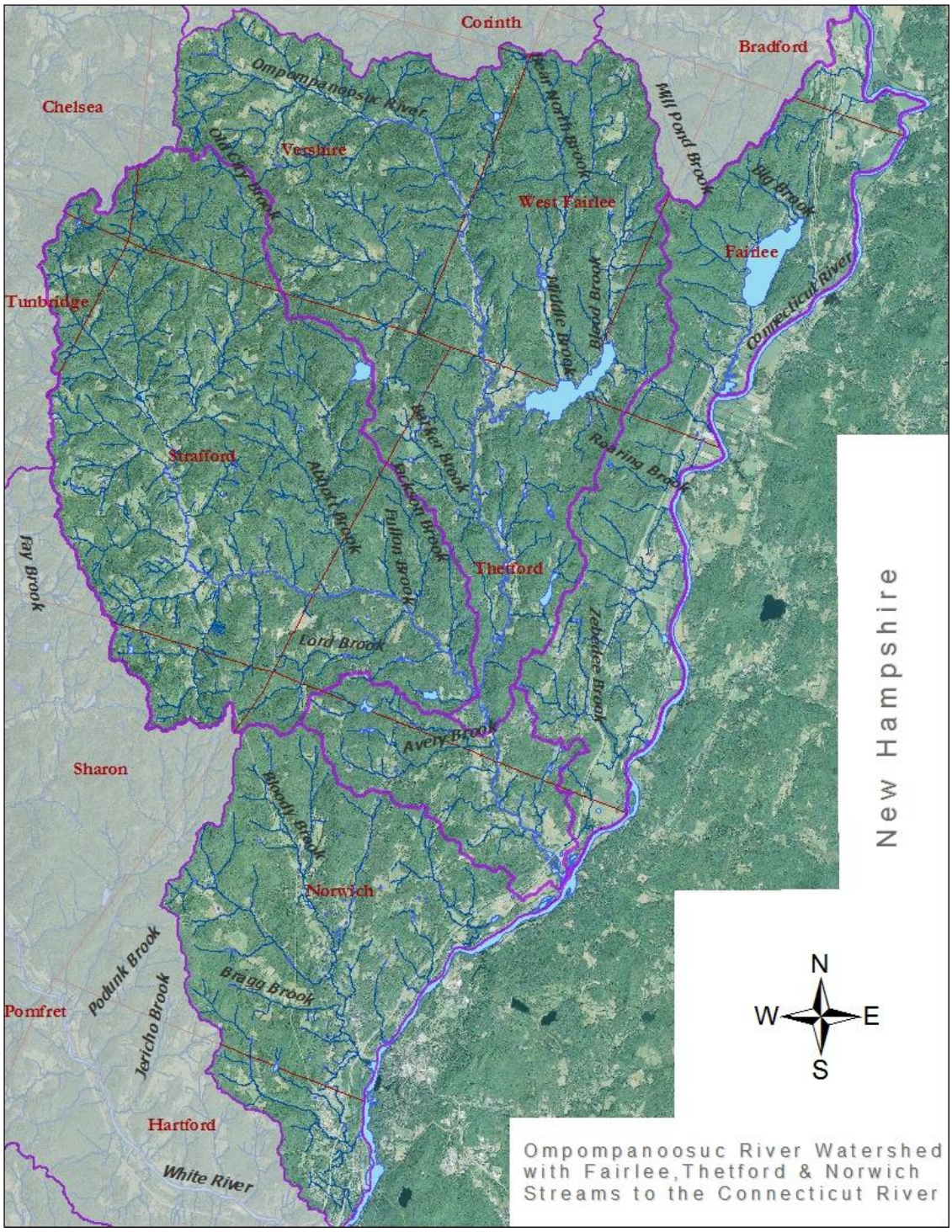
Ompompanoosuc River Watershed *and*
Fairlee,Thetford & Norwich Streams to Connecticut River
Water Quality and Aquatic Habitat Assessment Update
December 2014



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Ompompanoosuc River Watershed

Earlier Information on the Ompompanoosuc

The last time that a formal assessment report was done on the Ompompanoosuc River was in 1999 as the Basin 14 – Stevens, Wells, Waits, Ompompanoosuc Water Quality and Aquatic Habitat Assessment Report. Following that there was the Basin 14 "Little Rivers" Water Quality Management Plan dated June 2008. Updated information was used in the formation of that plan. This 2014 assessment is a further update in preparation for the 2015 Basin 14 plan preparation.

General Description of the Ompompanoosuc River Watershed

The Ompompanoosuc River originates above the town of Vershire in Vershire Heights and flows southeasterly for about six miles and then southerly for another 18 miles to its confluence with the Connecticut River near Pompanoosuc Village in the town of Norwich. The river drains a watershed of about 136 square miles or 87,040 acres. The river drops 1020 feet in elevation over the first 6 miles then 430 feet in the remaining 18 miles.

