



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Vermont

## Ski Resort Controls Erosion and Sedimentation, Restores Two Streams

### Waterbodies Improved

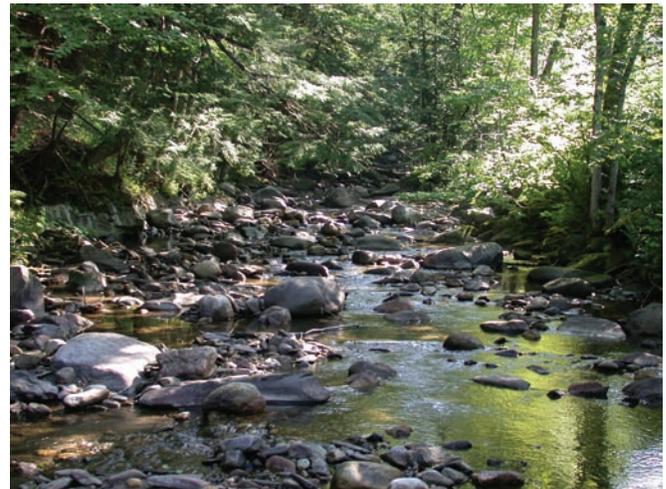
Erosion and sediment runoff from ski area parking lots and roads degraded biological communities in Chase and Slide Brooks. As a result, Vermont placed the streams on its 303(d) list for aquatic life use impairments due to excessive sediment. The installation of new runoff controls and improved management practices brought the streams into compliance with Vermont's water quality standards, and the state removed both streams from its 303(d) list in 2004.

### Problem

Chase and Slide Brooks, 1 and 3 miles long, respectively, flow through the Sugarbush Resort, a ski area and resort in the northern Vermont town of Fayston. The Vermont Department of Environmental Conservation (VT DEC) classifies both brooks as Class B waters—a designation defined as “suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value; acceptable for public water supply with filtration and disinfection.”

VT DEC monitored macroinvertebrates in both streams using several different techniques, including the EPT index—a measure of pollution-sensitive aquatic insects inhabiting a waterbody. Streams showing high EPT richness are less likely to be polluted than streams showing low richness in the same geographic region. In addition, VT DEC determined macroinvertebrate densities and the percentage of macroinvertebrates composed of pollutant-tolerant worms of the taxonomic class Oligochaeta.

In the mid-1990s biological monitoring found that a 0.5-mile segment of each stream did not fully meet Vermont's water quality standards for aquatic life. The segments had low EPT values, relatively low macroinvertebrate densities, and biotic communities with high percentages of oligochaetes. As a result, Vermont placed the segments on its 303(d) list of impaired waters in 1996. VT DEC attributed the impair-



Stream embeddedness—the extent to which sediment filled in gaps around rocks and cobbles in the Chase and Slide Brook streambeds—was 50–75 percent before the restoration effort. Embeddedness declined to 25–50 percent following restoration, representing significant habitat improvement.

ments to sediment washing from nearby gravel parking lots and smothering benthic habitat in the streams.

### Project Highlights

In compliance with Vermont's land development law (Act 250), which regulates expansions as well as new developments disturbing more than 10 acres in Vermont, the Sugarbush Resort prepared a comprehensive water quality remediation plan for the entire resort in the late 1990s. The remediation plan included a survey of all sites and sources believed to contribute to the water quality impairments,

along with a list of recommended actions to address these sources.

The resort completed the recommended improvements between 2000 and spring 2002. The improvements included re-grading gravel parking lots and routing drainage through grass islands and sediment traps; enhancing the riparian buffer along Chase Brook; revegetating sections of work roads; cleaning, shaping, and matting swales; installing stone check-dams; replacing gravel with wood chips in heavily used areas; changing snow disposal practices to eliminate dumping in riparian zones; and instituting regular fall/spring maintenance of all the runoff control measures.

## Results

Pre- and post-project biomonitoring results are shown in the accompanying tables. The tables compare results with the Class B water guidelines for aquatic life support. Data highlighted in bold indicate non-attainment of the Class B guidelines.

Chase Brook experienced a substantial decrease in the percentage of oligochaetes and increases in density and EPT indices. As a result, VT DEC assigned “very good” and “good” ratings to Chase Brook in 2000 and 2002, respectively. Both are passing grades under Vermont’s water quality standards.

The monitoring results for Slide Brook indicated similar improvements. A decreased percentage of oligochaetes, combined with consistently strong values for the other indices, allowed VT DEC to assign Slide Brook ratings of “excellent” and “very good” in 2000 and 2002, respectively.

The data indicated that the remediation practices had reduced sediment delivery to the

**Table 1. Chase Brook Biomonitoring Results**

Sampling site	Date	Assessment rating	EPT	Density (individuals/m <sup>2</sup> )	Individuals from Oligochaeta (%)
1.2	9/14/1993	Fair	<b>15.0</b>	357	10.6
1.2	9/20/1994	Fair	22.5	584	<b>23.8</b>
1.2	10/6/1998	Fair	19.0	493	11.7
1.2	9/18/2000	Very good	19.0	673	2.4
1.2	9/2/2002	Good	16.7	1253	1.4
Class B Guideline			>16.0*	>300	<12.0

\*Vermont Class B Guideline for EPT was 18.0 until the state changed it to 16.0 in 2002.

**Table 2. Slide Brook Biomonitoring Results**

Sampling site	Date	Assessment rating	EPT	Density (individuals/m <sup>2</sup> )	Individuals from Oligochaeta (%)
0.7	10/21/1991	Good-Fair	24.0	762	11.7
0.7	9/14/1993	Fair	20.5	856	<b>12.6</b>
0.7	9/18/2000	Excellent	25.0	522	0.3
0.7	9/2/2002	Very good	21.7	944	1.2
Class B Guideline			>16.0*	>300	<12.0

\*Vermont Class B Guideline for EPT was 18.0 until the state changed it to 16.0 in 2002.

streams, improved stream habitat, and allowed Vermont water quality standards to be met in both streams by the fall of 2002. The state removed both streams from its 303(d) list in 2004. The streams are scheduled to be monitored again in late 2006.

## Partners and Funding

Sugarbush Resort contributed \$11,500 to develop the remediation plan and \$14,000 to implement it. The resort also spends \$5,000–\$7,000 annually for operation and maintenance. In addition, approximately \$3,000 in section 319 funds supported stream monitoring work by VT DEC.

### For additional information contact:

**Eric Perkins**  
EPA Region 1  
617-918-1602 • perkins.eric@epa.gov

**Steve Fiske**  
VT Department of Environmental Conservation  
802-242-1378 • steve.fiske@state.vt.us

**Jason Lisai**  
Sugarbush Resort  
802-583-6324 • jlisai@sugarbush.com



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