Mad River Watershed Summary

Lilly Brook and Hitchcock Lake

WATERSHED DESCRIPTION

The Mad River watershed covers an area of approximately 13,024 acres in the western central area of Connecticut (Figure 1). There are several municipalities located at least partially in the watershed, including the City of Waterbury and the Town of Wolcott.

The Mad River watershed includes two segments impaired for recreation due to elevated bacteria levels (CT6914-06_01 and CT6914-06-1-L4_01). These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Several segments in the watershed are currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the 2010 Integrated Water Quality Report is included in Table 1 to show the status of waterbodies in the watershed (CTDEEP, 2010). Lilly Brook is not shown in Table 1 because it is a new listing for 2012.

Lilly Brook (CT6914-06_01) begins at the confluence with an unnamed tributary east of Todd Road in Wolcott, and ends at its confluence with the Mad River just west of Woodtick Road in Wolcott. This segment is 0.74 miles long and is located in the Town of Wolcott. Hitchcock Lake (CT6914-06-1-L1_01) is 100.3 acres and is located in the southeastern corner of Wolcott near the Waterbury and Cheshire town lines.

Lilly Brook and Hitchcock Lake have a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Both segments are impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches on Lilly Brook, the specific recreation impairment for Lilly Brook is for non-designated swimming and other water contact related activities. Hitchcock Lake has a designated beach, and the specific recreation impairment for Hitchcock Lake is for designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segments Name:
1. Lilly Brook (CT6914-06_01)
2. Hitchcock Lake (CT6914-06-1-L1_01)

Municipalities: Wolcott

Impaired Segment Length / Area: CT6914-06_01 (0.74 miles), CT6914-06-1-L1_01 (100.3 acres)

Water Quality Classification: Class A

Designated Use Impairment: Recreation

Sub-regional Basin Name and Code: Mad River, CT6914

Regional Basin: Naugatuck

Major Basin: Housatonic

Watershed Area (acres): 13,024

MS4 Applicable? Yes

Applicable Season: Recreation Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut

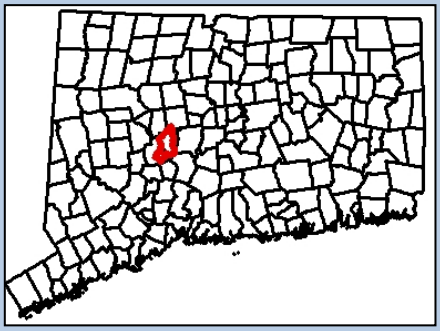


Table 1: Impaired Segment and nearby Waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles/ Acres	Aquatic Life	Recreation	Fish Consumption
CT6914-06-1-L1_01	Hitchcock Lake (Wolcott)	Southeast corner of Wolcott, near Cheshire border.	100.3	FULL	NOT	FULL
CT6914-00_01	Mad River (Waterbury) -01	From mouth at confluence with Naugatuck River (behind Roller Magic, off of Harvester Road), US to Route 69 crossing (US of I84 crossing, exit 22 area, and just US of Brass City Mall), Waterbury.	1.77	NOT	NOT	FULL
CT6914-00_02	Mad River (Waterbury) -02	From Route 69 crossing (US of I84 crossing, exit 22 area, and just US of Brass City Mall), US to confluence with Beaver Pond Brook, just US of I84 crossing (Scovill Pond no longer exists), Waterbury.	1.01	NOT	NOT	FULL
CT6914-00_03a	Mad River (Waterbury) -03a	From confluence with Beaver Pond Brook, (just US of I84 crossing and DS of Plank Road crossing, in former Scovill Ponds section), Waterbury, US to confluence with Lily Brook (CT6914-06 Gazetteer, and called Finch Brook in NHD), Wolcott.	3.46	NOT	NOT	FULL
CT6914-00_03b	Mad River (Waterbury) -03b	From confluence with Lily Brook (CT6914-06 Gazetteer, and called Finch Brook in NHD), US to Scoville Reservoir outlet dam (US of Nichol Road, parallel to Wolf Hill Road), Wolcott.	0.74	U	U	FULL
CT6914-00_04	Mad River (Waterbury) -04	From inlet to Scoville Reservoir (just US of Munson Road crossing), US to headwaters at Cedar Swamp Pond outlet dam, (just US of North Street crossing), northern Wolcott.	3.98	U	U	FULL

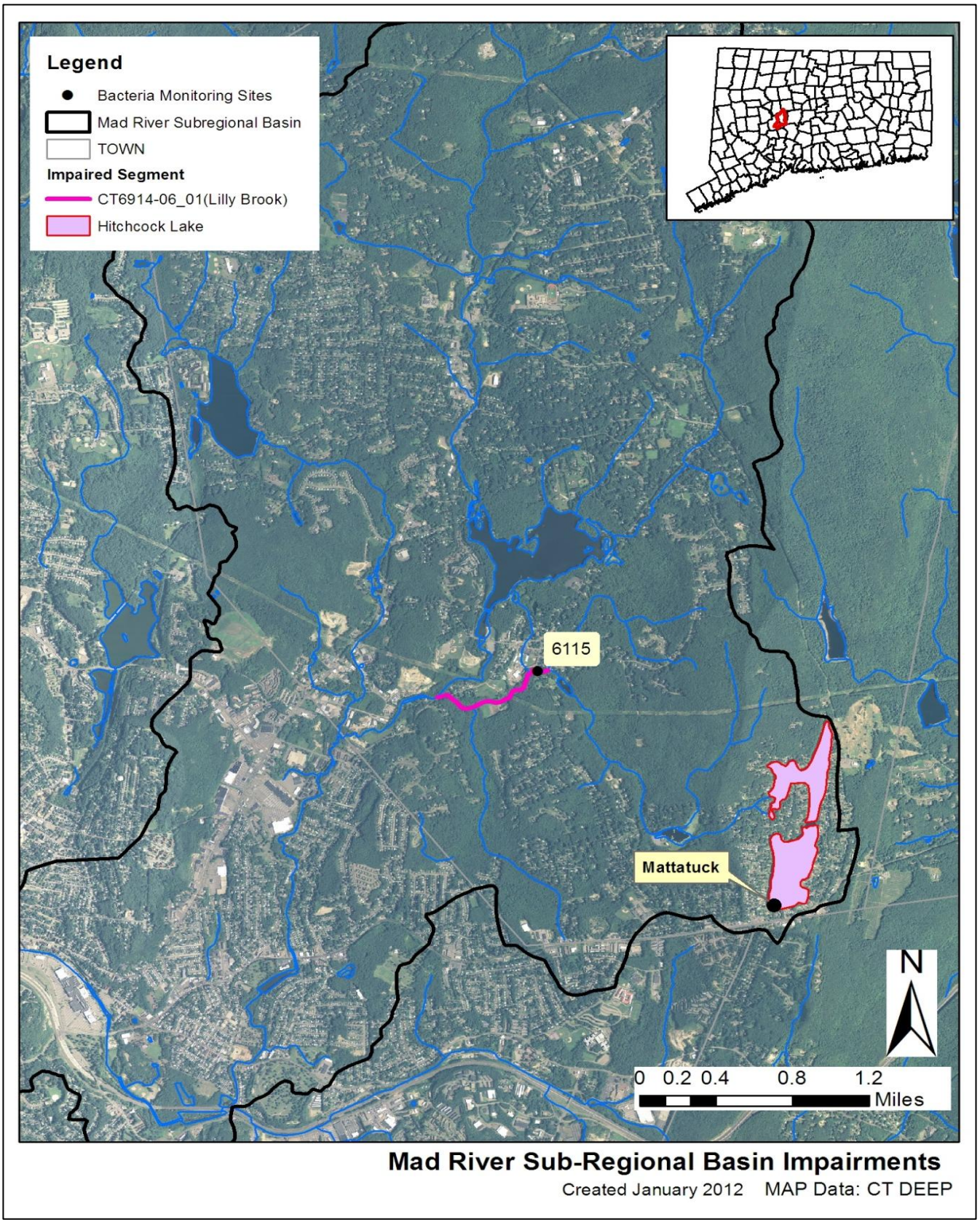
Shaded cells indicate impaired segment addressed in this TMDL

