

## Harry L. Gibbons, Jr., PhD

*Limnologist/Discipline Lead for Lake and Water Quality*

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| Education:           | Ph.D. 1981, Limnology (Washington State University); M.S. 1976, Environmental Engineering (Washington State University); B.S. 1973, Biology (Gonzaga University)                                                                                                                                                                                                                   |
| Affiliations:        | North American Lakes Management Society, Immediate Past President 2010, President 2009, President Elect 2008, Director 2004-2006, 1992-1994, Served on several Society Committees; Washington State Lake Protection Association, Past President; Western Aquatic Plant Management, Past Director; American Society of Limnology and Oceanography; Aquatic Plant Management Society |
| Years of Experience: | 40                                                                                                                                                                                                                                                                                                                                                                                 |
| Years with Tt:       | 30                                                                                                                                                                                                                                                                                                                                                                                 |

Dr. Gibbons has 40 years of experience in applied limnology, lake, reservoir, river, stream, and wetland restoration. Harry has specifically planned/designed management and restoration programs for over 250 lakes/reservoir and 40 stream and river systems. His expertise includes lake and watershed management, lake restoration, integrated aquatic plant management, aquatic invasive species (AIS) management, stream assessment, fish passage, aquatic habitat assessment, wetland restoration and stormwater management. Harry is a recognized leader in the development and implementation of in-lake activities for techniques like phosphorus inactivation (alum), dredging, hypolimnetic aeration, aeration and complete circulation, AIS management, and integrated aquatic plant management. In addition, he has conducted comprehensive river and reservoir limnological studies in several major river systems including the Columbia, Snake, Spokane, Clearwater, Chehalis, Green, Wynoochee, Susitna and Pend Oreille Rivers, including 15 hydroelectric reservoirs. These investigations have centered on water quality, primary and secondary productivity, fisheries habitat and passage, AIS management, and toxicology (i.e. Mercury).

Harry has been senior scientist on a number of watershed projects with the intent to inventory and assess aquatic resources and develop non-point source control solutions to enhance the water quality of the stormwater runoff from forested, agricultural, rural, and urban landscapes. In addition, he has worked to define stream enhancements that improve fish passage and habitat. Harry has developed detailed approaches and designs for structural and non-structural BMPs for water quality problems including TMDL compliance issues. He has prepared and designed the implementation of TMDLs and influenced the change in regulator frame work both as expert witness and as technical author for federal, state and local legislation. His in-lake and wetland BMP designs have earned him environmental excellence awards for example Phantom/Larsen Lakes and Lake Stevens restoration have received award honors from the Consulting Engineering Council of Washington for excellence in environmental projects in 1993 and 1995. Both projects included hypolimnetic aeration, stream and wetland restoration, stormwater BMPs and habitat enhancement. In 2012, Harry was given the Secchi Disk Award by the North American Lake Management Society for his outstanding technical contributions and service to help promote lake management.

Harry has authored numerous technical reports and limnological journal and magazine articles, he has also co-presenter and author for the *Phosphorus Inactivation & Interception Workshop & Manual, 2002-14*, co-author of *A Citizen's Manual for Developing an Integrated Aquatic Vegetation Management Plan* for the Washington State Department of Ecology, NALMS' *Aquatic Plant Management in Lakes and Reservoirs*, 1996 for EPA, and *Guide for Developing Integrated Aquatic Vegetation Management Plans in Oregon*, Portland State University, 1999.

### SUMMARY OF PROJECT EXPERIENCE

#### **Susitna Hydroelectric Project Baseline Water Quality Monitoring and Modeling, Alaska Energy Authority, Alaska, 2012-2016.**

Project Manager for development of technical documentation describing baseline water quality, toxics, water quality monitoring programs including mercury and water quality modeling for compliance with the Federal Energy Regulatory Commission requirements for development of a new large-scale dam on the Susitna River. Dr Gibbons has developed and is implementing several studies that are responding to regulatory agency concerns and is responsible for organizing the Tetra Tech technical team products and presentations. The project is on the Susitna River northeast of Anchorage, Alaska and extends more than 300 miles northeast into the Denali National Park. An extensive water quality parameter list is being collected (including nutrients) to determine how the presence of a dam will impact water quality and side-channel sloughs. All of these



habitats currently host anadromous and resident fisheries. Water quality conditions are primary drivers for changes expected to occur following completion of the dam and will be used to predict how dam operations will influence water quality conditions throughout the Project area.

