

Shaver's Lake Framing Analysis

January 2012

Dick Osgood, Certified Lake Manager (Cert. No. 07-01M)

The Shavers Lake Association Board requested a brief analysis to better frame the issues requiring attention in Shavers Lake. This report, a Framing Analysis, addresses these concerns and issues:

- A description of the physical environment (size, depth, tributary area, OHW)
- A description of lake water levels
- A description of water quality
- An assessment of the Highway 101 project and proposed filtering structures
- A description of sediment depths and conditions
- A statement of problems to be addressed
- A statement (or re-statement) of the mission of the plan
- A listing of remedial/restorative approaches
- Recommended next steps
- A presentation to the Shavers Lake Association Board on January 7, 2012

In addition, field testing and observations will be made to support the analysis in this report. These will include:

- Water depth measurements
- Sediment depth measurements and qualitative observations
- Plant distribution

ASSESSMENT

1. Physical Environment

According to the Barr Engineering¹, Shaver’s Lake is 22 acres (surface area) with mean and maximum depths of four and six feet, respectively. Based on a field assessment conducted on December 20, 2011, I estimate these dimensions:

	<u>Maximum Depth*</u>	<u>Average Depth**</u>	<u>Surface Area</u>
West Basin	4.3 – 6 feet	2 to 3 feet	4 acres
East Basin	4 to 6 feet	2 to 3 feet	11 acres
Channel	--	--	1 acre

* The range of measurements on December 20, 2011 and the Barr report.

** Estimated as 50% of maximum depth.

Lake depth is defined here as the depth from the surface of the lake to the sediment-water interface. This differs from the depth of the lake basin, which includes the depth of sediment deposits down to the bedrock.

The tributary area of to Shaver’s Lake is 240 acres and drainage is mainly via storm sewer conveyances (see figure 1).

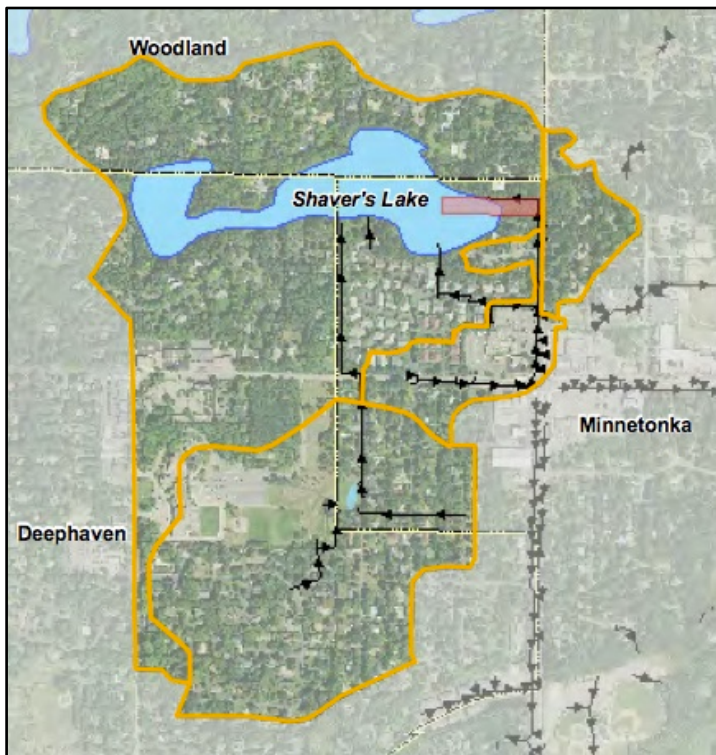


Figure 1. Shaver’s Lake Watershed, from Barr Engineering¹.

¹ Shaver’s Lake: Evaluation of property for potential stormwater treatment site. Letter to City of Minnetonka Engineer from Barr Engineering, June 9, 2011.

2. Water Levels

Water levels are measured by elevation, using sea level as a benchmark. The Minnesota Department of Natural Resources (DNR) has determined an 'Ordinary High Water' (OHW) elevation for Shaver's Lake at 930.4 feet above sea level. This level is considered an extreme level, meaning the lake level only gets this high in rare instances, but for long enough to leave visible marks on the landscape (such as water marks at the base of trees).

A 'normal' elevation is considered that level where the lake normally exists; however this is not a formal-determined level. The lake level on December 20, 2011, has been represented to me as a 'typical' or normal lake level. Based on the contours superimposed on a figure in the Barr¹ letter, I estimate this normal lake level to be approximately 926 feet.

