

Statement of Qualifications for:



For more information contact:

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Find HAB online at:
www.HABaquatics.com

COMPANY PROFILE

HAB Aquatic Solutions, LLC specializes in improving surface water quality through the use of aluminum-based products (e.g., alum and sodium aluminate). Our research and development efforts improved upon traditional alum treatment approaches by developing treatment systems to address the unique challenges of today's water resource management projects. HAB's cofounders (John Holz and Tadd Barrow) are two of only a handful of scientists qualified to provide complete alum treatment services: from dose calculation, to application, to project evaluation. Our fleet of vessels of various sizes is tailored to meet the application needs of small ponds, large lakes and reservoirs, and everything in between.

HAB has over 60 years of combined experience and provides the most comprehensive alum services available, including:

- Pre-project water quality monitoring
- Algae identification
- Lake sediment core collection and analysis
- Chemical dose determination
- Project coordination
- Precise, GPS-guided chemical application
- Alum injection systems for the treatment of storm water/stream water
- Post-project water quality monitoring and evaluation

Education

Ph.D. 1998,
Biological Sciences
(Aquatic Ecology)
(University of Nebraska,
Lincoln)

M.S. 1994,
Forestry, Fisheries and
Wildlife (University of
Nebraska, Lincoln)

B.S. 1991,
Natural Resources
(University of Nebraska,
Lincoln)

Affiliations

American Society
for Limnology and
Oceanography

Ecological Society
of America

North American Lake
Management Society

Years Experience
19

John C. Holz, Ph.D.

Water Quality Specialist

EXPERIENCE SUMMARY

Dr. Holz is a cofounder of HAB Aquatic Solutions and has over 19 years of experience in surface water quality/aquatic habitat management and research. While earning his Ph.D. from the University of Nebraska-Lincoln (UNL), Dr. Holz's research advanced our understanding of water resource issues and developed improved management tools for lakes, streams and watersheds, including assessing/interpreting/predicting the response of water bodies to pollutants and the effectiveness of restoration techniques. Dr. Holz conducted research that advanced our ability to address numerous unique water quality challenges and pollutant effects. Specific areas of expertise include lake restoration and management, watershed management, biological indicators of water quality, phytoplankton ecology and management, nutrient inactivation (alum), determination of appropriate water quality goals, nutrient criteria development, water quality monitoring, water quality modeling, internal phosphorus loading, and determining effectiveness of TMDL's using water quality and biological information. Dr. Holz was honored for his alum research advancements by the North American Lake Management Society in 1999 when he received their Technical Excellence Award in recognition for Outstanding Research in Lake Restoration, Protection and Management.

As a faculty member at UNL, Dr. Holz obtained \$7.95 million in funding to support water quality research, authored over 20 publications, taught courses in Limnology (the study of lakes and streams) and Lake and Reservoir Restoration, and served as a technical advisor to the U.S. Environmental Protection Agency (EPA) on water quality management issues in the U.S. Dr. Holz is a recognized leader in water quality/aquatic habitat management.



KEY PERSONNEL

EXPERIENCE

Owner & Water Quality Specialist, HAB Aquatic Solutions, LLC

Responsibilities:

- Business Development
- Project Design
- Project Proposals
- Project Presentations and Reports
- Client Relations
- Water Quality Assessment
- Chemical Application and System Installation
- Bathymetric Mapping
- Application Equipment Design and Manufacturing
- Post-project Assessment
- Product Research and Development

Assistant Professor, University of Nebraska

Research Projects and Responsibilities:

- Understanding causes of poor lake and stream water quality
- Research, develop, and assess water quality management tools (e.g., alum, aeration, dredging, watershed best management practices)
- Nutrient impacts on water quality
- Land-use impacts on water quality
- Lake restoration
- Estimating and determining impact of internal loading of nutrients in lakes/reservoirs
- Determination of realistic surface water quality expectations (TMDLs, nutrient criteria)
- Watershed and lake modeling
- Remote-sensing and GIS applications in water quality assessment and management
- Biological assessment of restoration and management technologies
- Obtain grant funding (\$7.95 million)
- Publish research, teaching, and extension articles (over 20 publications)
- Supervised and conducted lake and stream water quality sampling
- Supervised aquatic chemistry analytical laboratory
- Supervised technicians, undergraduate, and graduate students

