

## Principal Areas of Expertise:

- Water Quality Assessment and Management
- Watershed and Water Resource Management
- Water Quality Standards and Attainment
- Pollutant Fate & Transport
- Corporate Sustainability and Stewardship
- Resource Restoration and Remediation
- Computer Applications & Modeling
- Environmental Regulations & Compliance



## Education

- MSE Water Resources - Civil Engineering, Cum Laude  
The University of Michigan, Ann Arbor, Michigan, 1973
- BSE Science Engineering, Cum Laude  
The University of Michigan, Ann Arbor, Michigan, 1972

## Registration/Certification/Recognition

Professional Engineer, States of Illinois, Ohio and Michigan  
Board Certified Environmental Engineer (Diplomate), American Academy of Environmental Engineers and Scientists  
Member of National Academy of Engineers

## Experience Summary

Mr. Freedman is co-founder and CEO of LimnoTech. Since 1975, he has provided guidance and leadership for LimnoTech on over 3,500 water projects throughout the U.S. and around the globe. Mr. Freedman strives to emphasize the use of advanced science and engineering innovations to help clients make the best decisions. Mr. Freedman is known in the industry as a thought and technology leader. He has been a pivotal player in the advancement of important new technologies, approaches and policies both directly and now more so through his guidance and oversight of staff.

A cornerstone of his career and at LimnoTech has always been the use of computer simulation models for rivers, lakes, estuaries and watersheds. Both he and LimnoTech are well known for advancements in the use of models in decision support, regulation and management. Mr. Freedman is recognized for his expertise in water quality analysis and fate/transport modeling of pollutants, as they relate to regulation, restoration and watershed management. He was an early pioneer of eutrophication and toxic models, probabilistic modeling, micro-PC models, graphic user interfaces, and integrated watershed and receiving water models.

Mr. Freedman has been a pivotal leader in promoting the advancement and adoption of watershed management approaches in the U.S. to address urban, agricultural and rural water issues. He was an early advocate for watershed management, co-chairing with Federal agencies among the earliest national conferences on watershed management, and he has been a recognized expert in TMDLs. He has provided extensive training for state regulators on behalf of

EPA, conducting millions of dollars in groundbreaking research, authored scores of presentations and papers and developed and/or reviewed hundreds of TMDLs.

Mr. Freedman also has broad experience in the assessment, regulation, modeling, management and control of stormwater and urban CSOs for dozens of major cities, and has been an early and ongoing advocate for green practices, a necessary element of urban redesign to not only reduce stormwater pollution and flooding but also improve resilience to impacts from climate change and improve livability.

On a national and global basis, Mr. Freedman has helped pioneer new approaches to address problems related to energy-water nexus, food-water nexus, and water sustainability. He has been a significant thought and technology leader in developing new approaches for corporate water stewardship, including water footprints, water risk assessment and reporting, water balance/-replenish methodologies, and helped develop and pilot test the global AWS standard for water stewardship.

Mr. Freedman has worked for a diverse range of clients including international, national, state/provincial and regional government agencies, major cities and utilities, Fortune 500 global corporations, nonprofits and research organizations. He has not only provided research and consulting to these clients but also training, guidance and policy support.

Mr. Freedman's extensive professional involvement helps ensure that clients are served using the most up-to-date technical, regulatory and policy information, as well as the

best experts. As one example, Mr. Freedman was President of the Water Environment Federation (WEF), provided key leadership forming several committees including Watershed Management and Sustainability Community of Practice and chairing Government Affairs. WEF is a professional organization with 75 affiliated Member Associations representing water quality, water supply, and wastewater professionals around the world.

Mr. Freedman has organized or taught in dozens of technical training courses, provided over 250 technical presentations and papers, been involved in more than two

dozen committees and work groups, and chaired six national and international conferences on watershed management issues. Mr. Freedman was also past Chair of Water Supply and Wastewater Certification Subcommittee for the American Academy of Environmental Engineers, and has been on two National Academy of Sciences, National Research Council expert panels and was a reviewer for three others. He was founding co-chair of the U.S. Federal Advisory Committee on Water Resource Adaptation to Climate Change, and a long-time member of the Federal Advisory Committee on Water Information (ACWI).

## Summary of Individual/Corporate Experience

Paul Freedman is Co-Founder (1975) and CEO of LimnoTech. For almost a half century now, Mr. Freedman's experience and accomplishments are intimately commingled with those of LimnoTech. In the first few decades, he had direct involvement in most every project, but he continues to maintain involvement in all professional activities through his leadership, guidance, review and/or oversight, if not additionally direct project roles.

Mr. Freedman and LimnoTech under his direction were among the early pioneers in engineering, consulting to incorporate computer modeling/analysis into environmental projects. This approach has grown to become an integral part of the new field of environmental engineering. LimnoTech specializes in assessment, remediation and management in the natural water environment helping governments and industries solve water challenges. With Mr. Freedman's oversight, LimnoTech has conducted over 3,500 projects in all 50 states and around the globe for Federal, state and local governments, major NGOs, research institutions and large corporations.

Mr. Freedman and LimnoTech were among the earliest to bridge the gap in the water quality field between engineering firms focused on infrastructure solutions and scientific firms focused on just characterizing biologic conditions. Paul also had the vision to move beyond just designing and building large traditional infrastructure to address water quality and environmental problems holistically, looking at whole systems and the science behind them to understand the connections and interactions between the land, water and human impacts. This vision brought forward the field of environmental science, the utility of water quality analysis, and the idea of also using nonstructural "green" solutions. These ideas and the use of computers are now an integral part of our toolkit, and in many ways, have helped to create a new category of professional environmental engineering firms that have been highly beneficial in terms of addressing water quality and environmental problems.

**Model innovations:** Mr. Freedman individually and through LimnoTech has, for over four decades, advanced the use and development of new computer modeling technologies for water assessments and their use to develop science-based remediation and management strategies. Before the 1970s, use of computer models in the water field were rare, but today they are common and integral to the assessment and management of water

quality and water resources. Mr. Freedman and his company were early pioneers in this advancement, with thousands of computer applications on main frame, PC, tablets, and phones, with numerous new developments dating back to 1975 and continuing today. LimnoTech was among the pioneers in developing eutrophication and toxic models, river and estuary models, watershed models, probabilistic modeling, micro PC-based models, computer data and model visualizations, interactive model frameworks, integrated watershed and water quality models, sewer system and tunnel models, and many other advances in modeling used for design, management and decision support. LimnoTech remains a significant player in the environmental industry promoting further development of scientific and technological advances and creating new approaches for water and ecosystem assessment and management using various models and computerized decision support tools, including automated incorporation of monitoring data from sensor networks. For example, LimnoTech staffs and manages the Army Corp of Engineers Environmental Research and Development Center water modeling program, the premier agency engaged in extensive new model developments and support for many of the most commonly used computer models.

**Great Lakes and large ecosystems:** Under Mr. Freedman's direction, LimnoTech has been a key contributor in developing models and restoration and management strategies for many large water bodies. This includes as example, the Great Lakes, and numerous other water bodies such as the Everglades, Gulf of Mexico, the Potomac, Ohio, Mississippi, Missouri and Columbia Rivers and San Francisco, Narraganset and Chesapeake Bays to name just a few. In the Great Lakes Basin LimnoTech has become recognized as a leading research organization. We have developed eutrophication, toxic algae and toxic substance models in all the Great Lakes, and results have been used since the 1970s and through today to establish international and local strategies for restoring and protecting the Great Lakes. LimnoTech has also been key innovators and researchers in evaluating the problems and solutions related to invasive species, habitat restoration, and water level management. Today our models are being used to support international negotiations on water level management and establish target nutrient loads for the Great Lakes. LimnoTech has also been extensively involved in analyzing strategies restoring Great Lakes Areas of Concern harbors, bays and river outlets-impacted by toxics and habitat degradation, and the use of integrated models

and sensor monitoring to prevent harmful algal blooms and protect drinking water supplies.

**Watershed management:** Mr. Freedman and LimnoTech were early champions of watershed management to restore, manage, and protect water quality. As early as the 1980s, they were engaged in major studies on the impacts of urban and agricultural watershed sources on water quality and were early users and developers of watershed models. Mr. Freedman chaired, partnered with Federal agencies, several pivotal national conferences on watershed management that, early on, helped launch the concept into professional practice and every day conversation. Prior approaches to water quality problems focused only on control of wastewater sources. Aided by their advocacy and the numerous projects he and LimnoTech conducted, watershed management is now a central concept in the water quality field. The watershed-based TMDL program is now a key Clean Water Act tool, again aided by research, advocacy and work by Mr. Freedman and LimnoTech on several hundred impaired waters. Under Mr. Freedman's direction, LimnoTech has been involved in over a 1,000 watershed and TMDL evaluations and has conducted millions of dollars in key research.

**Corporate water stewardship:** Experts predict that without changes by 2030 almost half the world will live under severe water stress from scarcity and pollution, creating human, environment and economic harm. Mr. Freedman and LimnoTech have been engaged in pioneering work with dozens of global corporations and international NGOs to develop new methods of assessment and strategies for reducing impacts. Working with dozens of global corporations and international NGOs, LimnoTech helped pioneer the development of methodologies to assess water impacts of corporate activities/products and develop strategies to minimize and offset these. This includes the earliest work in Water Footprinting, the development of the first water replenish program for TNC/WWF and The Coca Cola Company to offset corporate water usage (later applied to numerous other companies), and support in the development of watershed/context-based strategies. They have worked with over two dozen major corporations in the food and beverage industries, agriculture and commodities, manufacturing, agribusiness, tech industry, hospitality industry, consumer and building supplies, and energy to develop their water stewardship strategies. Working with several other NGOs contributed to the formation of the Alliance for Water Stewardship and the development of the AWS global water standard for corporate water stewardship. In addition, Mr. Freedman and LimnoTech helped conceptualize and launch Equarius Risk Analytics, a finTech company that quantifies the impacts of water issues on corporate equity performance.

**Contaminated sediments:** Legacy discharges of toxic substances like PCBs have contaminated sediments and impaired waters in many of our major rivers and estuaries. Cleanup costs can be in the millions of dollars and for some individual sites hundreds of millions. LimnoTech has been working with corporations and Federal agencies to assess problems, causes and remediation strategies using advanced computer models and complex forensic scientific techniques. The results of these efforts have been innovations and advances in remediation plans that often save corporations and the government tens, even hundreds

of millions of dollars, yet still achieve environmental objectives. LimnoTech has been well known for working on some of the highest-profile and costliest cleanups of contaminated sediment sites including the Hudson River, the Fox River, the Passaic, the Columbia and numerous others. LimnoTech is known for developing and applying complex computer models and sophisticated chemical and geostatistical techniques to determine responsibility and help develop the most cost-effective strategies for remediating the sites, often saving tens, even hundreds of millions of dollars.

**Big data and innovative monitoring:** Big data have transformed many industries, and LimnoTech is now pioneering concepts, technology and applications for big data, sensor technology, database systems and models to advance decision-making for utilities and in environmental management. LimnoTech developed for NOAA enterprise database software to allow researchers and managers easy access to all Great Lakes data including tributary and cruise sampling, buoy data, model results, and satellite data on water quality. Working closely with Universities, NOAA and numerous government clients, LimnoTech has developed innovative monitoring buoy systems that include sensors for water quality, harmful blue-green algae, waves, weather, currents, even birds and bats, providing critical early warning data to drinking water utilities, lake researchers, boaters, fisherman and the public in general. LimnoTech has also developed and is active utilizing an inexpensive Arduino data logger and modem system to process sensor data and is suitable for both research, management and citizen science. We also have been leaders in integrating these advanced monitoring networks with computer models to allow for quicker and more effective management decisions to protect water quality and drinking water supplies.

**Wet weather and urban redesign:** Historically cities managed problems from urban waters and runoff with improved channels, sewers and "grey" infrastructure. Mr. Freedman and LimnoTech have working with over three dozen cities using new modeling approaches to develop strategies that meet regulations and public expectations by combining "green and grey" approaches, often saving millions even hundreds of millions of dollars. LimnoTech was among the earliest to demonstrate the benefits of large-scale application of green infrastructure. In pivotal research, LimnoTech demonstrated that extensive city-wide use of green practices had the potential to reduce stormwater runoff by over 40% in Washington, DC. LimnoTech is also working with over a dozen cities like Toronto, Dallas, Austin, and Detroit to help redesign their urban landscapes to incorporate water and runoff as a functional and aesthetic feature of the urban environment, reducing pollution, improving the resilience to climate change impacts and enhancing "livability."

**Thought leadership:** Mr. Freedman and LimnoTech have been an industry thought and technology leader for decades, often speaking, demonstrating and advocating new technologies and concepts that address emerging and priority challenges in the water field. Mr. Freedman and staff are very active professionally, in both leadership positions in professional societies and presenting and publishing papers extensively.

## Professional and Academic Appointments

CEO/President, 1981-Present	LimnoTech
Vice President, 1975-1981	Ann Arbor, Michigan
Research Associate 1973 - 1975	Great Lakes Resource Management Program, SeaGrant Program Civil/Environmental Engineering Department The University of Michigan Ann Arbor, Michigan

## Professional Affiliations

American Academy of Environmental Engineers (AAEE)  
 American Society of Civil Engineers Fellow (ASCE)  
 American Water Resources Association (AWRA)  
 American Water Works Association (AWWA)  
 International Association for Great Lakes Research (IAGLR)

Michigan Water Environment Association (MWEA, formerly MWPCA)  
 Member National Academy of Engineers  
 Water Environment Federation (WEF, formerly WPCF)

## Awards/Honors/Recognition

Elected National Academy of Engineers, 2020  
 Dan Wolz Clean Water Award for Environmental Excellence.  
 MWEA, June 26, 2012.  
 Water Environment Federation Fellow, Inaugural class 2011  
 American Society of Civil Engineers, Fellow 2008  
 International Association for Great Lakes Research,  
 Honorary Lifetime Membership for Important and  
 Continued Contributions to IAGLR, May 25, 2005.  
 Michigan Water Environment Association, Outstanding  
 Environmental Consultant, 2004.  
 Charles Alvin Emerson Medal (contributions to the water  
 environment profession), Water Environment  
 Federation, 2002.  
 Engineering Alumni Society Merit Award College of  
 Engineering (contribution in the field of Civil and  
 Environmental Engineering), University of Michigan,  
 2002  
 Chi Epsilon, National Civil Engineering Honor Society, Honor  
 Member, 2000.  
 Willard F. Shephard Award, MWEA, 2000

Water Environment Federation Service Award (outstanding  
 contributions to WEF and Watershed Management),  
 1999  
 Michigan Water Environment Association, Awardee,  
 Honorary Member, 1999.  
 Grand Traverse Bay Watershed Award (contribution to the  
 advancement of scientific research on Grand Traverse  
 Bay), 1996.  
 Water Environment Federation Service Award (outstanding  
 contribution to Government Affairs), 1996.  
 Select Society of Sanitary Sludge Shovelers (honorary  
 society for contributions to the Wastewater and Water  
 Quality Profession), 1996.  
 Arthur Sidney Bidell Award (outstanding contribution to the  
 Profession), Water Environment Federation, 1996.  
 James R. Rumsey Award, Best Paper, Michigan Water  
 Environment Association, "Great Lakes Environmental  
 Assessment," (with Paul W. Rodgers et al.), 1995.  
 Michigan Water Environment Association Service Award  
 (outstanding contributions to the Profession), 1994.  
 MWEA/MWPCF Service Recognition Awards, 1989, 1990,  
 1991, 1992, 1993.

## PROFESSIONAL ACTIVITIES

### Water Environment Federation (WEF)

Officer: Past President, 2010-2011  
 President 2009-2010  
 President Elect 2008-2009  
 Vice President 2007-2008

Water Environment Federation is a member association representing water quality professionals including over 80,000 members and affiliates worldwide. WEF provides educational and training services and products plus policy representation on the water environment. This includes books, journals, workshops, training, and conferences highlighted by WEFTEC, the world's largest annual water conference and exposition. He served as a member of the Board of Trustees, the governing body for WEF that has oversight and responsibility for all WEF activities, and later as the governing officer.

As a WEF Officer, Mr. Freedman promoted the WEF mission and strategic goals to preserve and enhance the global water environment by supporting and promoting WEF policies. He served as a spokesperson for and representative of WEF to its members, WEF Member Associations, the public, government agencies, policy makers, and water environment leaders throughout the world. During his four year term of service as an officer he not only promoted interest and active participation within WEF; but also raised awareness of issues and priorities of concern to the water environment profession

#### Selected Officer Speaking Roles:

As an officer, Mr. Freedman spoke in various settings (luncheons, dinners, opening sessions, award ceremonies and business meetings) from 2007 to 2011 on **Professional Accomplishments, Challenges, and Governance Issues** for WEF. Examples of these events include:

Association	City	Date
<b>Pennsylvania Water Environment Association</b>	State College, PA	June 2010
<b>Arizona Water Environment Association</b>	Glendale, AZ	May 2010
<b>Water Environment Association of Utah</b>	St. George, UT	April 2010
<b>Water Environment Association of Texas</b>	Galveston, TX	April 2009
<b>Missouri Water Environment Association</b>	Osage Beach, MO	March 2009
<b>RESEAU Environment</b>	Montreal, Canada	March 2009
<b>Rocky Mountain Water Environment Association</b>	Colorado Springs, CO	September 2008
<b>Virginia Water Environment Association</b>	Virginia Beach, VA	September 2008
<b>Ohio Water Environment Association</b>	Cleveland, OH	June 2008
<b>Michigan Water Environment Association</b>	Boyne, MI	June 2008
<b>Florida Water Environment Association</b>	Tampa, FL	May 2008
<b>RESEAU Environment</b>	Quebec City, Canada	April 2008
<b>Arkansas Water Environment Association</b>	Hot Springs, AR	April 2008
<b>Nebraska Water Environment Association</b>	Kearney, NE	November 2007

An example of a common speaking topic was: **"A Vision for Providing Knowledge & Leadership for Addressing 21st Century Water Challenges"** at these selected locations/events.

Association	City	Date
<b>Arizona Water Environment Association</b>	Glendale, AZ	May 2010
<b>Missouri Water Environment Association</b>	Osage Beach, MO	March 2009
<b>Virginia Water Environment Association</b>	Virginia Beach, VA	September 2008
<b>Florida Water Environment Association</b>	Tampa, FL	May 2008
<b>RESEAU Environment</b>	Quebec City, Canada	April 2008
<b>Nebraska Water Environment Association</b>	Kearney, NE	November 2007

Mr. Freedman also organized and spoke at WEFMAX Regional Water Environment Federation leadership meetings. He gave several speeches including the following examples:

- 21st Century Challenges for the Water Professional
- WEF Center of Excellence for Providing Knowledge & Leadership
- Water Environment Federation Global Responsibilities and Vision
- Member Association Exchange on Success & Challenges – A Facilitated Discussion

City	Date
<b>Austin, TX</b>	May 2008
<b>Minneapolis, MN</b>	March 2008
<b>Anchorage, AK</b>	May 2008
<b>Philadelphia, PA</b>	March 2008
<b>Ashville, NC</b>	February 2008

### Selected examples of other Remarks and Speeches include:

- **Water & Wastewater Technology Challenges & Recent Developments AIDIS** Dominica Republic November 2010
- **Role of Water Professional as Stewards of the Global Water Environment in a Time of Emerging Crisis**, WEF Officer Gavel Passing Ceremony, WEFTEC 2010, New Orleans, LA, October 2010.
- **Importance of Public Involvement in Global Water Issues**, World Water Monitoring Day, Washington DC, September 16, 2010.
- **Why Professional Associations are Important to Career Fulfillment**, Invited speaker: Regional Young Professional Summit. Alexandria, VA. April 2010.
- **The New Water Crisis and a Vision for New Approaches and Paradigms Needed by Water Professionals**, WEF Officer Gavel Passing Ceremony, WEFTEC 2009, Orlando, Florida, October 2009.
- **Role of Youth in Solving Global Water Challenges**, Speech and Judge, Stockholm Junior Water Prize Competition, Anchorage, Alaska, June 2009.
- **Role of US Water Professional and WEF in Global Water Issues**, WEF-AWWA Rocky Mountain Annual Joint Conference, Colorado Springs, September 2008.
- **Role of Professional Associations in Career Development**, Young Professional Summit, Austin, Texas, May 2008.

### Selected Officer Published Articles:

#### **WEF Highlights "From the President":**

- Shifting the Vision of Water Professionals, September 2010, Vol. 42, No. 7.
- Attracting a New Generation of Professionals, June 2010, Vol. 47, No. 5.
- Examining the Successes, Frustration, and Future of Clean Water, April 2010, Vol. 47, No. 3.
- Engaging the Public in Our Mission, February 2010, Vol. 47, No. 1
- A Vision of Leadership for the New Year, November 2009, Vol. 46, No. 9

#### **WEF Water Blog <http://wefwaterblog.blogspot.com/>**

- "Reflections from the President (Observations and priorities for the water professional)." Posted October 3, 2010.
- "Careers in Water." Posted June 7, 2010.
- "Urban Rivers: Don't Miss the Boat to a Sustainable Future for Our Cities!" Posted February 1, 2010
- "Speaking of Holiday Magic... (the importance of water to global public needs)," Posted December 14, 2009
- "Time to Reinvent the Clean Water Act," Posted October, 19, 2009
- "Show Me the Green Infrastructure," Posted April 13, 2009.
- "Global Water Stewardship and WEF," Posted March 2, 2009.

### WEF Chair/Director:

**WEF Long Range Planning Committee**, Member and Vice Chairman Strategic Planning and other strategic tasks. 2004-2007.

**WEF Sustainability Task Force Co-Chair:** Initiated planning for new strategic emphasis at WEF, involved

expanded programs, conference, services and technical products in the topic area of water sustainability. 2007.

**Water Environment Federation Board of Trustees**, 2003-2005.

**Water Environment Federation Director, House of Delegates**, 2003-2005.

**WEF Total Maximum Daily Load Conference Chair**, 2002 and 2003.

Mr. Freedman organized and co-chaired these two national conferences cosponsored by the Water Environment Federation, Association of State and Interstate Water Pollution Control Agencies, United States Environmental Protection Agency, United States Geological Service, United States Department of Agriculture, and other agencies.

**Water Environment Federation Board of Directors, Director-at-Large**, 2000-2003.

**WEF Watershed Management Committee Chair**, 1996-1999

Mr. Freedman established and chaired a new Water Environment Federation committee focused on Watershed Management. In this capacity, he recruited members, established a committee mission statement and committee goals, developed four subcommittees, and directed/managed numerous committee activities. His committee has organized three national conferences, several technical conference sessions and workshops, and contributed articles to journals, a national summit of watershed organizations, plus numerous other educational and professional activities.

**WEF Government Affairs Committee Chair**, 1994-1996

**WEF Government Affairs - V. Chair**, 1990-1993

**WPCF Regulatory Affairs Subcommittee Chair**, 1987-1990

As Chair of Water Environment Federation Government Affairs Committee and a leading GAC member for over a dozen years, Mr. Freedman helped establish direction of WEF activities related to government policies on water environment issues. He chaired or established over 25 technical work groups to comment on environmental regulatory policies and worked collaboratively with USEPA. He has testified before Congress on environmental legislation, helped develop legislative and regulatory proposals, organized and supervised dozens of technical conference sessions, given dozens of technical presentations, held several government affairs training

sessions, written several journal articles, and helped direct and organize a range of professional activities in the government affairs area. He directed the activities of four subcommittees and oversaw the development of a strategic plan for WEF government affairs.

