

## Basin 1

Batten Kill, Walloomsac River & Hoosic River Watersheds

Water Quality and Aquatic Habitat Assessment Report

August 2002

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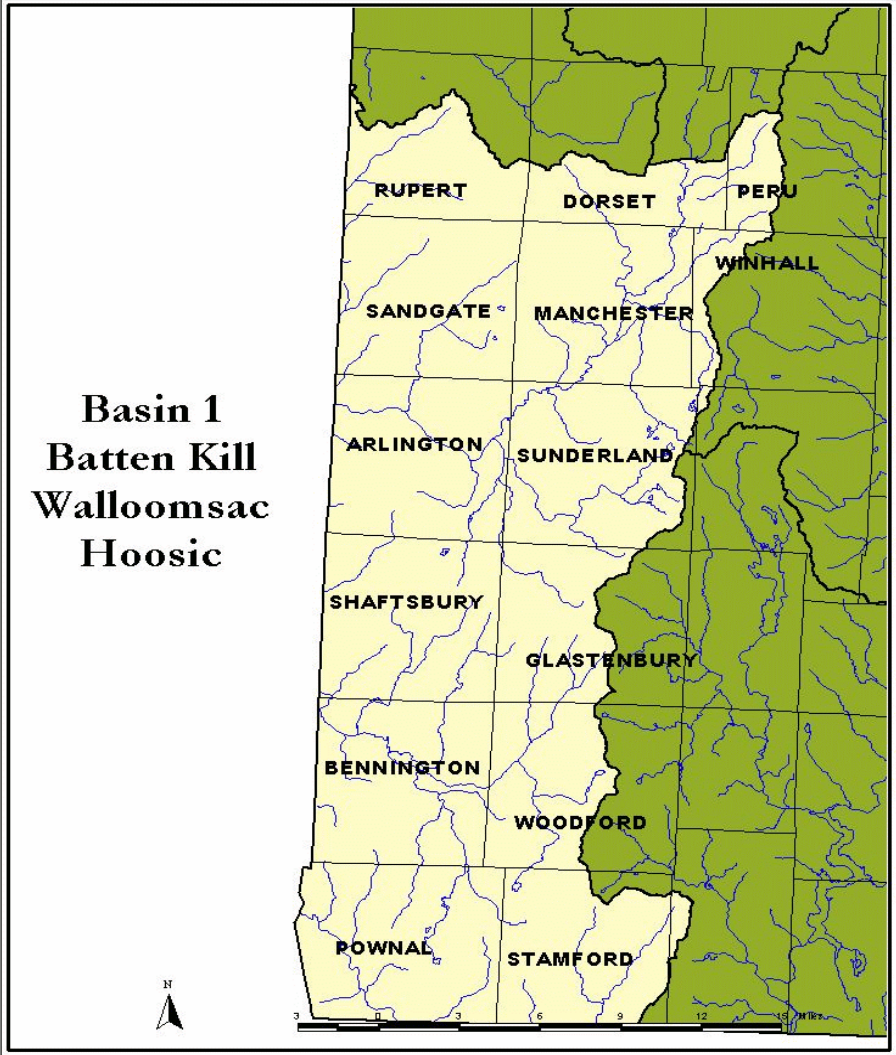
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# The Watersheds of Basin 1

Basin 1 includes the Batten Kill, Walloomsac River and Hoosic River watersheds, which are located in the southwestern corner of Vermont. The relatively small basin includes land in three of the biophysical regions of the state: the Taconic Mountains, the Vermont Valley and the Southern Green Mountains. Each of these three main rivers in the basin flow into New York state as part of the larger Hudson River drainage and so the information following is limited to the Vermont portion of the watershed unless otherwise specified. The figure below shows the location of the Basin 1 watersheds and the Vermont towns in these watersheds.



**Basin 1**  
**Batten Kill**  
**Walloomsac**  
**Hoosic**

**The Batten Kill Watershed**

The Vermont portion of the Batten Kill watershed drains much of the northern portion of Bennington County and includes an area of approximately 200 square miles. The Batten Kill rises in East Dorset and flows south with Mad Tom Brook soon joining it from the southern slope of Mount Tabor. It flows in a southwesterly direction to Arlington and then in a westerly direction to the Hudson River in New York, which it enters at a point one mile north of Schuylerville, New York. Two hundred and seven square miles of the drainage area of the basin are located in the New York portion of the watershed. From source to mouth following the major windings, it measures approximately 55 miles. The length of the river in Vermont is approximately 24 miles.

The Vermont portion of the Batten Kill watershed is mountainous, steep and heavily forested. The tributaries are, for the most part, wooded, steep and narrow. National Forest Service land in this watershed is almost 44,000 acres. The average yearly rainfall over the entire basin area is 42.9 inches. The following river and tributary descriptions for the Vermont portion of the basin were taken in part from the United States Geological Survey, Department of the Interior Publication *Surface Waters of Vermont*.

Mad Tom Brook rises on the southern slope of Mount Tabor in the northwestern part of the town of Peru at an altitude of 2,900 feet above sea level. It flows southward and southwestward to East Dorset where it joins the beginning of the Batten Kill from the north. Its length is about 5 ½ miles and its fall is about 2,100 feet.

The West Branch rises on the northern slope of Bear Mountain in the southeastern part of the town of Rupert at an altitude of about 2,500 feet above sea level. It flows eastward about 2 miles, then turns and flows southeastward to near Manchester Center. The West Branch has a length of about 9 miles and a fall of 1,800 feet, of which 1,600 feet occurs in the first 2 miles.

Bourn Brook rises in Bourn Pond in the northeastern part of the town of Sunderland at an altitude of 2,500 feet above sea level. It flows somewhat east of north for about 2 miles and then takes a northwesterly course to its junction with the Batten Kill half a mile south of Manchester Center. Its length is about 6 miles and fall about 1,800 feet of which 1,300 feet of drop occurs within 1 ½ miles in the middle of its course.

Lye Brook rises in Lye Brook Meadows in the northeastern part of Sunderland at an elevation of 2,640 feet above sea level. It flows in a northerly direction about 5 miles, then turns abruptly and flows southwestward to its junction with the Batten Kill. Its length is 6 miles and its fall is 1,900 feet of which 1,800 feet occurs in the northward flowing stretch.

Mill Brook rises near the center of Sunderland at an altitude of 2,550 feet above sea level and flows southwestward, westward and northwestward to its junction with the Batten Kill at Sunderland. Its length is approximately 4 ½ miles and its fall about 1,920 feet, of which 1,600 feet occurs within 2 ½ miles of the head of the stream.

### **The Batten Kill Watershed (cont.)**

Roaring Branch originates at the junction of Branch Pond Brook and Alder Brook west of

Kelly Stand. It is approximately 10 miles long and flows overall in a westerly direction with northerly and southerly jogs until the East Arlington area. Just north of East Arlington, Warm Brook joins Roaring Branch from the south. Roaring Branch continues north from there to join the Batten Kill.

The Green River rises in many forking branches on the western slopes of Bear Mountain in the towns of Sandgate and Manchester at an altitude of nearly 3,000 feet above sea level. It flows southwestward to Sandgate then takes a more southerly course to its junction with the Batten Kill in West Arlington. Its length is about 10 miles with a total fall of 2,400 feet from source of highest tributary to the mouth.

