

## VERMILLION RIVER WATERSHED



*An asphalt reclaimer worked wood chips into topsoil in February just off Dakota County Road 78. Frozen ground and rocks made it necessary to replace the implement's teeth after every pass. Photo Credit: Vermillion River Watershed JPO*

# Experimental nitrate treatment holds promise for water quality

Wood chip-enhanced wetland tied to Dakota County highway work



CASTLE ROCK TOWNSHIP — An experimental wood chip-enhanced wetland nitrate treatment project on the edge of a Dakota County farm field could cut in half the amount of the pollutant entering a Vermillion River tributary.

Nitrate contributes to water-quality problems in local rivers and in Hastings-area drinking water supplies.

Contractors built the 3-acre wetland this winter in conjunction with the Dakota County Highway 78 reconstruction south of Farmington.

The initial \$515,250 budget included \$412,200 in Clean Water Funds from the Minnesota Board of Water and Soil Resources, plus matching funds



*Travis Thiel, senior environmental specialist with the Vermillion River Watershed Joint Powers Organization, explained how a constructed wetland and wood-chip bioreactor would treat nitrates on a tributary upstream from a monitoring station on the South Branch Vermillion River in Castle Rock Township. A \$412,200 Clean Water Fund grant from the Minnesota Board of Water and Soil Resources provides the main funding source. Photo Credit: BWSR*





from the Vermillion River Watershed Joint Powers Organization and Dakota County. Pairing the wetland work with the highway project is expected to significantly reduce the final cost.

The wetland will treat runoff from 2.1 square miles of agricultural land, and holds promise for more widespread application. It's upstream from a monitoring station on the South Branch Vermillion River, which shows the highest nitrate loads in the 335-square-mile Vermillion River Watershed.

Travis Thiel, senior watershed specialist with the VRWJPO, said samples also were collected at the project site, which is upstream on an unnamed tributary of the South Branch.

"The sample concentrations we've collected (at this location) over the last few



**Top:** The experimental nitrate treatment involved about 1,000 cubic yards of wood chips. Mixed with topsoil, they will line a 2- to 3-foot-deep constructed wetland. The wood chips will grow a type of bacteria that strips nitrates out of the water. **Above:** Vermillion River Watershed Joint Powers Organization and Minnesota Board of Water and Soil Resources staff toured the construction site. **Photo Credits:** BWSR

years have shown at least twice the concentration of the drinking water standard, so we know that nitrate is elevated (from) those lands," Thiel said.

The maximum concentration allowed by water-quality standards is 10 parts per million. Nitrates are toxic to fish and potentially harmful to humans, according to the

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**We're getting nitrate treatment from a wetland as well as nitrate treatment from having the wood chips in the wetland. It's a combination of the two technologies to make a new practice.**

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— Travis Thiel, Vermillion River Watershed Joint Powers Organization

Minnesota Department of Health.

Nitrate concentrations can be higher in agricultural areas, shallow aquifers and





*A tributary to the South Branch Vermillion River will be diverted around a constructed wetland in Castle Rock Township while the plants take hold. The experimental nitrate treatment is slated to go online in 2019. Final ground work is scheduled for this spring. Photo Credit: BWSR*

sandier soils. All three exist in the Vermillion River Watershed.

This project alone won't solve the problem, but it does begin to address nitrate issues, and could give the VRWJPO a new treatment option.

"We know that the (nitrate) concentration there has been steadily going up over the last decade," Thiel said of the South Branch Vermillion River subwatershed. The trend doesn't show signs of reversing. "A multitude of practices are going to have to go in in order to get the concentration down so that it doesn't have a water-quality impact."

The coarse, sandy soils that allow river water to enter the groundwater supply between the cities of Vermillion and Hastings also make it easier

for nitrogen fertilizers to leach. Agricultural land is best-suited — partly because it requires more space, partly because it's more cost-effective in treating locations with high nitrate levels.

Based on Dakota County well testing data, nitrate levels in groundwater near Hastings have increased over the past 20 years. That's despite the best management practices farmers have adopted since elevated readings appeared.

When two of the city's six wells showed increasing nitrate levels, Hastings took pre-emptive action. A \$3.5 million treatment system, built with city water funds, went online in 2008.

Public Works Superintendent Mark Peine said when nitrates reach a certain level, water from those two wells is

blended with water from the other four. Concentrations, sometimes as high as 8 ppm, tend to spike in the summer.

Treatment has cut levels in half.

Combining a wetland with a wood-chip bioreactor is new in nitrate treatment, although each has been used independently. Wetlands have long been known to be effective at removing nitrates. Thiel said wood-chip bioreactor field trials have shown promise within the past five years. The cost and size necessary for a bioreactor alone to treat 2 square miles of drainage were prohibitive.

The hybrid project south of Farmington sits on 12 acres acquired for the road reconstruction. When the 3-acre wetland fills up, water will flow through a second,

5-acre mitigation wetland constructed as part of the highway project before it enters the unnamed tributary.

Earlier this winter, more than 1,000 cubic yards of wood chips sat onsite in mounds, ready to be mixed with topsoil in the wetland. Final grading and seeding were planned for spring. A diversion will keep water out until native plants take hold.

The project is expected to go online in 2019.

"We think it'll be demonstrable," Thiel said. "We're hoping that we can highlight this and other technologies to local producers so that they'll consider them."

The VRWJPO projects it will annually remove 13,600 pounds of nitrate.



*The Minnesota Board of Water and Soil Resources' mission is to improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private landowners. Website: [www.bwsr.state.mn.us](http://www.bwsr.state.mn.us).*