Wharton Brook (CT5207) Summary

Wharton Brook (CT5207-00_01), Wharton Brook (CT5207-00_02), and Unnamed Tributary to Wharton Brook (CT5207-01_01)

WATERSHED DESCRIPTION

The Wharton Brook sub-regional basin is located in the central portion of Connecticut (Figure 1). There are multiple towns located in the watershed, including the municipalities of Meriden, North Haven, and Wallingford, CT (Figure 2).

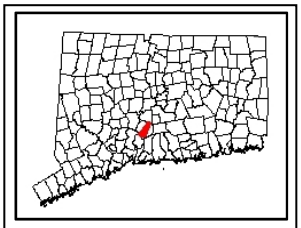


Figure 1: Watershed location in Connecticut

The Wharton Brook sub-regional basin includes three segments impaired for aquatic life use. These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2012 303(d) list of impaired waterbodies. Some segments in the watershed were currently unassessed as of the writing of this document. This does not signify that no concerns exist in those segments, rather it is an indication that there are not current data to evaluate the segments as part of an assessment process. An excerpt of the 2012 Integrated Water Quality Report is included in Table 1.

Wharton Brook (Figure 2) is a tributary to the Quinnipiac River and begins at the outlet of the North Farms Reservoir Dam in Wallingford, CT, just north of Route 68. From upstream to downstream, the first impaired segment of the brook, Wharton Brook (Segment 2) (CT207-00_02), consists of 2.94 miles of the brook and begins at the outlet of the North Farms Reservoir Dam. This segment continues southerly through residential neighborhoods parallel to North Farms Road and continues south through areas characterized by agricultural fields near East Main Street. Wharton Brook (Segment 2) then crosses Christian Street and flows just east of the Choate Rosemary Hall campus, a boarding school of about 850 students, and ends at the inlet to Simpson Pond, just north of Route 150.

Impaired Segment Facts

Impaired Segments:
1. Wharton Brook (CT5207-00_01)
2. Wharton Brook (CT5207-00_02)
3. Unnamed Tributary to Wharton Brook (CT5207-01_01)

Municipalities: Meriden**,** North Haven and Wallingford

Impaired Segment Lengths (miles):
1. Wharton Brook (5207-00_01): 3.97
2. Wharton Brook (5207-00_02): 2.94
3. Unnamed Tributary to Wharton Brook (5207-01_01): 1.80

Watershed Areas (square miles):
1. Wharton Brook (5207-00_01): 7.65
2. Wharton Brook (5207-00_02): 2.78
3. Unnamed Tributary to Wharton Brook (5207-01_01): 1.42

Watershed Impervious Cover:
1. Wharton Brook (5207-00_01): 20%
2. Wharton Brook (5207-00_02): 13%
3. Unnamed Tributary to Wharton Brook (5207-01_01): 18%

Water Quality Classifications:
Class A

Designated Use Impairments: Habitat for Fish, Other Aquatic Life, and Wildlife

Sub-regional Basin Name and Code:
Wharton Brook, 5207

Regional Basin: Quinnipiac

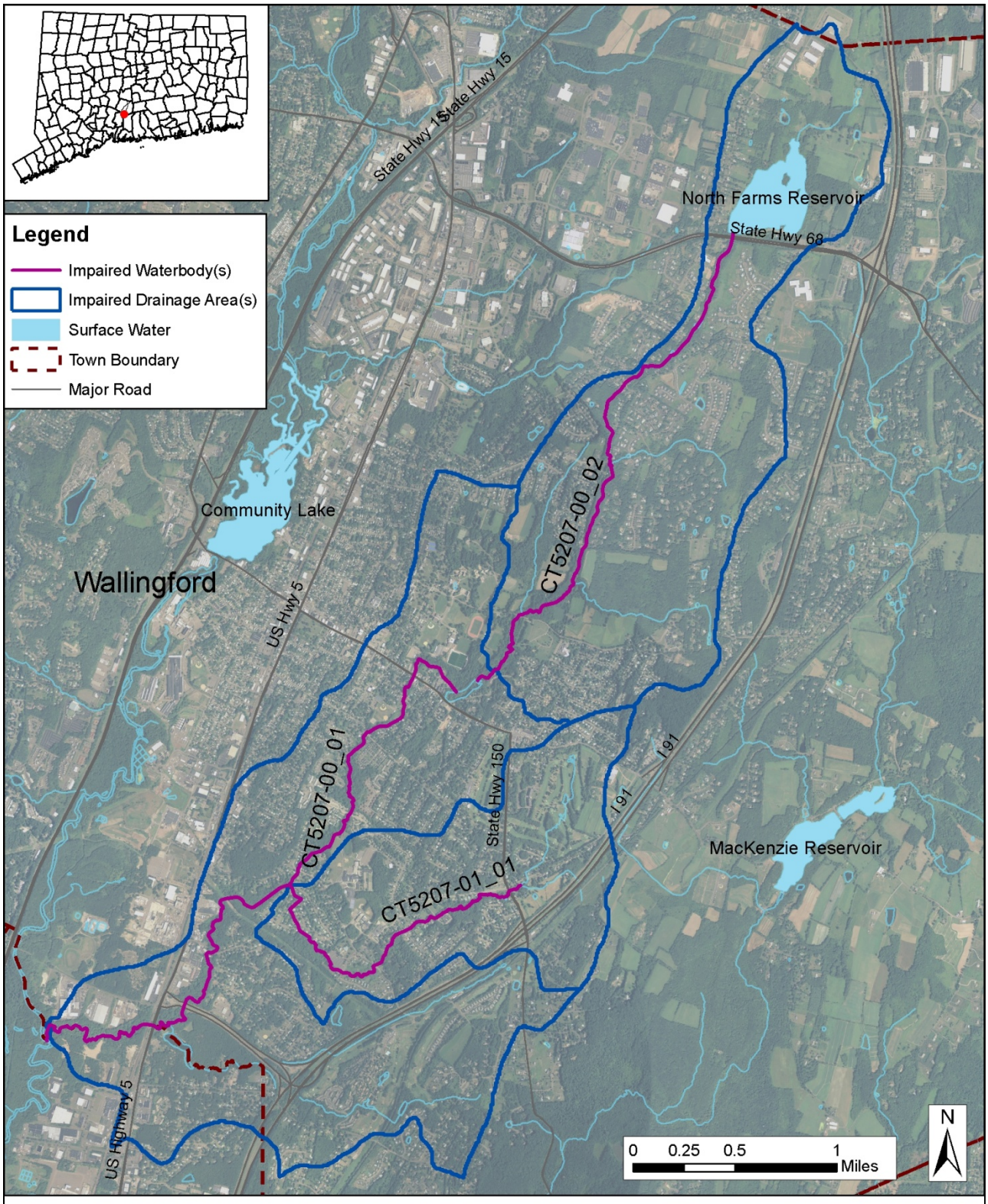
Table 1: Impaired segments in the Wharton Brook Sub-Regional Basin from the Connecticut 2012 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation
CT5207-00_01	Wharton Brook-01	From mouth at confluence with Quinnipiac River (DS of Route 5 and Railroad crossing), Wallingford/North Haven town borders, US to Simpson Pond outlet dam (US of Center Street, (Route 150) crossing), Wallingford	3.97	NOT	U
CT5207-00_02	Wharton Brook-02	From inlet to Simpson Pond, US to North Farms Reservoir outlet dam (just US of Church Street (Route 68) crossing), Wallingford	2.94	NOT	U
CT5207-01_01	Unnamed Tributary to Wharton Brook (Wallingford) -01	Mouth at confluence with Wharton Brook, just DS of Reskin Drive crossing (off of Pond Hill Road), US to confluence with another unnamed trib., just US of Route 150 crossing and between Airline Road and I91, Wallingford	1.80	NOT	U
NOT = Designated Use Not Supported **U = Designated Use Not Assessed**					