FULL = Designated Use Fully Supported

NOT = Designated Use Not Supported

U = Unassessed

Figure 2: GIS map featuring general information of the Mad River watershed at the sub-regional level



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Mad River watershed consists of 46% forest, 46% urban area, 1% agriculture, and 7% water. Lilly Brook's impaired segment flows through urban, forested, and agricultural areas. Portions of the watershed surrounding Hitchcock Lake in Wolcott are dominated by urban land use with some forested and agricultural uses (Figure 4).

Figure 3: Land use within the Mad River watershed

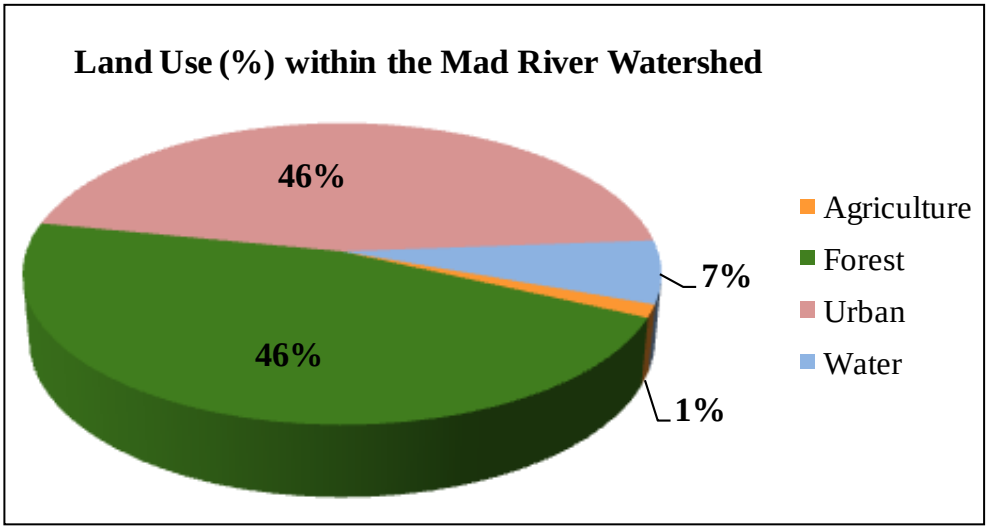
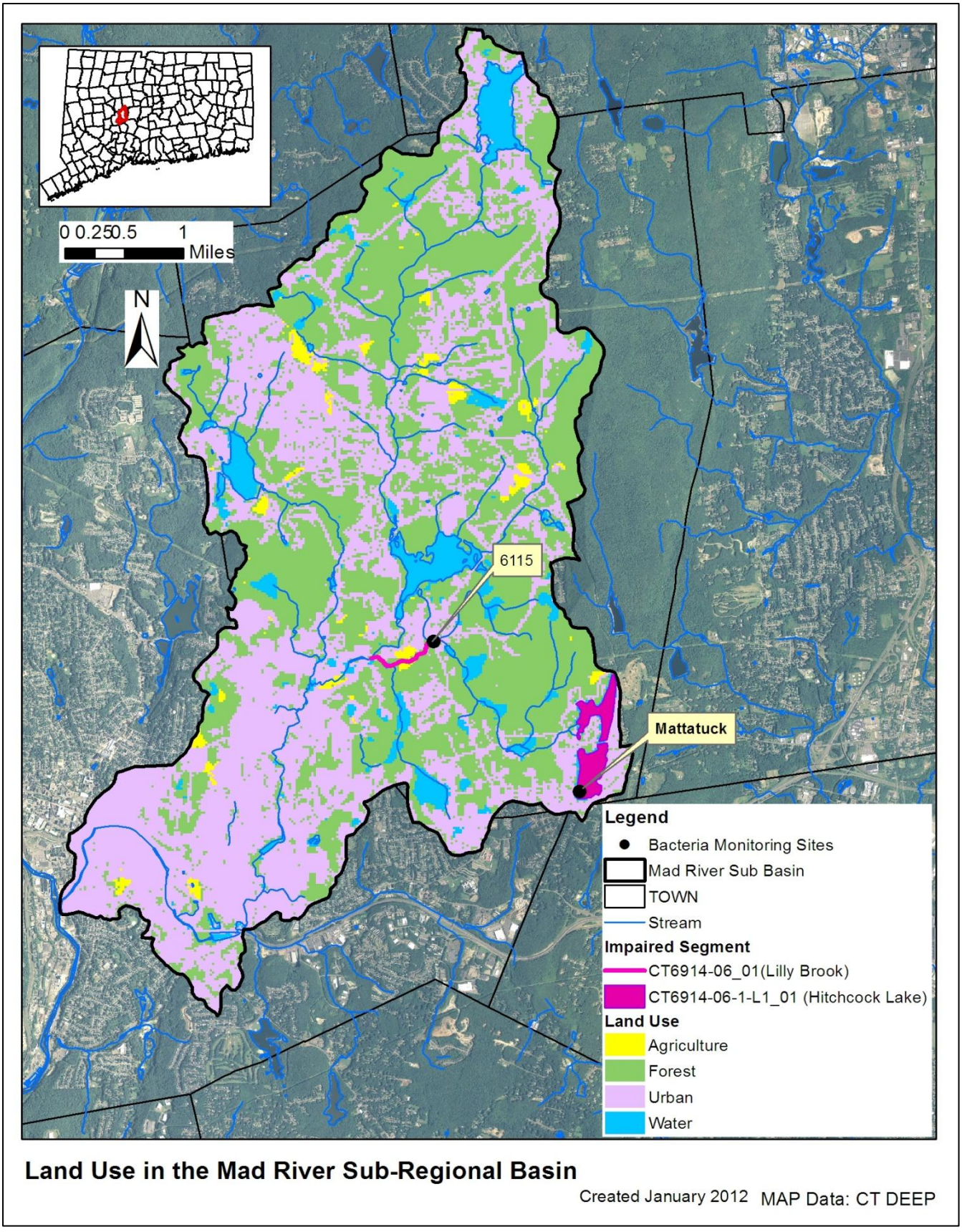


