



Morgan Brook

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Morgan Brook watershed covers an area of approximately 5,795 acres in the mid-northern half of Connecticut, west of the Connecticut River (Figure 1). The watershed is located in New Hartford, Winchester, and Barkhamsted, CT.

The Morgan Brook watershed includes three segments impaired for recreation due to elevated bacteria levels. 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 Waters. An additional segment (CT4305-00_03) in the watershed is currently unassessed for recreation as of the writing of this document. This does not mean 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. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of other waterbodies in the watershed (CTDEEP, 2010).

Morgan Brook begins at the dam outlet to W West Hill Pond in Barkhamsted, flows north to cross West Hill Road, Bsullak Road, and E West Hill Road, follows Route 44 (New Hartford Road) easterly, crosses Morgan Brook Road, and ends at the confluence with the West Branch Farmington River in Barkhamsted.

The bacteria impaired segment, Morgan Brook (Segment 1, CT4305-00_01), consists of stream 0.69 miles in Barkhamsted (Figure 2). Morgan Brook (Segment 1) begins at the confluence with an unnamed tributary on the east side of Route 44 downstream of the Route 318 (Ripley Hill Road) crossing, crosses Morgan Brook Road, and ends at the confluence with the West Branch Farmington River in Barkhamsted.

The bacteria impaired segment, Morgan Brook (Segment 2, CT4305-00_02), consists of 1.41 miles of the river in Barkhamsted (Figure 2). Morgan Brook (Segment 2) begins 50 meters upstream of the E West Hill Road crossing, flows easterly along Route 44, crosses Route 318 Ripley Hill Road, and ends at the confluence with an unnamed tributary on the east side of Route 44 in Barkhamsted.

The bacteria impaired segment, Morgan Brook (Segment 4, CT4305-00_04), consists of 1.52 miles of the river in Barkhamsted. Morgan Brook (Segment 4) begins at the dam outlet to West Hill Pond, flows

Impaired Segment Facts

Impaired Segments:

1. Morgan Brook (Segment 1) (CT4305-00_01)
2. Morgan Brook (Segment 2) (CT4305-00_02)
3. Morgan Brook (Segment 4) (CT4305-00_04)

Municipalities: Barkhamsted

Impaired Segment Length

(miles): 4305-00_01 (0.69), 4305-00_02 (1.41), 4305-00_04 (1.52)

Water Quality Classification:

Class A

Designated Use Impairment:

Recreation

Sub-regional Basin Name and

Code: Morgan Brook, 4305

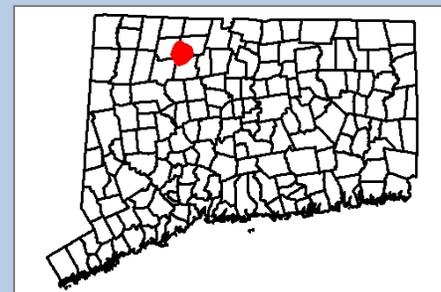
Regional Basin: Farmington

Major Basin: Connecticut

Watershed Area (acres): 5,795

MS4 Applicable? No

Figure 1: Watershed location in Connecticut



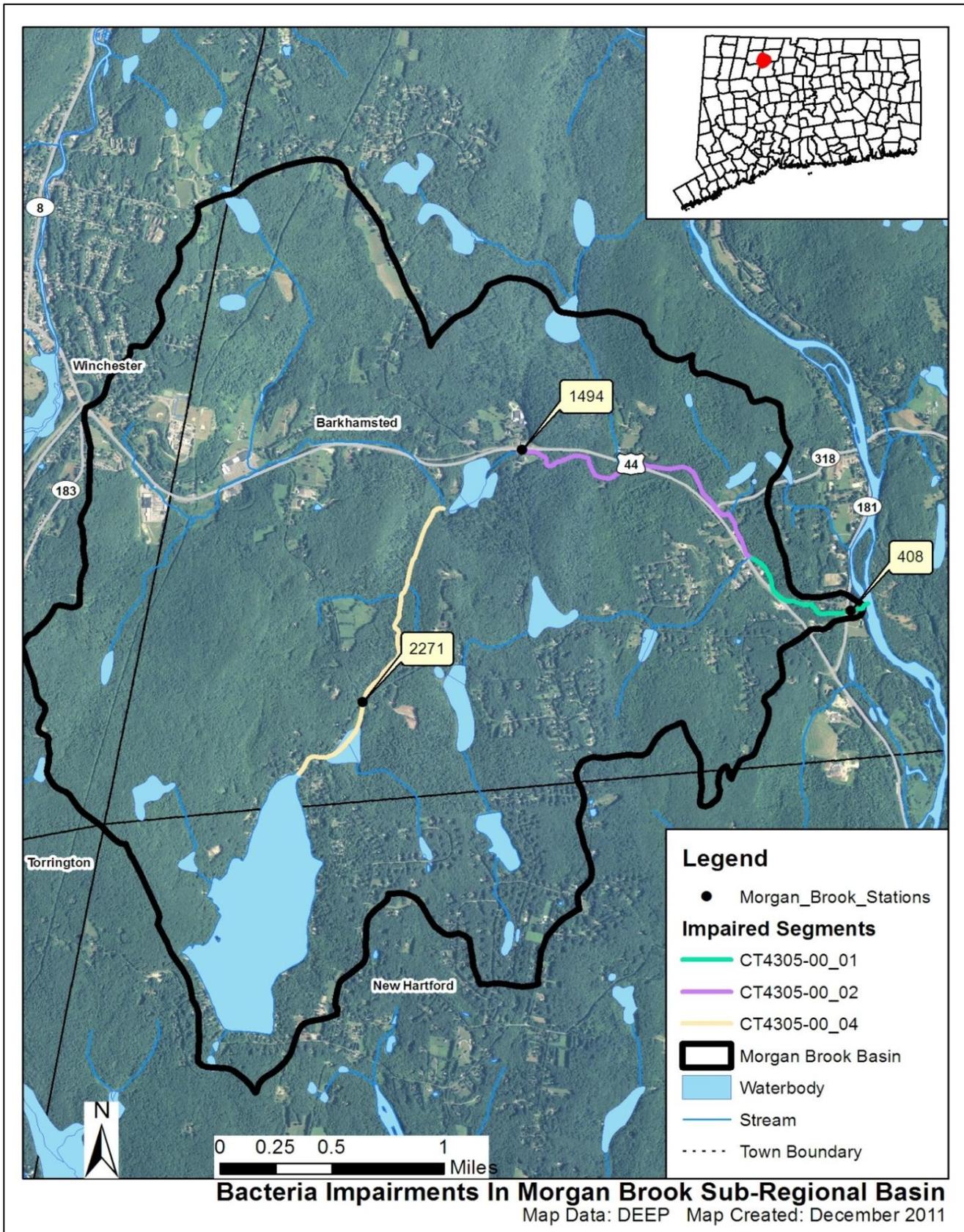
north to cross W West Hill Road and Bsullak Road, and ends at the confluence with Mallory Brook in Barkhamsted.

