A Shoreline Assessment of Pickerel Lake

Completed by Dennis Skadsen
Northeast Glacial Lakes Watershed Improvement and Protection Project
Day Conservation District

Introduction

The Northeast Glacial Lakes Watershed Improvement and Protection Project conducted a shoreline assessment of Pickerel Lake on August 10 and 25, 2016. The overall objective of the survey was to determine the condition of shoreline along Pickerel Lake measuring how much of the shoreline has been modified from its original condition. Resource agencies and the Pickerel Lake Conservancy could then determine the need and possible benefits of promoting vegetative buffers where possible along the lake's shoreline, and determine the need for other practices to reduce runoff to the lake.

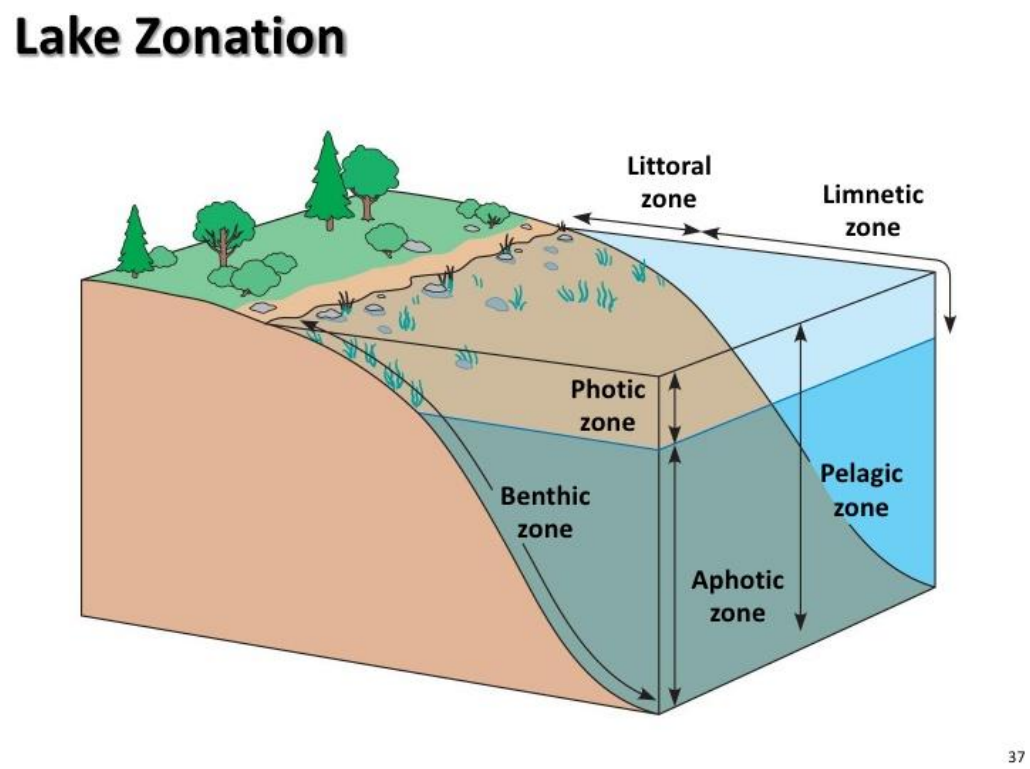
Methods

District personnel boated along the lake's shoreline on two separate days. GPS points were taken using a hand-held GPS Receiver. A number was assigned to each GPS point at the beginning and end of a contiguous stretch of like shoreline based on four categories of riparian and shoreline condition. These data points were then downloaded into ArcMap, a mapping and database program widely used by resource personnel. These data points were overlaid onto aerial imagery to produce a map of Pickerel Lake. Several photographs were taken of different shoreline and upland conditions observed around Pickerel Lake.

Definitions and Shoreline Classifications

By definition, the riparian area is the transitional zone between a terrestrial and aquatic system. Along Pickerel Lake this is best exemplified by the undisturbed areas along the State Park property north of the east park boat ramp. The aquatic system closest to the shoreline is called the littoral zone. In the littoral zone, only plants that can survive full or partial growth in the water (cattails, bulrushes etc.) and the continuous action of waves during the open water months can survive (Figure 1). Emergent plants that grow in the littoral zone are often cited as beneficial due to the fact they provide additional protection to shorelines from erosion.

Figure 1.



The riparian area is the terrestrial habitat that begins just above the littoral zone, and typical of most glacially formed lakes in northeast South Dakota, is comprised of various sized and shaped rocks held in place by the roots of woody vegetation (vines, shrubs, and trees). Just above this rocky shoreline, where the actions of waves and ice typically prevent vegetation from growing, will be several species of willows and dogwoods and other woody vegetation. This is the beginning of the riparian zone. There are also several sand beaches along Pickerel Lake. Natural beaches are depositional areas where the action of waves deposit fine sands. Terrestrial vegetation along beaches is similar to that found along rocky shorelines but may include more native grasses and sedges.