Figure 4: GIS map featuring land use for the Mad River watershed at the sub-regional level



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired segments in the Mad River watershed (stations organized downstream to upstream)

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT6914-06_01	Lilly Brook	6115	Todd and Frisbie Road intersection	Wolcott	41.576210	-72.978630
CT6914-06-1-L1_01	Mad River - Hitchcock Lake	MATT	--	Wolcott	--	--

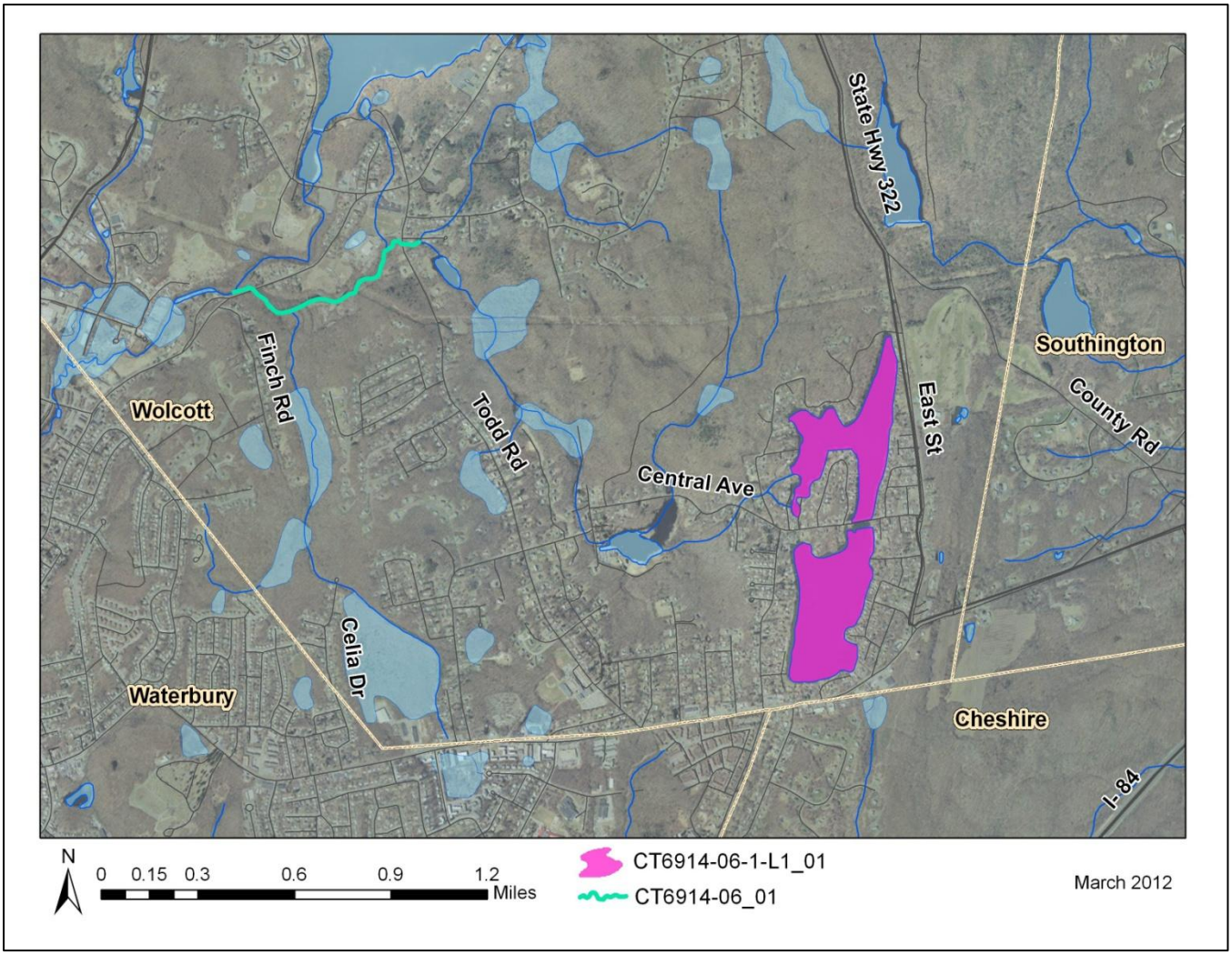
The impaired segment of Lilly Brook (CT6914-06_01) is a Class A freshwater stream. Hitchcock Lake (CT6914-06-1-L1_01) is a Class A freshwater pond (Figure 5). Their applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location (Station 6115) on Lilly Brook, and from one sampling location (Station MATT) on Hitchcock Lake (Table 2).

The water quality criteria for *E. coli*, along with bacteria sampling results from 2010, are presented in Table 8 for Lilly Brook, and sampling results from 2008-2011 are presented in Table 9 for Hitchcock Lake. The annual geometric mean was calculated for Station 6115 on Lilly Brook and exceeded the WQS for *E. coli* in 2010. Single sample values at this station also exceeded the WQS for *E. coli* on seven of the eleven (64%) samples taken in 2010. For Hitchcock Lake, single sample values for Station MATT exceeded the WQS for *E. coli* once in 2010. The annual geometric mean was calculated for Station MATT in each sample year, and the geometric mean did not exceed the WQS for *E. coli* in any sampling year.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days, where appropriate (Tables 8 and 9). For the impaired segment of Lilly Brook, the geometric mean during both wet and dry-weather exceeded the WQS for *E. coli* at Station 6115 with wet-weather values twice that of dry-weather. For Hitchcock Lake, the geometric mean did not exceed the WQS for *E. coli* at Station MATT for wet or dry-weather.