The three impaired segments of Morgan Brook 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. As there are no designated beaches in these segments of Morgan Brook, the specific recreation impairment is for non-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	Aquatic Life	Recreation	Fish Consumption
CT4305-00_01	Morgan Brook-01	From mouth at West Branch Farmington River, US to confluence with tributary 4305-04 (first confluence) on east side of Route 44, Barkhamsted.	0.69	FULL	NOT	FULL
CT4305-00_02	Morgan Brook-02	From confluence with tributary 4305-04 (end of seg-01) east side of Route 44, US to East West Hill Road crossing area (50 meters US of East West Hill Road crossing, entrance of 9/12/05 home heating fuel spill), Barkhamsted.	1.41	U	NOT	FULL
CT4305-00_03	Morgan Brook-03	From East West Hill Road crossing area (50 meters US of East West Hill Road crossing, entrance of 9/12/05 home heating fuel spill), US to confluence with Mallory Brook, Barkhamsted.	0.48	U	U	FULL
CT4305-00_04	Morgan Brook-04	From confluence with Mallory Brook, US to West Hill Pond outlet dam, Barkhamsted.	1.52	FULL	NOT	FULL
<p>Shaded cells indicate impaired segment addressed in this TMDL FULL = Designated Use Fully Supported NOT = Designated Use Not Supported U = Unassessed</p>						

Figure 2: GIS map featuring general information of the Morgan Brook 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 Morgan Brook watershed consists of 74% forest, 14% urban, 8% water, and 4% agricultural land uses. At the West Hill Pond dam outlet, land use around Morgan Brook (Segment 4) is characterized by residential development, and then rural forest downstream of Bsullak Road crossing to the end of Morgan Brook (Segment 4) just south of Route 44. Morgan Brook (Segment 2) follows Route 44 through residential development. Morgan Brook (Segment 1) flows adjacent to commercial development, including Stewart’s Used Auto Parts, restaurants, and various businesses, downstream of the Route 318 crossing. Commercial and agricultural development increases near its confluence with the West Branch Farmington River with a drive-in movie park to the north and hayfields to the south.

Figure 3: Land use within the Morgan Brook watershed

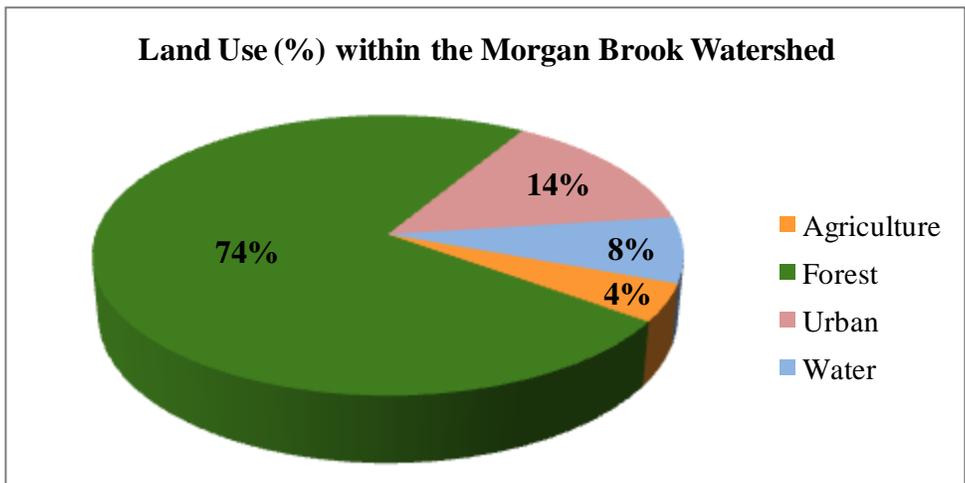
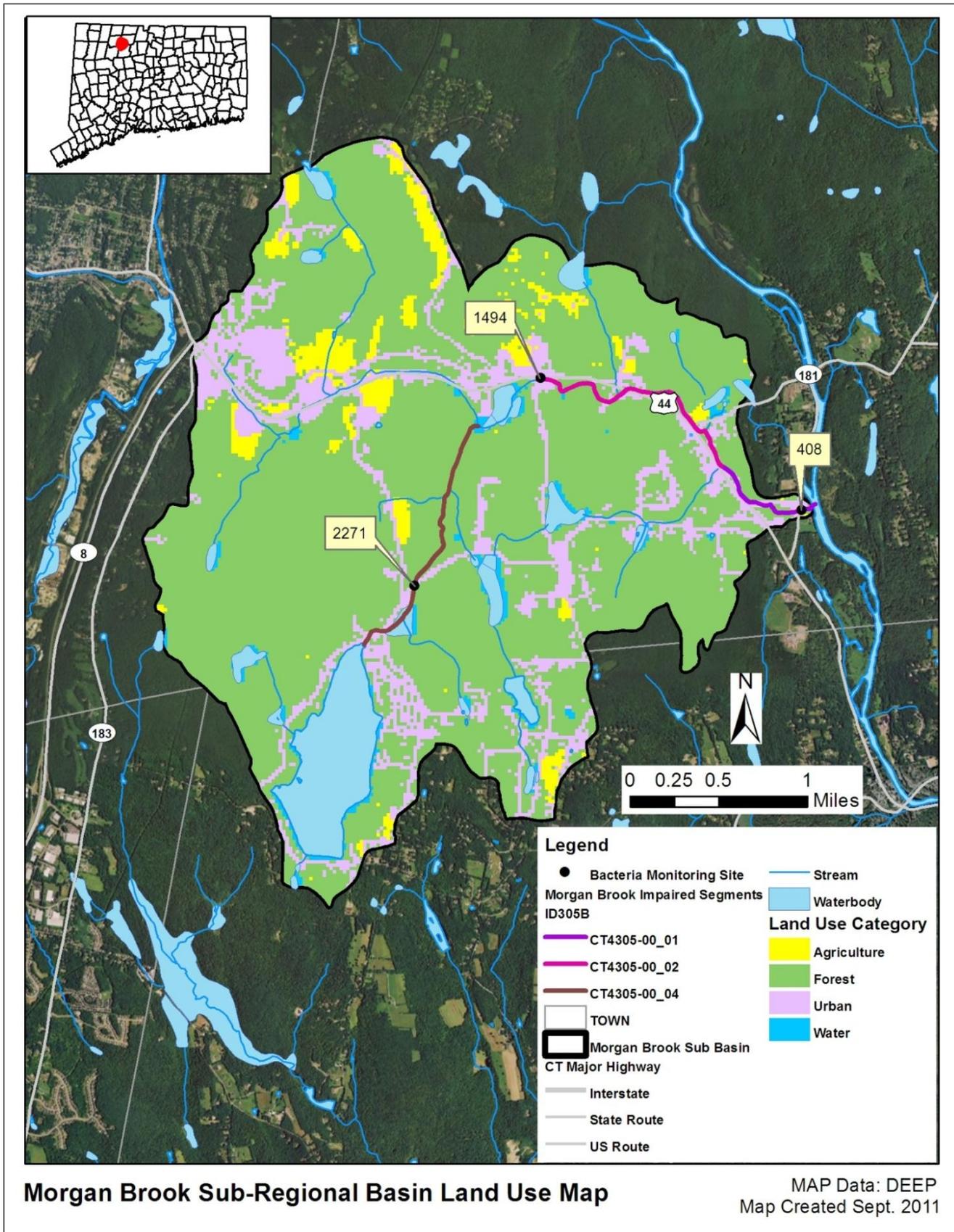