The West Branch is the largest tributary to the Ompompanoosuc River with a length of 16.5 miles and a watershed of about 60 square miles or 38,400 acres. The West Branch originates near Hawkins Mountain in the southwestern portion of Vershire. It flows south until South Strafford then flows generally easterly until its confluence with the Ompompanoosuc just above Union Village Dam.

The largest lakes in this watershed include Lake Fairlee (457 acres), Miller Pond (64 acres), Lake Abenaki (44 acres), and Mud Pond (20 acres).

Special Uses, Features, and Values

Boating

The West Branch of the Ompompanoosuc River runs in a steep-sided, narrow, wooded valley, parallel to Route 132. It is small and very rocky, and its watershed is steep. Due to its size and gradient, it is only boatable about 12 times each year. At medium high water, the stream is Class II or Class II+ and a demanding Class III at high water. The West Branch is rated highly important for boating. It is a continuous, exciting run, which is the most difficult water in this part of the state. At the end of the boating run at Rices Mills, there is a narrow gorge approximately 50 yards long and 10 feet wide, which is not recommended for boaters.

Swimming

There are two swimming holes that have been formally documented on the West Branch. One of the two holes has public access and is a local swimming hole. The other has two small cascades and two holes four to five feet deep.

A popular swimming hole, sandy beach and a developed picnic area are located at the Corps of Engineers Union Village Dam Recreation Area. Swimming holes also occur on the Ompompanoosuc at East Union Village Dam and “The Ledges” in the flood control area. “The Ledges” have scenic cascades and a small gorge with several nice pools up to 7 feet deep. Wooden steps and a railed walkway have been constructed.

Outstanding Resource Water

The Ompompanoosuc River, from its confluence with an unnamed tributary draining Gillette Swamp and Mud Pond to the West Branch, a distance of about 3.8 miles, was designated an Outstanding Resource Water in March 1996 due to exceptional natural, cultural, scenic and recreational values. There are a diversity of recreational opportunities, including swimming, white water boating, fishing, picnicking, photography and hiking. around the site. The largest swimming hole at “The Ledges” is 150 feet long and 10-45 feet wide.

Ompompanoosuc River and Tributaries Summary of Segments with Impacts

Table 1. Stream segments in Ompompanoosuc River watershed with problems

Stream or Lake Segment	Milage & Status	Pollutant	Source	Other information
Copperas Brook	1.0 miles ***Impaired*** – Part A list	metals, acid	Drainage from abandoned Elizabeth Mine	
Tribs to Lords Brook	0.5 miles ***Impaired*** – Part A list	metals, acid	Drainage from the “South Cut”	On 303d list – Lords Brook itself removed in 2014
Schoolhouse Brook and tributary	2.2 miles ***Impaired*** – Part A list	metals, acid	Drainage from abandoned Ely Mine	
Ompompanoosuc River from Brimstone Corners to ACOE swimming area	9.8 miles ***Impaired*** – Part D list	E. coli	Source unknown	EPA approved a TMDL September 30, 2011

