– Basin 12-13 –
Water Quality and Aquatic Habitat
Updated Assessment Report

Basin 12- Deerfield River watershed

The Deerfield River rises in the Green Mountains in the towns of Glastenbury and Stratton in the southern part of Vermont. The Deerfield River has four branches in Vermont: North Branch, South Branch, East Branch and West Branch. Two of the Deerfield's main tributaries, the East Branch of the North River and the Green River, originate in Vermont but then cross the Vermont-Massachusetts state line and enter the Deerfield River before it joins the Connecticut River near Greenfield, Massachusetts. The Deerfield River system, including the East Branch of the North River and the Green River, drains 14 towns in two counties and is about 318 square miles in area.

There are 17 lakes and ponds in the Deerfield Basin that are 20 acres or greater, which total approximately 4,000 acres. The largest is Harriman Reservoir (2,040 acres), followed by Somerset Reservoir (1,568 acres), Sadawga Lake (194 acres), and Sherman Reservoir (160 acres.) Harriman Reservoir is the second largest lake found entirely in Vermont.

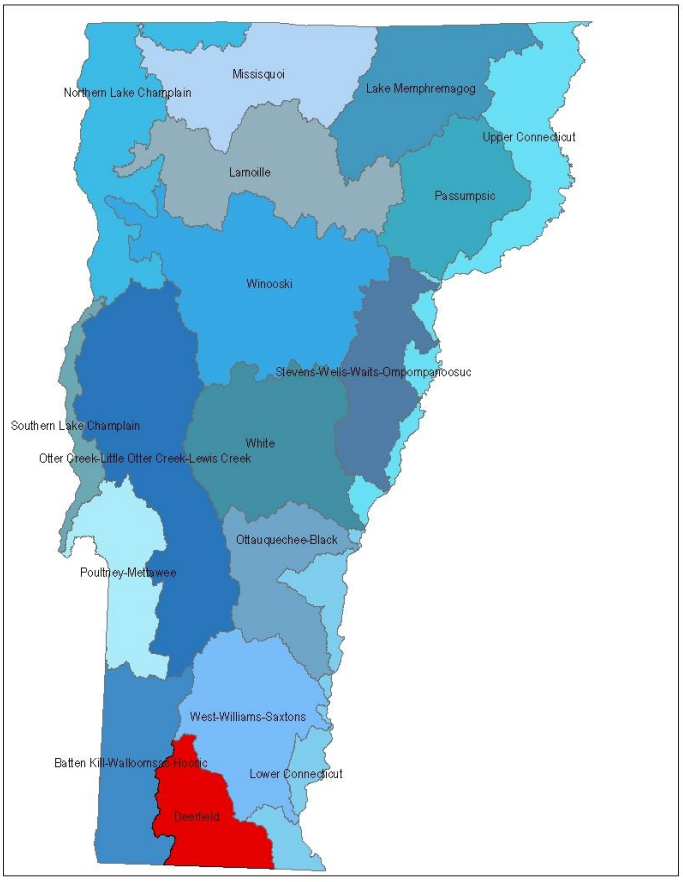
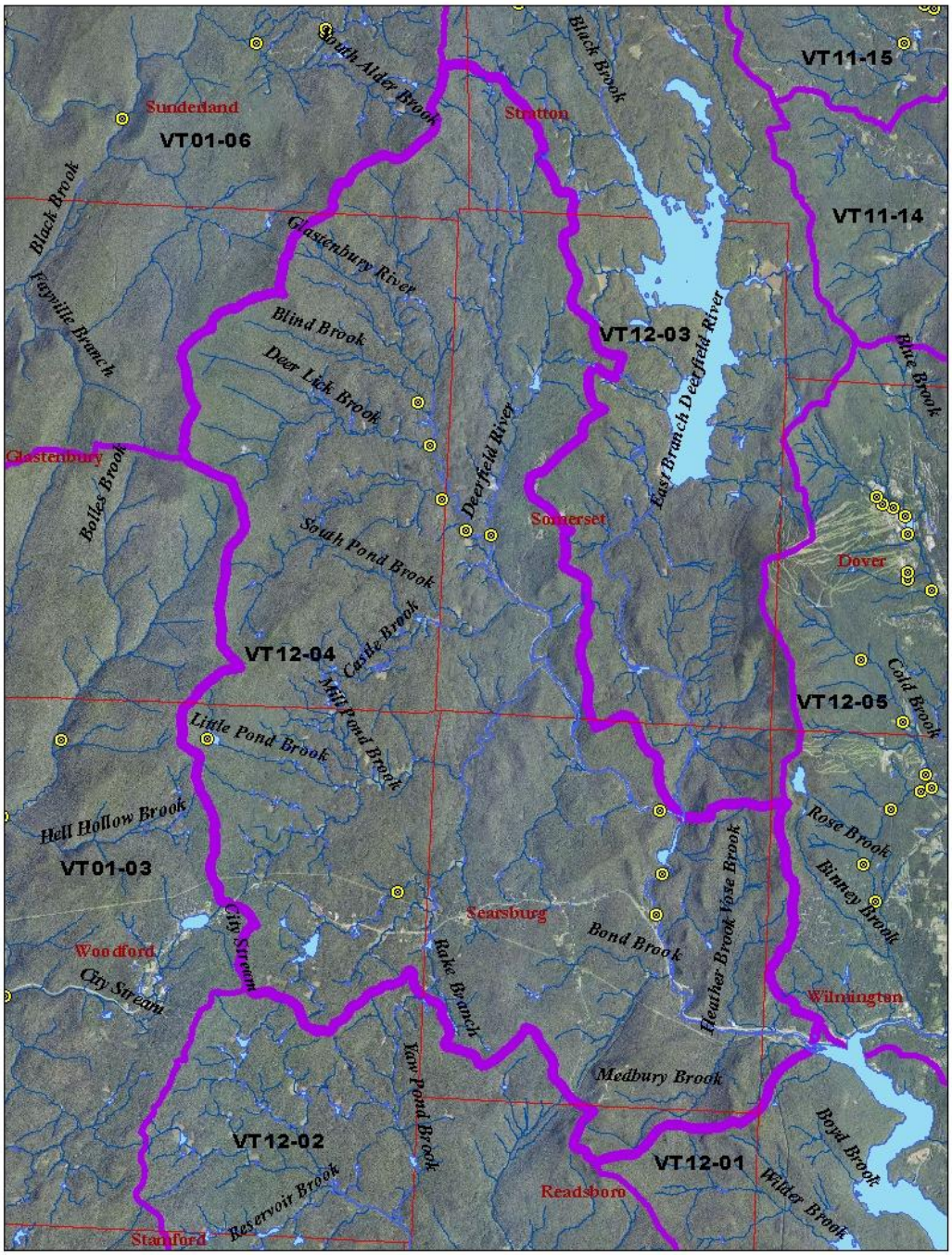


Figure 1. The Deerfield River basin in relation to the other planning basins in Vermont.

Deerfield River Watershed Aerial View

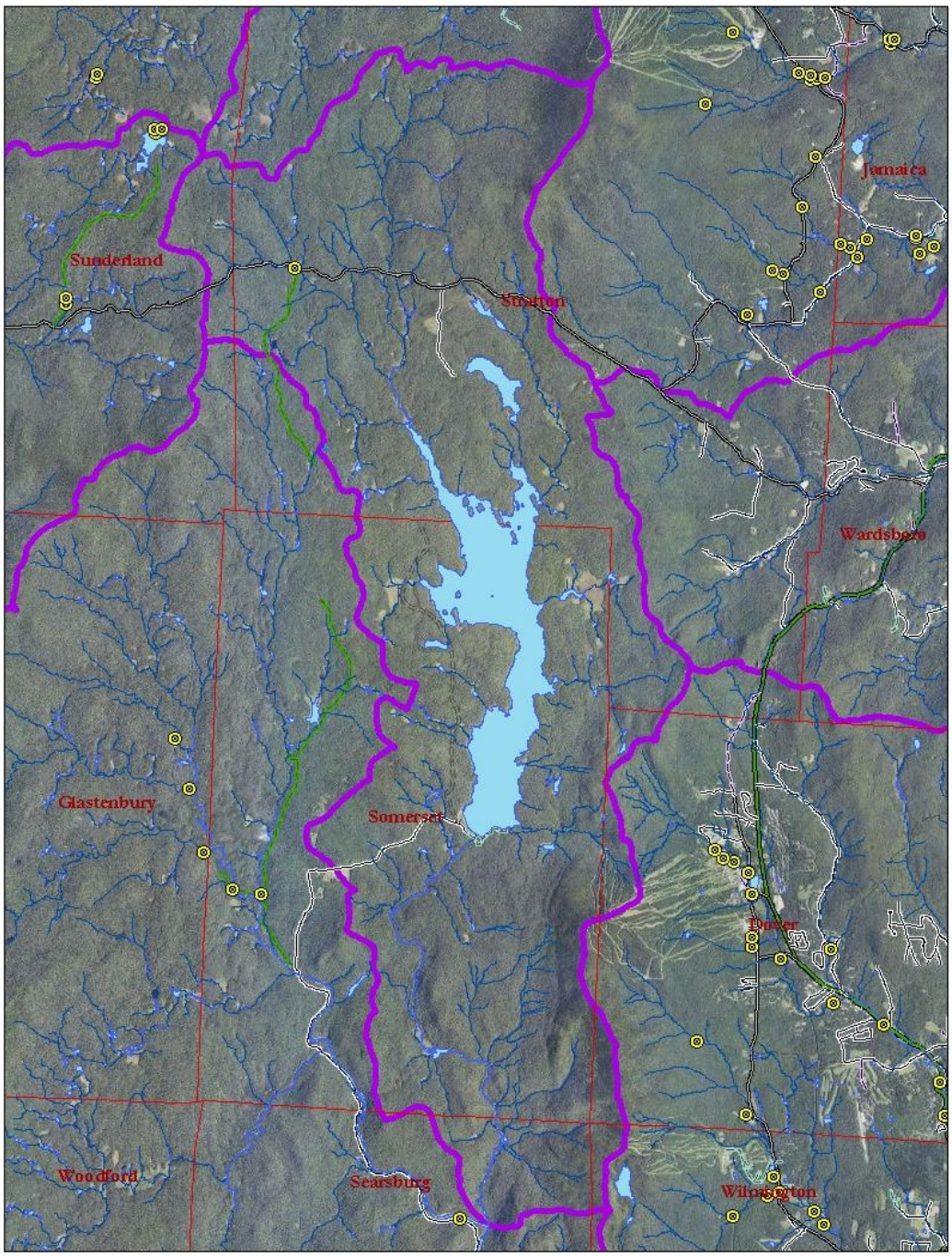
The Deerfield River flows through the counties of Bennington and Windham a distance of about 26 miles and comprises a drainage area of 224 square miles in Vermont. The mainstem of the Deerfield rises on the eastern slope of Glastenbury Mountain in the southwest corner of the town of Stratton. The **upper Deerfield** flows rapidly from its source for 5.0 miles, with a vertical drop of 500 feet, to its confluence with the Glastenbury River. The Deerfield continues in a southeasterly direction a distance of 5.3 miles to Searsburg Reservoir. At this point, the river is joined by the East Branch from the north.