Figure 4: GIS map featuring land use for the Morgan Brook watershed at the sub-regional level



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, 2011b). 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 impaired segments in the Morgan Brook watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT4305-00_01	Morgan Brook	408	mouth	Barkhamsted	41.901769	-72.988922
CT4305-00_02	Morgan Brook	1494	East West Hill Road adjacent to Route 44	Barkhamsted	41.912489	-73.017458
CT4305-00_04	Morgan Brook	2271	Bsullak Road	Barkhamsted	41.895517	-73.031159

The three impaired segments of Morgan Brook (Segments 1, 2, and 4) are Class A freshwater rivers (Figure 5). Their 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 one sampling location on Morgan Brook (Segment 1, Station 408) from 2004-2009, from one sampling location on Morgan Brook (Segment 2, Station 1494) from 2004-2009, and from one sampling location on Morgan Brook (Segment 4, Station 2271) from 2005-2009 (Table 2).

For Morgan Brook (Segment 1), the water quality criteria for *E. coli*, along with bacteria sampling results for Station 408 from 2004-2009 are presented in Table 8. The annual geometric mean was calculated for Station 408 and exceeded the WQS for *E. coli* in 2004. Single sample values at this station also exceeded the WQS for *E. coli* in all sampling years except 2005 on at least one sampling date.

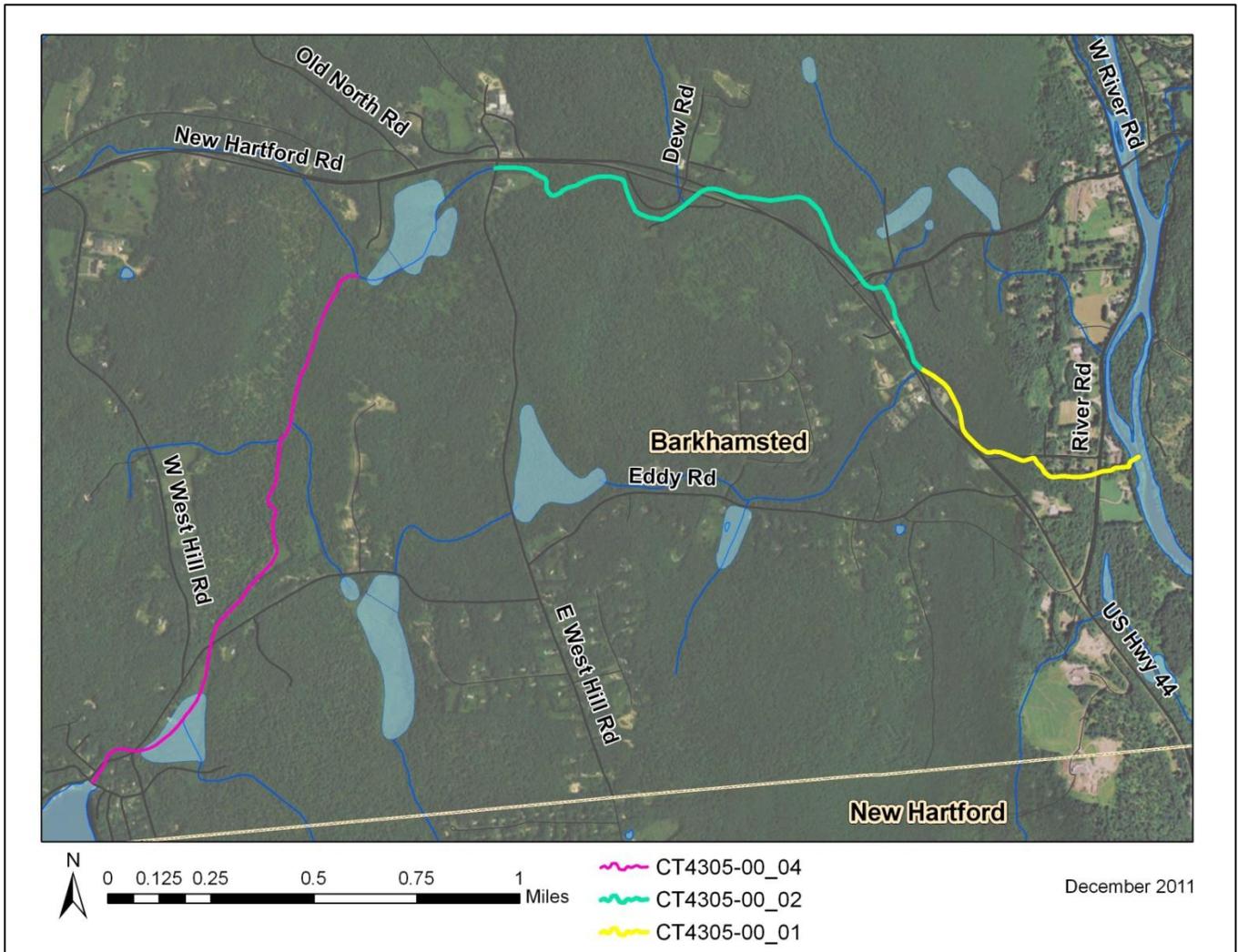
For Morgan Brook (Segment 2), the water quality criteria for *E. coli*, along with bacteria sampling results for Station 1494 from 2004-2009 are presented in Table 9. The annual geometric mean was calculated for Station 1494 and exceeded the WQS for *E. coli* in 2004. Single sample values at this station also exceeded the WQS for *E. coli* in all sampling years except 2005 on at least one sampling date.

For Morgan Brook (Segment 4), the water quality criteria for *E. coli*, along with bacteria sampling results for Station 2271 from 2005-2009 are presented in Table 10. The annual geometric mean was calculated for Station 2271 and did not exceed the WQS for *E. coli*. Single sample values at this station exceeded the WQS for *E. coli* on at least one sampling date in 2007 and 2008.

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 (Tables 8-10). For all impaired segments on Morgan Brook (Segments 1, 2, and 4), the wet weather bacteria levels were much higher than dry weather, with only geometric mean values during wet-weather exceeding the WQS for *E. coli*.