There is no particular width to a riparian zone, it will vary according to terrain and soils. Above the riparian area is the area typically referred to as the upland. Historically, along Pickerel Lake, native upland habitats included forest and tallgrass prairie.

The littoral zone and adjacent riparian area are often cited by resource personnel as one of the most biologically rich and diverse natural communities in North America. Hundreds of aquatic and terrestrial species call the littoral zone home. Figure 2 shows a cross section of a typical shoreline showing the different zones and types of vegetation found in each zone. Figure 3 shows two types of undisturbed shoreline along Pickerel Lake.

Figure 2.

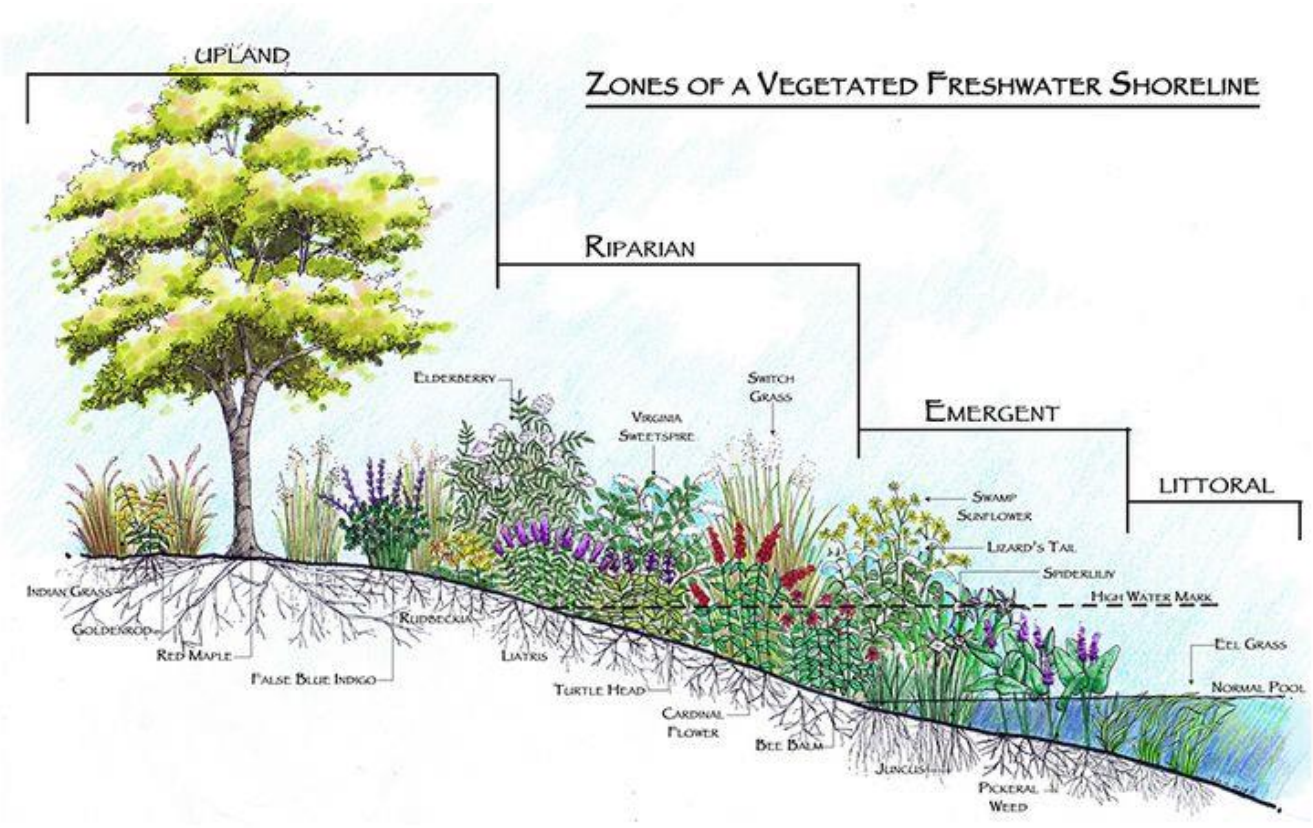


Figure 3.