The second impaired waterbody, Wharton Brook (Segment 1) (CT5207-00_01) begins at the outlet of the Simpson Pond Dam in Wallingford and consists of 3.97 miles of Wharton Brook. The segment flows southwesterly, crosses Route 150, and passes just west of the Wallingford Country Club. Wharton Brook (Segment 1) then flows through portions of the campuses of Lyman High School and Dag Hammarsjold Middle School on Pond Hill Road before it passes through a residential area and enters Wharton Brook State Park. The impaired segment then continues west across Route 5 (Washington Avenue) and flows just south of an industrial area on Toelles Road that includes the Connecticut Steel Corporation, a large warehouse for FedEx Ground, and AMETEK Specialty Metal Products before it empties into the Quinnipiac River at the border of Wallingford and North Haven at the northern edge of the Quinnipiac River State Park.

The third impaired waterbody, the Unnamed Tributary to Wharton Brook (CT5207-01_01), begins near I-91 near Airline Road in Wallingford and consists of 1.80 miles of the tributary. The segment flows southwesterly, crosses Route 50, and continues through residential neighborhoods near Kondracki Lane. The impaired segment then crosses Pond Hill Road and empties into the main branch of Wharton Brook (Segment 1) just downstream of Reskin Drive (Figure 2).

Figure 2: The Wharton Brook Sub-Regional Basin (the location and name of each impaired segment and its watershed boundary is indicated)



For surface water quality class A, the criteria to meet aquatic life use support includes the following:

> Biological Condition: Sustainable, diverse biological communities of indigenous taxa shall be present. Moderate changes, from natural conditions, in the structure of the biological communities, and minimal changes in ecosystem function may be evident; however, water quality shall be sufficient to sustain a biological condition within the range of Connecticut Biological Condition Gradient Tiers 1-4 as assessed along a 6 tier stressor gradient of Biological Condition Gradient (See Appendix G of the Water Quality Standards).

Data used to assess these waters are summarized in Table 2.

Table 2: Data used to assess Wharton Brook (CT5207-00_01), Wharton Brook (CT5207-00_02), and Unnamed Tributary to Wharton Brook (CT5207-01_01). An "x" indicates that data has been used in the assessment process.