**Black Lake Integrated Aquatic Vegetation Management Plan, Thurston County, WA, 2011**, - Dr. Gibbons is the senior limnologist and project manager for the Black Lake Integrated Aquatic Vegetation Management Plan (IAVMP). The project purpose is to develop a long-term strategy to be implemented by Thurston County and citizens of the Save Black Lake Coalition to eradicate milfoil, fragrant waterlily, and yellow iris from Black Lake and to have a quick response protocol in place if milfoil or other non-native species are re-introduced into the lake. At the same time the IAVMP will serve as a guide to continue improving existing beneficial and recreational uses, and insure water quality meets future demands.

**Scriber Lake Water Quality Investigation and Conceptual Design, City of Lynnwood, WA, 2011-2014** – Dr. Gibbons is the lead limnologist and project manager for the project, which has as its primary purpose to design how to improve the lake's water quality as indicated by water clarity, algal abundance organic matter content and increased oxygen content. The project is planned to proceed in a phased approach in order to maximize the effectiveness of implementation activities such as hypolimnetic aeration and floating islands. The first step is a study designed to determine which procedure(s) and options to those alternatives should be most cost effective implementation measures. Starting in 2013, phosphorus inactivation design will be complete for the implementation in April – May 2014.

**Colorado-Big Thompson Project West Slope Collection System Appraisal Study Grand County, CO, 2011-2012** – Dr. Gibbons is the senior limnologist relative to the appraisal study. The project purpose is to develop and analyze alternatives to improve water clarity in Grand Lake without adversely affecting the C-BT project, and without diminishing water quality in Grand Lake, Shadow Mountain Reservoir and Granby Reservoir. Alternatives will be evaluated for benefits and cost; ability to solve the identified problems, meet needs, and optimize opportunities; completeness in achieving project goals; and environmental and social acceptability.

**Grand Lake Saint Mary's Restoration Feasibility Study and Demonstration Design, OH, USEPA 2011-2014**. Dr Gibbons was the senior limnologist providing on-going advise to Ohio/EPA, USEPA, Ohio/DNR on data needs and approaches to addressing the excessive phosphorus loading to the lake and internal cycling of phosphorus within the lake leading to toxic cyanobacteria blooms (harmful algal blooms – HABs). Over 80 different alternative methodologies were reviewed and evaluate leading to a phosphorus inactivation demonstration to control limit phosphorus and reduce HABs production. Harry designed and directed implementation of several demonstrations projects and lead the feasibility and design of a whole lake activities to control the cyanobacteria in the lake including the design, and oversight of the implementation of the world's largest alum treatment in 2011 and again in 2012.

**Lake Tapps Integrated Aquatic Vegetation Management Plan, Cascade Water Alliance, Pierce County, WA, 2009 to 2015** – Lake Tapps is a 2,750 acre off-channel reservoir infested with invasive Eurasian watermilfoil. Dr. Gibbons lead the development of the Lake Tapps Integrated Aquatic Vegetation Management Plan based on Washington Department of Ecology guidance. The purpose of the plan is to provide a long-term strategy for Cascade to eradicate milfoil from Lake Tapps. Harry was responsible for all aspects of the IAVMP and on-going implementation support including surveying the lake to estimate plant density, summarizing the pros and cons of various aquatic plant control methods and the applicability of each in Lake Tapps, participating in public meetings, identifying beneficial and recreational uses, and making recommendations leading to the eradication of Eurasian watermilfoil from Lake Tapps while preserving a robust native plant community. This ongoing project involves additional aquatic plant surveys, management recommendations to support the milfoil eradication goal (this includes strategic use of herbicides with aggressive hand removal), and assistance with education and outreach.

**Lake Tahoe Basin Aquatic Invasive Species Plan, US Army Corps of Engineers, Sacramento District, CA and NV, 2007-2010** – Dr. Gibbons is the Principal Aquatic Ecologist for Aquatic Invasive Species (AIS) Management Plan that is part of a multi-stakeholder collaborative effort supported by an interagency agreement between the U.S. Army Corps of Engineers (USACE) (Sacramento District) and the California Tahoe Conservancy. The purpose of the Plan is to minimize the deleterious effects of AIS in the Lake Tahoe Basin by 1) preventing new introductions of AIS to the Tahoe Basin, 2) limiting the spread of existing AIS populations in the Tahoe Basin, and 3) abating harmful ecological, economic, social and public health impacts resulting from AIS. Plan elements include: 1) summaries of existing and potential AIS, current and potential management strategies, introduction pathways, and existing programs and regulations, 2) an analysis of economic impacts, 3) facilitation of stakeholder discussions to identify lead entities for implementing management actions, and 4) coordinating with the Aquatic Nuisance Species Task Force (ANSTF) to facilitate Plan approval. The ANSTF is an intergovernmental organization responsible for implementing mandates under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA).