Upper Deerfield River



The **East Branch** has Somerset Reservoir and its tributaries as its source. Grout Pond, with an area of 84 acres, flows into Somerset Reservoir which has an area of 1568 acres at elevation 2131 (normal spring high water). From the spillway at Somerset Reservoir, the East Branch flows rapidly for a distance of 5.5 miles to the Deerfield River.

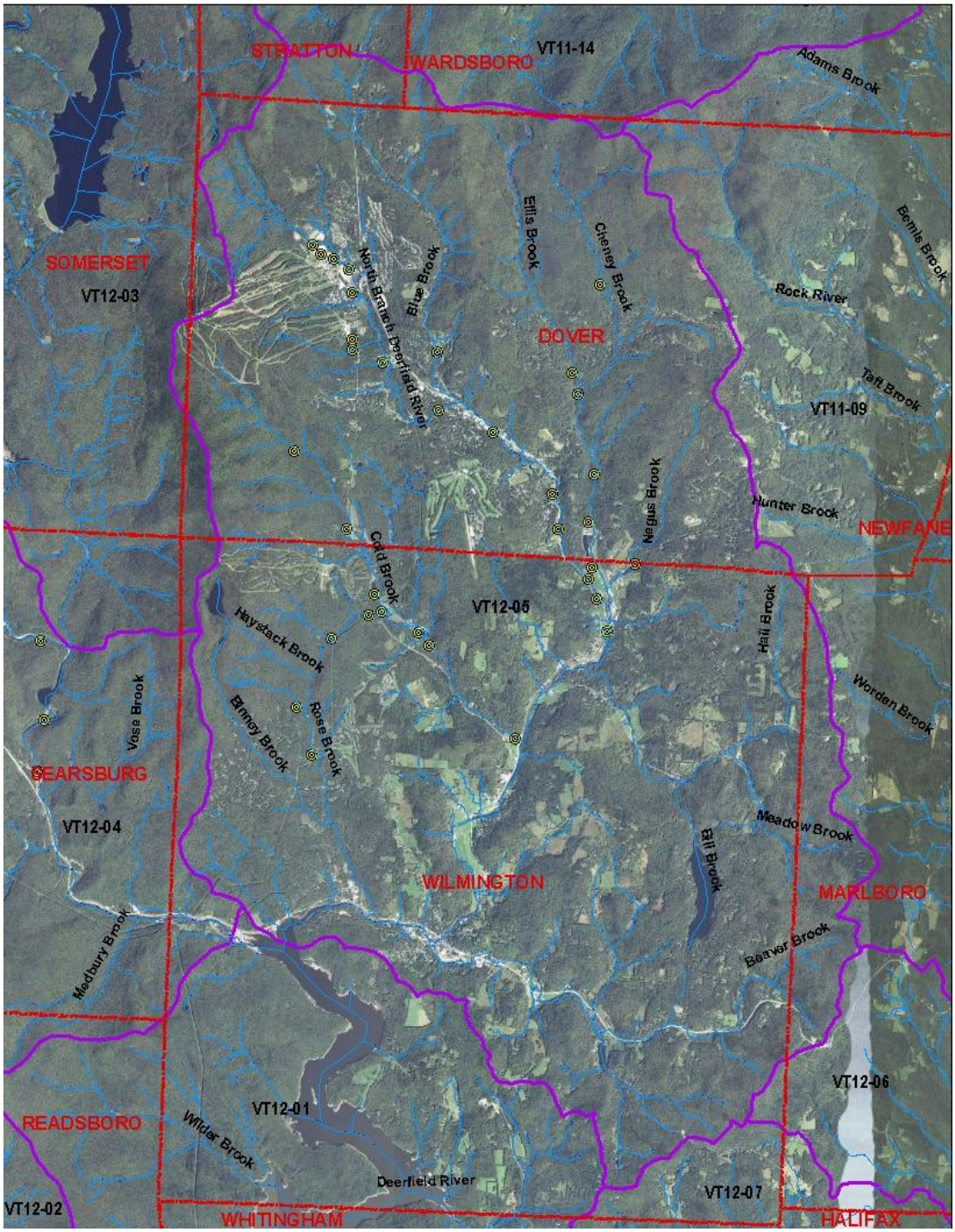
East Branch Deerfield River



From the spillway at Searsburg Reservoir, the Deerfield continues in a southerly and then an easterly direction to Harriman Reservoir. The North Branch of the Deerfield enters Harriman Reservoir about 2.0 miles east of the location where the main Deerfield River enters.

The **North Branch** of the Deerfield River drains the area northeast of Harriman Reservoir. The North Branch rises in the Green Mountain National Forest in the town of Dover and flows for approximately 11.0 miles to the village of Wilmington where it makes a turn west and enters the northeast corner of Harriman Reservoir. From around rivermile 13 downstream, the North Branch flows through a highly cleared and disturbed watershed with ski area development, parking, hotels, houses, condominiums, subdivisions, driveways, shopping centers.

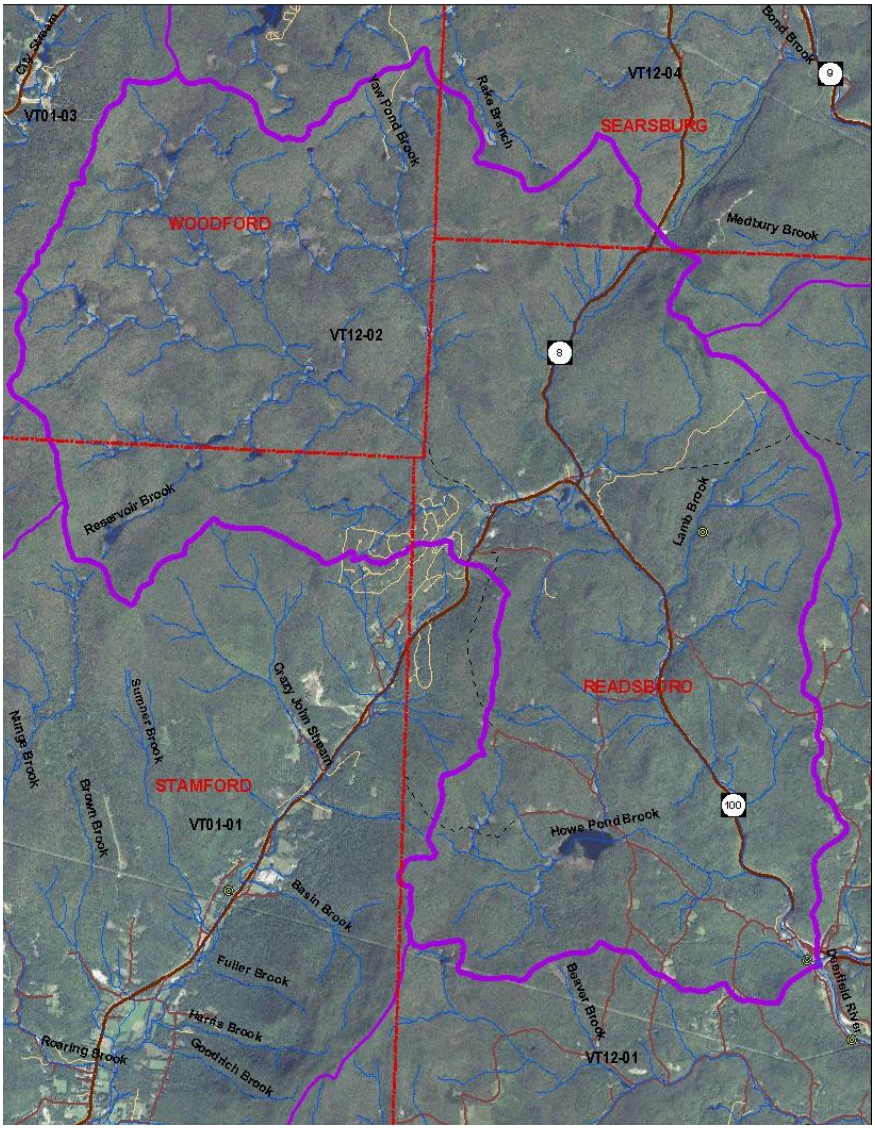
North Branch Deerfield River



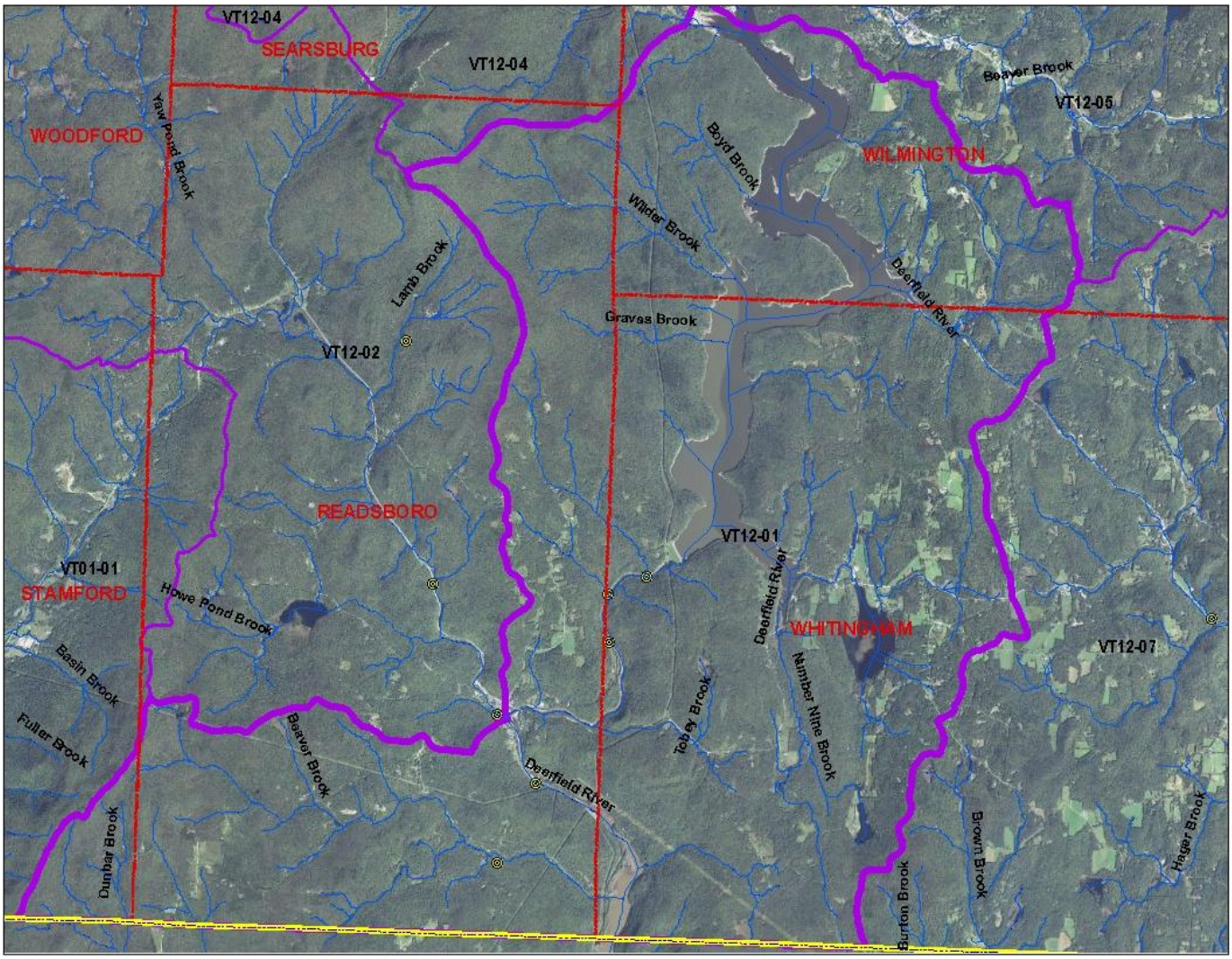
Harriman Reservoir extends approximately 9 miles southward through the valley south of Wilmington Village and has the following small tributaries starting at the source: Boyd Brook, Wilder Brook, Graves Brook, No. 9 Brook, the outlet of Clara Lake, the outlet of Sadawga Lake, and an unnamed tributary entering from the east. The surface area of this reservoir is 2040 acres at the spillway crest elevation 1492.