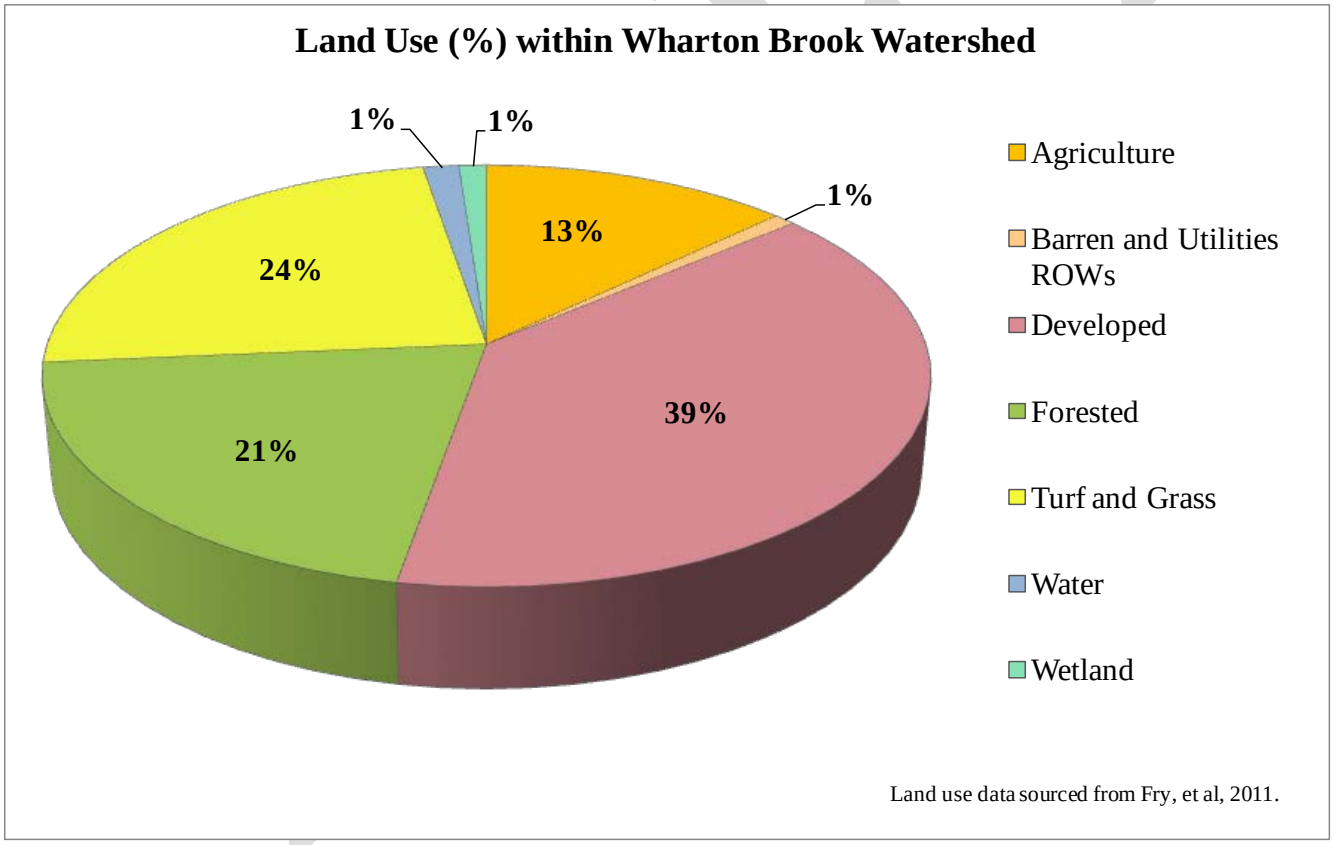
Segment ID	Waterbody Name	Macroinvertebrate Community	Fish Community	Volunteer RBV Data	Macroinvertebrate Model	Water Chemistry	Whole Effluent Toxicity	External Data	Listing Cycle
CT5207-00_01	Wharton Brook-01	x	x	x		x		x	2000
CT5207-00_02	Wharton Brook-02	x	x	x		x		x	2000
CT5207-01_01	Unnamed Tributary to Wharton Brook-01	x	x		x	x	x	x	2012

Land Use in the Watershed

The existing land use in a watershed can affect the water quality of the waterbodies within that watershed (USEPA, 2011b). 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 leaking 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, 2011b).

As shown in Figure 3, the Wharton Brook sub-regional basin consists of 39% developed areas, 24% turf and grasses, 21% forests (deciduous and coniferous), and 13% agriculture. Other land uses include wetlands, barren land/utility right-of-ways, and water.

Figure 3: Land uses within the Wharton Brook Watershed



Impervious Cover (IC)

Another way to measure land use impacts to aquatic life in streams is to evaluate the amount of impervious cover (i.e. roads, roofs, driveways, parking lots). Increasing the percentage of IC in a watershed is linked to decreasing stream health (CWP 2003, Bellucci 2007). Stormwater runoff from impervious surfaces contains pollutants such as oils, heavy metals, nutrients, bacteria sediment (USEPA

1983) and can cause temperature impacts to receiving waterbodies. The amount of stormwater pollutants transported during a rainstorm is directly related to the amount of impervious cover in the watershed.

The extent of land area associated with IC cover can be calculated by analyzing the types of land cover (developled, forested, agriculture, etc.) present in the landscape. The total percentage of impervious cover (%IC) can be compared to levels that are linked to impaired streams receiving excessive stormwater pollution. The %IC is used in the *Connecticut Watershed Response Plan for Impervious Cover* (Plan) as a surrogate to represent the impacts associated with stormwater pollution. Figure 4 shows the %IC for the Wharton Brook sub-regional basin. The watersheds for the impaired segments in the Wharton Brook sub-regional basin have impervious surface areas of 20% (Wharton Brook (Segment 1)), 13% (Wharton Brook (Segment 2)), and 18% (Unnamed Tributary to Wharton Brook).

CT DEEP has determined that to limit effect of stormwater pollution an IC area of less than 12% is needed to support habitat for fish, other aquatic life and wildlife use in these waterbodies. However, stormwater pollution is categorized under two types of pollutant loads: point and non-point sources. Point sources are permitted a waste load allocation (WLA) and regulated under the National Pollutant Discharge Elimination System (NPDES), but a load allocation (LA) is also contributed by non-point sources where no regulations are applicable. It is not feasible to draw a clear distinction between stormwater pollution originating from point and non-point sources because insufficient data are available for each parcel in the watershed and the fact that stormwater pollution is highly variable in frequency and duration. Consequently, a Margin of Safety (MOS) is incorporated into the %IC target in order to account for uncertainties regarding the relationship between water quality and sources (point and non-point). Therefore, a MOS of 1% IC was subtracted from the %IC target to account for uncertainty in the analysis, resulting in a combined target of 11% for Waste Load Allocation (WLA) and Load Allocation (LA). The reduction in impervious cover necessary to reach the target for each impaired waterbody in the Wharton Brook Watershed is shown in Table 3. The Plan target of 11% IC is intended to guide the application of Best Management Practices (BMP) and Low Impact Development (LID) techniques to reduce the *impact* of impervious surfaces.