Due to the elevated bacteria measurements presented in Tables 8 and 9, Lilly Brook's impaired segment and Hitchcock Lake did not meet CT's bacteria WQS, were identified as impaired, and were placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of Lilly Brook and Hitchcock Lake



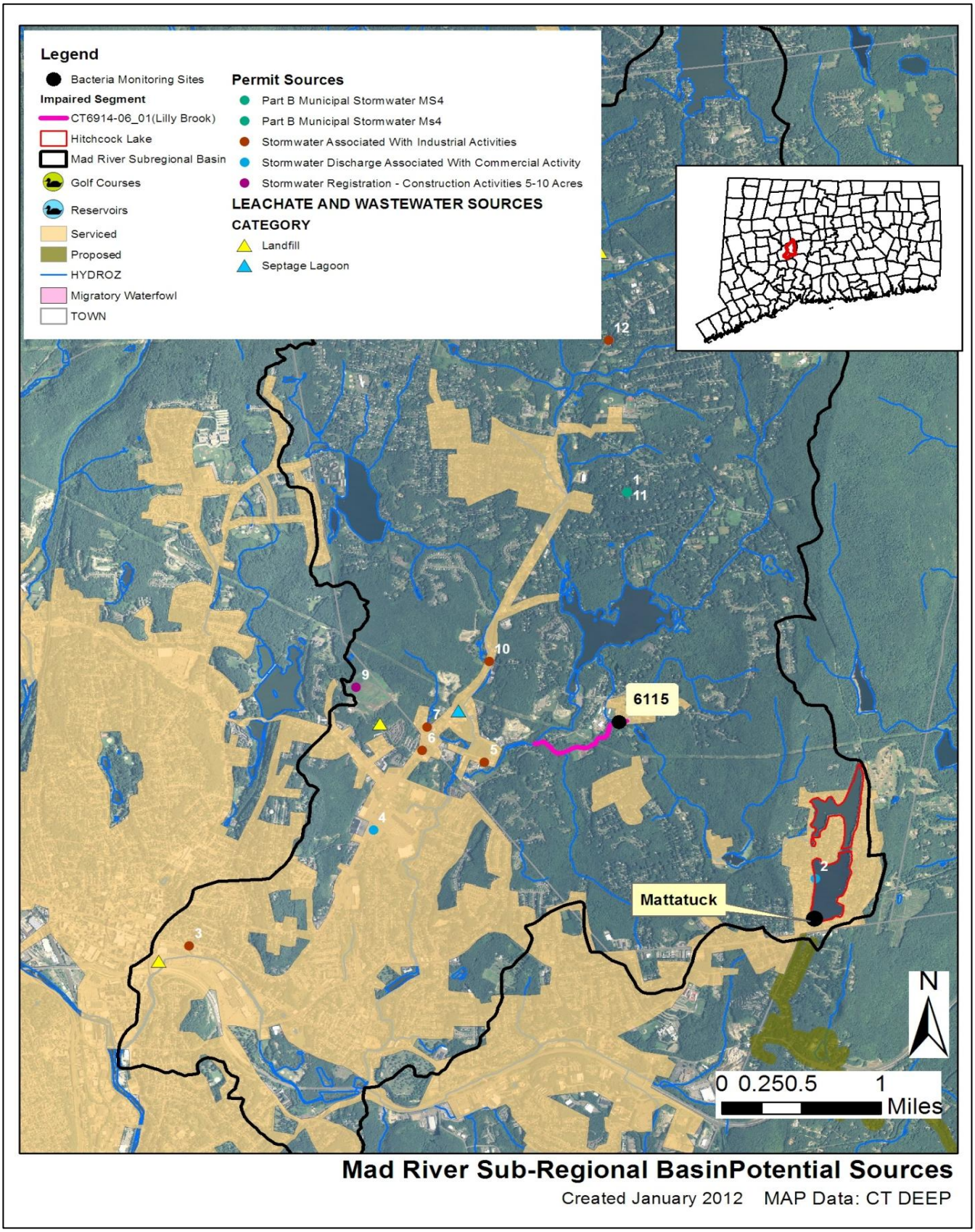
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Lilly Brook watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Lilly Brook CT6914-06_01	**x**	**x**		**x**	**x**	**x**	**x**	
Hitchcock Lake CT6914-06-1-L1_01	**x**	**x**		**x**		**x**	**x**	

Figure 6: Potential sources near Hitchcock Lake and Lilly Brook



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 6. Additional investigation and monitoring may reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type. When available, bacteria data results from these permitted sources are listed in Table 7.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	1
GSI	Stormwater Associated with Industrial Activity	6
GSM	Part B Municipal Stormwater MS4	1
GSN	Stormwater Registration – Construction	2
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Mad River watershed. Bacteria data is not currently available for any of these permitted discharges. However, permitted sources near the impaired segments (Figure 6) may be a potential source of bacterial contamination to Lilly Brook and Hitchcock Lake. Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Mad River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Waterbury	I.T.W. Inc.	GSI000251	Stormwater Associated With Industrial Activities	Itw Highland	6
Waterbury	Eyelet Design, Inc.	GSI001303	Stormwater Associated With Industrial Activities	Eyelet Design, Inc.	3
Waterbury	Wal-Mart Stores East, Lp	GSC000271	Stormwater Discharge Associated With Commercial Activity	Wal-Mart Store #3548	4
Waterbury	Supreme Industries, Inc.	GSN001877	Stormwater Registration - Construction Activities 5-10 Acres	Waterbury Landfill	9
Wolcott	Town Of Wolcott	GSM000033	Part B Municipal Stormwater Ms4	Wolcott, Town Of	N/A (11)
Wolcott	State Of Connecticut Department Of Transportation	GSI000087	Stormwater Associated With Industrial Activities	Wolcott Salt Storage Facility	12
Wolcott	Mattatuck Industrial Scrap Metal, Inc.	GSI000861	Stormwater Associated With Industrial Activities	Mattatuck Industrial Scrap Metal, Inc.	5
Wolcott	Secondaries, Inc.	GSI000919	Stormwater Associated With Industrial Activities	Secondaries, Inc.	7
Wolcott	Anstro Manufacturing, Inc.	GSI001797	Stormwater Associated With Industrial Activities	Anstro Manufacturing Inc.	10
WOLCOTT	HOME DEPOT U. S. A., INC. (Permittee), HOME DEPOT U. S. A., INC. (Unknown affiliation)	GSC000329	Stormwater Discharge Associated With Commercial Activity	Home Depot, The store #6235	2
Wolcott	TOWN OF WOLCOTT (Applicant)	200901957	Part B Municipal Stormwater MS4	WOLCOTT, TOWN OF	N/A (1)
Wolcott	State Of Connecticut Department Of Transportation	GSN002193	Stormwater Registration - Construction Activities 5-10 Acres	Route 69 With Woodtick Road And Long Swamp Road	8