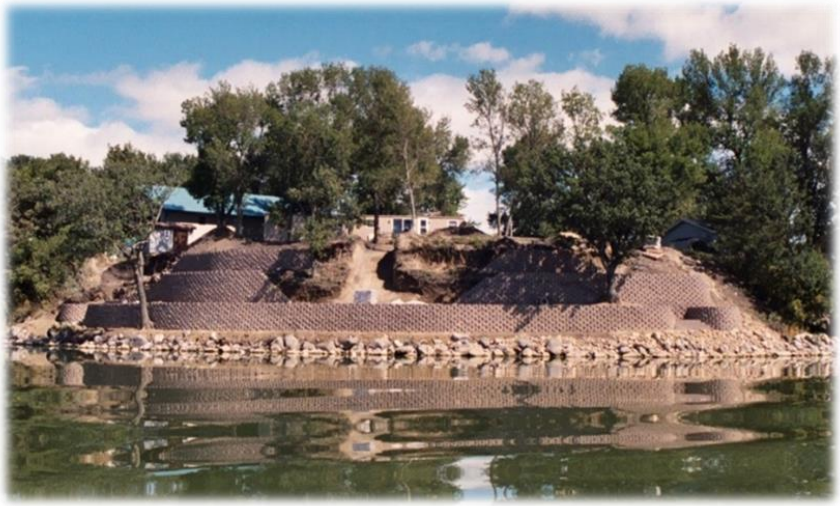
On the left is a typical rocky shoreline with shrubs and grass, on the right is a depositional beach protected by emergent aquatic plants, grasses, and sedges.

The four classifications of shoreline conditions used to describe Pickerel Lake's shoreline are as follows;

- ***Undisturbed Shoreline and Upland (shown below)***
  No alterations to shoreline observed, native vegetation in place along shoreline, upland habitat (forest or grassland) intact or planted wildlife habitat in place (pine/cedar plantings), no structural development present.

- ***Undisturbed Shoreline – Disturbed Upland (shown below)***
  No alterations to shoreline observed, native vegetation in place along shoreline, some trimming of trees and shrubs observed, some shoreline structures present (docks, boat houses), upland habitat removed and replaced with manicured lawn and structures.

- ***Disturbed Shoreline and Upland (shown below)***
  Shoreline altered by removal of natural shoreline structure and native vegetation, native trees and shrubs removed from water's edge to upland, upland replaced with manicured lawn and structures. Disturbed shorelines replaced with rock rip-rap, concrete seawalls, or hard landscaping features.



- ***Undisturbed Shoreline and Light Impact Agriculture***
  No alterations to shoreline observed, native vegetation in place along shoreline, upland utilized for hay. Only example along northwest and northeast shorelines located in the shallow bay north of North Pickerel Addition.

Survey Results

The survey found that nearly 50% or 25,705 lineal feet of Pickerel Lake's shoreline and upland has been altered from its original native state. Only 12,881 lineal feet or 24% of the lakes shoreline and upland is undisturbed, the majority of which is located along the shores of Pickerel Lake State Recreation Area's East Unit. There is an additional 7,800 lineal feet of disturbed upland where the shoreline has been left undisturbed except for walking paths to docks. Figure 4 shows a side-by-side comparison of disturbed and undisturbed shoreline along Pickerel Lake. In addition, there were at least four properties where shoreline buffers had been implemented, at least three with funds from the South Dakota Department of Game, Fish and Parks.

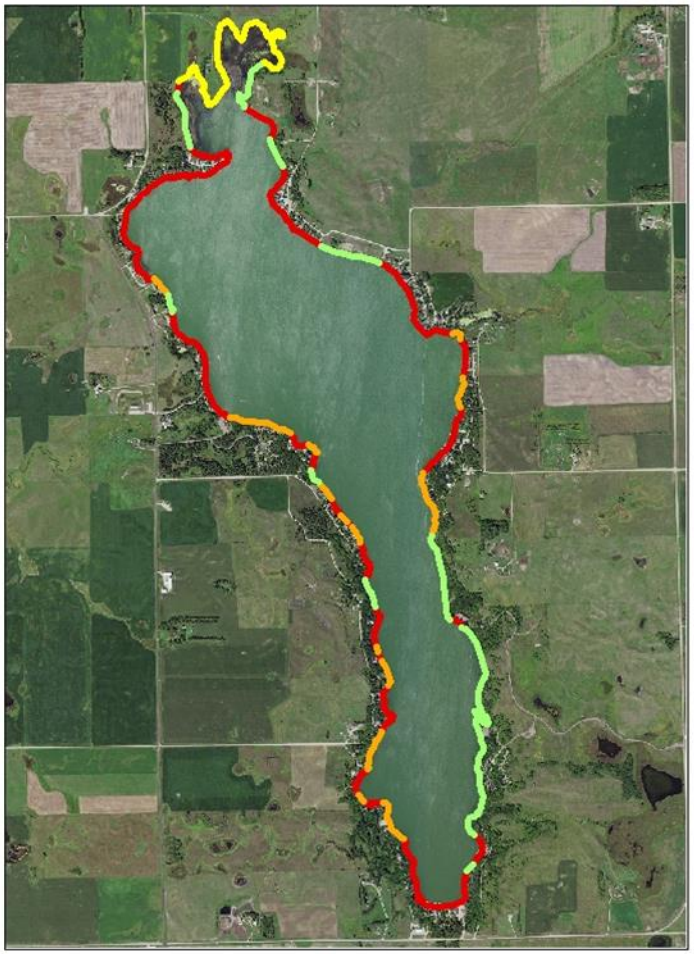
Figure 4. Undisturbed shoreline on the left with disturbed shoreline on the right.