Records from the DNR indicate the highest and lowest recorded lake levels are 929.1-feet and 920.9-feet, respectively. The lowest level was recorded on August 8, 2000.

For purposes of this interim assessment, I assume the normal lake level is 926 feet.

Critical Data

Lake elevation should be ascertained. I have contacted the Minnehaha Creek Watershed District (MCWD) requesting that the lake's elevation be determined. I have also contacted the MCWD requesting that Shaver's Lake be included in their volunteer lake level program. Once a volunteer is identified, the MCWD will arrange this in the Spring.

3. Water Quality

Lake water quality is typically assessed as a measure of the amount of algae growth. Three related measurements, phosphorus concentration (the plant nutrient that determines how much algae grows), chlorophyll (a pigment in algae) and Secchi depth (a white disk lowered until it disappears), determine water quality.

The figure below is copied from the Barr¹ report. These data summarize Shaver's Lake water quality for various years from 1993 through 2010. Generally, the data indicate the lake's quality is good. However, there are limitations. These measurements are taken in open water and therefore do not represent other aspects of lake condition, such as excessive weeds. While Shaver's Lake's water quality, based on these measurements, does not appear to be problematic.

Other aspects of water quality or lake condition include rooted plants, both emergent and submerged. Narrowleaf cattail or its hybrid now encircles nearly the entire lakeshore. There are reports that Eurasian watermilfoil is in the lake, although this could not be verified on the December 20, 2011 visit. In addition, Chara (a kind of algae that looks like a plant) occupies the entire lake bottom.

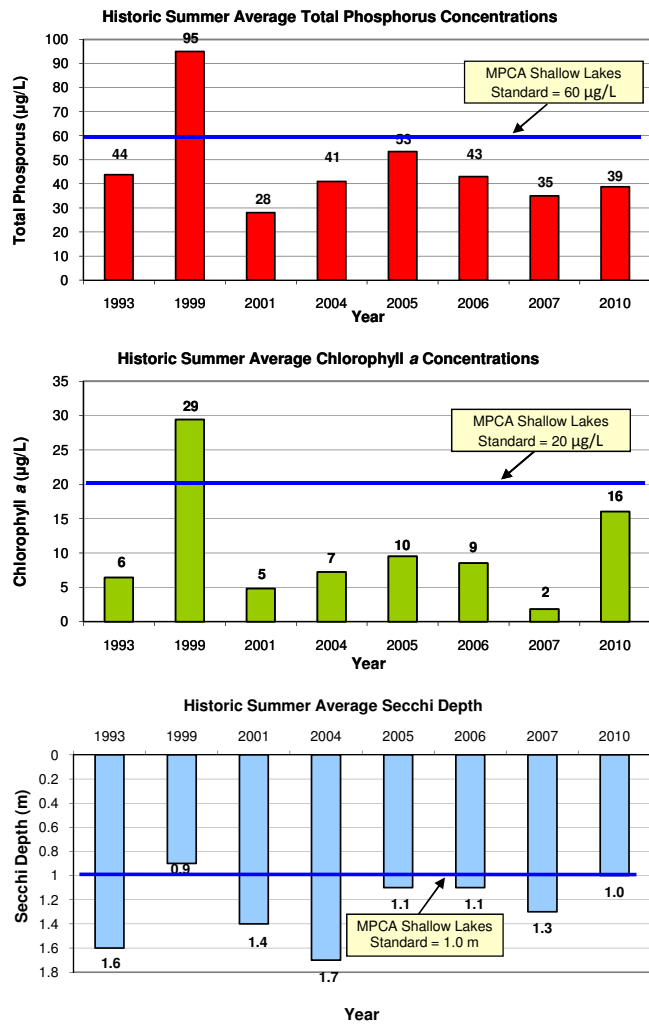


Figure 4
 Historic Summer Average Water Quality Sampling Results
 Shaver's Lake
 City of Minnetonka

Critical Data

While water quality does not seem to be a great concern, continued assessment is important. I recommend the Shaver's Lake Association continue with a volunteer water quality monitoring program, including dissolved oxygen profiles. In addition, there are no objective observations regarding the vegetation in and around Shaver's Lake. It is believed that Eurasian watermilfoil exists – this should be verified and mapped this summer. For recommendations on mapping and evaluating the cattails and trends of expansion, see the appendix.

