



Section 319

NONPOINT SOURCE PROGRAM SUCCESS STORY

Nebraska

Innovative System Clears Up Sediment Problem in Nebraska Lake

Waterbody Improved

Valentine Mill Pond was a popular destination for fishing and swimming from the turn of the century until the 1970s, when sediment problems made it impossible to enjoy the lake as before. Mechanical dredging deepened the lake and a sediment bypass system was designed and constructed to eliminate future sediment buildup. The sediment bypass system has effectively addressed the sedimentation problem, and the pond was removed from the state's 303(d) list in 2003.

Problem

Valentine Mill Pond was originally created in the 1890s by S.F. Gilman to power a gristmill. Since the 1970s the lake had shrunk from more than 30 acres to less than 15 acres. Exposed mud bars indicated the source of the problem—excessive sediment. A diagnostic feasibility study conducted by the Middle Niobrara Natural Resources District (NRD) indicated that the primary water quality concern was the amount of sand being deposited in the pond. Minnechaduzza Creek, the pond's water source, was depositing as much as 60 tons of sediment into the lake daily. As a result of the feasibility study, Valentine Mill Pond was added to the Nebraska Department of Environmental Quality's (DEQ) section 303(d) list for impairment to aquatic life due to excessive sediment.

Project Highlights

Mechanical dredging was necessary to remove sediment deposits and deepen the lake, but that alone would not solve the excessive sedimentation problems. To prevent excessive sedimentation from reoccurring, an innovative solution was needed. Rollin Hotchkiss, Ph.D., director of the Albrook Hydraulics Lab at Washington State University, joined the project team as a special consultant to Olsson Environmental Services. Dr. Hotchkiss, formerly with the University of Nebraska, had conducted research involving sediment bypass systems. To address the unique problems of Valentine Mill Pond, he designed a "hydrosuction



As part of the project, a unique labyrinth spillway was constructed to pass large storm event flows without manual operation. The hydrosuction system passes around the dam shown here.

sediment removal system" with a unique labyrinth spillway.

The system is designed to capture sediment as it enters the pond and to transport it via a pipeline around the dam to be discharged back into Minnechaduzza Creek, without the use of external energy. "The system was also designed with the capability of collecting, through hydrosuction dredging, the sediment that was not captured by the bypass system," said Daryoush Razavian of Olsson Environmental Services. "We believe that the sediment removal system implemented at the mill pond is the first system operating in the world capable of both bypassing and dredging sediment."

Pre- and Post-Project Summer Conditions for Valentine Mill Pond

Parameter	Number of Samples	Pre-Project Median 1997–1999 ^a	Number of Samples	Post-Project Median 2003 ^a	% Change
Conservation pool storage	NA	76 acre-feet	NA	162 acre-feet	+ 113%
Total phosphorus	13	0.13 mg/L	4	0.07 mg/L	-46%
Dissolved orthophosphorus	14	0.05 mg/L	5	0.02 mg/L	-60%
Total suspended solids	14	31.0 mg/L	5	6.5 mg/L	-79%
Water clarity	9	21 inches	5	57 inches	+ 170%
Algae density	10	5.38 mg/m ³	4	7.51 mg/m ³	+ 40%
Nitrate nitrogen	14	0.45 mg/L	5	0.21 mg/L	-54%

^aMedian not applicable to pool storage.

Results

The sediment removal system has effectively addressed the problem of excess sedimentation in Valentine Mill Pond. Ongoing monitoring, conducted by the Nebraska DEQ, has revealed significant water quality improvements, including reductions in phosphorus, nitrates, and total suspended solids. As a result of water quality improvements, Valentine Mill Pond was removed from the state's section 303(d) list in 2003. It now supports aquatic life, serves as an agricultural water supply, and offers aesthetic enjoyment.



The hydro-suction sediment removal system lies directly beneath the walkbridge shown here.

Partners and Funding

The Nebraska DEQ provided the initial funding for the NRD's diagnostic feasibility study. However, the project would not have been possible without the cooperation of the City of Valentine, Nebraska Public Power District, Cherry County, Nebraska Game and Parks Commission, Nebraska Environmental Trust, and Valentine Mill Pond landowners. The project cost a total of \$1.6 million, including \$155,000 of Clean Water Act section 319 funding.



Valentine Mill Pond has been transformed from a mud hole to a popular recreation area.



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