Shepaug River Watershed Summary

Walker Brook

WATERSHED DESCRIPTION AND MAPS

The Shepaug River watershed covers an area of approximately 45,400 acres in western Connecticut (Figure 1). There are several municipalities located at least partially in the watershed, including the Towns of Warren, Litchfield, Washington, Roxbury, New Milford, Southbury, and Bridgewater, CT.

The Shepaug River watershed currently includes one segment impaired for recreation due to elevated bacteria levels (Walker Brook CT6700-20_01). This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed are currently unassessed as of the writing of this document. However, this does not mean there are no problems on this segment, but is an indication that there is not current data to evaluate the segment as part of an assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of the other waterbodies in the watershed. Walker Brook is not shown in Table 1 because the impairment is based on sampling data from 2010. The segment will be included in the 2012 list.

Walker Brook begins in a forested area along the New Milford - Washington town line in northern New Milford and flows south. The impaired segment of Walker Brook (CT6700-20_01) begins at the confluence of Walker Brook and an unnamed tributary stream downstream of the Walker Brook Road crossing near the New Milford - Washington town line in Washington (Figure 2). The brook then begins to flow south east into Roxbury. Walker Brook ends where it enters the Shepaug River, upstream of the Metcalf Road crossing in Roxbury. Walker Brook's impaired segment is 0.64 miles long and located in the towns of Washington and Roxbury.

The impaired segment of Walker Brook has a water quality classification of AA. Designated uses include existing or proposed drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This segment is impaired due to elevated bacteria concentrations and the designated use affected by the impairment is recreation. As there are no designated beaches on the impaired segment of Walker Brook, the specific impairment for Walker Brook is for recreation for

Impaired Segment Facts

Impaired Segments Name:
Walker Brook (CT6700-20_01)

Municipalities:
Washington and Roxbury, CT

Impaired Segment Length:
CT6700-20_01 (0.64 miles)

Water Quality Classification:
CT6700-20_01: Class AA

Designated Use Impairment:
Recreation

Sub-regional Basin Name and Code: Shepaug River, CT6700

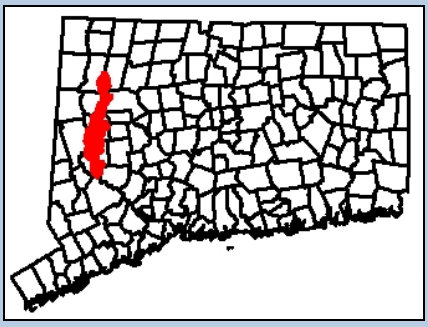
Regional Basin: Shepaug

Major Basin: Housatonic

Watershed Area (acres): 45,400

MS4 Applicable? No

Figure 1: Watershed location in Connecticut



non-designated swimming and other contact water-related activities.

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

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT6700-00_01	Shepaug River-01	From mouth at confluence with Housatonic River (northeast branch of Lake Lillinonah portion, just DS of Minor Bridge Road crossing), US to confluence with Bantam River (parallel with Whittlesey Road), Washington.	17.67	FULL	NOT*	FULL
CT6700-00_02	Shepaug River-02	From confluence with Bantam River (just DS of Whittlesey Road crossing), Washington, US to Shepaug Reservoir outlet dam (US of Valley Road crossing), Litchfield/Warren town border.	3.51	NOT	FULL	FULL