Figure 5 shows the status of shoreline around Pickerel Lake, including lineal feet and percentages of each shoreline classification.

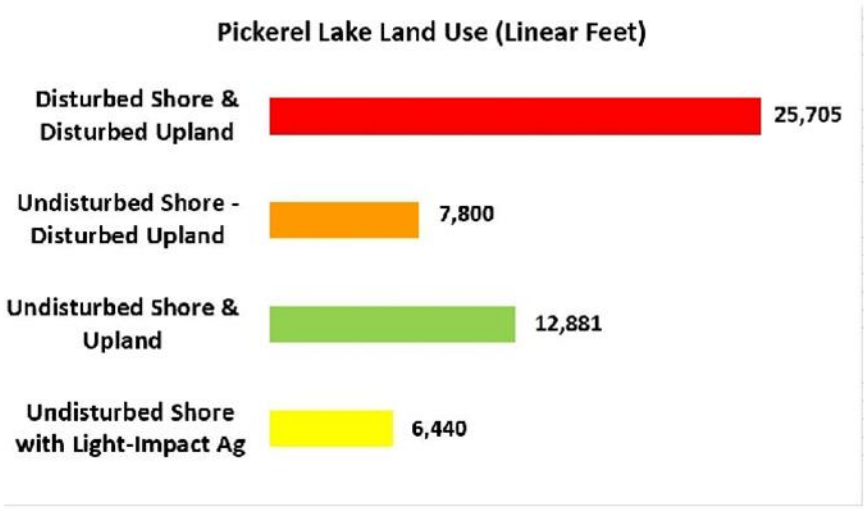
Further analysis was completed using topographic and soils maps to determine areas where steep slopes and highly erodible soils show areas where shoreline erosion may occur due to surface runoff from upland areas, especially from buildings and impervious surfaces like driveways and patios. These included areas known as Hyde Park, western shores of the South End development, undeveloped south end of Beal's Addition, and parts of Duncan's and Jewett's Additions. There were no major areas of shoreline erosion observed during the survey. However, there are some small areas of erosion mainly due to overland runoff from roof drainage on steeper shoreline and improperly aligned roadways.

There are five culverts draining into the lake. Four appear to be from upland drainages and one from a wetland.

Pickerel Shoreline



Prepared with assistance from USDA-Natural Resources Conservation Service



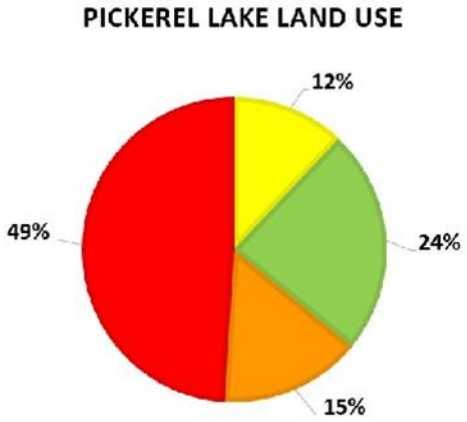


Figure 5. Shoreline Survey Map

Impacts of Shoreline Development to Water Quality

Water quality testing of Pickerel Lake has shown how shoreline development effects water quality. During 2006 and 2007, several areas of the lake were disturbed for completed and proposed developments, including conversion of the YMCA Camp Wisagoma to private lake lots, conversion of a lakeshore wetland to an open bay for development of lake lots in Block's Bay, and earthwork completed on Tribal Trust Land (Figure 7) on the lake's northeast shores for a proposed development that was never completed. Based on water quality test results during these two years, Pickerel Lake's Trophic Status based on Total Phosphorus moved from a more Mesotrophic TSI in 2004 and 2005 to a very high Eutrophic TSI in 2007 (Figure 6). While the sharp increase in TSI did not continue into 2008, the graph shows a steady increase in eutrophication is occurring and the cumulative effects of non-point source pollution from external and internal loadings is ongoing in Pickerel Lake.

