BRUCE BROOK
Watershed Based Plan

Final: July 30, 2025

Prepared For:

Town of Stratford
2725 Main Street
Stratford, CT 06615

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1. INTRODUCTION

1.1. BACKGROUND

The Bruce Brook watershed covers almost 2,220 acres along the Town of Stratford and City of Bridgeport boundary, within the Metropolitan Council of Governments (MetroCOG) planning region in Connecticut (Figure 1-1). The watershed is heavily developed, with residential development predominant throughout the northern portions, and commercial and industrial uses in the southern areas of the watershed. Bruce Brook flows approximately 4.17 miles from its headwaters in a southerly direction through west Stratford and Bridgeport, where it terminates in the tidal estuary Johnsons Creek in the Long Island Sound. Bruce Brook is crossed by several major roadways including Route 108, Broadbridge Avenue, Route 1, Barnum Avenue, Route 130 and Interstate 95, in addition to the Metro-North Railroad tracks.

In comparison to neighboring watersheds in the State, the Bruce Brook watershed is relatively small and densely developed (Figure 1-2). The watershed is similar in size and configuration to the watershed for the Yellow Mill Channel in Bridgeport. The developed nature of the Bruce Brook watershed has proved challenging to the Town of Stratford and City of Bridgeport when working to improve watershed health. Furthermore, historical land use decisions resulted in long stretches of concrete channelization of Bruce Brook, cutting off the stream from public access, views, and vegetated banks. Development, channel conditions, and other factors have contributed to water quality impairment which is addressed by the Watershed Based Plan.

Document at a Glance

As a watercourse that originates within and flows through a highly developed watershed, reducing impairments to Bruce Brook will require a multi-pronged approach. The municipalities of Stratford and Bridgeport will need to continue making improvements to water quality under their respective MS4 programs (which are not directly the subject of this document) while identifying opportunities for reducing nonpoint source pollution throughout the watershed. Notwithstanding the importance of reducing nonpoint sources throughout the watershed, the most effective opportunities for *directly* reducing bacteria loading will be projects located along the stream corridor and adjacent to the stream channel. The most effective projects will simultaneously reduce runoff, minimize exposure of floodwaters to developed properties, eliminate opportunities for entrainment of trash, and undo the channelization of Bruce Brook. Examples proposed in this document include full stream channel restoration at Clover Park, streambank restoration at Stony Brook Park, and partial stream restoration along Bruce Boulevard in Bridgeport. Some of these projects will require multiple planning and design phases. Apart from all of these recommendations for Bruce Brook and its watershed, the municipalities of Stratford and Bridgeport will need to make progress reducing the introduction of pet waste bags and trash/garbage into Bruce Brook, as they are likely introducing and then harboring bacteria.

Figure 1-1 Regional Location of the Bruce Brook Watershed

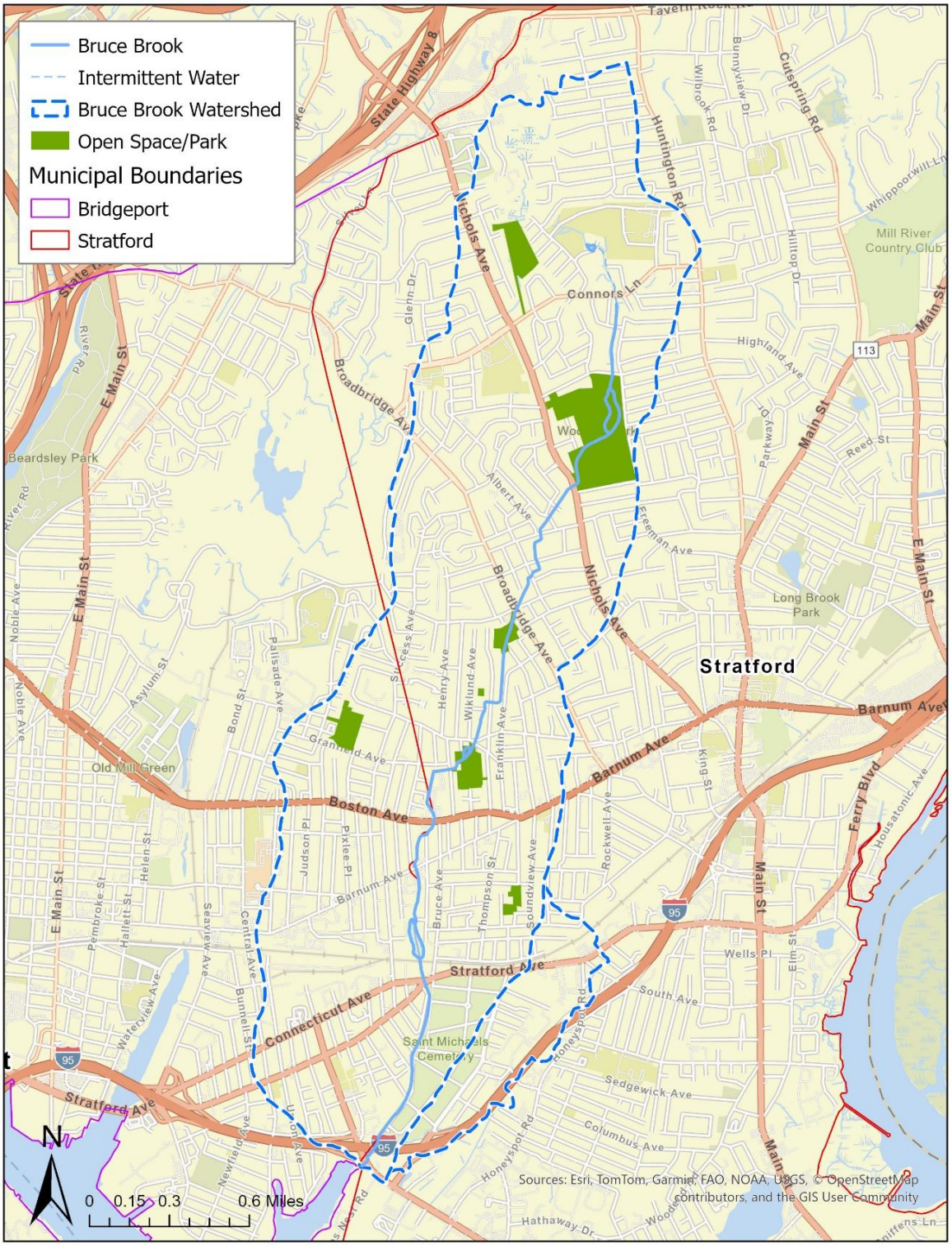


Figure 1-2 Bruce Brook Watershed

1.2. PLANNING PROCESS

Funding for the Bruce Brook Watershed Based Plan was provided by the Connecticut Department of Energy and Environmental Protection (DEEP) through a U.S. Environmental Protection Agency EPA) Clean Water Act Section 319 Nonpoint Source (NPS) Grant. The highly urbanized nature of the Bruce Brook watershed compels this watershed based plan to examine the intertwined issues of both nonpoint sources *and* point sources that contribute to water pollution in this river. A special effort has been made to emphasize nonpoint sources of water pollution within this watershed based plan. However, Stratford and Bridgeport maintain municipal stormwater systems and therefore have developed stormwater management plans with the six minimum control measures as required by the State of Connecticut under the municipal separate storm sewer system (MS4) general permit to address point sources of water pollution. As a result, it is recommended that this watershed based plan for Bruce Brook be implemented at the same time as the strategies in the stormwater management plans developed by the Town of Stratford and the City of Bridgeport.

The EPA and CT DEEP administers guidance for NPS watershed based plans which outlines nine key elements that must be addressed; the Bruce Brook WBP has been developed to be consistent with this guidance and these elements. Table 1-1 presents a crosswalk to identify locations in the report that directly relate to each element.

Table 1-1 Nine Element Crosswalk

EPA Watershed Based Plan Element	Report Cross-Reference
Identify causes and sources of pollution	Sections2.7 2.10, 2.11, 2.13, 2.14reviews multiple sources of pollution including those observed through monitoring and permitted discharges.
Estimate pollutant loading to the watershed and the expected load reductions	Section 3 presents the estimated current pollutants loads and reductions for each subwatershed.
Describe management measures that will achieve load reductions and targeted critical areas	The subwatershed sheets in Section 3.2 identifies a select few measures for each subwatershed, while Section 4 presents all measures for the watershed.
Estimated amount of technical and financial assistance and the relevant authorities needed to implement the plan.	The action matrix in Appendix E presents details on potential costs and implementing authorities, while Section 6 presents details on funding and technical resources.
Develop an information/education component.	Section 7 presents an information and education component
Develop a project schedule.	The action matrix in Appendix E presents implementation timeframe terms for each measure.
Describe the interim, measurable milestones.	Section 8.2 and Appendix E identifies milestones and criteria for implementation measures.
Identify indicators to measure progress.	Section 8.2 identifies milestones and criteria for implementation measures.
Develop a monitoring component.	Section 8.3 discusses monitoring components

The planning process for the Bruce Brook Watershed Based Plan relied on a series of meetings with an Advisory Committee that consisted of watershed stakeholder representatives; and a public engagement process with a Story Map, a survey, and separate community meetings held in Stratford and Bridgeport.

1.2.1. PROJECT ADVISORY COMMITTEE

Several meetings were held with the Advisory Committee and watershed stakeholders throughout the planning process. The Advisory Committee was comprised of representatives from various municipal departments, CT DEEP, non-profit organizations, and others who live and work in the watershed.

- **September 12, 2022** – A project kickoff meeting was hosted virtually by the Town of Stratford to introduce the project. A total of 14 people were in attendance representing the Town of Stratford, City of Bridgeport, CT DEEP, MetroCOG and Harbor Watch.

- **March 16, 2023** – A kickoff meeting was held virtually with the project consultants and the advisory committee. A total of 15 people were in attendance representing the Town of Stratford, City of Bridgeport, CT DEEP, MetroCOG, Save the Sound, and Harbor Watch.
- **September 6, 2023** – An advisory committee meeting was held to update participants on the project. Topics included the final approval of the QAPP (July 2023), data collection efforts to date, preliminary watershed reconnaissance, and the plans for public engagement.
- **October 18, 2023** – A meeting was held with representatives from Harbor Watch and a few members of the advisory committee to discuss the observations and findings from the stream reconnaissance work.
- **January 11, 2024** – An advisory committee meeting was held to discuss the outcomes of the stream reconnaissance, the status of the pollutant load estimation task, preliminary measurement strategies, and plan goals and objectives.
- **April 16, 2024** – An advisory committee meeting was held to discuss the findings and progress to date and discuss ideas for where the advisory committee can help in identifying target locations for actions and other suggestions for needed management strategies.

1.2.2. PUBLIC OUTREACH

The project was kicked off with the development and launch of an ArcGIS StoryMap in June 2023. The StoryMap was made publicly available and included information on the watershed today and how it has changed, Bruce Brook impairments, and resources on how residents can help improve watershed health on their own. In addition, there were two opportunities for feedback: a traditional survey, and a mapping activity where participants could choose a specific location and provide information on an issue or concern, they had regarding Bruce Brook.

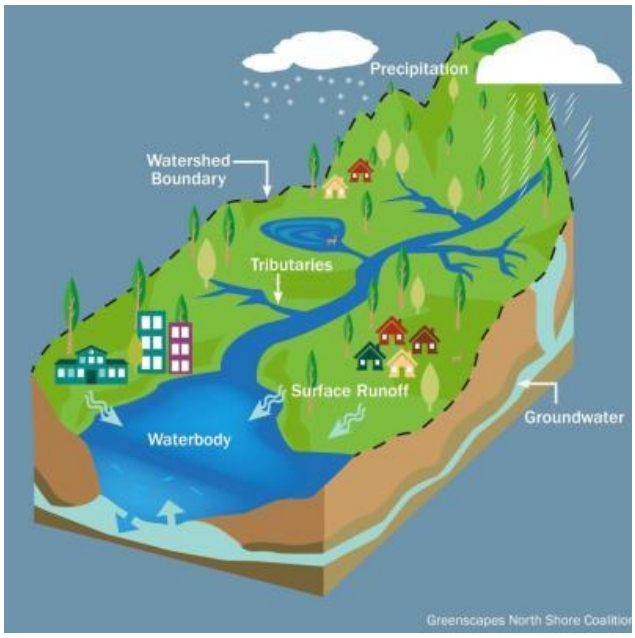
Two public meetings were held during the planning process to present the plan and its goals, to update residents on the field work, and collect resident feedback on the issues and needs of the watershed. The first meeting was held on September 9, 2023, at the Stratford Town Hall during a regularly scheduled Conservation Commission meeting, and the second was held on November 2, 2023, at the Edison School in Bridgeport.

A public meeting presentation was held at the Stratford Town Hall on July 14, 2025, to present the final draft of the Watershed Based Plan. The presentation included an overview of what the WBP is, the planning process, and plan findings and recommendations. Attendees were given the opportunity to ask questions or provide comments, and were then informed of an online survey were they could provide additional feedback. This survey was available from July 14 to July 30, 2025. All meeting materials, including presentations and minutes, can be found in Appendix A.

2. WATERSHED OVERVIEW

2.1. WHAT IS A WATERSHED?

The United States Environmental Protection Agency (EPA) defines a watershed as "the land area that drains to a stream, lake or river [which] affects the water quality in the water body that it surrounds." A majority of water that falls and flows within the watershed eventually finds its way into Bruce Brook and into Long Island Sound. This water flow can be over land directly into the stream, into stormwater catch basins where it connects directly to the stream, or through percolating groundwater. As this water flows it can pick up potentially harmful bacteria and materials, as well as litter and other debris, that degrades the water quality along Bruce Brook and harming ecosystems along the stream and in Long Island Sound.



Watersheds can be examined at very different scales. For example, Bruce Brook watershed is nested within larger scale regional and major watersheds, or drainage basins (Figure 2-1).

It is also understood that the overall health of a watershed protects, or harms, water quality and can provide greater benefits to the humans and wildlife living within the watershed boundaries. The overall health of the watershed can be attributed to a variety of factors including land use and land cover, geology, hydrography, contaminated sites, and other natural resources. These factors influence the health of the watershed to different degrees. For example, land cover can be defined as natural vegetation or forested and will increase health of a watershed due to increased biodiversity and natural water infiltration, while impervious land cover, which does not allow rainfall and stormwater runoff to naturally percolate, can carry pollutants, bacteria, and debris as it travels along impervious surfaces and into a stream.

Figure 2-1 Major and Regional Drainage Basins

2.2. LAND USE AND LAND COVER

The land use in the watershed (Figure 2-2 & Figure 2-3) that is associated with the Town of Stratford is predominantly residential, while the Bridgeport watershed uses are primarily commercial and industrial. Just over 50% of the watershed area is comprised of residential use. Residential uses include high density (HDR), medium density (MDR), low density (LDR), and multifamily. Roadways or transportation accounts for 19.9%, commercial use accounts for 8.1%, and religious or educational accounts for 7.4%. The remaining uses include cemetery, industrial, mixed-use, municipal, and unbuildable and vacant residential.

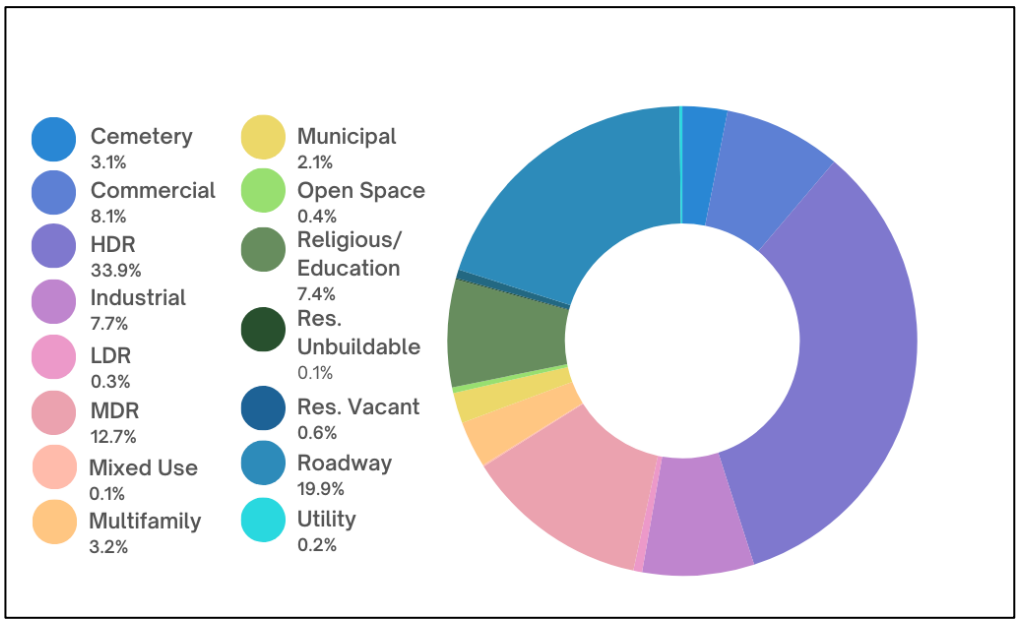


Figure 2-2 Bruce Brook Watershed Land Use

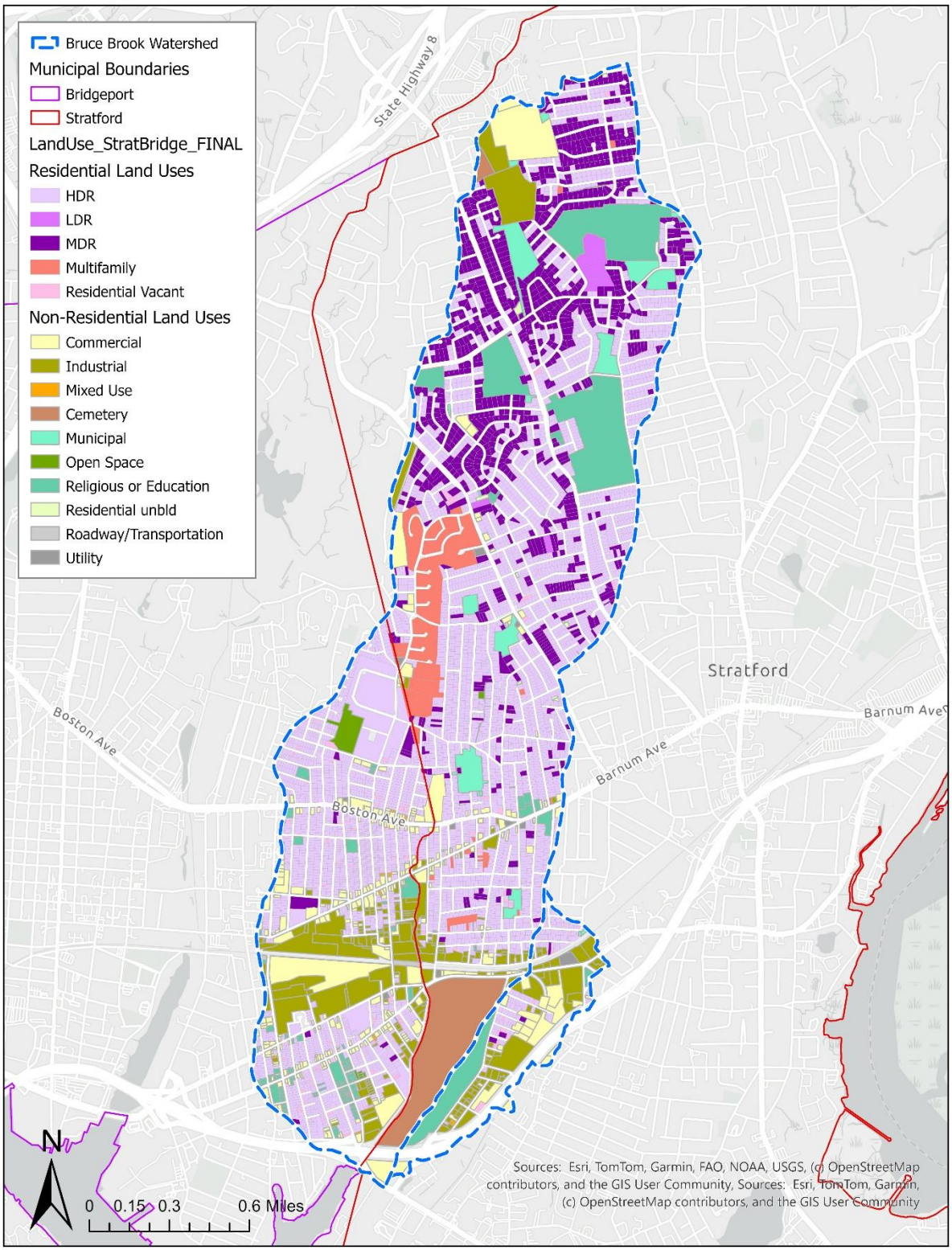


Figure 2-3 Bruce Brook Watershed Land Use

The National Oceanic and Atmospheric Administration (NOAA) Office of Coastal Management has developed high resolution land cover data for the entire state of Connecticut through the Coastal Change Analysis Program (C-CAP)[1]. This high resolution data (1 meter) classifies a total of 22 different land cover types and does not necessarily directly reflect land use (discussed above). The Bruce Brook watershed encompasses 11 different land cover types (Figure 2-4 below). Within this classification system, the watershed is predominantly developed impervious surface (49%), with developed open space (27%) and mixed forest (21%) being the second and third greatest land cover types. To clarify, mixed forest refers to the vegetation type throughout the watershed and does not necessarily indicate large swaths of forested area, but simply the presence of "mixed forest" variety trees throughout neighborhoods. As shown in Figure 2-4, the remaining land cover classes cover a small fraction of the watershed area.

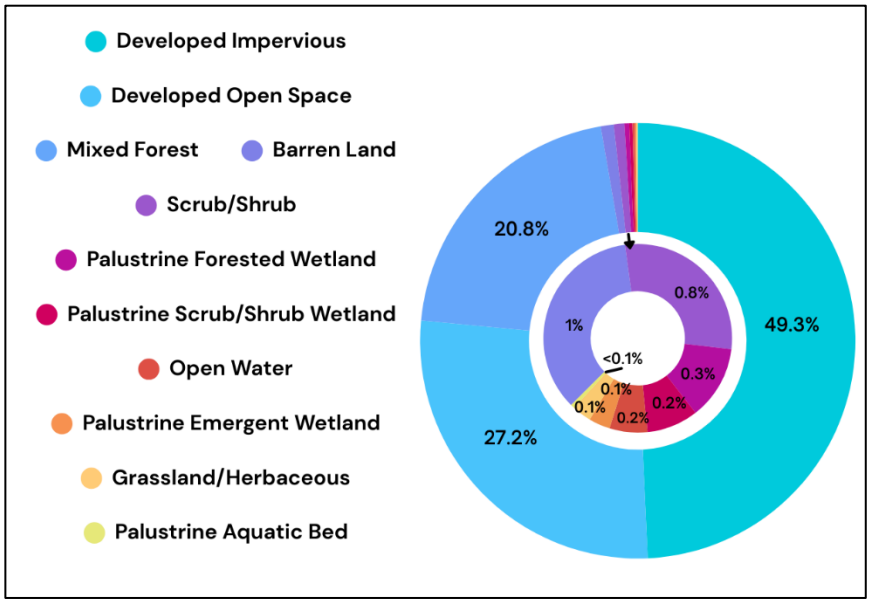


Figure 2-4 Watershed Land Cover Composition by Acre

[1] https://clear.uconn.edu/projects/landscape/ct-highres/

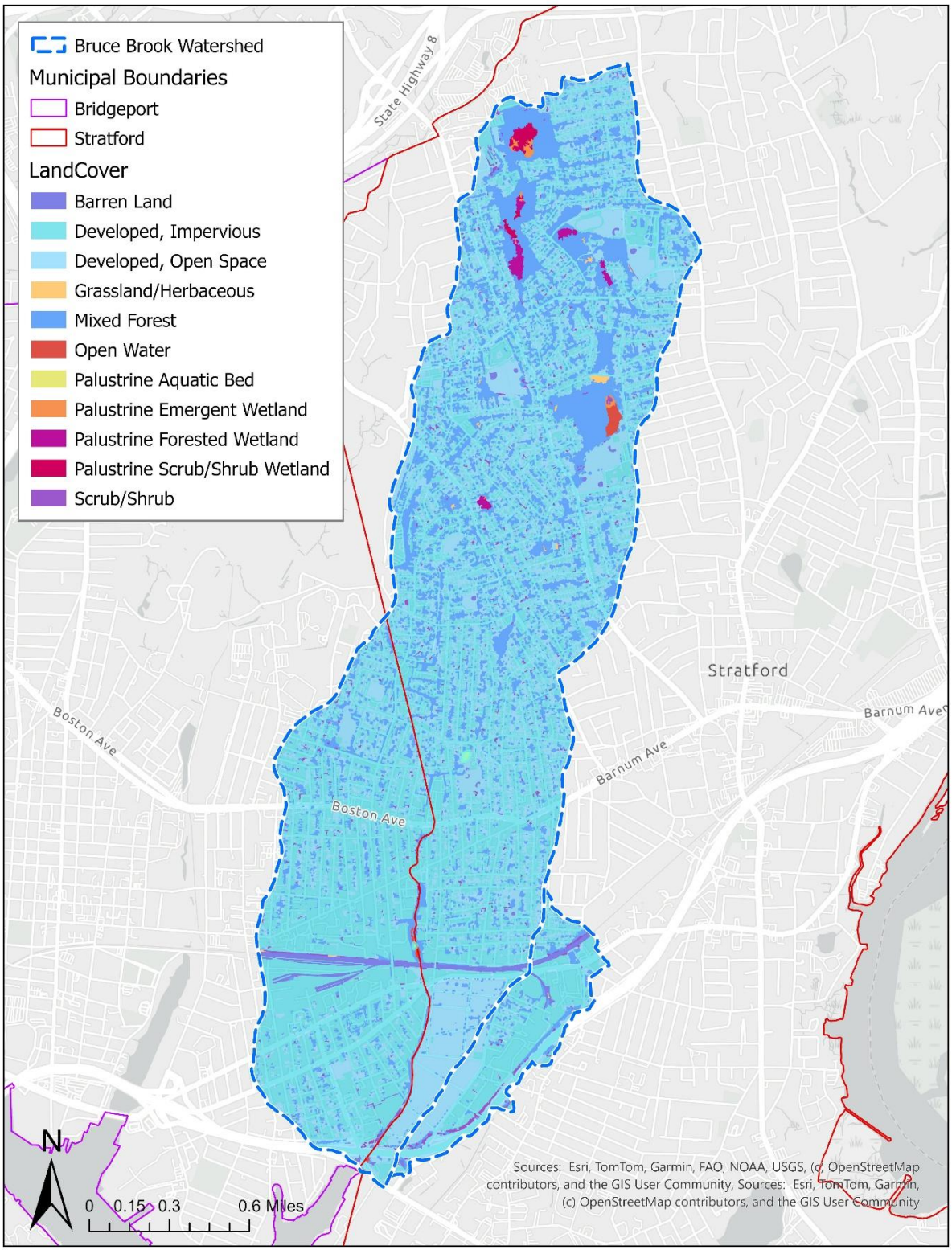


Figure 2-5 Bruce Brook Watershed Land Cover

2.3. SOILS AND GEOLOGY

The bedrock terrane (Figure 2-6) within the watershed is comprised of four formations comprised of gneiss (Pumpkin Ground formation) and schist (the remaining three). These oceanic terrane formations are all of the middle to early paleozoic age, and are metamorphic rock types. The southwest region of the watershed it outside of mapping limits.

Surficial materials (Figure 2-7), which are unconsolidated sediments that overlay bedrock, consist of unconsolidated glacial and postglacial deposits and are generally characterized by their grain size or texture. Surficial materials range from very coarse deposits, such as boulders, to very fine materials like silt and clay. Different material textures have different porosities, which ultimately influences the movement of water throughout an area. Soils (discussed below) are the uppermost layer of surficial materials

The majority of the watershed is comprised of thin and thick till. Thin till is generally less than 10 to 15 feet thick, with thick till being greater than 10 to 15 feet thick. The upper till can be loose to moderately compact, with deeper till layers being moderately to very compact. In thick till areas there is often an oxidized zone which shows closely-spaced joints that are stained with iron and manganese oxides.

Most of the southwestern portion of the watershed is covered by stratified sand deposits which can range from coarse to fine and may contain up to 25% gravel particles. About 5% of the watershed is a combination of sand and gravel, swamp deposits, sand overlaying fines and artificial fill.

As seen in Figure 2-8, the watershed is primarily comprised of urban influenced soils, which can also be considered fill, and are typically highly variable in composition from one location to the next. The remaining soil types include

- Deep organic inland: Organics are materials deposited from decaying vegetation and microorganisms.. Organic materials found along coastal and tidal areas are often saline and support distinctively separate habitats from the non-saline organic materials commonly found inland. The depth of the organic materials greater than 51 inches.
- Glaciofluvial: Glaciofluvial material has been transported by moving water from melting ice. The material is usually rounded, well sorted sands and gravels. It has very high air and water movement throughout, but very low available water making it very droughty. These materials are important for ground water and aquifer recharge.
- Lodgement till: Lodgement Till is material deposited directly beneath the glacier under enormous pressure. It is compact and contains a greater amount of fine-grained sediment. The compact or dense layer reduces the flow of air and water movement, producing a slowly permeable zone which supports perched water tables.
- Melt-out till: Melt-out till is material deposited, as the ice beneath the glacier slowly melts away. It is less consolidated and friable than lodgement till. There are varying depths to bedrock within the watershed including shallow (less than 20 inches) and moderate (20 to 40 inches).

- Shallow organic – inland: Organics are materials deposited from decaying vegetation and microorganisms. These materials have a very high water holding capacity and buffering capability. The depth of the organic materials is 16 to 51 inches.

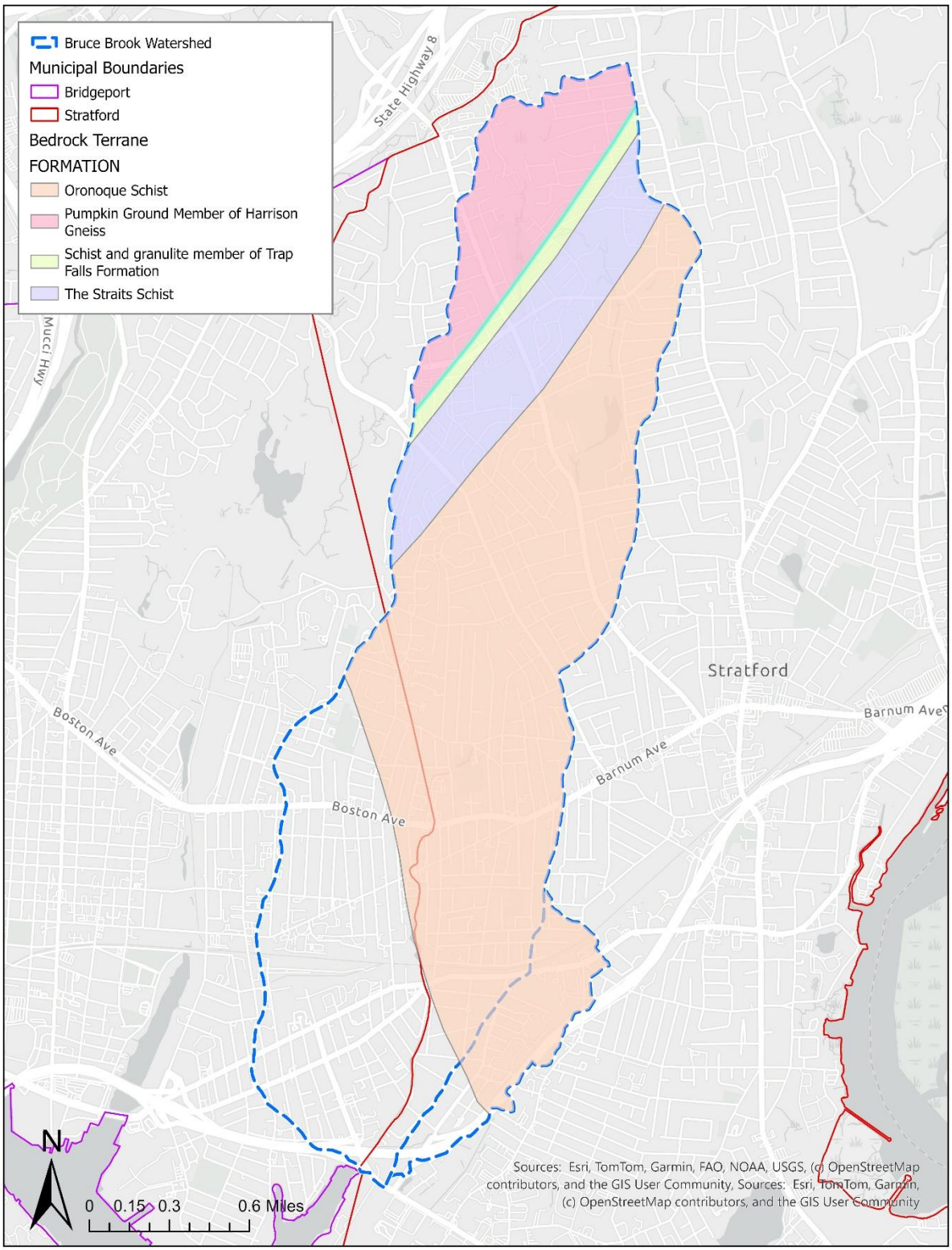


Figure 2-6 Bruce Brook Watershed Geologic Formations

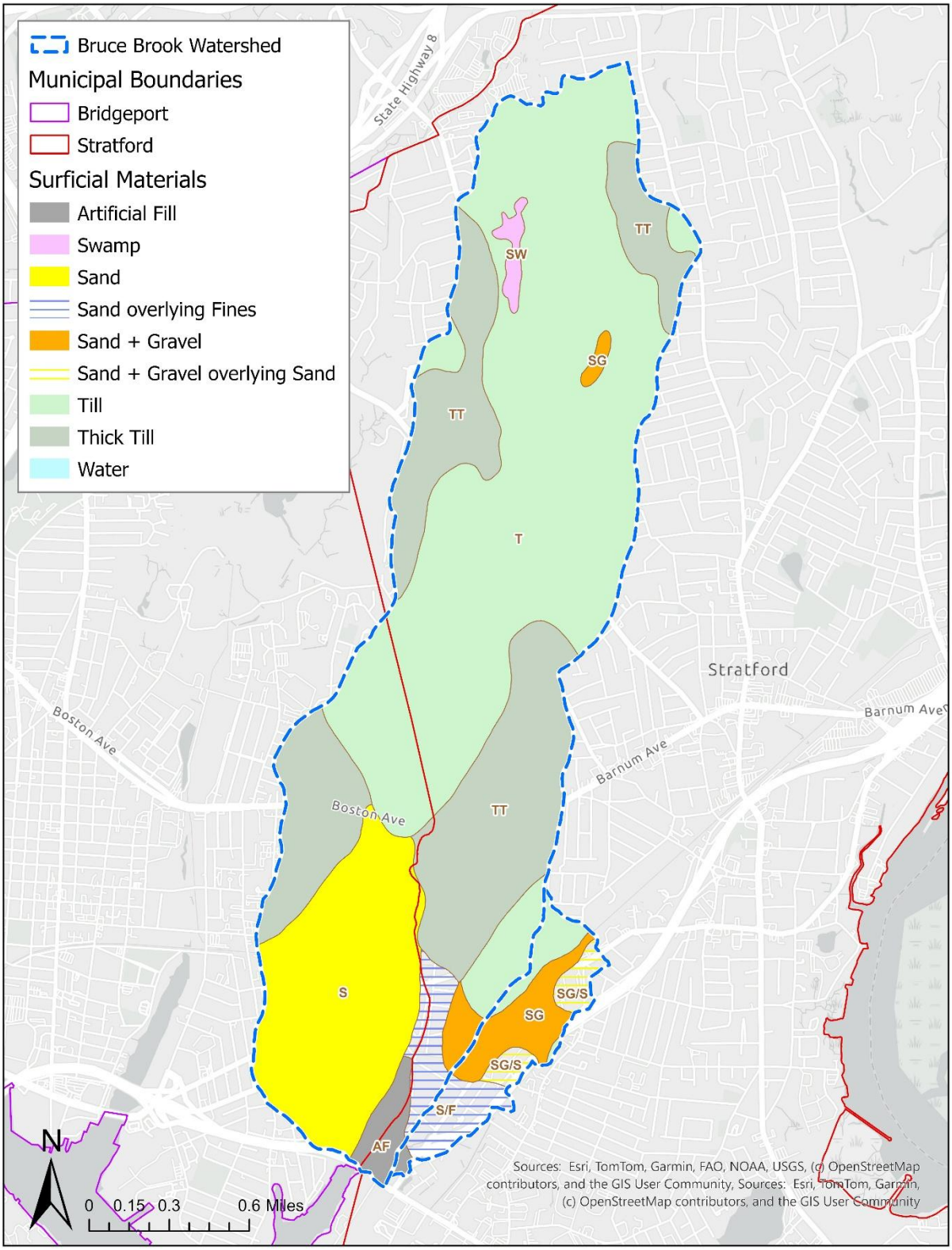


Figure 2-7 Bruce Brook Watershed Surficial Material

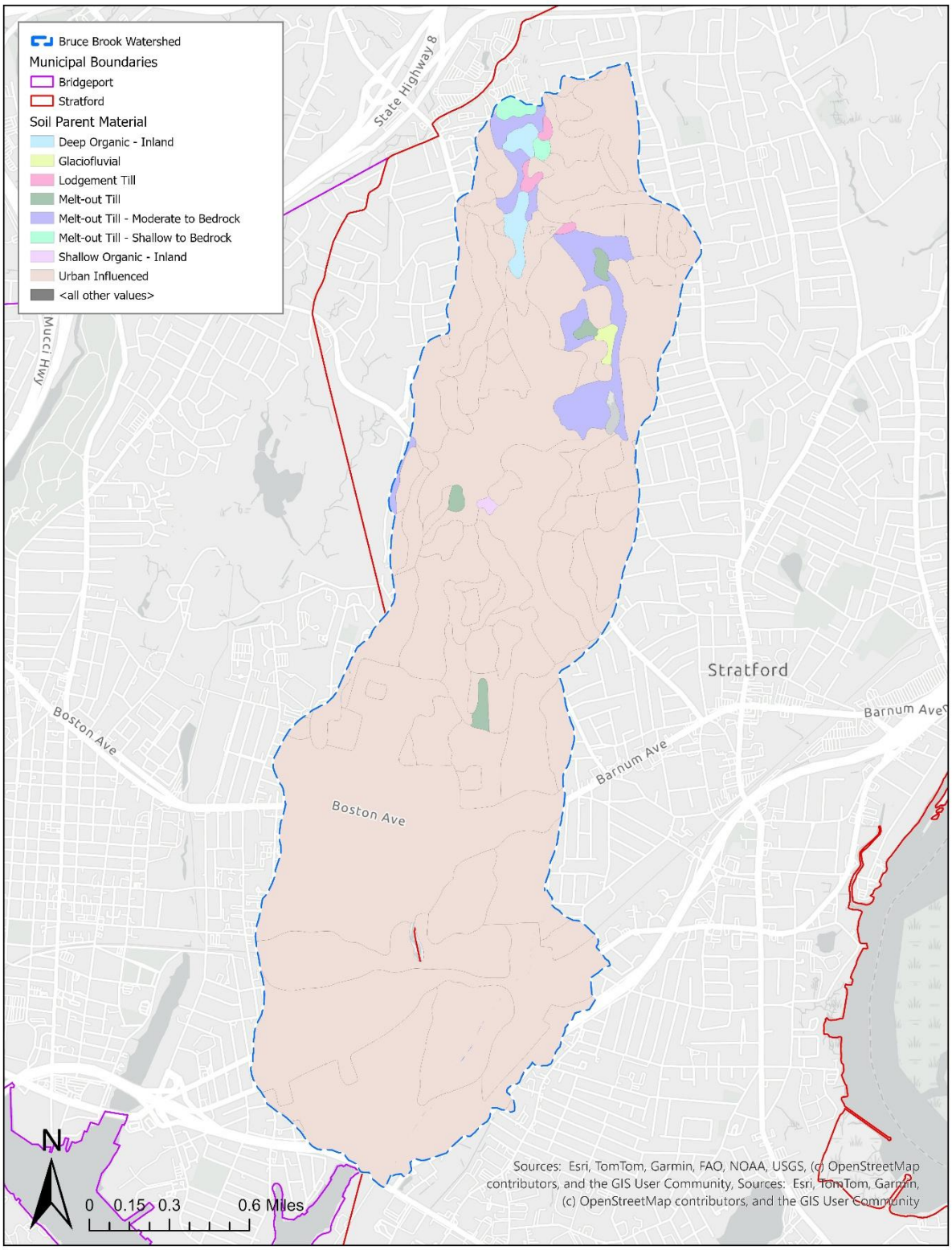


Figure 2-8 Bruce Brook Watershed Soils

2.4. HYDROGRAPHY

The Bruce Brook flows approximately 4.17 miles from its headwaters in the wetlands associated with Veterans Park (and adjacent areas) to the Long Island Sound. Along the Bruce Brook are two named ponds, Wooster Pond and Bruce Pond. Wooster Pond is approximately 3.5 acres, and Bruce Pond is approximately 2.6 acres in size but partially breached and no longer consists of open water. There is a third pond located at Clover Park which is offline from the main stream channel; a portion of Bruce Brook is diverted into the pond. About a third of the Bruce Brook is channelized and has therefore been redirected and contained within an artificially constructed streambed. The process of channelization is often executed to modify or straighten the path of a stream to adhere to developmental needs. About 0.35 miles of the brook is contained within underground conduits. The remaining stretches of the stream are entirely natural or have at least partially natural banks or streambed.

Most of the tributaries to Bruce Brook were placed into stormwater systems and conduits many years ago. Very few streams join Bruce Brook in a manner that is typical of a daylit, open tributary. One joins Bruce Brook in the vicinity of Nicki Laine Circle, and one joins Bruce Brook in the narrow space between Saint Michaels Cemetery and the north side of Interstate 95. All other tributaries enter through stormwater system outfalls and conduits.

To help guide the planning process and field reconnaissance for this Watershed Based Plan, Bruce Brook was divided into 11 reaches that roughly correspond to typologies common in the watershed such as channelized or natural stream banks. A total of nine subwatersheds were delineated to group typical land uses together, and the subwatersheds were further refined to ensure that water quality monitoring locations corresponded to the downstream ends of specific subwatersheds. Subwatershed boundaries were adjusted as needed to account for municipal stormwater systems that have altered natural subwatershed boundaries through installation of catch basins, pipes, and other stormwater infrastructure.

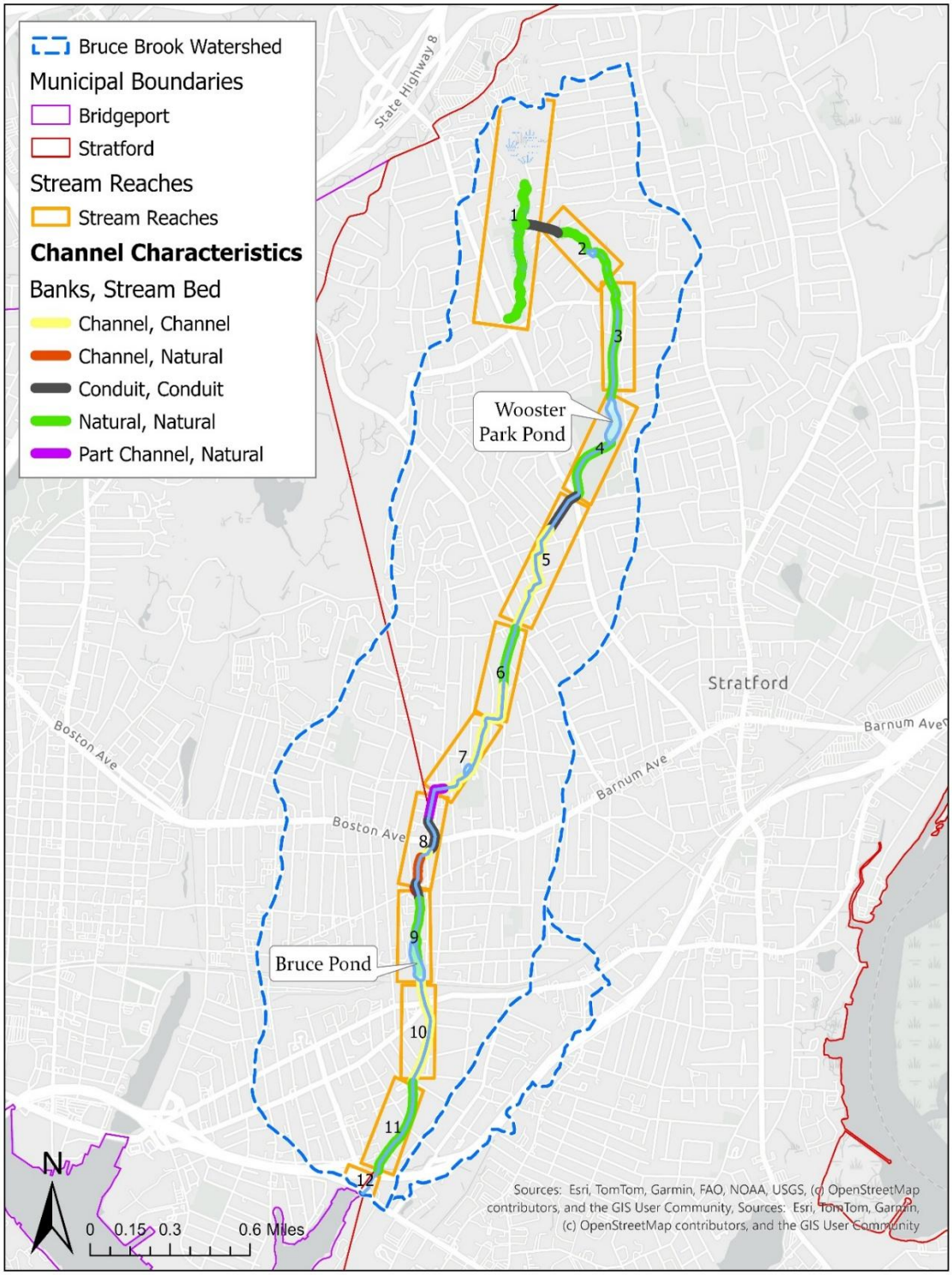


Figure 2-9 Bruce Brook Hydrography, Stream Reaches, and Stream Channel Characteristics

2.5. FEMA FLOOD ZONES

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) are used to determine flood insurance requirements and help communities locate areas that have the highest risk of flooding along a watercourse. The entire length of Bruce Brook has designated special flood hazard areas (SFHAs), or 1% annual chance flood hazard area, with 0.2% annual chance flood hazard area found from Route 1 to the mouth. The Brook also has a regulatory floodway along the entire stream. The floodway is a flood zone with some of the highest flood risk and is strictly regulated by communities. Lands adjacent to the floodway should remain undeveloped to allow for discharge of flood waters.

As shown in Figure 2-10, the FEMA flood zones are heavily developed as a majority of the development along the waterbody was constructed pre-FIRM (1978). The revised FEMA mapping that became effective in 2023 is similar to the mapping that was effective from 2013 through 2023, but some minor changes in floodplain mapping along Bruce Brook were apparent.

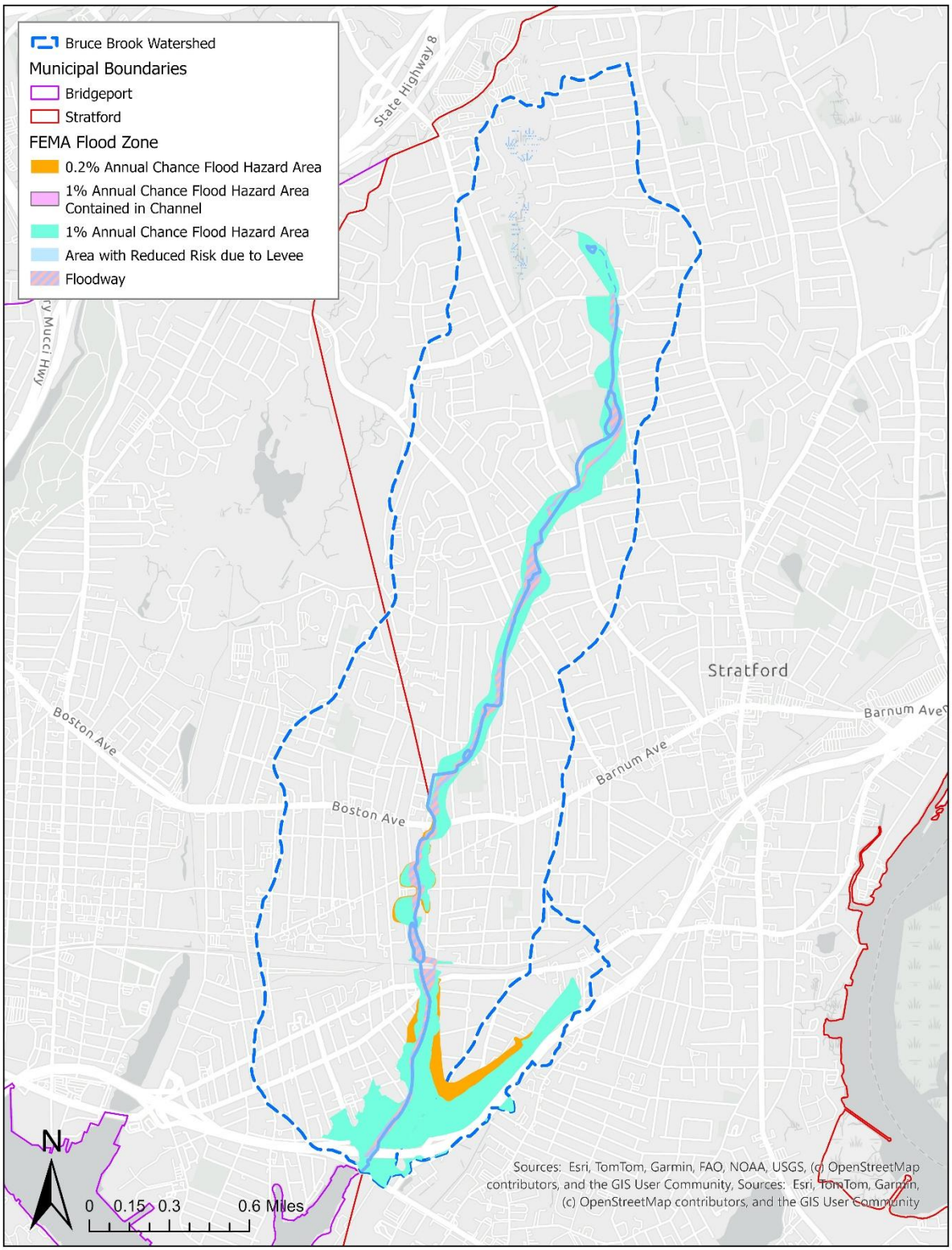


Figure 2-10 FEMA Flood Zones

2.6. DEMOGRAPHICS OF COMMUNITIES IN WATERSHED

The Town of Stratford is a relatively fully developed community with extensive build out including both urban and suburban neighborhoods; residential, commercial, and industrial areas; and a much higher population density than the State as a whole. Stratford had an estimated population of 52,454 in 2023, a population density of 3,000 people per square mile, and a median household income of $93,820 in 2023 according to census.gov. Approximately 64% of the population is white (non-Hispanic), 19% Hispanic or Latino/a, 12% Black, 2% Asian, and 3% other race and ethnicities.