Shaded cells indicate impaired segment addressed in this TMDL

FULL = Designated Use Fully Supported

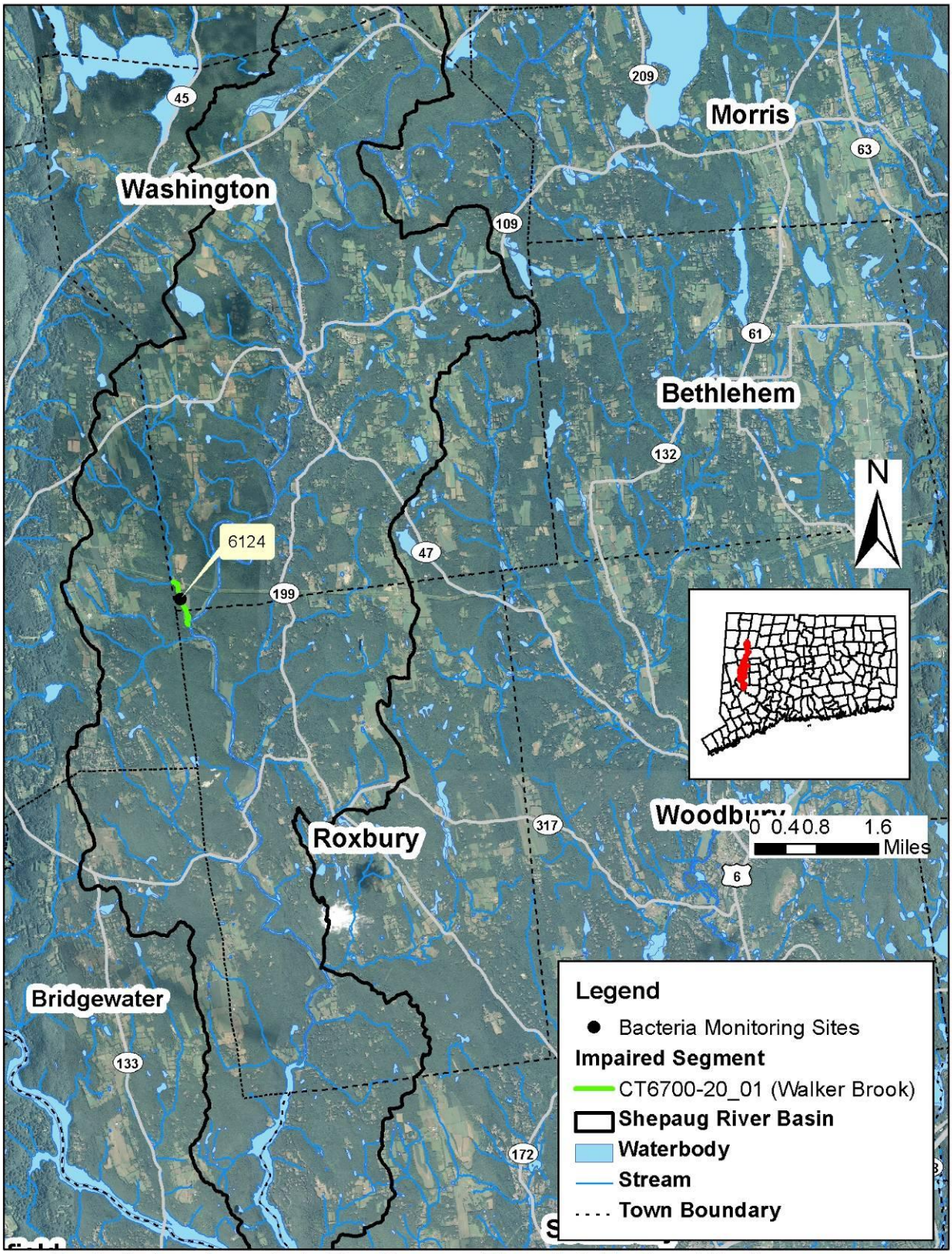
NOT = Designated Use Not Supported

U = Unassessed

***2010 monitoring data shows this segment now attains water quality standards and will be removed from the 2012 impaired waters list**

****Segment 6700-20_01 (Walker Brook) will be impaired in the 2012 Impaired Waters List due to 2010-11 data. It was not included in the 2012 Report and so is not in the above table.**

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



Bacteria Impairments In The Shepaug River Sub Regional Basin
Map Data: CT DEEP Map Created: August 2011

Land Use

The existing land use in a watershed can affect the water quality of the waterbodies within that watershed (USEPA, 2011c). In an undeveloped watershed, natural processes such as infiltration of stormwater into the soil and plant uptake of water and nutrients can occur. As watersheds become more developed with commercial, residential, and industrial land uses, the amount of stormwater runoff increases as the natural landscape is altered with impervious surfaces, such as rooftops, roads, and sidewalks. The amount of pollutants, such as nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities, can also increase, can become entrained in this runoff, and negatively affect nearby waterbodies. 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 Shepaug River watershed consists of 68% forest, 11% urban area, 16% agriculture, and 5% water. The majority of the land surrounding the impaired segment of Walker Brook in Washington and Roxbury are characterized by agricultural land uses. While much of the watershed is dominated by forest, there are many areas where urban, or agricultural land uses surround the impaired segment of Walker Brook.