**Snohomish County On-call Limnological Services, Snohomish County, WA, 1994-2015.** – Dr. Gibbons is the senior limnologist for Snohomish County’s lakes program. Harry provides assistance to County Staff in a variety of issues relative to the 35 lakes in their monitoring and management program. Examples include development of nutrient loading models, non-native species management of AIS and the development of integrated aquatic plant management plans, and alum treatments for several lakes and evaluation of existing aeration systems and feasibility design analysis for future potential aeration systems.

**Kent Lakes Monitoring, City of Kent, WA, 2003-2015** – Dr. Gibbons is the lead limnologist for annual monitoring of Lakes Fenwick, Meridian. This on-going monitoring program is design to track the current condition of the lake and to identify any potential environmental issues before they become significant problems from Cyanobacteria and aquatic plant management. Evaluation and assessment of the hypolimnetic aeration system design by Harry in the early 1990’s is also part of this effort. In 2009 and 2010 Harry led the retrofit design of the aeration system to improve its phosphorus control and habitat enhancement capabilities.

**Long Lake Integrated Lake Management Program, Kitsap County, WA, 2006-2010** – Dr. Gibbons is the lead limnologist and project manager for this 5 year integrated lake management program to enhance the water quality and lake conditions of Long Lake. Adaptive project elements include design and implementation of phosphorus inactivation, aquatic plant management, monitoring, and public awareness programs.

**Lake Limerick Limnological Services, LLCC, WA, 2001-2015** – On-call limnologist assisting the LLCC in the management of water quality, including a water quality monitoring program, aquatic plant management program, aquatic plant management implementation and potential algal bloom control.

**Six Counties Aquatic Resources Inventory, US Army Corps of Engineers, Sacramento District, 2009-2010** – Dr. Gibbons is the aquatic scientist to help develop a consistent categorization and geospatial characterization of aquatic resources within the Six County Area to aid local, state and federal agencies in making better informed and efficient decisions regarding proposed development and other activities. The six counties are El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba.

**Sunnyside Ecosystem Restoration, Yakima County, US Army Corps of Engineers, 2001-2011** – Project manager for the feasibility and design of a 240 acres riparian habitat wetland for the Port of Sunnyside using industrial treated effluent as the wetlands primary water supply. This feasibility study includes design elements through 35% to create the wetland habitat and infiltrate 2 to 4 MGD into the groundwater. This water will increase the cold water base flow groundwater discharge to the Yakama River address ESA and TMDL issues at the river. The design has been reduced to stage 1 construction 150 acres of wetland and upland habitat. The Yakima River has seen extreme reduction in historical wetland and riparian habitat. This project uses the Port of Sunnyside effluent to create riparian wetlands along the east bank of the Yakima River and restore lost floodplain wetland habitat. The wetland system consists of various weirs, channels, and a culvert to route water through three main wetland habitat areas that vary in size, vegetation, geometry, and depth to provide habitat diversity. After routing through the final wetland area, water is infiltrated into the groundwater through an infiltration trench, recharging river base flows and reducing TMDL issues in the Yakima River.

**Sunnyside Pilot Wetland Treatment Design and Study, Yakima County, Port of Sunnyside, 2010-2012.** – Project manager for the feasibility and design study for polishing treatment wetlands utilizing secondarily treated industrial waste water. The goal is to design a wetland system that will increase the water quality of the effluent before it is discharged to the riparian habitat wetlands along the Yakama River. Specific parameters to be address include salt, phosphorus, and temperature.

**Boundary Dam FERC Hydroelectric Relicensing Studies, Seattle City Light, Pend Oreille County, WA, 2007-2009** – Dr. Gibbons was the Water Resources Lead for Tetra Tech in the recent Seattle City Light FERC hydroelectric relicensing efforts for Boundary Dam, located near the US-Canadian border on the Pend Oreille River. Studies lead by Harry included Toxics, Water Quality, Aquatic Macrophytes, Aquatic Habitat Model Analysis and Model, and Aquatic Production.

The Boundary Toxics Assessment Study was conducted in response to active and historic mining operations to assess the possible toxic impacts that may have resulted from the metal input into the river. Boundary Toxics Assessment Study has completed and FERC has approved all 3 elements of this complex study effort. The first element was the FERC-approved Phase 2 SAP (SCL 2007b), which was a detailed sampling plan including toxic pathways analysis. The second element of the Toxics Study was to conduct the field sampling for water, sediment pore-water, and sediment and produce an Initial Study Report (ISR) that addressed the results of the sampling relative to the Toxics Pathways. This ISR was approved by FERC on September 24, 2008. Third element of the Toxics Study was to conduct additional sampling in the fall of 2008 to confirm the results and study conclusions made in the ISR.