From the spillway of Harriman Reservoir, the Deerfield River flows in a southwesterly direction for a distance of 3.0 miles where it is joined by the West Branch in the village of Readsboro.

The **West Branch** forms in the so-called Beaver and Camp Meadows in the southeast quarter of the town of Woodford. Reservoir Brook, Yaw Pond Brook, plus five unnamed tributaries comprise the headwaters. These tributaries are flashy streams draining a wooded and mountainous area. The West Branch reaches the village of Heartwellville 5.5 miles from its source where it is joined by another small tributary. The West Branch continues in a southeasterly direction for 5 miles to its confluence with the Deerfield River in Readsboro.



The Deerfield River then flows for about a mile and a half in a southeasterly direction into Sherman Reservoir, which is about a mile long to the Vermont-Massachusetts state line. The South Branch enters the Deerfield River about a quarter mile upstream from the state line.



The South Branch rises on the east side of the Hoosic Range of mountains, so-called, in the town of Readsboro. The branch is only 5.5 miles long and flows quite rapidly for its entire length. There is scattered rural habitation on this stream.

Following is updated data and information on the various sections and branches of the Deerfield River. The last water quality and aquatic habitat assessment report for the Deerfield was completed in March 2003.

Upper Deerfield River

The mainstem of the Deerfield rises on the eastern slope of Glastenbury Mountain in the southwest corner of the town of Stratton. The Deerfield flows rapidly from its source for 5.0 miles, with a vertical drop of 500 feet, to its confluence with the Glastenbury River. The Deerfield continues in a southeasterly direction a distance of 5.3 miles to Searsburg Reservoir. At this point, the river is joined by the East Branch from the north. From the spillway at Searsburg Reservoir, the Deerfield continues in a southerly and then an easterly direction to Harriman Reservoir.

Assessment Information for Rivers and Streams

Biological Monitoring

There has not been much biological monitoring in the Upper Deerfield River in recent years. The most recent samples are shown below:

Table 1. Biomonitoring assessments for sites in the Upper Deerfield River

Year	Rm 65.6	Rm 67.5
2003	---	---
2004	---	---
2008	---	---
2009	Vgood-Good	Very Good

The site, rivermile (rm) 65.6 is located on the upper Deerfield River below the Searsburg Dam about 1 mile and rm 67.5 is located on the upper Deerfield above the confluence with the East Branch about 200 meters.

Fishery Resource

Fisheries throughout the Upper Deerfield River subwatershed are limited by water chemistry and temperatures. The water is tannic and poorly buffered, hence of low productivity. Summer water temperatures in the unshaded mainstem and larger tributaries impairs habitat for coldwater fishes, such as trout. Somerset (East Branch) and Searsburg (mainstem) reservoirs are operated as part of a larger hydroelectric generation complex and these impoundments are subject to significant seasonal water level drawdowns. Additionally, fisheries and aquatic productivity in the standing waters are influenced by the geology, water chemistry and natural and/or regulated hydrology. The flow regime in the reach below Searsburg is greatly influenced by hydroelectric operations being most of the reach is bypassed by a penstock connecting Searsburg Reservoir Dam to the Searsburg Station powerhouse.

The fishery found instream includes:

***Mainstem from headwaters to Searsburg dam**:* wild brook trout; stocked brook trout
Mainstem from Searsburg dam to Harriman dam: wild brook and brown trout; stocked rainbow trout

Glastenbury River: wild brook trout.
Castle Brook and Rake Branch): wild brook trout.
Bond Brook**:** wild brook trout
Vose Brook**:** wild brook trout
Heather Brook**:** wild brook trout

And the fishery found in the lakes, ponds, and reservoirs include:

Adams Reservoir: brown bullhead; stocked brook trout. Woodford State Park.
Red Mill Pond: stocked brook trout. VFWD access area present.
Searsburg Reservoir: stocked brook trout.

Other
There is one operational stormwater permit for this subwatershed and one multi-sector general permit that has been issued to the Deerfield Valley Transit Association.

Assessment Status of Streams in the Upper Deerfield Watershed

Impaired Miles
Deerfield River: 3.6 - below Searsburg Dam down to Harriman Reservoir - aquatic biota/habitat and secondary contact recreation impaired due to low alkalinity, low pH, and summer temperature stress from low buffering capacity, acid rain, open and wide channel, lack of canopy coverage.

Deerfield River: 5.0 - upstream from confluence of Glastenbury River - aquatic habitat due to low pH caused by low buffering capacity and acid rain.

Listing Status of Rivers, Streams, Lakes, and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 303(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT12-04	Upper Deerfield River below the Searsburg dam	Aquatic life support	acid	Critically acidified; chronic acidification from atmospheric deposition

There are no Basin 12-04 waters on the **Part B** – Impaired Surface Waters not needing a Total Maximum Daily Load Determination list or on **Part C –** Stressed Waters in need of Further Assessment.

Part D – Waters with EPA-approved TMDLs

Id#	Waterbody	Pollutant	Problem	Date TMDL approved
VT12-04	Upper Deerfield River below Searsburg dam	mercury	elevated mercury in all fish	December 20,2007
VT12-04L01	Adams Reservoir (Woodford)	acid	Atmospheric deposition: extremely sensitive to acid-ification; episodic acidification	September 30, 2003
VT12-04L02	Lost Pond (Glastenbury)	acid	Atmospheric deposition: critically acidified; chronic acidification	September 20, 2004
VT12-04L04	Little Pond (Woodford)	acid	Atmospheric deposition: critically acidified; chronic acidification	September 30,2003
VT12-04L05	Searsbury Reservoir (Searsburg)	mercury	elevated mercury in all fish except brown bullhead	December 20, 2007

There are no waters on **Part E** – waters altered by aquatic invasive species or on **Part F** - waters altered by flow regulation list for Basin 12.

East Branch Deerfield River

The East Branch has Somerset Reservoir and its tributaries as its source. Grout Pond, with an area of 84 acres, flows into Somerset Reservoir which has an area of 1568 acres at elevation 2131 (normal spring high water). From the spillway at Somerset Reservoir, the East Branch flows rapidly for a distance of 5.5 miles to the Deerfield River.

The East Branch has many tributaries to it but only Black Brook, which flows into the northwest corner of Somerset Reservoir, is named.

Assessment Information for Rivers and Streams

General

The Vermont Department of Fish and Wildlife notes that, as with most waters in the Deerfield River watershed, low fertility is a factor limiting productivity in the East Branch. Since relicensing, minimum flows below Somerset Dam have improved, but as in the Deerfield below Harriman, the discharge produces a very cold environment.

Fishery Resources

The East Branch below Somerset Reservoir Dam has minimum flow requirements prescribed under the FERC license. Because of the deep water release from the reservoir, stream water temperatures are unseasonably cool so much so as to impair overall aquatic productivity and trout growth. The fisheries found in East Branch sub-watershed waters include:

***East Branch*:** wild brook and brown trout.
Grout Pond: smallmouth bass, rock bass, pumpkinseed, chain pickerel, brown bullhead, yellow perch.
Somerset Reservoir: smallmouth bass, rock bass, pumpkinseed, chain pickerel, brown bullhead, yellow perch; stocked brook trout. There is a TransCanada controlled boat launch and picnic area on this reservoir.

Assessment Status of Streams in the East Branch Deerfield Watershed

Impaired Miles

East Branch Deerfield River: 5.2 - below Somerset Reservoir - aquatic biota/habitat impaired (and secondary contact recreation stressed) due to low pH from atmospheric deposition and low alkalinity conditions and due to cold water from dam discharge.

Listing Status of Rivers, Streams, Lakes, and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 303(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT12-03	East Branch Deerfield River below the Somerset dam	Aquatic life support	acid	Critically acidified; chronic acidification from atmospheric deposition

There are no East Branch waters on the **Part B** – Impaired Surface Waters not needing a Total Maximum Daily Load Determination list or on **Part C –** Stressed Waters in need of Further Assessment.

Part D – Waters with EPA-approved TMDLs

Id#	Waterbody	Pollutant	Problem	Date TMDL approved
VT12-03	East Branch Deerfield River below Somerset dam	mercury	Elevated levels of mercury in all fish	December 20, 2007
VT12-03L01	Grout Pond (Stratton)	acid	Atmospheric deposition: extremely sensitive to acid-ification; episodic acidification	September 30, 2003
VT12-03L01	Grout Pond (Stratton)	mercury	Elevated mercury in all fish except brown bullhead	December 20, 2007
VT12-03L02	Somerset Reservoir (Somerset)	mercury	Elevated mercury in all fish except brown bullhead	December 20, 2007
VT12-03L02	Somerset Reservoir (Somerset)	acid	Atmospheric deposition: extremely sensitive to acid-ification; episodic acidification	September 30, 2003

There are no East Branch Deerfield River subwatershed waters (VT12-03) on **Part E** – waters altered by aquatic invasive species or on **Part F** - waters altered by flow regulation list for Basin 12.

North Branch Deerfield River

The North Branch of the Deerfield River drains the area northeast of Harriman Reservoir. The North Branch rises in the Green Mountain National Forest in the town of Dover and flows for approximately 11.0 miles to the village of Wilmington, where it turns westerly and enters the northeast corner of Harriman Reservoir. The tributaries of the North Branch starting near the headwaters are Blue Brook, Ellis Brook, Cheney Brook, Negas Brook, Bill Brook (outlet of Lake Raponda), and Cold Brook. These tributaries are of a steep and flashy nature.