Figure 3: Land uses within the Shepaug River watershed

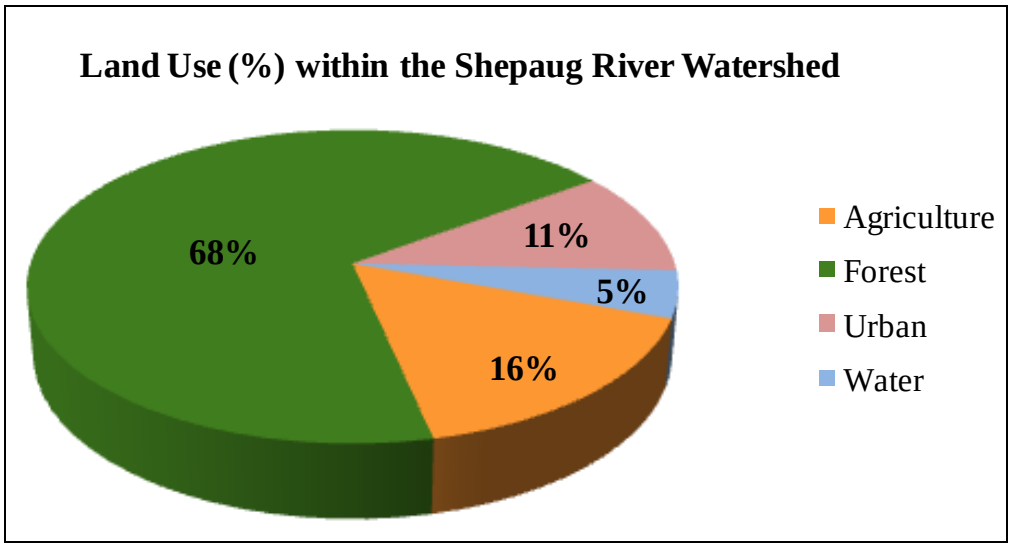
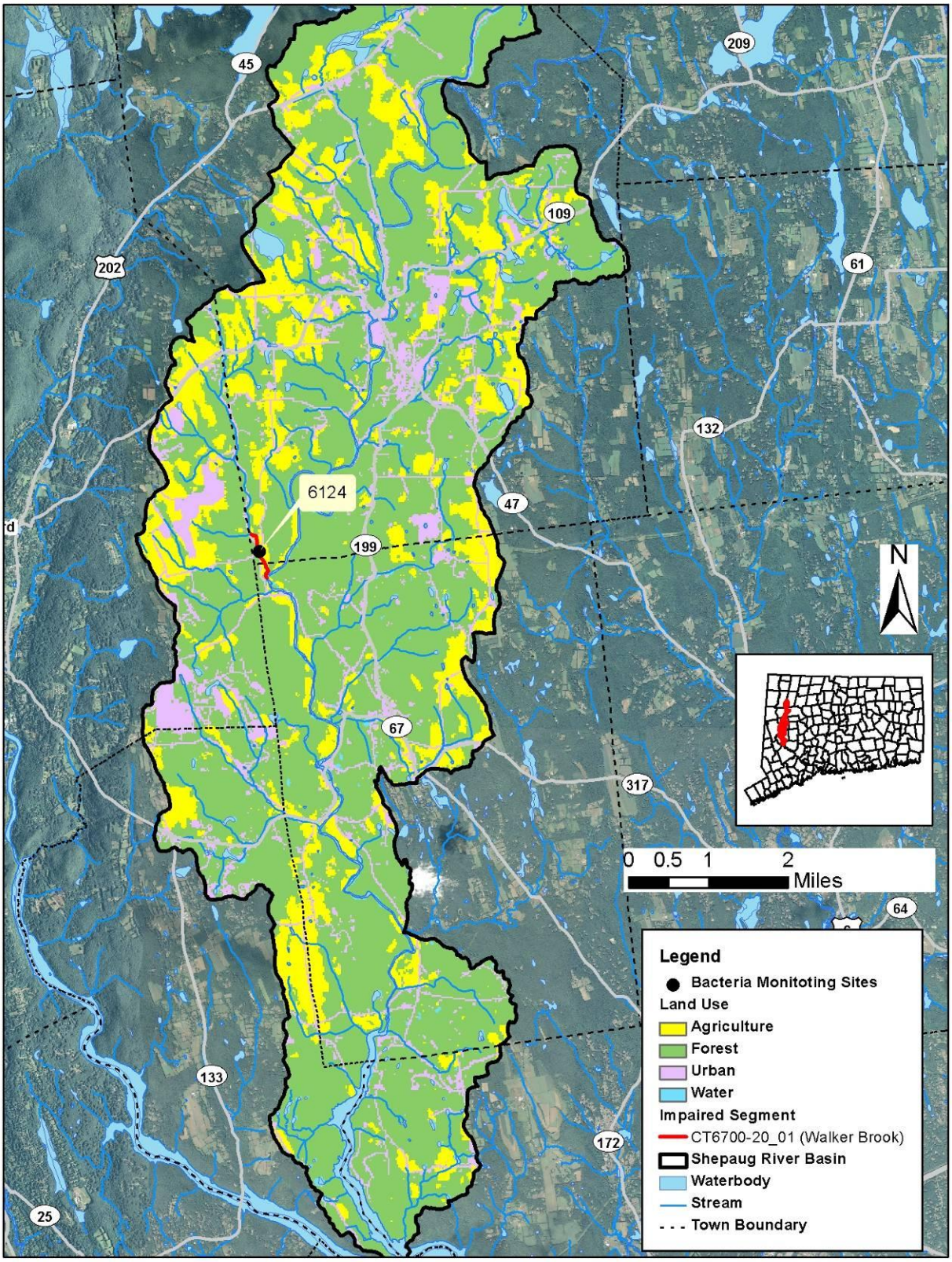


Figure 4: GIS map featuring land use for the Shepaug River watershed at the sub-regional level



Land Use In The Shepaug River Sub Regional Basin

Map Data: CT DEEP Map Created: August 2011

WHY IS A TMDL NEEDED?

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

Table 2: Sampling Station Location Description for the Impaired Segment in the