**WEF Watershed Specialty Conference Chair**, 1994-2000

Mr. Freedman organized and chaired two national watershed management conferences and one international conference, co-sponsored by as many as 14 Federal agencies and two Canadian agencies. This conference series has involved hundreds of speakers and dozens of workshops and field trips. Each has been unquestionably the premier conference of this nature, drawing national and international experts.

**WEF Great Lakes Task Force Chair**, 1991-1994

**WEF Committees:**

WEF Publication Committee, Trustee Liaison, 2003-2004

WEF Government Affairs Committee, Trustee Liaison, 2003-2004

WEF Ecology Committee, Trustee Liaison, 2003-2004

WEF Long Range Planning Committee, 2001-Present

WEF Watershed Management Committee, 1996-Present

WEF Specialty Conference, 1994-1998

WEF Ad Hoc Legislative Immediate Response Team (ALIRT), 1994-1998

WEF Collection Systems, 1994-1996

WEF Toxic Substances, 1987-1994

WEF Task Force on Governance, 1993-1994

WEF Government Affairs, 1985-1998

WEF Clean Water Act Reauthorization Committee, 1992-1996

## Professional Activities / Other Organizations:

### Michigan Water Environment Association (MWEA),

President 1993/1994

President-Elect MWEA/MWPCA, 1992/1993

Vice President MWPCA, 1991/1992

As an MWEA Officer, Mr. Freedman provided leadership and direction for a 1,300-member organization of environmental professionals. He managed the activities of over 30 committees and had oversight responsibility for approximately 25 seminars and workshops, and two annual conferences, each involving over 500 attendees over four

days. During his leadership term, he focused on strategic planning, government affairs and improvements in technical programming. During the course of his term, he gave dozens of presentations to professional and public groups on issues important to the environment and water environment professionals.

### Chair/Director:

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Board of Directors, 2001-2003.

MWEA Past President Committee Chair, 1994/1995

MWEA Audit & Budget Chair, 1993/1994

MWEA Conference Program Chair, 1993/1994 Mr. Freedman organized and chaired this MWEA annual technical conference and exposition involving three days of concurrent technical sessions as well as an exposition and various association functions.

MWEA Strategic Planning Chair, 1992/1993

MWPCA Time and Place Chair, 1992/1993

MWPCA Technical Conference Chair, 1992/1993 Mr. Freedman organized and chaired this MWPCA annual technical conference and exposition involving three days of concurrent technical sessions as well as an exposition and various association functions.

MWPCA Government Affairs Committee Chair, 1989-1991

### Committees

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MWEA Constitution & Bylaws, 1993-1995

MWEA Groundwater, 1992-1995

MWEA Membership, 1992-1994

MWEA Conference Planning, 1991-1994

MWEA Industrial Waste, 1990-1994

MWEA Strategic Planning, 1990-1994

MWEA Executive Committee, 1991-1995

MWEA Conference Program, 1986-1995

MWEA Government Affairs, 1985-1996

### Other Organizations & Committees:

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Member, National Academy of Engineers 2020- present

FACA Federal Advisory Committee on Water Information, 2013-Present.

Co-Founder, FACA Federal Water Resource Adaptation to Climate Change Work Group. Co-Chair, 2013-2018; Member, 2018-Present.

Advisory Committee to newly formed School Of Environment and Sustainability, University of Michigan, 2018-Present.

Advisory Committee to Civil and Environmental Engineering, College of Engineering, University of Michigan, 2003-2009.

University of Michigan Civil and Environmental Engineering Alumni, Board of Directors 2010-2013.

Sustainable Water Resource Roundtable, under Federal Administrative Committee on Water Information, Steering Committee, 2002-2010.

AAEE Water Supply and Wastewater Subcommittee, 1998-2001. (Responsible for development and revision of specialty certification exam for Diplomate Certification.)

AWWA Source Water Protection Committee, 2004-2007

AAEE Water Supply and Wastewater Sub-committee, 1993-2001

AAEE Task Force on Certification Requirements, 1992-1993

ASCE Impact Analysis, 1985-1986

IAGLR, Technical Reviewer, 1988

ASCE, Technical Reviewer, 1984/1985, 2004

World Bank, Technical Reviewer, 1983/1984



## TECHNICAL CONFERENCES: (Chair/Organizer/Session Manager)

More Restoration vs. More Land Protection: The Right Balance. Panel Moderator. AWRA National Conference, Baltimore, MD. November 7, 2018.

Nutrient Control a Watershed Approach to Large Ecosystem Protection. Keynote speaker, organizer, and moderator. BACWA San Francisco Bay Nutrients Symposium, Oakland, CA, October 6, 2014.

Fifty Years of Watershed Modeling. Session Moderator: Historical Evolution of Watershed Models and Impacts on the Current SOTA. Boulder, Colorado. September 24-26, 2012.

WEFTEC 2010. Opening General Session, October 4, 2010, New Orleans, LA.

Practical Guidance for Successfully Navigating the UAA Process, Workshop A. Session moderator and workshop organizer. TMDL Sciences 2007, June 24, 2007. Bellevue, WA.

Great Lakes Region Research Priorities Workshop for Sustainable Water Resources. Co-chair, organizer, and speaker. Ann Arbor, MI. April 4-5, 2005.

AWWA, Source Water Protection Symposium Pre-Conference Workshop, TMDLs Relevance to Drinking Water Utilities. Organizer, facilitator and speaker. Palm Beach, FL. January 22-26, 2005.

National TMDL Science and Policy Conference. Chair, organizer, and moderator. Chicago, IL. November 16-19, 2003.

National TMDL Science and Policy Conference. Chair, organizer, and panel moderator. Phoenix, AZ. November 13-16, 2002.

WEF Watershed Management 2002, Planning Committee, WEF Specialty Conference. Fort Lauderdale, FL. February 2002.

WEF Watershed Management 2002. Session Moderator: TMDLs, WEF Specialty Conference. Fort Lauderdale, FL. February 2002.

TMDL Science Issues Conference, Planning Committee, Co-chaired by WEF and the Association of State and Interstate Water Pollution Control Administrators. St. Louis, MO. March 4-7, 2001.

Michigan Chamber of Commerce, Environmental Issues Forum: A Dialogue with Experts. "Can You Drink the Water?" Panel Member. Lansing, MI. October 25, 2000.

WEFTEC 2000. Moderator/Chair, Preconference Workshop. "Tools for Achieving Point and Nonpoint Source Partnerships." Anaheim, CA. October 14, 2000.

WEFTEC 2000. Co-Chair/Co-Organizer, Preconference Workshop, "TMDL Development and Implementation." Anaheim, CA. October 14, 2000.

WEF Watershed Management 2000 Conference. Chair. Vancouver, B.C. July 9-12, 2000.

"Effective Watershed Planning." Moderator, Effective Watershed Management for a Clean Michigan. East Lansing, MI. April 1, 1999.

"Water Quality Protection: Scientific Insights for Successful National Policies." Moderator, WEF/USGS Briefing. Alexandria, VA. March 5, 1999.

"Watershed Management: Moving From Theory to Implementation." Conference Chair and organizer, WEF Specialty Conference. Denver, CO. May 3-6, 1998.

"TMDL's Impact on NPDES," Implementing Watershed Management. Organizer and Presenter, A Workshop for Decision Makers. Atlanta, GA. November 8, 1996.

"Washington Briefing." Organizer, Water Environment Federation Workshop. Alexandria, VA. March 21-22, 1996.

"What Should the Water Quality Goals be for Urban Streams?" Session Manager, Urban Wet Weather Pollution Controlling Sewer Overflows and Stormwater Runoff. Quebec City, Canada. June 16-19, 1996.

Watershed '96, Moving Ahead Together. Conference Chair and Organizer, An Interagency (14 Federal agencies) Conference and Workshop. Baltimore, MD. June 10-14, 1996.

"USEPA Regulatory Update." Moderator and Chair - Committee, WEFTEC 1995. Miami, FL, October 24, 1995.

"The Watershed Management Approach to Improving the Water Environment." Organizer, MWEA and MDNR. East Lansing, MI. May 23, 1995.

Toxic Substances in Water Environments: Assessment and Control. Program Committee Chair, Water Environment Specialty Conference, Sediment Transport Modeling and Assessment Track. Cincinnati, OH. May 14-17, 1995.

"EPA Regulatory Update." Chair and Organizer, Technical Session, WEFTEC Conference and Exposition. Chicago, IL. October 18, 1994.

"Influent and Effluent Toxic Discharge Limitations for POTWs." Organizer, Preconference Technical Workshop, WEFTEC Conference and Exposition. Chicago, IL. October 16, 1994.

"EPA Regulatory Updates." Organizer and Presenter, WEFTEC '94. Chicago, IL. October 17, 1994.

"A Global Perspective for Reducing CSOs: Balancing Technologies, Costs and Water Quality," A WEF Specialty Conference: Computer Modeling Session. Louisville, KY. July 1994.

Annual MWEA Technical Conference. Conference Organizer and Chair. Lansing, MI. June 1994.

"The Great Lakes Water Quality Initiative: A Teleconference." Conference Organizer and Moderator, MWEA. Broadcast from Kalamazoo, MI. July 14, 1993.

Annual MWEA Technical Conference. Conference Chair and Organizer. Boyne Highlands, MI. June 1993.

"Preparing for Environmental Change: The Clean Water Act, Hazardous Waste Laws and Regulatory Approaches in the New Administration." Presenter, WEF Washington Briefing. Washington, D.C. March 1993.

"Water Quality Based Toxics Control: Federal Guidance and State/Discharger Experience." Organizer, Pre-Conference Seminar, WEF Annual Conference. September 1992.

"Zero Discharge Returns? New Regulatory and Legislative Initiatives." Moderator and Presenter, WEF Washington Briefing. Washington, D.C. 1992.

Annual MWPCA Technical Conference. Conference Organizer and Chair. Bellaire, Shanty Creek, MI. June 1991.

Air, Water and Waste Conference; Water Quality Session, Water track manager, Engineering Society Detroit. Detroit, MI. December 1991.

## WORK GROUPS/WORKSHOPS / PUBLIC MEETINGS (Organizer/Chaired):

Origins, Pathways and Accumulation of Pollutants – An Urban Perspective. Stockholm International Water Week. Chair Workshop 8. September 2010.

New Vision for Reshaping Our Cities of the Future and Urban Water Ways. Panel Moderator. Cities of the Future & Urban Rivers Restoration Joint Conference. Boston, MA. March 2010.

Reconsidering the Clean Water Act, held by Johnson Foundation, Nichols Institute, Duke University and Water Environment Federation, co-organized. Racine, Wingspread, WI. October 2009.

Multi-stakeholder Public Meeting on Designated Uses and Use Attainability Analysis. Facilitator, Opening Remarks, and Committee Organization. USEPA/WEF. Atlanta GA, Sept. 20-21, 2005; Chicago, IL, Feb. 8-9, 2006.

Defining an Endpoint for CSO Control. Session Moderator, CSO LTCP Review Workshop, USEPA. Philadelphia, PA. December 2004.

American Water Works Association Research Foundation, Workshop on TMDLs and Drinking Water Utility Issues. Co-organizer, Co-chair and Facilitator. December 2003.

Navigating the TMDL Process, Critical Analysis & Improvements for the TMDL Program, WEFTEC-Water Environment Research Foundation Workshop. Chicago, IL. September 28, 2002.

WEF MA Leaders Workshop, "Improved Services, Increased Membership and Added Revenues through Member Association Activities in Watershed Management," WEFTEC, October 1, 2002.

USEPA/WEF TMDL Public Meeting. Moderator and Facilitator. Atlanta, GA and Kansas City, MO, September 22-23 and 29-30, 1999.

USEPA/WEF Experts Workshop on "Implementing the WQ-Based Provisions of the CSO-Control Policy." Organizer, Speaker and Facilitator. Washington, DC. September 24, 1999

WEF Workgroup "Urban Wet Weather Issues." 1999.

"Government Regulations." Session Organizer and Moderator, at MWPCA Annual Technical Conference 1990, 1991.

"Future Compliance, What's Next?" Organizer, WEF Washington Briefing. Washington, D.C. March 1990.

"CSO and Stormwater Controls," MWPCA and Michigan Municipal League. Lansing, MI. April 1989.

"Wetlands Permitting and Regulations." Conference Organizer and Moderator, MWPCA. Lansing, MI. 1988.

"Acid Rain Effects." Session Manager, ASCE, Environmental Engineer Div. Conference. Boston, MA. 1986.

"Great Lakes Water Quality." Session Manager, ASCE Annual Conference. Detroit, MI. 1985

WEF Workgroup on "Total Maximum Daily Load Regulations." 1998-2000.

"Watershed; for the 21st Century," A Summit of National Organizations Involved in Watershed Management. Co-organizer and Participant. Denver, CO. May 2, 1998.

WEF Workgroup on "USEPA ANPRM Water Quality Standards Revisions." 1997-1999.

Effluent Trading Workgroup, USEPA and Water Environment Federation, Regulatory Improvement Project. 1996-1997.

"Workshop on CSO Performance Measures." Facilitator, USEPA/Association for Metropolitan Sewer Agencies. Chicago, IL. November 7, 1996.

"Workshop on CSO Performance Measures." Facilitator, USEPA/Association for Metropolitan Sewer Agencies. Fort Mitchell, KY. October 29, 1996.

Pretreatment Streamlining Workgroup, USEPA Regulatory Improvement Project. Participant, Sponsored by USEPA, Water Environment Federation and AMSA. 1996.

Wet Weather Steering Task Force WEF. Member. 1995-1996

"Ideas for Redefining MDNR's Water Quality Programs, A Workshop for the Regulated Community to Work with the Michigan Department of Natural Resources." Organizer and Chair, MWEA. East Lansing, MI. March 16, 1994.

"Pollution Elimination Policy Work Group," WEF. Member. 1993-1995

"Analytical Detection Limits," WEF. Member. 1993-1995

Metals and Aquatic Criteria, WEF, Member. 1992-1994

Combined Sewer Overflow Regulations, WEF, Member. 1991-1994

Sediment Criteria, WEF, Member. 1991-1995

Great Lakes Initiative Regulation, WEF, Chair. 1991-1993

Stormwater Regulations, WPCF, Member. 1990-1992

"Technical Support Document for Water Quality Based Toxics Control," WPCF, Member. 1989-1991

Toxic Exposure Work Group, USEPA, Member. 1984

## PRESENTATIONS / PROCEEDINGS / SPEECHES at Conferences & Workshops

"A National Perspective: The Role of Land Protection and Watershed Restoration in Large Watersheds." Delaware River Water Initiative, Winter Gathering on Delaware Basin. Bear Mountain Resort, PA. February 2019.

"The Wider View: The Role of Government and NGOs in Large-Scale Watershed Programs" (with Ed Wilson). Session 37: Can NGOs Drive Programs as Government Takes a Backseat? American Water Resources Association Annual Conference, Baltimore, MD. November 7, 2018.

"More Restoration vs. More Protection: Is There a Magic Balance for Healthy Watersheds?" Panel Discussion, Organizer and Facilitator. American Water Resources Association Annual Conference, Baltimore, MD. November 7, 2018.

"Emerging Policies of the New Administration on Water Resources, Climate Research and Resiliency." American Water Resources Association Annual Conference, Portland, OR. November 9, 2017.

"Avoiding a Collision in Nutrient Policy" (with Carrie Turner). American Water Resources Association Annual Conference, Philadelphia, PA. June 13, 2017.

"Balancing Act: What Now for Corporate Water Goals?" Panel Discussion. Stockholm World Water Week. Stockholm, Sweden. September 1, 2016.

"Big Data, a new era for Clean Water Utilities" NACWA Winter Conference, San Diego, CA, February 21-14, 2016.

"The Era of Big Data: Opportunities and Legal Considerations" NACWA National Clean Water Law Seminar. Henderson, NV. November 4-6, 2015.

"Big Water Data: Not Just for Scientists. Emerging Technologies for Public Access" Keurig Green Mountain Summit: Current 2015 Collaborating for a Water-Secure World. Stowe, VT. September 3, 2015.

"Corporate Water Stewardship, Is this a Fad or a Growing Business Necessity?" Sustainability Leadership Forum, Philadelphia, PA, June 9, 2015.

"LimnoTech Case Study," Class presentation University of Michigan, Environ 302, *Blue is the New Green Michigan's Sustainable Economy*. John Austin professor. February 6, 2015.

"Application of Water Prism, a Decision Support System for Examining Strategies to Address Water, Energy, Food and Ecosystem Security Challenges." With Laura Weintraub, and RA Goldstein. Poster presentations Stockholm International Water Week. September 2014.

"LimnoTech Overview and Global Water Crisis: Moving from Crisis to Sustainability" CEO Connect, January 17, 2014.

"Water Prism: A Decision Support Tool for Sustainable Supplies at the Basin Level", Stockholm International Water Week, September 3, 2013.

"Corporate Strategies for Mitigating Water Risk" Bloomberg BNA webinar for Water & Climate Adaptation. February 6, 2013.

"Global Water Crisis: Moving from Crisis to Sustainability" University of Michigan, Rackham Centennial Alumni Lecture. October 24, 2012.

"Is There a Water Crisis?" invited lecturer and video production, Greenhills High School, Ann Arbor, MI. October 2012.

"Sustainability Metrics for Water Utility Management Practices and Operations" with Wendy Larson. AWWA Sustainable Water Management Conference. Portland Oregon. March 21, 2012.

"Water Stewardship, Standards & Certification" Department of Commerce, Standards Working Group, Seminar. Washington, DC. November 17, 2011.

"Is water the 21st Century oil? Water Stewardship for a Water Stressed Planet" Ann Arbor Rotary Club. September 2011.

"Corporate Water Stewardship, an Oxymoron of the New Norm?" 2011 Chemical Heritage Foundation Innovation Day Workshop. Philadelphia, PA. September 2011.

"The Energy Nexus, a National Security Issue" 2011 Chemical Heritage Foundation Innovation Day Workshop. Philadelphia, PA. September 2011.

"Water Research Needs for a Sustainable 21st Century." Sustainable Waters Research Workshop, University of Michigan, Ann Arbor, MI. March 18, 2011

"Water & Wastewater Technology Challenges & Recent Developments." AIDIS Dominica Republic. November 2010

"New Challenges and New Paradigms for the Water Professional as We Face a Growing Global Water Crisis." Opening General Session Speech and Moderator. WEFTEC 2010. New Orleans, LA. October 2010.

"History and Current Issues in Urban Water Pollution." Stockholm International Water Week. September 2010.

"Water Professionals: Role in Society Past & Future" MWEA/AWWA Annual Meeting – Opening Session keynote. Mt. Pleasant, MI. August, 2010.

"The Clean Water Act, a 20th Century Approach to 21st Century Problems: A Call for Action." Interactive Stakeholder Panel Discussion on Rewriting the CWA. 2010 Annual Meeting of ASIWPCA. Indianapolis, IN. July 2010.

"A Call to Action: The Need for New Approaches to National Water Policies and Regulations." Johnson Foundation Freshwater Summit. Racine (Wingspread), WI. June 2010.

"The Case for Global Water Stewardship and A Global Certification Program." Speech. Singapore International Water Week. Alliance for Water Stewardship side event. June 2010.

"The Role of Water Professional and the Developing Water Crisis" Arizona WEA and AWWA Annual Meeting. Glendale, AZ. May 2010.

"Western U.S. Challenges for the Water Professional" Utah Water Environment Association Annual Conference. April 2010.

"Why Professional Associations are Important to Career Fulfillment" Invited speaker: Regional Young Professional Summit. Alexandria, VA. April 2010.

"Role of Water Professional in Designing Cities of the Future" Speech. Cities of the Future & Urban Rivers Restoration Joint Specialty Conference. Boston, MA. March 2010.

"Role of Utilities in Solving 21st Century Water Challenge" Speech. Utility Management Conference. San Francisco, CA. February 2010.

"40th Anniversary of Earth Day. A retrospective and Prospective Look at Water Quality Priorities to Achieve National Goals of Swimmable/Fishable Waters." Invited speaker for Ohio River Sanitation Commission (ORSANCO) meeting February 2010.

"Future Directions in Clean Water Policy and Watershed Management." Key Note Speaker, Tennessee/Kentucky Water Environment Association. Nashville, TN, January 22, 2010.

"21st Century Needs for Clean Water Policy." MWEA Waste Water Administrators Conference. Frankenmuth, MI. January 14, 2010.

"United States Water Challenges & Priorities." Invited speaker: WATEC 5th International Water Technologies, Renewable Energy & Environmental Control Exhibition and 2nd International Conference. Tel Aviv, Israel. November 2009.

"TMDL Challenges 35 Years Later." Opening Conference Remarks, WEF TMDL Specialty Conference. Bloomington, MN. September 2009.

"Transboundary Water Pollution Control Efforts in the United States," World Water Week. Stockholm Sweden. August 2009.

"From Chesapeake, the Great Lakes and Beyond – Advocacy for a Viable Watershed Approach." 2009 National Clean Water Policy Forum, NACWA. Washington DC. May 2009.

"Watershed Management: An Overview," with Theodore Slaweki. Americana 2009. Montreal, Canada. March 2009.

"WEF Accomplishments but Also Our Challenges and Priorities for the Future." Invited speaker Water Sector - Reseau (Quebec). Americana 2009. Montreal, Canada. March 2009.

"21st Century Challenges for the Water Professional" Luncheon speaker at meeting of Federal Water Quality Association. Washington, DC. February 2009.

"Water Stewardship: Environmental Objectives," Water Summit. Miami, FL. February 26-27, 2009.

"Role of U.S. Water Professional and WEF in Global Water Issues." Invited speaker Rocky Mountain Water Environment Association and Rocky Mountain States-AWWA joint meeting. September 2008.

Testimony hearing before the Subcommittee on Water Resources and Environment, Comprehensive Watershed Management and Planning; Committee on Transportation and Infrastructure Rep. James L. Oberstar, Chairman, U.S. House of Representatives. June 24, 2008.

"National Needs and Strategies for Promoting Water Sustainability: Opportunities for the Sustainable Water Resources Roundtable," SWRR. June 2008.

"Water Sustainability: What it Means to the Water Professional," Featured speaker Opening Session, MWEA Annual Conference. June 2008.

"National TMDL Program: Status and Future Directions," Hawaii TMDL Conference. October 2007.

"The Role of Adaptive Watershed Management Concepts in Wet Weather Consent Decrees," (with J. A. Eger, J. P. Gibson Jr., N. Clements, A. D. Nemura) Water Environment Federation Annual Technical Exhibition and Conference. San Diego, CA. October 2007.