The Vermont DEC inventory identifies 18 lakes and ponds covering 259 acres in the Batten Kill watershed.

The dominant land cover type in the Vermont portion of the Batten Kill watershed is forest - 82% of the watershed area. The second greatest land use is agriculture with about 7% of the watershed in that category. Surface water covers a little over 4% of the watershed area and wetlands cover another 2.7%. Developed land, including transportation, occupies at least 4.1% of the watershed land area.

Table 1. Land Use and Land Cover in the Batten Kill Watershed<sup>1</sup>

Land Use	Acres	% of Total
Forested	113,046.4	81.7
Agriculture	9,772.8	7.1
Surface Water	5,798.1	4.2
Transportation	3,995.9	2.9
Wetlands	3,685.3	2.7
Developed Land <sup>2</sup>	1,704.0	1.2
Old Field & Barren	423.8	0.3
Total:	138,426.3	100

1 Vermont Land Cover Classification Project, 1997 (based on satellite photographs from 1991 - 1993).

2 Developed land = residential, commercial, industrial but not transportation, which is listed separately.

## Uses, Values and Features of the Batten Kill and Tributaries

### *Waterfalls, cascades and gorges*

The only site listed in the 1985 *Waterfalls, Cascades, and Gorges of Vermont* inventory and study for the Batten Kill watershed is Downer Glen on Bourn Brook in Manchester. This site, however, was not visited by the investigators for that inventory and so there is no description of it. A site on Roaring Branch was sought but not found during this study; however, during the later swimming hole study, a nice series of cascades and pools was found on this stream (see below) and is probably the original site sought.

### ***Swimming, fishing and boating***

Four swimming holes are listed in the 1992 *Vermont Swimming Hole Study* for the Batten Kill watershed: three are on the Batten Kill itself and one is on Roaring Branch. One of the sites on the Kill is the Wagon Wheel Campground swimming hole, which is accessible to guests at the campground. The river is wooded and shady on both sides and there are shallow pools, instream boulders, small rapids, and a gravel bar. The second site on the Batten Kill itself is just west of Arlington off of River Road. The parking area and grassy riverbank belongs to Batten Kill Canoe but the public has been allowed access for swimming and fishing. There is a long, fairly deep pool there. The third site on the river is at the West Arlington covered bridge and is “the most popular swimming area on the Vermont segment of the Batten Kill”. There is a large deep pool, good public access, a small beach, some grassy banks, and good fishing from the bridge piers.

The other identified swimming hole in the Batten Kill watershed was Roaring Branch Cascade in Sunderland. This site is a series of pools and cascades with clean water, natural vegetation, and carved rocks.

A stretch of the Batten Kill is listed in the 1989 *Whitewaters Rivers of Vermont* report due to some short stretches of Class I and II rapids. Class II rapids are found in a quarter-mile stretch below where Roaring Branch comes in. Below the Route 313 bridge in Arlington, the river is largely quickwater with occasional Class I rapids. From Arlington to the New York line, the Batten Kill is heavily used for recreational boating and tubing.

Fishing is the reason that the Batten Kill is a nationally known river. In 1989, Trout Unlimited named the Batten Kill as one of the nation’s 100 best trout streams. The river was Vermont’s first Outstanding Resource Water and its “exceptional fishery” due to the high quality habitat was a large part of the reason that the Batten Kill received ORW status. Its reputation for fishing has depended on the wild self-sustaining brown trout population that in the 1990s began a substantial decline. Studies are underway in attempts to determine the factors that may have contributed to the fishery decline.

### ***Significant natural communities***

An inventory of significant calcareous fens and riverside seeps done by the Vermont Nongame and Natural Heritage Program found two rich fen communities and one

intermediate fen community in the Batten Kill watershed. The two rich fens are located in Manchester: one is a small (1.5 acre) wetland, of which a portion is rich fen, and the other is a relatively large, mostly open fen with a diversity of vegetation types and a large population of a globally rare sedge. A two-acre intermediate fen is found in Shaftsbury and an uncommon water sedge grows there.

### ***Outstanding Resource Water status***

On January 8, 1991, the Vermont Water Resources Board designated all Vermont portions of the Batten Kill mainstem and the West Branch of the Batten Kill as Outstanding Resource Waters. They were designated for their exceptional natural, recreational, cultural, and scenic values. The findings of fact and conclusions of law present the case for a “high quality trout stream” due to physical and chemical qualities and a river that provides “exceptional wildlife habitat” with its productive floodplain, intact riparian zone in many places, north-south orientation for migratory birds, slow-moving waters for furbearers, and thriving food chains that begin with aquatic insects and trout.

The case is also made through the ORW designation for the exceptional recreational values including angling and canoeing. Access, aesthetics, a good fishery, and enough water in summer all contribute to the heavy use of the river for recreation. Scenic and cultural values are also presented in the ORW petition.

### **Lakes with Special Significance or Features**

Vermont DEC’s Lake Protection Classification System is one framework within which lakes can be evaluated for their special significance when compared to other lakes statewide. The Classification System identifies unique lakes based on: wilderness status; occurrence of scenic and natural features; existence of very high water quality; and/or the presence of very rare, threatened, and/or endangered species. In the Batten Kill watershed, two ponds out of eighteen in the DEC assessment database are significant for these reasons.

***Branch Pond, Sunderland:*** This pond may be the best example of a wilderness-like pond. The pond is undeveloped, essentially in a primitive state, but is relatively easily accessed. The pond supports two noteworthy aquatic plants, the rare pondweed *Potamogeton confervoides*, and the rare bladderwort *Utricularia geminiscapa*.

***Bourn Pond, Sunderland:*** This is a true wilderness pond with an attractive Sphagnum mat floating island. The pond supports populations of two noteworthy aquatic plants, the rare pondweed *Potamogeton confervoides* and the rare burreed *Sparganium fluctuans*. Bourn Pond is critical habitat for breeding common loons.

### **Water-Related Activities or Projects in the Batten Kill Watershed**

#### ***Batten Kill Watershed Alliance***

The Batten Kill Watershed Alliance was established in May 2001 to coordinate, educate, and promote the stewardship and enhancement of the Batten Kill watershed in New York and Vermont. Its board represents a balance of watershed interests including farming and forestry, recreation and sporting, local government, conservation organizations, landowners, and the business community. The Alliance's first executive director was hired in May 2002. In the near future, the Alliance intends to reach out to local government officials in both states; produce membership materials and increase membership; hold public meetings on a variety of watershed themes; and produce a long-range plan. Themes of interest include stream stability, roads and rivers, recreational conflict, forest and wildlife corridor fragmentation, stocking, landowner rights and responsibilities, and others.

### ***Batten Kill Study Team***

A team of state and federal fishery and aquatic biologists was established in late 1999 in order to investigate possible causes of the brown fishery decline in the Batten Kill. Fourteen possible factors for the decline were identified for investigation at the first meeting of the team. In July 2000, Senator James Jeffords announced a \$200,000 appropriation to the U.S. Forest Service - Green Mountain National Forest for habitat restoration and resource assessments of the Batten Kill. A number of studies, inventories, and assessments are now underway as a result of the team's efforts and the federal appropriation. The GMNF and Forest Service research have been working on assessing fine sediments in trout spawning gravels and its potential impacts on reproduction. GMNF fishery biologists also did a redd (fish nest) survey on four Batten Kill tributaries in fall 2001. Significant spawning was documented in the lowest 2 miles of the Green River.

