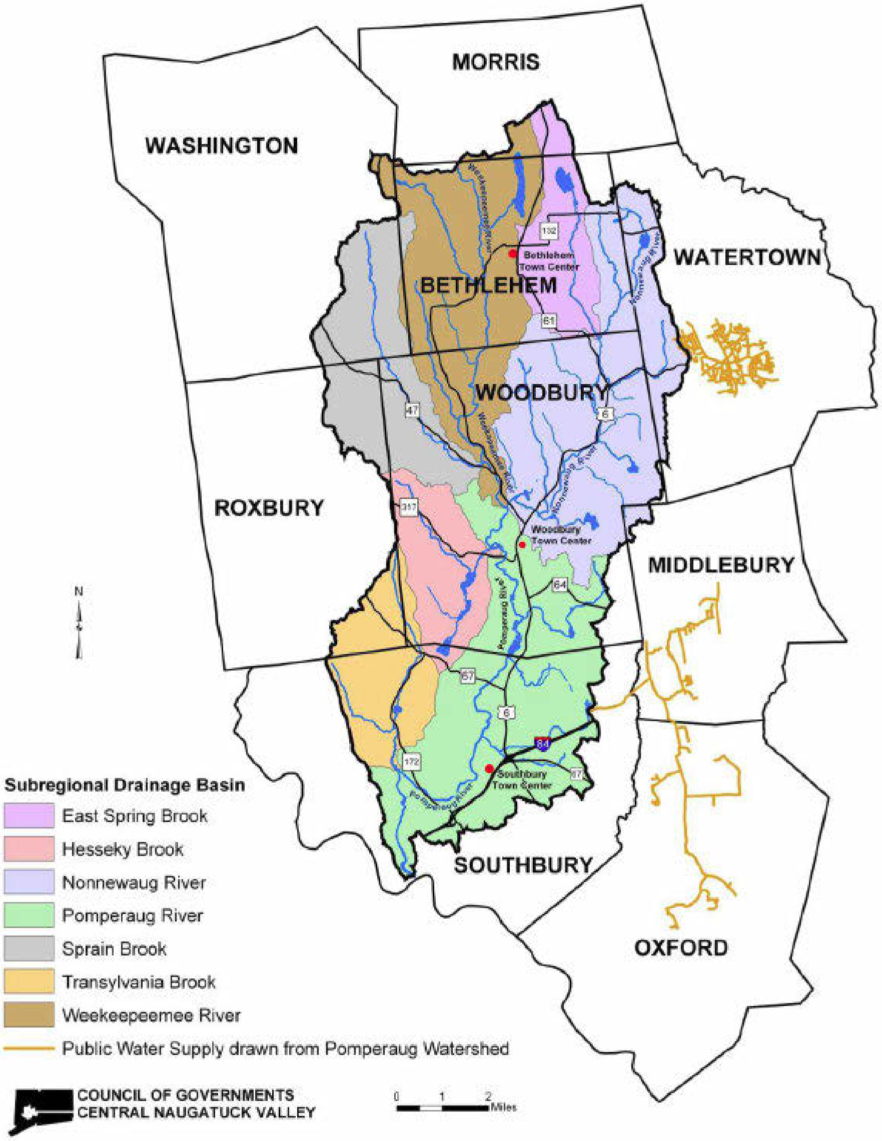
Volunteers

Pomperaug River Watershed

A 90-square mile watershed that drains to the Housatonic River Watershed in western Connecticut and that has geology mimicking the centrally located Connecticut River Watershed.







Need for Updated Watershed Plan

- Out of date Watershed Management Plan (2006)
  - New Data (Increased Number of Impaired Areas)
  - New prescribed format required by EPA
- Current identified solutions (i.e. TMDL plans) are generalized
- Need to identify and prioritize site specific solutions
- Provides mechanism for funding corrective actions

Watershed Plan Elements

Watershed Based Management Plan

(EPA's 9 Required Elements)

IMPAIRMENT

An identification of the causes and sources of pollution, that will need to be controlled to achieve the load reductions estimated to fix the impairment.

LOAD REDUCTION

An estimate of the load reductions expected for the management measures described.

MANAGEMENT MEASURES

A description of the NPS management measures that will need to be implemented to achieve the estimated load reductions.

TECHNICAL & FINANCIAL ASSISTANCE

An estimate of the amounts of technical and financial assistance needed.

PUBLIC INFORMATION & EDUCATION

An information/education component that will be used to enhance public understanding and engagement with the project.

SCHEDULE

An expedited schedule for implementing NPS management measures identified.

MILESTONES

A description of interim, measurable milestones for determining whether NPS management measures or other controls are being implemented.

PERFORMANCE

Criteria to determine whether loading reductions are being achieved over time.

MONITORING

A monitoring component to evaluate the effectiveness of the implementation efforts over time.

WBP VISION STATEMENT & GOALS

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What role do town land use commissions serve in the process?

- Become familiar with stream impairments*
- Share local land use knowledge and observations
- Identify potential sources related to impairment
- Help convene residents at public informational forums
- Identify sites for best practices to be implemented
- Help prioritize what BMP's to implement, when, and by whom

Impaired Waters

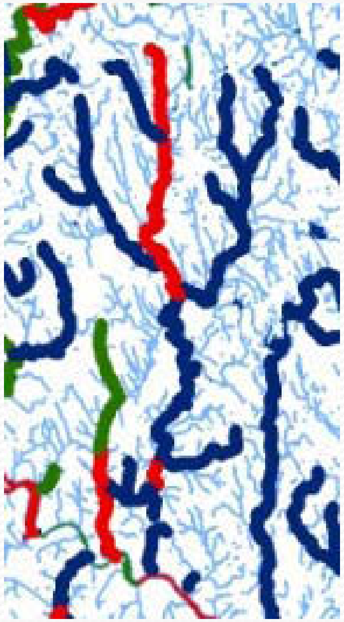
What are impaired waters?

- An impaired or threatened waterbody is any waterbody that is listed according to section 303(d) of the Clean Water Act.

  A waterbody is considered impaired if it does not attain water quality standards.

- For biologically impaired river segments, often multiple potential sources exist and determination of the definitive cause(s) and source(s) requires further investigative work.

What/Where are our locally impaired waters?



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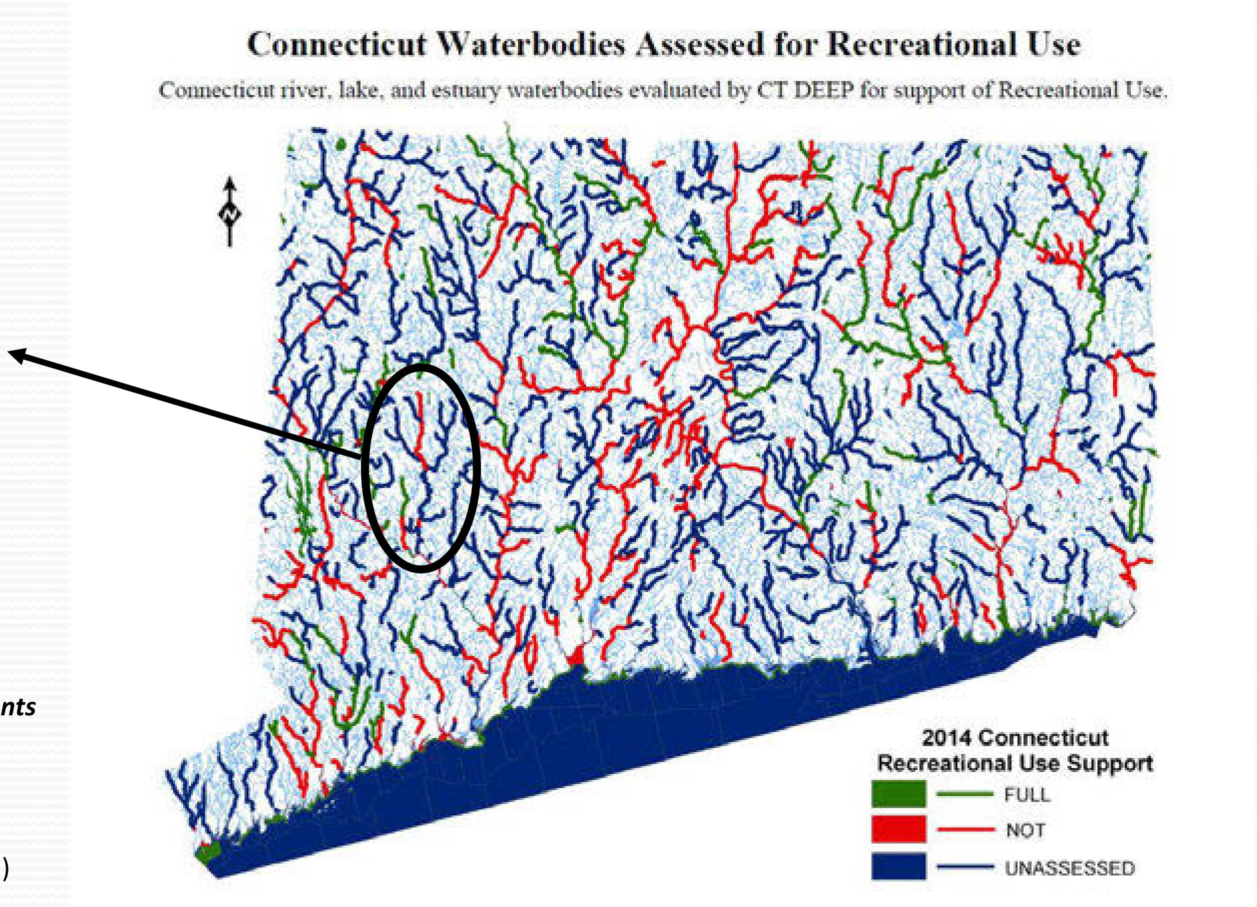

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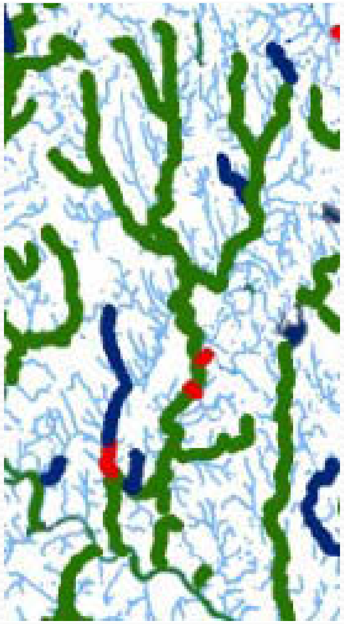

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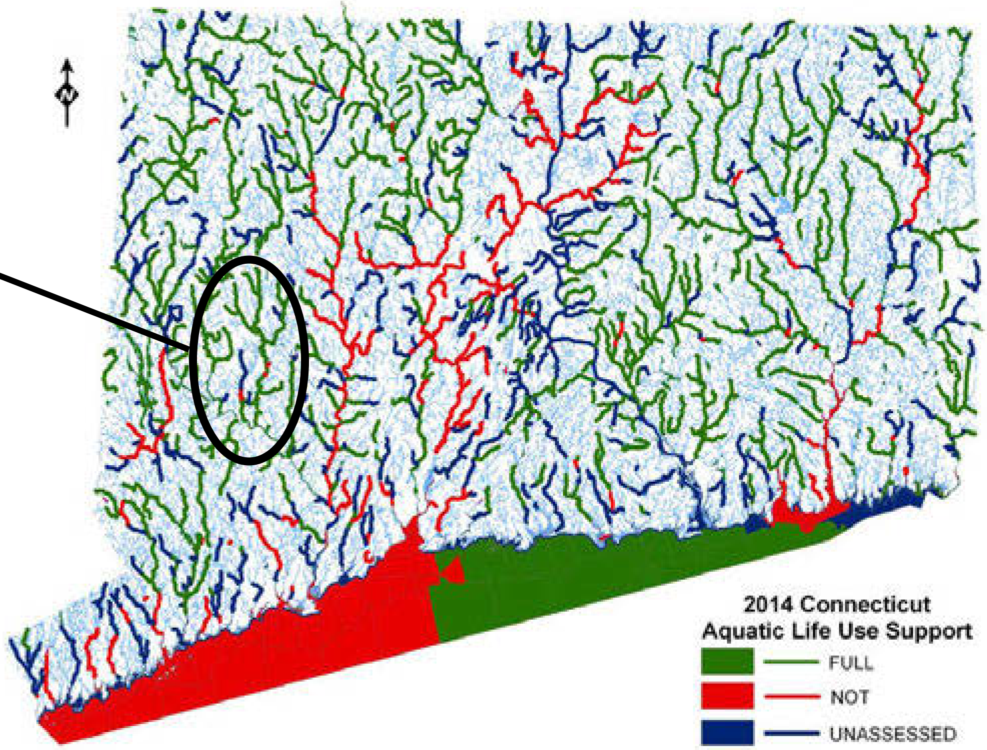

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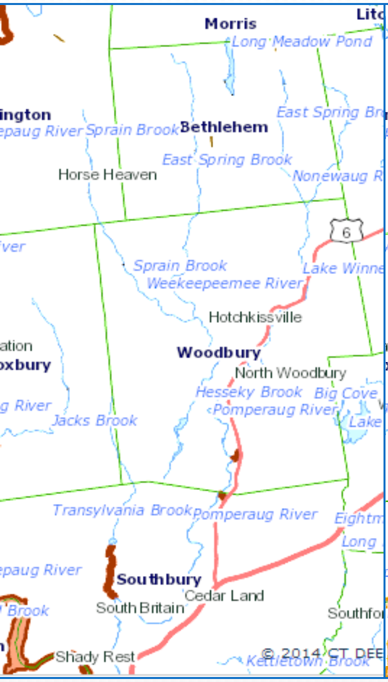

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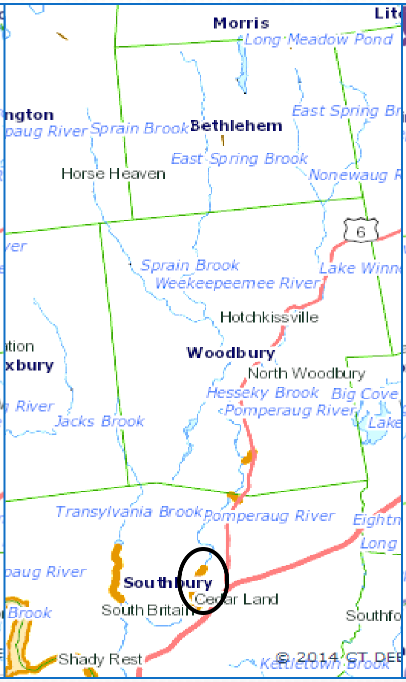

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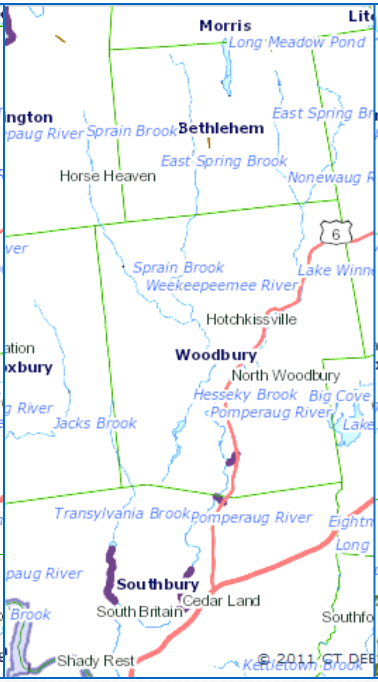

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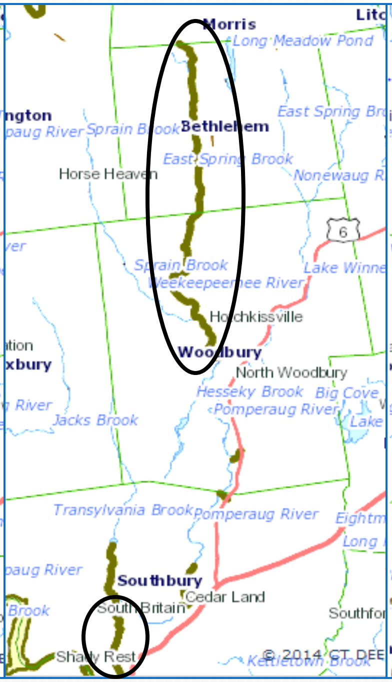

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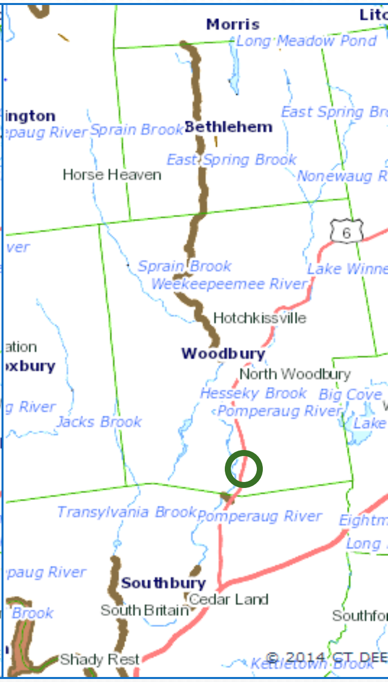

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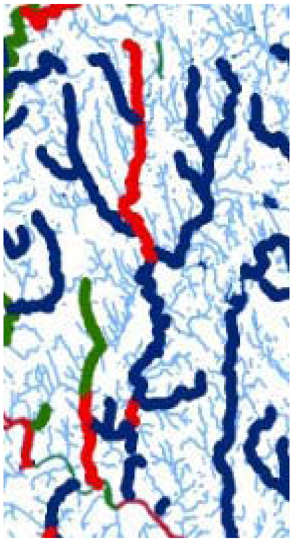

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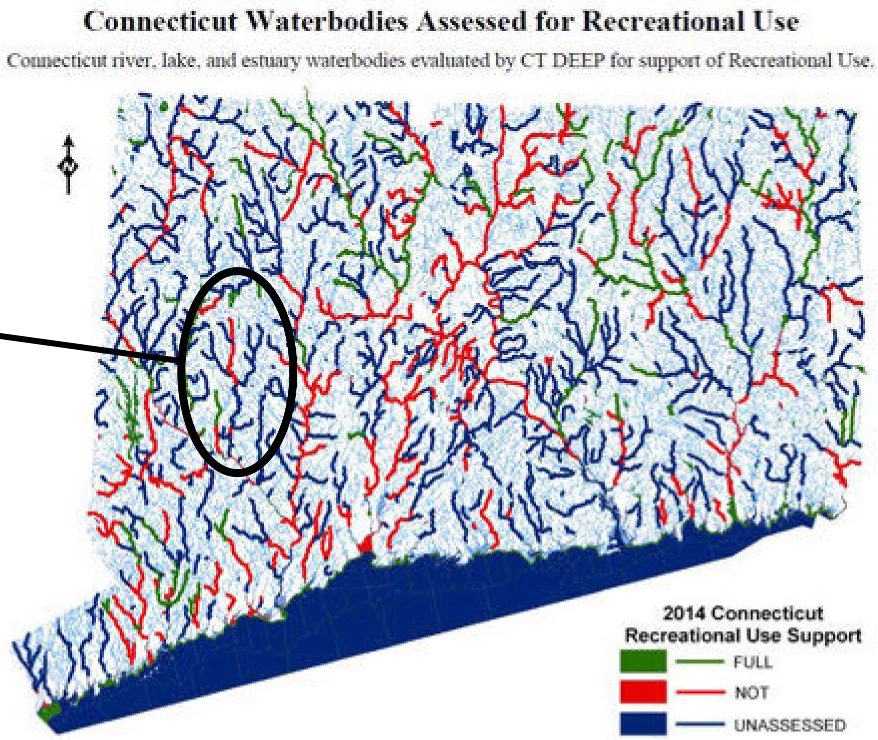

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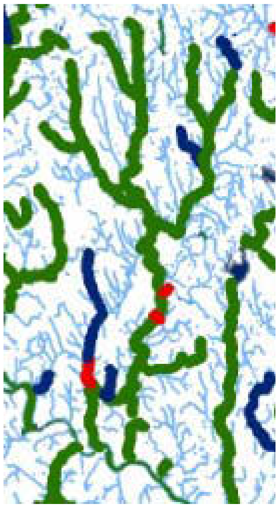

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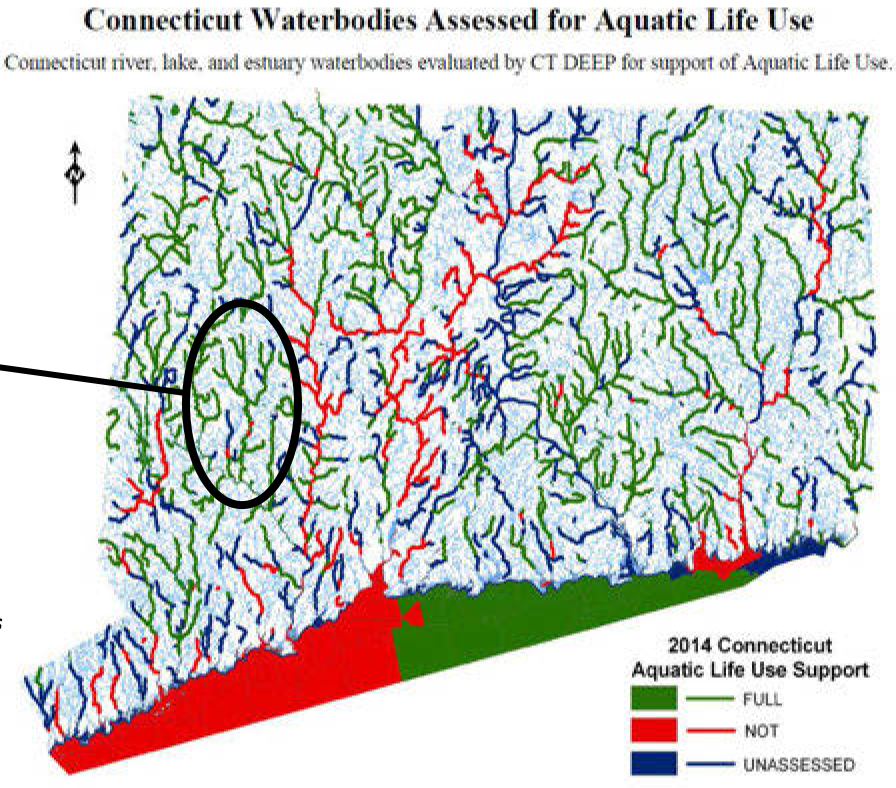

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From: DeLoris Curtis
To: Carol Haskins
Subject: RE: Thursday - Today
Date: Thursday, April 6, 2017 1:08:58 PM

Thank you as well. It seemed to work out well. I think you have everyone that was there. Maybe this is a new way to get up close and personal with the members. And, pass the word.

Thanks

DeLoris Curtis, AICP
Land Use Administrator
Planning@southbury-ct.gov
(203) 262-0634
(203)264-3719(Fax)

TOWN OF SOUTHBURY
501 Main Street South
Southbury, CT 06488
(203) 262-0600
www.southbury-ct.org

From: Carol Haskins [mailto:chaskins@pomperaug.org]
Sent: Thursday, April 06, 2017 12:17 PM
To: DeLoris Curtis
Cc: 'Len DeJong'; 'Vince McDermott'
Subject: RE: Thursday - Today

HI DeLoris -

Thanks SO MUCH for pulling together the wonderful group of Land Use commission representatives this morning! I think it was a really nice cross section of the commissions and a nice diversity in view points around the table. And, as always, a group with very astute questions related to water issues! In follow-up to the conversation, I wanted to share electronic copies of the hand-outs as I didn't have enough for everyone. I also wanted to make a follow-up note on something that I should have underscored in the conversation. That point is that the field surveys and WBP as a whole is not intended to be an exercise identifying enforcement actions to be taken, but is intended to be an exercise in creative problem solving. It occurred to me on the drive back to Woodbury that I didn't underscore that enough.

Please feel free to pass along the attachments to those in attendance as well as other land use commissioners as you see fit.

Thanks you again for orchestrating today's get together!
Carol

P.S. Can you confirm for me that this was the list of participants? I feel like I am missing someone...

Dan Slywka - Wetlands
Martin Ludorf - Zoning
Bill Spencer - Wetlands
Harmon Andrews - Planning
Nancy Clark - Planning
Susan B. Monteleone - Zoning
John Cottell - Public Works Dir.
Chris McGinness - Land Use Enforcement
Jeff Manville - First Selectman
DeLoris Curtis - Town Planner

From: DeLoris Curtis [mailto:planning@southbury-ct.gov]
Sent: Thursday, April 6, 2017 9:41 AM
To: Carol Haskins
Subject: Thursday - Today

Morning – just realizing I did not hear back from you. Are you still able to come this morning?

DeLoris Curtis, AICP
Land Use Administrator
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TOWN OF SOUTHBURY
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Woodbury
First land deed from the Indians
April 12th 1659

TOWN OF WOODBURY
Selectmen's Office
281 Main Street South
Woodbury, Connecticut 06798

TELEPHONE: (203) 263-2141
FAX: (203) 263-4755

Board of Selectmen Annual Joint Land Use Meeting
Wednesday, January 17, 2018
7:00 p.m.
Senior/Community Center

AGENDA

1. Call to Order
2. Introduction - First Selectman Bill Butterly
3. Guest Speaker – Thomas A. Kaelin, Attorney at Law
    a. *Discussion regarding Ethics and Conflicts of Interest*
    b. *Update on Sign Regulations*
4. Carol Haskins, Pomperaug River Watershed Coalition - Update on Watershed Management Plan
5. Brief Overview of Successes and Challenges – Commission Chairs/Designees
    a. Conservation Commission
    b. Historic District Commission
    c. Inland Wetlands & Watercourses Agency
    d. Planning Commission
    e. Zoning Board of Appeals
    f. Zoning Commission
6. Introduction of Gabe Rosen, Land Use Enforcement Officer – Mr. Butterly
7. Adjournment

Respectfully Submitted,

Wm J Butterly

William J. Butterly, Jr.
First Selectman

RECEIVED & FILED
IN WOODBURY, CT
This 11th day of Jan 2018
at 10:40 o'clock A M
Town Clerk

TOWN OF WOODBURY
281 Main Street South
Woodbury, Connecticut 06798-0369

Woodbury
First land deed from the Indians
April 12th 1659

Minutes of the Board of Selectmen Joint Land Use Meeting

Wednesday, January 17, 2018 ♦ 7:00 p.m. Senior/Community Center

Present: First Selectman Bill Butterly; Selectmen Barbara Perkinson and George Hale; Tom Amatruda, Andrew Chapman, Susan Cheatham, Bob Clarke, Mary Connolly, Joe Donato, Vincent Faricello, James Frey, Ruth Melchiori, Mike Novak, Lesa Peters, Don Richards, Kenneth Schultz, Deborah Schultz, Jeff Sherman, David Taylor, and Mary Tyrrell; also, Maryellen Edwards, Gabe Rosen, Attorney Tom Kaelin, Carol Haskins, Len DeJong, one additional member of the community, one member of the press, and clerk Deb Carlton

Call to Order

Mr. Butterly convened the meeting at 7:02 p.m.

Introduction – First Selectman

Mr. Butterly welcomed those present, and offered a look back at the past year. He noted Ms. Edwards has been faced with some arduous tasks in her first year here, including the MS4 stormwater management plan. A committee has been appointed to continue work on that. Initial surveys have begun regarding the POCD, too, and Milone & McBroom serves as the Town's on call engineers. Also this year, the Town has addressed dueling landlords, a sober house application, the question of a copper pineapple adorning the gallery cupola, the high school renovation project, the use of the barn on Rt. 6, a new brewery in the Middle Quarter, and replacing the outgoing zoning compliance officer. Along with all this, he noted implementation of the View Point permitting software, with Lisa Bigham in the Building Department as key to that project. He concluded by saying he no longer hears visitors bellowing from the first floor of Shove, complaining that the land use office is closed. He said good things are going on here and he urged keeping things moving forward.

Guest Speaker – Attorney Tom Kaelin

Attorney Kaelin spoke on the topic of conflicts of interest and gave an update on sign regulations.
Regarding conflicts of interest, he urged those present to begin with the Town Charter, where that subject is addressed, and noted this is our guideline for service. It is possible, he said, to have a conflict and still serve; however, if the conflict is a material one, it will be necessary to recuse. Material conflicts can be financial or personal, and he outlined the procedures for recusal as well as penalties for not doing so. He spoke about *predisposition*, where no specific circumstances cause a conflict, but a pre-existing mindset prevents the person from ever being persuaded. If found to have a predisposition, the member would be asked to recuse. He also spoke of *antagonism,* and urged members to be aware of it when it happens. Antagonism results when someone goes after a member to get him/her to say something prejudicial in order to disqualify that member from an application process. He urged members to be aware of what they say publically. Lastly, Attorney Kaelin spoke of *representation,* which prohibits anyone serving on a land use board within the past 12 months from appearing on behalf of or representing any person or entity before any land use board.
Regarding signs, he said the Town will emphasize sign enforcement this year. There are a number of signs not in compliance and those will be reviewed. Sign regulations may be revised. He noted a case in Milford involving signs and zoning, and is awaiting a decision on that. Asked if a sign ordinance is being considered, he said that an ordinance is not the preferred solution.

Update - Carol Haskins, Pomperaug River Watershed Coalition

Ms. Haskins discussed progress on the updating of the 2006 watershed plan. She gave status updates on: impaired waters, the Watershed Based Plan (WBP) vision statement and goals, a process overview showing steps completed or in progress, next steps, and public information sessions. She answered questions regarding bacteria levels in local waters, the extent of water sampling and monitoring, and ways to alert those who fish or swim of bacteria levels.

Brief Overview of Successes and Challenges – Commission Chairs (or designees):

Conservation Commission – *David Taylor:* This group completed a listing of open space last year, found there were more, and made changes/updates. A list of Town owned open space will be available at the Land Use office. The challenge is capturing information when land transfers are made and become protected as open space. This year, the group hopes to articulate the importance of conserving open space, will develop a management plan for the Sherwood property, and will contribute to the Town's PoCD.
Ms. Edwards added that one of her goals is to have pages on the Town website for each commission, with links added for public use. Mr. Taylor and the others present expressed interest in this idea.

Historic District Commission – *Susan Cheatham:* The charge of this group was reviewed. They seek to protect the Town from an historical perspective, looking to the future while preserving the past. Surveys have demonstrated there is an interest in preserving the historic aspects of the Town, she said.

Inland Wetlands & Watercourses Agency – *Mary Tyrrell*: thanked all those who volunteer in town, and feels the effort shows. This group has 2 applications currently: parking at the Marketplace, and the Dollar General. Public hearings are upcoming. Smaller applications have made up the rest of the year, along with review of floodplains for the NHS building project. She reviewed the group's charge of protecting viable water for now and the future, noting CT is one of four towns in the state that protects 500' from vernal pools. A proponent of farming, she stressed the need to be consistent in the consideration of all applications and the effects on wetlands.

Planning Commission – *Mary Connolly:* noted the Plan of Conservation and Development is ahead of schedule. It is being rewritten without consultants and her group will meet with other land use boards to help with revisions, and will do surveys for more detailed feedback. They are looking at other towns' plans for ideas, and they want it to be user friendly. Focus groups will also be set.

Zoning Board of Appeals – *Michael Novak:* noted he now has a full complement of a board, which is a good thing. He noted very good interactions with the Town Planner's office and thanked them for that. He spoke of the challenges of giving people reasonable use of their land, while recognizing that any variances granted goes with that land indefinitely. He feels his board works in a bi-partisan way and well together. And, even if an appeal ends up in court, the aim is to put the Town in the best position possible to defend itself legally.

Zoning Commission – *Bob Clarke*: last year, this group approved applications for 10 new businesses, 1 activity by use, 10 residential units in the Planned Industrial District (PID), a conversion back from a 1 family house with a business to a 2 family house, and the division of property on Rt. 61 into 2 separate building lots. His group is working on revisions to regulations. He requested that the Aquifer Protection Agency (APA) be included on future agendas, and he commented on a rumor that an agency is looking to take over the APA, which he pledged to defend against.

Ms. Edwards introduced Land Use Enforcement Officer, Gabe Rosen, a UCONN graduate with background in conservation who comes to us from Monroe. She also thanked all the land use boards and commissions, and said it is clear to her that they are all here for a purpose, care about what they are doing, and she attributes the good things going on in town to them.

First Selectman Butterly thanked everyone for coming and adjourned the meeting at 8:47 p.m.

Respectfully submitted,

Deb Carlton, Asst. to the First Selectman

Updating the Pomperaug Watershed Management Plan*

Town of Woodbury
Joint Land Use Boards Meeting
Thursday January 17, 2018

Carol Haskins, Outreach Director
Pomperaug River Watershed Coalition

The project of updating the Pomperaug Watershed Management Plan to an EPA 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.

Need for Updated Watershed Plan

- Out of date Watershed Management Plan (2006)
  - New Data (Increased Number of Impaired Areas)
  - New prescribed format required by EPA
- Current identified solutions (i.e. TMDL plans) are generalized
- Need to identify and prioritize site specific solutions
- Provides mechanism for funding corrective actions

Impaired Waters

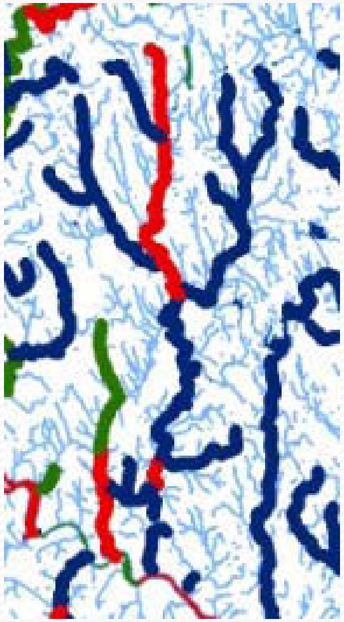
What are impaired waters?

- An impaired or threatened waterbody is any waterbody that is listed according to section 303(d) of the Clean Water Act.

  A waterbody is considered impaired if it does not attain water quality standards.

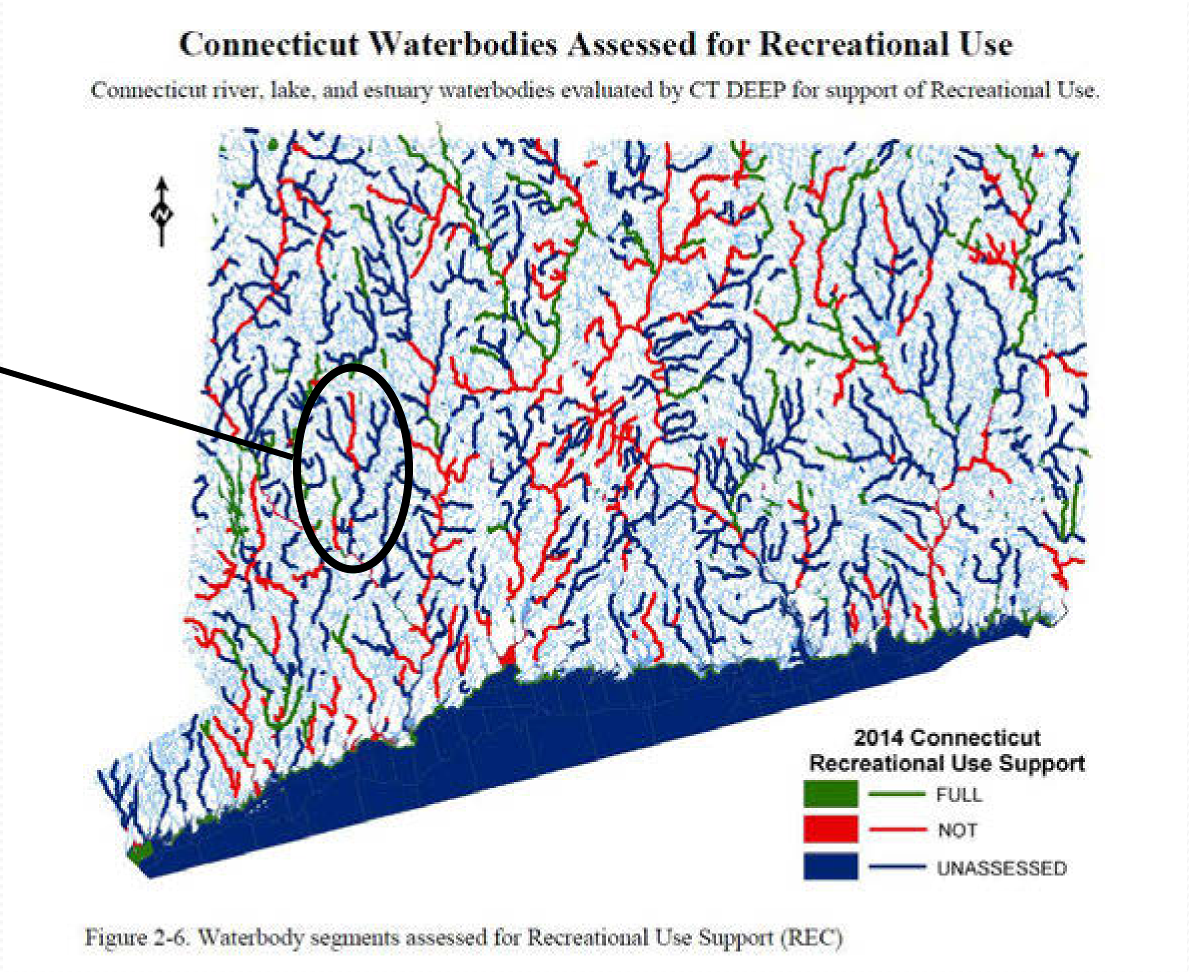
- For biologically impaired river segments, often multiple potential sources exist and determination of the definitive cause(s) and source(s) requires further investigative work.

What/Where are our locally impaired waters?



Pomperaug Recreational Impairments
due to elevated bacteria levels:

Weekeepeemee River (entire)
Pomperaug River (2 segments)
Transylvania Brook (lower section)

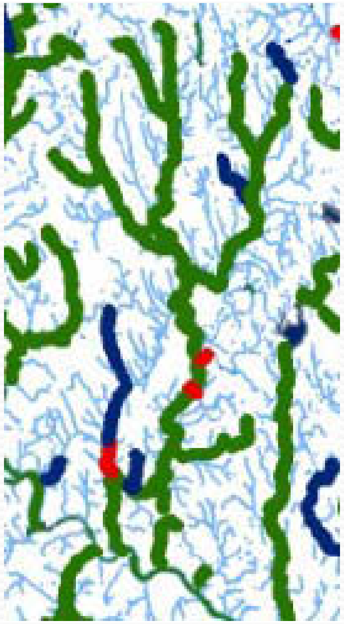


Connecticut Waterbodies Assessed for Recreational Use

Connecticut river, lake, and estuary waterbodies evaluated by CT DEEP for support of Recreational Use.

Figure 2-6. Waterbody segments assessed for Recreational Use Support (REC)

What/Where are our locally impaired waters?



Pomperaug Aquatic Life Use Impairments
due to flow regime alteration:

Stiles Brook (below dam)
South Brook (previously listed)

Due to ammonia, chlorine, copper, zinc:

Transylvania Brook (lower section)

Connecticut Waterbodies Assessed for Aquatic Life Use

Connecticut river, lake, and estuary waterbodies evaluated by CT DEEP for support of Aquatic Life Use.

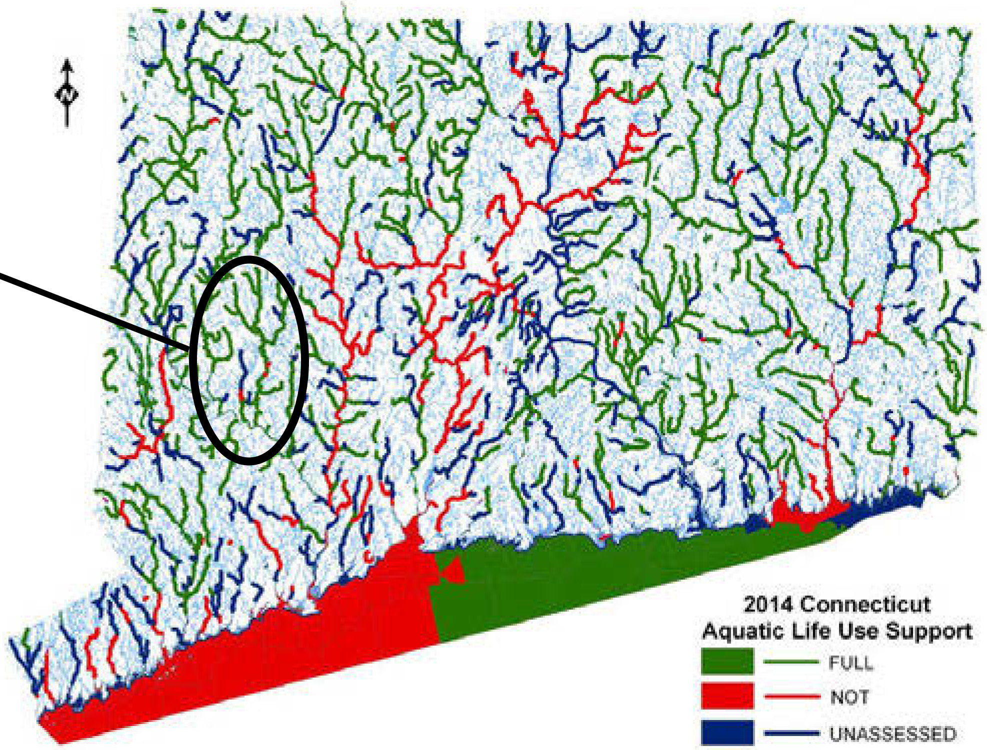


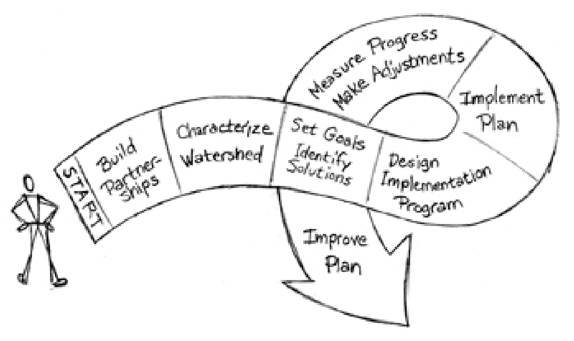
Figure 2-2. Waterbody segments assessed for Aquatic Life Use Support (ALUS)

WBP VISION STATEMENT & GOALS

PRWC's vision is that this Plan will be used as a road map to return impaired waters to swimmable and fishable conditions and that this document will be used as a guide to evaluate changes through time. PRWC's goal for the Pomperaug Watershed Based Plan is develop a document that:

- establishes an up-to-date baseline of conditions in the watershed;
- evaluates contributing causes of known water quality impairments;
- identifies water quality monitoring needs;
- identifies and prioritizes steps to reduce pollutant inputs to impaired rivers and streams;
- incorporates proactive measures to protect/maintain high quality streams; and,
- establishes community buy-in through public engagement in the planning and implementation process.

Process Overview



- Convene Steering Committee ✅
- Annotated List of Existing Plans and Studies ✅
- Vision Statement & Goals ✅
- Retention of Consultant Services ✅
- Identification of Data Gaps ✅
- Quality Assurance Project Plans (QAPP) ✅
- Load Reduction Goals Report ✓
- Public Outreach – Introduction and Presentation of Project ✓
- Field Assessment Report & Identification of Potential BMP Locations ✅
- BMP Conceptualization ✓
- BMP Prioritization
- BMP Implementation Strategy
- Draft, Review, Finalize Watershed Based Plan

✅ *Complete* ✓ *In-Progress*

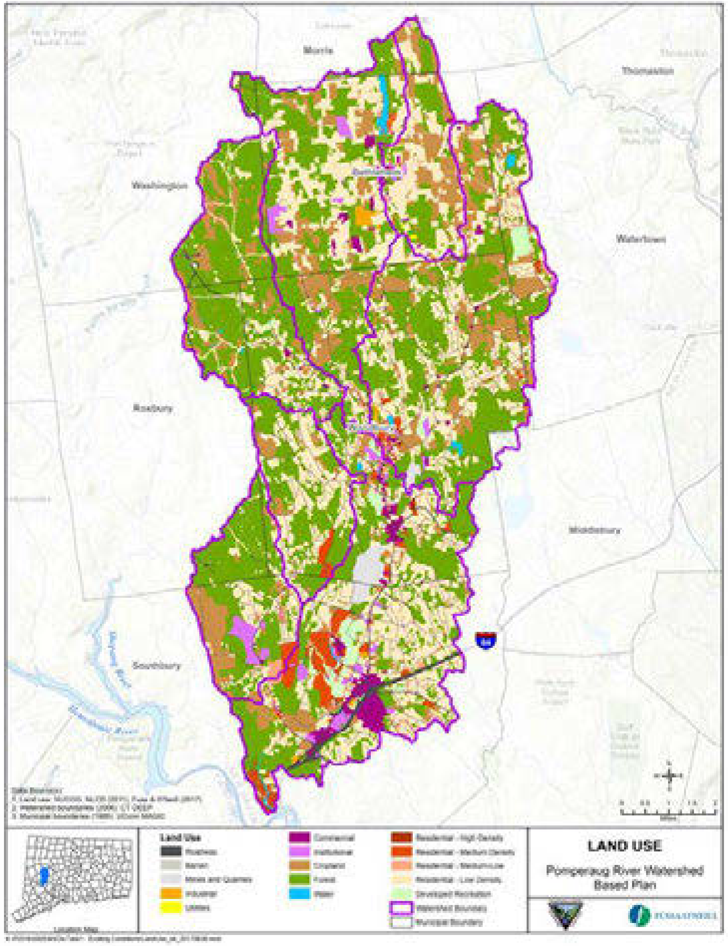
Next Steps

- Finalize Pollutant Load Modeling & Load Reduction Goals (January)
- **Present public information sessions in Woodbury, Southbury, and Bethlehem / capture community input (February)**
- Finalize Prioritize BMP Concepts and Implementation Strategy (February)
- Draft Watershed Based Plan, Review and Finalize (March / April)



Public information sessions

- Updated existing conditions of watershed
  - Impairments, land use, land cover, impervious surfaces, committed open space
- Pollutant loading model
  - Overview of model inputs and assumptions
  - Model estimates for bacteria, nutrients, and sediment loading
  - Load reduction goals
- Visual Assessment Survey Findings
- Overview of BMP Recommendations
- Capture community input / feedback



Share Your Knowledge & Observations

Pomperaug River Watershed Coalition
39 Sherman Hill Road, C103
Woodbury, CT 06798

203-263-0076
info@pomperaug.org
www.pomperaug.org

Acknowledgements

- Connecticut Environmental Conditions Online
- CT Department of Energy and Environmental Protection
- Connecticut Community Foundation
- US Environmental Protection Agency

The project of updating the Pomperaug Watershed Management Plan to an EPA Approved 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.

A Look at Water Quality in the Pomperaug Watershed

POMPERAUG RIVER
WATERSHED COALITION

TUESDAY JULY 17 at 7:00PM
Shove Building, Woodbury Municipal Complex

WEDNESDAY JULY 18 at 2:00 PM
Room 205, Southbury Town Hall

WEDNESDAY JULY 18 at 6:30 PM
Leever Room, Bethlehem Public Library

PRESENTATION HIGHLIGHTS WILL INCLUDE:

- Efforts to update the Pomperaug Watershed Management Plan*
- Overview of in-stream water quality conditions
- Description of current land cover conditions
- Results of pollutant loading model analysis
- General recommendations for reducing bacteria, nutrient, and sediment loads to local rivers and stream (and Long Island Sound)
- Plans for expanding local stream monitoring
- Opportunity for audience feedback and input

FOR MORE INFORMATION:
www.pomperaug.org | 203-263-0076

** PRWC is in the process of updating its 2005 Watershed Management Plan to a 9-Element Watershed Based Plan , a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation. Revisions to the Plan are being made with guidance and oversight from PRWC's Land Use Committee whose membership includes but is not limited to representatives from local conservation organizations, town land use departments, as well as regional, state, and federal agencies.*

Public Information Sessions: Pomperaug Watershed Based Plan

General Notes from Presentations Capturing Participant Comments & Questions

Woodbury 7/17/2018

- Question raised about organic turf management and land care practices and if possible to include recommendations for this in the WBP.
- Discussion around the MS4 permit requirements to reduce impervious areas draining to streams
- Discussion around the limited data set from DEEP and shift in monitoring priorities to public swimming areas and the need for more data to better assess the extent of the impaired areas and better target implementation of best practices.

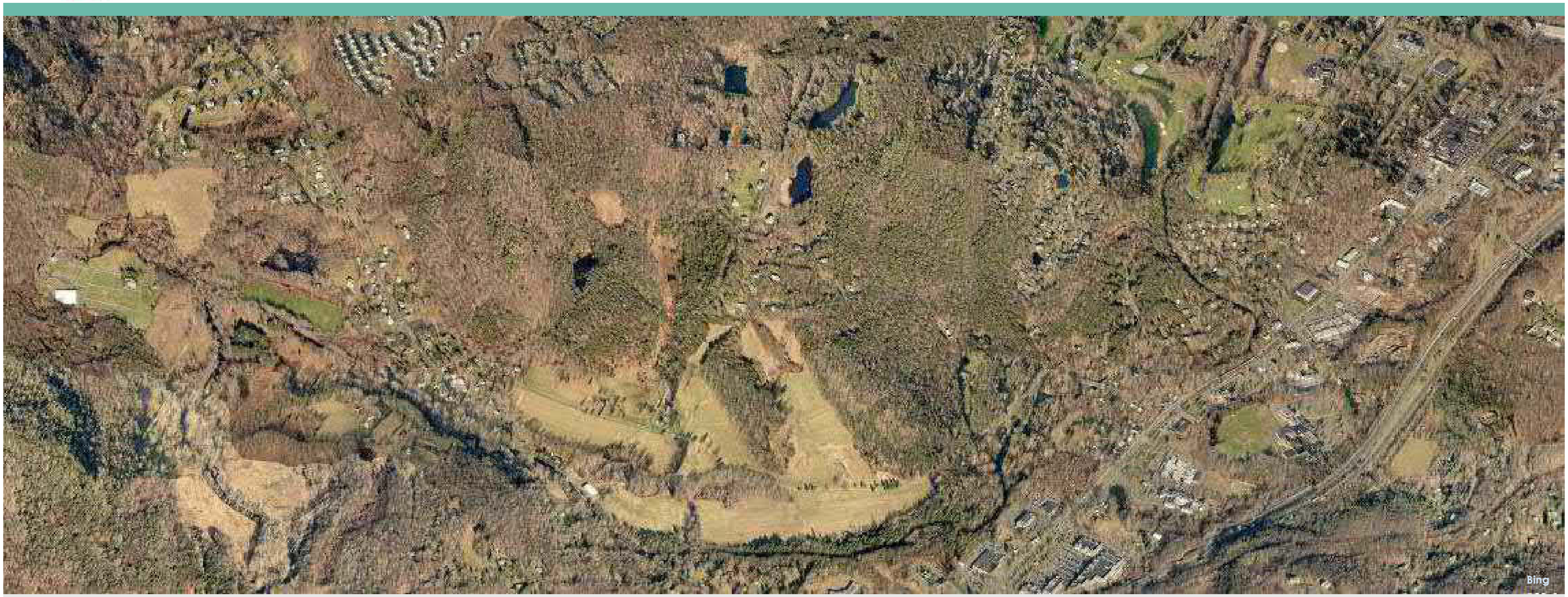
Southbury 7/18/2018

- Question regarding impacts of road salt on aquatic life and stream health.
- Discussion regarding road construction and the installation of culverts that discharge to streams. Question raised -- is there another way? Answer – Yes, and lead into a discussion of the MS4 permit requirements to reduce impervious areas draining to streams.
- Question raised about the power plant in Oxford and the impact of groundwater withdrawals where water is leaving the basin and noted observations of private, residential wells going dry.
- Red flag was waived regarding the cost barriers to implementing agricultural improvement projects related to manure management, especially when adhering to NRCS design guidelines. Discussion noted that there are several simpler alternative measures that could be implemented using other funding sources and reduced cost barriers.

Bethlehem 7/18/2018

- Question raised about the past use of fertilizers and pesticides on agricultural lands being persistent in the soil and whether or not that affects the ability of the soils to infiltrate rainfall?
- Discussion about Heritage Village possibly serving as a model / demonstration sites for stormwater retrofits and that it might be eligible for 319 funding as it is a private development (not town owned property – outside of municipal storm sewer system?)
- Audience member provided an example from Arcata, California where plants and other biota are being used in wastewater treatment process (instead of traditional sewage treatment plant)
- Question / comment made about ability to integrate less reflective surfaces into LID retrofits to limit nighttime light reflection back into the sky (i.e. light pollution concern)

FUSS & O'NEILL



Public Information Meeting

Pomperaug River Watershed Based Plan

July 17 & 18, 2018

POMPERAUG RIVER WATERSHED COALITION

Meeting Agenda

1. Welcome and Introductions
2. Update of Pomperaug River Watershed Management Plan
3. Water Quality Conditions
4. Land Use and Other Watershed Characteristics
5. Watershed Assessments
6. Initial Recommendations for Improving Water Quality
7. Next Steps
8. Discussion

Photo credit: National Audubon Society

Project Team

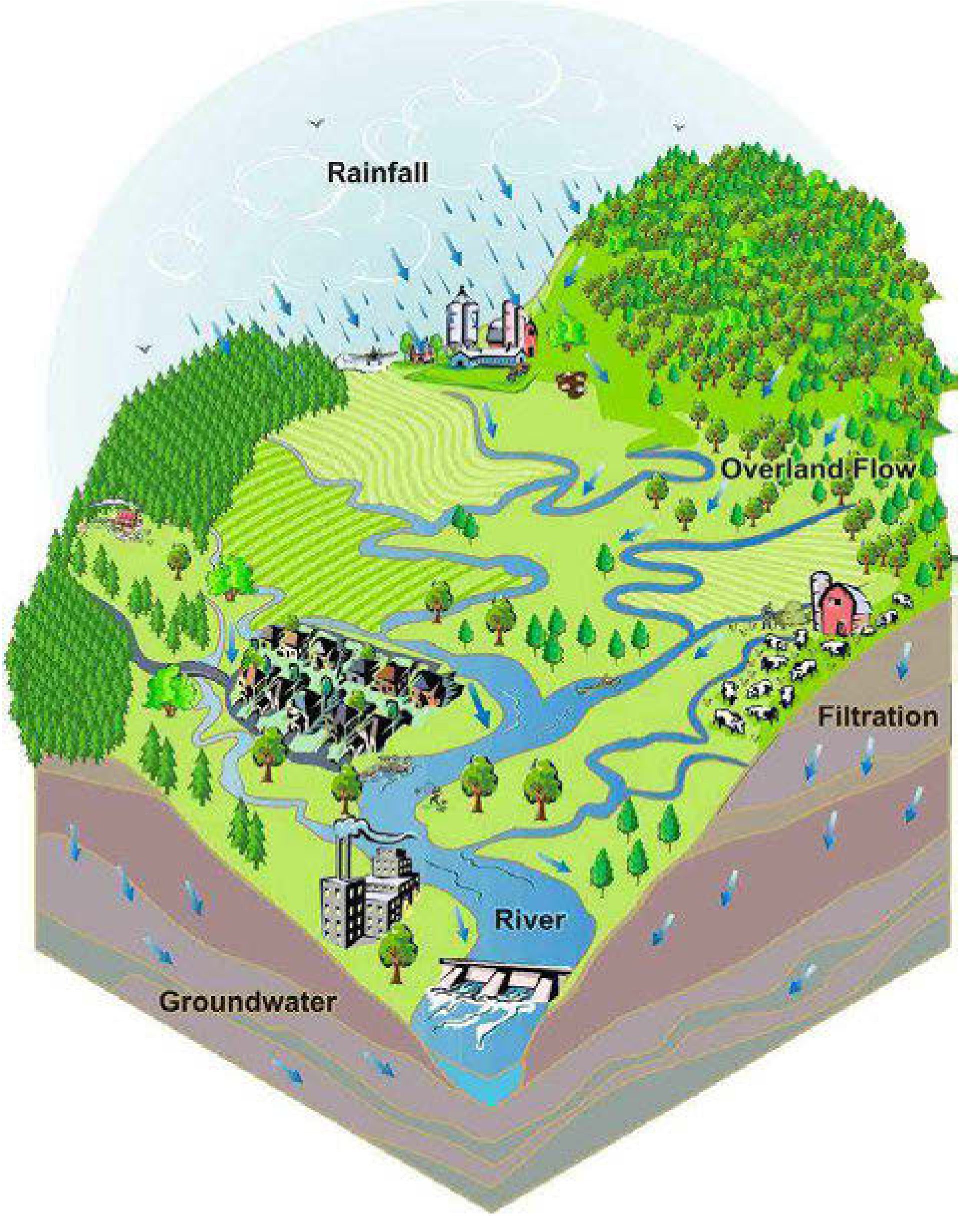
- Project Leaders
  - Pomperaug River Watershed Coalition (PRWC)
  - CT Department of Energy and Environmental Protection (CTDEEP)
  - Fuss & O'Neill, Inc.
- PRWC Land Use Committee
  - Town land use departments
  - Local conservation organizations
  - Regional, state, and federal agencies
- Project Funding
  - US EPA and CTDEEP Clean Water Act Section 319 Nonpoint Source Grant
  - Connecticut Community Foundation

The project of updating the Pomperaug Watershed Management Plan to an EPA 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.