Figure 6. Pickerel Lake Trophic State – Phosphorus

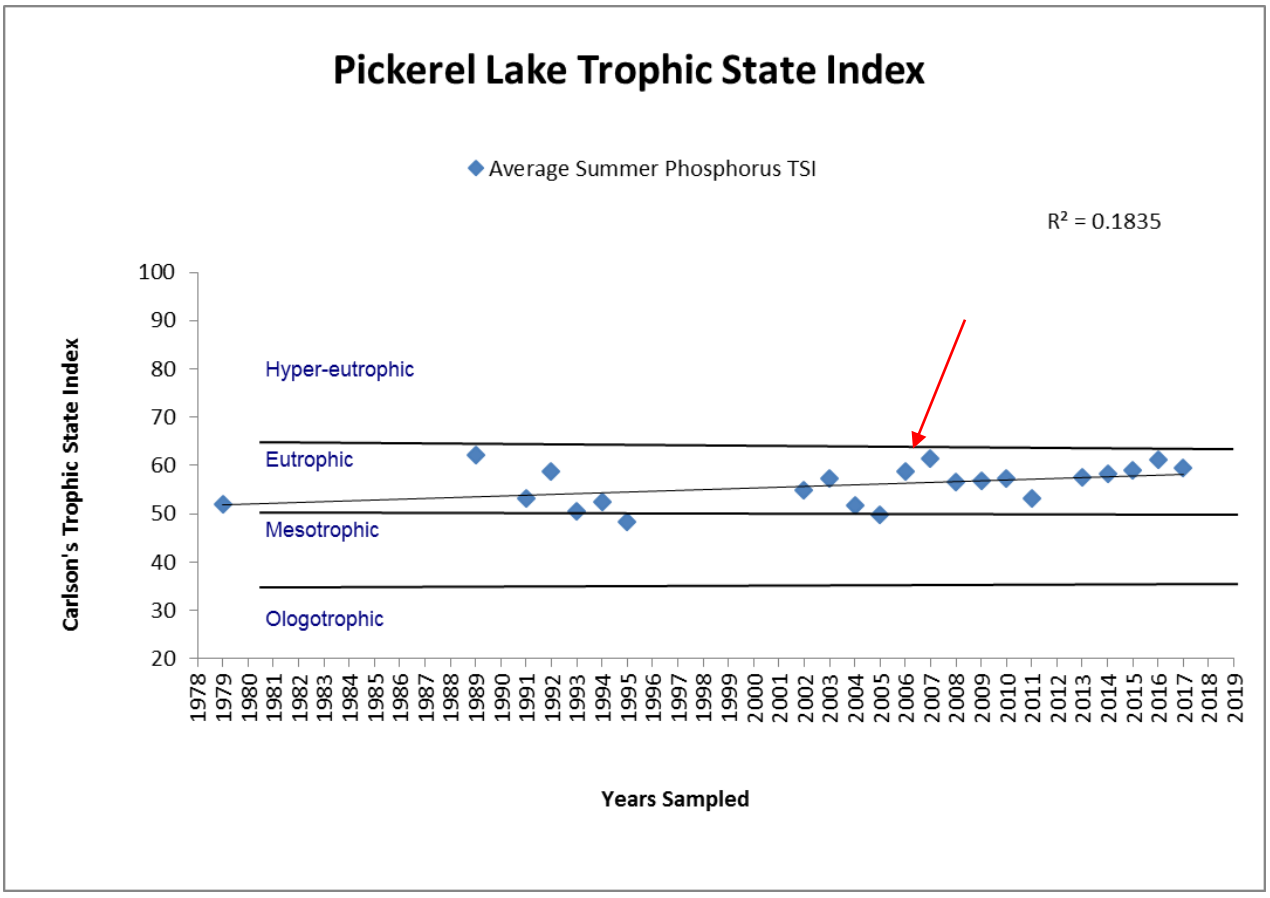


Figure 7. Shoreline Development Northeast Pickerel Lake - 2006

It is harder to quantify historically how shoreline development has affected Pickerel Lake. Looking at aerial imagery from 1938, 1958, 1971, 1979 and 1984, it appears the majority of shoreline development took place between 1958 and 1971. Hand measurements from several sets of aerial maps show that in 1938 approximately 7,300 lineal feet (1.4 miles) of Pickerel Lake's shoreline was developed, mainly in three areas: Hyde Park, Ramona Beach, and the largest area at the time, South End. By 1958, four more areas were developed: Bass Beach (later called Beal's Addition), Jewett's Addition, North Pickerel, and Tahahe Point, increasing developed shoreline to approximately 12,900 lineal feet (2.5 miles). Four more areas of developed shoreline were added by 1971 including Chekapa Bay, Dulynn Road, Duncan's Addition, and Pickerel Lake Outlet, increasing developed shoreline to approximately 20,500 lineal feet (4 miles). By 1979 two more areas were developed, Bullhead Bay and Pickerel Lake State Recreation Area, increasing developed shoreline to approximately 24,130 lineal feet (4.6 miles). Turtle Bay was added to the shoreline by 1984, increasing shoreline developments to approximately 25,120 lineal feet (4.8 miles). In 2007, Shepherd's Bay and the former YMCA camp were developed for lake homes.

One of the main changes brought about by conversion of native upland vegetation to structures and manicured lawns is an increase in surface water runoff. In undisturbed forest or prairie, 80% to 100% of rain percolates into the soil, with only 10% to 20% running across the surface before reaching a waterbody. In residential developments, nearly half of the rainfall hitting the surface will infiltrate into the soil, with the remaining 40% to 50% of rainfall running over the surface, increasing the amount of nutrients and sediment being carried by the runoff, and in this case reaching Pickerel Lake. Another major change affecting surface runoff occurred in the early 1990s when many of the smaller seasonal lake cabins on Pickerel Lake were torn down and replaced with larger year-round lake homes with more impervious services, including larger roofs, paved driveways and other hard landscaping features like patios. Utilizing the StepL watershed model, the change from native vegetation to developed shoreline would result in an increase of nitrogen by 93 pounds per year, phosphorus by 10 pounds per year, and sediment by 2 tons per year carried by surface runoff during rainfall events and snowmelt.