Information on the studies being conducted on the Batten Kill and the results of those investigations can be found in issues of the *Batten Kill News*, a newsletter produced twice a year by the Vermont Department of Fish and Wildlife. Fish population survey results, temperature monitoring results, habitat assessment work, and informational website addresses have all been featured in past issues.

### ***Bennington County Regional Planning Commission***

The Bennington County Regional Planning Commission has done an inventory and located all the culverts and catch basins along public roads in Arlington, Sandgate, and Sunderland. During the process, the Commission identified those structures at risk of failure and the results of their findings will be shared with the towns and the Batten Kill Study Team.

### ***Bennington County Conservation District***

The Bennington County Conservation District has served as project coordinator on several riparian projects beginning in 1999. With its partners, the U.S. Forest Service, the U.S. Fish & Wildlife Service's Partners for Wildlife Program, the Vermont Department of Fish & Wildlife, the Southwestern Vermont Chapter of Trout Unlimited, the town of Arlington and landowners

and businesses in the watershed, the District used natural channel design techniques on a 300-foot project in Manchester, a 200-foot project in West Arlington and a 300-foot project in Arlington. A project on the Green River in Arlington is in the works for the 2002 field season.

The Conservation District also conducted a buffer outreach program, "Better Buffers for the Batten Kill" for two years. The program included an educational and outreach component with a pamphlet, press releases and presentations as well as a hands-on buffer planting component. Arlington high school students helped landowners plant free native trees and shrubs along the banks of the Batten Kill in the spring of 2002 as part of this effort.

### ***Batten Kill Conservancy - New York***

There are two Batten Kill Conservancy organizations, one in New York and one in Vermont. The Batten Kill Conservancy - New York is a private, not-for-profit 501(c)(3) organization that does public education, monitoring through River Network, and land conservation work in the Batten Kill watershed in New York. They produce a newsletter *Voice of the River*.

### ***Batten Kill Conservancy - Vermont***

The Batten Kill Conservancy - Vermont based in Arlington is dedicated to the conservation and protection of the Batten Kill. Past activities have included facilitating easements and purchases to protect key pieces of the Batten Kill. The current focus of the group is to contribute to solving the problems of the trout fishery by improving the riparian habitat. The Conservancy has been involved in an erosion control project at the covered bridge in West Arlington and in a project evaluating two large eroding cliffs in Manchester and Arlington.

### ***Bennington and Rutland County Resource Assessment***

A local working group consisting of representatives from the Rutland County Natural Resources Conservation District (NRCD), the Bennington County Conservation District, the Poultney-Mettawee NRCD, the Natural Resources Conservation Service (NRCS), the Farm Services Agency, and the county foresters conducted a resource assessment of both Bennington and Rutland counties. The Hoosic, Walloomsac, and Batten Kill are all within Bennington County. The resource assessment inventoried and discussed issues relating to agriculture, forestry, recreation, water resources, and wildlife conservation. The report contains useful information for interested citizens, watershed groups, and resource managers. It is available from the Rutland County NRCD.

## **The Walloomsac River Watershed**

The Walloomsac River watershed drains much of the southcentral portions of Bennington County being bounded by the Batten Kill watershed on the north and the upper Hoosic River watershed on the south. Similar to the Batten Kill, the headwaters of the Walloomsac River are located in Vermont draining 139 square miles of the state before entering New York. The

Walloomsac River is a significant tributary to the Hoosic River.

The Walloomsac River begins where South Stream and Jewett Brook join just south of Bennington village. The river winds through Bennington in a northwesterly direction. Just north of Bennington village, the Roaring Branch enters from the east. As a larger river now, the Walloomsac flows northwestward through the northwest portion of the town of Bennington then into New York and to Hoosic Junction where it joins the Hoosic River. In addition to South Stream and the Roaring Branch, the major direct tributaries in Vermont include Jewett Brook, Furnace Brook, Paran Creek, and Cold Spring Brook.

South Stream rises in the central portion of Pownal west of The Dome and flows west of north into and through a large wetland complex east of Barber Pond. From there it flows northerly through more wetland communities in the central and northern portion of Pownal. It then flows into the town of Bennington where the Roaring Branch joins it and its slope steepens. Just south of the village of Bennington, it meets Jewett Brook. This convergence forms the beginning of the Walloomsac River. Its major tributary is Roaring Branch, which begins in the town of Stamford, flows through a narrow, steep valley and joins South Stream just as it enters Bennington.

Jewett Brook originates near Pownal Center and flows northerly and easterly meandering through numerous wetland communities including shrub and forested swamps as well as marshes until it joins South Stream south of the village of Bennington. Its length is 8 miles and its drop in elevation is 1,150 feet.

The Roaring Branch of the Walloomsac River originates in Woodford Hollow where Bolles Brook and City Stream meet. These two streams and Bickford Hollow Brook are the largest contributors to the Roaring Branch. Bickford Hollow Brook and Bolles Brook originate in the Green Mountains in the western part of Glastenbury and flow south into Roaring Branch. City Stream rises in Big Pond (also known as Woodford Lake), which is north of Prospect Mountain, at an altitude of 2,263 feet. It flows south, west, and northwest through central Woodford into the Roaring Branch of Walloomsac River. Its length is 5. miles and its drop in elevation is 1,093 feet.

Furnace Brook originates in northeastern Shaftsbury, south of Maple Hill, at an elevation of 1,520 feet. Its chief tributaries are Basin and Stratton Brooks, which flow off the western side of the Green Mountains and flow in an easterly direction until joining Furnace Brook. Furnace Brook is 10 miles long with a fall of 940 feet.

### **The Walloomsac River Watershed (cont.)**

Paran Creek rises in the northeastern part of Shaftsbury, west of Trumbull Mountain. It flows southwesterly through Shaftsbury; is dammed to form Lake Paran; and below Lake Paran flows west and south through several other dams to North Bennington, where it joins the Walloomsac River. A large branch that rises on West Mountain joins Paran Creek near

South Shaftsbury. Its length is 8 miles and its fall is 860 feet.

Little White Creek, also sometimes known as Shaftsbury Hollow Brook, rises in the southwestern part of Arlington, south of Grass Mountain, at an altitude of 2,450 feet. It flows southward and southwestward across the northwestern part of Shaftsbury and then through southeastern White Creek, New York. It joins the Walloomsac River near North Hoosick, New York. Its length is 13 miles and it has a drop in elevation of 2,050 feet, of which about 1,500 feet occurs in the 3 . miles of the steam above the New York-Vermont state line.

The Vermont DEC inventory has 6 lakes covering 193 acres in the Walloomsac watershed.

The dominant land cover type in the Vermont portion of the Walloomsac River watershed according to satellite photography from the early 1990s is forest with 71% of the total watershed area as coniferous, deciduous or mixed forest. Approximately 12% of the watershed is in some type of agricultural land use. Surface waters cover almost 5% of the watershed with wetlands about 3 . %. Developed lands, including transportation, is close to 9% of the watershed area. The paved, developed area of Bennington village accounts for a large portion of the 9%. Table 2 below contains the acres and percentages of each land use or land cover in the watershed based on satellite photograph analysis.