Purpose of Meeting

- Describe the watershed plan update process
- Summarize watershed conditions and issues
- Provide a forum for public input and discussion
  - Issues of concern
  - Local priorities
  - Project ideas

What is a Watershed?

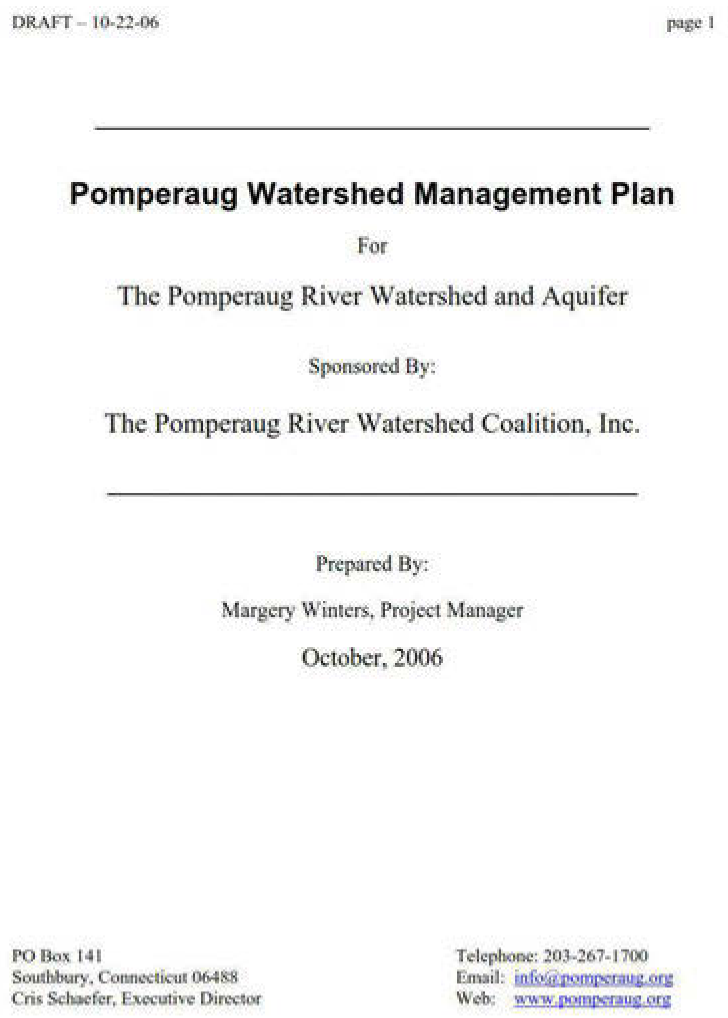


Project Goals

- Update the 2006 Pomperaug River Watershed Management Plan
  - Consolidate previous and ongoing work under one plan
  - Meet EPA's required Nine Elements
  - Improve chances for funding and implementation

EPA Nine 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**



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Pomperaug Watershed Management Plan

For

The Pomperaug River Watershed and Aquifer

Sponsored By:

The Pomperaug River Watershed Coalition, Inc.

Prepared By:

Margery Winters, Project Manager

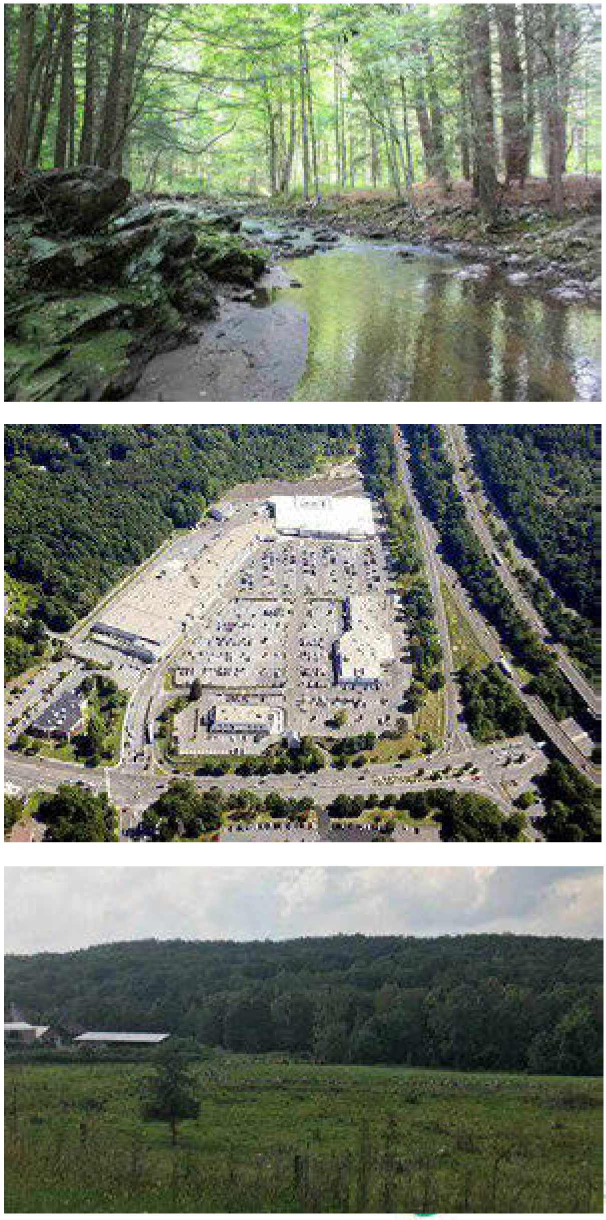
October, 2006

PO Box 141
Southbury, Connecticut 06488
Cris Schaefer, Executive Director

Telephone: 203-267-1700
Email: info@pomperaug.org
Web: www.pomperaug.org

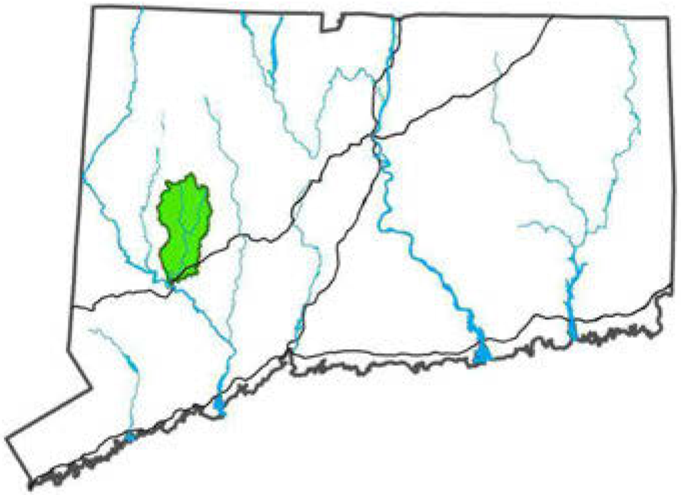
Watershed Based Plan Objectives

- Update baseline conditions in the watershed
- Identify existing water quality issues and pollutant sources
- Identify water quality monitoring needs
- Engage watershed municipalities and the public
- Prioritize projects to improve and protect water quality
- Improve water quality and de-list “impaired” waters



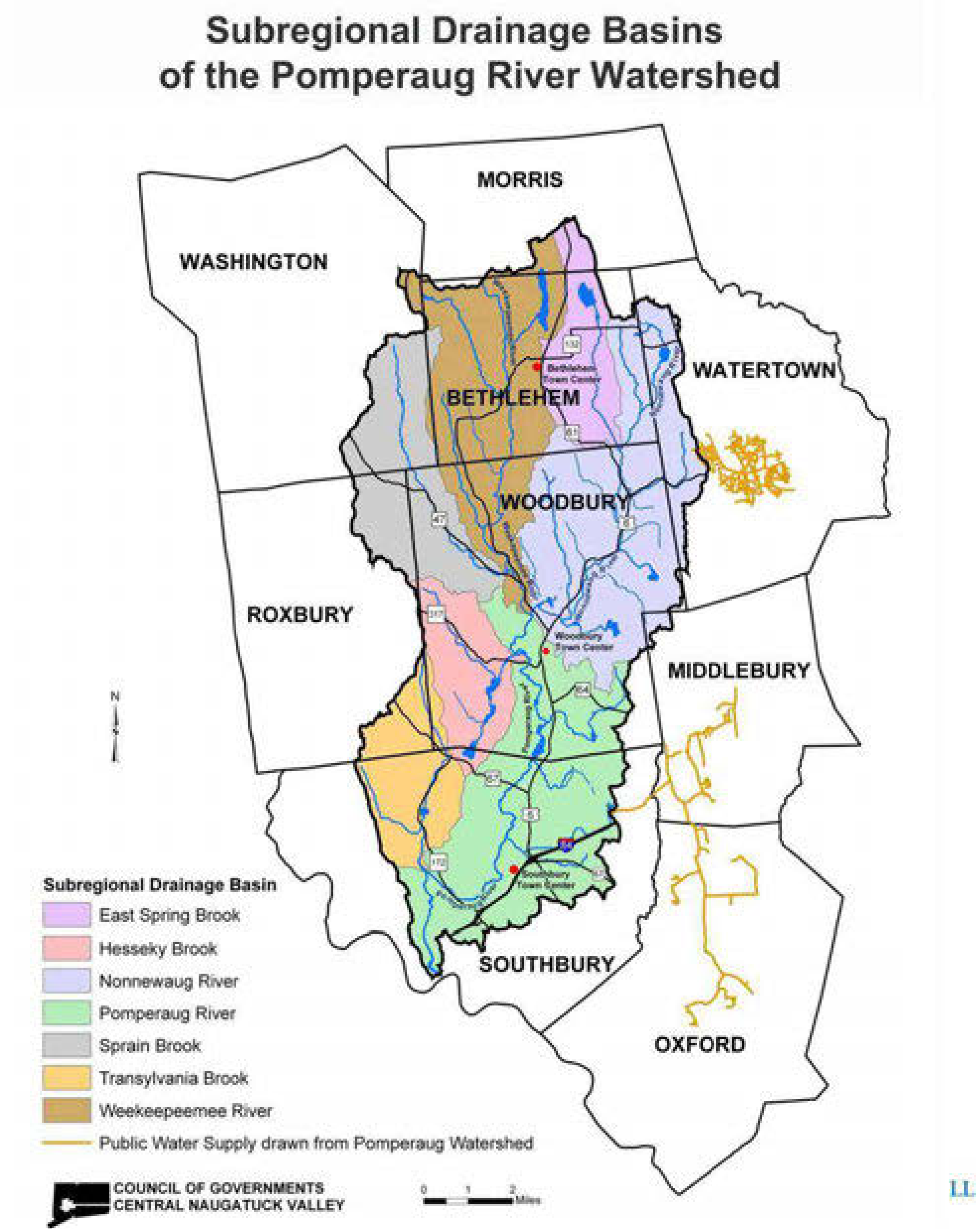
Pomperaug River Watershed Overview

- 90 square miles
- Portions of 8 towns
- 7 major subwatersheds
- Major tributaries

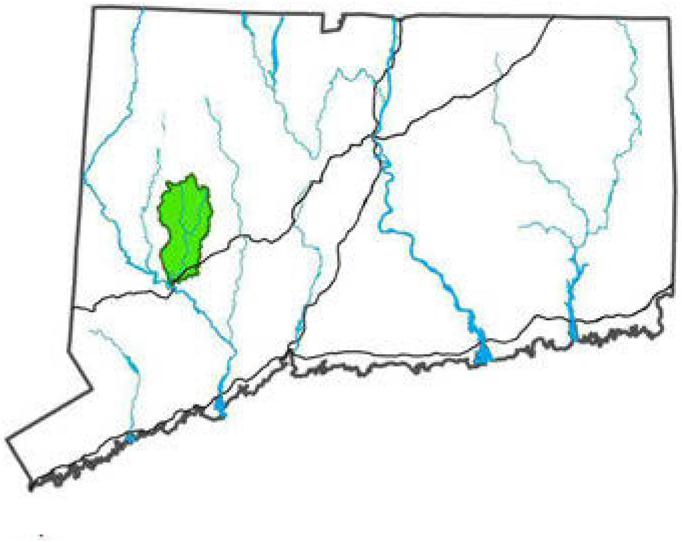


Pomperaug River Watershed Overview

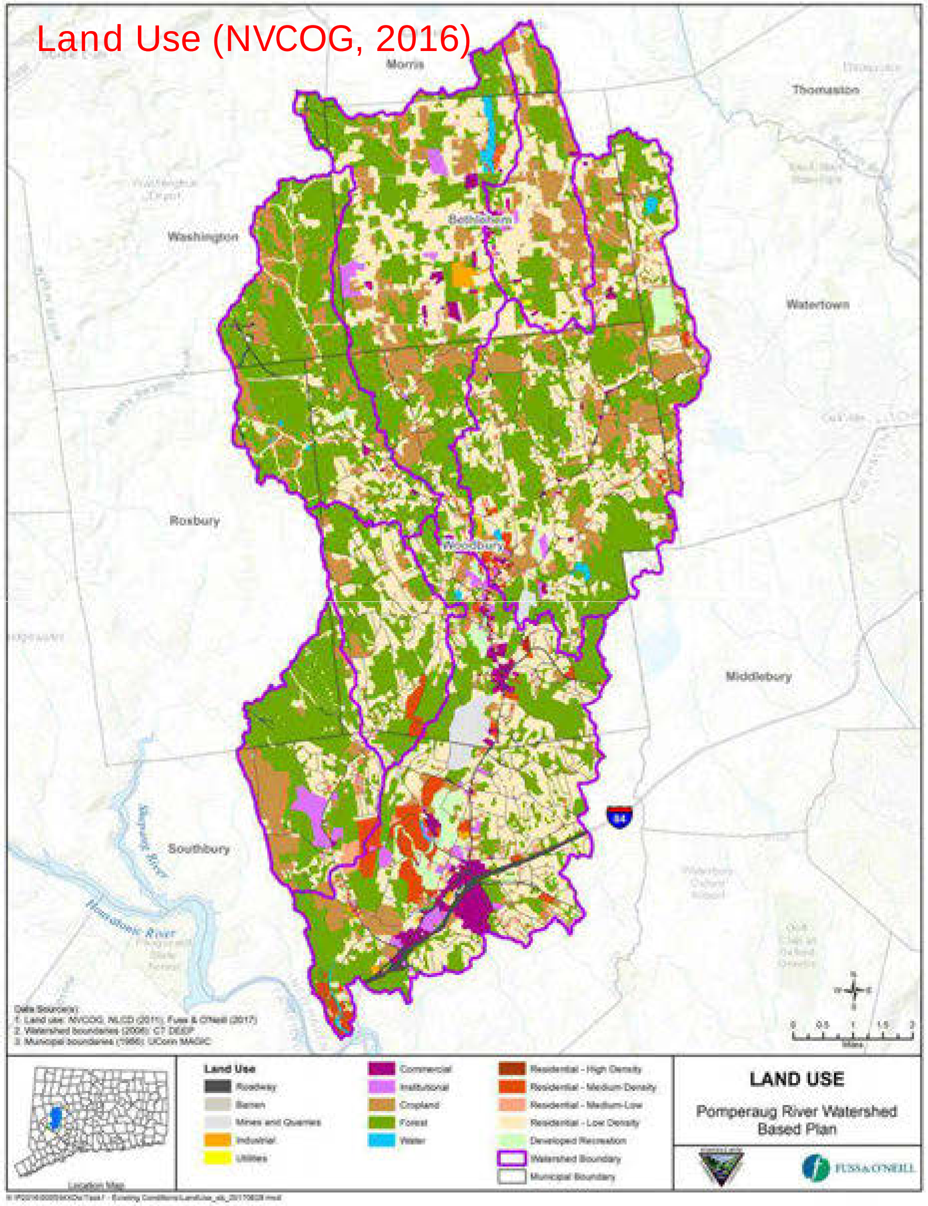
- 90 square mile Regional Basin
- Portions of 8 towns
- 7 major Subregional Basins
- Major tributaries



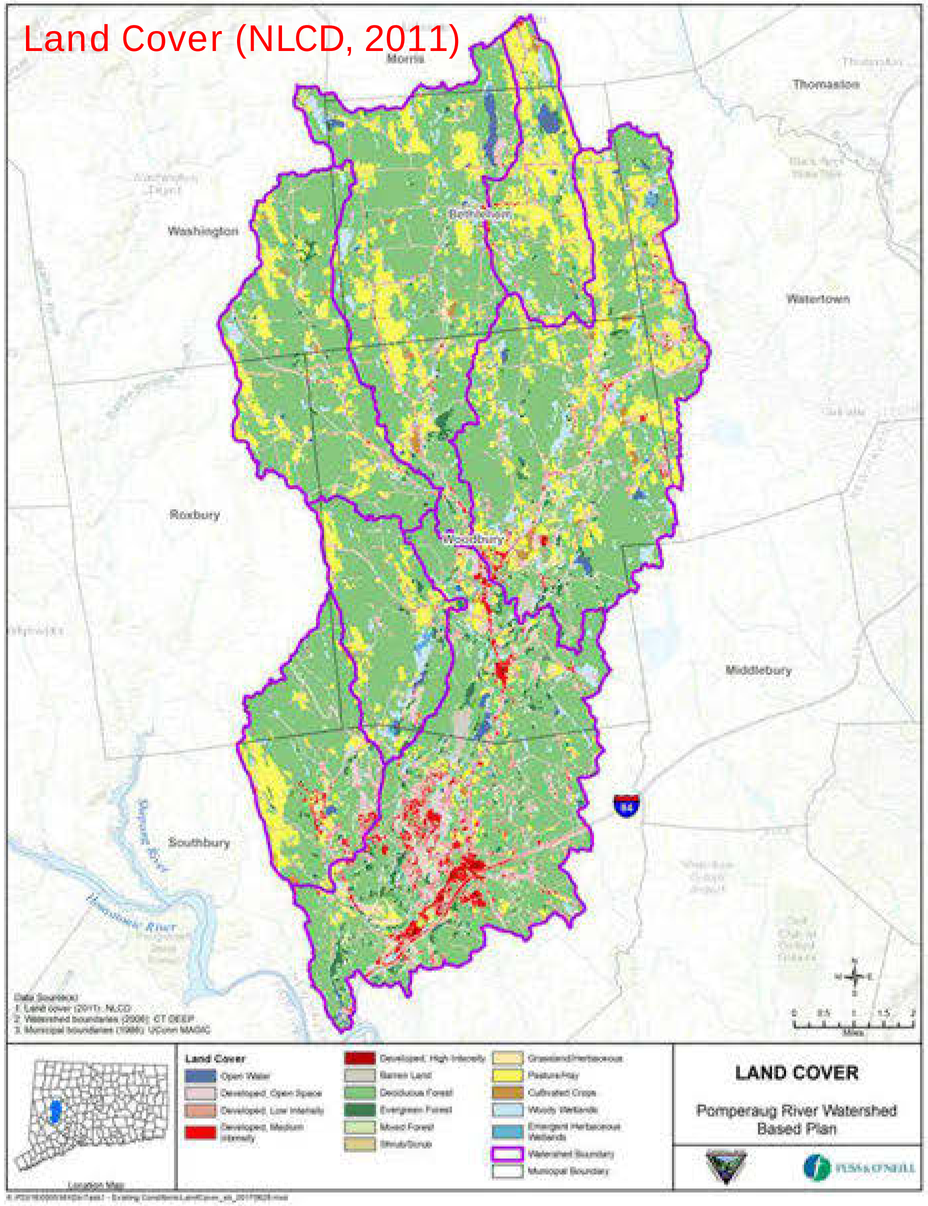
Subregional Drainage Basins of the Pomperaug River Watershed



Land Use / Land Cover

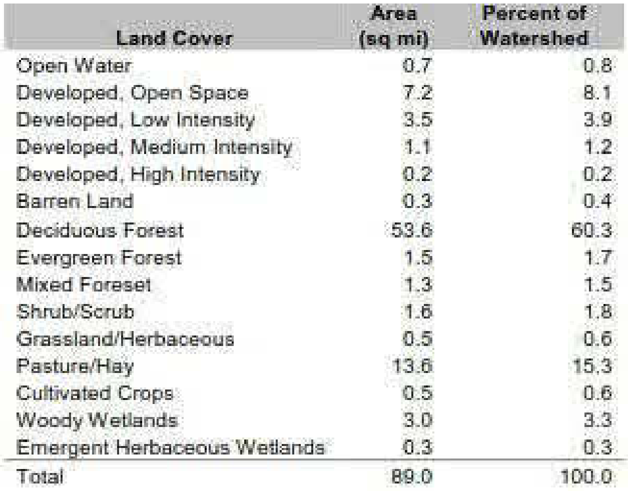


Land Use (NVCOG, 2016)



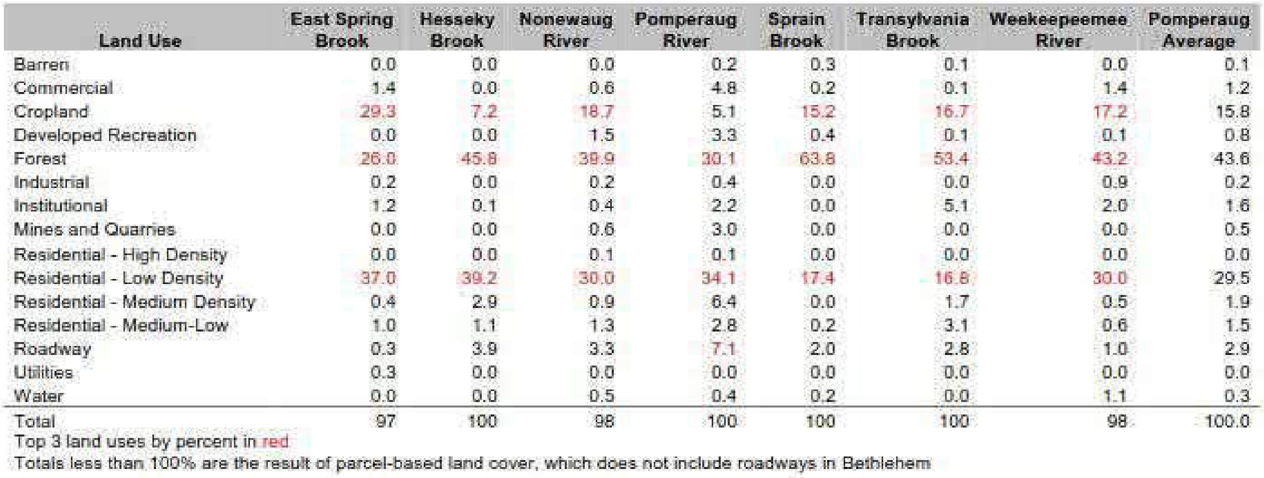
Land Cover (NLCD, 2011)

Land Use / Land Cover



Land Cover	Area (sq mi)	Percent of Watershed
Open Water	0.7	0.8
Developed, Open Space	7.2	8.1
Developed, Low Intensity	3.5	3.9
Developed, Medium Intensity	1.1	1.2
Developed, High Intensity	0.2	0.2
Barren Land	0.3	0.4
Deciduous Forest	53.6	60.3
Evergreen Forest	1.5	1.7
Mixed Foreset	1.3	1.5
Shrub/Scrub	1.6	1.8
Grassland/Herbaceous	0.5	0.6
Pasture/Hay	13.6	15.3
Cultivated Crops	0.5	0.6
Woody Wetlands	3.0	3.3
Emergent Herbaceous Wetlands	0.3	0.3
Total	89.0	100.0

- Top three land cover types:
  - Forest, Pasture/Hay, Developed
- Top three land uses:
  - Forest, Cropland, Low-density residential

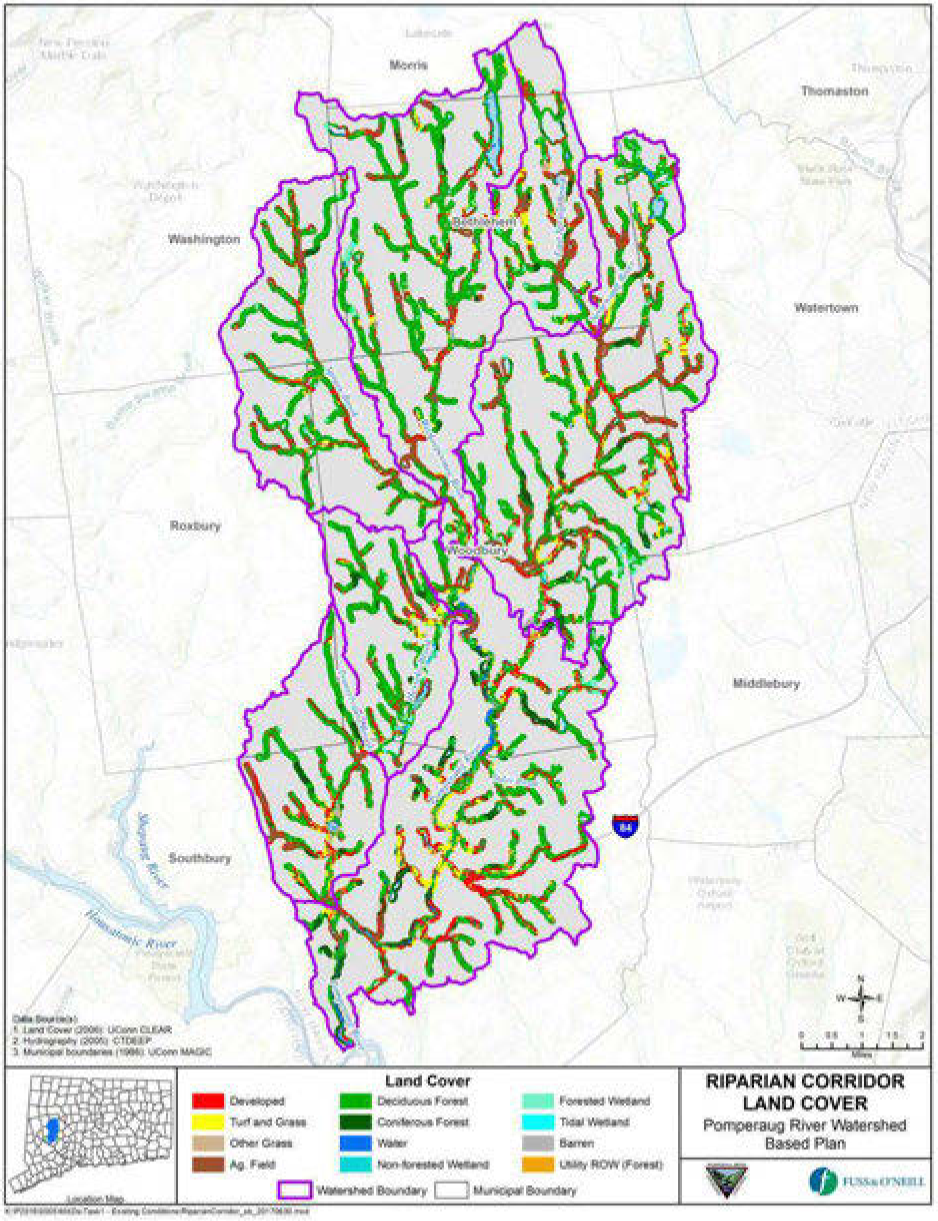


Land Use	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River	Pomperaug Average
Barren	0.0	0.0	0.0	0.2	0.3	0.1	0.0	0.1
Commercial	1.4	0.0	0.6	4.8	0.2	0.1	1.4	1.2
Cropland	29.3	7.2	18.7	5.1	15.2	16.7	17.2	15.8
Developed Recreation	0.0	0.0	1.5	3.3	0.4	0.1	0.1	0.8
Forest	26.0	45.8	39.9	30.1	63.8	53.4	43.2	43.6
Industrial	0.2	0.0	0.2	0.4	0.0	0.0	0.9	0.2
Institutional	1.2	0.1	0.4	2.2	0.0	5.1	2.0	1.6
Mines and Quarries	0.0	0.0	0.6	3.0	0.0	0.0	0.0	0.5
Residential - High Density	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Residential - Low Density	37.0	39.2	30.0	34.1	17.4	16.8	30.0	29.5
Residential - Medium Density	0.4	2.9	0.9	6.4	0.0	1.7	0.5	1.9
Residential - Medium-Low	1.0	1.1	1.3	2.8	0.2	3.1	0.6	1.5
Roadway	0.3	3.9	3.3	7.1	2.0	2.8	1.0	2.9
Utilities	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water	0.0	0.0	0.5	0.4	0.2	0.0	1.1	0.3
Total	97	100	98	100	100	100	98	100.0

Top 3 land uses by percent in red

Totals less than 100% are the result of parcel-based land cover, which does not include roadways in Bethlehem

Riparian Corridor Land Cover



- Natural buffers filter and infiltrate runoff, reduce flooding, and provide habitat
- UConn Center for Land Use Education And Research (CLEAR), 2006 Statewide Analysis
- 300-foot buffer either side of stream centerline
- All mapped perennial and intermittent streams in watershed

FUSS&O'NEILL

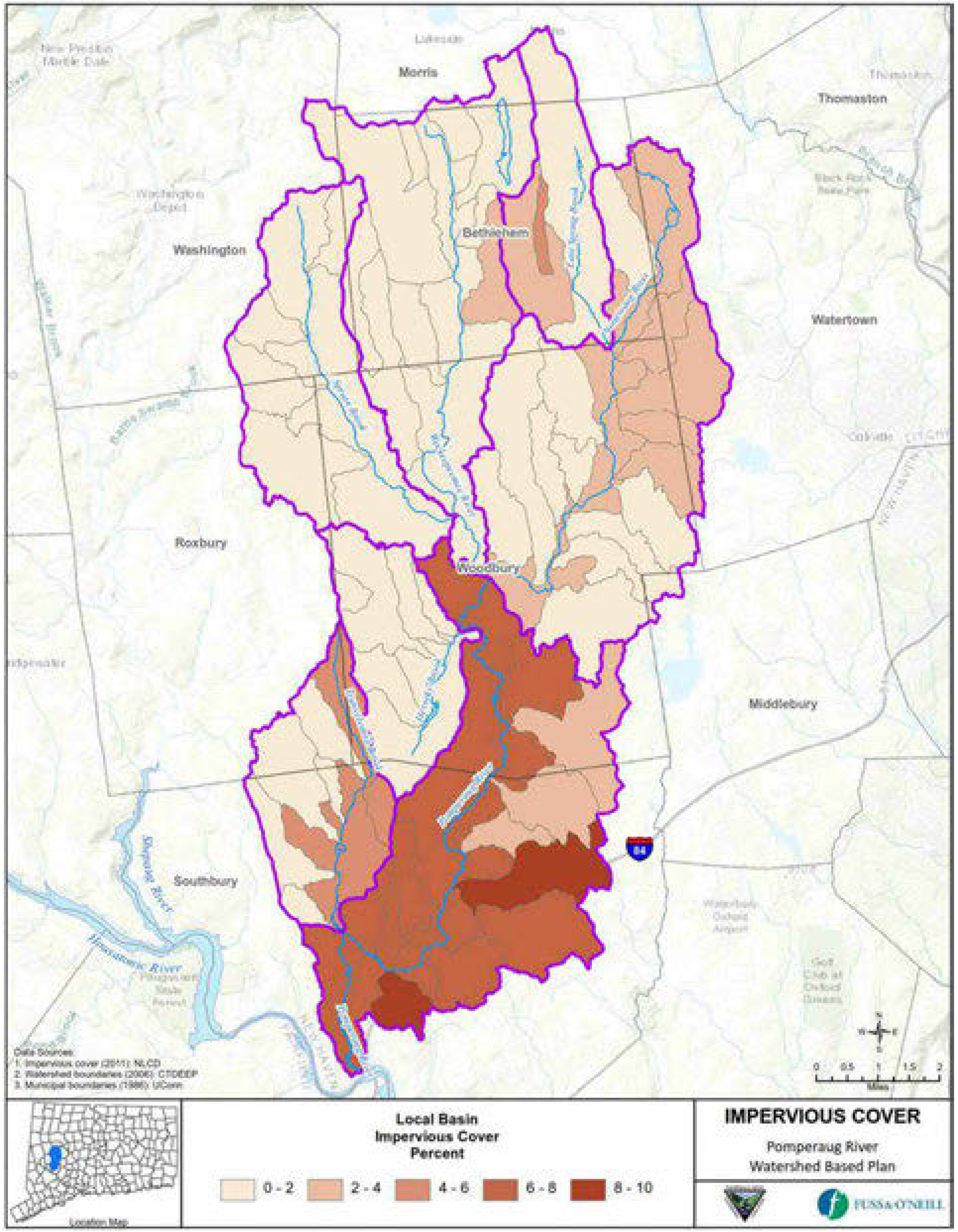
Riparian Corridor Land Cover

- Mostly forest and wetland
- Pomperaug Subregional Basin more developed than agricultural
- Other Subregional Basins show the opposite pattern

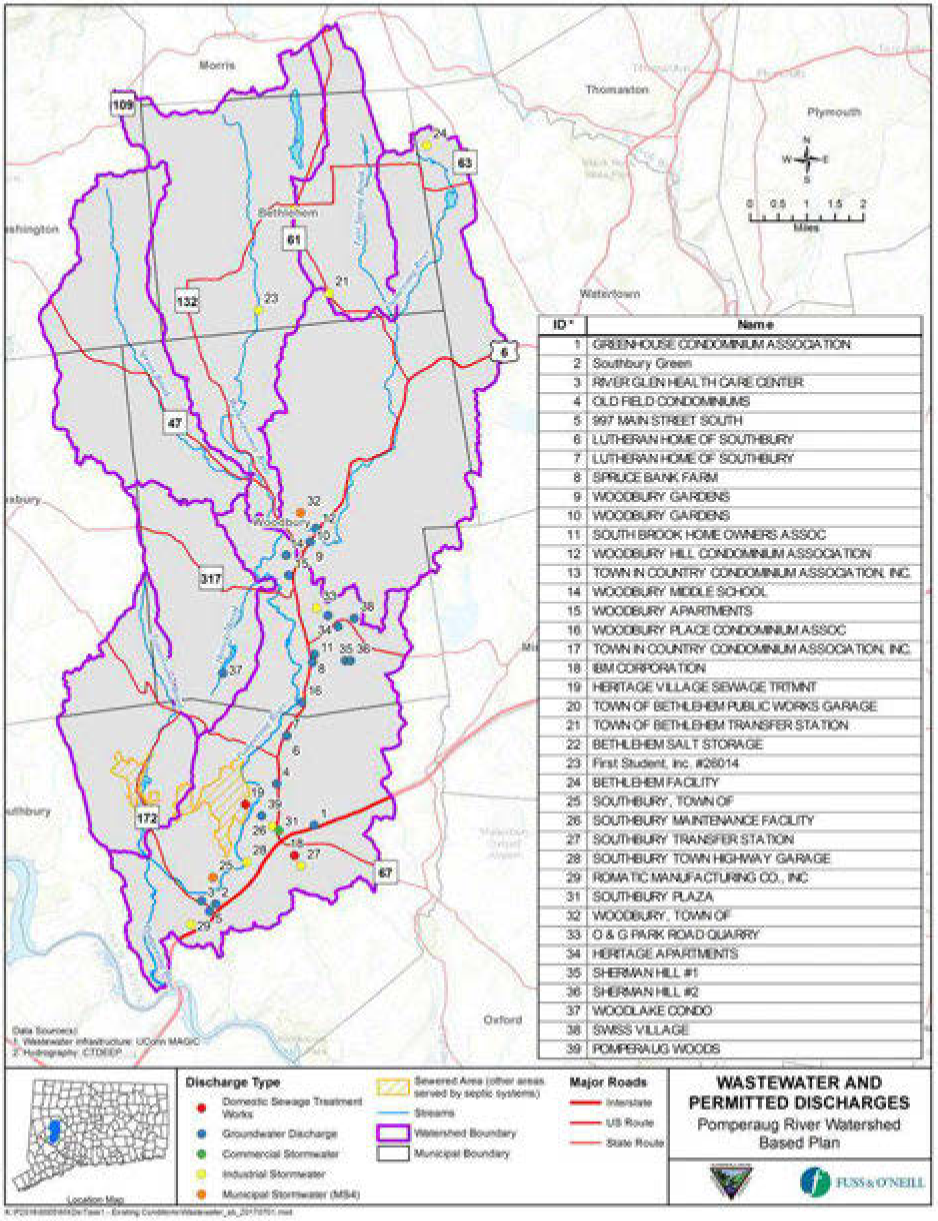
Land Cover Category	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Developed, Other Grasses, Barren	10.33	10.33	12.05	**22.05**	11.74	**17.63**	9.89
Agriculture, Turf & Grass	**30.38**	14.91	**26.76**	14.54	15.98	20.13	19.36
Forest, Wetland, Water	59.29	**74.76**	61.20	63.41	**72.28**	62.24	**70.74**
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Impervious Cover

- Analyzed by CT Local Basins and Subregional Basins
- All Subregional Basins below 10% IC threshold
- Most Subregional Basins in 6-10% range
- Several Subregional Basins in 8-10% range



Wastewater and Other Permitted Discharges



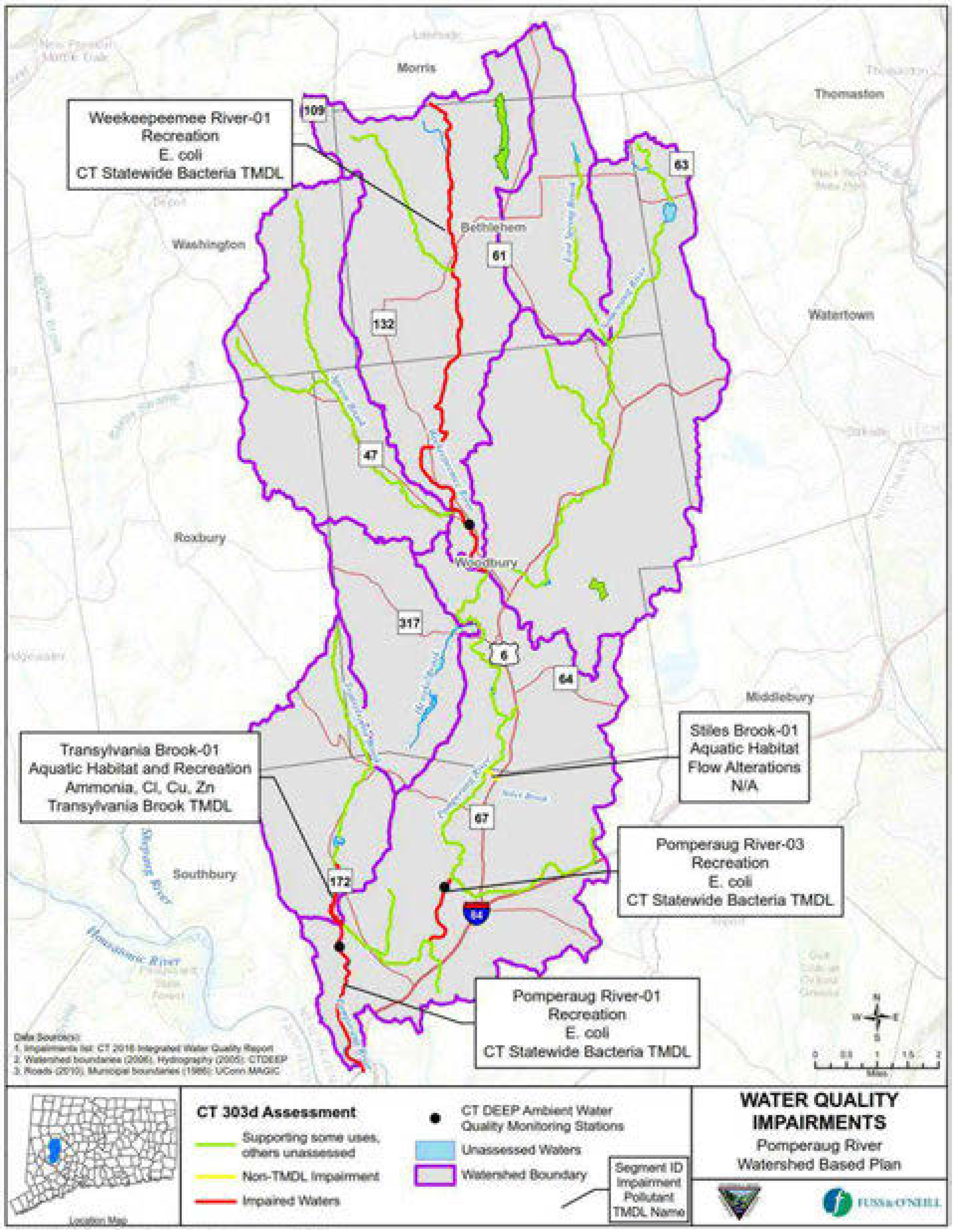
ID*	Name
1	GREENHOUSE CONDOMINIUM ASSOCIATION
2	Southbury Green
3	RIVER GLEN HEALTH CARE CENTER
4	OLD FIELD CONDOMINIUMS
5	997 MAIN STREET SOUTH
6	LUTHERAN HOME OF SOUTHBURY
7	LUTHERAN HOME OF SOUTHBURY
8	SPRUCE BANK FARM
9	WOODBURY GARDENS
10	WOODBURY GARDENS
11	SOUTH BROOK HOME OWNERS ASSOC
12	WOODBURY HILL CONDOMINIUM ASSOCIATION
13	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC.
14	WOODBURY MIDDLE SCHOOL
15	WOODBURY APARTMENTS
16	WOODBURY PLACE CONDOMINIUM ASSOC
17	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC.
18	IBM CORPORATION
19	HERITAGE VILLAGE SEWAGE TRTMNT
20	TOWN OF BETHLEHEM PUBLIC WORKS GARAGE
21	TOWN OF BETHLEHEM TRANSFER STATION
22	BETHLEHEM SALT STORAGE
23	First Student, Inc. #28014
24	BETHLEHEM FACILITY
25	SOUTHBURY, TOWN OF
26	SOUTHBURY MAINTENANCE FACILITY
27	SOUTHBURY TRANSFER STATION
28	SOUTHBURY TOWN HIGHWAY GARAGE
29	ROMATIC MANUFACTURING CO., INC
31	SOUTHBURY PLAZA
32	WOODBURY, TOWN OF
33	O & G PARK ROAD QUARRY
34	HERITAGE APARTMENTS
35	SHERMAN HILL #1
36	SHERMAN HILL #2
37	WOODLAKE CONDO
38	SWISS VILLAGE
39	POMPERAUG WOODS

- CTDEEP
  - Point discharges (versus nonpoint)
  - Discharge permits database, 2016
  - Sewered area, 1997

Wastewater and Other Permitted Discharges

- 39 permitted dischargers
  - Sewage treatment plants
  - Subsurface sewage disposal (septic) systems
  - Commercial, industrial, municipal stormwater discharges
- 2 sewage treatment plants
  - Heritage Village
  - IBM Campus
- Several apartments/condos with large septic systems
- Quarries

Water Quality



- CT 2016 Integrated Water Quality Report
- Designation based on "impaired" uses
  - Recreation (swimming, fishing, and boating)
  - Aquatic habitat
  - Fish consumption
  - Drinking water supply
- Very limited data set

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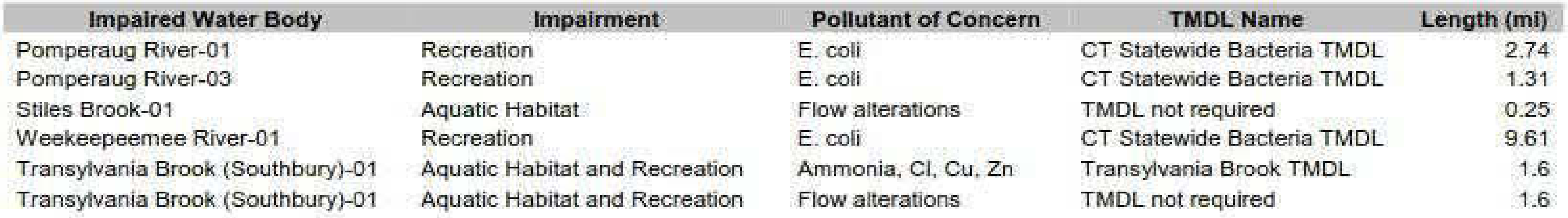
Water Quality Impairments

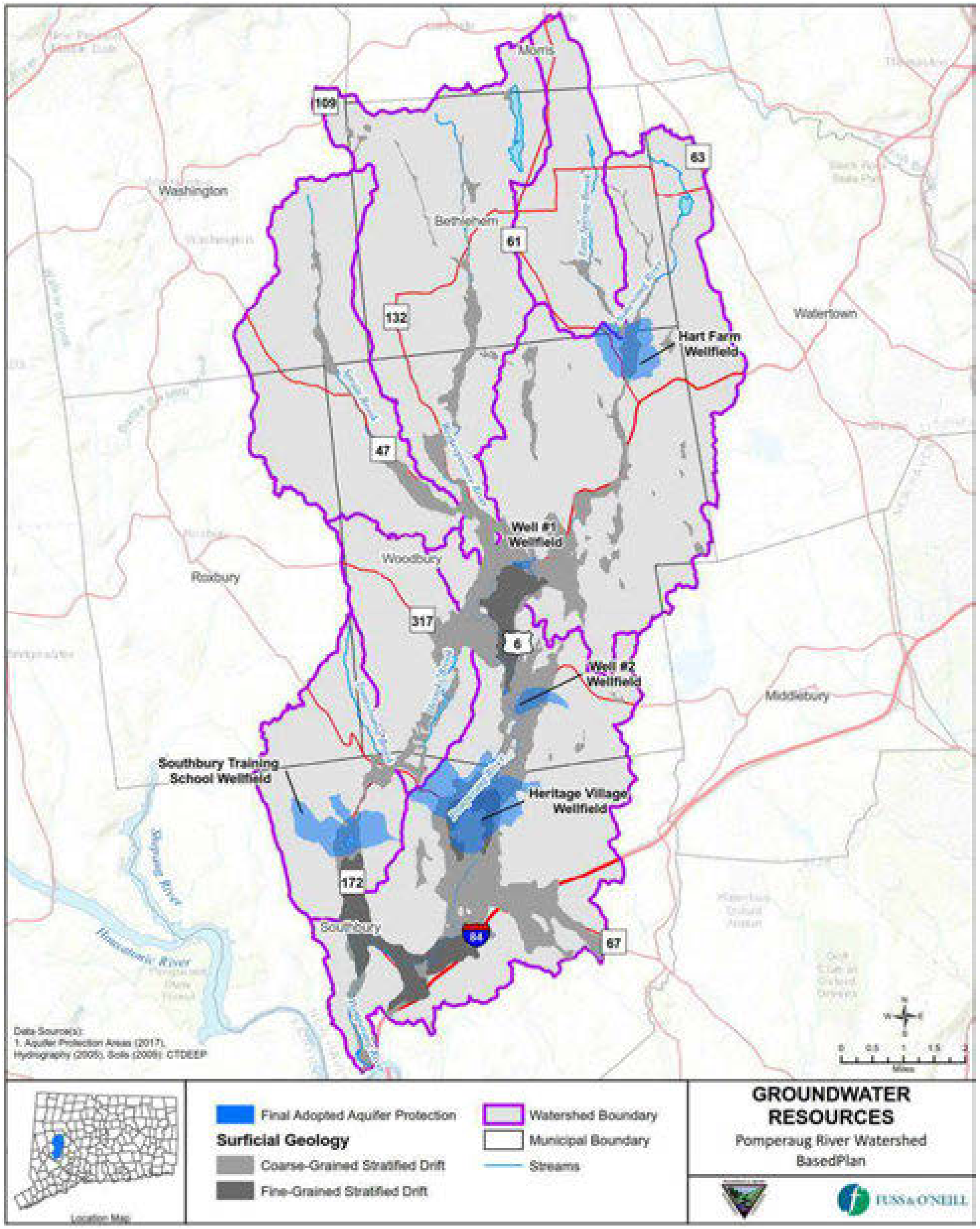
- Five impaired segments
  - Pomperaug River (2)
  - Weekeepeemee River
  - Transylvania Brook (3)
  - Stiles Brook

- State-wide Bacteria TMDL
  - Pomperaug River
  - Weekeepeemee River
- Transylvania Brook TMDL



Impaired Water Body	Impairment	Pollutant of Concern	TMDL Name	Length (mi)
Pomperaug River-01	Recreation	E. coli	CT Statewide Bacteria TMDL	2.74
Pomperaug River-03	Recreation	E. coli	CT Statewide Bacteria TMDL	1.31
Stiles Brook-01	Aquatic Habitat	Flow alterations	TMDL not required	0.25
Weekeepeemee River-01	Recreation	E. coli	CT Statewide Bacteria TMDL	9.61
Transylvania Brook (Southbury)-01	Aquatic Habitat and Recreation	Ammonia, Cl, Cu, Zn	Transylvania Brook TMDL	1.6
Transylvania Brook (Southbury)-01	Aquatic Habitat and Recreation	Flow alterations	TMDL not required	1.6
Transylvania Brook (Southbury)-01	Recreation	E. coli	Proposed for TMDL	1.6

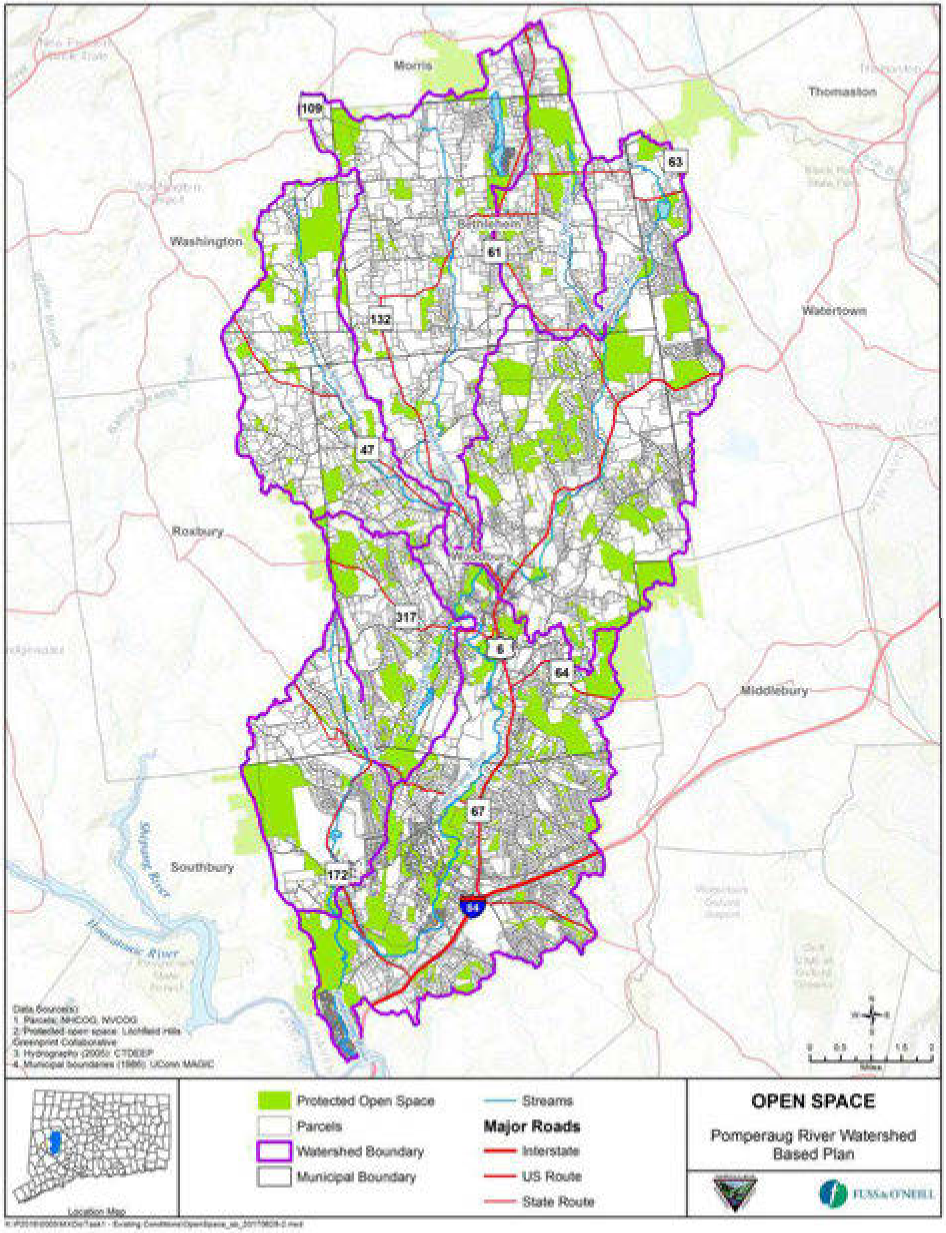
Groundwater Resources



- CTDEEP
  - Aquifer protection areas, 2017
  - Stratified drift soils, 2009
- Significant prior study of groundwater resources in the watershed

Committed Open Space

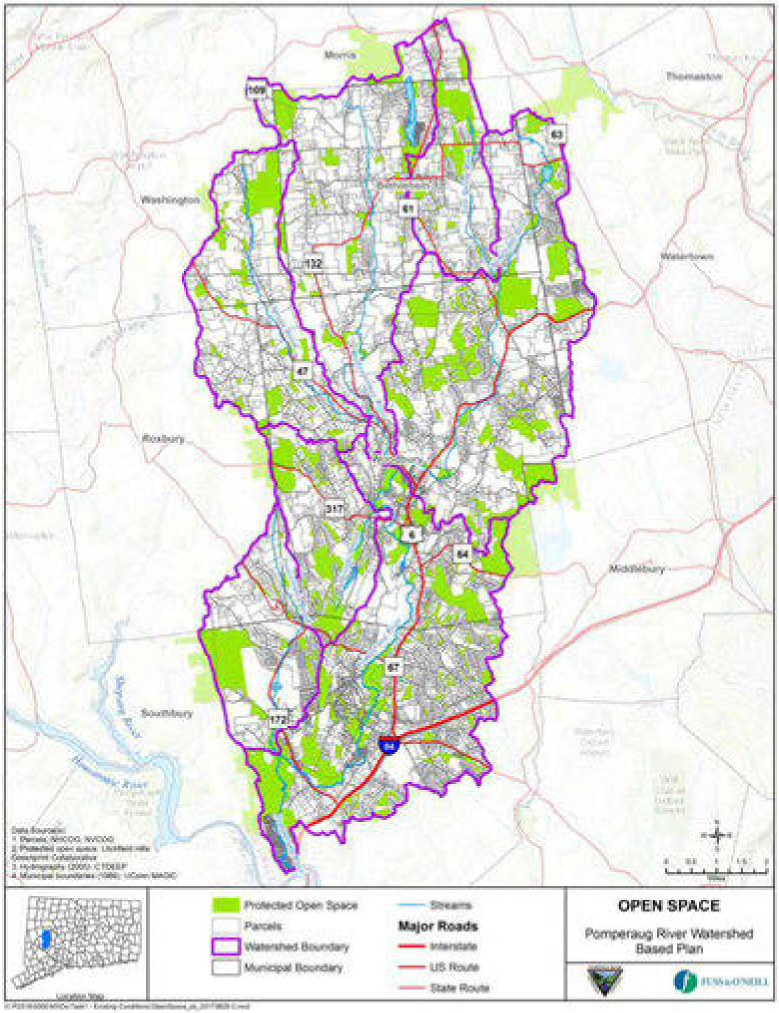
- Town owned parks, recreation areas, preserves
- Land trust properties with legal protections
- State of CT properties that are undeveloped
- Farms where the development rights have been acquired
- Excludes Public Act 490 land
- Class A water company property



Committed Open Space

- **Most large, undeveloped tracts in the watershed are already protected**

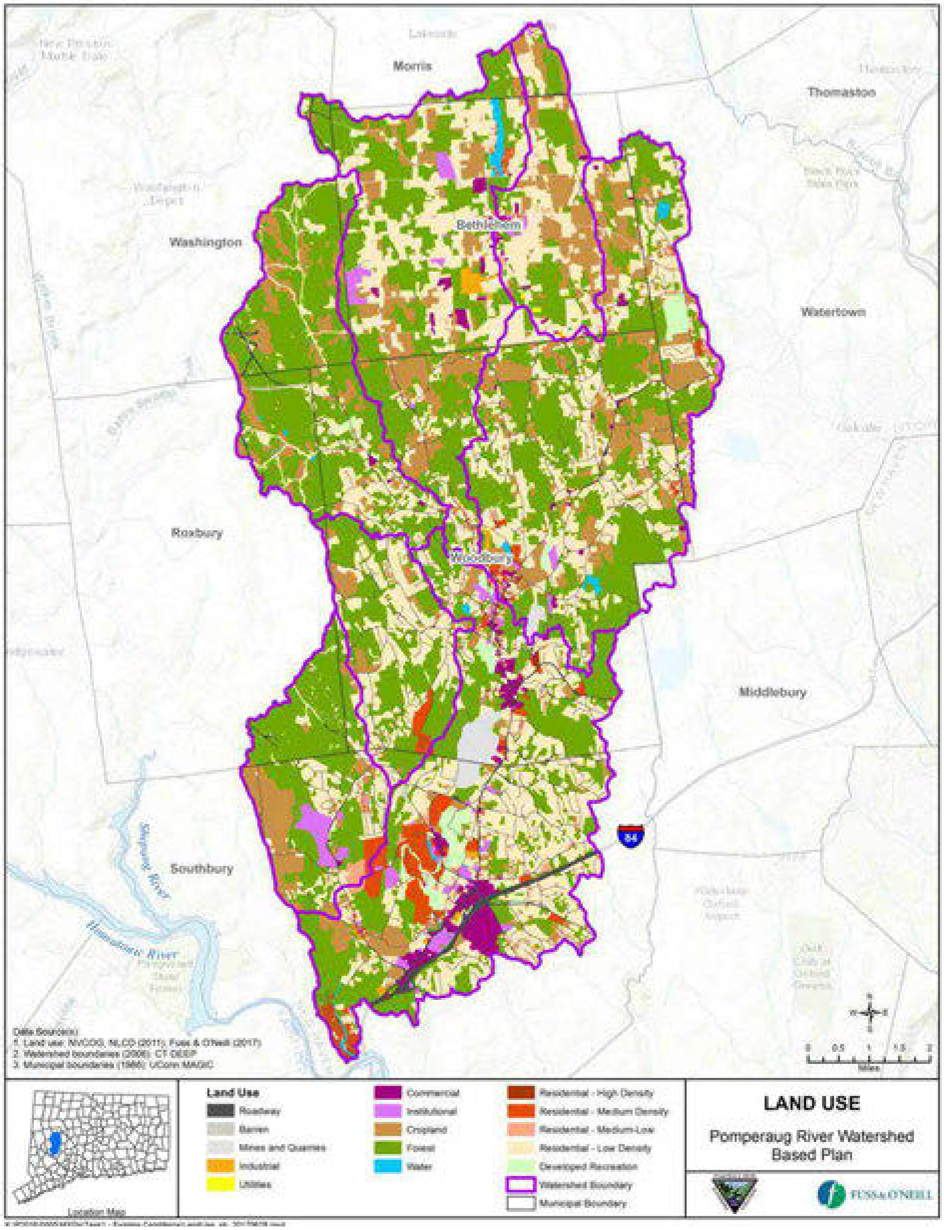
Subwatershed	Committed Open Space (sq mi)	Committed Open Space (percent)
East Spring Brook	0.92	15.8
Hesseky Brook	1.40	22.5
Nonewaug River	3.90	18.3
Pomperaug River	4.26	19.9
Sprain Brook	1.56	14.3
Transylvania Brook	1.25	17.4
Weekeepeemee River	1.25	7.8
Total	14.54	16.3



Data Sources:
1. Parcels: NHCOG, NVCOG
2. Protected open space: Litchfield Hills Greenprint Collaborative
3. Hydrography (2005): CTDEEP
4. Municipal boundaries (1986): UConn MAGIC

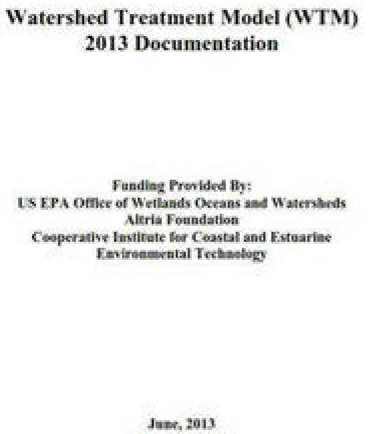
Pollutant Loading Model

- Watershed Treatment Model (WTM) – surface runoff pollutant loads
- Annual loadings of bacteria, nutrients, and sediment to surface waters
- Primary sources – land use
- Secondary sources – point sources, septic systems, illicit discharges, etc.