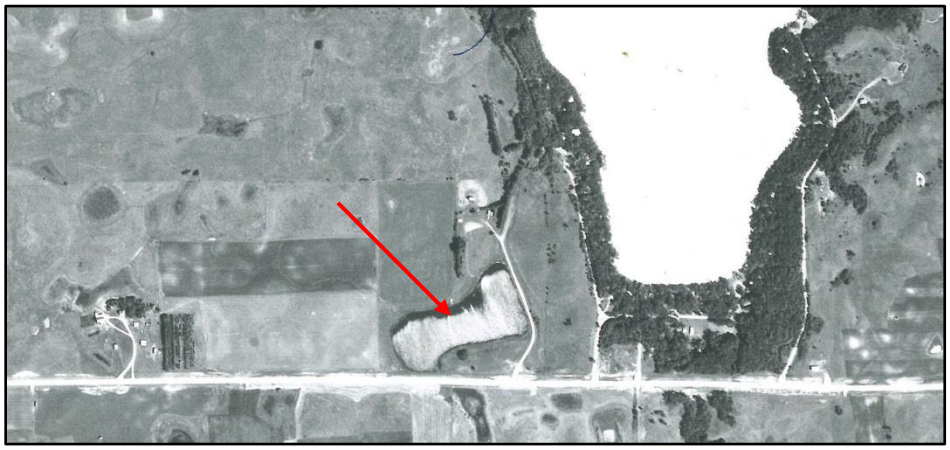
Several wetlands adjacent to or near the lake have been filled or drained for shoreline development and agricultural purposes. These wetlands trap nutrients and sediments from intermittent drainages before they reach the lake. Two wetlands adjacent to the lake, located in Turtle Bay and Bullhead Bay, were partially filled between 1958 and 1979 (Figures 8 and 9). The wetland in Shepard's Bay was opened to the lake in 2006 for shoreline development. A large wetland just southwest of Pickerel Lake, draining to Chilson's Bay, was drained sometime after 1971 (Figure 10).

Figure 8. 1958 Aerial Imagery

Figure 9. 1979 Aerial Imagery

Wetlands in predominately agricultural watersheds can remove up to 80% of the phosphorus and 90% of the nitrogen, and significantly reduce sediment from surface runoff. There is little that can be done to mitigate the effects of wetland losses along Pickerel Lake's shores since most of these areas are now developed with lake homes.

Figure 10.



Recommendations

- Riparian Buffers

Most resource agencies recommend a buffer width of 25 to 100 feet in width from the water's edge to a manicured lawn or other disturbance as shown in Figure 12. The length of the buffer should cover a minimum of 50% of the shoreline with 75% being optimal. Very few existing properties on Pickerel Lake would be able to implement any buffer greater than 25 feet in width due to the proximity of most lake homes and cabins to the shoreline. However, even buffers as wide as 10 feet would have benefits to the lake and wildlife.

Buffers should be planted with a variety of native grasses, forbs and shrubs from local cultivars. Grasses should be those with deep seated roots and be a mixture of both cool and warm season species. The same is true with forbs. A mixture of cool and warm species will provide color and nectar sources for native pollinators from late spring through early fall. Figure 11 shows how the complex root systems of native grasses and forbs compare with turf grass and their obvious benefits to shoreline stability.

Where rock rip-rap has been placed, willow cuttings should be placed near the water's edge. Peach-leaved willow, Pussy willow, and Black willow are very good for rooting from cuttings, and Prairie and Sandbar willows less so. Red-osier and Gray dogwood are two other species suitable for shoreline plantings. Other woody vegetation like Riverbank grape could be planted further up the slope. The roots of these plants will help hold rock rip-rap in place and provide further stability to the shoreline

Lake shore property owners should also consider planting trees along the shoreline. Tree roots provide stability to shoreline soils, habitat for wildlife, and provide shade over the water that is beneficial to several aquatic organisms.

Figure 11.