4. The Highway 101 Project

Highway 101 is proposed to be upgraded in the near future. This upgrade will result in increased runoff to Shaver's Lake from a drainage area proximate to the project area. The Barr¹ report evaluates whether stormwater mitigation methods are available and recommends a series of filtration ponds on the Reed's property.

Untreated runoff is not desirable. The proposed filtration ponds will be beneficial and therefore the Shaver's Lake Association should advocate for their placement.

A larger concern is the existing storm sewer outfall directly into Shaver's Lake (also described in the Barr¹ report). This outlet drains a large area and discharges untreated stormwater directly into Shaver's Lake and there is evidence of a delta formation and other materials being discharged into Shaver's Lake. The Shaver's Lake Association should advocate for mitigating measures, such as the series of ponds, to at least partially compensate for the stormwater pollution.

5. Lake Sediments

There is a substantial accumulation of sediments in Shaver's Lake. Field reconnaissance (December 20, 2011) indicates flocculent (that is, loose and fluffy) sediments about an inch or two in depth at the sediment-water interface. Below that, the depth of dense, highly organic sediments is at least 8 to 10-feet.

I estimate the rate of sediment accumulation to be about ¼-inch per year, much greater than most other lakes. My assessment is based on the appearance of the sediments and notable accumulation of recent vegetative matter.

Perhaps more concerning is the apparent and rapid encroachment of cattails around the lakeshore. Accounts from long-time lakeshore residents indicate the cattail fringe has been expanding for about two decades. The cattail fringe is up to about 50-feet wide in some areas of the lake and cattails now completely block the channel between the two basins.

Critical Data

It is important to determine the rate of sediment accumulation as well as the cause.

6. Situation Assessment and Problem Identification

Shaver's Lake is a small, shallow landlocked basin. The lake receives untreated stormwater runoff and has been infested with narrowleaf (or hybrid) cattails, which are invasive. The result of unchecked runoff pollution and the infestation of the invasive cattail have severely diminished the usefulness of the lake. Indeed, there is evidence the lake is filling in at a rapid rate and the two basins are now functionally separate.

There are reports of Eurasian watermilfoil in the lake, although this was not present on December 20, 2011. This should be verified in the upcoming open water season.

On a positive note, the blanket of Chara across the lake bottom probably has a moderating effect on water quality. There are no records of other native vegetation, which might be present during the summer season.

Shaver's Lake is changing rapidly in ways that diminish its recreational and wildlife values. Lacking intervention, Shaver's Lake is on a path to become filled in to a point of becoming a cattail marsh.

The filling in process in Shaver's lake is not natural. While lakes like Shaver's Lake do eventually fill in under natural conditions, this process takes centuries and millennia. In this case, the filling in of Shaver's Lake has accelerated unnaturally to a point where the filling in process is occurring over decades. There is concern that Shaver's Lake may be at a tipping point.

The predominant presenting problems in Shaver's Lake are:

- Excessive and expanding cattails, including the un-navigable channel
- Excessive sediment accumulation
- Rooted submersed plants (like milfoil) interfering with recreation
- Excessive, untreated runoff

7. Mission: Next Steps

The Shaver's Lake Association is:

Organized for the purpose of preserving and improving the environmental, recreational, aesthetic and economic values of Shaver's Lake.

At a recent meeting (December 6, 2011), representatives from Shaver's Lake identified these goals for the management of the lake:

- Keep Shaver's Lake a lake
- Slow or stop all silt-in processes
- Return (restore) shoreline and bottom similar to 1950's, dredging if necessary
- Filter (treat) water coming in with most effective method
- Aerate
- Pull, cut and or chemically kill invasive weeds

A management plan should be developed to frame the long- and short-term remedial actions necessary to address the Shaver's Lake Association's mission and identified problems as well as to justify agency permitting, cooperation and support.

8. Remedial Approaches

Monitoring and data evaluation, as recommended in the boxes throughout this report, should support management actions. To address the identified problems and goals, remedial actions should be considered on a short- and long-term basis. Categorically, these actions would include:

Short-Term Actions

Short-term actions are meant to relieve some of the immediate nuisance condition and increase the usability of the lake.