Model Inputs

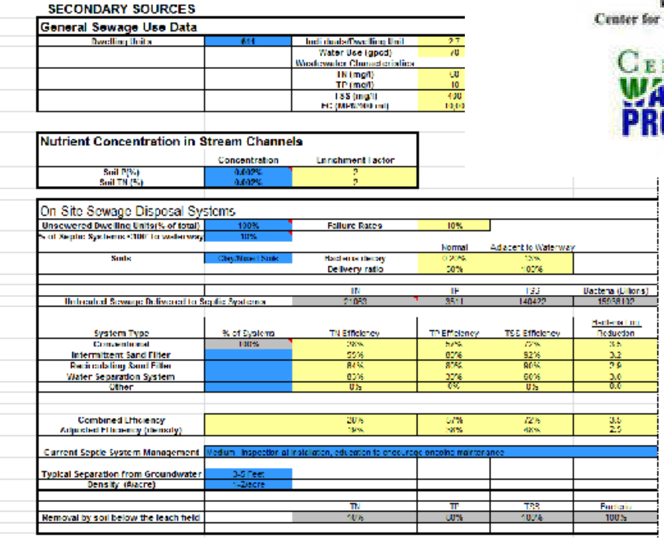
- Land Use and Impervious Cover
- Event Mean Concentrations (Developed Land Use)
- Export Coefficients (Rural Land Use)
- Annual Rainfall
- Hydrologic Soil Groups
- Runoff Coefficients
- Sewer Service Information
- Septic System Information
- Illicit Connections
- Road Sanding
- Livestock



Watershed Treatment Model (WTM)
2013 Documentation

Funding Provided By:
US EPA Office of Wetlands Oceans and Watersheds
Altria Foundation
Cooperative Institute for Coastal and Estuarine
Environmental Technology

June, 2013
Deb Caraco, P.E.
Center for Watershed Protection, Inc.



SECONDARY SOURCES

General Sewage Use Data

Dwelling Units	[illegible]	Individuals/Dwelling Unit	[illegible]
		Water Use (gpcd)	70
		Wastewater Characteristics	
		TN (mg/l)	[illegible]
		TP (mg/l)	10
		TSS (mg/l)	[illegible]
		FC (MPN/100 ml)	[illegible]

Nutrient Concentration in Stream Channels

	Concentration	Enrichment Factor
Soil P(%)	[illegible]	2
Soil TN (%)	[illegible]	2

On Site Sewage Disposal Systems

Unsewered Dwelling Units(% of total)	100%	Failure Rates	10%		
% of Septic Systems <100' to waterway	10%				
			Normal	Adjacent to Waterway	
Soils	[illegible]	Bacteria decay	[illegible]	[illegible]	
		Delivery ratio	30%	100%	
		TN	TP	TSS	Bacteria (Billions)
Untreated Sewage Delivered to Septic Systems		[illegible]	[illegible]	[illegible]	[illegible]
System Type	% of Systems	TN Efficiency	TP Efficiency	TSS Efficiency	Bacteria Log Reduction
Conventional	100%	[illegible]	[illegible]	[illegible]	[illegible]
Intermittent Sand Filter		55%	[illegible]	92%	[illegible]
Recirculating Sand Filter		84%	[illegible]	[illegible]	[illegible]
Water Separation System		[illegible]	[illegible]	60%	[illegible]
Other		0%	0%	0%	0.0
Combined Efficiency		20%	[illegible]	72%	[illegible]
Adjusted Efficiency (density)		[illegible]	[illegible]	[illegible]	2.5
Current Septic System Management	Medium Inspection at installation, education to encourage ongoing maintenance				
Typical Separation from Groundwater	3-5 Feet				
Density (#/acre)	1-2/acre				
		TN	TP	TSS	Bacteria
Removal by soil below the leach field		[illegible]	[illegible]	100%	100%

Event Mean Concentrations

- Developed Land Use

Land Use	WTM Default Values				Regional Values				Selected Values			
	TN	TP	TSS	FC	TN	TP	TSS	FC	TN	TP	TSS	FC
Low Density Residential	2.1	0.31	49	20,000	3.18	0.27	34	2,950	3.18	0.27	34	2,950
Medium Density Residential	2.1	0.31	49	20,000	3.5	0.41	49	12,360	3.5	0.41	49	12,360
High Density Residential	2.1	0.31	49	20,000	3.81	0.64	102	16,901	3.81	0.64	102	16,901
Highway	-	-	-	-	2.65	0.43	141	600	2.65	0.43	141	600
Commercial	2.1	0.22	43	20,000	1.85	0.15	44	9,306	1.85	0.15	44	9,306
Institutional	2.1	0.22	43	20,000	1.85	0.15	44	9,306	1.85	0.15	44	9,306
Industrial	2.2	0.25	81	20,000	4	0.11	42	1,467	4	0.11	42	1,467
Mining	-	-	-	-	1.18	0.15	94	300	1.18	0.15	94	300

Export Coefficients

- Rural Land Use

Land Use	WTM Default Values				Regional Values				Selected Values				Comments
	TN	TP	TSS	FC	TN	TP	TSS	FC	TN	TP	TSS	FC	
Forest	2.0	0.2	100	12	2.5	0.2	100	12	2.5	0.2	100	12	Selected regional values
Rural	4.6	0.7	100	39	-	-	-	-	4.6	0.7	100	39	Selected WTM Default values
Power Lines	4.6	0.7	100	39	-	-	-	-	4.6	0.7	100	39	Selected WTM Default values
Open Water	12.8	0.5	155	-	0.4 (2)	0.03 (2)	2 (2)	0.4 (2)	0.4	0.03	2	0.4	Selected regional values
Cropland	-	-	-	-	Pasture 1.9 (2) 7.7 (3) 5.6 (4) Row Crops 14.4 (3) 15.7 (4)	Pasture 0.1 (2) 1.3 (3) 0.5 (4) Row Crops 4.0 (3) 0.94 (4)	Pasture 47 (2) 591 (4) Row Crops 1997 (4)	Pasture 7 (2) Row Crops -	10	0.8	300	39	Selected TN, TP, and TSS based on regional sources for pasture and row crops; FC assumed same as Rural land use

Livestock Pollutant Source

- Export Coefficients

Livestock Type	Nitrogen[1] (lbs/animal/year)	Phosphorus[1] (lbs/animal/year)	E. coli (billion cfu/AU/year)
Cows	164	26	1,966
Horses	102	18	84
Sheep	18.5	3.2	7,165
Poultry	1.1	0.4	85

- Estimated Number of Livestock

Livestock Type	East Spring Brook	Hesseky Brook	Nonnewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Cows	20	175	450	100	15	40	150
Horses	60	40	50	100	15	25	40
Sheep	25	40	25	15	0	0	40
Poultry	30	75	50	50	250	25	50

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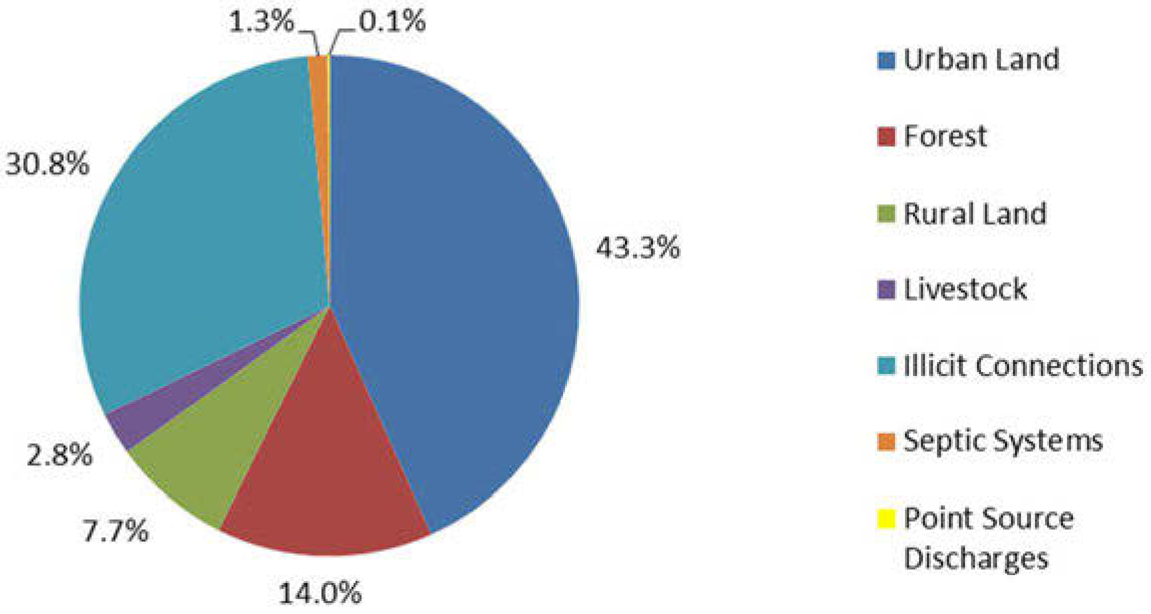
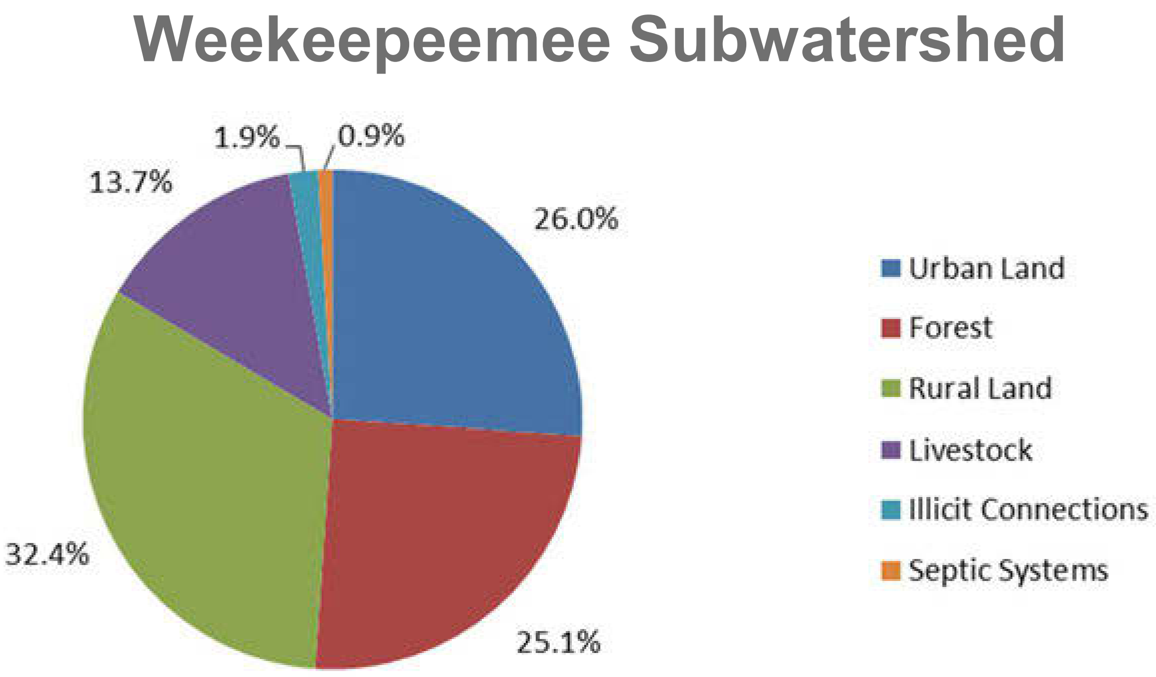
Modeled Relative Bacteria Sources

Pomperaug Subwatershed



- Stormwater runoff from developed land
- Illicit connections from residential and commercial land use
- Source controls, structural stormwater BMPs, education and outreach, illicit discharge detection and elimination

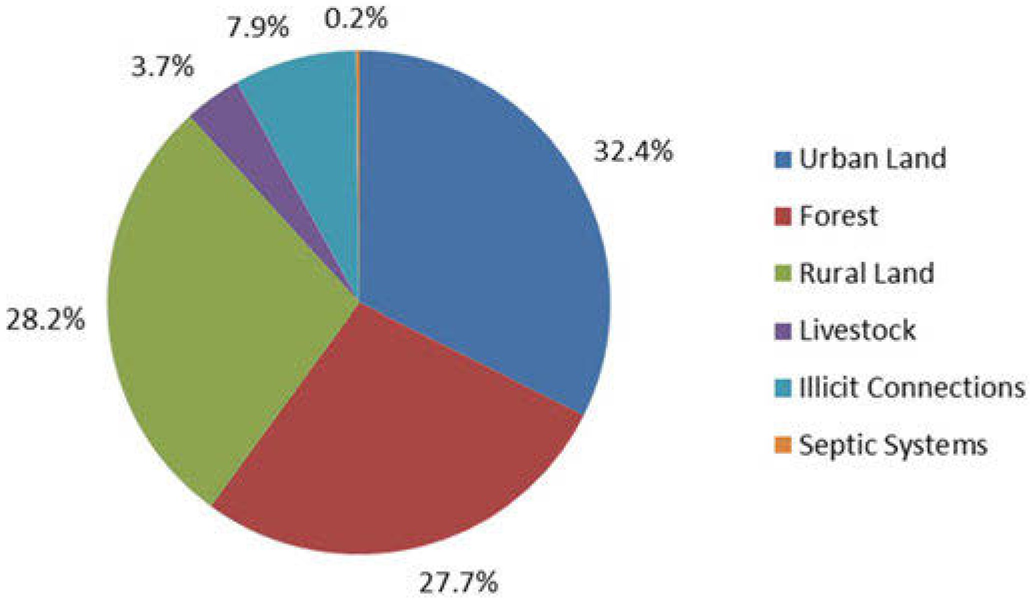
Modeled Relative Bacteria Sources



- Stormwater runoff from agricultural land use and some developed land use
- Agricultural BMPs (livestock and manure management)

Modeled Relative Bacteria Sources

Transylvania Brook



- Stormwater runoff from mix of agricultural and developed land uses

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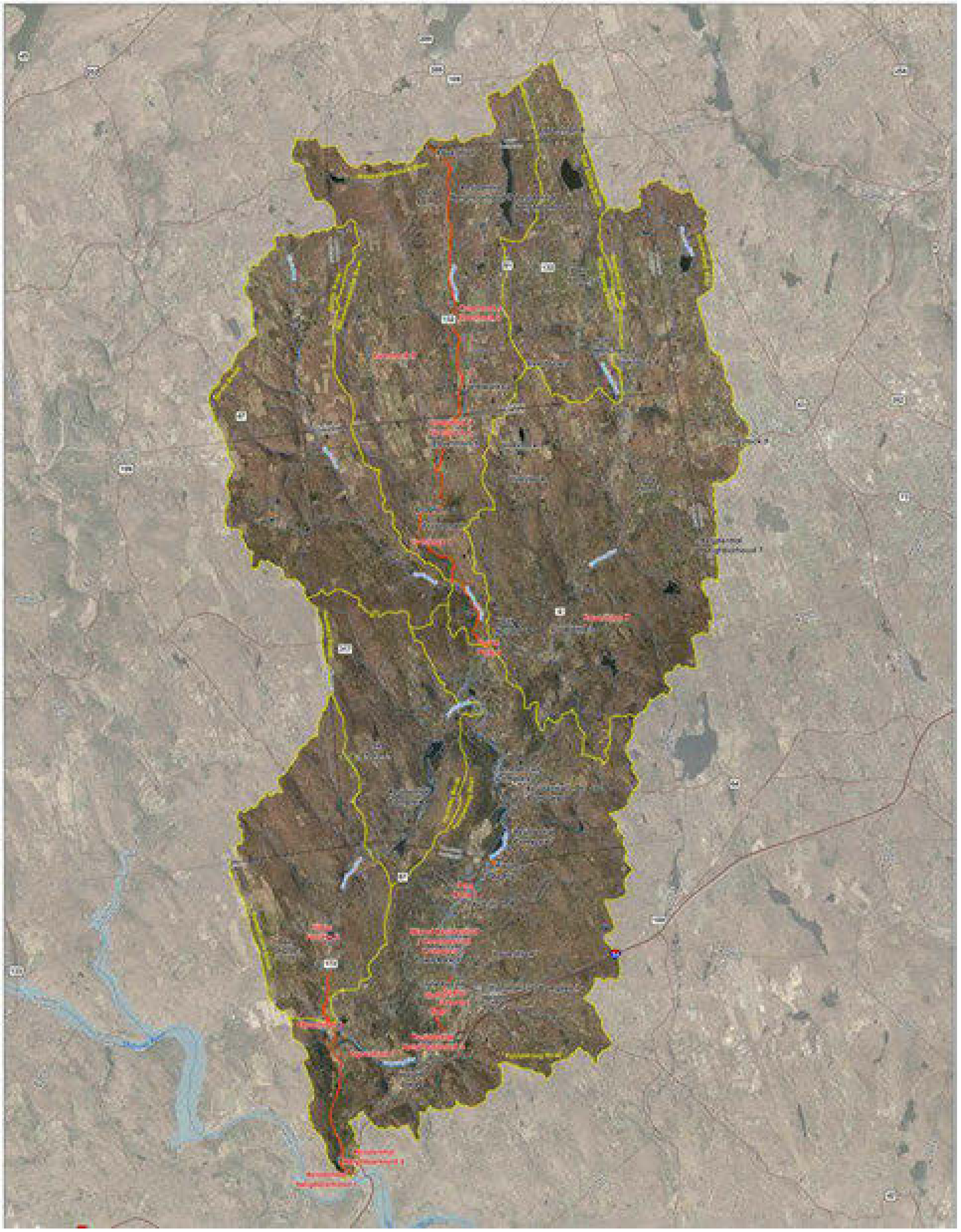
Visual Field Assessments

- Investigate suspected bacteria sources in areas with impairments
- Identify restoration, pollution prevention, and retrofit opportunities
- Standardized field protocols
  - Stream reaches
  - Neighborhoods
  - Hotspots

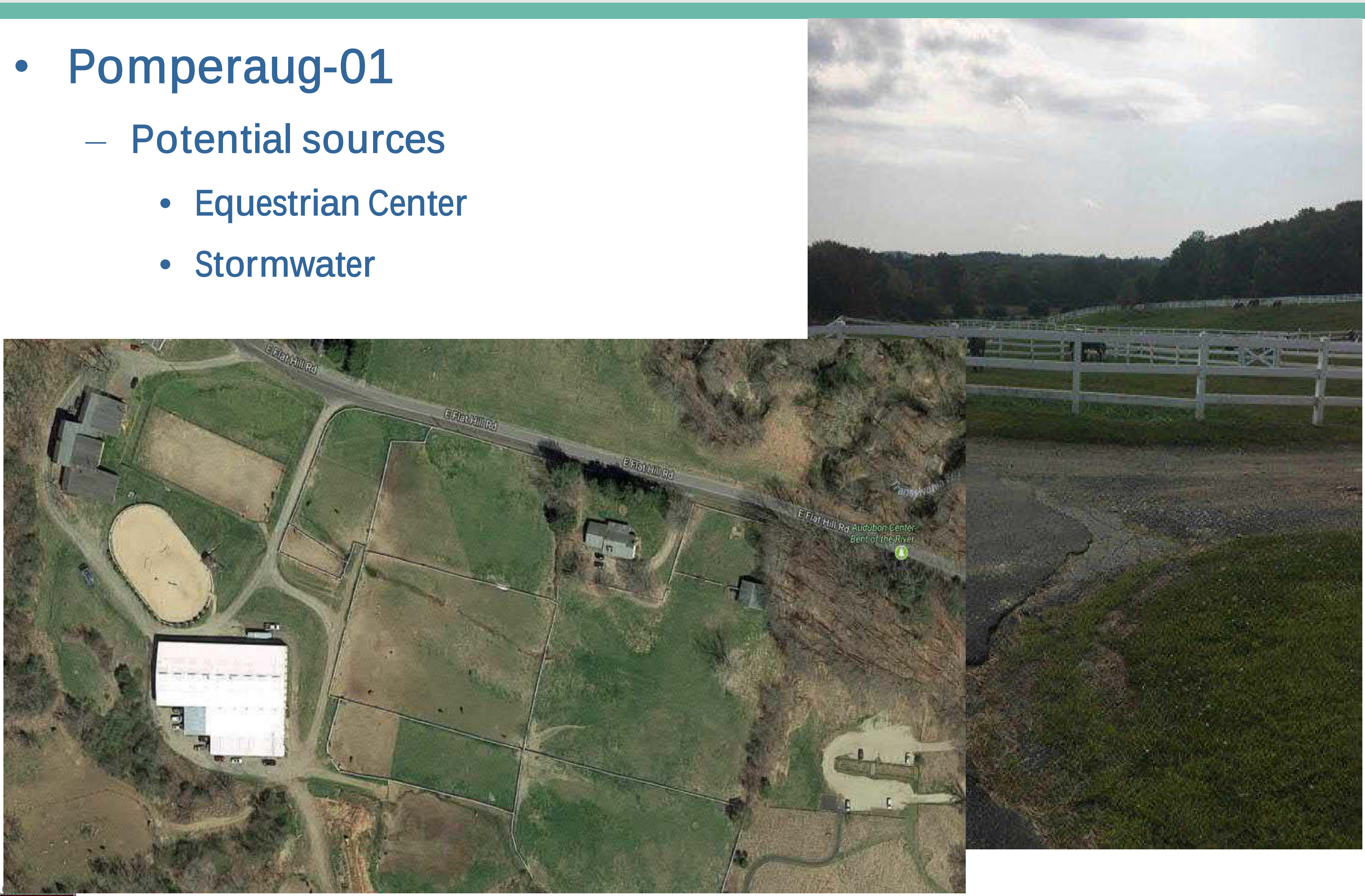
Pollution Hotspots/ Areas of Concern

- Identified by LUC and PRWC
- Roughly 60 sites identified (see board)
- Potential bacteria sources
  - Urban stormwater
  - Agricultural land adjacent to streams
  - Streambank erosion
  - Manure management
  - Septic system issues
  - Significant point discharges
  - Waterfowl, pet waste



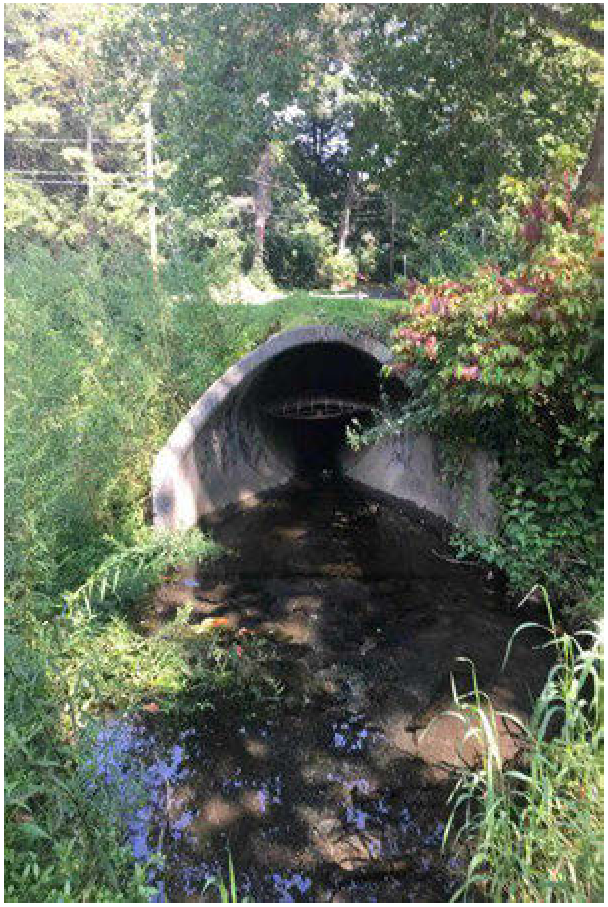
Reach Assessment Results

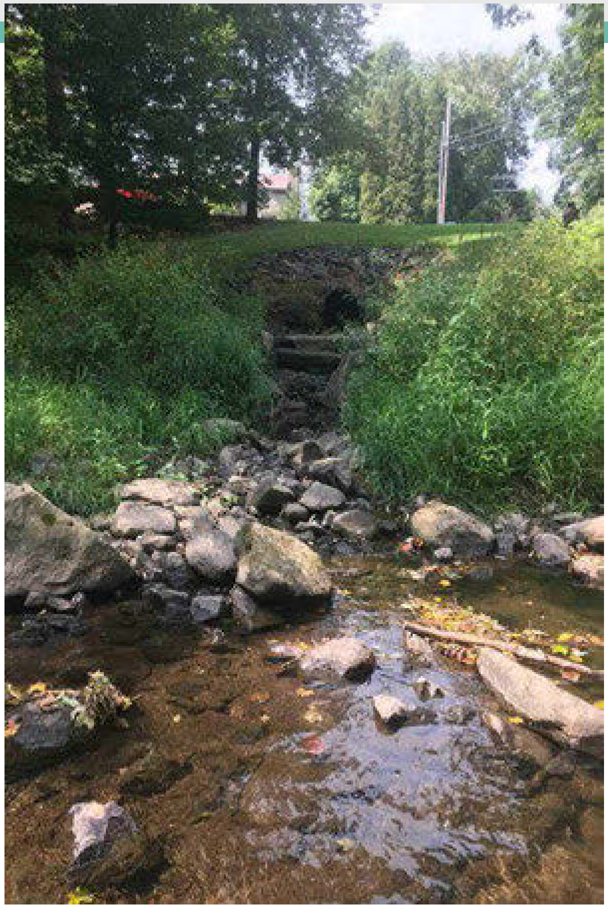
- Pomperaug-01
  - Potential sources
    - Equestrian Center
    - Stormwater



Reach Assessment Results

- Pomperaug-03
  - Potential sources
    - Geese
    - Stormwater
    - WWTP
    - Septic





Reach Assessment Results

- Weekeepeemee-01
  - Runoff from pastures and Paddocks

Neighborhood Assessment Results

- Residential Neighborhoods 1 and 2
  - Stormwater
  - Septic

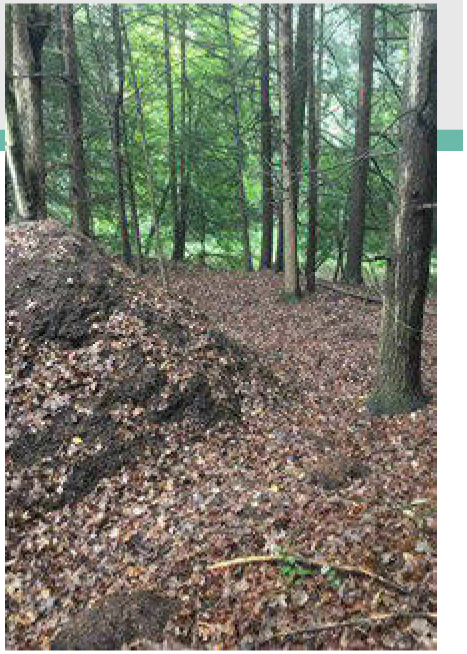
Neighborhood Assessment Results

- Mixed Residential/Commercial Complex 1
  - Stormwater
  - WWTP
  - Geese

Neighborhood Assessment Results

- Mixed Residential/Commercial Complex 1
  - Stormwater
  - WWTP
  - Geese

Hotspot Assessment Results



- Equestrian 2
  - Manure piles
  - Front Paddock Area
  - Farm Pond

Hotspot Assessment Results

- Equestrian 2

Hotspot Assessment Results

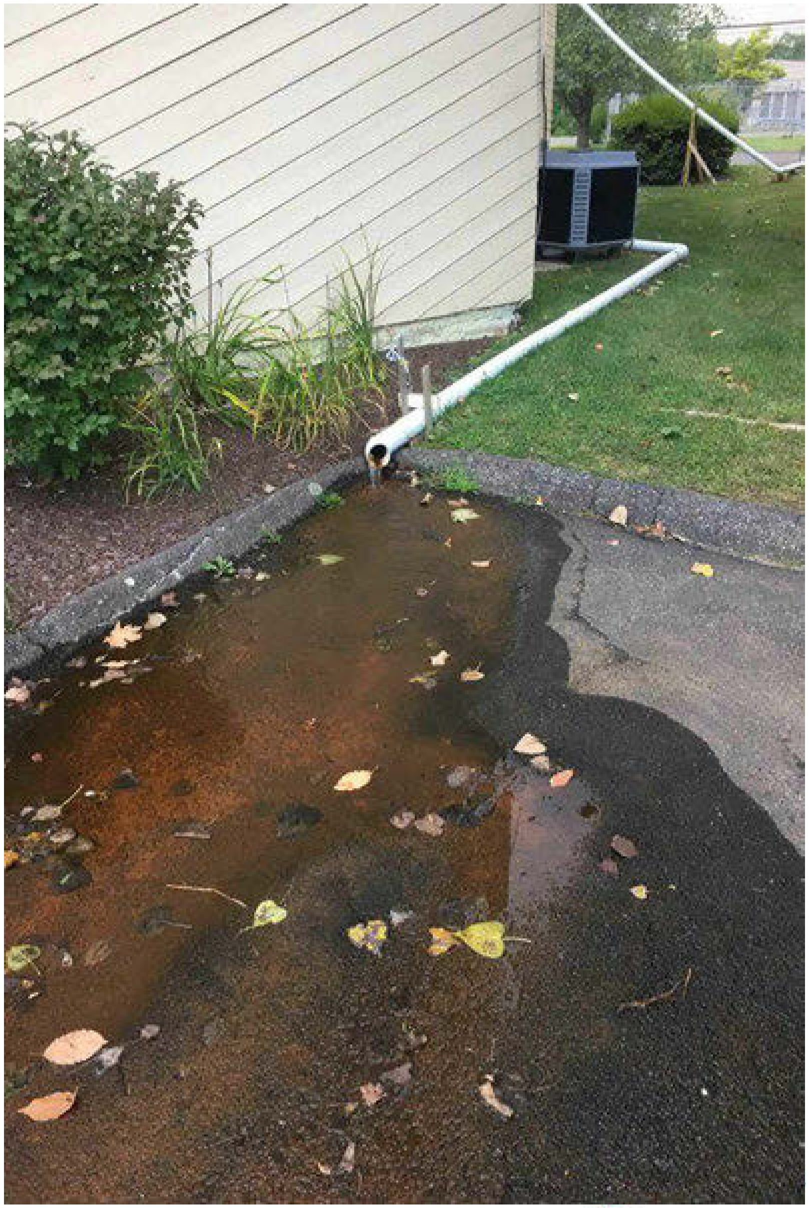
- Dairy Farm 2
  - Direct livestock access to tributaries
  - Buffer
  - Manure handling

Hotspot Assessment Results

- Dairy Farm 2
  - Direct livestock access to tributaries
  - Buffer
  - Manure handling

Hotspot Assessment Results

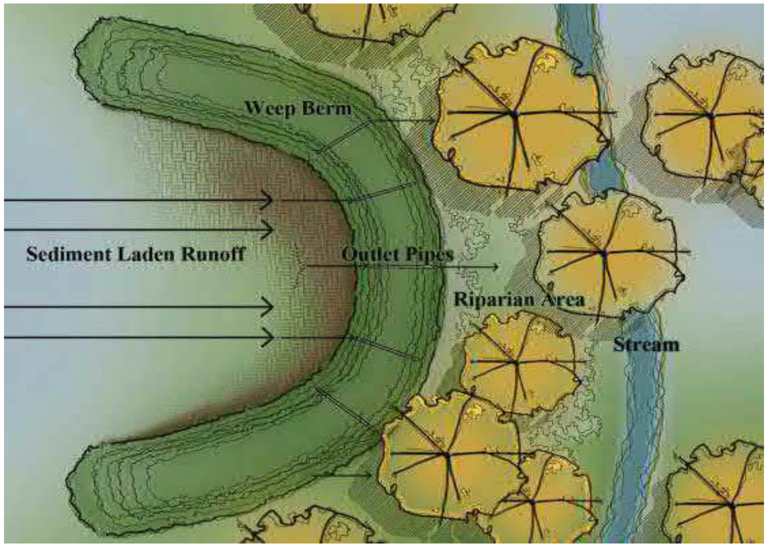
- Medical Office Building
  - Dry weather flows

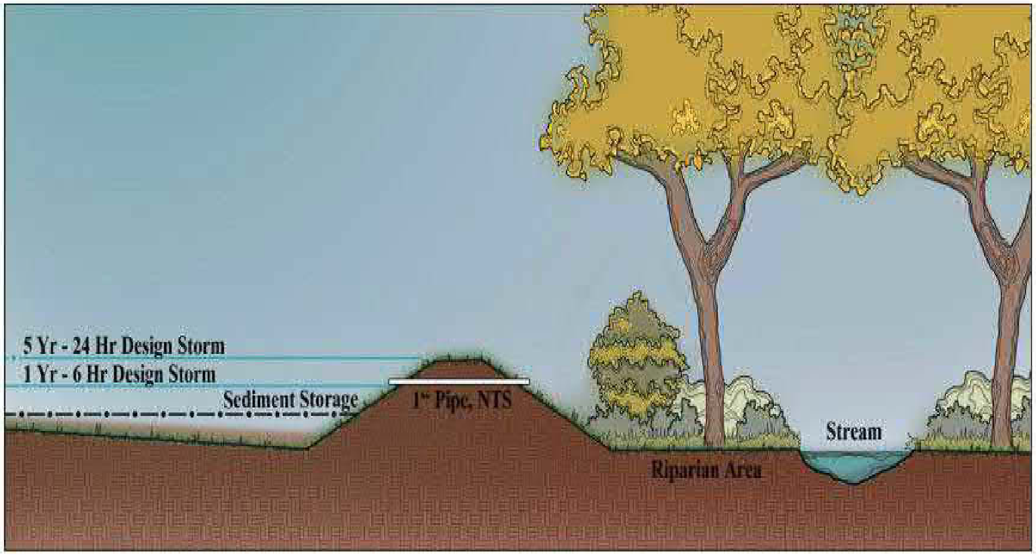


Best Management Practices (BMPs)

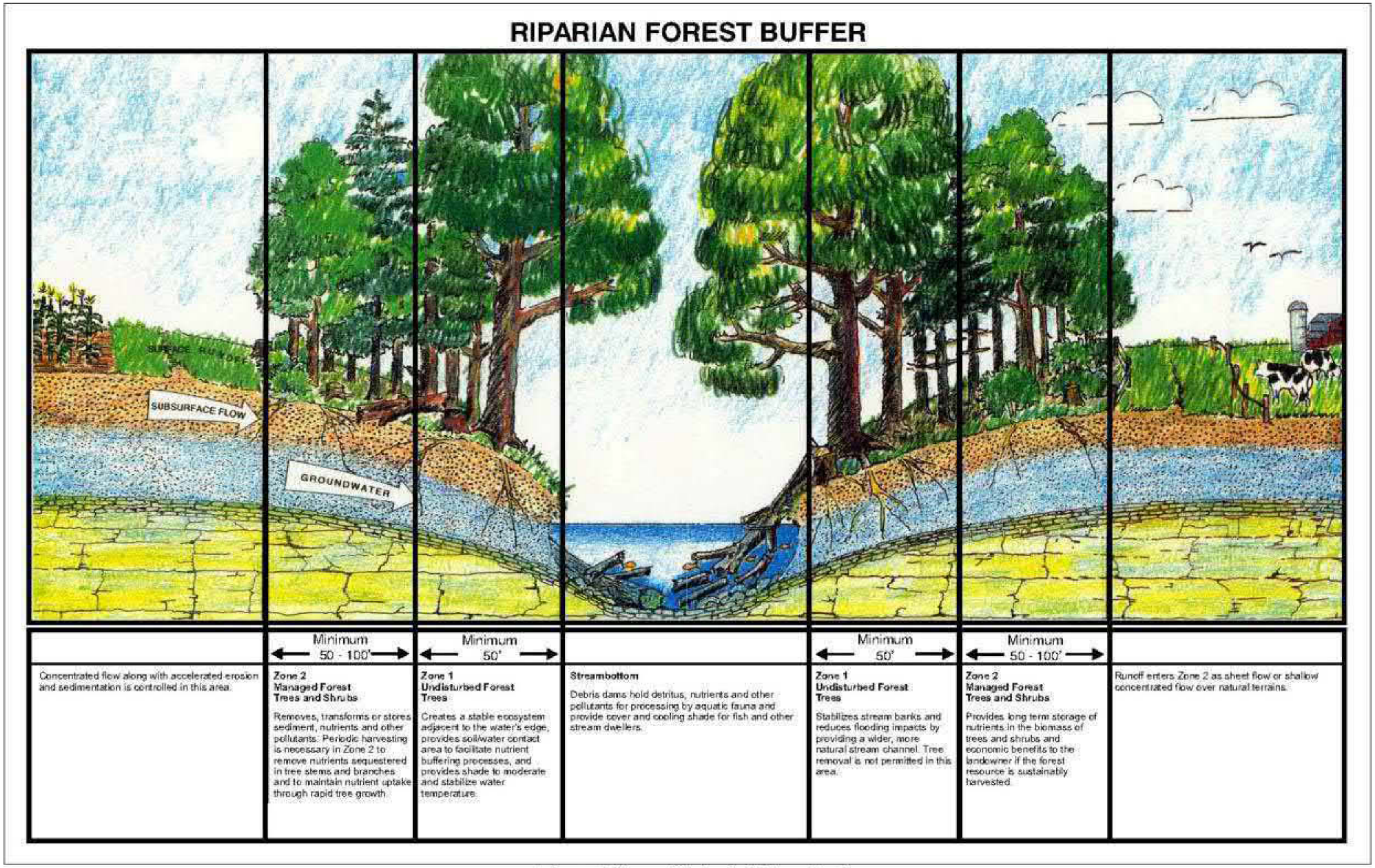
- Agricultural BMPs
  - Filter berms
  - Increased riparian buffer
- Structural stormwater BMPs
  - Infiltration systems
  - Bioretention systems
  - Underground solutions
- Non-structural BMPs
  - Geese management
  - Septic system management and outreach
  - Illicit discharge detection and elimination (IDDE)
  - Manure/nutrient management
  - Land use regulatory controls

Filter Berms





Increased Riparian Buffer



RIPARIAN FOREST BUFFER

	Minimum ← 50 - 100' →	Minimum ← 50' →		Minimum ← 50' →	Minimum ← 50 - 100' →	
Concentrated flow along with accelerated erosion and sedimentation is controlled in this area.	**Zone 2** **Managed Forest** **Trees and Shrubs** Removes, transforms or stores sediment, nutrients and other pollutants. Periodic harvesting is necessary in Zone 2 to remove nutrients sequestered in tree stems and branches and to maintain nutrient uptake through rapid tree growth.	**Zone 1** **Undisturbed Forest** **Trees** Creates a stable ecosystem adjacent to the water's edge, provides soil/water contact area to facilitate nutrient buffering processes, and provides shade to moderate and stabilize water temperature.	**Streambottom** Debris dams hold detritus, nutrients and other pollutants for processing by aquatic fauna and provide cover and cooling shade for fish and other stream dwellers.	**Zone 1** **Undisturbed Forest** **Trees** Stabilizes stream banks and reduces flooding impacts by providing a wider, more natural stream channel. Tree removal is not permitted in this area.	**Zone 2** **Managed Forest** **Trees and Shrubs** Provides long term storage of nutrients in the biomass of trees and shrubs and economic benefits to the landowner if the forest resource is sustainably harvested.	Runoff enters Zone 2 as sheet flow or shallow concentrated flow over natural terrains.

Adapted from Welsch (*Riparian*)

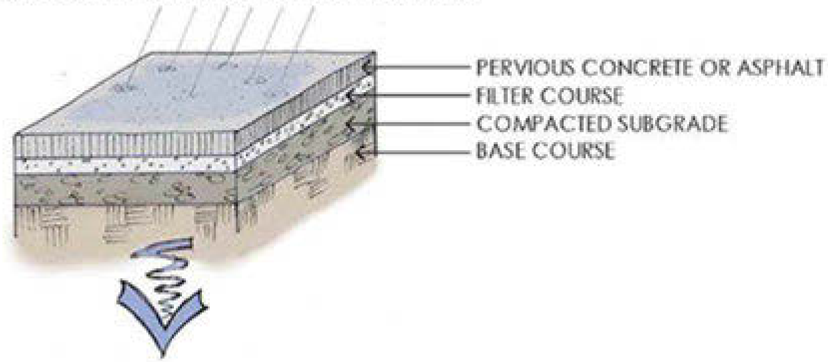
POMPERAUG RIVER WATERSHED COALITION

FUSS & O'NEILL

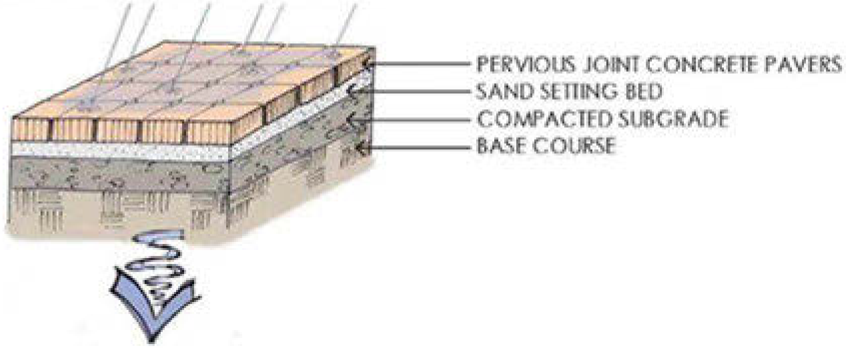
Structural Stormwater BMPs

- Permeable Pavement

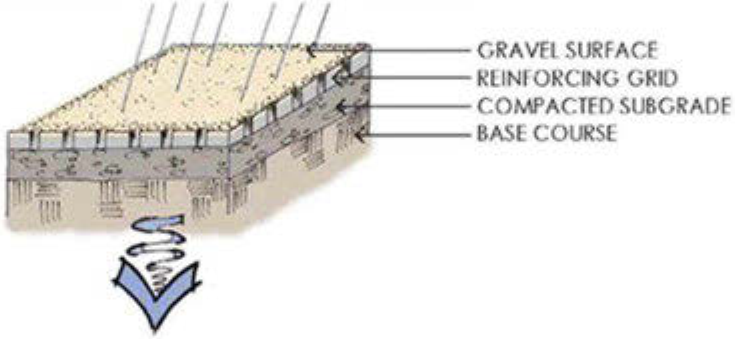
PERVIOUS CONCRETE/ASPHALT DIAGRAM



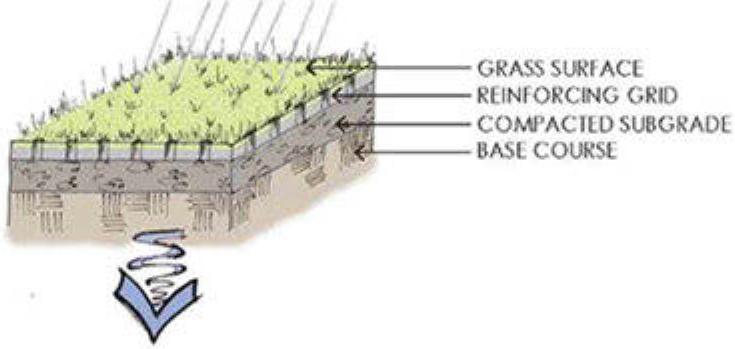
PERVIOUS JOINT PAVER DIAGRAM



REINFORCED GRAVEL PAVING DIAGRAM



REINFORCED GRASS PAVING DIAGRAM



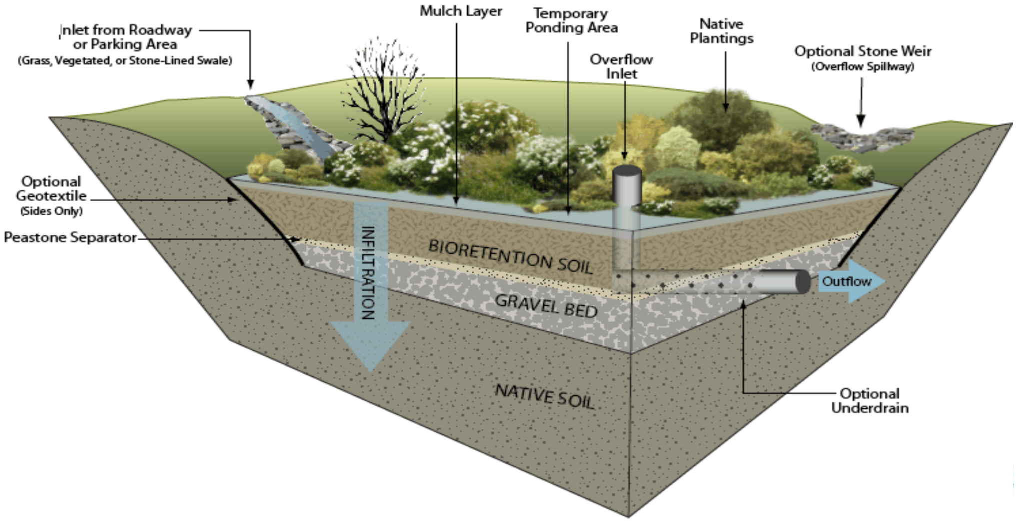
Source: San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook (2009)

Structural Stormwater BMPs

- Permeable Pavement

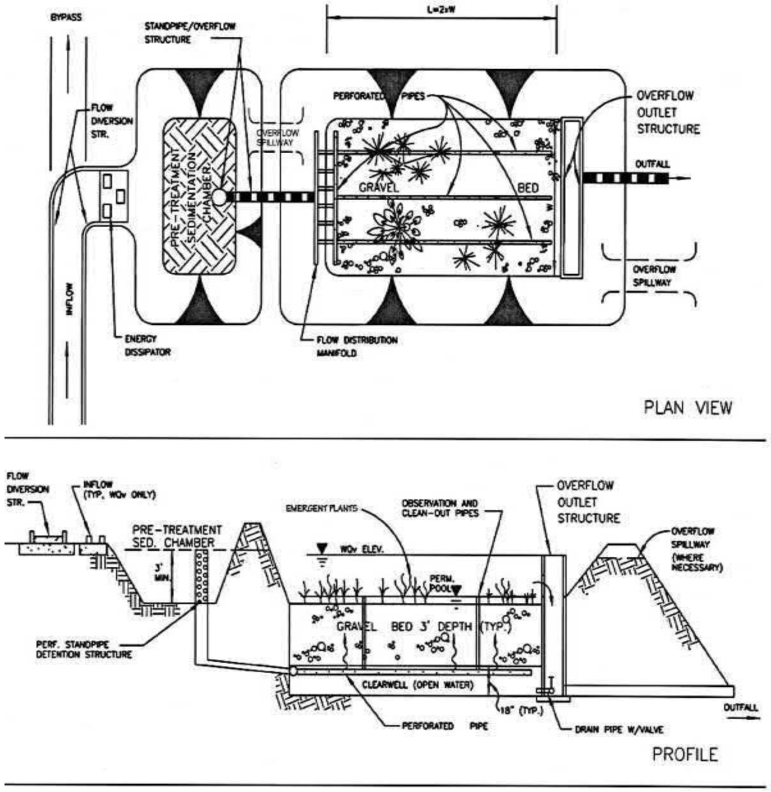
Structural Stormwater BMPs

- Bioretention/Infiltration



Structural Stormwater BMPs

- Vegetated Treatment Systems



Structural Stormwater BMPs

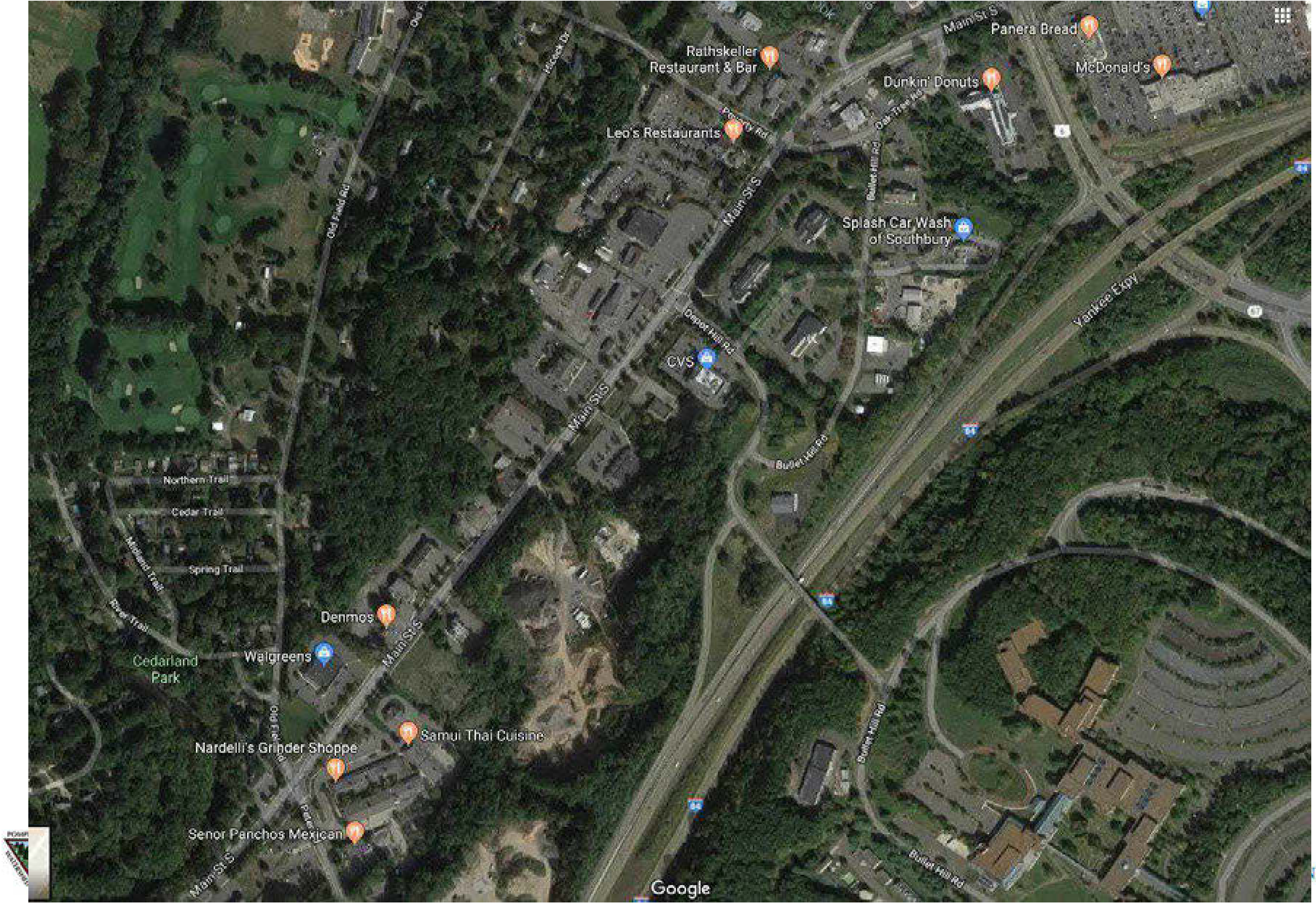
- Underground solutions
  - Parking lots
  - Public right-of-way