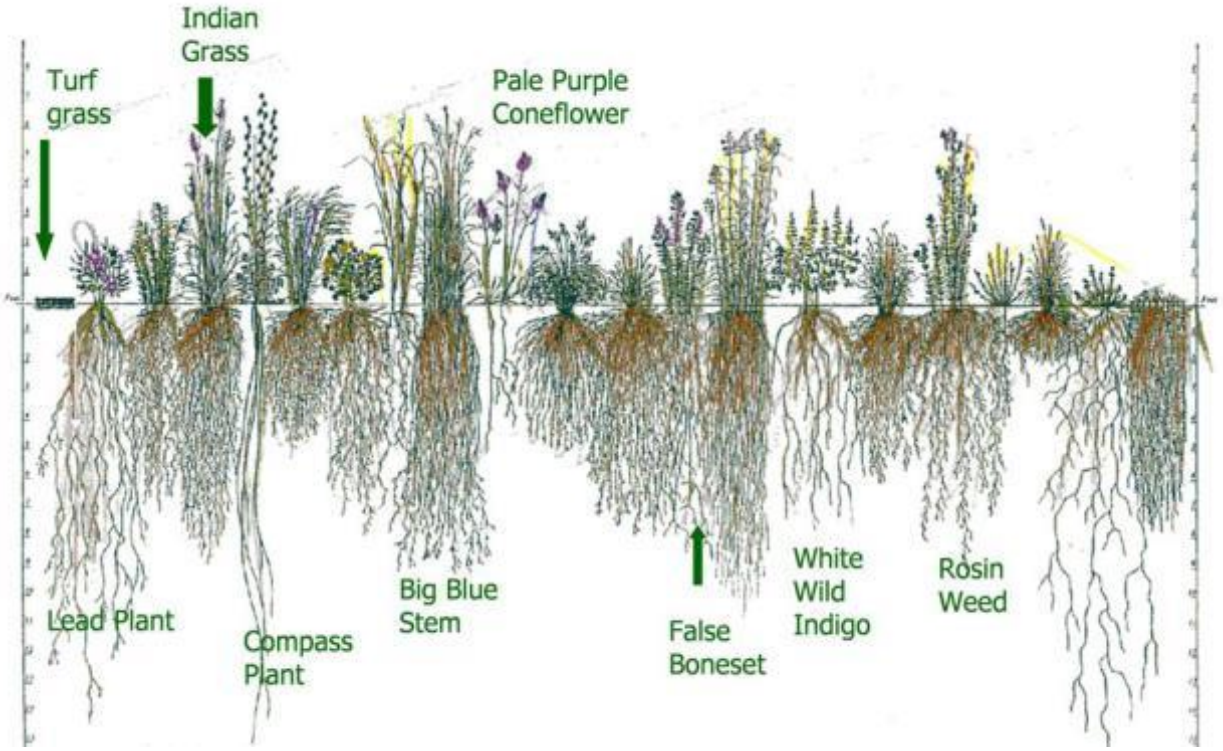


Figure 12. Completed Vegetative Buffer.

- Surface Runoff Control

Surface runoff from buildings can cause serious erosion in the riparian zone where steep slopes and highly erodible soils combine. In these areas, runoff from lake homes and other hard surfaces should be contained in rain barrels or rain gardens, or diverted away from the lake shore by placement of rain gutters and downspouts. Downspouts should not drain onto paved surfaces. Figure 13 shows a sub-surface drain system used to collect runoff from a lake home and carry it away from the lake.

Figure 13. Sub-Surface Drains System

- Drainage Culverts

Five culverts were observed above the water line draining into Pickerel Lake including the one shown in Figure 14 located in Block's Bay. There may be more that enter below the water line that we did not observe. These culverts appear to be located in areas of natural drainage, except for one that probably controls the elevation of a wetland to protect a county road. These culverts carry surface water and likely organic material and sediment to the lake during snowmelt and rainfall events. Where culverts drain into the lake, personnel should investigate the immediate upstream watersheds of these drainages to determine watershed size (acres), land use and possible water quality threats. At a minimum, sediment basins and trash screens at the upstream end of these culverts should be installed if possible to prevent organic material and sediment from reaching the lake. A Water Control and Sediment Basin should be considered on the lake's south end. I would suggest the Conservancy hire a civil engineer to undertake a feasibility study of these suggestions. The Pickerel Lake Conservancy will have to work with county and township personnel to design, implement, and maintain these structures if feasible.

Figure 14. Drainage Culvert located in Block's Bay

- Financial and Technical Assistance

The Pickerel Lake Conservancy may want to consider offering financial assistance or incentives to lake shore property owners who implement buffers and other management practices like rain gardens.

The South Dakota Department of Game, Fish and Parks can provide technical and financial assistance with the design and implementation of shoreline buffers. Contact information is given in the appendix.

The Northeast Glacial Lakes Watershed Protection and Improvement Project would provide technical assistance in designing buffers and surface water control. The Day Conservation District sells native grass seed, potted native grasses and forbs, and a variety of trees and shrubs for shoreline plantings.

Lake shore property owners should plan their shoreline buffers during the spring or summer months to be able to order plants in the fall if ordering from local Conservation Districts. These plants will then be available for planting the following spring. A partial list of plants available from the Day Conservation District and suitable for shoreline buffers is given in the appendix.