Shepaug River Watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT6700-20_01	Walker Brook	6124	Intersection of Hartwell Rd and Shinar Road and Walker Brook Road	Washington	41.597500	-73.347540

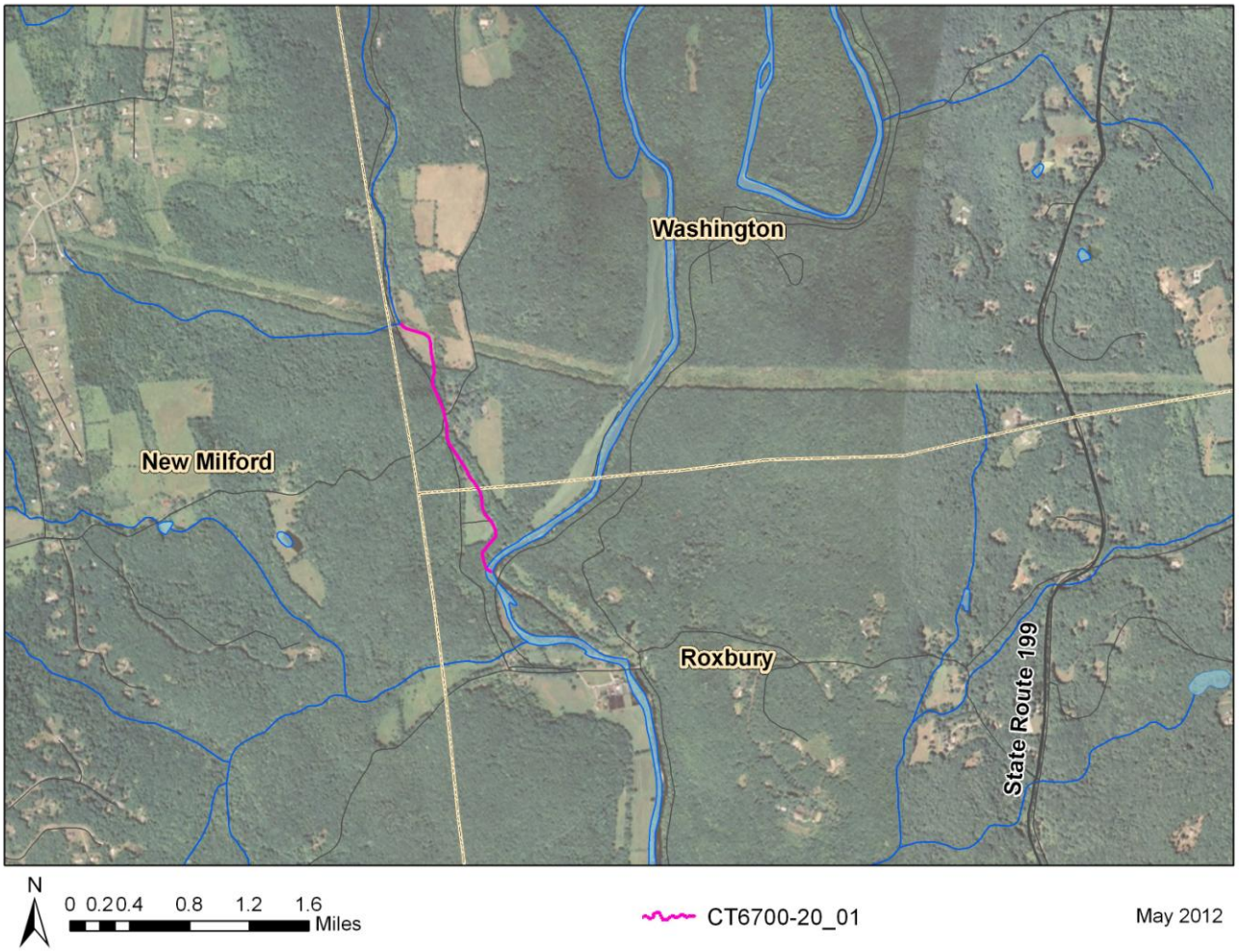
Walker Brook (CT6700-20_01) is a Class AA freshwater river. The applicable designated uses are proposed or existing drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analysis was conducted at one sampling location on Walker Brook (Station 6124).