Structural BMP Opportunities

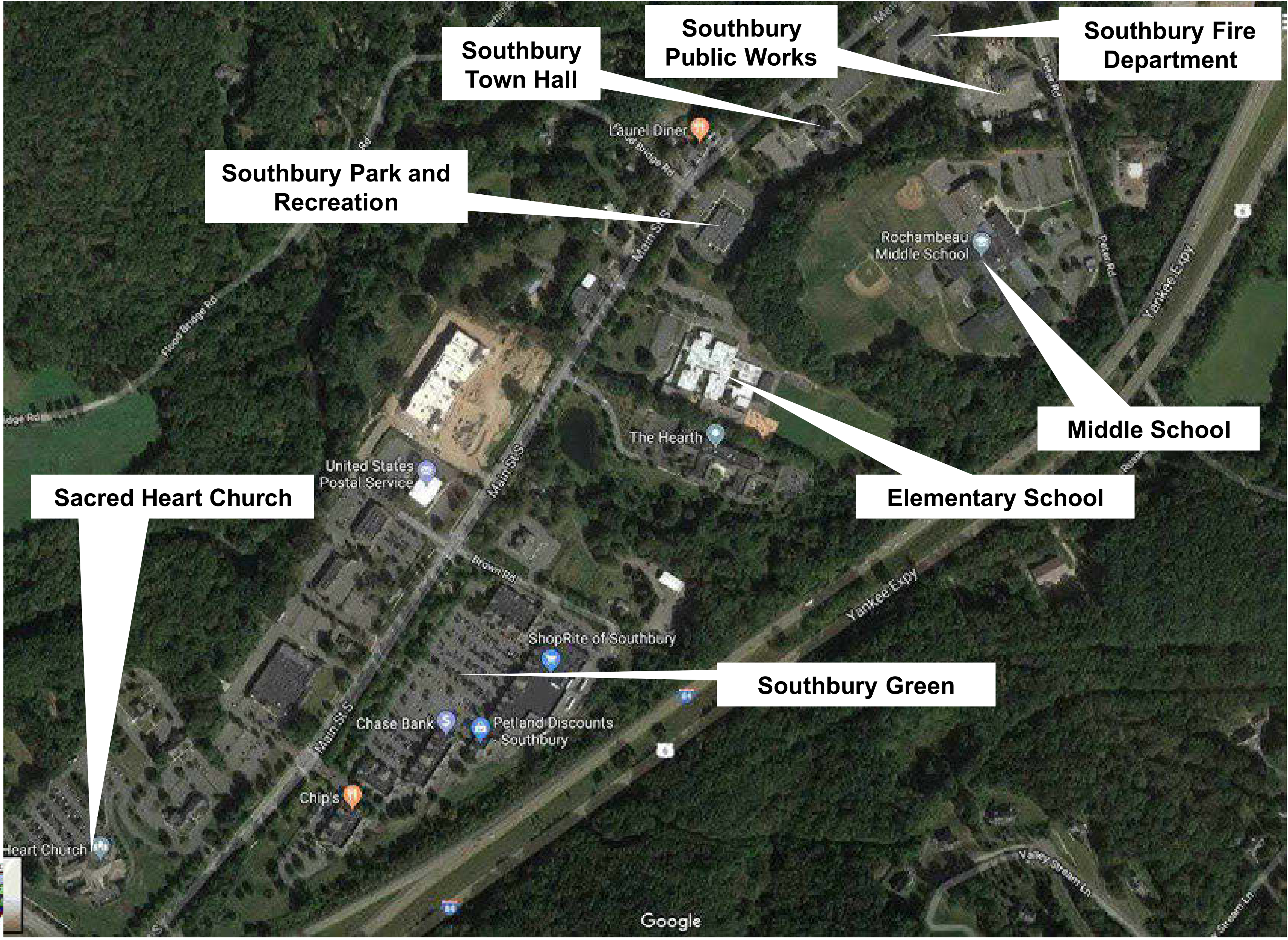
- Heritage Village
- Main Street South Corridor, Southbury

Southbury Plaza

Main Street South Corridor – North



Main Street South Corridor – South



O'NEILL

Heritage Village

Heritage Village

Illicit Discharge Detection and Elimination (IDDE)

- Requirements for MS4 regulated communities
- Encourage IDDE program implementation outside of regulated areas and in unregulated communities
- “Priority Areas” should include discharges to impaired segments

Manure Management

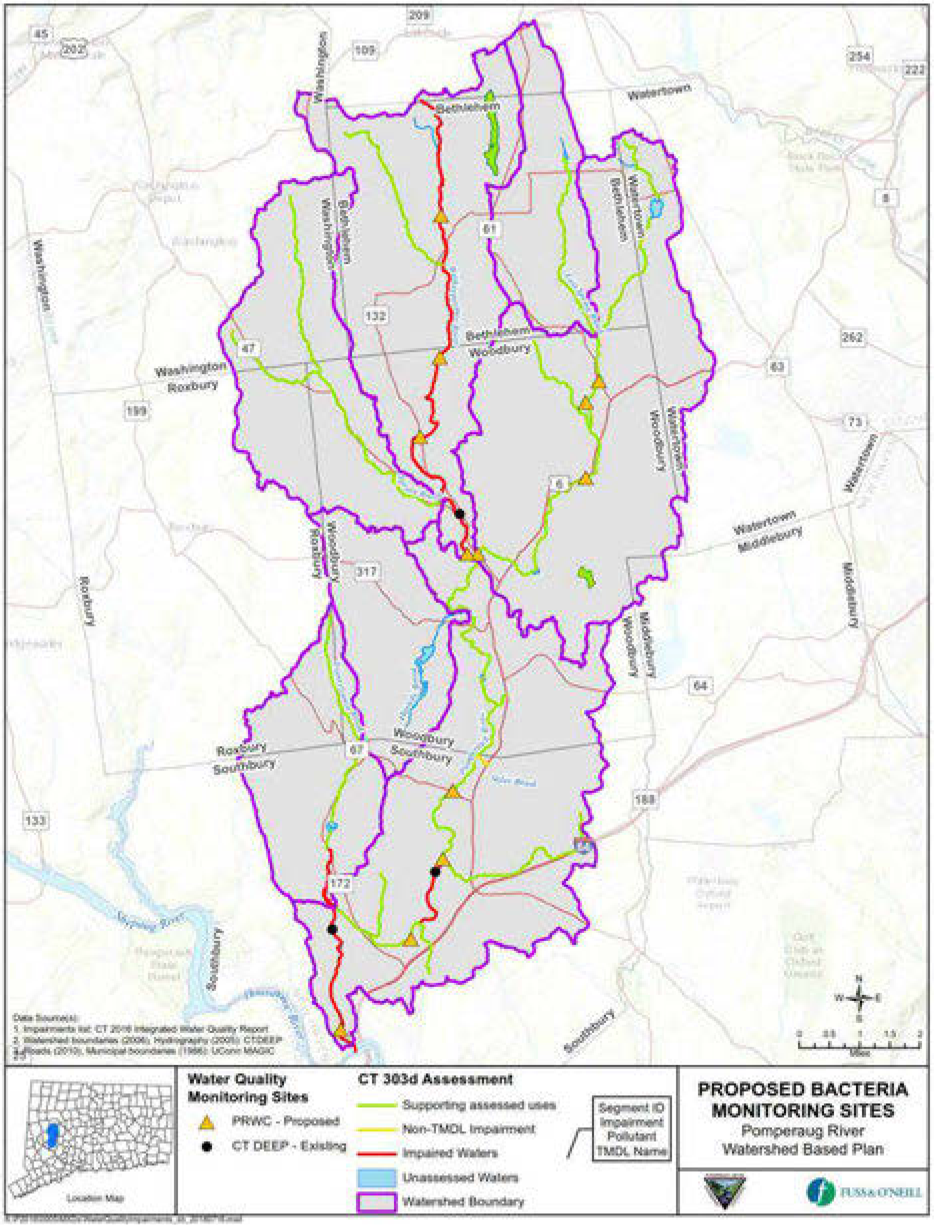
- Target equestrian facilities and livestock owners
  - Many likely doing a good job but could be better
- Focus on pastures as well as paddocks, barns, and storage areas

Site-Specific BMP Project Concepts

- 10 small and 5 large BMP project concepts
- Selection and Prioritization (refer to poster board)
  - Relative bacteria removal
  - Relative cost
  - Level of maintenance required

Proposed Bacteria Monitoring Program

- Monthly sampling April – October
- Approximately 14 stream locations
  - Upstream and downstream of potential sources
  - Bracket and isolate sources of pollution
  - Baseline for future WQ improvements
- Fecal indicator bacteria - E. coli
- Wet and dry weather conditions



Next Steps

1. Public information meetings	July 17 & 18
2. Release Draft Watershed Based Plan	August 15
3. Final public presentation	August 22
4. Finalize and submit Watershed Based Plan	August 31

Discussion and Comments

- Submit email or written comments by Friday, July 27th:

Carol Haskins, Outreach Director
Pomperaug River Watershed Coalition
39 Sherman Hill Road, Suite 103C, Woodbury, CT 06798
203-263-0076
chaskins@pomperaug.org

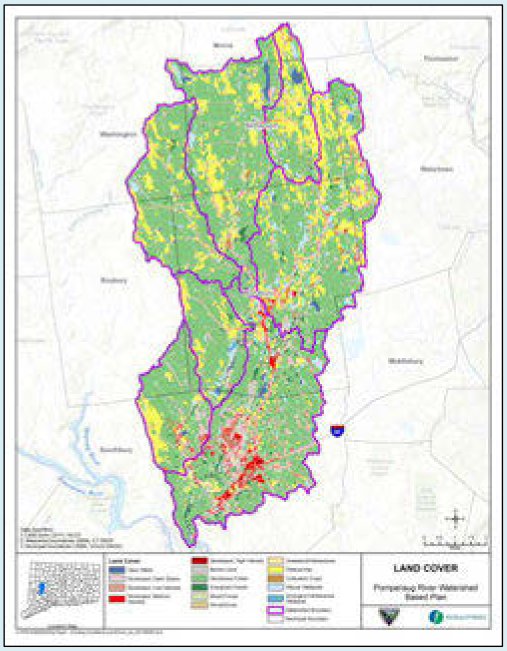
Thank you for your input and time!

Watershed Plan Presentation:

A Guidance Document for Improving Local Stream Health

POMPERAUG RIVER WATERSHED COALITION

WEDNESDAY AUGUST 22, 2018
7:00 – 8:30 PM
Woodbury Senior Center
Main Street South, Woodbury



PRESENTATION HIGHLIGHTS WILL INCLUDE:

- Efforts to update the Pomperaug Watershed Management Plan*
- Overview of in-stream water quality conditions
- Description of current land cover conditions
- Results of pollutant loading model analysis
- Recommendations for reducing bacteria, nutrient, and sediment loads to local rivers and stream (and Long Island Sound)
- Plans for expanding local stream monitoring
- Opportunity for audience feedback and input

FOR MORE INFORMATION:
www.pomperaug.org | 203-263-0076

** PRWC is in the process of updating its 2005 Watershed Management Plan to a 9-Element Watershed Based Plan , a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation. Revisions to the Plan are being made with guidance and oversight from PRWC's Land Use Committee whose membership includes but is not limited to representatives from local conservation organizations, town land use departments, as well as regional, state, and federal agencies.*

Press Release

From the Pomperaug River Watershed Coalition

39 Sherman Hill Road, Suite 103C, Woodbury 06798
Phone: (203) 263-0076
Email: info@pomperaug.org

For Immediate Release: August 3, 2018

Coalition Presents Updated Watershed Plan for Improving River Conditions

In follow-up to the three presentations held in July in Bethlehem, Woodbury and Southbury about the water quality conditions of local rivers and streams flowing through the Pomperaug Watershed, the Pomperaug River Watershed Coalition ("PRWC") invites area residents and other interested individuals to a presentation of its forthcoming Watershed Based Plan ("Plan"). The presentation is scheduled for Wednesday August 22 at 7:00 PM at the Woodbury Senior Center.

The focus of the Plan is to identify measures that should be implemented to reduce the amount of bacteria entering the local streams currently listed as impaired by CT Department of Energy and Environmental Protection ("DEEP") and the US Environmental Protection Agency ("EPA"). There are segments in the Pomperaug Basin where in-stream bacteria levels in the past have been measured in excess of the water quality standard for recreation. DEEP data supporting these results are limited and are dated; as such, future plan implementation will include additional water quality monitoring and analysis.

"As a science-based organization, we are aiming to better understand changing conditions and potential threats to our rivers and streams so we can continue to help protect healthy waters and work to improve conditions where necessary," says Carol Haskins, PRWC Outreach Director. "As a coalition-based organization, we want to ensure our community has an opportunity to learn about our work and to provide input regarding the long-term stewardship of our shared water resources."

During the upcoming presentation, PRWC and the environmental consulting team of Fuss & O'Neill will briefly recap the local impairments and the nuances of the data supporting the designation of these stream segments, provide an updated look at the land cover conditions in the watershed, and explain the results of the pollutant loading model that were shared during the July presentations. The team will then present strategies to be considered to reduce volume of bacteria, sediments, and nutrients entering local streams during rain storm and snow melt events. PRWC will also seek community input to help finalize the Plan which will serve as a guidance document for state and local agencies to implement measures to further protect and enhance local water resources. The reduction of bacteria to local rivers and streams also supports a state-wide initiative to reduce the amount of bacteria and nutrients flowing into Long Island Sound.

Recommendations included in the forthcoming Plan are made with guidance and oversight from PRWC's Land Use Committee whose membership includes but is not limited to representatives from local conservation organizations, town land use departments, as well as regional, state, and federal agencies. The development of the plan was funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency ("EPA") Clean Water Act Section 319 Nonpoint Source Grant as well as by Connecticut Community Foundation.

Additional information about the local water quality conditions and the Watershed Based Plan update can be found at www.pomperaug.org. Questions or comments may be directed to Carol Haskins at 203-263-0076 or outreach@pomperaug.org.

Final Public Information Session: Pomperaug Watershed Based Plan

August 22, 2018 from 7:00 to 9:00 PM at Woodbury Senior Center, Woodbury, CT

Presenters: Carol Haskins (Pomperaug River Watershed Coalition) & Erik Mas (Fuss & O'Neill)
Attendance: Approximately 25 people attended with representation from each of the core watershed municipalities of Bethlehem, Woodbury and Southbury (see sign-in sheet)

General Notes from Presentations Capturing Participant Comments & Questions

- Has any sampling for pharmaceuticals been done in the Pomperaug River?
- What is the impaired segment for the Weekeepeemee River so long when there is only one sampling point at the lower end of the river?
- What does TMDL mean?
- What methods or criteria are used for the bacteria sampling? Do the results reflect one-time samples, seasonal samples, averages, wet or dry conditions, etc?
- Discussion of the Connecticut Water Company / Heritage Village Water, Town of Southbury, and PRWC efforts to develop a low flow management plan for the Pomperaug
- What does "high yield aquifer" mean?
- Are illicit system contributions the same or different that a septic failure?
- In reviewing the modeled pollutant load inputs, question was asked if this reflects actual observations. Clarification / reinforcement was made that the pollutant load model is based on well-informed assumptions (based on scientific literature and follow-up conversations with local professionals)
- Referencing the monitoring requirements for the waste water treatment system at Woodlake Condominiums, a question was raised about the frequency of monitoring for other systems (surface and subsurface).
- Comment that there is clearly an obvious need for more data and question if this is a next step moving forward?
- What is the MS4 Permit / What does MS4 mean?
- With the understanding that Woodbury and Southbury are subject to MS4 permitting and recognition that there are State managed roads in town, the question was raised about who has "jurisdiction" or oversight for the drainage systems associated with State roads. Answer: CT DOT has its own MS4 permit for state maintained roads.
- Question and discussion about providing notifications and gaining access to private property for streamwalk survey programs or other monitoring efforts. In particular, what are the legalities?
- Question about whether or not PRWC's Watershed Based Plan meets the EPA 9-element criteria. Answer: It will.
- Will a copy of this presentation be added to the PRWC website along with the draft Plan? (Yes)

FUSS & O'NEILL

Public Information Meeting

Pomperaug River Watershed Based Plan

August 22, 2018

POMPERAUG RIVER WATERSHED COALITION

Purpose of Tonight's Meeting

- Describe the watershed plan update process
- Summarize watershed conditions and issues
- Present draft plan recommendations
- Seek additional community input to help finalize the plan

Project Team

- Project Leaders
  - Pomperaug River Watershed Coalition (PRWC)
  - CT Department of Energy and Environmental Protection (CTDEEP)
  - Fuss & O'Neill, Inc.
- PRWC Land Use Committee
  - Town land use departments
  - Local conservation organizations
  - Regional, state, and federal agencies
- Project Funding
  - US EPA and CTDEEP Clean Water Act Section 319 Nonpoint Source Grant
  - Connecticut Community Foundation

The project of updating the Pomperaug Watershed Management Plan to an EPA 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation

POMPERAUG RIVER WATERSHED COALITION

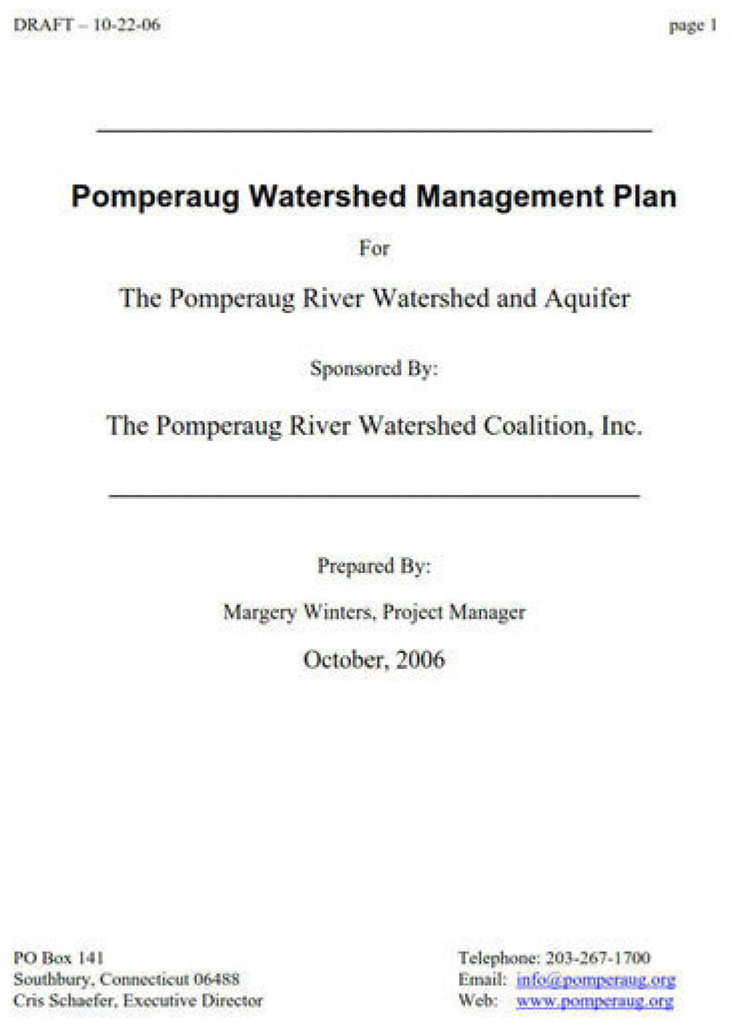
FUSS & O'NEILL

Project Goals

- Update the 2006 Pomperaug River Watershed Management Plan
  - Consolidate previous and ongoing work under one plan
  - Meet EPA's required Nine Elements
  - Improve chances for funding and implementation

EPA Nine 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



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Pomperaug Watershed Management Plan

For

The Pomperaug River Watershed and Aquifer

Sponsored By:

The Pomperaug River Watershed Coalition, Inc.

Prepared By:

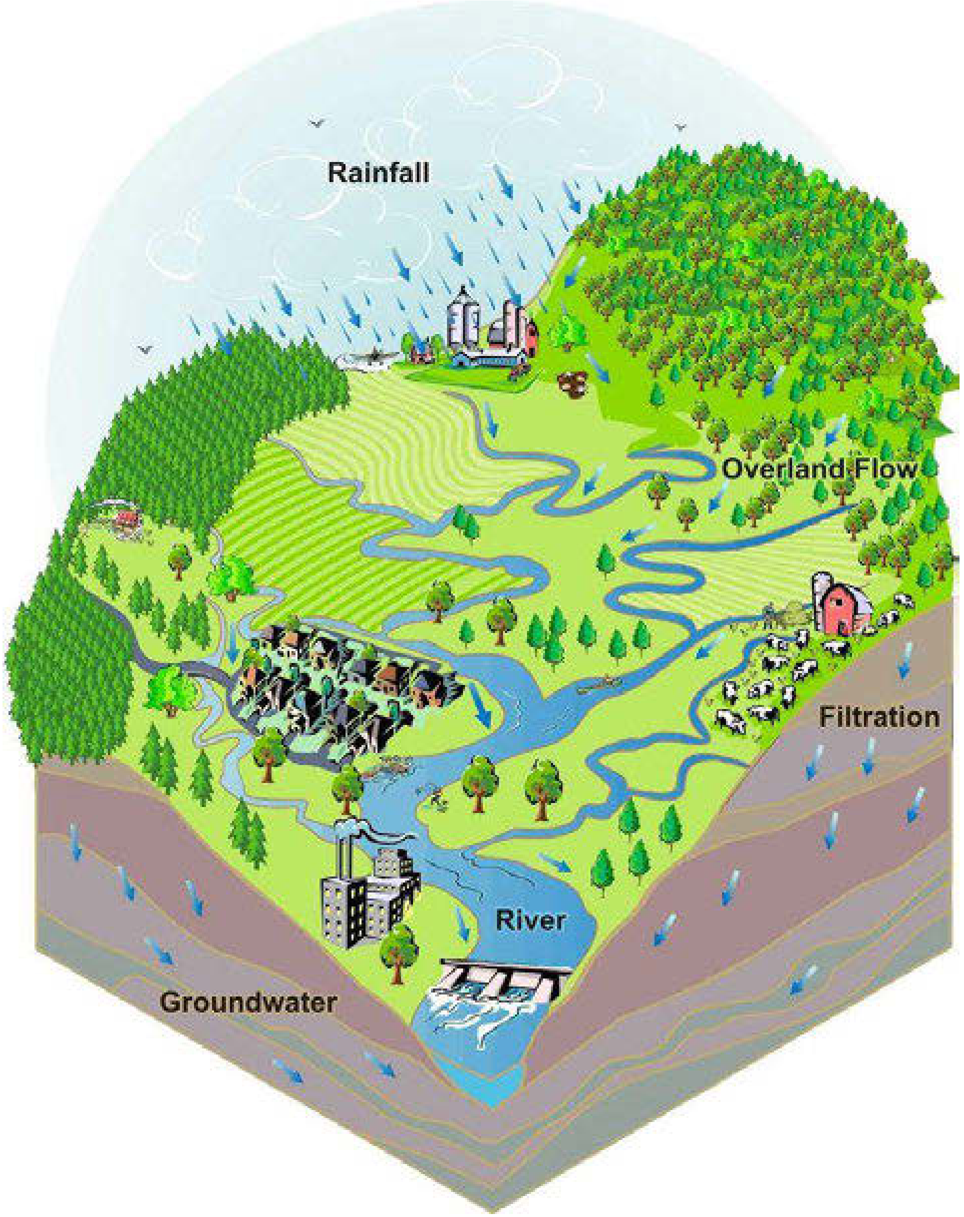
Margery Winters, Project Manager

October, 2006

PO Box 141
Southbury, Connecticut 06488
Cris Schaefer, Executive Director

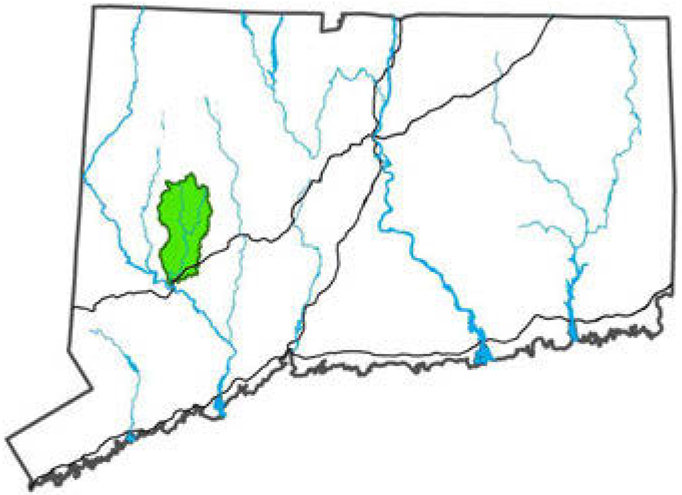
Telephone: 203-267-1700
Email: info@pomperaug.org
Web: www.pomperaug.org

What is a Watershed?



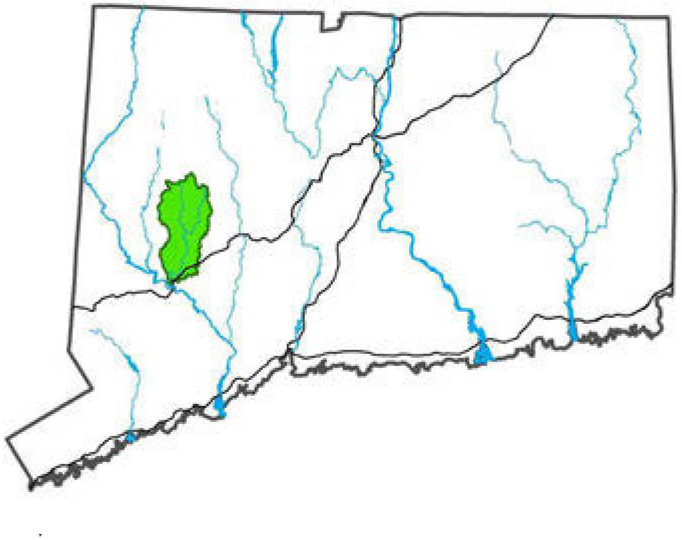
Pomperaug River Watershed Overview

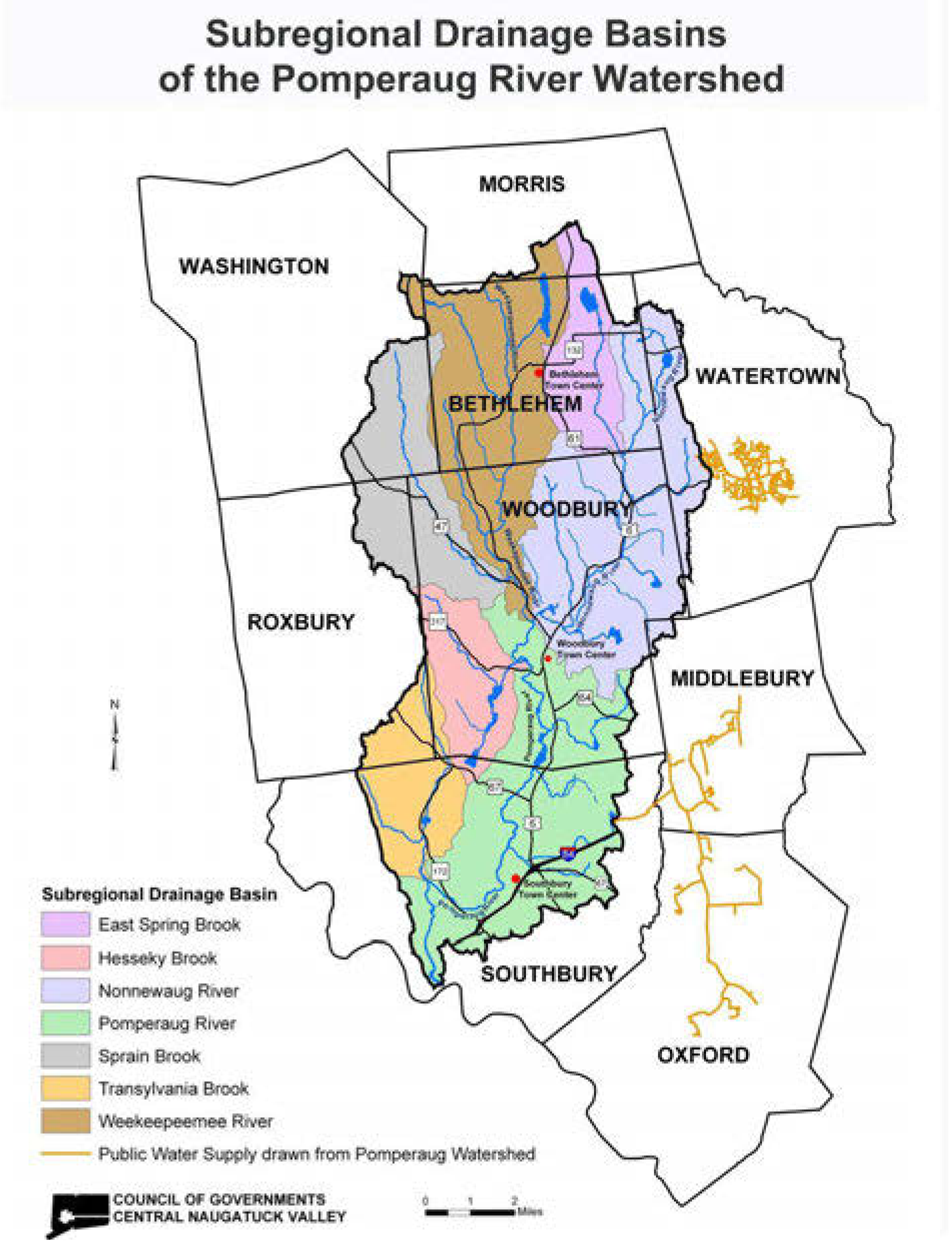
- 90 square-mile Regional Basin
- Portions of 8 towns



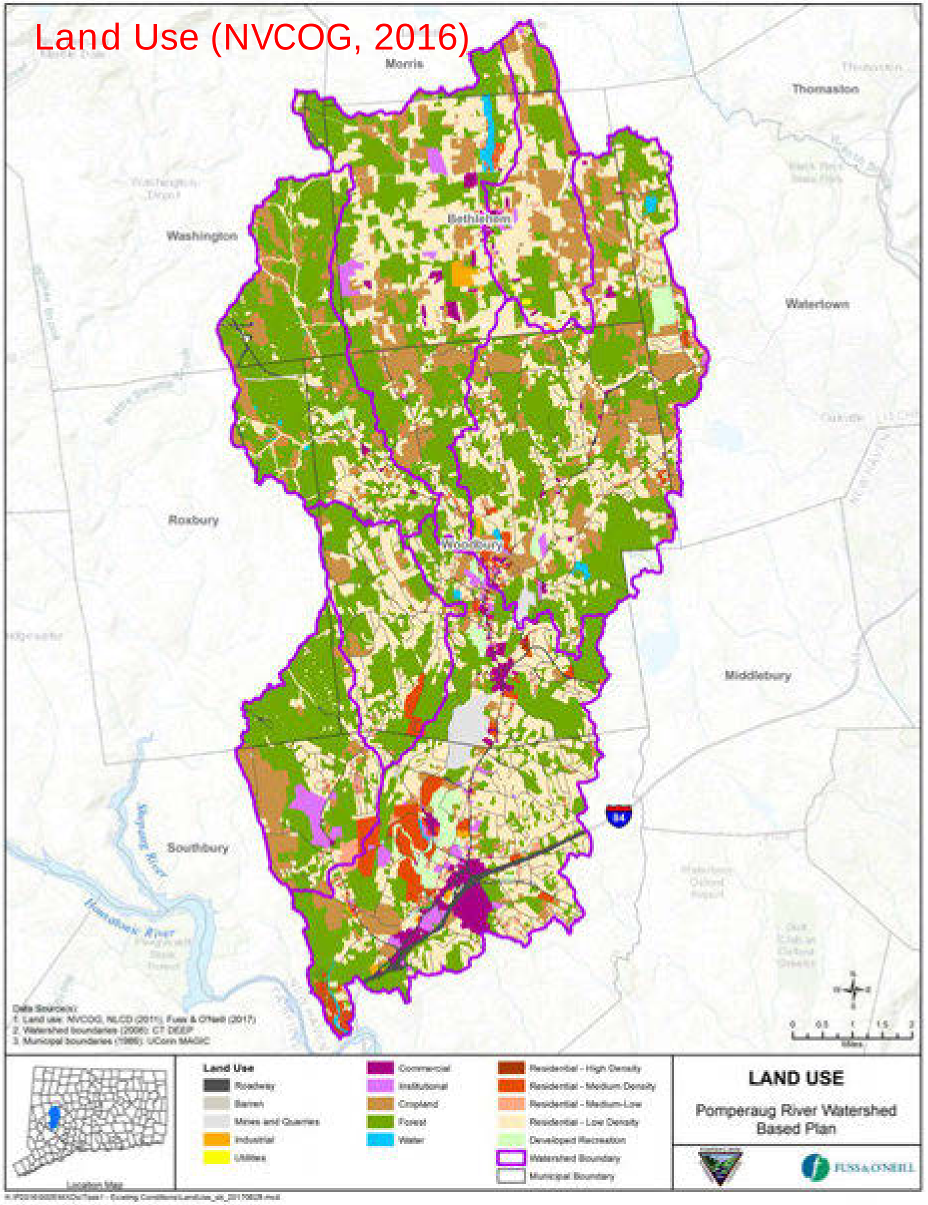
Pomperaug River Watershed Overview

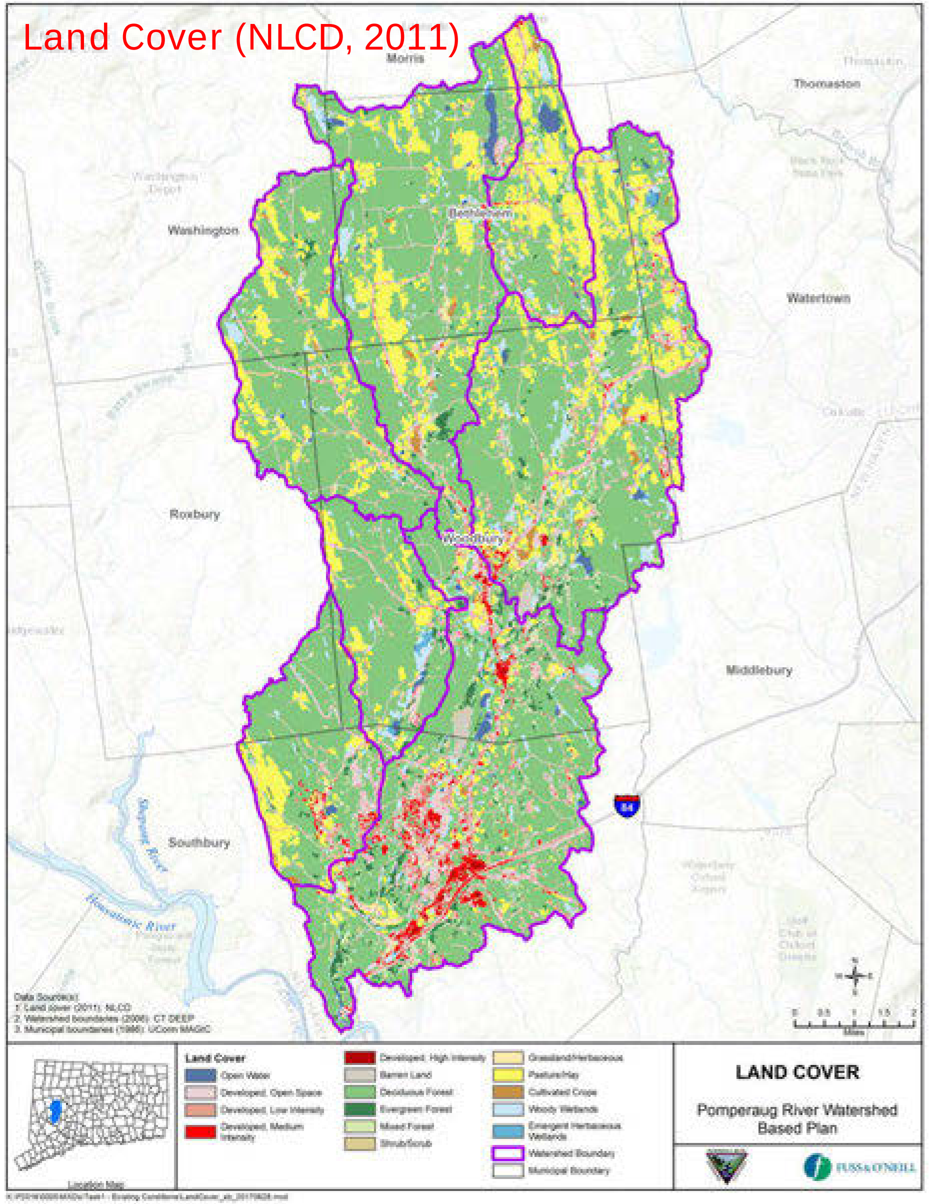
- 7 major Subregional Drainage Basins
- Major tributaries



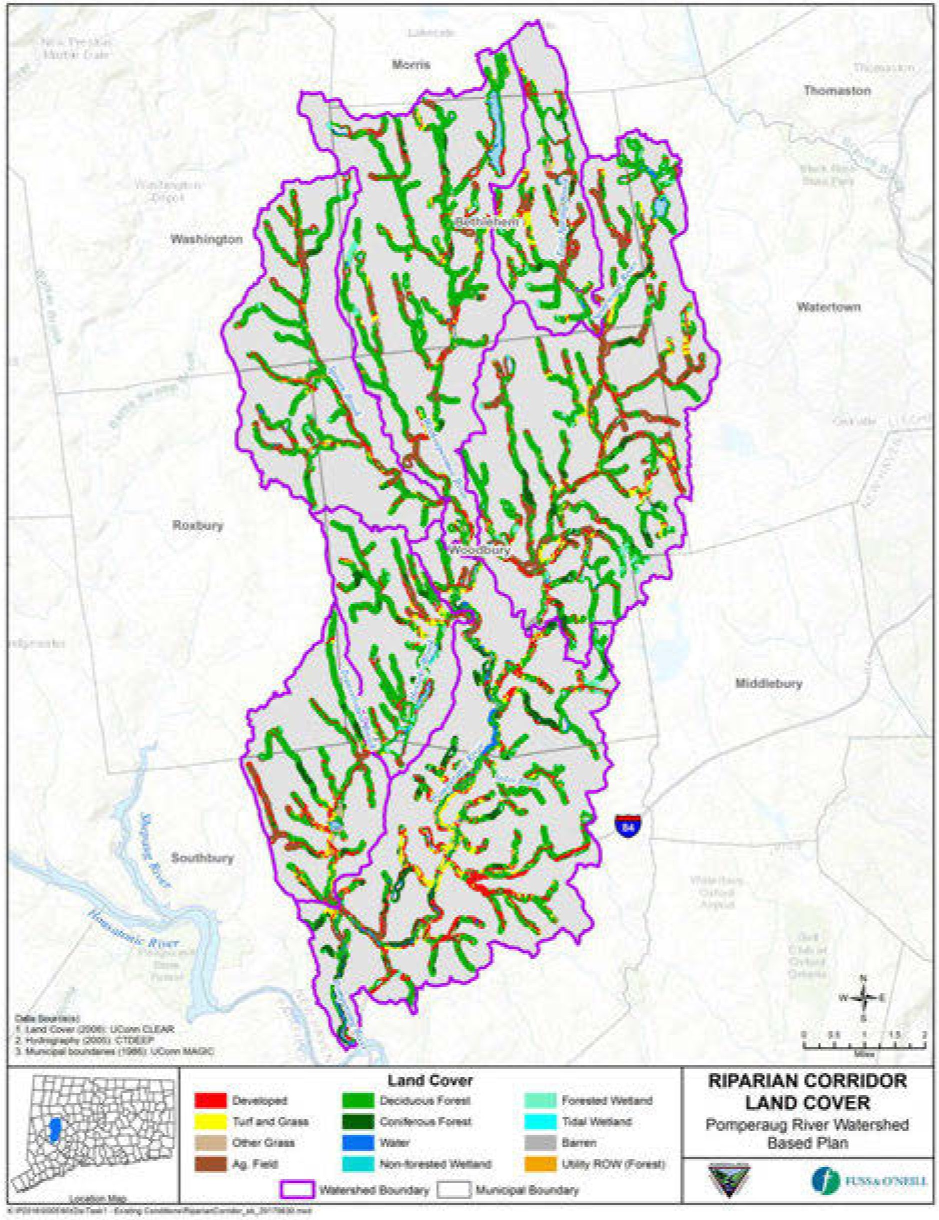


Land Use / Land Cover


Land Use (NVCOG, 2016)


Land Cover (NLCD, 2011)

Riparian Corridor Land Cover



- Natural buffers filter and infiltrate runoff, reduce flooding, and provide habitat
- UConn Center for Land Use Education And Research (CLEAR), 2006 Statewide Analysis
- 300-foot buffer either side of stream centerline
- All mapped perennial and intermittent streams in watershed

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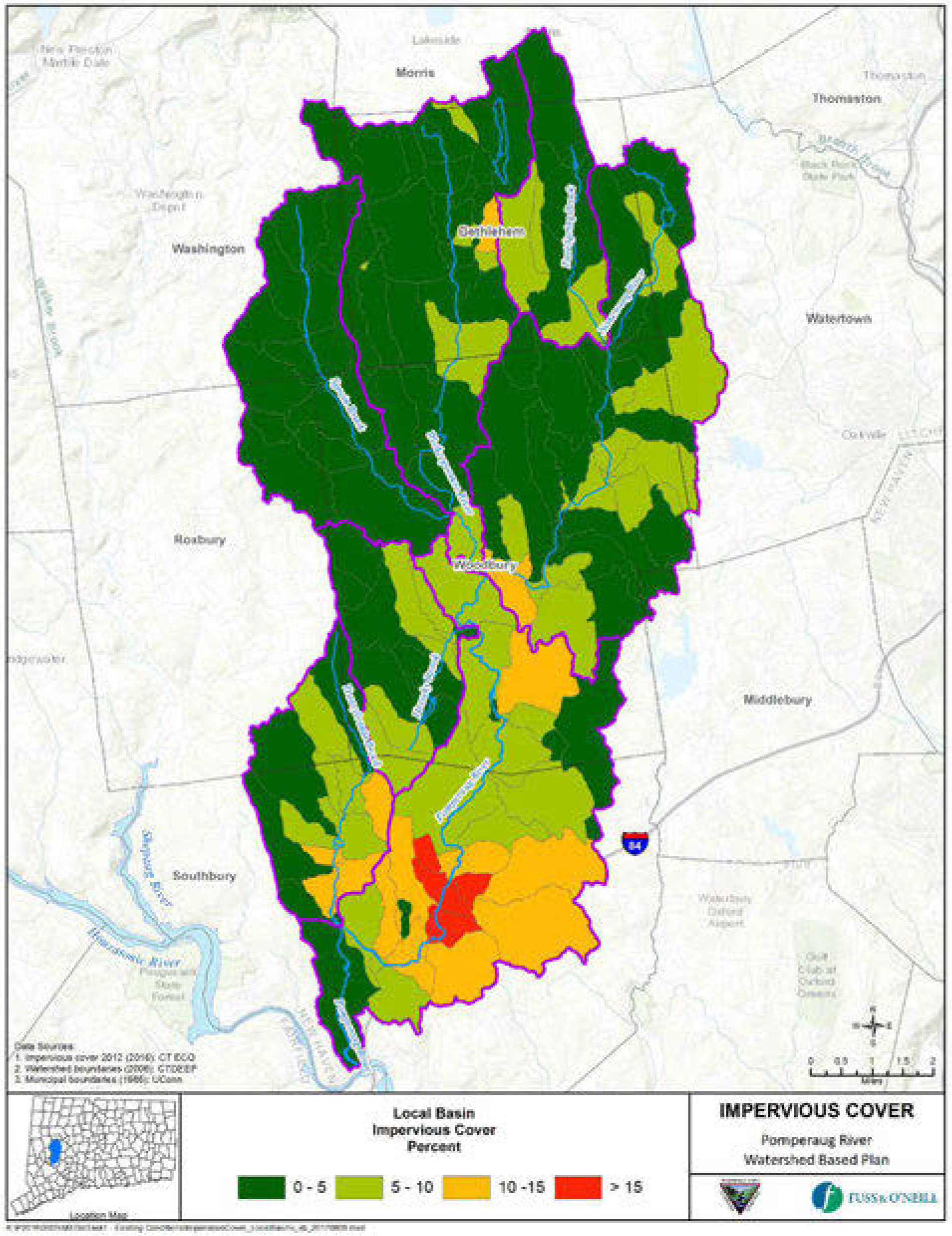
Riparian Corridor Land Cover

- Mostly forest and wetland
- Pomperaug Subregional Basin more developed than agricultural
- Other Subregional Basins show the opposite pattern

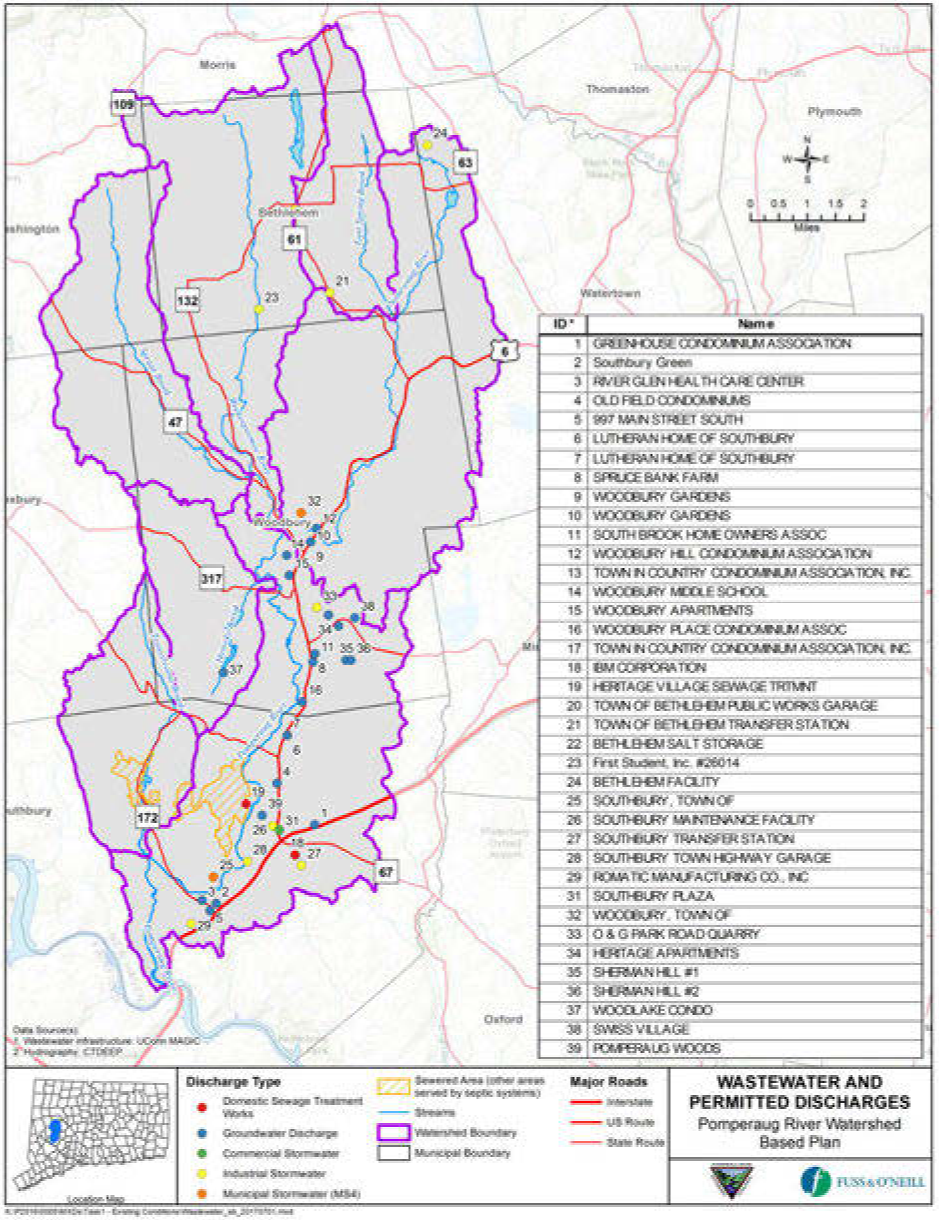
Land Cover Category	East Spring Brook	Hesseky Brook	Nonewaug River	Pomperaug River	Sprain Brook	Transylvania Brook	Weekeepeemee River
Developed, Other Grasses, Barren	10.33	10.33	12.05	**22.05**	11.74	17.63	9.89
Agriculture, Turf & Grass	**30.38**	**14.91**	**26.76**	14.54	**15.98**	**20.13**	**19.36**
Forest, Wetland, Water	**59.29**	**74.76**	**61.20**	**63.41**	**72.28**	**62.24**	**70.74**
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Impervious Cover

- 2012 statewide data, 1-foot resolution
- Analyzed by Local and Subregional Drainage Basins
- 12% “impacts” threshold
- Pomperaug Regional Basin: 5.6%
- Pomperaug Subregional Basin: 9.8%
- Local Basins: 9 exceed threshold (some 20-30%)



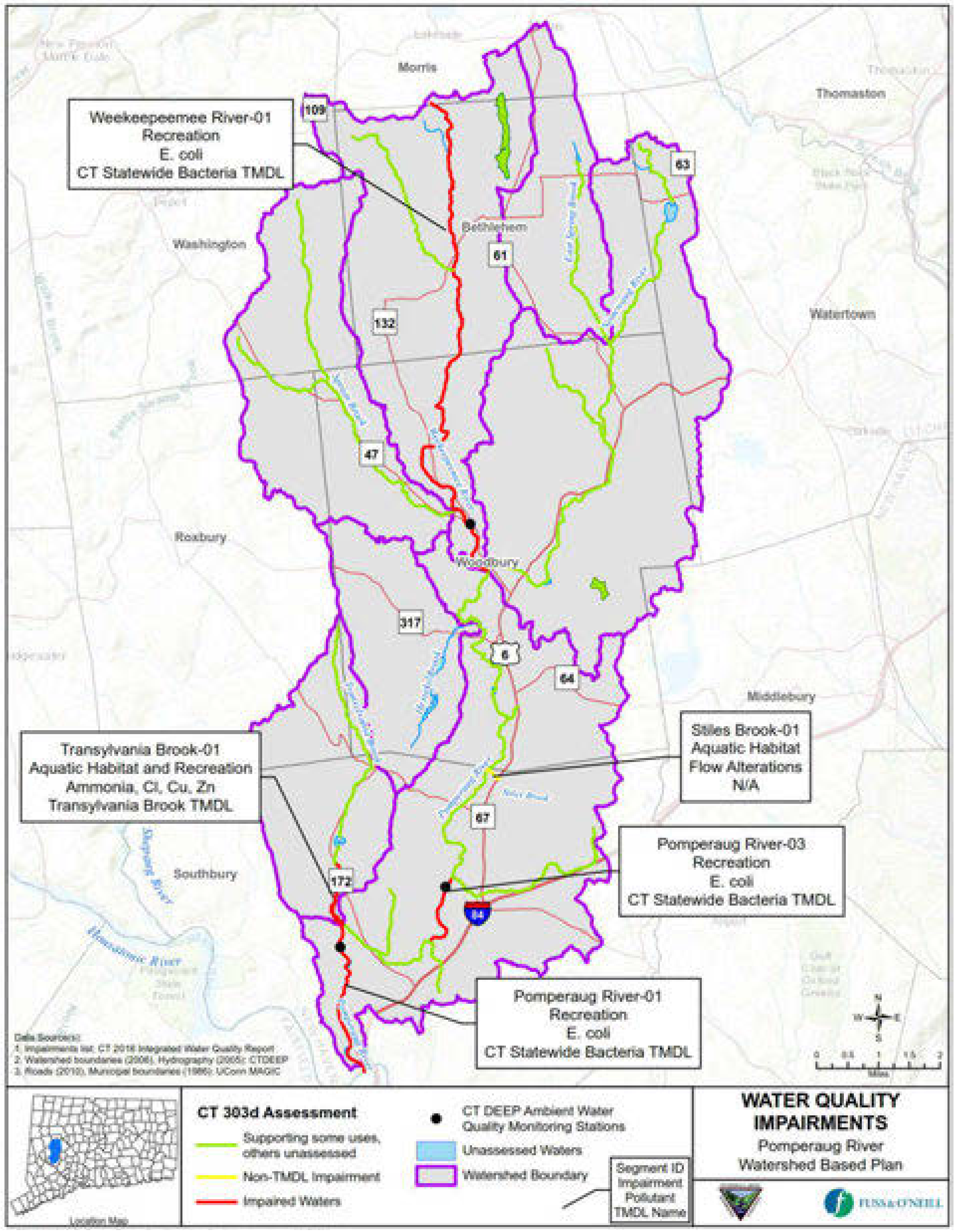
Wastewater and Other Permitted Discharges



ID *	Name
1	GREENHOUSE CONDOMINIUM ASSOCIATION
2	Southbury Green
3	RIVER GLEN HEALTH CARE CENTER
4	OLD FIELD CONDOMINIUMS
5	997 MAIN STREET SOUTH
6	LUTHERAN HOME OF SOUTHBURY
7	LUTHERAN HOME OF SOUTHBURY
8	SPRUCE BANK FARM
9	WOODBURY GARDENS
10	WOODBURY GARDENS
11	SOUTH BROOK HOME OWNERS ASSOC
12	WOODBURY HILL CONDOMINIUM ASSOCIATION
13	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC.
14	WOODBURY MIDDLE SCHOOL
15	WOODBURY APARTMENTS
16	WOODBURY PLACE CONDOMINIUM ASSOC
17	TOWN IN COUNTRY CONDOMINIUM ASSOCIATION, INC.
18	IBM CORPORATION
19	HERITAGE VILLAGE SEWAGE TRTMNT
20	TOWN OF BETHLEHEM PUBLIC WORKS GARAGE
21	TOWN OF BETHLEHEM TRANSFER STATION
22	BETHLEHEM SALT STORAGE
23	First Student, Inc. #26014
24	BETHLEHEM FACILITY
25	SOUTHBURY , TOWN OF
26	SOUTHBURY MAINTENANCE FACILITY
27	SOUTHBURY TRANSFER STATION
28	SOUTHBURY TOWN HIGHWAY GARAGE
29	ROMATIC MANUFACTURING CO., INC
31	SOUTHBURY PLAZA
32	WOODBURY , TOWN OF
33	O & G PARK ROAD QUARRY
34	HERITAGE APARTMENTS
35	SHERMAN HILL #1
36	SHERMAN HILL #2
37	WOODLAKE CONDO
38	SWISS VILLAGE
39	POMPERAUG WOODS

- CTDEEP
  - Point discharges (versus nonpoint)
  - Discharge permits database, 2016
  - Sewered area, 1997
- 39 permitted dischargers
- Sewage treatment plants
- Large permitted septic systems

Surface Water Quality

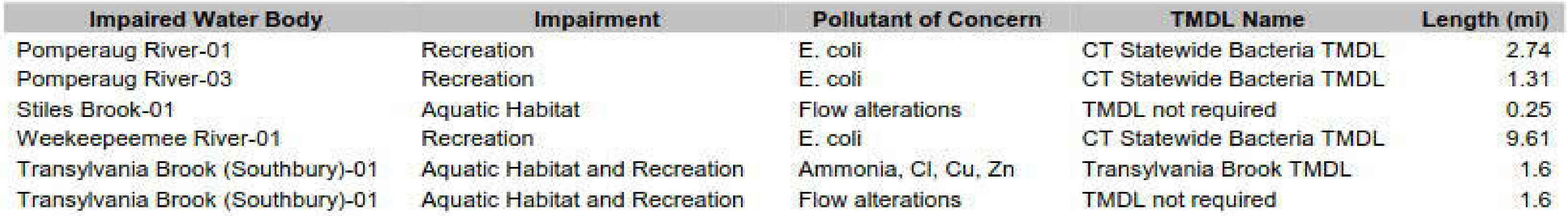


- CT 2016 Integrated Water Quality Report
- Designation based on “impaired” uses
  - Recreation (swimming, fishing, and boating)
  - Aquatic habitat
  - Fish consumption
  - Drinking water supply
- Very limited data set

Surface Water Quality Impairments

- Five impaired segments
  - Pomperaug River (2)
  - Weekeepeemee River
  - Transylvania Brook (3)
  - Stiles Brook

- State-wide Bacteria TMDL
  - Pomperaug River
  - Weekeepeemee River
- Transylvania Brook TMDL