Teaching Responsibilities:

- Taught courses in Limnology (study of lakes and streams) and Lake and Reservoir Management
- Taught a Natural Resource Seminar to undergraduates
- Advised undergraduate and graduate students

Extension Responsibilities:

- Supervised UNL's Lake Water Quality Extension Program
- Supervised UNL's Toxic Algae Outreach and Extension Program
- Assisted water resource managers, owners, regulators, and users with water quality related issues
- Produced written outreach publications on water quality problems and solutions
- Past member of Community Lake Enhancement and Restoration (CLEAR) team which provides Nebraska communities with technical and financial assistance to restore community lakes.

Co-chair and Technical Advisor, Nebraska Lake and Stream Nutrient Criteria Committee

Invited member of this group comprised of USEPA, Nebraska Department of Environmental Quality, and University of Nebraska personnel responsible for defining nutrient criteria for Nebraska.

Technical Advisor, USEPA Region VII Lake and Stream Regional Technical Assistance Group

Invited member of this group which is responsible for establishing realistic water quality expectations (nutrient criteria) for lakes, reservoirs, streams and rivers in KS, MO, IA, and NE. My role was to develop innovative statistical and modeling approaches to determining water quality expectations in agriculturally dominated ecosystems.

Assistant Director, Water Center, University of Nebraska

The Water Center is a unit within the UNL system that represents and coordinates all water-related faculty and activities (research, teaching and extension) at UNL. Responsibilities:

- Identify research funding opportunities for UNL's water faculty.
- Led multidisciplinary teams of faculty charged with obtaining large grants and conducting ecosystem level water-related research. In this effort, built and led research teams comprised of ecologists, hydrologists, GIS specialists, remote-sensing specialists, watershed modelers, soil scientists, agronomists, statisticians, engineers, resource managers/regulators, natural resource policy specialists, environmental consultants, computer software developers, economists, public policy specialists, and community laypeople.
- Assist in planning of Water Center activities, including research and teaching retreats, water resource tours, public outreach activities, website design, conferences, and staffing.

Board of Directors, North American Lake Management Society (NALMS)

- Elected to represent the Region VII members of NALMS, which includes the states of KS, MO, IA, and NE.
- Assisted with planning annual society budget, setting membership fees, society journal and magazine activities, planning annual conferences, planning conference sessions, and staffing decisions.

Research Project Manager, University of Nebraska

Responsibilities:

- Performed all aspects of an alum lake restoration project, including project design, obtaining grant funding, pre-project water quality monitoring, applying the chemical, post-application water quality monitoring, impact of treatment on lake biota, project evaluation, and final report/manuscript preparation.

HONORS AND AWARDS

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| 2001 | Environmental Council of the States Program Innovation Award in recognition of the accomplishments of the Community Lake Enhancement and Restoration (CLEAR) Program. |
| 1999 | North American Lake Management Society Technical Excellence Award for 1999 in recognition for Outstanding Research in Lake Restoration, Protection, and Management. |
| 1999 | Selected as a participant in the Dissertations Initiative for the Advancement of Limnology and Oceanography Symposium at the Bermuda Biological Station for Research |
| 1999 | Outstanding Water Resources Dissertation in the Field of Water Quality, Honorable Mention. The Universities Council on Water Resources. |
| 1997 | Best Student Presentation, 17th International Symposium of the North American Lake Management Society |

PUBLICATIONS (Selected)

