# *Fenton River Watershed Summary*

## *Bicentennial Pond*

### WATERSHED DESCRIPTION AND MAPS

The Fenton River watershed covers an area of approximately 21,988 acres in northeastern Connecticut (Figure 1). The watershed is located in Mansfield, Chaplin, Willington, Ashford, and Union, CT.

The Fenton River watershed includes one waterbody (Bicentennial Pond) impaired for recreation due to elevated bacteria levels. This waterbody was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. The other segments (CT3207-00_01a, CT3207-00_01b, CT3207-00_01c, and CT3207-00_02) 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 Integrated Water Quality Report is included in Table 1 to show the status of other waterbodies in the watershed (CT DEEP, 2010).

The Fenton River begins just upstream of Buchner Road crossing in Nipmuck State Forest in northeastern Willington, flows southerly through eastern Willington, crosses into northern Mansfield just upstream of the Route 44 crossing, and ends at the outlet to Mansfield Hollow Reservoir downstream of the Route 89 crossing in Mansfield. The bacteria impaired waterbody, Bicentennial Pond (CT3207-16-1-L1_01), consists of 6.05 acres of a tributary to the Fenton River in Mansfield (Figure 2). This impaired waterbody is located along an east tributary to Fenton River known as Schoolhouse Brook, which begins upstream of Spring Hill Road, crosses Route 195, and joins the Fenton River just upstream of the Route 89 crossing in Mansfield.

**Impaired Waterbody Facts**

**Impaired Waterbody:** Bicentennial Pond (CT3207-16-1-L1_01)

**Town:** Mansfield

**Impaired Waterbody Area (acres):** 6.05

**Water Quality Classification:** Class A

**Designated Use Impairment**: Recreation

**Sub-regional Basin Name and Code:** Fenton River, 3207

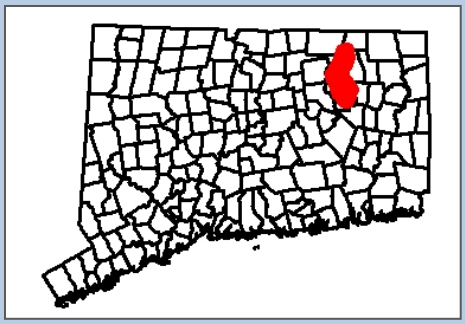
**Regional Basin:** Natchaug

**Major Basin:** Thames

**Watershed Area (acres):** 21,988

**MS4 Applicable?** No

**Figure 1: Watershed location in Connecticut**



Bicentennial Pond has 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. Bicentennial Pond is a designated beach and the specific recreation impairment is for designated swimming and other water contact related activities.

**Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report**

| Waterbody ID | Waterbody Name | Location | Miles/ Acres | Aquatic Life | Recreation | Fish Consumption |
|---|---|---|---|---|---|---|
| CT3207-00_01a | Fenton River-01a | From mouth at Mansfield Hollow Reservoir (Route 89/Warnerville Road crossing), US to Gurleyville Road Crossing, Mansfield. | 3.82 | FULL | U | FULL |
| CT3207-00_01b | Fenton River-01b | From Gurleyville Road crossing, US to confluence with unnamed tributary (~1 mile US of Gurleyville Road crossing), perpendicular to Hoursebarn Hill Road, Mansfield. | 1.24 | NOT | U | FULL |
| CT3207-00_01c | Fenton River-01c | From confluence with unnamed tributary (~1 mile US of Gurleyville Road crossing), perpendicular to Hoursebarn Hill Road, US to Route 44 crossing, Mansfield. | 0.95 | FULL | U | FULL |
| CT3207-00_02 | Fenton River-02 | From Route 44 crossing, Mansfield, US to headwaters (just US of Buchner Road crossing), Willington. | 10.75 | U | U | FULL |
| CT3207-16-1-L1_01 | Bicentennial Pond (Mansfield) | Impoundment of Schoolhouse Brook, Spring Hill area of Mansfield | 6.05 | U | NOT | FULL |

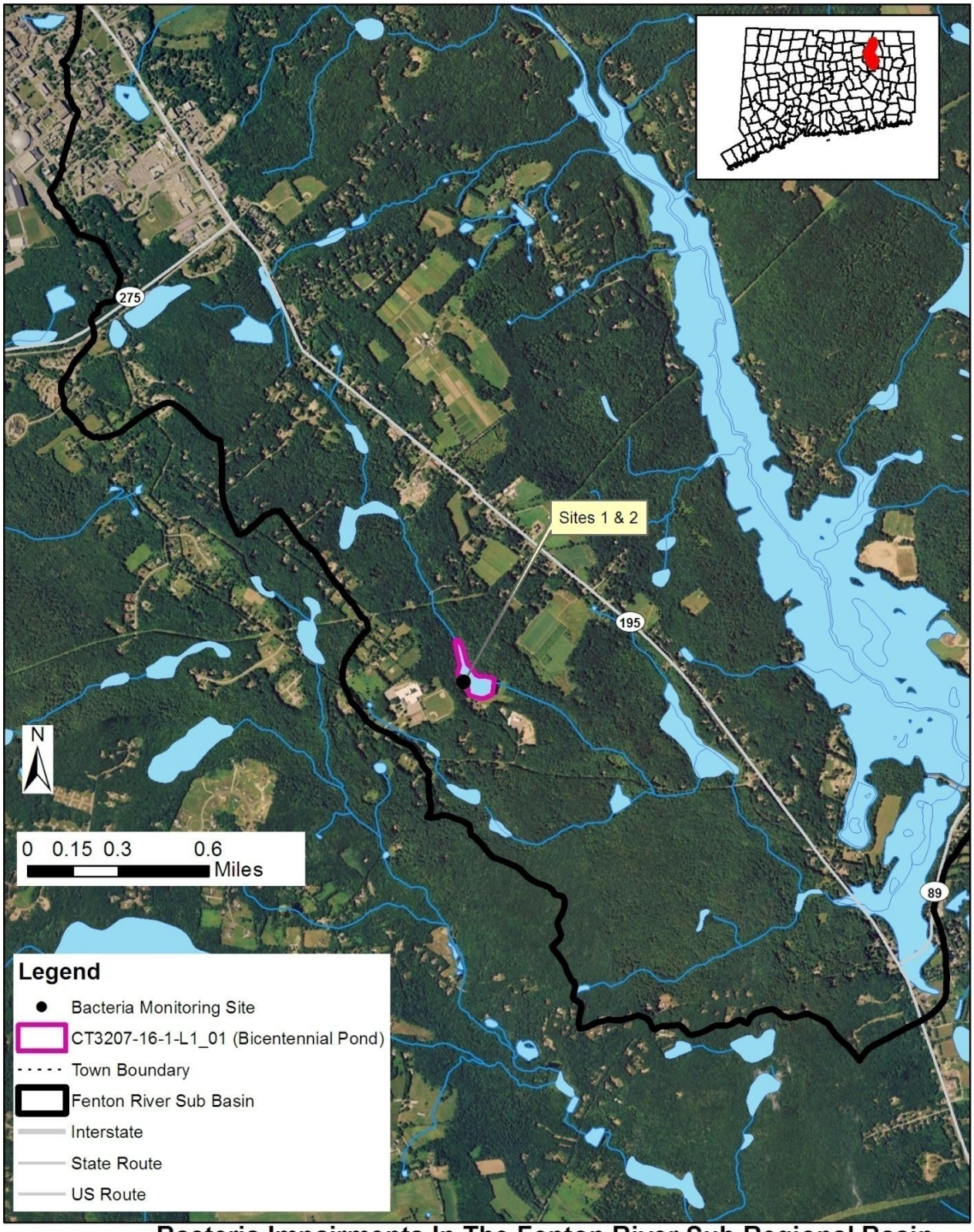
**Shaded cells indicate impaired waterbody addressed in this TMDL**