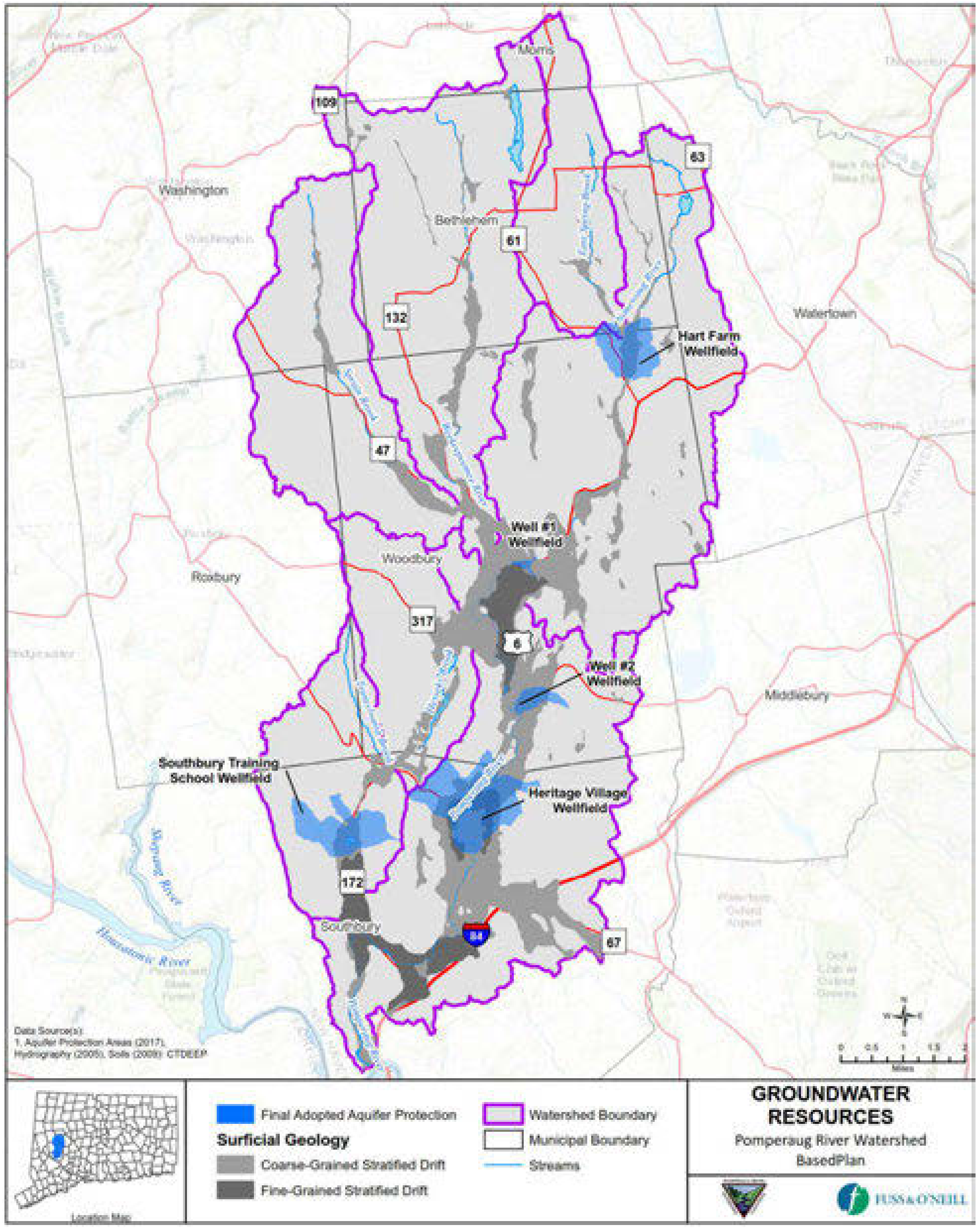


Impaired Water Body	Impairment	Pollutant of Concern	TMDL Name	Length (mi)
Pomperaug River-01	Recreation	E. coli	CT Statewide Bacteria TMDL	2.74
Pomperaug River-03	Recreation	E. coli	CT Statewide Bacteria TMDL	1.31
Stiles Brook-01	Aquatic Habitat	Flow alterations	TMDL not required	0.25
Weekeepeemee River-01	Recreation	E. coli	CT Statewide Bacteria TMDL	9.61
Transylvania Brook (Southbury)-01	Aquatic Habitat and Recreation	Ammonia, Cl, Cu, Zn	Transylvania Brook TMDL	1.6
Transylvania Brook (Southbury)-01	Aquatic Habitat and Recreation	Flow alterations	TMDL not required	1.6
Transylvania Brook (Southbury)-01	Recreation	E. coli	Proposed for TMDL	1.6

Physical Alterations

- Altered stream channels, floodplains, and riparian corridors
  - Dams
  - Gravel removal operations
  - Groundwater withdrawals
  - Land development
- Impacts to water quality, habitat, and flow regime
- Proposed Stream Flow Classifications
  - Standards for maintaining minimum flows in rivers and streams

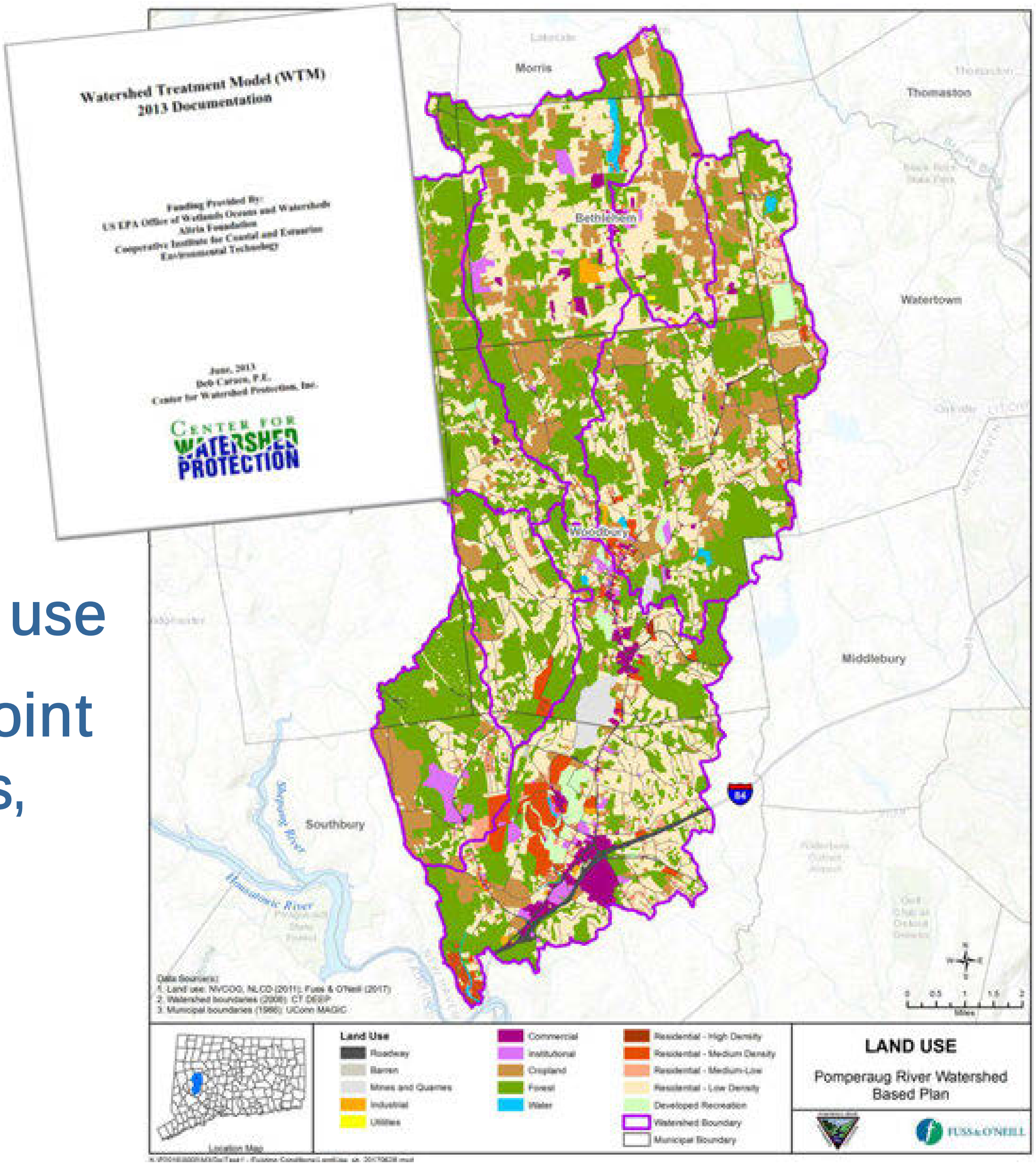
Groundwater Resources



- Significant prior study of groundwater resources
- Strong connection between groundwater and surface water
- High yield sand and gravel aquifers
- Susceptible to contamination, depleted wells, low river flows

Pollutant Loading Model

- Watershed Treatment Model (WTM) – surface runoff pollutant loads
- Annual loadings of bacteria, nutrients, and sediment to surface waters
- Primary sources – land use
- Secondary sources – point sources, septic systems, illicit discharges, etc.



Watershed Treatment Model (WTM)
2013 Documentation

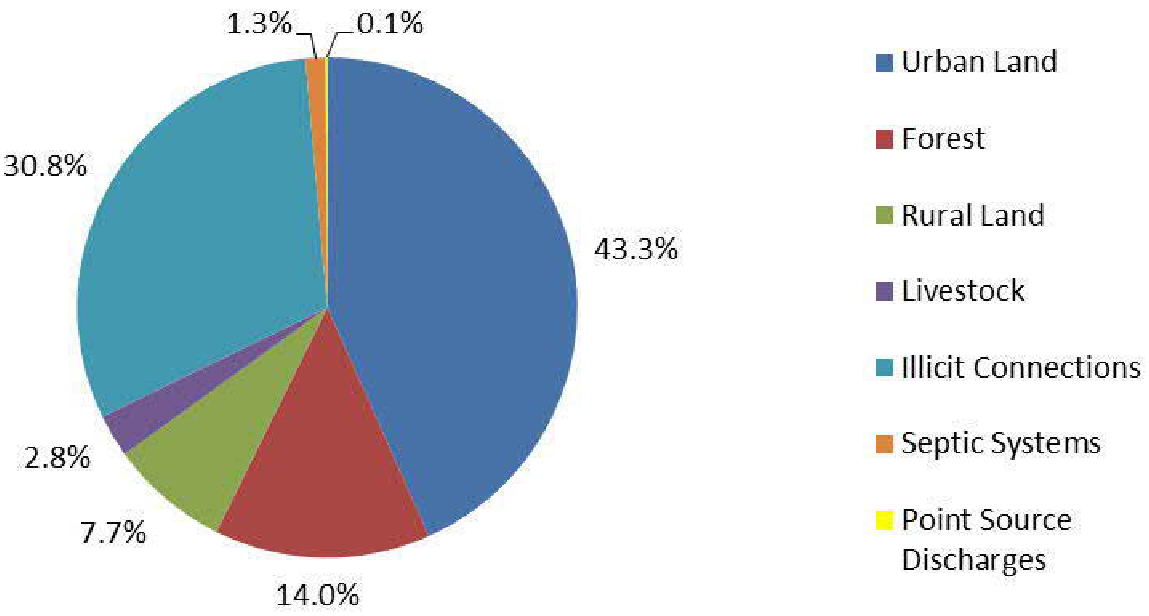
Funding Provided By:
US EPA Office of Wetlands Oceans and Watersheds
Altria Foundation
Cooperative Institute for Coastal and Estuarine
Environmental Technology

June, 2013
Deb Caraco, P.E.
Center for Watershed Protection, Inc.

CENTER FOR WATERSHED PROTECTION

Modeled Relative Bacteria Sources

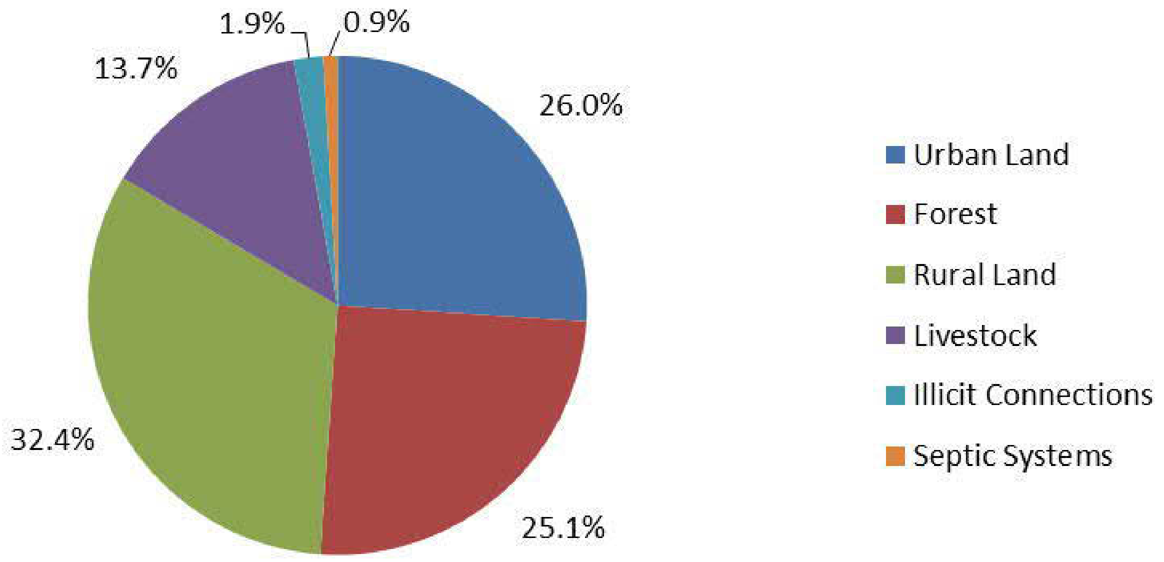
Pomperaug River Subregional Basin



- Stormwater runoff from developed land
- Illicit connections from residential and commercial land use
- Source controls, structural stormwater BMPs, education and outreach, illicit discharge detection and elimination

Modeled Relative Bacteria Sources

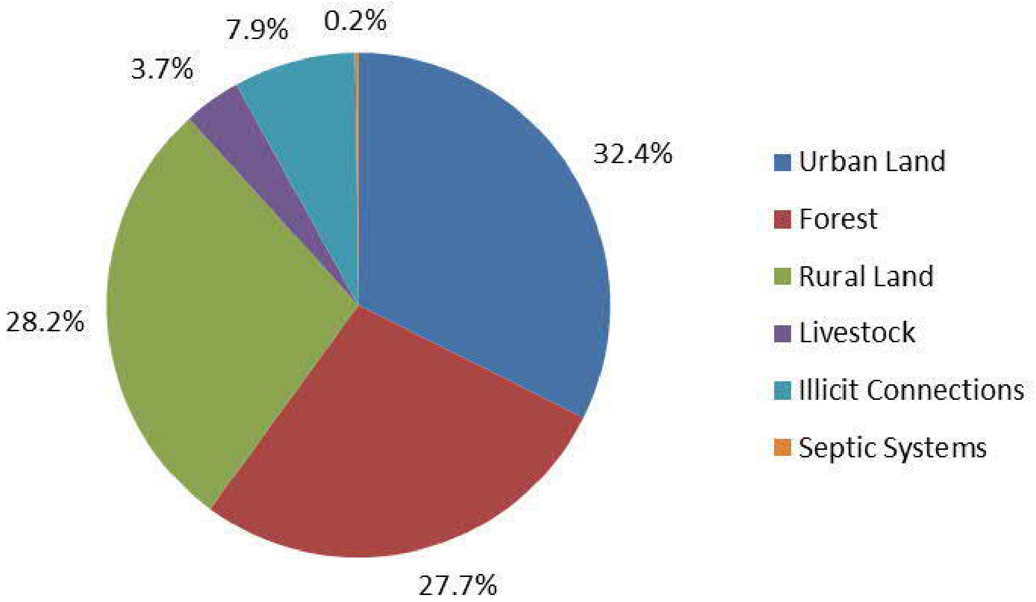
Weekeepeemee River Subregional Basin



- Stormwater runoff from agricultural land use and some developed land use
- Agricultural BMPs (livestock and manure management)

Modeled Relative Bacteria Sources

Transylvania Brook Subregional Basin



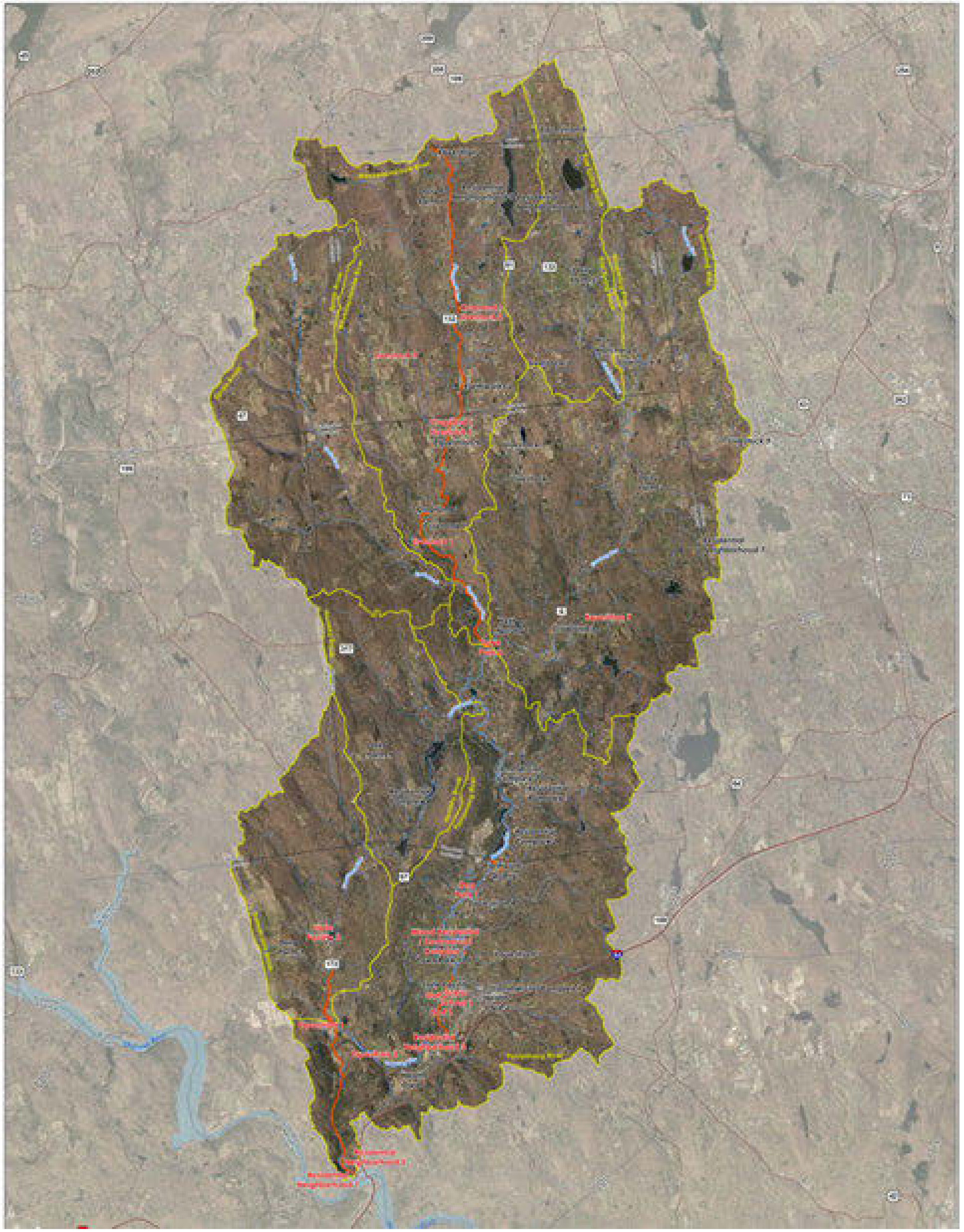
- Stormwater runoff from mix of agricultural and developed land uses

Visual Field Assessments

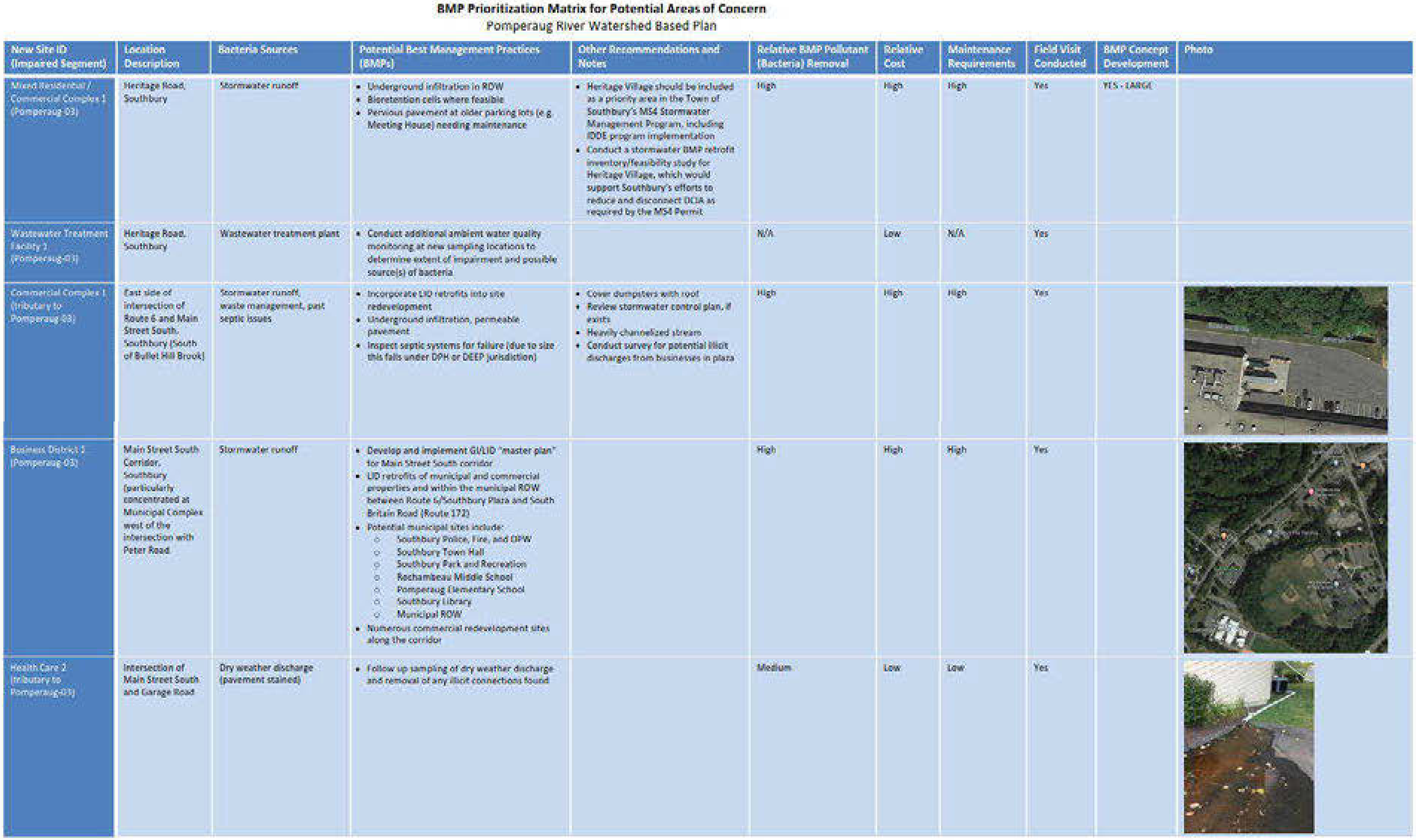
- Investigate suspected bacteria sources in areas with impairments
- Identify restoration, pollution prevention, and retrofit opportunities
- Standardized field protocols
  - Stream reaches
  - Neighborhoods
  - Hotspots

Pollution Hotspots/Areas of Concern

- Identified by LUC and PRWC
- Roughly 60 sites identified
- Potential bacteria sources
  - Urban stormwater
  - Agricultural land adjacent to streams
  - Streambank erosion
  - Manure management
  - Septic system issues
  - Significant point discharges
  - Waterfowl, pet waste



Site-Specific BMP Selection Matrix



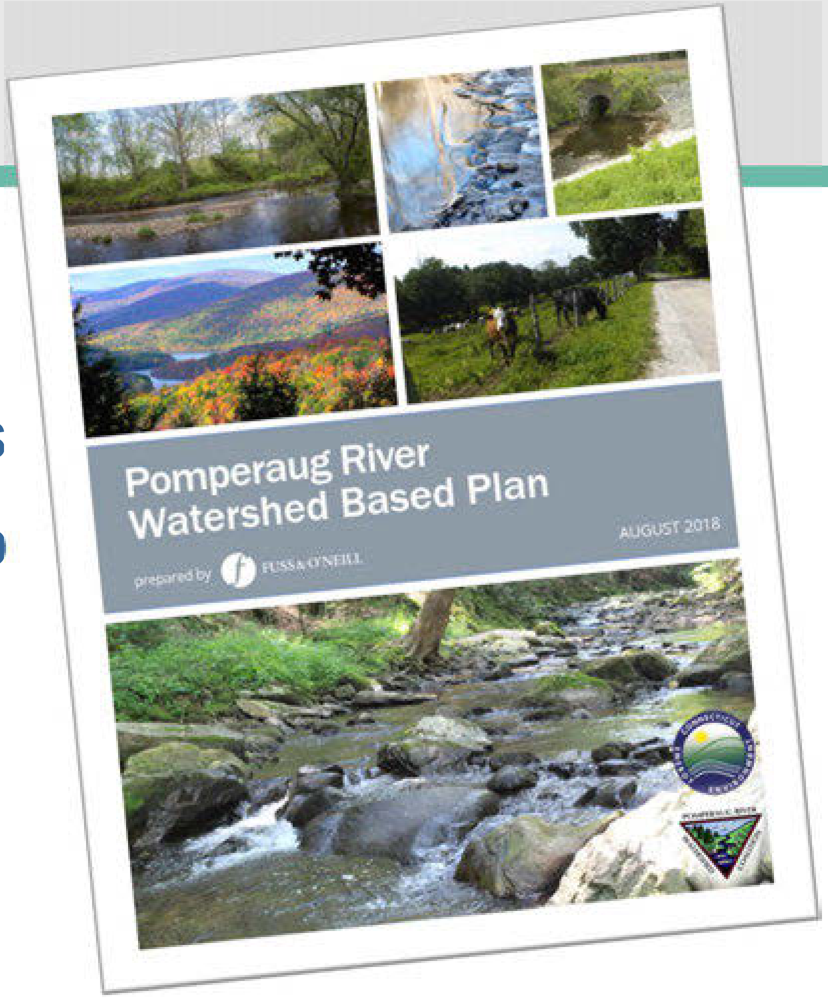
BMP Prioritization Matrix for Potential Areas of Concern

Pomperaug River Watershed Based Plan

New Site ID (Impaired Segment)	Location Description	Bacteria Sources	Potential Best Management Practices (BMPs)	Other Recommendations and Notes	Relative BMP Pollutant (Bacteria) Removal	Relative Cost	Maintenance Requirements	Field Visit Conducted	BMP Concept Development	Photo
Mixed Residential / Commercial Complex 1 (Pomperaug 03)	Heritage Road, Southbury	Stormwater runoff	▪ Underground infiltration in ROW ▪ Bioretention cells where feasible ▪ Pervious pavement at older parking lots (e.g. Meeting House) needing maintenance	▪ Heritage Village should be included as a priority area in the Town of Southbury's MS4 Stormwater Management Program, including IDDE program implementation ▪ Conduct a stormwater BMP retrofit inventory/feasibility study for Heritage Village, which would support Southbury's efforts to reduce and disconnect DCIA as required by the MS4 Permit	High	High	High	Yes	YES - LARGE	
Wastewater Treatment Facility 1 (Pomperaug-03)	Heritage Road, Southbury	Wastewater treatment plant	▪ Conduct additional ambient water quality monitoring at new sampling locations to determine extent of impairment and possible source(s) of bacteria		N/A	Low	N/A	Yes		
Commercial Complex 1 (tributary to Pomperaug 03)	East side of intersection of Route 6 and Main Street South, Southbury (South of Bullet Hill Brook)	Stormwater runoff, waste management, past septic issues	▪ Incorporate LID retrofits into site redevelopment ▪ Underground infiltration, permeable pavement ▪ Inspect septic systems for failure (due to size this falls under DPH or DEEP jurisdiction)	▪ Cover dumpsters with roof ▪ Review stormwater control plan, if exists ▪ Heavily channelized stream ▪ Conduct survey for potential illicit discharges from businesses in plaza	High	High	High	Yes		
Business District 1 (Pomperaug 03)	Main Street South Corridor, Southbury (particularly concentrated at Municipal Complex west of the intersection with Peter Road	Stormwater runoff	▪ Develop and implement GI/LID "master plan" for Main Street South corridor ▪ LID retrofits of municipal and commercial properties and within the municipal ROW between Route 6/Southbury Plaza and South Britain Road (Route 172) ▪ Potential municipal sites include: ○ Southbury Police, Fire, and DPW ○ Southbury Town Hall ○ Southbury Park and Recreation ○ Rochambeau Middle School ○ Pomperaug Elementary School ○ Southbury Library ○ Municipal ROW ▪ Numerous commercial redevelopment sites along the corridor		High	High	High	Yes		
Health Care 2 (tributary to Pomperaug-03)	Intersection of Main Street South and Garage Road	Dry weather discharge (pavement stained)	▪ Follow up sampling of dry weather discharge and removal of any illicit connections found		Medium	Low	Low	Yes		

Watershed Based Plan

Plan Objectives



Pomperaug River Watershed Based Plan

AUGUST 2018

prepared by FUSS & O'NEILL

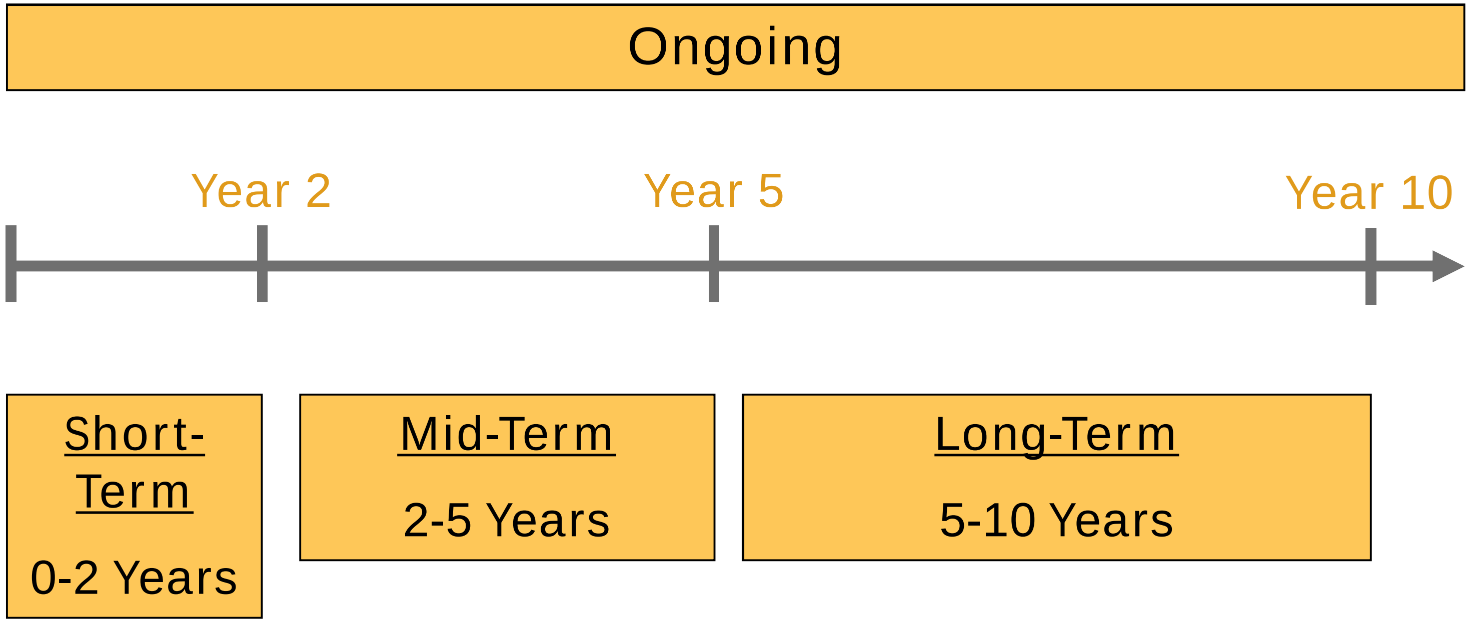
- Update baseline of water quality and land use conditions
- Evaluate contributing factors to impairments
- Identify water quality monitoring needs
- Establish community buy-in
- Identify and prioritize strategies to reduce pollutant inputs to impaired rivers and streams
- Incorporate proactive measures to protect/maintain high quality streams

POMPERAUG RIVER WATERSHED COALITION

FUSS & O'NEILL

Framework of Recommended Strategies

- Watershed-wide strategies
- Site-specific concepts/demonstration projects
- Timeframe



Ongoing

Year 2

Year 5

Year 10

Short-Term

0-2 Years

Mid-Term

2-5 Years

Long-Term

5-10 Years

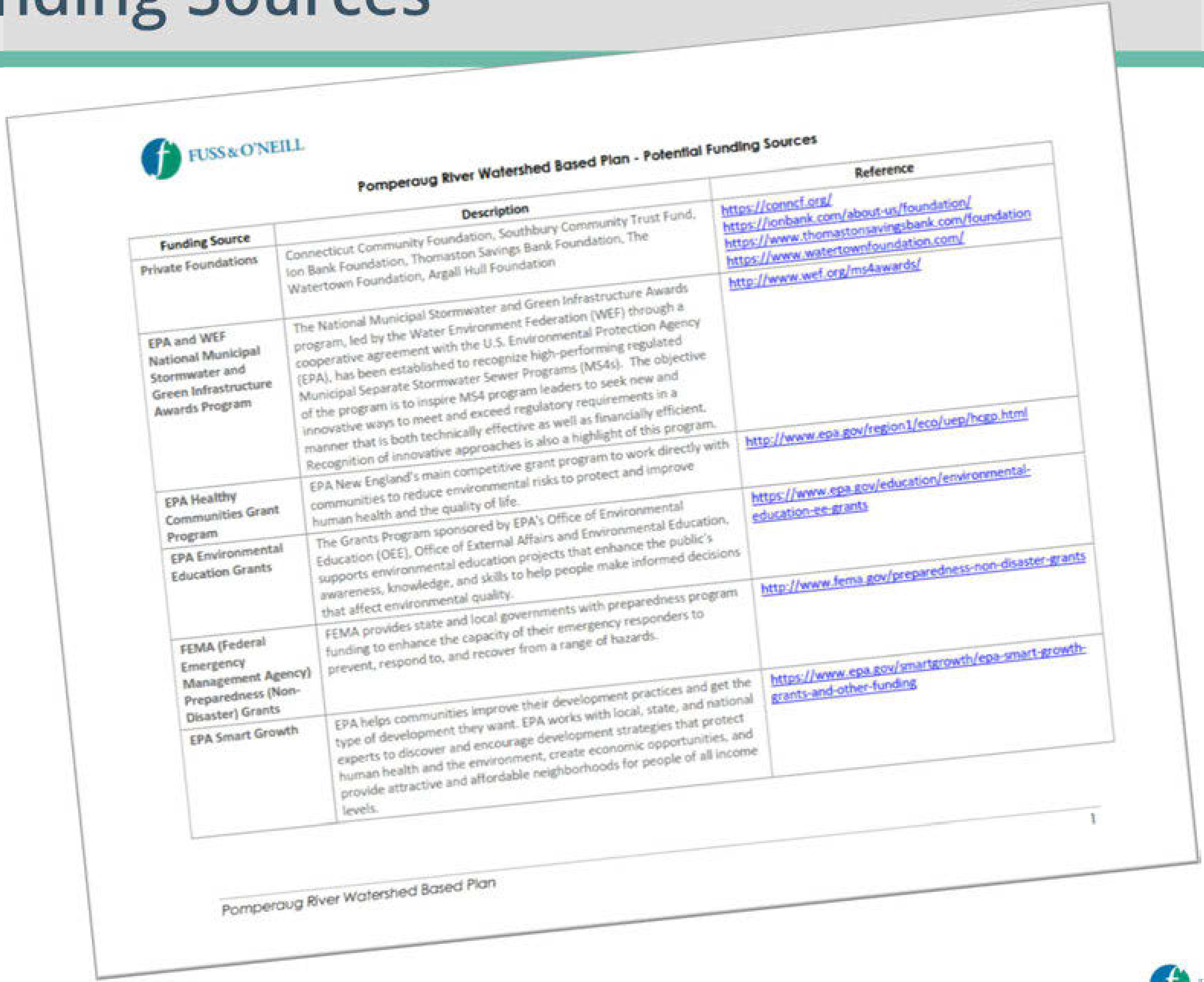
- Requires coordination and efforts by many partners

Capacity Building

Strengthen and build local capacity to implement the watershed management plan

1. Endorsement of the plan by municipal partners
2. Identify and pursue additional funding sources
    - Private foundations
    - CTDEEP/EPA Section 319 Nonpoint Source Grants
    - National Fish and Wildlife Foundation Long Island Sound Futures Fund
    - Connecticut Clean Water Fund (Green Infrastructure)

Funding Sources



Pomperaug River Watershed Based Plan - Potential Funding Sources

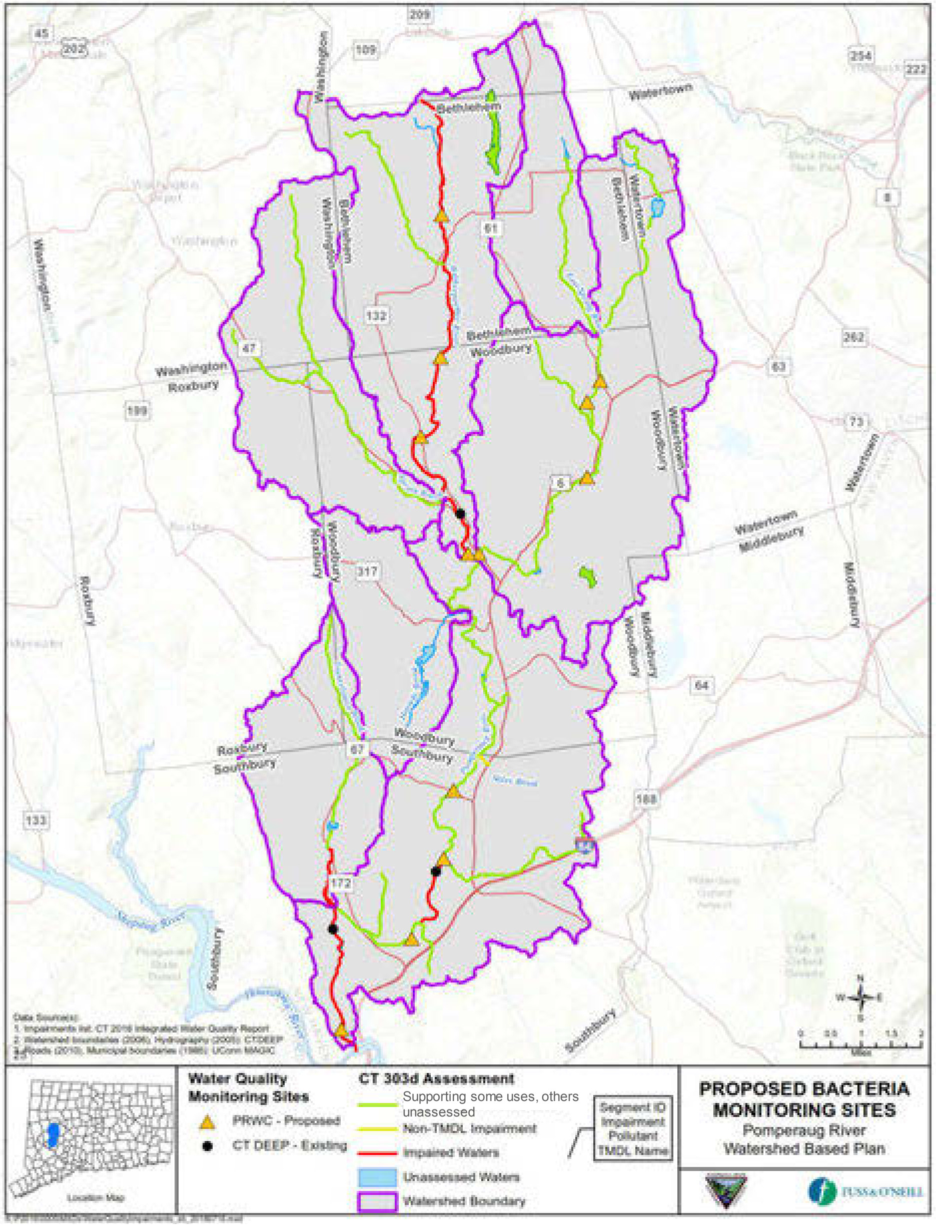
Funding Source	Description	Reference
Private Foundations	Connecticut Community Foundation, Southbury Community Trust Fund, Ion Bank Foundation, Thomaston Savings Bank Foundation, The Watertown Foundation, Argall Hull Foundation	https://conncf.org/ https://ionbank.com/about-us/foundation/ https://www.thomastonsavingsbank.com/foundation https://www.watertownfoundation.com/
EPA and WEF National Municipal Stormwater and Green Infrastructure Awards Program	The National Municipal Stormwater and Green Infrastructure Awards program, led by the Water Environment Federation (WEF) through a cooperative agreement with the U.S. Environmental Protection Agency (EPA), has been established to recognize high-performing regulated Municipal Separate Stormwater Sewer Programs (MS4s). The objective of the program is to inspire MS4 program leaders to seek new and innovative ways to meet and exceed regulatory requirements in a manner that is both technically effective as well as financially efficient. Recognition of innovative approaches is also a highlight of this program.	http://www.wef.org/ms4awards/
EPA Healthy Communities Grant Program	EPA New England's main competitive grant program to work directly with communities to reduce environmental risks to protect and improve human health and the quality of life.	http://www.epa.gov/region1/eco/uep/hcgp.html
EPA Environmental Education Grants	The Grants Program sponsored by EPA's Office of Environmental Education (OEE), Office of External Affairs and Environmental Education, supports environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality.	https://www.epa.gov/education/environmental-education-ee-grants
FEMA (Federal Emergency Management Agency) Preparedness (Non-Disaster) Grants	FEMA provides state and local governments with preparedness program funding to enhance the capacity of their emergency responders to prevent, respond to, and recover from a range of hazards.	http://www.fema.gov/preparedness-non-disaster-grants
EPA Smart Growth	EPA helps communities improve their development practices and get the type of development they want. EPA works with local, state, and national experts to discover and encourage development strategies that protect human health and the environment, create economic opportunities, and provide attractive and affordable neighborhoods for people of all income levels.	https://www.epa.gov/smartgrowth/epa-smart-growth-grants-and-other-funding

1

Pomperaug River Watershed Based Plan

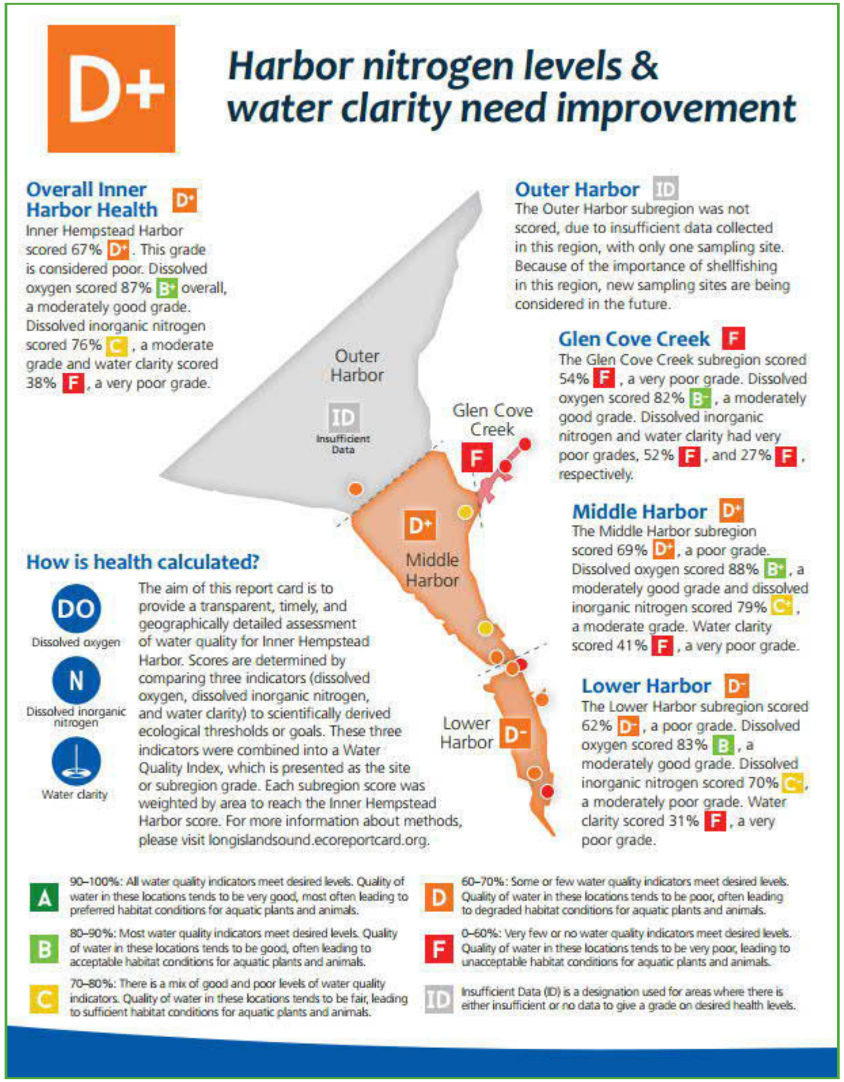
Proposed Bacteria Monitoring Program

- Monthly sampling April – October
- Approximately 14 stream locations
  - Upstream and downstream of potential sources
  - Bracket and isolate sources of pollution
  - Baseline for future WQ improvements
- Fecal indicator bacteria - E. coli
- Wet and dry weather conditions
- Complement MS4 Permit monitoring and investigations



Water Quality Report Card

- Disseminate information to the public
- Scores determined by comparing water quality indicators to scientifically-derived goals



D+

Harbor nitrogen levels & water clarity need improvement

Overall Inner Harbor Health D+

Inner Hempstead Harbor scored 67% D+. This grade is considered poor. Dissolved oxygen scored 87% B+ overall, a moderately good grade. Dissolved inorganic nitrogen scored 76% C, a moderate grade and water clarity scored 38% F, a very poor grade.

Outer Harbor ID

The Outer Harbor subregion was not scored, due to insufficient data collected in this region, with only one sampling site. Because of the importance of shellfishing in this region, new sampling sites are being considered in the future.

Glen Cove Creek F

The Glen Cove Creek subregion scored 54% F, a very poor grade. Dissolved oxygen scored 82% B-, a moderately good grade. Dissolved inorganic nitrogen and water clarity had very poor grades, 52% F, and 27% F, respectively.

Middle Harbor D+

The Middle Harbor subregion scored 69% D+, a poor grade. Dissolved oxygen scored 88% B+, a moderately good grade and dissolved inorganic nitrogen scored 79% C+, a moderate grade. Water clarity scored 41% F, a very poor grade.

Lower Harbor D-

The Lower Harbor subregion scored 62% D-, a poor grade. Dissolved oxygen scored 83% B, a moderately good grade. Dissolved inorganic nitrogen scored 70% C-, a moderately poor grade. Water clarity scored 31% F, a very poor grade.

How is health calculated?

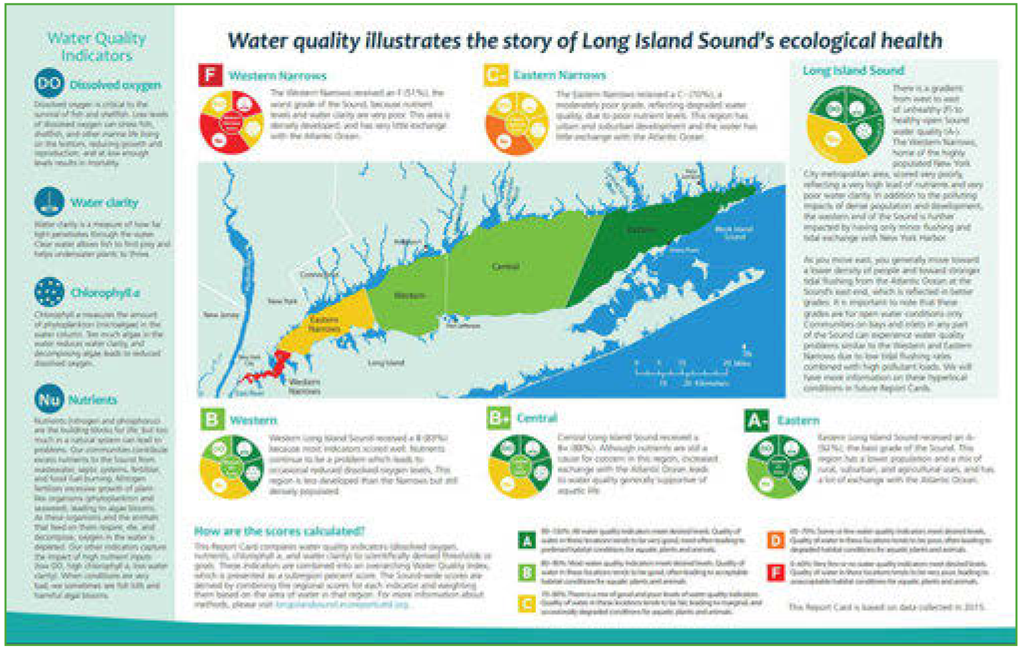
DO Dissolved oxygen

N Dissolved inorganic nitrogen

Water clarity

The aim of this report card is to provide a transparent, timely, and geographically detailed assessment of water quality for Inner Hempstead Harbor. Scores are determined by comparing three indicators (dissolved oxygen, dissolved inorganic nitrogen, and water clarity) to scientifically derived ecological thresholds or goals. These three indicators were combined into a Water Quality Index, which is presented as the site or subregion grade. Each subregion score was weighted by area to reach the Inner Hempstead Harbor score. For more information about methods, please visit longislandsound.ecoreportcard.org.

A	90–100%: All water quality indicators meet desired levels. Quality of water in these locations tends to be very good, most often leading to preferred habitat conditions for aquatic plants and animals.	D	60–70%: Some or few water quality indicators meet desired levels. Quality of water in these locations tends to be poor, often leading to degraded habitat conditions for aquatic plants and animals.
B	80–90%: Most water quality indicators meet desired levels. Quality of water in these locations tends to be good, often leading to acceptable habitat conditions for aquatic plants and animals.	F	0–60%: Very few or no water quality indicators meet desired levels. Quality of water in these locations tends to be very poor, leading to unacceptable habitat conditions for aquatic plants and animals.
C	70–80%: There is a mix of good and poor levels of water quality indicators. Quality of water in these locations tends to be fair, leading to sufficient habitat conditions for aquatic plants and animals.	ID	Insufficient Data (ID) is a designation used for areas where there is either insufficient or no data to give a grade on desired health levels.



Water Quality Indicators

DO Dissolved oxygen

Water clarity

Chlorophyll a

Nu Nutrients

Water quality illustrates the story of Long Island Sound's ecological health

F Western Narrows

C- Eastern Narrows

Long Island Sound

B Western

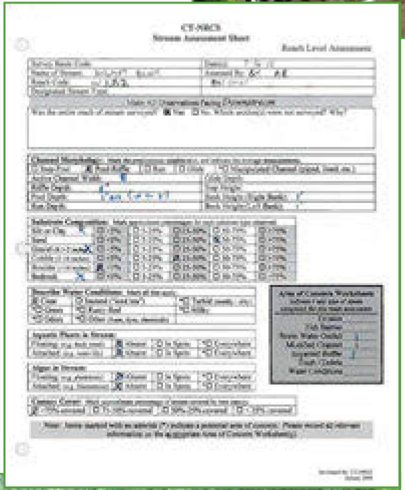
B+ Central

A- Eastern

How are the scores calculated?