Due to the elevated bacteria measurements presented in Tables 8-10, these segments of Morgan Brook 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 Morgan Brook



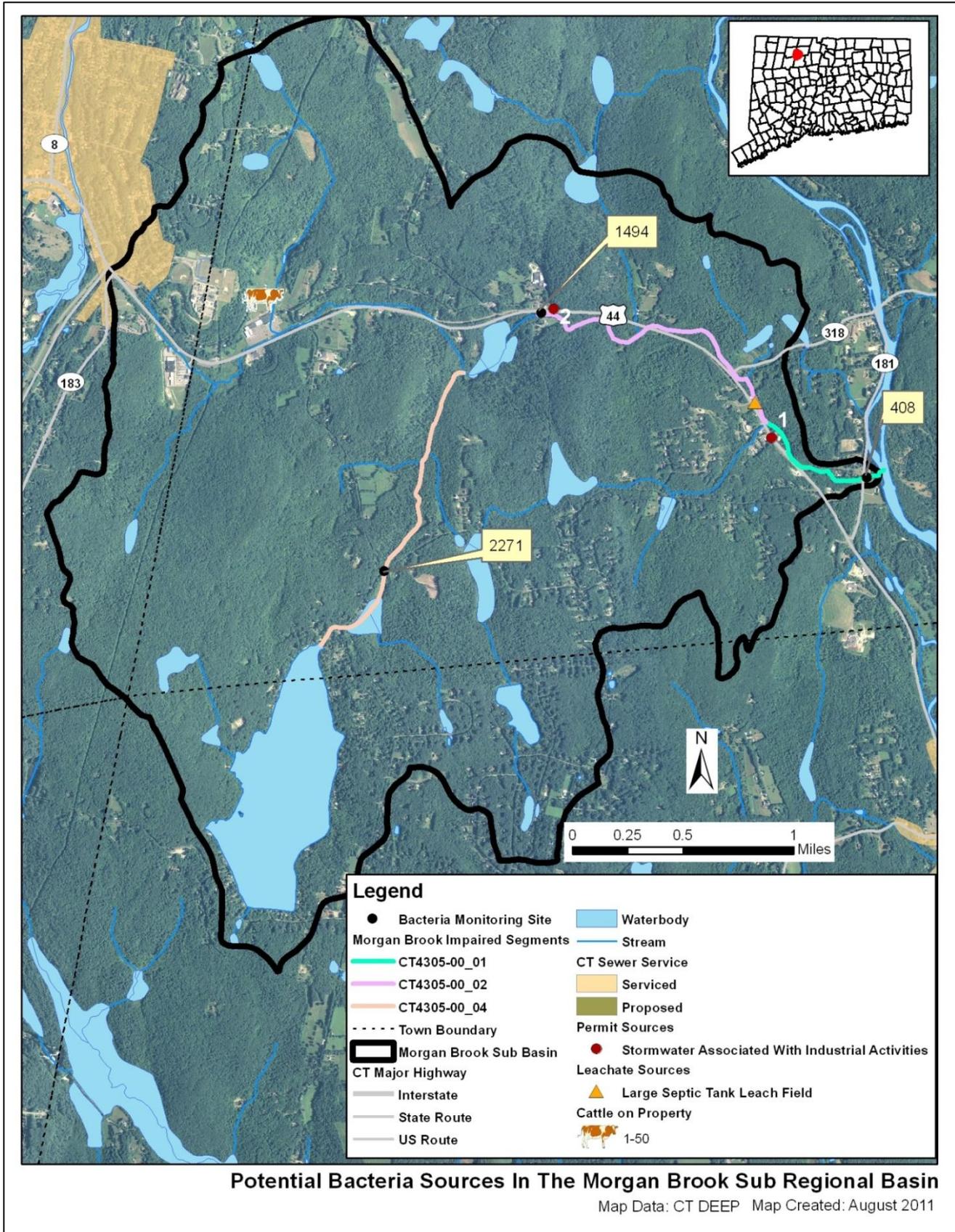
POTENTIAL BACTERIA SOURCES

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 may be 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 Morgan Brook watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Morgan Brook CT4305-00_01	x			x	x	x	x	
Morgan Brook CT4305-00_02	x			x	x	x	x	
Morgan Brook CT4305-00_04				x	x	x	x	

Figure 6: Potential sources in the Morgan Brook 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. Future investigation and monitoring may reveal the presence of 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 6.

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	2
GSM	Part B Municipal Stormwater MS4	0
GSN	Stormwater Registration – Construction	0
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are two permitted discharges in the Morgan Brook watershed. Bacteria data for Stewart's Auto Parts (GSI001058) along Route 44 and Morgan Brook (Segment 1) did not exceed fecal coliform standards on the single sample date in 2002. 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 Morgan Brook watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Barkhamsted	Stewart's Auto Parts, Inc.	GSI001058	Stormwater Associated With Industrial Activities	Stewart's Auto Parts Inc.	1
Barkhamsted	The Sterling Engineering Corporation	GSI000394	Stormwater Associated With Industrial Activities	Sterling Engineering Corporation	2

Table 6: Industrial permits on Morgan Brook and available fecal coliform data (colonies/100mL). The results cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Barkhamsted	Stewart's Auto Parts	GSI1058	Morgan Brook	--	05/13/02	10

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.

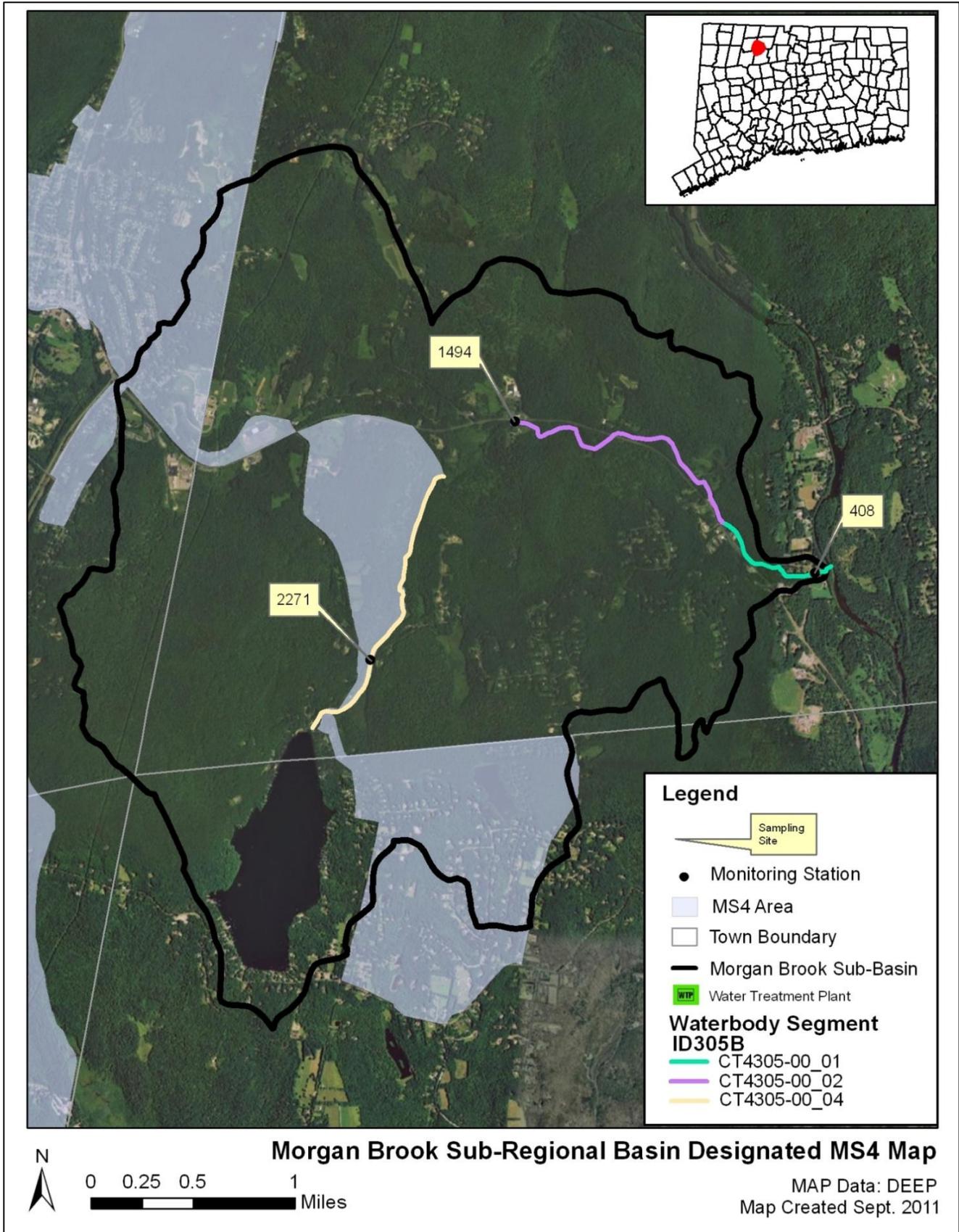
The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, 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. 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).