**FULL = Designated Use Fully Supported**

**NOT = Designated Use Not Supported**

**U = Unassessed**

**Figure 2: GIS map featuring general information of the Fenton 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 Fenton River watershed consists of 74% forest, 14% urban, 8% agriculture, and 4% water land uses. The portion of the watershed in Mansfield, particularly surrounding the impaired waterbody of Bicentennial Pond, is characterized by forested areas with agricultural land use to the east and urban development to the west and south. Schoolhouse Brook flows through a large forested preserve known as Schoolhouse Brook Park. There are several open fields, hayfields, and row crops along Route 195 east of the impaired waterbody. To the west of Bicentennial Pond is Hillside Cemetery and Mansfield Middle School, which has a large recreational soccer field. Along the southwest shore of Bicentennial Pond is a beach, mowed grass area, paved parking lot and playground. Immediately downstream of Bicentennial Pond is a commercial development area with areas of exposed soil.

**Figure 3: Land use within the Fenton River watershed**

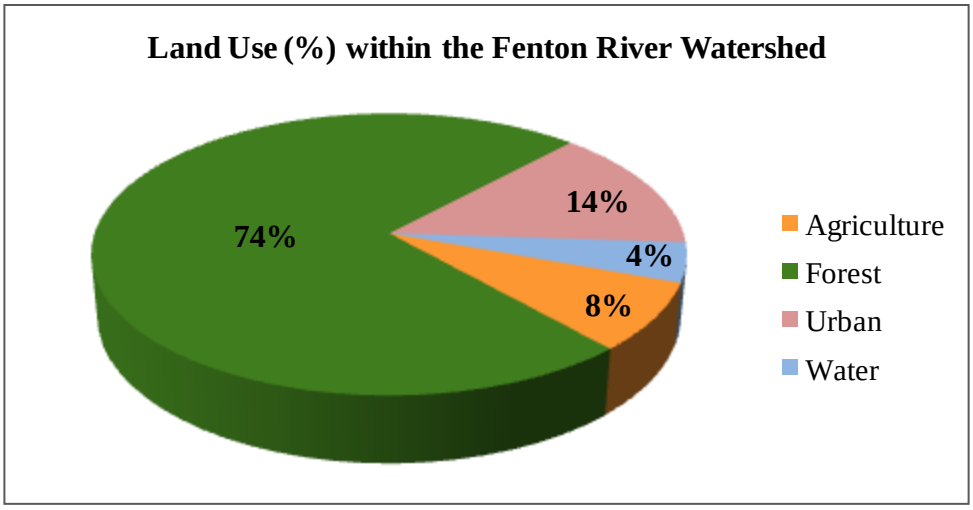
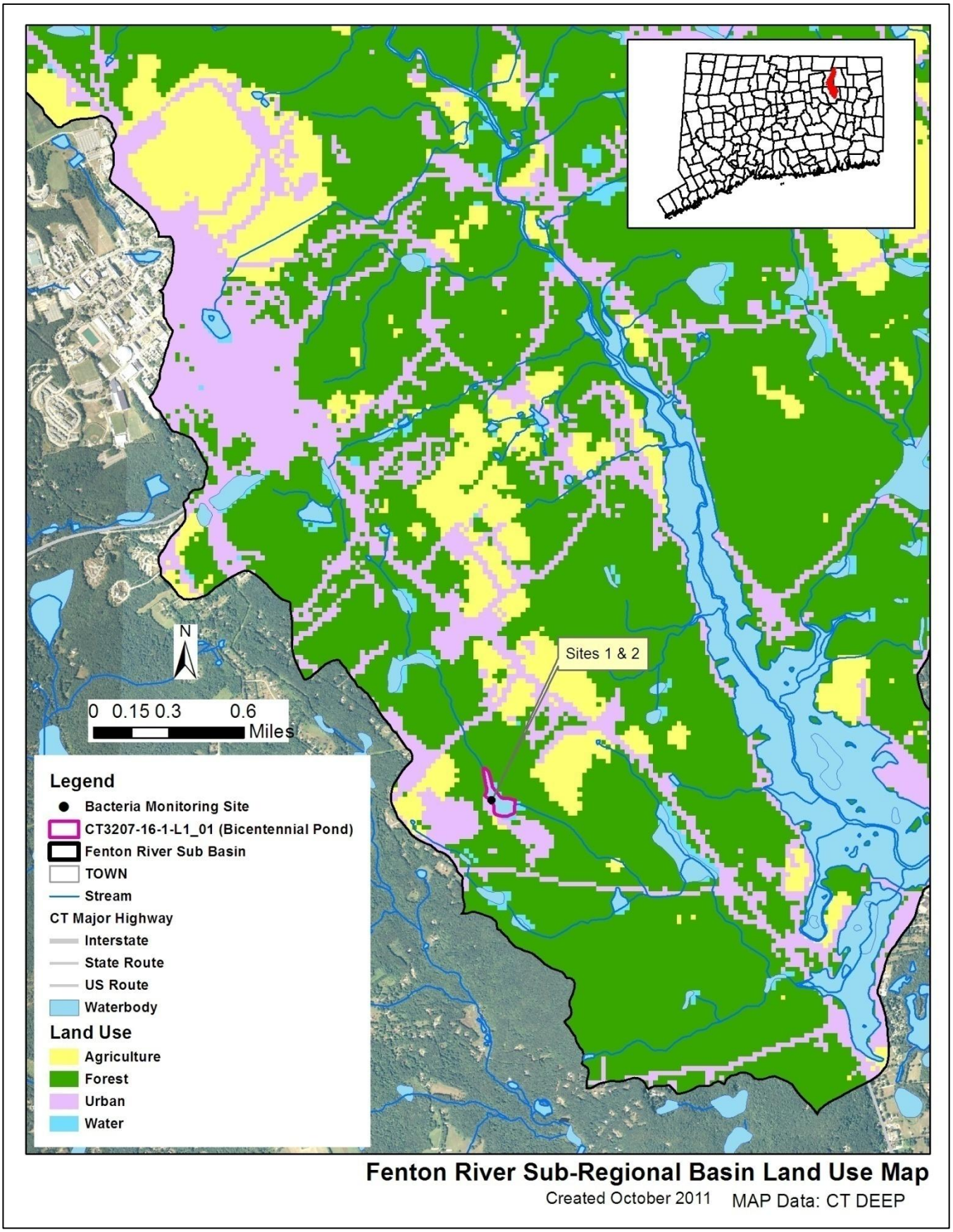


**Figure 4: GIS map featuring land use for the Fenton River watershed at the sub-regional level**



## 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 waterbody.

**Table 2: Sampling station location description for the impaired waterbody in the Fenton River watershed**

| Waterbody ID | Waterbody Name | Station | Station Description | Municipality | Latitude | Longitude |
|---|---|---|---|---|---|---|
| CT3207-16-1-L1_01 | Fenton River Bicentennial Pond | Site 1 | South Side | Mansfield | -- | -- |
| CT3207-16-1-L1_01 | Fenton River Bicentennial Pond | Site 2 | North Side | Mansfield | -- | -- |

Bicentennial Pond (CT3207-16-1-L1_01) is a Class A freshwater river (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from two sampling locations, Site 1 and Site 2, from 2008-2011 (Table 2).