Table 2. Land Use and Land Cover in the Walloomsac River Watershed<sup>1</sup>

Land Use	Acres	% of Total
Forested	61,509.5	70.7
Agriculture	10,263.2	11.8
Surface Water	4,172.2	4.8
Developed Land <sup>2</sup>	3,918.1	4.5
Transportation	3,770.0	4.3
Wetlands	3,015.3	3.5
Old Field & Barren	324.4	0.4
Total:	86,972.7	100

1 Vermont Land Cover Classification Project, 1997 (based on satellite photographs from 1991 - 1993).

2 Developed land = residential, commercial, industrial but not transportation, which is listed separately.

## Uses, Values and Features of the Walloomsac River and Tributaries

### ***Waterfalls, cascades and gorges***

No waterfalls or cascades were reported in the *Waterfalls, Cascades and Gorges* report

done for Vermont DEC. However, a small stretch where the stream cascades over ledges was observed on South Stream above and below the Coleville Road bridge.

### ***Swimming, fishing, and boating***

No swimming sites are named in the 1992 *Vermont Swimming Hole Study* for the Walloomsac and its tributaries. It is likely that the urban nature of the river for much of its course in Vermont plus the size and character (winding wetland streams) of some of its tributaries accounts for some of the lack of use.

A well-used fishing spot on the Walloomsac River is at Henry Bridge, a covered bridge just upstream of the Bennington Wastewater Treatment Facility. Old bridge piers make a good place for sitting and casting. Two anglers reported that good-sized trout can be caught in South Stream upstream of the fish hatchery.

The Appalachian Mountain Club River Guide describes a mostly flatwater paddle down the Walloomsac from Bennington to Walloomsac Village, New York. There are two dams around which to portage but the trip is described as a “delightful paddle through beautiful and historic terrain.”

### ***Significant natural communities***

Four sites from the Walloomsac River watershed were described in the Vermont Department of Fish and Wildlife study of significant calcareous fens and riverside seeps. One site identified is Pownal Bog north of Barber Pond, which is actually a fen community and not a bog. Six rare plants occur at the site as well as four uncommon plants and a rare moss. This two and a half acre peatland has formed in a kettlehole depression. Another small intermediate fen was briefly surveyed in Pownal although it seemed to be a transitional site and so its significance is not known.

The other two sites in the Walloomsac River watershed were found in Shaftsbury. Paran Creek Fen located south of Simeon Dean Road consists of two small rich fens that contain a population of a globally rare sedge. Serendipity Fen is a one-acre fen within a 100-acre plus wetland. It is a rich fen and also has the globally rare sedge in it.

## **Lakes with Special Significance or Features**

Vermont DEC's Lake Protection Classification System identifies unique lakes based on: wilderness status; occurrence of scenic and natural features; existence of very high water quality; and/or the presence of very rare, threatened, and/or endangered species. In the

Walloomsac watershed, two ponds are significant for these reasons.

**Big Pond, Woodford:** This pond supports one rare plant species, *Littorella americana*, which is a low-growing aquatic plant of shallow waters.

**Lake Hancock (a.k.a. Sucker Pond), Stamford:** This is a wilderness-like lake with difficult vehicular access.

## Activities or Projects in the Walloomsac River Watershed

### ***Walloomsac Watershed Stream Stability Assessment***

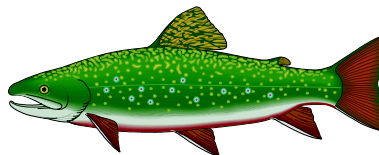
The Bennington County Conservation District and the Hoosic River Watershed Association are undertaking a stream stability assessment of several river and stream segments in the Walloomsac River watershed. The assessment includes separate qualitative and quantitative methods. The qualitative assessment visually assesses and scores five erosion-related parameters on much of the Walloomsac River mainstem in Bennington and downstream sections of Roaring Branch, South Stream, and Furnace Brook. The quantitative assessment is documenting geomorphological characteristics including width:depth ratio, bankfull channel depth, channel sinuosity, and pool:riffle spacing.

### ***Green Mountain National Forest Research***

With over 29,000 acres of the Walloomsac River watershed as National Forest land, Green Mountain National Forest (GMNF) fishery biologists have a strong interest in the fish populations and aquatic habitat of a number of the streams in the watershed. The GMNF has conducted stream habitat and fish population surveys in the mainstem Walloomsac River, City Stream, Bolles, Bickford and Stamford Streams. They have longterm monitoring sites in Bolles and Bickford Brooks for tracking fish habitat and population trends.

## **The Hoosic River**

The Hoosic River has its source about 2 miles northwest of Dalton, Massachusetts at an elevation of 1,500 feet above sea level. It flows through the extreme southwest corner of Vermont where it drains a small portion of southern Bennington County, an area of approximately 89 square miles. The Vermont



## **Watershed**

source about 2 miles northwest of Dalton, Massachusetts at an elevation of 1,500 feet above sea level. It flows through the extreme southwest corner of Vermont where it drains a small portion of southern Bennington County, an area of approximately 89 square miles. The Vermont

tributaries have narrow watersheds and drain the steep slopes of the Green Mountain Range for the most part.

The country drained is to a great extent rugged and mountainous, the summits of the Taghkanick and Petersburg ranges attaining elevations of 1,000 to 2,000 feet above sea level, and the Ragged Mountains, south of North Adams, culminating in Mount Greylock at 3,505 feet above sea level. The immediate valley of the Hoosic comprises a moderately hilly, open country, which is good farm land, and is well cultivated.

The North Branch of the Hoosic River rises in the town of Stamford south of Heartwellville, Vermont and flows southwestward to the city of North Adams, Massachusetts where it joins Hoosic River. Its length is 11 miles. Its principal tributary in Vermont is Roaring Brook. A number of small tributaries also flow down from the mountainsides of the Hoosic Range of the Green Mountains to join the North Branch.

Forested land dominates in the Vermont portion of the Hoosic River watershed with over 77% of the area comprised of this land cover type. Agricultural land use accounts for approximately 11% of the watershed with most identified as hayland or pasture. Surface water covers almost 6% of the watershed with wetlands only about 1%. Developed land, including transportation uses, accounts for about 4.2% of the watershed area.

*Table 3. Land Use and Land Cover in the Hoosic River Watershed<sup>1</sup>*

<b>Land Use</b>	<b>Acres</b>	<b>% of Total</b>
Forested	36,376.3	77.6
Agriculture	5,153.0	11.0
Surface Water	2,719.3	5.8
Transportation	1,577.4	3.4
Wetlands	558.8	1.2
Developed Land <sup>2</sup>	369.6	0.8
Old Field & Barren	95.7	0.2
Total:	46,850.1	100

<sup>1</sup> Vermont Land Cover Classification Project, 1997 (based on satellite photographs from 1991 - 1993).

<sup>2</sup> Developed land = residential, commercial, industrial but not transportation, which is listed separately.

## **Uses, Values and Features of the Hoosic River and Tributaries**

### ***Waterfalls, Cascades and Gorges***

The *Waterfalls, Cascades and Gorges* inventory and study described one cascade for the

watershed. Roaring Brook Cascade on Roaring Brook, which is a tributary to the North Branch of the Hoosic River, is a small cascade in the town of Stamford. The feature is about 75 to 100 feet long by 15 feet wide with a total drop of about 20 feet. The investigator considered it a small but pretty site.