In Figure 7, the grey areas within the Morgan Brook watershed, including the Towns of Winchester, New Hartford, and Barkhamsted, represent the Winsted Urban Cluster, and therefore is not part of the CT DEEP MS4 permit program.

Publicly Owned Treatment Works

As shown in Figure 7, there are no publicly owned treatment works (POTW), or wastewater treatment plants, in the Morgan Brook watershed. There is only a very small portion of the watershed which is part of any sewer service area. That area is located at northwestern edge of the watershed, far from the impaired segments. POTWs are not considered a potential source of loading to the impaired segments of the Morgan Brook watershed.

Figure 7: MS4 areas of the Morgan Brook 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 Morgan Brook watershed are described below.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Morgan Brook watershed represent a potential source of bacteria 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 these natural sources on water quality (USEPA, 2001). The majority of the Morgan Brook watershed is undeveloped and wildlife waste may be a potential source of bacteria. Morgan Brook runs through residential development along Route 44, so pet waste may also be a potential source of bacteria.

Morgan Brook (Segment 1) flows just south of a drive-in movie park near the confluence with the West Branch Farmington River. 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 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.

Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, the majority of the Morgan Brook watershed, particularly near the impaired segments, relies on onsite wastewater treatment systems, such as septic systems. A large septic tank leach field at a commercial building along Route 44 just downstream of the Route 318 crossing was identified in Figure 6. 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 Barkhamsted is part of the Farmington Valley Health District (<http://www.fvhd.org/>).

There is only a very small area within the Morgan Brook watershed, located far from the impaired segments, that is serviced by the municipal sewer system (Figure 6). Therefore, sewer system leaks and other illicit discharges or connections are likely not a potential source of bacteria to nearby surface waters in the Morgan Brook watershed.

Stormwater Runoff from Developed Areas

While the majority of the Morgan Brook watershed is undeveloped, approximately 14% of the land use in the watershed is considered urban, and the impaired segments of Morgan Brook run along Route 44, which is characterized by residential and commercial development (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 Figures 8 and 9, 100% of the Morgan Brook watershed contains less than 6% impervious cover, which is a reflection of the 74% forested land use depicted in Figure 4. As indicated above, the impaired segments of Morgan Brook flow adjacent to major roads, including Route 44, where residential and commercial development is prevalent, particularly along Morgan Brook (Segments 1 and 2); therefore, stormwater runoff pollution from adjacent urban development may be a higher contributor of bacterial contamination than the summarized statistics for land use and impervious cover reveal. Water quality data taken at all stations along Morgan Brook exceeded geometric means during wet-weather, which suggests that stormwater runoff may be a source of bacteria to Morgan Brook (Tables 8-10).

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

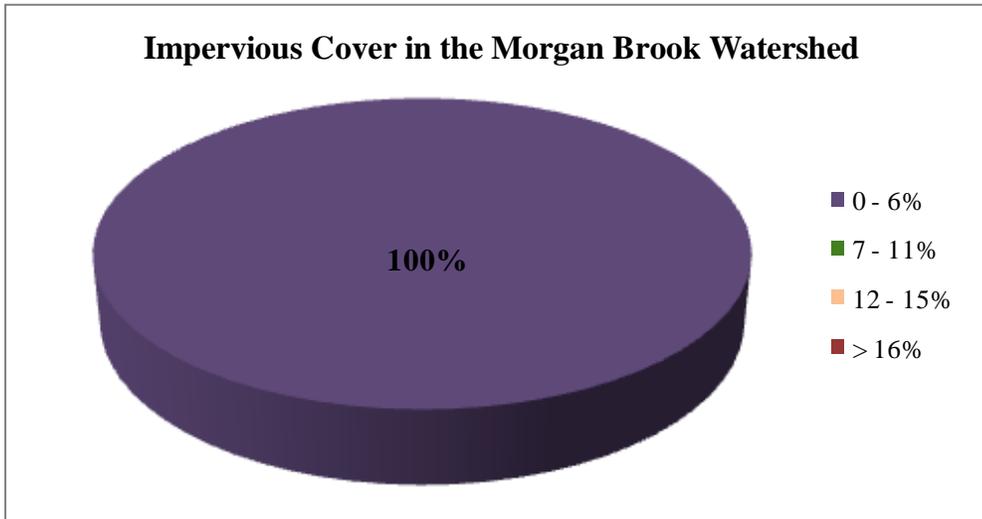
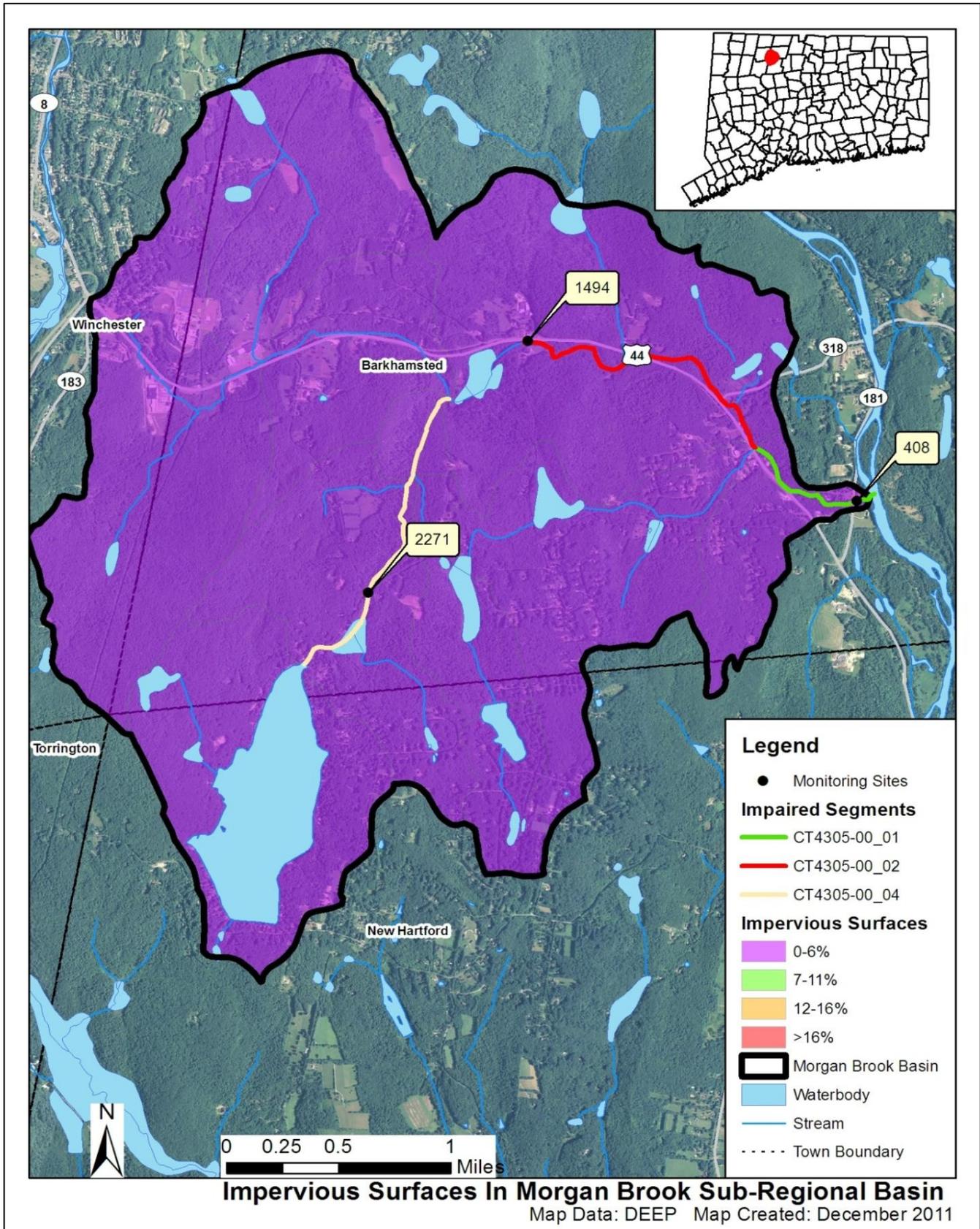