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All

participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

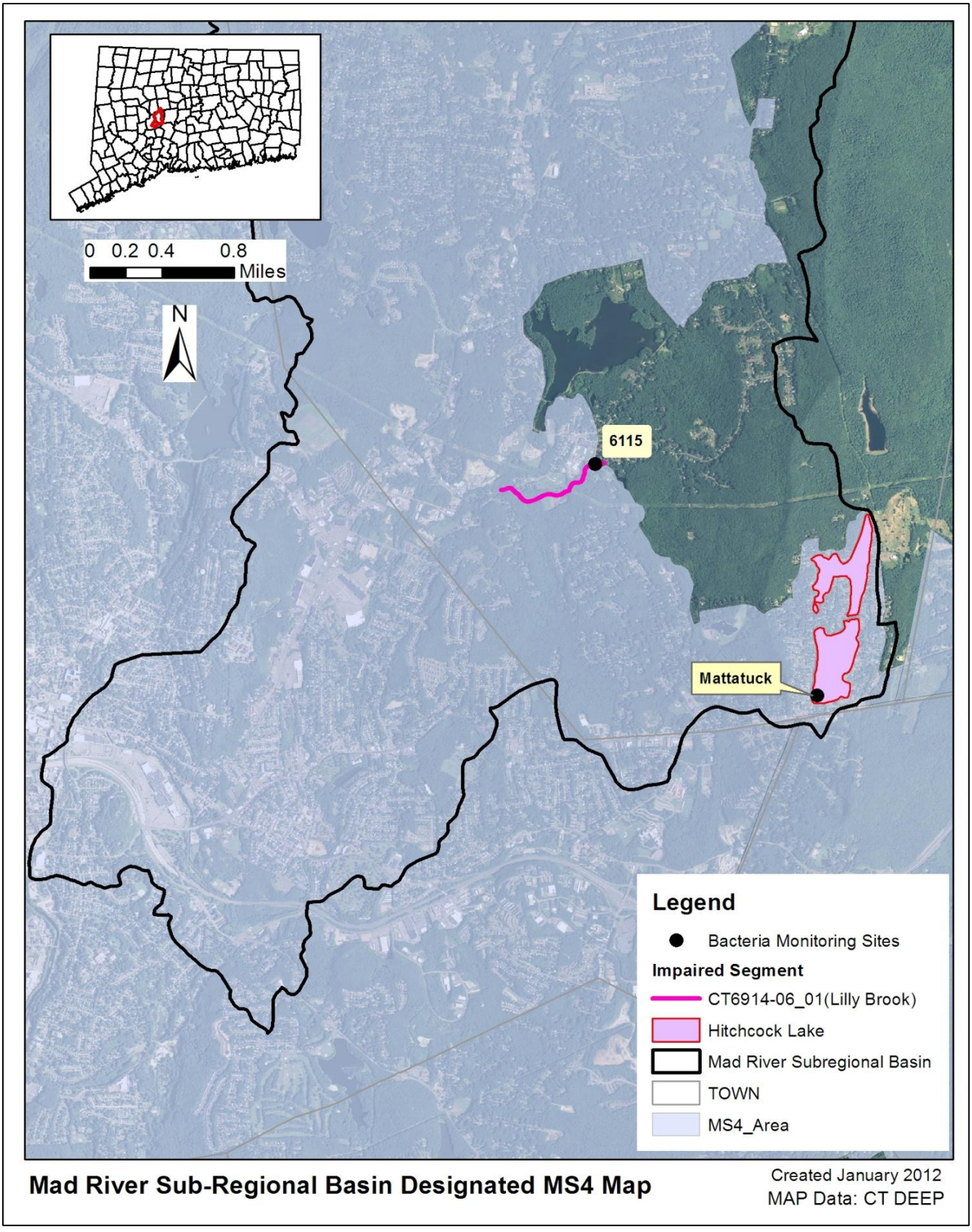
As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segments are located within the Town of Wolcott. Wolcott has designated urban areas, as defined by the U.S. Census Bureau, and is required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 10). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated

urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit required municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 7: MS4 areas of the Mad River watershed



Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Mad River watershed are described below.

Stormwater Runoff from Developed Areas

While portions of the Mad River watershed are undeveloped, approximately 46% of the watershed is considered urban, particularly surrounding the impaired segments in the Town of Wolcott (Figures 4 and 9). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

Approximately 10% of the Mad River watershed is characterized by 0-6% impervious cover, 46% is characterized by 7-11% impervious cover, 19% is characterized by 12-15%, and 24% is characterized by >16% impervious (Figure 8). Most of the highly developed portions of the watershed are located downstream of the impaired segments in the City of Waterbury. However, there are portions of the watershed consisting of 7-11% and 12-15% impervious cover near Lilly Brook's impaired segment and Hitchcock Lake (Figure 9). Water quality testing at Lilly Brook revealed WQS exceedances during wet-weather, which suggests that stormwater runoff is a likely source of bacterial contamination.