Assessment Information for the Ompompanoosuc River and tribs

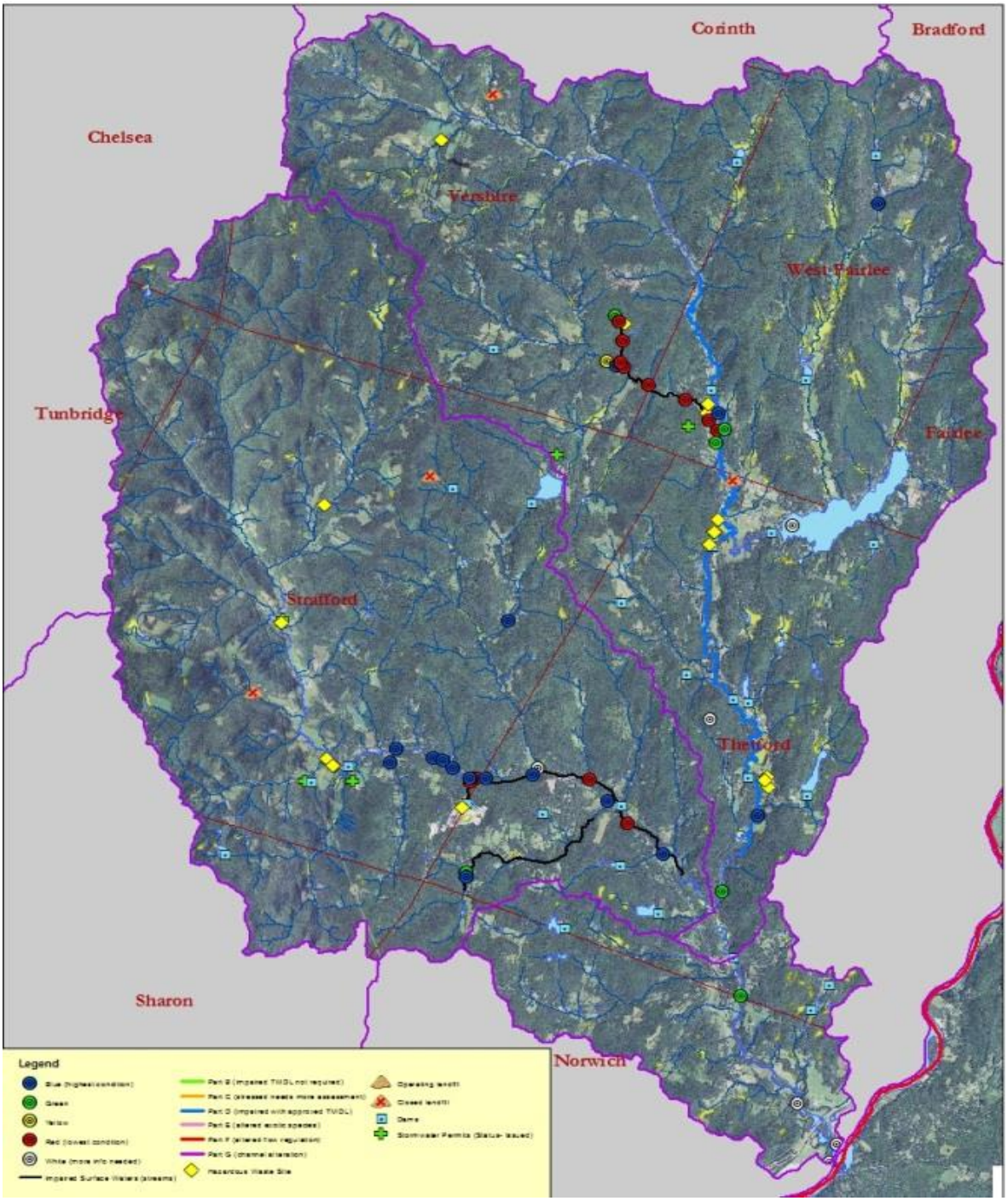

Figure 1. Assessment components for the Ompompanoosuc River watershed with colored dots being biomonitoring sites; yellow diamonds being hazardous waste sites; the brown triangles with a red x are old landfills; and the green plus signs are stormwater permits.

Biological Monitoring

Extensive biomonitoring has occurred in the Ompompanoosuc River watershed and especially in the West Branch subwatershed as documentation of the impacts to the streams affected by the abandoned copper mines has been necessary.

After decades of impairment to the streams below the Elizabeth Mine, recovery has occurred resulting from extensive remediation efforts by EPA and its contractors. A summary of the mine's impacts and documentation of the recovery can be found here:

Y:\WSMD_MAPP\Monitoring\Biological_Site_Reports_and_Data\VT14 - Stevens, Wells, Waits, Ompom\West Branch Ompompanoosuc\Elizabeth Mine 2012 BIOASSESSMENT.pdf

Ompompanoosuc Fisheries

The Ompompanoosuc River basin is home to a diversity of fish species, many of which support popular recreational fisheries. The vast majority of the streams within this watershed provide suitable habitat which support naturally reproducing, i.e. "wild" trout populations. Wild populations of native brook trout are supported in the colder, higher elevation streams and in the mainstem in Vershire. Lower reaches of the mainstem support low populations of brook trout, likely due to temperature and habitat limitations. In 2004, temperature monitoring by VDFW observed temperatures exceeding 75°F in four stations from West Fairlee to Thetford, with a maximum temperature of 80°F recorded below the Union Village Dam.

The Department of Fish and Wildlife stocks cultured (hatchery-reared) trout in the Ompompanoosuc River between Mill Village and the Union Village Dam to enhance recreational fishing opportunities. Naturalized populations of wild rainbow and brown trout are not found in the Ompomponoosuc River or its tributaries despite decades of past stocking. Tributary streams of the Ompompanoosuc River basin are primarily managed as wild trout waters, i.e. are not stocked with hatchery-reared trout, with the exception of the West Branch in Strafford. Historic impacts from copper mine drainage has limited fisheries management options within the West Branch below Strafford.

Trout from mainstem reaches of the Ompompanoosuc River and its larger tributaries may migrate into smaller tributary streams to spawn or seek refuge during stressful environmental conditions. These movements may be localized or may involve large distances. For example, during warm periods in the summer, trout often migrate to coldwater refuges such as the mouths of tributary streams or to areas of groundwater inflow. Likewise, trout may migrate in the fall to areas providing suitable overwintering habitat.

The lowest reach of the Ompompanoosuc River is a low gradient backwater of the Connecticut River and supports a diversity of fish species common to the larger receiving water. The Vermont Department of Fish and Wildlife maintains a formal public access area in this area.