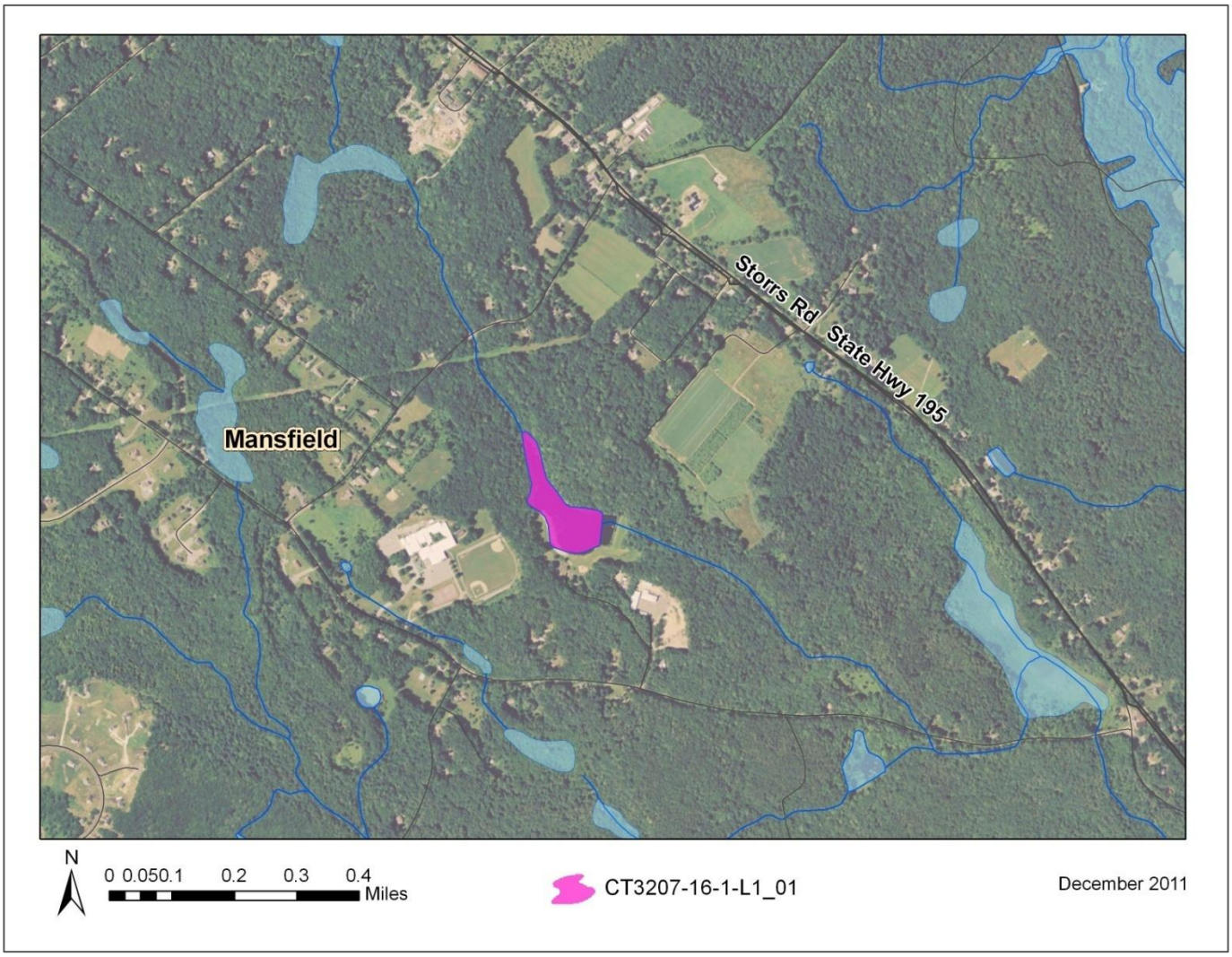
The water quality criteria for *E. coli*, along with bacteria sampling results for Site 1 from 2008-2011, are presented in Table 7. The annual geometric mean was calculated for Site 1 and did not exceed the WQS for *E. coli* in any sampling year. Single sample values at this station exceeded the WQS for *E. coli* multiple times in 2009 and once in 2011.

The water quality criteria for *E. coli*, along with bacteria sampling results for Site 2 from 2008-2011, are presented in Table 7. The annual geometric mean was calculated for Site 2 and did not exceed the WQS for *E. coli* in any sampling year. Single sample values at this station exceeded the WQS for *E. coli* multiple times in 2008 and 2009 and once in 2011.

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 possible (Table 7). For Bicentennial Pond, neither wet nor dry geometric mean values at Site 1 or Site 2 exceeded the WQS for *E. coli*. Of the single sample values at these stations exceeding the WQS for *E. coli*, 4 were during dry-weather events and 5 were during wet-weather events.

Due to the elevated bacteria measurements presented in Table 7, Bicentennial Pond did not meet CT's bacteria WQS, was identified as impaired, and was 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 Bicentennial Pond**