Table 3: Current impervious cover and the percent reduction to achieve the Plan target for each impaired segment in the Wharton Brook Sub-Regional Basin

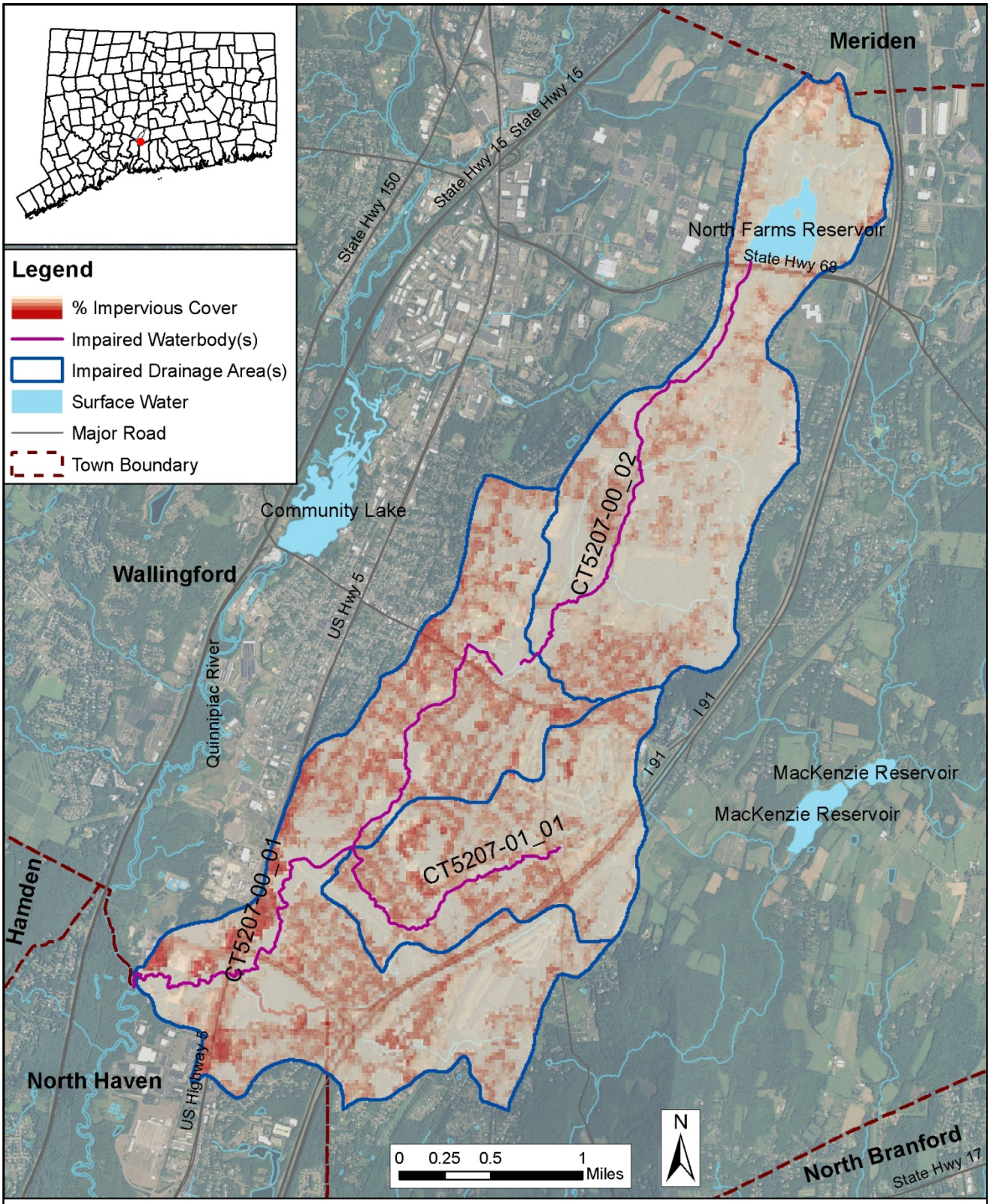
Impaired Segment	Current Watershed Impervious Cover	%IC Target [1]	Margin of Safety (MOS)	Percent IC Reduction to Meet Plan Target
Wharton Brook Segment 1 (CT5207-00_01)	20%	11%	1%	45%
Wharton Brook Segment 2 (CT5207-00_02)	13%	11%	1%	15%
Unnamed Tributary to Wharton Brook (CT5207-01_01)	18%	11%	1%	39%

Implementation of this Plan is directed at improving the condition of the aquatic life use support in these waterbodies. The impairments will be resolved once the instream monitoring and assessment as conducted

[1] These are target goals, not end-of pipe effluent limits, unless otherwise indicated in a permit issued pursuant to the National Pollutant Discharge Elimination System (NPDES) program.

by CT DEEP indicates an attainment of WQS. It is important to note that the aquatic life use impairment may not be due solely to the presence of IC, but that reducing the effect of IC within the basin is expected to improve water quality and support attainment of aquatic life use goals. Additionally, the IC reduction targets are guidance values to help address the component of the impairment which the current information suggests is attributable to IC due to stormwater pollution. The reduction targets are not recommended as regulatory limits for incorporation into permits. Best Management Practices to reduce the effect of IC through stormwater management are discussed below as appropriate implementation practices for permitted and non-permitted stormwater discharges.

Figure 4: Impervious cover (%) for the Wharton Brook Sub-Regional Basin



Percent Impervious Cover (IC) within Wharton Brook Subregional Basin with Impairment to Habitat for Fish, Other Aquatic Life and Wildlife

Created: CT DEEP, July 2012

CURRENT MANAGEMENT ACTIVITIES

Permitted Stormwater Sources

The control of stormwater pollution from regulated sources is noteworthy for addressing the effect of IC. Regulated stormwater discharges consist of those authorized under the General Permit for the Discharge of Stormwater from Municipal Separate Storm Sewer Systems (MS4 GP), General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (Construction GP), General Permit for the Discharge of Stormwater Associated with Industrial Activity (Industrial GP), and General Permit for the Discharge of Stormwater from Commercial Activities (Commercial GP). Each of these general permits requires the implementation of control measures and some type of a stormwater management plan (for more information go to www.ct.gov/deep/stormwater).