Lake and pond habitat in the Ompompanoosuc basin includes natural and man-made ponds which provide additional recreational fishing opportunities, where public access is available. Most notable are Lake Fairlee (Fairlee) and Miller Pond (Strafford) where formal access areas are maintained by the Department of Fish and Wildlife. Lake Fairlee supports a wide diversity of species which provide fishing opportunities for largemouth bass, smallmouth bass, yellow perch, chain pickerel, rainbow smelt, pumpkinseed, rockbass, brown bullhead, rainbow trout (stocked) and brown trout (stocked). Miller Pond is managed with annual stockings of hatchery-reared brook trout and rainbow trout and supports largemouth bass, pumpkinseed and bluegill populations. The CCC Pond in Sharon is a small, shallow pond with abundant aquatic vegetation and supports a marginal largemouth bass and pumpkinseed population. The Vermont Department of Fish and Wildlife maintains a public access area on this pond.

Wild brook trout fisheries are found throughout Vermont and very popular with resident anglers. The VDFW contracted with Cornell University's Human Dimensions Unit to conduct a survey of Vermont angler activity and opinions in 2010. The results of this survey indicate that 60% of Vermont anglers fish for trout in small streams and beaver ponds, further reporting that 44,455 anglers expended a total of 390,313 days fishing these waters in 2009. These important fisheries are distributed throughout the state and are available within the Ompompanoosuc watershed.

Based upon fish population surveys conducted by VDFW, these fisheries exist in the following waters:

- Mainstem above Brimstone Corner*
- Middle Brook (West Fairlee Center)*
- Bear Notch Brook (West Fairlee Center)*
- Old City Brook
- Abbott Brook tributary (Podunk WMA)*

The waters marked with an asterisk above meet VHQW standards for wild brook trout populations ($\geq$1000 fish /mile or $\geq$20lbs/acre). Future surveys may add other waters to this list.

Although clear criteria for VHQW lakes and ponds are not developed, Lake Fairlee should be considered for this designation due to the diversity and quality of its coldwater and warmwater fisheries.

Physical Assessment

Bear Creek Environmental did a Phase 2 geomorphic assessment on the West Branch of the Ompompanoosuc River in 2005 and on a portion of the Ompompanoosuc River mainstem in 2010. On the Ompompanoosuc River, 15 reaches were broken into 31 segments. One statement from the results was that "many sections of the Ompompanoosuc and its tributaries have straightened, especially along Route 113." Their report also noted the many sections with encroachments from roads or berms and with inadequate buffers.

The West Branch study assessed ten reaches on this river and then the six lowest reachest on six tributaries. The 16 reaches were divided into 22 segments. The results are summarized in a table below.

Table 2. Physical assessment results for segments of the Ompompanoosuc

Segment #	Habitat Condition	Geomorphic Condition
Ompompanoosuc mainstem		
R15-A	Not assessed – beaver dam	
R15-B	Not assessed – bedrock gorge	
R16	Fair	Fair
R17	Fair	Poor
R18	Fair	Poor
R19-A	Fair	Fair
R19-B	Fair	Fair
R20-A	Fair	Fair
R20-B	Fair	Fair
R21-A	Fair	Fair
R21-B	Fair	Fair
West Branch Ompompanoosuc River		
M03		Good
M04		Fair
M05		Fair
M06		Fair
M07		Fair
M08		Fair
M09-A		Fair
M09-B		Fair
M10		Fair
M11-A		Good
M11-C		Fair
M12		Good

E. coli Sampling & Bacteria TMDL

The Ompompanoosuc River is am impaired water due to elevated E. coli sample results most recently done in 2006 and 2007. More sampling will be done. A bacteria TMDL was done for all the bacteria-impaired waters and the stretch on the Ompompanoosuc River is described in Appendix 18 of the TMDL. Some potential sources of the elevated numbers are also identified in Appendix 18.

One possible source is the mobile home park on Georges Way. In spring (March/April) 2011, the owner applied for a wastewater permit to replace a failed wastewater disposal system that served three existing lots in Cold Springs Mobile Home Park. A tributary to the Ompompanoosuc River runs closely along the backside of this mobile home park. A new wastewater system was approved to replace the failed system and had received an "installation certification" that all was functioning well. It is possible that this once failed system could have been at least some of the source of the elevated *E. coli* found in the Ompompanoosuc River and as the park is close to a tributary to the Ompompanoosuc, the remaining systems should be checked.