"Thermal Electric Power Plant Water Uses; Improvements Promote Sustainability and Increase Profits" with J.R. Wolfe, Canadian/US Water Policy Workshop. Washington, DC. October 2, 2007,

"Source Water Protection Research Planning Workshop" AwwaRF/WERF joint workshop. Denver CO. August 1-2, 2007,

"21st Century Future for the Water Professional" NACWA Annual Conference. Cleveland, OH. July 19, 2007.

"Factors for Success in Developing Use Attainability Analysis," (with T. Dupuis, P. McGovern, L. Terry, and M. Stewart) WEF TMDL Specialty Conference Session 3B. Bellevue, WA. June 24, 2007.

"Practical Guidance for Navigating the UAA Process, an Overview," TMDL Sciences 2007 Conference, Workshop Presenter. Bellevue, WA. June 24, 2007.

"Watershed Implementation Strategies. Emerging Policies and Programs," Clean Water, Clean Lakes. Milwaukee, WI. April 24, 2007.

"New Approaches to Water Quality Restoration," Clean Water, Clean Lakes. Milwaukee, WI. April 24, 2007.

"21st Century Approaches to CSO & Water Quality Restoration," Wet Weather Partnership & NACWA. Chicago, IL. April 26-27, 2007.

Groundwater Sustainability Expert Workshop. Michigan Groundwater Conservation Advisory Council and Grand Valley State University. Grand Rapids, MI. March 26, 2007.

Sustainable Water Resources Roundtable. Sustainable Water Resources Roundtable Workshop. Washington, DC. January 25, 2007.

"Future Improvements to the TMDL Program: UAA & Adaptive Management." Faculty Member – Speaker, Clean

Water in the Midwest. Law Seminars International. Chicago, IL. September 13, 2006.

The Future of the TMDL Program: New Developments & Research Needs. Speaker, Electrical Power Research Institute (EPRI), Clean Water Act Workshop. Bar Harbor, ME. June 2006.

"Adaptive Implementation for Improved Water Quality Management: When Does it Make Sense? A Follow Up to the 2001 National Research Council TMDL Report" Coauthor with Jennifer Benaman. AWRA Adaptive Management of Water Resources. Missoula, MT. June 27, 2006.

"Model Evaluation of Management Options for Improving Truckee River Dissolved Oxygen." Nevada Water Environment Association Annual Conference. Reno, NV. March 23, 2006.

"Truckee River HSPF Model, History, Calibration, and Application." AWRA 2005 Annual Conference. Seattle WA. November 7-10, 2005.

"Protection of Water Quality in Large Systems: Hard Lessons, Simple Truths." Mississippi River Basin Nutrients Workshop. St. Louis, MO. October 2005.

The Need for Involvement by the Drinking Water Utilities in the TMDL Process, WEF TMDL. Philadelphia, PA. June 27-29, 2005

Adaptive Management and TMDL: Future Urban and Rural Solutions, with T. Slaweki. ASAE Third Conference on Watershed Management to Meet Emerging TMDL Environmental Regulations. Atlanta, GA. March 2005.

Duke University and Resources for the Future, NRC/NAS Expert Panel follow-on to "Use of Adaptive Management in TMDL's." 2004-2006.

"Total Maximum Daily Loads: Relevance to Drinking Water Utilities." AWWA WQTC Conference. San Antonio, TX. November 17, 2004.

"Viewing the Total Maximum Daily Load Requirement as a Process, not a Singular Number: The Call for Adaptive Management." Adaptive Implementation of TMDLs: Interpretation and Application Workgroup, Duke University. Durham, NC. October 25, 2004.

"A Different View of Leadership." Environmental Financial Consulting Group presentation. New York, NY. October 21, 2004,

"Expanding the Role of Drinking Water Utilities in the TMDL Process (with W.M. Larson)," MI AWWA/MWEA Joint Conference. Grand Rapids, MI. August 10, 2004.

"A Retrospective Look at Watershed Management (with V. Breidenbach, D. Infante, and A. Kuman)," WEF Watershed Management Conference. Dearborn, MI. July 11-14, 2004.

"Watershed-Based Permitting in Northern Kentucky" (with P. E. Moskus, D.W. Dilks, J.T. Lyons and L.S. Wilcher), WEF Watershed Management Conference. Dearborn, MI. July 11-14, 2004.

"Actions towards a Sustainable Great Lakes." Organizing committee, opening session moderator "A Shared Vision for the Great Lakes: Actions Taken and Actions Needed,"

session moderator and facilitator, "Human Health." Great Lakes Commission. Cleveland, OH. May 5-7, 2004.

"Future of the TMDL Program and Water Quality Standards Attainment," Nevada Water Environment Association Conference, Reno, NV, March 25, 2004.

"Trends and Future Direction in Water Quality Regulation." Keynote address for Preparing for Regulatory Change, COG Water Resources Workshop. Washington, DC. February 20, 2004.

"Identifying Knowledge Gaps with TMDLs and Drinking Water Utilities." Co-organizer, speaker and facilitator, AWWARF and WERF. Scituate, MA. December 10-12, 2003.

"WERF's Research Helps Professionals Navigate the TMDL Process." Coauthor, National TMDL Science and Policy Conference. Chicago, IL. November 17-19, 2003.

"Case Studies in the Use of Adaptive Watershed Management for Total Maximum Daily Loads." Coauthor, National TMDL Science and Policy Conference. Chicago, IL. November 17-19, 2003.

"Old and New Methods for Conducting Model Uncertainty Analyses for the TMDL Margin of Safety." Coauthor, National TMDL Science and Policy Conference. Chicago, IL. November 17-19, 2003.

"Linking Agricultural TMDL Implementations to Source Water Protection." Coauthor, National TMDL Science and Policy Conference. Chicago, IL. November 17-19, 2003.

"Refining Water Quality Standards for the Ohio River – Discussion of Strategies," ORSANCO POTW Committee Wet Weather Standards Work Group. Cincinnati, OH. July 25, 2003.

"An Adaptive Management Approach for TMDLs," UCOWR Conference on Water Security for the 21st Century. Washington DC. July 20-31, 2003.

"Navigating the TMDL Process: Evaluation and Improvements." Coauthor, National TMDL Science and Policy Conference. Phoenix, AZ. November 13-16, 2002.

"Need for an Adaptive Watershed Management Approach to TMDLs." Coauthor with A. Nemura and D. Dilks, National TMDL Science and Policy Conference. Phoenix, AZ. November 13-16, 2002.

"Guiding Principles for Modeling in a TMDL Process." Coauthor, National TMDL Science and Policy Conference. Phoenix, AZ. November 13-16, 2002.

"Incorporating Urban Wet Weather Sources in a TMDL: An Improved Approach." Presenter, National TMDL Science and Policy Conference. Phoenix, AZ. November 13-16, 2002.

"Approaching TMDLs Using Aristotle as a Teacher: An Adaptive Watershed Management Approach." Presenter, National TMDL Science and Policy Conference. Phoenix, AZ. November 13-16, 2002.

"Critical Analysis and Improvements for the TMDL Program, WERF Research." Presenter, WEFTEC. Chicago, IL. September 28, 2002.

"WERF: Navigating the TMDL Process: Evaluation – A WERF Project Update." Presenter, WEFTEC. September 27-October 1, 2002.

"Source Water Protection Monitoring – A Case Study." as Alternate Speaker for Dr. Rao Y. Surampalli, Ph.D., P.E., DEE, 8th International Conference on Drinking Water Quality Management and Treatment Technology. Kaohsiung, Taiwan. May 27-29, 2002.

"Watershed Management and Its Importance to Drinking Water Supplies in the U.S.," 8th International Conference on Drinking Water Quality Management and Treatment Technology. Kaohsiung, Taiwan. May 27-29, 2002.

"Model Complexity and Reliability Are Not Synonymous," Watershed 2002 Specialty Conference. Fort Lauderdale, FL. February 24-27, 2002.

National Academy of Sciences, National Research Council Technical Reviewer, "Assessing the TMDL Approach to Water Quality Management." 2001.

"A Critical Analysis of the TMDL Program," Energy and the Environment. PNWIS/A&WMA 41st Annual Conference. Big Sky Resort, MT. Dec. 5-7, 2001.

"Simplified Methods for Modeling in the TMDL Process," Changing Environment Awareness: Societal Concerns and Scientific Responses. Society of Environmental Toxicology and Chemistry, 22nd Annual Meeting. Baltimore, MD. November 11-15, 2001.

"Critical Assessment of the TMDL Process," WERF 2001 Subscriber Meeting. Chicago, IL, June 8, 2001 and Washington, DC, April 5, 2001.

TMDL Science Issues Conference. Panelist for TMDL Science Obstacles, Association of State and Interstate Water Program Administration USGS, USEPA, and WEF. St. Louis, MO. March 5-7, 2001.

"Overview of Simplified Methods for Modeling in the TMDL Process," TMDL Science Issues Conference. St. Louis, MO. March 5-7, 2001.

"Models and the TMDL Process: Science or Black Magic? A Guide to Debunking and Demystifying," AWWA 2001 Source Water Protection Symposium. Savannah, GA. January 28-31, 2001.

"Total Maximum Daily Loads: An Introduction for Water Suppliers Using Surface Water Sources." Instructor, Co-organizer and Speaker, AWWA 2001 Source Water Protection Symposium. Savannah, GA. January 28, 2001.

"Surviving a TMDL Project: Practical Advice for Municipalities." Speaker, Preconference Workshop, APWA International Public Works Congress and Exposition. Louisville, KY. September 9, 2000.

Water Quality: "Can You Drink the Water?" Panelist, Michigan Chamber of Commerce Environmental Permitting Update. Lansing, MI. October 25, 2000.

"Wet Weather Water Quality Standards for CSO Impacted Waters," WEFTEC 2000. Anaheim, CA. October 16, 2000.

"Leveraging Water Quality Assessment Resources – Why TMDLs and SWAPs Should Be Performed Together." Co-

Author (with Dan Schechter), WEFTEC 2000. Anaheim, CA. October 16, 2000.

Wet Weather Regulatory Panel: CSO's and Water Quality Standards. Speaker/Moderator, WEF Washington Briefing 2000. Washington, DC. April 11-12, 2000.

Total Maximum Daily Load Modeling – NPDES Permit/TMDL Seminar. Washington, DC. March 23-24, 2000.

"Groundtruthing SSO Abatement Programs," (with Julia Slack), Proceedings for WEFTEC '99. October 1999.

"Wet Weather Water Quality Standards, Framing the Discussion," Preconference Workshop, WEFTEC. New Orleans, LA. October 9, 1999.

USEPA/WEF Experts Workshop "Implementing the WQ-Based Provisions of the CSO-Control Policy." Organizer, Speaker and Facilitator. Washington, DC. September 24, 1999

USEPA Total Maximum Daily Load Public Meeting. Moderator and Facilitator. Atlanta, GA and Kansas City, MO. September 22-23 and 29-30, 1999.

"Watershed Management," USEPA 6th National Drinking Water and Wastewater Treatment Technology Transfer Conference. Kansas City, MO. August 2-4, 1999.

"Total Maximum Daily Loads: A National Perspective," MWEA Annual Conference. Boyne Highlands, MI. June 27-30, 1999.

"A Big Picture Look at the Future of Watershed Management," Effective Watershed Management for a Clean Michigan. East Lansing, MI. April 1, 1999.

"Concerns Over the Next Generation of Water Quality Standards," NVRAC Virginia Water Environment Association, Luncheon Series. Falls Church, VA. February 10, 1999.

"A Watershed Approach to Sustainable Development." Manila, Philippines. January 17-19, 1999.

Virginia WEA "Wet Weather Woes: Issues & Strategies to Deal with High Flows." Richmond, VA. November 17-18, 1998.

"Clean Water Act, 1998 Update," Watershed Management Panel Discussion; American Bar Association, Satellite seminar to 75 sites nationwide. Broadcast from Washington DC. May 12, 1998.

Pre-conference Workshop, "A Summit of National Watershed Organizations." Co-organizer and Participant, WEF. Denver, CO. May 2, 1998.

"Achieving Water Quality Standards Through the Use of TMDL, Models and the TMDL Process," University of Wisconsin Engineering and Professional Development Short Course. Madison, WI. February 18-19, 1998.

"Issues of Potential Significance with Respect to Wet-Weather Water Quality Standards," WEF Water Quality Standards Work Group, Wet Weather Subgroup, Satellite Teleconference. January 9, 1998.

"Selecting the Appropriate Water Quality Model for Watershed Management," Wissahickon Watershed Partnership, NIER. Philadelphia, PA. January 8, 1998.

"TMDLs and the Watershed Approach," Presenter, Chesapeake Water Environment Association and American Water Resources Association Seminar "TMDLs and Effluent Trading: The Key to Healthy Watersheds?" College Park, MD. November 20, 1997.

1997 AMSA CSO Permit Negotiation Workshop, "Strategies for Communities to Limit Liability for CSO Discharges." Facilitator. Cincinnati, OH. September 25, 1997.

"Wastewater NPDES: Water Quality Based Toxic Effluent Limits," Environmental Permitting and Compliance Course, Michigan Chamber of Commerce. Novi, Grand Rapids, and Lansing, MI. May 8, 14, and 28, 1997

"Environmental Permitting" sponsored by the Michigan Chamber of Commerce. Novi, Grand Rapids, and Lansing, MI. May 1997.

"Implementing Watershed Management," A Workshop for Decision Makers, sponsored by Brown and Caldwell and LimnoTech. Atlanta, GA. November 8, 1996.

"CSO Performance Measures as a Method of Tracking the Success of Control Efforts," sponsored by Association of Metropolitan Sewerage Agencies and LimnoTech, Boston, Cincinnati, Chicago, New York/New Jersey, Pittsburgh. October - November 1996.

"Watershed Management - Reinventing EPA's Water Management Program," United States Chamber of Commerce, CWIC Regulatory Forum. Washington, DC. October 31, 1996.

"TMDLs as a Tool for Watershed Management." Presenter, 34th Annual Fall Conference, Water Resources Association. Valley Forge, PA. October 17-18, 1996.

"Pre-treatment Streamlining Workshop," Regulatory Improvement Project co-sponsored by WEF, AMSA, and USEPA. Leesburg, VA. August 11-13, 1996.

"Emerging Issues in Environmental Legislation and Regulation," Ohio Water Environment Association 70th Annual Meeting. Akron, OH. June 21, 1996.

"Emerging Issues in Clean Water Act Regulation," Presenter, A Seminar on Advancements in Water & Wastewater, The 1996 Borchardt Conference, The University of Michigan. Ann Arbor, MI. January 30, 31 and February 1, 1996.

"Six Major Programs of the Clean Water Act" plus "Developing and Challenging Water Quality Based Toxic Effluent Limits," Executive Enterprises, Environmental Regulations Course. Dearborn, MI. October 30 - November 1, 1995.

"Great Lakes Initiative: The Water Environment Federation - Perspective," Annual WEFTEC Conference and Exposition. Chicago, IL. October 17, 1995.

Legislative and Regulatory Developments Effecting Pretreatment Requirements, Municipal and Industrial Pretreatment Seminar. Indianapolis, IN. September 13, 1995.

Great Lakes Initiative, Municipal Industrial Pretreatment Seminar. Indianapolis, IN. September 12-13, 1995.

"Clean Water Act Legislative and Regulatory Update," Michigan Chamber of Commerce, Environmental Regulations. Traverse City, MI. August 17-18, 1995.

"Modeling Requirements for Long Term CSO Control Plans," (with M.P. Sullivan and J.K. Marr). Louisville, KY. July 11, 1995.

"Use of Models to Develop Exposure Assessment" and "Toxic Substances in Water Environments: Assessment and Control Conference," Preconference Workshop, Water Environment Federation. Cincinnati, OH. May 14, 1995.

Everglades Mercury Research Workshop: Modeling Expert Facilitator. West Palm Beach, FL. November 15-17, 1994.

"Total Quality Management: A CEO Perspective." The Evolving Organization Conference, Presentation and Panel Discussion, American Society for Quality Control: Human Resources Division, Washtenaw Community College Business Center. Ypsilanti, MI. October 14, 1994.

"Federal Regulatory Update." WEF Member Association Government Affairs Congress. Chicago, IL. October 18, 1994.

"Working in Partnership with Government Organizations," WEF Member Association Congress. Chicago, IL. October 18, 1994.

GLI: The Water Environment Federation Perspective, at the 67th Water Environment Federation Conference. Chicago, IL. October 17, 1994.

"A Global Perspective for Reducing CSOs: Balancing Technologies, Costs, and Water Quality," Kentucky-Tennessee Water Environment Association, The CSO Partnership. Louisville, KY. July 10-13, 1994.

"Current Issues in the Environment," Michigan Public Radio (WKAR), Lansing, MI. May 6, 1994.

"The Ecosystem Approach and Pollution Prevention," Great Lakes Washington Roundtable, Northeast-Midwest Institute. Washington, DC. April 25, 1994.

"Great Lakes Initiative - Model Regulation Long Overdue or Government Excess, Short on Need, Long on Cost," Illinois Association of Wastewater Agencies Mini-Conference. Springfield, IL. March 10-11, 1994.

"New Directions for Michigan Water Environment Professionals," MWEA Wastewater Administrator's Winter Workshop. Grand Rapids, MI. February 17-18, 1994.

"Groundwater Modeling," MWEA Groundwater Remediation Conference. Novi, MI. February 23, 1994.

"Water Quality Based Effluent Standards and How They are Calculated," Reauthorizing the Clean Water Act Status and Strategies. Washington, DC. January 27-28, 1994.

"TMDL Regional Information Exchange Workshop: Including Regulatory Guidance, Modeling and Sampling," USEPA Office of Science and Technology, Exposure and Assessment Branch and Office of Wetlands, Oceans and Watersheds, Watershed Branch:

Region 4 and 5. Atlanta, GA. November 30-December 2, 1993

Regions 7 and 8. Denver, CO. October 19-21, 1993

Region 1 and 2. Danvers, MA. September 8-10, 1993

"Clean Water Act Reauthorization: The Michigan Position," a facilitated work group, Michigan Department of Natural Resources. Lansing, MI. 1993.

"Critical Water Toxics Issues," Institute of Business Law, California State University, Environmental Regulations in Michigan. Detroit, MI. September 29-30, 1993.

"The Toxic Permitting Process," Liquid and Solid Industrial Control Association, Radisson on the Lake. Ypsilanti, MI. September 20-22, 1993.

"New Directions for the Michigan Water Environment Professional," MWEA Fall Regional Meeting. Battle Creek, MI. September 14, 1993.

"Zero Discharge: A Controversial Debate," MWEA Annual Conference. Boyne Highland, MI. June 28, 1993.

"Monitoring CSO Impacts: A Strategy for the Ohio River; Role of Modeling," Ohio River Valley Sanitation Commission. Ft. Mitchell, KY. June 2-3, 1993.

"Water Environment Federation Involvement in Government Affairs," WEF Regional Meeting, Minneapolis, MN. April, 1993.

"How Water Quality Based Effluent Limits are Calculated," Executive Enterprises, The 1993 Clean "Water Update: How Will Reauthorization Impact Your Compliance Strategies." Chicago, IL, April 1993 and Washington, DC, March 4-5, 1993

"Water Quality Based Approaches to NPDES Permitting," AT&T Technology Transfer Conference, Summit. New Jersey. October 22, 1992.

"Toxic Waste Load Allocation," WEF Pre-Conference Seminar, Water Quality Based Toxics Control, Federal Guidance and State/Discharge Experience. New Orleans, LA. September 20, 1992.

"Toxic Permit Development," WEF Pre-Conference Seminar, Water Quality Based Toxics Control, Federal Guidance and State/Discharge Experience. New Orleans, LA. September 20, 1992.

"How Water Quality Based Effluent Limits are Established," Executive Enterprises, Water Quality Standards for Toxic Pollutants. Washington, DC, September 17-18, 1992, and Chicago, IL, October 22-23, 1992.

"Computers and Models for Environmental Regulation and Management," Chemical Manufacturers Association. Washington, DC. September 14, 1992.

"Great Lakes Initiative Technical and Policy Issues," Motor Vehicle Manufacturers Association. Detroit, MI. August 27, 1992.

"Using Simple Models to Evaluate Complex Storm Effects," (with J.K. Marr), prepared for the ASCE Water Forum 92. Baltimore, MD. August 4, 1992.

"Design Conditions for Wet Weather Controls," WEF Specialty Conference, Control of Wet Weather Water Quality Problems. Indianapolis, IN. June 2, 1992.

"Calculating Water Quality Based Effluent Limits," University of Wisconsin Short Course, The Engineering and Regulatory Aspects of NPDES Permits. Madison, WI. May 21-22, 1992.

"Water Quality Based Effluent Limits for NPDES," Environmental Regulation Course. Detroit, MI. April 7-9, 1992.

"Great Lakes Water Quality Initiative: Its Significance and Controversy," Great Lakes Initiative, A Program for Industry, sponsored by Michigan Water Pollution Association. Kalamazoo, MI, March 25, 1992, and Farmington, MI, March 18, 1992.

"Phased TMDL Case Study," USEPA TMDL Program Guidance Workshop. Chicago, IL. February 19-20, 1992.

"Great Lakes Water Quality Regulations: State/Province vs. National vs. International Jurisdiction," Water Pollution Control Federation, Member Association Congress. October, 1991.

"TMDL/Mixing Zone and Toxics Modeling Workshop," USEPA Exposure and Assessment Division, Office of Water Regulations and Standards, Ithaca, NY, August 6-8, 1991, and Portland, OR, August 13-15, 1991.

"TMDLs and Nonpoint Modeling," Workshop on the Water Quality-Based Approach for Point Source and Nonpoint Source Controls, sponsored USEPA. Chicago, IL. June 26-28, 1991.

Government Affairs Session, Session Chair, 66th Annual Conference Michigan Water Pollution Control Association. Harbor Springs, MI. June 23-26, 1991.

"Environmental Permitting," Seminar sponsored by the Michigan State Chamber of Commerce. Grand Rapids, MI. May 16, 1991.

"Selection of CSO Controls to Minimize Aesthetic," Public Health and Water Quality Impacts, - Poster Session on A Storm Brewing; Combined Sewer Overflow and Storm Water Control - Ohio River Valley Water Sanitary Commission. Fort Mitchell, KY. April 23, 1991.

"Great Lakes Water Quality Regulations: State/Province vs. National vs. International Jurisdiction," Water Pollution Control Federation, Member Association Congress. April 1991.

"Waste Load Allocations, Dilution and Biomonitoring," University of Wisconsin Short Course Identifying Effluent Toxicity with Biomonitoring and Toxicity Reduction Evaluations. Madison, WI, September 11-13, 1990; Madison, WI, October 21-23, 1990; and Berkeley, CA, February 1991.

"Comparing Benefits of CSO Controls," - Specialty Conference on Combined Sewer Overflow Abatement. Columbus, OH. November 28, 1990.

"A Simplified Framework for Toxics Modeling," - WPCF Annual Conference. Washington, DC. October 11, 1990.

"Waste Load Allocations, Dilution, and Biomonitoring," - Identifying Effluent Toxicity with Biomonitoring and Toxicity Reduction Evaluations. Milwaukee, WI. September 11-13, 1990.



"Approaches for Evaluating Water Quality Benefits of Combined Sewer Overflow Controls," - 1990 National Conference on Environmental Engineering, Arlington, VA. July 8-11, 1990.