The City of Bridgeport is the State's largest municipality according to population. Bridgeport is a fully developed community with urban and some suburban neighborhoods; residential, commercial, and industrial areas; and a much higher population density than the State as a whole. Bridgeport had an estimated population of 148,028 in 2023, a population density of 9,258 people per square mile, and a median household income of $56,584 in 2023 according to census.gov. Approximately 26% of the population is white (non-Hispanic), 45% Hispanic or Latino/a, 22% Black, 5% Asian, and 2% other race and ethnicities.

2.7. BROWNFIELDS AND CONTAMINATED SITES

According to a DEEP, eight sites located in the watershed are included in the brownfield inventory[2]. One of these locations is enrolled in two programs: the Abandoned Brownfields Cleanup Program (ABC) and the Municipal Liability Brownfield Relief Program (MBLR). These programs[3] provide guidance and incentives for property owners. Three of these properties, Boros Metal Finishing, Mercer Fuel, and Wade's Garage, are located in a FEMA special flood hazard area.

[2] https://ctdeep.maps.arcgis.com/apps/MinimalGallery/index.html?appid=eb8adbee72644fa1bbe4c5d08a10fb33#viewer=290b68d842d743dba1b97c3364f5ae46

[3] https://portal.ct.gov/deep/remediation--site-clean-up/brownfields/connecticut-brownfield-remediation--liability-relief-programs

Table 2-1 Watershed Brownfield and Contaminated Site Inventory

Municipality	Site Name	Site Address	Program
Bridgeport	American Fabrics Company	1069 Connecticut Avenue	None
Bridgeport	American Fabrics Company	1085 Connecticut Avenue	None
Bridgeport	Boros Metal Finishing	50 Miles Street	None
Bridgeport	Porters Grove Metal Recovery	1558 Barnum Avenue	None
Stratford	Wade's Garage	2370 Stratford Avenue	ABC & MBLR
Stratford	2 Road's Brewery	0-1700 Stratford Avenue	None
Stratford	Mercer Fuel	2350 Stratford Avenue	None
Stratford	Us Baird	1700 Stratford Avenue	None

The EPA Toxic Release Inventory (TRI) Program includes an inventory of those facilities within a community that release chemicals into the air, water, or land, or manage waste through other methods. A release can include spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment. The TRI has identified four facilities within watershed boundaries; two of which have been identified as having a history of water releases:

- Sprague Bridgeport Terminal[4] at 250 Eagles Nest Road, Bridgeport
- Tradebe Treatment & Recycling Of Bridgeport LLC at 50 Cross Street, Bridgeport

Of these two, the Tradebe facility has identified the release of Nitrate compounds into Bruce Brook between 2019 and 2023; the Sprague facility has identified Johnson's Creek, Long Island Sound, and an unnamed waterbody.

In addition to those identified above by DEEP, the Town of Stratford has noted that Raymark Industries Superfund Site impacted properties are located throughout Town, including an area of open space on Quail Street and a section of the Wooster School property. The Wooster School Property, along with 46 residential properties, was remediated in 1993. The former fill area located on Quail Street was recently remediated by EPA in 2021 in accordance with plans approved by DEEP. This site is situated along Bruce Brook, and more specifically, adjacent to a location flagged in the streamwalk. At this location, an increased presence of large trash and debris was observed and identified as potentially suitable for removal. It is worth noting that future efforts in the stream along the former Raymark waste site should be mindful of the adjacent soil conditions and seek prior agency review and approvals to ensure any contamination at depth is not improperly disturbed

[4] TRI Facility Report

2.8. NATURAL AND AQUATIC RESOURCES

While the watershed is densely developed, a number of natural and aquatic resources are present in the watershed and along Bruce Brook. Freshwater emergent wetlands and freshwater forest and shrub wetlands are identified at the northern end of the pond in Veterans Park and in the wetland complex just northeast of Veterans Park, also known locally as "The Snake Pit" (this term is used below for consistency with local discussions).

Downstream of the headwaters, freshwater emergent wetlands have been identified along the northern reach of Wooster Pond. Additional freshwater forest and shrub wetlands have been identified along the stream south of Bulldog Boulevard, along the perpendicular reach to Bunnell Avenue, along the stream south of Barnum Avenue and north of Bruce Pond, and a small wetland area at the dead end of North Abram Street. These wetland areas represent the transition area between consistently wet and dry habitats

CT CGA Chapter 440 Sec. 22a-36. Inland wetlands and watercourses. Legislative finding: "Many inland wetlands and watercourses have been destroyed or are in danger of destruction because of unregulated use …The preservation and protection of the wetlands and watercourses from random, unnecessary, undesirable and unregulated uses, disturbance or destruction is in the public interest and is essential to the health, welfare and safety of the citizens of the state."

It is important to note that the existing wetland complexes that comprise the headwaters of Bruce Brook play an integral role in maintaining stream health, and therefore the Town should seek to conserve these systems and maintain them as naturalized areas. Veterans Park and The Snake Pit, feed the headwaters of the Bruce Brook. The wetland areas are comprised of specially adapted plants and specific soil types. Therefore, development within these complexes could reduce the functionality of the wetlands, increase pollutant loads into groundwater and the stream, and reduce biodiversity.

The Snake Pit headwater complex is also within a Natural Diversity Database area (NDDB) mapped by DEEP. NDDB areas represent approximate locations of endangered, threatened, and special concern species. The NDDB areas can represent either plant or animal species and are an additional tool that residents and municipalities should consider when exploring projects and reviewing applications for land use and development in the area. The identification of these species throughout portions of the Snake Pit presents another reason to encourage conservation of the wetland complex.

During the stream reconnaissance completed for this WBP, fish were observed in reaches 3, 4, 8, 10, and 11. Even in the heavily altered section of stream along C-Town Plaza, fish were observed taking refuge in deep pools. Data from DEEP Fisheries indicates that the species historically present in Bruce Brook are American Eel, Bluegill Sunfish, Golden Shiner, Pumpkinseed, and White Sucker. Although none of these species are listed on an endangered, threatened, and special concern list, the presence of these fish shows that suitable habitat remains along certain reaches of Bruce Brook regardless of the channelized sections.

Figure 2-11 Headwater Wetland Complexes and NDDB Areas

2.9. CLEAR LOCAL WATERSHED ASSESSMENT TOOL

The UConn Center for Land Use and Education Research (CLEAR) developed the Local Watershed Assessment Tool[5] which utilizes land cover data to analyze and estimate the probable health of a watershed based on the land cover distribution throughout the watershed and within the 100-foot riparian zone.

The tool utilizes a metric call the Combined Condition Index (CCI), which is a calculation based on the ratio of natural, impervious, and agriculture-like land covers. The CCI scores range from 0 to 1, with a higher CCI indicating a watershed with more natural land cover, which increases the likelihood of having better water quality.

The average CCI for all basins across the state is 0.56; the Bruce Brook watershed has a CCI score of 0.05. the assessment tool estimates that approximately 40.7% of riparian zones in the watershed are natural, 31.9% are impervious, and 27.4% are agriculture-like. However, within the upland watershed area outside the riparian zone, approximately 50.2% is impervious, 27.2% is agriculture-like, and 22.6% is natural.

Nitrogen enrichment factors (EF) were also calculated and related to the CCI using the results of various models which estimate nitrogen export from land to waterways. The Bruce Brook watershed has an EF of 13.83; this is among one of the highest EF scoring basins in the state.

In conclusion, the watershed assessment tool has classified the Bruce Brook Watershed as a “mitigation” basin which indicates potentially increased likelihood of significant pollution problems and identifies the need for restoration measures, particularly within riparian zones. This conclusion, drawn by UConn CLEAR, is consistent with water quality findings discussed in the next few sections and the stream and watershed reconnaissance observations.

2.10. IMPAIRED WATERS LIST

Pursuant to the requirements of Sections 305(b) and 303(d) of the Federal Clean Water Act, DEEP prepares an Integrated Water Quality Report to Congress (IWQR) every two years. The 2022 report is currently effective statewide until the next edition is adopted. As part of the reporting process, selected waterbodies throughout the state are assessed to determine if they meet State Water Quality Standards to support water-based contact recreation (swimming, wading, etc.) and/or aquatic life (fish habitat, other aquatic life and wildlife). These waterbody uses are assessed and reported as: supporting, not supporting or not assessed. Known or suspected causes of water quality problems are listed elsewhere in the IWQR. Waterbodies where recreation and/or aquatic life uses have been deemed not supporting are considered to have “impaired” water quality. Waterbody Assessment results for Bruce Brook are:

- CT7102-00_03: 1.1 miles from Nichols Avenue upstream through Wooster Park to Bunnell High School: not assessed for aquatic life; not supporting recreation. Cause: *E.Coli* (bacteria).

[5] https://experience.arcgis.com/template/68b1ebdd244a4f1a800a15af0e600307/page/CCI-Dashboard/

- CT7102-00_02: 2.2 miles from Bruce Pond outlet to Nichols Avenue: not supporting aquatic life); Cause: unknown; not supporting recreation. Cause: *E. coli*.
- CT7102-00_01: 0.87 miles from mouth upstream to Bruce Pond outlet: not assessed for aquatic life; not supporting recreation. Cause: *E.Coli.*

The three impaired segments are depicted on the map below (Figure 2-12) with a black mark delineating the upstream, and downstream ends of each segment.

Although the cause is “unknown” for fish habitat not being supported, the segment of Bruce Brook denoted as CT7102-00_02 includes most of the channelized sections and all of the sections with concrete stream beds. These water quality impaired segments of Bruce Brook and the associated known/unknown causes of these impairments are the focus of this WBP.

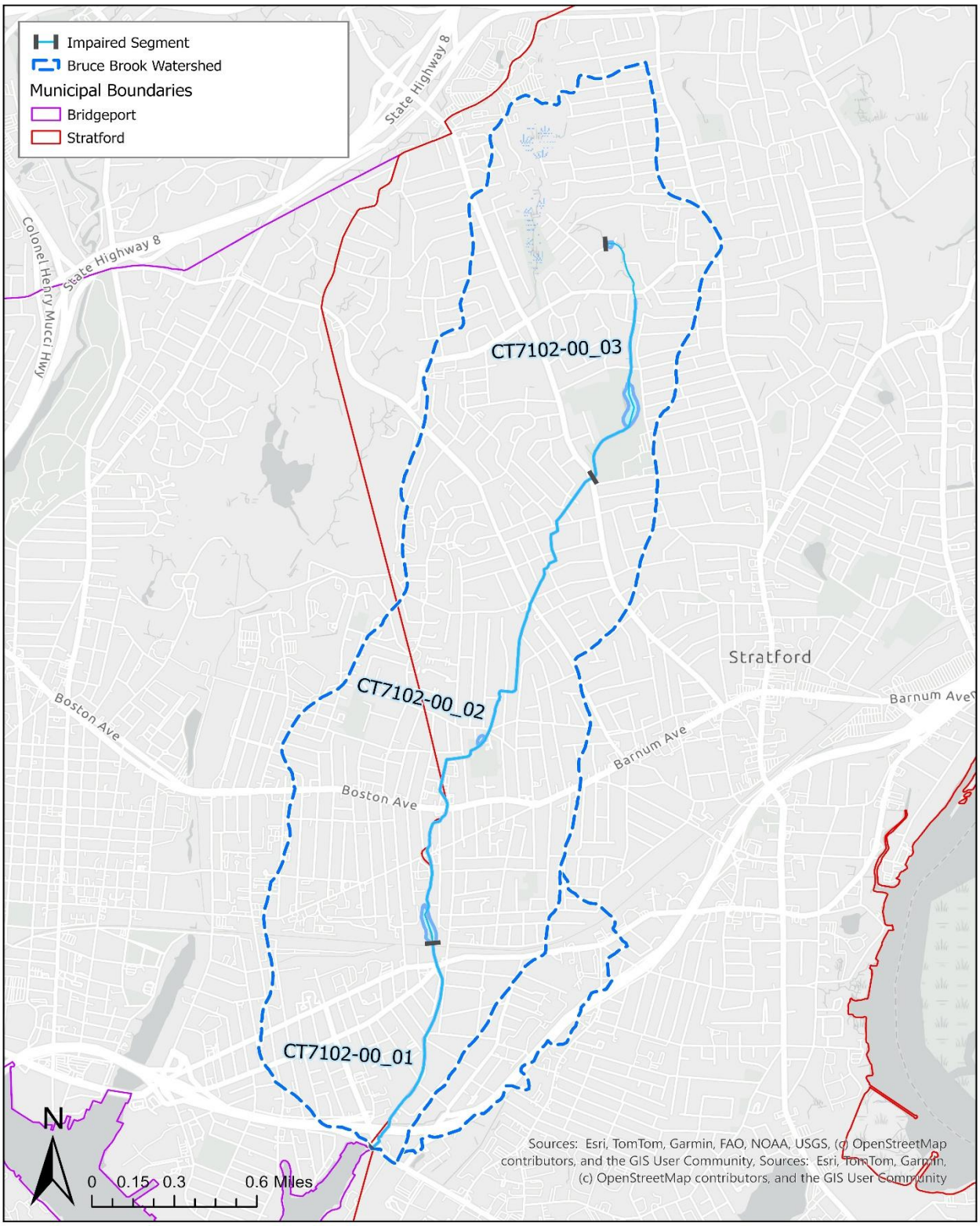


Figure 2-12 Bruce Brook Impaired Segments

2.11. TOTAL MAXIMUM DAILY LOAD ANALYSIS

Pursuant to Section 303(d) of the Federal Clean Water Act, the State of Connecticut has developed the Statewide Total Maximum Daily Load (TMDL) Analysis for Bacteria Impaired Waters[6] (Statewide Bacteria TMDL). The purpose of the TMDL is to determine the amount of pollutant a waterbody can assimilate before compromising State Water Quality Standards. The TDML considers both point and nonpoint pollution sources. The 2012 report provides information and documentation of selected impaired waters throughout the State where the cause is related to bacteria, details regarding potential sources of the impairment, water quality targets, and estimated percent reductions needed to attain State Water Quality Standards (WQS). The Statewide Bacteria TMDL has many appendices, each associated with a specific waterbody. One of these appendices pertains to segment 2 (CT7102-00_02) of Bruce Brook. The Bruce Brook watershed summary can be found in Appendix B of this WBP.

Point Source Pollutants are those that come from a known, identifiable source, such as the end of a pipe which is permitted to discharge. These sources can be traces back to a single source.

Nonpoint Source Pollutants are those that cannot be traced to a single source and are more challenging to identify. These are unregulated sources such as stormwater and surface water runoff from parking areas, agricultural fields, and other land.

The TMDL is needed for the Bruce Brook due to the elevated levels of *E. coli* present at the sampling site located near and downstream of the McDonalds off Barnum Avenue. As a result of these elevated bacteria levels, the segment of Bruce Brook sampled does not meet its designated uses for recreation and aquatic life, does not meet State Water Quality Standards, and has been designated as impaired. These water quality samples referenced in the TMDL date back to 2007 and 2008. However, ongoing and more recent sampling conducted by Harbor Watch (outlined below in Sec. 2.11) backs up this finding.

The TMDL lists potential sources of bacteria based on land use. These include, but are not limited to the following listed in Table 3 of the TMDL:

- Permitted sources
- Illicit discharge (and unpermitted discharge that is not comprised entirely of stormwater, and likely originates from human activity)
- Failing septic systems
- Stormwater runoff
- Nuisance wildlife/pets

[6] https://portal.ct.gov/-/media/DEEP/water/tmdl/CTFinalTMDL/STWDBact_tmdl_corefinal

According to the TMDL, five permitted discharges are located in the Bruce Brook watershed. These include stormwater systems owned by both municipalities, Bridgeport United Recycling, Inc., Reliable Plating & Polishing Co., Inc., and Greater Bridgeport Transit District. These were all authorized by permits or registrations at the time of the TMDL.

The TMDL identified four instances between 2007 and 2010 when Bridgeport sampling sites exceeded the single-sample water quality criteria for *E. coli*. Overall, the TMDL identifies stormwater runoff as a likely high contributor of poor water quality, with the additional possibility of waste from domestic animals, runoff from agricultural operations (potentially due to the identification of Clover Park as an agricultural operation) and failing septic systems (though they only serve a fraction of the watershed). It was also noted that the reduction in natural riparian buffer zones reduces the effectiveness of natural area capabilities to take up and absorb contaminants, ultimately contributing to increased bacteria levels.

The TMDL recommended the following:

1. Identify areas in the Bruce Brook watershed to implement Best Management Practices (BMPs) to control stormwater runoff.
2. Continue monitoring of permitted sources.
3. Implement a program to evaluate the sanitary sewer system.
4. Develop a system to monitor septic systems.
5. Evaluate municipal education and outreach programs regarding animal waste.
6. Ensure there are sufficient buffers on agricultural lands on Bruce Brook.

Of these next steps recommended in the TMDL, #1-3 are primarily aligned with MS4 compliance and best practices, #4 is believed to be a minor contributor to bacteria loading, and #6 is believed applicable only to the community garden on the south side of Connors Lane. The agricultural land mapped in the TMDL was situated at Clover Park, which is not an agricultural land use. Recommendation #5 is a key consideration of this WBP as explained in later sections.

The TMDL notes that, "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."

MS4: Municipal Separate Storm Sewer System
SMP: Strategic Monitoring Plan
BMP: Best Management Practices

2.12. MS4 PERMITTING

The Town of Stratford and City of Bridgeport are subject to the General Permit for the discharge of Stormwater form Small Municipal Storm Sewer Systems (MS4) which is issued by DEEP. On September 29, 2023, DEEP issued an updated MS4 permit, which went into effect October 1, 2023. The MS4 Permit applies to all municipalities that have at least 1,000 people within an "Urbanized Area" determined based on the U.S. Census. Communities subject to the MS4 Permit are required to develop, implement and enforce stormwater management plans centered around six minimum control measures (MCMs):

- Public education and outreach
- Public involvement and participation
- Illicit discharge detection and elimination
- Construction site stormwater runoff control
- Post-construction stormwater runoff control
- Pollution prevention and good housekeeping

The last two measures include requirements to consider and utilize Low Impact Development (LID) measures to reduce or disconnect impervious (surfaces that do not allow water to penetrate the ground) cover to infiltrate (when surface water enters the soil) more runoff on site.

The MS4 Permit also requires municipalities to address the sources of stormwater pollutants contributing to impaired waters. All stormwater regulated under the MS4 is considered a point source. For example, in this case, it means that Stratford and Bridgeport need to implement Best Management Practices (BMPs) that focus on reducing bacteria loads to Bruce Brook.

2.12.1. BRIDGEPORT MS4

In accordance with the MS4 requirements, the City of Bridgeport has developed a stormwater management plan (SMP). The most recent was published in March 2017, and updated February 7, 2020. The plan outlines best management practices (BMPs) for six MCMs.

In addition to those MCMs, the SMP outlines details on wet weather monitoring and reporting. Many of the BMPs identified are either complete, underway, or ongoing according to the 2023 Annual Report[7].

[7] https://www.bridgeportct.gov/sites/default/files/2024-03/MS4%20General%20Permit%20City%20of%20Bridgeport%202023%20Annual%20Report.pdf

As of 2023 the City has strengthened outreach and education with the implementation of several programs including refilling "MuttMutt" dispensers to make dog waste bags available to the public, educating on not feeding geese, and conducting virtual meetings on stormwater education. The City has developed an IDDE program, implemented a citizen reporting platform, and is in progress of addressing IDDE in areas of pollution concern. The City is perpetually providing training to staff on pollution prevention/good housekeeping, and the City meets annually with the Town of Stratford regarding Bruce Brook. The Parks and Recreation Department boasts a 50% reduction of fertilizers and herbicides on municipal grounds in the past decade and continues to seek opportunities for incorporating permeable pavements/infrastructure into projects.

The City has implemented a street sweeping program which includes sweeping residential areas eight times a year, main roads 16 times a year, and the downtown area 64 times a year. Parks and municipal lots are swept at least once per year. In addition, all catch basins are cleaned annually. Roadways are pretreated with brine and treated with bulk rock salt just before a snow event.

In addition to those actions identified above, the City has conducted outfall sampling in accordance with the MS4 permit requirements. The permit requires monitoring dry and wet weather screening, with, at a minimum, analysis for ammonia, chlorine, conductivity, salinity, *E. coli*, or enterococcus, surfactants, and temperature. Some outfall water quality sampling locations are within the Bruce Brook watershed boundary. Those locations and sampling findings to date are listed below.

Table 2-2 City of Bridgeport MS4 Sampling Results in the Watershed

Sample Outfall ID	Location	Date	Turbidity	Fecal Coliform	Total Coliform	*E. coli*	Enterococci	units
6-10	1313 CT Ave. (south of Bruce Pond)	3/29/20	10.40	-	-	>20000	-	
		EPA Test				>48392		
10-8	Boston Ave & Bruce Brook	6/24/19	1.85	980	>200000	39000	13000	Cfu/100mL
		EPA Test				>48392/1058		
10-9	70 Sage St	7/29/16		500				
10-10	Barnum and Sage (church parking lot)	6/25/19	24.0	70000	>200000	15000	95900	
		6/9/16		2100				
		12/5/17				1400		
10-11		6/25/19	13.70	28000	129000	4000	7500	

Sample Outfall ID	Location	Date	Turbidity	Fecal Coliform	Total Coliform	*E. coli*	Enterococci	units
	End of Brookfield (near Bruce Pond)	7/29/16		0				
10-12	St. Mathias Street	6/25/19	22.10	25000	>200000	30000	39000	
		12/12/16		5				

2.12.2. STRATFORD MS4

Similar to Bridgeport, the Town of Stratford has identified multiple BMPs for the same six MCMs as identified in the Bridgeport plan as required by the MS4 permit

As outlined in the 2023 annual MS4 report, the Town has executed several outreach projects including distributing MS4 information to contractors and has hosted outreach for the Bruce Brook WBP. The Town continuously publishes information online related to stormwater and participates and/or hosts events such as stream and park cleanups. The town has developed an IDDE program, implemented a citizen reporting program, and continues to address IDDE in areas with pollutants of concern. Stratford continues to improve capabilities, regulations, and collaboration regarding construction site runoff projects and post-construction stormwater management.

Preliminary designs have recently been completed for miscellaneous drainage improvements; and retrofit projects have been completed at the Baldwin Center and Bunnell High School parking lot. All streets are swept on an annual basis, with main roads additionally swept on an as need basis.

The Town has also executed stormwater outfall sampling in accordance with their 2017 MS4 permit. The most available data from recent years for *E. coli* monitoring can be found below in Table 2-3.

Table 2-3 Town of Stratford MS4 E. coli Monitoring Results for Years 2019, 2020, and 2023

Outfall	2019	2020	2023
	(MPN/100ml)		
BRB-OF-0001	0	0	0
BRB-OF-0002	0	13,000	13,000
BRB-OF-0003	0	0	1,960
BRB-OF-0004	0	24,200	0

Outfall	2019	2020	2023
	(MPN/100ml)		
BRB-OF-0005	0	2,480	9,210
BRB-OF-0006	1	0	13,000
BRB-OF-0007	0	0	4,110
BRB-OF-0008	1	3,080	8,160
BRB-OF-0009	0	0	1,080
BRB-OF-0010	160	0	7,700
BRB-OF-0011	0	0	0
BRB-OF-0012	6	0	0
BRB-OF-0013	0	0	0
BRB-OF-0014	15	0	19,900
BRB-OF-0015	1,553	24,200	7,700
BRB-OF-0016	0	12,000	0
BRB-OF-0017	1	0	414
BRB-OF-0018	1	24,200	0
BRB-OF-0020	2,420	0	9,210
BRB-OF-0021	0	0	565
BRB-OF-0022	0	3,650	0
BRB-OF-0023	2,420	9,210	0
BRB-OF-0024	0	17,300	0
BRB-OF-0025	0	0	0
BRB-OF-0026	0	0	0
BRB-OF-0027	0	0	0
BRB-OF-0028	0	0	0
BRB-OF-0029	0	0	0
BRB-OF-0031	0	0	0
BRB-OF-0032	5	0	0
BRB-OF-0033	0	0	0
BRB-OF-0034	0	0	0
BRB-OF-0035	11	0	0
BRB-OF-0036	0	0	0
BRB-OF-0037	3	0	0
BRB-OF-0038	0	0	0
BRB-OF-0039	0	0	0
BRB-OF-0040	0	0	0
BRB-OF-0041	5	0	0
BRB-OF-0042	126	0	480
BRB-OF-0043	1,120	8,660	0
BRB-OF-0044	0	4,880	0

Outfall	2019	2020	2023
	(MPN/100ml)		
BRB-OF-0045	41	9,800	0
BRB-OF-0046	0	0	0
BRB-OF-0047	0	0	0
BRB-OF-0048	2,420	0	0
BRB-OF-0049	154	0	0
BRB-OF-0050	2,420	17,300	0
BRB-OF-0051	2,420	8,160	0
BRB-OF-0052	1	0	0
BRB-OF-0053	0	0	0
BRB-OF-0054	0	0	0

2.13. HARBOR WATCH MONITORING SUMMARY

Harbor Watch at Earthplace (a non-profit organization) was founded in 1986 with the intentions and mission of improving water quality and ecosystems throughout Connecticut through field work, collaboration, and education. Harbor Watch conducts several projects, including river monitoring throughout Fairfield County. Bruce Brook is included in this project.

Harbor Watch has monitored water quality at 13 different sampling sites (Figure 2-13) along Bruce Brook since 2017. In 2020, however, there was a limited number of samplings during the season due to the COVID-19 pandemic. In general, the monitoring program has included five different parameters since 2017: *E. coli*, *Enterococci*, dissolved oxygen, conductivity, and temperature, with the addition of nutrient parameters in 2023 (NH_3, NO_X, TN, and TP) The number of samples for each sites varied over the years due to factors such as accessibility and stream flow.

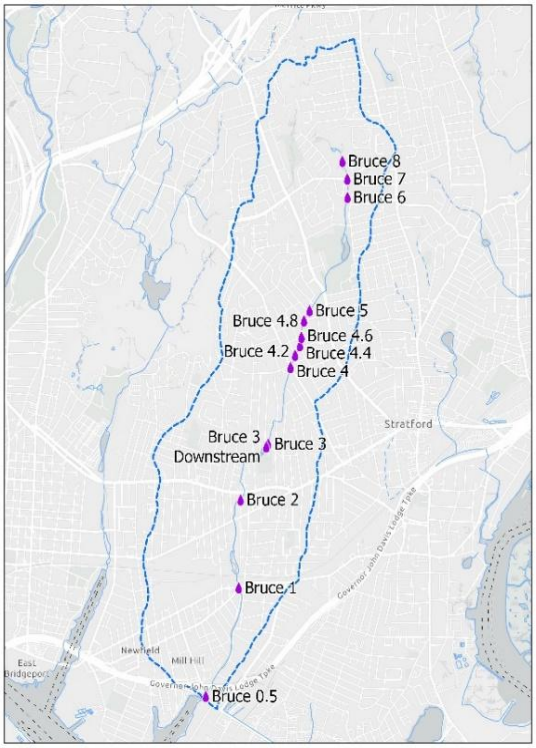


Figure 2-13 Harbor Watch Water Quality Sampling Sites

The northern testing sites, from Bruce 4 north, are primarily located along the channelized stretch of Bruce Brook that traverses moderately dense residential development. Bruce 2 and 3 are located in more densely developed residential areas, and Bruce 1 and Bruce 0.5 are located in areas where commercial and industrial land uses become more prominent.

Over the years, Harbor Watch has worked with the Town of Stratford and City of Bridgeport to identify sources of sanitary wastewater (sewage) pollution, which has resulted in both municipalities working to remove pollution sources along the brook. Despite these efforts, water quality issues remain a challenge for Bruce Brook.

From 2019 to 2023, Harbor Watch sampled for total coliform. Total coliform is a term for a full group of coliforms; this group also includes fecal coliform and *E. coli*. Total coliform testing acts as an indicator of potential water contamination. As seen in Figure 2-14, sample sites Bruce 0.5, 1, 2, and 3 were those with the highest average total coliform over the four year time frame. Site Bruce 1 had the highest recorded total coliform average with an average of 241,960 MPN/100 mL.

From 2017 to 2018, testing included fecal coliform specifically rather than total. As seen in Figure 2-14 for 2017 and 2018, site Bruce 1 had the highest average total coliform numbers for both years.

Site Name	Year of Date 2019	2020	2021	2022	2023
Bruce 0.5	142,639		73,572	62,043	
Bruce 1	154,854	241,960	104,442	71,340	67,974
Bruce 2	196,471	24,196	33,747	48,065	58,504
Bruce 3	7,743	9,678	21,074	41,617	26,884
Bruce 3 Downstream			24,196		
Bruce 3 Upstream			24,196		
Bruce 4	7,743	19,863	20,440	37,175	23,433
Bruce 4 Upstream			24,196		
Bruce 4.2				25,496	
Bruce 4.4				26,081	
Bruce 4.6				27,567	
Bruce 4.8				32,261	
Bruce 5	7,501	6,932	4,608	34,305	5,064
Bruce 6	7,569	9,678	20,144	5,259	9,052
Bruce 7	7,501		9,903	17,334	9,678
Bruce 8	7,501		9,968	35,129	9,582

Avg. Total Coliform
4,608 241,960

Site Name	Date 2017	2018
Bruce 1	62,726	66,680
Bruce 2	23,914	12,290
Bruce 3	12,060	7,438
Bruce 4	1,275	5,178
Bruce 5	1,163	2,943
Bruce 6	2,221	3,772
Bruce 7		10,150
Bruce 8		4,175

Avg. Fecal Coliform
1,163 66,680

Figure 2-14 Annual Average Total Coliform (2019 to 2023) and Fecal Coliform (2017 to 2018) at All Sites Sampled (MPN/100mL)

Bruce Brook was also tested for *E. coli* levels from 2017 to 2023 (Figure 2-15). Bruce 1 was consistently among the sites with the highest annual average of bacteria levels. In 2021 and 2022 when additional sites were included in the testing regimen, Bruce 8, which is the northern most site, and Bruce 1 and 8 were again among the highest average for 2022 with Brue 1 and 2 being the highest in 2023

Over the course of the Harbor Watch monitoring, site Bruce 1 has the highest average of total coliform, fecal coliform, and *E. coli* levels of all sites. Figure 2-15 shows a graphical representation of Bruce 1 in comparison to the other testing sites for *E. coli*.

Site Name	2017	2018	2019	2020	2021	2022	2023
				Date			
Bruce 0.5			11,798		4,260	17,066	
Bruce 1	57,286	64,240	90,813	241,960	15,101	20,311	37,489
Bruce 2	7,100	7,170	126,359	12,997	2,708	16,316	34,408
Bruce 3	11,906	4,138	3,418	1,642	2,956	8,693	8,493
Bruce 3 Downstream					2,187		
Bruce 3 Upstream					3,654		
Bruce 4	961	3,735	2,577	2,987	3,867	6,647	6,745
Bruce 4 Upstream					2,489		
Bruce 4.2						8,829	
Bruce 4.4						3,680	
Bruce 4.6						13,114	
Bruce 4.8						15,041	
Bruce 5	1,079	2,622	1,485	510	340	6,698	1,598
Bruce 6	1,783	3,066	3,280	6,213	5,771	3,840	5,518
Bruce 7		9,100	2,142		1,276	13,273	5,063
Bruce 8		3,850	2,324		914	24,509	5,668

Avg. E. coli (CFU/100 m..
340 241,960

*Figure 2-15 Annual Average E. coli (CFU/100mL) *2019-onward reported as (MPN/100mL)*

The northern test sites (Bruce 6, 7, and 8) are located in a Class A section of Bruce Brook, with the remaining sites in Class B sections of the Brook. the graphic below shows the indicator thresholds per Tabel 2A in the State Water Quality Standards[8]. By these standards, all samples taken since 2017 have exceeded the limits for all designated uses regardless of classification.

Designated Use	Indicator	Criteria by classification				
		AA	A	B	SA	SB
Drinking water supply[1]	Total Coliform	Monthly moving average less than 100/100 ml Single sample maximum 500/100 ml				
Recreation[2][3] **– Designated swimming**[4]	Escherichia coli	Geometric mean less than 126/100 ml				
		Single sample maximum 235/100 ml				
Recreation[2][3] **– Non Designated Swimming**[5]	Escherichia coli	Geometric mean less than 126/100 ml				
		Single sample maximum 410/100 ml				
Recreation[2][3] **– All other uses**	Escherichia coli	Geometric mean less than 126/100 ml				
		Single sample maximum 576/100 ml				

Figure 2-16 Connecticut State Water Quality Standards Indicator Bacteria Thresholds

2.14. OBSERVATIONS FROM STREAM WALK AND WATERSHED RECONNAISSANCE

The Bruce Brook was divided into 12 stream reaches for the purposes of stream walk and watershed reconnaissance (Figure 2-17). During the stream reconnaissance completed for this WBP (Appendix C), numerous types of debris were observed in Bruce Brook that can contribute bacteria or harbor bacteria, such as pet waste bags and trash. The following table provides a summary of debris observed and its potential relationship to poor water quality caused by bacteria.

[8] https://www.epa.gov/sites/default/files/2014-12/documents/ctwqs.pdf

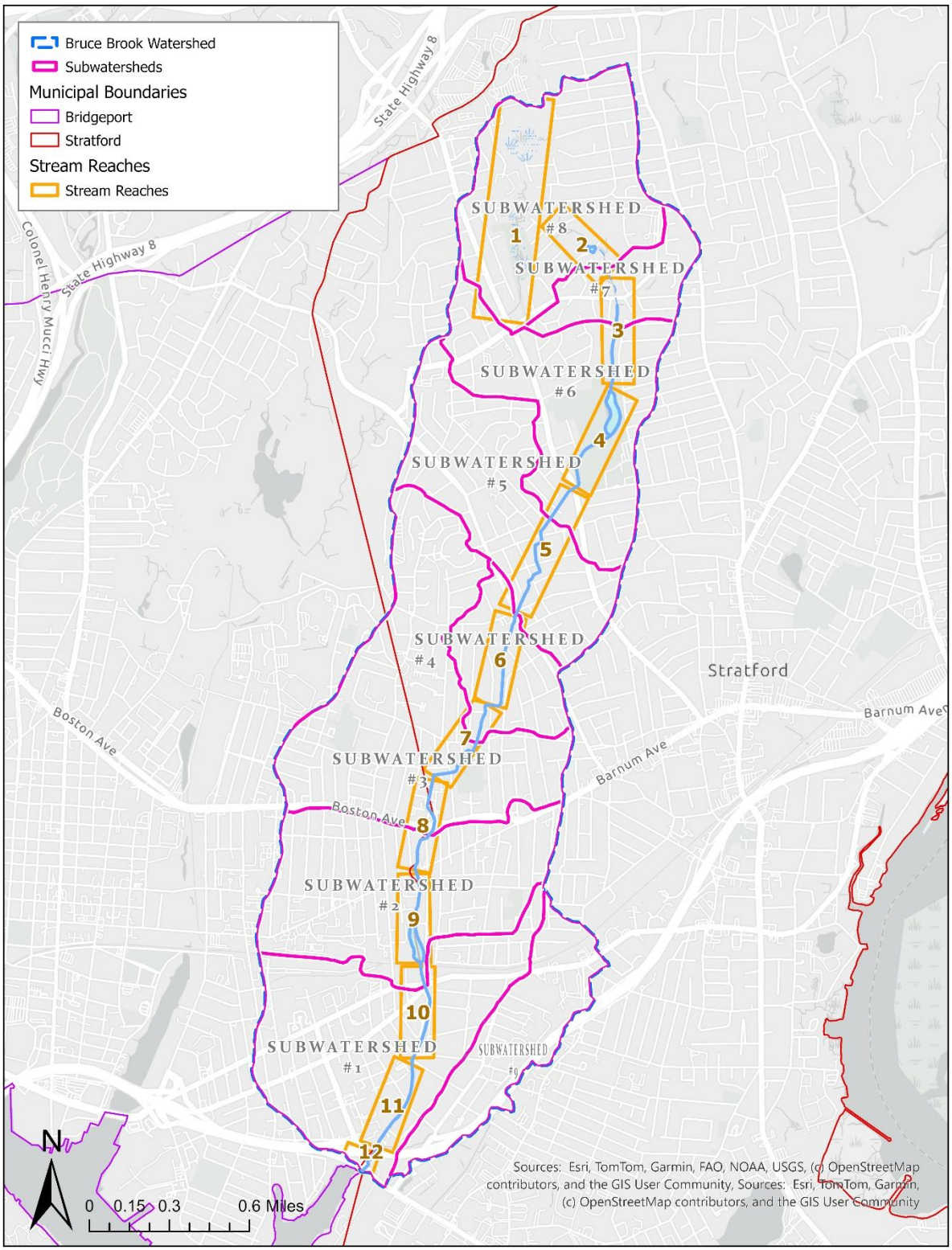


Figure 2-17 Stream Reach Delineation for Stream Walk and Field Reconnaissance

Table 2-4 Observed Types of Debris

Type of Debris	Stream Reaches	Associated Subwatersheds	Potential to Harbor Bacteria?
Residential and commercial yard waste	1, 6, 8	8, 4	Medium (numerous surfaces, can create rodent habitat, but will break down)
Empty pet waste bags	1, 2, 3, 4, 5, 6, 8, 9, 10, 11	8, 7, 6, 5, 4, 3, 2, 1	High (bags are a source, and some bacteria will remain in place after emptying)
Tires	1, 6, 10, 11	8, 4, 1	High (stagnant water inside tires, rubber surface area)
Bulky waste (household items, furniture)	1, 4, 6, 11	8, 6, 4, 1	Depends on composition
Household trash, garbage	3, 4, 6, 8, 9, 10, 11	7, 6, 4, 3, 2, 1	High (numerous surfaces, variable composition that includes plastics and food wastes)
Metal, chicken wire, appliances, vehicles, signs	3, 4, 6, 8, 10	7, 6, 4, 3, 2, 1	Assume low, but can catch trash
Concrete, stone, bricks	3, 6, 8, 9, 11	7, 6, 4, 3, 2, 1	Assume low
Large woody snags, trees	4, 10, 11	6, 1	Assume low, but can catch trash
Fence pieces (lumber, timber)	6, 8	4, 3, 2	Assume low, but can catch trash
Fabric	8, 9, 10, 11	3, 2, 1	High (numerous surfaces, variable composition that includes plastics)
Medical (gloves)	9	2	Unknown
Sections of PVC and metal pipe	9	2	Unknown

Direct evidence of bacteria was observed in several stream reaches through the appearance of rust-colored films and/or a foamy water surface. Although gray-colored water and other indications of illicit or accidental sewer connections were not observed on the handful of dates selected for the stream reconnaissance, Harbor Watch reports seeing indications of illicit or accidental sewer connections in the past.

2.15. SUMMARY OF WATER QUALITY

The water quality in Bruce Brook has been impaired by the presence of bacteria (specifically *E. Coli*, notwithstanding the presence of total and fecal coliform as well). This information was provided in the TMDL, has been verified by the impaired waters list as recently as 2022, and is consistent with the sampling conducted by Harbor Watch. The primary causes are likely pet waste that has been disposed improperly (which represents a nonpoint source when it enters Bruce Brook directly from roads, parks, and residential yards, and a point source where it enters from stormwater systems), accidental connections of sewer systems and stormwater systems that have not yet been discovered (point sources), and nonpoint source pollution in the adjacent watershed.

Stormwater systems are extensive in the watershed, directly connecting hundreds of acres of impervious surfaces and various land uses to the stream. During storm events, nonpoint source pollution originates throughout the watershed, enters stormwater systems, and then becomes point sources of pollution regulated per the MS4 programs in Stratford and Bridgeport.

Debris in Bruce Brook either catches pet waste bags and trash that carries bacteria, or provides substrates (e.g., plastic and fabric) where bacteria can persist. Some of this debris is natural woody debris, and therefore is desired, but it should not be catching trash. Non-natural debris is believed not beneficial in Bruce Brook.

Bruce Brook is considered impaired for not supporting fish habitat along a segment that is 2.2 miles long. This part of Bruce Brook is characterized by many channelized sections lined with concrete stream banks and long sections of concrete stream bed.

3. WATERSHED POLLUTANT LOADS

The Watershed Treatment Model (WTM)[9] was used to first estimate existing pollutant loads and then estimate pollutant load reductions based on the watershed management plan recommendations described in Chapters 4 and 5. The subwatersheds (1 to 9) provide the basis for the WTM analysis. As noted previously, the subwatersheds (Figure 2-17) were delineated using StreamStats and adjusted as needed in conjunction with the Bridgeport and Stratford stormwater system mapping. One WTM summary sheet is provided for each of the nine subwatersheds at the end of Section 3.2.

3.1. EXISTING POLLUTANT LOADS

The WTM is an excel-based tool that evaluates pollutant loads from primary and secondary sources. Primary sources include factors such as land use types, hydrological soil type, and depth to groundwater, and secondary sources include sewage system type and use data, road sanding practices, and channel erosion characteristics. The WTM was used to identify existing pollutant loads for each of the nine subwatersheds.

Table 3-1 below presents the existing pollutant loads for each subwatershed. The WTM result calculations include loads for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), fecal coliform, and the runoff volumes. Each of these can indicate varying sources of the pollutants present.

TN: Excessive nitrogen can result in eutrophication in a waterbody, and is typically the result of fertilizer, urban runoff, and atmospheric deposition.

TP: Excessive phosphorus can stimulate algal blooms which can ultimately reduce dissolved oxygen levels. Phosphorus typically comes from residential or agricultural runoff, industrial discharge, or sewage.

TSS: Total suspended solids are the undissolved particles in the water and can reduce water clarity, influence water temperatures, and can carry pollutants. High TSS can result from soil or streambank erosion, urban runoff, or industrial discharges.

Fecal Coliform: High levels of fecal coliform bacteria can indicate contamination in a waterbody and therefore make it unsuitable for recreation or consumption. Stormwater runoff, particularly in urban areas, is a major source of the bacteria, as runoff can often carry waste from pets and wildlife among other sources. It can also be a result of discharge or failing septic systems.

[9] https://owl.cwp.org/mdocs-posts/watershed-treatment-model-documentation-final/

Table 3-1 Watershed Treatment Model (WTM) Existing Pollutant Load Summary by Subwatershed

	Sum of TN (lb/year)	Sum of TP (lb/year)	Sum of TSS (lb/year)	Sum of Fecal Coliform (billion/year)	Sum of Runoff Volume (acre-feet/year)
Subwatershed 1	4,152.44	**1,111.25**	**273,303.34**	148,356.68	611.21
Subwatershed 2	3,370.90	693.47	164,553.40	138,305.35	575.73
Subwatershed 3	**4,308.61**	911.78	187,030.56	**161,374.40**	**672.39**
Subwatershed 4	980.84	224.46	49,270.24	41,166.32	174.09
Subwatershed 5	2,478.49	556.68	116,462.96	94,455.13	392.49
Subwatershed 6	3,190.07	826.49	186,478.15	114,786.58	474.83
Subwatershed 7	906.17	250.92	54,330.64	31,853.64	131.77
Subwatershed 8	2,581.42	690.12	130,151.56	79,640.53	325.16
Subwatershed 9	2,006.00	357.65	103,544.66	79,352.12	325.10
Grand Total	**23,974.95**	**5,622.81**	**1,265,125.51**	**889,290.75**	**3,682.76**

Of the nine subwatersheds, Subwatershed 3 has the highest estimated existing pollutant loads for TN and fecal coliform, with Subwatershed 1 having the highest TN and TSS load. Subwatershed 3 also has the greatest runoff volume. However, given then size diversity of the subwatersheds, Table 3-2 presents normalized (per acre) existing pollutant loads. These normalized values show Subwatershed 9 having the highest TN and Fecal Coliform loads, Subwatershed 1 having the highest TP and TSS. The table also presents the loads attributed to primary and secondary sources. Primary sources are the predominant contributor for all subwatersheds.

Table 3-2 Watershed Treatment Model (WTM) Existing Pollutant Load Summary by Subwatershed, Normalized Per Acre

	Sum of TN (lb/year)	Sum of TP (lb/year)	Sum of TSS (lb/year)	Sum of Fecal Coliform (billion/year)	Sum of Runoff Volume (acre-feet/year)
Subwatershed 1					
Secondary Sources	1.4	1.4	373.2	0.0	0.0
Primary Sources	9.8	1.1	373.2	409.1	1.7
Existing Surface Water Load	**11.3**	**3.0**	**743.1**	**403.4**	**1.7**
Subwatershed 2					
Secondary Sources	0.5	0.5	123.9	0.0	0.0
Primary Sources	10.1	1.2	371.8	423.7	1.7
Existing Surface Water Load	**10.1**	**2.1**	**491.6**	**413.2**	**1.7**

	Sum of TN (lb/year)	Sum of TP (lb/year)	Sum of TSS (lb/year)	Sum of Fecal Coliform (billion/year)	Sum of Runoff Volume (acre-feet/year)
Subwatershed 3					
Secondary Sources	1.1	0.5	115.5	1.0	0.0
Primary Sources	9.3	1.2	333.0	390.7	1.6
Existing Surface Water Load	**10.2**	**2.2**	**443.4**	**382.6**	**1.6**
Subwatershed 4					
Secondary Sources	0.4	0.4	110.0	0.0	0.0
Primary Sources	9.0	1.2	329.9	377.4	1.5
Existing Surface Water Load	**8.6**	**2.0**	**434.4**	**363.0**	**1.5**
Subwatershed 5					
Secondary Sources	0.6	0.4	111.9	0.2	0.0
Primary Sources	8.7	1.1	332.8	363.7	1.5
Existing Surface Water Load	**9.3**	**2.1**	**438.8**	**355.9**	**1.5**
Subwatershed 6					
Secondary Sources	1.3	1.2	323.6	0.1	0.0
Primary Sources	9.7	1.2	323.0	403.0	1.6
Existing Surface Water Load	**11.0**	**2.8**	**642.8**	**395.7**	**1.6**
Subwatershed 7					
Secondary Sources	1.2	1.2	307.0	0.0	0.0
Primary Sources	8.7	1.1	307.0	363.5	1.5
Existing Surface Water Load	**10.2**	**2.8**	**609.4**	**357.3**	**1.5**
Subwatershed 8					
Secondary Sources	1.8	1.1	248.3	1.3	0.0
Primary Sources	8.7	1.0	242.6	371.7	1.5
Existing Surface Water Load	**8.2**	**2.2**	**413.2**	**252.9**	**1.0**
Subwatershed 9					
Secondary Sources	0.6	0.6	162.4	0.0	0.0
Primary Sources	12.1	1.3	487.2	500.2	2.0
Existing Surface Water Load	**12.5**	**2.2**	**645.8**	**494.9**	**2.0**
Grand Total	**186.5**	**39.3**	**9,838.8**	**7,024.6**	**28.7**

3.2. ESTIMATED POLLUTANT LOAD REDUCTIONS

The watershed based planning process has identified future practices that can potentially reduce pollutant loads. Some of these future practices can be applied watershed-wide, such as increasing pet waste education, while others are subwatershed-specific. The process also identified additional site-specific recommendations that may be more challenging to implement but can have a greater impact on surface load reductions. Several future practice management strategies have been proposed in Sections 4 and 5, with many of the site-specific projects, outlined in Table 5-1, suggested for privately owned properties. Those that are highlighted in green can directly influence pollutant loads resulting in measurable reductions and were incorporated into the WTM to be evaluated for their impact on surface load reductions. Those that are not highlighted are not as easily quantified as the others and therefore not represented in the WTM.

The load reduction figures in Table 3-3 are compounded results and include those reductions from the future practices and site-specific actions. The figures demonstrate that a combination of watershed-wide best practices and site-specific complex, large projects will be needed to reduce nonpoint source pollution, make gains relative to goals of the MS4 programs, and ultimately reduce bacteria loading to Bruce Brook. As shown in Table 3-3, surface pollutant load reductions may range from 15.7% to 36.4% according to the WTM. A more detailed breakdown of action and practice related reductions can be found in Table 3-4.

Table 3-3 Watershed-Wide Existing Surface Loads and Surface Loads with Future Practices and Site-Specific Projects.