Permitted sources existing within the watershed that could potentially contribute to impairments in the Wharton Brook sub-regional basin are identified in Tables 4 and Figure 5. 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 basin.

Table 4: General categories of stormwater permitted discharges

Permit Code	Permit Description Type	Number in watershed
GSC	Stormwater Discharge Associated with Commercial Activity (Commercial GP)	0
GSI	Stormwater Associated with Industrial Activity (Industrial GP)	7
GSM	Municipal Storm Sewer Discharges (MS4 GP)	3
GSN	Stormwater Discharge Associated with Construction Activity (Construction GP)	1

Municipalities have been working hard to meet the challenges of stormwater management. The City of Meriden and the Towns of Wallingford and North Haven, have developed and implemented programs to protect water quality. As indicated previously, all of Meriden, Wallingford, and North Haven are regulated under the MS4 program. The MS4 GP requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants from storm sewer discharges to improve water quality. The SMP must address the following 6 minimum measures:

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

Subsequent to the initial preparation and implementation of the SMP, each municipality must submit an annual update outlining the steps they are taking to meet the six minimum measures. Relevant stormwater management measures are summarized below.

City of Meriden (Permit GSM000038) (from the 2010 Stormwater Management Plan Annual Report)

Acquired 7,000 storm drain markers and currently installed 40; the Quinnipiac River Watershed Association (QRWA) has marked an additional 750 storm drains since 2007.
Completed mapping all stormwater outfalls in the city.
Continued annual street-sweeping of all roads.
Continued sampling of six stormwater outfalls.
Continued annual city-wide catch basin cleaning program.
Continued annual training of Department of Public Works staff in stormwater pollution prevention.
Upgraded zoning regulations to protect sensitive areas such as wetlands and steep slopes and included green infrastructure requirements in some zones (e.g. rain gardens, pervious pavement).
Initiated the "Meriden Clean and Green" campaign to control littering.
Continued to incorporate Water Quality units into the Connecticut Department of Education Core Science Curriculum Frameworks.
Distributed the brochure "Storm Drains: Where does the Water Go?"

Town of North Haven (Permit GSM000095) (from the 2010 Stormwater Management Plan Annual Report)

Stenciled 40 storm drains.
Completed mapping all stormwater outfalls in the town.
Continued annual street-sweeping of all roads.
Continued sampling of six stormwater outfalls.
Continued annual town-wide catch basin cleaning program.
Continued annual training of Department of Public Works staff in stormwater pollution prevention.
Installed stormwater BMPS including a vortex separator at the North Haven Commons and North Haven Crossing Shopping Centers and a wetland restoration project at the North Haven Athletic Complex.
Included Water Quality units in school curriculum including offering self-contained teaching units on loan to individual teachers.
Distributed educational brochures on stormwater to over 400 homeowners.

Town of Wallingford (Permit GSM000050) (from the 2011 Stormwater Management Plan Annual Report)

Completed the stenciling of over 5,000 storm drains and distributed storm drain marker kits with educational brochures about non-point source pollution throughout the town.
Completed mapping all stormwater outfalls in the town.
Continued annual street-sweeping of all roads.
Continued sampling of six stormwater outfalls.
Continued annual town-wide catch basin cleaning program.
Installed stormwater BMPs including drainage projects on Whirlwind Hill and East Scard Roads.
Instituted an "Adopt a Road" program to clean up the trash and debris along roadways.

MS4 GP discharges

MS4 dischargers must implement the Stormwater Management Plan (SMP) required by the MS4 permit reissued on January 9, 2011, and as amended. The SMP includes best management practices (BMPs) grouped into six Minimum Control Measures, which consist of Public Education and Outreach, Public Involvement/ Participation, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff, Post Construction Stormwater Management in New Development and Redevelopment, and Pollution Prevention/Good Housekeeping.

Construction GP discharges

The Construction GP regulates the runoff from construction with 5 or more acres of soil disturbance for projects with municipal land use approvals and with 1 or more acres of soil disturbance for projects without municipal land use approvals. The Construction GP requires controls to reduce the discharge of sediment during construction and includes measures to address the long term impacts related to post-construction stormwater discharges. While the Construction GP reissued on April 9, 2010 (current permit) does not address impaired waters, the proposed modified Construction GP, expected to be reissued in 2013, specifies post-construction runoff standards. These post-construction discharges require the retention and/or infiltration of stormwater using LID and runoff reduction methods. Although the proposed post-construction performance standards are not based on the percentage of impervious cover, the runoff retention standards specified will serve to reduce and/or disconnect impervious area.

Industrial GP discharges

Industrial facilities are required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must include control measures (similar to BMPs) to reduce or eliminate the discharge of pollutants from the site. Typically, industrial sites are highly impervious. However site constraints, and cost considerations will complicate the reduction of impervious cover. To address the effect of IC, industrial sites where site expansion or redevelopment is planned should focus on the reduction and minimization of impervious area. The industrial facility consider which BMPs are appropriate for the site as well as those to address specific sources.

Commercial GP discharges

The Commercial GP regulates commercial sites with impervious surfaces exceeding 5 acres, such as malls and "big box" stores. The strategy to address the control of stormwater pollutants from these sites is called a Stormwater Management Plan (SMP). While the Commercial GP reissued on May 1, 2001 (current permit) does not discuss stormwater discharges to impaired waters, future versions of the permit will include measures similar to the Industrial and MS4 GPs. The commercial site consider which BMPs are appropriate for the site as well as those to address specific sources.