"Regulatory News from Lansing and Washington," MWPCA 65th Annual Conference. Sugar Loaf Resort, Cedar, MI. June 24-27, 1990.

"Future Compliance - What's Coming Next?" Panel Discussion Moderator, Compliance and Enforcement Seminar, Water Pollution Control Federation. Washington, DC. March 29, 1990.

"Waste Load Allocation, Dilution and Biomonitoring," Identifying Toxicity with Biomonitoring and Toxicity Reduction Evaluations, University of Wisconsin-Madison. Berkeley, CA. February 12-14, 1990.

Toxics Modeling Workshops: Including Theory, Approach, Regulations, Model Selection and Use, Calibration/Verification, Sampling, Mixing Zones, Probabilistic Techniques, Estuary Modeling, TMDL/WLA and Permitting, USEPA Assessment and Watershed Protection Division, Office of Water Regulations and Standards:

Region 3. Philadelphia, PA. December 5-7, 1990

Region 10. Seattle, WA. January 9-11, 1990

Region 2. New York, NY. September 19-20, 1989

Region 7. Kansas City, KS. August 17-18, 1989

Region 9. San Francisco, CA. August 8-10, 1989

Region 5. Chicago, IL. July 18-19, 1989

Region 3. Philadelphia, PA. September 1988

Toxic Modeling and Mixing Zone Assessment: Including Regulations, Model Theory, Selection and Use, Probabilistic Approaches, Permitting, USEPA Assessment and Watershed Protection Division, Office of Water Regulations and Standards:

Region 4. Atlanta, GA. October 10-12, 1990

Region 7. Boulder, CO. September 12-13, 1989

Toxics Modeling Workshop for E.I. DuPont. Wilmington, DE. December 5-6, 1989.

Water Quality Modeling Workshop: Including Regulations, WLA/TMDL, Toxics and Conventional Pollutant Modeling Theory, Selection and Use, Calibration/Verification, Mixing Zone, Probabilistic Approaches, Estuary and Bay, USEPA Assessment and Watershed Division, Office Water Regulations and Standards, Region 2. Atlanta, GA. November 28-30, 1989.

"SARA Title III: Alternative Methods for Distributing Required Information," Environmental Issues in Manufacturing for 1990 and Beyond. Lansing, MI. November 14, 1989.

"Modeling and Remedial Action Planning," Cuyahoga River RAP and Lake Erie Modeling Seminar. Cleveland, OH. October 26, 1989.

"Modeling Nonpoint Source Pollution Impacts in Lakes," Pre-Conference Workshops, Defining Nonpoint Source Pollution,

Water Pollution Control Federation. San Francisco, CA. October 14-15, 1989.

"Modeling of Toxic Effluents for NPDES Permit Limits," AWWA/MWPCA Joint Meeting, Amway Grand Plaza. Grand Rapids, MI. August 1-4, 1989.

"Waste Load Allocations, Dilution and Biomonitoring," Identifying Effluent Toxicity with Biomonitoring and Toxicity Reduction Evaluations, University of Wisconsin. Madison, WI. June 27-29, 1989.

Procedures for Water Quality Based Toxic Effluent Limits, USEPA Office of Water Regulations and Standards, Region 3. Philadelphia, PA. 1988.

"Dynamic Modeling for Toxic Permit Limits," Michigan Coalition for Clean Water. East Lansing, MI. October 17, 1988.

"Member Association Involvement in the WPCF Government Affairs Process," Member Association Congress. Dallas, TX. October 3, 1988.

"Dilution Modeling to Define Toxic Impairment in U.S. Estuaries," Water Pollution Control Federation, 61st Annual Conference, Dallas Convention Center. Dallas, TX. October 3-6, 1988.

"Tracing Groundwater Contaminants through Microcomputer Graphic Simulation," Water Pollution Control Federation, 61st Annual Conference, Dallas Convention Center. Dallas, TX. October 3-6, 1988.

A Review of the Great Lakes Water Quality Agreement as Amended November 18, 1987, Water Pollution Control Federation Annual Convention. Dallas, TX. October 1988.

"Wetlands Permitting and Regulations," Chairperson and Organizer, Michigan Water Pollution Control Association and Michigan Municipal League. Lansing, MI. September 8, 1988.

"Effectiveness of Crop Management Practices for Reducing Pollutant Loads and Improving Saginaw Bay Water Quality," International Association for Great Lakes Research 31st Conference. Hamilton, Ontario. May 17, 1988.

"Kalamazoo River Studies: Environmental vs. Wastewater Loading Impacts on Water Quality," Water Pollution Control Federation. Philadelphia, PA. October 5, 1987.

"A New Way for the Bay," A Workshop for the Future of Saginaw Bay. Bay City, MI. March 5, 1987.

Conventional and Probabilistic Modeling for Toxic Waste Load Allocation, USEPA Office of Water Regulations and Standards, Waste Load Allocation Branch:

Region 5. Chicago, IL. 1987

Region 1. Boston, MA. 1986

Region 2. New York, NY. 1986

"Overview: Microcomputer Graphics Provide New and Innovative Advances for the Water Pollution Control Specialist," 59th Annual Conference - Water Pollution Control Federation. Los Angeles, CA. October 6-9, 1986.

"Probabilistic Modeling for Toxic Waste Load Allocation: New Requirements," 59th Annual Conference - Water Pollution Control Federation. Los Angeles, CA. October 6-9, 1986.

"Kalamazoo River Water Quality Problems: Causes and Cures," National Council on Air and Stream Improvement, Central-Lake Status Meeting. Chicago, IL. September, 1986.

"Shanghai-Drinking Water and Sewage Disposal; Multiple Use Management of the Huangpu River," the American Society of Civil Engineers. Long Beach, CA. August 4-6, 1986.

"Water Quality and Facilities Planning for the Upper Potomac Estuary," (with Clyde Wilber, III), 1986 Annual Meeting of the Virginia Water Pollution Control Association.

"Waste: The Global Enigma of the 80's," (with P.W. Rodgers and D.R. Klemans), World Conference on Large Lakes. Mackinaw Island, MI. May 18-21, 1986.

"New Advances in the Use of Microcomputers for Defining Effluent Limits," University of Michigan Seminar on Computerization in the Water and Wastewater Fields. Ann Arbor, MI. February 5-7, 1986.

"Regional Wastewater Facilities Planning for Shanghai," China, Session No. 20 (Technological and Regulatory Advances Outside the U.S.A.), 58th Annual Conference - Water Pollution Control Federation. Kansas City, MO. October 6-10, 1985.

"Use of Computer Monte Carlo Analysis for Waste Load Allocation," (with R.P. Canale and J.K. Marr), Computer Applications in Water Resources, ASCE Conference. Buffalo, NY. June 10-12, 1985.

"Water Resource Planning: Multi-objective Concepts Applied to Rural Water Management," (with J.W. Bulkley and J.K. Marr), 1985 World Congress on Water Resources, ASCE. Brussels, Belgium. June 1985.

"New Advances in the Use of Microcomputers for Waste Load Allocation," Michigan Water Pollution Control Association/American Water Works Association, Computers in Water Resource Engineering. Ann Arbor, MI. February 1985.

"Environmental Solutions through Computer Simulations: Microcomputer Applications," Toward A Transboundary Monitoring Network: A Continuing Binational Exploration, International Joint Commission Workshop, Academy of Natural Sciences of Philadelphia. Philadelphia, PA. October 10-11, 1984.

"Defining Waste Load Allocation in Southern Louisiana Streams with Limited Assimilative Capacity," (with M. Khan, J.K. Marr, J.D. Givens and R. Hannah), 57th Annual Conference, Water Pollution Control Federation. New Orleans, LA. October 1-4, 1984.

"Comparison of Three Procedures for Establishing Seasonal Effluent Limitations," (with J.F. Pendergast), 57th Annual Conference, Water Pollution Control Federation. New Orleans, LA. October 1-4, 1984.

"Lake Modeling," presented at the Onondaga Lake Community Symposium. September 15, 1984.

"The Use of Simple Versus Complex Models for Planning Combined Sewer Overflow Control Programs," (with J.F. Pendergast, G.E. Bondy and J.K. Marr), 1984 ASCE National Specialty Conference on Urban Water. Baltimore, MD. May 28-31, 1984.

"The Shanghai Project - A Preliminary Report," (with J.W. Bulkley), 1984 ASCE National Specialty Conference on Urban Water. Baltimore, MD. May 28-31, 1984.

"Cost Benefit Analysis of Point Source Versus Agricultural Controls to Improve Saginaw Bay Water Quality," (with J.K. Marr and P.W. Rodgers), 27th Conference on Great Lakes Research, Brock University. St. Catherine's, Ontario. April 30-May 3, 1984.

"Application of Microcomputers for Uncertainty Analysis Associated with Wastewater Treatment Facilities Planning," (with R.P. Canale and D.W. Dilks), 1st National Conference on Microcomputers In Civil Engineering, ASCE, Florida Section. Orlando, FL. November 1983.

"Modeling the Risk of Groundwater Contamination," (with J.F. Pendergast, J.K. Marr and S.J. Wright), Association of Ground Water Scientists and Engineers, Eastern Regional Conference on Groundwater Management. Orlando, FL. November 1983.

"PCB Distribution in Saginaw River and Model Forecasts," (with P.W. Rodgers, D.L. Heidtke and C.P. Rice), presented at the 26th Conference on Great Lakes Research. Oswego, NY. May 24-26, 1983.

"Use of Models for Evaluating Stormwater Management Alternatives," (with J.F. Pendergast), Huron River Watershed Council Meeting. November 3, 1982.

"Use of Simple Modeling and Probability Analysis To Compare Combined Sewer Overflow Controls," (with J.F. Pendergast and J.K. Marr), 1982 National Conference on Environmental Engineering, ASCE. July 14-16, 1982.

"The Use of Event Simulation Models For the Projection of Long-Term Continuous Impacts in Combined Sewer Overflow Abatement Planning," (with C.B. Murphy, Jr., D.A. MacArthur, G.J. Welter, D.B. Jones, and J.F. Pendergast), 1982 National Conference on Environmental Engineering, ASCE. July 14-16, 1982.

"The Use of Water Quality Models to Determine Nitrification Treatment Requirements for Wastewater Treatment," (with R.B. Brownwell), Central State Water Pollution Control Conference. Delavan, WI. 1980.

"Modeling of Water Quality for Area-wide Planning," (with R.P. Canale and J.F. Pendergast), National Conference on Environmental Engineering. San Francisco, CA. 1979.

"Modeling Storm Impacts on Onondaga Lake Water Quality," P.L. Freedman, R.P. Canale and J.F. Pendergast, National Conference on Environmental Engineering. San Francisco, CA. 1979.

Assessing Storm Overflow Impacts on Lake Water Quality, (with R.P. Canale, J.F. Pendergast and P.E. Moffa), International Symposium on Urban Storm Runoff. Lexington, KY. July 22-26, 1979.

"Impact of Combined Sewer Overflows on an Urban Lake," (with P.E. Moffa, J.C. Byron, R.P. Canale, and J.M.

Karanek), 51st Annual Conference Water Pollution Control Federation. Anaheim, CA. 1978.

"The Use of Receiving Water Quality Models in Urban Runoff Pollution Abatement: Applications to Marginal Benefit-Marginal Cost Analysis," (with C.B. Murphy, G.J. Welter,

D.A. MacArthur, and R.P. Canale), Conference on Stormwater Impacts. Orlando, FL. November 1977.

"Sediment-Water Interactions and Regeneration of Nutrients in White Lake, Michigan," (with E. Callender, and C. Boatman), International Symposium on Geochemistry of Natural Waters Session III. August, 1975.

## WORKGROUPS / WORKSHOPS/SHORT COURSES / EXPERT PANELS

National Academy of Sciences, Engineering, and Medicine, Expert Panel Committee to Review New York City Department of Environmental Protection Operations Support Tool for Water Supply Management, 2016-2018

The Aspen Nicholas Water Forum: Data Intelligence and Water Sustainability. Invited guest and participant. Aspen CO, May 28-31, 2015.

"Clean Water Progress: Pride, Frustration and Future Directions." Considering the Clean Water Act. Co-Convener and remarks Johnson Foundation National Retreat. Wingspread, WI. October 2009 & June 2010.

Clean Water America Alliance "National Dialogue on an Integrated Water Policy." Washington, DC. September 2009.

National Academy of Sciences, National Research Council Technical Reviewer, Committee on the "Clean Water Act Implementation Across the Mississippi river Basin." 2009/2010.

National Academy of Sciences, National Research Council Technical Reviewer, Committee on the "Mississippi River and the Clean Water Act: Scientific, Modeling and Technical Aspects of Nutrient Pollutant Load Allocation and Implementation." 2008.

US/Canada Water Policy Forum, Water and Climate Change and Energy-Water Nexus. Washington, DC. October 2007.

"Source Water Protection Research Planning Workshop" AwwaRF/WERF joint workshop. August 1-2, 2007, Denver, CO.

Groundwater Sustainability Expert Workshop. Michigan Groundwater Conservation Advisory Council and Grand Valley State University. Grand Rapids, MI. March 26, 2007.

Sustainable Water Resources Roundtable. Sustainable Water Resources Roundtable Workshop. Washington, DC. January 25, 2007.

Duke University and Resources for the Future, NRC/NAS Expert Panel follow-on to "Use of Adaptive Management in TMDL's." 2004-2006.

"Viewing the Total Maximum Daily Load Requirement as a Process, not a Singular Number: The Call for Adaptive Management" Adaptive Implementation of TMDLs: Interpretation and Application Workgroup, Duke University. Durham, NC. October 25, 2004.

"A Different View of Leadership" Environmental Financial Consulting Group presentation. New York, NY. October 21, 2004.

"Actions Towards a Sustainable Great Lakes." Organizing committee, opening session moderator "A Shared Vision for

the Great Lakes: Actions Taken and Actions Needed." Session moderator and facilitator, "Human Health." Great Lakes Commission. Cleveland, OH. May 5-7, 2004.

"Identifying Knowledge Gaps with TMDLs and Drinking Water Utilities." Co-organizer, speaker and facilitator, AWWARF and WERF. Scituate, MA. December 10-12, 2003.

"Critical Analysis and Improvements for the TMDL Program, WERF Research." Presenter, WEFTEC. Chicago, IL. September 28, 2002.

National Academy of Sciences, National Research Council Technical Reviewer, "Assessing the TMDL Approach to Water Quality Management." 2001.

TMDL Science Issues Conference, Panelist for TMDL Science Obstacles, Association of State and Interstate Water Program Administration USGS, USEPA, and WEF. St. Louis, MO. March 5-7, 2001.

"Total Maximum Daily Loads: An Introduction for Water Suppliers Using Surface Water Sources." Instructor, Co-organizer and Speaker, AWWA 2001 Source Water Protection Symposium. Savannah, GA. January 28, 2001.

Water Quality: "Can You Drink the Water?" Panelist, Michigan Chamber of Commerce Environmental Permitting Update. Lansing, MI. October 25, 2000.

"Surviving a TMDL Project: Practical Advice for Municipalities." Speaker, Preconference Workshop, APWA International Public Works Congress and Exposition. Louisville, KY. September 9, 2000.

Total Maximum Daily Load Modeling – NPDES Permit/TMDL Seminar. Washington, DC. March 23-24, 2000.

USEPA Total Maximum Daily Load Public Meeting. Moderator and Facilitator. Atlanta, GA and Kansas City, MO. September 22-23 and 29-30, 1999.

USEPA/WEF Experts Workshop "Implementing the WQ-Based Provisions of the CSO-Control Policy." Organizer, Speaker and Facilitator. Washington, DC. September 24, 1999.

"Clean Water Act, 1998 update," Watershed Management Panel Discussion; American Bar Association, Satellite seminar to 75 sites nationwide. Broadcast from Washington, DC. May 12, 1998.

Pre-conference Workshop, "A Summit of National Watershed Organizations." Co-organizer and Participant, WEF. Denver, CO. May 2, 1998.

"Achieving Water Quality Standards Through the use of TMDL; Models and the TMDL Process," University of Wisconsin Engineering and Professional Development Short Course. Madison, WI. February 18-19, 1998.

"Issues of Potential Significance with Respect to Wet-Weather Water Quality Standards," WEF Water Quality Standards Work Group, Wet Weather Subgroup, Satellite Teleconference. January 9, 1998.

1997 AMSA CSO Permit Negotiation Workshop, "Strategies for Communities to Limit Liability for CSO Discharges." Facilitator. Cincinnati, OH. September 25, 1997.

"Environmental Permitting" sponsored by the Michigan Chamber of Commerce. Novi, Grand Rapids, and Lansing, MI. May 1997.

"Implementing Watershed Management," A Workshop for Decision Makers, sponsored by Brown and Caldwell and LimnoTech. Atlanta, GA. November 8, 1996.

"CSO Performance Measures as a Method of Tracking the Success of Control Efforts," sponsored by Association of Metropolitan Sewerage Agencies and LimnoTech. Boston, MA; Cincinnati, OH; Chicago, IL; New York/New Jersey, Pittsburgh, PA. October - November 1996.

"Pre-treatment Streamlining Workshop," Regulatory Improvement Project co-sponsored by WEF, AMSA, and USEPA. Leesburg, VA. August 11-13, 1996.

"Six Major Programs of the Clean Water Act" plus "Developing and Challenging Water Quality Based Toxic Effluent Limits," Executive Enterprises, Environmental Regulations Course. Dearborn, MI. October 30 - November 1, 1995.

"Federal Clean Water Act: New Directions". Annual Environmental Regulations Workshop. Michigan Chamber of Commerce. August 17-18, 1995.

"Use of Models to Develop Exposure Assessment" and "Toxic Substances in Water Environments: Assessment and Control Conference," Preconference Workshop, Water Environment Federation. Cincinnati, OH. May 14, 1995.

Everglades Mercury Research Workshop: Modeling Expert Facilitator. West Palm Beach, FL. November 15-17, 1994.

"Great Lakes Washington Roundtable: The Ecosystem Approach and Pollution Prevention," Northeast-Midwest Institute. Washington, DC. April 25, 1994.

"Water Quality Based Effluent Standards and How They are Calculated"; Reauthorizing the Clean Water Act Status and Strategies. Washington, DC. January 27-28, 1994.

"TMDL Regional Information Exchange Workshop: Including Regulatory Guidance, Modeling and Sampling," USEPA Office of Science and Technology, Exposure and Assessment Branch and Office of Wetlands, Oceans and Watersheds, Watershed Branch:

Region 4 and 6. Atlanta, GA. November 30-December 2, 1993

Regions 7 and 8. Denver, CO. October 19-21, 1993

Region 1 and 2. Danvers, MA. September 8-10, 1993

"Clean Water Act Reauthorization: The Michigan Position," a facilitated work group, Michigan Department of Natural Resources. Lansing, MI. 1993.

"Critical Water Toxics Issues," Institute of Business Law, California State University, Environmental Regulations in Michigan. Detroit, MI. September 29-30, 1993.

"Monitoring CSO Impacts: A Strategy for the Ohio River; Role of Modeling," Ohio River Valley Sanitation Commission, Ft. Mitchell, Kentucky, June 2-3, 1993.

"How Water Quality Based Effluent Limits are Calculated," Executive Enterprises, The 1993 Clean "Water Update: How Will Reauthorization Impact Your Compliance Strategies." Chicago, IL, April 1993 and Washington, DC, March 4-5, 1993.

"How Water Quality Based Effluent Limits are Established," Executive Enterprises, Water Quality Standards for Toxic Pollutants, Washington, DC, September 17-18, 1992, and Chicago, IL, October 22-23, 1992.

"Calculating Water Quality Based Effluent Limits," University of Wisconsin Short Course, The Engineering and Regulatory Aspects of NPDES Permits. Madison, WI. May 21-22, 1992.

"Clean Water Act - Water Quality Based Toxic Effluents," Executive Enterprises Inc., Environmental Regulations Course. Detroit, MI. April 7-9, 1992.

"TMDL/Mixing Zone and Toxics Modeling Workshop," USEPA Exposure and Assessment Division, Office of Water Regulations and Standards. Ithaca, NY, August 6-8, 1991, and Portland, OR, August 13-15, 1991.

"Waste Load Allocations, Dilution and Biomonitoring," University of Wisconsin Short Course Identifying Effluent Toxicity with Biomonitoring and Toxicity Reduction Evaluations. Madison, WI, September 11-13, 1990 and October 21-23, 1991, and Berkeley, CA, February, 1990.

Toxics Modeling Workshops: Including Theory, Approach, Regulations, Model Selection and Use, Calibration/Verification, Sampling, Mixing Zones, Probabilistic Techniques, Estuary Modeling, TMDL/WLA and Permitting, USEPA Assessment and Watershed Protection Division, Office of Water Regulations and Standards:

Region 3. Philadelphia, PA. December 5-7, 1990

Region 10. Seattle, WA. January 9-11, 1990

Region 2. New York, NY. September 19-20, 1989

Region 7. Kansas City, KS. August 17-18, 1989

Region 9. San Francisco, CA. August 8-10, 1989

Region 5. Chicago, IL. July 18-19, 1989

Region 3. Philadelphia, PA. September 1988

Toxic Modeling and Mixing Zone Assessment: Including Regulations, Model Theory, Selection and Use, Probabilistic Approaches, Permitting, USEPA Assessment and Watershed Protection Division, Office of Water Regulations and Standards:

Region 4. Atlanta, GA. October 10-12, 1990

Region 7. Boulder, CO. September 12-13, 1989

Toxics Modeling Workshop for E.I. DuPont. Wilmington, DE. December 5-6, 1989.

Procedures for Water Quality Based Toxic Effluent Limits, USEPA Office of Water Regulations and Standards, Region 3. Philadelphia, PA. 1988.

Conventional and Probabilistic Modeling for Toxic Waste Load Allocation, USEPA Office of Water Regulations and Standards, Waste Load Allocation Branch:

Region 5. Chicago, IL. 1987

Region 1. Boston, MA. 1986

Region 2. New York, NY. 1986

"New Advances in the Use of Microcomputers for Waste Load Allocation," Michigan Water Pollution Control Association/American Water Works Association, Computers in Water Resource Engineering. Ann Arbor, MI. February 1985.

Water Quality Modeling Workshop: Including Regulations, WLA/TMDL, Toxics and Conventional Pollutant Modeling Theory, Selection and, Use, Calibration/Verification, Mixing Zone, Probabilistic Approaches, Estuary and Bay, USEPA Assessment and Watershed Division, Office Water Regulations and Standards, Region 2. Atlanta, GA. November 28-30, 1989.

## SELECTED PUBLICATIONS

### Journal Articles

"Basinwide Programs in the Chesapeake and Delaware Basins: Similar Nature, Distinct Strategies" (with Matt Ehrhart and Kathy Hall). American Water Resources Association, Water Resources Impact, Vol. 20, No. 6, September 2018.

"Data and Models Help Define Effective Strategies for the Delaware River Watershed Initiative" (with David Arscott, Scott Haag and Kathy Hall). American Water Resources Association, Water Resources Impact, Vol. 20, No. 6, September 2018.