Appendix

Plants Suitable for Shoreline Buffers

Fact sheets for several species of native grasses, flowers, trees and shrubs can be found at:

https://plants.usda.gov/java/factSheet

Native Flowers (local favorites):

Beebalm/Bergamot

Blazing Star

Blanket Flower

Black-eyed Susan

Mexican Hat (dark colored prairie coneflower)

Milkweed

Purple Coneflower

Purple Prairie Clover

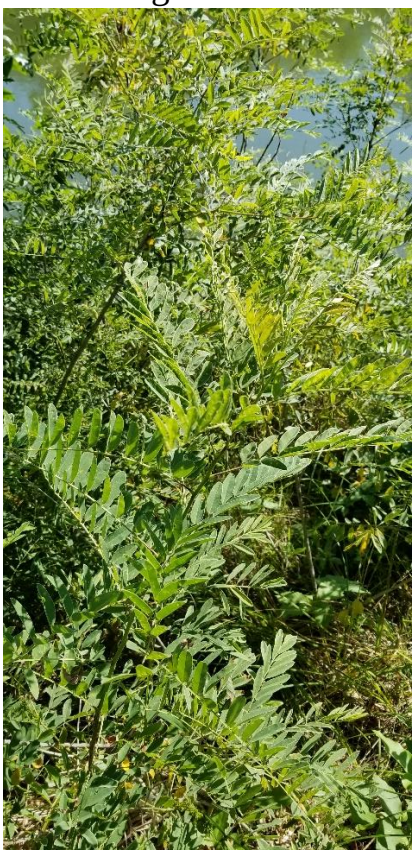
Trees, Shrubs, and Vines:

Shrubs and vines are ideal for planting in rock rip-rap. The species shown below are very hardy for northeast South Dakota. Trees like bur oak are great for upland areas, residents should no longer plant green ash due to the presence of the ash borer in South Dakota.

Riverbank Grape

Red-Osier Dogwood (also good - silky dogwood)

False Indigo



Bur Oak

Willows (Diamond, Peachleaf, and Sandbar)

Books

Lakescaping for Wildlife and Water Quality
By Carrol L. Henderson
1998
Non-game Wildlife Program
Minnesota Department of Natural Resources
176 pages

Websites

https://extension.umn.edu/water-resources/shoreland-property-owners

Contacts

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Water Quality Projects in Northeast South Dakota

Water quality projects like the Northeast Glacial Lakes Watershed Improvement and Protection Project are funded through a competitive grant process. The South Dakota Department of Environment and Natural Resources (DENR) receives a yearly allocation from the United States Environmental Protection Agency's Section 319 Clean Water Program for grant applicants to utilize for water quality assessments and implementation projects throughout the state. The Day, Marshall and Roberts Conservation Districts have all sponsored EPA 319 Clean Water Grant projects. Implementation and assessment projects have been completed on fifteen lakes located in these three counties. The first project sponsored by the Day Conservation District began in 1992 on Pickerel Lake. The Northeast Glacial Lakes Watershed Improvement and Protection Project began in 2007 as a collaborative project between the Day, Grant, Marshall, and Roberts Conservation Districts. The project was designed to continue the work of past projects sponsored by these Conservation Districts to improve and protect the water quality of thirteen northeast South Dakota lakes and the Upper Minnesota River Basin that includes the Little Minnesota River, Jorgenson River, North and South Forks of the Whetstone River, and North and South Forks of the Yellowbank River in Grant and Roberts counties.

Dennis Skadsen has been the 319 Project Coordinator for the Day Conservation District since 1993. Dennis graduated from the University of South Dakota Springfield in 1976 with an Associate Degree in Architectural Design. He worked for Bastian Engineering in Sioux Falls until 1982. In 1982 he married Lori Skadsen and moved to Milbank where he was employed by Larson Engineering until 1984 when they moved to the Platte Creek Recreation Area. In 1986 Dennis and his wife Lori moved to Pickerel Lake State Recreation Area where they reside today. While living at Pickerel Lake, Dennis became interested in biology and environmental education. He volunteered to manage the Waubay National Wildlife Refuge Bluebird Trail from 1986 to 1996, during which he banded over 600 bluebirds and taught environmental education classes at the NeSoDak Outdoor Learning Center on nearby Enemy Swim Lake. In 1993 he was hired by the Day County Conservation District as the Project Coordinator for the Pickerel Lake Watershed Protection Project where he continues to work overseeing assessment and implementation projects on the following lakes and reservoirs: Amsden, Blue Dog, Enemy Swim, Minnewasta, Pickerel and Pierpont. He has also completed major studies on eastern South Dakota freshwater mussels, northeast South Dakota and west central Minnesota bird populations, small mammals including finding the first confirmed specimen of the Northern Water Shrew since 1878 on Pickerel Lake, and continues to study and monitor populations of rare prairie butterflies including the Dakota Skipper. He was recently awarded a grant to determine the species composition of several families of aquatic insects in northeast lakes, streams and rivers starting 2018. In 2009 Dennis received the Citizens Award from the South Dakota Chapter of the Wildlife Society for his contributions to wildlife management in the State of South Dakota. He continues to educate youth and adults about our natural resources through several yearly workshops and classes.