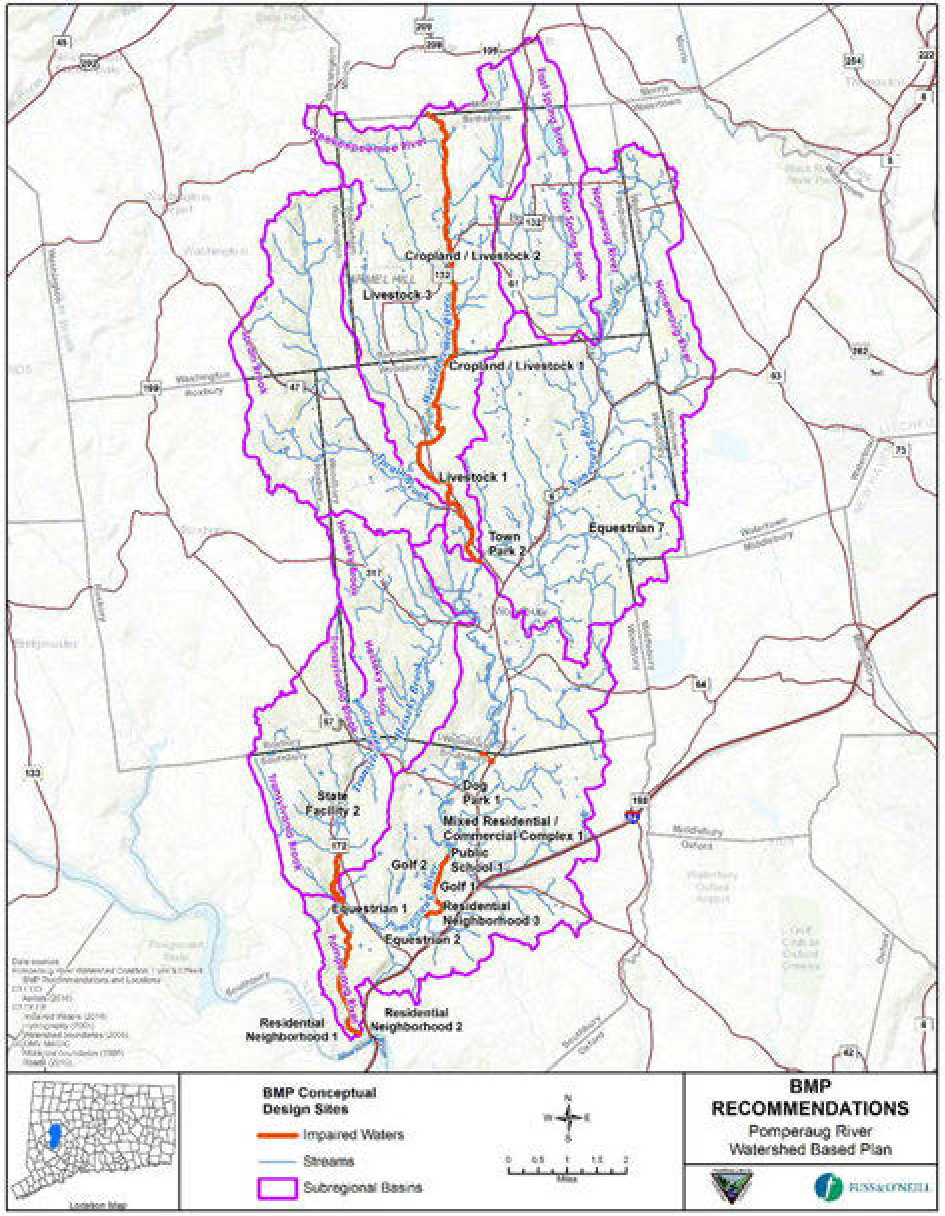
Streamwalks and Track Down Surveys

- Streamwalks last performed in 2010
- NRCS visual stream assessment protocols
- Conduct "track down" surveys of identified pollution sources
- Develop subwatershed action plans for priority subregional basins
    - Pomperaug River
    - Weekeepeemee River
    - Transylvania Brook

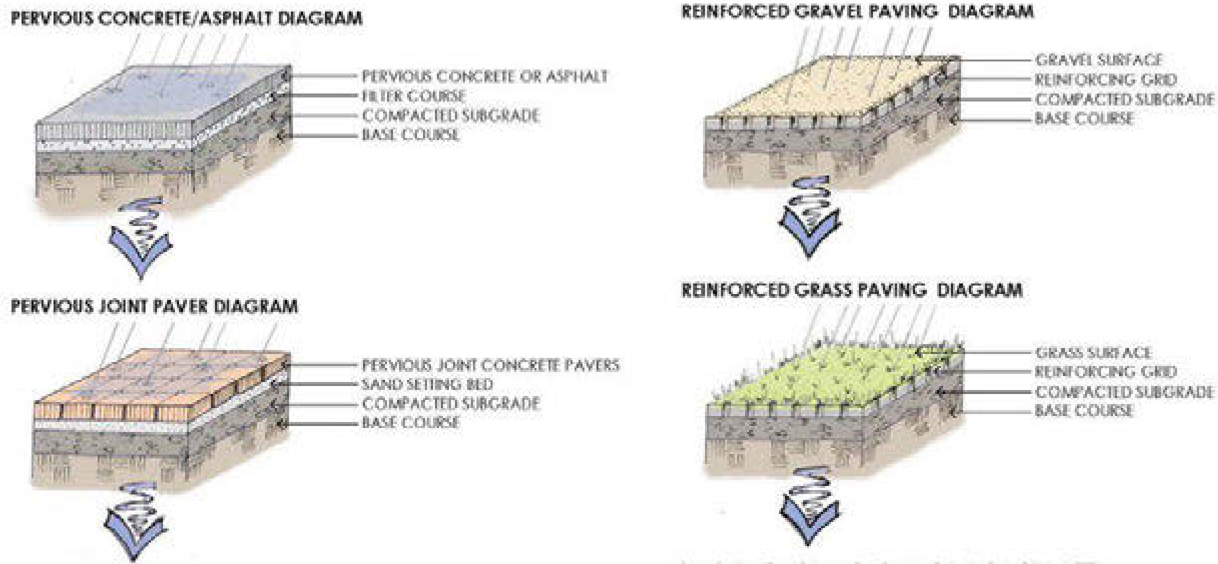
Green Infrastructure and LID

- Many opportunities for GI/LID in the Pomperaug
- Implement GI and LID retrofits on public land
  - Site-specific retrofit concepts →
- Require the use of GI and LID for new development and redevelopment (MS4 Permit requirement)

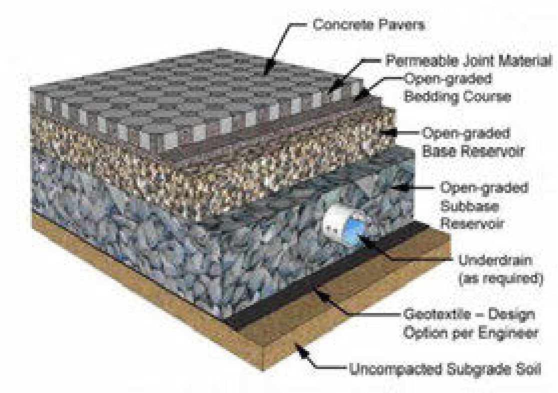


Green Infrastructure and LID

Permeable Pavement

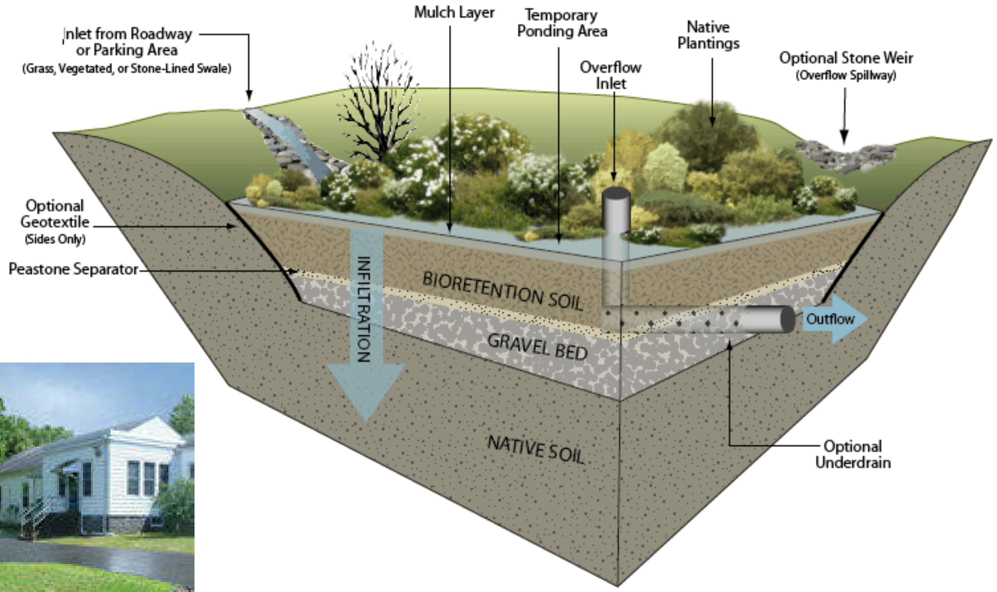


Source: San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook (2009)



Green Infrastructure and LID

Bioretention/Infiltration



Green Infrastructure and LID

Underground Solutions

- Parking lots
- Public right-of-way

Site-Specific BMP Concepts

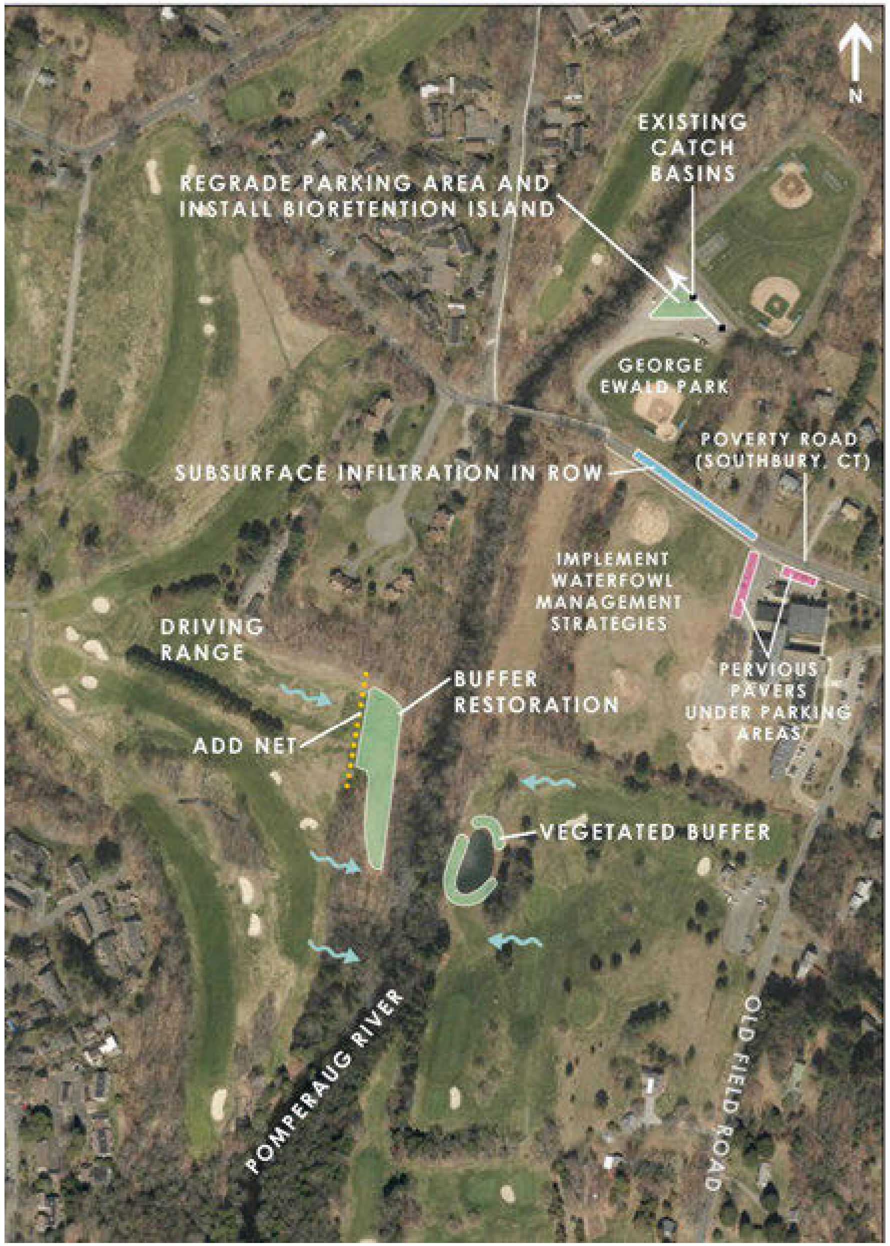
Residential Neighborhood

- Oakdale Road, Southbury
- Lower Pomperaug River
- Estimated Costs:
  - Subsurface Infiltration: $80-170K
  - Infiltration Basins: $50-100K

Site-Specific BMP Concepts

Golf Courses, School, Town Park

- Poverty Road Crossing, Southbury
- Pomperaug River
- Estimated Costs:
  - Bioretention: $26-56K
  - Subsurface Infiltration: $175-375K
  - Permeable Pavement: $13-29K
  - Buffer Restoration: $8-18K



POMPERAUG RIVER WATERSHED COALITION

Site-Specific BMP Concepts

Mixed Residential/Commercial

- Heritage Village, Southbury
- Pomperaug River
- Significant opportunities, GI/LID retrofit master planning
- Estimated Costs:
  - Bioretention: $29-63K
  - Subsurface Infiltration: $100-210K
  - Infiltration Basins: $170-360K
  - Water Quality Swale: $16-35K
  - Permeable Pavement: $110-240K

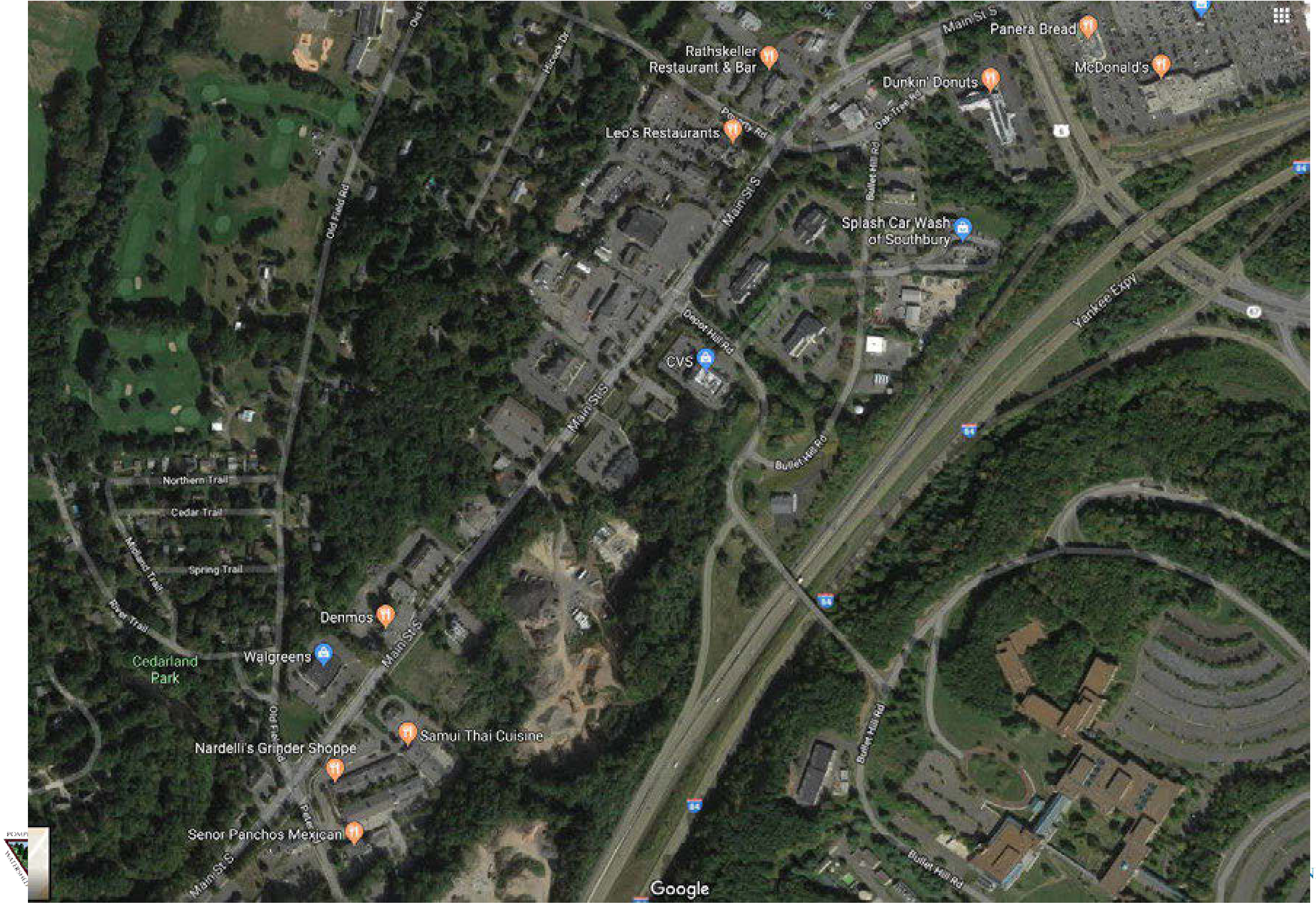
Site-Specific BMP Concepts

State Facility

- Southbury Training School, Southbury
- Transylvania Brook
- Incorporate GI/LID into potential future reuse or redevelopment plans
- Estimated Costs:
    - Permeable Pavement: $170-360K
    - Bioretention: $155-230K
    - Water Quality Swales: $60-130K
    - Buffer Restoration: $12-26K

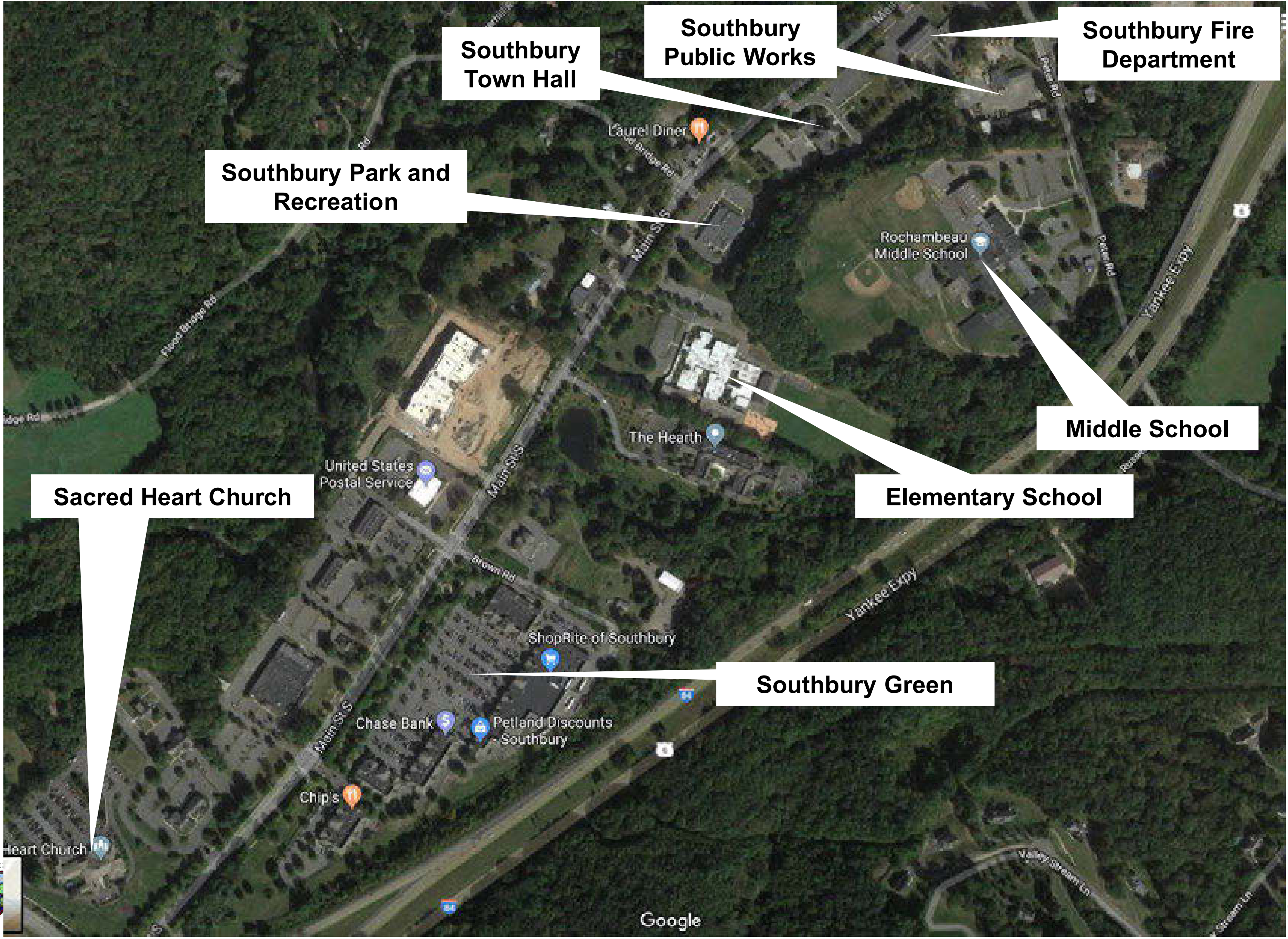
POMPERAUG RIVER WATERSHED COALITION

Main Street South Corridor – North



NEILL

Main Street South Corridor – South



Homeowner BMPs

- Promote residential BMPs by homeowners, including River Smart practices
- Encourage disconnection of rooftop runoff
  - Redirect roof leaders to lawn areas and through the use of dry wells, rain barrels or rain gardens

Reroute your downspout so your yard or rain garden absorbs and filters the runoff from your roof.

Disconnecting your downspout is a simple and effective way of reducing stormwater runoff. (Photo from grandbuilding.ca)

Homeowner BMP Incentive Programs

- River Smart "Pledge"
- Other Incentive Programs
  - Stormwater Fee Discounts or Credits
  - Rebates and Installation Financing
  - Workshop and Give-Away Programs
  - Certification and Recognition Programs
  - Municipal sponsored public workshops

The BLUE Program

What is BLUE®?

Why Become BLUE®?

So how do you become BLUE®?

Lake Champlain BLUE® Certification Program

RainScapes Rewards Rebates

How Much of a Rebate am I Eligible For?

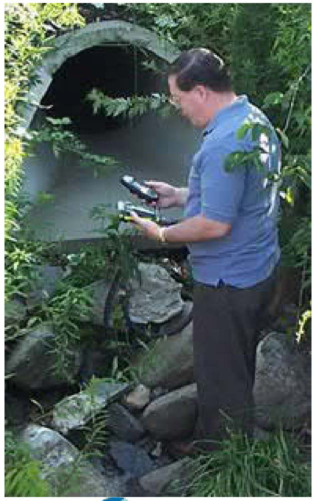
Property Type	Maximum Rebate (per parcel)
Residential Property	$2,500
Commercial, HOAs, multi-family, or institutional property	$10,000

Am I Eligible for a Rebate?

Montgomery County, MD Rainscapes Rewards

Municipal Stormwater – MS4 Permits

- Municipal Separate Storm Sewer System (MS4) Permits
  - Southbury and Woodbury (effective July 2017)
  - CTDOT (effective July 2019)
- Regulates the <u>quality</u> of stormwater discharges



Municipal Stormwater – MS4 Permits

Some overlap between Watershed Based Plan and MS4 permit

- Southbury and Woodbury – continue to implement MS4 Stormwater Management Programs
- PRWC – review and comment on draft CTDOT Stormwater Management Plan
- PRWC – work collaboratively with Southbury, Woodbury, and CTDOT
  - MS4 Stormwater Program Implementation
  - Coordinate PRWC water quality monitoring with MS4 outfall monitoring
- NVCOG exploring possibility of providing regional MS4 training

Illicit Discharge Detection and Elimination (IDDE)

- Requirements for MS4 regulated communities
- Implement IDDE Programs
  - Southbury, Woodbury, CTDOT
- Focus on "Priority Areas"
  - Discharges to impaired rivers/streams
  - Area with high amounts of impervious cover

- Illicit discharges can have a big impact on water quality
- IDDE is more cost-effective than structural stormwater treatment
- IDDE is the "low-hanging fruit"

Subsurface Sewage Disposal Systems

Failing or sub-standard septic systems can impact surface and groundwater quality

- Inventory, map, and prioritize State-regulated systems in the watershed
- Encourage regular maintenance by homeowners
- Consider changes to state/local requirements, point-of-sale inspections and upgrades

Septic Systems

- Small systems (<2,000 GPD) regulated by local health districts
- Medium systems (2,000-7,500 GPD) reviewed and approved by CTDPH
- Large systems (>7,500 GPD) regulated by CTDEEP

Source: PDDH

Stream Buffers

Naturally vegetated areas adjacent to streams, ponds, and wetlands

- Encourage "backyard" buffers
- Implement priority buffer restoration projects on public land
- Include incentives and/or requirements for stream buffers in future land use regulation updates (MS4 Permit)

Benefits of Stream Buffers

- Promotes infiltration of runoff
- Filters pollutants
- Regulates stream water temperature
- Provides habitat for plants and animals

Site-Specific BMP Concepts

Dog Park

- Pomperaug River, Southbury
- Buffer Restoration, Parking Lot Stormwater Retrofit, Pet Waste Station
- Estimated Costs
  - Buffer Restoration: $3-6K
  - Infiltration Basin: $20-40K

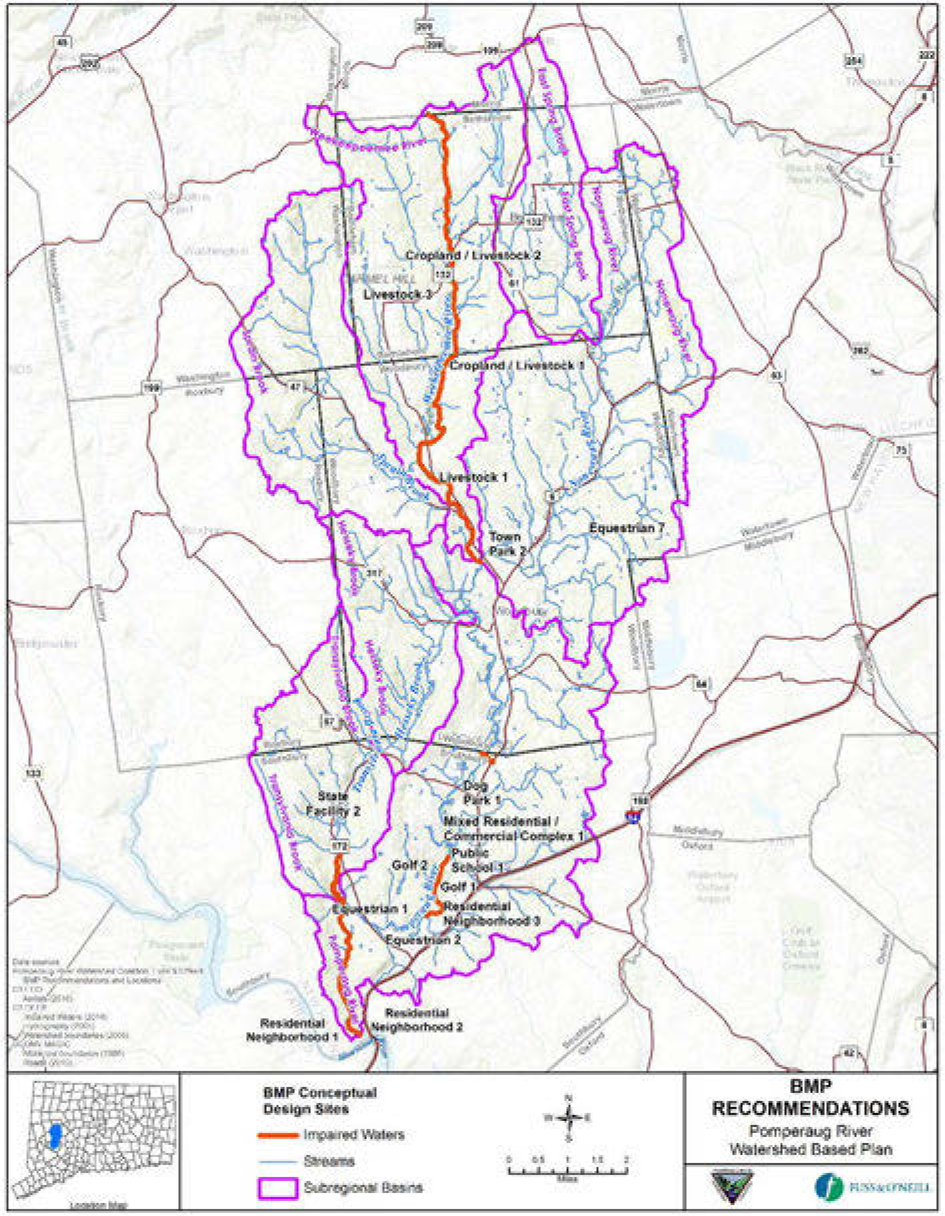
Site-Specific BMP Concepts

Town Park

- Weekeepeemee, Nonnewaug, & Pomperaug Rivers, Woodbury
- Buffer Restoration, Parking Reconfiguration, Additional Pet Waste Disposal along Trail
- Buffer restoration explored in 2010 Yale study
- Estimated Costs
  - Buffer Restoration: $40-90K
  - Jacks Bridge Rd. to Judson Ave.

Agricultural BMPs

- Agricultural operations can be a source of pollutants to surface waters and groundwater
- Partner with equestrian and livestock facilities
- Focus on pastures as well as paddocks, barns, and storage areas
- Potential Agricultural BMPs
  - Vegetated buffers, filter strips
  - Livestock exclusion fencing
  - Manure collection and storage
  - Filter berms
- Site-specific retrofit concepts →



Agricultural BMPs

Manure/Nutrient Management

- Manure piles, paddock areas
- Locate manure storage areas and paddocks away from streams, cover manure piles where possible




Agricultural BMPs

Vegetated Buffers, Filter Strips, Exclusion Fencing

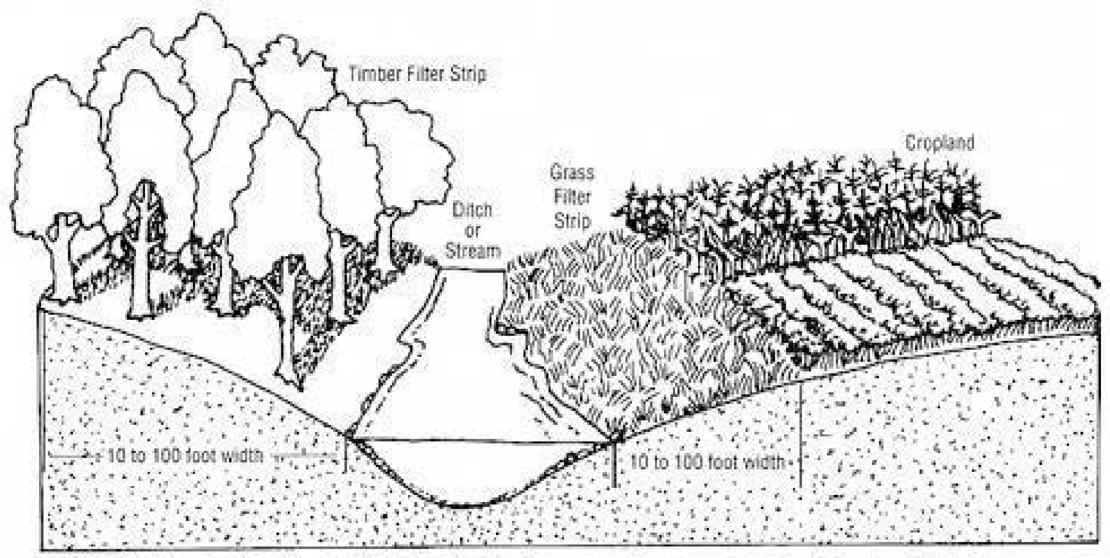
- Many farms located close to streams or have streams flowing through them
- Livestock access to streams
- Drainage channels flowing through paddock areas

POMPERAUG RIVER WATERSHED COALITION

FUSS & O'NEILL

Agricultural BMPs

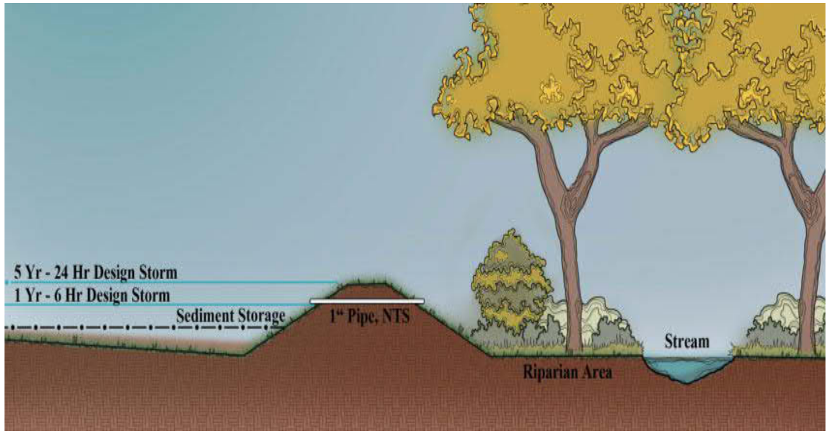
Vegetated Buffers, Filter Strips, Exclusion Fencing

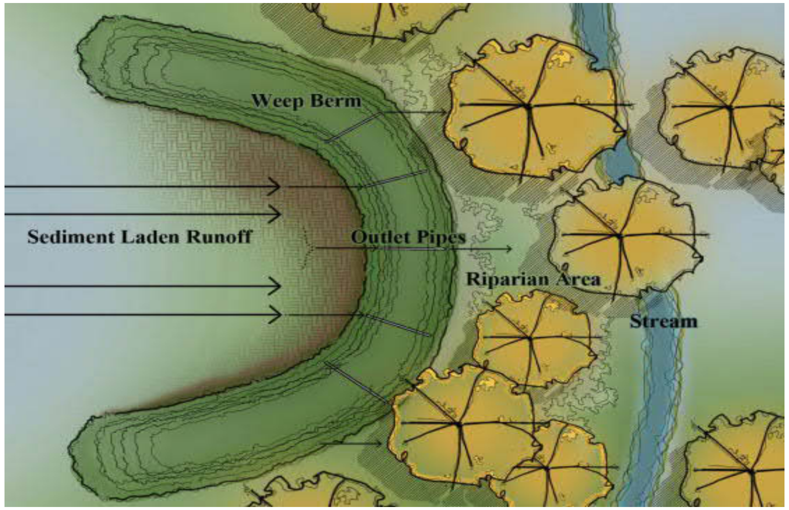


Agricultural BMPs

Filter Berms

- Gravel or compost berm placed at downgradient edge of field, manure storage and composting facilities, and livestock areas
- Filter runoff and enhance infiltration





Site-Specific BMP Concepts

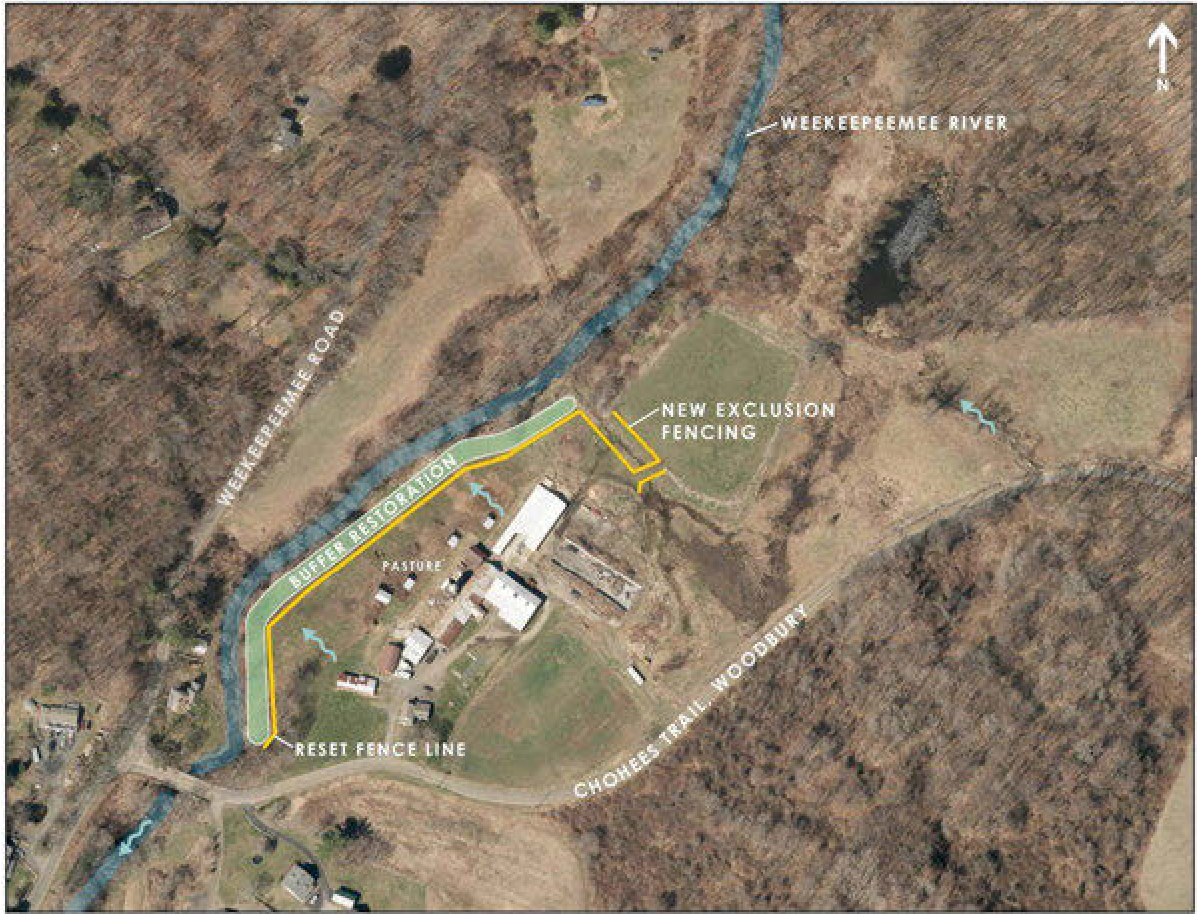
Livestock Farm, Bethlehem

- Dowd Brook, Tributary to Weekeepeemee River
- Buffer Restoration and Paddock Reconfiguration
- Optional Filter Berm
- Estimated Costs
    - $30-70K

Site-Specific BMP Concepts

Livestock Farm, Woodbury

- Weekeepeemee River
- Buffer Restoration, Exclusion Fencing
- Estimated Costs
  - $25-55K



Site-Specific BMP Concepts

Equestrian Facility, Southbury

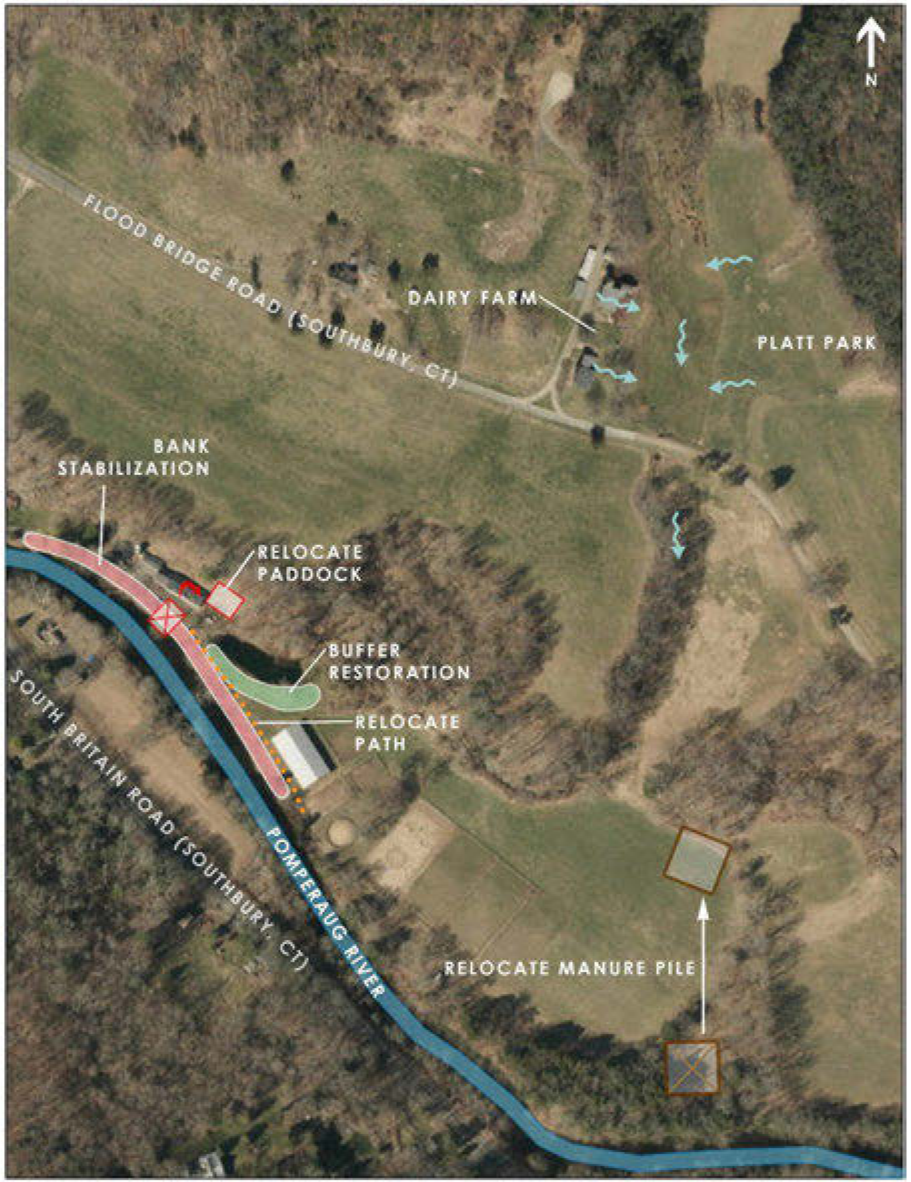
- Transylvania Brook and Pomperaug River near Audubon Center at Bent of the River
- Buffer Restoration, Exclusion Fencing/Paddock Reconfiguration
- Estimated Costs
    - $40-60K

POMPERAUG RIVER WATERSHED COALITION

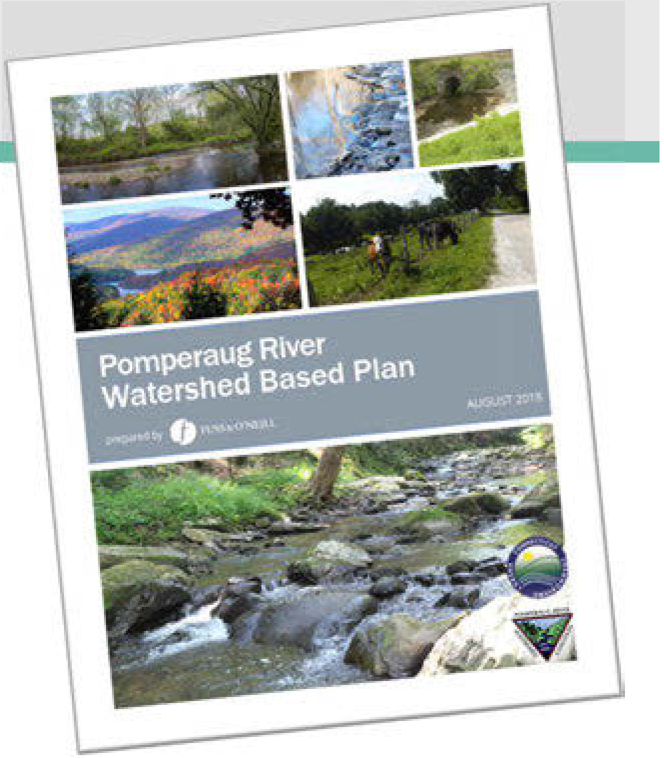
Site-Specific BMP Concepts

Equestrian Facility, Southbury

- Pomperaug River
- Manure Pile Relocation (completed)
- Paddock Relocation
- Buffer Restoration and Bank Stabilization
- Estimated Costs
  - $50-100K



Comments on Draft Plan


Pomperaug River Watershed Based Plan

AUGUST 2018

prepared by FUSS & O'NEILL

- Plan will be available for download from PRWC website
- Submit email or written comments to PRWC by September 7:

Carol Haskins, Outreach Director

Pomperaug River Watershed Coalition

39 Sherman Hill Road, Suite 103C, Woodbury, CT 06798

203-263-0076

info@pomperaug.org

Thank you for your input and time!

POMPERAUG RIVER WATERSHED COALITION

FUSS & O'NEILL

PRINT AND ONLINE NEWSPAPER ARTICLES

Republican American Newspaper: Towns Seek Watershed Plan: Southbury, Woodbury, Bethlehem to Hunt Pollution Sources (page 1B)
Date: January 25, 2017
Link: N/A

Republican American Newspaper: (Daily Digest) SOUTHBURY – Residents to learn about water quality at Pomperaug Watershed (page 1B)
Date: July 6, 2018
Link: N/A

Southbury HamletHub.com: Public Information Sessions Scheduled: A Look at Water Quality in the Pomperaug Watershed
Date: July 11, 2018
Link: https://news.hamlethub.com/southbury/neighbors/3871-public-information-sessions-scheduled-a-look-at-water-quality-in-the-pomperaug-watershed

Republican American Newspaper: (Daily Digest) AREA – Presentations on Water Quality Conditions Today (page 1B)
Date: July 18, 2018
Link: N/A

Republican American Newspaper: – Group to Tackle Bacteria in River (page 1B)
Date: July 19, 2018
Link: N/A

REPUBLICAN-AMERICAN WEDNESDAY, JANUARY 25, 2017

Local News

Patriots' Tom Brady

SECTION B

SPORTS STARTS ON THE BACK OF THIS SECTION

DAILY DIGEST

SOUTHBURY

29,000 without power as wind throws trees, limbs onto lines

A night of high winds from a nor'easter knocked out power to around 29,000 Eversource Energy customers statewide.

Mitch Gross, a spokesman for Eversource, said 154 Southbury customers were still without power as of 3 p.m. on Tuesday.

"Last night it was very busy for the crews," he said. "The biggest problem was the high winds taking down trees and branches on the lines, and we responded to accidents with icy roads causing vehicles to go into utility poles, as well."

News reports said the winds reached speeds of close to 50 mph.

"We're concerned when winds are in the 40 mph or higher range, because it's not safe for our crews to be in the bucket trucks," Gross said. "They sometimes have to wait for the winds to die down before they respond to a call."

Statewide, he said approximately 2,000 customers were still without power in the afternoon.

"We're making very good progress and we continue hard at work to get those remaining customers back on," Gross said.

Southbury Public Works Director John F. Cottell Jr. said one big tree fell onto wires on

Towns seek watershed plan

Southbury, Woodbury, Bethlehem to hunt pollution sources

BY HANNA SNYDER GAMBINI
REPUBLICAN-AMERICAN

> **"THIS PLAN WILL BE USED AS A ROAD MAP TO RETURN IMPAIRED WATERS TO SWIMMABLE AND FISHABLE CONDITIONS."**
>
> CAROL HASKINGS, PRWC OUTREACH DIRECTOR

WOODBURY — The Pomperaug River Watershed Coalition will work with land use officials in Southbury, Woodbury and Bethlehem to create an updated watershed plan.

The goal of the plan is twofold, to identify sources of river bacteria and determine remediation and prevention of further pollution.

"This plan will be used as a road map to return impaired waters to swimmable and fishable conditions, and this document will be used as a guide to evaluate changes through time," said PRWC Outreach Director Carol Haskings. She gave a presentation at a recent joint land use meeting in Woodbury where land use board members and town officials gathered.

Haskings said the coalition is early in the process, but attending the land use meeting was a way of introducing the work that needs to be done to create the plan. Coalition members have been talking with Southbury's town planner and will meet with land use boards there. Meetings with members of Bethlehem's wetlands board and conservation commission are planned in about three weeks, Haskings said.

"We want them involved early on in the process, and we're looking for their expertise and wisdom that we might not know about," she said. Mainly, coalition members are looking for town officials to brainstorm potential sources of bacteria in the Weekeepeemee and Pomperaug rivers and the Transylvania Brook.

"We're trying to hone in what type of land use activities or locations are contributing to bacteria, and re-

See **WATER**, *Page* **4B**

WATER: It's time to update 2006 plan

mediation projects to reduce levels," she said. "This will be an exercise in creative problem solving."

Analyzing how the bacteria affects recreational activities like swimming and fishing in these waterways is a priority, but it's difficult to determine if bacteria levels have increased.

Haskings said more data is available on bacteria levels because there has been more monitoring in the past five years or so. "There may have been just as much 10 years ago but we didn't know because we didn't monitor," she said.

The coalition was formed in 1999 and a watershed management plan was created in 2006. That plan's shelf life is just about expired, so it's time for an updated plan, she said. Furthermore, the coalition needs to have an approved plan to be eligible for federal grants and grants specific to implementing the remediation process.

The Environmental Protection Agency is the funding source, and it has created a template for what is to be included in a management plan.

"Were' updating our plan to meet that template," she said.

The goal is to have a plan in place by the end of this year, with field work starting in April or May, Haskings said. The next step is to circle back with town planners or wetland agents after the initial presentations to get the brainstorming started.

Funding for the plan comes from the Department of Energy and Environmental Protection and the Connecticut Community Foundation.

REPUBLICAN-AMERICAN **FRIDAY, JULY 6, 2018**

Local News

P

DAILY DIGEST

SOUTHBURY

Man arrested after dumping pitcher of water on woman

A local man was arrested after a domestic incident Tuesday night in which he allegedly dumped a pitcher of water over a woman's head

SOUTHBURY

Residents to learn about water quality at Pomperaug Watershed

The Pomperaug River Watershed Coalition invites residents of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown, Morris and Middlebury to attend one of three upcoming presentations to learn about the water quality conditions of local rivers and streams flowing through the Pomperaug Watershed.

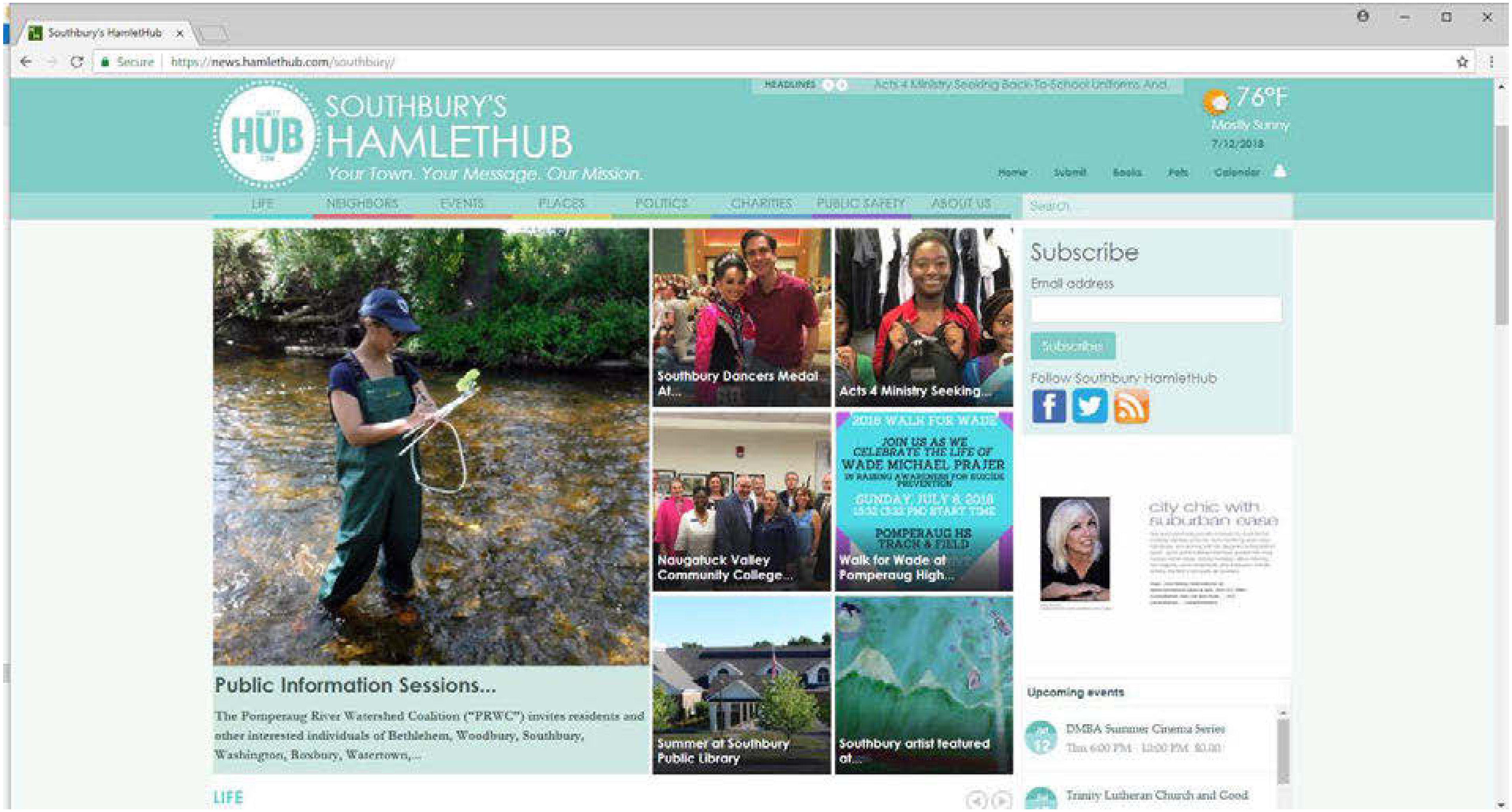
The presentations will provide an update and overview of the stream conditions and estimates on the volume sediment, nutrients and bacteria that have potential to find their way into nearby rivers and streams during a rainstorm or during snow melt.

PRWC is in the process of updating its 2005 Watershed Management Plan to a 9-Element Watershed Based Plan. It will seek community input to help refine the plan, which will serve as a road map for state and local agencies to implement measures to further protect and enhance local water resources. The reduction of bacteria to local rivers and streams also supports a statewide initiative to reduce the amount of bacteria and nutrients flowing into Long Island Sound.

Presentation dates, times, and locations are: Tuesday July 17 at 7 p.m. in the Shove Building at the Woodbury Municipal Complex; Wednesday July 18 at 2 p.m. in Room 205 at Southbury Town Hall; and Wednesday July 18 at 6:30 p.m. in the Leever Room at the Bethlehem Public Library.

A fourth presentation, one that integrates the community input during the July presentations and overall strategies included in the updated Watershed Pan, is scheduled for Wednesday Aug. 22 at 7 p.m. at the Woodbury Senior Center.

Information about the local water quality conditions and the Watershed Plan update can be found at www.pomperaug.org. For information, contact Carol Haskins at 203-263-0076 or outreach@pomperaug.org.



Public Information Sessions...

The Pomperaug River Watershed Coalition ("PRWC") invites residents and other interested individuals of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown,...

Southbury Dancers Medal At...

Acts 4 Ministry Seeking...

Naugatuck Valley Community College...

2018 WALK FOR WADE
JOIN US AS WE CELEBRATE THE LIFE OF
WADE MICHAEL PRAJER
IN RAISING AWARENESS FOR SUICIDE PREVENTION
SUNDAY, JULY 8, 2018
12:30 PM START TIME
POMPERAUG HS TRACK & FIELD

Walk for Wade at Pomperaug High...

Summer at Southbury Public Library

Southbury artist featured at...

DMBA Summer Cinema Series
Thu 6:00 PM - 10:00 PM $0.00

Trinity Lutheran Church and Good

Public Information Sessions Scheduled: A Look at Water Quality in the Pomperaug Watershed

Like Share Share G+ Tweet

Published on Wednesday, 11 July 2018 16:29
Written by Pomperaug River Watershed Coalition

PREV 1 of 3 NEXT

The Pomperaug River Watershed Coalition ("PRWC") invites residents and other interested individuals of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown, Morris, and Middlebury to attend one of three upcoming presentations to learn about the water quality conditions of local rivers and streams flowing through the Pomperaug Watershed.

The presentations will provide an update and overview of the stream conditions as described in Connecticut Department of Energy and Environmental Protection's Integrated most recent Water Quality Report to Congress (2016) as well as the results of a geospatial computer model used to estimate the volume sediment, nutrients, and bacteria that have potential to find their way into nearby rivers and streams during a rain storm or during snow melt.

"As a science-based organization, we are aiming to better understand changing conditions and potential threats to our rivers and streams so we can continue to help protect healthy waters and work to improve conditions where necessary," says Carol Haskins, PRWC Outreach Director. "As a coalition-based organization, we want to ensure our community has an opportunity to learn about our work and to provide input regarding the long-term stewardship of our shared water resources."

PRWC is in the process of updating its 2005 Watershed Management Plan to a 9-Element Watershed Based Plan ("Plan"), a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency ("EPA") Clean Water Act Section 319 Nonpoint Source Grant as well as by Connecticut Community Foundation. Revisions to the

Plan are being made with guidance and oversight from PRWC's Land Use Committee whose membership includes but is not limited to representatives from local conservation organizations, town land use departments, as well as regional, state, and federal agencies.

A key milestone for the Plan was recently completed and is ready to share and pertains to the pollutant loading model that was applied to the watershed. The model results describe the relative potential of different land cover types to contribute pollutants like bacteria, nutrients, and sediment to nearby rivers and streams as well as the overall volume of each pollutant that could end up in a local waterway. Both the relative potential and volume are estimated using a computer-based pollutant loading model and the most current land cover, precipitation, soil, slope, and other geospatial data available.

The main focus of the Plan is to identify measures that should be implemented to reduce the amount of bacteria entering the local streams currently listed as impaired by CT Department of Energy and Environmental Protection and EPA. There are four stream segments in the Pomperaug Basin where in-stream bacteria levels were measured in excess of the water quality standard for recreation. It is important to note that the DEEP data supporting these listings are limited and are dated. Further evaluation and potential restoration is required to remove these stream segments from the State/Federal list of impaired waters.

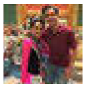
During the upcoming presentations, PRWC and the environmental consulting team of Fuss & O'Neill will describe the local impairments and the nuances of the data supporting the designation of these stream segments, provide an updated look at the land cover conditions in the watershed, explain the results of the pollutant loading model, and discuss general strategies that could be implemented to reduce the volume of bacteria entering local streams. PRWC will seek community input to help refine the Plan which will serve as a road map for state and local agencies to implement measures to further protect and enhance local water resources. The reduction of bacteria to local rivers and streams also supports a state-wide initiative to reduce the amount of bacteria and nutrients flowing into Long Island Sound.

The three presentations coming up will be identical in content and are being offered at different locations and times throughout the watershed with the hope to make it convenient for residents to attend. Presentation dates, times, and locations are: Tuesday July 17 at 7:00PM in the Shove Building at the Woodbury Municipal Complex; Wednesday July 18 at 2:00 PM in Room 205 at Southbury Town Hall; and Wednesday July 18 at 6:30 PM in the Leever Room at the Bethlehem Public Library.

A fourth presentation, one that integrates the community input during the July presentations and overall strategies included in the updated Watershed Pan, is scheduled for Wednesday August 22 at 7:00 PM at the Woodbury Senior Center.

Additional information about the local water quality conditions and the Watershed Plan update can be found at www.pomperaug.org. Questions or comments may be directed to Carol Haskins at 203-263-0076 or outreach@pomperaug.org .

Next article



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REPUBLICAN-AMERICAN **WEDNESDAY, JULY 18, 2018**

Local News

P

DAILY DIGEST

SOUTHBURY

Crews to begin storm debris pickup Monday

Residents should have vegetative storm debris from the May tornado in the town right-of-way, about 10 feet from the road, by this Monday when workers will start the process of removing it all.

Several crews will move as quickly as possible, according to the First Selectmen's Office. But residents should be advised the crews will only make one pass on each street.

AREA

Presentations on water quality conditions today

The Pomperaug River Watershed Coalition invites residents and other interested individuals of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown, Morris and Middlebury to attend presentations to learn about the water quality conditions of local rivers and streams flowing through the Pomperaug Watershed.