### ***Swimming and Boating***

The Hoosic River basin has very few swimming sites according to the *Vermont Swimming Hole Study*: the mainstem has poor water quality and the tributaries are generally too small and shallow for swimming holes. Of the two known sites on Tubbs Brook mentioned in the study, one was on posted private property and the other is known to receive light to moderate use.

The Appalachian Mountain Club River Guide describes two canoeing stretches on the Hoosic River that include the portion of the river in Vermont. One stretch from North Adams, Massachusetts below the last dam to North Pownal, Vermont, including a portage around the North Pownal dam is smooth with only occasional rapids. The other stretch from North Pownal, Vermont to Hoosick Falls, New York is described as a “pleasant run through farming country” that includes a “few easy riffles.”

### ***Significant natural communities***

No lakes with special significance or features have been identified in the Hoosic watershed.

A high quality stretch of riverine floodplain forest and one of the very few floodplain forest remaining in southwestern Vermont is located on the hairpin bend in the Hoosic River below North Pownal. The floodplain forest occupies about 25 acres and consists of both sugar maple-basswood-ostrich fern type and successional floodplain forest.

## **Activities or Projects in the Hoosic River Watershed**

### ***Pownal Tannery Site Remediations***

There has been much investigation, assessment, monitoring and other activity and

hundreds of millions of dollars spent on the Pownal Tannery site along the Hoosic River. The former tannery building has been decontaminated and taken down. The landfill that received sludge from the lagoons has been graded and capped. About 2500 cubic yards of contaminated fill has been removed from the Woods Road Disposal Area and the area has been graded. Rip-rap was put in place along the edge of the Hoosic River where the disposal area meets it. At the lagoon area, the clarifier and press buildings were removed. Sludge with metals (arsenic, lead, other) and other toxics remain in lagoon 1 and 5. Lagoons 2, 3a, 3b and 4 have been cleaned out. The lagoon area is the site of the proposed wastewater treatment facility for Pownal. Sediment testing in the vicinity of the tannery site (about 2.5 miles upstream, adjacent to, and downstream) found PCB concentrations from non-detect to 0.041 mg/kg. The site specific human health risk exposure level calculated for the site by EPA assuming an intensive recreational use by all ages was 0.000021 mg/kg. The Ontario Ministry of Environment default sediment concentrations for risk to aquatic organisms is 0.00001 mg/kg.

### ***Pownal Wastewater Treatment Facility Planning***

A wastewater facilities planning report done for the Town of Pownal in 2000, updated March 2002, documents the direct sewage discharges and failed septic systems that are polluting the Hoosic River. Three pipes from 17 homes discharge raw sewage to the Hoosic; surfacing effluent from over 80 mobile homes makes its way through drainage ditches and a stream to the Hoosic; and surfacing effluent from 2 other homes and an apartment building also go to a stream then the Hoosic. In addition to these failures that go to the Hoosic River, there are a number of sources of untreated wastewater to Jewett Brook which flows north to the Walloomsac: Royal Pine Villa Mobile Home Park, the Cozy Meadows Mobile Home Park, Pownal Elementary School, and a home where an overflow pipe goes to a wetland that flows to the brook.

After more than a decade of various failures and temporary fixes, the town of Pownal with the help of consulting engineers, the state DEC Wastewater Management Division and other state and federal officials came up with a plan to build a wastewater management system. The system consists of collection sewers in Pownal Village, Pownal Center, and North Pownal with a secondary wastewater treatment facility in North Pownal. The treated discharge is to the Hoosic River.

## **Basin 1 River and Stream Assessment**

The assessment of Basin 1 rivers and streams involves identification of those miles where important uses and values of the waters are compromised by poor water quality or alterations. It also involves identification of the “causes” (specific pollutants or changes) and the “sources”

(activity or land use) of the problem that result in less than full support of the uses. The assessment process also is used to identify waters and aquatic habitat in good condition as well as rivers and streams where Vermont DEC does not have enough information to determine the conditions of the waters and habitat.

### Designated Use Support Status for Basin 1 Rivers and Streams

For each river use or value that is assessed, the miles of river or stream fully supported, fully supported but threatened, partially supported, or not supported are determined. For example, river miles that are fully supported for aquatic biota have macroinvertebrate and fish communities in good to excellent health and good physical habitat. River miles that are fully supported for swimming have no known high levels of *E. coli*, a bacteria that is used as an indicator for pathogens. The miles in each support category for seven uses or values: aquatic biota and/or habitat, contact recreation (swimming, tubing), secondary contact recreation (boating, fishing), aesthetics, drinking water supply, agricultural water supply and fish consumption are shown in Table 4 below.

The ability of the rivers and streams in this basin to support aquatic biota and habitat is very good with only about 14 miles identified as not fully supporting those uses. These 14 miles include all of the Hoosic River mainstem in Vermont and parts of Hewitt Brook, Lye Brook and Branch Pond Brook. Contact recreation (swimming, bathing) is not fully supported for 8.2 miles. This use is not supported on the Hoosic River and Jewett Brook where there are failed septic systems and straight pipes sending sewage to these waters and on Hewitt Brook below the Bennington Landfill where the surface waters and sediments have high levels of metals and PCBs. Secondary contact recreation is partially supported on the Hoosic and not supported on Hewitt Brook. Aesthetics are partially supported on the Hoosic and Jewett Brook. Drinking and agricultural water supplies are not supported on Hewitt Brook. Fish consumption is not supported on the Hoosic River mainstem and this use is threatened on all other miles because of elevated levels of mercury in fish tissue. There is a statewide fish consumption advisory due to this pollutant in surface waters and the food chain.

*Table 4. Use Support Status for Basin 1 Rivers and Streams*

Use	Miles of full support	Miles threatened	Miles of partial support	Miles of non-support	Miles not assessed

Aquatic biota/habitat	178.9	45.3	10.8	4.7	24.6
Contact recreation	218.7	12.8	8.0	0.2	24.6
Secondary contact recreation	190.7	40.0	8.8	0.2	24.6
Aesthetics	196.6	35.1	8.0	0	24.6
Drinking water supply	104.3	7.2	0	0.2	152.6
Agricultural water supply	104.3	7.2	0	0.2	152.6
Fish consumption	0	257.3	0	7.0	0

## Causes and Sources of Impacts & Threats to Basin 1 Rivers and Streams

Nutrients and pathogens are the primary causes of impacts to rivers and streams in the basin. These come from the problematic or nonexistent onsite wastewater systems that overflow or discharge to wetlands and streams in the basin. Metals are the third greatest cause of impact in the basin and affect the Hoosic River and Hewitt Brook. The fourth greatest cause is pH from acid deposition. These causes and others are shown in Table 5 below.