Figure 9: Impervious cover (%) for the Morgan Brook sub-regional watershed



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 4% of the Morgan Brook watershed, and hayfields are located along W West Hill Road near Morgan Brook (Segment 4), Route 44 along Morgan Brook (Segment 2), and at the confluence with the West Branch Farmington River where Morgan Brook (Segment 1) joins it. As identified in Figure 6, there is a cattle farm with approximately 1-50 head of cattle along a tributary to Morgan Brook (Segment 4), but it is most likely a small source of bacterial contamination to Morgan Brook.

Additional Sources

There are two permitted sources identified in Figure 6, including Stewart's Used Auto Parts along Route 44 just downstream of the Route 318 crossing in Barkhamsted. Bacteria data for Stewart's Used Auto Parts showed no exceedances for 2002 sampling. There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in Morgan Brook. 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

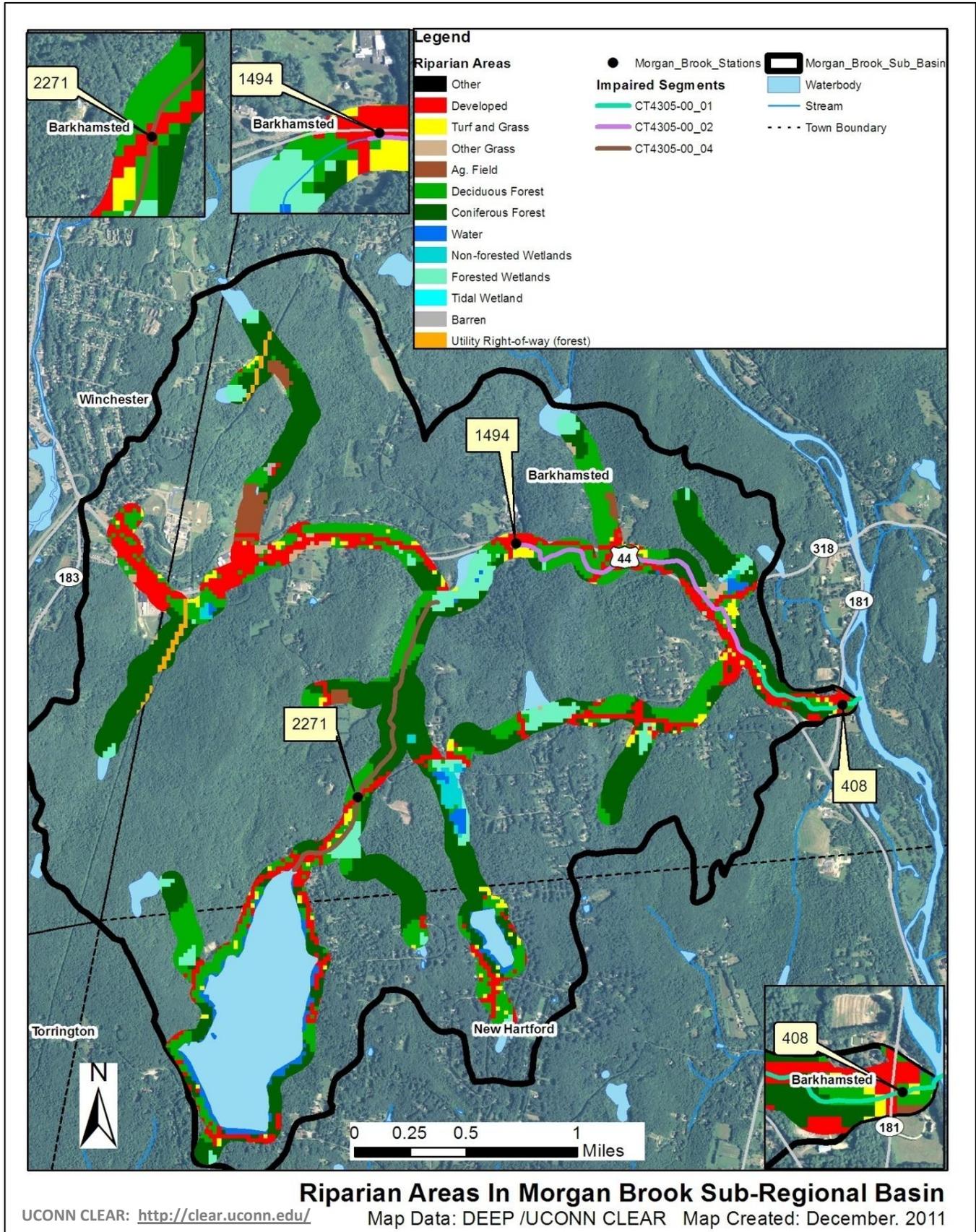
Riparian Buffer Zones

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 riparian zone for Morgan Brook (Segments 1 and 2) is characterized by mixed forest with developed and turf/grass land use areas (Figure 10). The riparian area along Morgan Brook (Segment 4) is characterized by mixed forest with small tracts of development and turf/grass. As previously noted, if not properly treated, runoff from developed areas may contain pollutants such as bacteria and nutrients.