	TN (lb./yr)	**TP (lb./yr)**	**TSS (lb./yr)**	**Fecal Coliform (billion/yr)**	**Runoff Vol. (acre-feet/yr)**
Existing Surface Water Load	23,974.95	5,622.81	1,265,125.51	889,290.75	3,682.76
Surface Load with Future Practices and Site Specific Actions	15,240.26	4,317.21	1,066,791.81	644,128.55	2,541.96
Percent Reduction (%)	36.4	23.3	15.7	27.6	31.0

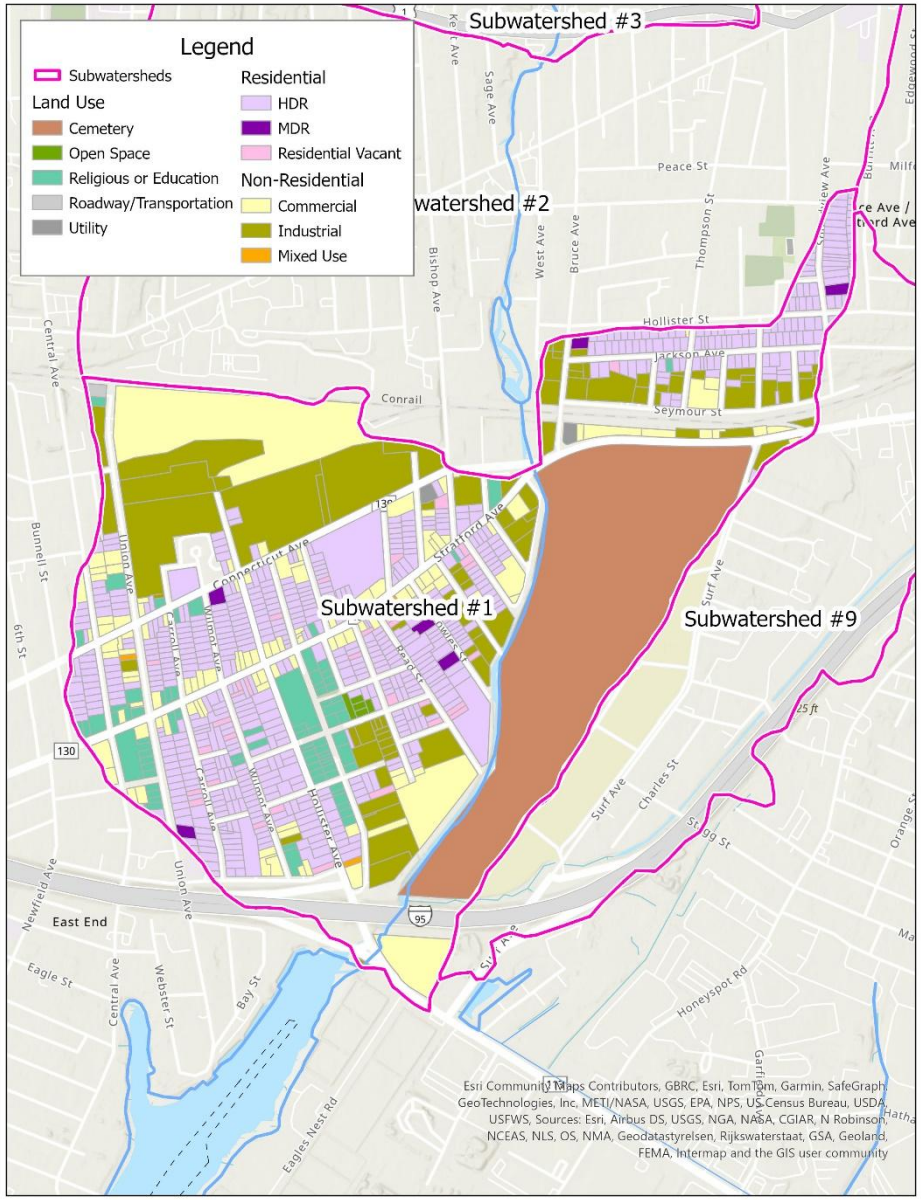
As shown below in Table 3-4, management strategies with a measurable impacts result in varying percent reductions within the subwatershed. Subwatershed 4 would see the greatest pollutant load reductions across the board if all suggested measurable management strategies were implemented. These strategies include pet waste education, bioswales on Leonard Street, and streambank restoration along Stonybrook Park. Other notable projects with significant impact include streambank restoration along St. Michaels Cemetery (Subwatershed 1), streambank and streambed restoration in Clover Park (Subwatershed 3), and streambed and streambank restoration at Wooster Park (Subwatershed 6).

Table 3-4 Estimated Pollutant Load Reductions by Subwatershed and Management Strategy

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Subwatershed 1					
Pet Waste Education	-484.2	-63.2	0	-4,210.4	0
Riparian Buffers	-950.0	-159.1	-41,091.4	-43,543.7	-184.6
Bioswales	-357.1	-43.4	-14,607.5	-11,299.7	-40.9
Cemetery Maintenance Building Relocation	-3.0	-0.3	-96.8	-123.2	-0.5
Existing Surface Water Load	**4,152.44**	**1,111.25**	**273,303.34**	**148,356.68**	**611.21**
Surface Load with Future Practices in Place	**2,358.1**	**845.3**	**217,507.6**	**89,179.8**	**385.3**
Percent Reduction	**43.2**	**23.9**	**20.4**	**39.9**	**37.0**
Subwatershed 2					
Pet Waste Education	-813.7	-106.1	0.0	-7,075.3	0.0
Property Acquisitions	-39.1	-5.6	-1,163.6	-1,718.9	-7.0
Bioswales	-215.9	-27.6	-8,309.6	-5,921.6	-24.0
Existing Surface Water Load	**3,370.9**	**693.5**	**164,553.4**	**138,305.5**	**575.7**
Surface Load with Future Practices in Place	**2,302.3**	**554.1**	**155,080.2**	**123,589.6**	**544.7**
Percent Reduction	**25.7**	**12.5**	**3.5**	**9.9**	**5.1**
Subwatershed 3					
Pet Waste Education	-882.0	-115.0	0.0	-7,669.6	0.0
Riparian Buffers	-1,106.4	-214.2	-51,722.5	-57,628.6	-252.1
Bioswales	-82.5	-11.1	-3,084.3	-2,274.1	-9.2
Existing Surface Water Load	**4,308.61**	**911.78**	**187,030.56**	**161,374.40**	**672.39**
Surface Load with Future Practices in Place	**2,237.7**	**571.4**	**132,223.8**	**93,802.2**	**411.1**
Percent Reduction	**48.1**	**37.3**	**29.3**	**41.9**	**38.9**
Subwatershed 4					

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Pet Waste Education	-377.5	-49.2	0.0	-3,282.5	0.0
Riparian Buffers	-324.0	-74.7	-21,479.9	-22,159.3	-101.8
Bioswales	-6.5	0.9	-242.6	-219.6	0.9
Existing Surface Water Load	**980.84**	**224.46**	**49,270.24**	**41,166.32**	**174.09**
Surface Load with Future Practices in Place	**272.88**	**99.67**	**27,547.71**	**15,504.90**	**71.44**
Percent Reduction	**72.2**	**55.6**	**44.1**	**62.3**	**59.0**
Subwatershed 5					
Pet Waste Education	-490.3	-64.0	0.0	-4,263.7	0.0
Impervious Pavement Reductions	-9.4	-1.3	-294.2	-390.8	-1.6
Existing Surface Water Load	**2,478.5**	**556.7**	**116,463.0**	**94,455.1**	**392.5**
Surface Load with Future Practices in Place	**1,978.8**	**491.5**	**116,168.7**	**89,800.7**	**390.9**
Percent Reduction	**20.2**	**11.7**	**0.3**	**4.9**	**0.4**
Subwatershed 6					
Pet Waste Education	-501.6	-65.4	0.0	-4,361.8	0.0
Riparian Buffers	-868.0	-153.1	-35,301.0	-42,331.1	-182.1
Existing Surface Water Load	**3,190.1**	**826.5**	**186,478.2**	**114,786.6**	**474.8**
Surface Load with Future Practices in Place	**1,820.4**	**608.0**	**151,177.2**	**68,093.7**	**292.7**
Percent Reduction	**42.9**	**26.4**	**18.9**	**40.7**	**38.3**
Subwatershed 7					
Pet Waste Education	-127.7	-16.7	0.0	-1,110.1	0.0
Existing Surface Water Load	**906.2**	**250.9**	**54,330.6**	**31,853.6**	**131.8**
Surface Load with Future Practices in Place	**778.5**	**234.3**	**54,330.6**	**30,743.6**	**131.8**
Percent Reduction	**14.1**	**6.6**	**0.0**	**3.5**	**0.0**
Subwatershed 8					
Pet Waste Education	-250.2	-32.6	0.0	-2,175.3	-250.2
Bioswales	-455.1	-55.7	-12,933.9	-15,806.3	-63.9
Existing Surface Water Load	**2,581.4**	**690.1**	**130,151.6**	**79,640.5**	**325.2**
Surface Load with Future Practices in Place	**1,876.2**	**601.8**	**117,217.7**	**61,658.9**	**261.2**
Percent Reduction	**27.3**	**12.8**	**9.9**	**22.6**	**19.7**
Subwatershed 9					
Pet Waste Education	-196.2	-25.6	0.0	-1,705.7	0.0

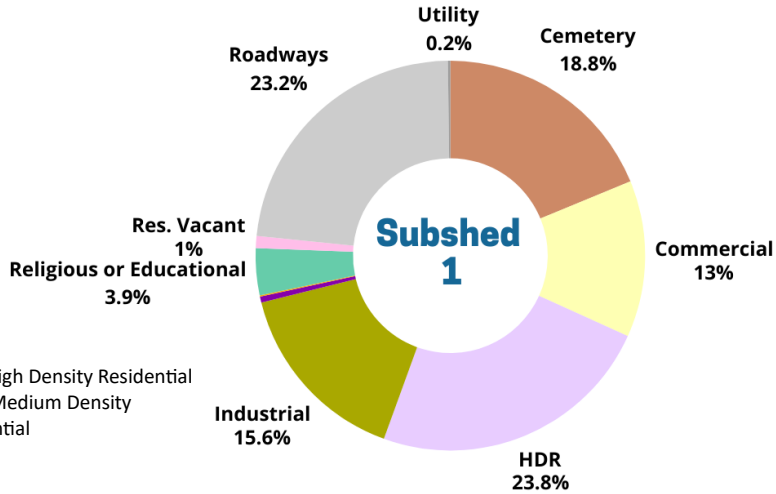
	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Impervious Surface Reductions	-36.0	-4.1	-1,322.3	-1,460.0	-5.9
Bioswales	-158.5	-18.5	-6,684.1	-4,430.9	-17.9
Existing Surface Water Load	**2,006.0**	**357.6**	**103,544.7**	**79,352.1**	**325.1**
Surface Load with Future Practices in Place	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Percent Reduction	**19.5**	**13.5**	**7.7**	**9.6**	**7.3**



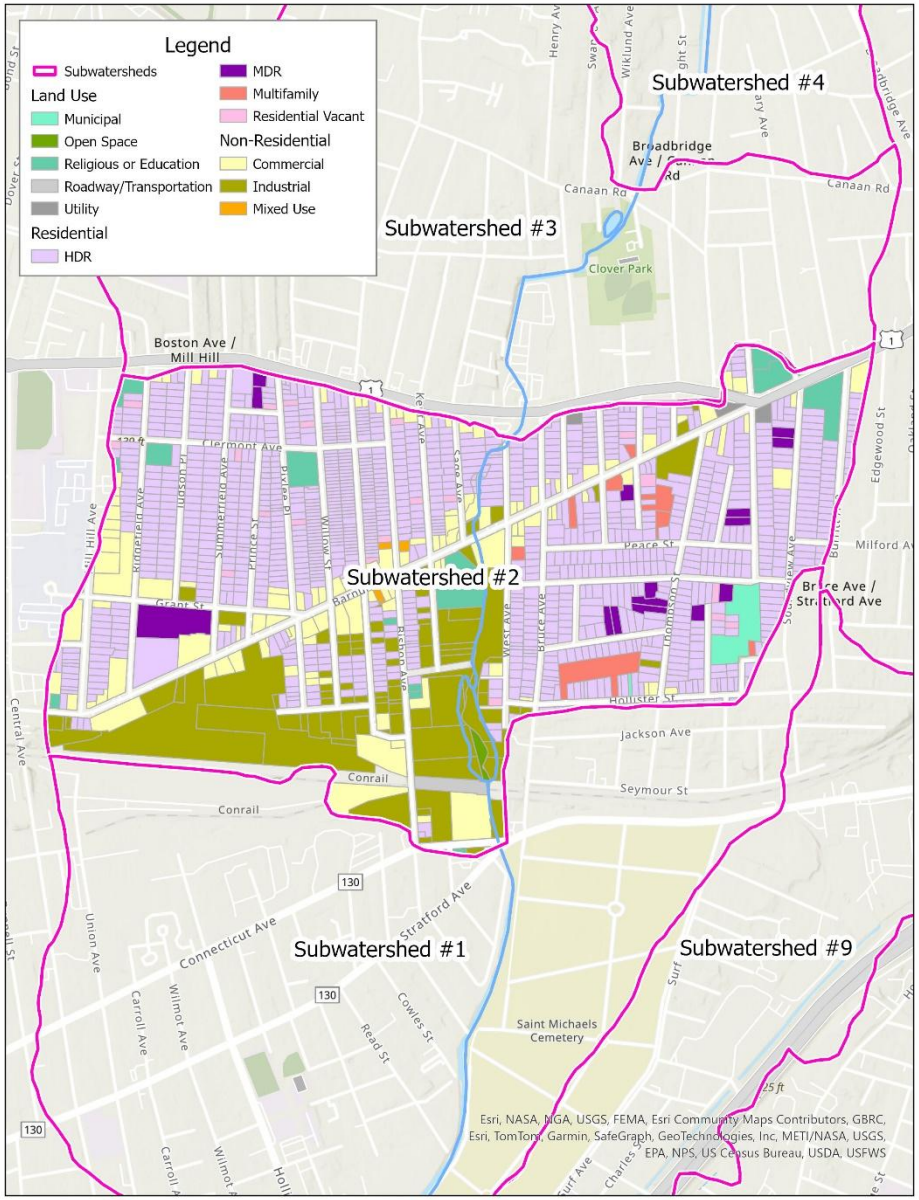
Subwatershed #1

- 11 Land use types as categorized by the WTM
- Approximately 367.77 acres
- Future practices may include:
  - Increasing pet waste education
  - Infiltration and riparian buffer applications
  - Bioswales

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	4,152.4	1,111.2	273,303.3	148,356.7	611.2
Surface Load with Future Practices	2,358.1	845.3	217,507.6	89,179.8	385.3
Percent Reduction (%)	43.2	23.9	20.4	39.9	37.0



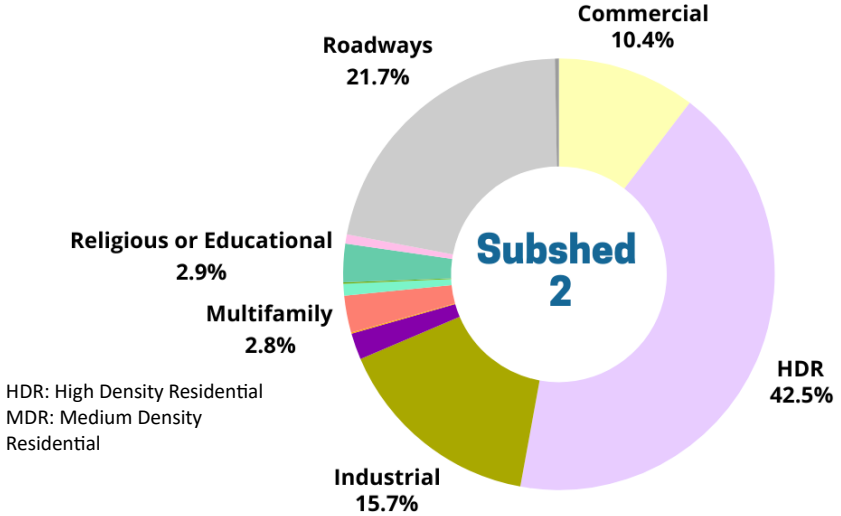
HDR: High Density Residential
MDR: Medium Density Residential



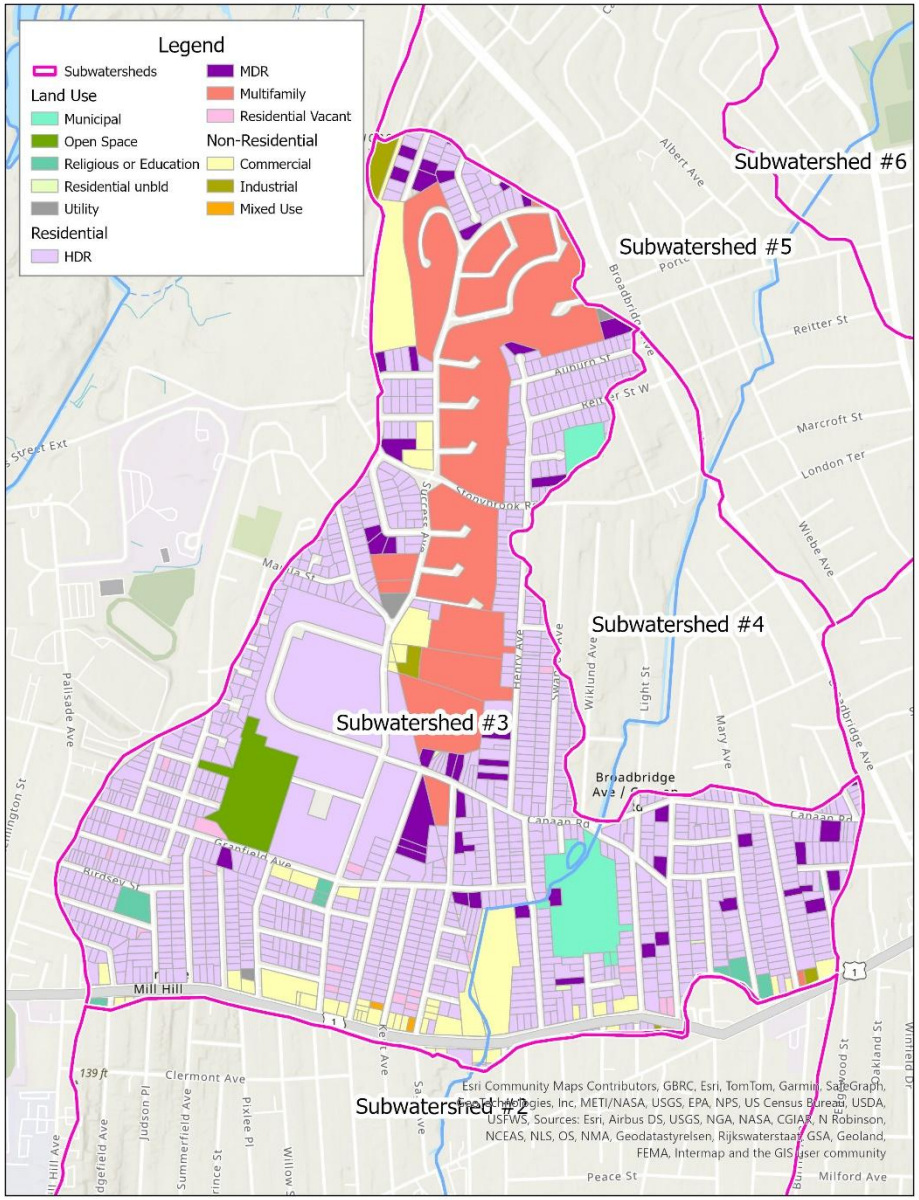
Subwatershed #2

- 12 Land use types as categorized by the WTM
- Approximately 334.75 acres
- Future practices may include:
  - Increasing pet waste education
  - Property Acquisitions/Floodplain Restoration
  - Bioswales

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	3,370.9	693.5	164,553.4	138,305.4	575.7
Surface Load with Future Practices	2,302.3	554.1	155,080.2	123,589.6	544.7
Percent Reduction (%)	31.7	20.1	5.8	10.6	5.4



HDR: High Density Residential
MDR: Medium Density Residential

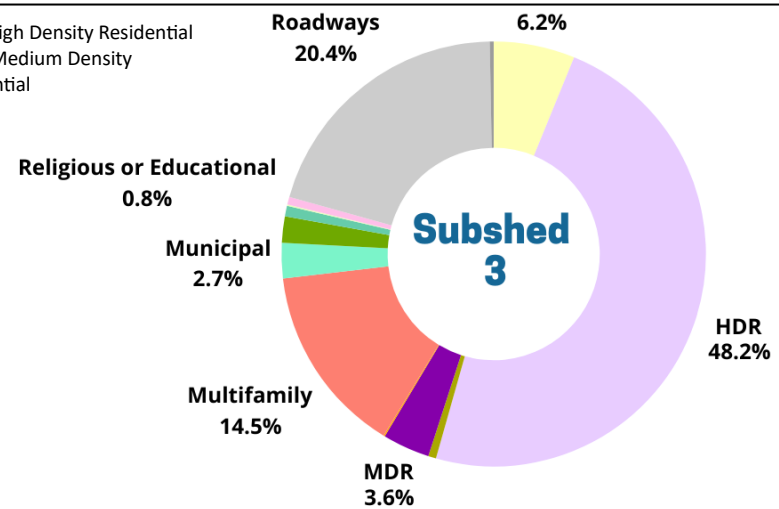


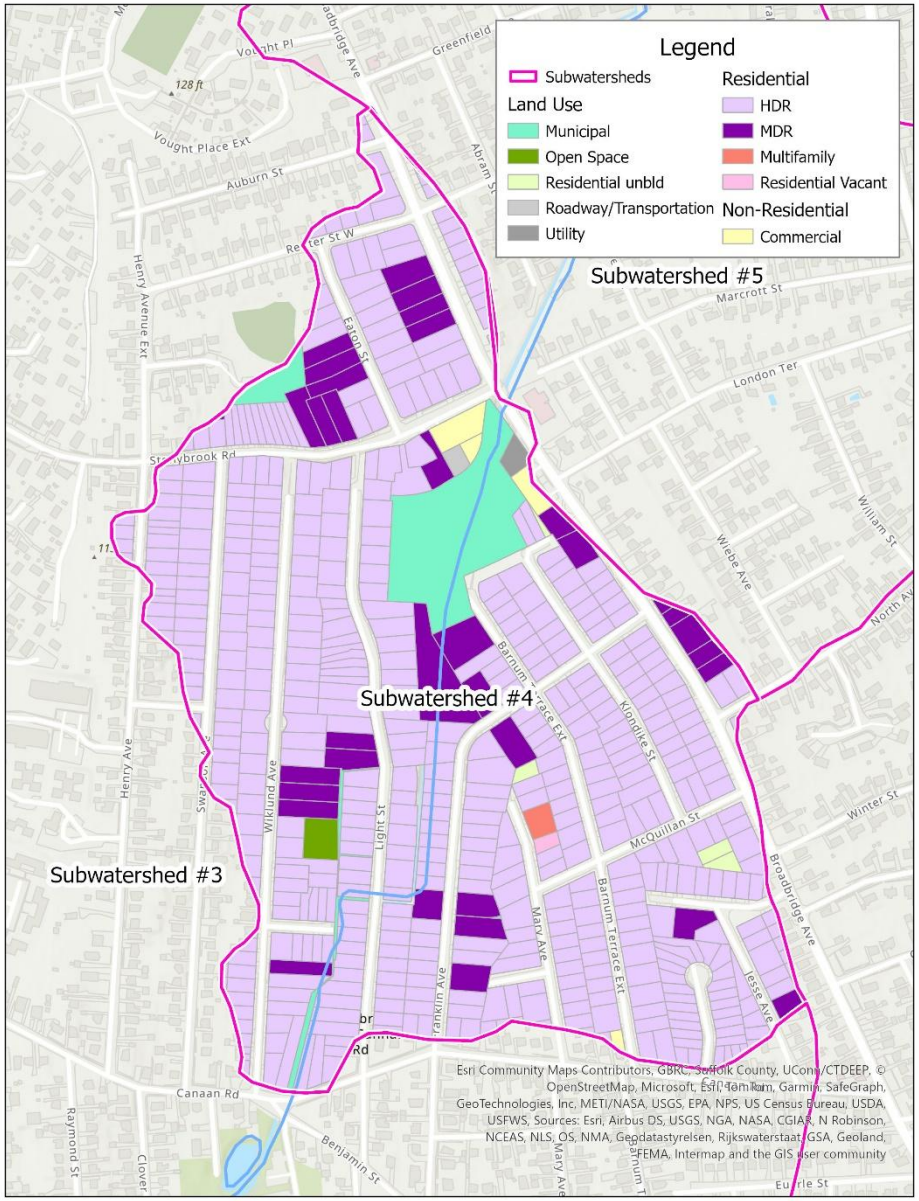
Subwatershed #3

- 12 Land use types as categorized by the WTM
- Approximately 421.79 acres
- Future practices may include:
  - Increasing pet waste education
  - Bioswales/drainage infrastructure
  - Riparian buffers

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	4,308.6	911.8	187,030.6	161,374.4	672.4
Surface Load with Future Practices	2,237.7	571.4	132,223.8	93,802.2	411.1
Percent Reduction (%)	48.1	37.3	29.3	41.9	38.9

HDR: High Density Residential
MDR: Medium Density Residential



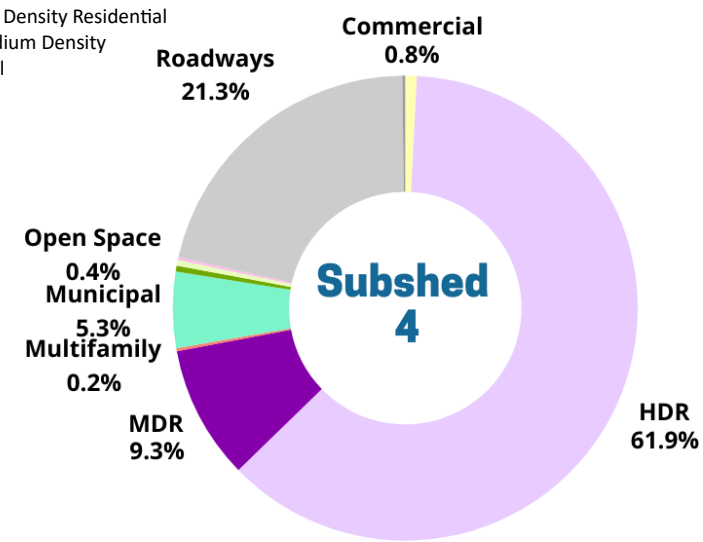


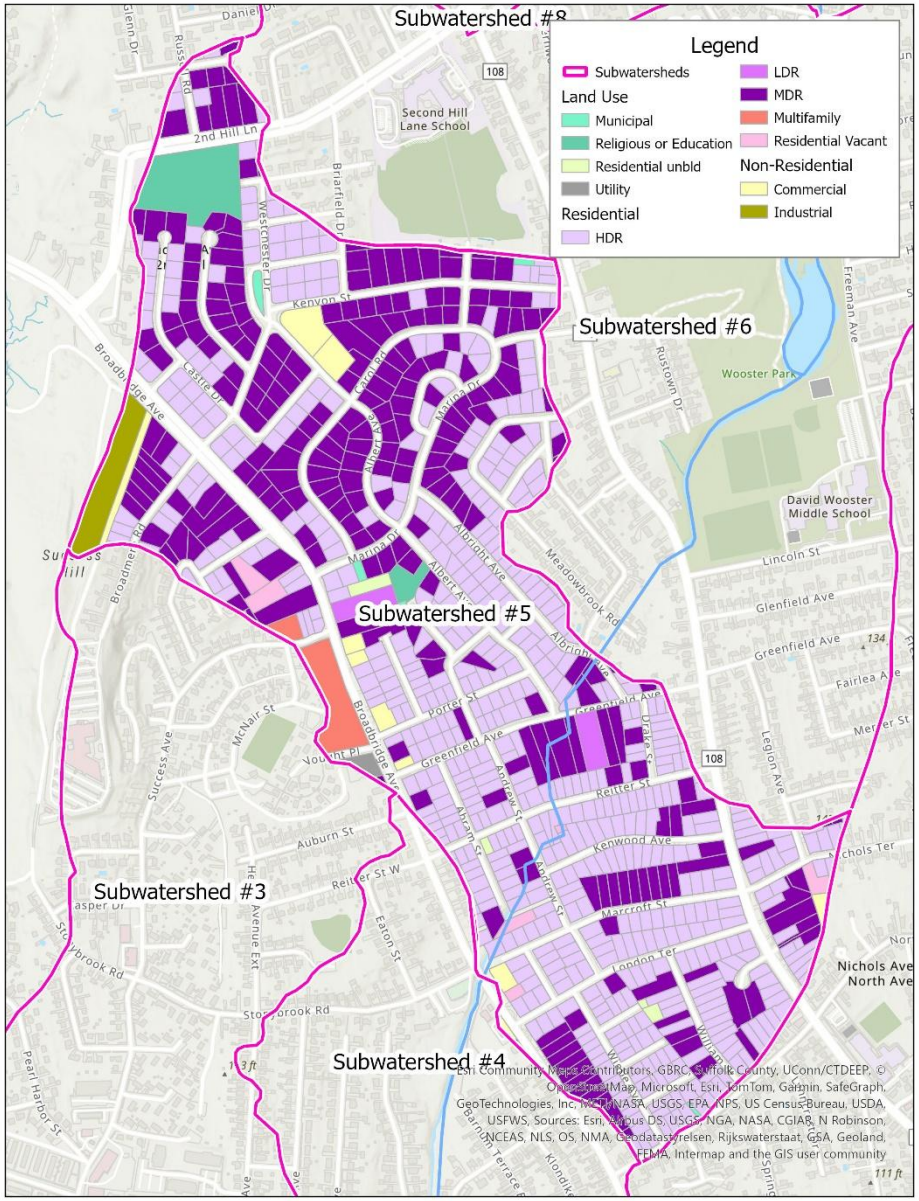
Subwatershed #4

- 10 Land use types as categorized by the WTM
- Approximately 113.42 acres
- Future practices may include:
  - Increasing pet waste education
  - Riparian buffers along Stonybrook Park

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	980.8	224.5	49,270.2	41,166.3	174.1
Surface Load with Future Practices	272.9	99.7	27,547.7	15,504.9	71.4
Percent Reduction (%)	72.2	55.6	44.1	62.3	59.0

HDR: High Density Residential
MDR: Medium Density Residential

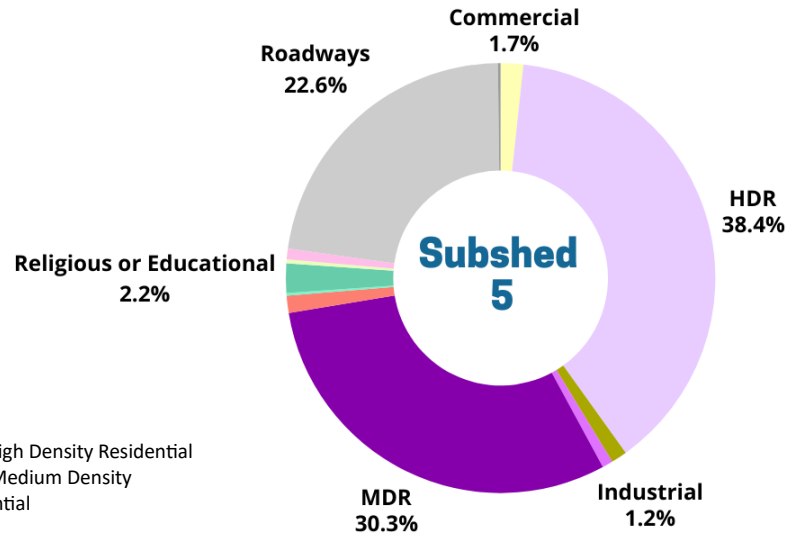




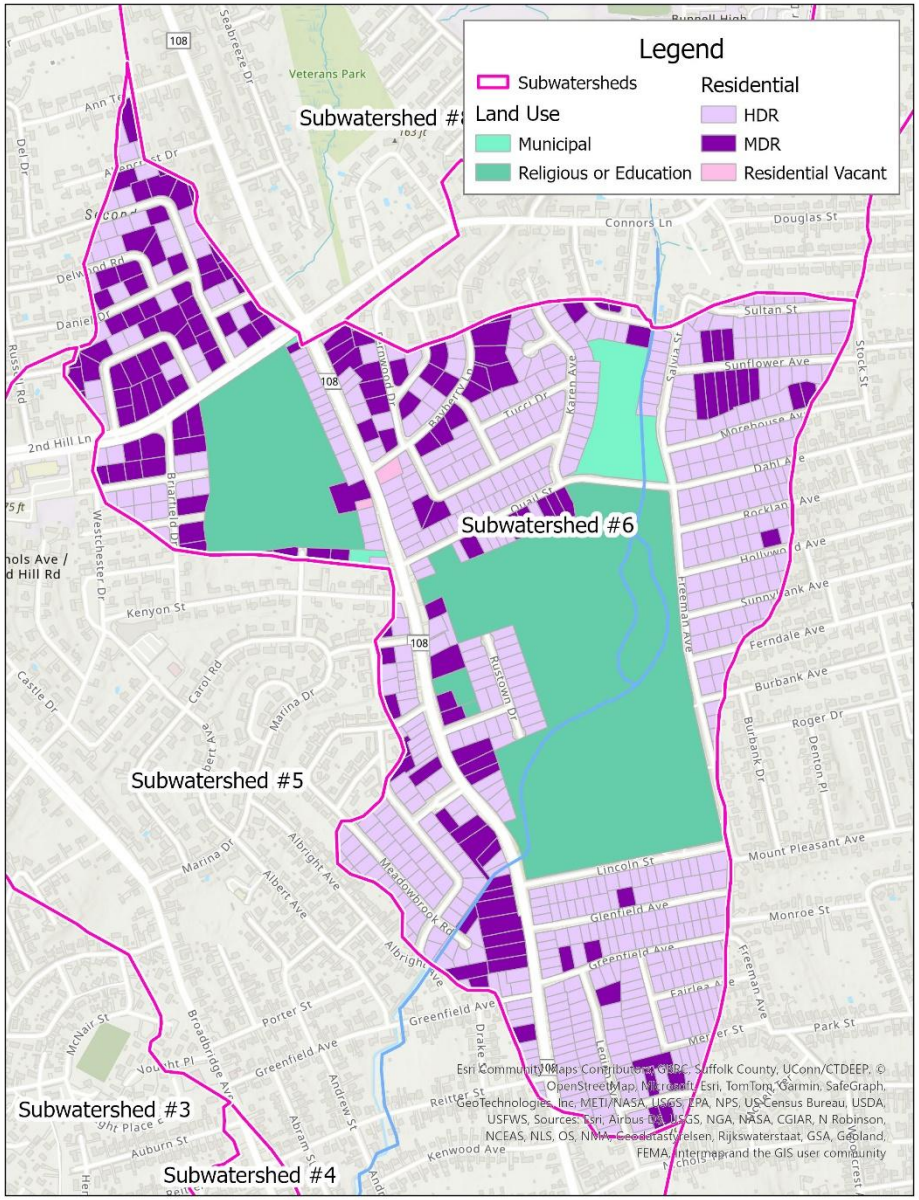
Subwatershed #5

- 11 Land use types as categorized by the WTM
- Approximately 265.39 acres
- Future practices may include:
  - Increasing pet waste education

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	2,478.5	556.7	116,463.0	94,455.1	392.5
Surface Load with Future Practices	1,978.8	491.5	116,168.7	89,800.7	390.9
Percent Reduction (%)	20.2	11.7	0.3	4.9	0.4



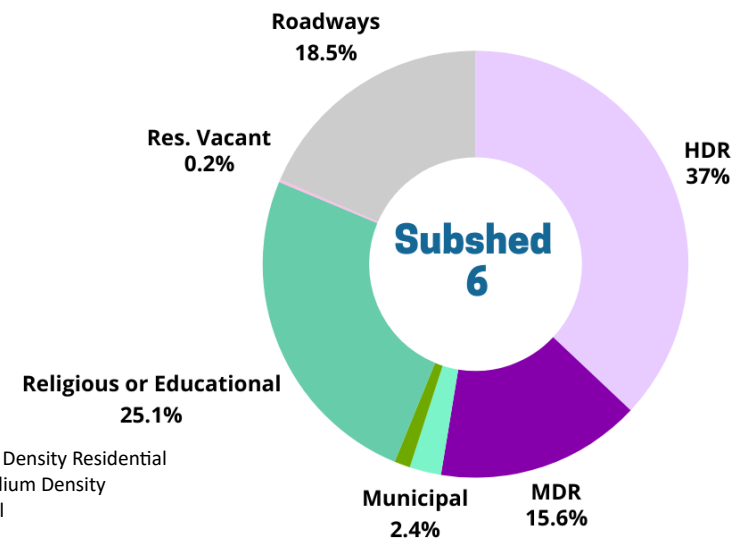
HDR: High Density Residential
MDR: Medium Density Residential



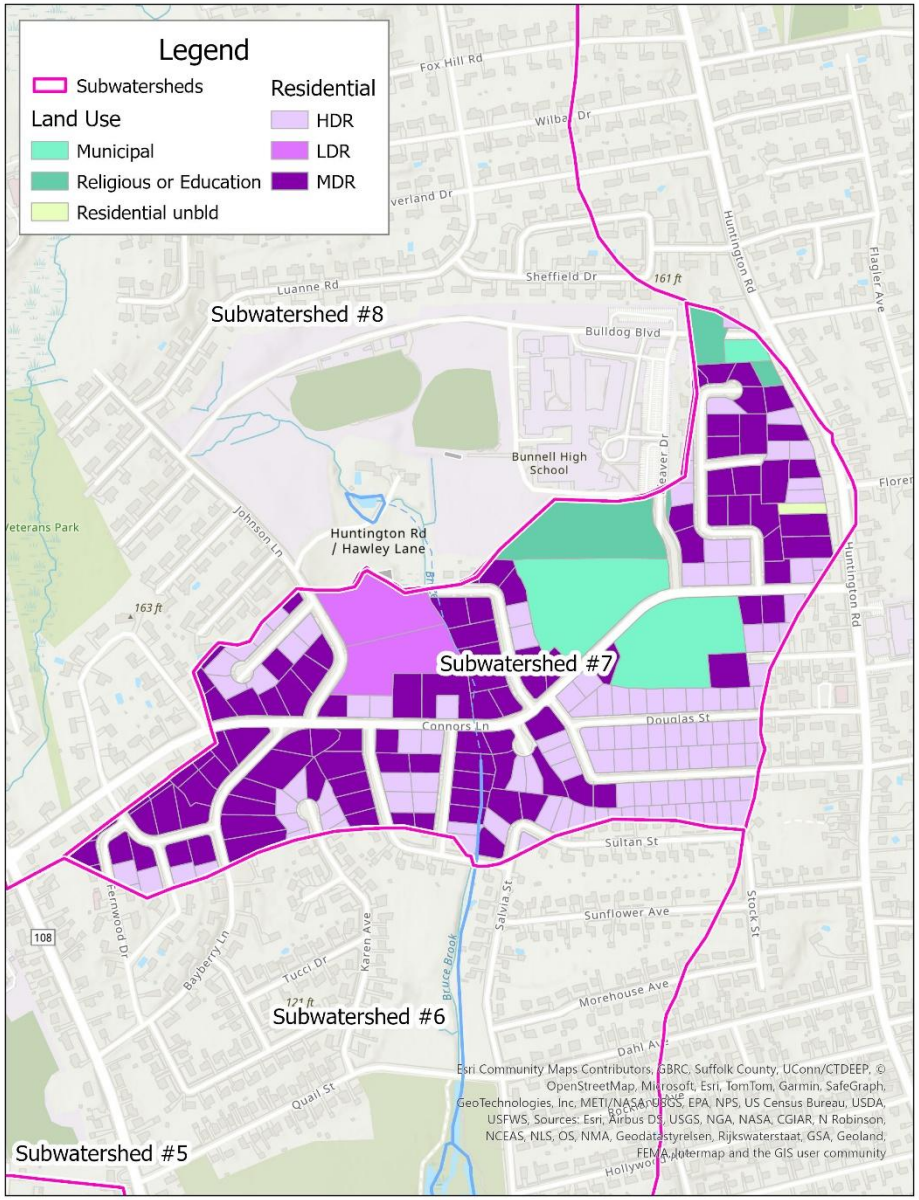
Subwatershed #6

- 5 Land use types as categorized by the WTM
- Approximately 290.02 acres
- Future practices may include:
  - Increasing pet waste education

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	3,190.1	826.5	186,478.2	114,786.6	474.8
Surface Load with Future Practices	1,820.4	608.0	151,177.2	68,093.7	292.7
Percent Reduction (%)	42.9	26.4	18.9	40.7	38.3



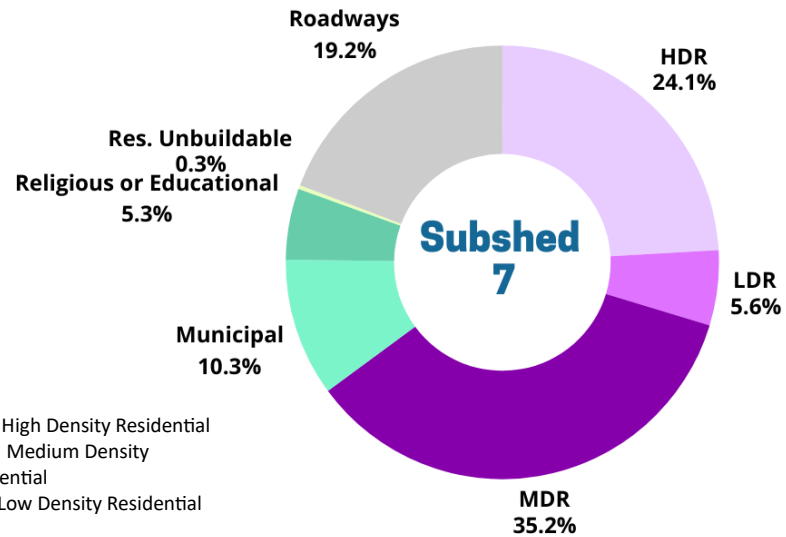
HDR: High Density Residential
MDR: Medium Density Residential



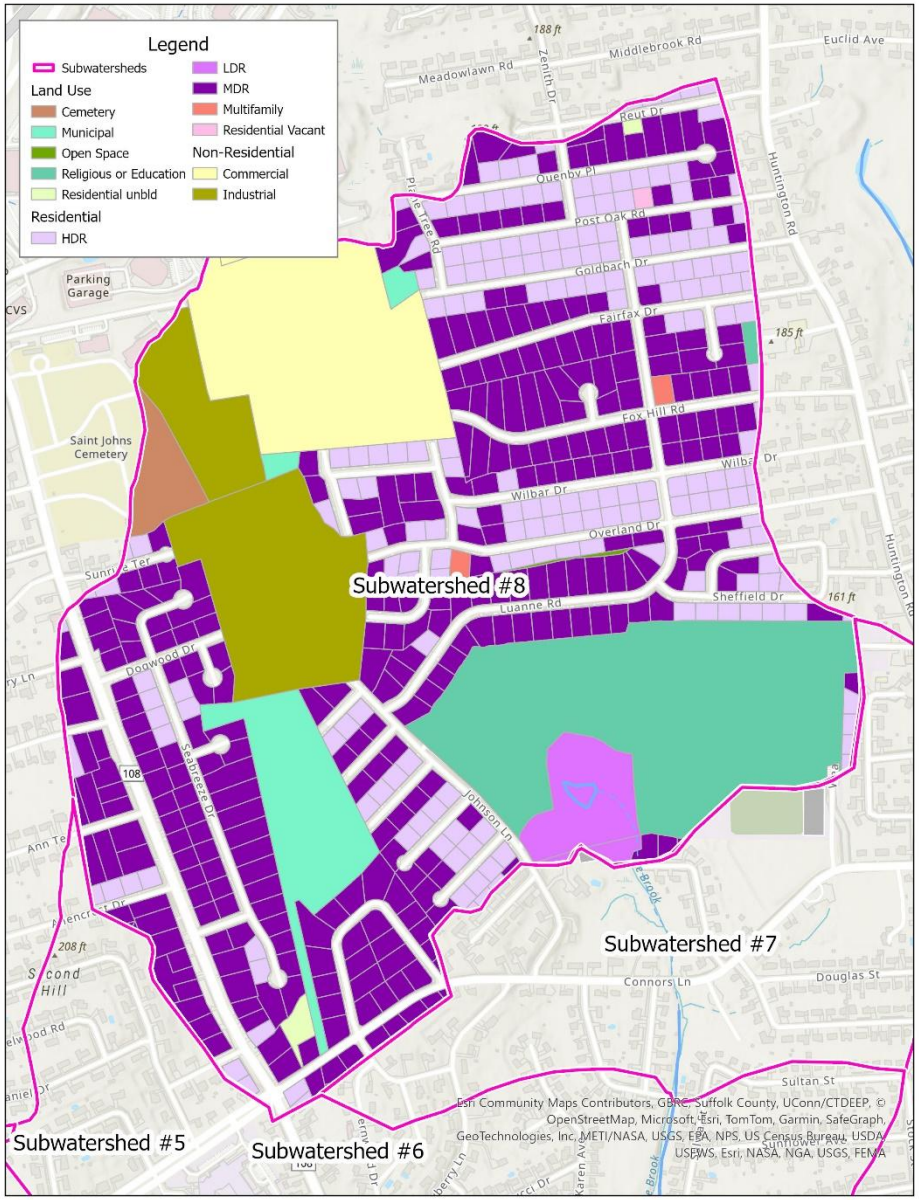
Subwatershed #7

- 6 Land use types as categorized by the WTM
- Approximately 89.15 acres
- Future practices may include:
  - Increasing pet waste education

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	906.2	250.9	54,330.6	31,853.6	131.8
Surface Load with Future Practices	778.5	234.3	54,330.6	30,743.6	131.8
Percent Reduction (%)	14.1	6.6	0	3.5	0



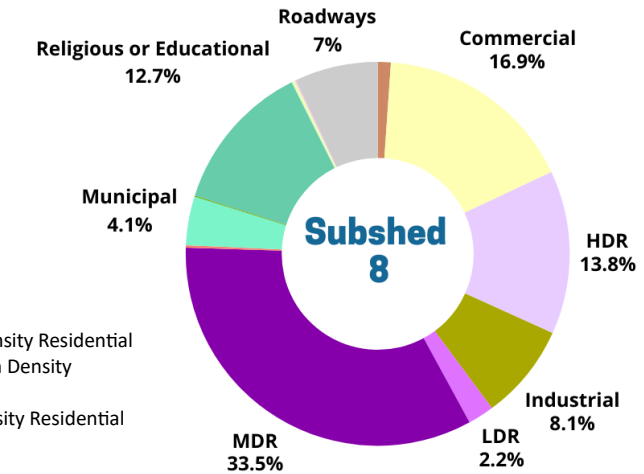
HDR: High Density Residential
MDR: Medium Density Residential
LDR: Low Density Residential



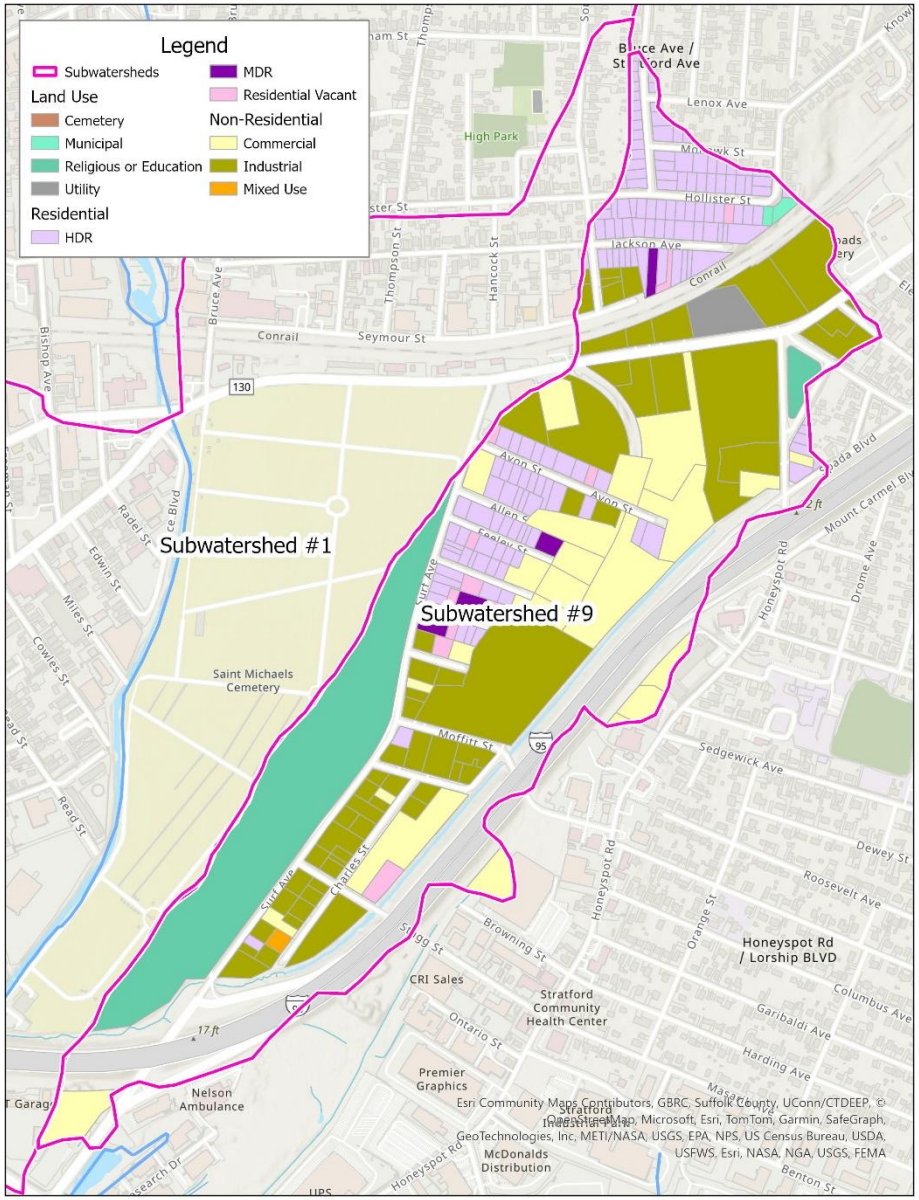
Subwatershed #8

- 12 Land use types as categorized by the WTM
- Approximately 314.95 acres
- Future practices may include:
  - Increasing pet waste education
  - Pervious pavement at Bunnell High School
  - Habitat improvement/invasive species survey and management in woodland along Bunnell High

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	2,581.4	690.1	130,151.6	79,640.5	325.2
Surface Load with Future Practices	1,876.2	601.8	117,217.7	61,658.9	261.2
Percent Reduction (%)	27.3	12.8	9.9	22.6	19.7



HDR: High Density Residential
MDR: Medium Density Residential
LDR: Low Density Residential

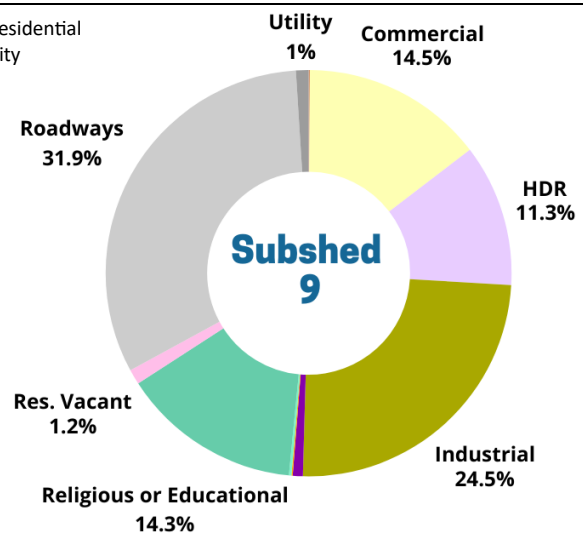


Subwatershed #9

- 10 Land use types as categorized by the WTM
- Approximately 160.34 acres
- Future practices may include:
  - Increasing pet waste education
  - Bioswales along Surf Avenue

	TN (lb./yr)	TP (lb./yr)	TSS (lb./yr)	Fecal Coliform (billion/yr)	Runoff Vol. (acre-feet/yr)
Existing Surface Water Load	2,006.0	357.6	103,544.7	79,352.1	325.1
Surface Load with Future Practices	1,615.4	309.5	95,538.3	71,755.4	301.3
Percent Reduction (%)	19.5	13.5	7.7	9.6	7.3

HDR: High Density Residential
MDR: Medium Density Residential



4. MANAGEMENT STRATEGIES

4.1. WATERSHED MANAGEMENT GOALS AND OBJECTIVES

The advisory committee worked to identify six goals that encompass various objectives with measurable actions to address NPS impairments. These management strategies, which are also detailed in Appendix E, include actions such as regulatory considerations, water and streambed quality monitoring, increasing infrastructural and program capacities, expanding collaboration between municipalities and organizations, protecting and improving riparian buffers and existing habitats, and developing and improving educational programs.