The water quality criteria for *E. coli*, along with bacteria sampling results from 2010 are presented in Table 7 for Walker Brook. The annual geometric mean was calculated for Station 6124 on Walker Brook in 2010 and exceeded the WQS for *E. coli.* Single sample values exceeded the WQS for *E. coli* at Station 6124 on nine out of the eleven (82%) samples in 2010.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days, where appropriate (Tables 7). For Walker Brook both the wet and the dry-weather geometric means exceeded the WQS for *E. coli* at Station 6124. At Station 6124, the dry-weather geometric mean was more than two times the value of the calculated wet-weather geometric mean.

Due to the elevated bacteria measurements presented in Tables 7, Walker Brook did not meet CT's bacteria WQS, was identified as impaired, and 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 Walker Brook



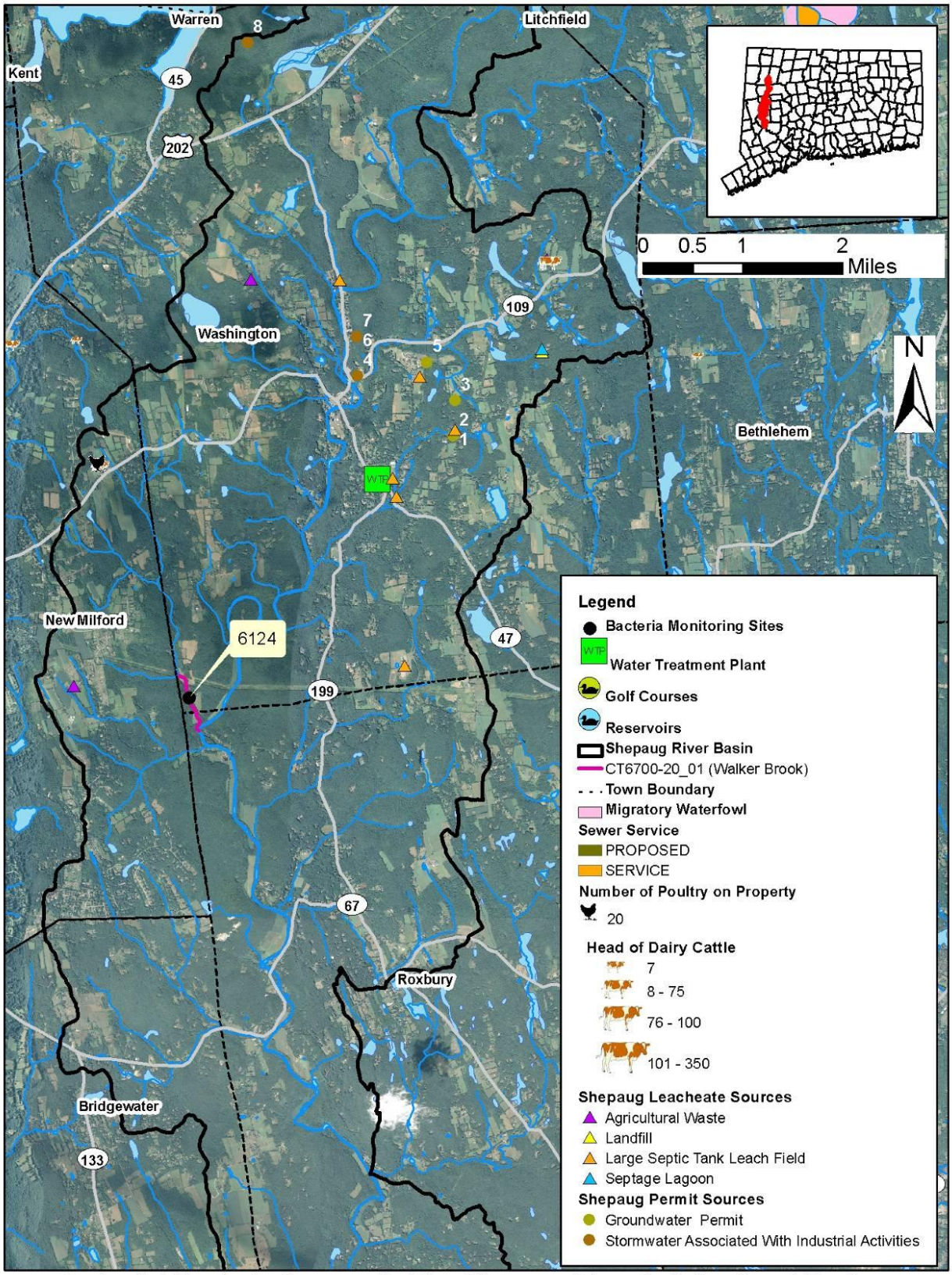
POTENTIAL BACTERIA SOURCES

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 Shepaug River watershed based on land use (Figures 2 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 below and shown in 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 segment. Further monitoring and investigation will confirm listed sources and discover additional sources. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not mean that there are no data nor that there are no impairments in existence in the segment. In some of these 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 Shepaug River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Walker Brook CT6700-20_01				**x**	**x**	**x**	**x**	

Figure 6: Potential sources in the Shepaug River watershed



Potential Bacteria Sources In The Shepaug River Sub Regional Basin

Map Data: CT DEEP Map Created: August 2011

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 it is because no examples of that specific source were discovered to be present during the analysis of the basin. The following is the list of potential sources that were evaluated during analysis of the impaired basin: 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 exist 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 could 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	3
GSM	Part B Municipal Stormwater MS4	0
GSN	Stormwater Registration – Construction	0
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	5

Permitted Sources

As shown in Table 5, there are several permitted discharges in the Shepaug River watershed. Bacteria data from 2001 from several of these industrial permitted facilities are included in Table 6. Though this data cannot be compared to a water quality standard as Connecticut does not have a water quality standard to evaluate recreation use for fecal coliform bacteria, several samples were high. Samples taken from the Town of Roxbury's Town Garage (GSI1171) and the Town of Roxbury's Landfill (GSI868) were greater than 1,000 colonies/100mL. These results indicate that permitted facilities in the Shepaug River watershed may be contributing bacteria to other stream segments 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 Shepaug River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Washington	Devereux Glenholme School	UI0000014	Groundwater Permit	Devereux Glenholme School	5
Washington	Quarry Ridge Condo	UI0000153	Groundwater Permit	Quarry Ridge Condominiums	6
Washington	Wykeham Rise Llc	UI0000220	Groundwater Permit	Int. College Of Hosp. Mgmt.	1
Washington	Wykeham Rise Llc	UI0000220	Groundwater Permit	International College Of Hospitality Management	2
Washington	Gunnery, Incorporated	UI0000365	Groundwater Permit	Gunnery, Inc., The	3
Washington	State Of Connecticut Department Of Transportation	GSI000077	Stormwater Associated With Industrial Activities	Washington Salt Storage	8
Washington	Town Of Washington	GSI000736	Stormwater Associated With Industrial Activities	Washington Transfer Station	7
Washington Depot	Town Of Washington	GSI000160	Stormwater Associated With Industrial Activities	Washington Town Garage	4

Table 6: Industrial permits in the Shetucket River watershed 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
Roxbury	Town of Roxbury	GSI1171	Shepaug River	town garage	09/14/01	1,100
Roxbury	Town of Roxbury	GSI868	Shepaug River	landfill	09/14/01	3,000
Washington	Town of Washington	GSI160	Shepaug River	town garage	09/14/01	850

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)