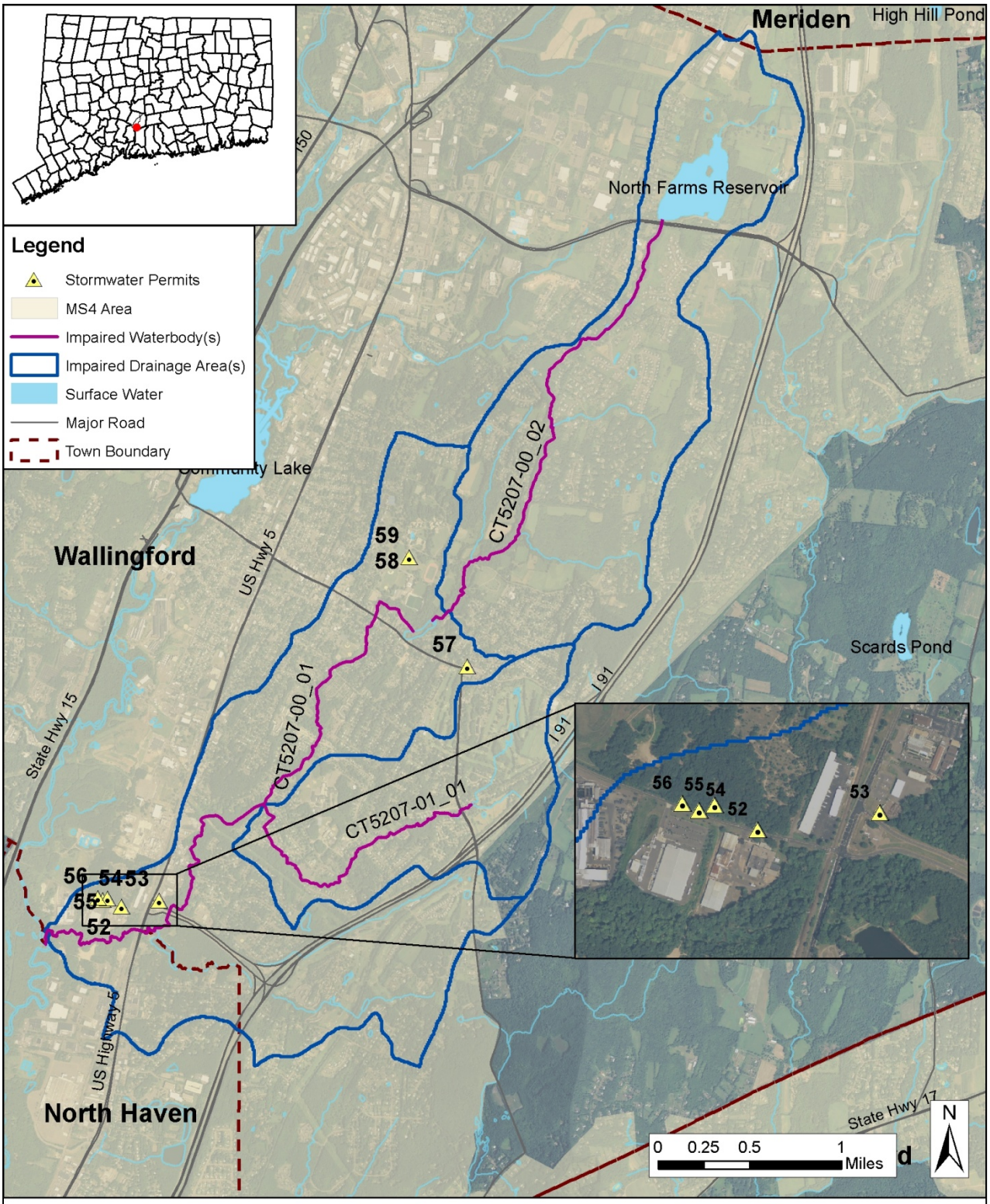
<u>Non-Regulated Discharges</u>

Many municipalities in Connecticut do not do not fall under the current MS4 permit (reissued January 9, 2011). Non-MS4 municipalities can voluntarily implement the BMPs within the MS4 permit and this document. Any facilities that discharge non-regulated stormwater can update their Pollution Prevention Plans to include BMPs that can reduce pollutants from entering surface waters. These BMPs could include revised housekeeping procedures to reduce pollutants or techniques that increase infiltration to reduce runoff. Additionally, sites or areas that are not regulated by a NPDES permit (such as small scale commercial and construction sites, residential sites, etc.) should consider implementation measures to minimize and/or disconnect impervious areas. Improving water quality within the community to address nonpoint source pollution requires actions, large and small, by the community.

Table 5: Permitted stormwater discharges within the Wharton Brook Sub-Regional Basin

Municipality	Permit ID	Permittee	Permit Type	Latitude	Longitude	# in Figure 5
Wallingford	GSI000076	State Of CT Department of Transportation	Industrial GP	41.457	-72.810	58
Wallingford	GSI000897	Atlantic Equipment Installers, Inc.	Industrial GP	41.457	-72.810	59
Wallingford	GSI000906	Ametek, Inc.	Industrial GP	41.429	-72.841	52
Wallingford	GSI000940	L. Suzio Concrete Company, Incorporated	Industrial GP	41.430	-72.843	56
Wallingford	GSI001902	Nucor Steel Connecticut, Inc.	Industrial GP	41.429	-72.842	54
Wallingford	GSI002244	Fedex Ground Package System, Inc.	Industrial GP	41.430	-72.842	55
Wallingford	GSI002317	State Of CT Department of Transportation	Industrial GP	41.429	-72.837	53
Meriden	GSM000038	City of Meriden	MS4 GP	--	--	--
North Haven	GSM000095	Town of North Haven	MS4 GP	--	--	--
Wallingford	GSM000050	Town of Wallingford	MS4 GP	--	--	--
Wallingford	GSN002174	Shawmut Design & Construction	Construction GP	41.448	-72.804	57