Figure 4-1 Watershed Based Plan Goals and Objectives

Some of the goals and objectives are aligned with the control measures of stormwater management plans administered per the MS4 authorizations. These are noted below as appropriate.

4.2. DIRECTLY ADDRESS WATER QUALITY

4.2.1. IMPROVE STORMWATER QUALITY

One of this greatest challenges in the Bruce Brook watershed is the dense development contributing to questionable or impaired stormwater quality. This is true for stormwater that enters municipal stormwater systems (the subject of the MS4 authorizations for Stratford and Bridgeport) as well as stormwater that does not enter stormwater systems and therefore remains a significant source of nonpoint source pollution. There are several actions the City and Town can take to reduce stormwater volumes discharging into Bruce Brook and to improve the quality of stormwater that cannot be removed; these actions include:

1. Increase street sweeping frequency in subwatersheds that potentially contribute the most to sediment loading. For example, runoff from a road can enter Bruce Brook directly at the crossing pictured to the right, without involvement of a municipal stormwater system. If efforts are not feasible for an entire subwatershed, the City and Town should consider focusing on increased sweeping efforts at municipal properties.
2. In accordance with the Town of Stratford POCD, promote the use of low impact development (LID) practices where possible, particularly the use of green infrastructure such as tree box filters, and focused in areas with a greater density of development. LID and green infrastructure can help reduce the formation of stormwater in the first place, and infiltrate stormwater that originates in adjacent areas.
3. In accordance with Objective 2 in the Town of Stratford POCD, prioritize improvements to stormwater infrastructure in the watershed to reduce flooding and therefore improve water quality. Floodwaters are a major contributor to poor water quality, as they carry pollutants from all types of land uses and vehicles that are not meant to be exposed to water.
4. The City of Bridgeport should continue to pursue and apply LID and green infrastructure practices as outlined in the BGreen Sustainability Plan (2020). As noted above, LID and green infrastructure can help reduce the formation of stormwater in the first place, and infiltrate stormwater that originates in adjacent areas.
5. Install pervious pavement or pavers on municipal property, in both Stratford and Bridgeport, including existing parks that have paved areas. Pervious pavement and pavers can help reduce the formation of stormwater in the first place and infiltrate some stormwater that originates in adjacent areas.

6. Where feasible, install bioswales in subwatersheds with greatest estimated total suspended solids estimates. Bioswales can direct stormwater into specific areas and foster infiltration. The City of New Haven has installed more than 200 on City-owned streets.
7. Consider the development of subwatershed plans for stormwater retrofits, which include conceptual designs for LID, tree boxes, and other best management practices.
8. Encourage commercial and industrial property owners along Bruce Brook and tributaries (whether visible/daylit or within stormwater systems) to install stormwater detention or retention infrastructure and disconnect from municipal stormwater systems. Stormwater retrofits and upgrades should be required for these properties in the future when new development or additions occur. These actions would also help with progress toward the six minimum control measures in the MS4-required stormwater management plans.
9. Institute an annual Bruce Brook community clean up event; this can be integrated into the Town's stormwater management plan where appropriate. Given that public health risks may be present at certain locations, sites for clean-up should be targeted that are easily accessible by volunteers and where exposure risks are low.

4.2.2. CONTINUE WATER QUALITY MONITORING

Efforts to measure water quality have been underway for several years, primarily driven by the efforts of Harbor Watch. The town should continue to collaborate with Harbor Watch and also look to expand monitoring efforts. The expansion of efforts, and the inclusion of additional water quality parameters, may aid in narrowing down relative contributions of non-point sources of pollution. Actions to directly address water quality include:

1. Pursue funding to support water quality monitoring endeavors. Continuing and expanding water quality monitoring will help identify sources of impairment.
2. Continue collaboration with ongoing Harbor Watch water quality sampling efforts. Harbor Watch has been a key partner in the pursuit of improved water quality in Connecticut. The organization can provide ongoing assistance.
3. Consider conducting benthic microorganism or invertebrate surveys to monitor ongoing progress in water quality improvement. Benthic microorganisms and invertebrates are often important indicators of water quality. Establishing baseline conditions soon will allow future water quality improvement efforts to be evaluated.
4. Consider conducting bacterial testing in sediment along naturalized stretches of the brook to further understand bacteria loading from sediments to the stream. The science involving movement of bacteria to and from streambed sediments is limited. Understanding whether the sediment in Bruce Brook is a factor in the presence of bacteria will help identify future efforts such as trash screening and collection in specific reaches and selective sediment management.

4.2.3. IDENTIFY/REMOVE ILLICIT DISCHARGES

While the Town and City have been proactive in identifying and removing illicit discharges, both should continue to improve upon efforts to ensure activities are productive. Actions to identify and remove illicit discharges include:

1. Ensure IDDE efforts are applicable to the Bruce Brook watershed area.
2. Promote the IDDE reporting system with other educational and outreach activities.

These actions would also help with progress toward the six minimum control measures in the MS4-required stormwater management plans.

4.3. CAPACITY AND COLLABORATION

Improving the health of Bruce Brook and the watershed as a whole will require collaboration between the City of Bridgeport, Town of Stratford, and other organizations and stakeholders that can play a role in taking action.

4.3.1. ENDORSE THE WATERSHED BASED PLAN

The success of this plan relies on the endorsement and acceptance of the document by the Town of Stratford and City of Bridgeport, in addition to reviewing local policies and procedures that may impose barriers to implementation. This also includes keeping the plan alive and active beyond acceptance. Actions for endorsing the plan include:

1. The Advisory Committee should endorse the WBP and encourage the Town and City to adopt the WBP to better support planning and implementation efforts.

2. The Advisory Committee should convene on an annual basis to assess the progress of WBP actions. This could coincide with a Stratford Conservation Commission meeting.

4.3.2. INCREASE ORGANIZATIONAL COLLABORATION

Improving the health of the watershed relies partly on strong working relationships with organizations outside of municipal offices. There are several organizations that can assist the Town and City with action planning, implementation, and education. Actions to increase organizational collaboration include:

1. Work with local, regional, and statewide organizations to implement actions in the watershed. In particular, MetroCOG is interested in fostering and advancing climate resilience actions in Stratford and Fairfield, which can benefit stormwater quality and reduce flooding.

2. Identify and secure funding for specific projects recommended below in the next chapter, or those that may indirectly impact the watershed health and overall goals.

3. Incorporate components of actions into Capital Improvement Plan projects where feasible. This might include general concepts such as LID measures, permeable paving, and upsizing drainage. Specifically look for opportunities for the following projects, or similar efforts in future years.

    a) Barnum Avenue culvert carrying Bruce Brook ($5,000,000 in FY 2025)

    b) Streetscaping Improvements (i.e., bioswales or tree boxes) ($2,500,000 FY 2025)

    c) Resurfacing BOE parking lots ($200,00 FY 2025)

4. If pursuing complete streets project in Stratford within the watershed, Environmental Conservation Superintendent and Engineering should work with lead planning department to ensure stormwater management strategies are maximized along roadways to reduce discharge volumes into Bruce Brook.

4.4. CLIMATE RESILIENCE AND FLOODPLAIN MANAGEMENT

Increasing climate and community resilience will often coincide with improving water quality and environmental and public health. Many of the reasons have been cited above. For example, riverine flooding captures pollutants from buildings and land uses that are not meant to be exposed to water (i.e., commercial or industrial uses such as hazardous material storage facilities or heavy equipment storage yards), and pluvial flooding leads to stormwater of impaired quality that flows more rapidly into streams. Furthermore, flooding can lead to combined sewer overflows which may be a challenge in the extreme southwest part of the watershed. Reducing all types of flooding can reduce bacteria loading into Bruce Brook.

When reviewing tools such as the flood CCVI and heat CCVI maintained by the Connecticut Institute for Resilience and Climate Adaptation (CIRCA), the watershed area is identified as a relatively vulnerable area within the State. Leveraging and designing projects to address watershed quality *and* climate and flood resilience can provide multiple benefits to the watershed and those living within it.

4.4.1. SEEK CO-BENEFITS OF WATERSHED PROJECTS AND UPGRADES

Many projects and actions recommended to treat, reduce, or remove stormwater can have direct benefits for improving extreme heat and flood resilience, as well as associated public health outcomes. Targeting projects that have co-benefits are extremely beneficial for the community and can potentially expand upon potential funding opportunities. Actions include:

1. Encourage increased tree plantings and greening at commercial, industrial, and residential properties for new and redevelopment projects. These efforts can help reduce stormwater generation while reducing heat exposure due to expansion of shading.

2. Encourage impervious surface reductions during redevelopment projects, particularly in those areas with high impervious density. These efforts can help reduce stormwater generation while reducing heat exposure due to reductions in paved surfaces. This could include exploring regulatory revisions that would reduce parking requirements and encourage LID in "overflow" parking areas.

3. Target areas for bioswale applications in right-of-way to reduce floodwater pooling; locations identified using the Flood CCVI. These efforts can help reduce stormwater flooding while reducing heat exposure due to expansion of vegetated areas.

4. Evaluate culverts and stream crossings to identify those that may need to be replaced and upsized/upgraded to accommodate for increased flood levels.

4.4.2. PROTECT/RESTORE FLOODPLAINS WHERE FEASIBLE

While flooding may not be as great a concern along Bruce Brook as it is along other waterways in Bridgeport and Stratford, protecting and restoring floodplains can reduce the impacts of flooding while also addressing water quality deficiencies and reducing pollution. Naturalized floodplains provide more water quality and habitat benefits than channelized or hardened banks; therefore, restoring and protecting floodplains should be a priority. Actions for protecting and restoring floodplains include:

1. Continue to seek opportunities for property acquisitions and floodplain restoration along Bruce Brook to increase floodplain capacity and reduce the pollution in floodwaters. Target under-utilized non-residential properties and properties that have suffered flood damage in the past, as these can be acquired without detrimental changes to a neighborhood.

2. Consider implementing more stringent regulations regarding riparian buffers and the activities permitted within the buffer during redevelopment; efforts may be supported by Public Act 21-29[10]. This could also vary by land use/zoning type. This action will be challenging to implement, as many of the concrete walls along Bruce Brook are not due for repair or replacement. Without a pending activity that requires Town or City approval, opportunities for change may be rare.

4.5. HABITAT PROTECTION AND RESTORATION

With much of the Bruce Brook functioning as a hardened or channelized stream, there is a reduced opportunity for natural ecosystems to perform their functions in the removal of bacteria and nutrients from the waterway. The restoration and protection of habitats along the stream will provide habitat for fish and native wildlife and increase capacity for natural water quality improvement processes.

[10] https://www.cga.ct.gov/2021/act/pa/pdf/2021PA-00029-R00HB-06107-PA.pdf

4.5.1. MANAGE INVASIVE SPECIES

Invasive and/or non-native vegetation species were identified and noted during the stream reconnaissance. In an effort to protect and restore existing habitats, a thorough invasive species survey should be conducted to prioritize areas for invasives removal and for native plantings. The removal of invasives and planting of native species will promote a more natural habitat for flora and fauna and also create a more stabilized riverbank ultimately reducing erosion and sediment movement. Actions include:

1. Conduct an invasive species survey in the naturalized locations along the stream including behind Bunnell High School, in Wooster Park, in Stonybrook Park, and along the former Bruce Pond. Priority focus on those locations identified in Appendix C - Stream Condition.

2. Prioritize invasive removal at locations with the greatest density of invasives. These areas should be prioritized for native plantings to maintain stream bank integrity and to reduce erosion.

4.5.2. PROTECT/RESTORE RIPARIAN HABITATS

Approximately 1.37 miles of the Bruce Brook is channelized with a concrete stream bed. These existing artificial stream beds increase stream velocity rates which can exacerbate erosion in some locations while leading to excess accretion (accumulation of sediment) in others; and they do not allow for natural filtering of water in vegetation that would otherwise be present. Furthermore, concrete banks and stream beds reduce the natural discharge of cold groundwater to Bruce Brook; this groundwater would normally dilute the water column in the stream and would benefit some fish species.

1. Naturalized stream banks that are moderately to minimally vegetated should be targeted for native planting applications to minimize erosion and increase habitat quality.
2. Conduct feasibility assessment of concrete removal at various locations to restore natural banks and/or stream beds.
3. Clean and restore the health of Bruce Brook south of Stratford Avenue
4. Protect and conserve existing headwater wetland complexes to maintain water quality and biodiversity in the northern reaches of Bruce Brook.

4.6. EDUCATION AND OUTREACH

A critical component to improving watershed and stream health relates back to educating the public and residents within the watershed boundaries. An increased resident awareness of their effect on stream health, and the consequences of actions can help to reduce instances of violations of littering, dumping, or discharging.

The following recommendations target various audiences throughout the watershed including residents and businesses.

4.6.1. RAISE BUSINESS AWARENESS ON OPERATIONAL IMPACTS

There are numerous commercial and industrial properties throughout the watershed; educating these property and business owners about healthy watersheds, proper waste and material handlings, and the benefits of stormwater best practices can improve Bruce Brook and the watershed. Actions include:

1. Develop an outreach campaign for commercial and industrial properties located in the watershed to educate on the importance of proper waste disposal, the impacts of illegal dumping, and the benefits of stormwater retrofits and upgrades.
2. Invest in enforcement efforts to address specific instances of dumping such as the tires dumped near the former Bruce Pond. Consider leveraging DEEP spill reports and/or health department complaints as a source of identifying those in need of intensive outreach and enforcement.

4.6.2. BUILD AWARENESS AMONGST RESIDENTS

Numerous pet waste disposal bags were identified along the entire length of the brook during the stream reconnaissance. The presence of these bags shows that residents in the watershed are not properly disposing of pet waste. Bags are likely left at the curbside and forgotten (to later be washed into catch basins) or deliberately placed into stormwater catch basins. The Town of Stratford should identify gaps in knowledge or capacity and develop a pet waste outreach campaign or program to better inform pet owners of the need for proper waste disposal. The EPA has developed a pet waste management document to aid municipalities in education and outreach on the subject.[11] Some potential actions for addressing the challenge could include:

1. The Town of Stratford should develop a more robust outreach program for proper dog waste disposal. This might include a social media campaign, signage on catch basins, or implementing a town wide dog waste disposal system. The EPA maintains resources on how to conduct a dog waste campaign[12]. Campaign components could include:

    - Surveying parks and/or walking trails for waste receptacles
    - Social media campaigns
    - Signage in residential areas

2. Increase outreach and engagement on maintaining waterways and the impacts of dumping in Bruce Brook, with targeted engagement to those residents living in the watershed.

4.7. PUBLIC ACCESS AND RECREATION

4.7.1. ENHANCE TRAILS AND PARKS ALONG THE STREAM

Create a dog waste system and education campaign in locations where dogs are often walked, such as Wooster Park and Clover Park. This might include signage and waste disposal stations.

5. LOCATION-SPECIFIC STRATEGIES

The Bruce Brook watershed is densely developed, and therefore there are few opportunities available for leveraging open and green spaces for reducing nonpoint source pollution. This section provides a description of potential strategies or projects that can be completed at three properties owned by the Town of Stratford (Bunnell High School, Stonybrook Park, and Clover Field Park) and one privately-owned commercial property (Stratford Plaza); and potential strategies and projects involving segments of roadways. These strategies have been identified due to their potential implementation feasibility and estimated impact on pollutant load reductions. This section concludes with a map and list of all site-specific strategies that are recommended in the watershed.

5.1. WATERSHED SITES FOR POTENTIAL ACTIONS AND PROJECTS

In order to make significant reductions in nonpoint source pollution loading to Bruce Brook, the Town of Stratford and City of Bridgeport should (1) undertake projects on public properties and (2) strive to encourage progress on private properties through incentive programs and other tools. The grouped strategies or "projects" described above provide a menu of options for high-profile, impactful actions. In addition to the strategies and projects described above, numerous sites offer potential opportunities for green infrastructure and other projects that can be implemented (as opposed to regulatory, educational, or policy strategies) to directly reduce nonpoint source pollution. The following map depicts locations of these site-specific recommendations. The projects described below in Sections 5.2 through 5.7 are included for consistency.

[11] https://www.epa.gov/system/files/documents/2023-01/bmp-pet-waste-management.pdf
[12] https://www.epa.gov/system/files/documents/2023-01/bmp-pet-waste-management.pdf

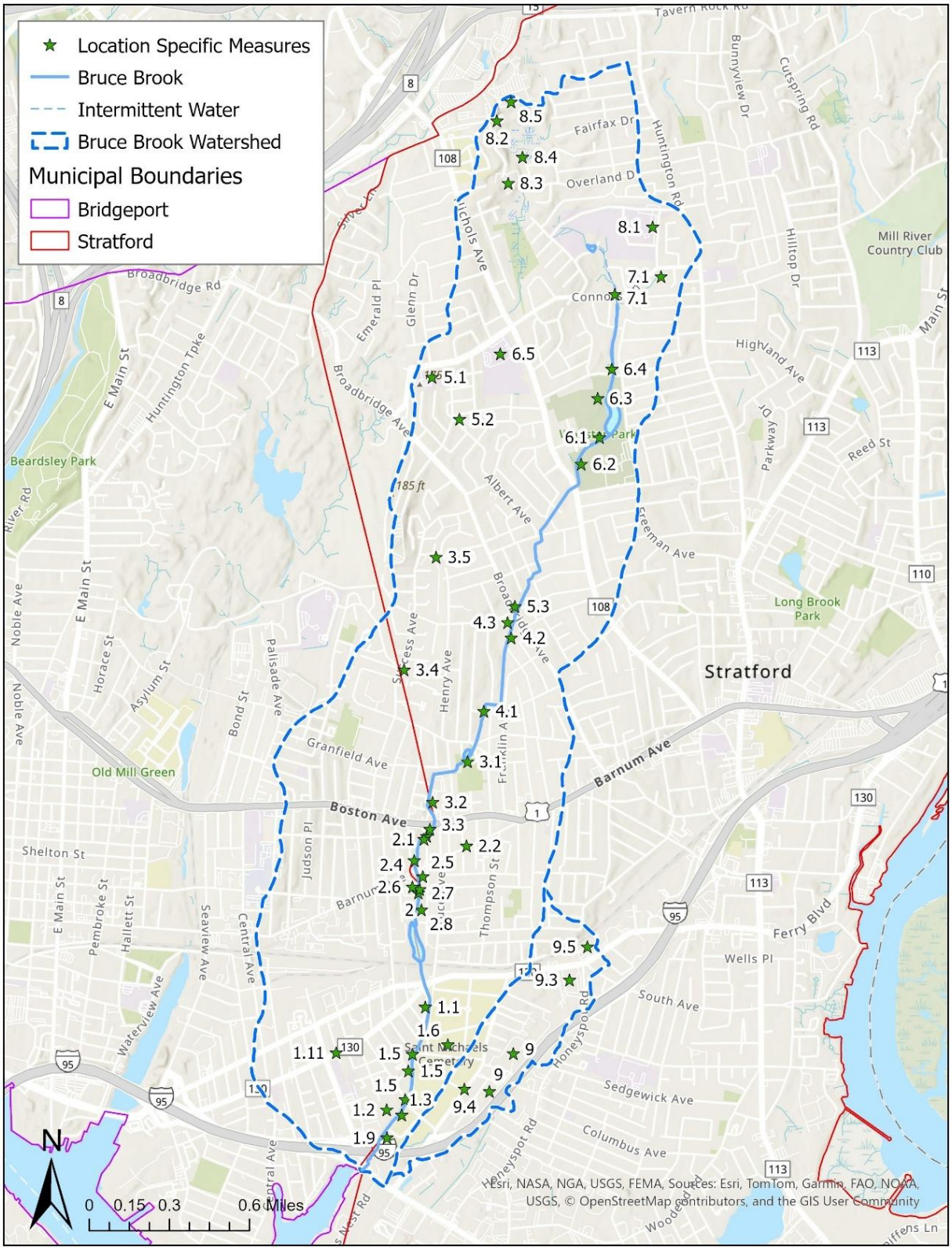


Figure 5-1 Site-Specific Recommendations in Watershed

Table 5-1 provides a summary of potential site-specific opportunities. Actions (projects) that have been incorporated into the WTM for load reduction calculations are highlighted in green. Load reduction estimates are described in Section 3.2.

Table 5-1 Site-Specific Recommendations

Map ID	Location	Municipality	Project
1.2	School bus facility	Bridgeport	Green stormwater infrastructure (GSI)
1.5	Read Street	Bridgeport	GSI and frequent sweeping/cleanup at dead end
1.5	Cowles Street	Bridgeport	GSI and frequent sweeping/cleanup at dead end
1.5	Miles Street	Bridgeport	GSI and frequent sweeping/cleanup at dead end
1.1	Bruce Boulevard	Bridgeport	Road diet (one lane northbound), roadway green infrastructure, streambank restoration, and stream channel restoration
1.1	Bruce Boulevard southward / St. Michaels Cemetery	Town line	Remove fabric, tires, and large debris from stream channel
1.3	St. Michaels Cemetery	Stratford	Improve streambank vegetation (native, easily managed species)
1.6	St. Michaels Cemetery	Stratford	Eliminate drainage swales from plots to streambank
1.9	St. Michaels Cemetery	Stratford	Relocate maintenance facility from southern end of property to another location
1.9	St. Michaels Cemetery	Stratford	If maintenance facility cannot be relocated, reconfigure the site to reduce potential for pollution from runoff
1.9	St. Michaels Cemetery	Stratford	If maintenance facility cannot be relocated, reconfigure the site to eliminate potential for exposure to floodwaters
2.8	179 West Avenue	Stratford	Acquire this property and restore natural floodplain along east side of Bruce Brook and former Bruce Pond. Also increases neighborhood green space.
2	West side of former Bruce Pond	Bridgeport	Eliminate tire piles
2	West side of former Bruce Pond	Bridgeport	Green infrastructure and drainage modifications at rear of parking lots
2.7	Graham Street alignment	Town line	Trash racks and Bandalong Bandit (or equivalent) upstream of former Bruce Pond to eliminate trash in former Bruce Pond area. (Would need to explore maintenance agreement)
2.5	McDonalds	Stratford	Green infrastructure and drainage modifications at rear of parking lots
2.6	Calvary New Testament Church (Barnum Ave)	Bridgeport	Green infrastructure and drainage modifications at rear of parking lots
2.4	50-60 Sage Avenue	Bridgeport	Acquire this property and restore natural floodplain along west side of Bruce Brook

Map ID	Location	Municipality	Project
2.1	North end of Bowe Avenue	Town line	Bowe Avenue improvements (already designed?)
2.3	95 Bowe Avenue	Stratford	Acquire 95 Bowe Avenue to eliminate exposure of building contents to floodwaters and allow floodplain restoration
2.2	Barnum Avenue	Stratford	Bioswales along roadway
3.3	305 Boston Avenue/Optimus Health Care	Both (Parking lot in Bridgeport)	Green infrastructure and drainage modifications at rear of parking lots (eliminate direct sheet flow into Bruce Brook at south end of conduit)
3.2	Stratford Plaza	Stratford	Green infrastructure and drainage modifications along west side and north side of property
3.1	Clover Field Park	Stratford	Streambank and streambed restoration
3.4	590 Success Avenue	Stratford	GSI and drainage modifications
3.5	Stonybrook Gardens Co-Op	Stratford	GSI and drainage modifications
4.1	Leonard Street	Stratford	GSI and frequent cleanup at dead end
4.2	Stonybrook Park	Stratford	Streambank replanting, vegetation management (e.g., knotweed), and riparian buffer
4.3	29 Stony Brook Road	Stratford	Streambank replanting and vegetation management (e.g., knotweed) behind strip mall
5.3	Small parcel on east side of Broadbridge Ave	Stratford	GSI on north bank of concrete wall to filter stormwater before it reaches the catch basin flows and Bruce Brook
5.1	Our Lady of Grace	Stratford	Reduce area of impervious pavement, install GSI if possible
5.2	Vazzano's Four Seasons & Convenience store	Stratford	Reduce area of impervious pavement, install GSI if possible
6.1	Wooster Park pond	Stratford	Waterfowl elimination
6.2	Wooster Park south	Stratford	Streambank and streambed restoration, invasive management if needed
6.3	Wooster Park north	Stratford	Trail management and pet waste disposal education/locations
6.4	North of Quail Street	Stratford	Large debris removal. May be limitations surrounding this area given the history of Raymark Waste remediation efforts[13]
6.5	Second Hill Lane School	Stratford	Potential location for underground stormwater retention or detention systems under ballfields and/or the esplanade.
7.1	Community Garden	Stratford	Uncertain what could be done, potentially riparian habitat enhancement for tributary.
7.1	Connors Lane	Stratford	Potential location for trash collector

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Map ID	Location	Municipality	Project
8.1	Bunnell High School	Stratford	Reduce area of impervious pavement, install GSI and/or underground storage to disconnect parking areas adjacent to the fieldhouse.
8.2	Hawley Lane/ Paradigm property	Stratford	Green infrastructure and/or pavement elimination at large parking lot to the northwest of the Veterans Park wetlands.
8.3	Ella Grasso Center	Stratford	Drainage improvements and parking lot management to reduce sediment runoff/improve stormwater quality
8.3	Ella Grasso Center	Stratford	Treat all stormwater on site to eliminate discharge to Bruce Brook headwaters
8.4	North end of North Johnson	Stratford	Drainage improvements to reduce flooding behind properties on western side of N Johnson
8.5	Big Y on Hawley Lane	Stratford	Green infrastructure and drainage modifications along south side of property which flows directly into headwater wetlands
9	Sunbelt Rentals (Mead Street)	Stratford	Green infrastructure and drainage modifications along southeast side of property where equipment is stored, and flows directly into stream
9	30 Moffitt Street	Stratford	Work with property owner on potential impervious reduction opportunities
9.3	1785 Stratford Avenue (Town Fair Tire)	Stratford	Work with property owner on potential impervious reduction opportunities
9.5	1700 Stratford Avenue (Two Roads)	Stratford	Work with property owner on potential impervious reduction opportunities - multiple drains in lot likely draining directly into stream
9.4	Surf Avenue	Stratford	Bioswales along roadway

All of the sites identified above drain either into Bruce Brook or a tributary (nonpoint sources) or into municipal storm drainage systems that discharge to Bruce Brook (point sources managed through MS4 authorizations and stormwater management plans). In general, sites adjacent to Bruce Brook are associated with nonpoint sources of pollution, whereas more distant sites (e.g., the Stonybrook Gardens Co-op) drain to municipal stormwater systems and are therefore covered by MS4 stormwater management actions. Nevertheless, reducing imperviousness and installing green infrastructure at sites that discharge to municipal stormwater systems will indirectly benefit Bruce Brook.

5.2. PAVEMENT MODIFICATIONS AT BUNNELL HIGH SCHOOL

Although the entirety of the Bunnell High School property is not as impervious as other locations in the watershed, it is owned by the Town, potentially making implementation of nonpoint source management strategies more feasible. Furthermore, portions of the site drain directly into Bruce Brook or small tributaries, which means that stormwater reduction strategies may have direct benefits to the stream apart from MS4 efforts.

There are several types of pervious or permeable pavement applications, with reduction effectiveness ranging between 25% to 100%.[14] Pollutant removal rates vary by installation type with applications having upwards of 67% for total suspended solids, and between 34% and 72% for nutrient removals.

The proposed application would include the installation of a permeable pavement throughout the primary parking area at the high school, with additional installation along the roadway. In summary, water quality would be improved as follows:

- ✓ Replacement of impervious surfaces with partially permeable surfaces, thereby reducing the formation of stormwater that would otherwise enter Bruce Brook and enhancing infiltration of stormwater into the ground.

[14] https://www.epa.gov/system/files/documents/2021-11/bmp-permeable-pavements.pdf

5.3. STONYBROOK PARK STREAM RESTORATION

Stonybrook Park includes a segment of Bruce Brook characterized by limited sections of streambank lacking vegetation and extensive sections of streambank with non-native nuisance vegetation such as Japanese knotweed (pictured to the right). The Town of Stratford wishes to replace vegetation with native streambank species that reduce the potential for erosion, filter stormwater from adjacent areas such as the park and nearby roads and provide habitat co-benefits. In summary, water quality would be improved as follows:

- ✓ Removing knotweed and planting beneficial native species of vegetation would reduce potential for erosion; and
- ✓ Native types of streambank vegetation could more appropriately filter stormwater from adjacent areas.

5.4. CLOVER FIELD PARK STREAM RESTORATION

Bruce Brook is entirely contained within a concrete channel (bottom and sides) through Clover Field Park. This is one of the few locations where the Town of Stratford has control and ownership of a channelized section without residential properties lining the stream. Nonpoint source pollution has the ability to flow from adjacent fields into Bruce Brook. Furthermore, Bruce Brook lacks any meaningful connection to a vegetated floodplain; if floodwaters could access a restored floodplain, then water quality benefits would likely be realized.

Clover Field Park includes a sizeable pond immediately adjacent to Bruce Brook, separated by the concrete stream bank. The level of the pond is maintained by a small diversion from the concrete channel of Bruce Brook (entering the pond at its upstream end), and the pond flows back into Bruce Brook at its downstream end. The pond is surrounded by a variety of vegetation including native and non-native nuisance species and aquatic species (pictured to the right). During the summer, the pond likely warms the water coming from Bruce Brook before returning water to Bruce Brook; in other words, the pond likely reduces the habitat quality of Bruce Brook by changing the water temperature.

The Town of Stratford would like to evaluate the feasibility and cost of restoring the Bruce Brook channel while restoring an area of directly connected floodplain. In summary, water quality would be improved as follows:

- ✓ Natural streambanks and beds would provide filtration from adjacent areas;
- ✓ A connected floodplain could reduce water surface elevations and flood velocities during flood events while providing some settling and infiltration of flood waters; and
- ✓ A modification to the adjacent pond (and its vegetation) could help reduce its warming impacts.

5.5. STRATFORD PLAZA

The Stratford Plaza on Boston Avenue, which is home to the C-Town Supermarket, Aaron's, and a Family Dollar, among others, is a potential candidate for green infrastructure applications. The plaza is approximately ten acres in size and almost entirely impervious.

Bruce Brook flows along the north and west edges of the plaza. Stormwater can flow directly from the plaza into Bruce Brook, carrying nonpoint sources of pollution. Few stormwater systems with catch basins are present on the plaza. Gaps in the curb system allow direct flow of stormwater from the parking lot. Furthermore, on at least one occasion, leaves, dust, and trash were observed being swept into the stream corridor, introducing nonpoint source pollution that is not associated with stormwater.

While the plaza is privately owned, the Town and City should work with the property owner to incentivize installation of green infrastructure applications to improve stormwater quality while also reducing the stormwater flows currently directed into the stream via asphalt swales.

Figure 5-2 Stratford Plaza on Boston Avenue

The proposed applications include three vegetated swales placed strategically along the west edge of the plaza where drainage cuts already exist, the installation of a long vegetated swale or retention area along parking spaces, and a green infrastructure application to capture runoff from the loading areas behind the supermarket. In summary, water quality would be improved as follows:

- ✓ Replacement of impervious surfaces with green infrastructure, thereby reducing the formation of stormwater and enhancing infiltration of stormwater; and
- ✓ Filtration of excess stormwater before it runs into Bruce Brook.

5.6. BIOSWALE AND TREE WELL/TREE BOX PROGRAM

Three roadways across the southern portion of the watershed have been identified based on potential suitability for bioswale installation, in addition to high extreme heat vulnerability based on the CCVI. Installation of bioswales (similar to those installed along the sides of streets in New Haven) and/or tree boxes along these roadways could provide co-benefits of reducing extreme heat exposure along primary roadways that are likely to be heavily utilized by pedestrians. The roads include:

- Surf Avenue (Stratford)
- Barnum Avenue (Stratford)
- Stratford Avenue (Bridgeport)

The application of street side drainage swales along these three roadways would address stormwater runoff in three different subwatersheds: 1, 2, and 9. In summary, water quality would be improved as follows:

- ✓ Replacement of impervious surfaces with green infrastructure, thereby reducing the formation of stormwater and enhancing infiltration of stormwater; and
- ✓ Filtration of excess stormwater before it runs into Bruce Brook.

5.7. BRUCE BOULEVARD ROAD DIET AND GREEN INFRASTRUCTURE

Bruce Boulevard runs south off Stratford Avenue in Bridgeport, parallel to the west bank of Bruce Brook. The Brook in this location is entirely channelized within stacked rock walls with some concrete. The stream bed may be mostly natural, but it is covered with fabrics, tires, and metal debris. The Boulevard traverses the rear of commercial or industrial operations and serves mainly as secondary access to those locations. This area has experienced flooding problems in recent history. For example, the stream overtopped on December 18, 2023 (Figure 5-3) and flooded Bruce Boulevard along with the yards and laydown areas used by businesses at industrial properties. During flood events, water contacts a variety of pollution sources, and then it flows directly into Bruce Brook. Stormwater systems are not extensive in this area, or are lacking completely, such that MS4-related efforts would not be effective for reducing pollution.

Figure 5-3 Flooding on Bruce Boulevard on December 18, 2023

The potential concept for this location relies on downsizing Bruce Boulevard from a two lane to a one lane road, installing green infrastructure immediately along the roadway, and removing the stacked rock channel wall and replacing this with a vegetated/bioengineered sloped embankment. This application would serve multiple purposes as it would allow for a partially restored bankfull width of the stream, promote a more natural habitat in and along the stream, and promote filtration of stormwater runoff from the roadway and adjacent properties. Depending on the geometry of the new channel and sloped bank, water surface elevations during flood events will likely be lower than the current flood water elevations. This would reduce the frequency of road inundation and the exposure of business laydown areas to water which likely leads to pollution. The construction process would enable rapid removal of tires, fabric, and metal debris from this part of Bruce Brook if they are not removed in the near term through other efforts. In summary, water quality would be improved as follows:

- ✓ Removal of fabric, tires, and debris that likely harbor bacteria;
- ✓ Restoration of a natural stream bed where vegetation can help filter pollutants;
- ✓ Restoration of the west bank of Bruce Brook where new vegetation can help filter water already in Bruce Brook (during high flows) and stormwater flowing overland from Bruce Boulevard;
- ✓ Provision of space for green infrastructure between the top of the bank and the edge of Bruce Boulevard to reduce stormwater formation and infiltrate some stormwater;
- ✓ Reduction of impervious surfaces associated with Bruce Boulevard, therefore reducing stormwater formation; and
- ✓ Reducing the frequency of inundation of Bruce Boulevard and adjacent industrial properties, which currently exposes floodwaters to pollutants.

6. TECHNICAL AND FINANCIAL ASSISTANCE

6.1. FEDERAL FUNDING SOURCES

Environmental Protection Agency (EPA)			Actions it May Fund
Urban Waters Small Grants	Every two years grants are awarded to eligible applicants to address local water quality, provide additional community benefits, engage underserved communities, and foster partnership. The program has not been awarded since 2018; however, this may be an option in the future. Award amounts of up to $60,000.	https://www.epa.gov/urbanwaterspartners/urban-waters-small-grants	
Environmental Education Grants	Funds support environmental education projects to promote awareness and stewardship and provide people with tools to take environmental responsibility. EE Grants have not been awarded since 2023.	https://www.epa.gov/education/grants#:~:text=Under%20the%20Environmental%20Education%20Grants,actions%20to%20protect%20the%20environment.	EO.A.1, EO.A.2, EO.B.1, EOB2, PAR.A.1
Smart Growth Funding Opportunities	EPA developed a list of national funding resources to assist local and state governments, communities, and nongovernmental organizations who are addressing the varied aspects of smart growth.	https://www.epa.gov/smartgrowth/smart-growth-national-funding-opportunities	
Federal Emergency Management Agency (FEMA)			**Actions it May Fund**
Preparedness Grants	FEMA funds efforts to increase community capacity to protect against, respond to, recover from and mitigate disasters and emergencies.	https://www.fema.gov/grants/preparedness	
Hazard Mitigation Assistance	The HMA programs focus on funding projects that protect life and property from natural disasters. There are three grant programs under HMA. • Hazard Mitigation Grant Program (HMGP) which funds long-term natural hazard mitigation efforts following a declared disaster.	https://www.fema.gov/grants/mitigation	(any acquisitions; also, the Bruce Boulevard project because it would reduce water surface elevations at businesses)

	• Building Resilient Communities and Infrastructure (BRIC) funds hazard mitigation projects with a focus on capacity building, innovation, large infrastructure, and partnerships. • Flood Mitigation Assistance (FMA) funds projects that reduce or eliminate flood risks to buildings that are insured by the NFIP.		
United States Fish and Wildlife Service (USFWS)			**Actions it May Fund**
United States Fish and Wildlife Service (USFWS)	The USFWS administers a number of natural resource and conservation grants.	https://www.fws.gov/service/financial-assistance	
North American Wetlands Conservation Act (NAWCA) Grants	A competitive matching grant program which supports public-private partnerships and projects involving long-term protection, restoration, and/or enhancement of wetlands and associated uplands for the benefit of wetlands-associated migratory birds.	https://www.fws.gov/service/north-american-wetlands-conservation-act-nawca-grants-us-standard-program	
National Coastal Wetlands Conservation Grants	The NCWCGP provides grants up to $1 million to coastal states to restore and enhance coastal wetland ecosystems and associated uplands.	https://www.fws.gov/service/national-coastal-wetlands-conservation-grants	
Partners for Fish and Wildlife	The Partners for Fish and Wildlife Program provides free technical and financial assistance to landowners, managers, tribes, corporations, schools and nonprofits interested in improving wildlife habitat on their land. The voluntary program is customized to landowners' needs.	https://www.fws.gov/program/partners-fish-and-wildlife	HPR.B.1, HPR.B.2, HPR.B.3
National Oceanic and Atmospheric Administration (NOAA)			**Actions it May Fund**
National Coastal Resilience Fund	Through a partnership with the National Fish and Wildlife Foundation, funding is awarded to projects that focus on enhancing, restoring, and protecting fish and wildlife habitat in coastal communities.	https://coast.noaa.gov/funding/bil/ncrf/overview.html	HPR.B.1, HPR.B.2, HPR.B.3

Community-Based Habitat Restoration Program	NOAA's Community-based Restoration Program provides funding and technical assistance for restoration projects that ensure fish have access to high-quality habitat. The goal of these projects is to recover and sustain fisheries—particularly those species managed by NOAA Fisheries, or those listed as endangered or threatened under the Endangered Species Act.	https://www.fisheries.noaa.gov/national/habitat-conservation/community-based-habitat-restoration	
Natural Resources Conservation Service (NRCS)			**Actions it May Fund**
Watershed and Flood Prevention Operations (WFPO)	The program provides funding to state and local governments and Tribal organizations to execute watershed projects for a variety of purposes including flood prevention, watershed protection, public recreations, and water quality management.	Watershed and Flood Prevention Operations (WFPO) Program | Natural Resources Conservation Service (usda.gov)	WQ.C.6, WQ.C.7
Environmental Quality Incentives Program (EQIP)	EQIP provides technical and financial assistance to agricultural producers and forest landowners to address natural resource concerns.	https://www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives	
Emergency Watershed Protection	The EWP is a recovery program that helps communities after a natural disaster. The program offers technical and financial assistance to local communities to alleviate threats to life and property caused by floods, fires, windstorms and other natural disasters that impair a watershed.	https://www.nrcs.usda.gov/programs-initiatives/ewp-emergency-watershed-protection	
Floodplain Easement Option	As part of the EWP, NRCS purchases an easement from landowners which gives the agency authority to restore and enhance the floodplain functions.	https://www.nrcs.usda.gov/sites/default/files/2022-09/EWP-FPE%20Factsheet.pdf	

Healthy Forest Reserve Program	The Healthy Forests Reserve Program (HFRP) helps landowners restore, enhance and protect forestland resources on private and tribal lands through easements and financial assistance.	https://www.nrcs.usda.gov/programs-initiatives/hfrp-healthy-forests-reserve-program	HPR.B.4
National Fish and Wildlife Foundation (NFWF)			**Actions it May Fund**
Long Island Sound Futures Fund	The Long Island Sound Futures Fund supports projects in local communities that aim to protect and restore Long Island Sound. It unites federal and state agencies, foundations and corporations to achieve high-priority conservation objectives. Funded activities demonstrate a real, on-the-ground commitment to securing a healthy future for Long Island Sound.	https://longislandsoundstudy.net/about/grants/lis-futures-fund/	HPR.B.1, HPR.B.2, HPR.B.3
Five Start and Urban Waters Restoration Grant Program	The Five Star and Urban Waters Restoration Program seeks to develop nation-wide community stewardship of local natural resources, preserving these resources for future generations and enhancing habitat for local wildlife. Grants seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development.	https://www.nfwf.org/programs/five-star-and-urban-waters-restoration-grant-program	
U.S. Department of Housing and Development (HUD)			
Community Development Block Grant	The Community Development Block Grant (CDBG) Program provides annual grants on a formula basis to states, cities, and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons. Certain watershed projects may be eligible.	https://www.hud.gov/program_offices/comm_planning/cdbg	

Other Federal/National Opportunities			Actions it May Fund
National Forest Foundation	Through its on-the-ground conservation programs, the National Forest Foundation supports action-oriented projects that directly enhance the health and well-being of America's National Forests and Grasslands and that engage the public in stewardship.	https://www.nationalforests.org/grant-programs	
The Land and Water Conservation Fund	There are a number of LWCF programs where funding is used to protect natural resources and outdoor recreational land.	https://lwcf.tplgis.org/about/lwcf-programs/	
The Water Finance Clearing House	A database of federal financial sources which may fund a variety of watershed projects.	https://ordspub.epa.gov/ords/wfc/f?p=165:1	
Wildlife Conservation Society Climate Adaptation Fund	The WCS funds projects that advance learning and scale effective interventions that help wildlife, ecosystems, and the people who value and depend on them. Funding opportunities prioritize adaptation implementation and adaptation mainstreaming (adaptation at a larger scale).	https://www.wcsclimateadaptationfund.org/program-information/	

6.2. STATE FUNDING SOURCES

Connecticut DEEP			Actions it May Fund
Section 319 Grant Program	Nonpoint source grants are awarded for watershed based plan implementation of development projects that target pollutant load reductions and restoring/repairing impaired waters.	https://portal.ct.gov/deep/business-and-financial-assistance/grants-financial-assistance/clean-water-act-section-319-nonpoint-source-grants	WQ.A.3, WQ.A.4
Clean Water State Revolving Fund	The CWSRF partners with local governments in building and financing projects to improve water quality and protect public health. While the program is focused primarily on wastewater there is a set aside under the Sewer Overflow & Stormwater Reuse Municipal (OSG) Grant.	https://portal.ct.gov/deep/municipal-wastewater/financial-assistance-for-municipal-wastewater-projects	
Recreational Trails Program	This program awards funding to municipalities, private nonprofits, state departments, and tribal governments to plan, maintain, improve accessibility, purchase easements, and increase education to promote safety and environmental health.	https://portal.ct.gov/deep/outdoor-recreation/trails/crt--funding	PAR.A.1
Long Island Sound License Plate Program	The Long Island Sound License Plate Program has funded projects supporting outreach and education, increasing public access, protection and restoration of Sound habitats, and scientific research. As of April 2025, DEEP was not conducting funding cycles due to budgetary constraints. The Town or City could consider this opportunity if it were to open again in the future.	https://portal.ct.gov/deep/coastal-resources/lis-license-plate/lis-license-plate	
Open Space and Watershed Land Acquisition	The OSWA Grant Program funds open space acquisitions pursued by municipalities, nonprofits, and water companies which will provide high conservation and recreational value.	https://portal.ct.gov/deep/open-space/open-space-and-watershed-land-acquisition-grant-program	

Recreation and Natural Heritage Trust Program	CT DEEP administers the program which focuses on funding land and water acquisitions that will expand the State's natural open spaces including parks, forests, and wildlife habitats.	https://portal.ct.gov/deep/open-space/the-recreation-and-natural-heritage-trust-program	
Urban Forestry Grant Program	The Urban and Community Forestry Planning Grant Program offers funding for municipalities and non-profit organizations to pursue planning projects such as tree inventories, management plans, or other monitoring programs that will help communities to make informed management decisions.	https://portal.ct.gov/deep/forestry/urban-forestry/grants/urban-forestry-grant-opportunities	
Climate Resilience Fund	The DCRF program provides funding to communities to initiate planning and develop projects that will help communities become more resilient to the effects of climate change. Some of the actions with climate co-benefits may be eligible for funding.	https://portal.ct.gov/connecticutclimateaction/executive-order/deep-climate-resilience-fund	
Urban Forested Natural Areas and Riparian Corridor Restoration Grant Program	The Urban Forested Natural Area and Riparian Corridor Restoration Grant Program was created to support local land managers in their efforts to address forest health issues. It does this by providing funding to support management interventions that promote the health and resilience of urban natural forested areas and riparian corridors. Projects may include, but are not limited to, chemical or mechanical removal of invasive plant species, vine removal, tree planting, and other site treatments intended to slow the spread of invasive plants and promote regeneration of native tree species.	Urban Forested Natural Areas and Riparian Corridor Restoration Grant Program	HPR.A.1, HPR.A.2, HPR.B.1
Connecticut Office of Policy and Management (OPM)			**Actions it May Fund**
Urban Act Grant Program	The Urban Act grant program is open to all municipalities designated as economically distressed, public investment communities or urban centers. Funds are provided to improve and expand state activities which promote	https://portal.ct.gov/decd/content/community-development/03_funding_o	

	community conservation and development and improve the quality of life for urban residents of the state.	pportunities/capital-infrastructure-grants/urban-act-grant-program	
Small Town Economic Assistance Program (STEAP)	The Town is eligible for STEAP funds as an Opt-In community given that they do not have an urban center as per an adopted plan. The STEAP grants fund economic development, community conservation, and quality-of-life capital projects.	https://portal.ct.gov/opm/igpp/grants/steap/small-town-economic-assistance-program---steap	
Other Regional Opportunities			**Actions it May Fund**
Long Island Sound Research Grant Program (LISRGP)	Long Island Sound Research Grant Program awards funds to researchers whose work helps meets the needs of decision-makers to improve the management of Long Island Sound.	https://lispartnership.org/about/grants/	

6.3. TECHNICAL RESOURCES

Water Finance Center	Provides financing information to help local decision makers with decisions regarding drinking water, wastewater, and stormwater infrastructure.	https://www.epa.gov/waterfinancecenter
Funding Resources for Watershed Protection and Restoration	This page provides information on funding, technical, planning, and capacity building resources.	https://www.epa.gov/nps/funding-resources-watershed-protection-and-restoration

7. PUBLIC INFORMATION AND EDUCATION PROGRAMS

In addition to those management measures identified above, the Town and City should work to build community and stakeholder engagement programs to increase involvement, education, and awareness.

Much of the success of watershed management measures relies upon the education and understanding various target audiences including public officials, residents, business owners and operators, and landowners in the watershed.

The EPA provides numerous free resources and materials for communities to use when building and launching collaboration and outreach campaigns. Some of these resources include *Getting in Step: A Guide for Conducting Watershed Outreach Campaigns* which can help shape a campaign by addressing public perceptions, promoting management measures, and informing stakeholders. The EPA also hosts the NPS Outreach Toolbox which is a catalog of over 700 ready to use print, radio, social media, and TV materials; some of which are also available in Spanish. For example, the sign shown in Figure 7-1 accompanies "Mutt Mitt" stations throughout the city of Austin, Texas to promote pet clean up in public places.

Figure 7-1 "Scoop the Poop" Sign Seen Throughout Austin, Texas

The City and Town should also continue to identify stakeholders throughout the watershed, municipality, and region that may also play an integral role in community outreach and education.

8. IMPLEMENTATION AND MILESTONES

8.1. IMPLEMENTATION TIMEFRAMES

The management measures outlined in Section 4 vary widely in scale, cost, and implementation terms. To aid in implementation of these measures, the management measure matrix has identified several factors that will influence success of implementation including an estimated cost range, potential funding sources, and time frame for implementation. In general, almost all recommended measures can either be implemented by 2030, or it is feasible to begin planning or design by 2030.

Near term actions, those that can be completed within the next one to two years, are primarily centered around outreach and education, incorporating measures into preexisting happenings, and identifying areas for targeted applications such as native plantings or bioswale applications.

Mid-term actions, those targeted for between 2026 and 2028, primarily include additional planning at the sub-watershed scaled, invasive species surveys, additional testing along the stream, and feasibility studies. Unlike many of those near-term measures, the mid-term actions will likely require funding outside of capital and operational budgets. Therefore, this time frame gives the Town and City time to pursue and secure outside funding.

The long-term actions, which are those slated for completion or planning/design beyond 2028, are large scale projects including impervious pavement reductions, bioswale construction, and invasive species removal. These projects will require increased funding and stakeholder engagement, and some are predicated on the success of near- and mid-term measures.

In addition, the Town and City have been tasked with certain “ongoing” and “annual” tasks. These include continuing to work with local and regional stakeholders on efforts, perpetually seeking funding opportunities for project implementation, and seeking other opportunities for acquisitions and floodplain restoration.

The location specific projects identified in Table 5-1 do not have implementation time frames associated given that a majority are associated with privately owned property which may ultimately mean an additional barrier to implementation and additional time.

8.2. IMPLEMENTATION MILESTONES AND CRITERIA

The measures matrix (Appendix E) also includes measurable milestones for each of the actions identified. Many of these could be considered simple and are easily tracked. These might include:

- Number of grants applied for on an annual basis
- Number of surveys or testing samples executed
- Flyers distributed, number of event attendees or volunteers
- Signs erected in public places with educational messages
- Changes to regulatory standards, new ordinances, or new overlay zones
- Number of bioswale locations identified and installed
- Stakeholders contacted and integrated into watershed related efforts
- Properties acquired in flood hazard areas

In addition to the programmatic milestones above, certain criteria can be applied to some measures that will also help determine whether loading reductions are being achieved over time, and that progress is being made toward improved water quality standards. These criteria are more quantitative in nature than those milestones discussed above. Below is a description of criteria associated with certain objectives of the WBP.