- Controlling Nuisance Cattails – This level of control will provide access through the cattails for lakeshore residents and navigation through the channel. These short-term and small-scale actions are generally permissible, but will not result in long-term control. Physical methods (for example, cutting, pulling, harvesting) or chemical methods using herbicides are available for this level of control.
- Nuisance Submerged Vegetation – To the extent submerged vegetation (such as Chara or Eurasian watermilfoil) is problematic, it may be controlled using physical or chemical methods. Because my assessment was conducted in December, it is likely other species of plants are normally present in the summertime. The desire to control these plants should be balanced against the desire to protect some plants because some species are likely beneficial to maintaining good water quality. A detailed inventory of submerged plants should be conducted during the summer to properly target the nuisance species.

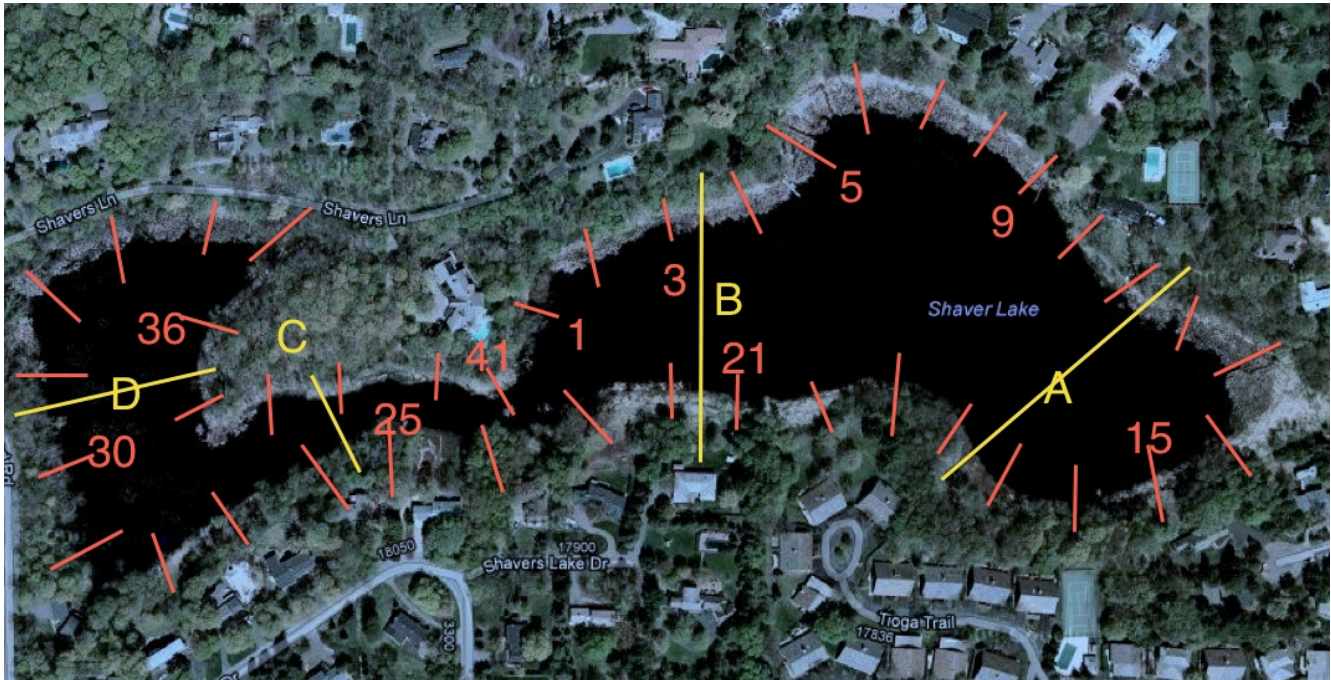
Long-Term Actions

Long-term actions are intended to be more permanent and restorative in nature, but these are larger-scale, more intensive projects requiring intense regulatory involvement. Typically, detailed diagnostic studies will be required by permitting agencies to support these management actions.

- Cattails – Comprehensive, systematic control of the invasive cattails around Shaver's Lake will require a demonstration that the cattails are degrading the lake and diminishing its primary ecological function. I believe this case can be made; however, it is clear that regulatory agencies and their existing rules believe the invasive cattails are normal and natural and therefore should not be controlled. Indeed, Minnesota does not recognize narrowleaf or hybrid cattail as being 'invasive.' Lacking long-term, comprehensive control of the invasive cattails around Shaver's Lake, a significant causal mechanism for the lake filling-in will not be addressed.
- Filling of the Lake Basin – Dredging is a drastic intervention, which I believe will be necessary to effectively accomplish any other management goal. The regulatory requirements for dredging are significant, including detailed engineering studies. As well, the costs for commercial, traditional dredging are high, typically estimated at \$20,000 to \$50,000 per acre. Prior to dredging, the causal factors contributing to the excessive filling of the lake must be identified and controlled. It appears the two main causal factors are encroaching invasive cattails and untreated stormwater runoff.