Figure 5: Permitted stormwater facilities in the Wharton Brook Sub-Regional Basin including MS4s (numbers correspond with permitted facilities listed in Table 5)



Permit(s) within Wharton Brook Subregional Basin with Impairment to Habitat for Fish, Other Aquatic Life and Wildlife

Created: CT DEEP, July 2012

RECOMMENDED NEXT STEPS

CT DEEP can assist with reducing the effect of IC by providing technical and financial assistance to the watershed towns and local citizen watershed advocacy groups, effectively administering stormwater permitting programs, and monitoring aquatic life in the surface waters. Under Section 319 of the Clean Water Act (§319 C.W.A.), the U.S. Environmental Protection Agency awards a grant annually to the CT DEEP to fund eligible projects that control and/or abate nonpoint source pollution through a competitive bid process. More information on grant programs can be found on the Department's website (http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325594&deepNav_GID=1654).

1) Reduce the effect of impervious cover in the Wharton Brook Sub-Regional Basin through the implementation of BMPs to control stormwater runoff.

As noted previously, 39% of the Wharton Brook sub-regional basin is considered developed and the municipalities within the watershed are MS4 communities regulated by the MS4 program. The amount of IC in the basin ranges from 20% (Wharton Brook Segment 1), to 13% (Wharton Brook Segment 2), to 18% (Unnamed Tributary to Wharton Brook).

Reducing the effect of IC in the watershed is an important step to decrease the impacts of stormwater runoff on water quality. For new development, LID principles (http://www.ct.gov/deep/watershed) should be utilized to retain and infiltrate stormwater runoff and/or reduce the amount of runoff from IC. In developed areas, IC should be disconnected from surface waterbodies, where practicable. Disconnection of impervious surface runoff should be pursued to the degree feasible when reconstruction of a site and/or its infrastructure occurs. For example, stormwater outfalls could be redirected to vegetated areas to encourage natural filtration before reaching nearby waterbodies.

An excellent guide on how to implement a reduction in IC is found in Appendix 3 of the core document and on the web (http://clear.uconn.edu/projects/tmdl/). A retrofit assessment of the watershed would identify areas where BMPs such as gravel wetlands, porous pavement, and vegetated buffers could be implemented to most effectively treat stormwater runoff throughout the watershed. This type of assessment could be linked to existing Municipal Comprehensive or Master Plans, MS4-required SMPs or watershed management plans.

2) Prevent future degradation of Wharton Brook and its tributaries by evaluating local stormwater control ordinances.

As the amount of IC in the Wharton Brook sub-regional basin is greater than 12%, the adoption of a municipal stormwater ordinance can be an effective method to protect the water quality in the watershed. Stormwater ordinances can focus on different aspects of stormwater management to reduce the quantity and quality of the stormwater that reaches nearby waterbodies. Effective stormwater ordinances prohibit non-stormwater discharges (to the storm sewer or surface waterbodies) such as sanitary sewage and wastewater discharges, require the use of adequate controls to prevent erosion and sedimentation, and specify enforcement mechanisms to address non-compliance. In addition to local ordinances, the establishment of a stormwater utility (i.e. a user fee) can be an effective way to address the impact of stormwater runoff from impervious surfaces while also providing the fiscal means of addressing municipal stormwater infrastructure needs. Utility fees are usually based on the size of effective impervious area and so, strongly encourage the reduction of impervious area.

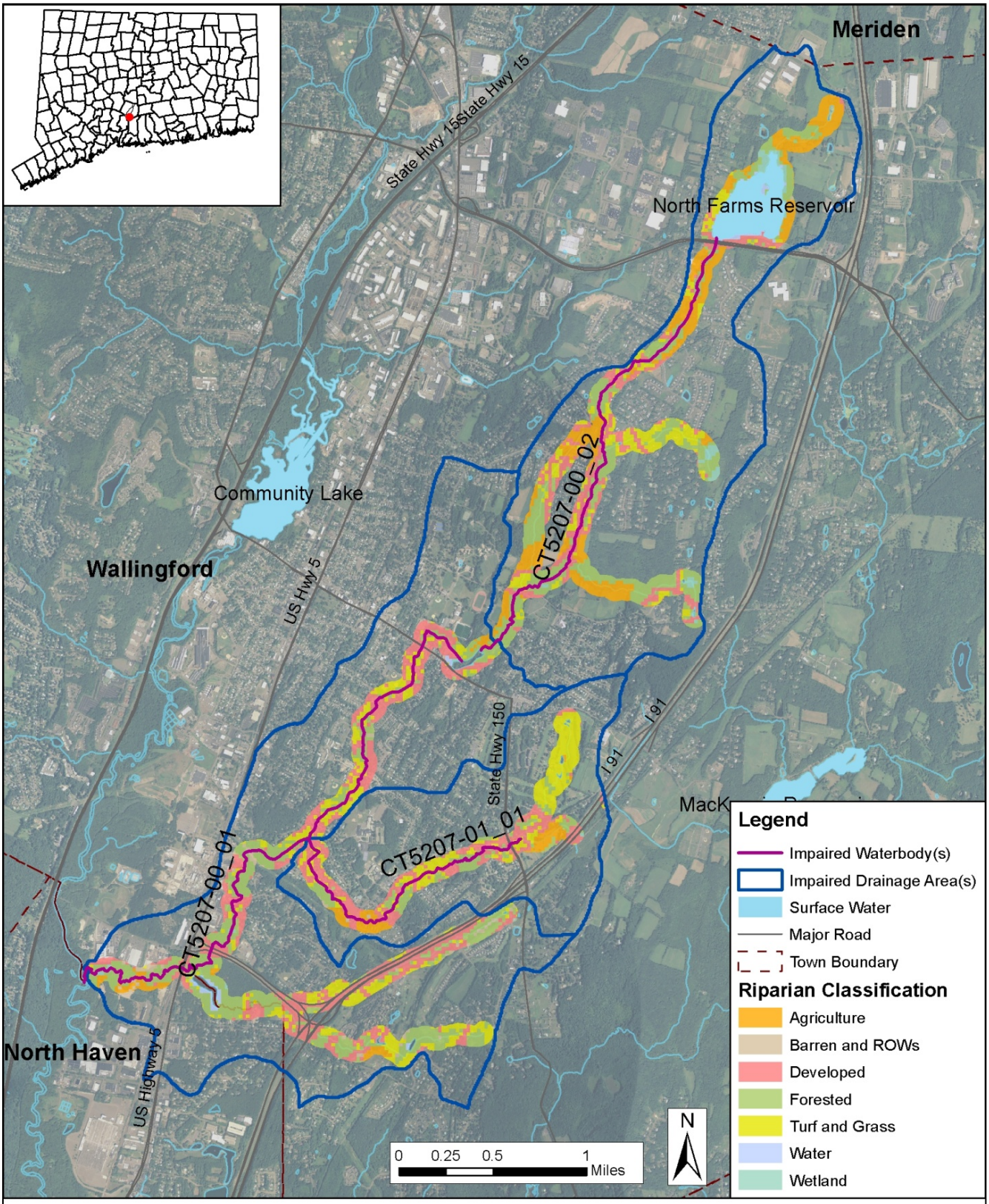
3) Protect existing buffers along the riparian corridor and other conservation lands throughout the watershed.