- Gitelson, A.A., G. Dall Olmo, W. Moses, D.C. Rundquist, T. Barrow, T.R. Fisher, D. Gurlin, and J.C. Holz. 2008. A simple semi-analytical model for remote estimation of chlorophyll-a in turbid waters: Validation. *Remote Sensing of Environment* 112:3582-3593.
- Bulley, H., D. Marx, J. Merchant, J. Holz and A. Holz. 2008. A Comparison of Nebraska Reservoir Classes Estimated from Watershed-Based Classification Models and Ecoregions, *Journal of Environmental Informatics* 11:90-102.
- Eades, R., L. Richters, T. Barrow, J. Holz, P. Brakhage, and E. Traylor. 2008. Improving Nebraska lakes via the Community Lakes Enhancement and Restoration (CLEAR) program. R. Eades, J. Neal, T. Lang, K. Hunt, and P. Pajak, editors. *Proceedings of the 2007 Urban Fishing Symposium*. American Fisheries Society Special Publication. Bethesda, Maryland.
- Walker, S.R., J.C. Lund, D.G. Schumacher, P.A. Brakhage, B.C. McManus, J.D. Miller, M.M. Augustine, J.J. Carney, R.S. Holland, K.D. Hoagland, J.C. Holz, T.M. Barrow, D. C. Rundquist, and A.A. Gitelson. 2007. Nebraska Experience. H. Kenneth Hudnell (Ed.): *Proceedings of the Interagency, International Symposium on Cyanobacterial Harmful Algal Blooms*. *Advances in Experimental Medicine and Biology* 619:135-148.
- Bennett, D.M., S.C. Fritz, J.C. Holz, A.A. Holz, and V.A. Zlotnik. 2007. Evaluating climatic and non-climatic influences on ion chemistry in natural and man-made lakes of Nebraska, USA. *Hydrobiologia* 591:103-115..
- Bulley, H.N.N., J.M. Merchant, D.B. Marx, J.C. Holz, and A.A. Holz. 2007. A GIS-based approach to watershed classification for Nebraska reservoirs. *Journal of American Water Resources Association* 43:605-621.
- Wortmann, C.S., M. Al-Kaisi, J. Sawyer, M. Helmers, D. Devlin, c. Barden, P. Scharf, R. Ferguson, C.A. Shapiro, R. Spalding, D. Tarkalson, W. Kranz, J. Holz, D. Francis, J. Schepers. 2007. Agricultural nitrogen management for water quality protection in the Midwest. University of Nebraska RP 189
- Wortman, C.S., M. Helmers, A. Mallarino, C. Barden, D. Devlin, G. Pierzynski, J. Lory, R. Massey, J. Holz, C. Shariro, J. Kovar. 2006. Agricultural phosphorus management and water quality protection in the Midwest. University of Nebraska.
- Dall'Olmo, G., A.A. Gitelson, D.C. Rundquist, B. Leavitt, T.M. Barrow, and J.C. Holz. 2005. Assessing the potential of SeaWiFS and MODIS for estimating chlorophyll concentration in turbid productive waters using red and near-infrared bands. *Remote Sensing of Environment* 96: 176-187.
- Barrow, T.M. and J.C. Holz. 2003. Controlling pond plant growth with bottom barriers. *NebGuide: G03-1529-A*
- Barrow, T.M. and J.C. Holz. 2003. Bottom barriers for lakes and ponds: sources of supply. *NebFact: NF03-586*.
- Holz, J.C. 2000. Controlling pond algae with barley straw. *NebFact*. University of Nebraska Cooperative Extension NF00-429.
- Holz, J.C., K.D. Hoagland and A. Joern. 2000. Aquatic food web interactions: microcosms as lake models. *Proceedings of the 21st Conference of the Association for Biological Laboratory Education* 21:305-323.
- Hoagland, K.D. and J.C. Holz. 1999. Aquatic food web interactions: microcosms as lake models for teaching. *American Society of Limnology and Oceanography Bulletin* 8:24-25.
- Holz, J.C. and K.D. Hoagland. 1999. Effects of phosphorus reduction on water quality: comparison of alum-treated and untreated portions of a hypereutrophic lake. *Journal of Lake and Reservoir Management* 15:70-82.

- Holz, J.C., K.D. Hoagland, and A. Joern. 1999. Experimental Mesocosm Study of Phytoplankton Species Composition, Alternate Lake States, and Community Breakpoints Along a Phosphorus Gradient. American Society of Limnology and Oceanography Aquatic Sciences Meeting. (Abstract)
- Holz, J.C., K.D. Hoagland, R.L. Spawn, A. Popp, and J.L. Anderson. 1997. Phytoplankton community response to reservoir aging. *Hydrobiologia* 346: 183-192.
- Holz, J.C. and K.D. Hoagland. 1996. Experimental microcosm study of the effects of phosphorus reduction on plankton community structure. *Canadian Journal of Fisheries and Aquatic Sciences* 53:1754-1764.