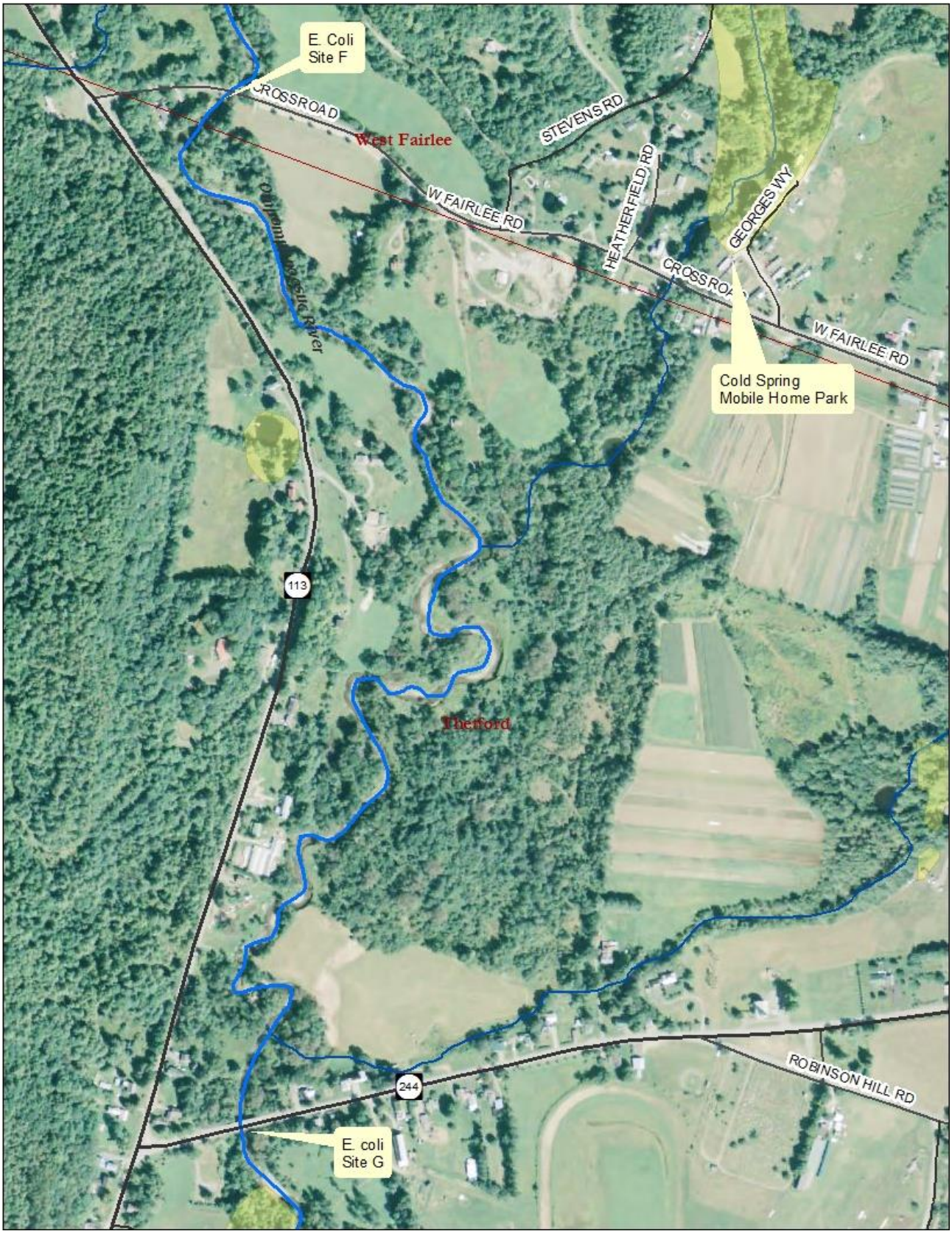

Figure 2. Sites of highest E. coli samples Ompompanoosuc River 2006 & 2007

Fairlee, Thetford, & Norwich Streams to the Connecticut River

Earlier Information on Streams Direct to the Mid Connecticut River

The last time that a formal assessment report was done on these streams from Fairlee, Thetford, and Norwich to the Connecticut River was in 2011 as part of the Basin 16 Northern Connecticut River and Direct Tributaries Assessment Report. The general descriptions below and the Norwich waterfalls information come directly from the 2011 Basin 16 Water Resources, Water Quality, Aquatic Habitat Assessment Report. This current 2014 assessment is an update in preparation for the 2015 Basin 14-16 basin plan.

General Descriptions

Fairlee Streams

Bog Pond Brook begins in the northern portion of the town of Fairlee. It flows northeasterly and easterly in Fairlee then northeasterly again into the town of Bradford where it continues on into the Connecticut River. The brook is culverted under the Maurice Roberts Highway and then Interstate 91 in Fairlee and then it is culverted and channelized through a farm in Bradford before reaching the Connecticut River.