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



CURRENT MANAGEMENT ACTIVITIES

The Northwest Conservation District (NCD) completed the Morgan Brook Watershed Based Plan in August of 2012 under a CT DEEP CWA Sec 319 NPS Program grant. The plan focuses on bacterial impairment and provides field survey information gathered by NCD based on potential sources of impairment. Check the CTDEEP Watershed Management Plan and Documents webpage for updates (http://www.ct.gov/dep/cwp/view.asp?a=2719&q=379296&depNav_GID=1654). This document can also be referenced for suggested targets in the recommended next steps section.

RECOMMENDED NEXT STEPS

Several municipalities have worked with the Farmington River Watershed Association (FRWA) www.frwa.org to develop and implement programs to protect water quality from bacterial contamination. Any municipalities not already working with this watershed association are encouraged to contact them for assistance with future efforts dealing with bacteria impairment in the Morgan Brook Watershed, a tributary of the Farmington River. Future mitigative activities are necessary to ensure the long-term protection of Morgan Brook and have been prioritized below.

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

As most of the Morgan Brook watershed is forested with developed residential areas along Route 44 adjacent to Morgan Brook, any education and outreach program should highlight the importance of managing waste from horses, dogs, and other pets and not feeding waterfowl and wildlife. The municipalities and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of Morgan Brook 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 Morgan Brook 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-use areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

2) Develop a system to monitor septic systems.

The majority of the Morgan Brook watershed relies on septic systems, particularly near the impaired segments, and a large septic tank leach field was identified at a commercial building along Route 44 just downstream of the Route 318 crossing (Figure 6). If not already in place, Barkhamsted should establish programs 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. Barkhamsted should also develop a program to assist citizens with the replacement and repair of older and failing systems.

3) Identify areas along Morgan Brook to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 14% of the Morgan Brook watershed is considered urban, particularly near the impaired segments of Morgan Brook along Route 44, and all stations along Morgan Brook exceeded

geometric means during wet-weather. As such, stormwater runoff is likely contributing bacteria to the waterbodies. To identify areas that are contributing bacteria to the impaired segments, Barkhamsted should continue to conduct wet-weather sampling. To treat stormwater runoff, Barkhamsted should identify areas along the impaired segment 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) Identify and monitor permitted sources.

Although the only available permitted sources data identified in Figure 6 did not exceed fecal coliform water quality standards, the Town of Barkhamsted should continue monitoring these industrial activities permits, including Stewart's Used Auto Parts, to determine whether the sites are contributing bacteria to Morgan Brook. 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 Morgan Brook 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

Class	Bacteria Source	Instantaneous <i>E. coli</i> (#/100mL)						Geometric Mean <i>E. coli</i> (#/100mL)	
		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.

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

Agricultural areas, particularly hayfields, represent only 4% of the Morgan Brook watershed, and are located along W West Hill Road and Route 44 near the impaired segments of Morgan 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 access to livestock and horses from streams and wetlands, and that animal waste handling, disposal, and other appropriate BMPs are in place.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL**Table 8: Morgan Brook Bacteria Data****Waterbody ID:** CT4305-00_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: 410 colonies/100 mL

Percent Reduction to meet TMDL:Geometric Mean: **35%**Single Sample: **59%****Data:** 2004-2009 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from Station 408 on Morgan Brook (Segment 1) with annual geometric mean calculated**

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
408	Mouth of Morgan Brook	7/9/2004	300	wet	193* (35%)
408	Mouth of Morgan Brook	7/27/2004	10	dry	
408	Mouth of Morgan Brook	8/31/2004	450	dry	
408	Mouth of Morgan Brook	9/28/2004	1000* (59%)	wet	
408	Mouth of Morgan Brook	10/19/2004	200	wet	
408	Mouth of Morgan Brook	3/29/2005	260	wet	31
408	Mouth of Morgan Brook	4/28/2005	10	wet	
408	Mouth of Morgan Brook	5/19/2005	40	dry	
408	Mouth of Morgan Brook	6/16/2005	40	dry	
408	Mouth of Morgan Brook	8/18/2005	10	dry	
408	Mouth of Morgan Brook	9/22/2005	20	dry	
408	Mouth of Morgan Brook	10/20/2005	30	dry	

Single sample *E. coli* (colonies/100 mL) data from Station 408 on Morgan Brook (Segment 1) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
408	Mouth of Morgan Brook	3/30/2006	10	dry	47
408	Mouth of Morgan Brook	4/26/2006	39	wet	
408	Mouth of Morgan Brook	5/24/2006	10	dry	
408	Mouth of Morgan Brook	6/14/2006	90	dry	
408	Mouth of Morgan Brook	7/19/2006	50	dry	
408	Mouth of Morgan Brook	7/21/2006	60	dry	
408	Mouth of Morgan Brook	8/30/2006	600	wet	
408	Mouth of Morgan Brook	9/20/2006	10	wet	
408	Mouth of Morgan Brook	10/18/2006	170	wet	
408	Mouth of Morgan Brook	4/11/2007	3	dry	
408	Mouth of Morgan Brook	5/9/2007	20	dry	
408	Mouth of Morgan Brook	7/11/2007	20	dry	
408	Mouth of Morgan Brook	8/8/2007	80	wet	
408	Mouth of Morgan Brook	9/12/2007	860	wet	
408	Mouth of Morgan Brook	10/10/2007	110	wet	
408	Mouth of Morgan Brook	4/9/2008	2	dry	20
408	Mouth of Morgan Brook	5/14/2008	40	dry	
408	Mouth of Morgan Brook	6/11/2008	28	wet	
408	Mouth of Morgan Brook	7/9/2008	10	dry	
408	Mouth of Morgan Brook	8/13/2008	500	wet	
408	Mouth of Morgan Brook	9/10/2008	100	wet	
408	Mouth of Morgan Brook	10/8/2008	5	dry	
408	Mouth of Morgan Brook	11/12/2008	5 [†]	dry	
408	Mouth of Morgan Brook	9/14/2009	30	dry	41
408	Mouth of Morgan Brook	9/21/2009	7	dry	
408	Mouth of Morgan Brook	9/28/2009	448	wet	
408	Mouth of Morgan Brook	10/5/2009	31	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 408 on Morgan Brook (Segment 1)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
408	Mouth of Morgan Brook	2004-2009	16	23	43	143	19

Shaded cells indicate an exceedance of water quality criteria
 Weather condition determined from rain gage at the Norfolk 2 SW in Norfolk, CT