Education

M.S. 1998,
School of Natural
Resources (University of
Nebraska, Lincoln)

B.S. 1996,
Forestry, Fisheries and
Wildlife (University of
Nebraska, Lincoln)

Affiliations

North American Lake
Management Society

American Fisheries Society

Years Experience

14

Tadd M. Barrow, M.S.

Water Quality Specialist

EXPERIENCE SUMMARY

Mr. Barrow is a cofounder of HAB Aquatic Solutions and has over 14 years of experience in fisheries, surface water quality/aquatic habitat management and research. While earning his M.S. from the University of Nebraska-Lincoln (UNL), Mr. Barrow's research advanced our understanding of the management of sensitive fish species related to unique water quality stressors, including assessing/interpreting/predicting the response of fishes to pollutants and the available aquatic biota. Mr. Barrow conducted research that advanced our ability to address numerous unique water quality challenges and pollutant effects. Specific areas of expertise include communication with public and private agencies and businesses discussing lake ecology and restoration and management, watershed management, biological indicators of water quality, phytoplankton ecology and management, nutrient inactivation (alum), determination of appropriate water quality goals, nutrient criteria development, water quality monitoring, water quality modeling, internal phosphorus loading, and determining impacts of toxic algae using water quality and biological information. In 2001, Mr. Barrow was honored for these achievements by the 1) Environmental Council of the States Program Innovation Award and 2) Nebraska Rural Development Commission receiving awards in recognition for work as part of the Community Lakes Enhancement and Restoration (CLEAR) program.



As a faculty member at UNL, Mr. Barrow obtained \$5.96 million in funding to support water quality research, authored over 15 publications, guest lectured courses in Limnology (the study of lakes and streams) and Lake and Reservoir Restoration, organized and led laboratory sections of limnology. Mr. Barrow established a nationally unique lake water quality volunteer monitoring program. Mr. Barrow is also a graduate of the National Extension Leadership and Development, which serves to build leadership and provide University Extension leaders the vision, courage and tools to lead in a changing world. Mr. Barrow is a recognized leader in water quality/aquatic habitat management and toxic algae assessment.

EXPERIENCE

Owner & Water Quality Specialist, HAB Aquatic Solutions, LLC

Responsibilities:

- Business Development
- Project Design
- Project Proposals
- Project Presentations and Reports
- Client Relations
- Water Quality Assessment
- Chemical Application and System Installation
- Bathymetric Mapping
- Application Equipment Design and Manufacturing
- Post-project Assessment
- Product Research and Development

Lake Water Quality Extension Educator and Water Resources Specialist, University of Nebraska

Extension related activities:

- Primary contact for lake water quality issues
- Member of four agency Statewide Alert Network providing weekly updates on toxic algae outbreaks
- Conducted radio interviews and utilized television news media to disseminate information on issues of toxic algae
- Assessed water quality problems and developed comprehensive management plans for public and private lakes
- Taught toxic algae workshops
- Created water quality articles for monthly on-line newsletters.
- Developed a Lake Water Quality website <http://water.unl.edu/lakes>
- Distributed lake test kits to participants in volunteer monitoring program

Research Projects and Responsibilities:

- Understanding causes of poor lake and stream water quality
- Research, develop, and assess water quality management tools (e.g., alum, aeration, dredging, watershed best management practices)
- Nutrient impacts on water quality
- Land-use impacts on water quality
- Lake restoration
- Estimating and determining impact of internal loading of nutrients in lakes/reservoirs
- Determination of realistic surface water quality expectations (TMDLs, nutrient criteria)
- Remote-sensing applications in water quality, algae assessment and management
- Biological assessment of restoration and management technologies
- Obtain grant funding (\$5.92 million)
- Publish research, teaching, and extension articles (over 15 publications)
- Supervised and conducted lake and stream water quality sampling
- Supervised aquatic chemistry analytical laboratory
- Supervised technicians, undergraduate, and graduate students

Teaching Responsibilities:

- Guest lecture in Limnology (study of lakes and streams) and Lake Reservoir Management
- Lead laboratory section of Limnology
- Guest lecture a Natural Resource Seminar to undergraduates
- Advised undergraduate and graduate students
- Instructed Jr./Sr. high students on basic lake ecology, the use of lake sampling equipment, lab analysis techniques, and data interpretation.