The presentations will provide an update and overview of the stream conditions as described in Connecticut Department of Energy and Environmental Protection's Integrated most recent Water Quality Report to Congress as well as the results of a geospatial computer model used to estimate the volume sediment, nutrients and bacteria that have potential to find their way into nearby rivers and streams during a rainstorm or during snow melt.

There are two presentations today at 2 p.m. in Room 205 at Southbury Town Hall; and at 6:30 p.m. in the Leever Room at the Bethlehem Public Library.

A presentation that integrates the community input during the July presentations and overall strategies included in the updated Watershed Pan, is scheduled for Wednesday, Aug. 22 at 7 p.m. at the Woodbury Senior Center.

Additional information about the local water quality conditions and the Watershed Plan update can be found at www.pomperaug.org. Questions or comments may be directed to Carol Haskins at 203-263-0076 or email outreach@pomperaug.org.

SOUTHBURY

Police: Middlebury man, 23, crashed car on side of road

Extens

Neighbors opposed

BY BILL BITTAR
REPUBLICAN-AMERICAN

SOUTHBURY — A hearing on developer Kevin Bennett's plan to build The Meadows apartments, a 14-unit affordable housing community at 390 Roxbury Road, has been continued to Aug. 28.

A group of neighbors opposed to the application at-

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REPUBLICAN-AMERICAN THURSDAY, JULY 19, 2018

Local News

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Group to tackle bacteria in river

BY STEVE BIGHAM
REPUBLICAN-AMERICAN

SOUTHBURY — The Pomperaug River Watershed received mostly high marks this week, but officials say there are areas along the river system that are considered "impaired" due to high e-coli bacteria levels.

And the culprits include increased land development, poor drainage, failed septic systems, geese and farms animals.

But it's not the drinking water that residents have to be concerned with — the aquifers here run deep and the water is pure, officials said. The concern lies in the bacteria-filled water runoff that makes its way into rivers and streams, affecting swimming, boating and fishing.

On Wednesday, officials from the Pomperaug River Water Coalition laid out some of the issues facing the 90-square mile watershed along with recommendations to address the problem. It's part of the group's mission to provide information, hear from residents and then complete an improved water quality plan of action by late summer.

The Pomperaug River Watershed sits mainly in the towns of Bethlehem, Southbury and Woodbury, although it touches eight towns.

The Weekeepeemee River is part of the watershed and has been on the state's impaired list since 2012. According to the environmental consulting firm of Fuss & O'Neill, much of the problem stems from runoff from agricultural areas and equestrian facilities. The firm — hired to assist in the planning update — is calling for improved manure management. It has suggested a variety of

See **RIVER**, *Page* **3B**

STEVE BIGHAM REPUBLICAN-AMERICAN

Stefan Bengtson of Fuss & O'Neill makes a presentation Wednesday in Southbury on plans to improve water quality in the Pomperaug River Watershed.

RIVER: Simple tasks will help watershed

berms, buffers and other mechanisms to keep bacteria out of the groundwater. Some improvements are as simple as cleaning up better after livestock, but others are bigger projects.

Southbury First Selectman Jeffrey A. Manville said the costs to farmers to incorporate these measures are prohibitive.

"It can cost a farmer $175,000. There's no way for a small farmer to afford this. I've done the numbers. It's impossible for farmers. I'm a farmer. I would love to, but it's impossible," he said.

Susan Peterson of the state's Department of Energy and Environmental Protection said there are a number of grants and other funding aids farmers can use. But she understands the struggle.

"I realize it's difficult, but we want to crack that nut somehow," she said.

In more developed areas where more land is paved and covered with buildings and homes, storm water is unable to percolate into the ground where it can be naturally filtered. Instead, officials say, this "urban drainage" is making its way directly into streams or wetlands that lead to the Pomperaug River, then into Lake Zoar, the Housatonic River and eventually Long Island Sound.

"We're trying to get the water to go directly into the ground where it can be filtered rather than directly into the pipe that leads to a stream," explained scientist Stefan Bengtson of Fuss & O'Neill.

Low impact development solutions include permeable pavement, bio-retention safeguards, underground filtration systems and even a vegetative treatment system, which replicates natural water-treating wetlands.

Another source of contaminated water are geese whose droppings get into the brooks and streams of the watershed.

Officials also point to what they refer to as illicit connections such as pipes, ditches and other manmade structures that deliver sediments, bacteria and other material directly into the watershed.

Southbury resident Thad Burr voiced his concerns about not just water quality, but water quantity, or lack thereof. He reported that a number of wells have gone dry since the recent opening of CPV Towantic Energy Center power plant in Oxford.

PRWC Executive Director Len DeJong said that is not part of this report — nor is pesticide and herbicide pollutants — but that they are issues that are being tackled at the state level. Another threat to the watershed is the salt used on roads during the winter, Burr said.

The Transylvania Brook is also considered impaired as are some isolated spots along the Pomperaug River itself.

Officials plan to increase their monitoring of bacteria counts at 14 stream locations. These areas will be tested once a month from April to October.

The Pomperaug River Watershed encompasses all the land that drains into the Pomperaug River. The watershed plan — which is required by the DEEP and Environmental Protection Agency for funding eligibility- was last updated in 2006.

PRWC WEBSITE

Project Landing Page: Pomperaug Watershed Based Plan
Link: http://www.pomperaug.org/water-resources-management-plan

Blog Post: Updating the Pomperaug Watershed Management Plan
Date: December 5, 2016
Link: http://www.pomperaug.org/single-post/2016/12/05/Updating-the-Pomperaug-Watershed-Management-Plan

Blog Post: Pomperaug River Watershed Based Plan Proposals Sought
Date: May 19, 2016
http://www.pomperaug.org/single-post/2016/05/19/Pomperaug-River-Watershed-Based-Plan-Proposals-Sought

Blog Post: Stream Surveys Soon Underway
Date: April 14, 2017
Link: http://www.pomperaug.org/single-post/2017/04/14/Stream-Surveys-Soon-Underway

Blog Post: Watershed Coalition to Assess Local Streams in August
Date: August 8, 2017
Link: http://www.pomperaug.org/single-post/2017/08/08/Watershed-Coalition-to-Assess-Local-Streams-in-August

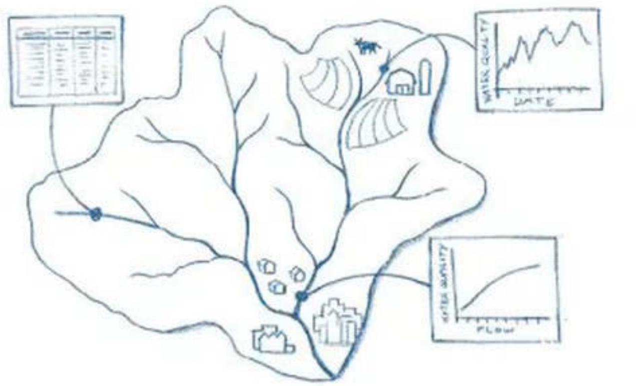
Blog Post: Watershed Based Planning Continues
Date: November 17, 2017
Link: http://www.pomperaug.org/single-post/2017/11/17/Watershed-Based-Planning-Continues

Blog Post: Pollutant Load Modeling Completed for the Pomperaug
Date: April 2, 2018
Link: http://www.pomperaug.org/single-post/2018/03/26/Pollutant-Load-Modeling-Completed-for-the-Pomperaug

Blog Post: Public Information Sessions Scheduled – A Look at Water Quality in the Pomperaug Watershed
Date: July 6, 2018
Link: http://www.pomperaug.org/single-post/2018/07/05/Information-Sessions-Scheduled-%E2%80%93-A-Look-at-Water-Quality-in-the-Pomperaug-Watershed

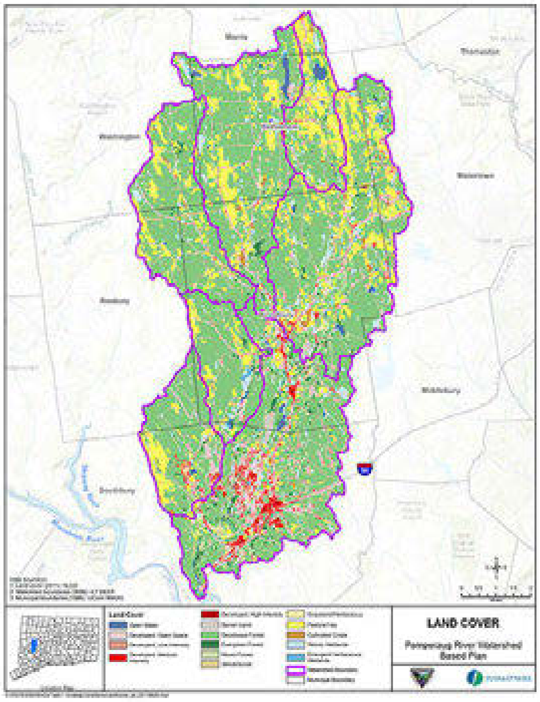
Blog Post: PRWC Presents on Water Quality Conditions
Date: July 20, 2018
Link: http://www.pomperaug.org/single-post/2018/07/20/PRWC-Presents-on-Water-Quality-Conditions

Pomperaug Watershed Based Plan



PRWC received a grant award from CT Department of Energy and Environmental Protection to update and upgrade its Watershed Management Plan to an EPA 9 Element Watershed Based Plan (WBP) in accordance with Section 319 of the Federal Clean Water Act. This is a critical first step to be eligible for future Federal funding for corrective-action projects to improve sections of river that do not fully support recreation or aquatic life because of water-quality or habitat limitations.

In particular, PRWC will develop plans to address elevated bacteria levels and alterations to the flow regime (historical channelization in particular). PRWC is developing the plan with input from watershed municipalities and other important stakeholders. We will be hosting a series of public forums and seeking input from residents, municipal leaders, town commissions, health departments, and key stakeholder groups (utilities, agriculture, business owners, environmental groups, etc). PRWC has engaged the services of Fuss & O'Neill, an environmental consulting firm, to update the Pomperaug Watershed Management Plan to a 9-element Watershed Based Plan for approval by the US Environmental Protection Agency.



The focus of our Watershed Based Plan is to reduce the amount of bacteria entering local streams listed as impaired by CT DEEP and EPA. There are three stream segments in the Pomperaug Basin where in-stream bacteria levels have been measured in excess of the water quality standard for recreation and thus have been listed as impaired.

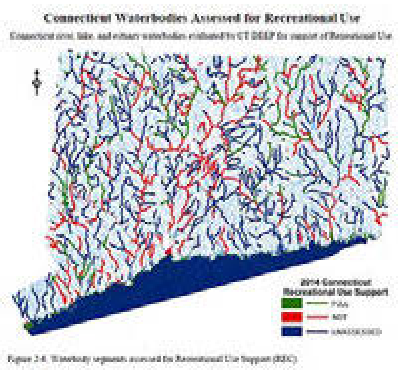
A key milestone in developing plans to reduce bacterial level was to estimate the potential volume of it that could be carried from the watershed lands into our rivers and streams. We used a pollutant loading model to make such an estimate. The model also provided us with estimates for other pollutants including nutrients like nitrogen and phosphorus as well as total suspended solids (a factor of soil erosion). The model used the most recent land cover data, precipitation data, soil data, and more to estimate the relative sources of these pollutants and their potential volumes that could enter our streams.

PRWC's Land Use Committee will be using this information to determine what practices can be implemented to reduce the pollutant loads and where they may most effectively be implemented to improve in-stream water quality. We encourage you to review the findings of the pollutant loading model and to attend one of the upcoming information sessions (to be scheduled) to learn more about the model results and next steps in developing and implementing the updated Watershed Based Plan.

You can read the existing Pomperaug Watershed Management Plan here.

Updating the Pomperaug Watershed Management Plan

December 5, 2016



Earlier this year, PRWC signed a grant contract with the State of Connecticut's Department of Energy and Environmental Protection that awarded PRWC with a grant to be used to update its Watershed Management Plan (WMP). We also received a matching grant from the Connecticut Community Foundation.

In September, we hired the consulting firm of Fuss & O'Neill to help us create a Plan that will develop site specific plans for remediating stream pollutants like bacteria and restoring instream habitat.

This update of the Pomperaug Watershed Management Plan is being driven by a couple of factors: (1) timing- it has been 10 years since the plan was last updated; (2) format - the U.S. Environmental Protection Agency has adopted a prescribed format for these plans and organizations must have an approved plan to be eligible for program. future restoration project funding; and, (3) new areas of concern - a greater number of monitoring locations since the time of the last WMP has revealed new sites where data do not meet federal water quality standards.We are compiling the existing information and conducting field assessment surveys to better gauge the scope of factors that may be contributing to reduced water quality conditions.Stakeholder input will also be sought throughout the planning process. Please stay tuned for announcements about presentations of this information in your town and the opportunity to share your input on issues we may have missed.

Photo caption: Stream segments shown in red do not meet water quality standards to support recreational activities like swimming.Image Source: CT DEEP's 2014 Integrated Water Quality Report to Congress.

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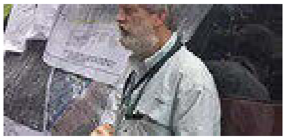

U.S. Geological Survey Work Resumes Within and Near the Pomperaug River Watershed Region

June 11, 2018

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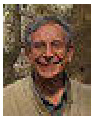
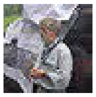


PRWC Seeks Nominees for 2018 Dr. Marc Taylor Environmental Stewardship Award.
June 13, 2018



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May 24, 2018

A Collaborative Approach to Water Resource Management for the Pomperaug River Presented At: Water Supply in Western Connecticut Conference
May 22, 2018

Water Supply in Western Connecticut Conference Friday May 18, 2018, 9:00 am – 2:30 pm Roxbury Town Hall
May 11, 2018

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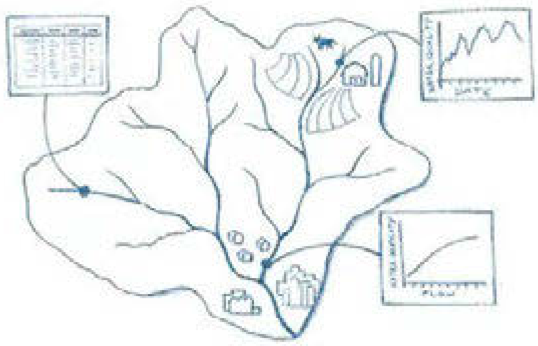
Pomperaug River Watershed Based Plan Proposals Sought

May 19, 2016

The Pomperaug River Watershed Coalition (PRWC) is requesting proposals from qualified professionals to assist in the preparation of an EPA 9 Element Watershed Based Plan (WBP) in accordance with Section 319 of the Federal Clean Water Act (CWA). This project will update PRWC's current watershed management plan to address the effect of Non-Point Source (NPS) pollution within the Pomperaug River Watershed, consistent with policies and guidance set forth by the U.S. Environmental Protection Agency (EPA) and the Connecticut Department of Energy and Environmental Protection (CT DEEP).

Proposal Deadline: Interested consultants shall submit 5 copies of their qualifications, detailed scope of services and fee by 2:00 PM on June 24, 2016



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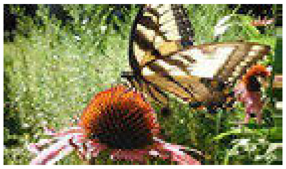

Rain Garden Installation Planned for Community House Park

April 2, 2018

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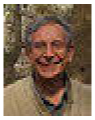

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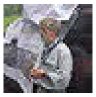

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Stream Surveys Soon Underway

April 14, 2017

This spring, field technicians from Fuss & O'Neill, the consulting firm we hired to assist us in revising our Watershed Management Plan, will be conducting visual assessment surveys along impaired stream segments of the Pomperaug and Weekeepeemee Rivers. Surveys data will help us better gauge the scope of factors that may be contributing to reduced water quality conditions of these waterways.

The findings will be used to develop site specific plans for remediating pollutants like bacteria and for restoring instream habitat. These plans will then be incorporated into the updated Watershed Management Plan.

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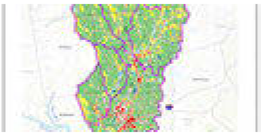

Information Sessions Scheduled – A Look at Water Quality in the Pomperaug Watershed

July 5, 2018

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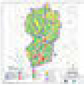

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July 5, 2018

Town of Woodbury Planning Commission Public Workshops - July 19th.
July 5, 2018

River Ramblers: Southford Falls
July 2, 2018

River Ramblers: Swendsen Farm Preserve
July 2, 2018

PRWC seeking volunteers for Rain Garden planting

July 2, 2018

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Pomperaug River Watershed Coalition

HOME ABOUT US SCIENCE EDUCATION OUR WATERSHED EVENTS GET INVOLVED

Watershed Coalition to Assess Local Streams in August

August 8, 2017

During the month of August, field scientists from the consulting firm Fuss & O'Neill will be traveling throughout Bethlehem, Woodbury, and Southbury to conduct Visual Assessment Surveys of local rivers and streams on behalf of the Pomperaug River Watershed Coalition (PRWC). This work is part of a larger effort led by PRWC to update and upgrade its Watershed Management Plan ("WMP"), a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.

Carol Haskins, PRWC Outreach Director said, "Our objectives in updating the Pomperaug Watershed Management Plan are to further evaluate current watershed conditions and identify ways to additionally protect and enhance local water resources."

Haskins noted that the Plan update is being driven by three key factors: (1) timing- it has been 10 years since the plan was last updated; (2) format - the U.S. Environmental Protection Agency has adopted a prescribed format for these plans and organizations must have an approved plan to be eligible for future restoration and protection project funding; and, (3) new areas of concern - a greater number of monitoring locations since the time of the last WMP has revealed new sites where data does not meet federal water quality standards.

In order to best inform this Plan, existing watershed conditions are being evaluated though the use of GIS mapping for the watershed as well as visual assessment survey data that will be collected along various river and stream segments. Visual surveys will provide a general assessment of in-stream habitat, streambank, riparian buffer, and floodplain conditions; the potential for stormwater runoff to deliver soil, nutrients, and bacteria from the land to nearby waterways; and opportunities to implement green infrastructure (new and retrofits) to reduce stormwater runoff.

In regards to how the data will be used, Erik Mas, Project Manager and Vice President at Fuss & O'Neill said, "These data will help us better gauge the factors that may be contributing to reduced water quality conditions, and will allow us to develop site specific plans where measures can be implemented to minimize bacteria, nutrient and soil inputs into the Pomperaug River and its tributaries as well as to restore in-stream habitat."

The proposed field work will generally occur between 8:00 a.m. and 6:00 p.m., Monday through Friday, during the month of August 2017. Field crews from Fuss & O'Neill will conduct as much of the assessments as possible from within the stream corridor, on public property, and within the public right-of-way. In the event field personnel ask for permission to access property, PRWC hopes that residents living along the waterways will permit Fuss & O'Neill staff access with the understanding that doing so is voluntary.

The findings will be shared during informational sessions slated to be held in Bethlehem, Woodbury, and Southbury in October and November 2017. At that, time PRWC will seek community input. The results of the field assessments will be described in the WMP. State and town agencies in the watershed will be able to utilize the WMP (due in early 2018) to further protect and enhance local water resources.

PRWC's mission is to ensure the availability of high quality water in the Pomperaug Watershed communities through the use of science and education. We share our knowledge and expertise with others committed to the protection of water resources for future generations. Additional information can be at www.pomperaug.org. Questions about the visual assessment surveys and the WMP development can be directed to Carol Haskins, PRWC Outreach Director at 203-263-0076 or by email at chaskins@pomperaug.org; or Erik Mas, P.E. of Fuss & O'Neill, Inc. at 800-286-2469 or at emas@fando.com.

Photo Caption: During the month of August, field scientists from the consulting firm Fuss & O'Neill will be traveling throughout Bethlehem, Woodbury, and Southbury to conduct Visual Assessment Surveys of local rivers and streams (pictured - Nonnewaug River) on behalf of the Pomperaug River Watershed Coalition (PRWC). This work is part of a larger effort led by PRWC to update and upgrade its Watershed Management Plan for the 90-square mile Pomperaug Watershed.

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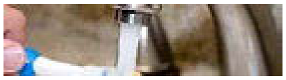

Water Drop Watchers Education and Awareness Program Winners Announced 2000 Students Learn About Water Conservation

April 11, 2018

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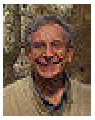

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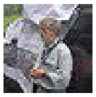

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Watershed Based Planning Continues

November 17, 2017

Late this summer, field scientists from the consulting firm Fuss & O'Neill traveled throughout the watershed to conduct Visual Assessment Surveys of select rivers and streams on behalf of PRWC. This work is part of a larger effort led by PRWC to update and upgrade its Watershed Based Plan, a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant and the Connecticut Community Foundation.

To best inform this Plan, current watershed conditions have been evaluated through the use of GIS mapping, bacteria and nutrient load potential has been estimated through computer modeling, and visual assessment survey data has been collected. The visual surveys have provided a general assessment of in-stream habitat, streambank, riparian buffer, and floodplain conditions; evaluated the potential for stormwater runoff to deliver soil, nutrients, and bacteria from the landscape to nearby waterways; and identified opportunities to implement green infrastructure to reduce stormwater runoff.

In regards to how the data will be used, Erik Mas, Project Manager and Vice President at Fuss & O'Neill said, "These data will help us better gauge the factors that may be contributing to reduced water quality conditions, and will allow us to develop site specific plans where measures can be implemented to minimize bacteria, nutrient and soil inputs into the Pomperaug River and its tributaries as well as to restore in-stream habitat."

Findings and recommendations will be shared during informational sessions slated to be held in Bethlehem, Southbury, and Woodbury early this winter. At that time, PRWC will seek community input to help refine the Plan which will serve as a road map for state and local agencies to implement protection and restorative measures to further protect and enhance local water resources. The final Plan is expected in late winter.

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John Pittari Named Recipient of 2018 James J. Clark, Jr., Community Service Award

May 24, 2018

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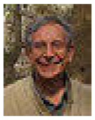
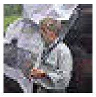


PRWC Seeks Nominees for 2018 Dr. Marc Taylor Environmental Stewardship Award.
June 13, 2018



U.S. Geological Survey Work Resumes Within and Near the Pomperaug River Watershed Region
June 11, 2018

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May 22, 2018

Water Supply in Western Connecticut Conference Friday May 18, 2018, 9:00 am – 2:30 pm Roxbury Town Hall
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Pollutant Load Modeling Completed for the Pomperaug

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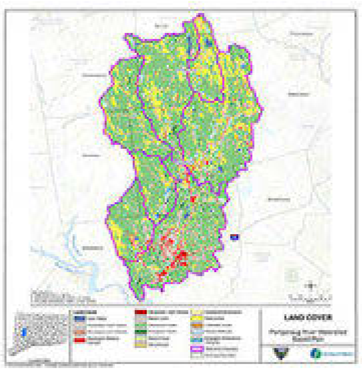

Over the past several months, PRWC has been working with Fuss & O'Neill, an environmental consulting firm, to update the Pomperaug Watershed Management Plan to a 9-element Watershed Based Plan for approval by the US Environmental Protection Agency.

The focus of our Watershed Based Plan is to reduce the amount of bacteria entering the local streams which are listed as impaired by CT Department of Energy and Environmental Protection and EPA. There are three stream segments in the Pomperaug Basin where in-stream bacteria levels were measured in excess of the water quality standard for recreation. While the data supporting these listings have been limited, further evaluation is still required to remove these streams from the State's list of impaired waters.

A key milestone in developing plans to reduce bacterial level was to estimate the potential volume of it that could be carried from the watershed lands into our rivers and streams. We used a pollutant loading model to make such an estimate. The model also provided us with estimates for other pollutants including nutrients like nitrogen and phosphorus as well as total suspended solids (a factor of soil erosion). The model used the most recent land cover data, precipitation data, soil data, and more to estimate the relative sources of these pollutants and their potential volumes that could enter our streams.

PRWC's Land Use Committee will be using this information to determine what practices can be implemented to reduce the pollutant loads and where they may most effectively be implemented to improve in-stream water quality.

We encourage you to review the findings of the pollutant loading model and to attend one of the upcoming information sessions (to be scheduled) to learn more about the model results and next steps in developing and implementing the updated Watershed Based Plan.

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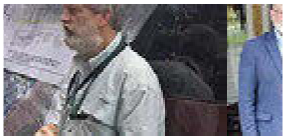

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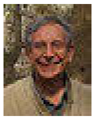

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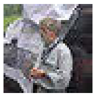

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Pomperaug River Watershed Coalition

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Information Sessions Scheduled – A Look at Water Quality in the Pomperaug Watershed

July 5, 2018

The Pomperaug River Watershed Coalition ("PRWC") invites residents and other interested individuals of Bethlehem, Woodbury, Southbury, Washington, Roxbury, Watertown, Morris, and Middlebury to attend one of three upcoming presentations to learn about the water quality conditions of local rivers and streams flowing through the Pomperaug Watershed. The presentations will provide an update and overview of the stream conditions as described in Connecticut Department of Energy and Environmental Protection's Integrated most recent Water Quality Report to Congress (2016) as well as the results of a geospatial computer model used to estimate the volume sediment, nutrients, and bacteria that have potential to find their way into nearby rivers and streams during a rain storm or during snow melt.

"As a science-based organization, we are aiming to better understand changing conditions and potential threats to our rivers and streams so we can continue to help protect healthy waters and work to improve conditions where necessary," says Carol Haskins, PRWC Outreach Director. "As a coalition-based organization, we want to ensure our community has an opportunity to learn about our work and to provide input regarding the long-term stewardship of our shared water resources."

PRWC is in the process of updating its 2005 Watershed Management Plan to a 9-Element Watershed Based Plan ("Plan"), a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency ("EPA") Clean Water Act Section 319 Nonpoint Source Grant as well as by Connecticut Community Foundation. Revisions to the Plan are being made with guidance and oversight from PRWC's Land Use Committee whose membership includes but is not limited to representatives from local conservation organizations, town land use departments, as well as regional, state, and federal agencies.

A key milestone for the Plan was recently completed and is ready to share and pertains to the pollutant loading model that was applied to the watershed. The model results describe the relative potential of different land cover types to contribute pollutants like bacteria, nutrients, and sediment to nearby rivers and streams as well as the overall volume of each pollutant that could end up in a local waterway. Both the relative potential and volume are estimated using a computer-based pollutant loading model and the most current land cover, precipitation, soil, slope, and other geospatial data available.

The main focus of the Plan is to identify measures that should be implemented to reduce the amount of bacteria entering the local streams currently listed as impaired by CT Department of Energy and Environmental Protection and EPA. There are four stream segments in the Pomperaug Basin where in-stream bacteria levels were measured in excess of the water quality standard for recreation. It is important to note that the DEEP data supporting these listings are limited and are dated. Further evaluation and potential restoration is required to remove these stream segments from the State/Federal list of impaired waters.

During the upcoming presentations, PRWC and the environmental consulting team of Fuss & O'Neill will describe the local impairments and the nuances of the data supporting the designation of these stream segments, provide an updated look at the land cover conditions in the watershed, explain the results of the pollutant loading model, and discuss general strategies that could be implemented to reduce the volume of bacteria entering local streams. PRWC will seek community input to help refine the Plan which will serve as a road map for state and local agencies to implement measures to further protect and enhance local water resources. The reduction of bacteria to local rivers and streams also supports a state-wide initiative to reduce the amount of bacteria and nutrients flowing into Long Island Sound.

The three presentations coming up will be identical in content and are being offered at different locations and times throughout the watershed with the hope to make it convenient for residents to attend. Presentation dates, times, and locations are: Tuesday July 17 at 7:00PM in the Shove Building at the Woodbury Municipal Complex; Wednesday July 18 at 2:00 PM in Room 205 at Southbury Town Hall; and Wednesday July 18 at 6:30 PM in the Leever Room at the Bethlehem Public Library.

A fourth presentation, one that integrates the community input during the July presentations and overall strategies included in the updated Watershed Pan, is scheduled for Wednesday August 22 at 7:00 PM at the Woodbury Senior Center.

Additional information about the local water quality conditions and the Watershed Plan update can be found at www.pomperaug.org. Questions or comments may be directed to Carol Haskins at 203-263-0076 or outreach@pomperaug.org.

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April 11, 2018

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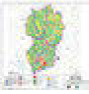

Information Sessions Scheduled – A Look at Water Quality in the Pomperaug Watershed
July 5, 2018

Town of Woodbury Planning Commission Public Workshops - July 19th.
July 5, 2018

River Ramblers: Southford Falls
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River Ramblers: Swendsen Farm Preserve
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PRWC seeking volunteers for Rain Garden planting

July 2, 2018

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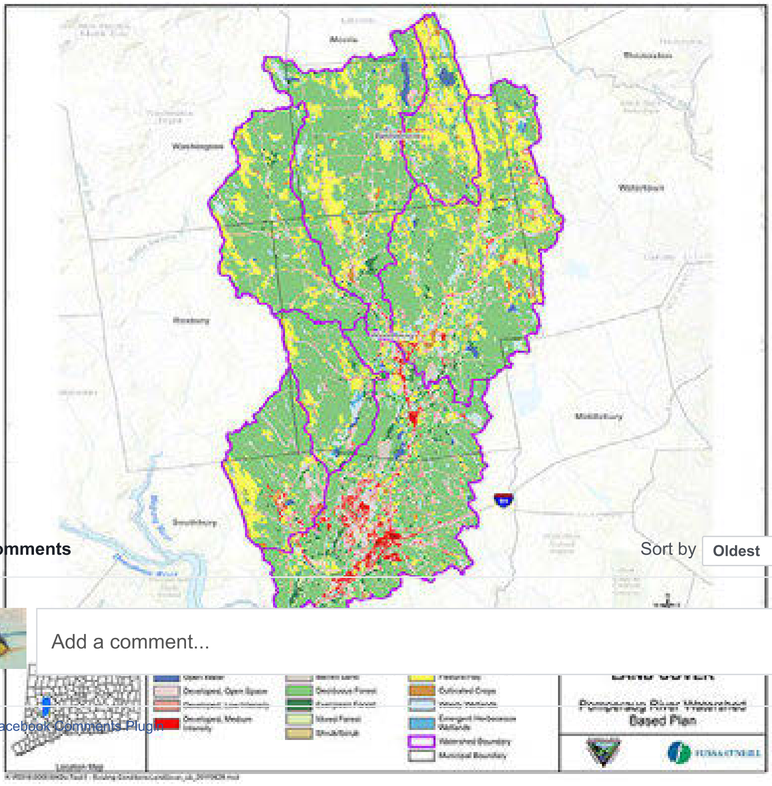

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Pomperaug River Watershed Coalition

PRWC Presents on Water Quality Conditions

July 20, 2018

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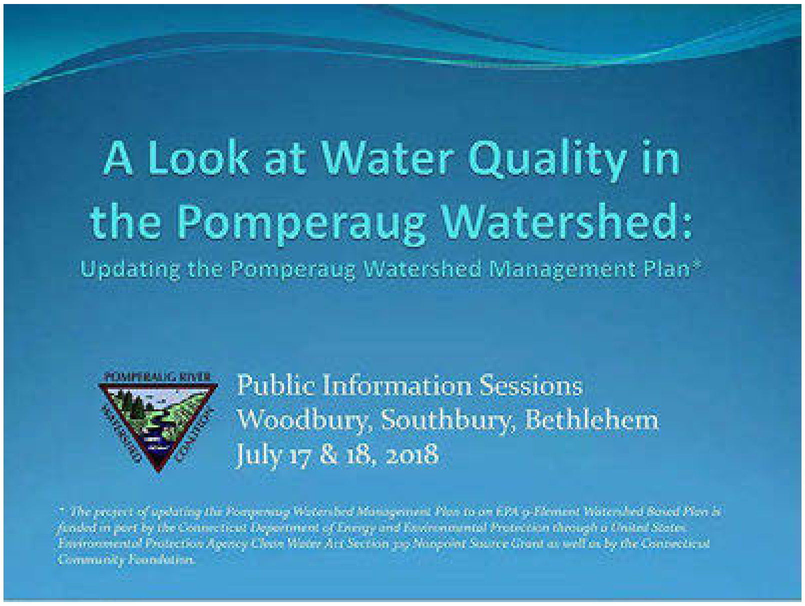

A Look at Water Quality in the Pomperaug Watershed:

Updating the Pomperaug Watershed Management Plan*

Public Information Sessions
Woodbury, Southbury, Bethlehem
July 17 & 18, 2018

* The project of updating the Pomperaug Watershed Management Plan to an EPA 9-Element Watershed Based Plan is funded in part by the Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant as well as by the Connecticut Community Foundation.

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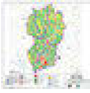

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Fall Winter 2016-2017 - Watershed News
Updating the Pomperaug Watershed Management Plan (page 1)
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Spring Summer 2017 Watershed News
Stream Surveys Soon Underway (page 2)
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POMPERAUG RIVER WATERSHED COALITION

WATERSHED NEWS

Finding ways to keep our water pure and plentiful

Serving the Community Since 1999

Spring 2016

Shaping Connecticut's State Water Plan

The planning effort for the State Water Plan is underway and PRWC is an active "voice at the table" in many aspects of its development, which is led by the Connecticut Water Planning Council. Under Public Act 14-163, the Council was charged with the development of a State Water Plan that is to be submitted to the joint standing committees of the General Assembly by January 1, 2018.

The Public Act identifies 17 requirements for the State Water Plan relating to the environment, public health, planning and development and energy and technology. While each requirement is significant, three are particularly meaningful to PRWC in that the requirements serve to highlight the importance of our core work related to science, research and educational outreach:

> (1) Identify the quantities and qualities of water that are available for public water supply, health, economic, recreation and environmental benefits on a regional basin scale considering both surface and groundwater.
>
> (2) Recommend the utilization of the state's water resources, including surface and subsurface water, in a manner that balances public water supply, economic development, recreation and ecological health.
>
> (8) Inform residents of the state about the importance of water resource stewardship and conservation.

PRWC is applying our data and research to the development of the State Water Plan and is underscoring the future local and regional water resource planning needs for our watershed and others across the state. Our participation allows us to highlight what we see as being the most relevant issues including the review of registered water diversion permits and the impact of groundwater withdrawals on stream flow. When completed, the State Water Plan may lead to key water resource policy changes that would be supported by new state laws and regulations.

To learn more about the development of State Water Plan and to stay connected with new information, the state has launched the following website: www.ct.gov/water.

PRWC Hosts Woodbury Earth Day

Woodbury Earth Day is preparing for its 21st Annual Earth Day Celebration. As the largest Earth Day celebration in Connecticut, you won't want to miss this fun celebration with earth-friendly activities for the entire family!

Woodbury Earth Day will feature 130+ vendors, a Main Stage, a Community Stage, a Kids' Activities Tent, and some of the best food trucks in Connecticut. Among the many talented performers and engaging presentations, The Regulators and HannaH's Field will rock the audience while Bring the Hoopla gets them moving. Caseus Cheese Truck, Hardcore Sweet, El Camion and several others will be serving up your favorite eats and Aquarion Water Company will provide drinking water to help wash it all down.

While thinking global and acting local, visitors will enjoy a lively vendor fair including artisans, farmers and growers, environmental organizations, and home improvement services, along with demonstrations like the Live Birds of Prey presented by Audubon Sharon.

Woodbury Earth Day is presented under the leadership of PRWC, and a team of dedicated community volunteers. Event sponsors include New Morning Market, Aquarion Water Company, O&G Industries, USA Hauling, Eversource, The Farm of Woodbury, Brown Tufts Montessori School, Civil 1 Engineering, Woodbury Chevrolet, Power Home Remodeling Group, and Energy Conservation Specialists - Aeroseal, Renewal by Anderson, Splash Car Wash, and Secor, Cassidy & McPartland PC.

Visit our News & Blog at WWW.POMPERAUG.ORG for expanded articles, additional photos, and to learn more about our past, current, and upcoming activites!

This edition of Watershed News is sponsored by Secor, Cassidy, & McPartland, PC. Thank you!

POMPERAUG RIVER WATERSHED COALITION

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Executive Director
Len DeJong
Outreach Director
Carol Haskins
Administrative Assistant
Anne Urkawich

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The Pomperaug Watershed

Reviewing Towantic Energy's Water Management Plan

Historically low river flows and groundwater levels observed during Fall 2015 underscore the importance of proactive water resource management and planning. As reported in our last newsletter, PRWC has been an active participant in advocating for the protection of our water resources in matters pertaining to the future operation by Towantic Energy, LLC of the 785 mega-watt electric generating facility in the town of Oxford. The water supply for the facility would rely mostly on water from a public drinking water source drawn from the Pomperaug Watershed.

The Connecticut Siting Council approved the construction of the facility and, in so doing, required that Towantic update its Water Supply/ Management Plan. When issued, PRWC voiced its concern that the Plan did not adequately address the need to protect our water resources. Most notably PRWC feels that the Plan lacks (1) the required detail needed on securing supplemental out-of-basin water supply that would serve to augment local water resources during periods of drought and high water demand, and (2) the required planning for the facility's water use during drought or other events so as not to unfairly burden existing water customers and cause increased negative impact on stream flow and aquatic health.

In Septemeber 2015, a significant stretch of the Weekeepeemee River at Three Rivers Park in Woodbury was completely dry. Other streams throughout the watershed also experienced dry channel conditions last fall.

With the support of the Southbury First Selectman's office, PRWC will continue to discuss its concerns with Towantic officials in an effort to address these water management planning deficiencies. Doing so is consistent with the commitment made by Towantic within the Plan for: "Communication and coordination with PRWC to facilitate understanding of the dynamic natures of the project's water demands."

Out and About: Conducting Research and Motivating Stewardship

PRWC prides itself in its research and restoration activities as well as its outreach and eduction initiatives. In a typical year PRWC conducts an average of 55 programs a year reaching upwards of 150,000 people with water conservation and environemntal stewardship messages. Among PRWC's recent activities were presentations to Connecticut Watershed Conservation Network Conference and the Naugatuck Valley Council of Governments (NVCOG) Regional Planners Commission, the Western CT Leadership Program, and the Waterbury Garden Club. Topics included River Smart, Towantic Power, Drought Planning, and the State Water Plan.

Rachael Caron, 2015 summer intern, joined up with Southbury Public Works and UCONN's Cooperative Extension program for a release of weevils to control Mile-a-Minute vine at Ballantine Park in Southbury.

With the help of Rachael Caron, 2015 Dr. Marc J. Taylor summer intern, PRWC further extended its environmental stewardship message at the local Farmers' Markets and similar community events like Woodbury's Fall Fest and Southbury's Volunteer Fair. Caron, a Woodbury resident in her junior year at the College of William and Mary, also helped further our research and restoration efforts that include stream temperature monitoring, macroinvertebrate surveying, streamside buffer planting, and stormdrain marking.

FirstLight Models Shoreline Erosion Prevention

This winter, Earth Tones Native Plant nursery installed an array of erosion prevention measures at the Shepaug Dam canoe portages in Southbury. A ribbon cutting and tour of the rain gardens, swales, and resurfaced trails is slated for Saturday April 30 at 9:00 AM. Attendees are invited to learn about these and other "RiverSmart" practices they can adopt at home. The event coincides with Housatonic Valley Association's 10-day Source to Sound paddling trip.

Lisa Turoczi of Earth Tones points out a new rain garden at the Shepaug Dam canoe portage on Lake Lillinoah in Southbury.

Community Foundation Honors Collaborations

On August 20, 2015, Connecticut Community Foundation's Trustees honored the two recipients of its first-ever Trustee Fund Award: River Smart CT, a collaboration of several local environmental organizations and land trusts (including PRWC and Housatonic Valley Association), and Almost Home Summer Camp, an educational and recreational summer program in Waterbury.

PRWC joined with River Smart CT partners in receiving first-time Trustee Fund Award from the Connecticut Community Foundation.

UCONN "Water Credits" Research Project

On October 23, PRWC met with Professor Stephen Swallow and a team of researchers from UConn's Agricultural and Resource Economics program and showed them around the watershed to help them get familiarized with the local hydro-geography. Pomperaug Watershed, with its abundant scientific data, will be a case example in this latest research project focusing on resource economics and water allocation.

PRWC and "Water Credits" reasearch team from UCONN toured the watershed last fall.

Southbury Receives FEMA Grant for Floodplain Restoration

At an August press conference, Congresswoman Elizabeth Esty and Senators Richard Blumenthal and Chris Murphy joined the Town of Southbury in announcing receipt of a grant award made through FEMA's Hazard Mitigation Grant Program to fund the acquisition and demolition of nine properties in Southbury in a flood-prone area of town.

Over the course of six months during 2011, each house suffered flooding above the first floor elevation, resulting in property damage, ground erosion, loss of personal belongings, and structural damage to the houses. The grant will allow for the houses to be removed and for the parcels to be designated as open space along the Pomperaug River.

Senator Murphy stated that he is "glad that Southbury can finally move forward with this project and help residents transition these dangerous, flood-prone properties along the Pomperaug River into a safe, public space for all residents to enjoy." Senator Blumenthal underscored that, "[this is] the best course of action for public safety, the environment, and for taxpayers."

State, federal, and local officials joined together in announcing a FEMA grant award given to the Town of Southbury to mitigate flood hazards; funds were used to buy out nine homes and get the homeowners out of harm's way.

POMPERAUG RIVER WATERSHED COALITION
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Help Us Safeguard Water Resources for Generations

Communities need clean water to be vibrant, healthy and sustainable. Pomperaug River Watershed Coalition's volunteers, Board and Advisory Council members, and staff are working on your behalf and those you care about, to ensure continued access to clean water. ***We cannot do this critically important work without you.***

Please help us maximize your support by making an online donation to PRWC during Give Local on May 3-4. Your gift will be amplified by matching funds and bonus prize opportunities. Donate online at: www.pomperaug.org.

GIVE LOCAL
Greater Waterbury & Litchfield Hills!
May 3 - 4, 2016
Presented by:
Connecticut Community Foundation

Volunteers in Action

Last summer and fall, 500 stormdrain markers were installed by volunteers like 6 year old, Brody Dugas (below) of Southbury. Will you help us with the next 500 markers this season?

In September, volunteers joined PRWC for its 10th Annual Macroinvertebrate Survey. The focus of this project is to help the CT Department of Energy and Environmental Protection document high quality streams throughout the state. A special "Gettin' Buggy" kids program (above) was added as part of the activities this year.

PRWC Signs Grant Contract with State

In March 2016, PRWC signed a grant contract with the State of Connecticut's Department of Energy and Environmental Protection that awards PRWC with approximarly $52,000 to be used to update its Waterhsed Management Plan. The Plan aims to develop site specific plans for remediating stream pollutants like bacteria and restoring instream habitat.

Carol Haskins and Len DeJong, PRWC staff, and Susan Peterson from CT Department of Energy and Environmental Protection look on while John Lacadie, PRWC Secretary, and Vince McDermott, PRWC Chairman, sign a grant contract with the State of CT.

This newsletter is printed on 10% post-consumer recycled paper.

POMPERAUG RIVER WATERSHED COALITION

WATERSHED NEWS

Finding ways to keep our water pure and plentiful

Serving the Community Since 1999

Fall / Winter 2016-17

Teaching the Next Generation of Watershed Stewards

Science has long been at PRWC's core, but education is our hallmark. This October, we continued our legacy of teaching the next generation of stewards how to care for our shared water resources with two very special programs.

(LEFT) Mr. Nate and his fourth grade students from the Children's Community School of Waterbury searched for signs of animal life in and around the Woodbury Reservoir during an October field trip with PRWC. (RIGHT) Carol Haskins leads the Long Island Sound in a Jar activity to help Woodbury's seventh graders learn about sources of pollution that can affect Connecticut's water resources.

First, PRWC facilitated a field trip to the Woodbury Reservoir for third through fifth grade students from the Children's Community School of Waterbury. The trip was organized in partnership with the After School Arts Program (ASAP!) as one component of Metamorphosis, a school-based experiential learning program. During the field trip, students learned how limited and precious our freshwater resources are while visiting the site of the former water supply for Woodbury and rotating through three activity stations. The activities -- Awesome Aquifers, Animal Signs Scavenger Hunt, and Tie-Dying -- emphasized how plants, animals, and people all rely on water to survive and thrive. This learning was further integrated through other activities lead by an artist serving a two-week long residency at the school as part of ASAP's Metamorphosis program.

A few weeks later, PRWC was one of five guest speakers who facilitated hands-on activities for Woodbury Middle School's seventh grade students as part of the school's annual Make a Splash Day. Carol Haskins, Outreach Director, lead the Long Island Sound in a Jar activity which teaches students about different sources of pollution that can affect Connecticut's water resources. Students also learned about water monitoring, human health and water borne pathogens, rain gardens, and pollution prevention as they cycled through the different activities. The concepts students learn during Make a Splash Day are revisited frequently as they continue with their watershed studies in science class. Concepts are further reinforced later in the year with a unit on erosion.

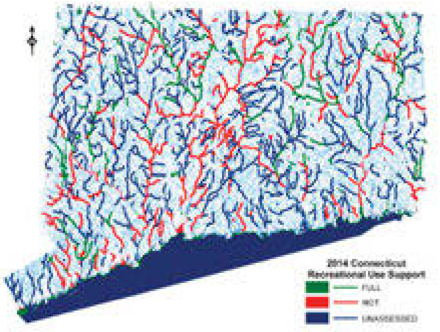
Updating the Pomperaug Watershed Management Plan

Earlier this year, PRWC signed a grant contract with the State of Connecticut's Department of Energy and Environmental Protection that awarded PRWC with a grant to be used to update its Waterhsed Management Plan (WMP). We also received a matching grant from the Connecticut Community Foundation.

In September, we hired the consulting firm of Fuss & O'Neill to help us create a Plan that will develop site specific plans for remediating stream pollutants like bacteria and restoring instream habitat.

This update of the Pomperaug Watershed Management Plan is being driven by a couple of factors: (1) timing - it has been 10 years since the plan was last updated; (2) format - the U.S. Environmental Protection Agency has adopted a prescribed format for these plans and organizations must have an approved plan to be eligible for *(continued on Page 4)*

Connecticut Waterbodies Assessed for Recreational Use



Stream segments shown in red do not meet water quality standards to support recreational activities like swimming.

Image Source: CT DEEP's 2014 Intergrated Water Quality Report to Congress.

Visit our News & Blog at WWW.POMPERAUG.ORG for expanded articles, additional photos, and to learn more about our past, current, and upcoming activites!

This edition of Watershed News is sponsored by Secor, Cassidy, & McPartland, PC. Thank you!

POMPERAUG RIVER WATERSHED COALITION

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Social Media:

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Executive Director
Len DeJong
Outreach Director
Carol Haskins
Manager of Admin. & Development
Anne Urkawich

BOARD OF DIRECTORS

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Joseph Eisenberg, Vice-Chairman
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Marianne Bette
Anne Delo
Ann Feinberg
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Dan Slywka
Christopher Wood
J. Lawrence Pond, Emeritus

The Pomperaug Watershed

Stream Monitoring Efforts Continue

While facing extremely dry conditions this fall, volunteers were able to get out to survey the macroinvertebrate populations in our small rivers and streams that still had some water. We found that the sites with low flow conditions (versus no flow) were still supporting creatures like mayflies, stoneflies, crayfish, and aquatic worms. However, these "bugs" were especially tiny this year and we had to dig a little deeper under the rocks in the wettest portion of the channel to find them taking refuge. The types of creatures we found indicated high quality water, essential to supporting aquatic life. Streams surveyed this season were Sprain Brook, East Spring Brook and Weekeepeemee River. At the first two sites (and eight others), we also collected hourly stream temperature data for the entire summer season (June through October). We've submitted these data to CT DEEP in support of their statewide monitoring efforts. Later this winter, PRWC will summarize the data and compare it to data recorded since 2012. Among our goals for these efforts is to establish a baseline of data we can use to begin looking for trends while also trying to identify critical cold water habitat that can support native brook trout. Of the ten sites we currently monitor, one is considered "cold" while the others are "cool" or "transitioning." To learn more, visit the "Science" section of our website.


Volunteers Tracy Frate and Jonathan Goldberg survey for macroinvertebrates in Sprain Brook off Papermill Road in Woodbury.

Board Changes: New Faces and Fond Farewells

At our Annual Meeting in September, PRWC elected Frank Sherer, Jr. of Woodbury and Dan Slywka of Southbury to the Board of Directors.

Vince McDermott, PRWC Board Chairman, emphasized that "in electing Frank and Dan to the Board of Directors we are welcoming individuals with the highest credentials and a demonstrated commitment to sharing their respective skill sets to strengthen their communities through volunteer support." He went on to say that "PRWC will benefit immensely from their proven professional and leadership capabilities. Both Frank and Dan are strong additions to the PRWC team and will complement our work of using science, research and educational outreach to promote the protection of our water resources." Learn more about Frank and Dan by reading their biographies found in the "News/Blog" section of our website.

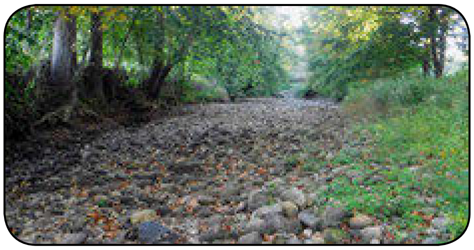

Welcome new Board Members Dan Slywka and Frank Sherer, Jr.


Our gratitude to exiting Board Members Fred Sell and Virginia Mason.

During the Annual Meeting the Board of Directors also re-elected Dr. Marianne Bette (Southbury) and Chris Wood (Woodbury) to serve new terms on the Board. The Board elected its slate of officers including Vince McDermott (Bethlehem) as chairman, Joe Eisenberg (Woodbury) and Gail McTaggart (Southbury) as co-vice chairs and John Lacadie (Woodbury) as secretary/ treasurer.

The Board of Directors also recognized outgoing members Virginia Mason and Fred Sell for their significant contributions to the Board and for their many years of volunteer service and environmental stewardship dedicated to the protection of the Pomperaug River water resources.

Our State Water Plan



Recent local drought conditions, like those seen on the Weekeepeemee in 2015, have been highlighted in developing the State Water Plan. This Plan aims to balance the needs of public water supply, economic development, recreation and ecological health, and to provide a framework for improved or more efficient water management in the future.

In earlier communications we noted that PRWC has been a local "voice at the table" in matters pertaining to the development of Connecticut's first State Water Plan. The Plan is being prepared in two phases. Phase I will soon be completed and includes an assessment of current conditions and practices along with prioritizing future planning issues. Phase II of the Plan will develop consensus-based policy recommendations where possible, identify pathways to address unresolved planning needs, and formulate a decision framework for solving existing and future water issues.

As a member of the Water Planning Council Advisory Group and the Science & Technical Committee, PRWC has highlighted and provided data on water issues of importance to us such as streamflow, groundwater withdrawals, and drought. Public Act 14-163 charged the CT Water Planning Council with delivering a completed State Water Plan to the General Assembly by January 1, 2018. Since this is our State Water Plan, your assistance with the development of the Plan is also encouraged through public meeting participation or by submitting written comments. To learn more please visit www.ct.gov/water or contact us.

Sharing Our Expertise Across the Region

As you know, our mission is to ensure the availability of high quality water in the Pomperaug Watershed communities through the use of science and education. But, did you know we are also committed to sharing our knowledge and expertise with others outside the watershed who are also committed to protecting water resources for future generations?

Len DeJong discusses drought planning and the State Water Plan process with an audience in Southbury.

This fall, PRWC made great efforts to share our scientific research and outreach programs across the region. Len DeJong shared the results of a Pomperaug Watershed focused USGS study that investigated impacts of climate change on watersheds across the country. This presentation was made at a Climate Change Conference presented by Rivers Alliance of Connecticut in October. Attending the conference were municipal and state officials who make important decisions regarding our natural resources. DeJong gave a similar presentation with additional emphasis on the State Water Plan and drought planning to the Southbury Business Association as well as to employees at Timex Group in Middlebury.

Carol Haskins shared PRWC's expertise in community outreach by showcasing the River Smart program materials available to municipalities to use in meeting State Stormwater Permit requirements at a topical conference hosted by the Connecticut Council of Small Towns in October. She also presented on what it means to be River Smart at the Western Connecticut Leadership Program's Environment Day in September.

In a typical year PRWC conducts an average of 55 outreach programs and presentations reaching upwards of 150,000 people with water conservation and environmental stewardship messages.

Steering Committee Volunteers Sought for Woodbury Earth Day 2017

Photo credit: GGDavis.com

Mark your calendars - Woodbury Earth Day has been scheduled for Saturday April 22, 2017 at Hollow Park!

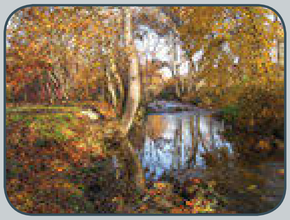
While planning is already underway, we need YOUR help to make this the best event yet!

Steering Committee volunteers are needed to help plan and organize the following aspects of Connecticut's largest Earth Day celebration: Vendor Registration; Event Promotion; Music/Sound Coordination; Arts & Crafts; Site Logistics; Special Activities & Presentations.

Please email us at earthday@pomperaug.org or call 203-263-0076 if you are interested in volunteering. For additional information, including, forthcoming vendor applications and sponsorship forms, please visit www.woodburyearthday.org.

Help Us Safeguard Water Resources for Generations

Communities need clean water to be vibrant, healthy and sustainable. Pomperaug River Watershed Coalition is working on your behalf and those you care about, to ensure continued access to clean water. ***We cannot do this critically important work without you.***



We rely on support from people just like you to do the work we do. By making a tax-deductible donation today, you help safeguard our vital water resources for generations.

Donate online at www.pomperaug.org.

Pomperaug RIver Watershed Coalition
39 Sherman Hill Road, C103
Woodbury, CT 06798
Email: info@pomperaug.org

Donor Recognition List Inside!

(TOP) Kyle and Sarah Turoczi of Earth Tones replant the riparian buffer along the Pomperaug River with native species after removing invasive plants. (BOTTOM) One of the new access points to the river at Cedarland Park on River Trail in Southbury.

Riparian Buffer and River Access Project Completed

Since 2012, volunteers have been hard at work restoring the riparian buffer at Cedarland Park in Southbury. What began as an effort to remove invasive species and replant native species along the small stream that flows through the neighborhood park on River Trail expanded to a larger effort to do the same along the banks of the Pomperaug River. The buffer along the Pomperaug also included plans to install natural stone stairs down to the river at two points heavily eroded by past foot traffic to the water. In August, this vision became a reality! And, not without the support of many community partners. We wish to extend our thanks to ALL the volunteers who helped pull weeds and plant native species over the past four seasons; Earth Tones Native Plant Nursery and Landscaping for site designs, plant material, and labor; Civil 1 for engineering review and support through the permitting process; O&G Industries for donating round rubble for the access areas; Haynes Materials for donating large stone slabs for the steps; FirstLight Power for donating plants; CT DEEP and Patagonia Westport for grant funding support; the Town of Southbury for allowing us to create a model site for best river practices at one of their parks and having their Public Works crew provide weed disposal support throughout the project.

With all said and done (minus the continued weeding and occasional watering), we restored 270 feet of riparian buffer habitat along the Pomperaug River and another 100 feet along Spring Brook. The native buffer brings a great number of benefits including food and shelter for birds, pollinators, and other small creatures; shade over the river to help keep the water cool for fish; a soft, green barrier to absorb stormwater runoff flowing towards the river; and a maze of roots that helps keep the riverbank intact during floods.

If you haven't already checked out our work at Cedarland Park, we encourage you to do so. And, you might want to bring a fishing pole if you visit in the spring. This is afterall, a trophy trout section of the river stocked by the State!

Watershed Management Plan *(continued from Page 1)*

future restoration project funding; and, (3) new areas of concern - a greater number of monitoring locations since the time of the last WMP has revealed new sites where data do not meet federal water quality standards.

We are compiling the existing information and conducting field assessment surveys to better gauge the scope of factors that may be contributing to reduced water quality conditions. Stakeholder input will also be sought throughout the planning process. Please stay tuned for announcements about presentations of this information in your town and the opportunity to share your input on issues we may have missed.

This newsletter is printed on 10% post-consumer recycled paper.

POMPERAUG RIVER WATERSHED COALITION

WATERSHED NEWS

Finding ways to keep our water pure and plentiful

Serving the Community Since 1999

Spring-Summer 2017

Employing Area Young People to Aide Conservation Projects

Building on the past successes of stormdrain marker installations, invasive plant removal, and streambank stabilization, the Pomperaug River Watershed Coalition is launching a Youth Conservation Corps pilot-program this summer thanks to generous grant support from the Connecticut Community Foundation. PRWC plans to hire a small crew of high school students that work together with a crew leader over the course of six weeks to implement conservation projects throughout the watershed. Projects will include activities such as maintaining trails and bridges in parks, constructing rain gardens, improving riparian habitat, removing invasive species, mitigating soil erosion, and more.