WEF Highlights "From the President": 2009-2010

"Shifting the Vision of Water Professionals," September 2010, Vol. 42, No. 7.

"Attracting a New Generation of Professionals," June 2010, Vol. 47, No. 5.

"Examining the Successes, Frustration, and Future of Clean Water," April 2010, Vol. 47, No. 3.

"Engaging the Public in Our Mission," February 2010, Vol. 47, No. 1

"A Vision of Leadership for the New Year," November 2009, Vol. 46, No. 9

"A Vision of Leadership for the New Year," WEF President's Message. MWEA Matters, Vol. 5. No. 4, Winter 2010.

"Don't Debate; Adapt Adaptive Implementation Can Help Water Quality Professionals Achieve TMDL Goals." (with Len Shabman, and Kenneth Reckhow). Water Environment & Technology. Vol. 20, No. 8. August 2008.

"A New Approach to Adaptive Implementation in the TMDL Program," (with Kenneth Reckhow, Leonard Shabman, Jennifer Benaman, Richard Schwer, and Thomas Stiles). Water Practice, Water Environment Federation, Vol. 2, No. 1. January 2008.

"Factors for Success in Developing Use Attainability Analysis," (with Tom Dupuis, Hans Holmberg, Patricia McGovern, Lori Terry, and Margaret Stewart). Water Practice, Water Environment Federation, Vol. 2, No. 1. January 2008.

"Hard Lessons, Simple Truths," (with Victor J. Bierman Jr. and Joseph V. DePinto). Water Environment & Technology, Vol. 19, No. 6, June 2007.

"The Need for Involvement by Drinking Water Utilities in the Total Maximum Daily Load (TMDL) Process" (with W. Larson, J. Rosen, and J. Sobrinho). Watershed & Wet Weather Technical Bulletin, Water Environment Federation. Sept./Oct. 2006.

"Improved Consideration of the Margin of Safety in TMDL Development" (with D. Dilks), Journal of Environmental Engineering ASCE Special TMDL Issue, June 2004.

"Viewing TMDLs as a Process, not a Singular Value: Adaptive Watershed Management" (with A. Nemura), Journal of Environmental Engineering ASCE Special TMDL Issue, June 2004.

"Models Quantify the TMDL Process" (with J. DePinto and D. Dilks), Journal of Environmental Engineering ASCE Special TMDL Issue, June 2004.

"Improving TMDLs" (with D. Dilks and W.M. Larson), Water Environment & Technology, June 2003.

"CWA's New Clothes, A Critical Review of the TMDL Program," Water Environment & Technology, June 2001.

"Urban-Rural Partnerships Needed to Achieve Clean Water," Water Environment & Technology, February 2001.

"Old, New Rules Blur Watershed Focus, Viewpoint," Water Environment & Technology, April 1998.

"Watershed Management," CWEA Eco Letter, Spring 1998.

"Watershed Management: Overcoming the Politics of Pollution," (with L. Wise), Watershed & Wet Weather Technical Bulletin, Water Environment Federation, June 1996.

"Amending Antidegradation Policy" (with G. Burk and K. Schroeder), Water Environment & Technology, December 1995.

"Nonpoint Sources" (with Rick Moore), Water Environment & Technology, September 1995.

"Great Lakes Initiative: The Water Environment Federation - Perspective," Annual WEFTEC Conference and Exposition Proceeding. Chicago, IL. October 17, 1995.

"Great Lakes Environment Assessment," Annual WEFTEC Conference and Exposition Proceeding. Chicago, IL. October 1995.

"A Watershed Event in Water Quality Protection" (with D. Dilks, G. Dukes, B. Kreutzberger), Water Environment & Technology, September 1994.

"Revised Methods Considered for Aquatic Life Criteria" (with D. Dilks), Water Environment & Technology, March 1994.

"A Picture is Worth a Thousand Words" (with T.A. Slaweki), Special Report on Computer Technology, Industrial Wastes, October/November 1993.

"Environmental Market, Clean Water: Trend Toward Zero Discharge Continues" (with P. Selig), Engineering News Record, February 15, 1993.

"Zero Discharge: A Goal Whose Time Has Come?" (with D. Blake; L. Ford, J., and L. Melton), Water Environment & Technology, October 1992.

"Modeling Total Residual Chlorine in the Upper Potomac Estuary," Estuarine and Coastal Modeling Conference. Newport, RI. November 1989.

"The Great Lakes Water Quality Agreement" (with Bruce A. Monson), Water Environment & Technology, October 1989.

"Seasonal Changes and Effluent Limits" (with James F. Pendergast, Clyde Wilber III, and Shih Cheng Chang), Journal Water Pollution Control Federation, March 1988.

"Worth A Thousand Words" (with David W. Dilks, Raymond P. Canale, and Theodore A.D. Slaweki), Civil Engineering, July 1987.

"Water Supply and Sewage Disposal: Shanghai, China" (with J.W. Bulkley, Chen Jiang Tao, Zheng Wei-Min, Kan Chen, and Wang Peibo), ASCE Conference Proceedings, Water Forum, 1986.

"Modeling Storm Runoff Impacts on a Eutrophic Urban Lake" (with R.P. Canale and J.F. Pendergast), Journal of the Environmental Engineering Division, ASCE, Vol. 106, No.EE2, pages 335-349, 1980.

"Impact of Wastewater Diversion on Lake Water Quality" (with R.P. Canale), Journal of the Environmental Engineering Division, ASCE, Vol. 105, No. EE5, pages 867-881, 1979.

"Assessing Storm Overflow Impacts on Lake Water Quality" (with R.P. Canale, J.F. Pendergast, and P.E. Moffa), Proceedings of the International Symposium on Urban Storm Runoff. Lexington, KY. 1979.

"Aquatic Macrophytes in White Lake, Michigan" (with R. P. Canale), Journal of the Environmental Engineering Division, ASCE, Vol. 103, No. EE3, pages 431-444, 1977.

"Nutrient Release from Anaerobic Sediments" (with R.P. Canale), Journal of the Environmental Engineering Division, ASCE, Vol. 103, No. EE2, pages 233-244, 1977.

"Phosphorus Models for Eutrophic Lakes" (with W.S. Lung and R.P. Canale), Water Research, Vol. 10, No. 12, pages 1101-114, 1976.

## Books and Published Reports

"Charting New Waters: A National Call to Action to Address U.S. Freshwater Challenges," Co-Author. The Johnson Foundation Freshwater Summit. September, 2010.

"Factors for Success in Developing Use Attainability Analyses" (with Tom Dupuis). Water Environment Research Foundation 04-WEM-1, 2007.

"Adaptive Implementation of Water Quality Improvement Plans: Opportunities and Challenges" (with L. Shabman, K. Reckhow, M. Beck, J. Benaman, S. Chapra, M. Nellor, J. Rudek, D. Schwer, T. Stiles, and C. Stow). Nicholas School of the Environment and Earth Sciences. 2007

"An Energy/Water Sustainability Research Program for the Electric Power Industry," EPRI Project 062994, May 2007

"Total Maximum Daily Loads (TMDLs) and Drinking Water Utilities" (with J. Rosen, J. Sobrinho and W. Larson). Awwa Research Foundation. 2005.

"Navigating the TMDL Process: Evaluation and Improvements" (with W. Larson, D. Dilks, D. Schechter, A. Nemura, T. Naperala, J. DePinto, M Prothro, G. Boese, A. Dettelbach, L. Nothman, K. Thorton, D. Ford, P. Massier, T. Soerens, K. Stevens, and J. Sobrinho). Water Environment Research Foundation 00-WSM-01, 2003.

"Navigating the TMDL Process: Method Development for Addressing Narrative Criteria" (with D. Dilks, H. Holmberg, P. Moskus, G. McBride, C. Hickey, D. Smith, and P. Striplin).

Water Environment Research Foundation 01-WSM-01, 2003.

Navigating the TMDL Process: Listing and Delisting (with Kent Thornton). Water Environment Research Foundation 00-WSM-02, 2003.

Receiving Water Impacts, Chapter 3 of Control and Treatment of Combined Sewer Overflows edited, Peter Moffa, Van Nostrand Reinhold, 1990, second edition 1996.

Receiving Water Impacts, Chapter 3 of Control and Treatment of Industrial and Municipal Stormwater edited, Peter Moffa, Van Nostrand Reinhold, 1990, second edition 1996.

Technical Writing Manual (with J. Marr), LimnoTech., 1986, Revised May 1991.

System Analysis in Different Social Settings: Extension of a Case Study of Water Pollution Control in China (with Kan Chen and Jonathan W. Bulkley), National Science Foundation, Grant No. INT-8212774, 1986.

Applicability of Land Treatment of Wastewater in the Great Lakes Area Basin: Impact of Wastewater Diversion and Spray Irrigation on Water Quality in the Muskegon County, Michigan Lakes (with R.P. Canale and M.T. Auer), U.S. Environmental Protection Agency, EPA-905/9-79-006-A, 260 pages, 1979.

Saginaw Bay Limnological Data (with R.P. Canale, M.T. Auer and J. Sygo), Sea Grant Technical Report No. 54, MICHU-SG-76-207, Michigan Sea Grant Program, 175 pages, 1976.

The Limnology of Grand Traverse Bay, Lake Michigan (with M.T. Auer and R.P. Canale), Sea Grant Technical Report No. 47, MICHU-SG-76-200, Michigan Sea Grant Program, 175 pages, 1976.

Grand Traverse Bay Limnological Data (with M.T. Auer and R.P. Canale), Technical Report No. 48, MICHU-SG-76-200, Michigan Sea Grant Program, 87 pages, 1976.

Saginaw Bay: An Evaluation of Existing and Historical Conditions, U.S. Environmental Protection Agency Publication, EPA-905/9-74-003, April 1974.

## SELECTED PROJECT CONSULTING EXPERIENCE

This summary considers both individual project experience and LimnoTech experience where Mr. Freedman as CEO had corporate oversight. Many of the innovations are highlighted in the publication and presentation portion of this resume.

### Corporate Water Stewardship and Sustainability

For over a decade Mr. Freedman and LimnoTech have been engaged helping global NGOs develop methods and approaches to water sustainability and also working with corporations to develop and implement water stewardship programs. This has included water footprints, water use and sustainability reporting, water conservation and reuse, replenish programs, watershed engagement, water stewardship certification and assessing financial impacts of water scarcity and pollution. We have worked with dozens of major corporations in food and beverage, agribusiness, big-tech, hospitality, manufacturing, energy and other sectors to develop and implement water stewardship and sustainability programs. Many of the corporate engagements are confidential but below are some examples.

Water Sustainability Metrics and Goals for the Electric Power Industry, Electric Power Research Institute, 2017-2018, Technical advisor and oversight.

Water Balance Targets: Exploring the Role of Volumetric Goals in Corporate Water Stewardship, World Wildlife Fund for Nature, 2015-2016, Technical contribution and reviewer.

Water Risk Assessment for a Global Brewer, 2015, Technical oversight.

Water Footprint Assessment for Coffee, using Whole Pot and Single Serve Delivery, Keurig-Green Mountain, 2014, Technical reviewer and oversight.

Quantifying Water Quantity and Quality Benefits of Watershed Restoration Projects in South America through Various Water Funds, FEMA, PepsiCo, Keurig and Heineken, 2014-2016, Corporate oversight.

Comparative Testing of the Various Water Stewardship Tools and Specifically Pilot Testing the AWS Global Water Standard for Large Industries in the Great Lake Basin, including energy, paper, chemical and others. Council of Great Lakes Industries, 2014-2016, Technical reviewer and oversight.

Development of Water Stewardship Plan and Water Benefit Goals for Keurig-Green Mountain, 2014-2016, Technical advisor and oversight.

Establishing Water Balance/Replenish Goals for Several Global Corporations, including PepsiCo, Heineken, Miller-Coors and Keurig, 2012-2017, Technical advisor and corporate oversight.

Support for Development of a Corporate Global Water Stewardship Strategy for Holcim Cement, 2012, Technical advisor, reviewer and oversight.

Water Footprint Assessment for Lettuce Producers in the Americas, Chiquita, 2012, Technical advisor and oversight.

Support for Development of Global Water Stewardship Program for PepsiCo, 2011-2013, Technical advisor.

Water Footprint Assessment for Juices in the United States, Central and South America, The Coca-Cola Company, 2010, Technical reviewer and oversight.

Assessing the Water Benefits of Drip Irrigation for Crop Productivity, Water Use and Groundwater Depletion in India, Jain Corporation and International Finance Corporation, 2010, Technical reviewer and oversight.

Part of Formulation Committee and Ongoing Technical Support for Development of the Alliance for Water Stewardship Global Water Standard, 2009-2018, Technical reviewer.

Development of a Water Benefit (offset) Methodology to Meet the Coca-Cola Company Water Replenish Goals, with the Nature Conservancy and managing the Program Assessment with the Nature Conservancy, 2009-2018, Technical contribution, review and oversight.

"Water Prism: A Decision Support Tool for Sustainable Supplies at the Basin Level", Electric Power Research Institute, 2010-2012

An Energy/Water Sustainability Research Program for the Electric Power Industry, EPRI Project. Principal investigator, project oversight, 2006-2007.

## Wet Weather

Since the late 1970's Mr. Freedman and LimnoTech have been thought and technology leaders in assessing wet weather problems and developing cost effective solutions for scores of significant municipal clients and utilities, coast to coast. We have helped clients address stormwater, CSO, and SSO problems to meet regulatory, environmental, citizen, and financial objectives. This has involved monitoring, modeling, alternative assessments, and design of both green and grey infrastructure, including many new advances in assessment technologies. Below are some examples of early and some major projects:

Clean River Program, Washington, DC, DC Water, 2008-Present, Technical advisor and corporate oversight.

Regulatory, Watershed, and Water Quality Assistance for Control of Sewer Overflows for the Sanitation District No. 1 Northern Kentucky. 2006 – 2014. Technical Advisor.

Development of a Hydraulic Transient Model for the Washington, D.C. Water and Sewer Authority. 2007 – Ongoing. Technical Advisor.

Watershed Characterization and Planning Services for Northern Kentucky in Support of Consent Decree Requirements. 2007. Technical Advisor.

Development of Work Plans for an Update of the CSO Long-term Control Plan for the St. Louis Metropolitan Sewer District. Technical Advisor.

East Bay Wet Weather Control Program, Studies for finding areas to reduce discharge and meet regulatory requirements. 2006. Technical Advisor, Group Panelist.

New York City CSO Long Term Control Plan and Basin Plans. 2005- 2006. Project Director, Technical Reviewer.

Water Quality Strategy for the Northside Wastewater Reclamation Plant for Chicago, IL. 2005 – 2007. Project Oversight.

Regulatory & Water Quality Support for Wet Weather Programs, Kansas City, MO. 2005 – Ongoing. Technical Reviewer, Adviser.

Report to Congress on the Implementation and Enforcement of the Combined Sewer Overflow Control Policy. 2003 – 2004. Technical Reviewer.

Report to Congress on the Impacts and Control of Combined Sewer Overflows and Sanitary Sewer Overflows. 2003 – 2004. Technical Reviewer.

Evaluation of CSO Control Alternatives for Three Counties in Northern Kentucky. 1995 – 2005. Technical Reviewer.

Assessing the Feasibility of Effective Watershed Management in Northern Kentucky through the NPDES Permitting Process. 2002-2004. Technical Reviewer.

Development and Implementation of a Watershed Protocol for Northern Kentucky. 2001 – 2003. Project Director.

Water Quality and Regulatory Strategy for the North-East Ohio Regional Sewer District CSO Phase II Facilities Plan in Cleveland, Ohio. 2000 – 2005. Advisor.

Wet Weather Water Quality Standards-Ohio River, 2003 – 2004. Project Director.

Permit Renewal Support to the Detroit Metropolitan Wayne County Airport. 2001-Present. Technical Advisor.

USEPA National CSO Control Policy Support. January 2002 - 2005. Project oversight and Technical Advisor.

USEPA Technical Support for the SSO Program. January 2002 - 2005. Technical Advisor.

USEPA Technical Support Municipal Stormwater. January 2002 - 2005. Project oversight.

Louisville Area Wet Weather Demonstration Study, Louisville, Kentucky. 2000-2003. Technical Advisor.

Development of a Long-Term Control Plan for Combined Sewer Overflows in the City of Toledo, Ohio. 1999-2006. Project oversight.

Development of a River Model to Evaluate Combined Sewer Overflow Impacts on the Elkhart and St. Joseph Rivers for the City of Elkhart, Indiana. Technical Advisor. 2001.

Portland, Oregon Reassessment of Combined Sewer Overflow Water Quality Characterization. 1996-1999. Technical Advisor.

Easterly District Wet Weather Combined Sewer Overflow for North East Ohio Sewer District. 1997-2003. Project oversight.

Water Quality Assessment for the Southerly District CSO Facilities Plan in Cleveland, Ohio. 1999 2003. Project oversight.

Review of Westerly District – Water Quality, Uses and Limitations in Cleveland, Ohio. 1996-2000. Project oversight.

Workshops and Review of Water Quality Standards in CSO-Impacted Receiving Waters for USEPA. 1999-00. Project oversight.

Sewer System and Receiving Water Modeling to Support Combined Sewer Overflow Long Term Control Plan for Washington, D.C. 1998-Present. Technical Advisor.

Development of a Storm Water Pollution Prevention Plan for Rouge Steel, Dearborn, MI. 1998-99. Technical Advisor.

Stormwater Controls Permitting Support for the Willow Run Airport, Wayne County, Michigan. 1996-2001. Technical Advisor.

Portland, Oregon Reassessment of Combined Sewer Overflow Controls for Water Quality Improvement. 1996-2000. Technical Advisor.

Evaluation and Demonstration of Deicing Runoff Management Alternatives at the Portland International Airport for meeting TMDL Water Quality Requirements. 1996-2000. Technical Advisor.

Calibration and Verification of the Ohio River Wet Weather Water Quality Model for Bacteria and Dissolved Oxygen. 1997-1999. Project oversight.



Development of Combined Sewer Overflow Case Study Fact Sheets for the USEPA. 1996-1997. Technical Advisor.

Corvallis, Oregon Combined Sewer Overflow Permitting Assistance and Development of a Long Term Control Strategy. 1996-1997. Technical Advisor.

Evaluation of CSO Controls and WWTP Bypasses including Development of Receiving Stream Models for the Ottawa and Maumee Rivers and Swan Creek in Toledo, Ohio. 1996-1998. Technical Advisor.

Local Government Expert Peer Review of Rouge River Wet Weather and Watershed Modeling. A National Demonstration Project. 1996-1997. Project manager.

Implementation of Performance Measures for the National Combined Sewer Overflow Control Program. 1996-1997. Technical Advisor.

Simulation of Alexandria, Virginia Combined Sewer Overflows for NPDES Permitting. 1996-1998. Technical Advisor.

Northern Kentucky SSO/CSO Control Program, XP-SWMM Sewer System Modeling Peer Review. 1996. Project oversight.

Assessment of Wet Weather Water Quality Impacts on the Ohio River. A National Demonstration Project for developing methods in assessing wet weather impacts on large rivers. 1995-1999. Project oversight.

Combined Sewer Overflow Water Quality Monitoring, Assessment, and Development of Control Measures for Two Counties in Northern Kentucky. 1995-1999. Project oversight.

Development of a National Wet Weather Monitoring Program for the USEPA to Quantify Benefits Associated with Storm Water and CSO Control. 1995-1997. Project oversight and Technical Advisor.

Evaluation of the Need and Best Means for Control of Combined Sewer Overflows from Mishawaka, Indiana. 1995-1998. Technical Advisor and Reviewer.

Water Quality Assessment for the Cambridge, Maryland Combined Sewer Overflow (CSO) Control Study. 1994-1996. Technical Advisor and Reviewer.

Development of a GIS-Based Stormwater Management Program and NPDES Permit Application for the District of Columbia. 1994-1996. Technical Advisor and Reviewer.

Developing Rationale to Support USEPA Wet Weather Monitoring Protocol. 1994. Project oversight.

EXTRAN Sewer Modeling and Evaluation of the Evergreen-Farmington Sewer System, Oakland County, Michigan. 1993-1996. Technical Advisor and Reviewer.

Update and Evaluation of Richmond, Virginia Combined Sewer Overflow (CSO) Modeling to Assess Compliance with Draft USEPA CSO Policy. 1993-1998. Technical Advisor and Reviewer.

Investigation of Stormwater Quality and Management Options at a Fuel and Solvent Recovery Facility in Kentucky. 1993. Project oversight.

Development of a Stream Monitoring Program for a National Assessment of Stormwater Impacts and the Benefits of Controls. 1992-1993. Project oversight for development of watershed and receiving water quality models in support of TMDL development.

St. Joseph River Combined Sewer Overflows Impact Assessment for the City of South Bend, Indiana in Support of the Development of Control Strategies. 1991-1994. Technical Advisor and Reviewer for development and application of a dynamic model to forecast the benefits of CSO controls for improving water quality in the river.

Sewer and Water Quality Modeling for Evaluating Controls for Alexandria, Virginia Combined Sewer Overflows. 1990-1993. Project oversight for runoff, sewer and water quality modeling assessments to determine cost-effective and appropriate CSO controls.

GIS Assistance to Metropolitan Washington Council of Governments in the Development of Model Inputs for, and Mapping of the Potomac Interceptor to the Blue Plains Wastewater Treatment Plant. 1992-1994. Technical Advisor and Reviewer.

Development of Performance Measures for the National Combined Sewer Overflow Control Program for USEPA and Association of Metropolitan Sewerage Agencies (AMSA). 1994-1996. Technical Advisor and Reviewer.

Participation in Rouge Combined Sewer Overflow (CSO) Demonstration Project Technical Review Committee. 1994-1996. Technical Advisor and Reviewer.

Portland, Oregon Combined Sewer Overflow Water Quality Assessment in Support of Selection of Control Alternatives. 1992-1996. Technical Advisor and Reviewer for monitoring design development, calibrations of a new water quality model program, and mixing zone model and forecasts of water quality benefits.

Detroit Wayne County Airport NPDES Stormwater Studies to Reduce Pollution, Improve Permit Compliance and Obtain Appropriate Stormwater NPDES Permit Modifications. 1991-1999. Project oversight.

Value Engineering Study for Combined Sewer Overflow Facilities Planning for Northeast Ohio Regional Sewer District. 1992.

Stormwater Permitting Analysis of Water Quality Effects in Alexandria, Virginia. 1991-92. Project oversight for assessment of water quality effects of urban stormwater.

Portland, Oregon Combined Sewer Overflow Water Quality Assessment in Support of the Preliminary Development of Alternatives for Control Strategies. 1990-1992. Technical Advisor and Reviewer for preliminary development and application of a site-specific water quality model to forecast the benefits of CSO controls.

Combined Sewer Overflow and Water Quality Modeling Support for Facilities Design and Planning in Richmond, Virginia. 1989-1992. Project oversight for modeling support and evaluations.

Evaluation and Modeling of Combined Sewer Overflows and Impacts to Develop Cost Effective Control Strategies in Richmond, Virginia. 1986-1988. Project manager.

Assessment of the Effects of Regional Combined Sewer Overflow Control Strategies on Rouge River Water Quality. 1987. Project oversight.