Table 9: Morgan Brook Bacteria Data*Waterbody ID:* CT4305-00_02*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: 410 colonies/100 mL

*Percent Reduction to meet TMDL:*Geometric Mean: **47%**Single Sample: **55%***Data:* 2004-2009 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from Station 1494 on Morgan Brook (Segment 2) with annual geometric mean calculated**

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1494	East West Hill Road adjacent to Route 44	7/9/2004	200	wet	236* (47%)
1494	East West Hill Road adjacent to Route 44	7/27/2004	30	dry	
1494	East West Hill Road adjacent to Route 44	8/31/2004	460	dry	
1494	East West Hill Road adjacent to Route 44	9/28/2004	920* (55%)	wet	
1494	East West Hill Road adjacent to Route 44	10/19/2004	290	wet	
1494	East West Hill Road adjacent to Route 44	3/29/2005	150	wet	82
1494	East West Hill Road adjacent to Route 44	4/28/2005	50	wet	
1494	East West Hill Road adjacent to Route 44	5/19/2005	80	dry	
1494	East West Hill Road adjacent to Route 44	6/16/2005	290	dry	
1494	East West Hill Road adjacent to Route 44	8/18/2005	20	dry	
1494	East West Hill Road adjacent to Route 44	9/22/2005	80	dry	
1494	East West Hill Road adjacent to Route 44	10/20/2005	90	dry	

Single sample *E. coli* (colonies/100 mL) data from Station 1494 on Morgan Brook (Segment 2) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1494	East West Hill Road adjacent to Route 44	3/30/2006	10	dry	57
1494	East West Hill Road adjacent to Route 44	4/26/2006	18	wet	
1494	East West Hill Road adjacent to Route 44	5/24/2006	10	dry	
1494	East West Hill Road adjacent to Route 44	6/14/2006	160	dry	
1494	East West Hill Road adjacent to Route 44	7/19/2006	90	dry	
1494	East West Hill Road adjacent to Route 44	7/21/2006	40	dry	
1494	East West Hill Road adjacent to Route 44	8/30/2006	620	wet	
1494	East West Hill Road adjacent to Route 44	9/20/2006	40	wet	
1494	East West Hill Road adjacent to Route 44	10/18/2006	260	wet	
1494	East West Hill Road adjacent to Route 44	4/11/2007	11	dry	
1494	East West Hill Road adjacent to Route 44	5/9/2007	30	dry	
1494	East West Hill Road adjacent to Route 44	7/11/2007	90	dry	
1494	East West Hill Road adjacent to Route 44	8/8/2007	350	wet	
1494	East West Hill Road adjacent to Route 44	9/12/2007	860	wet	
1494	East West Hill Road adjacent to Route 44	10/10/2007	150	wet	
1494	East West Hill Road adjacent to Route 44	4/9/2008	7	dry	82
1494	East West Hill Road adjacent to Route 44	5/14/2008	80	dry	
1494	East West Hill Road adjacent to Route 44	6/11/2008	150	wet	
1494	East West Hill Road adjacent to Route 44	7/9/2008	360	dry	
1494	East West Hill Road adjacent to Route 44	8/13/2008	430	wet	
1494	East West Hill Road adjacent to Route 44	9/10/2008	800	wet	
1494	East West Hill Road adjacent to Route 44	10/8/2008	40	dry	
1494	East West Hill Road adjacent to Route 44	11/12/2008	5	dry	
1494	East West Hill Road adjacent to Route 44	9/14/2009	110	dry	97
1494	East West Hill Road adjacent to Route 44	9/21/2009	28	dry	
1494	East West Hill Road adjacent to Route 44	9/28/2009	691	wet	
1494	East West Hill Road adjacent to Route 44	10/5/2009	41	dry	

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 1494 on Morgan Brook (Segment 2)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1494	East West Hill Road adjacent to Route 44	2004-2009	16	23	91	233	48
<p>Shaded cells indicate an exceedance of water quality criteria</p> <p>Weather condition determined from rain gage at the Norfolk 2 SW in Norfolk, CT</p>							

Table 10: Morgan Brook Bacteria Data**Waterbody ID:** CT4305-00_04**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: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: NA

Single Sample: 43%

Data: 2005-2009 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle**Single sample *E. coli* (colonies/100 mL) data from Station 2271 on Morgan Brook (Segment 4) with annual geometric mean calculated**

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
2271	Bsullak Road crossing	3/29/2005	70	wet	60
2271	Bsullak Road crossing	4/28/2005	10	wet	
2271	Bsullak Road crossing	5/19/2005	10	dry	
2271	Bsullak Road crossing	6/16/2005	70	dry	
2271	Bsullak Road crossing	8/18/2005	130	dry	
2271	Bsullak Road crossing	9/22/2005	240	dry	
2271	Bsullak Road crossing	10/20/2005	190	dry	

Single sample *E. coli* (colonies/100 mL) data from Station 2271 on Morgan Brook (Segment 4) with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
2271	Bsullak Road crossing	3/30/2006	10	dry	44
2271	Bsullak Road crossing	4/26/2006	8	wet	
2271	Bsullak Road crossing	5/24/2006	10	dry	
2271	Bsullak Road crossing	6/14/2006	140	dry	
2271	Bsullak Road crossing	7/19/2006	20	dry	
2271	Bsullak Road crossing	7/21/2006	70	dry	
2271	Bsullak Road crossing	8/30/2006	400	wet	
2271	Bsullak Road crossing	9/20/2006	50	wet	
2271	Bsullak Road crossing	10/18/2006	180	wet	
2271	Bsullak Road crossing	4/11/2007	4	dry	
2271	Bsullak Road crossing	5/9/2007	10	dry	
2271	Bsullak Road crossing	7/11/2007	145 [†]	dry	
2271	Bsullak Road crossing	8/8/2007	720* (43%)	wet	
2271	Bsullak Road crossing	9/12/2007	220	wet	
2271	Bsullak Road crossing	10/10/2007	200 [†]	wet	
2271	Bsullak Road crossing	4/9/2008	18 [†]	dry	64
2271	Bsullak Road crossing	5/14/2008	17 [†]	dry	
2271	Bsullak Road crossing	6/11/2008	145 [†]	wet	
2271	Bsullak Road crossing	7/9/2008	80	dry	
2271	Bsullak Road crossing	8/13/2008	500	wet	
2271	Bsullak Road crossing	9/10/2008	300	wet	
2271	Bsullak Road crossing	10/8/2008	100	dry	
2271	Bsullak Road crossing	11/12/2008	5	dry	
2271	Bsullak Road crossing	9/14/2009	31	dry	30
2271	Bsullak Road crossing	9/21/2009	12	dry	
2271	Bsullak Road crossing	9/28/2009	231	wet	
2271	Bsullak Road crossing	10/5/2009	10	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 2271 on Morgan Brook (Segment 4)

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
2271	Bsullak Road crossing	2005-2009	13	21	54	131	31

Shaded cells indicate an exceedance of water quality criteria
Weather condition determined from rain gage at the Norfolk 2 SW in Norfolk, CT

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