Riparian buffers and other natural landscapes can protect the water quality of waterbodies within a watershed. The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The incorporation of buffer requirements in the municipal land use approval process will help protect these areas near the impaired segments of the Wharton Brook sub-regional basin from the effect of IC, and these streams can be protected from further degradation due to stormwater runoff.

Riparian zones differ from the uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. These areas can reduce the impacts of IC by filtering pollutants and slowing runoff. 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. They also can protect the shoreline from erosion, aid in flood control, provide habitat for wildlife, shade waters for fish, and offer scenic value. 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, 2011a).

The riparian zones for the impaired segments in the Wharton Brook sub-regional basin are characterized by a mix of land uses including developed, forested, and agriculture (Figure 6). The riparian zone for the upstream impaired segment (Wharton Brook (Segment 2)) is less developed than the downstream impaired segments, Wharton Brook (Segment 1) and the Unnamed Tributary to Wharton Brook. The IC within all developed areas is typically transporting stormwater via structured drainage systems that often discharge within the riparian areas or directly to surface waters.

Figure 6: Riparian buffer zone information for the Wharton Brook Sub-Regional Basin



Riparian classification within Wharton Brook Subregional Basin with Impairment to Habitat for Fish, Other Aquatic Life and Wildlife

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

Created: CT DEEP, July 2012

4) Continue to encourage citizen involvement to ensure the long-term protection of Wharton Brook and its tributaries.

Citizens in the watershed have long recognized that importance of managing IC and the impacts on water quality. The following quote from the forward of the Quinnipiac Watershed Action Plan (http://www.ct.gov/deep/lib/deep/water/watershed_management/wm_plans/quinnipiac_wap2004.pdf) is a demonstration of the level of understanding and recognition of the path to improve watershed health.

"Despite progress in controlling point sources of water pollution like municipal sewage and industrial wastewater, many watershed problems remain. Present water quality impairments are primarily the result of pollution from widely spread sources. These sources include runoff from roads, parking lots, rooftops, lawns, farms, and failing septic systems....Bold steps will be needed to accomplish the vision of a healthy Quinnipiac Watershed - for ourselves, for future generations, and for the wildlife with which we share the land. The key to long-term watershed health is a careful reevaluation of the way we use the land, and the way we go about our daily lives. We are all part of the problem and part of the solution."

The Quinnipiac Watershed Action Plan has actionable items for citizen involvement and is an excellent resource to consult for anyone interested in participating in efforts to improve water quality.

Groups of concerned citizens within a watershed with a shared goal of maintaining or restoring water quality for the use of its residents for future generations have shown to be effective in ensuring the long-term protection of a waterbody. These groups include watershed associations and municipal conservation commissions. Activities include water quality monitoring, developing a public education strategy, and working with local boards to upgrade existing water resource protection laws.

The Quinnipiac River Watershed Association (QRWA) is currently active in the area of the Wharton Brook sub-regional basin. The mission of the QRWA is to protect and restore the water quality of the Quinnipiac River. As Wharton Brook is a major tributary to the Quinnipiac River, the efforts of the QRWA have also focused on the health of Wharton Brook. Future efforts of this organization and other citizen groups should be to protect open space and limit development along the riparian corridors of the Wharton Brook Watershed. More information on the QRWA can be found here: http://www.qrwa.org/. Education of citizens regarding the management of stormwater runoff from individual properties is important to ensure long term protection.

5) Evaluate and implement Low Impact Development practices for future development and retrofit opportunities.

LID techniques and BMPs to reduce the impact of stormwater within the Wharton Brook watershed are important tools to reduce the effect of IC. A list of these techniques includes (but is not limited to): rain gardens, bioretention areas, "green streets" techniques, porous asphalt, porous concrete, permeable pavers, other permeable pavement systems, green roofs, cisterns and rain barrels, engineered vegetated swales, and tree box filters.

Some resources for more information are:

NEMO (Nonpoint Education for Municipal Officials) is a University of Connecticut Program for local land use officials addressing the relationship of land use to natural resource protection (http://nemo.uconn.edu/)
CT DEEP's Watershed Municipal Outreach and Low Impact Development Program (http://www.ct.gov/deep/cwp/view.asp?A=2719&Q=464958).

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