Figure 8: Range of impervious cover (%) in the Lilly Brook watershed

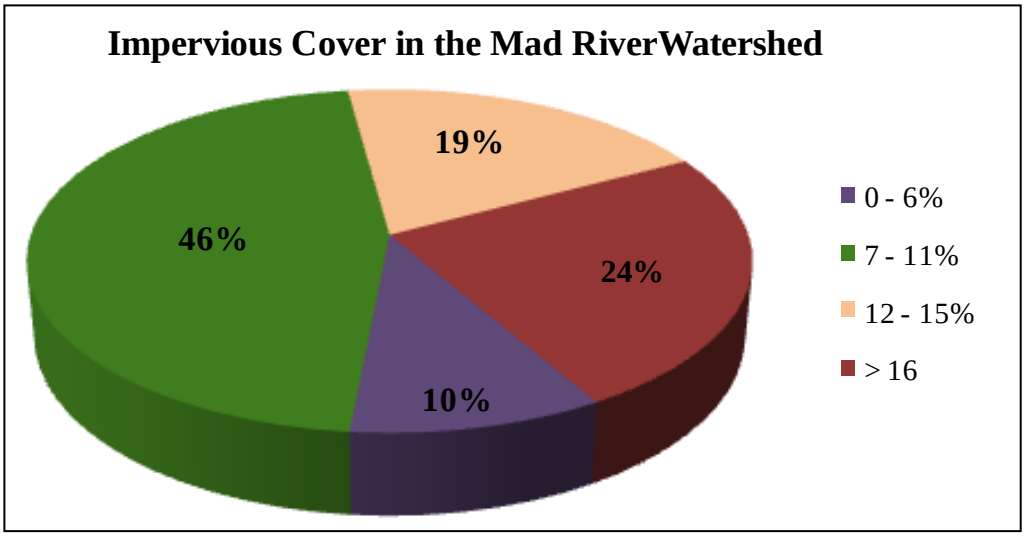
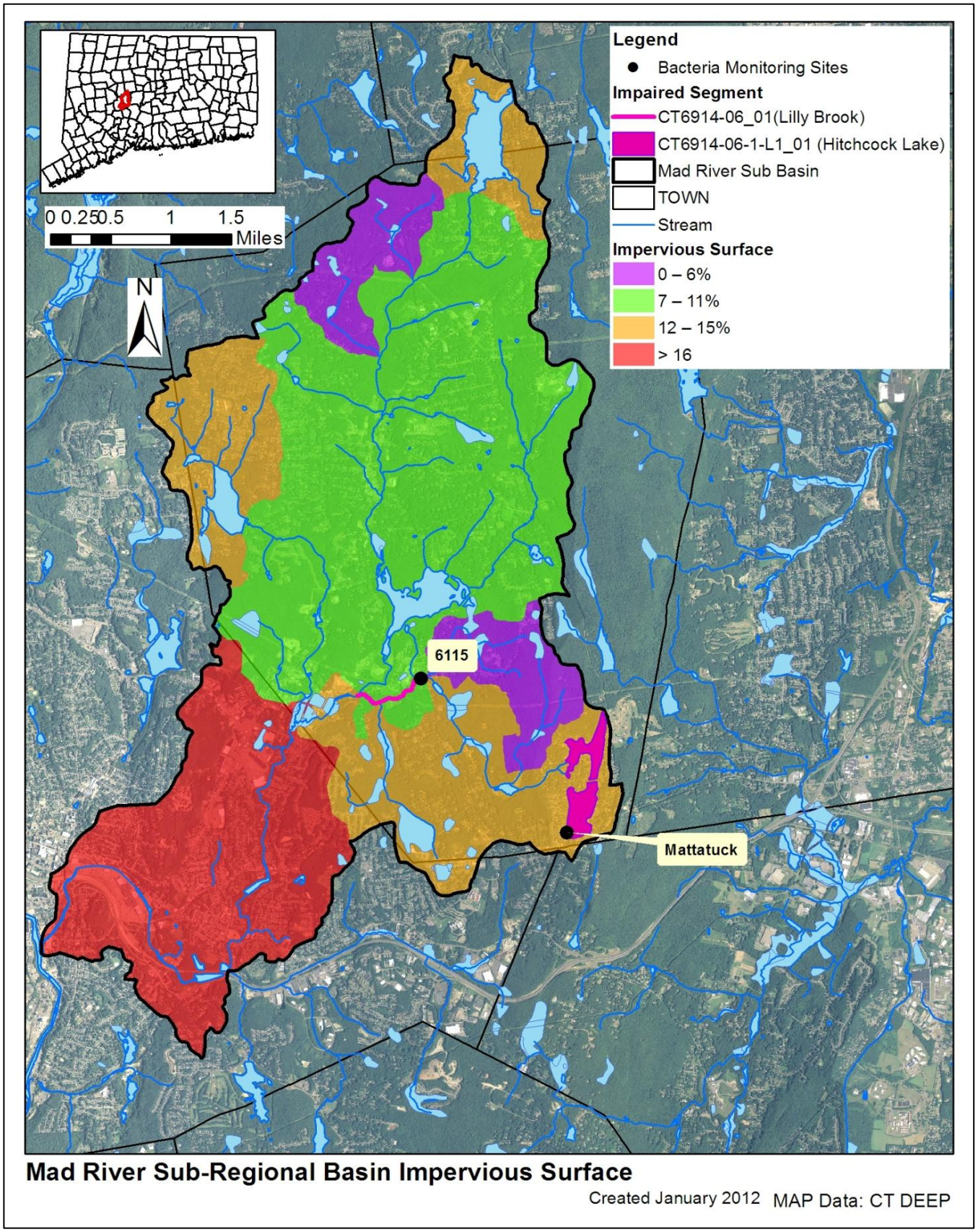


Figure 9: Impervious cover (%) for Mad River sub-regional watershed



Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, most residents surrounding Lilly Brook rely on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of Wolcott is part of the Chesprocott Health District (www.chesprocott.org/), which handles septic systems within the town.

There are multiple areas within the watershed with access to sanitary sewer, particularly Hitchcock Lake. Sewer system leaks and other illicit discharges within the watershed may be contributing bacteria to these waterbodies.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Mad River watershed represent a potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001).

The water surface of Hitchcock Lake itself may provide an area for waterfowl to congregate. Geese and other waterfowl are known to congregate in open areas, including recreational fields, golf courses, and agricultural crop fields. The recreational fields at the Frisbie School in Wolcott off Todd Road are near the impaired segment of Lilly Brook. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Dense residential development surrounds portions of Lilly Brook's impaired segment and the entire shoreline of Hitchcock Lake (Figure 4). When not disposed properly, waste from domestic animals, such as dogs, can enter surface waters directly or through stormwater infrastructure. Therefore, pet waste may also be contributing to bacteria concentrations in the impaired segment of Lilly Brook and Hitchcock Lake.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, allowing livestock to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Agricultural land use makes up only 1% of the Lilly Brook watershed. There is an agricultural operation located along Lilly Brook's impaired segment off Woodtick Road. This agricultural area is potentially carrying pollutants, including bacteria, into the impaired segment of Lilly Brook.

Additional Sources

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in Lilly Brook and Hitchcock Lake. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

