



# NONPOINT SOURCE SUCCESS STORY

## Vermont

### Cleanup of Abandoned Copper Mine Restores the Ompompanoosuc River and Lords Brook

#### Waterbodies Improved

Acid mine drainage from the Elizabeth Mine had degraded biological communities in the West Branch of the

Ompompanoosuc River (WBOR) and a small tributary stream, Lords Brook, for decades. As a result, Vermont placed the waterbodies on its Clean Water Act (CWA) section 303(d) list for aquatic life use impairments due to metals and acidity in 1998 and 2002, respectively. Elizabeth Mine was placed on the U.S. Environmental Protection Agency's (EPA's) National Priorities List (also known as the Superfund List) on June 14, 2001. Cleanup activities, which included diverting groundwater and surface water, consolidating and capping waste rock and tailings, and treatment of the leachate have brought the waterbodies into compliance with Vermont's water quality standards. As a result, the state of Vermont delisted the Ompompanoosuc River and Lords Brook from the CWA section 303(d) list in 2014.

#### Problem

The Elizabeth Mine site is an abandoned copper mine in the towns of Strafford and Thetford, Vermont. The mine operated from the early 1800s until its closure in 1958. Numerous studies, including biological surveys performed in 1986, and again in 1998, by the Vermont Department of Environmental Conservation (VTDEC) reported biological impacts (i.e., very low numbers and species of macroinvertebrates and fish) in waterbodies downstream of the mined area, including an approximately four-mile reach on the WBOR (Figure 1) and a small tributary stream known as Lords Brook.

#### Project Highlights

EPA began response actions at the Elizabeth Mine site in 2003 to stabilize a tailings dam to prevent a catastrophic failure. EPA then focused on the waste rock and tailings that were the major source of copper, iron and acidity to the WBOR. EPA installed 6,300 linear feet of surface water diversion channels and a 1,150-linear foot shallow groundwater diversion trench to divert water around an area containing tailings and waste rock. EPA excavated 400,000 cubic yards of waste rock that was the major source of copper in the WBOR and placed the material on the 45-acre tailings impoundment. A cover system was then installed over the waste rock and tailings. In 2008 EPA installed a temporary water treatment system to treat iron-rich leachate discharging from the tailings impoundment during construction activities. EPA plans to operate this system until the reduction in leachate flow allows

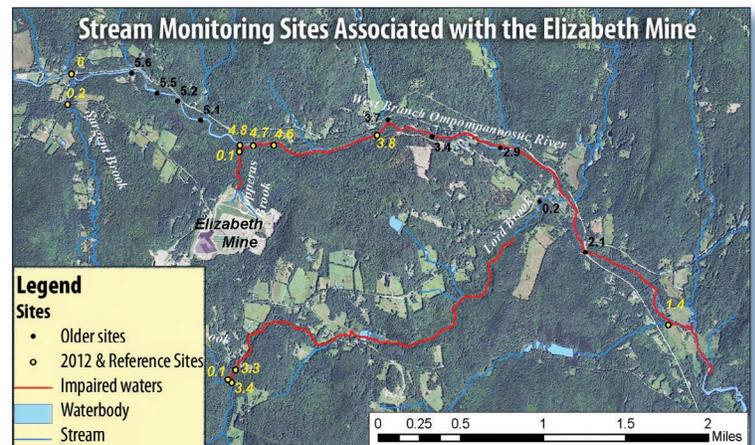


Figure 1. Monitoring locations and impaired sections on the West Branch of the Ompompanoosuc River and Lords Brook.

a passive treatment wetland to be installed. The surface water, groundwater, waste excavation and cover system installation activities were completed in 2013.

The source of the toxic metals in Lords Brook is from the area of the mine known as the South Cut, a waste rock pile (referred to as TP-4), and the South Mine. TP-4 and much of the waste rock around the South Mine and at the outlet of the South Open Cut were removed as part of the consolidation of waste rock under the tailing impoundment cover system. EPA is planning additional cleanup actions for the South Open Cut and the contaminated areas remaining at the South Mine to address impairments in two un-named tributaries to Lord Brook.



Figure 2. The WBOR before (top: pre-2009) and after (bottom: post-2012) implementation of restoration efforts.

