

## Whetstone Brook

### Watershed Description

This bacteria TMDL summary applies to a 2.5-mile reach of Whetstone Brook. Whetstone Brook flows west to east from the hills of Marlboro across Brattleboro before emptying into the Connecticut River in downtown Brattleboro (Whetstone). The brook's headwaters originate at over 1,500 feet above sea level at Hidden Lake. The brook cascades down from steep hills and follows Vermont Rte. 9 to the Connecticut River flatlands. The brook empties into the Connecticut River at 250 feet above sea level, dropping over 1,250 feet in just seven miles of stream length (Whetstone). Approximately 69% of the watershed resides in Brattleboro with 29% of the land in Marlboro and 2% of the land within Dummerston (Whetstone, 2008). The watershed contains nearly 20 miles of streams and a mix of rural, residential and urban land.

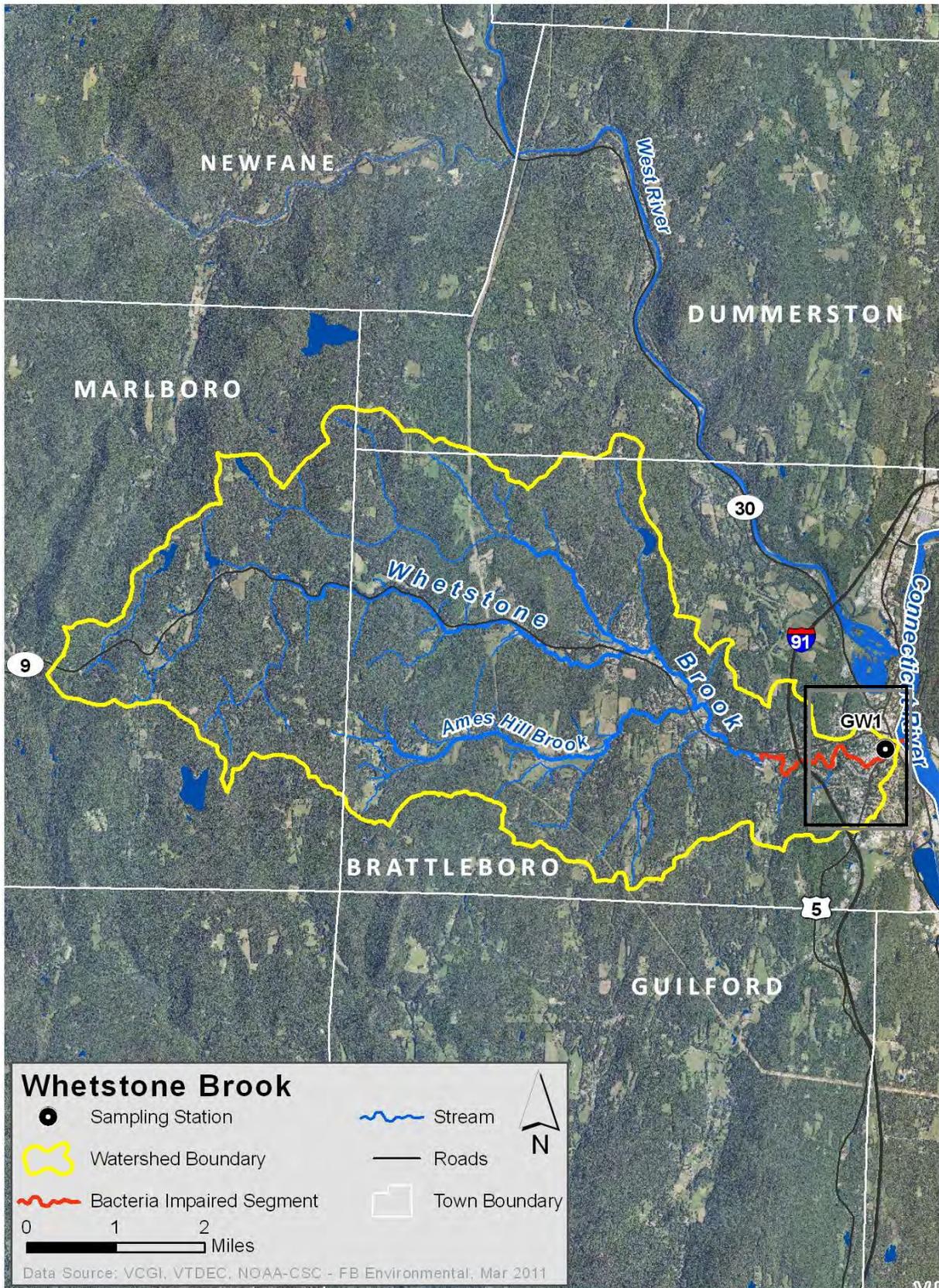
Brattleboro has a population of around 12,000 people and is the largest municipality within Windham County, Vermont. Brattleboro is over twice as populated as any other town in Windham County (Brattleboro, 2003). Once the brook enters West Brattleboro Village, development is concentrated around its banks. Dense residential and commercial development remains around the brook as it flows east. After passing under Interstate 91 Whetstone Brook continues into downtown Brattleboro where development is densely concentrated, as seen in figure 5 (Whetstone, 2008).