Objective: Continue Water Quality Monitoring

Harbor Watch has the most robust monitoring program to date in Bruce Brook; therefore, the Town and City should continue collaboration with the organization, and support future monitoring efforts. In addition, the Town and City can look to implement their own monitoring programs and potentially expand efforts to include benthic surveys. The ongoing collaboration and potential expansion of monitoring efforts can be measured by specific criteria in multiple ways. These criteria can include:

- Analyzing Harbor Watch data from years past to ensure a reduction in testing parameters which might include *E. coli*, fecal coliform, and total coliform.
- Biological indexes such as the EPT richness index. This includes mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera).
- A reduction in nutrient pollutants including total phosphorus, total nitrogen, or nitrates.

Objective: Better Manage Stormwater Quality

The actions identified to address stormwater are typically directed at the quality of the stormwater entering the Bruce Brook, or the quantity of stormwater which can ultimately reduce harmful load levels into the stream.

The criteria that can be used to measure stormwater quality management, some of which are similar to those for water quality monitoring, include:

- Indicator bacteria count such as those measured by Harbor Watch and identified in the TMDL including *E. coli*, fecal coliform, and total coliform.
- Nutrient pollutants including total phosphorus, total nitrogen, or nitrates.
- Biological indexes such as the EPT richness index. This includes mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera).
- Acres of impervious surface reduction or conversion to permeable materials.
- Increase in street sweeping instances in the Town or City.
- Number of bioswale installations and the relative stormwater treatment volumes.
- Number of volunteers at clean up events.

Objective: Control Invasive Species

The Bruce Brook is only partially a natural stream, with the remained being channelized to some degree. These naturalized stretches are integral in maintaining a healthy ecosystem. A healthy and native streambank can play a vital role in improving and maintaining healthy water quality, therefore ensuring streambanks are rid of invasives is a suggested measure.

Criteria that can be used to measure improved ecosystem health and riparian buffer enhancement, which can in turn improve water quality, include:

- Turbidity and flow, in conjunction with;
- Invasive species surveys and;

- Length of streambed restored with native plantings
- Length of stream dechannelized

There are a number of other surface water parameters that can be used in conjunction with those above to determine improvements in water quality and riparian health. Many of these can be incorporated into measures surrounding water quality testing and streambank and riparian restoration.

- Water temperature
- Dissolved oxygen
- pH
- Turbidity
- Vegetative cover
- Wetland plant composition
- Fishery populations

8.3. MONITORING PROGRAM

As of the development of this plan, Harbor Watch is the primary source for consistent and indicative water quality sampling data; therefore, the Town and City will continue to rely on this publicly available data. Assuming Harbor Watch can continue its monitoring program in perpetuity, the Town and City can utilize this already established dataset to identify trends in water quality standards going forward.

Notwithstanding the ongoing Harbor Watch efforts, monitoring actions have been identified as part of this watershed plan; these include benthic organism surveys and sediment bacterial sampling. The implementation of these two water quality sampling programs would provide a baseline understanding of current water quality along the Brook and would allow for more in depth monitoring of water quality improvements and measure effectiveness. Because these programs do not yet exist, specific indicators for water quality improvements cannot be set. However, when programs are implemented the Town and City should evaluate how the results can contribute to meeting objectives. For example, questions can be asked such as:

- What does the current benthic community convey regarding water quality (i.e., primarily pollutant tolerant or intolerant species). Also, must be aware that benthic communities will be impacted by habitat before water quality.
- What water quality parameters need to be addressed to increase pollutant intolerant populations?
- What management measures might specifically address those water quality parameters?
- How do sediment sampling results compare to Harbor Watch water sampling?
- If there are contradictions, might the sediment results reflect a more accurate location of potential sources?

- What management measures might specifically address the source and/or bacterial parameters?

These questions will contribute to setting a baseline of existing conditions and also aid in assessing whether implemented measures are effective over time.

As a whole, the plan will be evaluated on an annual basis for progress on all management measures, not just those related to water quality sampling and monitoring. The Bruce Brook Advisory Committee will meet at least annually to discuss progress made on any actions, barriers to implementation, and potential opportunities for funding, collaboration, or additional measures related to watershed health.

If by 2030 (the recommended timeframe for management measure implementation or planning) milestones and objective criteria identified above in Section 8.2 have not been met or do not indicate progress, the Advisory Committee should collaborate on understanding why progress had been limited, and how recommended management measures should be modified to achieve progress. Observed progress can be quantitative, such as an increase in number of bioswales, or a downward trend in Harbor Watch indicator bacteria data; it may also be qualitative such as new regulations to promote buffers or the expansion of an educational program. The full suite of management measures and associated milestones can be found in Appendix E. It is anticipated that progress and/or revisions will be discussed during annual meetings, therefore any *lack* of progress toward meeting water quality improvements would not go unnoticed over a five year period.

APPENDIX A. PUBLIC OUTREACH MATERIALS

Meeting Minutes – Advisory Committee
Bruce Brook Watershed Based Plan

Date: September 6, 2023
Time: 9:30 to 10:30 am
Location: Virtual

Attendees			
Kelly Kerrigan	Environmental Conservation Superintendent Town of Stratford	John Casey	Town Engineer, Town of Stratford
David Murphy	Resilient Land and Water	Nikki Spiller	Director of Harbor Watch
Victoria Vetre	Resilient Land and Water	Lauren Mappa	Bridgeport WPCA
Susan Peterson	CT DEEP	Susmitha Attota	Planner, Town of Stratford
Chadwick Schroeder	Sustainability Manager City of Bridgeport	Jon Urquidi	City Engineer, City of Bridgeport
Joseph Gresko	State Representative for the 121st District	Josh Hannant	
Matthew Fulda	MetroCOG	Chris	
Cathey Fletcher	Planner, City of Bridgeport		

David and Victoria presented slides on the following agenda Items:

1. Update on Progress
    a. QAPP – the review and approval took a few months but it was signed in mid-July 2023
    b. Data Collection – underway; additional information can be provided if available
    c. Watershed Reconnaissance – partly completed in July after the QAPP was signed
    d. Story Map – additional comments and edits can be incorporated https://experience.arcgis.com/experience/0781838834874e84843923a4d53fe7d0
    e. Survey https://experience.arcgis.com/experience/0781838834874e84843923a4d53fe7d0/page/Survey/
2. Agenda for September 12, 2023, Conservation Commission/Public Meeting – A second meeting may be added to help provide flexibility
3. Next Steps and Updated Schedule – the goal is to use the fall for analysis and prepare a draft for winter (January 2023) review
4. Open Discussion – see below

Open Discussion:

- Joseph Gresko raised a concern about the public meeting on 9/12 because Town Council will move meeting originally scheduled for 9/11 to 7 PM on 9/12; the Conservation Commission may be shuffled out of council chambers to accommodate both meetings.

- Kelly acknowledged the concern and confirmed that the Town Council meeting would start at 7:30 which allows for one and a half hours for the public meeting. This should be sufficient for the planned presentation.

- Susan mentioned that if there is a 2nd public meeting, this will be ideal for her because extensive notice is needed for her to get approval to attend evening meetings.
- Susmitha raised a concern that there will not be enough turnout and it may be a waste of resources to host the meeting on the 12th.
    - Kelly acknowledged the concern. David noted that in the scope there are multiple conservation commission meetings, therefore the public meeting on the 12th could qualify as that, and an additional public meeting event would not be a problem.
- David asked if the conservation commission has been asking about WBP updates.
    - Kelly noted that the conservation commission has been asking for updates and that there have been few to give, so keeping this date is ideal.
- Susan asked if hosting an additional meeting in or near Bridgeport would be an option.
    - Kelly and David agreed that this would be a good idea.
- David suggested identifying potential dates for a 2nd public meeting. The committee targeted October 3, 4, or 5 for the next public meeting event. Kelly and Chadwick can work to identify a venue in Bridgeport.
- David asked if anyone wanted to discuss anything related to data or field reconnaissance.
    - Nikki noted that if we see anything that appears to suggest sanitary wastewater (sewage) we can reach out to her, and Harbor Watch can quickly respond to conduct water sampling as they have budget to do so.
- Susan asked if there was intent was to look at the watershed on a larger scale and trace potential sources upstream or on higher ground during field recon.
    - David discussed how the windshield surveys already included taking a look at locations upstream and uphill (using an example of a community farm/garden), and this will continue as stream walks are conducted.
- David asked Nikki if there were any additional datasets that may be useful or that may have been missing.
    - Nikki noted that Kelly and the consulting team should have everything that Harbor Watch has, but if any gaps are found to let her know and Harbor Watch may be able to fill those in.
- Kelly asked if there could be potentially be a location to have a site meeting along the stream where we could show the public what is going on and why we are doing this.
    - David said there should be no problem as there were a few locations noted during the windshield survey that could have sufficient space and parking.
- Susan wanted to confirm that Harbor Watch had a new QAPP in place for this monitoring season.
    - Nikki confirmed that there was an approved QAPP. Kelly will make sure Susan receives a copy.

Meeting Minutes – Advisory Committee
Bruce Brook Watershed Based Plan

Date: January 11, 2024
Time: 10:00 to 11:00 am
Location: Virtual

Attendees			
Kelly Kerrigan	Environmental Conservation Superintendent Town of Stratford	John Casey	Town Engineer, Town of Stratford
David Murphy	Resilient Land and Water	Nikki Spiller	Director of Harbor Watch
Victoria Vetre	Resilient Land and Water	Lauren Mappa	Bridgeport WPCA
Susan Peterson	CT DEEP	Susmitha Attota	Planner, Town of Stratford
Chadwick Schroeder	Sustainability Manager City of Bridgeport	Jon Urquidi	City Engineer, City of Bridgeport
Joseph Gresko	State Representative for the 121st District	Josh Hannant	Engineering, City of Bridgeport
Aaron Curry	Deputy Director of Public Facilities	Chris	
Cathey Fletcher	Planner, City of Bridgeport	Alivia Coleman	Stratford Health Department
Josh Hannant	Engineering, City of Bridgeport	Greg Dancho	Chair of Stratford Conservation Commission
Elizabeth Rodriguez	Director of Health and Social Services, City of Bridgeport	Erik Mas	Fuss & O'Neill

David and Victoria presented slides on the following agenda Items:

1. Update on Progress
    a. Public engagement
    b. Watershed reconnaissance
2. Water quality and pollutant load estimates
3. Draft goals and objectives
4. Next steps

Open Discussion:

- When discussing goals, Kelly noted that public access and recreation is important, however this will be limited given that there are only few opportunities for access, such as Clover Park.
- Victoria presented a summary of results from Harbor Watch and Nikki noted that there is nutrient data from 2022. Victoria will follow up with Nikki on this.

- Susan discussed the importance of the Integrated Quality Report, and how the entirety of Bruce Brook is considered impaired. It appears that the current pollutant load estimates and the Harbor Watch data align with DEEP's findings. It is important to cross-reference this report with findings in the final document.
- During a discussion on debris removal, Jon Urquidi noted that even though some items may not be as high a priority for removal, it may make sense to conduct one large sweep in certain locations given that manpower and hauling equipment will already be allocated for cleanup.
    - Nikki noted that NOAA invited Harbor Watch to submit a full proposal for funding to install litter traps along certain streams; Harbor Watch is hoping to install some along Bruce Brook. Harbor Watch will need letters of support for this from the City and Town, and if funding is acquired these can hopefully be installed after some level of clean up has been done in some areas.
- Susan reiterated that the plan needs to focus on the nutrient and bacteria impairments. To the point of debris removal, this is just the visual aspect and will get residents to care, but there are still other needs that cannot be seen. The City and Town are also MS4 communities, so it is important to point out that out and identify
- Chadwick commented that many of the issues along Bruce Brook may be able to be addressed in tandem with flood and climate resilience efforts, so this is something to consider when developing management measure suggestions.
- Gregg Dancho agreed that all six draft goals presented are important, and that each one will have a direct effect on the project. He noted that it is critical to make this a collaborative, larger group effort, in order to make clean up of the Brook an issue of community pride.
- When the examples of site specific concepts were presented Jon U. was interested in how the funding might work for a private property strategy given that there is always a concern with ownership and maintenance. It was also noted that a concept such as Bruce Boulevard would also be tricky in determining how to downsize a two-lane road to a one-lane.
    - David noted that these are always topics of concern.
- Joe Gresko suggested the idea of a "pilot location" for debris removal. This would be a site that is in proximity to a Harbor Watch sampling location, and hopefully debris removal efforts would show that extensive clean up could in fact improve water quality.
- Susan asked if the Southwest Conservation District was invited to participate in the effort.
    - Kelly confirmed that they had not been contact, and that they should be going forward.
- Next steps were discussed
    - It was agreed that at least one more advisory committee meeting should occur before circulating a draft report. If necessary, a second meeting can be scheduled before report circulation to the committee.
    - Time remaining on the grant was also discussed. Susan noted that there is in fact time remaining on the grant, and that the initial Winter 2024 deadline is somewhat flexible.

Meeting Minutes – Advisory Committee
Bruce Brook Watershed Based Plan

Date: April 16, 2024
Time: 9:00 to 10:00 am
Location: Virtual

Attendees			
Kelly Kerrigan	Environmental Conservation Superintendent Town of Stratford	Anthony Paoletto	
David Murphy	Resilient Land and Water	Nikki Spiller	Director of Harbor Watch
Victoria Vetre	Resilient Land and Water	Lauren Mappa	Bridgeport WPCA
Susan Peterson	CT DEEP	Susmitha Attota	Planner, Town of Stratford
Chadwick Schroeder	Sustainability Manager City of Bridgeport	Alivia Coleman	Stratford Health Department
Joseph Gresko	State Representative for the 121st District	Greg Dancho	Chair of Stratford Conservation Commission
Cathey Fletcher	Planner, City of Bridgeport	Chris Sullivan	Director SW Conservation District
William Lucey	Long Island Soundkeeper, Save the Sound	John Casey	Town Engineer, Town of Stratford
		John Urquidi	City Engineer, City of Bridgeport

David and Victoria presented slides on the following agenda Items:

- Report from NEIWPCC NPS Conference
- Recap of Technical Findings to Date
- Where We Need Help
    - Review of Site-Specific Actions
    - Review of Watershed-Wide Actions
- Next Steps
- Open Discussion

Open Discussion:

- In response to the portion of the presentation about focusing actions on specific properties, Bill Lucey asked if the plan would address private properties located along the stream. He noted there has been a push to develop mandatory setbacks/riparian buffers in the current spring 2024 legislative session. If not, could this be part of the report, e.g. a buffer or overlay or sorts.
    - David noted that specific recommendations have not been developed for the single-family residential properties, which is a good majority of the watershed along the stream, but the has been identified for public parcels/parks. David explained why

residential properties may be tough to target for projects. Watershed-wide policy and education recommendations may need to target single-family residential properties.
    - Kelly noted this challenge could result in a policy to come out of the plan, such as more stringent policy recommendations for improving stream buffers in the future when residents and property owners request permits or approvals for other kinds of actions.
    - Susan recommended reviewing the CLEAR data for riparian buffers as this may be a helpful tool.
    - Chris recommended developing recommendations and perhaps including concepts depicting what residential property owners can do on their own property to help manage stormwater and streambanks, rather than targeting specific parcels.
    - Overlays were generally identified as a way to accomplish much of the above. The plan could suggest the boundaries of this overlay or use a typical width.

David then reviewed the site-specific action excel sheet

- **Subsheds 9 & 8**
    - Kelly recommended tapping into economic development team to determine interest on participation from commercial property owners.
    - Chris mentioned taking this list to stakeholders to help prioritize actions, as he experienced with the Farm River Watershed Based Plan.
    - Joe Gresko mentioned the town is in the final stages of taking over the Ella Grasso property so there is a small window to make property specific recommendations.
    - Bill recommends a column that has sq footage of DCIA to help prioritize these properties and projects. He suggested that MS4 actions could also be noted in the matrix.
    - Susan reminded attendees that this watershed based plan process is complicated relative to MS4 and the nonpoint issues; with the nonpoint source funding, this plan should focus on voluntary actions rather than those required under the MS4. One recent example includes working with the property owners to determine implementable actions on their own property.
    - Bill mentioned the statewide stormwater and erosion control guidelines have finally been made effective in spring 2024, and the stormwater retention volume increased from capturing one inch to capturing 1.3 inches.
- **Subsheds 6 & 7**
    - It was suggested to use a term other than “waterfowl elimination”, such as “waterfowl management”. David acknowledged that the team did not intend for this to sound like a broad eradication across all species.
    - Use term other than “debris” to describe large trash in stream. This may be confusing with large woody debris that provides habitat. David noted that the true concern in this context was human-made debris and explained that the plan will be in favor of natural woody debris.
    - Kelly mentioned that the Quail Street property is used often by kids on ATVs and dirt bikes, and there has been a historic challenge with exposed soils. The plan could help suggest ways to stabilize soils.
    - Chris described a success story of a rain garden at a school where the teachers used the rain garden for educational purposes, and students helped with weeding and

maintenance at times. David noted that there was room for some diversity of approaches in this plan, with the Second Hill Lane School and Bunnell High School located in different positions relative to the stream and serving different age groups.

- **Subsheds 5 & 4**
    - Bill mentioned looking at using DEEP money to purchase conservation easements for riparian buffers/access.
- **Subsheds 3 & 2**
    - A recent tree planting project occurred at Clover Park; maybe this could be extended to other efforts at the park.
    - Susan mentioned the DEEP Forestry Division has received money to help distressed communities with tree plantings.
- **Subshed 1**
    - Joe believes there would be little pushback on the Bruce Boulevard project if flood-related benefits occurred. Years ago, the business owners brought flood concerns to Joe's attention.
    - Susan suggested reaching out to the City of New Haven as they have recently implemented multiple green infrastructure actions.
    - John Casey asked if funding would be available for an acquisition, specifically referencing the Sage Avenue property. David noted that a combination of FEMA funds and other sources could be pursued. David asked if the property was mostly in Bridgeport, and John noted that part of the property was in Stratford.
    - Bill questioned who funded the recent property acquisitions in West Haven. It was confirmed this was NRCS; and use of NRCS was a somewhat unique funding opportunity.

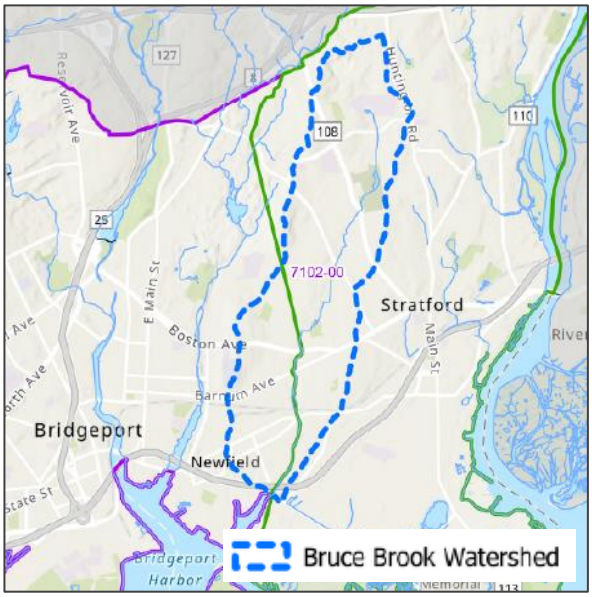
Town of Stratford

Bruce Brook Watershed Based Plan

Informational Meeting

September 12, 2023

6:00 PM Town of Stratford Town Hall, Town Council Chambers



The Town of Stratford is in the early stages of developing the Bruce Brook Watershed Based Plan. This plan will help to identify **water quality challenges** and describe management measures that may be implemented to improve **water quality**.

To learn more about the plan and the planning process, please join us at the informational meeting or visit the site below.

https://tinyurl.com/BruceBrookWBP

To learn more, please visit the informational website where you can participate in a survey or share your concerns

Any individual with a disability who needs special assistance to participate in the meeting should contact the ADA Coordinator at 203-385-4020 or 203-385-4022 (TDD) 5 days before the meeting, if possible.

Meeting Minutes – Public Informational Meeting
Bruce Brook Watershed Based Plan

Date: September 12, 2023
Time: 6:00 to 7:00 pm
Location: Town of Stratford, Town Council Chambers

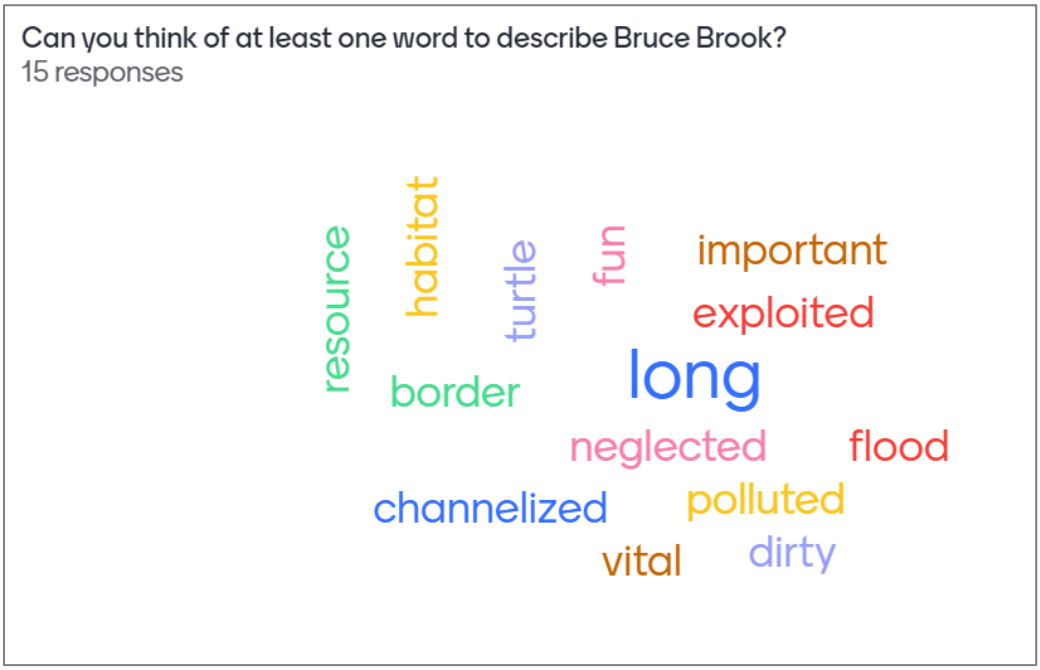
Attendees			
Kelly Kerrigan	Environmental Conservation Superintendent Town of Stratford	Alivia Coleman	Stratford Health Dept.
David Murphy	Resilient Land and Water	Donna Wells	Community Member
Victoria Vetre	Resilient Land and Water	Joseph DiMenno	Conservation Commission
Karen Rodia	Conservation Commission	Gregg Dancho	Conservation Commission
Jason Ruiz		Rich Fredette	Blight Officer
Linda Palermo		David Chess	Wetlands Commission
Laura Dancho	State Representative	Joe Gresko	State Representative
Lauren Mappa	Bridgeport WPCA	David Margonis	
Joe Koripsky	Conservation Commission	Susmith Attota	Stratford Town Planner

David and Victoria presented slides on the following agenda Items:

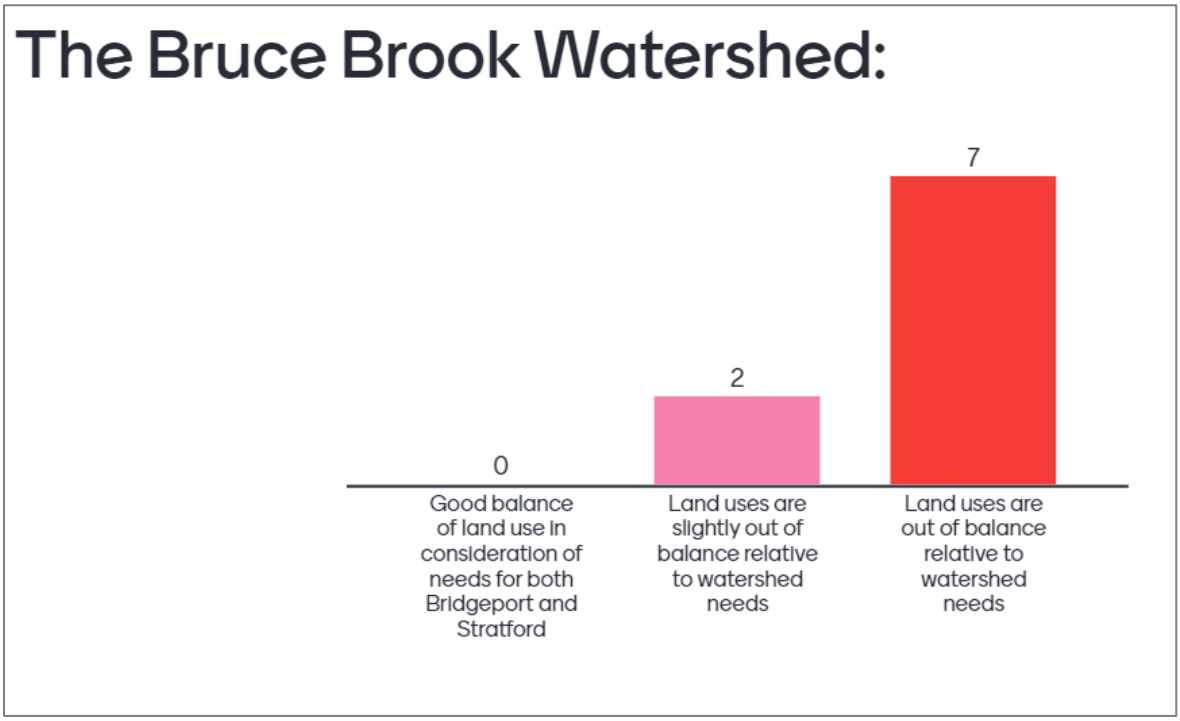
1. Bruce Brook Watershed
2. What is a Watershed Based Plan (WBP)
3. Why does Bruce Brook Watershed need one?
4. The planning process

Throughout the presentation Mentimeter was used to poll attendees on various topics. The following are the questions and results of the polls. In cases where participants chose “other” as the option, David asked participants to verbally elaborate by opening the floor to all attendees.

Question one asked participants to think of words that they thought best described Bruce Brook. The word “fun” was a test of Mentimeter and is not a true public response.

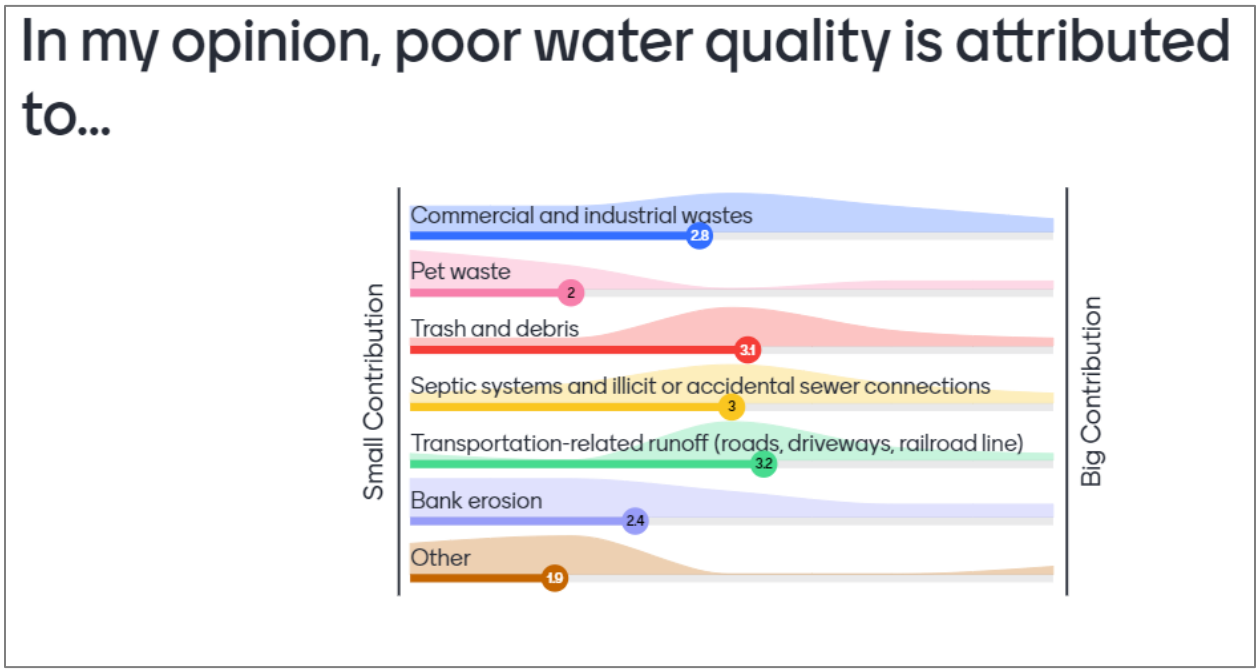


Question two asked participants to choose how balanced they believed land use currently is throughout the watershed. One attendee not participating in Mentimeter noted they felt option number three, “Land uses are out of balance relative to watershed needs”, best represented their opinion.



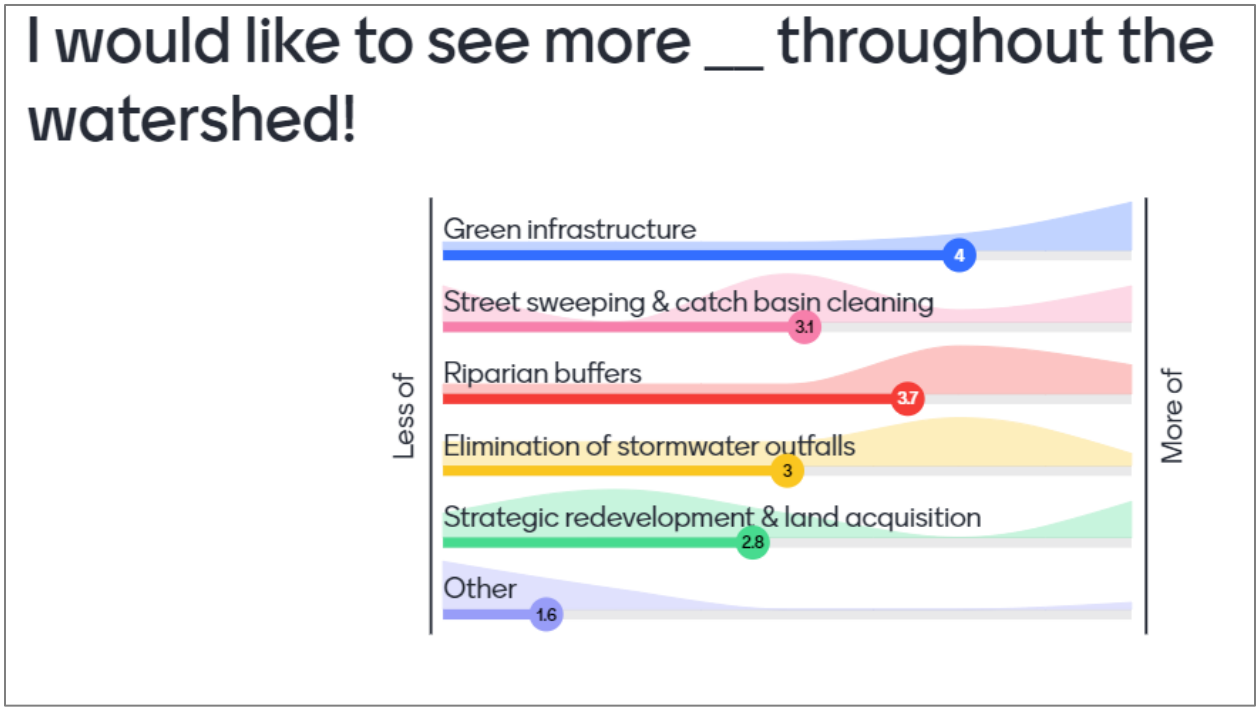
Question three asked attendees to rank potential sources of impairment based on how much they believed each contributed to poor water quality. Several attendees chose “other” and expressed the following concerns:

- Neglect and poor maintenance along the stream.
- Lack of natural stream bottom.
- Runoff from adjacent lawns.
- In the past, the cemetery dumped flowers from funerals and other services into the stream. While this likely no longer occurs, there may be a lingering impact.
- Pesticides and trash.
- Vegetation needs to be maintained along the stream.



Question four then asked attendees what types of potential management strategies they would like to see more of throughout the watershed. One attendee not using Mentimeter noted she would like to see more of all of the options. Other attendees provided the following additional details:

- The City of Bridgeport is currently looking to locate illegal and unlawful stormwater hookups. This may be something to think about for the rest of the watershed.
- Daylight (make visible by removing from conduits) some areas of the stream.
- There is a need for more education and outreach directed to the property owners who also own parts of Bruce Brook. This could potentially look like a public and private partnership, or more graphics and signage to educate and raise awareness.



At the end of presentation, the floor was open for discussion and questions.

- One attendee asked how the assessment of pollutant loads was being done, implying that some water quality testing would be helpful.
    - David explained that desktop analysis is being done in conjunction with industry standard figures accepted by the EPA and Connecticut DEEP. These figures account for pollutant loads associated with specific practices and land use types. Harbor Watch is also conducting water sampling this year in addition to years past. This data will be used to validate the pollutant loading analysis and, more broadly, to develop the plan.
- Another attendee asked if, once the plan is complete and recommendations are assembled, to what extent will Bruce Brook be cleared of debris?
    - A brief discussion ensued to help clarify what "clear" means in this context, as the clearing of desirable vegetation would not be warranted. This type of action, clearing and cleaning the stream, will likely be included in the management strategies recommended, however, the implementation will be dependent on Town and City capacities and grant eligibility.
- An attendee inquired about the grant to develop this project, and asked how much of the grant is allocated for outreach and engagement?
    - Kelly explained that the Town was awarded $115,000, with $25,000 of that being allocated to Harbor Watch for water sampling, and the remainer to Resilient Land and Water for analysis and the plan development. The exact figure for outreach was unknown at the time of the meeting, however, the scope includes meetings with the Stratford Conservation Commission, public informational meetings, and sustained engagement efforts like the ESRI StoryMap and surveys.

- Attendees asked if the Town might apply for grants after the development of the plan?
    - Kelly noted that applying for grants to implement strategies is very likely. The WBP will lay out a framework that links recommended management practices and suitable grant opportunities.
- An attendees asked if this watershed plan can or should be used by the Conservation Commission to help with land use planning and policy decisions?
    - David and Kelly explained that this is better assessed on a case-by-case basis, as some goals will be policy-based and some will be education-based, whereas many will be for specific projects that may benefit the watershed. This plan can be used to support various watershed goals and land use changes in the future given that those changes could support improved water quality and watershed health goals.
- In response to one of the slides, an attendee asked if updated aerial imagery and data be included in the plan versus the images shown during the presentation from 1934 and 1965.
    - David and Victoria explained that the most up to date data and imagery will be used in the plan. These graphics were presented tonight to display how rapidly the watershed developed in the just a few decades.

Town of Stratford

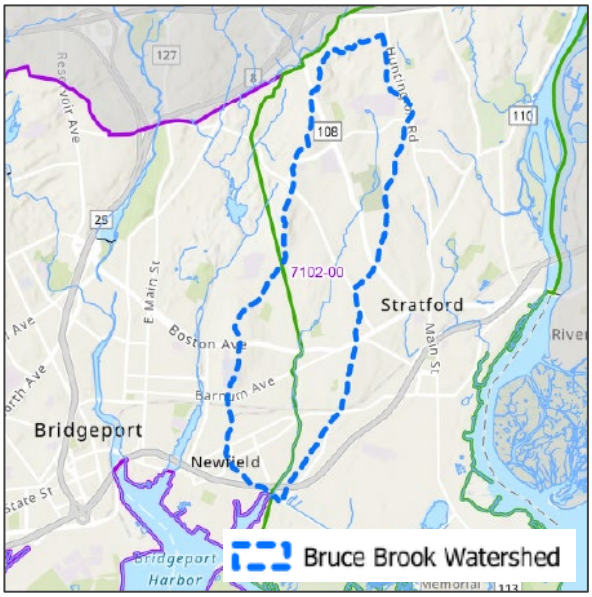
Bruce Brook Watershed Based Plan

Informational Meeting

November 2, 2023

6:00 PM Edison Elementary School

115 Boston Terrace, Bridgeport



The Town of Stratford is working with City of Bridgeport to develop the Bruce Brook Watershed Based Plan. This plan will help to identify **water quality challenges** and describe management measures that may be implemented to improve **water quality**.

To learn more about the plan and the planning process, please join us at the informational meeting or visit the site below.

https://tinyurl.com/BruceBrookWBP

To learn more, please visit the informational website where you can participate in a survey or share your concerns

Any individual with a disability who needs special assistance to participate in the meeting should contact the ADA Coordinator at 203-385-4020 or 203-385-4022 (TDD) 5 days before the meeting, if possible.

Meeting Minutes – Public Informational Meeting
Bruce Brook Watershed Based Plan

Date: November 2, 2023
Time: 6:00 to 7:00 pm
Location: Edison School, City of Bridgeport

Attendees			
David Murphy	Resilient Land and Water	David Margonis	Stratford Resident
Victoria Vetre	Resilient Land and Water	Josh Randall	Resident
Chadwick Schroeder	City of Bridgeport Sustainability Manager	Rene Gibson	Resident
Susan Peterson	CT DEEP	Joe Gresko	State Rep/Stratford West End Resident
Nikki Spiller	Harbor Watch	Almariet Roberts	Groundwork Bridgeport
Tom Galatie	Resident		

A public information meeting was held at the margin of the Bruce Brook watershed in Bridgeport. This meeting was available to people who had attended the previous public meeting, as well as additional interested citizens and stakeholders who had not yet been able to participate.

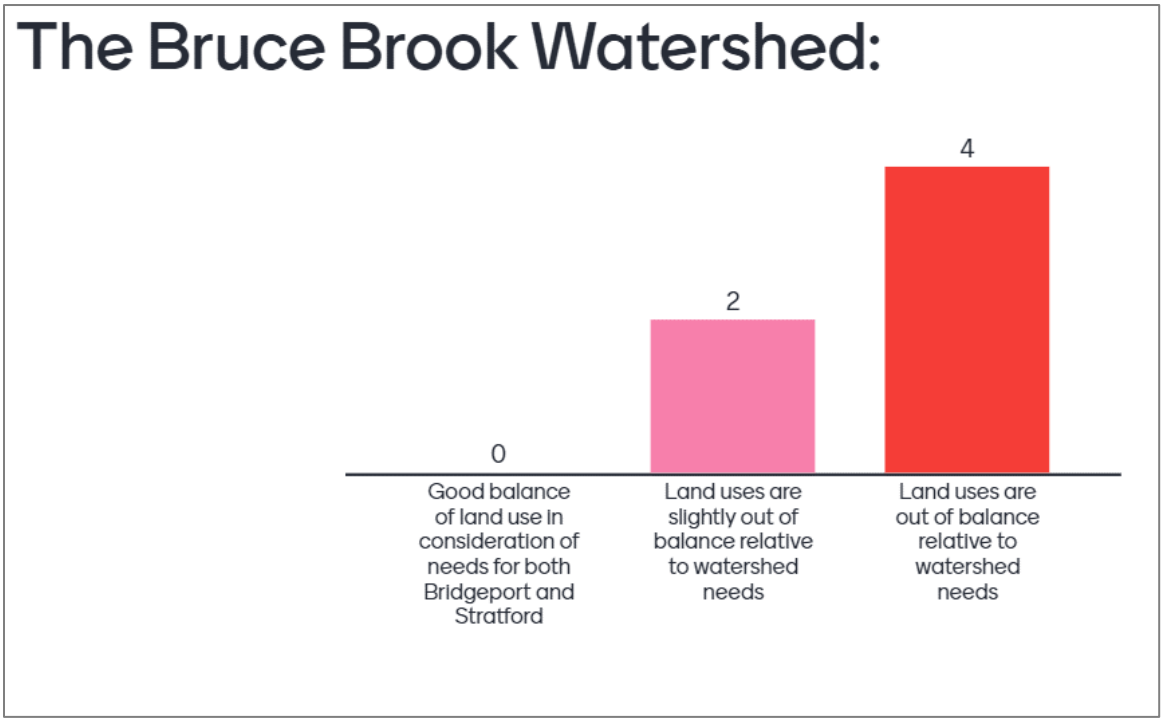
David and Victoria presented slides on the following agenda Items:

1. Bruce Brook Watershed
2. What is a Watershed Based Plan (WBP)
3. Why does Bruce Brook Watershed need one?
4. The planning process

Throughout the presentation Mentimeter was used to poll attendees on various topics. One attendee participated via a paper survey. The following are the questions and results of the polls.

Question one asked participants to think of words that they thought best described Bruce Brook. The paper survey was noted with the phrase “not maintained”.

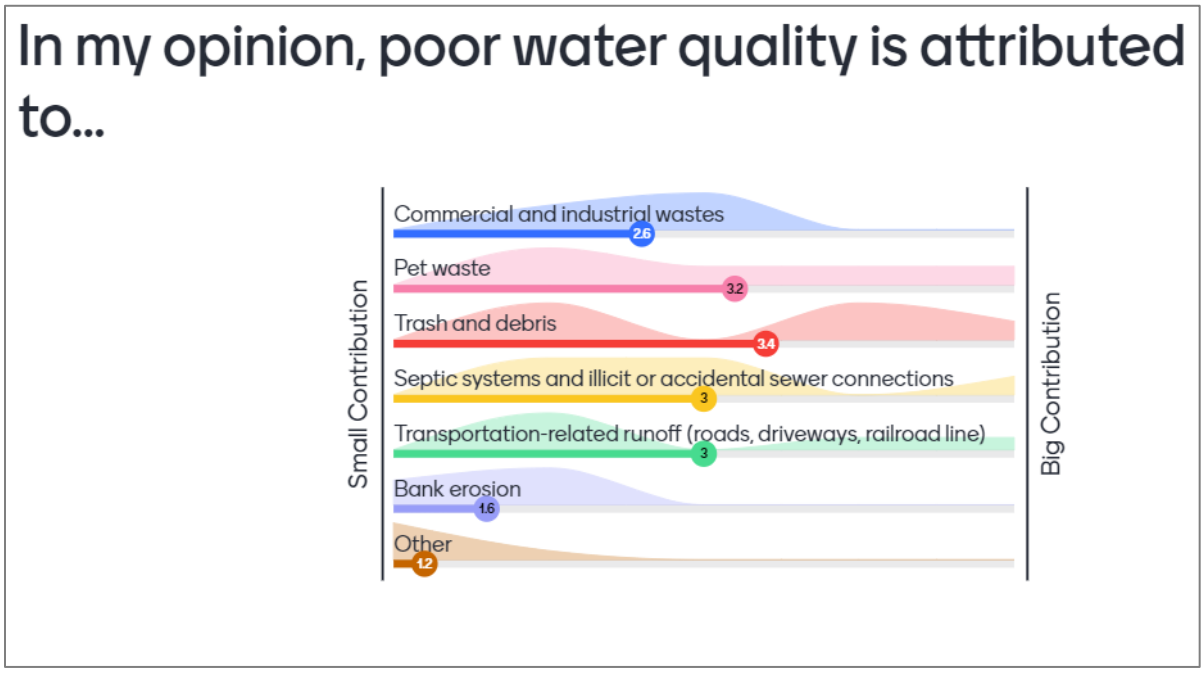
Question two asked participants to choose how balanced they felt land use currently is throughout the watershed. One attendee not participating in Mentimeter noted they felt option number three, “Land uses are out of balance relative to watershed needs”, be represented their opinion.



Question three asked attendees to rank potential sources of impairment based on how much they felt each contributed to poor water quality. The attendee not using Mentimeter noted the following.

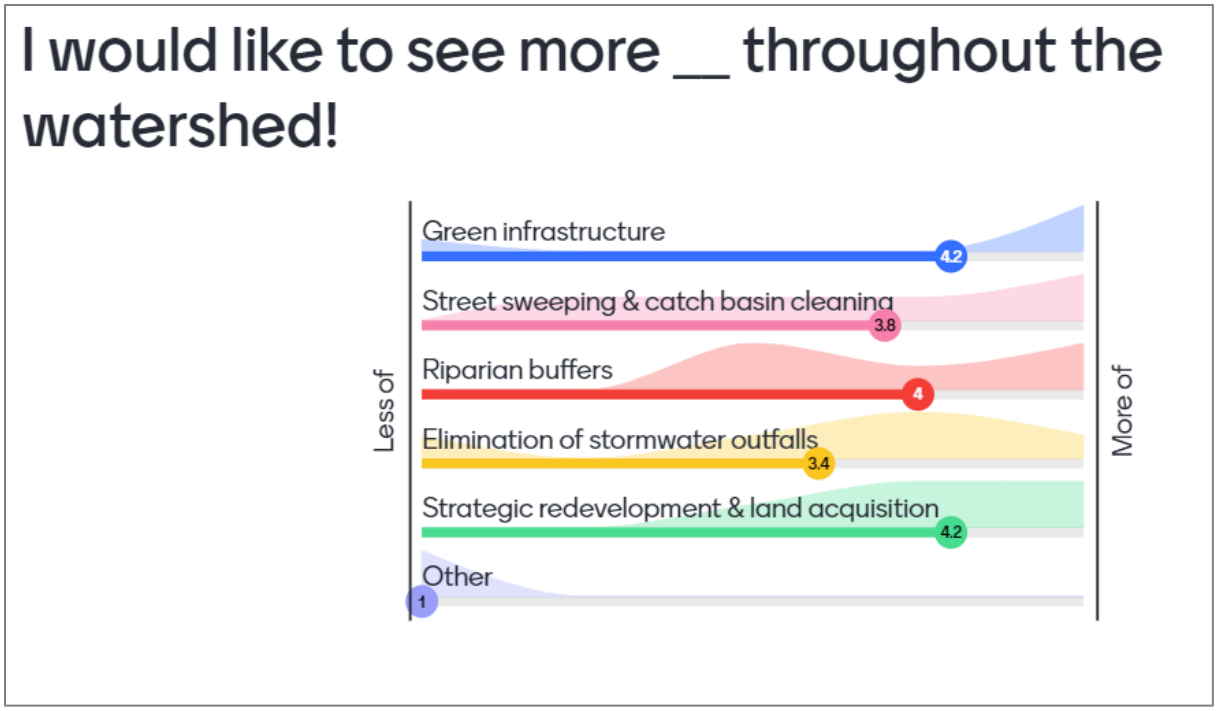
- Commercial and industrial waste = 2
- Pet waste = 2
- Trash and debris = 5
- Septic Systems/illicit/accidental sewer connections = 4
- Transportation related = 4
- Bank erosion = 4

One attendee noted that “other” could include a lack of education.



Question four then asked attendees what types of potential management strategies they would like to see more of throughout the watershed. One attendee not using Mentimeter noted the following:

- Green infrastructure = 5
- Street sweeping/catch basin cleaning = 5
- Riparian buffers = 5
- Elimination of outfalls = 4
- Strategic redevelopment and land acquisition = 3



At the end of presentation, the floor was open for discussion and questions.

- Several attendees inquired about the responsibility for education of proper pet waste disposal. Most attendees agreed that pet waste disposal is a large challenge in the watershed.
    - This is not entirely clear and there is likely not a single municipal staff member responsible for this. Chadwick noted that from the City of Bridgeport this may be someone from public works or could be addressed through the typical channels for logging complaints.
- An attendee asked if sewer connections and combined sewer overflows were major issues in the watershed.
    - Overall, attendees acknowledged that some progress with combined sewers has been made over the last few decades.
    - It was noted that the WPCA uses drone technology to locate and seal off any sewer connections in the City's stormwater system.
    - Per the drainage system GIS data received from the Town and City, it did not appear that many connections between sewer and stormwater systems were present throughout the watershed area.
    - Discussion was also had on the challenges of what happens to a property if an illicit hookup is sealed off and who is responsible for hooking into the sewer system.
- One attendee asked if there has been any consideration to restoring or installing a natural bottom along the Bruce Brook.
    - David and Victoria noted that during the stream walk, a somewhat natural bottom was noted in some of the channelized sections where concrete was not present and even in

some locations where concrete was present in the stream bed. This is an option that could be evaluated for other locations.
    - Discussion occurred about whether a natural stream bed could help with water quality.
- An attendee asked if coordination with John Casey's office (regarding channel modifications) was going to occur, and David confirmed that this is ongoing.
- Several attendees asked who is responsible for cleaning debris/jams; this was noted specifically in context of the large debris jam noted in the vicinity of the cemetery, but a larger discussion about trash occurred throughout the meeting as well.
    - Attendees discussed trash removal needs throughout the watershed, and briefly touched on this issue being directly related to water quality but also somewhat distinct from water quality as a separate need.
    - Unfortunately, there has not been a clear distinction about who is responsible for larger debris, and these are conversations that need to occur. Woody debris can be beneficial and not all of it is problematic.
    - Nikki (Harbor Watch) shared that there are ongoing conversations surrounding issues of clearing, including who is responsible for cleanup and how this might occur. Harbor Watch is exploring the possibility of installing trash nets along the stream to collect trash and debris flowing downstream at certain locations.
    - Joe posed a hypothetical situation wherein the Town and the City could use emergency declaration capabilities to enable the removal of trash and debris from Bruce Brook without the constraints related to watercourse permitting. The target area would be along the cemetery. One question from Joe was whether the near-term removal of trash would impede data collection or plan development; David noted that this would not be a concern, and trash removal could occur in parallel from the plan development process.
- In addition to the specific topics above, attendees inquired about the condition of Bruce Brook in several locations such as the headwaters, Wooster Park (the presence of geese), the channelized sections, Bruce Pond (general condition), and the cemetery (trash and debris). David and Victoria responded as appropriate. Attendees noted that fish were present in some surprising locations, especially where pools and cover were present.