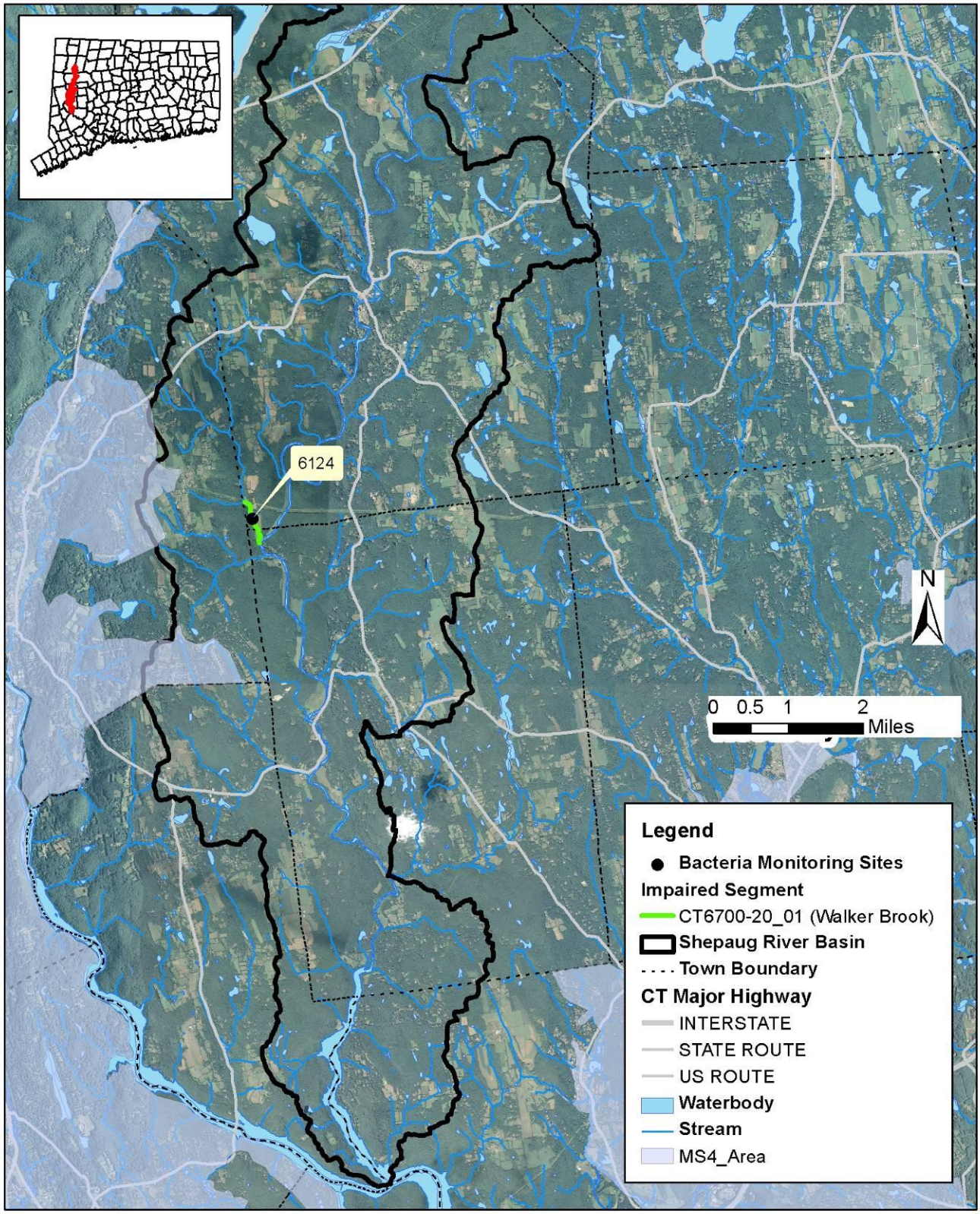
While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some 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 segment Walker Brook is located in the towns of Washington and Roxbury. As there are no urbanized locations as defined by the U.S. Census Bureau around the impaired segments, the towns are not MS4 areas and are not required to comply with the General Permit for the MS4 permit issued by the CT DEEP (Figure 7). Information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (www.ct.gov/dep/stormwater).

Figure 7: MS4 areas of the Shepaug River watershed



Shepaug River Sub Regional Basin Designated MS4 Map
Map Data: CT DEEP Map Created:January 2012

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 contract recreation (swimming or wading). Potential sources of NPS within the Shepaug River watershed are described below.

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 a vegetated buffer along the shoreline. Agricultural land use makes up 16% of the Shepaug River watershed. There are several agricultural operations near Walker Brook.

Agricultural fields are located to the east of Walker Brook's impaired segment for most of its course. Agricultural operations are located adjacent to the Brook off Walker Brook Road and Shinar Mountain Road in Washington. As seen in Figure 6, there are several farms with cattle and poultry within the watershed. There are also several areas where agricultural waste is identified as a potential source of bacterial contamination (Figure 6). These agricultural areas are potentially carrying pollutants, including bacteria, into Walker Brook.

Insufficient Septic Systems

As shown in Figure 6, none of the residents within the Shepaug River watershed do have access to a sanitary sewer. The residents surrounding Walker Brook rely on onsite wastewater treatment systems, such as septic systems to treat their waste. 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 of failing septic systems in a specific municipality. The Town of Roxbury is part of the Newtown Health District, which serves the municipalities of Newton, Bridgewater, and Roxbury, CT (http://www.newtown-ct.gov/Public_Documents/NewtownCT_Health/index). The Town of Washington has its own Department of Health (http://www.washingtonct.org/health.html).

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Shepaug 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 these natural sources on water quality (USEPA, 2001).

Open spaces located along the impaired segments may provide an area for waterfowl to congregate. Geese and other waterfowl are known to congregate in open areas including recreational fields, golf courses, and agricultural crop fields. There are large agricultural crop fields around the impaired segment of Walker Brook. These fields adjacent to the Brook can provide an area for wildlife to congregate. 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