Assessment Information for Rivers and Streams

Tropical Storm Irene Impacts

The North Branch of the Deerfield River suffered severe damage and the village of Wilmington was one of the worst hit in the state during Tropical Storm Irene August 28, 2011. Beaver Brook, Ellis Brook, Blue Brook and other tributaries not yet identified were also damaged.

Macroinvertebrate Sampling

North Branch Deerfield mainstem

Biological sampling in 1998 on the North Branch Deerfield River discovered impacts associated with development at Mt. Snow Ski Area. The river was assessed at four different river mile sites: one below the town of West Dover at rivermile 5.8, one about a mile below Snow Lake at the Tanney road crossing at rivermile 11.0, immediately above Snow Lake at rivermile 12.0 and above the Mt. Snow maintenance sheds at rivermile 12.6.

The biological assessments indicated that at rivermile 12.0 and 11.0, above and below Snow Lake respectively, the macroinvertebrate community was depressed in density compared to both the upper rivermile at 12.6 and lower site at 5.8 indicating an impact to the macroinvertebrate community. The cobble substrate at both low density sites was embedded 50-75%, which was probably in large part responsible for the low densities. High turbidity events from a construction project on Mount Snow in summer 1998 also likely accounted for the low density numbers. (This information is directly from a memorandum dated 11/18/98 from Steve Fiske and Rich Langdon to The Record).

Table 2. More recent macroinvertebrate sampling results on the North Branch

Year	Rm 6.5	Rm 7.0	Rm 7.6	Rm 8.9	Rm 11.0	Rm 12.1	Rm 12.6
2000			Very good	---	---	---	---
2002	---	---	---	Good	Good	---	Very good
2003	---	---	---	---	Good	Good-Fair	---
2004	---	---	---	---	Good	Fair	---
2005	Good	---	Vg-Good	---	---	Fair	Excellent
2008	Very good	Very good	---	---	---	Poor	Excellent
2010	Fair	---	Vg-Good	---	---	---	---

At rivermile 12.1 in 2008, which is located immediately below a small tributary draining the Mount Snow baselodge and opposite lot “E”, the macroinvertebrate sample was “poor” as shown above. The density was very low in both replicates, richness was very good and EPT good but somewhat variable between replicates. This was due to a number of EPT taxa mostly with only a single animal representing a number of taxa in one of the replicates. Over 40% of community was *Oligochaeta* mostly *Lumbriculidae*. This is an extremely high percentage and coupled with low density, it is the main reason that the reach has been assessed as “poor”. Both *Plecoptera* and *Ephemeroptera* are very low in composition of community as a result. A low density community dominated by *Oligochaeta* strongly indicates sediment as the primary stressor. Habitat sediment observations report sand to be high at 20%, as well as embeddedeness being rated poor >75%, and silt rating being also very high 4/5. Water quality data show the reach is low in alkalinity similar to upstream reach 12.6. Nutrients were also low. Chloride showed slight increase from background above. Several metals were elevated but not above Aquatic Life Use criteria, these were iron and manganese.

Ellis Brook

Ellis Brook is a four mile long stream draining a 9 ¼ square mile watershed that flows to the North Branch of the Deerfield River in Wilmington. It originates in a wetland in the northern part of Dover and flows south, with Cheney Brook joining it, into Wilmington. There is an indirect discharge to Ellis Brook from the sprayfields of the Dover WWTF. The biological monitoring sites are above and below the WWTF and the sprayfields to which the indirect discharge permit applies.

Table 3. Macroinvertebrate Sampling Results for Ellis Brook

Year	Rm 0.5	Rm 1.0
2003	Vgood-Good	---
2004	Very good	---
2008	Good	Vgood-Good
2009	Very good	Excellent

The fish community in 2008 was considered in "fair" condition on Ellis Brook.

Cold Brook

Macroinvertebrate sampling on Cold Brook in Dover occurred at rivermile 0.1 in 1992, 1998, and 2004. The community integrity and health was found to be "good" in 1992 and 1998 and "excellent" in 2004. Cold Brook was sampled at rm 3.3 in 2003 and was "good" at this location.

Fish community sampling occurred on Cold Brook also sampled in 2003 and was in "excellent" health at rm 3.3.

Other Tributary Streams to the North Branch Deerfield

Iron Stream was sampled at rivermile 0.2 in 1996 and the community was found to be in “poor” condition. It was sampled again at the same location in 2004 and was “poor” again. “Habitat observations indicate the stream bed to be entirely covered with iron precipitate to the point where the cobble was considered over 50% embedded.”

Jacks Brook was sampled in Dover at rm 0.3 and in 2004 and 2008 was in "very good-good" condition both times. Jacks Brook was sampled as a local control stream for Iron Stream because of its very small size.

Tannery Brook was also sampled in 1996 and the community at that site (rivermile 0.3) was in “good” condition.

Baselodge Tributary was sampled in Dover in 2004 and at rm 0.1, the macroinvertebrate community was "fair" in health and integrity. This tributary comes into the North Branch Deerfield River just above rm 12.1. Baselodge Tributary was described as “highly incised, often to bedrock, and channelized. The cobble left in the stream was found not to be highly embedded, however over 12 percent sand was estimated in the substrate. The low density of macroinvertebrates in this stream is more likely due to extreme scour of the stream bed.” (See Aquatic Life report cited below).

Fishery Resource

Environmental and aquatic habitat impacts associated with a long history of land and water developments, such as stream flow diversions for snowmaking, on-stream impoundments (e.g., Snow Lake), barriers (dams and culverts), increased storm water runoff and sediment loading, loss of riparian corridor vegetation, past channelization activities after flood events, stream bank encroachment and development, bank erosion, gravel extraction, etc.) have exacted a very heavy toll on this watershed and its fishery. All of these anthropogenic impacts have only exacerbated the natural limitations (low fertility) characteristic of the Deerfield River watershed. Water level manipulations for hydropower generation in Harriman Reservoir, which back up into the North Branch as far upstream as almost to the center of downtown Wilmington, may also impact the river at different times of the year. The most recent impact to habitat was Tropical Storm Irene in August 2011, although the flooding and post-Irene stream work in this watershed was not as severe as other watersheds in southern and southeastern Vermont such as the Green River, East Branch North River, Whetstone, and West River watersheds. A few stretches of tributaries such as Blue Brook were dredged and rip-rapped post Irene.

The fisheries supported in North Branch watershed streams include:
***North Branch*:** wild brook and brown trout; stocked brook trout
Blue Brook: wild brook and brown trout.
Ellis Brook/Cheney Brook: wild brook and brown trout.
Negus Brook: wild brook and brown trout.
Bill Brook/Hall Brook: wild brook and brown trout.
Cold Brook/Haystack Brook: wild brook trout.
Beaver Brook: wild brook and brown trout.
Binney Brook: wild brook and brown trout.

Lake Raponda: smallmouth bass, largemouth bass, rock bass, bluegill, brown bullhead, chain pickerel, yellow perch; stocked rainbow trout. VFWD boat launch and access area.

Snowmaking Issues - Mount Snow and Haystack

There are three snowmaking water withdrawals for Mount Snow and Haystack (which were once owned by one company but are now owned by two separate entities). One withdrawal is on Cold Brook and goes to a reservoir called Mirror Lake. This reservoir

serves both Mount Snow and Haystack currently (October 2012). Conservation flows on Cold Brook do not meet current standards because of this withdrawal. Haystack had planned to make a second reservoir and withdraw from Haystack Brook, which would then allow for conservation flows to occur on Cold Brook at the withdrawal that goes to Mirror Lake, but that has not happened to date.

A second of the three snowmaking withdrawals is the on-river Snow Lake impoundment withdrawal. The third is the Carinthia Pond withdrawal which is part way up Mount Snow.

Right now (October 2012) there is a new permitted withdrawal from Cold Brook that is downstream from the one described above and yet to be constructed. This permitted withdrawal has to meet conservation flows and it will have a reservoir in the vicinity of the gravel pits. Mount Snow is hoping to begin clearing in winter 2012/2013. Once the system is developed (the withdrawal works and the reservoir) then Snow Lake would be taken out and the North Branch of the Deerfield River restored in that area.

Stormwater

The North Branch Deerfield River has many construction and operational stormwater permits in its watershed. A number of these permits are for large projects with much land conversion and development. The number of permits is summarized in the table below.

	Operational sw permits	Construction permits
North Branch and unnamed tributaries	19	10
Cold Brook and tributaries	6	6
Haystack Brook and tributaries	2	0
Blue Brook and tributaries	3	1
Ellis Brook	2	0
Beaver Brook	2	0
Negus Brook	1	0

Indirect Discharge Sampling

Ellis Brook and the North Branch of the Deerfield have been sampled monthly at two locations each by the North Branch Fire District #1 in accordance with the requirements of their Indirect Discharge Permit ID-9-0074. The sampling stations are located upstream and downstream of their spray disposal areas for each stream. Samples are collected for *E. coli* and a number of other parameters and the results reported to Vermont DEC – Indirect Discharge Permit Program.

For the five-year period 2006-2010, there were two exceedences of the state *E. coli* standard of 77 per 100 mL on Ellis Brook at the upstream station and one exceedence of the same standard at the downstream station.

For the five-year period 2006-2010, there were eight exceedences of the state *E. coli* standard of 77 per 100 mL on the North Branch Deerfield River at the upstream station and nine exceedences of the same standard at the downstream station.

For the five-year period for both monitored streams, only one North Branch Deerfield River upstream station sample value and one Ellis Brook downstream station sample value exceeded the EPA designated beach area single sample maximum of 235 per 100 mL. The results were 244 per 100 mL and 313 per 100 mL, respectively.

All the data are housed at the Vermont DEC Drinking Water and Groundwater Protection Division – Indirect Discharge Permit Program.

Landfills

The Wilmington landfill is in the North Branch Deerfield River watershed. It was closed in 1993 and has a post-closure monitoring plan for 20 years. Semi-annual monitoring occurs to detect changes in groundwater quality in the vicinity of the landfill. Shallow groundwater beneath the Site flows from north to south, toward Meadow Brook. An intermittent stream, an unnamed tributary to Meadow Brook, is adjacent to the landfill and leachate from the landfill reaches this stream. The stream has not been sampled although it may be in the future in lieu of sampling one of the groundwater monitoring wells.

Groundwater monitoring wells MW-1, MW-4 and MW-5 are within 80 feet of the downgradient end of the landfill, monitoring well MW-2 is approximately 400 feet southwest of the landfill, and monitoring well MW-3 is approximately 200 feet south of the landfill. Two monitoring wells had dissolved iron and manganese levels above groundwater enforcement standards in October 2001. Two volatile organic compounds were also detected at the same two wells but were below standards. In May 2002, manganese exceeded the groundwater enforcement standard at all three downgradient wells and dissolved iron was above standard at one well. One volatile organic compound was detected at one well but again the level was below the enforcement standard. In October 2002, dissolved iron and dissolved manganese were above VGES in both downgradient wells and dissolved iron was above the average allowable concentration in the stream. Cis-1-2 dichloroethene was detected in the stream but there is no water quality standard for this organic compound.