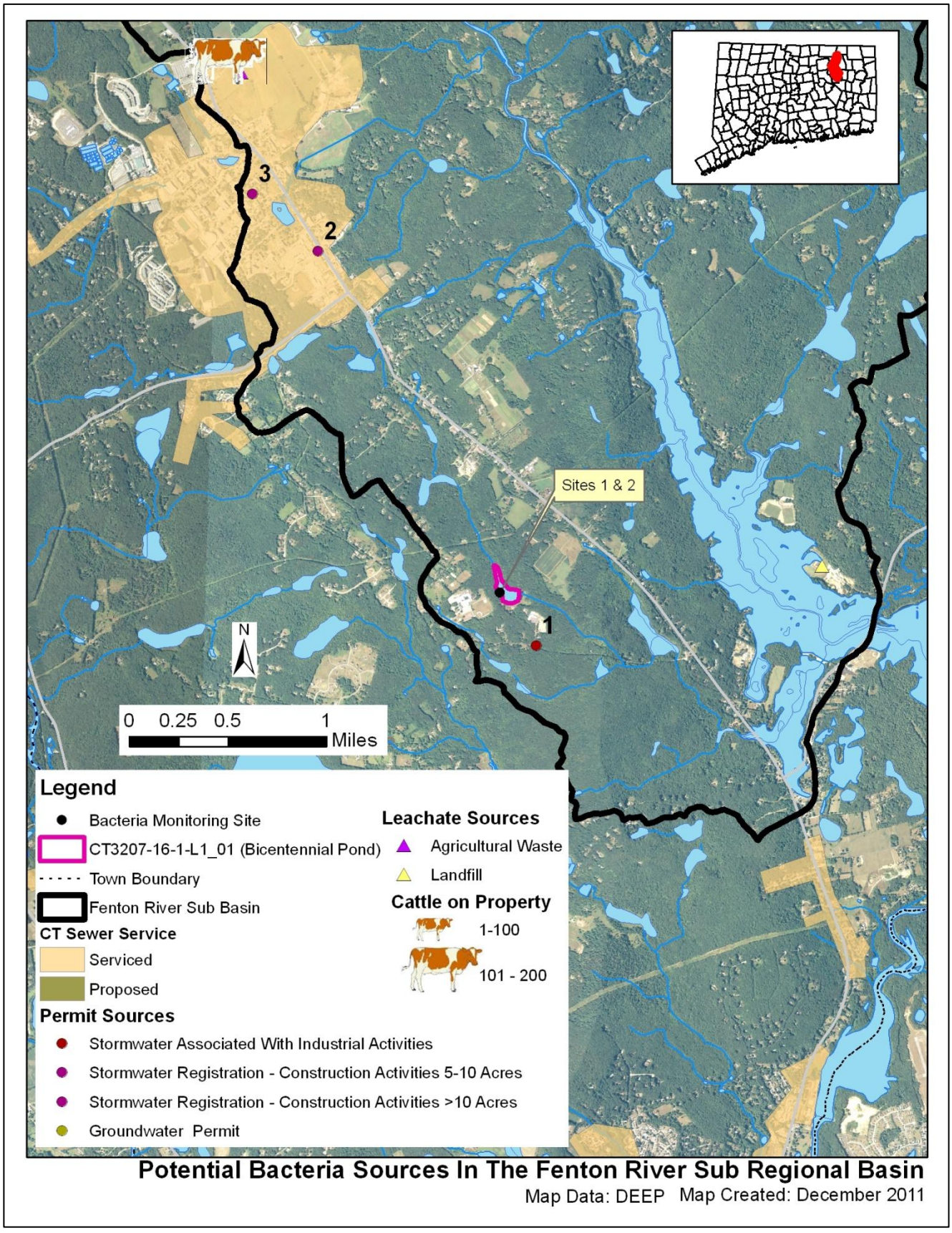
## POTENTIAL BACTERIA SOURCES

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 Fenton River watershed**

| Impaired waterbody | Permit Source | Illicit Discharge | CSO/ SSO Issue | Failing Septic System | Agricultural Activity | Stormwater Runoff | Nuisance Wildlife/Pets | Other |
|---|---|---|---|---|---|---|---|---|
| Bicentennial Pond CT3207-16-1-L1_01 | **x** | **x** | | **x** | **x** | **x** | **x** | |

**Figure 6: Potential sources in the Fenton River watershed at the sub-regional level**



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 5. 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.

**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 | 0 |
| GSI | Stormwater Associated with Industrial Activity | 1 |
| GSM | Part B Municipal Stormwater MS4 | 0 |
| GSN | Stormwater Registration – Construction | 3 |
| LF | Groundwater Permit (Landfill) | 0 |
| UI | Underground Injection | 0 |

### *Permitted Sources*

As shown in Table 5, there are multiple permitted discharges in the Fenton River watershed. Bacteria data are currently not available for any of the permitted discharges in the watershed. 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 Fenton River watershed**

| Town | Client | Permit ID | Permit Type | Site Name/Address | Map # |
|---|---|---|---|---|---|
| Storrs Mansfield | Town Of Mansfield | GSI000 558 | Stormwater Associated With Industrial Activities | Mansfield Town Garage | 1 |
| Storrs Mansfield | Regional School District #19 | GSN00 2192 | Stormwater Registration - Construction Activities 5-10 Acres | E.O. Smith High School | 2 |
| Mansfield | Storrs Center Alliance, Llc | GSN00 2211 | Stormwater Registration - Construction Activities >10 Acres | Storrs Center | 4 |
| Storrs | University Of Connecticut | GSN00 2144 | Stormwater Registration - Construction Activities 5-10 Acres | East Classroom Building | 3 |

***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)

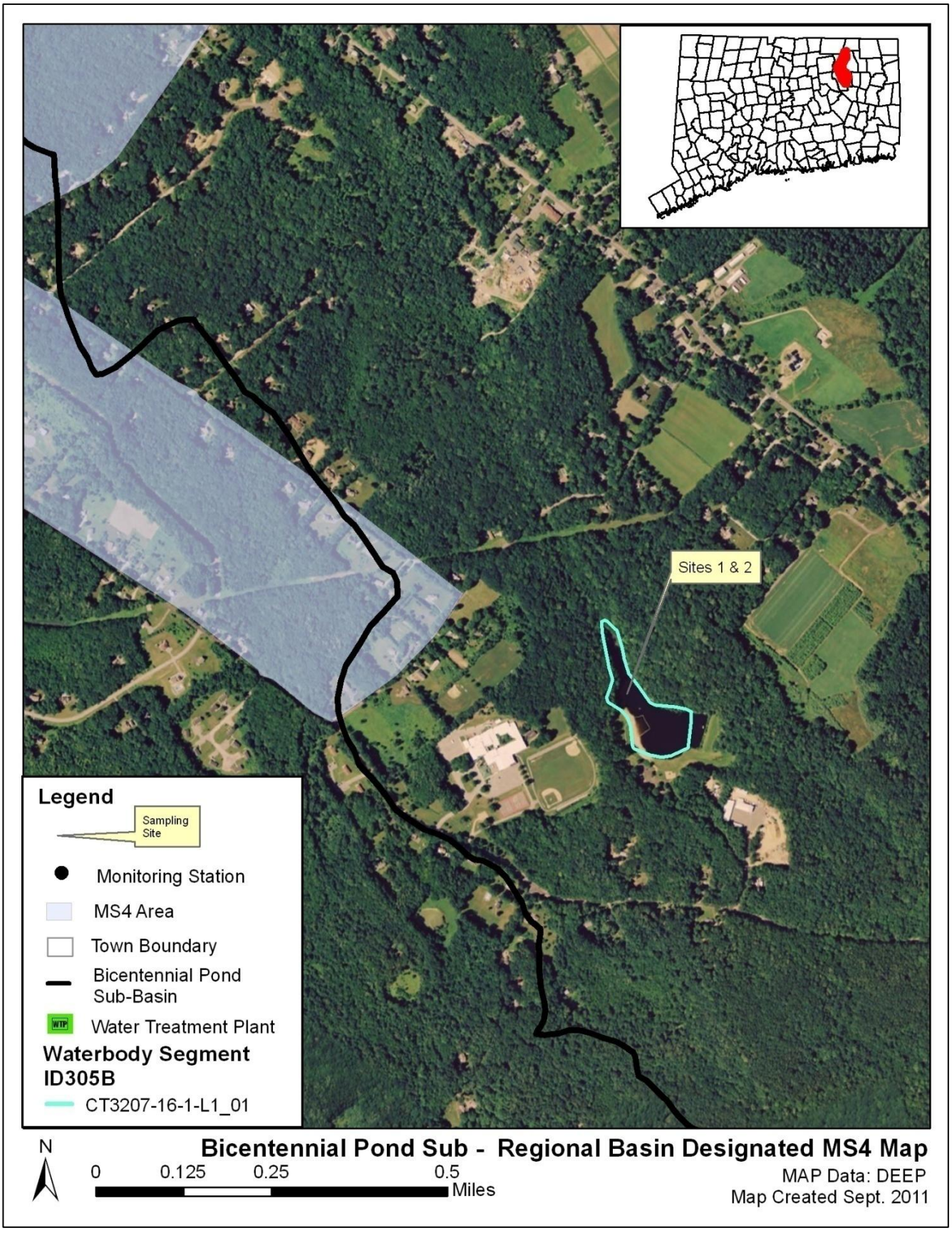
While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some 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 waterbody of the Fenton Brook watershed is located within the Town of Mansfield, CT. As there are no urbanized locations as defined by the U.S. Census Bureau within this area, the town is not an MS4 area and is not required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the CT DEEP (Figure 7). The Urban Cluster for Storrs, CT, which does not participate in the MS4 program, is shown in Figure 7. 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 Fenton River watershed**