Meeting Minutes – Public Informational Meeting on Draft Plan
Bruce Brook Watershed Based Plan

Date: July 14, 2025
Time: 5:00 to 6:00 pm
Location: Town of Stratford, Town Council Chambers

David and Victoria of the Resilient Land and Water consulting team presented slides on the draft Watershed Based Plan with the following agenda Items:

1. Bruce Brook Watershed
2. What is a Watershed Based Plan (WBP)
3. What does the Bruce Brook WBP tell us?
4. Plan Recommendations
    a. Watershed-wide actions
    b. Site specific actions
    c. Big ideas
5. Next steps

Throughout the presentation, and at the conclusions, attendees asked questions and commented on various aspects of the Brook and the plan. These included:

- Joe Gresko asked if the Bridgeport WPCA drone work had helped address illicit discharges and Victoria described some of the observations related to bacteria.
- Joe Koripsky, of the Stratford Inland Wetlands Commission (IWC) asked if untreated sewage was flowing into Bruce Brook. Victoria responded that this was not something that would have been determined through the nature of the observations.
- Joe K. explained that he had a history of observing Bruce Brook since his childhood, and he remembers drums of oil being dumped as well as other past actions. He recently developed a summary of points from the watershed based plan.
- An attendee described stormwater retention or detention techniques used in New Haven on City land, and recommended the same kind of approach could be used in Stratford.
- Joe responded to comments during the presentation that fish and wildlife habitats were present, noting that turtles were observed on the basketball hoop caught in Bruce Brook.
- Joe raised the topic of volunteers clearing debris and trash from Bruce Brook, and a discussion about appropriate precautions ensued. Many attendees offered ideas about stream corridor cleanup. The idea of an emergency declaration – previously raised in public meetings related to Bruce Brook – was discussed. David and Victoria explained that Health Department and Town Management would be needed for such decisions, however it was not recommended that this be organized solely by volunteers without professional consultation. It may be possible for streamside vegetation to be removed by volunteers with fewer logistical challengers, because this work could be done from land.

- Attendees asked if concrete walls cannot be removed, are some locations feasible for at least replacing the streambed with natural material. Victoria noted that this is discussed in the plan, and that a map also presents the varying streambank and streambed characteristics.
- An attendee asked for clarification regarding the benefits of the projects at Clover Field. David provided a summary of some of the potential benefits and noted that field space did not need to be lost.
- Joe asked about funding for next steps. Molly, a Town of Stratford employee, responded that grants would be secured for projects that resulted from the watershed based plan. As example is the upcoming Stonybrook Park vegetation management project.

APPENDIX B. BRUCE BROOK TMDL AS DEVELOPED BY CT DEEP

Bruce Brook

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Bruce Brook watershed covers an area of approximately 2,199 acres in the southwestern portion of Connecticut (Figure 1). There are two municipalities located in the watershed, including the Town of Stratford and the City of Bridgeport, CT.

The Bruce Brook watershed includes one segment impaired for recreation due to elevated bacteria levels (CT7102-00_02). 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 were currently unassessed 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 waterbodies in the watershed (CT DEEP, 2010).

Bruce Brook begins north of Route 108 in Stratford. The bacteria impaired segment of Bruce Brook (CT7102-00_02) begins at the town line of Bridgeport and Stratford at Barnum Avenue and consists of 0.22 miles of the brook (Figures 2 and 5). This segment flows southerly through a developed area parallel to West Avenue and ends at the inlet to Bruce Pond. Bruce Brook continues southerly through the outlet of Bruce Pond, crosses Route 130 and Interstate 95, and flows to its outlet at Bridgeport Harbor.

The impaired segment of Bruce Brook has a water quality classification of B. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in this segment of Bruce Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segment: Bruce Brook (CT7102-00_02)

Municipalities: Stratford and Bridgeport

Impaired Segment Length (miles): 0.22

Water Quality Classifications: Class B

Designated Use Impairments: Recreation

Sub-regional Basin Name and Code: Bruce Brook, 7102

Regional Basin: Southwest Eastern

Major Basin: Southwest Coastal

Watershed Area (acres): 2,199

MS4 Applicable? Yes

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

Figure 1: Watershed location in Connecticut

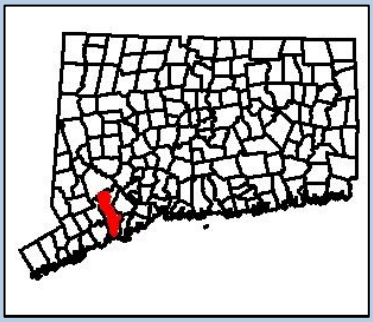
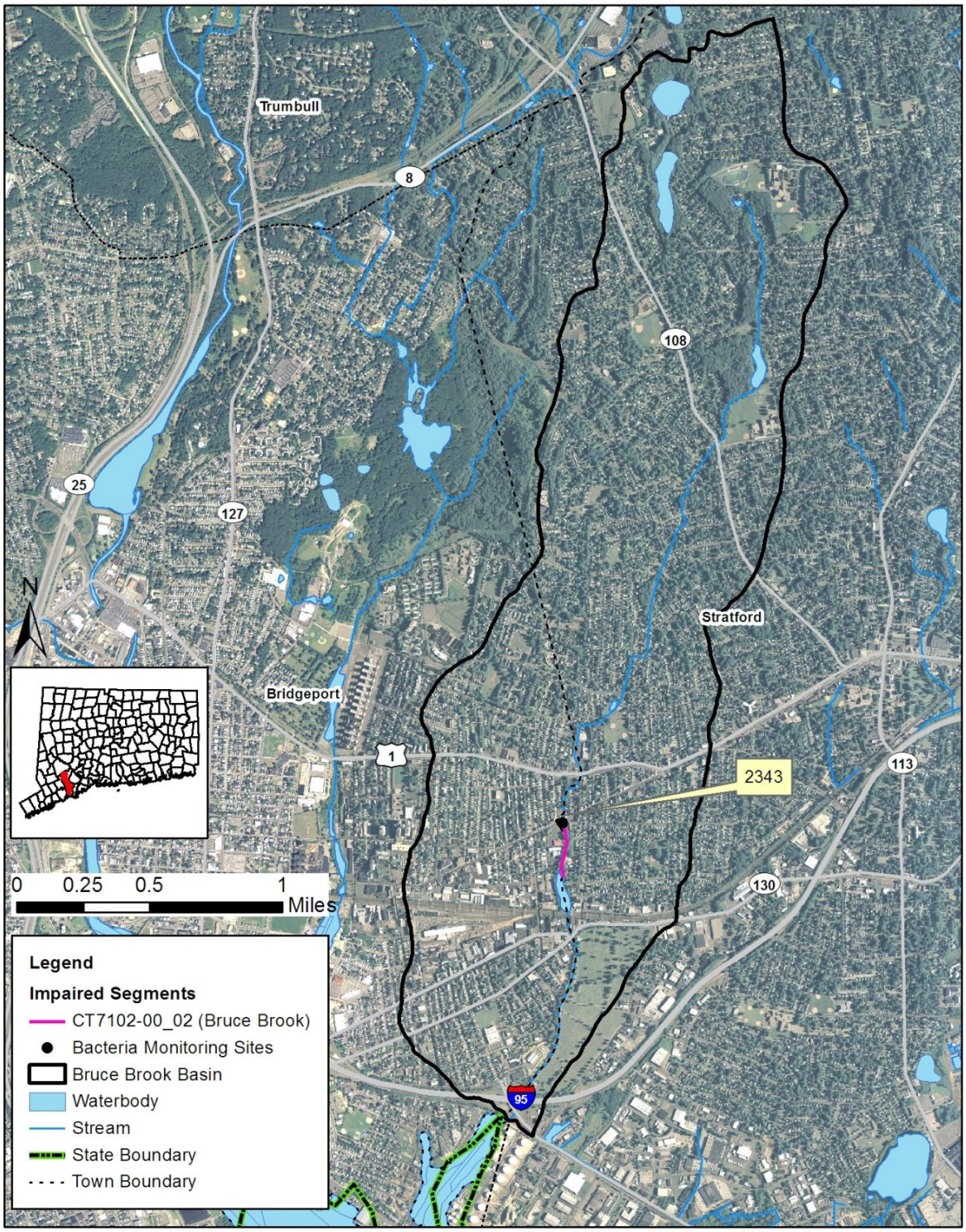


Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT7102-00_01	Bruce Brook (Bridgeport/Stratford)-01	Mouth on Bridgeport Harbor at Route 113 crossing, US to Bruce Pond outlet, just US of Stratford Avenue and RR crossings, Bridgeport/Stratford town line.	0.87	U	U	FULL
CT7102-00_02	Bruce Brook (Bridgeport/Stratford)-02	Inlet to Bruce Pond, US to Barnum Avenue crossing, Bridgeport/Stratford town line.	0.22	NOT	NOT	FULL
Shaded cells indicate impaired segment addressed in this TMDL **FULL= Designated Use Fully Supported** **NOT = Designated Use Not Supported** **U = Unassessed**						

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



Bacteria Impairments In The Bruce Brook Sub Regional Basin

Map Data: CT DEEP Map Created: July 2011

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 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 Bruce Brook watershed consists of 94% urban area, 5% forests, 1% water, and less than 1% agriculture. The majority of the watershed is developed, though small sections to the north are forested. By contrast, the middle and southern portions of the watershed are almost entirely developed (Figure 4).

Figure 3: Land use within the Bruce Brook watershed

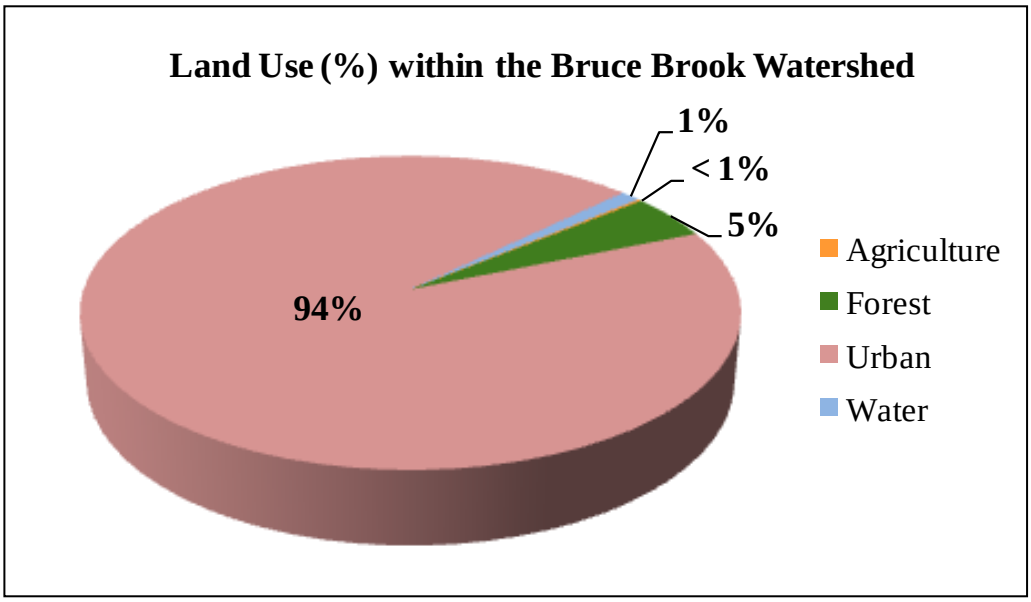
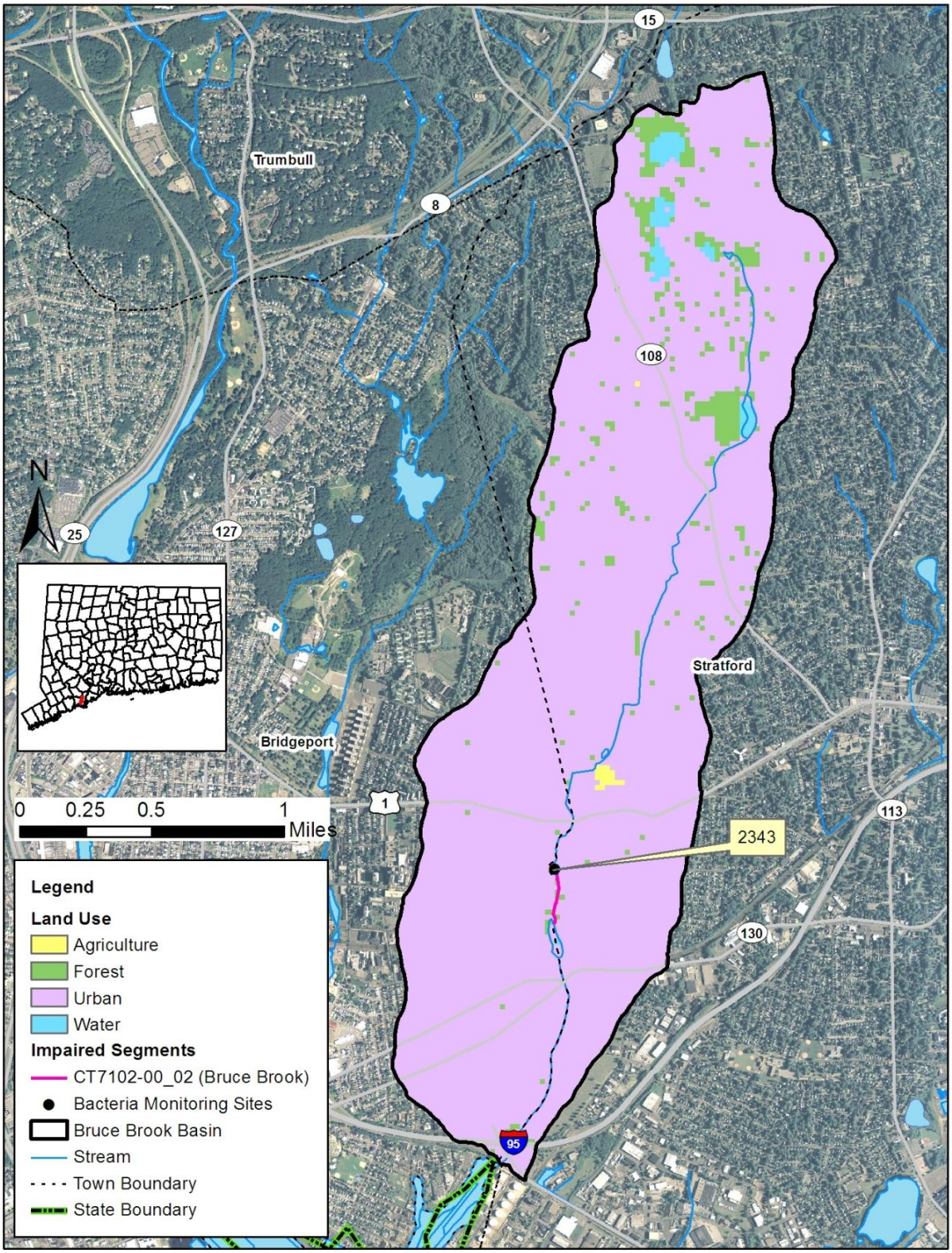


Figure 4: GIS map featuring land use for the Bruce Brook watershed at the sub-regional level



Land Use In The Bruce Brook Sub Regional Basin

Map Data: CT DEEP Map Created: July 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.

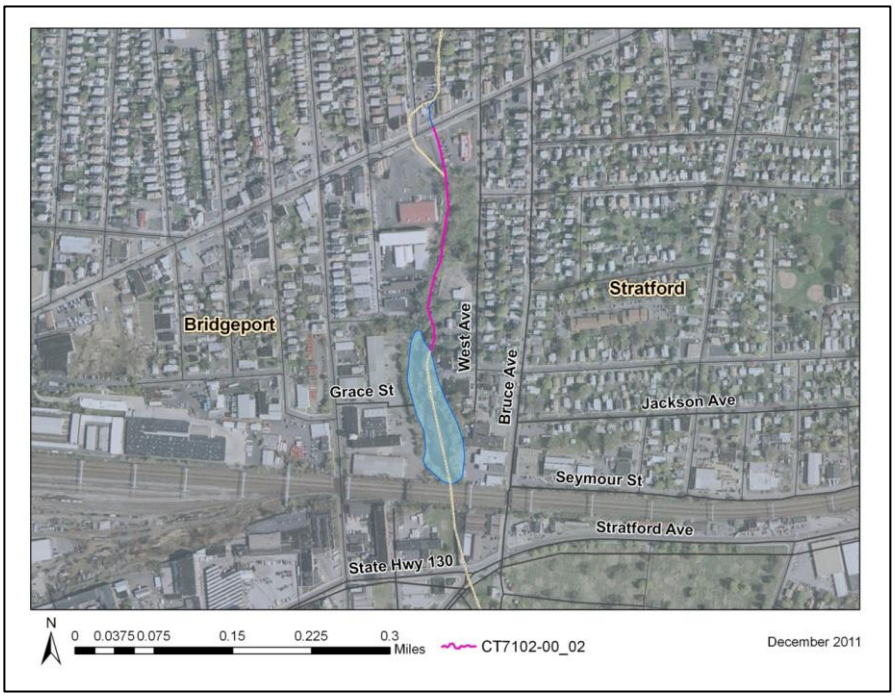
Table 2: Sampling station location description for the impaired segment in the Bruce Brook watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT7102-00_02	Bruce Brook	2343	McDonalds off Barnum Avenue	Bridgeport	41.189900	-73.155100

The impaired segment of Bruce Brook (CT7102-00_02) is a Class B freshwater river (Figure 5). Its applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location in 2007 and 2008 (Table 2). Water quality criteria for *E. coli*, along with bacteria sampling results from 2007 and 2008, are presented in Table 9. Single sample values for Station 2343 exceeded the WQS for *E. coli* on both sample dates.

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

Figure 5: Aerial map of Bruce Brook



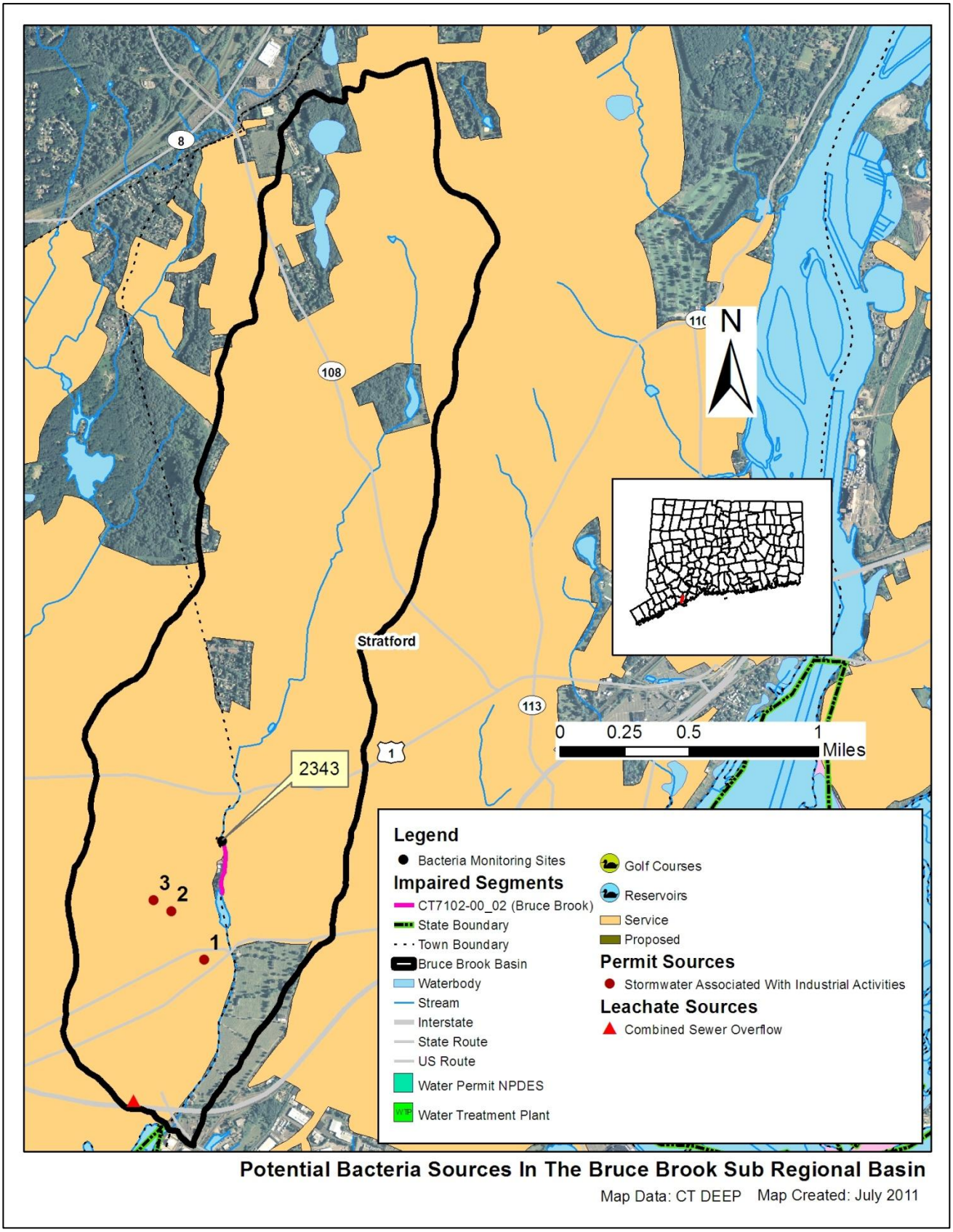
POTENTIAL BACTERIA SOURCES

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 Bruce Brook watershed based on land use (Figures 3 and 4) and a collection of local information for each of the waterbodies is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not mean that there are no data nor that there are no impairments in existence in the segment. 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 Bruce Brook watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/ SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Bruce Brook CT7102-00_02	x	x		x		x	x	

Figure 6: Potential sources in the Bruce 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. 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.

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	2
GSN	Stormwater Registration – Construction	0
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are five permitted discharges in the Bruce Brook watershed, though many of these discharges occur downstream of the impaired segment. 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 Bruce Brook watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Bridgeport	Bridgeport United Recycling, Inc.	GSI000514	Stormwater Associated With Industrial Activities	Bridgeport United Recycling, Inc.	2
Bridgeport	Reliable Plating & Polishing Co., Inc.	GSI000881	Stormwater Associated With Industrial Activities	Reliable Plating & Polishing Co., Inc.	1
Bridgeport	Greater Bridgeport Transit District	GSI001118	Stormwater Associated With Industrial Activities	Greater Bridgeport Transit District	3
Bridgeport	City of Bridgeport	GSM000017	Part B Municipal Stormwater MS4	City of Bridgeport	NA
Stratford	Town of Stratford	GSM000105	Part B Municipal Stormwater MS4	Town of Stratford	NA

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.

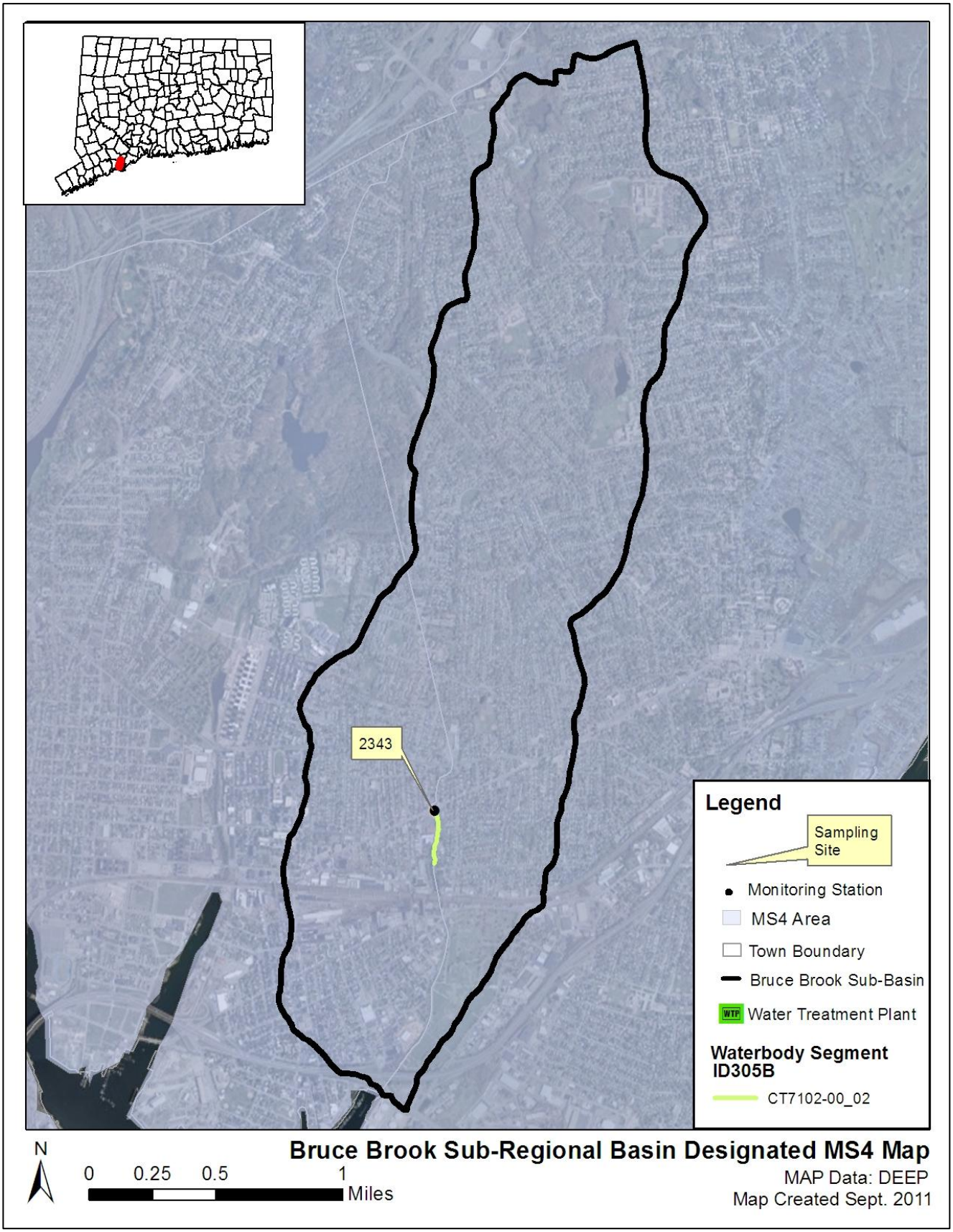
The Bruce Brook watershed is located within the Town of Stratford and the City of Bridgeport. Both municipalities have designated urban areas, as defined by the U.S. Census Bureau and are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. It would be beneficial for both municipalities to adjust their monitoring locations to target some spots within the Bruce Brook watershed. CT DEEP staff will provide assistance with monitoring locations if requested by the municipality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

One monitored outfall for the Bridgeport MS4 permit appears to be within the Bruce Brook watershed (Table 6). This outfall had multiple results over 1,000 colonies/100 mL of *E. coli*.

Table 6: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in Bruce Brook

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Bridgeport	Connecticut Avenue	Industrial	LIS	12/01/04	43
Bridgeport	Connecticut Avenue	Industrial	LIS	10/17/06	0
Bridgeport	Connecticut Avenue	Industrial	LIS	10/19/07	1,260
Bridgeport	Connecticut Avenue	Industrial	LIS	09/06/08	1,840
Bridgeport	Connecticut Avenue	Commercial	LIS	07/21/09	4,240
Bridgeport	Connecticut Avenue	Commercial	LIS	09/16/10	>4000
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Figure 7: MS4 areas of the Bruce Brook watershed



Non-point Sources

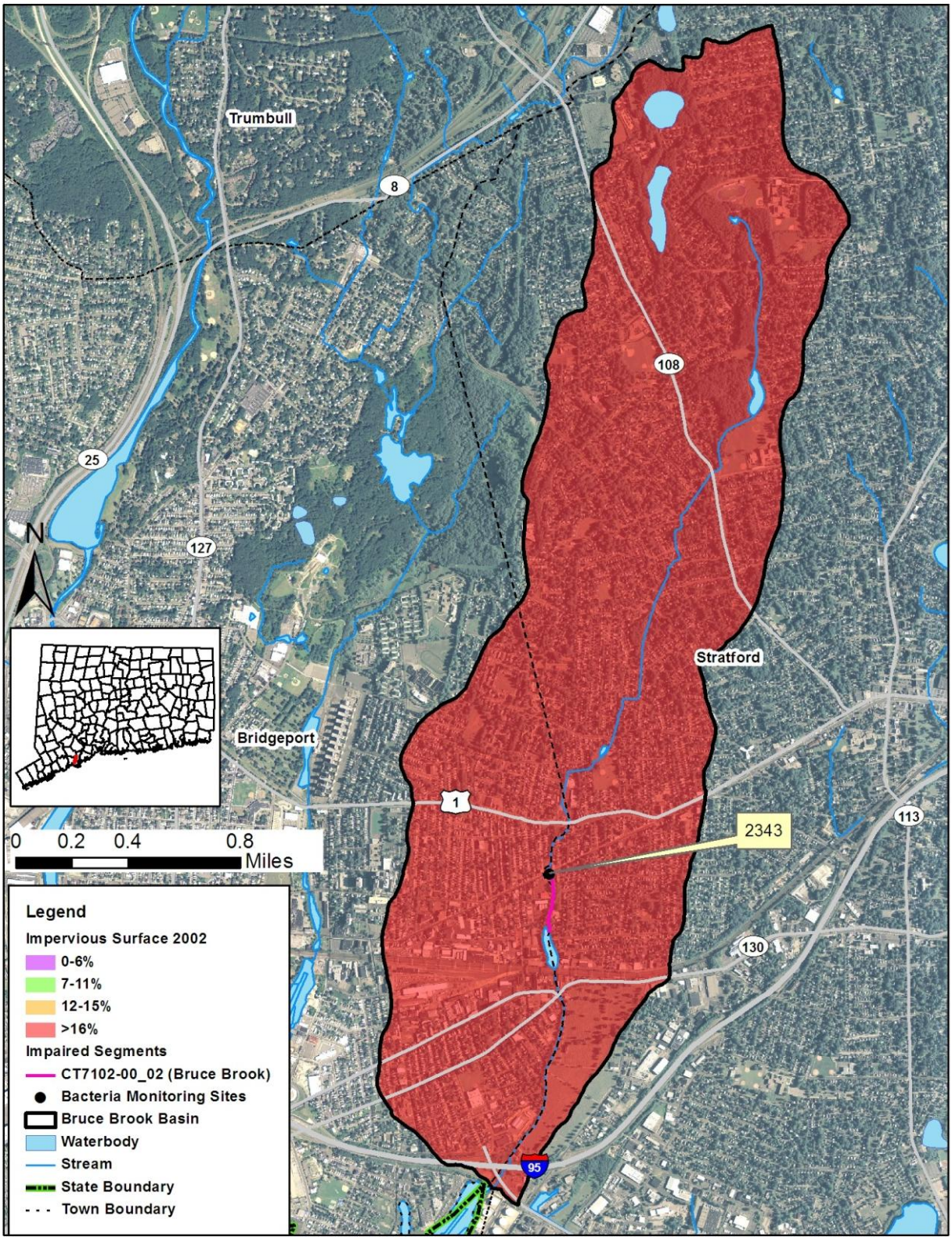
Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture,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

Stormwater Runoff from Developed Areas

Approximately 94% of the watershed is considered urban, and the entire watershed characterized by greater than 16% impervious surfaces (Figure 8). 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 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).

Water quality data were insufficient to calculate geometric means during dry and wet-weather, but single sample values were high, exceeding 24,000 colonies/ mL of *E. coli*. These high readings, in combination with the MS4 monitoring data, indicate that stormwater runoff is a likely source of bacteria to Bruce Brook.

Figure 8: Impervious cover (%) for the Bruce Brook sub-regional watershed



Impervious Surface In The Bruce Brook Sub Regional Basin

Map Data: CT DEEP Map Created: July 2011

Illicit Discharges and Insufficient Septic Systems

As shown in Figure 6, the majority of the Bruce Brook watershed, including the area around the impaired segment, relies on the municipal sanitary sewer system. Sewer system leaks and other illicit discharges can contribute bacteria to nearby surface waters.

A small portion of the watershed also relies on onsite wastewater treatment systems, such as septic systems. Properly managed septic systems and leach fields have the ability to effectively remove bacteria from waste. If systems are not maintained, bacteria will not be adequately treated and may result in bacteria reaching nearby surface and ground water. 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 Stratford (http://www.townofstratford.com/content/1302/402/615/default.aspx) and the City of Bridgeport (http://www.bridgeportct.gov) have full-time health directors.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Bruce Brook watershed represent another potential source of bacteria to the impaired waterbodies. Any elevated bacteria levels that are due solely to a natural population of wildlife are not subject to the WQS. Any exacerbation of wildlife population sizes or residency times influenced by human activities are subject to the CT WQS and TMDL provisions. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001).

Though only a small portion of the watershed is undeveloped, wildlife waste is a potential source of bacteria in the Bruce Brook watershed. Wildlife and waterfowl may congregate in parks such as Wooster Park and Veterans Park, located in the northern portions of the watershed. Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants. Waste from domestic animals such as dogs, may also be contributing to bacteria concentrations in the impaired segment in the Bruce Brook 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). Though agricultural land use occupies only less than 1% of the land use in the watershed, there is an agricultural operation upstream of the impaired segment of Bruce Brook, just north of US Route 1 (Figure 4). Agricultural runoff from this farm and others in the area is a potential source of bacteria to Bruce Brook.

Additional Sources

There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in the Bruce Brook watershed. Further monitoring and investigation will confirm 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

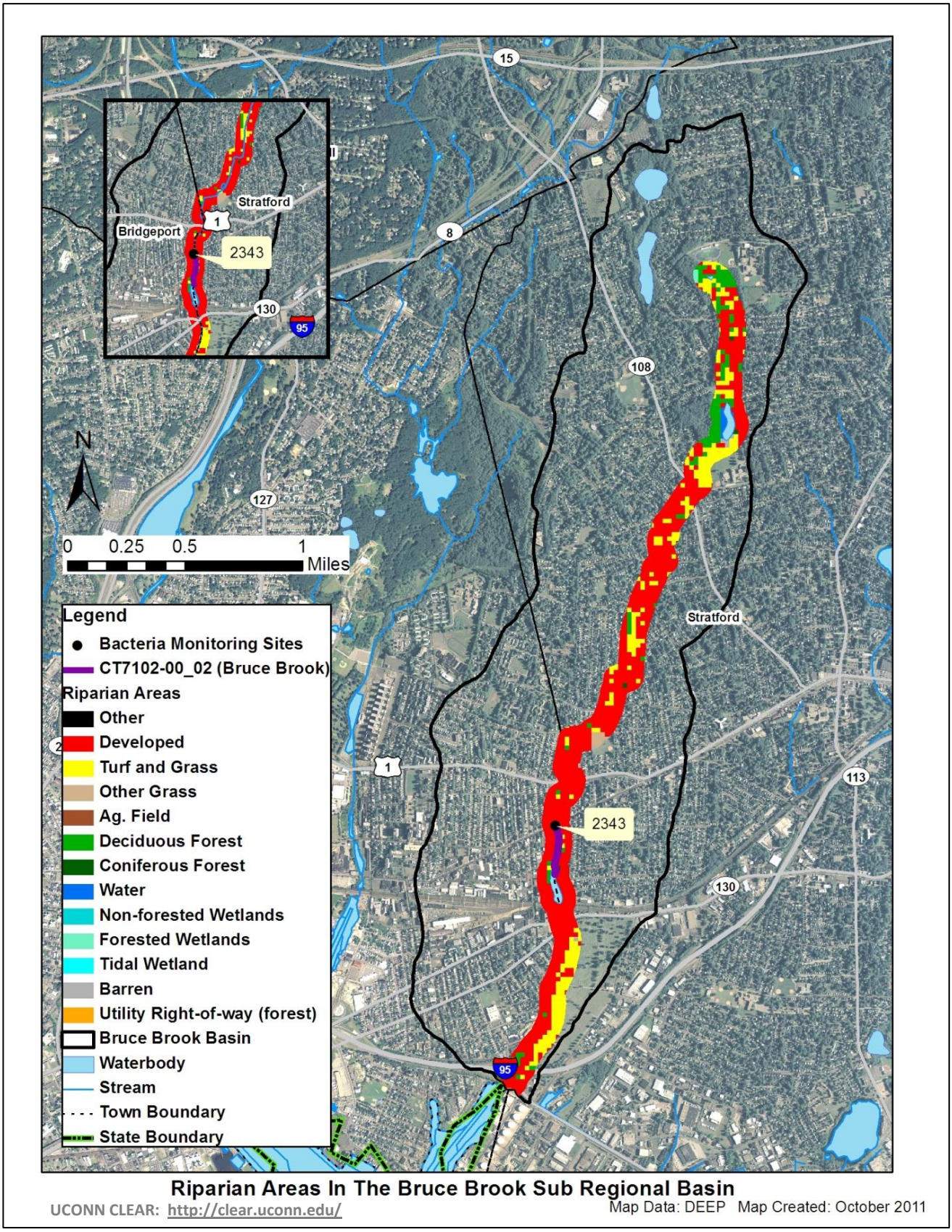
Riparian Buffer Zones

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 for the northern portion of the impaired segment of Bruce Brook are characterized by urban areas (Figure 9). Developed areas within the riparian zone likely contribute pollutants such as bacteria to the waterbody since the natural riparian buffer is not available to treat runoff.

Figure 9: Riparian buffer zone information for the Bruce Brook watershed



CURRENT MANAGEMENT ACTIVITIES

The municipalities within the Bruce Brook watershed have developed and implemented programs to protect water quality from bacterial contamination. As indicated previously, portions of the watershed in Stratford and Bridgeport are regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the state. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

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

Each town is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 7 and 8.

Table 7: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Bridgeport, CT (Permit # GSM000017)

Minimum Measure	Bridgeport Annual Report Update (2010)
Public Outreach and Education	1) MS4 information distributed in WPCA tax bill.
Public Involvement and Participation	1) Continued catch basin stenciling program.
Illicit Discharge Detection and Elimination	1) Mapped all 12” storm drains.
Construction Site Stormwater Runoff Control	1) Reviewed and updated all land use regulations to meet MS4 requirements.
Post Construction Stormwater management	1) Continued to develop long term maintenance program for BMPs.
Pollution Prevention and Good Housekeeping	1) All roads swept 6 times per year (minimum). 2) All catch basins and outfalls inspected and cleaned. 3) Identified sewer lines in need of repair and obtained funding to line 30,000 linear feet of sewer.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Stratford, CT (Permit # GSM000105)

Minimum Measure	Stratford Annual Report Update (2010)
Public Outreach and Education	1) Stormwater information distributed in public hallway information slots outside of Engineering and Building Departments. 2) A "Notice to Developers and Contractors" is attached to all zoning applications. 3) Received a grant for a stormwater stenciling program from LISFF. 4) Received a grant for training municipal employees. 5) Developed two educational brochures.
Public Involvement and Participation	1) Held a volunteer clean-up day (Project GreenSweep) every other year since 2005.
Illicit Discharge Detection and Elimination	1) Developed a base map of existing storm sewer system. 2) Approximately 30% of stormwater outfalls have been identified. 3) Conducted wet weather sampling at 6 locations during all permit years. 4) Drafted an IDDE/Stormwater ordinance that was not approved by the town council in 2010.
Construction Site Stormwater Runoff Control	1) Reviewed and revised zoning regulations to clarify and strengthen requirements for controlling stormwater runoff and maintaining effective erosion and sedimentation control measures.
Post Construction Stormwater management	1) Reviewed and revised zoning regulations to clarify and strengthen requirements for controlling stormwater runoff and maintaining effective erosion and sedimentation control measures.
Pollution Prevention and Good Housekeeping	1) Completed annual street sweeping. 2) Developed the Project First Impression to identify streets to sweep more regularly.

RECOMMENDED NEXT STEPS

Though the municipalities within the Bruce Brook watershed have developed and implemented programs to protect water quality from bacterial contamination, future mitigative activities are necessary to ensure the long-term protection of Bruce Brook and have been prioritized below.

1) Identify areas in the Bruce Brook watershed to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 94% of the Bruce Brook watershed is considered urban, and the municipalities within the Bruce Brook watershed are MS4 communities regulated by the MS4 program. The entire watershed has an impervious cover greater than 16%, and the impaired segment of Bruce Brook is located adjacent to a parking lot in a heavily urbanized area. As such, stormwater runoff is likely contributing bacteria to Bruce Brook.

To identify specific areas that are contributing bacteria to the impaired segments, Stratford and Bridgeport should conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segment of Bruce Brook watershed. To treat stormwater runoff, all watershed towns should identify areas along the brook 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.

2) Continue monitoring of permitted sources.

Previous sampling has shown high levels of bacteria in Bruce 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 9 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 Bruce 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 9. Bacteria (e.coli) TMDLS, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	**1**	**2**	**3**	**1**	**2**	**3**	**All**	**All**
B[4]	Non-Stormwater NPDES	235	410	576				126	
	CSOs	235	410	576				126	
	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.

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

Most of the Bruce Brook watershed relies on a municipal sewer system (Figure 6). It is important for Bridgeport and Stratford to develop a program to evaluate its sanitary sewer system and reduce leaks and overflows. This program should include periodic inspections of the sewer line.

4) Develop a system to monitor septic systems.

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

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

Any education and outreach program in the watershed should highlight the importance of not feeding waterfowl and wildlife and managing waste from horses, dogs, and other pets. The towns and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the impaired segments 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 Bruce Brook 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.

6) Ensure there are sufficient buffers on agricultural lands on Bruce Brook.

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to any agricultural operations located upstream of the impaired segment of Bruce Brook (Figure 4).

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 10: Bruce Brook Bacteria Data

Waterbody ID: CT7102-00_02

Characteristics: Freshwater, Class B, 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: **NA**

Single Sample: **98%**

Data: 2007 - 2008 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 2343 on Bruce Brook

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
2343	Behind McDonalds off Barnum Avenue	11/28/2007	**24001*† (98%)**	dry	NA
2343	Behind McDonalds off Barnum Avenue	6/18/2008	9800†	wet	NA

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

***Indicates single sample value used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100mL) geometric means for Station 2343 on Bruce Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
2343	Behind McDonalds off Barnum Avenue	2007-2008	1	1	15337	NA	NA

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gauges at Tweed KMMK station in New Haven, CT and at Hartford Bradley International Airport

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APPENDIX C. CURRENT STREAM CONDITION AS NOTED FROM THE STREAM WALK

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Existing Conditions Report for Bruce Brook

Bruce Brook was observed following review and approval of the Quality Assurance Project Plan (QAPP) in July 2023. Observations were conducted by two professionals of Resilient Land And Water on July 26, September 22, October 2, and October 9, 2023. Observations were made in the watershed and at crossings on July 26, and directly from the stream channel and the streambank on the latter three dates. Photographs were taken by both professionals. GPS methods were used to document specific observations such as stormwater outfalls, unspecified outfalls, water intakes, larger areas of trash buildup, large woody debris, bulky waste, changes in channel substrate, and changes in bank material.

The unnamed tributary of Bruce Brook that joins in the vicinity of the Interstate 95 crossing (downstream of the cemetery) was not subject to direct observations for its entire length. However, this tributary was spot-checked in numerous locations such as crossings.

Reach 1

This area of Bruce Brook is the furthest north and contains the headwaters of the stream. The reach includes wetlands of Veterans Park, and two systems further north; a “middle” wetland system which is southeast of the Ella Grasso center, and one situated east of Armory Road. These wetland areas and associated streams all converge and presumably flow into a conduit located behind a residential property on Red Fox Road. This conduit flows beneath Johnson Lane and emerges from below Luanne Road on the north side of Bulldog Boulevard, which is the westerly access road to Bunnell High School and the north end of Reach 2.

Beginning at the most northern end of Reach 1 in the wetland system bounded by Armory Road, Big Y, Plane Tree Road, and Peacock Drive, a stream flows into the wetlands from a stormwater outfall off Goldbach Drive. This stream flows down a relatively steep gradient along a cobble stream bed at the northeast corner of the wetland system, passing through boulders before the gradient flattens and the stream enters a series of pools. A large Phragmites presence was observed within the system in the southern section of Veteran Park. Pet waste bags were observed along the stream. The stream flows from the wetlands into a small pond and then a conduit at the northeast end of Johnson Lane. The stream then discharges from the southern end of this conduit at the southwest side of Johnson Lane into the Veterans Park wetland system. Increased evidence of bacteria (such as rusty colored water and scum) was noted along parts of the stream. There were also signs of recent heavy runoff along the banks.

The “middle” wetlands of Veterans Park receive water from the northernmost system, in addition to discharge received from at least two stormwater outfalls associated with the Ella Grasso Center. The stream was relatively defined in this area, with saturated soils along the banks. The stream bed and banks were mostly sandy or silty, with little cobble in comparison to the northern stream where it emerged from Goldbach Drive. The middle section of stream traverses a moderately to heavily vegetated area and ultimately converges with the stream from the southern part of Veterans Park. Just south of the convergence of the two streams, at least two sewer mains were located (manholes were visible); one large area with iron colored groundwater discharge, and another location with an oil sheen noted on the water surface.

The stream channel in the southern section of Veterans Park could be directly observed only in a few areas, but this section could not be walked continuously due to the density of reedy vegetation. Observed debris in this part of Veterans Park included a shopping cart, tires, child car seats, and a few other bulky items. Leaves have been disposed in Veterans Park at the ends of dead-end roads.

Overall, observations from Reach 1 indicate that two headwater streams merge to become Bruce Brook: the stormwater system outfall at Goldbach Drive, and the culvert that daylights on the north side of Connors Lane. These two streams merge between Seabreeze Circle and Red Fox Road before entering the conduit beneath Johnson Lane that emerges from below Luanne Road on the north side of Bulldog Boulevard. The presence of pet waste bags immediately downstream of the Goldbach Drive outfall indicates that this residential area is the source of pet waste. The presence of bulky items and leaves in Veterans Park indicates that the park is used for occasional disposal of unwanted items and yard waste.

Reach 2

Reach 2 stretches from Luanne Road to the end of Bunnell Avenue. The stream flows from a large conduit under Luanne, immediately through a culvert under Bulldog Boulevard into a wooded area just southwest of Bunnell High school. From the culvert, the stream flows to pond approximately halfway through the reach. This approximate 0.15 mile of stream is comprised of a natural stream channel, with a few small pools, moderately dense vegetation, and riffle/run habitats.

No outfalls were found along this stretch of the stream near the high school; however, some runoff from the high school, track, and playing fields are likely collected and drains into Bruce Brook somewhere. One location along the stream was characterized by the presence of an iron colored bacteria (Figure 1). The bacteria were limited to small area, and the color was not noted at any other location along this portion of the stream.

Figure 1 Iron colored bacteria located between Bulldog Boulevard and Bunnell Avenue

The section of Bruce Brook immediately downstream of the pond appeared as long sections of exposed stream bed for approximately 200 to 300 feet, likely as a result of sediment aggradation. After this stretch, the brook had similar characteristics to the northern stretch of stream in the reach. There was natural channelization, moderately dense vegetation, and small pools and riffles. In addition, this was the first location where several cinder blocks were noted along the stream bed, likely from crumbling walls, in addition to some trash, pet waste bags, and small spots of an oil residue on the surface of the water. Just south of where the stream passes Bunnell

Avenue, a small, buried pipe was noted intersecting the stream. The Town Engineer later confirmed that this was a sewer line.

Overall, debris observed in Reach 2 was limited to naturally occurring woody material and cinder blocks as noted above. However, pet waste bags were observed in several locations.

Reach 3

The third reach is comprised of a small stretch of stream beginning north of Conners Lane (which is captured above in Reach 2), passing under Old Spring Road, to just south of Quail Street. Approximately 200 feet south of Conners Land was the first documented finding of pipes and hoses draining into the brook from adjacent properties (Figure 3). There is also a small tributary that flows from the community garden on Conners Lane which converges with Bruce Brook at this location of the stream; the convergence is just downstream of the severe erosion shown Figure 2. The remaining ~400 feet of stream to Old Spring Road was moderately vegetated, low flow, and natural debris. Observations demonstrated a significant difference in how each property owner maintains the streambank adjacent to their property. Some properties were cut and maintained lawn, others were unmaintained natural vegetation, and others were relatively maintained natural vegetation and/or pachysandra. A trash rack located on the north side of Old Spring Road had limited debris build up; perhaps more notable, a buildup of sediment was observed just before this crossing.

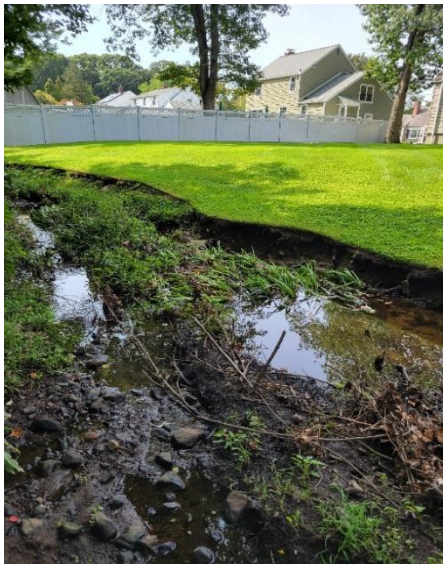

Figure 2 Severe Bank Erosion South of Conners Lane

Figure 3 Pipe and Hose Draining into Bruce Brook South of Conners Lane

The stretch of Bruce Brook between Old Spring Road and Quail Street had at least three locations with hoses draining into the stream from adjacent properties, and two outfalls, one of which was flowing during dry weather. This area was also the first where large debris was found along the stream corridor, which presumably caused an accumulation of sediment and debris (Figure 4).

Overall, debris in Reach 3 included natural woody debris, pet waste bags, trash, metal waste, concrete pieces from walls or foundations, and a partially buried riding mower.

Figure 4 Large Debris and Sediment Accumulation Between Old Spring Road and Quail Street

Reach 4

The fourth reach is primarily comprised of Wooster Park and Wooster Pond (a dammed impoundment). This area has been split into two sub-reaches given that Wooster Pond is along Bruce Brook. Reach 4A, which is the shorter segment north of the pond, flows under Quail Street through three large culverts, where there is also very apparent drainage from the street into the stream (Figure 5).

Figure 5 Culverts and Street Drainage from Quail Upstream of Wooster Pond

Approximately 130 feet downstream of the culverts was a large outfall on the west bank. The outfall was about halfway submerged, and there was significant streambed scour at the base of the outfall indicating heavy discharges during rain events. There was a second outfall approximately 125 feet downstream from the first outfall. This outfall was actively flowing and while there was evidence of scouring, it was not as severe as that immediately upstream. From here the stream branched into two smaller streams and ultimately flowed into a wetland area associated with the pond. This stretch of the stream was moderately vegetated flowing from Quail, with density increasing as it approached the wetlands and pond.

One large outfall was documented flowing directly into Wooster Pond along the eastern bank, in addition to a small dam at the southern end where is continued to flow into Bruce Brook. There was also a significant presence of water fowl on the lawn surrounding the pond.