Assessment of Combined Sewer Overflow Impacts on the Nearshore Waters of Lake Michigan in the Vicinity of Indiana Harbor. 1984-1985. Project oversight for evaluation of water quality impacts of wet weather events on a coastal area.

Monte Carlo Modeling of Stormwater Bacterial Impacts and Controls for Onondaga Lake, New York to Assess Benefits of Proposed Controls. 1983. Project oversight for development and application of probabilistic modeling framework to assess the benefits of CSO controls on lake water quality.

Evaluation of Poughkeepsie, New York Combined Sewer Overflows on Hudson River Water Quality. 1982-1983. Project manager for monitoring design, data evaluations and water quality modeling of CSO effects on water quality.

Post-Audit Evaluation of Combined Sewer and Water Quality Modeling for the City of Detroit, Michigan. Ecosciences Environmental Group, Detroit, Michigan and Wade, Trim and Associates, Taylor, Michigan. 1982. Project manager.

Evaluation of Need and Best Means for Combined Sewer Overflow Control for the City of Perrysburg, Ohio. 1981-1982. Project manager for monitoring design and water quality modeling guidance and assistance.

Evaluation of the Need and Best Means for Combined Sewer Overflow Control for Maumee, Ohio. 1981-1982. Project Manager.

Evaluation of the Impacts of Grand Rapids Combined Sewer Overflows on Grand River Water Quality and the Need for Controls. 1980-1982. Project Manager for development, calibration and application of water quality models to determine dissolved oxygen impacts of CSOs.

Water Quality, Runoff and Sewer System Modeling in Support of Planning for Wayne County Combined Sewer Overflow Controls in the Rouge River Basin. 1980-1982, 1987. Project Manager for application of water quality models to determine the dissolved oxygen impact of combined sewer overflows to the Rouge River.

Monitoring and Modeling of Washington, D.C. Impacts on Water Quality in the Potomac and Anacostia Rivers, and Rock Creek to Develop a Combined Sewer Overflow Control Plan. 1977-1982. Project Manager for development and application of hydrodynamic and water quality models for the Potomac and Anacostia estuaries.

A Review of City of Detroit Combined Sewer Overflow Modeling. 1981. Technical Advisor and Reviewer.

Evaluation of Delphos, Ohio Combined Sewer Overflow Impacts on Receiving Streams and Benefits of Alternative Control Strategies. 1981. Project Manager for monitoring and probabilistic modeling study to forecast water quality benefits of CSO controls.

Modeling Evaluation of Urban Stormwater Impacts on Saginaw River and Bay. 1978-1981. Project Manager.

## Surface Water Quality and Sediments

Investigations of surface water quality and bottom sediment contamination have been the root of experience for Mr. Freedman and LimnoTech and continue to be an area of excellence today. They have worked on issues in thousands of water bodies coast to coast, and some others globally as well. Issues addressed have ranged from nutrients, eutrophication, and harmful algal blooms, to toxic substances from PCB to mercury and PFAS. Computer simulation and sophisticated data analysis have been a foundational element of this work experience. We have used these tools coupled with sophisticated and innovative monitoring approaches to develop management and remediation plans. Below are some historical examples where Mr. Freedman had a strong role, beyond his corporate oversight and guidance on hundreds of others.

San Francisco Bay Assessment of Harmful Algal Blooms, Bay Area Clean Water Agencies, 2016-2018.

Support to Geomorphic Site Investigation - Tittabawassee River. Technical Advisor.

Water Quality Modeling and Regulatory Support for the Cities of Reno and Sparks, Nevada Related to Truckee River TMDL. 2000-2013. Project director and technical advisor.

Screening Analysis of Nutrient Impacts on Pyramid Lake, NV. 2005-2006. Project director.

Factors for Success in Developing Use Attainability Analyses. 2005-2006 Principal investigator.

Ohio River Use Attainability Analysis Demonstration Study near Wheeling, WV. 2005-2006. Principal investigator.

Development of TMDLs for Nine Watersheds in Illinois. 2004-2006. Technical advisor.

Development of an Integrated Ecological Response Model for the Lake Ontario-St. Lawrence River Water Level/Flow Study. 2002 - 2005. Technical Advisor.

Developing Methods to Analyze Protect, and Restore Flow regimes in the Great Lakes Basin. 2003. Technical Advisor.

Analysis of NPDES Phosphorus Discharge Limits for a Facility in South Carolina. 2002-2003. Technical Reviewer.

Investigation of Ecological Impacts of Water Withdrawals in the Great Lakes Basin. 2001-2004. Technical Reviewer.

Croton Watershed Strategy Support to Protect Drinking Water Supplies. 2000- 2002. Technical Reviewer.

Analysis of NPDES Phosphorus Discharge Limits for a Facility in South Carolina 2002-2003. Technical Reviewer.

Development of a Dissolved Oxygen Model for the Lower Black River from Elyria, Ohio to Lake Erie. 2000-2003. Technical Advisor.

Great Lakes Area of Concern Research. March 2002 - 2003. Project Advisor.

Kalamazoo River PCB Fate and Transport Model. 1999-2001. Technical Advisor.

Fox River, WI and Green Bay PCB Fate and Transport Model Evaluations. 1997-1999. Technical Advisor.

Waste Assimilative Capacity of Selected Indian Estuarine Systems. 1999-2001. Technical Advisor.

TMDL Study for Patrick Bayou in Houston, Texas. 2000. Technical Advisor.

Modeling the Thermal Effluent from the Donald C. Cook Nuclear Plant to Lake Michigan. 1998-2000. Technical Advisor.

Review of USEPA Draft Guidance "Implementation Framework for the Use of Equilibrium Partitioning Sediment Guidelines." 1999. Technical Management.

Mathematical Modeling of PCB Fate and Transport in Hudson River in Support of Reassessment of Remedial Alternatives. 1998-1999. Technical Advisor.

Ashtabula River Comprehensive Sediment Management Plan for the Ashtabula River Partnership and U.S. Army Corps of Engineers. 1998-1999. Technical oversight.

Sediment Characterization and Application for Open Water Disposal of Dredge Slip Sediments from a Commercial Dock in Ashtabula, Ohio. 1997-1998. Project oversight.

Sediment Sampling and Dredging Evaluation for Section 401 Certification, Commercial Docking Facility, Ohio. 1996 - 1999. Technical Advisor.

Expert Assistance on Chesapeake Bay Modeling and Nutrient Reduction Strategy Review for Metropolitan Washington Council of Governments. 1996-1998. Project oversight.

Eutrophication and Salinity Model Review in Support of the Tampa Water Resource Recovery Project. 1996. Technical Advisor.

Review and Comments on Great Lakes Water Quality Guidance Implementation by the State of Michigan. 1996. Technical Advisor.

Evaluation of Chesapeake Bay Nutrient Reduction Strategy for Fairfax County, Virginia. 1995-1996. Technical Advisor.

Preparation of a Mixing Zone Guidance Manual for the American Petroleum Institute. 1995-1997. Technical Advisor and Reviewer.

Lake Lanier Watershed Management and Water Quality Modeling Studies to Protect Recreational and Water Supply Uses. 1995-1997. Technical Advisor and Reviewer.

Demonstration and Evaluation of Aeration and Bioaugmentation in Austin Lake - Portage, Michigan. 1995-1996. Project oversight.

Water Quality Modeling and Dilution Analysis in a Virginia Embayment and the Potomac River in Support of NPDES Permit Review. 1995. Technical Advisor and Reviewer.

Investigation into Measures to Control Deicing Impacts on Receiving Waters at the Dayton International Airport. 1995-1996. Technical Advisor and Reviewer.

Conducting Regional Training Workshops for USEPA on Development of Total Maximum Daily Loads. 1993-1995. Project oversight.

Critical Review of Sediment Transport Due to Wave Action in Manistique Harbor to Assess the use of Armoring as an Alternative to Dredging. 1994. Technical Advisor and Reviewer.

Wasteload Allocation Modeling for the City of Lincoln, Nebraska Wastewater Treatment Plants. 1994-1996. Technical Advisor and Reviewer.

Hypoxia on the Louisiana Inner Shelf: Water Quality Modeling the Impacts of Mississippi-Atchafalaya River Nutrient Load Reductions. 1994-2000. Administrative oversight.

Preparation of Dissolved Oxygen Study Plan for the Rouge River Wet Weather Evaluations. 1994-1996. Project Manager.

Comments on the State of the Lakes Ecosystem Conference Papers. 1994. Technical Advisor and Reviewer.

White Lake, Michigan Mixing Zone Monitoring and Modeling to Define Toxic Effluent Limits for a Groundwater Remediation Discharge. 1993-1995. Technical Advisor, Reviewer and project oversight.

Great Lakes Environmental Assessment for National Council of the Paper Industry for Air and Stream Improvements. 1993-1994. Technical Advisor and Reviewer for evaluation of the environmental condition of the Great Lakes.

Kalamazoo River Sampling for Toxic Chemicals in Support of Remedial Investigation and Feasibility Studies. 1993-1994. Project oversight.

Testing the Use of Computer Models for NPDES Permit Development to Protect Sediment Quality. 1992-1993. Oversight for project to apply models previously developed by LimnoTech to implement sediment quality criteria in NPDES permitting and remedial design.

Menomonee River Artificial Aeration Study to Evaluate Alternatives for Increasing Dissolved Oxygen Levels. 1992-1993. Technical Advisor and Reviewer for study involving forecasts of dissolved oxygen benefits from various innovative aeration approaches.

Water Quality Analysis and Modeling in Support of NPDES Requirements for the Expansion of the Lower Potomac Pollution Control Plant, Fairfax County, Virginia. 1992-1993. Project oversight for application of hydrodynamic, toxic pollutant, conventional pollutant/eutrophication and mixing zone models to determine water quality impacts of alternative discharge locations.

Field Studies and Modeling of Mixing Zone Impacts from a Chemical Plant on the Ohio River in Kentucky to Support NPDES Negotiations. 1992-1993. Project Manager.

Critical Review of the Great Lakes Initiative Water Quality Regulations on Behalf of the City of Niagara Falls, New York. 1993. Technical Advisor and Reviewer.

Analysis of Discharge Alternatives for West Rehoboth, Delaware in Support of Facilities Planning. 1992. Project oversight for estuarine waste load allocation modeling and quality review of reports and modeling results.

Re-Calibration of the Tidal Anacostia Model for Evaluating Combined Sewer Overflow Control Benefits near Washington, D.C. 1992. Project oversight.

Eutrophication Modeling of Providence River and Upper Narragansett Bay, Rhode Island in Support of Dissolved Oxygen Restoration. 1992. Project Manager for application of a eutrophication model to determine nutrient loading reductions required to restore dissolved oxygen to desired levels.

Risk Assessment to Evaluate PCB Volatilization During Implementation of Remedial Actions at Waukegon Harbor, Illinois. 1992. Technical Advisor and Reviewer.

Critical Review of James River Instream Flow Investigations and Draft Environmental Impact Study Related to Proposals for Water Supply Withdrawals. 1991-1993. Project oversight for technical guidance and quality review of study findings, reports and guidance in HEC-2 hydraulic model application.

Modeling of the Discharge Dilution Characteristics for a Delaware Coastal Outfall. 1991-1992. Project oversight.

Development of a Modeling Protocol to Support NPDES Permit Limits to Protect Sediment Quality. 1991-1992. Project oversight to develop models to implement sediment quality criteria in NPDES permitting and remedial design.

Modeling Mixing Zone Impacts of Intermittent Blue Plains Wastewater Chlorine Discharges in Support of NPDES Permitting. 1991-1992. Project Manager.

Evaluation of Potential Impacts of Nitrogen Removal on Eutrophication in the Potomac Estuary. 1991-1992. Technical Advisor and Reviewer.

Evaluation of Muskegon Waste Management System Phosphorus Limits in Support of NPDES Litigation. 1990. Project Manager.

Modeling of District of Columbia Combined Sewer Overflows to the Anacostia River to Evaluate Controls and Impacts. 1990. Project Manager for revised sewer modeling of CSO pollutant discharges to the Anacostia River to assess conditions after implementation of control plan.

Geographic Information System (GIS) for Water Quality Data in Support of Remedial Action Planning for the Detroit River. 1989. Technical Advisor and Reviewer.

Consistency Review of 304(I) Water Quality Limited Segments, Short List Submittals for the States of New York and New Jersey. 1989. Project oversight.

Consistency Review of 304(I) Long List of Impaired Waters. 1988-1989. Project oversight.

Development of Proposed State Procedures for Waste Load Allocation Methodology for Toxic Discharges of Wastewater in New Jersey. 1988-1989. Technical Advisor and Reviewer.

Reaeration Studies on Brushy Creek in Support of Waste Load Allocation Modeling and NPDES Permitting. 1988-1989. Project Manager.

Review of Draft 304(I) Lists of Impaired Waters for Nine States on Behalf of USEPA. 1988. Project oversight.

Dilution Modeling to Verify 304(I) Lists of Waters Impaired by Toxics on Behalf of USEPA. 1988. Project oversight.

Development of a Dissolved Oxygen Model of the Amelia River Estuarine System to Assist in Determination of Effluent Limitations for a Pulp and Paper Mill. 1988. Technical Advisor and Reviewer for development of WASP model of hydrodynamics and dissolved oxygen.

Assistance to States in Identifying 304(I) Impacted Waterbodies: Candidate Lists for Six States for USEPA. 1988. Project oversight for review of state databases and files to develop lists of impaired waters.

Dilution Modeling of Toxic Impairment in U.S. Estuaries due to Toxic Discharges to Develop List of Potentially Impaired Waters as Part of 304(I) Requirements. 1987-1988. Project oversight for database development and model application for 161 pollutants in 96 U.S. estuaries.

Preparation of 301(g) Variance Requests for Phenols and Ammonia Discharges from a Steel Plant in Detroit, Michigan. 1986-1987. Project Manager.

Dissolved Oxygen Studies of the Potomac Estuary to Evaluate the Need for Wastewater Treatment by Nitrification. 1986-1987. Project Manager for dissolved oxygen modeling and review, also conducted Monte Carlo assessment of variability in algal productivity.

Evaluation of Water Quality and Aquatic Weed Propagation in the Kalamazoo River, Michigan as Related to Phosphorus Controls. 1985-1986. Project oversight.

Two-Dimensional Dynamic Estuary Model for the Delaware River for NPDES Waste Load Allocation and Assessment of Wet Weather Controls. 1985. Project Manager.

Evaluation of Detroit Wastewater Treatment Plant Plume Impacts on the Detroit River for Determining NPDES Requirements. 1984-1986. Project oversight for a multi-faceted study to evaluate the water quality impacts of a billion gallons per day POTW discharging to a major waterway.

Summary of Water Quality and Toxics Data in the Upper Great Lakes Connecting Channels to Support Great Lakes Research. 1984-1985. Technical Advisor and Reviewer for study to characterize the environmental status of an area designated for a major new assessment by state, regional and international authorities.

Water Quality Monitoring and Modeling Evaluation of Dissolved Oxygen and Algae in the Kalamazoo River, Michigan for Negotiation of NPDES Revisions. 1984. Project Manager for a comprehensive monitoring and modeling study to assess point source effects on dissolved oxygen and eutrophication.

Sampling and Evaluation of Sediments in Great Lakes Harbors and Confined Disposal Areas in Support of Army Corps of Engineers Dredging Operations. 1983-1986. Project Manager.

Evaluation and Expert Testimony on the Impact of Zoning Restrictions on Water Quality in Occoquan Reservoir. 1983-1985. Technical Advisor and Reviewer in a major legal case testing land use planning as a method for protecting water quality.

Evaluation of Causes for 1983 Potomac River Algal Bloom in Defense of Existing Wastewater Treatment Practices. 1983. Technical Advisor and Reviewer for study of contributing factors to an algal bloom, including nutrient sources and a unique combination of environmental factors.

Water Quality Analyses and Modeling to Support Facilities Plans for Blue Plains Wastewater Treatment Plant Phase II Planning and Feasibility Study. 1982-1984. Project Manager.

Studies of Phytoplankton and Dissolved Oxygen Kinetics in Onondaga Lake. 1982-1983. Technical Advisor and Reviewer for development and calibration of microcomputer eutrophication model for Onondaga Lake.

General Water Quality Consultation for the District of Columbia. 1981-1982. Project Manager.

Evaluation of Water Quality Impacts from the Muskegon Wastewater System Lagoon Seepage Discharge as Related to NPDES Requirements. 1980. Project Manager for modeling and statistical evaluations relating to permit negotiations.

Water Quality Modeling in Badfish Creek to Determine Nitrification Requirements and Weed Harvesting for Madison, Wisconsin Wastewater Facilities. 1979-1980. Project Manager.

Research Evaluation of Performance and Impacts of the Muskegon County Wastewater Spray Irrigation Treatment System on Three Lakes in Western Michigan. 1978-1980. Project Manager to evaluate land treatment effects on receiving waters.

Limnological Research Investigations of Onondaga Lake. 1976-1980. Project Manager.

Modeling Assessment of Water Quality Impacts in Onondaga Lake, New York to Determine Needed Combined Sewer Overflow Controls. 1976-1978. Project Manager.

Model Development and Evaluations of Saginaw River and Bay Water Quality in Support of Areawide Planning. 1976-1978. Project Manager.

Validation and Update of Badfish Creek, Wisconsin Water Quality Model to Evaluate Advanced Wastewater Treatment Needs. 1976-1977. Project Manager.

Water Quality Model Framework Development for Saginaw River and Bay for Use in Regional Planning. 1976-1977. Project Manager.

Water Quality Modeling for Use in Facilities Planning for Skaneateles, New York. 1976. Technical Coordinator.

Evaluation of Existing and Historical Water Quality Conditions of Saginaw Bay. U.S. Environmental Protection Agency, Region 5, Chicago, Illinois. 1976. Project Manager.

Water Quality Modeling in Genesee River and Rochester Embayment, Lake Ontario in Support of Wastewater Facilities Planning. 1975-76, 1980. Project Manager.

Annotated Research Compilation for Lake Michigan Limnology. University of Michigan Sea Grant Program. 1975. Project Manager.

Lake Sediment-Water Interactions and Nutrient Regeneration as it Relates to Eutrophication Reductions. University of Michigan Sea Grant Program, Ann Arbor, Michigan. 1975. Project Manager.

Limnological Significance of Macrophytes in White Lake, Michigan. Great Lakes Resource Management Program, University of Michigan, Ann Arbor, Michigan. 1975. Project Manager.

Effect of Wastewater Land Treatment on Eutrophication in Three Muskegon County Michigan Lakes. 1972-1982. Project Manager for pollutant loading trend analysis and eutrophication modeling of the lakes before and after land treatment.

Assessment and Modeling of the Immediate Impacts of Wastewater Diversion Land Treatment on Three Muskegon County Lakes. Muskegon County, Michigan, and Michigan Department of Natural Resources, Lansing, Michigan. 1972-1977. Project Manager.

Limnological Studies of Great Traverse Bay Lake Michigan to Evaluate it as a Microcosm for Great Lakes Water Quality Problems. University of Michigan Sea Grant Program. 1972-1975. Technical Contributor.

Limnological Studies of Grand Traverse Bay, Lake Michigan to Evaluate the Impacts of Nutrient Loadings. 1968-1973. Technical Contributor.

## Watershed and Lake Management

Watershed and lake management have been a core service of LimnoTech since the late 1970's. Mr. Freedman and staff at LimnoTech have been involved in some of the highest profile sites and been responsible for significant innovations in assessment and computer modeling. In particular, Mr. Freedman was an early pioneer and advocate of watershed management, convening several pivotal national conferences partnered with Federal agencies that helped launch watershed management into the mainstream of our field. Their experience is coast to coast in hundreds of watersheds. With respect to lake management the experience spans scores of lakes big and small from Lake Champlain and Lake Lanier in the East to the Great Lakes in

the Midwest to Pyramid and Lake Mead in the West. Below are some examples of notable historical projects.

Application of a Mass Balance and Ecosystem Model in Support of a Lake Ontario Lake Management Plan Load Reduction Strategy; 2018-2020. Corporate oversight

Clean Water Roadmap for Lake Champlain and its Watershed. 2016-2017. Corporate oversight.

Forecasting the Causes, Consequences, and Potential Solutions for Hypoxia and Harmful Algal Blooms in Lake Erie, series of projects. 2009-2015. Corporate oversight.

Integrated Watershed and Water Quality Model for the Lower Maumee River and Western Basin of Lake Erie to evaluate watershed management strategies for controlling harmful algal blooms. 2013-2015. Corporate oversight.

Development of Integrated Ecological Response Models for the Lake Ontario / St. Lawrence River and the Upper Great Lakes Systems, multiple projects. 2002-2017. Corporate oversight

Developing a Model Framework for Assessing the Impacts of Water Withdrawals in the Great Lakes-St. Lawrence Basin; 2004-2005. Corporate oversight

Quantifying Watershed Restoration Benefits in Community Water Partnership Projects. 2008 - Ongoing. Project management oversight.

Critical Review of James River Instream Flow Investigations and Draft Environmental Impact Study Related to Proposals for Water Supply Withdrawals. Technical advisor.

Adaptive Management TMDL Expert Panel. 2004-2006.

Water Quality Modeling to Support Management of a New Water Supply Reservoir in Atlanta, Georgia. Technical advisor.

Develop Predictive Models for the Great Lakes. 2006 - 2008 Technical Advisor.

Assessing the Feasibility of Effective Watershed Management in Northern Kentucky through the NPDES Permitting Process. 2002-2004. Technical Reviewer.

Upper Cahaba Watershed Study, Phase I Birmingham, Alabama. 2002-2004. Technical advisor.

Development of an Integrated Ecological Response Model for the Lake Ontario - St. Lawrence River Water Level/Flow Study. 2002 - 2005. Technical Advisor.

Evaluation of the Significance of the TMDL Program to Drinking Water Utilities and Related Challenges. 2003. Principal Investigator.

Navigating the TMDL Process: Evaluation and Design. 2000 - 2003. Principal Investigator.

Navigating the TMDL Process: Listing and Delisting. 2000 - 2001. Principal Investigator.

Method Development for Addressing Narrative Criteria in the TMDL Process. 2001-2003. Principal Investigator. Water Environment Research Foundation.

TMDL Study for Patrick Bayou in Houston, Texas. 2000 - 2001, Technical Advisor.

Development of a Process-oriented Aquatic Ecosystem Model to Investigate Multi-stressor Interactions in Saginaw Bay, Lake Huron. 1999-2003. Corporate oversight

Alcovy River Basin Water Supply Watershed Protection Plan. 1999-2001. Project management oversight.

Watershed Management for Laguna de Bay and Subic Bay in the Philippines. 1998-1999. Technical Advisor.

Expert Assistance on Chesapeake Bay Model Review for Assessing Regional Nutrient Reduction Strategies. 1996-2005. Project oversight.

Las Vegas Total Maximum Daily Load (TMDL) Critical Assessment for Lake Mead Water Quality Protection. 1996-1998. Technical Advisor.

Phase II of Lake Lanier Water Quality Modeling and Watershed Protection Study. 1996-1999. Technical Advisor.