### *Publicly Owned Treatment Works*

As shown in Figure 7, there are no publicly owned treatment works (POTWs), or wastewater treatment plants, in the Fenton Brook watershed, and therefore, POTWs are not a potential source of loading to Bicentennial Pond.

## 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 Fenton River watershed are described below.

### *Wildlife and Domestic Animal Waste*

Wildlife and domestic animals within the Fenton River watershed represent a potential source of bacteria. Wildlife, including waterfowl, may be a significant bacteria source to surface waters. 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). As the majority of the watershed is undeveloped, especially around the impaired waterbody located in Schoolhouse Brook Park, wildlife waste is a potential source of bacteria to Bicentennial Pond. The playground and grassy area along the south bank of Bicentennial Pond encourage dog owners to utilize the space as a dog park. As such, waste from domestic animals, such as dogs, may also be contributing to bacteria concentrations in this impaired waterbody in the Fenton River watershed.

A large recreational field at Mansfield Middle School is located within the Fenton River watershed adjacent to the impaired waterbody (Figure 6). The large mowed grass strip along the south bank of Bicentennial Pond may also provide easy access for geese. Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. 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.

### *Recreation at Bicentennial Pond Beach*

People coming in direct contact with surface water presents another potential source of bacterial contamination. Microbial source tracking (MST) surveys conducted in New Hampshire have shown humans to be a source of bacterial contamination at beaches (Jones, 2008). Since there is a designated beach on Bicentennial Pond, it is possible that humans are depositing fecal matter, which contains high levels of bacteria, directly into Bicentennial Pond at the beach.

### *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 8% of the Fenton River watershed. There are multiple agricultural hayfields and row crops located east of Bicentennial Pond. An agricultural waste site and a large cattle farm with 101-200 cattle was identified in Figure 6 far upstream of Bicentennial Pond in Storrs-Mansfield, CT, and since its drainage does not directly connect to Schoolhouse Brook, this livestock farm is most likely a small source of bacteria to Bicentennial Pond.

### *Insufficient Septic Systems and Illicit Discharges*

As shown in Figure 6, only the area surrounding Storrs-Mansfield relies on the municipal sewer system. Sewer system leaks and other illicit discharges or connections can contribute bacteria to nearby surface waters, but are most likely a small source of bacteria to Bicentennial Pond. The rest of the watershed, particularly around the impaired waterbody, relies on onsite wastewater treatment systems, such as septic systems. While neither wet-weather nor dry-weather geometric mean standards were exceeded at Sites 1 and 2, four out of nine single sample exceedances were during dry-weather, which suggests that failing septic systems may be a source of bacteria to Bicentennial Pond (Table 7). 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 Mansfield is part of the Eastern Highlands Health District (http://www.ehhd.org).

### *Stormwater Runoff from Developed Areas*

Approximately 14% of the land use in the Fenton River watershed is considered urban, and the impaired waterbody is located south of the densely populated Storrs-Mansfield area (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).

As shown in Figure 8, approximately 1% of the Fenton River watershed contains more than 16% impervious cover, particularly in the Storrs-Mansfield area (Figure 9). Although the majority of the drainage area surrounding Bicentennial Pond is undeveloped with only 0-6% impervious cover, there are large development complexes with impervious surfaces upstream of Bicentennial Pond along Route 195 and to the west at Mansfield Middle School. While neither wet-weather nor dry-weather geometric mean standards were exceeded at Sites 1 and 2, five out of nine single sample exceedances were during wet-weather, which suggests that stormwater runoff may be a source of bacteria to Bicentennial Pond (Table 7). Stormwater pollution sources include fertilizer runoff, leaky septic systems, horse farms, golf courses, and impervious surfaces.