Extension Responsibilities:

- Supervised UNL's Lake Water Quality Extension Program
- Supervised UNL's Toxic Algae Outreach and Extension Program
- Assisted water resource managers, owners, regulators, and users with water quality related issues
- Produced written outreach publications on water quality problems and solutions
- Member of Community Lake Enhancement and Restoration (CLEAR) team which provides Nebraska communities with technical and financial assistance to restore community lakes.

Administrator for Water Based-Education for Nebraska's Educators, Youth and Families Program, University of Nebraska. Invited by Dean of Extension to administer grant and facilitate water based education workshops.

Graduating Member National Extension and Leadership Development. As a leader in the field of water quality, toxic algae and public education Tadd applied for and was accepted into the program. Attended sixteen days of workshops held in Colorado Springs, Orlando, Washington D.C. and Seattle serving to build leadership and provide University Extension leaders the vision, courage and tools to lead in a changing world.

HONORS AND AWARDS

- 2001 Environmental Council of the States Program Innovation Award in recognition of the accomplishments of the Community Lake Enhancement and Restoration (CLEAR) Program.
- 2001 Outstanding 100 Rural Development Initiatives. Nebraska Rural Development Commission. In recognition of the CLEAR Program

PUBLICATIONS (Selected)

- Barrow, T.M. 2010. Controlling pond plant growth with bottom barriers. NebGuide 2025 Extension, IANR, UNL.
- Gittleson, A., D. Gurlin, W. J. Moses and T. Barrow. 2009. A bio-optical algorithm for the remote estimation of the chlorophyll-a concentration in case 2 waters. Environmental Research Letters 4 (2009) 1-5.
- Gitelson, A.A., G. Dall'Olmo, W. Moses, D. C. Rundquist, T. Barrow, T. R. Fischer, D. Gurlin, and J. Holz. 2008. A simple semi-analytical model for remote estimation of chlorophyll-a in turbid waters: Validation. Remote Sensing of Environment. 112 (2008) 3582-3593.
- Janssen, D. and T.M. Barrow. 2008. Stormwater Management: Yard Waste Management. University of Nebraska-Lincoln. NebGuide G1855.

- Walker, S., Lund JC, Schumacher DG, Brakhage PA, McManus BC, Miller JD, Augustine MM, Carney JJ, Holland RS, Hoagland KD, Holz JC, Barrow TM, Rundquist DC, Gittleson AA. 2008. Nebraska Experience. Cyanobacterial Harmful Algal Blooms: State of the Science and Research Needs. In K. Hudnell (ed.), *Advances in Experimental Medicine and Biology* 619:135-148.
- Eades, R., L. Richters, T. Barrow, J. Holz, P. Brakhage, and E. Traylor. 2007. Improving Nebraska lakes via the Community Lakes Enhancement and Restoration (CLEAR) program. R. Eades, J. Neal, T. Lang, K. Hunt, and P. Pajak, editors. *Proceedings of the 2007 Urban Fishing Symposium*. American Fisheries Society Special Publication. Bethesda, Maryland.
- Dall'Ollmo, G. A.A. Gitelson, D.C. Rundquist, B. Leavitt, T.M. Barrow and J.C. Holz. 2005. Assessing the potential for SeaWiFS and MODIS for estimating chlorophyll concentration in turbid productive waters using red and near-infrared bands. *Remote Sensing of Environment*. 96(2): 176-187.
- Barrow, T.M. and E. J. Peters. 2001. Movements of rainbow trout in response to dissolved oxygen and food availability in Lake Ogallala, Nebraska. *Journal of Freshwater Ecology*. 16(3): 321-329.
- Barrow, T.M. and J. C. Holz. 2003. Bottom barriers for lakes and ponds: Sources of supply. NebFact NF03-586. Cooperative Extension, IANR, UNL.
- Barrow, T.M. and J. C. Holz. 2003. Controlling pond growth with bottom barriers. NebGuide 603-1529-A.