Eutrophication and Salinity Model Review in Support of the Tampa Water Resource Recovery Project. 1996-1998. Technical Advisor.

Interactive Watershed Management Workshop for the Louisville and Jefferson County MSD. 1996. Technical Advisor.

Diagnostic Watershed Assessment of the Upper Hillsborough River Near Tampa, Florida. 1995-1997. Technical Advisor.

Evaluation of Chesapeake Bay Nutrient Reduction Strategy for Fairfax County, Virginia. 1995. Technical Advisor.

Development of a Linked Model for Management of Water Quality in South Florida. 1994-1995. Technical Advisor and Reviewer.

Technical Support for the Fairfax County Water Authority, Virginia to Protect Water Supply and Quality. 1994-1997. Technical Advisor and Reviewer.

Diagnostic Feasibility Study for the Sister Lakes, Ann Arbor, Michigan. 1994-1995. Project oversight.

Identification and Conceptual Design of Best Management Practices for the Lake Thonotosassa Watershed in Florida. 1993-1995. Administrative oversight.

Technical Assistance in Preliminary Scoping of Denver, Colorado Metro Total Maximum Daily Loads for Watershed Protection. 1993-1994. Project oversight.

Urban Stream Studies for National Park Service. 1993-1994. Technical Advisor and Reviewer.

Development of a Demonstration Total Maximum Daily Load for Paradise Creek Watershed in the Northwest in Support of USEPA Training. 1992-1993. Project oversight for development of watershed and receiving water quality models in support of TMDL development.

Expert "SWAT Team" Assistance to USEPA and States in Development of Watershed Total Maximum Daily Loads. 1992. Project oversight for providing expert assistance to numerous states in developing total maximum daily loads.

Presentation of Total Maximum Daily Load Modeling Approaches at USEPA National Planning Workshop. 1992. Project oversight for presentations of technical approaches to watershed-based water quality control at a nationwide series of USEPA workshops.

Development of a Solids and Nutrient Demonstration Total Maximum Daily Load for San Luis Obispo Creek as a Case Study for USEPA and State Regulatory Staff Training. 1991-1992. Project oversight for development of watershed and receiving water quality models in support of TMDL development.

Support of Total Maximum Daily Load Water Quality Model Development for South San Francisco Bay. 1990-1991. Project oversight for development of screening level WASP

model application using available data and monitoring recommendations to collect data required to support more rigorous modeling.

Watershed Total Maximum Daily Load/Wasteload Allocation Case Studies in Support of Training Programs for USEPA. 1989-1990. Project oversight.

Water Quality Modeling of Walloon Lake and Development of a Basin-Wide Watershed Management Plan. 1988-1989. Technical Advisor and Reviewer of report providing the lake community with comprehensive long-term management guidance and land use planning tools.

Walloon Lake Water Quality Investigations in Support of Watershed Management Plans and Zoning. 1986-1989. Technical Advisor and Reviewer for sampling design, community relations and water quality assessment to assist a lake community in long-term management activities.

Critical Review of Proposals to Breach the Browns Island and Manchester Dams on the James River, Richmond, Virginia. 1986. Project Manager.

Demonstration of Cost Effectiveness of Crop Management Practices in Reducing Pollutant Loads and Improving Saginaw Bay Water Quality as a Demonstration Site for Great Lakes Management. 1983-1987. Project Manager for study to model agricultural nonpoint nutrients and their effects on eutrophication in the river and bay.

## Hydrogeology and Site Contamination

Investigation and remediation of hydrogeology and site contamination has been a 35 year practice and an area of expertise at LimnoTech. This is an area that Mr. Freedman has provided corporate direction and guidance but limited direct management except a few significant projects. LimnoTech has broad experience in Superfund, RCRA and state programs for contamination investigations and remediation. Of particular note has been LimnoTech experience in contaminated sediment sites, includes some of the highest profile sites in the country including the Hudson, Kalamazoo, Fox, Passaic and Tittabawassee Rivers, Great Lakes Areas of Concern and harbors coast to coast. Below are some examples of corporate and individual experience.

Site Remediation of Lubricating Oil Contamination of Soils and Groundwater for an Industrial Manufacturer in Support of a No Further Action Application to a State Environmental Agency. 1997-Ongoing. Project oversight.

Site Investigation and Remedial Action and Remedial Design for Chlorinated Solvent Impacts at an Industrial Site in Fayette, Ohio. 1994-Ongoing. Technical Consulting and project oversight.

Remedial Investigation, Feasibility Study and Site Remediation for a CERCLA Site on the Kalamazoo River, Michigan with Groundwater Contamination. 1989-Ongoing. Project oversight.

Groundwater and Hydrogeologic Investigation and Remedial Action Plan for a Solvent Interim Storage and Transfer Facility in Mason, Michigan; including Data Analysis and Groundwater Cleanup Consultation; Soil Sampling of Retention Basin; Installation and Operation of a Soil Vapor

Evaluation of Tillage Practices in Reducing Pollutant Loads in Saginaw Bay Water Quality. 1983-1987. Project Manager for project involving guidance for nonpoint source and eutrophication modeling of agricultural pollutants.

Evaluation of Expected Water Quality Impacts from Hydropower Dam Restoration on the Kalamazoo River. 1983. Project Manager for evaluation and modeling of PCB and dissolved oxygen concerns of dam restoration.

Hydrologic Modeling of Ellsworth Lake to Evaluate Effects of Withdrawals on Lake Levels. 1982. Technical Advisor and Reviewer for hydrographic survey, model development, and application to determine causes of beach exposure.

Benefits of Agricultural Conservation Tillage versus Wastewater Treatment to Improve Saginaw Bay Water Quality to Support Basic Planning and Great Lakes Management Strategies. 1980-1983. Project Manager for nonpoint source and eutrophication modeling of the bay and assessment of point versus nonpoint source cost-effectiveness.

Water Quality Model Framework Development for Saginaw River and Bay for use in Regional Planning. 1976-1977. Project Manager.

Water Quality Modeling for Central New York State Area-Wide (208) Planning. 1976-1977. Project Manager.

Extraction System and RCRA Site Closure and Management. 1991-2004. Project Oversight.

Evaluation of PCB Impacts and Remedial Alternatives for a Paper Industry in Kalamazoo, Michigan. 1989-2005. Project oversight for extensive services to evaluate the conditions and potential remedial actions for a PRP at a major Superfund site.

Implementation of Phase II RCRA Facility Investigation at a Solvent Recycle Center in Chicago for Confirmation of Extent and Distribution of Chemicals in Soil and Groundwater. 1995-2004. Project oversight and Technical Advisor.

Mathematical Modeling of PCB Fate & Transport for Hudson River PCB in Support of Reassessment of Remedial Alternatives. 1993-2002. Technical Advisor and Reviewer for study to model and evaluate remedial alternatives for major Superfund site.

Technical Consulting for Determining Site Hydrogeologic Properties and Remedial Effectiveness of a Bioremediation Process at a Contaminated Site in Sullivan, Illinois. 1994-1999. Technical Advisor and Reviewer.

Site and Risk Assessment of Lubricating Oil Release from an Industrial Manufacturer in Support of a No Further Action Application. 1997-1999. Project oversight.

Closure Plan Preparation & Implementation for a RCRA Interim Status Facility in Indianapolis, Indiana. 1994-1999. Administrative oversight.

Implementation of a Closure Plan & SSIP at the Safety-Kleen Portage, Indiana, Facility. 1993-1996. Administrative oversight, Technical Advisor and Reviewer.

Site Investigation and RCRA Closure of a Solvent Transfer Facility in Pontiac, Michigan including a Soil Gas Survey; Maintenance of Groundwater Wells; and Operations and Maintenance of a Soil Vapor Extraction System. 1992-1999. Project oversight.

Preparation and Implementation of Closure Plans for a RCRA Interim Status TSD, South Bend, Indiana; including Offsite Groundwater Extend and Distribution Investigations with a Geoprobe Device; Well Installations and Sampling; and Site Investigations. 1994-1998. Technical Advisor and Reviewer and project oversight.

Geoprobe/Additional Hydrogeological and Preliminary Remedial Investigations at a Solvent Recycling Center in South Bend, Indiana for Underground Storage Tank Closure. 1993-1996. Technical Advisor and Reviewer.

Review of Phase I, Phase II and Consent Order of GM Willow Run Plant in Support of Property Acquisition. 1996. Project oversight.

Environmental Closure of Heating Oil Underground Storage Tank Located in Detroit, Michigan. 1996. Project oversight.

Contaminant Fate and Transport Analyses in Support of Litigation at a Gasoline and Oil Terminal Site in Port Huron, Michigan. 1995-1996. Project manager.

Phase I Environmental Site Assessment for a Vacant Property in Pontiac, Michigan. 1995. Technical Advisor and Reviewer.

Underground Storage Tank Investigation and Remediation for a Truck Stop in Hartland, Michigan. 1994-1998. Technical Advisor and Reviewer.

Technical Evaluations in Support of Expert Testimony Regarding Groundwater Impacts at a Chemical Distribution Facility in Muskegon Heights, Michigan. 1994-1996. Project manager.

Closure of Former Sanitary Sewage Lagoons for a Truck Stop in Hartland Township, Michigan. 1993-1996. Project oversight.

Groundwater Investigation and Remediation at an Automotive Parts Plating Facility. 1994-1996. Administrative oversight, Technical Advisor and Reviewer.

Preparation and Implementation of Closure Plan for a RCRA Interim Status TSD, Saginaw, Michigan. 1994-1996. Administrative oversight, Technical Advisor and Reviewer.

Site Investigation and Corrective Action for Releases from Underground Storage Tanks at a Maintenance Garage in Kalamazoo, Michigan. 1992-1996. Project oversight.

Critical Review of Sediment Transport Due to Wave Action in a Harbor in Support of Armoring Alternatives. 1994. Technical Advisor and Reviewer.

Soil Remediation at a Commercial Property in Detroit, Michigan. 1993. Project oversight.

Software Development to Predict Remediation Effectiveness and Environmental Compartment Partitioning. 1992-1994. Technical Advisor and Reviewer.

Kalamazoo River Sampling for Toxic Chemicals in Support of Remedial Investigation and Feasibility Studies. 1993-1994. Technical Advisor and Reviewer.

Site Assessment Review for Commercial Property in Rochester Hills, Michigan. 1993. Administrative oversight.

Site Investigation and Corrective Action for Underground Storage Tank Releases at an Automotive Dealership in Sterling Heights, Michigan. 1991-1994. Project oversight.

Underground Storage Tank Removal and Site Remediation for Commercial Property in Detroit, Michigan. 1993-1996. Administrative oversight.

Phase I Site Assessment for a Rural Site in Washtenaw County, Michigan. 1993-1994. Project oversight.

Spill Response and Remediation at a RCRA Solvent Transfer Facility in Romulus, Michigan. 1993. Administrative oversight.

NPDES Discharge Permit Evaluation for Treated Site Remediation Groundwater from an Inactive Chemical Manufacturing Facility in Western Michigan. 1993. Technical Advisor and Reviewer for assessment of whether an appeal of the permit was warranted based on site-specific characteristics.

Negotiation of HSWA (RCRA) Permit and Act 64 License for a Solvent and Waste Storage Facility in Saginaw, Michigan. 1992-1993. Project oversight.

Evaluations in Support of a Gravel Quarry NPDES Permit Application in Southeast Michigan. 1992-1993. Project manager.

Remedial Investigation for a Metal Fabricator at the Conrail Yards Area Site in Grand Rapids, Michigan. 1992-1993. Project oversight.

Underground Storage Tank Removal and Site Remediation for Commercial Property in Detroit, Michigan. 1992-93. Administrative oversight.

Site Investigation and Hoist Removal for Commercial Property in Detroit, Michigan. 1992-1993. Administrative oversight.

Soils Remediation at a Solvent Transfer Facility in Romulus, Michigan. 1992-1993. Administrative oversight, Technical Advisor and Reviewer.

Underground Storage Tank Removal and Site Remediation in Livonia, Michigan. 1992-1993. Project oversight.

Remedial Investigation and Corrective Action Implementation for a Former Gasoline Station in Detroit, Michigan. 1991-1993. Project oversight.

Site Investigation of Impacts Related to an Underground Storage Tank and Site Remediation for a Manufacturing Site in Lexington, Michigan. 1990-1993. Project oversight.

Risk Assessment to Evaluate PCB Volatilization During Implementation of Remedial Actions at Waukegon Harbor, Illinois. 1992. Technical Advisor and Reviewer.



Underground Storage Tank Release Remediation at a Parking Garage in Detroit, Michigan. 1992. Administrative oversight.

Remedial Investigation for a Solvent and Waste Transfer Facility in Dearborn, Michigan. 1992. Administrative oversight, Technical Advisor and Reviewer.

Remedial Investigation for a Solvent and Waste Transfer Facility in Grand Rapids, Michigan. 1992. Administrative oversight, Technical Advisor and Reviewer.

Underground Storage Tank Removal and Site Remediation for a Plumbing Contractor in Ann Arbor, Michigan. 1991-1992. Project oversight.

Regulatory Compliance Assessment and Underground Storage Tank Removal for a Milling Company in Carson City, Michigan. 1991-1992. Technical Advisor and Reviewer.

Groundwater Impact Assessment at a CERCLA Chemical Company Site in Dalton Township, Michigan in Support of Litigation. 1990-1991. Project manager.

Remedial Investigations of Potential Releases from a Hydraulic Lift System and Maintenance Garage in Kalamazoo, Michigan. 1989-1991. Project oversight.

Underground Storage Tank Removal and Remediation at a Former Gas Station in Kalamazoo, Michigan. 1990. Project oversight.

Determination of Allowable Groundwater Loads from the Wood Treating Site into the Mobile River and Bay in Support of a Remedial Investigation and Feasibility Study. 1989. Technical Advisor and Reviewer for evaluation of

## Environmental Regulations and Permitting

Mr. Freedman and experts at LimnoTech have been active advocates for clients on regulation and permitting issues since 1975. The use of the best information and science insures that client actions meet environmental regulations and protect the environment using cost effective approaches. Below are some historical examples.

An Energy/Water Sustainability Research Program for the Electric Power Industry, EPRI Project. Principal investigator, project oversight, group panelist.

Report to Congress CSO and SSO Overflows. 2003. Technical Reviewer.

Development of TMDLs for the Rock Creek Watershed Group within the District of Columbia. 2002 – 2004. Technical Review.

Critical Review, Advocacy and Negotiation of NPDES Permit for a Municipality in Northwest Ohio. 2003 – 2005. Project Oversight.

Development and Implementation of a Watershed Protocol for Northern Kentucky. 2001 – 2003. Project Director.

Navigating the TMDL Process: Evaluation and Design. 2000 – 2003. Principal Investigator.

Navigating the TMDL Process: Listing and Delisting. 2001 – 2003. Principal Investigator.

Method Development for Addressing Narrative Criteria in the TMDL Process. 2001-2003. Principal Investigator.

contaminated groundwater on water quality impacts in Mobile Bay to guide remedial actions.

Analyses and Modeling of Groundwater Contamination of Municipal Water Wells at a Battle Creek, Michigan CERCLA Site in Support of Expert Testimony to Determine Responsible Parties and Cost Allocation. 1987-1989. Project manager.

Fate and Transport of Barium and Nickel at an Industrial Waste Lagoon Site in Midland, Michigan. 1987. Technical Advisor and Reviewer.

PCB Modeling, Exposure Analysis and Risk Assessment in Support of ROD Changes in the Remedial Action Plan for Waukegan Harbor, Illinois. 1986-1987. Technical Advisor and Reviewer for the PRP of a major Superfund site.

Development of a Screening Model for Lake Toxics Impacts for USEPA to Evaluate the Impacts of Hazardous Waste Landfills. 1986-1987. Project oversight for development of modeling methodology to determine if landfill controls designed for protecting riverine water quality would also be protective for lakes.

Groundwater Model Evaluation of Brine Contamination Near Brighton, Michigan. 1983. Technical Advisor and Reviewer for groundwater assessment of chloride plume threatening private wells and two lakes.

Evaluation of Groundwater Contamination at Norwich, New York. 1982. Technical Advisor and Reviewer.

Development of Protocol for Testing Sewer System Wet Weather Flow Computer Models. 1998-2001. Technical Advisor.

National Combined Sewer Overflow Control Policy Support. 2000-2001. Technical Advisor.

Technical Support to USEPA for Sanitary Sewer Overflow Reduction Program. 2000-2001. Technical Advisor.

Technical Support to USEPA for Sanitary Sewer Overflow Reduction Program. 2000-2001. Technical Advisor.

Technical Support for USEPA's Municipal Storm Water Program. 2000-2001. Technical Advisor.

CSO Workshops and Review of Water Quality Standards in CSO-Impacted Receiving Waters. 1999. Project oversight.

Review of USEPA Draft Guidance "Implementation Framework for the Use of Equilibrium Partitioning Sediment Guidelines." 1999. Technical management

Stormwater Permitting Support to the Willow Run Airport, Wayne County, Michigan. 1996-1998. Technical Advisor.

Portland, Oregon Reassessment of Combined Sewer Overflow Control Plan for Meeting Water Quality and NPDES Requirements. 1996-1999. Technical Advisor.

Evaluation and Demonstration of Deicing Runoff Management Alternatives at the Portland International Airport. 1996-1999. Technical Advisor.

Las Vegas Total Maximum Daily Load (TMDL) Assessment. 1996-1998. Technical Advisor.

Assessment of Sediments Related to Dredging for a Commercial Docking Facility in Ohio and the Application for Open Water Disposal. 1996-1999. Project Manager.

Review and Comments on Great Lakes Water Quality Guidance Regulation Implementation by the State of Michigan. 1996. Technical Advisor.

NPDES Permit Application Studies and Preparation for a Steel Manufacturing Facility in Wayne County, Michigan. 1995. Project manager.

Evaluation of Chesapeake Bay Nutrient Reduction Strategy Impacts on Fairfax County, Virginia NPDES Requirements. 1995-1998. Technical Advisor.

Water Quality Evaluation of Pond Brook to Support NPDES Expansion of a Wastewater Treatment Plant, Summit County, Ohio. 1995. Project manager.

Mixing Zone Analysis for a Cooling Water Discharge to Lake Huron at Harbor Beach, Michigan. 1995. Technical Advisor and Reviewer.

Evaluation and Revision of the Draft NPDES Permit for a Foundry in New Haven, Michigan. 1995-1996. Technical Advisor and Reviewer.

Ottawa River Modeling to Determine Effluent Requirements for a New Discharge. 1995-1997. Technical Advisor and Reviewer.

Evaluation of the Environmental and Regulatory Consequences of Glycol-Based Hydraulic Fluids at a Steel Plant in Dearborn, Michigan. 1995. Project oversight and Technical Advisor.

Development of a Site-Specific Biomonitoring Plan for Discharge from a Specialty Steel Manufacturer in Southeast Michigan. 1994-1995. Technical Advisor and Reviewer.

Review and Evaluation of Water Quality Based Effluent Limits for the OxyChem Chlor-Alkali Facility in Muscle Shoals, Alabama. 1994-1995. Technical Advisor and Reviewer.

Critical Review of Draft South Commerce Wastewater Treatment Plant NPDES Permit. 1994-1995. Technical Advisor and Reviewer.

Evaluation of Proposed NPDES Limitations for a Michigan Chemical Manufacturer. 1994. Technical Advisor and Reviewer.

NPDES Permit Guidance for an Electronics Manufacturer in Pennsylvania. 1994-1996. Technical Advisor and Reviewer.

Wasteload Allocation Modeling for the City of Lincoln, Nebraska NPDES Wastewater Treatment Plants. 1994-1997. Technical Advisor and Reviewer.

Preparation of Dissolved Oxygen Study Plan for the Rouge River in Support of NPDES Permits. 1994-1995. Project manager.

Evaluation of a Municipal NPDES Discharge Permit to Support Negotiation of Revisions. 1993-1994. Technical Advisor and Reviewer.

Critical Evaluation of Detroit River Wasteload Allocation for a Major Steel Company in Support of NPDES Revisions. 1993. Technical Advisor and Reviewer.

Preparation of a Kentucky Pollutant Discharge Elimination System (KPDES) Permit Application for a Fuel and Solvent Recovery Facility. 1993. Project oversight.

Development of a GIS-Based Stormwater Management Program and NPDES Permit Application for the District of Columbia. 1994-1996. Administrative oversight.

Water Quality Modeling Support for Appeal of Toxic Effluent Limits for a Municipal Discharger in Pennsylvania. 1993-1994. Technical Advisor and Reviewer.

Technical Assistance in Preliminary Scoping of Denver, Colorado Metro Total Maximum Daily Loads. 1993-1994. Project oversight.

Evaluation of NPDES Discharge Permit Issues for Treated Site Remediation Groundwater from an Inactive Chemical Manufacturing Facility in Western Michigan. 1993. Technical Advisor and Reviewer for assessment of whether an appeal of the permit was warranted based on site-specific characteristics.

Technical Analysis and Negotiation for NPDES Toxics Permitting at Two Coal-Fired Power Plants in Pennsylvania. 1992-1994. Technical Advisor and Reviewer for proactive mixing zone and water quality modeling evaluation of toxic effluent limits for proactive guidance to the State permitting agency.

Testing the Use of Computer Models for NPDES Permit Development to Protect Sediment Quality. 1992-1993. Oversight for project to apply models previously developed by LimnoTech to implement sediment quality criteria in NPDES permitting and remedial design.

Evaluations in Support of a Gravel Quarry NPDES Permit Application in Southeast Michigan. 1992-1993. Project Manager.

Review of Ohio USEPA WASP4 Dissolved Oxygen Modeling of the Cuyahoga River as it Relates to Combined Sewer Overflow Control Requirements. 1992-1993. Project Manager.

Water Quality Analysis and Modeling in Support of NPDES Requirements for the Expansion of the Lower Potomac Pollution Control Plant, Fairfax County, Virginia. 1992-1993. Project oversight for application of hydrodynamic, toxic pollutant, conventional pollutant/eutrophication and mixing zone models to determine water quality impacts of alternative discharge locations.

Development of a Demonstration Total Maximum Daily Load for Silver Creek, Arizona for Use in USEPA Training. 1992-1993. Project oversight.

Field Studies and Modeling of Mixing Zone Impacts from a Chemical Plant on the Ohio River in Kentucky to Support NPDES Negotiations. 1992-1993. Project Manager.

Analysis of Discharge Alternatives for West Rehoboth, Delaware in Support of Facilities Planning. 1992. Project oversight for estuarine WLA modeling and quality review of reports and modeling results.

Evaluation of Industrial Operations Effluent Discharges and River Impacts for a Steel Coating Company in Support of Permit Revisions. 1991-1993. Project Manager.

Stormwater Permitting Analysis of Water Quality Effects in Alexandria, Virginia. 1991-1992. Project oversight for assessment of water quality effects of urban stormwater.

Evaluation and Comments on TMDL/WLA and WQBEL NPDES for a Microelectronics Plant in Pennsylvania. 1992. Technical Advisor and Reviewer for project involving technical comments and critique of the state agency's proposed effluent limits.