**Figure 8: Range of impervious cover (%) in the Fenton River watershed**

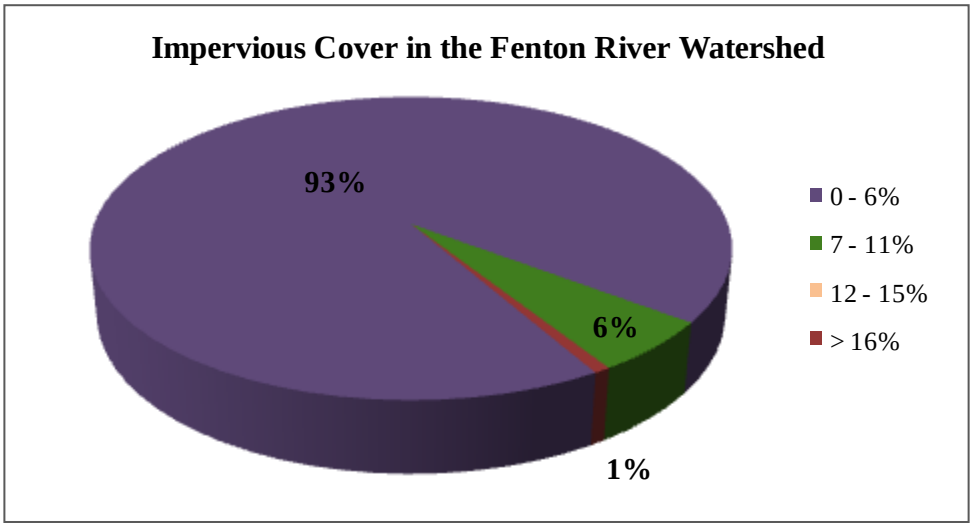
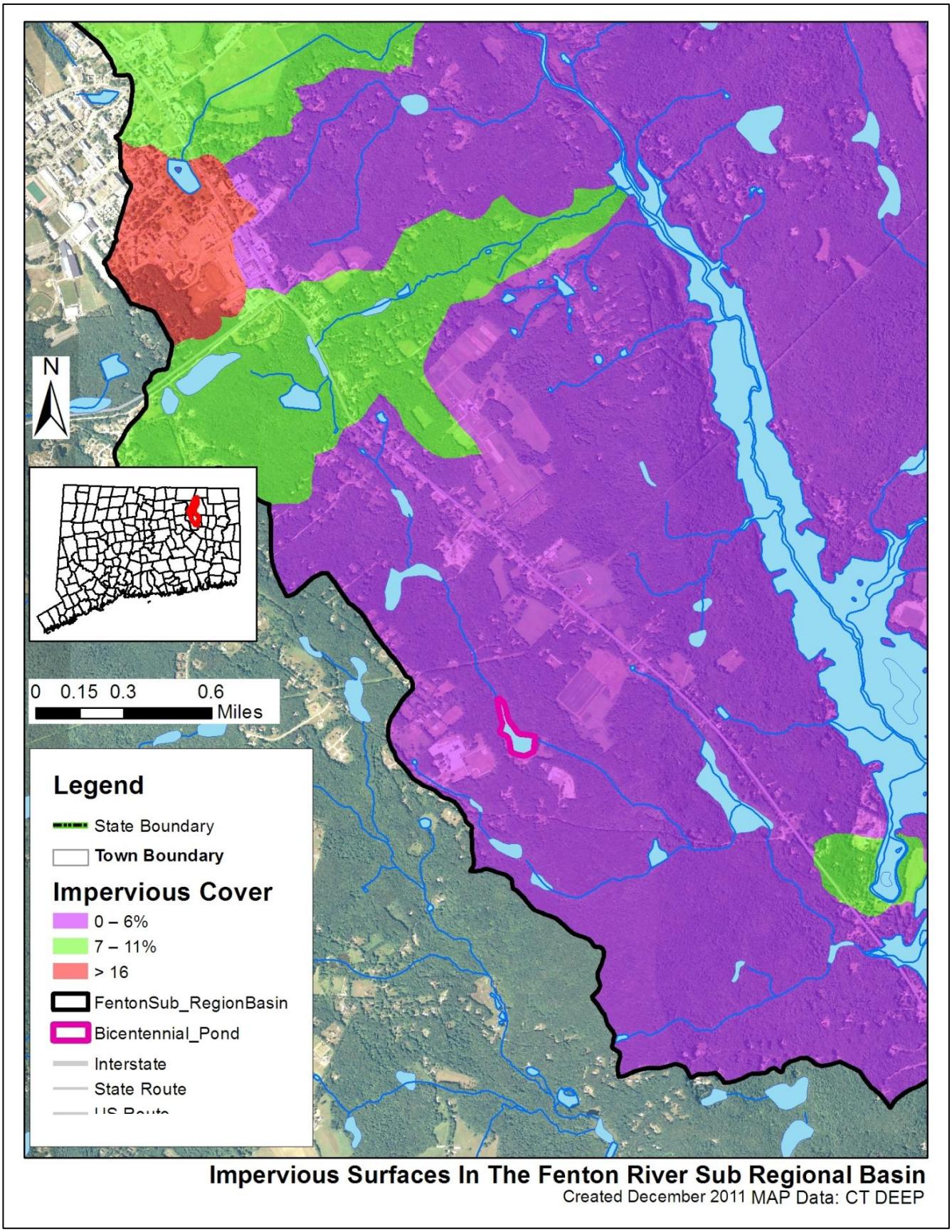


**Figure 9: Impervious cover (%) for the Fenton River sub-regional watershed**



## Additional Sources

As shown in Figure 6, a landfill was identified along Fenton River, upstream of the confluence with Schoolhouse Brook. Due to its location within the drainage patterns of the Fenton River watershed, this landfill is not contributing to the waterbody impairment of Bicentennial Pond, but may be a source of bacteria for other segments on the Fenton River.

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment of Bicentennial Pond. 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

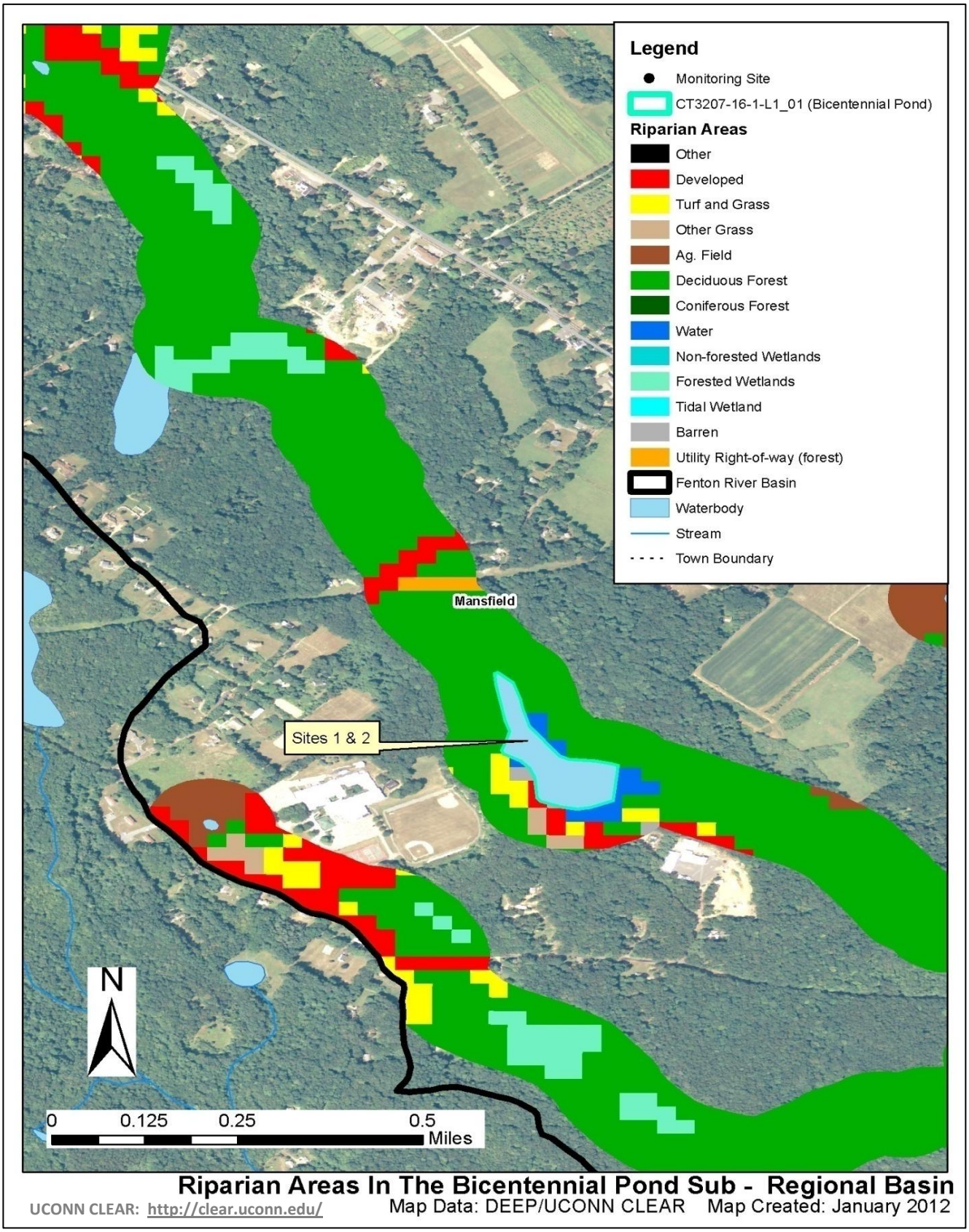
### *Riparian Buffer Zones*

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 waterbody of Bicentennial Pond is characterized by deciduous forest land use with portions of turf/grass/other grass and developed areas (Figure 10). As previously noted, if not properly treated, runoff from open grassy fields and developed areas may contain pollutants such as bacteria and nutrients.