Several streams drain into Lake Morey and then the Lake Morey outlet stream flows south into the Connecticut River. Big Brook begins to the east and north of May Hill and flows east/southeast to the wetlands at the northern end of Lake Morey. Glen Falls Brook begins to the west of Lake Morey and flows east/southeast into the lake. An unnamed tributary also originating west of Lake Morey flows easterly into the southern end of the lake. At least three unnamed tributaries also join the Lake Morey outlet stream as it flows south under the interstate and through wetlands.

An unnamed tributary originates on the north side of Ely Mountain and flows north before turning east and southeast to flow into the Connecticut River near the village of Ely. Route 244 follows much of its length west of the interstate.

Thetford Streams

There are at least five streams flowing from the town of Thetford into the Connecticut River. Two of these are named streams, Roaring Brook and Zebedee Brook, and three are unnamed streams although one goes by the name North Thetford Brook.

Zebedee Brook begins on the east side of Thetford Hill and makes its way, with many direction changes, to the Connecticut River. A forked tributary enters Zebedee just west of Interstate 91. Zebedee Brook is 4.5 miles long and drains a 5.2 square mile watershed.

The so-called North Thetford Brook is also a brook with many forks or branches. It begins in Childs Pond, which is quite near the Connecticut River itself, then flows northwest and then northeast and joins the Connecticut in North Thetford.

Roaring Brook begins in the drainage between High Peak and some hills to the north and flows down a steep valley to the Connecticut River.

Norwich Streams

The watershed of Bloody Brook and its tributaries is the largest watershed feeding to the Connecticut River in Norwich. Bloody Brook originates east of Gile Mountain up near the Sharon/Norwich town line. It flows generally southerly, but at times, southeasterly, for 7.5 miles to the Connecticut River. The upper two-thirds of the watershed is forest land and rural residential while the lower third includes the village area of Norwich as well as the Interstate 91 interchange 13. Turnpike Road follows Bloody Brook fairly closely for much of its length. Bloody Brook drains an 18 square mile watershed. Named tributaries to Blood Brook include New Boston Brook, Charles Brown Brook, and Bragg Brook.

New Boston Brook originates near the drainage divide with the Ompompanoosuc River watershed. It flows south-southwesterly in a small valley for 3.4 miles before reaching Bloody Brook. A large area of wetland surrounds the brook in its middle section.

Charles Brown Brook is a significant tributary to Bloody Brook. It originates south of Stone Hill near the drainage divide with the White River watershed. It flows south then southeasterly for approximately 4.5 miles until it joins Bloody Brook just upstream of Moore Road. Beaver Meadow Road follows the brook for much of its length. Charles Brown Brook drains a 5.7 square mile watershed.

Special Uses, Features, and Values

Norwich Waterfalls and Cascades

The so-called “Grand Canyon of Norwich” is a beautiful series of cascades through a narrow, somewhat steep valley on a tributary to Charles Brown Brook. A town trail, the Bill Ballard trail, takes hikers to the top of the cascades.

Two waterfalls, both on Charles Brown Brook, were identified on a map in a Bloody Brook Watershed Study done by the regional planning commission of the time – no descriptions were given.

Zebedee Wetlands

In 2010, the Upper Valley Land Trust with help from many local people and organizations purchased the 27.3 acres that is now called the Zebedee Wetlands (originally Zebedee Headwaters). This beaver-influenced wetland area is a valuable educational and recreational resource.