The bacteria-impaired segment of Whetstone Brook runs from its mouth on the Connecticut River upstream for 2.5 miles. The Whetstone Brook watershed (Figure 1) covers 28 square miles, in Dummerston, Marlboro, and Brattleboro. Overall, land use in the watershed is 84% forested, 8% agricultural, 7% developed, and 1% wetland, as shown in Figure 2 (based on 2006 Land Cover Analysis by NOAA-CSC).

### Waterbody Facts (VT13-14)

- **Towns:** Brattleboro
- **Impaired Segment Location:** Mouth of Brook upstream to Living Memorial Park
- **Impaired Segment Length:** 2.5 miles
- **Classification:** Class B
- **Watershed Area:** 28 square miles
- **Planning Basin:** 13 – Lower Connecticut, Mill Brook





**Figure 1: Map of Whetstone Brook watershed with impaired segment and sampling stations indicated. Insert area corresponds to figure 4 below.**

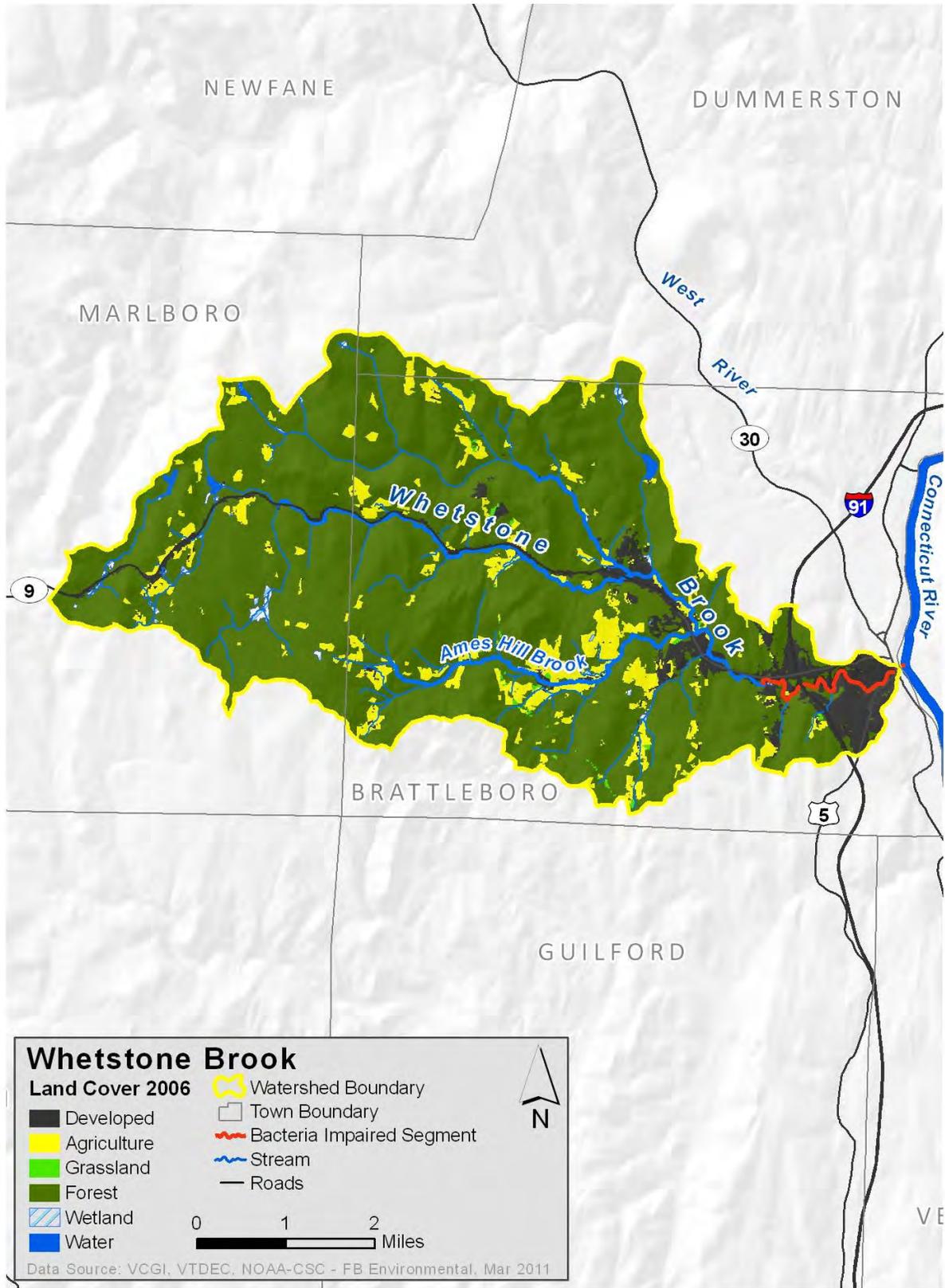
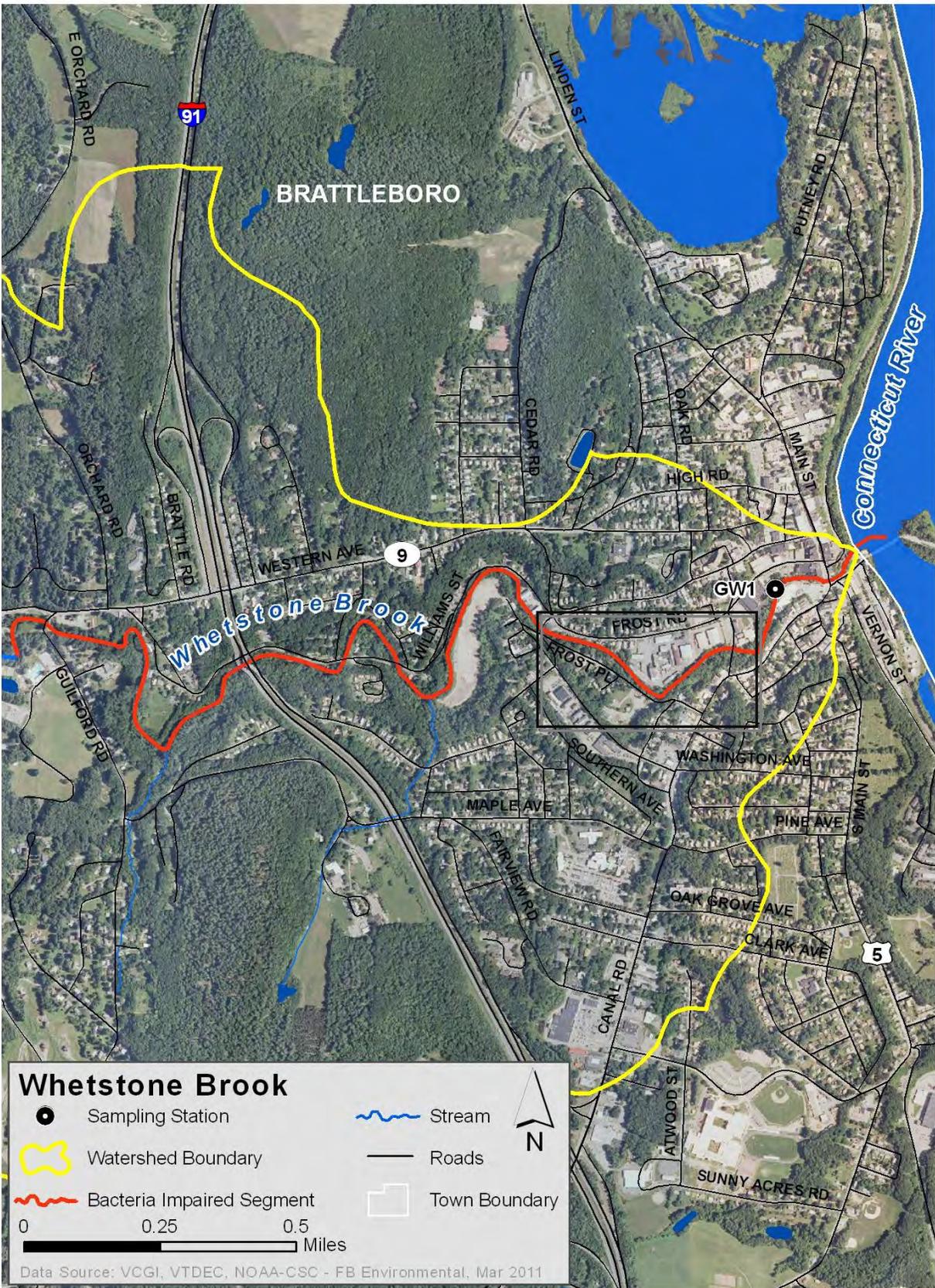
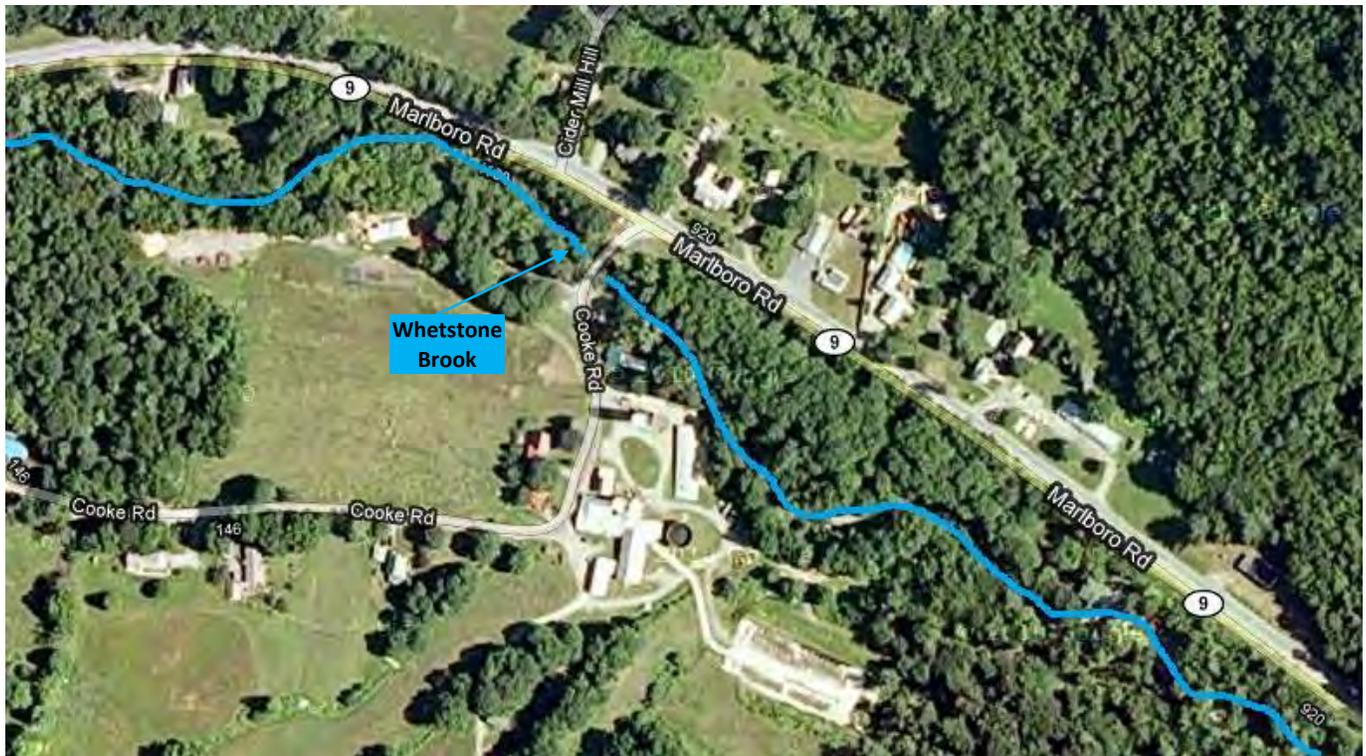