OTHER PUBLICATIONS: ARTICLES, MAPS, SOFTWARE

- Barrow, T.M. 2010. Lawn Maintenance Around Ponds. *Acreage & Small Farm Insights Monthly Newsletter* (April). University of Nebraska Lincoln - Extension.
- Barrow, T.M. 2010. Filamentous Algae Control around ponds. *Acreage & Small Farm Insights Monthly Newsletter* (May). University of Nebraska Lincoln - Extension.
- Barrow, T.M. 2010. Extra Care to Fertilizer Application can help maintain ponds. *Educator Extra Monthly Newsletter* (May). University of Nebraska Lincoln - Extension
- Barrow, T.M. 2010. Fertilizer Runoff can Create Deadly Water. *Educator Extra Monthly Newsletter* (June). University of Nebraska Lincoln - Extension
- Ogg, Clyde L., Erin Bauer, Project Coordinators and Tadd M. Barrow, Content Specialist. 2010. *Aquatic Pest Control Recertification DVD*. University of Nebraska-Lincoln.
- McManus, B., Augustine, M., Tunik, D., Barrow, T. 2010. Toxic Blue Green Algae Health Alerts. Weekly Press Release collaboration through Nebraska Department of Environmental Quality. May-October 2009.
- McManus, B., Augustine, M., Tunik, D., Barrow, T. 2009. Toxic Blue Green Algae Health Alerts. Weekly Press Release collaboration through Nebraska Department of Environmental Quality. May-October 2009.
- Ogg, Clyde L., Erin Bauer, Project Coordinators and Tadd M. Barrow, Content Specialist. 2009. *Aquatic Pest Control Recertification DVD*. University of Nebraska-Lincoln.
- McManus, B., M. Augustine, D. Tunik and T. Barrow. 2008. Toxic Blue-Green Algae Health Alerts. Weekly Press Release collaboration through Nebraska Department of Environmental Quality. May-October 2008.

- Barrow, T.M. 2008. Toxic Algae Volunteer Monitoring Program. Acreage & Small Farm Insights Monthly Newsletter. University of Nebraska Lincoln - Extension.
- Barrow, T.M. 2008. Aquatic Plant Control with Herbicides. Acreage & Small Farm Insights Monthly Newsletter. University of Nebraska Lincoln - Extension.
- Barrow, T.M. 2008. Pond Management Tool: Surface Area and Volume Calculators. Webpage development. University of Nebraska-Lincoln. <http://water.unl.edu/lakes>
- Fech, J. C., D. Janssen, S. Skipton and T. M. Barrow. 2007. English to Spanish Guide for Communication for the Service Industry. University of Nebraska-Lincoln Extension.
- Barrow, T.M. 2007. Toxic Algae in Nebraska Lakes. Water-Related Research In Brief: Information for Nebraska's Water Resources Decision-Makers.
- Ogg, C.L., E. Bauer, T.M. Barrow and K. Hoagland. 2006. Aquatic Pest Control Initial DVD. University of Nebraska-Lincoln, Extension.
- Ogg, C.L., E. Bauer, T.M. Barrow and K. Hoagland. 2006. Aquatic Pest Control Recertification DVD. University of Nebraska-Lincoln, Extension.

SELECTED PROJECT DESCRIPTIONS

Grand Lake St. Marys

Grand Lake St. Marys, a 13,500 acre lake located in west central Ohio, was the site of the world's largest alum treatment in June 2011. Multiple annual treatments are anticipated to deliver the full alum dose. During the first year of the project (June 2011), a 4,900 acre middle portion of the lake was treated by HAB Aquatic Solutions with 2.6 million gallons of aluminum-based products. This first dose represented 42% of the required full dose for the center portion and only 12% of the full dose needed for the entire lake. However, the lake is already showing signs of improvements after this light application. The improvements are presented in an independent study prepared by the consulting firm Tetra Tech (visit www.habaquatics.com for the full report).



The alum treatment resulted in the following changes:

- Total phosphorus declined 20-30% in the mid lake treated area
- Total phosphorus declined 56% at the central sampling of the mid lake treated area. Indicating results attainable if the entire lake was treated at 42% of the recommended dose
- Concentrations of the nerve and liver toxin microcystin did not reach levels as they did in 2010
- All major lake events occurred in 2011, many of which were cancelled in 2010 due to toxin levels

Carter Lake

Carter Lake is a 315 acre oxbow lake along the Missouri River between Nebraska and Iowa. Elevated phosphorus levels resulted in cyanobacteria (a.k.a. blue-green algae) blooms and subsequent microcystin algae toxin production. From 2005-2008, beach warnings were posted for 21 of the 80 weeks of peak summer recreation. A whole lake alum treatment was completed in May 2010, a success story jointly published by Nebraska and Iowa officials can be viewed at www.habaquatics.com.