The most recent sampling available from May 2011 indicates that the following analytes exceed VGES: the concentration of dissolved manganese in MW -2 and -5 exceeded the primary and secondary VGES and the concentration of dissolved iron in MW-2 and MW-5 exceeded the secondary VGES. “Analysis of groundwater data indicates the following trends. Groundwater quality at MW-2 (farthest from the landfill) remained static or slightly improved. All reported inorganic analytes are within historical ranges at MW-2. The dissolved manganese was the lowest since 2005. Groundwater quality at MW-5 (closer to the landfill) generally improved. All analyte concentrations are within normal ranges except for dissolved manganese which was the lowest reported concentration to date. The stream water quality is generally improving with time.”

Physical Stream Assessments

Phase I and 2 Stream Geomorphic Assessments of the North Branch of the Deerfield River watershed were completed by Bear Creek Environmental during the summer of 2005. A report was done summarizing the results in June 2006 and includes:

“The Phase 2 Rapid Geomorphic Assessment (RGA) is important for understanding the geomorphic stability of a reach. The RGA includes an evaluation of reach condition

(departure from reference condition), channel adjustment process, and the reach sensitivity. The reach condition describes the degree of departure of the channel from its reference stream type. The channel adjustment process is a change in the form of the channel due to natural causes or human impacts. Reach sensitivity describes how sensitive a stream reach is to changes within the watershed, and is dependent upon the existing stream type and the condition of the reach.

Only two of the nineteen reaches included in the Phase 2 assessment resulted in a geomorphic condition of reference. Two segments resulted in a geomorphic condition of good. The majority, fourteen of the segments assessed resulted in a geomorphic condition of fair. One segment, in the Village of West Dover, resulted in a condition of poor.

The Rapid Habitat Assessment (RHA) is used to evaluate the physical components of a stream (the channel bed, banks, and riparian vegetation) and how the physical condition of the stream affects aquatic life. The results can be used to compare physical habitat condition between sites, streams, or watersheds, and also serve as a management tool in watershed planning or similar land-use planning. In general, the Rapid Habitat Assessment (RHA) rating was similar to the RGA. Two of the nineteen segments resulted in a reference habitat rating. Fifteen of nineteen Phase I Stream segments resulted in a rating of fair for the RHA. Two segments resulted in a poor rating for habitat."

Assessment Status of Streams in the North Branch Deerfield Watershed

Impaired Miles

Iron Stream: 0.4 - aquatic biota/habitat impaired due to high levels of iron due to ski area associated land development.

North Branch Deerfield: 0.5 - 0.5 miles above Snow Lake (rm 12.1) to Snow Lake - aquatic biota/habitat impaired due high levels of sedimentation, habitat alterations and likely thermal modifications caused by parking lot runoff, land development (construction erosion), streambank encroachment and erosion.

Altered Miles

North Branch Deerfield River: 11.5 - below Mt Snow/Haystack snowmaking water withdrawal - aquatic habitat altered due to low flows from withdrawals

Trib to North Branch Deerfield: 1.0 - below 1 of the 3 Mt Snow/Haystack withdrawals - aquatic habitat altered due to low flows from withdrawals

Cold Brook: 2.5 - from 2.5 miles below 1 of the 3 Mt Snow/Haystack withdrawals - aquatic habitat altered due to low flows from withdrawals

Stressed Miles

North Branch Deerfield River: 0.6 - Snow Lake to Tannery Brook Road (rm 11.0) - aquatic biota/habitat stressed due to habitat alterations and thermal modifications caused by the lake and the upstream land uses cited under impaired miles (parking lot runoff, land development (construction erosion), streambank encroachment and erosion.)

Baselodge Tributary: 0.2 - from mouth upstream - aquatic biota/habitat stressed (at least) due to habitat alteration, sedimentation due to land development, stream channel changes.

Beaver Brook: 2.8 - from 1st place Route 9 crosses brook east of Wilmington and extending east - aquatic habitat stressed due to sedimentation and physical habitat alteration from channel alteration and relocation and removal of streamside vegetation due to highway reconstruction.

Binney Brook: 3.0 - from mouth to Haystack Pond - threats to aquatic biota/habitat and water clarity from metals, acidity, sedimentation, and turbidity due to atmospheric deposition, land development, and recreation activities.

Cold Brook: 2.5 - upstream from the mouth and Haystack Brook: 1.0 - threats to water clarity, aesthetics, and aquatic biota/habitat from sedimentation, turbidity, and thermal modifications due to land development, a gravel mining operation and loss of riparian vegetation.

Rose Brook: 1.0 - upstream from mouth - threats to aquatic biota/habitat and aesthetics from sedimentation and nutrient enrichment due to land development and watershed hydrology changes.

Listing Status of Rivers, Streams, Lakes, and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 303(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT12-05	North Branch Deerfield from Tannery Brook Road to 0.2 miles above Snow Lake	Aquatic life support, aesthetics	storm-water	Stormwater runoff, land development, construction erosion
VT12-05	Iron Stream (Trib to Tannery Brook)	Aquatic life support	iron	Land development, other causes/sources?

There are no Basin 12-05 waters on the **Part B** – Impaired Surface Waters not needing a Total Maximum Daily Load Determination list

Part C – Stressed Waters in need of Further Assessment

Id #	Waterbody	Uses stressed	Pollutant	Issues
VT12-05	Ellis Brook	Aquatic life	undefined	Macroinvertebrate assessment dropped from excellent to good; fish were “fair”.

Part D – Waters with EPA-approved TMDLs

Id#	Waterbody	Pollutant	Problem	Date TMDL approved
VT12-05	North Branch Deerfield, vicinity of West Dover	E. Coli	High E. coli levels but sources are unknown	September 30, 2011
VT12-05L01	Haystack Pond (Wilmington)	acid	Critically acidified; chronic acidification from atmospheric deposition	September 30, 2003.

Part F – Waters Altered by Flow Regulation

Id#	Waterbody	Uses affected	Problem	Action
VT12-05	Cold Brook	aquatic life support	Artificial & insufficient flow below Mt. Snow/Haystack shared snowmaking water withdrawal	
VT12-05	North Branch Deerfield River	aquatic life support	Artificial & insufficient flow below Mt. Snow snowmaking water withdrawal	Mt. Snow plans new withdrawal and reservoir with conservation flows

Information Sources

Biological and Aquatic Life Use Attainment Assessment of the North Branch of the Deerfield River and Tribs in the Upper Reaches of the Watershed, draft April 24, 2008. Vermont DEC Water Quality Division Biological and Aquatic Studies Section, Waterbury, Vermont.

Semi-Annual Monitoring Report, Wilmington, Vermont Municipal Landfill, June 13, 2011. Prepared for the Town of Wilmington by KAS, Williston, Vermont

Phase 1 and 2 Stream Geomorphic Assessments: North Branch of Deerfield River Watershed, Windham County, Vermont. Final Report January 30, 2006. Bear Creek Environmental, Middlesex, Vermont.

West Branch Deerfield

The **West Branch** forms in the so-called Beaver and Camp Meadows in the southeast quarter of the town of Woodford. Reservoir Brook, Yaw Pond Brook, plus five unnamed tributaries comprise the headwaters. These tributaries are flashy streams draining a wooded and mountainous area. The West Branch reaches the village of Heartwellville 5.5 miles from its source where it is joined by another small tributary. The West Branch continues in a southeasterly direction for 5 miles to its confluence with the Deerfield River in Readsboro.

Assessment Information

Macroinvertebrate Sampling

Red Mill Brook macroinvertebrate community was sampled at rm 0.7 in 2008 and was in "excellent - very good" condition. The fish community was also sampled at the same location and year and was assessed as "good". There are multiple wetlands and ponds upstream of this sampling site which influences what the natural aquatic community is.

The macroinvertebrate community was sampled on the West Branch of the Deerfield River at rm 0.1 in 2004. The assessment of the community was "excellent."

Fishery Resource

The fisheries of waterbodies in the West Branch watershed include:

***West Branch*:** wild brook and brown trout; stocked brook trout
Reservoir Brook: wild brook trout
Yaw Pond Brook: wild brook trout
"Heartwellville" Brook: wild brook and brown trout
Lamb Brook: wild brook trout.

Howe Pond: pumpkinseed, chain pickerel, brown bullhead. Readsboro municipal water supply.

Lower Deerfield River and South Branch

Assessment Information

Biological Monitoring

Biological sampling on the Deerfield River occurred in 2003, 2004, and 2008. Rm 52.4 is about a quarter mile below Harriman Reservoir in Whitingham; rm 51.8 is located just above the 4th small tributary below Harriman Reservoir; rm 51.3 is located about a mile below the reservoir; and rm 44.4 is located adjacent to Tunnel Road below Readsboro.

The results of the macroinvertebrate sampling are below.

Table 4. Macroinvertebrate sample assessment results 2003 – 2009.

Year	Rm 44.4	Rm 51.3	Rm 51.8	Rm 52.4
2003	---	Fair	---	Poor
2004	Excellent	---	Good-Fair	---
2008	---	---	---	Poor

Fishery Resource

The Deerfield lower mainstem includes the 4.5 mile Harriman bypass, a section of river where flows from Harriman Reservoir Dam are diverted to Harriman Station powerhouse at the head of Sherman Reservoir via a penstock. The VFWD and USFS restored a wild brook trout population and fishery to the reach following the 1997 FERC relicensing of the project since FERC relicensing minimum flows are required in Harriman Bypass. Bypass flows are primarily from a deepwater release from Harriman Reservoir, therefore the thermal regime of the bypass at least as far downstream as the confluence with the West Branch is very cold and inhibits aquatic productivity and trout growth. Sherman Reservoir straddles the Vermont-New Hampshire state line. There is no fishing license reciprocity agreement between the two states, as there is for Vermont and New Hampshire, therefore the reservoir is managed under two sets of regulations.

The fishery in other portions of the lower watershed is:

***Toby Brook*:** wild brook trout
South Branch: wild brook and brown trout
***Sherman Reservoir*:** chain pickerel, yellow perch, brown bullhead; stocked brown trout (VFWD) and rainbow trout (MADFW). There is a TransCanada controlled boat launch and picnic area on the reservoir.

Assessment Status of Streams in the Lower Deerfield Watershed

Impaired Miles

Deerfield River: 3.1 - aquatic biota/habitat and secondary contact recreation (fishing) impaired due to cold summer water temperatures from Harriman Reservoir dam releases and low alkalinity and low pH.

Stressed Miles
South Branch Deerfield: 3.0 - upstream from Sherman Reservoir - aquatic biota/habitat and secondary recreation stressed from low alkalinity and low pH due to low buffering capacity and from atmospheric deposition.

Listing Status

There are no **Part A** – Impaired Surface Waters in Need of a TMDL for waters and no **Part B**– Impaired Surface Waters not needing a Total Maximum Daily Load Determination list waters in the lower Deerfield River watershed.