Figure 2: Map of Whetstone Brook watershed with impaired segment and land cover indicated.



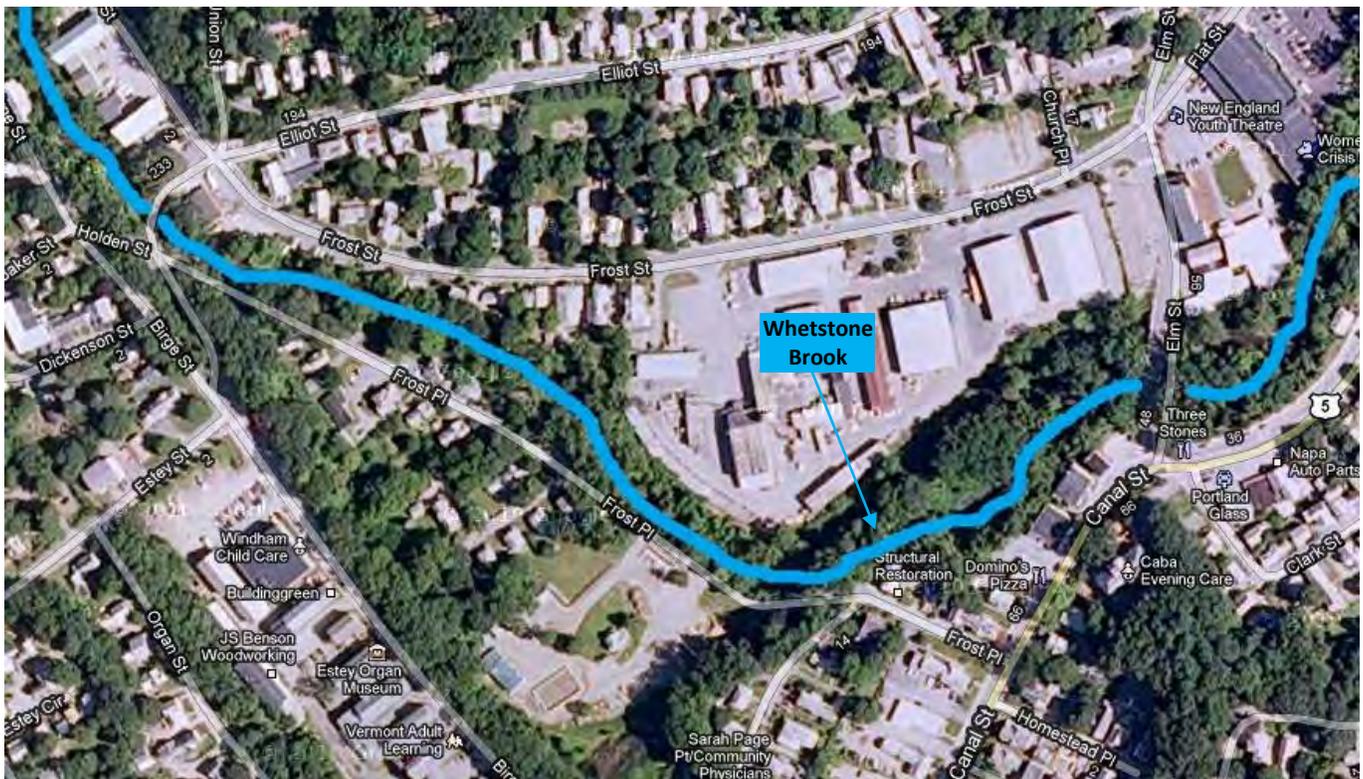
**Figure 3: Map of Whetstone Brook watershed impaired segment and sampling stations indicated. Insert area corresponds to figure 5 below.**



**Figure 4: Aerial view of Whetstone Brook (shown in blue) as it follows along VT Rte. 9 in Brattleboro (Source: Google Maps).**

Figure 4 provides a more detailed aerial view of Whetstone Brook as it flows along VT Rte. 9 in central Brattleboro. Much of the rural and residential development within Brattleboro is concentrated around the brook and its tributaries in a similar manner as shown in Figure 4. Large sections of Whetstone Brook's floodplain have development in and around it. The brook has a history of frequent, severe, and unpredictable flooding, especially in areas where development is encroaching on the brook's floodplain (Whetstone). The frequent flooding is likely a product of development restricting the brook's access to its floodplain and the rapid descent of the brook into the Connecticut River flatlands in central and eastern Brattleboro. Nearly 20% of the land within Brattleboro is comprised of slopes greater than 25%. During severe rain, or rapid snowmelt in the spring, water from these steep hillsides reaches the low lying portions of the watershed quickly, causing significant flood damage and saturating the surrounding soils (Brattleboro, 2003).