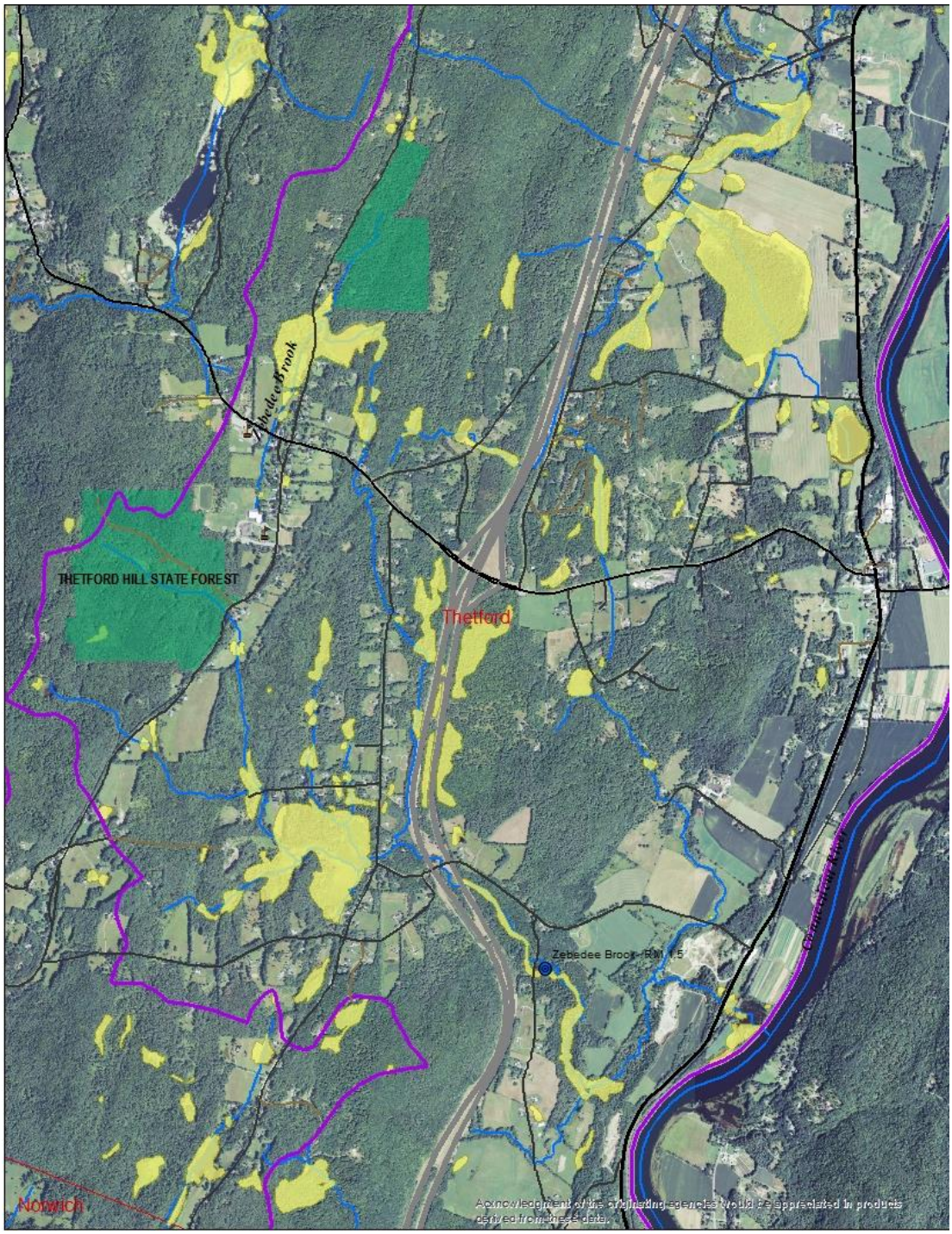

Figure 3. Zebedee Brook, its wetlands (yellow), the one biological monitoring site (blue dot) and watershed.

Assessment Information for Thetford, Fairlee, Norwich Tributaries

Biological Monitoring

The table below has the biomonitoring that has been done since 2010 and the Basin 16 assessment report dated March 2011.

Table 3. Macroinvertebrate and fish sampling in Thetford and Fairlees streams 2010 – 2013.

Wbid	Stream	Station (rm)	Date	Assessment - macroinvertebrates	Assessment - fish
VT16-20	Zebedee Brook	1.5	10/16/2012	Exc-very good	---
VT16-20	Zebedee Brook	1.5	9/06/2013	Excellent	Excellent
VT16-21	Bloody Brook	6.7	10/13/2010	Excellent	----

Zebedee Brook

On Zebedee Brook, 2013 was the second year of an excellent rating for the macroinvertebrate community. The fish community was also sampled in 2013 and rated *excellent*. The stream is one of only a few locations in the Connecticut River watershed with Allegheny Pearl Dace.

The macroinvertebrate community is moderate in abundance, high in richness and EPT richness. Five of the ten dominant taxa are water quality sensitive. The substrate composition shows the habitat to be low in sand and embeddedness, with a silt rating of 2/5. The canopy cover is high, and there is a noteworthy amount of LWD in the stream channel. The periphyton community was also diverse with good amounts of moss, micro algae not thick, and no macro algae noted. Water quality data shows the stream to be alkaline with low nutrients. Chloride is elevated at 39 mg/l indicating the stream does receive significant road salt. Interstate 91 and several gravel road crossings are with the small drainage of 8 km2.

Bloody Brook

Bloody Brook was last sampled in 2010 and up at rivermile 6.7, the macroinvertebrate community was in *excellent* condition. Prior to this sample, both the macroinvertebrates and the fish community were sampled in 2006 at rm 1.6 and the assessment was *very good* and *good* respectively.

Charles Brown Brook

This tributary to Bloody Brook has never been sampled and it would be valuable to do so. In 2011, Tropical Storm Irene took out a dam that impounded a section of this brook and so currently the aquatic community and aquatic habitat have one less major stressor and it would be helpful to document the current condition of the aquatic biota.