## Results

VTDEC’s Monitoring, Assessment and Planning Program–Biomonitoring and Aquatic Studies Section conducted biological assessments before and after restoration efforts, which were compared with the Class B water guidelines for aquatic life support. Data show that both the WBOR and Lords Brook now meet applicable aquatic life use support biocriteria guidelines for Class B at all previously impaired sites (Table 1). Based on all these assessments, both the WBOR and Lords Brook are eligible for removal from the state’s 2014 impaired waters list because they now support their aquatic life designated uses (Figure 2).

Fish data also reflected this improvement in water quality as seen in the change in the Index of Biotic Integrity in WBOR from *poor* in 1998 to *good* in 2013, and the increase in brook trout density in Lords Brook from one fish per 100 square meters (100 m<sup>2</sup>) in 2000 to 38.8 fish per 100 m<sup>2</sup> in 2013. The immediate headwater streams from the Elizabeth Mine area remain impaired, including Copperas Brook and two un-named tributaries to Lord Brook.

## Partners and Funding

The cleanup involved a diverse group of stakeholders. The U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers and U.S. Geological Survey have all been significantly involved in the studies and assessments. The local community has been engaged in the investigation, cleanup and historic assessments. The Elizabeth Mine Study Group (EMSG), a local volunteer effort, performed an assessment of the Elizabeth Mine and helped bring EPA Superfund attention to the Elizabeth Mine. EMSG received \$6,000 in CWA section 319 funding through the town of Strafford in 2000. EPA and VTANR worked with the community to form the 10-member Elizabeth Mine Community Advisory Group (EMCAG), which contributed valuable local feedback regarding the investigation and cleanup activities. Efforts by EMSG provided either the seed or much of impetus for creation of EMCAG. The EMCAG was given independent technical support through the Copperas Hill Coalition (which received a \$130,000 Superfund Technical Assistance Grant and provided in-kind contributions of \$16,250). In 2004 the towns of Strafford and Thetford commissioned an EPA-funded reuse assessment, in part to help inform EPA’s cleanup decisions. The overall federal expenditure at the Elizabeth Mine is approximately \$70 million dollars through 2013, including \$8 million received under the American Recovery and Reinvestment Act. This funding was critical to the initiation of the cleanup actions to control the release of toxic metals from the waste piles and tailings in the Copperas Brook watershed.

**Table 1. West Branch Ompompanoosuc River (WBOR) RM 3.8 and Lords Brook RM 3.3 Macroinvertebrate Biomonitoring Results 2 years pre- and 3 years post-attainment**

Waterbody	Sampling site (River Mile)	Date	Assessment Rating	EPT	Density (individuals/m <sup>2</sup> )	Richness
WBOR	3.8	9/2000	Poor	<b>9.3<sup>a</sup></b>	<b>117</b>	<b>20.0</b>
WBOR	3.8	9/2009	Fair	<b>14.0</b>	<b>188</b>	33.5
WBOR	3.8	9/2010	Good	24.0	459	40.0
WBOR	3.8	9/2012	Very Good	31.5	2552	54.0
WBOR	3.8	9/2013	Excellent	30.0	1708	50.0
WBOR Class B Guideline <sup>b</sup>				>18	>300	>30
Lords Br.	3.3	9/2000	Fair	<b>11.3</b>	<b>164</b>	<b>22.3</b>
Lords Br.	3.3	9/2008	Fair	<b>15.5</b>	<b>172</b>	33.0
Lords Br.	3.3	9/2010	Very Good	22.0	613	38.5
Lords Br.	3.3	9/2012	V. Good/Good	25.5	901	39.5
Lords Br.	3.3	9/2013	Excellent	25.5	1136.1	46.0
Lords Br. Class B Guideline <sup>b</sup>				>16	>300	>27

<sup>a</sup> Bolded items indicate nonattainment.

<sup>b</sup> River-specific guidelines from Biocriteria for Fish and Macroinvertebrate Assemblages in Vermont Wadeable Streams and Rivers (2004). [http://www.watershedmanagement.vt.gov/bass/htm/bs\\_biomon.htm](http://www.watershedmanagement.vt.gov/bass/htm/bs_biomon.htm)



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