Part C – Stressed Waters in need of Further Assessment

Id #	Waterbody	Uses stressed	Pollutant	Issues
VT13-05	Connecticut River below Vernon Dam	Drinking water supply	tritium	Tritium leak from Vermont Yankee

Part D – Waters with EPA-approved TMDLs

Id#	Waterbody	Pollutant	Problem	Date TMDL approved
VT12-01L01	Harriman Reservoir (Whitingham)	mercury	Elevated mercury in all fish except brown bullhead	December 20, 2007
VT12-01L01	Harriman Reservoir (Whitingham)	acid	Atmospheric deposition: extremely sensitive to acid-ification; episodic acidification	September 20, 2004
VT12-01L04	Sherman Reservoir (Whitingham)	mercury	Elevated mercury in all fish except brown bullhead	December 20, 2007

There are no lower Deerfield River waters on the Part E – waters altered by aquatic invasive species list.

Part F – Waters Altered by Flow Regulation

Id#	Waterbody	Uses affected	Problem	Action
VT12-01	Lower Deerfield River below Harriman Reservoir	aquatic life support	Low temperature hypolimnetic water release from reservoir	Provision in 401 requires this to be addressed

East Branch of the North River

The East Branch of the North River drains 41 square miles of hilly wooded terrain southeast of the Deerfield River drainage basin. The branch has Ryder Pond, located in the northern portion of the town of Whitingham about 2 miles northwest of Jacksonville, as its source. The East Branch of the North River flows in a southeasterly direction through Whitingham and Halifax, a distance of 11 miles, to the Vermont-Massachusetts state line.

From Ryder Pond to Jacksonville, a distance of 1.7 miles, the East Branch of the North River flows rapidly. At Jacksonville, the river is joined by a small tributary which is fed by three ponds: Laurel Lake, Gates Pond and Jacksonville Pond.

Another small tributary joins the East Branch main stem at Jacksonville. This unnamed tributary parallels Route 100. The stream is flashy and flows a distance of 1.3 miles.

Continuing its southeast course for 4.5 miles, the East Branch of the North River forms small rapids until it reaches a short stretch of cascades opposite the turn-off road which leads to West Halifax. The river continues another half mile to its confluence with Branch Brook, which enters from the north. In this 4.5 mile stretch, five small tributaries join the river, all but one entering from the southwest.

Branch Brook, the largest tributary to the East Branch of the North River, flows from its source near the Marlboro-Halifax town line a distance of 5.5 miles in a southerly direction to its confluence with the East Branch. Three miles from its source, Branch Brook flows through the village of West Halifax. A distance of 1.5 miles further downstream it joins with Sperry Brook, a small tributary 1.5 miles long, and then travels a distance of 1.0 mile to its juncture with the East Branch North River.

Continuing in a southeast direction, the East Branch North River flows a 2.5 miles to the Vermont-Massachusetts line. This stretch of river receives six more small flashy tributaries.

Assessment Information

Biological monitoring

Macroinvertebrate sampling results from two sites on the East Branch North River are shown in the table below:

Table 5. Biomonitoring assessment results on East Branch North River

	2003	2008	2009	2010	2011
Rm 11.7	---	excellent	excellent	excellent	good-fair
Rm 17.6	excellent	very good	---	---	---

The site at rm 11.7 is located just to the east of the confluence with Randall Brook about 1.8 miles from the Massachusetts border in Halifax and rm 17.6 is located below the first bridge below the Jacksonville WWTF outfall.

The biomonitoring results in 2011 showed that abundance was very low - at threshold - due to Tropical Storm Irene scour of the stream reach. All other metrics are in excellent range for a medium high gradient (MHG) stream type. This includes richness and EPT taxa present. Several *Ephemeroptera* seem to be the fastest re-colonizers here. The sample was collected 5 weeks post Tropical Storm Irene. There was evidence of flood debris in trees 15 feet up and well out into floodplain.

Fishery Resource

In the East Branch North River, summer water temperatures and natural low flows may be the most significant habitat impediments to wild trout populations in the mainstem where trout abundance is typically low. Several shallow ponds in the upper sub-basin (Ryder, Gates, Laurel and Jacksonville ponds) may be important contributors to this temperature stressed system.

The fisheries present in this watershed include:

***Mainstem**:* wild brook and brown trout; stocked brook trout. Atlantic salmon fry stocked by MADFW in recent past years as part of Connecticut River Basin salmon restoration
***Hager Brook**:* wild brook trout.
***Branch Brook**:* wild brook and brown trout

***Ryder Pond**:* no data
***Gates Pond**:* no data
***Laurel Pond**:* no data
***Jacksonville Pond**:* no data; unconfirmed report of chain pickerel
North Pond: no data
Shippee Pond: no data

Stormwater

There is one multi-sector general permit (MSGP) issue in this watershed for Bartlett and Boyd gravel pit plus one operational and one construction permit.

Green River

The Green River drainage basin lies directly to the east of the East Branch North River. The Green River from its source in the southwest corner of of Marlboro flows through Halifax in a westerly direction until it crosses the Halifax-Guilford town line where it changes to a southerly direction. The total length of the river in Vermont is 13.0 miles.

The Green River flows a distance of 3.5 miles from its source to Harrisville where it is joined by Harrisville Brook. From Harrisville, the Green River flows 0.5 miles to its confluence with Pond Brook, which originates at South Pond 1.0 miles east of Marlboro College. Pond Brook travels a slow and then rapid course a distance of 3.3 miles. The Green River then continues for 3.8 miles in a southeast direction to its confluence with Hinesburg Brook. This stretch of the river flows through a sparsely populated area and lies in a narrow valley.

Hinesburg Brook joins the Green River at a bend in the river 1.0 mile south of Hinesburg. This brook is 4.0 miles long and drains a small farming area.

Continuing southward, the Green River flows 1.8 miles to the village of Green River. From Green River Village, the Green River flows a distance of 3.2 miles to where it crosses the Vermont-Massachusetts state line. The Green River flows southerly in Massachusetts joining the Deerfield River just before it joins the Connecticut River.

Assessment Information

Biological monitoring

Table 6. Biomonitoring assessment results from the Green River

	2003	2008	2011
Green River rm 16.0	---	---	fair
Green River Trib 6 rm 1.7	exc-very good	excellent	---

Fishery Resources

In the summer, water temperatures and base flows are significant habitat limitations. Streams throughout the watershed were heavily altered by both TS Irene flooding and post-flood recovery work.
***Mainstem**:* wild brook and brown trout; stocked rainbow trout (MADFW). Atlantic salmon fry stocked by MADFW in recent years as part of Connecticut River salmon restoration.
***Hinesburg Brook**:* wild brook trout.
***Roaring Brook**:* wild brook trout. Atlantic salmon fry stocked by MADFW in recent past years as part of Connecticut River Basin salmon restoration.
***Borden Brook and Thorpe Brook**:* no data.
***South Pond**:* brown bullhead; stocked rainbow and brown trout. There is a VFWD boat launch and access area on this pond.
***Deer Park Ponds**:* no data.

Table 7 - Basin 12 and lower 13 Lake and Pond Information and Status

LakeID	Town	WBID	Lake Area	Basin Area	OutletType	Monitoring[1]	Shoreland_2011[2]	Invasives	Atmospheric	Water Quality
ADAMS (WOODFD)	Woodford	VT12-04L01	21	821	ARTIFICIAL	SP, AcidLAke	3	0	1	6
BILLINGS	Searsburg		4	2070						
CLARA	Whitingham	VT12-01L05	18	412		SP	-1	0	2	6
CRYSTAL (WILMTN)	Wilmington	VT12-05L03	3							
GROUT	Stratton	VT12-03L01	84	411	NATURAL	SP	-1	0	1	6
HARRIMAN (WHITHM)	Whitingham	VT12-01L01	2040	116840	ARTIFICIAL	SP, AcidLake	3	0	1	6
HAYSTACK	Wilmington	VT12-05L01	27	132	NATURAL	AcidLake	-1	0	1	6
HOWE	Readsboro	VT12-02L02	52	1647	NATURAL	SP, AcidLake	3	0	1	6
LITTLE (WOODFD)	Woodford	VT12-04L04	16	323	NATURAL with ARTIFICIAL CONTROL	SP, AcidLake	-1	0	1	6
LOST (GLASBY)	Glastenbury	VT12-04L02	1	65		SP, AcidLake	-1	0	1	6
MILL (WOODFD)	Woodford		7	988						
MUD (WOODFD)	Woodford	VT12-02L01	6	23						
NORTH (WHITHM)	Whitingham	VT12-01L03	20	229	ARTIFICIAL	LakeAsmt	-1	0	2	6
RAPONDA	Wilmington	VT12-05L02	121	616	NATURAL with ARTIFICIAL CONTROL	SP, LMP	-1	0	2	6
RED MILL	Woodford	VT12-04L03	7	1258						
SADAWGA	Whitingham	VT12-01L02	194	1169	NATURAL with ARTIFICIAL CONTROL	SP, LakeAsmt	-1	1	2	6
SEARSBURG	Searsburg	VT12-04L05	25	98	ARTIFICIAL					
SHERMAN	Whitingham	VT12-01L04	160	143000	ARTIFICIAL					
SOMERSET	Somerset	VT12-03L02	1568	16313	ARTIFICIAL	SP, AcidLake, LakeAsmt, RemapHg	-1	0	1	6
SPRUCE (WILMTN)	Wilmington	VT12-05L04	12	987	ARTIFICIAL					

STAMFORD	Stamford	VT12-02L03	12	260		SP, AcidLake	-1	0	1	6
YAW	Readsboro	VT12-02L04	2	2007						
CASTLE;	Somerset									
DEERFIELD-LOWER;	Stratton									
DEERFIELD-N;	Stratton									
DEERFIELD-UPPER;	Stratton									
DUBLIN;	Stratton									
EAST;	Somerset									
ELLIS;	Dover									
GROUT-N;	Stratton									
HEARTWELLVILLE;	Readsboro									
MT. SNOW;	Dover									
SOMERSET-N;	Somerset									
SOMERSET-W;	Somerset									
DEER PARK	Halifax	VT12-06L02	22	607	ARTIFICIAL	SP, LakeAsmt	3	0	2	6
DEER PARK-WEST;	Halifax	VT12-06L01	6	247						
SOUTH (MARLBR)	Marlboro	VT12-07L01	68	344	NATURAL	SP, AcidLake	-1	0	1	6
GATES	Whitingham	VT12-07L02	30	1486	NATURAL with ARTIFICIAL CONTROL	SP, LakeAsmt	3	0	2	6
JACKSONVILLE	Whitingham	VT12-07L03	20	3349	ARTIFICIAL	SP, LakeAsmt, RemapHg	2	0	2	6
LAUREL	Whitingham	VT12-07L04	16	76	NATURAL	SP, LakeAsmt	-1	0	2	6
RYDER	Whitingham	VT12-01L06	14	115						
SHIPPEE	Whitingham	VT12-07L05	24	366	NATURAL with ARTIFICIAL CONTROL	SP	3	0	2	6
BLUE;	Halifax									
BROWN;	Whitingham									
GATES-NE;	Marlboro									
TULIP;	Whitingham									
GUILFORD-E;	Guilford		5							

LILY (VERNON)	Vernon	VT13-16L01	41	41	NATURAL with ARTIFICIAL Control	SP, LakeAsmt				
SWEET	Guilford	VT13-17L01	20	20	ARTIFICIAL	SP				
VERNON HATCHERY;	Vernon	VT13-16L02	10							
WEATHERHEAD HOLLOW	Guilford	VT13-17L02	33	33	ARTIFICIAL	SP				

1 SP= spring phosphorus sampling; acid = acid rain sampling; LakeAsmt = a two-day (check!) lake assessment that includes…; RemapHg =

2 The right four columns in the table above reflect the results in the Lake Score Card, which uses three simple colors to convey the meaning of complex data sets and the status of Vermont lakes for each category (blue is good, yellow is fair, red is poor).