*Table 5. Causes of Impacts and Threats to Basin 1 Rivers and Streams*

Cause or pollutant	Miles of high impact	Miles with moderate impact	Total miles of impact	Miles threatened
Nutrients	0	8.0	8.0	12.2
Pathogens	1.0	7.0	8.0	0
Metals	0.2	7.0	7.2	0.3
pH	4.5	2.0	6.5	9.0
Habitat alterations	0	1.8	1.8	28.6
Sedimentation	0	0.3	0.3	34.7
Thermal modification	0	0	0	20.0

Sedimentation, habitat alterations and thermal modifications threaten quite a few miles. It is likely that these threats are actually having an impact on some portion of these Basin 1 rivers and streams but the impact is not clearly documented at this time. The GMNF and Forest Service Research team have been working on assessing fine sediments in trout

spawning gravels in the Batten Kill and its potential impacts on reproduction. Preliminary results based on two years of work indicate that about 40% of the sites evaluated are over the threshold for negative effects on hatching and incubation. Further assessment of these causes and other conditions or activities are especially important to pursue on the Batten Kill mainstem and Walloomsac River mainstem.

Sources having an impact on some river or stream miles include failed onsite wastewater systems, hazardous waste, atmospheric deposition and streambank de-stabilization. Removal of riparian vegetation, developed land and road/bridge runoff, and some agricultural activities all threaten some of the river or stream water uses. Sources of impacts and threats to Basin 1 rivers and streams are listed in Table 6 below with the miles currently known to be affected.

*Table 6. Sources of Impacts and Threats to Basin 1 Rivers and Streams*

Source	Miles of high impact	Miles with moderate impacts	Total miles of impact	Miles threatened
Onsite wastewater systems	1.0	7.0	8.0	0
Hazardous waste	7.0	0	7.0	0
In-place contaminants	0	7.0	7.0	0.1
Atmospheric deposition	4.5	2.0	6.5	9.0
Streambank de-stabilization	0	1.8	1.8	21.0
Removal of riparian vegetation	0	0	0	21.5
Urban/developed land runoff	0	0	0	16.0
Agricultural activities	0	0	0	15.2
Road/bridge runoff	0	0	0	8.0
Golf courses	0	0	0	4.0

**Basin 1 Lake and Pond Assessment**

## Designated Use Support Status for Basin 1 Lakes

Overall, there are 96 lake acres in these drainages which only partially support one or more uses, and 83 acres where one or more uses are not supported. All designated uses are fully supported on 80 assessed lake and pond acres. All acres are assessed for at least one use. Table 7 provides an accounting of lake acres where designated uses are supported, threatened, or not fully supported.

*Table 7. Use Support of Basin Lakes and Ponds (in acres)*

Use	Full Support of Uses	Full Support but Threatened	Partial Support of Uses	Non-Support of Uses	Acres Not Assessed
Overall Uses	80	193	96	83	0
Aesthetics	248	164	40	0	0
Aquatic Life Use Support	80	193	96	83	0
Agricultural Water Supply	0	0	0	0	452
Drinking Water Supply	0	0	0	0	51
Fish Consumption	452	0	0	0	0
Secondary Contact Uses	267	94	40	0	51
Swimming Uses	240	121	40	0	51

## Causes and Sources of Impacts and Threats to Basin 1 Lakes and Ponds

Impairments to lakes in this basin are related to acidification (6 lakes, 139 acres), and to the presence of non-native nuisance aquatic species (1 lake, 40 acres). Threats to uses are also caused by siltation (128 acres), exotic species (99 acres), pH (82 acres), nutrients and phosphorus (60 acres), turbidity (51 acres), and the presence of algae (40 acres). Table 8 provides an accounting of the causes of impairments and threats to lakes in this drainage system.

*Table 8. Causes of Impacts and Threats to Basin 1 Lakes and Ponds (in acres)*

Cause of Impact	High	Med	Low	Total	Threatened
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900 Nutrients	0	0	0	0	60
1000 pH	139	0	0	139	82
1100 Siltation	0	0	0	0	128
2210 Aquatic plants - Algae	0	0	0	0	40
2500 Turbidity	0	0	0	0	51
2600 Exotic Species	40	0	0	40	99

The following sources impair or threaten lake uses in the Batten Kill, Walloomsac, and Hoosic watersheds. Atmospheric deposition of acids, as well as natural susceptibility to low pH is responsible for the acidification of 139 acres and threats to an additional 82 acres. Recreational boating and the associated release of non-native plant propagules is a primary source of the impairment of 40 acres due to the presence of these species, and threatens an additional 99 acres. Other important threats include road runoff and development. Table 9 lists the sources of impairment and threats to lakes in this basin.

*Table 9. Sources of Impacts and Threats to Basin 1 Lakes and Ponds*

Source of Impact	High	Moderate	Low	Total	Threat
3200 Land Development	0	0	0	0	52
7000 HYDROMODIFICATION	0	0	0	0	8
7700 Streambank Modification/Destabilization	0	0	0	0	5
7910 Recreational Boating: In-Water releases	0	40	0	40	99
8100 Atmospheric deposition	139	0	0	139	82
8300 Road Maintenance and runoff	0	0	0	0	75
8600 NATURAL SOURCES	8	69	62	139	122
9000 SOURCE UNKNOWN	0	0	0	0	27

A summary of overall use support by individual lake (Table 10) provides useful information about lakes in the Batten Kill, Walloomsac, and Hoosic watersheds. The paragraphs following the table describe impacts and major threats to specific lakes.

*Table 10. Overall Use Support by Individual Lake in Basin 1 (in acres)*

Lake Name	Lake Area (ac)	Last Assessed (YYYYMM)	Assessment Type	Full Support	Full Support but Threatened	Partial Support	Non-Support
BARBER	19	200110	Evaluated	0	19	0	0
BARBOS	7	200110	Evaluated	7	0	0	0
BEEBE (SUNDLD)	8	200110	Evaluated	0	0	8	0
BIG	31	200110	Monitored	0	31	0	0
BOURN	48	200110	Monitored	0	0	48	0
BRANCH	34	200110	Monitored	0	0	0	34
BULLHEAD (MANCHR)	5	200110	Evaluated	5	0	0	0
DUFRESNE	8	200110	Evaluated	0	8	0	0
EQUINOX	15	200110	Evaluated	15	0	0	0
HANCOCK (STAMFD)	51	200110	Evaluated	0	51	0	0
HOPPER	1	200110	Evaluated	1	0	0	0
KENT HOLLOW;	10	200110	Evaluated	10	0	0	0
LITTLE MUD (WINHLL)	21	200110	Evaluated	0	0	0	21
LOST (SUNDLD)	2	200110	Evaluated	2	0	0	0
LYE BROOK-N;	10	200110	Monitored	0	0	0	10
LYE BROOK-S;	18	200110	Evaluated	0	0	0	18
MADELEINE	20	200110	Evaluated	20	0	0	0
MILLER;	11	200110	Evaluated	11	0	0	0
PARAN	40	200110	Monitored	0	0	40	0
PICKEREL	9	200110	Evaluated	9	0	0	0
SHAFTSBURY	27	200110	Monitored	0	27	0	0
SOUTH STREAM	24	200110	Evaluated	0	24	0	0
SOUTH VILLAGE	5	200110	Evaluated	0	5	0	0
THOMPSONS	28	200110	Evaluated	0	28	0	0

Note that the use of a semi-colon (;) after the pond name denotes a water for which Vermont DEC has established a name based on USGS topographic map features. These names were established for tracking purposes, and may not reflect local pond names.

**Barber Pond:** This pond is threatened by sedimentation due to erosion from construction sites and dirt roads in its watershed.

