The Shell Rock River Watershed District (the District) performs field surveys and collects water samples on Pickerel Lake twice a month from June through September. The District uses this information to guide watershed and lake management strategies.

**Water Quality Indicator: Water Clarity**

Water clarity is measured by lowering a black and white disk (Secchi disk) into the water and identifying the depth at which it is no longer visible. The summer-average clarity of Pickerel Lake was greatly improved in 2010 and 2011, meeting the Minnesota Pollution Control Agency’s (MPCA) standard in both years. During 2011, the Secchi disk was often still visible when sitting on the bottom of the lake. This improvement can be attributed to the District’s efforts to control rough fish in the lake (see reverse).

**Water Quality Indicator: Chlorophyll-a**

The District has monitored chlorophyll-a, the main photosynthetic pigment found in algae, in Pickerel Lake since 2005. The summer-average chlorophyll-a concentrations in the lake have historically been higher than the MPCA’s standard for shallow lakes in southern Minnesota, indicating an abundance of algae in the lake. The 2011 summer-average concentration met the MPCA’s standard for the second straight year.

**Water Quality Indicator: Phosphorus**

The District has monitored phosphorus—a plant nutrient in soil that stimulates the growth of algae in lake water—in Pickerel Lake since 2005. Summer-average phosphorus concentrations in the lake have historically been higher than the MPCA’s standard for shallow lakes in southern Minnesota. However, the 2011 summer-average phosphorus concentration met the MPCA standard for the first time on record, an improvement likely resulting from the District’s recent restoration project.
Pickerel Lake continued to make impressive water quality gains in 2011. For the second year in a row, water clarity increased and phosphorus concentrations decreased as a result of the lake management project which eliminated rough fish from the lake in the fall of 2009.

**Aquatic plants signal a healthy ecosystem**

Clean, clear water is also fueling a resurgence of aquatic plants in the lake. Aquatic plants are a key component of a healthy lake. They shelter invertebrates that feed on algae; their roots help to stabilize the bottom of the lake so that it is not stirred up by wind; and they oxygenate the water, keeping phosphorus locked up in the bottom sediment.

Pickerel Lake’s shift to cleaner, clearer water is an example of the “two-state” theory of shallow lake ecology, which holds that shallow lakes will either have clear water and abundant aquatic plants, or cloudy water with abundant algae and few aquatic plants. Prior to the carp removal project in the fall of 2009, Pickerel Lake had poor water quality. The water clarity was very low due to abundant algae populations and the effects of carp, which can prevent healthy aquatic plant populations from thriving. Carp forage for food along the lake bottom, uprooting the existing vegetation, eating plant seeds, and stirring up the soft sediments. As a result, the water becomes cloudy with sediment and light is unable to penetrate to the bottom of the lake, preventing sufficient light for new aquatic plants to grow. Plant surveys of Pickerel Lake before 2010 showed that aquatic plants had been nearly eliminated from the lake. Pickerel Lake had achieved a cloudy water state, and a significant disturbance was required to shift it back to a clear water state.

That “disturbance” was provided by the 2009 carp removal project completed by the District and the Minnesota DNR. Once carp were removed from Pickerel Lake, the few plants that remained kicked off a rapid recovery. In August of 2011, a DNR survey found that virtually the entire lake was covered by submerged and emergent aquatic plants. Nine native plant species were found, including coontail, which was the dominant plant in the lake. Coontail is relatively tolerant of poor water quality and was the most abundant plant species before the project. New clear water species should arrive in future years as seeds are spread by the waterfowl which now frequent Pickerel Lake.

**Keeping an eye on curly-leaf pondweed**

One non-native aquatic plant, curly-leaf pondweed (CLP), was found in the 2011 survey. The presence of CLP is not surprising. Like carp, CLP was introduced to the U.S. many years ago, and by about 1950 it was present in most of the country. CLP is an invasive species which gains an advantage over native plant species by growing rapidly early in the season, even before the ice has thawed. It reproduces rapidly both by seed and by shedding tough vegetative propagules known as “turions,” which sink to the bottom and can survive in the lake sediment for years before sprouting. CLP degrades water quality because it grows vigorously early in the season, taking up phosphorus from the sediment, then dies back in mid-summer, releasing phosphorus to the water as it decomposes at just the right time to stimulate algal growth in the warm water.

In the spring of 2011, the District identified areas of Pickerel Lake where CLP was most dense, and treated those areas with herbicide. During the spring, most native plants are not growing rapidly and therefore are not as sensitive to the herbicide as CLP. Once established, CLP is virtually impossible to eliminate from a lake. But a diverse and healthy population of native plants makes it less likely that CLP will dominate Pickerel Lake, and a small amount of CLP will not seriously degrade Pickerel Lake’s water quality. During 2012 and in future years the District will continue to survey to assess the effectiveness of the 2011 treatment and ensure that CLP does not expand its presence in the lake.