Many wetland acres within Windham County and within the Whetstone Brook watershed have been filled in or degraded by urbanization and land development activities (WRC, 2006). Whetstone Brook has over 250 acres of wetland remaining within its watershed. 60% of those wetland areas are found in the town of Marlboro where encroachment from development is not nearly as prevalent as in Brattleboro (Whetstone). Wetlands play a critical role in reducing runoff pollution and help with flood attenuation. Removing or decreasing wetlands and developing along a stream's bank, as seen in the Whetstone Brook watershed, restricts the brook's access to its natural flood plain and decreases the watershed's ability to attenuate flooding. Flooding can cause damage to homes, businesses, and infrastructure such as sanitary sewer pipes and onsite septic disposal systems (USEPA, 2005).



**Figure 5: Aerial view of the impaired segment of Whetstone Brook in downtown Brattleboro where the brook begins to widen out (Source: Google Maps)**

Development within the Whetstone Brook watershed is greatest in downtown Brattleboro along the impaired segment of the brook, as shown in Figure 5. This dense residential and commercial development causes high volumes of stormwater to enter the brook during rain events. Stormwater flows off of impervious surfaces such as roads, sidewalks, and rooftops when it rains. Stormwater can flow directly into the brook or into Brattleboro's separate storm sewer (Brattleboro, 2003). Storm sewers are pipes that carry water away from impervious surfaces such as roads and parking lots to the nearest surface water. Where the storm sewer releases the water into the brook is called an outfall. Stormwater released at outfalls into Whetstone Brook can have a negative impact on the brook's water quality. As stormwater

flows over impervious surfaces in a developed area, it picks up a suite of pollutants, including bacteria (Smartwaterways, 2010).

### Why is a TMDL needed?

Whetstone Brook is a Class B, cold water fishery with designated uses including swimming, fishing and boating (VTDEC, 2008). Since 2005 samples have been collected in the summer from the sampling station shown in Figure 1 and Figure 3 near the brooks outlet. Bacteria data from sampling location Whetstone\_2 has exceeded Vermont's water quality criteria for *E.coli* bacteria. Table 1 below provides bacteria data collected at this sampling location in 2007. Table 1 provides the water quality criteria for *E.coli* bacteria along with the individual sampling event bacteria results and geometric mean concentration statistics for Whetstone Brook. For Whetstone Brook, the current single sample water quality criterion is exceeded in two of the four sampling events.

Due to the elevated bacteria measurements presented in Table 1, Whetstone Brook from its outlet upstream 2.5 miles, did not meet Vermont's water quality standards, was identified as impaired and was placed on the 303(d) list. The 303(d) listing states that use of Whetstone Brook for contact recreation (i.e., swimming) is impaired. 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 water quality standards.

### Potential Bacteria Sources

There are several likely sources of bacterial contamination to Whetstone Brook. These sources include: failing or malfunctioning onsite septic systems, leaking sanitary sewer pipes, stormwater runoff from developed areas, and illicit discharges. Vermont's 303(d) listing of Whetstone Brook for contact recreation impairment does not specify a known source of bacterial contamination. It does, however, suggest that failing septic systems and / or leaking sanitary sewer pipes are a probable cause (VTDEC, 2008).

Of the 12,000 residents that live in Brattleboro, nearly 9,000 live in areas that are not serviced by the town's municipally operated wastewater treatment facility (Brattleboro, 2003). These residents rely on onsite septic disposal (septic) systems to treat their wastewater. Much of the development outside of the sewer serviced area is close to Whetstone Brook and its tributaries. If these septic systems were to fail or malfunction they could release bacteria to the brook or its tributaries. Failed septic systems can have a negative impact on the quality of life, human health, and environmental quality through the release of bacteria and other pathogens (WRC, 2006).