**Figure 10: Riparian buffer zone information for the Fenton River watershed**



## RECOMMENDED NEXT STEPS

Future mitigative activities are necessary to ensure the long-term protection of Bicentennial Pond and have been prioritized below.

**1) Evaluate municipal education and outreach programs regarding animal and human waste.**

As most of the Fenton River watershed surrounding Bicentennial Pond is undeveloped and its designated beach area is frequented by geese, pets, and humans, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife, picking up after dogs and other pets, and properly disposing human waste (such as diapers) along Bicentennial Pond beach. The town and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of Bicentennial Pond 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 Bicentennial Pond and can harm human health and the environment. Animal and human wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal and human waste on water quality include installing signage, providing waste receptacles in high-use areas, enacting ordinances requiring the clean-up of waste, and targeting educational and outreach programs in problem areas.

**2) Ensure there are sufficient buffers on agricultural lands along Bicentennial Pond.**

Agricultural land use represents 8% of the Fenton River watershed, and is a potential concern for water quality, especially with the identified hayfields and row crops adjacent to Bicentennial Pond. 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.

**3) Identify areas along Bicentennial Pond to implement Best Management Practices (BMPs) to control stormwater runoff.**

As noted previously, 14% of the Fenton River watershed is considered urban, and Sites 1 and 2 exceeded single sample values five out of nine times during wet-weather. As such, stormwater runoff may be contributing bacteria to the impaired waterbody. To identify areas that are contributing bacteria to the impaired waterbody, the town should conduct wet-weather sampling at stormwater outfalls that discharge directly to or upstream of the impaired waterbody in the Fenton River watershed. Outfalls that show high bacteria concentrations should be prioritized for BMP installation. To treat stormwater runoff, the towns should identify areas along the impaired waterbody to install BMPs designed to encourage stormwater to infiltrate into the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

**4) Develop a system to monitor septic systems.**

Most residents surrounding the impaired waterbody rely on septic systems. If not already in place, Mansfield should establish a program to ensure that existing septic systems are properly operated and maintained, and 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 sub-standard systems within a reasonable timeframe can be adopted. Mansfield can also develop a program to assist citizens with the replacement and repair of older and failing systems.

**5) Monitor permitted sources.**

As shown in Figure 6 and Table 5, there are multiple permitted facilities within the Fenton River watershed. Two construction-related permits in Storrs-Mansfield to the north of Bicentennial Pond drain east to the Fenton River, and may not be a direct source to Bicentennial Pond. Another construction-related permit is located immediately downstream of Bicentennial Pond. 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 6 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 Fenton 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 6. 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]** |
| 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 7: Bicentennial Pond Bacteria Data**

***Waterbody ID:*** CT3207-16-1-L1_01

***Characteristics:*** Freshwater, Class A, Potential Drinking Water Supplies, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, 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: **79%**

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

**Single sample *E. coli* (colonies/100 mL) data from Sites 1 and 2 on Bicentennial Pond with annual geometric means calculated**

| Station Name | Station Location | Date | Results | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| Site 1 | South Side - Right | 5/19/2008 | 10 | dry** | 34 |
| Site 1 | South Side - Right | 5/27/2008 | 53 | wet** | |
| Site 1 | South Side - Right | 6/2/2008 | 42 | dry** | |
| Site 1 | South Side - Right | 6/9/2008 | 120 | wet** | |
| Site 1 | South Side - Right | 6/11/2008 | 180 | dry** | |
| Site 1 | South Side - Right | 6/16/2008 | 200 | wet** | |
| Site 1 | South Side - Right | 6/24/2008 | 20 | wet** | |
| Site 1 | South Side - Right | 6/30/2008 | 10 | wet** | |
| Site 1 | South Side - Right | 7/2/2008 | 120 | dry** | |
| Site 1 | South Side - Right | 7/7/2008 | 10 | dry** | |
| Site 1 | South Side - Right | 7/14/2008 | 53 | wet** | |
| Site 1 | South Side - Right | 7/21/2008 | 10 | wet** | |
| Site 1 | South Side - Right | 7/28/2008 | 180 | wet** | |
| Site 1 | South Side - Right | 8/4/2008 | 10 | dry** | |
| Site 1 | South Side - Right | 8/11/2008 | 160 | wet** | |
| Site 1 | South Side - Right | 8/13/2008 | 10 | dry** | |
| Site 1 | South Side - Right | 8/18/2008 | 10 | dry** | |
| Site 1 | South Side - Right | 8/26/2008 | 10 | dry** | |

**Single sample *E. coli* (colonies/100 mL) data from Sites 1 and 2 on Bicentennial Pond with annual geometric means calculated (continued)**

| Station Name | Station Location | Date | Results | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| Site 1 | South Side - Right | 5/18/2009 | 10 | dry** | 33 |
| Site 1 | South Side - Right | 5/26/2009 | 31 | dry** | |
| Site 1 | South Side - Right | 6/1/2009 | 10 | dry** | |
| Site 1 | South Side - Right | 6/8/2009 | 10 | dry** | |
| Site 1 | South Side - Right | 6/15/2009 | 10 | wet** | |
| Site 1 | South Side - Right | 6/22/2009 | 10 | wet** | |
| Site 1 | South Side - Right | 6/29/2009 | 10 | dry** | |
| Site 1 | South Side - Right | 7/6/2009 | 20 | dry | |
| Site 1 | South Side - Right | 7/13/2009 | 10 | wet | |
| Site 1 | South Side - Right | 7/20/2009 | 10 | dry | |
| Site 1 | South Side - Right | 7/27/2009 | 64 | wet | |
| Site 1 | South Side - Right | 8/3/2009 | **1100* (79%)** | wet | |
| Site 1 | South Side - Right | 8/5/2009 | 20 | dry | |
| Site 1 | South Side - Right | 8/10/2009 | 20 | dry | |
| Site 1 | South Side - Right | 8/19/2009 | 310 | dry | |
| Site 1 | South Side - Right | 8/21/2009 | 630 | dry | |
| Site 1 | South Side - Right | 8/24/2009 | 160 | dry | |
| Site 1 | South Side - Right | 5/24/2010 | 10 | dry | 16 |
| Site 1 | South Side - Right | 6/1/2010 | 10 | dry | |
| Site 1 | South Side - Right | 6/7/2010 | 20 | dry | |
| Site 1 | South Side - Right | 6/14/2010 | 31 | wet | |
| Site 1 | South Side - Right | 6/21/2010 | 64 | dry | |
| Site 1 | South Side - Right | 6/28/2010 | 31 | dry | |
| Site 1 | South Side - Right | 7/6/2010 | 10 | dry | |
| Site 1 | South Side - Right | 7/15/2010 | 10 | wet | |
| Site 1 | South Side - Right | 7/19/2010 | 10 | dry | |
| Site 1 | South Side - Right | 7/26/2010 | 53 | wet | |
| Site 1 | South Side - Right | 8/2/2010 | 10 | dry** | |
| Site 1 | South Side - Right | 8/9/2010 | 10 | dry** | |
| Site 1 | South Side - Right | 8/16/2010 | 10 | dry** | |