A resident noted several factors of their concern for this area of the stream and the pond including the increased activity of feeding water fowl at the pond, heavy dog walking activity along the trails surrounding the stream, and a high rat population in the neighborhood surrounding the park. She reported that rats live in outfalls and adjacent drainage systems.

Reach 4B, which is the located between the Wooster Pond Dam and Nichols Avenue, was naturally channelized with moderately dense vegetation cover, showed some signs of bank erosion, locations with heavy debris build up, and four stormwater outfalls. There were also other notable characteristics of this stretch of Bruce Brook including:

A formation of rocks that created a small weir and a deep pool upstream

Natural debris jam that likely exacerbated erosion along the east bank by focusing flows

Bank erosion likely exacerbated by the debris jam

A sandbar downstream of the debris jam which is likely a result of eroding bank

In addition to those locations shown above, there was evidence of the adjacent sports playing fields draining directly into the stream, and an unnamed tributary flowing into Bruce Brook from the west which runs behind several properties along Nichols Avenue.

Overall, debris in Reach 4 included natural woody debris, pet waste bags, sports equipment (e.g., a kickball), trash, metal waste, and concrete pieces.

Reach 5

From Nicholes Avenue, Bruce Brook flows approximately 850 feet through an underground conduit and emerges on the south side of Albright Ave. This conduit of Bruce Brook is located within Reach 5; however, it was not directly assessed due to it being underground. Albright Avenue marks the beginning of the channelized section of Bruce Brook where the banks and bed are comprised of concrete. The stream is channelized for the entirety of Reach 5 from Albright to Broadbridge Avenue, which is approximately 0.4 miles long.

Figure 6 Sanitary Sewer Crossing between Andrew Street and Broadbridge Avenue

This section of the stream traverses through residential neighborhoods until it reaches Broadbridge Avenue. There was a total of nine outfalls observed along the channel. Four outfalls were observed under the Greenfield (2), Reitter (1), and Andrew Street (1) bridges, and an additional five were observed along the channel walls. In addition to stormwater outfalls there were two instances of hoses running from adjacent properties into the stream, and several instances of smaller outfalls from adjacent properties that either drained directly from yards into the channel, or potentially from gutters. An exposed 20 foot 8” cast iron sanitary sewer crossing was noted between Andrew Street and Broadbridge Avenue (Figure 6). At Broadbridge Avenue the stream splits under the road into two large box culverts and then continues to flow downstream into a natural channel which is part of Reach 6.

Along some stretched of channel in Reach 5, the stream bed was comprised of a slippery algae/vegetative cover that has developed on concrete. About half of the length of Reach 5 was moderately covered by overhead vegetation, with remained being sparsely covered or completely exposed to the sun. Some properties have fences installed along the channel which limits stream access, while others do not, making Bruce Brook extremely accessible. However, there were no obvious signs of dumping or littering at any location. The discharge velocities are likely too high in the channelized brook for significant debris to remain stationary. Nevertheless, pet waste bags were observed snagged on vegetation.

Reach 6

The Broadbridge Avenue box culvert (bridge) has two outfalls embedded, with one on the east wall and one on the west, which enter the stream from the headwall before the natural channel begins.

The natural streambed running along Stonybrook Park was comprised primarily of cobble and rock larger than observed in the upstream natural sections of the stream. Three outfalls, all on the east bank, were located on the roughly 850 feet of stream running along Stonybrook Park. One of these outfalls appeared to be equipped with a backflow valve that, at the time, was partially open and showed signs of recent outflows.

Figure 7 Outfall with Backflow Valve in Stonybrook park

The stream banks were lightly vegetated immediately following the Broadbridge culvert and increased in density further downstream. The lighter vegetation could likely be attributed to flood levels during rain events as there was evidence of potentially high water levels with trash and debris high on the banks.

Approximately 1,000 feet downstream from Broadbridge Avenue in the vicinity of the bend in Yukon Street, the stream transformed from natural bed and banks to channelized. Along this section of Bruce Brook, a small pipe was observed actively discharging water into the channel from the concrete wall; this could potentially have been a sump pump based on the timing of discharges. unmaintained property lines were observed with large sections of fencing in the channel, grass clippings dumped into the channel, signs of actively flowing discharges from properties, and trash and household items collecting along fence lines. This was also the first reach with direct signs of animal activity (droppings) situated in the channel.

Overall, debris in Reach 6 included natural woody debris, yard waste and grass clippings, timber fence sections and pieces, pet waste bags, animal waste droppings, trash, tires, metal waste such as an old street sign, and concrete pieces.

Reach 7

This entirely channelized section of Bruce Brook runs from Light Street to the rear side of the C-Town Plaza. This reach of the stream traverses through Clover Park, which includes a small pond located at the end of Putnam Street. Part of Bruce Brook is diverted and flows into this pond at the northern end of Clover Park, and the pond then flows back into Bruce Brook just under the foot bridge connecting Putnam Street and the park. Certain stretches of the stream in this area had increased vegetation growing through cracks and crevices both from the walls and along the stream bed.

Figure 8 A section of wall in disrepair along a Light Street property

In addition, one location behind a property on Light Street showed signs of the channel wall failing (Figure 8). A failing channel wall would not directly relate to water quality impairments; however, it could play a role in future flow disruptions or a change in runoff from the adjacent property.

Similar to Reach 5, the discharge velocities are likely too high through Reach 7 for significant debris to remain stationary on the concrete streambed. Nevertheless, trash was observed caught in fences lining the channel and indicated that trash sources are common through Reach 7.

Reach 8

This stretch of Bruce Brook includes the stream that flows behind and along the C-Town Plaza, from Bowe Street, downstream to Barnum Avenue. When flowing from Clover Street to behind the plaza, the stream transforms from entirely channelized to partially channelized. The stream bed along the plaza outskirts is natural with large cobble, deep pools, and riffles. The west bank along the plaza is mostly channelized by concrete walls (except where a natural bedrock outcrop occurs) while the east bank is almost entirely natural. However, very little vegetation is present, and signs of erosion are visible in some areas. There was an increased presence of larger trash items in the stream along the plaza. Some items included a beach umbrella, volley ball netting, and a shopping cart. Asphalt-lined swales were observed that directly convey stormwater from the C-Town Plaza parking lot into Bruce Brook.

The stream then flows into a conduit that passes under Route 1. This conduit daylights at the north end of Bowe Avenue where again Bruce Brook is lined with concrete walls and streambed. The stream bed eventually transforms into natural sand and cobble approximately 100 feet downstream from where it daylights at the end of Bowe Avenue. Along this stretch of Bruce Brook, signs of unkept property lines, large debris in the stream (likely overflowing from private properties), and several small, unknown pipes or hoses discharging into the stream were all observed.

At the southern end of Reach 8, the stream enters a commercial neighborhood at Sage Avenue and Barnum Avenue. An excessive amount of heat was observed building up in the area of Sage Avenue just

before the stream flows into the three culverts that convey Bruce Brook under Barnum Avenue. While temperature is not a listed impairment, the present of heat in this area could affect water quality and reduce fish habitat. Debris build up was also noted just before the three culverts and the separate conduit that flows under Sage Avenue and Barnum Avenue.

Overall, debris in Reach 8 included natural woody debris, yard waste, pet waste bags, trash, a section of timber fence, fabric, metal waste, concrete pieces, and (as noted above) a beach umbrella, volleyball netting, and a shopping cart.

Reach 9

Bruce Brook emerges from the underground conduit and three culverts behind McDonalds on Barnum Avenue and then flows downstream to the former Bruce Pond and Metro North Railroad in Reach 9. The west bank is predominantly populated with commercial and industrial properties and associated activity, while the east bank is partly residential with some commercial businesses. One property on the west bank just downstream from Barnum Avenue was noted to have an excessive amount of trash along the fence line trailing down the bank (Figure 9).

Figure 9 Tires along stream embankment

The stream bed was primarily large cobble for approximately 200 feet downstream from the outlets of the conduit and culverts, and then the bed transformed almost entirely to a soft sand with some gravel. This soft sand continued downstream to the train tracks. Multiple outfall pipes were identified along the stream between Barnum Avenue and the former Bruce Pond. Dumping along the banks of Bruce Pond was apparent with a large number of tires coming from the industrial property on the west bank. A very large natural debris jam was identified at the southern end of Bruce Pond. Water quality appeared to degrade flowing downstream with an oil sheen noted along stream edges, and a film on the stream surface.

Overall, debris in Reach 9 included natural woody debris, pet waste bags, trash, medical gloves, sections of PVC and metal pipe, other metal waste, and concrete pieces.

Figure 10 Apparent water quality degradation in the southern end of Bruce Pond

Reach 10 and 11

These two reaches will be discussed together as they include the small stretch of stream between the train tracks and Connecticut Avenue; and the entire length of stream that flows along the cemetery. The stretch between the tracks and the Connecticut Avenue/Stratford Avenue crossing is entirely channelized with a concrete, sand covered streambed. There was vegetation growth along the eastern wall where sediment has accumulated over time.

Figure 11 Trash and tire debris build up

The stream then flows through a double box culvert (bridge) into a section where stream walls are stacked rocks. The stream bed appeared to be natural where its banks were stacked rock walls, but for at least 500 feet the stream bed was lined and/or covered in a cloth like material. In addition, extensive debris was observed along this 500 feet stretch (Figure 11) including numerous tires, pieces of fencing, and trash hung up in vegetation growing from walls. The water did not appear to have any oil or film; however, it was somewhat turbid compared to other reaches. The channelized walls, whether rock or pieces of concrete, ran approximately 1,700 feet downstream from Stratford Avenue, giving way to natural stream banks in the vicinity of Cowles Street.

From Cowles Street to Interstate 95 the banks became moderately vegetated, with a natural stream bed which was sporadically littered with tires and debris. A large natural jam (Figure 12) was impeding flow and served as a catch for trash and other items. There were some signs of erosion on both sides of the bank. Several small drainage ditches were observed from the cemetery roadway to the stream. These are likely to alleviate roadway flooding during heavy precipitation events. Japanese Knotweed and Phragmites predominantly covered the western bank from the school bus yard downstream to I-95.

Figure 12 Large natural dam with debris caught throughout

Overall, debris in Reaches 10 and 11 included natural woody debris and snags, pet waste bags, trash, numerous tires, long sections of fabric, metal waste, bulky waste, and concrete pieces.

A summary of debris observed in Bruce Brook is provided in the Table 1 below. Additional notes are in Table 2.

Table 1 Observed Types of Debris

Type of Debris	Stream Reaches	Adjacent Subwatersheds	Potential to Harbor Bacteria?	Ease of Removal	Priority for Removal
Residential and commercial yard waste	1, 6, 8	8, 4	Medium (numerous surfaces, but will break down)	Low	Low; focus on prevention
Empty pet waste bags	1, 2, 3, 4, 5, 6, 8, 9, 10, 11	8, 7, 6, 5, 4, 3, 2, 1	High (bags are a source, and some bacteria will remain in place after emptying)	Low	Medium; focus on prevention
Tires	1, 6, 10, 11	8, 4, 1	High (stagnant water inside tires, rubber surface area)	Low	High
Bulky waste (household items, furniture)	1, 4, 6, 11	8, 6, 4, 1	Depends on composition	Medium	Medium
Household trash, garbage	3, 4, 6, 8, 9, 10, 11	7, 6, 4, 3, 2, 1	High (numerous surfaces, variable composition that includes plastics and food wastes)	Medium	High; also focus on prevention
Metal, chicken wire, appliances, vehicles, signs	3, 4, 6, 8, 10	7, 6, 4, 3, 2, 1	Assume low, but can catch trash	Low	Low
Concrete, stone, bricks	3, 6, 8, 9, 11	7, 6, 4, 3, 2, 1	Assume low	Low	Low
Large woody snags, trees	4, 10, 11	6, 1	Assume low, but can catch trash	Varies	Medium
Fence pieces (lumber, timber)	6, 8	4, 3, 2	Assume low, but can catch trash	High	High
Fabric	8, 9, 10, 11	3, 2, 1	High (numerous surfaces, variable composition that includes plastics)	Low	High
Medical (gloves)	9	2	Unknown	Low	Medium; also focus on prevention
Sections of PVC and metal pipe	9	2	Unknown	Varies	Medium

Table 2 Stream Reach Summary

Reach	Subshed	Stream Bed Composition	Stream Bank Condition	Water Appearance	Invasives or vegetation notes	Greatest Challenge in the Reach	Potential needs	Potential strategies
1	8	Natural, cobble and sand	Natural, moderately to heavily vegetated.	Normal (no oil sheen, clear), iron bacteria noted at multiple locations	Overall minimal invasives. Large Phragmites stands	Future development in commercial areas could potentially increase stormwater	Explore source of unknown sediment from State property outfall	Private property drainage improvements
2	8	Natural, larger cobble behind school, sandier between pond and Bunnell Ave.	Natural, moderately vegetated, some signs of slight erosion in areas, some small outcrops	Normal (no oil sheen, clear), iron bacteria behind school	Minimal invasives, woody undergrowth, jewelweed noted on residential properties, ferns	Presence of dog waste bags, location where stream goes almost dry just upstream from Bunnell Avenue	Vegetation management/native plantings	Private property green infrastructure applications
3	7/6	Natural, mostly sandy with some cobble and riffles	Natural, moderately vegetated, some signs of slight erosion in areas, one large outcrop, some small rock walls/bulkhead type structures	Normal (no oil sheen, clear)	Minimal invasives, pachysandra along some residential properties appear to be holding stream bank	Unknown discharges from private properties, heavy erosion on private property downstream of tributary confluence	Evaluate pesticide use from the community garden located upstream along a tributary	Trash collector (subshed 7)

Table 2 Stream Reach Summary

Reach	Subshed	Stream Bed Composition	Stream Bank Condition	Water Appearance	Invasives or vegetation notes	Greatest Challenge in the Reach	Potential needs	Potential strategies
4	6	Natural mixture of sand and gravel up and downstream of Wooster Pond	Natural, moderately vegetated, some signs of erosion in areas, one large outcrop	Normal (no oil sheen, clear)	Minimal invasives, woody undergrowth	Some outfalls/discharges south of Wooster Pond not noted in GIS data Waterfowl at pond Runoff from fields Large area west of stream drains just north of Wooster Pond	Explore unidentified outfalls/discharges	Streambank restoration in Wooster Park
5	6/5	>95% Concrete	Channelized	Normal (no oil sheen, clear)	Minimal, some growth through cracks on floor and walls	Small unknown discharges from private properties	Impervious reductions in some areas of subshed 5	Impervious surface reductions on private properties
6	4	65% Natural with large cobble 35% concrete	65% natural, with stretches of dense, invasive vegetation 35% channel	Normal (no oil sheen, clear)	Japanese knotweed along park banks,	Unknown discharges Large debris Crumbling “retaining walls”	Explore unknown residential discharges	Natural stream bed installation

Table 2 Stream Reach Summary

Reach	Subshed	Stream Bed Composition	Stream Bank Condition	Water Appearance	Invasives or vegetation notes	Greatest Challenge in the Reach	Potential needs	Potential strategies
7	4/3	>95% Concrete	Channelized	Normal (no oil sheen, clear)	Minimal, Possibly Oriental bittersweet	Properties abutting the channel with trash and debris abutting fences. Some vegetation working through channel cracks	Channel wall repair	Natural stream bed in channelized locations Reclaim stream along Clover park
8	3/2	25% Channel 75% Natural	Predominantly channelized, ~25% natural with signs of erosion/little vegetation	Normal (no oil sheen, clear)	Minimal	Excessive runoff from the C-Town Plaza and the Bridgeport Hospital parking lot, unkept and illicit discharges from private properties.	Address jam before Barnum Avenue crossing	Work with C-Town Plaza to install GI or pervious pavement to reduce runoff and erosion.
9	2	Natural sand and cobble	Natural, moderate to heavy vegetation,	Normal north of Bruce Pond, obvious decline roughly ½ way along Bruce Pond	Japanese knotweed	Water quality traveling downstream along the pond appeared to drastically change	Clean banks and jam at Bruce Pond	Explore pipes identified during the stream walk.

Table 2 Stream Reach Summary

Reach	Subshed	Stream Bed Composition	Stream Bank Condition	Water Appearance	Invasives or vegetation notes	Greatest Challenge in the Reach	Potential needs	Potential strategies
10 & 11	10: 2/1 11: 1	90% Natural 10% Channel	30% Chanel/rock wall 70% Natural, moderately vegetated with some signs of erosion	No oil or film, somewhat turbid	Japanese knotweed and Phragmites	Debris along streambed	Stream cleaning	Garbage and debris removal, impervious surface reductions, and green infrastructure applications along rights-of-way

APPENDIX D. WINDSHIELD SURVEY MEMO

A windshield survey of the Bruce Brook Watershed (Subsheds a through 8) was conducted on July 26, 2023. The survey was conducted by two members of the consultant team and included a windshield level inspection of neighborhoods throughout the watershed, with certain locations selected for a more thorough visual inspection. The windshield survey included observations of areas and neighborhoods both adjacent to the stream, and areas of interest that are not in proximity to the stream but can influence pollutant loads. Overall, the windshield survey had the following goals:

- Verify the land uses in the watershed and understand if they are consistent with land use mapping and land cover datasets available through GIS methods
- Understand where pollutants could be originating, especially as related to the impairments in Bruce Brook
- Understand where potential watershed interventions such as green infrastructure could be sited or located
- Locate appropriate access locations and other needs (e.g. type of waders) for the Bruce Brook stream walk

A total of 38 locations were observed, with some having more than one point of interest such as commercial plazas or parks. The specific locations visited were primarily chosen prior to the survey using satellite imagery and input from the Advisory Committee and were selected due to characteristics such as historic challenges related to flooding, changes between natural and channelized streams, and because they were potential sources of impairments. In addition to the specific sites documented below, the windshield survey also included general inspection of neighborhoods throughout the watershed to characterize potential impairments at a large scale. Table 1 presents some of the findings from each of the specific locations visited, and a general findings summary of the windshield survey is below.

The medium to low density residential neighborhoods throughout the watershed, which are primarily located north of Boston and Barnum Avenues (Subsheds 3 through 8), presented no obvious sources of impairment aside from the “normal” activity one might expect in residential neighborhoods. This might include yard waste, lawn and garden chemical or pesticide use, pet waste, and pool chemical usage/disposal of water. Lawn clippings and woody debris were noted in some areas throughout the northern half of the watershed either in side yards or dumped at dead ends in the lightly wooded areas.

In addition to the residential neighborhoods throughout subsheds 3 through 8, there were certain locations observed that have increased potential for impairment sources. These include the Big Y plaza, Armory, Ella Grasso Center, community garden south of Connors Lane, Vazzano’s Four Seasons, and Clover Park. A majority of the potential impairments might include increased

stormwater runoff from large impervious surfaces, presence of dumpsters, and spills at loading docks. The community garden and Clover Park are special exceptions to these however, as the primary concern here is the use of herbicide and pesticides in the gardens and for park lawn maintenance, in addition to pet waste disposal.

South of Barnum and Boston Avenues (Subsheds 1 and 2) the watershed shifts into more high density residential neighborhoods, with significantly more commercial and industrial activity throughout. With the higher density residential areas comes less concern with lawn and garden chemicals, and more concern about the stormwater quality with the increased impervious surface coverage. Higher density residential can also mean less green space to capture runoff and naturally infiltrate and an increased numbers of cars (including oil and chemicals) or household waste volumes that can find their way into runoff, and ultimately catch basins. It was noted in these high density residential neighborhoods that roadways often lacked existing vegetated areas along sidewalks which could provide some degree of stormwater retention.

The commercial and industrial land uses could be seen all throughout the southern portion of the watershed, some with greater potential for impairments than others. For example, an automotive repair and auto body shop is adjacent to (and overlies) the stream on Sage Avenue. Potential impairments here include housekeeping challenges, runoff from the storage lot, or chemical and hazardous material spills. Other commercial and industrial activity noted in these areas included an industrial complex with several loading docks and a large number of tires dumped in the rear lot, a fencing company with a large amount of equipment and materials stored outside, machinery shop, other autobody operations, a school bus yard, and an environmental cleaning services business. While not one of these operations, or any other commercial or industrial business, can be pinpointed as a specific source of impairment, there is potential from every commercial and industrial operation. These can be from chemical or hazardous material spills, illegal dumping of materials, improper disposal of materials in dumpsters, and runoff from parking lots, storage yards, and loading docks.

Commercial and industrial land uses along Bruce Boulevard are additionally challenged by direct riverine flood inundation associated with Bruce Brook. These properties present two pathways for pollutants to enter Bruce Brook: stormwater runoff and direct exposure to floodwaters.

A supplemental watershed windshield survey was conducted on October 19, 2023. This survey focused on Subshed 9, which is the southeastern most subshed in the Bruce Brook watershed. Although this subshed joins Bruce Brook at the north embankment of Interstate 95 and therefore does not contribute to impairments along the Bruce Brook main stem, the subshed was nevertheless observed for potential sources of impairment as it does ultimately influence the health of the estuary and Long Island Sound. Furthermore, because this tributary joins

Bruce Brook where it is tidally influenced, pollutants can potentially travel upstream into the main stem of Bruce Brook along the cemetery during the incoming high tides.

This part of the watershed is primarily commercial and industrial, with some residential north of the rail line and multifamily housing off Surf Avenue. These residential areas, which are medium to high density housing, have similar impairment concerns as those previously noted. The non-residential operations in the subshed include Two Roads Brewery, Town Fair Tire, a lumber yard, equipment rental company, manufacturing companies, and a painting company, among others. As with those commercial and industrial operations found just to the west, these location are all potential impairment sources from spills, housekeeping challenges, improper waste management, and stormwater runoff. Specific sites visited and their impairments can also be found in Table 1.

Overall, the watershed reconnaissance for Bruce Brook did not reveal any unexpected findings. Specifically:

- Observed land uses in the watershed are consistent with land use mapping and land cover datasets available through GIS methods
- Pollutants could be originating as nonpoint source pollution throughout the watershed, especially as related to the impairments (i.e., bacteria) in Bruce Brook.
- Potential watershed interventions such as green infrastructure could be sited in many locations, and the watershed based plan should identify potential sites based on their potential to reduce pollutant loading as well as their potential to be utilized by the Town of Stratford and City of Bridgeport.
- Appropriate access locations for the Bruce Brook stream walk are limited due to the many private properties and channelized sections. Furthermore, waders would be needed for all stream segments downstream of the Bunnell High School access road.

Table 1 Windshield Survey Locations and Relative Potential Impairment Sources

Subshed	Location Name/Summary	Description of Potential Impairment Source
8	Rear of the Big Y	The rear of this store drains toward the headwater's wetlands. Impairments could include parking lot stormwater runoff, spills at loading docks, and dumpsters.
8	Rear of Merritt Staffing campus	The rear of this store drains toward the headwater's wetlands. Impairments could include parking lot stormwater runoff. Map platforms show that an old road extended southward; this area is now mowed lawn.
8	Armory	Part of the Armory building and its parking and equipment storage areas are in the watershed. Impairments could include parking lot stormwater runoff, spills from equipment, and dumpsters.
8	Ella Grasso Center, CT DDS	This State facility includes parking lots, several buildings (one which encloses a pool), and dumpsters. Impairments could be associated with parking lots, dumpsters, and the swimming pool.
8	Dogwood Drive	Dogwood Drive slopes downward toward the headwater's wetlands. A "no dumping" sign implies that yard waste disposal may be a challenge at the end of dead-end roads. Dead ends with wetland access include Sunrise Terrace, Seabreeze Drive, and Dogwood Lane. Dead ends of Washburn Drive and Seabreeze Circle were also viewed. Potential impairments include yard waste, trash, lawn maintenance chemicals, pool chemicals, and pet waste.
8	Western end of closed road that formerly accessed Bunnell High School, aka "Bulldog Blvd"	Bruce Brook was accessed from Johnson Lane. Potential impairments include stormwater runoff from the road, although it is closed to daily active-use vehicle traffic.
8	Woods south of North Johnson Lane dead end.	The stream channel was visible here, but it is not yet evident how this flows into (becomes) Bruce Brook. Potential impairments include yard waste and pet waste in the woods.
8	Luanne Road	Potential impairments include yard waste, lawn maintenance chemicals, pool chemicals, and pet waste. The catch basin at the location of the photograph appears to be surface representation of a small tributary of Bruce Brook.
8	Northern edge of asphalt along "Bulldog Blvd" at the track	Potential impairments include direct stormwater runoff (no catch basins present) from parking lot.
8	Bunnell High School	Potential impairments include dumpsters and stormwater runoff from parking lots.

Subshed	Location Name/Summary	Description of Potential Impairment Source
7	Community garden south of Connors Lane	Potential impairments include fertilizers, pesticides, and garden waste.
7	Tributary that originates at the edge of the community garden	Potential impairments include fertilizers, pesticides, and garden waste.
7	Bruce Brook at the end of Bunnell Ave.	Potential impairments include yard waste, trash, lawn maintenance chemicals, pool chemicals, and pet waste.
6	Old Spring Road	Trash rack visible. Potential impairments include yard waste and trash.
6	Wooster Park	Potential impairments include pet waste and park landscaping maintenance chemicals.
6	Rustown Drive and Bellaire Terrace	This is an older, more densely developed neighborhoods. Potential impairments include yard waste, lawn maintenance chemicals, pool chemicals, and pet waste.
6	North end of Argonne Drive at the rear of school grounds	This area was viewed because a small tributary may originate at the rear of the school grounds. Potential impairments include pet waste and school landscaping maintenance chemicals.
5	Vazzano's Four Seasons, convenience store, and parking lots	Potential impairments include stormwater runoff from parking lots, food service area spills, and dumpsters.
5/3	Closed business park southwest of Broadbridge Avenue	Potential impairments include stormwater runoff from parking lots and access roads.
5	Albright Avenue	This is where Bruce Brook emerges from a conduit that begins at Nichols Ave. Impairments include enclosure (upstream of Albright) and channelization (downstream of Albright), stormwater runoff, yard waste, lawn maintenance chemicals, pool chemicals, and pet waste.
5	Greenfield Avenue	Potential impairments include channelization, stormwater runoff, yard waste, lawn maintenance chemicals, pool chemicals, and pet waste.

Subshed	Location Name/Summary	Description of Potential Impairment Source
5	Andrew Street	Potential impairments include channelization, stormwater runoff, yard waste, lawn maintenance chemicals, pool chemicals, and pet waste. Photo 3071 shows that a stormwater system or tributary joins the stream at this location, and it is flowing during dry weather.
5	Reitter Street	Potential impairments include channelization, stormwater runoff, yard waste, lawn maintenance chemicals, pool chemicals, and pet waste.
5	End of Abram Street	Potential impairments include channelization, numerous driveway and footpath crossings, stormwater runoff, yard waste, lawn maintenance chemicals, pool chemicals, and pet waste.
4	Broadbridge Ave and Stonybrook Road	This is a commercial area at the intersection. Small strip malls are located along both of these roads. Potential impairments include channelization, stormwater runoff from parking lots, food service area spills, and dumpsters. Direct connection between a catch basin and an outfall was visible on the upstream side in the channelized right bank; stormwater caught on the street side of the channel wall is collected and conveyed through the channel wall, into the stream. While present, public works personnel were using a riding mower to cut grass around the catch basin. Potential impairments could also include maintenance equipment spills.
4	Park north of Klondike Street	Potential impairments include pet waste and park landscaping maintenance chemicals.
4	Light Street	Mr. Washington approached the field staff to report that people are dumping in the stream, and the mess caused raccoons to congregate. Potential impairments include encroachment, channelization, stormwater runoff, trash and food waste (reported by Mr. Washington), yard waste, lawn maintenance chemicals, pool chemicals, and pet waste.
4	Leonard Street	Potential impairments include encroachment, yard waste, trash, lawn maintenance chemicals, pool chemicals, and pet waste.
3	Clover Park	Potential impairments include pet waste and park landscaping maintenance chemicals.
3	Stratford Plaza north of Dunkin Donuts	These photos depict the many points of direct stormwater discharge from the parking lot to Bruce Brook. Potential impairments include stormwater runoff from parking lots, food service area spills, and dumpsters.
3	North end of Stratford Plaza	These photos depict Bruce Brook along the north side of the plaza. Potential impairments include stormwater runoff from parking lots, food service area spills, and dumpsters.

Subshed	Location Name/Summary	Description of Potential Impairment Source
2	Northern end of Bowe Ave	Bruce Brook emerges from a conduit here and enters another channelized section. Potential impairments include encroachment, channelization, stormwater runoff (especially direct sheet flow from businesses on Route 1), trash, yard waste, lawn maintenance chemicals, and pet waste.
2	Sage Ave	Tightly-spaced automotive repair and auto body shops are located at the southern end of Sage Avenue, directly on top of a conduit section of Bruce Brook. Potential impairments include dumping, stormwater runoff from the parking lots and loading docks, spills of chemicals and hazardous materials, etc.
2	Neighborhood east of hospital	Potential impairments include stormwater runoff from an urbanized area. Barnum Avenue is lined with commercial and industrial land uses.
2	"Bruce Pond"	Commercial and industrial land uses lie along this segment of Bruce Brook (the old "Bruce Pond"). Potential impairments include dumping, stormwater runoff from the parking lots and loading docks, spills of chemicals and hazardous materials, etc.
2/1	View of Bruce Brook under Stratford Avenue	Potential impairments include stormwater runoff from an urbanized area.
1	Bridgeport side of Cemetery	Commercial and industrial land uses extend from Bruce Pond and the railroad downstream to I-95. Potential impairments include encroachment, dumping, stormwater runoff from parking lots and loading docks, spills of chemicals and hazardous materials, etc. Tires and trash were viewed in Bruce Brook.
1	Stratford side (Saint Michael's Cemetery)	Potential impairments include encroachment of burial plots (at least two are immediately adjacent to the stream bank), dumping of cemetery yard waste, and stormwater runoff. Tires and trash were viewed in Bruce Brook.
9	Residential area north of rail line/condos on Miranda Lane	Potential impairments include runoff, yard and garden maintenance chemicals, and pet waste. Elevation change between neighborhood and stream below is significant, therefore runoff from residential properties could exacerbate runoff from the wooded areas into the stream below.
9	Two Roads Brewery	Impairments include runoff from parking lot and facility into the several catch basins located in the parking lot. Active flow from facility into catch basin on the day of the survey.
9	Rings End Lumber	Potential impairments from stormwater runoff, dumping, or improper disposal of waste. On day of survey several large trucks were noted coming and going from the property, and the stream running along the parking lot was slow moving, almost stagnant. A warning sign for flooding was also posted on the fence.
9	Town Fair Tire Plaza	Potential impairments from stormwater runoff from very large, impervious lot, and dumping or spills from Town Fair Tire. This was a very large parking lot, with a majority going unused at the time of the visit.

Subshed	Location Name/Summary	Description of Potential Impairment Source
9	Large commercial lot off Moffitt Street	Very large parking lot and industrial/commercial buildings with catch basins throughout the lot. Much of the impervious area was unused at the time of the visit. Potential impairments include stormwater runoff, spills from trucks accessing the site, and chemical or hazardous materials from the plastics company or industrial supply operations.
9	Commercial operations south of Moffitt Street.	Several businesses here with outdoor storage for equipment, vehicles, and materials. Potential impairments include stormwater runoff, spills and leaks from equipment storage lots, chemical or hazardous material spills, and illegal dumping. Stream that flows along the eastern side of these properties was very slow moving and looking oily and unclean.

APPENDIX E. MANAGEMENT MEASURES MATRIX

Goal	Objective	Management Measure	Target Priority Subsheds	Cross Reference to Specific Locations (if applicable)	Climate Co-Benefits (if applicable)	Resources	Measurable Milestones	Term	Potential Funding Source	Approx. Cost	Responsible Entity	Action or Effort that Precedes
Directly address water quality (WQ)	A. Continue water quality monitoring	1. Pursue funding to support water quality monitoring endeavors.	All				Identify and apply for at least one	2025	Capital Funds	$$$	St: ESC and/or Br: SM	
		2. Continue collaboration with ongoing Harbor Watch water quality sampling efforts.	All				Continued monitoring in future years.	Ongoing	Capital Funds	$	St: ESC and/or Br: SM	
		3. Consider conducting benthic microorganism surveys to monitor ongoing progress in water quality improvement.	1, 2, 4, 6, 7, & 8				Execution of surveys.	2026-2028	Capital Funds, LISRGP	$$	St: ESC and/or Br: SM	Complete/Pursue WQ.A.1
		4. Consider conducting bacterial testing in sediment along naturalized stretches of the brook to further understand bacteria loading from sediments to the stream.	1, 2, 4, 6, 7, & 8				Execution of surveys.	2026-2028	Capital Funds, LISRGP	$$	St: ESC and/or Br: SM	Complete/Pursue WQ.A.1
		5. Develop a routine bacteria monitoring schedule which aligns with the previous Harbor Watch Locations to continue long-term monitoring. This should be done in the event that Harbor Watch sampling efforts are discontinued.	All				Development and funding of a testing program.	2025-2026	Capital Funds, LISRGP	$$	St: ESC and/or Br: SM	Complete/Pursue WQ.A.1
	B. Identify/remove illicit discharges	1. Ensure IDDE efforts are applicable to the Bruce Brook watershed area.	All				Annual review includes assessment of efforts	2025	Capital Funds	$	MS4 Contacts - St: DPW and Br:WPCAGM	
		2. Promote the IDDE reporting system with other educational and outreach activities.	All				Language included in outreach materials	Beginning in 2025	Capital Funds	$	MS4 Contacts - St: DPW and Br:WPCAGM	
	C. Better manage stormwater quality	1. Increase street sweeping frequency in subsheds that potentially contribute the most to sediment loading. If efforts are not feasible for an entire subshed, the City and Town should consider focusing on increased sweeping efforts at municipal properties.	All				Increased number of sweepings in certain areas and/or at designated locations.	2025	Capital Funds	$$	St: PW and Br: Pw	

Goal	Objective	Management Measure	Target Priority Subsheds	Cross Reference to Specific Locations (if applicable)	Climate Co-Benefits (if applicable)	Resources	Measurable Milestones	Term	Potential Funding Source	Approx. Cost	Responsible Entity	Action or Effort that Precedes
Directly address water quality (WQ)	C. Better manage stormwater quality	2. In accordance with the Town of Stratford POCD, promote the use of LID practices where possible, particularly the use of tree box filters, and focused in areas with increased commercial or industrial uses. This could be information inlcuded in a permit application, or included with mailing from the City and Town such as tax bills.	All		Flood and extreme heat	https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote	Development and distribution of informative flyer	Beginning in 2025	Capital Funds	$	St: ESC	Develop educational resource to use for promotion.
		3. In accordance with Objective 2 in the Town of Stratford POCD, prioritize improvements to stormwater infrastructure in the watershed to reduce flooding and improve water quality.	All		Flooding			Beginning in 2025	Capital Funds	$	St: ED	
		4. The City of Bridgeport should continue to pursue and apply LID and green infrastructure practices as outlined in the BGreen Sustainability Plan (2020)	1, 2, & 3		Flooding		Increased number of applications in the watershed.	Ongoing	Capital Funds	$	Br: SM and/or Responsible Parties Identified in the Plan	
		5. Install pervious pavement or pavers on municipal property, both Stratford and Bridgeport, where feasible, including existing parks and open spaces.	1, 3, 4, & 8		Flooding		Increased area of pervious pavement applications in the watershed.	2026-2030	Capital Funds, OPM,	$$$	St: PW, Br: PW and St: ED, Br: ED	
		6. Where feasible, install bioswales in subsheds with greatest estimated total suspended solids estimates. Consider creating a training program similar to that of Pawtucket, RI to train public works on maintenance.	1, 2, & 9		Flooding	https://www.youtube.com/watch?v=tm75UIa-UJ0	Successful installation of bioswales along main roadways.	2026-2030	Capital Funds, CDBG, DEEP DCRF, LISRGP, DEEP Urban Green and Community Gardens Grant Program	$$$$	St: ED, Br: ED	Secure funding for installation
		7. Consider the development of subwatershed plans for stormwater retrofits, which include conceptual designs for LID, tree boxes, and other best management practices.	All				Development of a plan.	2026-2028	Capital Funds, DEEP	$$$	St: ESC and/or Br: SM	Secure funding for planning

Goal	Objective	Management Measure	Target Priority Subsheds	Cross Reference to Specific Locations (if applicable)	Climate Co-Benefits (if applicable)	Resources	Measurable Milestones	Term	Potential Funding Source	Approx. Cost	Responsible Entity	Action or Effort that Precedes
Directly address water quality (WQ)	C. Better manage stormwater quality	8. Encourage commercial and industrial property owners along Bruce Brook and related tributaries to install stormwater detention or retention infrastructure. Stormwater retrofits and upgrades should be required for these properties in the future when new development or additions occur (a consideration for a Bruce Brook Watershed overlay).	All		Flooding	https://www.reducerunoff.org/ https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote		Beginning in 2025	Capital Funds	$	St: ESC and/or Br: SM	Develop educational resource to use for promotion.
		9. Institute an annual Bruce Brook Watershed community clean up event; this can be integrated into the Town's stormwater management plan where appropriate. Sites considered could be directly along the stream, Veteran's Park, and other open space or municipal locations throughout the watershed where debris and trash may flow into the Brook. Given that public health risks may be present at certain locations, sites for clean up should be targeted that are easily accessible by volunteers and where exposure risks are low.	4, 6, 7 & 8				At least one annual event.	2025-2026	Capital Funds	$	St: ESC and/or Br: SM	
Capacity and collaboration (CC)	A. Endorse WBP	1. The Advisory Committee should endorse the WBP and encourage the Town and City to adopt the WBP to better support planning and implementation efforts.	All				Endorsement and adoption.	2024	Capital Funds	$	AC	
		2. The Advisory Committee should convene on an annual basis to assess the progress of WBP actions.	All				Annual meetings	Annually	Capital Funds	$	AC	
	B. Increase organizational collaboration	1. Work with local, regional, and statewide organizations to implement efforts.	All					Ongoing		$	Various	
		2. Identify and secure funding for both specific projects, or those that may indirectly impact the watershed health and overall goals	All					Ongoing		$	St: ESC	

Goal	Objective	Management Measure	Target Priority Subsheds	Cross Reference to Specific Locations (if applicable)	Climate Co-Benefits (if applicable)	Resources	Measurable Milestones	Term	Potential Funding Source	Approx. Cost	Responsible Entity	Action or Effort that Precedes
Capacity and collaboration (CC)	B. Increase organizational collaboration	3. Incorporate comopnenets of actions into Capital projects where feasible. This might include general concepts such as LID measures, impervious paving, upsizing drainage. Specifically look for opportunities for the following projects. A. Barnum Avenue culvert carrying Bruce Brook ($5,000,000 in FY 2025) B. Streetscaping Improvements (i.e., bioswales or tree boxes) ($2,500,000 FY 2025) C. Resurfacng BOE parking lots ($200,00 FY 2025)	All					2024	Capital Funds	$$$$	St: ESC, St: ED, or Other Depts. as Necessary	
		4. If pursuing complete streets project in Stratford within the watershed, Environmental Conservation Superintendent and Engineering should work with lead planning department to ensure stormwater management strategies are maximized along roadways to reduce discharge volumes into Bruce Brook.	1 & 9, and any other considered for Complete Streets		Flooding & Extreme Heat			Dependent upon project initiation		$	St: ESC	
Climate resilience and floodplain management (CR)	A. Seek co-benefits of watershed projects and upgrades	1. Encourage increased tree plantings and greening at commercial and industrial properties for new and redevelopment projects.	1, 2, 3, 8, & 9		Extreme heat	https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote		Beginning in 2025	Capital Funds, DEEP	$	St: PZ and Br: ZO	Develop educational resource to use for promotion.
		2. Encourage impervious surface reductions during redevelopment projects, both public and private, particularly in those areas with high impervious density.	1,2,3, & 9	30 Moffitt St., 1700 & 1785 Stratford Ave.		https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote		Beginning in 2025	Capital Funds	$	St: PZ and Br: ZO	Develop educational resource to use for promotion.
		3. Target areas for bioswale applications in right-of-way to reduce floodwater pooling; locations identified using the Flood CCVI	All	Barnum Ave, Surf Ave., Stratford Ave.	Flooding			2025	Capital Funds	$	St: PW, Br: PW and St: ED, Br: ED	
ain management (CR)	A. Seek co-benefits of watershed projects and upgrades	4. Evaluate culverts and stream crossings to identify those that may need to be replaced and upsized/upgraded to accommodate for increased flood levels, and ensure new/modified stream crossings follow CT stream crossing guidance.	All	Specific locations of concern might include the Quail Street culvert	Flooding	https://portal.ct.gov/-/media/DOT/finalcrossinggguidelinesFeb262008highrespdf.pdf		Beginning in 2025	Capital Funds	$$	St: PW, Br: PW and St: ED, Br: ED	

Goal	Objective	Management Measure	Target Priority Subsheds	Cross Reference to Specific Locations (if applicable)	Climate Co-Benefits (if applicable)	Resources	Measurable Milestones	Term	Potential Funding Source	Approx. Cost	Responsible Entity	Action or Effort that Precedes
Climate resilience and floodpl	B. Protect/restore floodplains where feasible	1. Continue to seek opportunities for property acquisitions and floodplain restoration along Bruce Brook to increase floodplain capacity and reduce the impairment of floodwaters.	All	179 West Ave., 50-60 Sage Ave., 95 Bowe Ave.	Flooding		Number of properties acquired	Ongoing	Capital Funds, NRCS, USFWS	$$$$	St: PZ and Br: ZO	
		2. Consider creating an overlay district along Bruce Brook which may include stringent riparian buffer regulations.	All				Successful approval of overlay district	2025	Capital Funds	$	St: PZ and Br: ZO	
Habitat protection and restora	A. Control inv	1. Conduct an invasive species survey in the naturalized locations along the stream including behind Bunnell High School, in Wooster Park, in Stonybrook Park, and along the former Bruce Pond. Priority focus on those locations identified in Appendix B - Stream Condition	1, 2, 3, & 4					2026-2027	Capital Funds, LISRGP, DEEP	$$	St: ESC	
		2. Prioritize invasive removal at locations with the greatest density of invasives. These areas should be prioritized for native plantings to maintain stream bank integrity and to reduce erosion.	1, 2, 3, & 4		Flooding			2027-2029	Capital Funds, LISRGP, DEEP	$$$	St: ESC	
	B. Protect/restore riparian habitats	1. Naturalized stream banks that are moderately to minimally vegetated should be targeted for native planting applications to minimize erosion and increase habitat quality.	1, 2, 4, 6, & 7		Flooding			2025-2026	Capital Funds, LISRGP, DEEP	$$$	St: ESC and/or Br: SM	
Habitat protection and restoration (HPR)	B. Protect/restore riparian habitats	2. Conduct feasibility assessment of concrete wall removal at various locations to restore natural banks and stream beds.	1 & 3	Clover Field Park				2026-2028	USFWS, NOAA	$$$	St: ESC and/or Br: SM	Secure funding
		3. Clean and restore the health of Bruce Brook south of Stratford Avenue.	1	Cemetery	Flooding				USFWS, NOAA	$$$$	St: ESC and/or Br: SM	Secure funding
		4. Protect and conserve existing headwater wetland complexes to maintain water quality and biodiversity	1	"The Snake Pit" headwater wetland complexes	Flooding			2025	Capital Funds	$	St: ESC and St: PZ	

Goal	Objective	Management Measure	Target Priority Subsheds	Cross Reference to Specific Locations (if applicable)	Climate Co-Benefits (if applicable)	Resources	Measurable Milestones	Term	Potential Funding Source	Approx. Cost	Responsible Entity	Action or Effort that Precedes
Education and outreach (EO)	A. Raise business awareness on operational impacts	1. Develop an outreach campaign for commercial and industrial properties located in the watershed to educate on the importance of proper waste	All			https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote		2025-2026	Capital Funds, EPA, DEEP	$$	St: ESC and/or Br: SM	Develop educational resource to use for promotion.
		2. Conduct storm drain marker or stenciling or public art campaign to raise awareness of where the drains flow.	All				Number of storm drains with markers	2025-2026	Capital Funds, EPA	$$	MS4 Contacts - St: DPW and Br:WPCAGM	Secure funding
		3. Invest in enforcement efforts to address specific instances of dumping such as the tires dumped near the former Bruce Pond.	All					2025-2027	Capital Funds	$		
	B. Build awareness amongst residents	1. Town of Stratford should develop a more robust outreach program for proper dog waste and lawn waste disposal. This might include a social media campaign, signage on catch basins, implementing a town wide dog waste disposal system, or promoting the transfer stations capabilities of taking yard waste. The EPA maintains resources on how to conduct a dog waste campaign.	All			https://cfpub.epa.gov/npstbx/files/NHDES%20Pet%20Waste%20Campaign2.pdf	Number of resources posted online, number of signs installed along popular dog walking trails, or number of times the message is published in documents or on social media.	2025-2026	Capital Funds, EPA	$$	St: ESC	
		2. Increase outreach and engagement on maintaining waterways and the impacts of dumping in Bruce Brook, with targeted engagement to those residents living in the watershed.	all			https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote		2025-2026	Capital Funds, EPA	$$	St: ESC and/or Br: SM	Develop educational resource to use for promotion.
Public access and recreation (PAR)	A. Enhance trails and parks along the stream	1. Create a dog waste system and education campaign in locations where dogs are often walked, such as Wooster Park and Clover Park. This might include signage and waste disposal stations.	3, 4, 6, & 8			https://www.epa.gov/npdes/stormwater-smart-outreach-tools#promote		2025-2026	Capital Funds, EPA	$$	St: RD	

Approx. Costs	
$	Less than $5,000
$$	$5,000 to $10,000
$$$	$10, 000 to 50,000
$$$$	Greater than $50,000

Responsible Entities		
AC Advisory Committee	**Br: WPCAGM** Bridgeport WPCA General Manager	**St: ESC** Stratford Environmental Conservation
Br: ED Bridgeport Engineering Department	**Br: ZO** Stratford Planning and Zoning & Bridgeport Zoning	**St: PZ** Stratford Planning and Zoning & Bridgeport Zoning
Br: PW - Bridgeport Public Works	**St: DPW** Stratford Director of Public Works	**St: PW** Stratford Public Works
Br: SM Bridgeport Sustainability Manager	**St: ED** Stratford Engineering Division	**St: RD** Stratford Recreational Department

APPENDIX F. WTM RESULTS

Subshed 1 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Loads With Existing Practices
- ☐ Benefits of Existing Practices
- oads With Future Practices
- ☐ Benefits of Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	3,613.6	416.9	137,241.7	150,461.9	608.8
Uncontrolled Load from Secondary Sources	521.5	521.5	137,235.0	0.0	0.0
Load Reduction from Existing Practices	-17.3	-172.8	1,173.3	2,105.2	-2.4
Existing Surface Water Load	**4,152.4**	**1,111.2**	**273,303.3**	**148,356.7**	**611.2**
Existing Load - Storm	**4,151.6**	**1,111.2**	**273,296.6**	**148,356.7**	**611.2**
Existing Load - Nonstorm	**0.8**	**0.0**	**6.7**	**0.0**	
Load Reduction from Future Practices	1,794.4	266.0	55,795.8	59,176.9	226.0
Surface Load with Future Practices in Place	**2,358.1**	**845.3**	**217,507.6**	**89,179.8**	**385.3**
Surface Load Change From Existing (%)	**-0.4**	**-0.2**	**-0.2**	**-0.4**	**-0.4**
Surface Load with Future Practices - Storm	**2,357.2**	**845.2**	**217,500.9**	**89,179.8**	**385.3**
Surface Load with Future Practices - Nonstorm	**0.8**	**0.0**	**6.7**	**0.0**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**2,358.1**	**845.3**	**217,507.6**	**89,179.8**	**385.3**
Surface Load Change From Existing (%)	**-0.4**	**-0.2**	**-0.2**	**-0.4**	**-0.4**
Surface Load Including New Development - Storm	**2,357.2**	**845.2**	**217,500.9**	**89,179.8**	**385.1**
Surface Load Including New Development - Non-Storm	**0.8**	**0.0**	**6.7**	**0.0**	**0.2**
Groundwater Loads with Existing Practices in Place	**8,554.8**	**603.9**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	0.0	0.0	0.0	0.0	0.0
Residential : Vacant	16.3	2.4	379.2	705.5	2.9
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

	0.0	0.0	0.0	0.0	0.0
Commercial : Utility	8.1	0.8	165.3	350.5	1.4
Commercial : Religious/Education	169.9	17.8	3,479.0	7,374.7	29.8
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	570.6	64.8	21,008.3	23,640.9	95.6
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**3,613.6**	**416.9**	**137,241.7**	**150,461.9**	**608.8**
Primary Source Storm Load	**3,612.8**	**416.9**	**137,235.0**	**150,461.9**	**608.8**
Primary Source Non-Stormwater Load	**0.8**	**0.0**	**6.7**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	521.5	521.5	137,235.0	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**521.5**	**521.5**	**137,235.0**	**0.0**	**0.0**
Secondary Source Storm Load	**521.5**	**521.5**	**137,235.0**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-293.2	-208.9	0.0	0.0	-2.4
Pet Waste Education	242.1	31.6	0.0	2,105.2	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	33.7	4.5	1,173.3	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0

Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**-17.3**	**-172.8**	**1,173.3**	**2,105.2**	**-2.4**
Storm Reduction	**-17.3**	**-172.8**	**1,173.3**	**2,105.2**	**-2.4**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-8,554.8	-603.9	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-8,554.8**	**-603.9**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	3,629.3	589.6	136,001.3	148,348.6	611.0
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	521.5	521.5	137,235.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	1.7	0.1	67.0	8.0	0.2
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**4,152.4**	**1,111.2**	**273,303.3**	**148,356.7**	**611.2**
Total Storm Load	**4,151.6**	**1,111.2**	**273,296.6**	**148,356.7**	**611.2**
Total Non-Storm Load	**0.8**	**0.0**	**6.7**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	8,554.8	603.9	0.0	0.0	0.0
OSDS - Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**8,554.8**	**603.9**	**0.0**	**0.0**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	484.2	63.2	0.0	4,210.4	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	950.0	159.1	41,091.4	43,543.7	184.6
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	3.0	0.3	96.8	123.2	0.5
Stormwater Retrofits	357.1	43.4	14,607.5	11,299.7	40.9
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**1,794.4**	**266.0**	**55,795.8**	**59,176.9**	**226.0**
Storm Load Reduction	**1,794.4**	**266.0**	**55,795.8**	**59,176.9**	**226.0**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	-1,131.1	0.0	0.0	0.0	0.0
Stormwater Retrofits	-159.3	-5.2	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**-1,290.5**	**-5.2**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,834.9	323.6	80,205.6	89,171.7	385.1
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	521.5	521.5	137,235.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	1.7	0.1	67.0	8.0	0.2
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,358.1**	**845.3**	**217,507.6**	**89,179.8**	**385.3**
Total Storm Load	**2,357.2**	**845.2**	**217,500.9**	**89,179.8**	**385.3**
Total Non-Storm Load	**0.8**	**0.0**	**6.7**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	9,845.3	609.1	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**9,845.3**	**609.1**	**0.0**	**0.0**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	1,834.9	323.6	80,205.6	89,171.7	385.1
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	521.5	521.5	137,235.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	1.7	0.1	67.0	8.0	0.2
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,358.1**	**845.3**	**217,507.6**	**89,179.8**	**385.3**
Total Storm Load	**2,357.2**	**845.2**	**217,500.9**	**89,179.8**	**385.1**
Total Non-Storm Load	**0.8**	**0.0**	**6.7**	**0.0**	**0.2**
Groundwater Loads					
Urban Land	9,845.3	609.1	0.0	0.0	0.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**9,845.3**	**609.1**	**0.0**	**0.0**	**0.0**