**Beebe Pond, Bourn Pond, Branch Pond, Lye Brook Ponds N and S (all in Sunderland), Little Mud Pond (Winhall):** These ponds are all impaired due to acidification. Beebe and Bourn Ponds are considered only episodically acidified, while the remaining ponds are chronically acidic.

**Big Pond, Woodford:** This pond is threatened by acidification, by its proximity to milfoil-infested waterbodies, and due to small nearshore erosion sites.

**Dufresne Pond, Manchester:** This is a small impoundment created by a dam. It continues to trap sediments derived from upper portions of the watershed. This

sedimentation, an unavoidable consequence of the impoundment itself, threatens aquatic life and swimming uses.

**Lake Hancock, Stamford:** This 51-acre remote lake is threatened by acidification due to natural acid sensitivity as well as atmospheric deposition.

**Lake Shaftsbury, Shaftsbury:** This 27-acre recreational lake may be threatened by nutrients, however, further assessment is needed.

**South Stream Pond, Pownal:** This 24-acre pond is threatened by the potential infestation of Eurasian watermilfoil due to the proximity of existing infestations in other lakes.

**South Village Pond, Dorset:** This small 5-acre pond may be threatened by development practices on the surrounding shoreline.

**Thompsons Pond, Pownal:** This 28-acre pond is threatened by the potential infestation of Eurasian watermilfoil due to the proximity of existing infestations in other lakes. There are also poorly substantiated threats attributed to general development near the pond. Further assessment is needed.

### Lakes in Basin 1 that Need Further Assessment

There are 10 lakes and ponds in this drainage system identified as needing further assessment at this time. A summary of information from the Lake Assessment database is provided below. There are several very small ponds (less than 10 acres in size) in the basin for which Vermont DEC has little or no information. The accessibility of all of these smaller lakes to the public is unknown.

**Barber Pond, Pownal:** Assessment is needed to determine if sedimentation is having an impact on this pond.

**Equinox Pond, Manchester:** Vermont DEC has no information nor data on this pond, which should be reassessed during the next Basin 1 assessment cycle.

**Lake Hancock, Stamford:** The degree to which off-road vehicles is causing sedimentation at the access should be established. The lake was last visited by Vermont DEC in 1989.

**Kent Hollow Pond, Sandgate:** The question of whether this remote waterbody is a pond or simply a forested wetland remains unanswered. A site visit is necessary to determine the exact nature of this pond.

**Little Mud Pond, Winhall:** This pond should be reassessed for acidification.

**Lake Madeleine, Sandgate:** This pond has not been visited by Vermont DEC since the mid-1980s. It is presently posted against public access.

**Miller Pond, Arlington:** This marshy pond is thought to be of extremely high wildlife value, and a follow-up visit to verify this is in order.

**Shaftsbury Lake, Shaftsbury:** An assessment of trophic status is warranted on this recreational lake.

**South Stream Pond, Pownal:** This is another waterbody for which there is an unanswered question as to whether it is a pond or wetland.

**Thompsons Pond, Pownal:** This lake was last visited by Vermont DEC in 1989. Assessment for trophic status and use support is warranted.

### Municipal Discharges in Basin 1

Two municipal wastewater treatment facilities (WWTF) discharge treated effluent to waters of Basin 1. The Bennington WWTF discharges to the Walloomsac River and the Manchester WWTF discharges to the Batten Kill. The Pownal WWTF is in the planning stage and will treat wastewater from the three growth centers in Pownal discharging to the Hoosic River.

Table 12. Municipal Wastewater Treatment Facilities in Basin 1

WWTF	WBID	Receiving Water	Permitted flow (gallons/day)	Annual Average Flow (gallons/day)
Bennington	VT01-03	Walloomsac River	5,100,000	3,605,800
Manchester	VT01-04	Batten Kill	600,000	260,000

### 303(d) Impaired Waters in Basin 1

There are eight waterbodies in the basin that are listed on the Vermont Year 2000 List of Impaired Surface Waters. Impaired surface waters are those where chemical, physical or biological data gathered from monitoring shows a violation of one or more Vermont Water Quality Standards criteria. The Year 2002 list is in draft form and there are few changes proposed for Basin 1 waters.

*Table 13. 303(d) Impaired Waters in Basin 1*

Waterbody ID	Segment	Pollutant	Problem
VT01-02	Hoosic River - all 7 miles in Vermont	PCBs	PCBs in brown trout - consumption advisory
VT01-02	Hoosic River - lowest 2 miles in Vermont	pathogens, organic enrichment	untreated domestic waste from failed or nonexistent septic systems in Pownal
VT01-05	Lye Brook - 2.5 miles above mouth to headwaters	pH	critically acidified, chronic
VT01-05L01	Bourn Pond	pH	extremely sensitive to acidification, episodic
VT01-05L11	Lye Brook - N	pH	critically acidified, chronic
VT01-05L12	Lye Brook - S	pH	critically acidified, chronic
VT01-06	Branch Pond Brook	pH	critically acidified, chronic
VT01-06L01	Branch Pond	pH	critically acidified, chronic
VT01-06L02	Beebe Pond	pH	extremely sensitive to acidification, episodic

## References and Resources for Basin 1 Watersheds

- 1) *AMC River Guide: New Hampshire/Vermont*, Second Edition, 1989. Appalachian Mountain Club Books, Boston, Massachusetts.
- 2) *Battenkill, Walloomsac and Hoosic River Basins Water Quality Management Plan*, February 1976. Vermont Department of Water Resources, Montpelier, Vermont
- 3) *Calcareous Open Fens and Riverside Seeps of Vermont: Some Sites of Ecological Importance*. Elizabeth Thompson and Robert Popp, Vermont Nongame and Natural Heritage Program. March 1995.
- 4) *Floodplain Forests of Vermont: Some Sites of Ecological Significance*, July 1998. Eric Sorenson, Marc Lapin, Brett Engstrom, and Robert Popp for Nongame and Natural Heritage Program, Vermont Fish and Wildlife Department, Agency of Natural Resources, Waterbury, Vermont.
- 5) *Petition to Designate The Battenkill as an Outstanding Resource Water*, September 1989. Submitted by the Vermont Natural Resources Council and Trout Unlimited on behalf of the Signatories.
- 6) *State of Vermont Water Resources Board Findings of Fact, Conclusions of Law and Order RE: Batten Kill*, June 12, 1991.
- 7) *Town of Pownal, Vermont Wastewater Facilities Planning Preliminary Engineering Report*, August 2000, updated 2002. Forcier, Aldrich & Associates, Inc.
- 8) *Vermont Swimming Hole Study*, 1992. Jerry Jenkins, Deborah Benjamin, and Jane Dorney for Vermont DEC, Water Quality Division. Unpublished.
- 9) *Waterfalls, Cascades and Gorges of Vermont*, 1985. Jerry Jenkins & Peter Zika for the Vermont Department of Environmental Conservation and Department of Forests, Parks and Recreation.
- 10) *Whitewater Rivers of Vermont*, 1989. Jerry Jenkins for Vermont DEC.