**Single sample *E. coli* (colonies/100 mL) data from Sites 1 and 2 on Bicentennial Pond with annual geometric means calculated (continued)**

| Station Name | Station Location | Date | Results | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| Site 1 | South Side - Right | 5/24/2011 | 53 | unknown | 32 |
| Site 1 | South Side - Right | 5/31/2011 | 10 | unknown | |
| Site 1 | South Side - Right | 6/6/2011 | 10 | unknown | |
| Site 1 | South Side - Right | 6/13/2011 | 830 | unknown | |
| Site 1 | South Side - Right | 6/15/2011 | 160 | unknown | |
| Site 1 | South Side - Right | 6/20/2011 | 20 | unknown | |
| Site 1 | South Side - Right | 6/28/2011 | 10 | unknown | |
| Site 1 | South Side - Right | 7/5/2011 | 10 | unknown | |
| Site 1 | South Side - Right | 7/11/2011 | 42 | unknown | |
| Site 1 | South Side - Right | 7/19/2011 | 20 | unknown | |
| Site 2 | North Side - Left | 5/19/2008 | 10 | dry** | 40 |
| Site 2 | North Side - Left | 5/27/2008 | 10 | wet** | |
| Site 2 | North Side - Left | 6/2/2008 | 42 | dry** | |
| Site 2 | North Side - Left | 6/9/2008 | 430 | wet** | |
| Site 2 | North Side - Left | 6/11/2008 | 20 | dry** | |
| Site 2 | North Side - Left | 6/16/2008 | 20 | wet** | |
| Site 2 | North Side - Left | 6/24/2008 | 20 | wet** | |
| Site 2 | North Side - Left | 6/30/2008 | 340 | wet** | |
| Site 2 | North Side - Left | 7/2/2008 | 220 | dry** | |
| Site 2 | North Side - Left | 7/7/2008 | 53 | dry** | |
| Site 2 | North Side - Left | 7/14/2008 | 180 | wet** | |
| Site 2 | North Side - Left | 7/21/2008 | 10 | wet** | |
| Site 2 | North Side - Left | 7/28/2008 | 210 | wet** | |
| Site 2 | North Side - Left | 8/4/2008 | 10 | dry** | |
| Site 2 | North Side - Left | 8/11/2008 | 290 | wet** | |
| Site 2 | North Side - Left | 8/13/2008 | 10 | dry** | |
| Site 2 | North Side - Left | 8/18/2008 | 10 | dry** | |
| Site 2 | North Side - Left | 8/26/2008 | 10 | dry** | |

**Single sample *E. coli* (colonies/100 mL) data from Sites 1 and 2 on Bicentennial Pond with annual geometric means calculated (continued)**

| Station Name | Station Location | Date | Results | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| Site 2 | North Side - Left | 5/18/2009 | 10 | dry** | |
| Site 2 | North Side - Left | 5/26/2009 | 53 | dry** | |
| Site 2 | North Side - Left | 6/1/2009 | 10 | dry** | |
| Site 2 | North Side - Left | 6/8/2009 | 10 | dry** | |
| Site 2 | North Side - Left | 6/15/2009 | 31 | wet** | |
| Site 2 | North Side - Left | 6/22/2009 | 10 | wet** | |
| Site 2 | North Side - Left | 6/29/2009 | 10 | dry** | |
| Site 2 | North Side - Left | 7/6/2009 | 10 | dry | |
| Site 2 | North Side - Left | 7/13/2009 | 10 | wet | 29 |
| Site 2 | North Side - Left | 7/20/2009 | 10 | dry | |
| Site 2 | North Side - Left | 7/27/2009 | 20 | wet | |
| Site 2 | North Side - Left | 8/3/2009 | 480 | wet | |
| Site 2 | North Side - Left | 8/5/2009 | 10 | dry | |
| Site 2 | North Side - Left | 8/10/2009 | 41 | dry | |
| Site 2 | North Side - Left | 8/19/2009 | 560 | dry | |
| Site 2 | North Side - Left | 8/21/2009 | 390 | dry | |
| Site 2 | North Side - Left | 8/24/2009 | 64 | dry | |
| Site 2 | North Side - Left | 5/24/2010 | 20 | dry | |
| Site 2 | North Side - Left | 6/1/2010 | 10 | dry | |
| Site 2 | North Side - Left | 6/7/2010 | 10 | dry | |
| Site 2 | North Side - Left | 6/14/2010 | 99 | wet | |
| Site 2 | North Side - Left | 6/21/2010 | 64 | dry | |
| Site 2 | North Side - Left | 6/28/2010 | 10 | dry | |
| Site 2 | North Side - Left | 7/6/2010 | 20 | dry | 16 |
| Site 2 | North Side - Left | 7/15/2010 | 20 | wet | |
| Site 2 | North Side - Left | 7/19/2010 | 10 | dry | |
| Site 2 | North Side - Left | 7/26/2010 | 10 | wet | |
| Site 2 | North Side - Left | 8/2/2010 | 10 | dry** | |
| Site 2 | North Side - Left | 8/9/2010 | 10 | dry** | |
| Site 2 | North Side - Left | 8/16/2010 | 10 | dry** | |

**Single sample *E. coli* (colonies/100 mL) data from Sites 1 and 2 on Bicentennial Pond with annual geometric means calculated (continued)**

| Station Name | Station Location | Date | Results | Wet/Dry | Geomean |
|---|---|---|---|---|---|
| Site 2 | North Side - Left | 5/24/2011 | 53 | unknown | **43* (NA)** |
| Site 2 | North Side - Left | 5/31/2011 | 20 | unknown | |
| Site 2 | North Side - Left | 6/6/2011 | 10 | unknown | |
| Site 2 | North Side - Left | 6/13/2011 | 780 | unknown | |
| Site 2 | North Side - Left | 6/15/2011 | 220 | unknown | |
| Site 2 | North Side - Left | 6/20/2011 | 20 | unknown | |
| Site 2 | North Side - Left | 6/28/2011 | 42 | unknown | |
| Site 2 | North Side - Left | 7/5/2011 | 10 | unknown | |
| Site 2 | North Side - Left | 7/11/2011 | 140 | unknown | |
| Site 2 | North Side - Left | 7/19/2011 | 10 | unknown | |

**Shaded cells indicate an exceedance of water quality criteria**

**** Weather conditions for selected data taken from Hartford because local station had missing data**

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

**Wet and dry weather geometric mean values for Sites 1 and 2 on Bicentennial Pond**

| Station Name | Station Location | Years Sampled | Number of Samples | | Geometric Mean | | |
|---|---|---|---|---|---|---|---|
| | | | Wet | Dry | All | Wet | Dry |
| Site 1 | South Side - Right | 2008-2010 | 17 | 31 | 28 | 42 | 22 |
| Site 2 | North Side - Left | 2008-2010 | 17 | 31 | 28 | 48 | 21 |

**Shaded cells indicate an exceedance of water quality criteria**

**Weather condition determined from rain gages at Norwich Public Utility Plant in Norwich, CT and at Hartford Bradley International Airport**

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