There are several reasons why failing septic systems are a likely cause of bacterial contamination to Whetstone Brook. Numerous factors can limit a septic system from functioning properly. Septic systems must be well maintained through regular inspections and must be pumped out regularly. They also must be set in soils that are adequate for septic waste disposal. Soils on steep slopes, with a shallow depth to bedrock, with a high water table, with a high flood potential, that drain to quickly, or clay soils with low

permeability, are all limiting factors for adequate disposal of septic waste (Brattleboro, 2003). Onsite septic management has been identified as one of the principal surface water planning issues within Windham County and the Whetstone Brook watershed (WRC, 2006).

Most of the Whetstone Brook watershed is covered with soils of class 5 or 6, which have limitations for septic waste disposal (Brattleboro, 2003). It has been documented that many of the residential septic systems within the region are pumped too infrequently or not at all, which makes them prone to failure. Nearly one third of the region's housing was constructed prior to 1940, which raises concerns about the piping and infrastructure of the onsite systems located at such properties (WRC, 2006). Furthermore, the flooding within the Whetstone Brook watershed can affect septic systems, if they are located within the flooded area. When the soil around a septic system becomes saturated the system itself can be damaged and fail if it is not properly inspected and cleaned out after the flood (USEPA, 2005). When systems are old, unmaintained, or placed on soils with poor suitability they can malfunction and release high concentrations of dangerous bacteria to nearby surface waters (USEPA, 2002). These characteristics of the Whetstone Brook watershed make failing or malfunctioning septic systems a potential source of bacterial contamination.

In Brattleboro, there are approximately 3,000 residents that reside within the section of town serviced by the wastewater treatment facility (Brattleboro, 2003). The facility is located on the Connecticut River off of VT Rte. 142 to the south of Whetstone Brook's outlet. Sewer lines in the downtown area, all the way up to West Brattleboro Village, cross over Whetstone Brook at several locations. The facility and sewer pipes that carry wastewater were constructed in the 1960's, and are aging and in need of an upgrade (Wastewater, 2011). Given the age of the infrastructure, leaks within the sanitary sewer pipes are possible. If there were to be any leaks within this sewer, the waste from the sewer, containing bacteria, could enter the brook. Spills and leaks from sanitary sewer systems can pose threats to human health from high bacteria levels, and can cause ecological damage (Mallin et. al., 2007).

One way of testing for sewer leaks is to test for optical brighteners. These chemicals are added to laundry detergents to make whiter whites and brighter colors. Optical brighteners give off fluorescence in their excited state when light from specific ranges of the spectrum are shined on them. Water from washing machines is carried from homes and businesses in the sanitary sewer. If leaking sanitary sewers are suspected, the presence of optical brighteners in Whetstone Brook's water is one indication that leaks are present (Tavares et. al., 2009). The age of the sanitary sewer infrastructure and the fact that the lines cross the brook in multiple locations, makes leaking sanitary sewer pipes a possible source of bacterial contamination to Whetstone Brook.

There are many possible sources for bacteria in stormwater. *E. coli* is a bacteria naturally found within the intestinal tract and thus fecal matter of warm blooded animals such as dogs, cows, birds, and humans. Its presence within surface water is a strong indication of fecal matter contamination. Testing for *E. coli* helps to indicate the presence of other water borne fecal pathogens that can pose serious threats to human health (USDA, 2000). One of the most widely documented and likely sources of *E. coli* in stormwater

from urban areas is pet fecal matter, specifically that of dogs. Single and multiple family residential homes are abundant along the banks of Whetstone Brook, especially after it enters West Brattleboro Village and flows toward downtown. There are also many storm sewer outfalls on the brook in the more developed areas (Brattleboro, 2003). If residents are not properly disposing of their pet's fecal matter or not picking fecal matter up from streets where storm drains catch runoff, it can enter and contaminate Whetstone Brook. This fecal matter can be a major source of bacterial contamination, especially in areas where residential development is so prevalent around the brook (Smartwaterways, 2010).

Illicit discharges are any discharge to the storm sewer or the brook itself that contains any substances other than stormwater. These discharges can include sanitary sewer pipes from a residence or an under drain from a mechanics garage that are connected into the storm sewer. These discharges have the potential of releasing bacteria (and other pollutants) into the storm sewer which can reach the brook at one of the storm sewer outfalls. Brattleboro has a storm sewer network that may contribute untreated stormwater directly to Whetstone Brook (Brattleboro, 2003). Given the extensive storm sewers in downtown Brattleboro, and the high bacteria levels recorded at sampling station Whetstone\_2 in the downtown area, illicit discharges to Brattleboro's storm sewer is another potential source of bacterial contamination.