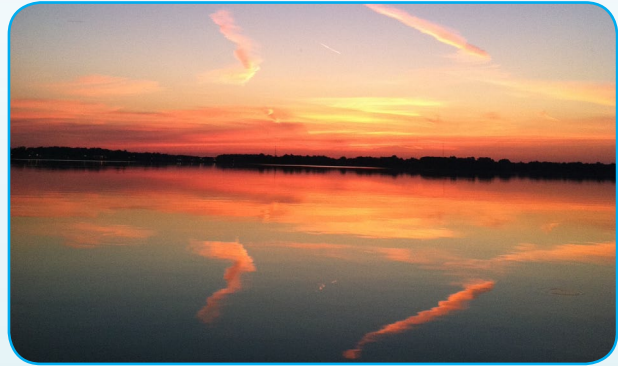
The alum treatment resulted in the following changes:

- Total phosphorus declines of 72%
- Total nitrogen declines of 52%
- Algae toxins are virtually non-detectable and beaches have not been closed since the treatment
- Water clarity has improved
- Newly stocked game fish have flourished
- The lake is proposed to be removed from USEPA's Clean Water Act section 303(d) list for impaired waters due to algae toxins

SELECTED PROJECT DESCRIPTIONS

Fremont State Lake #20

Fremont State Lake #20 is a 50 acre sandpit located in eastern Nebraska along the Platte River. By 2005, the lake had very high phosphorus concentrations and significant toxic cyanobacteria (blue-green algae) blooms. Algal toxins lead to lake closures during the summer recreation season. Average total phosphorus concentration was 139 ppb, chlorophyll a concentration was 100 ppb and water clarity was only 14 inches. Alum and sodium aluminate was added to the lake in May, 2007 to control internal phosphorus loading, resulting in less algae and better water quality.



In the three summers after the alum treatment (2007-09):

- Total phosphorus was reduced by 85% to 21 ppb
- Chlorophyll a (algal abundance) was reduced by 92% to 8 ppb
- Water clarity increased by over 8 feet
- Algal toxins were eliminated and the lake was re-opened for recreation
- Visit www.habaquatics.com to read a full report on this project
- The lake was removed from USEPA's Clean Water Act section 303(d) list for impaired waters

Lake Ventura

Lake Ventura is a sandpit lake located near the Platte River in eastern Nebraska. Water quality deteriorated with increased internal loading and total phosphorus in the water column ranged well over 100 ppb. In May of 2007, Lake Ventura was treated with alum and sodium aluminate to control internal phosphorus loading and generally improve water quality. Phosphorus levels were monitored during the summers of 2007-2009 to determine the effectiveness of the treatment in controlling internal loading and reducing the amount of phosphorus in the lake.



Dissolved phosphorus was monitored three feet above the lake bottom as an estimate of the amount of phosphorus leaving the sediments. The treatment reduced dissolved phosphorus near the bottom from 192 ppb (pre-treatment) to 8.6 ppb (post-treatment average). This indicates a 96% reduction in internal phosphorus loading.

Total phosphorus levels were also monitored three feet below the lake surface to determine how much phosphorus was available to fuel algal growth. Total phosphorus was reduced by 77% from 130 ppb (pre-treatment) to 30 ppb (post-treatment average).

SELECTED PROJECT DESCRIPTIONS

Lake Leba: A Case Study

Lake Leba was the site of an experimental alum research project. A small portion of the lake was completely isolated from the main lake and the smaller portion received an alum treatment. The effects of the alum on water quality were then compared to the untreated main lake for a period of three years. The results of the study were published as a scientific research article in the *Journal of Lake and Reservoir Management*. The results of the experiment are summarized below (visit www.habaquatics.com to view the entire research article).



The treatment resulted in the following changes in water quality over the three year experiment:

- 97% reduction in internal phosphorus loading
- 74% reduction in phosphorus in the water column
- 65% reduction in chlorophyll (a measure of the amount of algae)
- 134% increase in water clarity