



NONPOINT SOURCE SUCCESS STORY

Vermont

Ski Resort Improves Stormwater Management and Restores Two Streams in Jay Branch Watershed

Waterbodies Improved

In the early 2000s, sediment in stormwater runoff from parking lots, driveways and construction projects at Jay Peak Resort (JPR) in Jay, Vermont, degraded biological communities in Jay Branch and a contributing stream identified as Tributary 9. As a result, the Vermont Department of Environmental Conservation (DEC) placed the two streams on its Clean Water Act (CWA) section 303(d) list of impaired waters in 2006. In response, JPR designed and installed numerous stormwater runoff treatment, control and prevention projects, which ultimately reduced sediment levels in both streams. Biological monitoring in 2016 and 2017 demonstrated both streams achieved full compliance with Vermont’s water quality standards (WQS) for aquatic life. As a result, DEC removed both streams from the CWA section 303(d) list in 2018.

Problem

A portion of the Jay Branch and Tributary 9 flow through the JPR, a ski and summer resort in the northern Green Mountains of Vermont (Figure 1). DEC classifies both streams as Class B Waters, which must be managed to maintain a specific level of quality for aquatic biota and wildlife, aquatic habitat, aesthetics, boating, fishing, swimming and other recreational uses, public water supply, and irrigation of crops and other agricultural uses.

DEC assesses the biological integrity of Jay Branch and Tributary 9 using a standard set of eight biomonitoring metrics to evaluate the density and composition of benthic macroinvertebrates in the streams as part of regular, state-wide stream assessments. For example, one metric, the EPT Index — short for the insect orders of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) — measures the number and types of pollution-sensitive macroinvertebrates living in the stream. Streams with a high EPT Index value indicate higher water quality, and vice-versa. In addition to the EPT Index, DEC assessed water quality indirectly with a variety of other metrics based on the known water quality tolerances of different macroinvertebrate groups.

Water quality monitoring conducted in the early 2000s found that neither stream met the Vermont WQS necessary for aquatic life in Class B waters. Both Jay Branch and Tributary 9 had inadequate macroinvertebrate density, insufficient species richness, a low percentage of EPT

taxa and an excess of oligochaetes (a group of macroinvertebrates associated with poor-quality waters). In the CWA section 303(d) listing, DEC attributed the impairment primarily to sediment in both streams resulting from “erosion from land development activities,” (i.e., construction-related stormwater runoff).

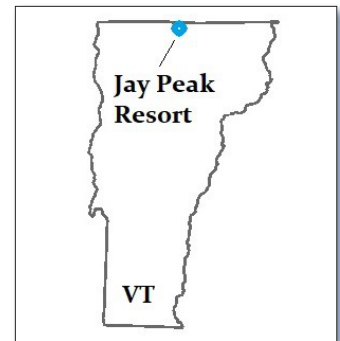


Figure 1. Jay Peak Resort is in northern Vermont.

Story Highlights

To address these issues, JPR developed a comprehensive Water Quality Remediation Plan that was refined annually as projects were completed and each year’s biomonitoring data were collected. The remediation plan included a survey of all the sites and sources believed to contribute to the water quality impairments in the watershed, as well as a list of recommended projects and best management practices (BMPs) to address the sources of impairment.

Between 2008 and 2016, JPR implemented 10 different categories of sediment control projects, such as building treatment swales, improving ski trail waterbars, and lining ditches to better control stormwater runoff and improve water quality in the streams. Providing treatment for areas of existing untreated impervious cover by directing

their runoff to the newly constructed BMPs that were being built as the resort expanded was a major source of improvement. A number of smaller projects and creative adjustments in site maintenance procedures (especially changes to management of plowed snow) also contributed to the improvements.

JPR eliminated a segment of road next to one of Tributary 9's headwater streams and enhanced the vegetated stream buffer. In addition, nearly 800 feet of another headwater stream draining to Tributary 9 that had undersized culverts and gully erosion was restored, with two culverts replaced and upsized and the banks revegetated (Figure 2). Not only does the restored reach minimize the volume of sediment delivered to downstream reaches, the addition of native shrubs and trees along the restored streambanks provide shade, which lowers water temperatures and improves water quality.

Results

Biomonitoring results from 2011 to 2017 demonstrate improvements in the composition of aquatic biota in Jay Branch and Tributary 9. Both segments, which had not been meeting the Vermont WQS benchmarks for macro-invertebrate density and composition, steadily improved at all sampling locations until reaching the full suite of attainment benchmarks in 2016 (Table 1).

These data demonstrate that the resort's remediation practices reduced sediment delivery and improved in-stream habitat for aquatic organisms in both streams. Because the streams are now consistently meeting WQS,



Figure 2. Tributary 9 headwater stream channel, before and after restoration.

both Jay Branch and Tributary 9 were removed from the CWA section 303(d) list of impaired waters in 2018. Monitoring efforts are continuing at both streams to ensure that they continue to meet WQS and provide quality aquatic habitat in the Jay Branch watershed.

Partners and Funding

JPR invested approximately \$430,000 to install the BMPs described above, and spent \$95,000–\$110,000 in labor and materials each year for the operation, monitoring and maintenance of the BMPs. Vermont DEC staff, supported in part by U.S. Environmental Protection Agency CWA section 319 funds, worked closely with the resort on the restoration strategy and BMP identification.

Table 1. Water quality monitoring data: Jay Branch and Tributary 9 (2011–2017)

Location	Class B – SHG WQS	2011	2012	2013	2014	2015	2016	2017
Jay Branch (JB 8.3)	Density ≥ 300	117	230	238	403	347	413	490
	EPT ≥ 16	15	17	22	23	24	22	21
	% Oligo ≤ 12	18	7	10	26	13	9	5
Jay Branch (JB 7.3)	Density ≥ 300	98	176	327	340	378	394	464
	EPT ≥ 16	11	20	21	26	24	25	24
	% Oligo ≤ 12	4	9	9	9	14	8	3
Tributary 9 (JB-TB 0.1)	Density ≥ 300	77	95	157	168	209	373	333
	EPT ≥ 16	15	16	20	15	16	21	25
	% Oligo ≤ 12	9	21	14	15	27	4	6

Notes: SHG = small, high-gradient stream type; WQS = water quality standards; % Oligo = % of the population composed of oligochaetes. Shaded cells denote metrics failing to meet the WQS.



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