Water Quality - this score is derived from a statistical trend analysis of phosphorus, chlorophyll-a, and Secchi depth data over time. Stable or improving trends are scored with a blue or good rating, declining trends are scored with a yellow or fair rating, and highly significantly declining trends receive a red or reduced score. Phosphorus is a key plant nutrient and increased phosphorus concentrations typically result in increased algae growth (measured by chlorophyll-a) and decreased water clarity (measured by Secchi depth).

Shoreland and Lake Habitat – this score reflects the conditions of a lake's shoreland and shallow water habitat. The more lawn and development near the water's edge, the lower the shoreland condition. Blue scores represent lakes with >75% vegetated shores; yellow shows lakes with 50-75% vegetated shores; and red shows lakes with less than 50% lakeshore vegetation. Loss of shoreland habitat is now considered by the US Environmental Protection Agency to be the primary threat to lake biota.

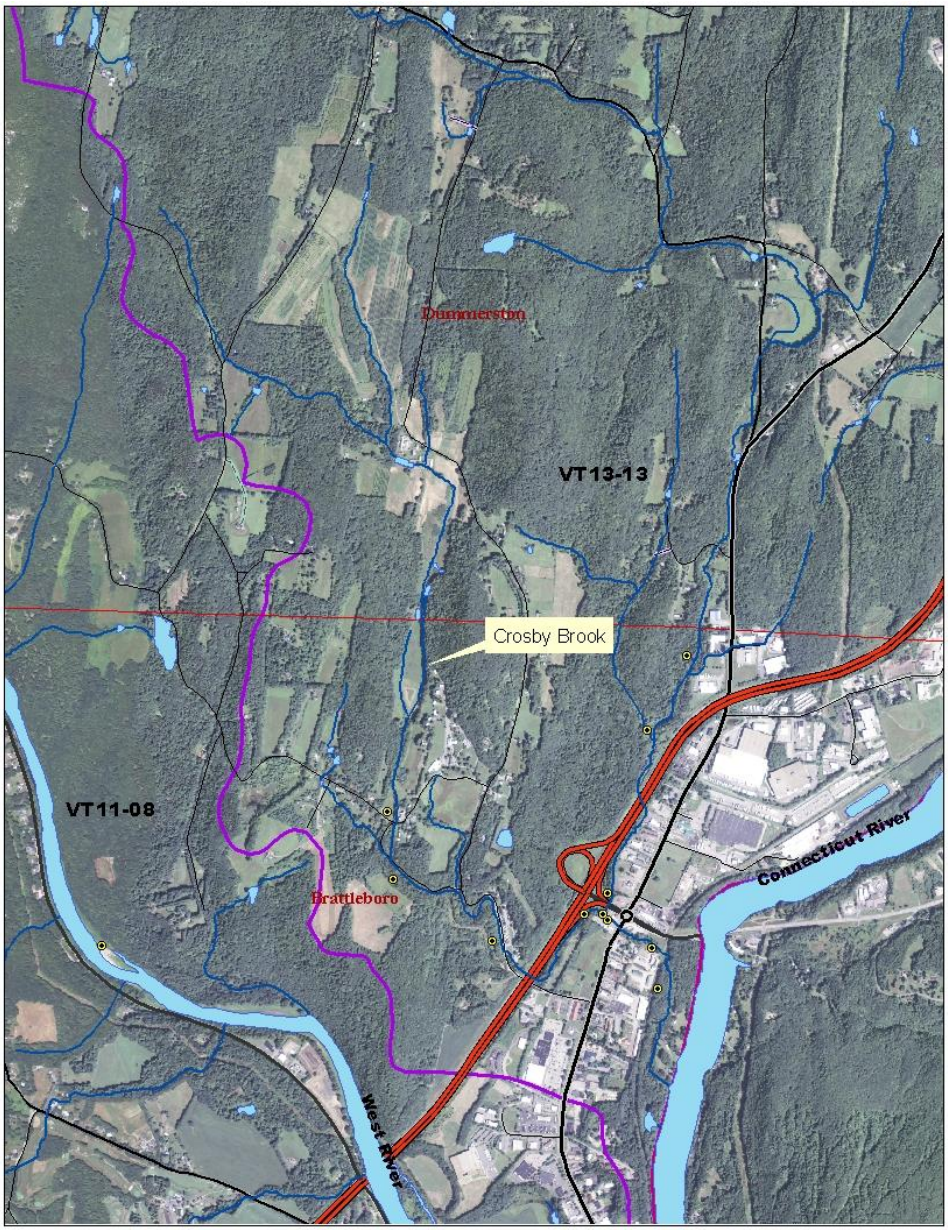
Aquatic Invasive Species - this score measures the presence or absence of invasive species (blue no known invasive; red confirmed invasive). It does not reflect the abundance or degree of nuisance posed by the species present. Left unchecked, invasive species can cause significant harm to a lake's recreational experience and its ecosystem. The score card also tells which, if any, invasive is in a lake.

Atmospheric Pollution – there are two main airborne pollution types reflected in this score. Mercury contamination has resulted in fish consumption advisories in nearly every lake in Vermont (and those of nearby states as well – so all Vermont lakes, but two, get a yellow score). Acid precipitation has resulted in the acidification of some of the high elevation lakes, but this trend is improving for acid-sensitive lakes.

Basin 13- Lower Connecticut River direct

Crosby Brook

Crosby Brook (also known as Black Mountain Brook or Sargeant Brook) is a direct tributary to the Connecticut River in Dummerston and Brattleboro. The brook begins when a set of small headwater tributaries from unnamed hills in Dummerston join together. The brook then flows southeasterly and southerly through a portion of Brattleboro to the Connecticut River entering just below the Route 9 bridge to New Hampshire. The brook is about six miles long and drains a watershed of about 15 square kilometers. The South Branch Crosby Brook, which drains a 4.5 km^2 watershed, enters Crosby Brook just below the I-91 exit above the junction of Routes 5 and 9.



Assessment Information

Biological Monitoring

Macroinvertebrate sampling on Crosby Brook found:

Table 8. Biomonitoring assessment results from Crosby Brook

	Rm 0.3	Rm 0.4	Rm 0.7	Rm 1.5	Rm 1.8
2002	fair	----	----	----	----
2003	fair	fair	----	fair	----
2004	poor	good-fair	good-fair	good-fair	exc-vgood
2012					

Fish community sampling on Crosby Brook found: at rm 0.3, a community in "fair" health in 2003; at rm 0.5, "fair" in 2003; and at rm 1.5, "excellent" in 2003.

On the South Branch of Crosby Brook, the macroinvertebrate community was "excellent" to "very good" in 2003 at rm 0.5. In 2004, it was "good" at rm 0.1, "very good" at rm 0.5, and "very good" at rm 1.3. The fish community on the South Branch Crosby Brook was "excellent" in 2003 (rm 0.5).

Conclusions from a report on the biota conclude that: “two stressors, sediment and temperature, have been shown to increase significantly longitudinally, and to be at levels high enough at rivermile 0.3 to be stressful to aquatic life. In the case of sediment, it appears that during high flows, the South Branch begins to carry a significant sediment load from areas above SBCB 0.5. The stream runs immediately adjacent to a long reach of gravel road immediately above this cite. On Crosby Brook proper, sediments measures appear to significantly increase at CB rm 0.6. This is the first reach on Crosby Brook that is within a more urban land use setting and receives stormwater runoff… Sediment addition to the stream is clearly related to freshet runoff events....Temperature has been shown to be high enough at the lowest site CB0.3 to be stressful to cold-water aquatic life.”

Physical Stream Assessments

A Phase 1 and Phase 2 Assessment of Crosby Brook and the South Branch Crosby Brook was done by Fitzgerald Environmental. Information in this section is taken from Fitzgerald reports listed below. A total of 16 reaches were identified during the Phase 1 analysis for the 10.1 mile channel network. Based on an analysis of impact ratings generated from the Phase 1 data, 9 reaches were selected for further Phase 2 assessment in 2008, including 6 reaches on the mainstem and 3 reaches on the South Branch.

During the Phase 2 surveys, the division of mainstem reaches resulted in a total of nine segments, while the division of South Branch reaches resulted in a total of seven segments. Each segment was walked entirely and detailed physical data were collected using the SGA Phase 2 methods. This included a summary of geomorphic stability (RGA rating), habitat conditions (RHA rating), and channel evolution stage and stream sensitivity.

Of the nine segments analyzed on Crosby Brook, a stretch of three segments (M01-B – M03) had a fair or poor RGA and RHA condition and two other segments (M05 and M06-A) had a fair condition for one of the two assessments. Eight of the nine segments were

rated high, very high, or extreme sensitivity. Of the seven segments on the South Branch, five of the seven had fair or poor (only one) as the RGA and RHA conditions with one segment having good for both and one segment having reference for both.

Assessment Status

Impaired Miles

Crosby Brook: mouth to 0.7 miles upstream - aquatic biota impaired due to sedimentation, habitat alterations, temperature due to urban runoff, roads, channelization, some loss of riparian vegetation.

Listing Status of Rivers, Streams, Lakes, and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 303(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT13-13	Crosby Brook, mouth to rm 0.7	Aquatic life support	sediment	Habitat impacts due to sedimentation, channelization, buffer loss

There are no Crosby Brook reaches or tributaries to it that are on the **Part B**, **Part C**, **Part D**, **Part E**, **Part F** lists.

Information Sources

The Biotic Condition of Crosby Brook and the Exploration of the Environmental Stressors on the Aquatic Communities, June 2005. Vermont DEC WQD BASS, Waterbury, Vermont.