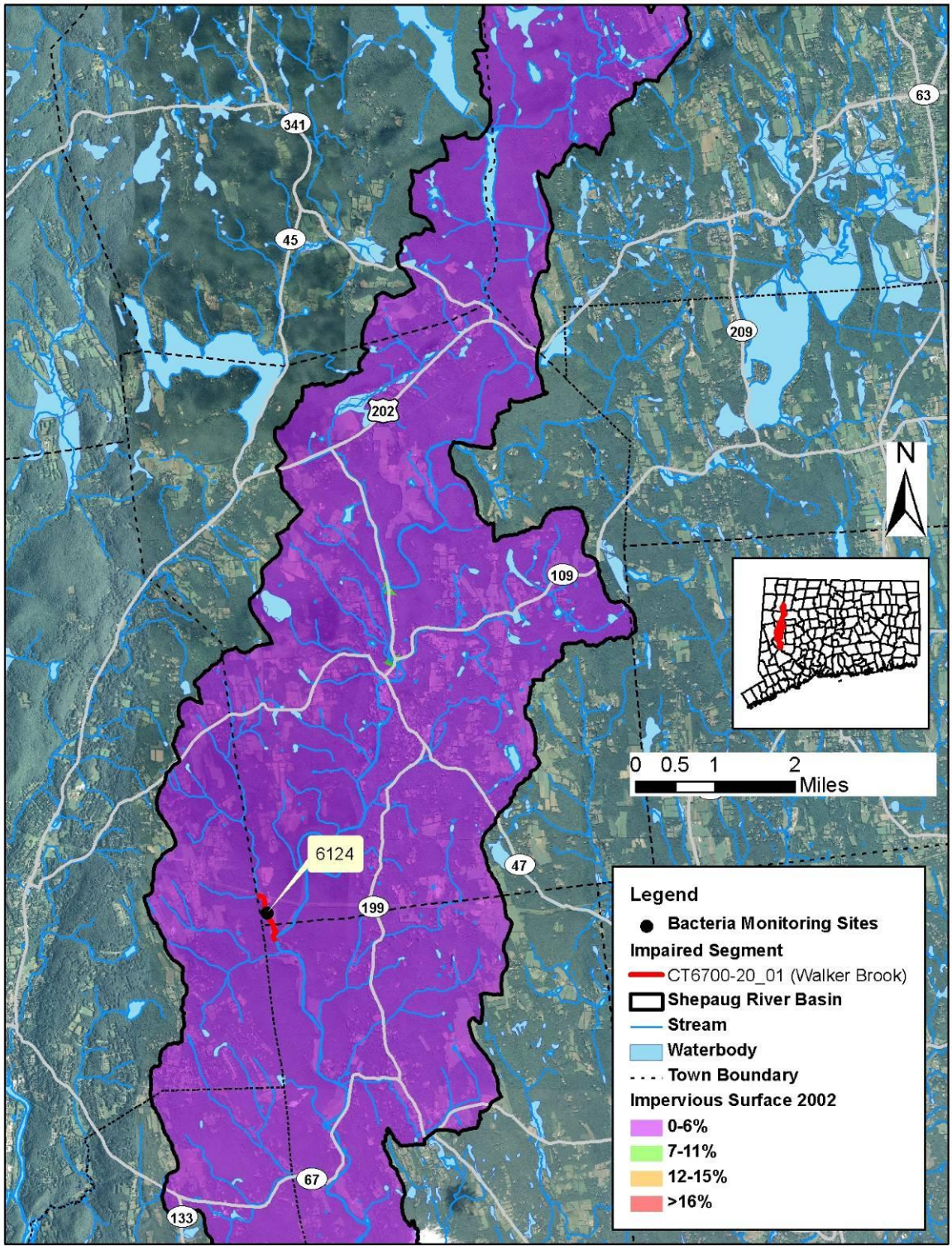
plants. These factors make wildlife waste a potential source of bacteria to the impaired segment of Walker Brook.

Stormwater Runoff from Developed Areas

Approximately 11% of the land use in the watershed is considered urban with little of this area surrounding the impaired segment on Walker Brook(Figure 4). 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. Past studies have shown a link between the amount of impervious area in a watershed and water quality conditions (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).

The Shepaug River watershed is characterized by land with 0 to 6% impervious cover. None of the land in the watershed is characterized by 7 to 11%, 12 to 15% or >16% impervious cover (Figure 8). While there is not a considerable amount of impervious surfaces within the watershed, there are many areas in the more urbanized portions of Washington and Roxbury where impervious surfaces are in close proximity to the Shepaug River. Where there is specifically less urbanized areas around Walker Brook. Development is concentrated around the Shepaug River off River Road in Washington. There are also numerous road crossing on Walker Brook's impaired segment. These crossings can carry large volumes of stormwater into these waterbodies during storm events. The proximity of some impervious surfaces to Walker Brook, indicate that stormwater runoff from developed areas are a potential source of bacterial contamination.

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



Impervious Surface In The Shepaug River Sub Regional Basin

Map Data: CT DEEP Map Created: August 2011

Additional Sources

There may be other sources not listed here or identified in Figure 6 which contribute to the observed water quality impairment in Walker 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