Appendix A  
Macroinvertebrate Sampling Sites of Basin 1  
1992 - 1999

**Table A.1. Basin 1 River or Stream Macroinvertebrate Sampling Sites 1992-1999**

<b>WBID</b>	<b>River or Stream</b>	<b>Town</b>	<b>Mile-point</b>	<b>Date</b>	<b>Assessment</b>
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VT01-03	Walloomsac River	Bennington	9.2	10/8/92	Good
VT01-03	Walloomsac River	Bennington	9.2	10/5/94	Good
VT01-03	Bickford Hollow Brook	Woodford	0.4	9/21/95	Good
VT01-03	Bickford Hollow Brook	Woodford	0.4	10/4/96	Good
VT01-04	Batten Kill	Arlington	34.9	10/8/92	Good
VT01-04	Batten Kill	Arlington	34.9	10/7/98	Excellent
VT01-04	Batten Kill	Manchester	48.2	10/7/98	Excellent
VT01-05	Lye Brook	Manchester	1.8	9/22/93	Excellent
VT01-05	Lye Brook	Manchester	1.8	9/19/94	Excellent
VT01-05	Lye Brook	Manchester	1.8	9/20/95	Excellent
VT01-05	Lye Brook	Manchester	3.4	9/22/93	Fair
VT01-05	Lye Brook	Manchester	3.4	9/19/94	Poor
VT01-05	Lye Brook	Manchester	3.4	9/19/95	Poor
VT01-05	Lye Brook	Sunderland	7.0	7/17/95	Poor
VT01-05	Bourn Brook	Manchester	1.6	9/21/93	Excellent
VT01-05	Bourn Brook	Manchester	1.6	9/20/94	Excellent
VT01-05	Bourn Brook	Manchester	1.6	9/20/95	Excellent
VT01-05	Bourn Brook	Winhall	4.1	9/21/93	Good
VT01-05	Bourn Brook	Winhall	4.1	9/21/94	Good
VT01-05	Bourn Brook	Winhall	4.1	9/15/95	Excellent
VT01-05	West Branch Batten Kill	Manchester	3.4	10/6/93	Good
VT01-06	Warm Brook	Arlington	1.4	10/8/92	Good
VT01-06	Fayville Branch	Glastenbury	3.7	10/8/92	Good
VT01-06	Branch Pond Brook	Sunderland	0.1	9/19/94	Fair
VT01-06	Branch Pond Brook	Sunderland	0.1	9/20/95	Good
VT01-06	Branch Pond Brook	Sunderland	0.1	10/4/96	Fair

## Appendix B

### Population Data of Basin 1

Table B.1. Population of the Batten Kill watershed

Town	1970	1980	1990	2000	change 1970-1980	change 1980-1990	change 1990-2000
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Arlington	1934	2184	2299	2397	13%	5%	4%
Sunderland	601	768	872	850	28%	13%	-3%
Manchester	2919	3261	3622	4180	12%	11%	15%
Sandgate	127	234	278	353	84%	19%	27%
Dorset	1293	1648	1918	2036	27%	16%	6%
Watershed	6874	8095	8989	9816	18%	11%	9%

Small portions of Shaftsbury, Glastenbury, Peru and Winhall are also in the watershed.

Table B.2. Population of the Walloomsac River watershed

Town	1970	1980	1990	2000	% change 1970-1980	% change 1980-1990	% change 1990- 2000
Shaftsbury	2411	3001	3368	3767	24%	12%	12%
Glastenbury	0	3	7	16	-	-	-
Bennington	14586	15815	16451	15737	8%	4%	-4%
Woodford	286	314	331	414	10%	5%	25%
Pownal	2441	3269	3485	3560	34%	7%	2%
Watershed	19724	22402	23642	23494	14%	5%	-1%

Small portions of Stamford and Arlington are in this watershed.

Table B.3. Population of the Hoosic River watershed

Town	1970	1980	1990	2000	% change 1970-1980	% change 1980-1990	% change 1990-2000
Pownal	2441	3269	3485	3560	34%	66%	2%
Stamford	752	773	773	813	3%	0%	5%
Watershed	3193	4042	4258	4373	27%	5%	3%

A small portion of Bennington is in this watershed.

Appendix C  
Dams of Basin 1

Table C.1. Dams in Basin 1

Dam Name						Re-
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and ID	Stream	Town	Status	Use*	Built	con+
Miller Pond (5.01)	Warm Brook	Arlington	In Service	R	1937	
Red Mill (5.02)	Batten Kill	Arlington	Breached			
Ice Pond (5.06)	Warm Brook	Arlington	Unknown			
Lake Paran (17.01)	Paran Creek	Bennington	In Service	R	1851	1979
Whites Mill (17.02)	Paran Creek	Bennington	Unknown			
Stark Mill (17.03)	Paran Creek	Bennington	Unknown		1918	
Cushman (17.04)	Paran Creek	Bennington	Unknown			
Polygraphic (17.05)	Paran Creek	Bennington	Unknown			
Bennington Reservoir (17.06)	Barney Brook - OS	Bennington	Unknown			
Southern Vermont Orcha (17.07)	Jewitt Brook	Bennington	Unknown		1963	
Vermont Tissue (17.10)	Walloomsac River	Bennington	Unknown			
Vermont Veterans Home (17.16)	Roaring Branch - Trib	Bennington	Unknown	S	1890	1930
Beech Street (17.17)	South Stream - Trib	Bennington	Unknown			
South Village Pond (60.03)	Batten Kill - TR	Dorset	In Service	R	1890	1929
Marble Mill (60.06)	West Branch Batten Kill	Dorset	In Service	R	1875	1991
Dufresne Pond (121.01)	Batten Kill	Manchester	In Service	R	1908	1957
Equinox Pond (121.02)	Batten Kill - TR	Manchester	In Service	R	1890	
Dam Name	Stream	Town	Status	Use	Built	Re-con
Pickerel Pond						

(121.03)	Batten Kill - TR	Manchester	Unknown		1965	
South Stream Pond (159.02)	South Stream	Pownal	In Service	R	1958	
Barber Pond (159.03)	South Stream - TR	Pownal	In Service	R	1910	
Thompson Pond (Lower) (159.04)	South Stream - TR	Pownal	Unknown	R		1989
Thompson Pond (Upper) (159.05)	South Stream - TR	Pownal	In Service	R	1900	1989
North Pownal Reservoir (159.06)	Reservoir Hollow	Pownal	Unknown			
Pownal Tanning Co (159.07)	Hoosic River	Pownal	Not in Use	O	1907	1955
Lake Madeleine (181.01)	Hopper Brook	Sandgate	In Service	H	1957	
Barbos Lake (181.02)	Hopper Brook - TR	Sandgate	In Service	H	1957	
Hopper Pond (181.03)	Hopper Brook	Sandgate	In Service	H	1920	
Lake Madeleine Dike (181.04)	Green River - TR	Sandgate	In Service	H	1957	
Lake Shaftsbury (183.01)	Warm Brook - TR	Shaftsbury	In Service	R	1937	
Sucker Pond (195.01)	Sucker Pond Brook	Stamford	Unknown			
Bugbee Mill Pond (253.04)	City Stream	Woodford	Unknown	O	1936	
Big Pond (253.06)	City Stream	Woodford	Unknown			

\* H = hydroelectric, R = recreation, C = flood control, S= water supply, O = other

+ reconstructed

Appendix D  
Individual Waterbody Reports for  
Basin 1 Rivers and Streams