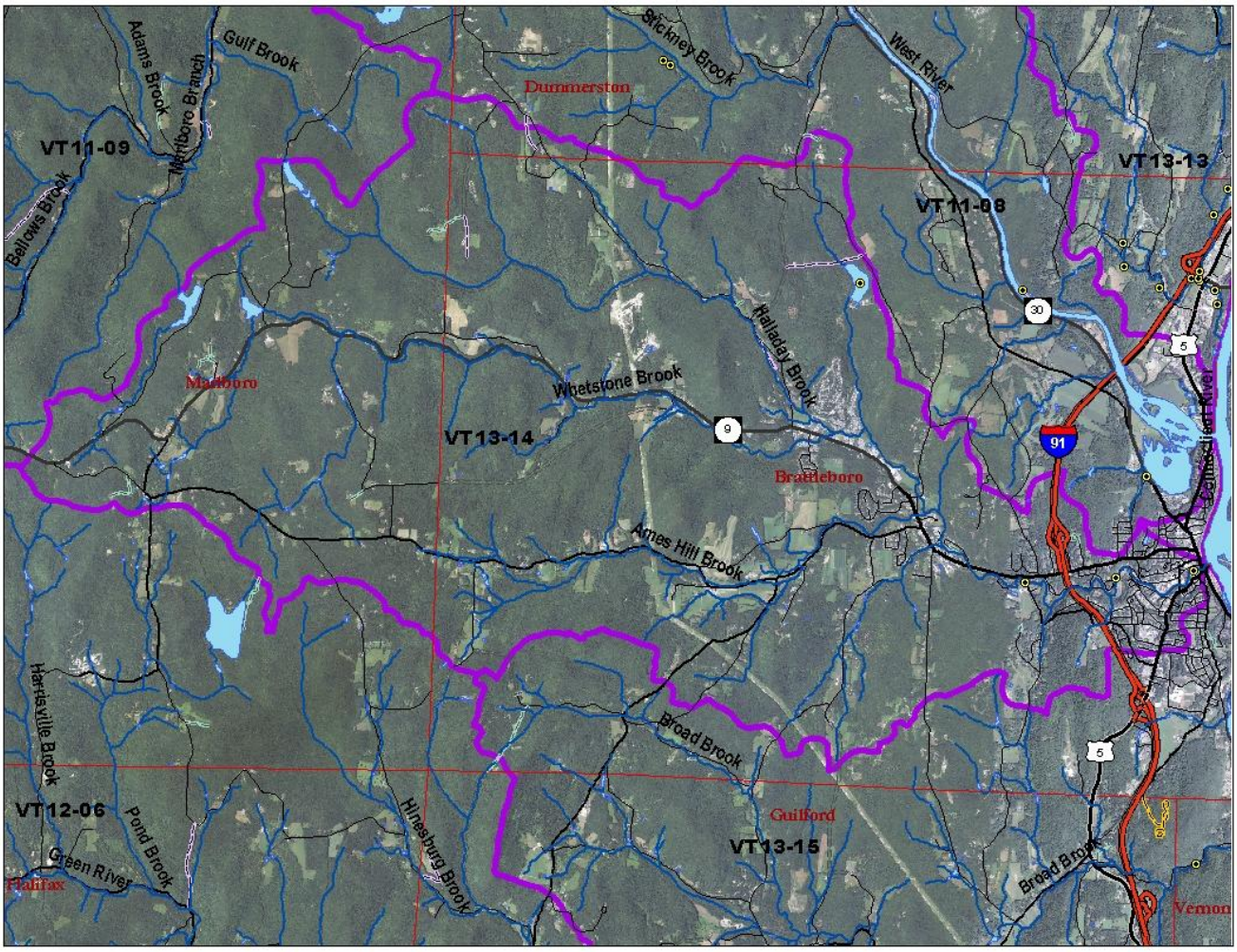
Crosby Brook Phase 1 Stream Geomorphic Assessment Report, October 2007. Prepared for the Windham County Natural Resources Conservation District by Fitzgerald Environmental Associates, LLC, Colchester, Vermont.

Crosby Brook Phase 2 Stream Geomorphic Assessment Summary, July 2008. Prepared for the Windham County Conservation District by Fitzgerald Environmental Associates, LLC, Colchester, Vermont.

Crosby Brook Watershed Stream Corridor Restoration Plan, June 2009. Prepared for the Windham County Conservation District by Fitzgerald Environmental Associates, LLC, Colchester, Vermont.

Whetstone Brook

Whetstone Brook originates in the eastern portion of Marlboro and flows for 11 miles and following Route 9 easterly for much of its length down through Brattleboro to the Connecticut River. The brook drains a 28 square mile watershed. The 6-mile long Halladay Brook enters from the north and the 5-mile long Ames Hill Brook parallels the Whetstone and enters it in West Brattleboro.



Assessment Status of Streams in the Whetsone Brook Watershed

Impaired Miles

Whetstone Brook: 2.2 - from the bend in the stream NW of the Living Memorial Park swimming pool (upstream of covered bridge) downstream to Conn. River - contact recreation impaired due to pathogens caused by likely failed sewage lines or additionally failed septic systems, urban stormwater runoff.

Stressed Miles

Whetstone Brook: 2.5 - upstream from bend in the stream NW of the Living Memorial Park swimming pool - aquatic biota/habitat, secondary contact recreation, and aesthetics stressed from sediments, enrichment from streambank erosion and developed land runoff.

E.coli Issues in the Whetstone watershed

The Whetstone Brook was one of the twenty rivers and streams described and evaluated as part of the TMDL for Bacteria Impaired Waters done by FB Environmental (out of Maine) for Vermont ANR DEC. Following is some of the analysis done on the source of the bacterial contamination taken directly from Appendix 17 of the TMDL document – Appendix 17 focuses on Whetstone Brook.

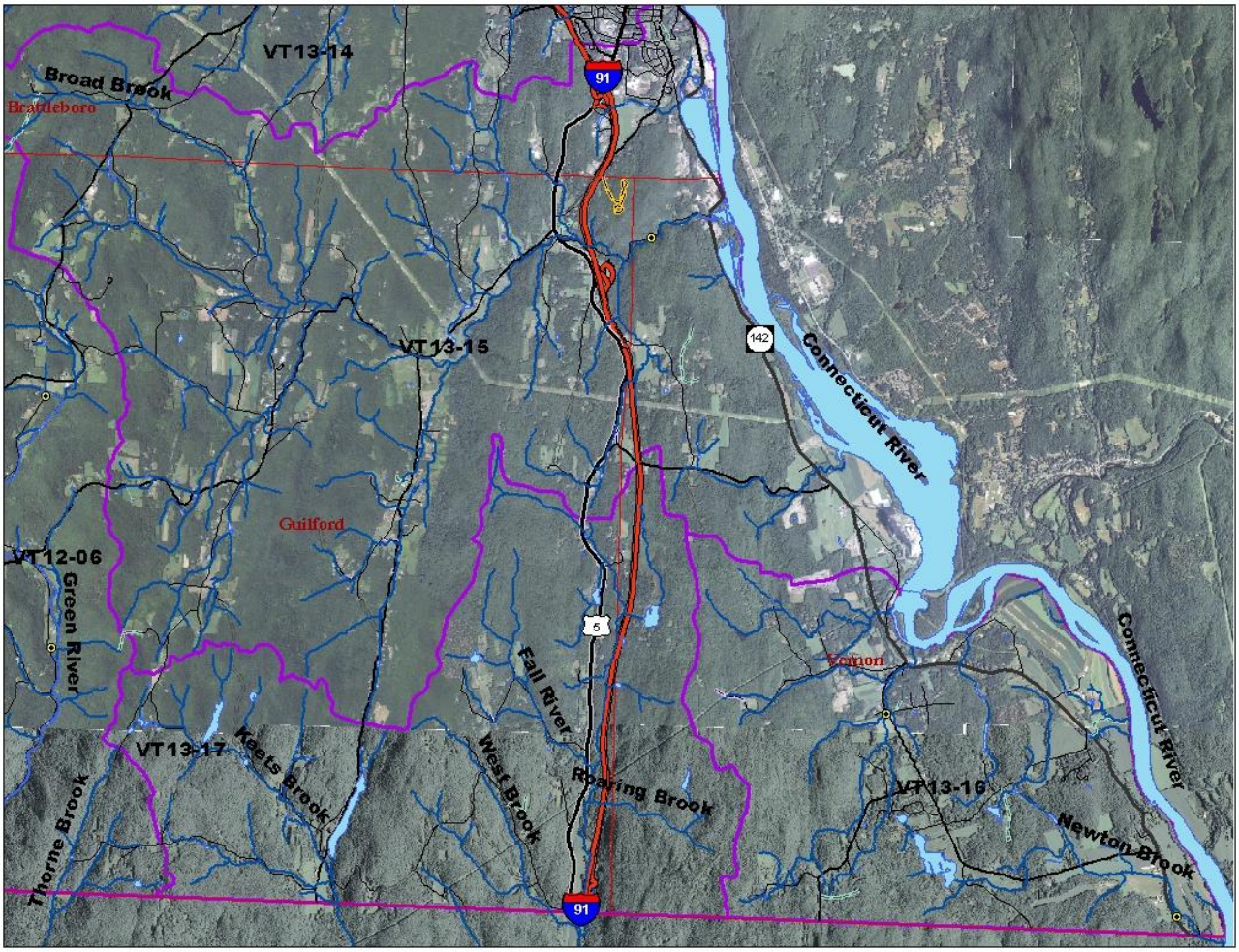
> "There are several likely sources of bacterial contamination to Whetstone Brook. These sources include: failing or malfunctioning onsite septic systems, leaking sanitary sewer pipes, stormwater runoff from developed areas, and illicit discharges….Of the 12,000 residents that live in Brattleboro, nearly 9,000 live in areas that are not serviced by the town's municipally operated wastewater treatment facility. 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…Most of the Whetstone Brook watershed is covered with soils of class 5 or 6, which have limitations for septic waste disposal. 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…
>
> The [WWT] facility is located on the Connecticut River side of Vermont Route 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 1960s, and are aging and in need of an upgrade…. 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. "

The report goes on to note that pet fecal matter, especially dog waste, and illicit discharges could also be contributing bacteria and pathogens and also should be investigated.

E. coli sampling results – geometric means for the season

Year sampled	Whetstone 0.2	Whetstone 6.4	Whetstone 9.6
2007	7	---	---
2010	195.6	27.1	6.4
2011	327.7	50.4	113.6

Miscellaneous Basin 13 Streams



Broad Brook, Newton Brook, Central Park Brook, Fall River and tributaries

The group of tributaries in the southeastern corner of Vermont that go directly to the Connecticut River in either Vermont or Massachusetts have not been monitored or assessed recently by Vermont DEC Watershed Management Division staff. This includes Broad Brook, Newton Brook, Central Park Brook, and Fall River and tributaries Roaring Brook, West Brook and Keets Brook.

Fall River Fishery Resource
There is no data on the mainstem fishery resource.

Sweet Pond: largemouth bass, yellow perch. Population status unknown since pond was drained in 2011. Sweet Pond State Park is there.
Weatherhead Hollow Pond: largemouth bass, pumpkinseed, yellow perch, American eel. VFWD boat launch and access area.

12/19/2012