The Youth Conservation Corps will provide employment opportunities for area students to gain conservation experience and knowledge while working outdoors on meaningful conservation projects. "Our goal of this new program is to foster a sense of responsibility for natural resources, civic engagement and a life-long connection to the environment in our next generation of stewards," said Carol Haskins, PRWC Outreach Director.

Haskins explained that while projects are not fully firmed up, PRWC has been in discussion with its municipal partners from Woodbury, Southbury, and Bethlehem about potential worksites including Cedarland Park, Bennett Park, and Settlers' Park in Southbury; Strongtown Preserve, Woodbury Reservoir, and Hollow Park in Woodbury, and Swendson Farm in Bethlehem.

In addition to launching the Youth Conservation Corps, PRWC is looking forward to welcoming its fourth summer intern that will be selected for the prestigious Dr. Marc Taylor Internship position. The intern is an essential staff person supporting PRWC's science and outreach initiatives.

Together, projects worked on by the Youth Conservation Corps and the Dr. Marc Taylor Intern will underscore our roles as stewards of our environment and promote good habits to keep our watershed and rivers healthy. For more information or an application for employment, contact us at 203-263-0076 or outreach@pomperaug.org.

Give Local: Support the Next Generation of Environmental Stewards

Make your dollars go further! An anonymous donor has pledged to **match every dollar given to PRWC through Give Local (April 25 & 26) up to $10,000**. This match is a great opportunity to do more than twice the good with one donation. Your gift of $25 becomes $50, and, thanks to Connecticut Community Foundation, your gift is boosted even more with event bonus funds and prizes. Please, don't let this generous matching opportunity float away. Visit www.pomperaug.org/givelocal for more information.

State Water Planning Update

Significant effort by numerous stakeholders continues on two statewide planning efforts important to the protection of local water resources. Under the leadership of the Connecticut Water Planning Council (WPC), the effort to develop Connecticut's first comprehensive State Water Plan has successfully advanced as the July 2017 delivery of a draft Plan draws near. As previously reported PRWC has been an active "voice at the table" throughout the Plan development. The goal of our efforts is to effect meaningful change in the way water resources are both looked at and planned for in the future to re-balance the many competing and critical needs for water. We, along with other participants, have shared local knowledge, ideas, and concerns, and contributed to science and technology as well as policy aspects of the Plan. One example of participant contributions is that "estimated ecological flows" required to maintain the aquatic health of rivers statewide are now included as data points within the Plan to be used for future water resource management planning. As the planning process continues, we encourage your participation in public meetings and informational sessions like the two recently held in Southbury.

(continued on page 2)

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The Pomperaug Watershed

Water Education & Conservation Challenge for Third Graders

Earlier this year, PRWC was brought on by Connecticut Water Company (CWC) to help develop a Water Conservation Education Program for third grade classes for schools served by CWC. Schools served by Connecticut Water are currently being invited to participate in the program for the 2017-18 school year.

PRWC has developed educational programs for schools that are consistent with the state curriculum requirements using lesson plans from Project WET ("Water Education for Teachers" curriculum manual) which can supplement classroom teaching.

CWC employees will visit schools that sign-up for the Conservation Education program to teach students about the water cycle and water conservation through hands-on activities. The goal is to help students understand how limited and precious freshwater is on our planet and why we collectively need to protect it and use it wisely. As part of the program, students will be encouraged to sign a Water Conservation Pledge to conserve water at home. The classes with the highest percentage of returned pledges will be eligible to enter into a drawing to win a free trip to the CT Science Center.

This summer, PRWC will train CWC staff in how to lead the classroom activities.

Stream Surveys Soon Underway

This spring, field technicians from Fuss & O'Neill, the consulting firm we hired to assist us in revising our Watershed Mangement Plan, will be conducting visual assessment surveys along impaired stream segments of the Pomperaug and Weekeepeemee Rivers. Surveys data will help us better gauge the scope of factors that may be contributing to reduced water quality conditions of these waterways. The findings will be used to develop site specific plans for remediating pollutants like bacteria and for restoring instream habitat. These plans will then be incoroporated into the updated Watershed Mangement Plan. Learn more about this effort and opportunities for community input at www.pomperaug.org.

State Water Planning *(continued from page 1)*

We also encourage your public comments and ask for your support of the State Water Plan. To learn more please visit www.ct.gov/water.

PRWC has also been engaged in a second significant water resource planning effort that is underway, which is the delineation of Exclusive Service Areas (ESAs) for the provision of public water supply throughout the State. ESA designations are an important planning component of the Water Utility Coordinating Committee (WUCC) work as overseen by the Connecticut Department of Public Health. ESAs can provide for an orderly plan to assure that public health related to water supply is properly accounted for. However, there is also a risk associated with how much water is drawn from a water source to supply future ESAs. As this issue continues to be debated, PRWC is working with state and local officials to understand the potential adverse impacts. Proposed ESA's for the are area have been reviewed and adopted by the Western WUCC membership and are now out for public comment. To learn more please visit www.ct.gov/dph/wucc.

Rain Barrel Workshop

Join Pomperaug River Watershed Coalition under the Pavilion at Hollow Park during Woodbury Earth Day and Make Your Own Rain Barrel

Saturday April 22, 2017

Workshop 1 - 11:30 AM
Workshop 2 - 2:00 PM

Cost: $40 per barrel
(55-gallon barrel & conversion kit included)

Register Today!*
203-263-0076

Materials donated by:
River Network and Coca Cola

*Registration is limited to 1 barrel per household & 10 households per workshop.
Pre-registration and payment is REQUIRED.
Participants MUST be prepared to bring their rain barrel home with from the event.

Celebrate Trails Day Weekend with PRWC

Connecticut Trails Day Weekend will be here soon and, in celebration, the Pomperaug River Watershed Coalition will lead an outing to Nonnewaug Falls on Sunday June 4 at 12:30 PM.

Join PRWC for a leisurely paced nature walk along the edge of a farm field, up a moderate hill, over uneven terrain and into a well-wooded area that surrounds the beautiful and culturally significant waterfalls.

Participants are invited to bring their own lunch to eat at the edge of the falls while learning about the historical and modern day importance of this site. Highlights include discussion about the native tribe after which the Nonnewaug River is named. Guests will learn about the role the Nonnewaug River has in supplying a portion of the community with their drinking water as well as supporting the downstream flows of the Pompearug River. Points of interest on the hike include the large oak "Treaty Trees" (c. 1700) and the plaque dedicated to Cheif Nonnewaug.

Participants should bring lunch, water, wear sturdy shoes, be prepared for nuisance bugs and be aware of slippery surfaces and steep slopes near the falls. Participants are encouraged to pre-register by calling 203-263-0076 or emailing outreach@pomperaug.org. Due to limited parking at the trail head, participants should plan to meet in the parking lot of the Woodbury Senior Center located at 281 Main Street South.

This hike will mark the first in a series of hikes slated for this summer as part of a new "River Ramblers" program where we will invite the community to join us in exploring a variety of trails near our rivers and streams. Visit our website for announcementss regarding dates and locations.

NEW! Statewide River Data Now Available Through Online Interactive Maps

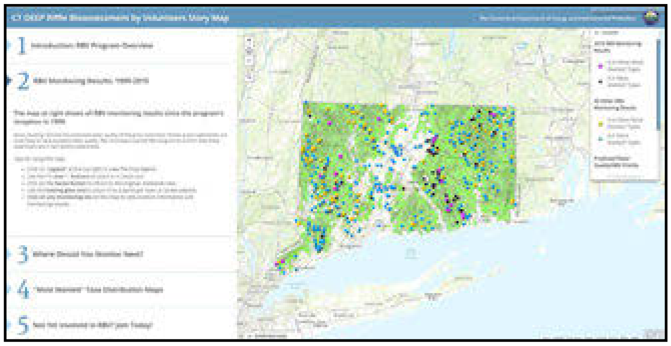
Macroinvertebrate Survey Results

We realize most people are not very big fans of river bugs, but we are! They can tell us a lot about water quality. That's why PRWC participates in Connecticut Department of Energy and Environmental Protection's Riffle Bioassessment by Volunteers program (aka Macroinvertebrate Survey Program) every fall. While we usually share results from our fall survey results with readers this time of year, we are instead going to direct you to a really cool online story map put together by CT DEEP where you can explore the results for yourself.

The story map is actually an interactive website that includes information and maps such as an RBV Program Overview; statewide volunteer monitoring results dating from 1999 through 2016; distribution maps of the "most wanted" taxa (aka "good bugs"); site photos; a list of current coordinators and participating organizations; and much more! Check it out today! https://tinyurl.com/RBVStoryMap

Fish Community Data

Ever wonder what types of fish live in our local rivers and streams? Or wonder how the fish community might be changing over time? Well, thanks to a really great effort between CT DEEP and UCONN's Center for Land Use Education and Research, you can now access fish community survey data statewide! Using the online interactive map hosted on the Connecticut Environemntal Condtions Online (CT ECO) portal, you are able to find out where CT DEEP collects its samples and what types of fish were observed each time they visited the site. There are several locations with the Pomperaug Watershed including ones on the Pomperaug, Nonnewaug, and Weekeepeemee Rivers as well as smaller tributaries like Sprain Brook, Wood Creek, Lewis Atwood Brook, and Bullet Hill Brook. Check it out! http://cteco-web1.grove.ad.uconn.edu/projects/fish/index.htm



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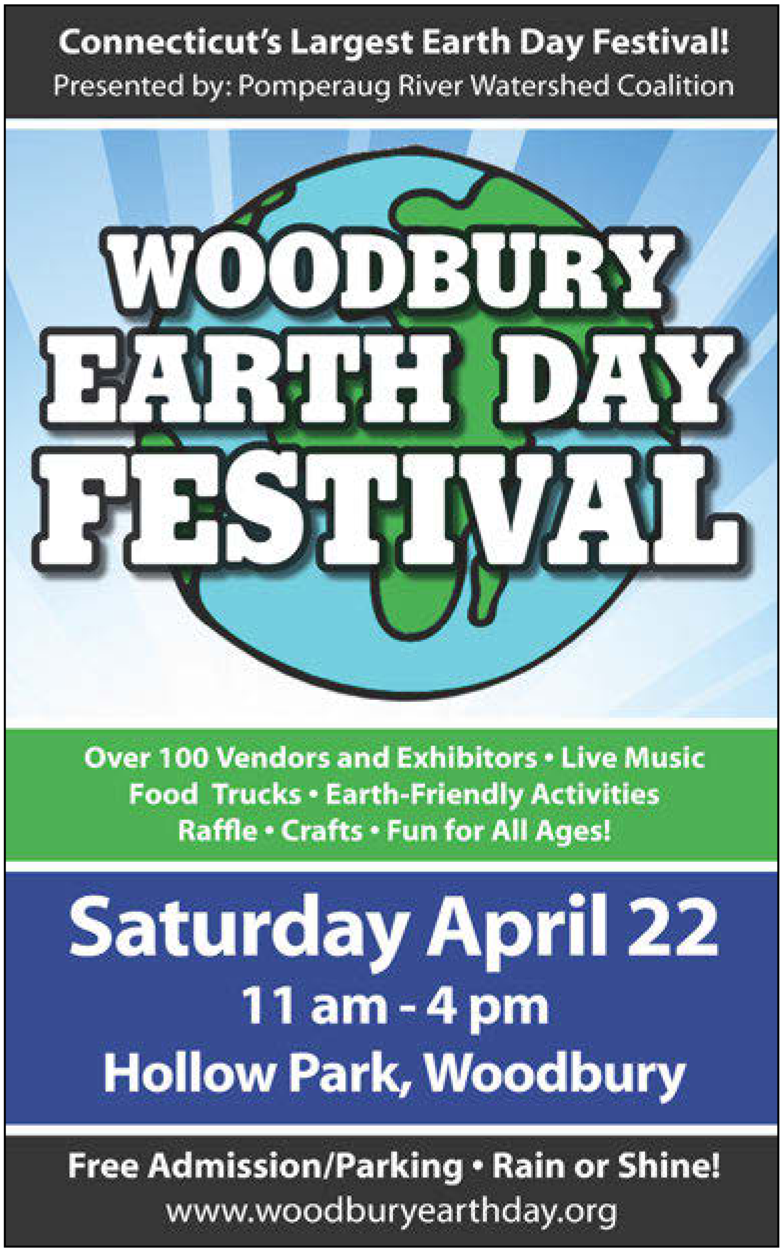

Connecticut's Largest Earth Day Festival!
Presented by: Pomperaug River Watershed Coalition

WOODBURY EARTH DAY FESTIVAL

Over 100 Vendors and Exhibitors • Live Music
Food Trucks • Earth-Friendly Activities
Raffle • Crafts • Fun for All Ages!

Saturday April 22
11 am - 4 pm
Hollow Park, Woodbury

Free Admission/Parking • Rain or Shine!
www.woodburyearthday.org

MAIN STAGE
Kristen Graves • The Wool Hats String Band
Maia Dobbs • The Dr. Steve Band
Raffle for the River Drawing & More!

FOOD TRUCKS
G-Monkey • Fryborg • Tipsy Cones
Chet's Italian Ice • Pizza to the People
Sonny's Grinders • Raw Youniverse • The Lucky Dog
The Farm Truck (Winvian) • Keifer's Kettle Korn

100+ VENDORS & EXHIBITORS
Local Artisans • Farmers & Growers
Nonprofit Organizations • Wellness Practictioners
Landscapers & Arborists • Home Energy Solutions
Home Improvement Services • & More

EARTH-FRIENDLY ACTIVITIES
Live Birds of Prey Presentation by Audubon Sharon
Yoga with Flow to Fit Yoga
Hoola Hooping with Bring the Hoopla
Arts & Crafts Tent by The Golden Button
Various Nature Walks along the Pomperaug River

THANK YOU TO OUR SPONSORS!
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New Morning Market
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Newtown Savings Bank • Waterbury Hospital

This newsletter is printed on 10% post-consumer recycled paper.

POMPERAUG RIVER WATERSHED COALITION

WATERSHED NEWS

Finding ways to keep our water pure and plentiful

Serving the Community Since 1999

Fall/Winter 2017-18

State Water Plan Update

At the end of June, the Final Draft of a comprehensive State Water Plan (SWP) was released for a 120-day public comment period ending November 20.

Along with numerous other key stakeholders, PRWC has been an active voice at the table in the planning for the SWP. Our engagement has been as members of both the Water Planning Council Advisory Group and the SWP Science & Technical Committee. That committee was charged with assisting with the science behind the SWP. Our goal had been to export local watershed knowledge into the SWP with the desired outcome being that the SWP would provide for the assembly of critical water resource data and meaningful policies and pathways to balance the competing needs for our water resources. *We believe that the SWP overall meets this goal.* It was an honor for us to have participated in the development of the SWP while working alongside so many talented individuals. We applaud the State Water Planning Council for its leadership in developing the SWP.

You can locate a copy of the Final Draft of the SWP at the following link: www.ct.gov/water. Although it is a very large document, we encourage you to review as much of the material as you have the time for while underscoring that the executive summary will give you a good understanding of the SWP. The link above also provides you with an opportunity to review comments on the SWP as provided by PRWC and others.

Once revised to reflect the outcome of public comment, the SWP is scheduled to be submitted to the Connecticut General Assembly by January 1, 2018 where the Joint Standing Committees on Environment, Public Health, Planning & Development and Energy & Technology may conduct a joint public hearing on the SWP. Changes may then be requested before it returns to the General Assembly for proposed adoption. PRWC looks forward to approval of the SWP and future participation in its implementation.

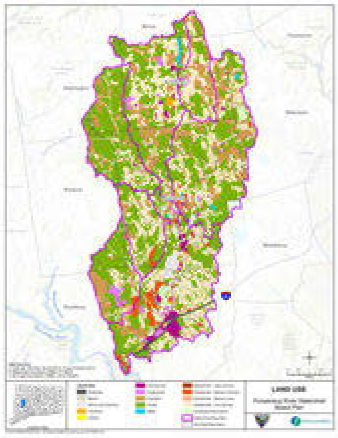
Successful Launch of Youth Conservation Corps

Thanks to generous environmental grant support from the Connecticut Community Foundation and other supporters, we successfully piloted a Youth Conservation Corps program this summer. We were able to further on-the-ground conservation efforts by hiring a team of local high school students to work on projects throughout the watershed. ***See page 2 for more photos of the team in action and to read about their accomplishments.***

Watershed Based Planning Continues

Late this summer, field scientists from the consulting firm Fuss & O'Neill traveled throughout the watershed to conduct Visual Assessment Surveys of select rivers and streams on behalf of PRWC. This work is part of a larger effort led by PRWC to update and upgrade its Watershed Based Plan, a project funded in part by Connecticut Department of Energy and Environmental Protection through a United States Environmental Protection Agency Clean Water Act Section 319 Nonpoint Source Grant and the Connecticut Community Foundation.

To best inform this Plan, current watershed conditions have been evaluated through the use of GIS mapping, bacteria and nutrient load potential has been estimated through computer modeling, and visual assessment survey data has been collected. The visual surveys have provided a general assessment of in-stream habitat, streambank, riparian buffer, and floodplain conditions; evaluated the potential for stormwater runoff to deliver soil, nutrients, and bacteria from the landscape to nearby waterways; and identified opportunities to implement green infrastructure to reduce stormwater runoff.



Current land cover map for the Pomperaug Watershed.

In regards to how the data will be used, Erik Mas, Project Manager and Vice President at Fuss & O'Neill said, "These data will help us better gauge the factors that may be contributing to reduced water quality conditions, and will allow us to develop site specific plans where measures can be implemented to minimize bacteria, nutrient and soil inputs into the Pomperaug River and its tributaries as well as to restore in-stream habitat."

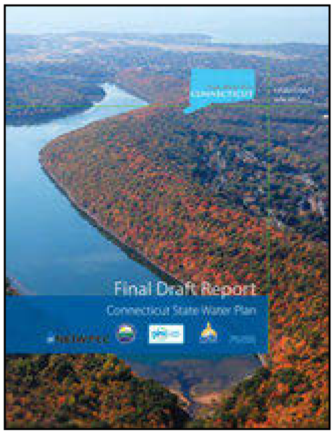
Findings and recommendations will be shared during informational sessions slated to be held in Bethlehem, Southbury, and Woodbury early this winter. At that time, PRWC will seek community input to help refine the Plan which will serve as a road map for state and local agencies to implement protection and restorative measures to further protect and enhance local water resources. The final Plan is expected in late winter.

Contact us to learn more about our activities: 203-263-0076 | info@pomperaug.org | www.pomperaug.org

Science, Stewardship, & Restoration

In the 2017 field season, PRWC's volunteers and staff surveyed macroinvertebrates at stream locations throughout the watershed as part of a statewide effort to document high quality streams - three of the sites are new this year and preliminary results show they will be ranked high. The team also deployed data loggers to record summer stream temperatures in an effort to document cold water habitat as well as thermally stressed areas. This year also marked the launch of the Youth Conservation Corps (YCC) program working throughout the watershed. Over the course of six weeks, the 5-member YCC crew diligently cleared more than a half acre of land area of invasive plants using only hand pulling methods and removed approximately 175 forty-five gallon bags (or 40 cubic yards) of invasive plant material from eight different work sites. In the process, the team learned how to identify 70 species of plants (native and invasive). The crew installed 380 stormdrain markers along 40 roads in Woodbury and Southbury, and they assembled and painted one rain barrel that was sold at the annual benefit in September. These activities were intended to help abate stormwater runoff and to improve riparian buffer habitat as well as stream water quality and to raise awareness among residents about where stormwater goes.

Water Resource Planning & Coalition Building



Final Draft Report

Connecticut State Water Plan

This year, PRWC has served as a technical resource and key leader in a number of water resource planning efforts on both the state and local level. These efforts include the development of Connecticut's first ever State Water Plan, an update/upgrade to the Pomperaug Watershed Based Plan to address factors potentially contributing to streams with known impairments; and facilitating discussions between municipal and utility representatives to establish drought and water conservation triggers to alleviate in-stream habitat stressors during times of low streamflow. Essential to each of these efforts has been PRWC's collection of scientific data and our ability to apply our research in partnership with stakeholders.

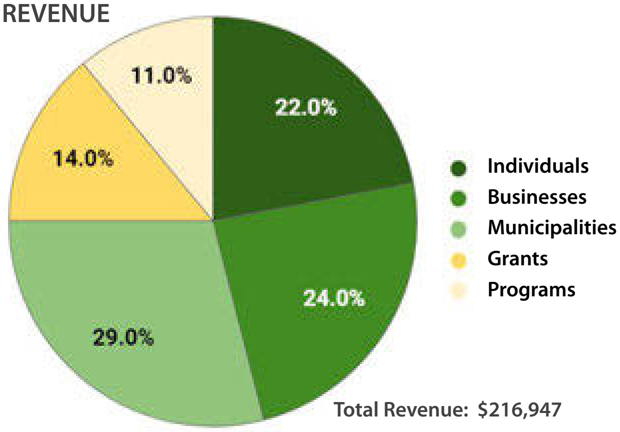
For more information and photos of our activities, visit www.pomperaug.org or follow us on Facebook.

Outreach & Education

Outreach and education programs have been strong over the past year! Highlights include: hosting Woodbury Earth Day with support from the town, an event that drew in 6000+ visitors; launching River Ramblers, a guided hike/walk series that kicked off during Connecticut Trails Day Weekend in June and that will continue next year; developing a water conservation education program in partnership with Connecticut Water Company, which they are teaching in schools in their 55 town service-area; leading hands-on water conservation activities at Woodbury's Parks & Recreation Summer Camp; facilitating a field trip to the Trolley Bed Preserve in collaboration with the After School Arts Program for third, fourth, and fifth grade students from the Children's Community School of Waterbury; introducing participants of the Western Connecticut Leadership Program to the charismatic creatures (fish and bugs) that reside in and rely on the Pomperaug; and raising community awareness about the watershed as an exhibitor at events like Woodbury Fall Festival, the Southbury Farmers' Market, Make a Splash Day at Woodbury Middle School, and so much more!

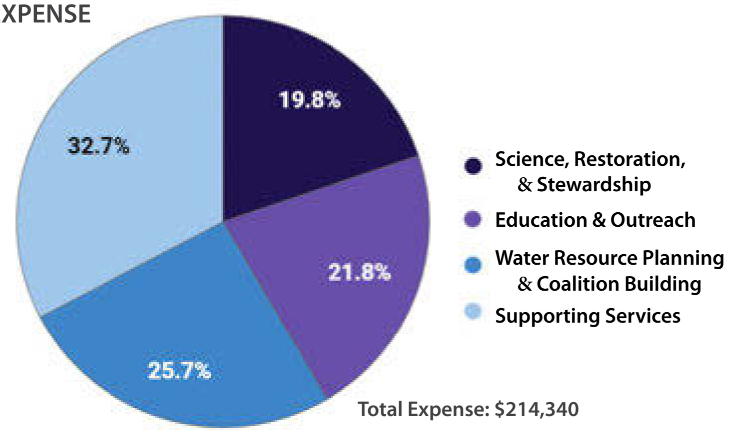
Fiscal Year 2017 Financial Summary

REVENUE



Total Revenue: $216,947

EXPENSE

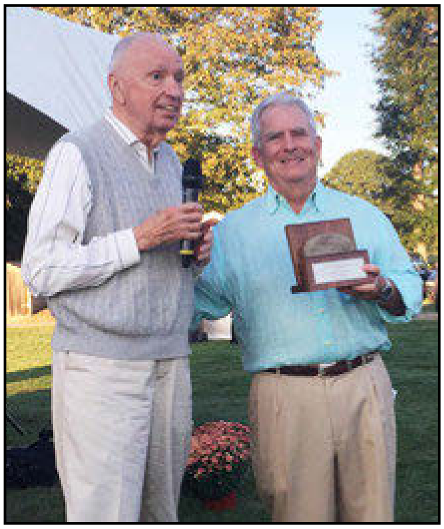


Total Expense: $214,340

The charts above summarize our revenue and expenses for the fiscal year ending June 30, 2017. Each revenue category is critical to the balance for the overall funding required for us to be successful in our mission. The expense summary shows how we utilize that funding support for our core areas of work. **You'll see that your financial support truly makes a difference and comes with our heartfelt appreciation!**

Pomperaug River Watershed Coalition
39 Sherman Hill Road, C103
Woodbury, CT 06798
www.pomperaug.org

FY 2017 Financial Summary &
Donor Recognition List Inside!



Dick Leavenworth Honored Recipient of the Dr. Marc J. Taylor Environmental Stewardship Award

At the end of September, PRWC held its annual benefit, JAZZ at the Lake, at Tranquillity Farm in Middlebury. Thanks to the support and dedication of many volunteers and donors, the generosity of our hosts Scott and Jean Peterson, our remarkable honorary chair Faith Middleton and our talented auctioneer Rick Richardson, some 240 supporters enjoyed a wonderful event.

During the celebration, Frederick "Dick" Leavenworth, of Woodbury, was presented with The Dr. Marc J. Taylor Environmental Stewardship Award. Dick was recognized as a tireless leader and advocate for protecting and enhancing the natural systems that make this corner of the world a special place. He has provided not only the Town of Woodbury but also northwest Connecticut with decades of conservation leadership that has effected meaningful protection and progress in the preservation of natural systems. *(Read more about Dick's achievements in the News section of our website.)*

In presenting the award, Vince McDermott, PRWC Board Chairman, remarked: "It is an honor for me to present Dick Leavenworth with the 2017 Dr. Marc J. Taylor Environmental Stewardship Award. The importance of his leadership and his conservation work cannot be overstated. He is a genuine man, highly regarded as a visionary and protectorate of all that surrounds us and one that we are all grateful to call a friend."

In accepting the award Dick spoke of the importance of everyone's actions toward environmental protection and stewardship. He emphasized the significance of Marc Taylor's ability to passionately fight for water resource and land protection as well as the need to prepare the next generation of environmental stewards. Dick spoke of his honor in receiving the award and to having joined a distinguished group of past recipients who include Margaret Minor of Rivers Alliance of Connecticut and Tom Crider of the Southbury Land Trust.

CONTACT INFORMATION

Phone: 203-263-0076
Email: info@pomperaug.org
Website: www.pomperaug.org

PRWC STAFF

Len DeJong, Executive Director
Carol Haskins, Outreach Director
Anne Urkawich, Mngr. Admin. & Devel.

POMPERAUG RIVER WATERSHED COALITION

WATERSHED NEWS

Finding ways to keep our water pure and plentiful

Serving the Community Since 1999

Spring/Summer 2018

Youth Conservation Corps Program Continues Another Season

Josephine Purdy (left), 2017 Dr. Marc Taylor Intern, worked together with the YCC crew to remove invasive plants growing along the banks of the Pomperaug River at a site in Woodbury.

Thanks to generous grant support from the Connecticut Community Foundation (CCF), the Pomperaug River Watershed Coalition (PRWC) will again hire high school students this summer to serve on the Youth Conservation Corps. The Youth Conservation Corps provides employment opportunities for area students to gain experience and knowledge while working outdoors on meaningful conservation projects throughout the watershed. Projects will include activities such as maintaining local trails, constructing rain gardens, improving riparian habitat, removing invasive species, mitigating soil erosion, and more.

Josh Carey, Director of Grants Management at CCF, noted, "the Youth Conservation Corps leverages the talent and energy of our young residents to create real environmental impacts in our communities. This program will also help the next generation to develop critical leadership skills as they educate the broader public about effective ways to protect our natural resources. The Foundation is happy to support PRWC in offering these innovative opportunities for civic engagement and environmental stewardship."

(continued page 2)

Pollutant Load Modeling Completed for the Watershed

Over the past several months, PRWC has been working with Fuss & O'Neill, an environmental consulting firm, to update the Pomperaug Watershed Management Plan to a 9-element Watershed Based Plan for approval by the U.S. Environmental Protection Agency (EPA).

The focus of our Watershed Based Plan is to reduce the amount of bacteria entering the local streams which are listed as impaired by CT Department of Energy and Environmental Protection and EPA. There are three stream segments in the Pomperaug Basin where in-stream bacteria levels were measured in excess of the water quality standard for recreation. While the data supporting these listings have been limited, further evaluation is still required to remove these streams from the State's list of impaired waters.

A key milestone in developing plans to reduce bacterial level was to estimate the potential volume of it that could be carried from the watershed lands into our rivers and streams. We used a pollutant loading model to make such an estimate. The model also provided us with estimates for other pollutants including nutrients like nitrogen and phosphorus as well as total suspended solids (a factor of soil erosion). The model used the most recent land cover data, precipitation data, soil data, and more to estimate the relative sources of these pollutants and their potential volumes that could enter our streams.

PRWC's Land Use Committee will be using this information to determine what practices can be implemented to reduce the pollutant loads and where they may most effectively be implemented to improve in-stream water quality.

We encourage you to review the findings of the pollutant loading model and to attend one of the upcoming information sessions (to be scheduled) to learn more about the model results and next steps in developing and implementing the updated Watershed Based Plan.

Most recent land use map for the Pomperaug Watershed.

Contact us to learn more about our activities: 203-263-0076 | info@pomperaug.org | www.pomperaug.org

POMPERAUG RIVER WATERSHED COALITION

CONTACT INFORMATION

Phone: 203-263-0076
Email: info@pomperaug.org
Website: www.pomperaug.org

BOARD OF DIRECTORS

Vince McDermott, Chairman
Gail McTaggart, Vice-Chairman
John Lacadie, Treasurer / Secretary

Marianne Bette
Ann Feinberg
Curt Jones
Dick Leavenworth
Wayne McCormack
Frank Scherer
Dan Slywka
Christopher Wood

PRWC STAFF

Len DeJong, Executive Director
Carol Haskins, Outreach Director
Anne Urkawich, Mgr. Admin. & Devel.

THE POMPERAUG WATERSHED

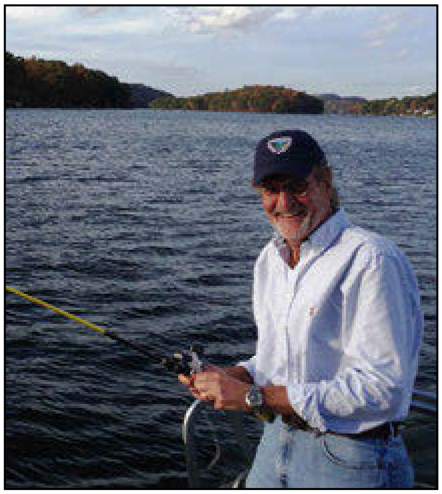
A MESSAGE FROM THE EXECUTIVE DIRECTOR

Going Fishin' and So Much More!

I suspect that I'm not alone in bidding farewell to the March Nor'easters and welcoming the warmth of springtime and all that our beautiful Pomperaug watershed affords us. Shortly the fishing equipment will appear at my home as "opening day" arrives. So too, I'll locate my walking stick as I venture out with family and friends on hiking trails through spectacular lands dotting the watershed. These lands have been preserved as open space and stream protection buffers by our municipal and conservation partners. I'll locate a spot to reflect along the water's edge by some of the most well cared for and highest quality rivers and streams in Connecticut. I'll bring along and enjoy water from my public water supply tap knowing the critical importance that river protection stewardship has on the groundwater below and the water we drink. And there is so much more…

At PRWC we strive to be true to our mission to use sound science and educational outreach for the protection of our local water resources. Our nearly two year collaborative effort in regard to State-wide water resource planning along with our local focus toward an EPA-approved watershed based plan are but two examples of how we have recently and effectively used science. On April 21, in partnership with the Town, as part of our educational outreach we'll again host Woodbury Earth Day, the largest celebration of its kind in the State. And shortly, our Dr. Marc Taylor Internship and Youth Conservation Corps programs will be kicking off. And there is so much more…

As a coalition-based organization none of our accomplishments happen without our volunteers, community partners, sponsors and donors. For that support I am sincerely appreciative. I hope that you agree that our work toward the protection of our water resources is the best way we can thank you. I invite you to visit our website or give us a call. Please do find that fishing pole or walking stick and enjoy the beauty of our watershed. There is truly so much more…

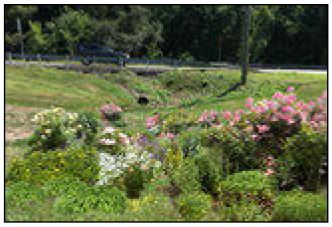


Gratefully, LEN

Youth Corps *(continued from page 1)*

Over the course of their six-week employment, students will work under the leadership of the Dr. Marc Taylor Intern on initiatives that achieve local conservation goals and promote the protection, restoration and remediation of water resources. This year's project sites include Audubon Bent of River, Flanders Nature Center & Land Trust, Roxbury Land Trust, the Southbury Land Trust, and a couple of local town parks. Together, our team will be underscoring our collective roles as stewards of our environment and promote good habits to keep our watershed and rivers healthy.

For more information or an application for employment, visit www.pomperaug.org/employment. Applications for Youth Conservation Corps crew member positions for this season will be accepted through April 22, 2018.



Rain Garden Installation Planned for Community House Park

Thanks to the diligent planning of our past interns, we are looking forward to installing a rain garden at Community House Park in Southbury this summer! The rain garden will help absorb and filter stormwater runoff flowing from the former basketball court, the bathhouse, and a driveway before flowing into a tributary to Bullet Hill Brook. Last fall, approvals for the rain garden were received from Southbury Parks & Recreation and the Public Works Department as they oversee management of the town owned property. Funding for the project has been made possible through a Watershed Assistance Small Grants Program grant administered by Rivers Alliance of Connecticut. Stay tuned to learn more about opportunities to volunteer on this and other conservation projects this summer.

Rain Barrel Workshop

Join Pomperaug River Watershed Coalition
under the Pavilion at Hollow Park
during Woodbury Earth Day
and Make Your Own Rain Barrel

Saturday April 21, 2018

Workshop 1 - 11:30 AM
Workshop 2 - 1:00 PM
Workshop 3 - 2:30 PM

Cost: $40 per barrel
(55-gallon barrel & conversion kit included)

Materials donated by:
River Network and Coca Cola

**Registration is limited to 1 barrel per household & 10 households per workshop.*
Pre-registration and payment is REQUIRED.
Participants MUST be prepared to bring their rain barrel home with them from the event.

CT Trails Day Weekend!
June 2-3, 2018
www.ctwoodlands.org

Join us for a walk around Transylvania Pond!

Guided Nature Water at Janie Pierce Park
Saturday, June 2, 2:00pm - 4:30pm

Kicking off this year's River Ramblers series with PRWC is a relatively flat walk around Transylvania Pond, which straddles the Southbury/Woodbury town line. Transylvania Pond is the headwater of Hesseky Brook, which flows north into a lush wetland that hosts numerous bird, mammal, reptile and amphibian species. Participants will learn about the history of the park, local flora and fauna, current issues surrounding the pond, and what steps we can all take to be good river stewards. Please dress for outside, wear sturdy shoes, bring water and snacks, and be prepared for nuisance bugs. Participants should meet in the parking lot at Janie Pierce Park located on Transylvania Road a few minutes before 2pm for check-in. For a listing of all 2018 Connecticut Trails Day Events, visit www.ctwoodlands.org

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Support PRWC during GiveLocal

This year, your gift to Pomperaug River Watershed Coalition during Give Local online giving campaign will do more than twice the good. **A generous donor just pledged to match all donations to PRWC through Give Local up to $10,000.** Support the PRWC Youth Conservation Corps and interns between April 24-25 and your gift of $25 becomes $50. Every dollar raised during the 36-hour online giving campaign will be stretched further by bonus funds and prizes donated by Connecticut Community Foundation and generous sponsors.

Please make a special gift to PRWC before the match runs out to have your gift more than doubled. Your gift will foster a sense of responsibility for natural resources, civic engagement and a life-long connection to the environment in our next generation of stewards. Every gift at any level makes a difference!

Don't let this generous matching opportunity float away!

Greater Waterbury and Litchfield Hills

April 24-25, 2018

Connecticut Community Foundation
www.GiveLocalCCF.org

Pomperaug River Watershed Coalition
39 Sherman Hill Road, C103
Woodbury, CT 06798
info@pomperaug.org

Catch up on the latest
Watershed News online!
www.pomperaug.org

Connecticut's Largest Earth Day Celebration!

Presented by:
Pomperaug River Watershed Coalition

Saturday April 21
11 am - 4 pm
Hollow Park, Woodbury

Event Highlights

MAIN STAGE
Hannah's Field • Al DeCant • The Sea, The Sea • Byron Eddy
The Wool Hats String Band • Maia Dobbs • Raffle for the River Drawing

FOOD TRUCKS
El Camion • The Big Green Eggs & Hamburgers • Sonny's Grinders • Fryborg
Pizza to the People • Hardcore Sweet • Chet's Italian Ice • Sonny's Grinders
Lenny & Joe's Fish Tales • Pork N' More Grill • Keifer's Kettle Korn • Tipsy Cones

100+ VENDORS & EXHIBITORS
Local Artisans • Farmers & Growers • Nonprofit Organizations
Specialty Foods • Wellness Practictioners • Landscapers & Arborists
Home Energy Solutions • Home Improvement Services • & So Much More

EARTH-FRIENDLY ACTIVITIES
Arts & Crafts • Live Animals • Yoga • Hoola Hooping • Nature Walks
Scavenger Hunt • Rain Barrel Workshops • & So Much More

THANK YOU TO OUR SPONSORS!
Heritage Village/Connecticut Water Company
New Morning Market • Aquarion Water Company • O & G Industries
Classic Turf • Giuliano Richardson & Sfara LLC • Haynes • Ion Bank
Milone & MacBroom, Inc. • Secor Cassidy, McPartland P.C. • Thule
Bennet Sullivan Association • Civil 1 • Daffodil Hill Growers • ECS Aeroseal
The Farm/Woodbury Sugar Shed • Gager, Emerson, Rickart, Bower & Scalzo, LLP
Hine Bros • Pediment Construction • Timex Group USA • Waterbury Hospital
Class Cycles • Echo Bay Marina • Pine Meadow Gardens • Riverview Cinema 8
USA Hauling • Woodbury Farm Market • JustWoodbury.com • Natural Awakenings

www.woodburyearthday.org

Free Admission/Parking • Fun for All Ages • Rain or Shine

This newsletter is printed on 10% post-consumer recycled paper.

Appendix H

Potential Funding Sources, Technical Assistance, and Other Resources

Pomperaug River Watershed Based Plan

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
Federal Sources		
EPA and WEF National Municipal Stormwater and Green Infrastructure Awards Program	The National Municipal Stormwater and Green Infrastructure Awards program, led by the Water Environment Federation (WEF) through a cooperative agreement with the U.S. Environmental Protection Agency (EPA), has been established to recognize high-performing regulated Municipal Separate Stormwater Sewer Programs (MS4s). The objective of the program is to inspire MS4 program leaders to seek new and innovative ways to meet and exceed regulatory requirements in a manner that is both technically effective as well as financially efficient. Recognition of innovative approaches is also a highlight of this program.	http://www.wef.org/ms4awards/
EPA Healthy Communities Grant Program	EPA New England's main competitive grant program to work directly with communities to reduce environmental risks to protect and improve human health and the quality of life.	http://www.epa.gov/region1/eco/uep/hcgp.html
EPA Environmental Education Grants	The Grants Program sponsored by EPA's Office of Environmental Education (OEE), Office of External Affairs and Environmental Education, supports environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality.	https://www.epa.gov/education/environmental-education-ee-grants
FEMA (Federal Emergency Management Agency) Preparedness (Non-Disaster) Grants	FEMA provides state and local governments with preparedness program funding to enhance the capacity of their emergency responders to prevent, respond to, and recover from a range of hazards.	https://www.fema.gov/non-disaster-grants-management-system
EPA Smart Growth	EPA helps communities improve their development practices and get the type of development they want. EPA works with local, state, and national experts to discover and encourage development strategies that protect human health and the environment, create economic opportunities, and provide attractive and affordable neighborhoods for people of all income levels.	https://www.epa.gov/smartgrowth/epa-smart-growth-grants-and-other-funding

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
FEMA Hazard Mitigation Assistance	FEMA's Hazard Mitigation Assistance grant programs provide funding to protect life and property from future natural disasters. • Hazard Mitigation Grant Program (HMGP) assists in implementing long-term hazard mitigation measures following a major disaster. • Pre-Disaster Mitigation (PDM) provides funds for hazard mitigation planning and projects on an annual basis. • Flood Mitigation Assistance (FMA) provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis.	http://www.fema.gov/hazard-mitigation-assistance
US Forest Service Land and Water Conservation Fund	The Land and Water Conservation Fund (LWCF) provides money to federal, state and local governments to purchase land, water and wetlands for the benefit of all Americans.	https://www.fs.fed.us/land/staff/LWCF/
United States Fish and Wildlife Service (USFWS)	The USFWS administers a variety of natural resource assistance grants to governmental, public and private organizations, groups and individuals.	http://www.fws.gov/grants/
USFWS North American Wetlands Conservation Act (NAWCA)	NAWCA provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands conservation projects in the United States, Canada, and Mexico for the benefit of wetlands-associated migratory birds and other wildlife.	https://www.fws.gov/birds/grants/north-american-wetland-conservation-act/how-to-apply-for-a-nawca-grant.php
USFWS National Coastal Wetlands Conservation Grant Program (NCWCGP)	The NCWCGP provides States with financial assistance to protect and restore these valuable resources. Projects can include (1) acquisition of a real property interest (e.g., conservation easement or fee title) in coastal lands or waters (coastal wetlands ecosystems) from willing sellers or partners for long-term conservation or (2) restoration, enhancement, or management of coastal wetlands ecosystems. All projects must ensure long-term conservation.	http://www.fws.gov/coastal/coastalgrants/

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
USFWS Partners for Fish and Wildlife Program	The Partners Program provides technical and financial assistance to private landowners and Tribes who are willing to work with USFWS and other partners on a voluntary basis to help meet the habitat needs of Federal Trust Species. The Partners Program can assist with projects in all habitat types which conserve or restore native vegetation, hydrology, and soils associated with imperiled ecosystems such as longleaf pine, bottomland hardwoods, tropical forests, native prairies, marshes, rivers and streams, or otherwise provide an important habitat requisite for a rare, declining or protected species.	http://www.fws.gov/partners/
National Oceanic and Atmospheric Administration (NOAA) Coastal Resilience Grants Program	This competitive grant program funds projects that are helping coastal communities and ecosystems prepare for and recover from extreme weather events, climate hazards, and changing ocean conditions.	http://www.coast.noaa.gov/resilience-grant
NRCS Conservation Reserve Program	The Conservation Reserve Program (CRP) pays a yearly rental payment in exchange for farmers removing environmentally sensitive land from agricultural production and planting species that will improve environmental quality.	https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index
NRCS Environmental Quality Incentives Program (EQIP)	For implementation of conservation measures on agricultural lands.	https://www.nrcs.usda.gov/wps/portal/nrcs/main/ct/programs/financial/eqip/
NRCS Emergency Watershed Protection (EWP) Program	The Emergency Watershed Protection (EWP) Program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, wind-storms, and other natural occurrences. EWP is an emergency recovery program, which responds to emergencies created by natural disasters. It is not necessary for a national emergency to be declared for an area to be eligible for assistance. EWP is designed for installation of recovery measures. Activities include providing financial and technical assistance to remove debris from stream channels, road culverts, and bridges, reshape and protect eroded banks, correct damaged drainage facilities, establish cover on critically eroding lands, repair levees and structures, and repair conservation practices.	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
NRCS Floodplain Easement Program	The Emergency Watershed Protection - Floodplain Easement Program (EWP-FPE) provides an alternative measure to traditional EWP recovery, where it is determined that acquiring an easement in lieu of recovery measures is the more economical and prudent approach to reducing a threat to life or property. The easement area will be restored to the maximum extent practicable to its natural condition. Restoration utilizes structural and nonstructural practices to restore the flood storage and flow, erosion control, and improve the practical management of the easement. Floodplain easements restore, protect, maintain and enhance the functions of floodplains while conserving their natural values such as fish and wildlife habitat, water quality, flood water retention and ground water recharge. Structures, including buildings, within the floodplain easement must be demolished and removed, or relocated outside the 100-year floodplain or dam breach inundation area.	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ct/programs/financial/ewp/?cid=stelprdb1244478
NRCS Healthy Forests Reserve Program	Helps landowners restore, enhance and protect forestland resources on private lands through easements and financial assistance.	http://www.nrcs.usda.gov/programs/hfrp/proginfo/index.html
U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Program	The Community Development Block Grant (CDBG) program is a flexible program that works to ensure decent affordable housing, provide services to the most vulnerable in our communities, and create jobs through the expansion and retention of businesses. CDBG-financed projects could incorporate green infrastructure into their design and construction. The Disaster Relief Appropriations Act of 2013 (Pub. L. 113–2) allocated $5,400,000,000 of Community Development Block Grant disaster recovery (CDBG–DR) funds for the purpose of assisting recovery in the most impacted and distressed areas declared a major disaster due to Superstorm Sandy.	https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
State Sources		
CT Department of Agriculture (CT DOAG) Farmland Restoration Program (FLRP)	The main objective of this voluntary program is to increase the State's resource base for food and fiber production agriculture focusing primarily on prime and important farmland soils.	http://www.ct.gov/doag/cwp/view.asp?a=3260&Q=498322
CTDEEP Section 319 Grant Program	Federal Clean Water Act Section 319 funds, administered by CTDEEP, are intended to effectively and efficiently address nonpoint source pollution are available to municipalities, nonprofit environmental organizations, regional water authorities/planning agencies, and watershed associations. Section 319 funds may be used for watershed based plans implementation projects, watershed based plan development, implementation of non-structural BMPs, and other related activities.	http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325594&deepNav_GID=1654
CTDEEP Connecticut Clean Water Fund	The Connecticut Clean Water Fund (CWF) is the state's environmental infrastructure assistance program. The fund was established in 1986 to provide financial assistance to municipalities for planning, design and construction of wastewater collection and treatment projects. This program was developed to replace state and federal grant programs that had existed since the 1950s. The 1987 amendments to the Federal Clean Water Act required that states establish a revolving loan program by 1989. The fund was modified in 1996 to include the Drinking Water State Revolving Fund (DWSRF) to assist water companies in complying with the Safe Drinking Water Act by providing low cost financing. The CWSRF currently includes set-asides or reserves categories for green infrastructure, river restoration and small community wastewater (including decentralized) systems.	http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325576&deepNav_GID=1654%20
Long Island Sound Study - Long Island Sound Research Grant Program	To support research that will enhance scientific understanding of Long Island Sound, and provide information needed by managers to protect and effectively manage the Sound and its valuable resources. Available to Connecticut academic institutions.	http://longislandsoundstudy.net/research-monitoring/lis-research-grant-program/

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
CTDEEP Recreational Trails Grants Program	Since 2015, CTDEEP's recreational trails program has provided funding to non-profits, municipalities, state departments and tribal governments in support of trail construction and/or restoration projects, accessibility improvements, purchase of trail maintenance equipment, land acquisition, and educational programs. Requests should be under $1million, and a 20% match is required.	http://www.ct.gov/deep/cwp/view.asp?a=2707&q=513740&deepNav_GID=1650
CTDEEP Long Island Sound License Plate Program	Section 14-21e of the Connecticut General Statutes (CGS) authorizes the issuance of the Long Island Sound license plate by the Department of Motor Vehicles, while CGS Section 22a-27k establishes the Long Island Sound Fund to be administered by the Department of Energy and Environmental Protection into which proceeds from the sale of the plates are deposited.	http://www.ct.gov/dep/cwp/view.asp?a=2705&q=323782&depNav_GID=1635
CTDEEP Open Space and Watershed Land Acquisition	The Open Space and Watershed Land Acquisition (OSWA) Grant Program provides financial assistance to municipalities and nonprofit land conservation organizations to acquire land for open space and to water companies to acquire land to be classified as Class I or Class II water supply property.	http://www.ct.gov/dep/cwp/view.asp?a=2706&q=323834&depNav_GID=1641
CTDEEP Recreation and Natural Heritage Trust Program	The Recreation and Natural Heritage Trust program was created by the Legislature in 1986 in order to help preserve Connecticut's natural heritage. It is the CTDEEP's primary program for acquiring land to expand the state's system of parks, forests, wildlife, and other natural open spaces.	http://www.ct.gov/dep/cwp/view.asp?a=2706&q=323840&depNav_GID=1641
CTDEEP Urban Forestry Grant Programs	America the Beautiful Urban Forestry Grants: Grants of up to $12,000 are available to assist municipalities and non-profits in local urban forestry efforts. Urban Forestry Outreach Grant: Grants for non-profit organizations in urbanized areas to foster outreach in these areas.	http://www.ct.gov/dep/cwp/view.asp?a=2697&q=322872&depNav_GID=1631&depNav=|

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
Connecticut Institute for Resilience and Climate Adaptation (CIRCA) – Municipal Resilience Grant Program and Matching Funds Program	The Municipal Resilience Grant Program is for municipal governments and councils of government for initiatives that advance resilience, including the creation of conceptual design, construction (demonstration projects or other) of structures, or the design of practices and policies that increase their resilience to climate change and severe weather. The Matching Funds Grant Program is applicable to municipalities, institutions, universities, foundations, and other non-governmental organizations for matching funds for projects that address the mission of CIRCA. As of June 1, 2017, CIRCA is currently not accepting applications for the Municipal Resilience Grant Program or Matching Funds Program.	https://circa.uconn.edu/
CTDEEP Supplemental Environmental Project (SEP) Funds	In the settlement of an environmental enforcement case, CTDEEP will require the alleged violator to achieve and maintain compliance with State environmental laws and regulations and to pay a civil penalty. To further CTDEEP's goals to protect and enhance public health and the environment, in certain instances one or more environmentally beneficial projects, or Supplemental Environmental Projects, may be included in the settlement.	https://www.ct.gov/deep/lib/deep/enforcement/policies/seppolicy.pdf
CT Office of Policy and Management (OPM) Small Town Economic Assistance Program (STEAP)	Funds economic development, community conservation and quality of life projects for localities that are ineligible to receive Urban Action (CGS Section 4-66c) bonds. This program is administered by the Office of Policy and Management. STEAP funds are issued by the State Bond Commission and can only be used for capital projects. Eligible projects include projects involving environmental protection.	http://www.ct.gov/opm/cwp/view.asp?Q=382970
Connecticut In-Lieu Fee Program	The National Audubon Society, Inc., through its Connecticut program (Audubon Connecticut) is the sponsor of an In-Lieu Fee Program for aquatic resource compensatory mitigation required by Department of the Army authorizations. Audubon Connecticut administers a competitive grant funding program, soliciting proposals for wetland and waters restoration, enhancement, creation and/or preservation.	http://ct.audubon.org/conservation/in-lieu-fee-program http://www.nae.usace.army.mil/Missions/Regulatory/Mitigation/In-Lieu-Fee-Programs/CT/

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
Other Sources		
Private Foundations	Connecticut Community Foundation, Southbury Community Trust Fund, Ion Bank Foundation, Thomaston Savings Bank Foundation, The Watertown Foundation, Argall Hull Foundation, Kresge Foundation	https://conncf.org/ https://ionbank.com/about-us/foundation/ https://www.thomastonsavingsbank.com/foundation https://www.watertownfoundation.com/ www.kresge.org/programs/environment
NOAA Community-Based Restoration Program Partnership	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.	https://www.fisheries.noaa.gov/national/habitat-conservation/strategic-habitat-restoration
FishAmerica Foundation Conservation Grants	FishAmerica, in partnership with the NOAA Restoration Center, awards grants to local communities and government agencies to restore habitat for marine and anadromous fish species. Successful proposals have community-based restoration efforts with outreach to the local communities.	https://www.fishamerica.org/grants/
National Fish and Wildlife Foundation (NFWF) Five Star and Urban Waters Restoration Grant Program	The Five Star and Urban Waters Restoration Program seeks to develop nation-wide-community stewardship of local natural resources, preserving these resources for future generations and enhancing habitat for local wildlife. Projects seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development. The program focuses on the stewardship and restoration of coastal, wetland and riparian ecosystems across the country.	http://www.nfwf.org/fivestar/Pages/home.aspx
NFWF Long Island Sound Futures Fund	The Long Island Sound Futures Fund supports projects in local communities that aim to protect and restore Long Island Sound. It unites federal and state agencies, foundations and corporations to achieve high-priority conservation objectives. Funded activities demonstrate a real, on-the-ground commitment to securing a healthy future for the Long Island Sound.	http://longislandsoundstudy.net/about/grants/lis-futures-fund/
National Forest Foundation	Through its on-the-ground conservation programs, the National Forest Foundation supports action-oriented projects that directly enhance the health and well-being of America's National Forests and Grasslands and that engage the public in stewardship.	https://www.nationalforests.org/grant-programs

Pomperaug River Watershed Based Plan - Potential Funding Sources, Technical Assistance, and Other Resources

Funding Source	Description	Reference
Corporate Wetlands Restoration Partnership (CWRP)	The Corporate Wetlands Restoration Partnership (CWRP) is an innovative private-public initiative aimed at preserving, restoring, enhancing and protecting aquatic habitats throughout the United States. Bringing together corporations, federal and state agencies, non-profit organizations and academia, the CWRP allows members to contribute in a fundamental way to crucial projects involving America's coastal and inland aquatic resources and support related education programs. Since its inception in 1999, CWRP has aided in the restoration of more than 64,000 acres and 1,050 stream miles through the monetary donations and in-kind services of its corporate partners.	http://www.cwrp.org/
Trout Unlimited Embrace A Stream	Embrace-A-Stream (EAS) is a matching grant program administered by TU that awards funds to TU chapters and councils for coldwater fisheries conservation.	http://www.tu.org/conservation/watershed-restoration-home-rivers-initiative/embrace-a-stream
Wildlife Conservation Society Climate Adaptation Fund	Provides $2.5 million in funding annually, with awards ranging from $50,000 to $250,000. The program focuses on projects that promote functionality of ecosystems, long-term conservation impact, and landscape-scale impacts. All projects must conduct on-the-ground implementation; research and planning are not funded.	https://www.wcsclimateadaptationfund.org/program-information/

Note: Some grant programs, particularly federally-funded grant programs, may not allow the use of funds for projects/actions that are required as part of State or federal permit or enforcement-related actions. For example, projects intended to meet mandated requirements of the MS4 General Permit are not eligible for Section 319 NPS grants. However, Section 319 NPS grant proposals that provide stormwater mitigation above and beyond permit requirements may be considered.

Grant Search Resources

Please also see the following grant search resources for assistance in finding additional state, federal, local, and private sources of funding related to nonpoint source pollution management:

- Grants.gov
  http://grants.gov/

- Federal Assistance Listings
  https://www.cfda.gov/

- CTDEEP Watershed and Stormwater Funding Website
  http://www.ct.gov/dep/cwp/view.asp?a=2719&q=335494&depNav_GID=1654&pp=12&n=1

- EPA Funding Sources for Watershed Protection and Restoration
  https://www.epa.gov/nps/funding-resources-watershed-protection-and-restoration

- EPA Watershed Funding
  http://water.epa.gov/aboutow/owow/funding.cfm

- EPA Water Infrastructure and Community Resiliency Finance Center
  https://www.epa.gov/waterfinancecenter

- EPA Green Infrastructure Funding Website
  https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities

- Foundation Center: Philanthropy News Digest
  http://philanthropynewsdigest.org/rfps/(search)/?tags_interest[]=environment

- USDA National Agriculture Library: Water Quality Information Center
  https://www.nal.usda.gov/waic/water-quality#quicktabs-waic_water_quality=2

Other Nonpoint Source Funding Opportunities

Congressional Appropriation - Direct Federal Funding
State Appropriations - Direct State Funding
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 A stormwater utility operates much like an electric or drinking water utility. Fees collected from property owners go into a dedicated fund to pay specifically for the work of operating, maintaining, and improving stormwater infrastructure.
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.

Other Nonpoint Source Funding Opportunities

Excise Taxes
These taxes require special legislation, and the funds generated through the tax are limited to specific uses: lodging, food, etc.

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.

Green Bonds are a growing mechanism for funding green projects, including green infrastructure and flood resilience projects. Green bonds are debt instruments issued to finance environmental projects focused on climate change initiatives. The identification and labeling of a green bond is typically based on a set of voluntary standards drafted by a consortium of investment banks that outlines the process for issuers to designate specific green projects. The guidelines specify that a bond issue qualifies as green if the issuer uses the proceeds solely for capital expenditures associated with green or climate-related environmental benefits in accordance with certain standards.

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 for 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.

Other Nonpoint Source Funding Opportunities

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, Maryland is implementing a P3 program to retrofit 2,000 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.

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