The goal of The Boundary Water Quality and Productivity Study was to evaluate existing water quality conditions in and immediately downstream of Boundary Reservoir in support of the application for Section 401 certification and Fish and Aquatics Resource studies. This goal was accomplished by addressing two objectives. The first was to characterize water quality conditions in and immediately downstream of Boundary Reservoir to determine whether the Project meets Ecology's water quality standards in support of the Section 401 application. The second was to determine water quality, nutrient, primary production, and zooplankton levels in support of the assessment of reservoir productivity being conducted as part of the Fish and Aquatic Resources studies. To meet this second objective, samples were collected seasonally in both the pelagic (mid-river channel) and littoral (shoreline) zones of the reservoir.

The goals of Aquatic Macrophyte DO and pH study were 1) to assess whether macrophytes are contributing to high pH and low DO readings in Boundary Reservoir, and 2) to investigate potential indirect effects of Project operations on pH and DO via macrophytes. To achieve these goals the magnitude of the impact macrophyte respiration/photosynthesis and senescence have on pH and DO levels was determined. In addition, the effect of Project operations, specifically inundation and frequency of dewatering, on changes in pH and DO in macrophyte beds was also determined.

The goal of the Mainstem Aquatic Habitat Modeling Study and its component study efforts is to provide quantitative indices of the effects of operations scenarios on aquatic habitats for macrophytes, periphyton, and benthic macroinvertebrates.

The goal of the Productivity Assessment study was to determine the effects of current Project operations (e.g., wet, dry, and average hydraulic conditions) and operations scenarios on primary and secondary production in Boundary Reservoir. The objective of this study was to quantify indices of primary and secondary production in reaches of the Pend Oreille River within the Boundary Project area under current (wet, dry, and average hydraulic conditions) and operations scenarios. The Productivity Assessment consisted of evaluating nutrients, phytoplankton, periphyton, and macrophytes as indices of primary production and zooplankton and BMI as indices of secondary production.

**Long Lake Phosphorus Inactivation Assessment, Thurston County, WA, 2006-2008** – Dr. Gibbons assisted Thurston County and the citizens of Long Lake in the assessment and design and implementation of the phosphorus inactivation of the South Long Lake basin.

**Wapato Lake Water Quality Investigation, Tacoma Parks, WA, 2006-2009** – Dr. Gibbons was called upon to lead the water quality investigation into the environmental problems that have led to mysterious deaths of waterfowl, fish, and turtles at this lake. The study centered on the causes of massive toxic Cyanobacteria blooms and the environmental conditions that follow leading to the design and implementation of a phosphorus inactivation treatment in 2008 using the highest aluminum dose used in the state to date. Since the treatment Cyanobacteria blooms have been greatly reduced and non-toxic.

**Tukwila Pond Management Evaluation and Implementation Design Tukwila, WA, City of Tukwila, 2006 – 2009** – Dr. Gibbons was asked to review the available environmental information on the pond and to outline a management program for future feasibility study. This program would enhance the wildlife and fisheries habitat while improving water quality and increases the human urban experience. He then led his team in the design of an aeration/circulation system with alum injection system to improve water quality condition within the pond.

**Bear Lake Alum Treatment and Water Clarity Project, Bear Lake Preservation Association, FL, 2006-2007.** – Dr. Gibbons led the Citizen groups monitoring and analysis program leading to the design and implementation of an alum treatment of the lake in 2007.

**Green Lake Alum Treatment, Seattle, WA, Seattle Parks, 2003-2005** – Tetra Tech assisted the Seattle Department of Parks and Recreation in improving water quality and preventing toxic algal blooms in Green Lake via an alum treatment to inactivate phosphorus. Dr. Gibbons was the lead limnologist for the project. Dr. Gibbons was responsible for overseeing all technical elements of the Green Lake Alum treatment including, alum jar test procedures and alum dose calculations. Dr. Gibbons was also responsible for the QA/QC of the alum dose calculations and formulating construction specifications. Dr. Gibbons attended multiple meetings with Seattle Parks and potential contractors and made a recommendation as to which bidder should be awarded the contract. Dr. Gibbons was primarily responsible for providing engineering and scientific directives during construction to both the contractor and engineer on site. He reviewed lake water quality data and alum floc behavior daily in order to determine the schedule of the treatment.