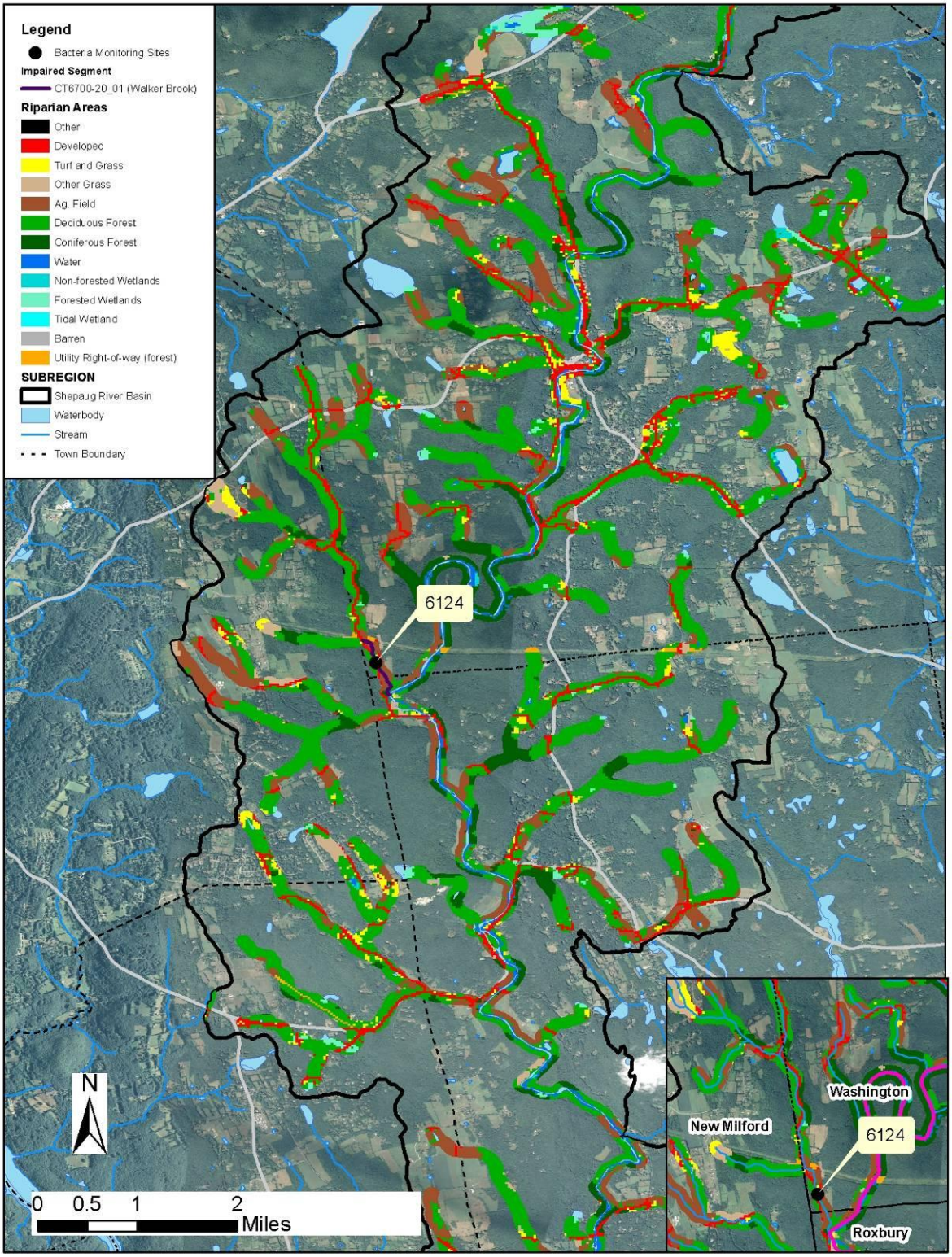
Riparian Buffer Zones

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 unique 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 zones of Walker Brook are mostly forested (Figure 10). However, there are multiple areas, such as near Station 6124 on Walker Brook where portions of the riparian zone are characterized by agricultural lands. As previously mentioned agricultural areas, especially when within the riparian zone, can be sources of bacterial contamination.

Figure 10: Riparian buffer zone information for the Shepaug River watershed



Riparian Areas In The Shepaug River Sub Regional Basin

Map Data: DEEP Map Created: October 2011

UCONN CLEAR: http://clear.uconn.edu/

RECOMMENDED NEXT STEPS

Future mitigative activities are necessary to ensure the long-term protection of the Shepaug River watershed and have been prioritized below.

1). Ensure there are sufficient buffers on agricultural lands along Walker 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 to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place.

2). Develop a system to monitor septic systems.

All of the residents within the Shepaug River watershed rely on septic systems to dispose of their waste. If not already in place, Roxbury and Washington should establish programs to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

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

Any education and outreach programs within Roxbury and Washington should highlight the importance of not feeding waterfowl and wildlife, picking up after dogs and other pets within parks and the other recreational areas located along Walker Brook. 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 Walker 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 the Shepaug River watershed and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

4). Identify areas along the more developed portions of the watershed to implement Best Management Practices (BMPs) to control stormwater runoff.

Since urban development and roads are around specific portions of Walker Brook, stormwater runoff may be contributing bacteria to these waterbodies. To identify specific areas that are contributing bacteria, the municipalities in the watershed should conduct wet-weather sampling at stormwater outfalls that discharge directly to Walker Brook. To treat stormwater runoff, the towns should also identify areas along the more developed sections of Walker Brook, to install BMPs designed to encourage stormwater to

infiltrate into the ground before entering these waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the impaired segments in the Shepaug River watershed. More detailed information and BMP recommendations can be found in the core TMDL document.

5). Continue monitoring permitted sources.

As Figure 6 shows, there are multiple permitted discharges within the Shepaug River watershed, with some close to the Shepaug River. None of these locations appear to directly impact the impaired segment of Walker Brook, however they could trigger future impairments on other segments if not properly monitored for compliance with permit limits. Also, the discharges from the town of Roxbury that were sampled in 2001 displayed high levels of fecal coliform bacteria, an indicator of bacterial pollution. 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 is an additional recommendation. Monitoring should continue on 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. Table 6 details the appropriate bacteria criteria for use as water quality targets for permittees as permits are renewed and updated, within the Shepaug 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 Recreation

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	**1**	**2**	**3**	**1**	**2**	**3**	**All**	**All**
AA	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) These values can be "as naturally occurs" if the only pollutant source is 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: Walker Brook Bacteria Data

Waterbody ID: CT6700-20_01

Characteristics: Freshwater, Class AA, Existing or proposed Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **90%**

Single Sample: **98%**

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

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on Walker Brook with annual geometric means calculated by station (notes located at the end of the table)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	5/18/2010	20	dry	**1271* (90%)**
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	6/2/2010	47†	wet	
6124	Intersection of Hartwell Road, Shinar Road and	6/15/2010	1100	dry**	

	Walker Brook Road				
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	6/24/2010	430†	wet	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	7/6/2010	1500	dry	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	7/12/2010	860	dry	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	7/22/2010	4100	dry	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	7/29/2010	6100	dry	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	8/5/2010	**24000* (98%)**	wet**	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	8/12/2010	4900	dry**	
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	9/2/2010	8300	dry	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** 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 all monitoring stations on Walker Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6124	Intersection of Hartwell Road, Shinar Road and Walker Brook Road	2010	3	8	1271	789	1522

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages in Danbury, CT and at Hartford Bradley International Airport

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