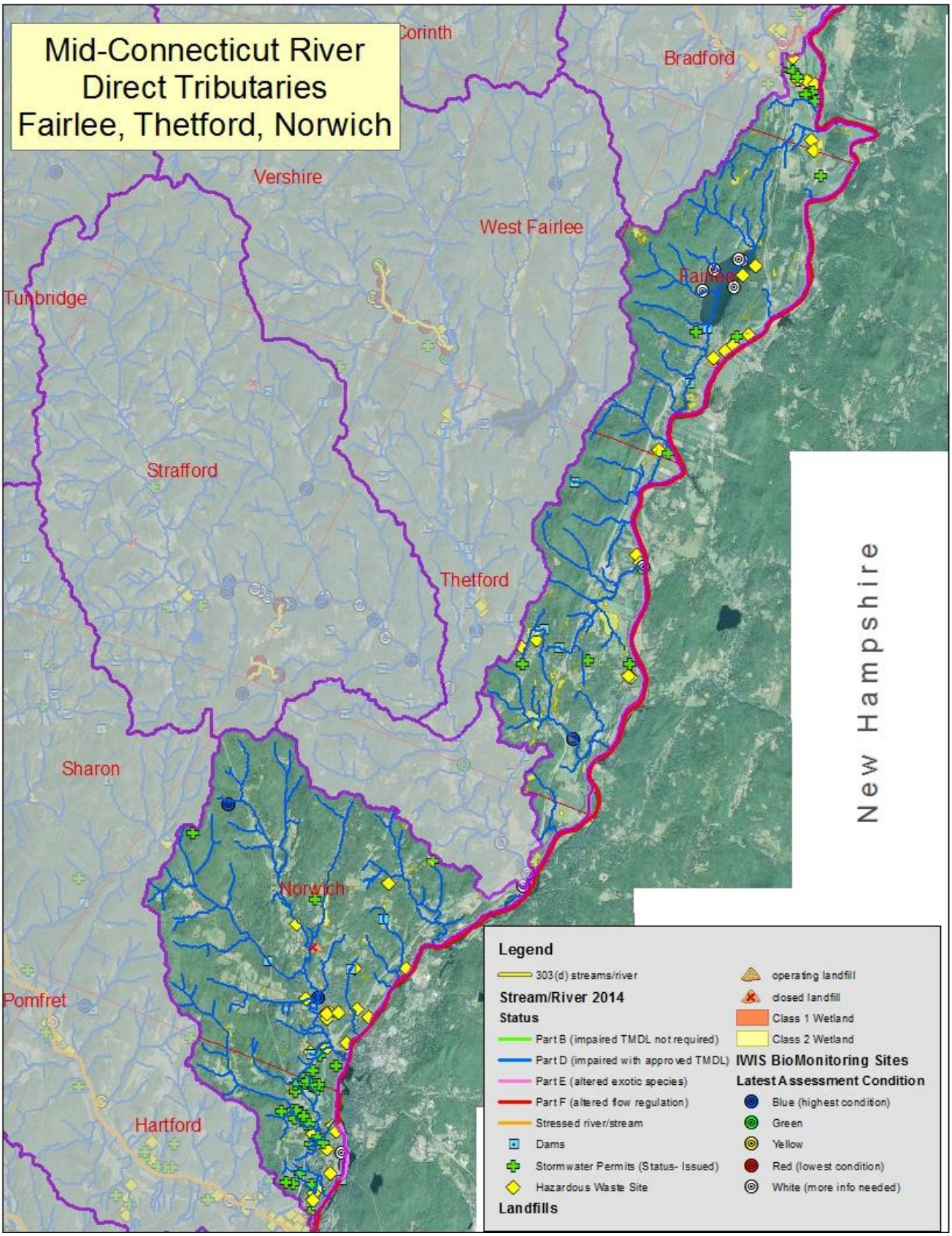

Figure 4. Fairlee, Thetford, Norwich Streams to Connecticut River Assessment Information

Sources of Information

Aquatic Life Use Attainment Assessment of Streams Influenced by the Elizabeth Copper Mine site in Strafford, Vermont F I N A L May , 2013. Prepared by Steve Fiske and Rich Langdon, Vermont Department of Environmental Conservation, Watershed Management Division, Monitoring, Assessment and Planning Program, Montpelier, Vermont.

Bloody Brook Watershed Study, Norwich, Vermont, February 10, 2000. Upper Valley Lake Sunapee Regional Planning Commission. Funded in part by a FFY98 Clean Water Act 604(b) Grant from the Vermont Department of Environmental Conservation.

Northern Connecticut River and Direct Tributaries Basin 16 Water Resources, Water Quality, and Aquatic Habitat Assessment Report, March 2011, Vermont ANR DEC, Watershed Management Division, Monitoring, Assessment and Planning Program.

Ompompanoosuc River Corridor Plan: West Fairlee to Thetford, Vermont, April 28, 2011. Prepared by Bear Creek Environmental LLC, Middlesex, Vermont.

Vermont Department of Fish and Wildlife, Fishery Biologist write-up, 2014.

West Branch of the Ompompanoosuc River Corridor Management Plan, Strafford, Vermont, October 30, 2006. Bear Creek Environmental, Middlesex, Vermont.