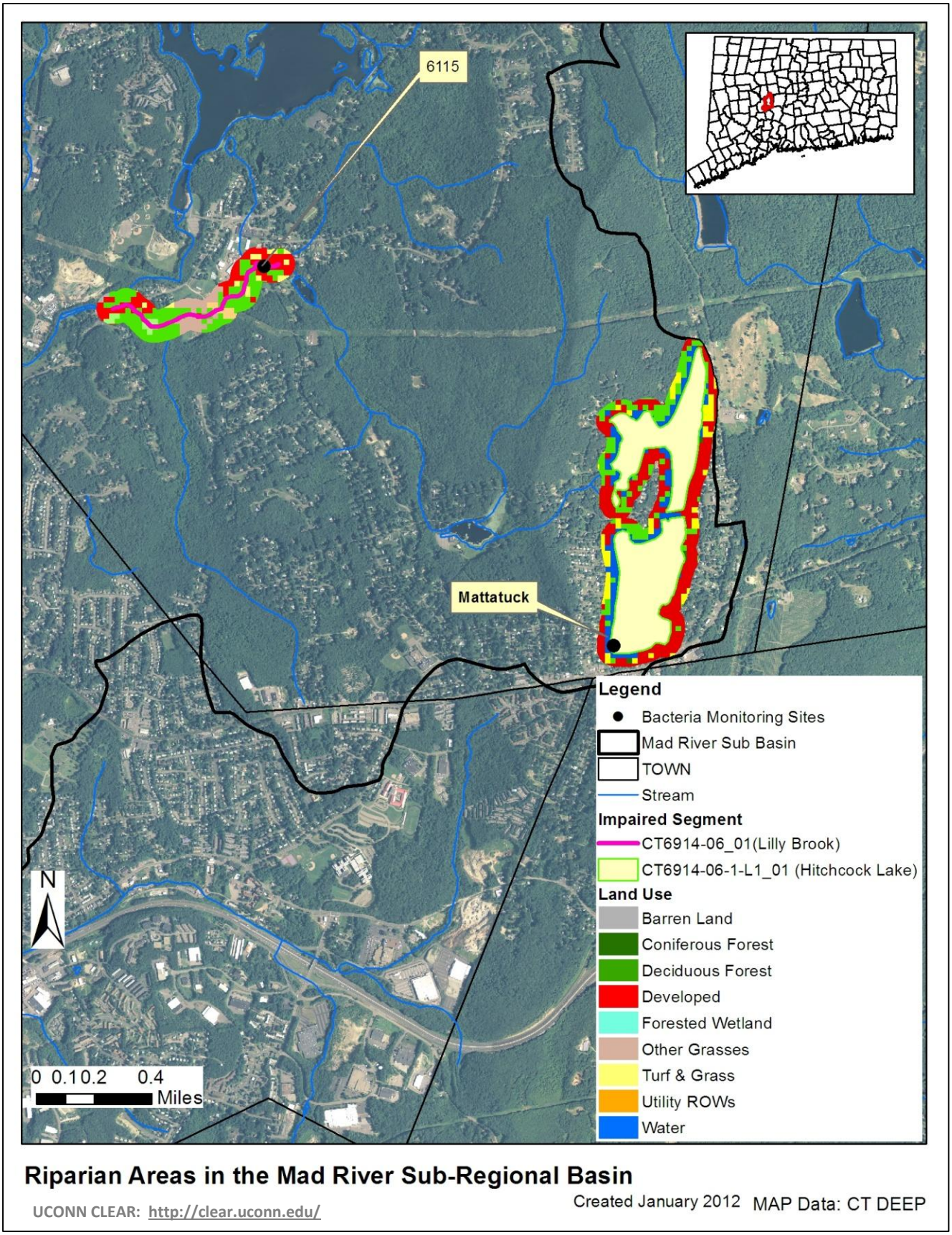
Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The majority of the riparian zone for the impaired segment of Lilly Brook is forested with some grassed and developed areas. The majority of Hitchcock Lake's riparian zone is developed with some forested and turf grass areas (Figure 10). As previously mentioned, developed areas and grassed areas (when frequented by waterfowl) are potential sources of bacteria.

Figure 10: Riparian buffer zone information for the Lilly Brook watershed



CURRENT MANAGEMENT ACTIVITIES

As indicated above, the portion of the watershed surrounding the impaired segments is regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Table 6.

Table 6: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Wolcott, CT (Permit # GSM000033)

Minimum Measure	Wolcott 2010 Annual Report
Public Outreach and Education	No updates.
Public Involvement and Participation	No updates.
Illicit Discharge Detection and Elimination	1) Hitchcock Lake Association mapped all drains that discharge to Hitchcock Lake. 2) Conducted 3 samplings on discharge areas required for permitting.
Construction Site Stormwater Runoff Control	1) Ensured that all applications adhere to the 2004 Stormwater Quality Manual.
Post Construction Stormwater Management	1) Reestablishing sediment and erosion controls after heavy rains.
Pollution Prevention and Good Housekeeping	1) Performed annual maintenance of catch basins. 2) Will repair deteriorated drainage areas. 3) Swept all town roads.

RECOMMENDED NEXT STEPS

Future mitigative activities are necessary to ensure the long-term protection of Lilly Brook and Hitchcock Lake and have been prioritized below.

1) Identify areas along Lilly Brook and Hitchcock Lake to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, the Town of Wolcott within the Mad River watershed is a MS4 community regulated by the MS4 program. Since 46% of the watershed is considered urban with a high percentage of impervious surfaces around the impaired segments, stormwater runoff may be contributing bacteria to these waterbodies. To identify specific areas that are contributing bacteria to the impaired segment of Lilly Brook and Hitchcock Lake, the town should conduct wet-weather sampling at stormwater outfalls that discharge directly to Lilly Brook and Hitchcock Lake. To treat stormwater runoff, the town should also identify areas along the more developed sections of Lilly Brook, particularly along the impaired segment and near Hitchcock Lake, to install BMPs that encourage stormwater to infiltrate into the ground before entering these waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to Lilly Brook's impaired segment and Hitchcock Lake. More detailed information and BMP recommendations can be found in the core TMDL document.

2) Implement a program to evaluate the sanitary sewer system.

Portions around Lilly Brook's impaired segment and the entire shoreline of Hitchcock Lake rely on a municipal sewer system (Figure 6). Ensuring there are no leaks or overflows from the sanitary sewer in this area should be made a priority. It is important for Wolcott to develop a program to evaluate its sanitary sewer and reduce leaks and overflows, especially in the areas around Lilly Brook's impaired segment and Hitchcock Lake. This program should include periodic inspections of the sewer line.

3) Develop a system to monitor septic systems.

The majority of residents adjacent to Lilly Brook's impaired segment rely on septic systems. If not already in place, Wolcott should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems**.**

4) Evaluate municipal education and outreach programs regarding animal waste.

Any education and outreach programs within Wolcott should highlight the importance of not feeding waterfowl and wildlife, and managing waste from dogs and other pets within the town. The Town of Wolcott and its residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the impaired segment of Lilly Brook and Hitchcock Lake that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Lilly Brook watershed, especially Lilly Brook and Hitchcock Lake, and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste

receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

5) Ensure there are sufficient buffers on agricultural lands along Lilly Brook.

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. As shown in Figure 10, there is an agricultural area within the riparian zone of Lilly Brook's impaired segment and particular attention should be paid to this area.

6) Monitoring of permitted sources.