Appendix: Measuring Cattails

The Shavers Lake Association is concerned about the expansion of cattail growth around the lake. To provide an objective basis to evaluate the rate of cattail expansion, the following methodology is recommended:



Using the figure above, measure the width of cattails and the span of open water. This can be done in the field or using historic aerial photographs. In either case, measurements of the width of cattails (red lines) and the span of open water (yellow lines) should be made and recorded. If using aerial photographs, record the width in millimeters (preferred) or inches and be sure to include the scale. Copies of the photograph should be made. Also record the date of the field measurements or the date of the photograph.

Minnesota Department of Natural Resources

Aquatic Nuisance Plant Permit Overview

Activities Not Allowed

- Excavating the lake bottom for aquatic plant control
- Use of hydraulic jets
- Destroying or preventing the growth of aquatic plants by using lake bottom barriers
- Removing aquatic plants from an undeveloped shoreline
- Removing aquatic plants where they do not interfere with swimming, boating, or other recreation

When Permits Are Not Needed

- Cutting or pulling submerged vegetation – less than 2,500 square feet, but not more than 50-feet along your shore or half the shore length, whichever is less
- Cutting or pulling submerged or floating-leaf vegetation (not lotus) for a 15-wide boat channel to open water

Control Activities that Must Have a Permit

- Destruction of any emergent vegetation (cattails and bulrushes)
- Cutting or pulling submerged vegetation in an area larger than 2,500 square feet
- Applying herbicides or algicides
- Moving or removing a bog of any size that is free-floating or lodged in any area other than its place of origin in public waters
- Transplanting aquatic plants into public waters
- The use of WeedRollers or similar devices
- The physical removal of floating-leaf vegetation from an area larger than a channel 15 feet wide extending to open water

More information is available from the DNR website:
<http://www.dnr.state.mn.us/shorelandmgmt/apg/regulations.html>

Qualifications & Experience

Awards & Certifications

- **Secchi Disk Award**, the North American Lake Management Society's highest award
- **Outstanding Corporation**, North American Lake Management Society
- **Certified Lake Manager** (Cert. No. 07-01M), North American Lake Management Society

OSGOOD CONSULTING, LLC - Shorewood, MN (1993 - present).

Principal.

Consulting services for lake and watershed planning, management, citizen participation, facilitation, conflict & dispute resolution, expert testimony, organizations, research and education.

- Lake and Watershed Management Plans & Programs
- Alum Application Strategies & Dose Determination
- Aquatic Invasive Species – Protection & Management
- Water Quality Modeling
- Lake Surface Use Management
- Aquatic Plant Management, including Eurasian watermilfoil
- Environmental Assessments – EAW, EIS
- Lakeshore Development Planning Support
- Strategic Planning & Organizational Development
- Mediation, Facilitation & Public Participation
- Volunteer, Education & Training Programs
- Expert Testimony

FRESHWATER FOUNDATION - Wayzata, MN (1991 - 1993).

Director of Surface Water Programs

Policy Research, Facilitation and Strategic Planning

- Directed *The Minnesota Lake Management Forum*, a program advocating a new lake management system in Minnesota
- Developed and communications new management approaches for exotic species
- Managed *LakeWatch*, a volunteer lake monitoring program
- Managed the *Metro Wetland Forum*

Communication

- As 'scientist-in-residence,' responded to inquiries
- Wrote columns for newsletters and media, made frequent presentations
- Responded to media inquiries and published guest editorials

Administration

- Budget preparation and oversight, project management
- Prepared and submitted grant requests to public and private foundations
- Hired and directed staff and consultants

METROPOLITAN COUNCIL - St. Paul, MN (1980 - 1991).
Limnologist/Environmental Planner.

As manager of the program, responsible for monitoring, analyzing and evaluating data from 121 lakes in the metro area. Through these studies, built one of the most comprehensive lake databases in the world. Convinced the Metropolitan Council and other water resources management entities to provide better protection of lakes and watersheds.