### Recommended Next Steps

The town of Brattleboro, local stakeholders, as well as other community and watershed based groups are encouraged to implement education and outreach programs, restoration programs, and the identification of land use activities that might be influencing *E. coli* levels. Citizens should be reminded of the importance of picking up after pets, especially in urban areas near the brook.

Additional bacteria data collection may be beneficial to support identification of sources of potentially harmful bacteria in the Whetstone Brook watershed. For example, continued and expanded sampling upstream and downstream of potential bacteria sources (a practice known as "bracket sampling") may be beneficial for identifying and quantifying sources. Sampling activities focused on capturing bacteria data under different weather conditions (e.g., wet and dry) may also be beneficial in support of source identification. Field reconnaissance surveys focused on stream buffers, stormwater runoff, and other source identification may also be beneficial.

Previous investigations and concerned groups (VTDEC, 2010a; Brattleboro, 2003; Whetstone; WRC, 2006) have recommended the following actions to support water quality goals in Whetstone Brook:

- Septic Systems- Ensure that new development has properly designed constructed and inspected onsite septic disposal systems. Support programs that assist with the replacement or upgrading of failed onsite septic systems or expansion of the municipal wastewater system to reach more residences.

- Sewer Leaks and Illicit Discharges –Begin testing for sanitary sewer leaks especially in the downtown area. Begin testing for illicit discharges even though Brattleboro’s storm sewers are not regulated by EPA.
- Stormwater – Expand citizen education about the negative impacts of stormwater, with a focus on the importance of picking up after one’s pet.
- Land Use Protection – Landowners should be encouraged and incentives should be in place for them to place conservation easements on important lands within the watershed, such as; contiguous forest land, wetland areas, and floodplains.
- Flood Plain Protection and Riparian Corridors – Develop appropriate regulations to protect lands within the identified floodplain. Encourage landowners to install buffers, and other tools that protect shoreline and/or riparian areas. Seek to enhance buffers through a combination of buffer plantings, land conservation, and incentive programs.

Several of the steps outlined above are ongoing and should be continued and enhanced to focus on the goals of bacteria TMDL implementation. If implemented, these actions will provide a strong basis toward the goal of mitigating bacteria sources and meeting water quality standards in Whetstone Brook.

### **Bacteria Data**

Vermont’s current criteria for bacteria are more conservative than those recommended by EPA. For Class B waters, VTDEC currently utilizes an E. coli single sample criterion of 77 organisms/100ml. Although, Vermont is in the process of revising their bacteria WQS to better align with the National Recommended Water Quality Criteria (NRWQC) of a geometric mean of 126 organisms/100ml, and a single sample of 235 organisms/100ml. Therefore, in Table 1 below, bacteria data were compared to both the current VTWQS and the NRWQC for informational purposes.

**Whetstone Brook, Mouth upstream to Living Memorial Park (2.5 miles).****WB ID:** VT13-14**Characteristics:** Class B**Impairment:** *E. coli* (organisms/100mL)**Current Water Quality Criteria for *E. coli*:**

Single sample: 77 organisms/100 mL

**NRWQC for *E. coli*:**

Single sample: 235 organisms/100 mL

Geometric mean: 126 organisms/100 mL

**Percent Reduction to meet TMDL (Current):**Single Sample: **86%****Percent Reduction to meet NRWQC**Single sample: **57%**Geometric mean: **NA****Data:** 2007, West River Watershed Association**Table 1: *E.coli* (organisms/100 mL) Data for Whetstone Brook (2007) and Geometric Mean (organisms/100mL) for each Station based on Calendar Year.**

Station Name	Station Location	Date	Result	Geometric Mean**
Whetstone_.2	Whetstone Brook	9/4/2007	0	7
Whetstone_.2	Whetstone Brook	8/7/2007	0	
Whetstone_.2	Whetstone Brook	7/10/2007	308	
Whetstone_.2	Whetstone Brook	6/12/2007	548	

\*Shaded cells indicate single sample and geometric mean used to calculate percent reduction.

\*\*Only geometric mean values calculated with 5 data points or more are used to determine percent reduction.

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