Subshed 2 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	3,392.1	413.7	124,446.9	141,843.0	573.9
Uncontrolled Load from Secondary Sources	157.6	157.6	41,480.7	0.0	0.0
Load Reduction from Existing Practices	178.8	-122.2	1,374.2	3,537.6	-1.8
Existing Surface Water Load	**3,370.9**	**693.5**	**164,553.4**	**138,305.4**	**575.7**
Existing Load - Storm	**3,370.3**	**693.4**	**164,548.5**	**138,305.4**	**575.7**
Existing Load - Nonstorm	**0.6**	**0.0**	**4.9**	**0.0**	
Load Reduction from Future Practices	1,068.6	139.4	9,473.2	14,715.7	31.0
Surface Load with Future Practices in Place	**2,302.3**	**554.1**	**155,080.2**	**123,589.6**	**544.7**
Surface Load Change From Existing (%)	**-0.3**	**-0.2**	**-0.1**	**-0.1**	**-0.1**
Surface Load with Future Practices - Storm	**2,301.7**	**554.1**	**155,075.3**	**123,589.6**	**544.7**
Surface Load with Future Practices - Nonstorm	**0.6**	**0.0**	**4.9**	**0.0**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**2,302.3**	**554.1**	**155,080.2**	**123,589.6**	**544.7**
Surface Load Change From Existing (%)	**-0.3**	**-0.2**	**-0.1**	**-0.1**	**-0.1**
Surface Load Including New Development - Storm	**2,301.7**	**554.1**	**155,075.3**	**123,589.6**	**544.6**
Surface Load Including New Development - Non-Storm	**0.6**	**0.0**	**4.9**	**0.0**	**0.1**
Groundwater Loads with Existing Practices in Place	**7,518.9**	**525.3**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	77.6	11.4	1,809.7	3,366.5	13.6
Residential : Vacant	10.8	1.6	252.7	470.0	1.9
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	10.6	1.1	216.8	459.7	1.9
Commercial : Religious/Education	113.8	11.9	2,329.8	4,938.6	20.0
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	527.1	59.9	19,407.3	21,839.4	88.3
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**3,392.1**	**413.7**	**124,446.9**	**141,843.0**	**573.9**
Primary Source Storm Load	**3,391.5**	**413.7**	**124,442.0**	**141,843.0**	**573.9**
Primary Source Non-Stormwater Load	**0.6**	**0.0**	**4.9**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	157.6	157.6	41,480.7	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**157.6**	**157.6**	**41,480.7**	**0.0**	**0.0**
Secondary Source Storm Load	**157.6**	**157.6**	**41,480.7**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-269.9	-181.1	0.0	0.0	-1.8
Pet Waste Education	406.8	53.1	0.0	3,537.6	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	41.9	5.9	1,374.2	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**178.8**	**-122.2**	**1,374.2**	**3,537.6**	**-1.8**
Storm Reduction	**178.8**	**-122.2**	**1,374.2**	**3,537.6**	**-1.8**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-7,518.9	-525.3	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-7,518.9**	**-525.3**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	3,212.1	535.7	123,023.7	138,299.5	575.6
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	157.6	157.6	41,480.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	1.2	0.1	49.0	5.9	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**3,370.9**	**693.5**	**164,553.4**	**138,305.4**	**575.7**
Total Storm Load	**3,370.3**	**693.4**	**164,548.5**	**138,305.4**	**575.7**
Total Non-Storm Load	**0.6**	**0.0**	**4.9**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	7,518.9	525.3	0.0	0.0	0.0
OSDS - Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**7,518.9**	**525.3**	**0.0**	**0.0**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	813.7	106.1	0.0	7,075.3	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	39.1	5.6	1,163.6	1,718.9	7.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	215.9	27.6	8,309.6	5,921.6	24.0
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**1,068.6**	**139.4**	**9,473.2**	**14,715.7**	**31.0**
Storm Load Reduction	**1,068.6**	**139.4**	**9,473.2**	**14,715.7**	**31.0**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	-89.1	-3.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**-89.1**	**-3.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	2,143.4	396.4	113,550.5	123,583.8	544.6
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	157.6	157.6	41,480.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	1.2	0.1	49.0	5.9	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,302.3**	**554.1**	**155,080.2**	**123,589.6**	**544.7**
Total Storm Load	**2,301.7**	**554.1**	**155,075.3**	**123,589.6**	**544.7**
Total Non-Storm Load	**0.6**	**0.0**	**4.9**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	7,608.1	528.3	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**7,608.1**	**528.3**	**0.0**	**0.0**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	2,143.4	396.4	113,550.5	123,583.8	544.6
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	157.6	157.6	41,480.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	1.2	0.1	49.0	5.9	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,302.3**	**554.1**	**155,080.2**	**123,589.6**	**544.7**
Total Storm Load	**2,301.7**	**554.1**	**155,075.3**	**123,589.6**	**544.6**
Total Non-Storm Load	**0.6**	**0.0**	**4.9**	**0.0**	**0.1**
Groundwater Loads					
Urban Land	7,608.1	528.3	0.0	0.0	0.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**7,608.1**	**528.3**	**0.0**	**0.0**	**0.0**

Subshed 3 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	3,939.1	503.5	140,449.2	164,775.3	668.5
Uncontrolled Load from Secondary Sources	464.5	225.6	48,699.2	433.9	0.0
Load Reduction from Existing Practices	95.0	-182.7	2,117.9	3,834.8	-3.9
Existing Surface Water Load	**4,308.6**	**911.8**	**187,030.6**	**161,374.4**	**672.4**
Existing Load - Storm	**4,011.1**	**863.5**	**185,032.9**	**160,940.5**	**672.4**
Existing Load - Nonstorm	**297.5**	**48.3**	**1,997.6**	**433.9**	
Load Reduction from Future Practices	2,070.9	340.4	54,806.8	67,572.2	261.3
Surface Load with Future Practices in Place	**2,237.7**	**571.4**	**132,223.8**	**93,802.2**	**411.1**
Surface Load Change From Existing (%)	**-0.5**	**-0.4**	**-0.3**	**-0.4**	**-0.4**
Surface Load with Future Practices - Storm	**1,940.2**	**523.1**	**130,226.1**	**93,368.3**	**411.1**
Surface Load with Future Practices - Nonstorm	**297.5**	**48.3**	**1,997.6**	**433.9**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**2,237.7**	**571.4**	**132,223.8**	**93,802.2**	**411.1**
Surface Load Change From Existing (%)	**-0.5**	**-0.4**	**-0.3**	**-0.4**	**-0.4**
Surface Load Including New Development - Storm	**1,940.2**	**523.1**	**130,226.1**	**93,368.3**	**408.7**
Surface Load Including New Development - Non-Storm	**297.5**	**48.3**	**1,997.6**	**433.9**	**2.3**
Groundwater Loads with Existing Practices in Place	**13,422.6**	**917.0**	**0.0**	**617.4**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	503.0	74.3	11,737.2	21,833.6	88.3
Residential : Vacant	10.9	1.6	253.8	472.1	1.9
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	12.2	1.3	249.6	529.1	2.1
Commercial : Religious/Education	36.9	3.9	754.6	1,599.5	6.5
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	22.9	2.6	842.5	948.1	3.8
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**3,939.1**	**503.5**	**140,449.2**	**164,775.3**	**668.5**
Primary Source Storm Load	**3,928.3**	**503.0**	**140,363.1**	**164,775.3**	**668.5**
Primary Source Non-Stormwater Load	**10.8**	**0.5**	**86.1**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	286.7	47.8	1,911.5	433.9	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	177.8	177.8	46,787.7	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**464.5**	**225.6**	**48,699.2**	**433.9**	**0.0**
Secondary Source Storm Load	**177.8**	**177.8**	**46,787.7**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**286.7**	**47.8**	**1,911.5**	**433.9**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	3,530.2	221.9	0.0	617.4	0.0
Total Groundwater Load	**3,530.2**	**221.9**	**0.0**	**617.4**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-413.2	-249.9	0.0	0.0	-3.9
Pet Waste Education	441.0	57.5	0.0	3,834.8	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	67.1	9.7	2,117.9	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**95.0**	**-182.7**	**2,117.9**	**3,834.8**	**-3.9**
Storm Reduction	**95.0**	**-182.7**	**2,117.9**	**3,834.8**	**-3.9**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-9,892.4	-695.1	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-9,892.4**	**-695.1**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	3,822.6	684.5	137,470.3	160,837.2	670.0
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	177.8	177.8	46,787.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	21.5	1.7	861.0	103.3	2.3
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	286.7	47.8	1,911.5	433.9	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**4,308.6**	**911.8**	**187,030.6**	**161,374.4**	**672.4**
Total Storm Load	**4,011.1**	**863.5**	**185,032.9**	**160,940.5**	**672.4**
Total Non-Storm Load	**297.5**	**48.3**	**1,997.6**	**433.9**	**0.0**
Groundwater Loads					
Urban Land	9,892.4	695.1	0.0	0.0	0.0
OSDS - Subsurface	3,530.2	221.9	0.0	617.4	0.0
Total Groundwater Load	**13,422.6**	**917.0**	**0.0**	**617.4**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	882.0	115.0	0.0	7,669.6	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	1,106.4	214.2	51,722.5	57,628.6	252.1
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	82.5	11.1	3,084.3	2,274.1	9.2
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**2,070.9**	**340.4**	**54,806.8**	**67,572.2**	**261.3**
Storm Load Reduction	**2,070.9**	**340.4**	**54,806.8**	**67,572.2**	**261.3**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	-1,067.1	-8.2	0.0	-2,205.6	0.0
Stormwater Retrofits	-34.8	-1.2	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**-1,101.9**	**-9.4**	**0.0**	**-2,205.6**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,751.7	344.1	82,663.5	93,265.0	408.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	177.8	177.8	46,787.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	21.5	1.7	861.0	103.3	2.3
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	286.7	47.8	1,911.5	433.9	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,237.7**	**571.4**	**132,223.8**	**93,802.2**	**411.1**
Total Storm Load	**1,940.2**	**523.1**	**130,226.1**	**93,368.3**	**411.1**
Total Non-Storm Load	**297.5**	**48.3**	**1,997.6**	**433.9**	**0.0**
Groundwater Loads					
Urban Land	10,994.3	704.5	0.0	2,205.6	0.0
OSDSs	3,530.2	221.9	0.0	617.4	0.0
Total Groundwater Load	**14,524.5**	**926.4**	**0.0**	**2,823.0**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	1,751.7	344.1	82,663.5	93,265.0	408.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	177.8	177.8	46,787.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	21.5	1.7	861.0	103.3	2.3
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	286.7	47.8	1,911.5	433.9	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,237.7**	**571.4**	**132,223.8**	**93,802.2**	**411.1**
Total Storm Load	**1,940.2**	**523.1**	**130,226.1**	**93,368.3**	**408.7**
Total Non-Storm Load	**297.5**	**48.3**	**1,997.6**	**433.9**	**2.3**
Groundwater Loads					
Urban Land	10,994.3	704.5	0.0	2,205.6	0.0
Septic Systems	3,530.2	221.9	0.0	617.4	0.0
Total Groundwater Load	**14,524.5**	**926.4**	**0.0**	**2,823.0**	**0.0**

Subshed 4 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	1,022.4	131.9	37,421.9	42,807.6	173.3
Uncontrolled Load from Secondary Sources	47.4	47.4	12,471.1	0.0	0.0
Load Reduction from Existing Practices	89.0	-45.2	622.8	1,641.3	-0.8
Existing Surface Water Load	**980.8**	**224.5**	**49,270.2**	**41,166.3**	**174.1**
Existing Load - Storm	**979.8**	**224.4**	**49,261.5**	**41,166.3**	**174.1**
Existing Load - Nonstorm	**1.1**	**0.1**	**8.7**	**0.0**	
Load Reduction from Future Practices	708.0	124.8	21,722.5	25,661.4	102.6
Surface Load with Future Practices in Place	**272.9**	**99.7**	**27,547.7**	**15,504.9**	**71.4**
Surface Load Change From Existing (%)	**-0.7**	**-0.6**	**-0.4**	**-0.6**	**-0.6**
Surface Load with Future Practices - Storm	**271.8**	**99.6**	**27,539.0**	**15,504.9**	**71.4**
Surface Load with Future Practices - Nonstorm	**1.1**	**0.1**	**8.7**	**0.0**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**272.9**	**99.7**	**27,547.7**	**15,504.9**	**71.4**
Surface Load Change From Existing (%)	**-0.7**	**-0.6**	**-0.4**	**-0.6**	**-0.6**
Surface Load Including New Development - Storm	**271.8**	**99.6**	**27,539.0**	**15,504.9**	**71.3**
Surface Load Including New Development - Non-Storm	**1.1**	**0.1**	**8.7**	**0.0**	**0.2**
Groundwater Loads with Existing Practices in Place	**2,843.9**	**200.8**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	2.0	0.3	47.8	89.0	0.4
Residential : Vacant	1.1	0.2	24.8	46.1	0.2
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	2.6	0.3	53.8	114.1	0.5
Commercial : Commercial	10.5	1.1	215.8	457.5	1.9
Commercial : Mixed Use	0.0	0.0	0.0	0.0	0.0
Commercial : Cemetary	0.0	0.0	0.0	0.0	0.0
Commercial : Municipal	70.0	7.3	1,432.6	3,036.8	12.3
Commercial : Religious/Education	0.0	0.0	0.0	0.0	0.0
Roadway : Roadway	394.1	42.8	22,962.7	15,619.8	63.2
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Forest : Forest	0.0	0.0	0.0	0.0	0.0
Forest : Open Space	1.1	0.1	43.0	5.2	0.1
Forest : Unbuildable Residential	1.1	0.1	44.0	5.3	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Rural : Rural	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**1,022.4**	**131.9**	**37,421.9**	**42,807.6**	**173.3**
Primary Source Storm Load	**1,021.4**	**131.8**	**37,413.2**	**42,807.6**	**173.3**
Primary Source Non-Stormwater Load	**1.1**	**0.1**	**8.7**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	47.4	47.4	12,471.1	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**47.4**	**47.4**	**12,471.1**	**0.0**	**0.0**
Secondary Source Storm Load	**47.4**	**47.4**	**12,471.1**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Reductions to Surface Water Loads					
Turf Management - Surface	-119.6	-72.7	0.0	0.0	-0.8
Pet Waste Education	188.7	24.6	0.0	1,641.3	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	19.8	2.9	622.8	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**89.0**	**-45.2**	**622.8**	**1,641.3**	**-0.8**
Storm Reduction	**89.0**	**-45.2**	**622.8**	**1,641.3**	**-0.8**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-2,843.9	-200.8	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-2,843.9**	**-200.8**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	931.3	176.9	36,712.2	41,155.9	173.9
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	47.4	47.4	12,471.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.2	0.2	87.0	10.4	0.2
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0

Total Surface Water Load	**980.8**	**224.5**	**49,270.2**	**41,166.3**	**174.1**
Total Storm Load	**979.8**	**224.4**	**49,261.5**	**41,166.3**	**174.1**
Total Non-Storm Load	**1.1**	**0.1**	**8.7**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,843.9	200.8	0.0	0.0	0.0
OSDS - Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,843.9**	**200.8**	**0.0**	**0.0**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	377.5	49.2	0.0	3,282.5	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	324.0	74.7	21,479.9	22,159.3	101.8
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	6.5	0.9	242.6	219.6	0.9
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**708.0**	**124.8**	**21,722.5**	**25,661.4**	**102.6**
Storm Load Reduction	**708.0**	**124.8**	**21,722.5**	**25,661.4**	**102.6**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	-299.9	-1.0	0.0	-290.2	0.0
Stormwater Retrofits	-3.4	-0.1	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**-303.3**	**-1.1**	**0.0**	**-290.2**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	223.3	52.1	14,989.6	15,494.5	71.3
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	47.4	47.4	12,471.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.2	0.2	87.0	10.4	0.2
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**272.9**	**99.7**	**27,547.7**	**15,504.9**	**71.4**
Total Storm Load	**271.8**	**99.6**	**27,539.0**	**15,504.9**	**71.4**
Total Non-Storm Load	**1.1**	**0.1**	**8.7**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	3,147.2	201.9	0.0	290.2	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**3,147.2**	**201.9**	**0.0**	**290.2**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	223.3	52.1	14,989.6	15,494.5	71.3
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	47.4	47.4	12,471.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.2	0.2	87.0	10.4	0.2
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0

Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**272.9**	**99.7**	**27,547.7**	**15,504.9**	**71.4**
Total Storm Load	**271.8**	**99.6**	**27,539.0**	**15,504.9**	**71.3**
Total Non-Storm Load	**1.1**	**0.1**	**8.7**	**0.0**	**0.2**
Groundwater Loads					
Urban Land	3,147.2	201.9	0.0	290.2	0.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**3,147.2**	**201.9**	**0.0**	**290.2**	**0.0**

Subshed 5 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	2,312.4	296.3	88,322.2	96,529.0	390.5
Uncontrolled Load from Secondary Sources	150.1	118.2	29,693.3	57.9	0.0
Load Reduction from Existing Practices	-15.9	-142.1	1,552.5	2,131.8	-2.0
Existing Surface Water Load	**2,478.5**	**556.7**	**116,463.0**	**94,455.1**	**392.5**
Existing Load - Storm	**2,439.2**	**550.3**	**116,200.0**	**94,397.2**	**392.5**
Existing Load - Nonstorm	**39.3**	**6.4**	**263.0**	**57.9**	
Load Reduction from Future Practices	499.7	65.2	294.2	4,654.4	1.6
Surface Load with Future Practices in Place	**1,978.8**	**491.5**	**116,168.7**	**89,800.7**	**390.9**
Surface Load Change From Existing (%)	**-0.2**	**-0.1**	**0.0**	**0.0**	**0.0**
Surface Load with Future Practices - Storm	**1,939.5**	**485.0**	**115,905.8**	**89,742.8**	**390.9**
Surface Load with Future Practices - Nonstorm	**39.3**	**6.4**	**263.0**	**57.9**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**1,978.8**	**491.5**	**116,168.7**	**89,800.7**	**390.9**
Surface Load Change From Existing (%)	**-0.2**	**-0.1**	**0.0**	**0.0**	**0.0**
Surface Load Including New Development - Storm	**1,939.5**	**485.0**	**115,905.8**	**89,742.8**	**390.8**
Surface Load Including New Development - Non-Storm	**39.3**	**6.4**	**263.0**	**57.9**	**0.1**
Groundwater Loads with Existing Practices in Place	**7,472.1**	**523.9**	**0.0**	**82.4**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	27.4	4.0	639.3	1,189.3	4.8
Residential : Vacant	8.6	1.3	199.6	371.3	1.5
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	5.1	0.5	104.9	222.4	0.9
Commercial : Religious/Education	66.9	7.0	1,369.3	2,902.7	11.7
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	32.0	3.6	1,178.4	1,326.0	5.4
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**2,312.4**	**296.3**	**88,322.2**	**96,529.0**	**390.5**
Primary Source Storm Load	**2,311.5**	**296.2**	**88,314.4**	**96,529.0**	**390.5**
Primary Source Non-Stormwater Load	**1.0**	**0.0**	**7.8**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	38.3	6.4	255.2	57.9	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	111.9	111.9	29,438.1	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**150.1**	**118.2**	**29,693.3**	**57.9**	**0.0**
Secondary Source Storm Load	**111.9**	**111.9**	**29,438.1**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**38.3**	**6.4**	**255.2**	**57.9**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	471.3	29.6	0.0	82.4	0.0
Total Groundwater Load	**471.3**	**29.6**	**0.0**	**82.4**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-310.1	-181.2	0.0	0.0	-2.0
Pet Waste Education	245.2	32.0	0.0	2,131.8	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	49.1	7.1	1,552.5	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**-15.9**	**-142.1**	**1,552.5**	**2,131.8**	**-2.0**
Storm Reduction	**-15.9**	**-142.1**	**1,552.5**	**2,131.8**	**-2.0**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-7,000.8	-494.2	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-7,000.8**	**-494.2**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	2,326.4	438.3	86,691.7	94,387.9	392.4
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	111.9	111.9	29,438.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.0	0.2	78.0	9.4	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	38.3	6.4	255.2	57.9	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,478.5**	**556.7**	**116,463.0**	**94,455.1**	**392.5**
Total Storm Load	**2,439.2**	**550.3**	**116,200.0**	**94,397.2**	**392.5**
Total Non-Storm Load	**39.3**	**6.4**	**263.0**	**57.9**	**0.0**
Groundwater Loads					
Urban Land	7,000.8	494.2	0.0	0.0	0.0
OSDS - Subsurface	471.3	29.6	0.0	82.4	0.0
Total Groundwater Load	**7,472.1**	**523.9**	**0.0**	**82.4**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	490.3	64.0	0.0	4,263.7	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	9.4	1.3	294.2	390.8	1.6
Stormwater Retrofits	0.0	0.0	0.0	0.0	0.0
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**499.7**	**65.2**	**294.2**	**4,654.4**	**1.6**
Storm Load Reduction	**499.7**	**65.2**	**294.2**	**4,654.4**	**1.6**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,826.7	373.1	86,397.4	89,733.4	390.8
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	111.9	111.9	29,438.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.0	0.2	78.0	9.4	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	38.3	6.4	255.2	57.9	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**1,978.8**	**491.5**	**116,168.7**	**89,800.7**	**390.9**
Total Storm Load	**1,939.5**	**485.0**	**115,905.8**	**89,742.8**	**390.9**
Total Non-Storm Load	**39.3**	**6.4**	**263.0**	**57.9**	**0.0**
Groundwater Loads					
Urban Land	7,000.8	494.2	0.0	0.0	0.0
OSDSs	471.3	29.6	0.0	82.4	0.0
Total Groundwater Load	**7,472.1**	**523.9**	**0.0**	**82.4**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	1,826.7	373.1	86,397.4	89,733.4	390.8
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	111.9	111.9	29,438.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.0	0.2	78.0	9.4	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	38.3	6.4	255.2	57.9	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**1,978.8**	**491.5**	**116,168.7**	**89,800.7**	**390.9**
Total Storm Load	**1,939.5**	**485.0**	**115,905.8**	**89,742.8**	**390.8**
Total Non-Storm Load	**39.3**	**6.4**	**263.0**	**57.9**	**0.1**
Groundwater Loads					
Urban Land	7,000.8	494.2	0.0	0.0	0.0
Septic Systems	471.3	29.6	0.0	82.4	0.0
Total Groundwater Load	**7,472.1**	**523.9**	**0.0**	**82.4**	**0.0**

Subshed 6 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	2,815.9	337.9	93,722.3	116,930.9	473.0
Uncontrolled Load from Secondary Sources	380.3	360.2	93,883.2	36.5	0.0
Load Reduction from Existing Practices	6.1	-128.4	1,127.3	2,180.9	-1.8
Existing Surface Water Load	**3,190.1**	**826.5**	**186,478.2**	**114,786.6**	**474.8**
Existing Load - Storm	**3,165.9**	**822.5**	**186,317.2**	**114,750.1**	**474.8**
Existing Load - Nonstorm	**24.1**	**4.0**	**160.9**	**36.5**	
Load Reduction from Future Practices	1,369.7	218.5	35,301.0	46,692.9	182.1
Surface Load with Future Practices in Place	**1,820.4**	**608.0**	**151,177.2**	**68,093.7**	**292.7**
Surface Load Change From Existing (%)	**-0.4**	**-0.3**	**-0.2**	**-0.4**	**-0.4**
Surface Load with Future Practices - Storm	**1,796.3**	**604.0**	**151,016.2**	**68,057.1**	**292.7**
Surface Load with Future Practices - Nonstorm	**24.1**	**4.0**	**160.9**	**36.5**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**1,820.4**	**608.0**	**151,177.2**	**68,093.7**	**292.7**
Surface Load Change From Existing (%)	**-0.4**	**-0.3**	**-0.2**	**-0.4**	**-0.4**
Surface Load Including New Development - Storm	**1,796.3**	**604.0**	**151,016.2**	**68,057.1**	**292.7**
Surface Load Including New Development - Non-Storm	**24.1**	**4.0**	**160.9**	**36.5**	**0.0**
Groundwater Loads with Existing Practices in Place	**6,748.6**	**474.1**	**0.0**	**52.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	0.0	0.0	0.0	0.0	0.0
Residential : Vacant	1.8	0.3	41.2	76.7	0.3
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	0.0	0.0	0.0	0.0	0.0
Commercial : Religious/Education	812.1	85.1	16,629.0	35,249.9	142.6
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	44.5	1.7	539.4	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**2,815.9**	**337.9**	**93,722.3**	**116,930.9**	**473.0**
Primary Source Storm Load	**2,815.9**	**337.9**	**93,722.3**	**116,930.9**	**473.0**
Primary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	24.1	4.0	160.9	36.5	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	356.1	356.1	93,722.3	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**380.3**	**360.2**	**93,883.2**	**36.5**	**0.0**
Secondary Source Storm Load	**356.1**	**356.1**	**93,722.3**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**24.1**	**4.0**	**160.9**	**36.5**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	297.2	18.7	0.0	52.0	0.0
Total Groundwater Load	**297.2**	**18.7**	**0.0**	**52.0**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	**TP (lb/year)**	**TSS (lb/year)**	**Fecal Coliform (billion/year)**	**Runoff Volume (acre-feet/year)**
Turf Management - Surface	-280.6	-166.2	0.0	0.0	-1.8
Pet Waste Education	250.8	32.7	0.0	2,180.9	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	35.9	5.1	1,127.3	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**6.1**	**-128.4**	**1,127.3**	**2,180.9**	**-1.8**
Storm Reduction	**6.1**	**-128.4**	**1,127.3**	**2,180.9**	**-1.8**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-6,451.4	-455.4	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-6,451.4**	**-455.4**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	2,765.2	464.6	92,055.5	114,750.1	474.8
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	356.1	356.1	93,722.3	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.0	0.0	0.0	0.0	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	24.1	4.0	160.9	36.5	0.0
Open Water	44.5	1.7	539.4	0.0	0.0
Total Surface Water Load	**3,190.1**	**826.5**	**186,478.2**	**114,786.6**	**474.8**
Total Storm Load	**3,165.9**	**822.5**	**186,317.2**	**114,750.1**	**474.8**
Total Non-Storm Load	**24.1**	**4.0**	**160.9**	**36.5**	**0.0**
Groundwater Loads					
Urban Land	6,451.4	455.4	0.0	0.0	0.0
OSDS - Subsurface	297.2	18.7	0.0	52.0	0.0
Total Groundwater Load	**6,748.6**	**474.1**	**0.0**	**52.0**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	501.6	65.4	0.0	4,361.8	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	868.0	153.1	35,301.0	42,331.1	182.1
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	0.0	0.0	0.0	0.0	0.0
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**1,369.7**	**218.5**	**35,301.0**	**46,692.9**	**182.1**
Storm Load Reduction	**1,369.7**	**218.5**	**35,301.0**	**46,692.9**	**182.1**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	-814.9	0.0	0.0	0.0	0.0
Stormwater Retrofits	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**-814.9**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,395.6	246.1	56,754.5	68,057.1	292.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	356.1	356.1	93,722.3	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.0	0.0	0.0	0.0	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	24.1	4.0	160.9	36.5	0.0
Open Water	44.5	1.7	539.4	0.0	0.0
Total Surface Water Load	**1,820.4**	**608.0**	**151,177.2**	**68,093.7**	**292.7**
Total Storm Load	**1,796.3**	**604.0**	**151,016.2**	**68,057.1**	**292.7**
Total Non-Storm Load	**24.1**	**4.0**	**160.9**	**36.5**	**0.0**
Groundwater Loads					
Urban Land	7,266.3	455.4	0.0	0.0	0.0
OSDSs	297.2	18.7	0.0	52.0	0.0
Total Groundwater Load	**7,563.5**	**474.1**	**0.0**	**52.0**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	1,395.6	246.1	56,754.5	68,057.1	292.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	356.1	356.1	93,722.3	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.0	0.0	0.0	0.0	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	24.1	4.0	160.9	36.5	0.0
Open Water	44.5	1.7	539.4	0.0	0.0
Total Surface Water Load	**1,820.4**	**608.0**	**151,177.2**	**68,093.7**	**292.7**
Total Storm Load	**1,796.3**	**604.0**	**151,016.2**	**68,057.1**	**292.7**
Total Non-Storm Load	**24.1**	**4.0**	**160.9**	**36.5**	**0.0**
Groundwater Loads					
Urban Land	7,266.3	455.4	0.0	0.0	0.0
Septic Systems	297.2	18.7	0.0	52.0	0.0
Total Groundwater Load	**7,563.5**	**474.1**	**0.0**	**52.0**	**0.0**

Subshed 7 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	771.6	96.1	27,371.4	32,408.7	131.1
Uncontrolled Load from Secondary Sources	104.0	104.0	27,369.1	0.0	0.0
Load Reduction from Existing Practices	-30.6	-50.8	409.8	555.0	-0.7
Existing Surface Water Load	**906.2**	**250.9**	**54,330.6**	**31,853.6**	**131.8**
Existing Load - Storm	**905.9**	**250.9**	**54,328.3**	**31,853.6**	**131.8**
Existing Load - Nonstorm	**0.3**	**0.0**	**2.3**	**0.0**	
Load Reduction from Future Practices	127.7	16.7	0.0	1,110.1	0.0
Surface Load with Future Practices in Place	**778.5**	**234.3**	**54,330.6**	**30,743.6**	**131.8**
Surface Load Change From Existing (%)	**-0.1**	**-0.1**	**0.0**	**0.0**	**0.0**
Surface Load with Future Practices - Storm	**778.2**	**234.3**	**54,328.3**	**30,743.6**	**131.8**
Surface Load with Future Practices - Nonstorm	**0.3**	**0.0**	**2.3**	**0.0**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**778.5**	**234.3**	**54,330.6**	**30,743.6**	**131.8**
Surface Load Change From Existing (%)	**-0.1**	**-0.1**	**0.0**	**0.0**	**0.0**
Surface Load Including New Development - Storm	**778.2**	**234.3**	**54,328.3**	**30,743.6**	**131.7**
Surface Load Including New Development - Non-Storm	**0.3**	**0.0**	**2.3**	**0.0**	**0.0**
Groundwater Loads with Existing Practices in Place	**2,336.5**	**164.9**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	0.0	0.0	0.0	0.0	0.0
Residential : Vacant	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	0.0	0.0	0.0	0.0	0.0
Commercial : Religious/Education	54.4	5.7	1,113.7	2,360.8	9.6
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**771.6**	**96.1**	**27,371.4**	**32,408.7**	**131.1**
Primary Source Storm Load	**771.3**	**96.1**	**27,369.1**	**32,408.7**	**131.1**
Primary Source Non-Stormwater Load	**0.3**	**0.0**	**2.3**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	104.0	104.0	27,369.1	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**104.0**	**104.0**	**27,369.1**	**0.0**	**0.0**
Secondary Source Storm Load	**104.0**	**104.0**	**27,369.1**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-107.5	-61.1	0.0	0.0	-0.7
Pet Waste Education	63.8	8.3	0.0	555.0	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	13.1	1.9	409.8	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**-30.6**	**-50.8**	**409.8**	**555.0**	**-0.7**
Storm Reduction	**-30.6**	**-50.8**	**409.8**	**555.0**	**-0.7**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-2,336.5	-164.9	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-2,336.5**	**-164.9**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	801.6	146.9	26,938.6	31,850.9	131.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	104.0	104.0	27,369.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.6	0.0	23.0	2.8	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**906.2**	**250.9**	**54,330.6**	**31,853.6**	**131.8**
Total Storm Load	**905.9**	**250.9**	**54,328.3**	**31,853.6**	**131.8**
Total Non-Storm Load	**0.3**	**0.0**	**2.3**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,336.5	164.9	0.0	0.0	0.0
OSDS - Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,336.5**	**164.9**	**0.0**	**0.0**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	127.7	16.7	0.0	1,110.1	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	0.0	0.0	0.0	0.0	0.0
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**127.7**	**16.7**	**0.0**	**1,110.1**	**0.0**
Storm Load Reduction	**127.7**	**16.7**	**0.0**	**1,110.1**	**0.0**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	673.9	130.2	26,938.6	30,740.8	131.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	104.0	104.0	27,369.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.6	0.0	23.0	2.8	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**778.5**	**234.3**	**54,330.6**	**30,743.6**	**131.8**
Total Storm Load	**778.2**	**234.3**	**54,328.3**	**30,743.6**	**131.8**
Total Non-Storm Load	**0.3**	**0.0**	**2.3**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,336.5	164.9	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,336.5**	**164.9**	**0.0**	**0.0**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	**TP**	**TSS**	**Fecal Coliform**	**Runoff Volume**
Surface Water Loads					
Urban Land	673.9	130.2	26,938.6	30,740.8	131.7
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	104.0	104.0	27,369.1	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.6	0.0	23.0	2.8	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**778.5**	**234.3**	**54,330.6**	**30,743.6**	**131.8**
Total Storm Load	**778.2**	**234.3**	**54,328.3**	**30,743.6**	**131.7**
Total Non-Storm Load	**0.3**	**0.0**	**2.3**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,336.5	164.9	0.0	0.0	0.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,336.5**	**164.9**	**0.0**	**0.0**	**0.0**

Subshed 8 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	2,742.0	329.1	76,417.9	117,068.4	473.7
Uncontrolled Load from Secondary Sources	559.2	335.2	78,199.9	406.8	0.0
Load Reduction from Existing Practices	719.8	-25.9	24,466.3	37,834.7	148.5
Existing Surface Water Load	**2,581.4**	**690.1**	**130,151.6**	**79,640.5**	**325.2**
Existing Load - Storm	**2,311.3**	**645.2**	**128,348.8**	**79,233.7**	**325.2**
Existing Load - Nonstorm	**270.2**	**44.9**	**1,802.8**	**406.8**	
Load Reduction from Future Practices	705.2	88.4	12,933.9	17,981.6	63.9
Surface Load with Future Practices in Place	**1,876.2**	**601.8**	**117,217.7**	**61,658.9**	**261.2**
Surface Load Change From Existing (%)	**-0.3**	**-0.1**	**-0.1**	**-0.2**	**-0.2**
Surface Load with Future Practices - Storm	**1,606.0**	**556.9**	**115,414.9**	**61,252.1**	**261.2**
Surface Load with Future Practices - Nonstorm	**270.2**	**44.9**	**1,802.8**	**406.8**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**1,876.2**	**601.8**	**117,217.7**	**61,658.9**	**261.2**
Surface Load Change From Existing (%)	**-0.3**	**-0.1**	**-0.1**	**-0.2**	**-0.2**
Surface Load Including New Development - Storm	**1,606.0**	**556.9**	**115,414.9**	**61,252.1**	**261.1**
Surface Load Including New Development - Non-Storm	**270.2**	**44.9**	**1,802.8**	**406.8**	**0.1**
Groundwater Loads with Existing Practices in Place	**12,135.2**	**778.2**	**0.0**	**578.9**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	5.5	0.8	127.2	236.6	1.0
Residential : Vacant	0.9	0.1	21.4	39.8	0.2
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	0.0	0.0	0.0	0.0	0.0
Commercial : Religious/Education	462.8	48.5	9,476.8	20,088.7	81.3
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	248.2	28.2	9,136.8	10,281.7	41.6
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**2,742.0**	**329.1**	**76,417.9**	**117,068.4**	**473.7**
Primary Source Storm Load	**2,740.7**	**329.0**	**76,407.5**	**117,068.4**	**473.7**
Primary Source Non-Stormwater Load	**1.3**	**0.1**	**10.4**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	268.9	44.8	1,792.4	406.8	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	290.3	290.3	76,407.5	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**559.2**	**335.2**	**78,199.9**	**406.8**	**0.0**
Secondary Source Storm Load	**290.3**	**290.3**	**76,407.5**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**268.9**	**44.8**	**1,792.4**	**406.8**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	3,310.1	208.1	0.0	578.9	0.0
Total Groundwater Load	**3,310.1**	**208.1**	**0.0**	**578.9**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-355.9	-208.7	0.0	0.0	-2.3
Pet Waste Education	125.1	16.3	0.0	1,087.6	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	13.8	2.0	416.6	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	936.8	164.6	24,049.7	36,747.1	150.8
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**719.8**	**-25.9**	**24,466.3**	**37,834.7**	**148.5**
Storm Reduction	**719.8**	**-25.9**	**24,466.3**	**37,834.7**	**148.5**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-8,075.6	-570.1	0.0	0.0	0.0
Riparian Buffers	-749.4	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-8,825.1**	**-570.1**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	2,019.6	354.8	51,847.7	79,221.2	325.0
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	290.3	290.3	76,407.5	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.6	0.2	104.0	12.5	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	268.9	44.8	1,792.4	406.8	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,581.4**	**690.1**	**130,151.6**	**79,640.5**	**325.2**
Total Storm Load	**2,311.3**	**645.2**	**128,348.8**	**79,233.7**	**325.2**
Total Non-Storm Load	**270.2**	**44.9**	**1,802.8**	**406.8**	**0.0**
Groundwater Loads					
Urban Land	8,825.1	570.1	0.0	0.0	0.0
OSDS - Subsurface	3,310.1	208.1	0.0	578.9	0.0
Total Groundwater Load	**12,135.2**	**778.2**	**0.0**	**578.9**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	250.2	32.6	0.0	2,175.3	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	455.1	55.7	12,933.9	15,806.3	63.9
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**705.2**	**88.4**	**12,933.9**	**17,981.6**	**63.9**
Storm Load Reduction	**705.2**	**88.4**	**12,933.9**	**17,981.6**	**63.9**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	749.4	0.0	0.0	0.0	0.0
Stormwater Retrofits	-238.5	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**510.9**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,314.4	266.4	38,913.8	61,239.6	261.1
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	290.3	290.3	76,407.5	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.6	0.2	104.0	12.5	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	268.9	44.8	1,792.4	406.8	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**1,876.2**	**601.8**	**117,217.7**	**61,658.9**	**261.2**
Total Storm Load	**1,606.0**	**556.9**	**115,414.9**	**61,252.1**	**261.2**
Total Non-Storm Load	**270.2**	**44.9**	**1,802.8**	**406.8**	**0.0**
Groundwater Loads					
Urban Land	8,314.1	570.1	0.0	0.0	0.0
OSDSs	3,310.1	208.1	0.0	578.9	0.0
Total Groundwater Load	**11,624.2**	**778.2**	**0.0**	**578.9**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	TP	TSS	Fecal Coliform	Runoff Volume
Surface Water Loads					
Urban Land	1,314.4	266.4	38,913.8	61,239.6	261.1
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	290.3	290.3	76,407.5	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	2.6	0.2	104.0	12.5	0.1
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	268.9	44.8	1,792.4	406.8	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**1,876.2**	**601.8**	**117,217.7**	**61,658.9**	**261.2**
Total Storm Load	**1,606.0**	**556.9**	**115,414.9**	**61,252.1**	**261.1**
Total Non-Storm Load	**270.2**	**44.9**	**1,802.8**	**406.8**	**0.1**
Groundwater Loads					
Urban Land	8,314.1	570.1	0.0	0.0	0.0
Septic Systems	3,310.1	208.1	0.0	578.9	0.0
Total Groundwater Load	**11,624.2**	**778.2**	**0.0**	**578.9**	**0.0**

Subshed 9 WTM Results

Show/Hide Results

- ☐ Source Loads
- ☐ Benefits of Existing Practices
- ☐ Benefits of Future Practices
- ☐ Loads With Existing Practices
- oads With Future Practices
- oads With New Development

This sheet provides a summary of results of the WTM model runs. The first table provides an overview of all loads (existing, with future practices and with new development). Use the check boxes to select more detailed descriptions of pollutant loads or practice benefits. Note that the cells in this sheet are locked. The "**Results-Unlocked**" tab has the same information, but unlocked so that the user can copy data from the model results.

This summary table summarizes pollutant loads and runoff volume in the Existing Condition, with Future Practices in place, and with New Development. The purple cells in this table represent final loads (or % change from Existing). The grey cells are interim calculations, such as the load reduction from practices (summarized). Surface water loads represents all loads during stormflow or during non-storm events that are delivered to surface waters, and Groundwater Loads include loads directly to groundwater from urban lawns, On-Site Sewage Disposal Systems, and BMPs that provide infiltration. While some of the loads to groundwater may ultimately be delivered to surface waters, the WTM does not make this calculation. To calculate loads to surface waters from groundwater, multiply the groundwater loads by a delivery ratio (known from local conditions), and add to surface water loads.

Summary Table

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Surface Water Loads					
Uncontrolled Load from Primary Sources	1,938.4	216.0	78,119.1	80,205.0	324.5
Uncontrolled Load from Secondary Sources	99.0	99.0	26,039.7	0.0	0.0
Load Reduction from Existing Practices	31.3	-42.7	614.2	852.9	-0.6
Existing Surface Water Load	**2,006.0**	**357.6**	**103,544.7**	**79,352.1**	**325.1**
Existing Load - Storm	**2,006.0**	**357.6**	**103,544.7**	**79,352.1**	**325.1**
Existing Load - Nonstorm	**0.0**	**0.0**	**0.0**	**0.0**	
Load Reduction from Future Practices	390.7	48.1	8,006.3	7,596.7	23.8
Surface Load with Future Practices in Place	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Surface Load Change From Existing (%)	**-0.2**	**-0.1**	**-0.1**	**-0.1**	**-0.1**
Surface Load with Future Practices - Storm	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Surface Load with Future Practices - Nonstorm	**0.0**	**0.0**	**0.0**	**0.0**	
Load from New Development	0.0	0.0	0.0	0.0	0.0
Total Surface Load Including New Development	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Surface Load Change From Existing (%)	**-0.2**	**-0.1**	**-0.1**	**-0.1**	**-0.1**
Surface Load Including New Development - Storm	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Surface Load Including New Development - Non-Storm	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Groundwater Loads with Existing Practices in Place	**2,316.7**	**163.5**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes from ***Uncontrolled*** pollutant sources, including both the Primary Sources and Secondary Sources included in the "**Sources"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). THIS LOAD DOES NOT INCLUDE TURF MANAGEMENT. Note that the load from turf managment typically appears as a "negative reduction", and will likely increase teh laods beyond those reported as Primary Sources.

Source Loads (Without Practices)

Primary Sources

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Residential : Multifamily	0.0	0.0	0.0	0.0	0.0
Residential : Vacant	8.5	1.3	198.7	369.6	1.5
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0

Commercial : Utility	19.9	2.1	406.7	862.1	3.5
Commercial : Religious/Education	267.8	28.1	5,483.9	11,624.7	47.0
	0.0	0.0	0.0	0.0	0.0
Industrial : Industrial	389.1	44.2	14,327.2	16,122.6	65.2
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Active Construction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Primary Source Load	**1,938.4**	**216.0**	**78,119.1**	**80,205.0**	**324.5**
Primary Source Storm Load	**1,938.4**	**216.0**	**78,119.1**	**80,205.0**	**324.5**
Primary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Sources					
Secondary Load to Surface Waters					
OSDSs - Surface	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Channel Erosion	99.0	99.0	26,039.7	0.0	0.0
Hobby Farms/Livestock	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Point Source Discharges	0.0	0.0	0.0	0.0	0.0
Total Surface Water Secondary Source Surface Load	**99.0**	**99.0**	**26,039.7**	**0.0**	**0.0**
Secondary Source Storm Load	**99.0**	**99.0**	**26,039.7**	**0.0**	**0.0**
Secondary Source Non-Stormwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Secondary Load to Groundwater					
OSDSs- Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant load and runoff reductions achieved by practices included in the **"Existing Practices"** tab. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load due to a management practice such as turf management, or a contribution to groundwater from a practice that uses infiltration.

Benefits (Load Reductions) of Existing Practices

Reductions to Surface Water Loads

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Turf Management - Surface	-81.9	-57.3	0.0	0.0	-0.6
Pet Waste Education	98.1	12.8	0.0	852.9	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	15.1	1.9	614.2	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0

Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**31.3**	**-42.7**	**614.2**	**852.9**	**-0.6**
Storm Reduction	**31.3**	**-42.7**	**614.2**	**852.9**	**-0.6**
Non-Storm Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Turf Management	-2,316.7	-163.5	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Structural Stormwater Management Practices	0.0	0.0	0.0	0.0	0.0
Total Groundwater Reduction	**-2,316.7**	**-163.5**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** tab. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Existing Practices

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,907.0	258.7	77,504.9	79,352.1	325.1
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	99.0	99.0	26,039.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.0	0.0	0.0	0.0	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**2,006.0**	**357.6**	**103,544.7**	**79,352.1**	**325.1**
Total Storm Load	**2,006.0**	**357.6**	**103,544.7**	**79,352.1**	**325.1**
Total Non-Storm Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,316.7	163.5	0.0	0.0	0.0
OSDS - Subsurface	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,316.7**	**163.5**	**0.0**	**0.0**	**0.0**

Future Practices

This table summarizes the ***Net pollutant load and runoff reductions*** achieved by practices included in the **"Future Practices"** tab. The reductions presented in this table include only the benefits beyond the practices already in place in the Existing Conditions. So, for example, an improvement to an existing education program would include only the ***additional load reduction*** achieved by improving the program. The purple cells summarize the total load reduction from all practices, while the grey cells report the benefits of individual practices. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the reductions from loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load). In some cases, a *negative load reduction* may be reported. This represents an *increase* in load, which would occur if a program or practice was made *less* effective in the future condition.

Net Benefit (Load Reductions) of Future Practices

	TN (lbs/year)	TP (lbs/year)	TSS (lbs/year)	Bacteria (billion/year)	Runoff Reduction (acre-ft/yr)
Reductions to Surface Water Loads					
Lawn Care Education Surface	0.0	0.0	0.0	0.0	0.0
Pet Waste Education	196.2	25.6	0.0	1,705.7	0.0
Erosion and Sediment Control	0.0	0.0	0.0	0.0	0.0
Street Sweeping	0.0	0.0	0.0	0.0	0.0
Street Sweeping - Sanding	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleanouts	0.0	0.0	0.0	0.0	0.0
Marina Pumpouts	0.0	0.0	0.0	0.0	0.0
Urban Downsizing	0.0	0.0	0.0	0.0	0.0
Redevelopment With Improvements	36.0	4.1	1,322.3	1,460.0	5.9
Stormwater Retrofits	158.5	18.5	6,684.1	4,430.9	17.9
Illicit Connection Removal	0.0	0.0	0.0	0.0	0.0
CSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
SSO Repair/ Abatement	0.0	0.0	0.0	0.0	0.0
OSDS Programs - Surface	0.0	0.0	0.0	0.0	0.0
Stream Restoration	0.0	0.0	0.0	0.0	0.0
Point Source Reduction	0.0	0.0	0.0	0.0	0.0
Total Surface Water Reduction	**390.7**	**48.1**	**8,006.3**	**7,596.7**	**23.8**
Storm Load Reduction	**390.7**	**48.1**	**8,006.3**	**7,596.7**	**23.8**
Non-Storm Load Reduction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Reductions to Groundwater Loads					
Urban Turf	0.0	0.0	0.0	0.0	0.0
Riparian Buffers	0.0	0.0	0.0	0.0	0.0
Stormwater Retrofits	-64.0	-1.5	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load Reduction	**-64.0**	**-1.5**	**0.0**	**0.0**	**0.0**

This table summarizes the pollutant loads and runoff volumes in the Future Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads with Future Practices in Place

	TN (lb/year)	TP (lb/year)	TSS (lb/year)	Fecal Coliform (billion/year)	Runoff Volume (acre-feet/year)
Loads to Surface Waters					
Urban Land	1,516.4	210.6	69,498.6	71,755.4	301.3
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	99.0	99.0	26,039.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.0	0.0	0.0	0.0	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0

OSDS - Surface	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Total Storm Load	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Total Non-Storm Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,380.7	165.1	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,380.7**	**165.1**	**0.0**	**0.0**	**0.0**

Loads With New Development

This table summarizes the pollutant loads and runoff volumes in the Existing Condition, which includes the loads on the **"Sources"** tab, minus the benefits of the practices on the **"Existing Practices"** and **"Future Practices"** tabs. The purple cells summarize loads from each broad category of sources. Note that, while the summary table presents only the Total Surface Water loads, this table also breaks out the difference between loads during storm events (i.e., the Storm Load) and the loads occurring during dry weather conditions (i.e., the Non-Stormwater Load).Also note that the "Urban Land" category represents a summary of all residential, commercial, industrial and transportation land uses included in the **"Sources"** tab, minus all practices that reduce the load from urban Primary Sources.

Loads to Surface Waters with Projected New Development

	TN	**TP**	**TSS**	**Fecal Coliform**	**Runoff Volume**
Surface Water Loads					
Urban Land	1,516.4	210.6	69,498.6	71,755.4	301.3
Active Construction	0.0	0.0	0.0	0.0	0.0
SSOs	0.0	0.0	0.0	0.0	0.0
CSOs	0.0	0.0	0.0	0.0	0.0
Channel Erosion	99.0	99.0	26,039.7	0.0	0.0
Road Sanding	0.0	0.0	0.0	0.0	0.0
Forest	0.0	0.0	0.0	0.0	0.0
Rural Land	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Illicit Connections	0.0	0.0	0.0	0.0	0.0
Marinas	0.0	0.0	0.0	0.0	0.0
Point Sources	0.0	0.0	0.0	0.0	0.0
OSDSs	0.0	0.0	0.0	0.0	0.0
Open Water	0.0	0.0	0.0	0.0	0.0
Total Surface Water Load	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Total Storm Load	**1,615.3**	**309.5**	**95,538.3**	**71,755.4**	**301.3**
Total Non-Storm Load	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Groundwater Loads					
Urban Land	2,380.7	165.1	0.0	0.0	0.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Total Groundwater Load	**2,380.7**	**165.1**	**0.0**	**0.0**	**0.0**