- Designed a citizen-assisted lake monitoring program involving chemical analyses and physical observations. This program has been implemented.
- Developed lake water quality models with specific reference to seasonal responses to external and internal phosphorus loading events.
- Assisted watershed management organizations in the preparation of management plans and prepared formal reviews of those plans for action by the Metropolitan Council.
- Designed, conducted and administered diagnostic-feasibility studies of lakes. This involved preparing grant applications, designing and conducting field studies, planning and facilitating public meetings, and writing quarterly and final reports.
- Developed lake and watershed management plans for local governmental agencies.
- Prepared environmental review documents for action on behalf of the Metropolitan Council.
- Organized, facilitated a workshop on lake and watershed management, including editing and publishing a proceedings.
- Examined region-wide impacts of nonpoint sources pollution on lake water quality by designing, implementing and directing surveys of metro area lakes.

LAKE SUPERIOR BASINS STUDY CENTER - Duluth, MN (1979).
Scientist.

- Assess the impacts of lake level changes on the U.S. shoreline of the Great Lakes.

UNIVERSITY OF MINNESOTA - Duluth, MN (1977 - 1979)
Research and Teaching.

- Designed the research protocol for a baseline study of 25 lakes in Voyageurs National Park.
- Taught courses in Ecology, Botany, General Biology and Limnology.

PROFESSIONAL ACTIVITIES

- President, North American Lake Management Society (2007-2009).
- Board of Directors and Vice-President, Minnesota Waters (2006-2012).

- Instructor of the Alum Workshop, North American Lake Management Society (2003 - present).
- Co-Organizer of the Minnesota Shallow Lakes Forum (2003 – 2008).
- Treasurer, North American Lake Management Society (2002-2005).
- Columnist, LAKELINE, a quarterly publication of the North American Lake Management Society (1998 - 2009).
- Board of Directors, Vice President, Minnesota Lakes Association (2002-2005).
- Keynote Speaker, *The Ecological Basis for Lake Management*, the Annual meeting of the New England Chapter of the North American Lake Management Society, Maine (June 1999).
- Author of Chapter 8, *Developing and Implementing the Plan*, in *Managing Lakes and Reservoirs*. 2001. North American Lake Management Society, U.S. EPA, Terrene Institute.
- Invited speaker and delegate, International Symposium, *The Ecological Basis for Lake and Reservoir Management*. University of Leicester, England (1996).
- Instructor, *The Ecology and Management of Aquatic Plants in Minnesota Lakes*, MN Landscape Arboretum (1994 & 1996).
- Water Law, Science and Public Policy Committee, American Water Resources Association (1993).
- Policy Committee Chair, North American Lake Management Society (1992, 1993, 1997-2002).
- Editorial Reviewer, Journal of the American Water Resources Association (1982-2003); Hydrobiologia (1992-2000); Lake and Reservoir Management (1992-present).
- Instructor, *Minnesota Lakes: An Introduction to Lake Ecology*. University of Minnesota (1982, 1983).
- Numerous scientific publications and presentations at professional meetings.
- Professional Associations:
 - Aquatic Plant Management Society
 - Minnesota Waters
 - North American Lake Management Society

RELATED EXPERIENCE

- Excelsior Rotary (2007 – present).
- Board of Directors & Executive Committee, South Lake – Excelsior Chamber of Commerce (2005 – 2012).
- Board of Directors, University of MN Biological Sciences Alumni Society (1999 - 2003), Board President (2001/2002).
- Citizens League Committee on Graduate Education and Research Quality at the University of Minnesota (1997).
- Mediator & Facilitator, West Suburban Mediation Center (1996 - 2001).
- Vadnais Heights Planning Commission (1989 - 1991), chair (1990 & 1991).

EDUCATION AND TRAINING

- Phosphorus Inactivation in Stratified/Unstratified Lakes and Inflow Interception Workshop: North American Lake Management Society Workshop (1996 & 2002).
- Community Mediation & Facilitation Training, West Suburban Mediation Center (1996).
- Supplemental Mediation Training, Mediation Center (1995).
- Mediation Training, Erickson Mediation Institute (1995).

- Team Focus, Executive Development, Inc. (1994).
- Decision Focus, Executive Development, Inc. (1993).
- Lake Restoration Techniques, University of Wisconsin (1981).
- Master of Science - Aquatic Ecology/Geology. University of Minnesota, Duluth (1979).
- Bachelor of Science - Biology. University of Minnesota, Twin Cities (1977).