While no data currently exists for the permitted discharges within the Mad River watershed, these discharges may still be contributing bacteria to Lilly Brook and Hitchcock Lake. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 7 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Mad River watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 7. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	1	2	3	1	2	3	**All**	**All**
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with “natural levels” if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 8: Lilly Brook Bacteria Data

Waterbody ID: CT6914-06_01

Characteristics: Freshwater, Class A, Potential Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **84%**

Single Sample: **97%**

Data: 2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 6115 on Lilly Brook with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
6115	Todd and Frisbie Road intersection	5/19/2010	490	wet	
6115	Todd and Frisbie Road intersection	6/9/2010	310	wet	
6115	Todd and Frisbie Road intersection	6/16/2010	110	dry	
6115	Todd and Frisbie Road intersection	6/23/2010	1700	wet	
6115	Todd and Frisbie Road intersection	6/30/2010	73	dry	
6115	Todd and Frisbie Road intersection	7/8/2010	290	dry	**765* (84%)**
6115	Todd and Frisbie Road intersection	7/14/2010	**12000* (97%)**	wet	
6115	Todd and Frisbie Road intersection	7/21/2010	880	wet	
6115	Todd and Frisbie Road intersection	8/4/2010	1600	dry	
6115	Todd and Frisbie Road intersection	8/12/2010	6900†	dry	
6115	Todd and Frisbie Road intersection	9/21/2010	750	dry	

Shaded cells indicate an exceedance of water quality criteria

†**Average of two duplicate samples**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for Station 6115 on Lilly Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6115	Todd and Frisbie Road intersection	2010	5	6	765	1222	518

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gage at Markham Municipal KMMK station in Meriden, CT

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 9: Hitchcock Lake Bacteria Data

Waterbody ID: CT6914-06-1-L1_01

Characteristics: Freshwater, Class A, Potential Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 235 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **NA**

Single Sample: **72%**

Data: 2008 - 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station MATT on Hitchcock Lake with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
MATT	Hitchcock Lake	5/27/2008	10	wet	20
MATT	Hitchcock Lake	6/2/2008	10	dry	
MATT	Hitchcock Lake	6/9/2008	140	wet	
MATT	Hitchcock Lake	6/16/2008	75	wet	
MATT	Hitchcock Lake	6/23/2008	64	wet	
MATT	Hitchcock Lake	6/30/2008	99	dry	
MATT	Hitchcock Lake	7/7/2008	10	dry	
MATT	Hitchcock Lake	7/14/2008	10	wet	
MATT	Hitchcock Lake	7/21/2008	10	dry	
MATT	Hitchcock Lake	7/28/2008	31	wet	
MATT	Hitchcock Lake	8/4/2008	10	dry	
MATT	Hitchcock Lake	8/11/2008	10	wet	
MATT	Hitchcock Lake	8/18/2008	10	dry	
MATT	Hitchcock Lake	8/25/2008	10	dry	

Single sample *E. coli* (colonies/100 mL) data from Station MATT on Hitchcock Lake with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
MATT	Hitchcock Lake	6/8/2009	10	dry	
MATT	Hitchcock Lake	6/15/2009	53	wet	
MATT	Hitchcock Lake	6/22/2009	53	wet	
MATT	Hitchcock Lake	6/29/2009	53	dry	
MATT	Hitchcock Lake	7/6/2009	53	dry	
MATT	Hitchcock Lake	7/13/2009	10	dry	
MATT	Hitchcock Lake	7/20/2009	53	dry	19
MATT	Hitchcock Lake	7/27/2009	10	dry	
MATT	Hitchcock Lake	8/3/2009	10	dry	
MATT	Hitchcock Lake	8/10/2009	10	dry	
MATT	Hitchcock Lake	8/17/2009	10	dry	
MATT	Hitchcock Lake	8/24/2009	10	dry	
MATT	Hitchcock Lake	8/31/2009	10	dry	
MATT	Hitchcock Lake	6/7/2010	42	dry	
MATT	Hitchcock Lake	6/15/2010	53	dry	
MATT	Hitchcock Lake	6/21/2010	42	dry	
MATT	Hitchcock Lake	6/28/2010	10	dry	
MATT	Hitchcock Lake	7/6/2010	10	dry	
MATT	Hitchcock Lake	7/12/2010	10	dry	
MATT	Hitchcock Lake	7/19/2010	**830* (72%)**	wet	
MATT	Hitchcock Lake	7/22/2010	10	wet	35*
MATT	Hitchcock Lake	8/2/2010	10	dry	
MATT	Hitchcock Lake	8/9/2010	31	dry	
MATT	Hitchcock Lake	8/16/2010	31	wet	
MATT	Hitchcock Lake	8/19/2010	31	dry	
MATT	Hitchcock Lake	8/24/2010	110	wet	
MATT	Hitchcock Lake	8/25/2010	160	wet	
MATT	Hitchcock Lake	8/30/2010	31	dry	

Single sample *E. coli* (colonies/100 mL) data from Station MATT on Hitchcock Lake with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
MATT	Hitchcock Lake	5/31/2011	99	unknown	28
MATT	Hitchcock Lake	6/7/2011	110	unknown	
MATT	Hitchcock Lake	6/14/2011	31	unknown	
MATT	Hitchcock Lake	6/28/2011	10	unknown	
MATT	Hitchcock Lake	7/5/2011	31	unknown	
MATT	Hitchcock Lake	7/12/2011	10	unknown	
MATT	Hitchcock Lake	7/19/2011	10	unknown	
MATT	Hitchcock Lake	7/26/2011	20	unknown	
MATT	Hitchcock Lake	8/2/2011	53	unknown	

Shaded cells indicate an exceedance of water quality criteria

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for Station MATT on Hitchcock Lake

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
MATT	Hitchcock Lake	2008-2010	14	28	24	47	17

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gage at Markham Municipal KMMK station in Meriden, CT

REFERENCES

Costa, Joe (2011). Calculating Geometric Means. Buzzards Bay National Estuary Program. **Online**: http://www.buzzardsbay.org/geomean.htm

CTDEEP (2010). State of Connecticut Integrated Water Quality Report. **Online:** http://www.ct.gov/dep/lib/dep/water/water_quality_management/305b/ctiwqr10final.pdf

CTDEEP (2011). State of Connecticut Water Quality Standards. **Online:** http://www.ct.gov/dep/lib/dep/water/water_quality_standards/wqs_final_adopted_2_25_11.pdf

CWP (2003). Impacts of Impervious Cover on Aquatic Systems. Center for Watershed Protection. **Online**: http://clear.uconn.edu/projects/tmdl/library/papers/Schueler_2003.pdf

Federal Register 67 (March 15, 2002) 11663-11670. Urban Area Criteria for Census 2000

Mallin, M.A., K.E. Williams, E.C. Escham, R.P. Lowe (2000). Effect of Human Development on Bacteriological Water Quality in Coastal Wetlands. Ecological Applications 10: 1047-1056.

USEPA (2001). Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water. **Online**: http://www.epa.gov/safewater/sourcewater/pubs/fs_swpp_petwaste.pdf.

USEPA (2011a). Managing Nonpoint Source Pollution from Agriculture. **Online:** http://water.epa.gov/polwaste/nps/outreach/point6.cfm

USEPA (2011b). Riparian Zone and Stream Restoration. **Online:** http://epa.gov/ada/eco/riparian.html

USEPA (2011c). Land Use Impacts on Water. **Online**: http://epa.gov/greenkit/toolwq.htm