Evaluation of Industrial Operations, Effluent Discharges and River Impacts for a Major Steel and Automobile Manufacturing Complex in Support of Permit Revisions, Wayne County, Michigan. 1991-1993. Project Manager for confidential project to provide scientific support for appeal of metals limitations proposed by the state.

Monitoring and Modeling Evaluation of Toxicant Effluent Limits for Metal Finishing Industry in Ohio in Support of Litigation to Revise Limits. 1991-1993. Technical Advisor and Reviewer for assessment of proposed toxic effluent limits using steady-state models and historical data.

Toxic NPDES Effluent Limits Evaluation and Negotiations for a Major Microelectronics Manufacturer in Support of Permit Revisions. 1991-1993. Project oversight for monitoring and modeling project to support revisions in NPDES metals limitations.

Advanced Probabilistic Modeling Evaluation of Toxicant Effluent Limits for Metal Finishing Industry in Ohio to Conclude Revised Permit Settlement. 1991-1993. Technical Advisor and Reviewer for evaluation of regulatory waste load allocations for metals.

Preparation of Stormwater Permit Application for a Steel Mill in Jackson, Michigan. 1991-1992. Project oversight.

Investigation of Proposed NPDES Limits for Two Monroe County, New York Treatment Plants in Support of Permit Revision. 1991-1992. Project oversight for water quality modeling guidance and quality reviews of water quality evaluations and modeling.

Modeling Mixing Zone Impacts of Intermittent Blue Plains Wastewater Chlorine Discharges in Support of NPDES Permitting. 1991-1992. Project Manager.

NPDES/WLA Evaluation for Toxics Limits for a New Jersey Power Generating Facility Discharging to Arthur Kill Estuary in Support of Permit Revisions. 1991. Technical Advisor and Reviewer for study to provide technical comments and guidance for critique of proposed effluent limitations.

Effluent Mixing Zone Sampling in Lake Superior for a Mining Company in Support of NPDES Requirements. 1991. Project oversight.

Review of Mixing Zone NPDES Application for Pago Pago Harbor. 1991. Technical Advisor and Reviewer for USEPA Region 10 of UDKHDEN mixing zone model application.

Water Quality Modeling and Statistical Analysis in Support of a Contested NPDES Permit for a Shellfish Canning Operation in Willis Wharf, Virginia. 1991. Project oversight.

NPDES Permit Review for a Brass Manufacturing Company in Southeast Michigan. 1991. Technical Advisor and Reviewer.

Waste Load Allocation Modeling for Lead Mining Industry NPDES Discharges. 1991. Project oversight for development of a surface water and bed sediment quality model for heavy metals.

Ottawa River, Ohio Biological and Water Quality Sampling and Modeling in Support of NPDES Requirements to Evaluate Industrial Wastewater Impacts from an Oil and Chemical Company. 1990-1993. Project oversight for project involving extensive monitoring and dissolved oxygen modeling of innovative dissolved oxygen management approaches to improve water quality conditions and meet standards.

NPDES Toxic and WQBEL Evaluation and Negotiations for Two Coal-Fired Power Plants in Pennsylvania. 1990-1992. Project oversight.

NPDES Toxic and WQBEL Evaluation for a Coal-fired Power Plant in Support of Permit Revisions. 1990-1991. Project oversight.

Critical Review of the 1990 Draft NPDES Permit for a Paper Mill in Manistique, Michigan in Support of Permit Revision. 1990. Project Manager.

Evaluation of Muskegon Waste Management System Phosphorous Limits in Support of NPDES Litigation. 1990. Project Manager.

Waste Load Allocation Investigations for a Major Metals Industry in Alabama in Support of NPDES Permit Revisions. 1989-1992. Project Manager for monitoring and modeling reevaluation to determine appropriate effluent limits for an industrial discharge to a small creek.

Technical Negotiations of NPDES Permit Revision for a Steel Mill in Trenton, Michigan. 1989-1990. Project Manager.

NPDES and WQBEL Evaluation for Two Coal-Fired Power Plants in Support of Permit Revisions. 1989-1990. Technical Advisor and Reviewer for modeling evaluation of proposed toxic effluent limits for discharges to a creek to support less stringent, revised limits equally protective of water quality.

Case Studies Using Monitoring Data in TMDL/WLA Development in Support of Training for USEPA and State Regulatory Staff. 1989-1990. Project oversight.

Critical Review of Proposed Seasonal NPDES Limits for the Kalamazoo Wastewater Treatment Plant. 1989. Project oversight.

Water Treatment Plant Consultation for City of Niagara Falls Involving Statistical Analyses and Groundwater Modeling. Technical advisor. Investigation and Control of Elevated Cyanide Measurement in the Cadillac Wastewater Treatment Plant Discharge and Revision of NPDES Limits. 1989. Project oversight.

Critical Review of the NPDES Permit for a Steel Mill in Jackson, Michigan to Support Negotiation of Permit Revision. 1988-1990. Project Manager.

Reaeration Studies on Brushy Creek in Support of Waste Load Allocation Modeling and NPDES Permitting. 1988-1989. Project Manager.

Investigation of Wastewater Treatment Plant Effluents Impacts on Sweetwater Creek in Support of NPDES Permit Development. 1988. Project Manager for field survey data collection and water quality model application to determine effluent limitations required in response to increased discharge flow.

Critical Review and Revision of the NPDES Permit for a Steel Mill in Gibraltar, Michigan. 1988. Project Manager.

Review of the City of Jackson Wastewater Treatment Plant NPDES Permit Renewal. 1988. Project Manager.

Critical Review of NPDES Permit for a Steel Mill in Trenton, Michigan and Negotiation of Permit Revisions. 1988. Project Manager.

Wastewater Discharge Mixing Zone Definition in Lake Macatawa, Michigan in Support of NPDES Revision. 1988. Project Manager.

Evaluation of Residual Chlorine Discharge Impacts on the Potomac Estuary in Support of NPDES Permitting. 1987-1988. Project Manager.

Water Quality Investigation and Modeling in Support of NPDES Permitting of Advanced Wastewater Treatment Discharges into Brushy Creek, Florida. 1987-1988. Project Manager.

Environmental Assessment of a Steel Plant Discharge to a Wetland in Support of NPDES Permitting in Jackson, Michigan. 1987. Project Manager.

Critical Review of NPDES Effluent Limits for Fairfax County, Virginia. 1985-1987. Project Manager.

Analyses and Modeling in Support of NPDES Effluent Limitations for Industrial and Municipal Dischargers to Six Large Louisiana River Basins. 1984. Project oversight for waste load allocation evaluations for over 100 discharges to these rivers for the State regulatory agency.

Critical Evaluation of Grand Rapids, Michigan and Wyoming, Michigan NPDES Effluent Limits to Support Permit Revisions. 1983-1984. Project Manager for data evaluation and modeling for the Grand River to assess effluent limits for dissolved oxygen and toxic parameters.

Water Quality Monitoring and Modeling to Critically Evaluate and Revise NPDES Effluent Limits for the City of Owosso, Michigan. 1983-1984. Project Manager for design of field surveys, and calibration and application of dissolved oxygen model to determine appropriate permit limits to protect water quality.

Evaluation of Causes for 1983 Potomac River Algal Bloom in Defense of Existing Wastewater Treatment Practices. 1983. Technical Advisor and Reviewer for study of contributing factors to an algal bloom, including nutrient sources and a unique combination of environmental factors.

Review of NPDES Effluent Limits at Little Hunting Creek Wastewater Treatment Plant Based on Water Quality Modeling. 1983. Technical Advisor and Reviewer.

Evaluation of the Need for Advanced Wastewater Treatment at the Mount Clemens, Michigan Wastewater Treatment Plant. 1983. Project Manager for water quality modeling guidance and support to determine appropriate BOD and ammonia limits.

Water Quality Monitoring Investigation, Modeling and Regulatory Negotiation to Revise Flint Wastewater Treatment Plant Effluent Requirements. 1982-1986. Project oversight for study to support proposed permit revisions that were implemented.

Water Quality Analyses and Modeling to Support Facilities Plans for Blue Plains Wastewater Treatment Plant Phase II Planning and Feasibility Study. 1982-1984. Project Manager.

Analyses and Modeling in Support of Effluent NPDES Limits for Municipal Point Source Dischargers Throughout the State of Louisiana. 1982-1984. Project Manager for development of WLA policies monitoring design and waste load allocation modeling for hundreds of discharges to over 60 receiving water systems.

Critical Evaluation of City of Richmond Wastewater Treatment Plant NPDES Effluent Requirements in Support of Permit Negotiations. 1982-1984. Project Manager.

Critical Review of Stochastic Modeling Used by Iron and Steel Industry to Characterize Effluent Characteristics and Water Quality Impacts. 1982. Reviewed and critiqued stochastic water quality model application for USEPA.

General Water Quality Consultation for the District of Columbia. 1981-1982. Project Manager.

Evaluation of Water Quality Impacts from the Muskegon Wastewater System Lagoon Seepage Discharge as Related to NPDES Requirements. 1980. Project Manager for modeling and statistical evaluations relating to permit negotiations.

Investigation and Expert Testimony on the Blue Plains Wastewater Treatment Plant NPDES Waste Load Allocation Regarding Nutrient Removal. 1979-1981. Project Manager for modeling and statistical evaluations relating to permit negotiations.

Water Quality Modeling in Badfish Creek to Determine Nitrification Requirements and Weed Harvesting for Madison, Wisconsin Wastewater Facilities. 1979-1980. Project Manager.

Evaluation of the Impact of Coldwater Wastewater Treatment Plant on Messenger - Hodunk Chain of Lakes in Support of Facilities Planning. 1977-1979. Project Manager.

Cass River Water Quality Modeling for NPDES Waste Load Allocation and Areawide Planning. 1976-1978. Project Manager.

Critical Review and Litigation of Advanced Wastewater Treatment Requirements for City of Solon on Tinkers Creek Ohio. 1976-1977. Technical Contributor.

Modeling the Impacts of Thermal Discharges to Onondaga Lake in Support of NPDES Permitting. 1976. Technical Advisor and Reviewer.

Water Quality modeling Impacts of the Madison, Wisconsin Wastewater Treatment Plant Discharge to Various Alternative Receiving Waters in Support of Facilities Planning. 1975-1976. Technical Advisor and Reviewer.

Water Quality Modeling in Genesee River and Rochester Embayment, Lake Ontario in Support of Wastewater Facilities Planning. 1975-1976, 1980. Project Manager.

Critical Review and Revision of Steel Plant NPDES Waste Load Allocation for Black Creek, Ohio. 1975-1976. Technical Advisor and Reviewer.

## Modeling Pollutant Fate and Transport

Computer modeling has always been a key focus for Mr. Freedman and LimnoTech, being among the pioneers in developing new models and approaches. This has included eutrophication and toxic models, river and estuary models, watershed models, probabilistic modeling, micro PC-based models, computer data and model visualizations, interactive model frameworks, integrated watershed and water quality models, sewer system and tunnel models, and many other advances in modeling used for design, management and decision support. Although Mr. Freedman no longer is actively engaged in the programming and hands-on modeling, he stays actively engaged in corporate oversight and guidance on numerous new applications and advances. Below are some examples of recent and past projects.

Lake Erie Ecosystem Model of nutrients, algae, HABs, cladophora and hypoxia to support Annex 4 of Great Lakes Water Quality agreement: HABs, hypoxia, Cladophora: 2019-2020. Corporate oversight.

Integrated field-scale and watershed model for the Maumee River to assess benefits of BMP practices to reduce nutrient loading to Lake Erie and Harmful Algal Blooms, several projects; 2016-2019. Corporate oversight

Clean Water Roadmap, Lake Champlain, a web-based tool designed to support Basin planning and meet Lake objectives: 2016-2017. Corporate oversight.

Upper Mississippi River and Lake Pepin – nutrient and eutrophication management model; 2015-2019. Corporate oversight.

Data Needs and Modeling Approaches for Developing Site-Specific Nutrient Goals and Criteria, two projects; 2012-2013 and 2012-2019. Corporate oversight

Development of Integrated Ecological Response Models for the Lake Ontario / St. Lawrence River and the Upper Great Lakes Systems, multiple projects. 2002-2017. Corporate oversight

Forecasting the Causes, Consequences, and Potential Solutions for Hypoxia and Harmful Algal Blooms in Lake Erie, series of projects. 2009-2015. Corporate oversight

Green Bay Water Quality Model to Address Hypoxia and Harmful Algal Blooms; 2009-2011. Corporate oversight.

Development of an Integrated Ecological Response Model for the Lake Ontario-St. Lawrence River Water Level/Flow Study. 2002 – 2004. Technical Advisor.

Development of a Dissolved Oxygen Model for the Lower Black River from Elyria, Ohio to Lake Erie. 2000-2003. Technical Reviewer.

Developing Methods to Analyze Protect, and Restore Flow regimes in the Great Lakes Basin. 2003. Technical Advisor.

Development of a Process-oriented Aquatic Ecosystem Model to Investigate Multi-stressor Interactions in Saginaw Bay, Lake Huron. 1999-2003. Corporate oversight

Saginaw Bay Ecosystem Model to address Harmful Algal Blooms and Cladophora; 1999-2002. Corporate oversight.

Evaluation and Refinement of Fox River and Green Bay Models. 1997-2000. Technical Advisor.

Mathematical Modeling of PCB Fate and Transport in Hudson River in Support of Reassessment of Remedial Alternatives. 1997-2000. Technical Advisor.

Revision of USEPA's DYNTOX Probabilistic Surface Water Quality Toxic Model for Inclusion in TMDL Guidance. 1996. Technical Advisor.

Preparation of a Mixing Zone Guidance Manual for the American Petroleum Institute. 1995-1997. Technical Advisor and Reviewer.

Lake Lanier Water Quality Modeling and Watershed Protection Study. 1995. Technical Advisor and Reviewer.

Enhancement of the Simplified Method Program - Toxics (SMPTOX) to Predict Non-Ionic Organic Concentrations in Sediments. 1995-1997. Project oversight and Technical Advisor.

Planning Support for the Everglades Mercury Research Program. 1995-1997. Project manager.

Revision of DYNTOX and DESCON Models in Response to USEPA's Revision of Aquatic Life Metal Criteria. 1995-1997. Project oversight.

Research Workshop on Mercury in the Everglades. 1994-1995. Project manager.

Development of a Linked Model for Management of Water Quality in South Florida. 1994-1997. Technical Advisor and Reviewer.

Expert Review of Chatahoochee River Modeling. 1994. Project oversight.

Conducting Regional Workshops for USEPA on Development of Total Maximum Daily Loads. 1994-1995. Project oversight.

Development of Enhanced SMPTOX to Simulate Metal's Binding to AVS. 1994-1996. Project oversight.

Development of a User-Friendly DYNTOX Probabilistic Toxics Model for the USEPA. 1994. Project oversight.

Hypoxia on the Louisiana Inner Shelf: Modeling the Impacts of Mississippi-Atchafalaya River Nutrient Load Reductions. 1994. Technical Advisor and Reviewer.

Mathematical Modeling of PCB Fate & Transport for Hudson River PCB in Support of Reassessment of Remedial Alternatives. 1993-2000. Technical Advisor and Reviewer for study to model and evaluate remedial alternatives for major Superfund site.

Documentation of CORMIX Mixing Zone Model Revisions for U.S. Environmental Protection Agency. 1993. Technical Advisor and Reviewer. Oversight of project involving review of applicability of DRBC-sponsored changes to the Model CORMIX designed to facilitate estuarine mixing zone analysis.

Conducting Regional Training Workshops for USEPA on Development of Total Maximum Daily Loads. 1993-1996. Project oversight for presentation of a series of nationwide technical training workshops explaining the development of TMDLs.

Development of Pre- and Post-Processor Software for the CORMIX Mixing Zone Models for the Delaware River Basin Commission. 1993. Project oversight.

Development of a Summary Document for an USEPA TMDL Coordinator's Meeting and workshop. 1993. Project oversight.

Software Development to Predict Remediation Effectiveness and Environmental Compartment Partitioning. 1992-1994. Administrative oversight, Technical Advisor and Reviewer.

Development of a Multi-Branched Stream Toxics Model for Wasteload Allocation Purposes for Pennsylvania DER. 1992-1993. Project oversight for development of C-language watershed-based expert system of performing water quality simulation and effluent permitting.

Development of a Demonstration Total Maximum Daily Load for Silver Creek, Arizona for Use in USEPA Training. 1992-1993. Project oversight.

Development of the User Friendly PC-Based DYNTOX Probabilistic Toxics Model for Use in NPDES Development. 1992-1993. Project oversight for conversion of mainframe-based DYNTOX probabilistic model to user-friendly, PC-based platform.

Determination of Mixing Zones for Three Dischargers in the Missouri River for USEPA Region 7. 1992-1993. Project oversight for mixing zone model calibration to field dye survey data.

Enhancements to Multi-SMP Surface Water Toxics Model for USEPA Use in Assistance to States. 1992-1993. Project oversight for update of the Multi-SMP model to include refined user interface and additional modeling capabilities.

Water Quality Modeling to Support Evaluations of Interim Combined Sewer Overflow Control Measures in Portland, Oregon. 1992-1993. Technical Advisor and Reviewer for application of an LimnoTech-developed transient water quality model to assess interim BMPs.

Training Workshops on USEPA's Technical Support Document for Water Quality-based Toxics Control. 1991-1993. Project oversight.

Advanced Probabilistic Modeling Evaluation of Toxicant Effluent Limits for Metal Finishing Industry in Ohio to Conclude Revised Permit Settlement. 1991-1993. Technical Advisor and Reviewer for evaluation of regulatory waste load allocations for metals.

Modeling Mixing Zone Impacts of Intermittent Blue Plains Wastewater Chlorine Discharges in Support of NPDES Permitting. 1991-1992. Project Manager.

Development of a Modeling Protocol to Support NPDES Permit Limits to Protect Sediment Quality. 1991-1992. Project oversight to develop models to implement sediment quality criteria in NPDES permitting and remedial design.

Comparison of Toxic NPDES Permit Limits Developed Using Dynamic and Steady State Approaches in Support of USEPA Training Workshops. 1991-1992. Project oversight for application of water quality and mixing zone models, and resulting permit derivation, to determine permit limits for toxic pollutants.

Water Quality Modeling Workshop for Pennsylvania Department of Environmental Regulations Staff. 1991. Project oversight for workshop on modeling of toxic chemicals in the environment.

Development of a SMPTOX 123 Surface Water Toxic Chemical Model for USEPA to Improve Availability and Use of Models for Support of NPDES Permits. 1991. Project oversight for development and testing of a variable complexity water quality and sediment toxics model.

Analysis of Needs and Alternatives for Region 3 Estuarine Waste Load Allocation and Mixing Zone Assessments. 1990-1991. Project oversight for review of available modeling approaches for estuarine mixing zones, provided recommendations to USEPA.

SMPTOX3 Toxic Model Update and Toxic Modeling Handbook for USEPA. 1990-1991. Project oversight for development and testing of a steady-state water quality and sediment toxics model.

Support of Total Maximum Daily Load Water Quality Model Development for South San Francisco Bay. 1990-91. Project oversight for development of screening-level WASP model application using available data and monitoring recommendations to collect data required to support more rigorous modeling.

Toxics Modeling and NPDES Permitting Training Workshops for USEPA and State Regulatory Staff. 1990. Project Manager for a series of nationwide technical training workshops explaining the development and application of water quality models for NPDES permitting.

Technical Guidance for Narragansett Bay Waste Load Allocation Modeling. 1989-1992. Co-chaired Water Quality Modeling Advisory Board overseeing development of a dissolved oxygen wasteload allocation model for the Providence River and Upper Narragansett Bay.

Modifications and Enhancements to the Pennsylvania DER Water Quality Analysis Model. 1989-1991. Project oversight for conversion of expert system dissolved oxygen model from Applesoft Basic to C-language.

QUAL2E-UNCAS Modeling for use in USEPA Technical Guidance Manual. 1989-1990. Project oversight for

modeling analysis and chapter on QUAL2E modeling for USEPA technical guidance manual.

Preparation of USEPA Permit Writer's Guide to Water Quality-Based Toxics Control for Marine and Estuarine Discharges. 1989-1990. Project oversight for chapter on exposure assessment modeling, describing alternative modeling methodologies.

Preparation of Draft Final Estuarine Technical Guidance Manuals Parts I and II for USEPA. 1989-1990. Project oversight.

Technical Assistance to USEPA in Development of Section 303(d) Wasteload Allocation Program Guidance. 1989. Project oversight for technical assistance to USEPA on a wide range of issues related to water quality assessment and modeling.

Estuarine Guidance Manual Case Study Development and Critical Review for USEPA. 1989. Project Manager.

Revision of USEPA Technical Guidance Manuals for Wasteload Allocation. 1988-1989. Project oversight.

Supplemental Assistance for Development of USEPA Wasteload Allocation Modeling and Proceedings. 1988-1989. Project oversight.

Development of Proposed State Procedures for Waste Load Allocation Methodology for Toxic Discharges of Wastewater in New Jersey. 1988-1989. Technical Advisor and Reviewer.

Development of Waste Load Allocation Technical Guidance Manual for Estuarine Systems on Behalf of USEPA. 1988-1989. Project oversight for development of two technical guidance manuals on estuarine wasteload allocation modeling.

Modification of the Interactive Modeling Framework for USEPA to Include a New Version of QUAL-2E. 1988. Project oversight.

Waste Load Allocation Case Studies in Support of USEPA Training. 1988. Project oversight.

Training Workshop for USEPA and State Regulatory Staff on Development of Water Quality Based Toxic Effluent Limits for NPDES Permits. 1988. Project oversight for a series of nationwide technical training workshops explaining the development and application of water quality models for NPDES permitting.

Development of Methodologies to Evaluate Chlorinated Discharge Impacts on Delaware's Surface Waters. 1986-1987. Technical Advisor and Reviewer.

Development of a Screening Model for Lake Toxics Impacts for USEPA to Evaluate the Impacts of Hazardous Waste Landfills. 1986-1987. Project oversight for development of modeling methodology to determine if landfill controls designed for protecting riverine water quality would also be protective for lakes.

Development of a Microcomputer Model of Toxic Effluent Impacts on Rivers from Multiple Discharges. 1986. Project oversight.

Development of Prototype Pre-Processor for USEPA Water Quality Models. 1986. Project oversight.

Development of Interactive Modeling Framework in Support of USEPA Water Quality Models for NPDES Permitting. 1986. Project Manager.

Documentation of the Interactive Model Framework (IMF) for USEPA to Improve User-Friendliness of Water Quality Models. 1986. Project oversight.

Development of Real-Time Screen Displays for the QUAL2E Water Quality Program for USEPA Use in Training and State Regulatory. 1986. Project oversight.

Development of Prototype Post-Processor for USEPA Water Quality Models to Improve Use by Regulatory Staff. 1986. Project oversight.

Toxics Modeling Workshops for Training USEPA and State Regulatory Personnel in Their Use in NPDES Permitting. 1985-1987. Project Manager.

Development of Computer Graphics for USEPA NPDES Waste Load Allocation Software Models. 1985-1986. Project oversight.

Development of Interactive Microcomputer Programs on the Simplified Method for Conventional and Toxic Waste Load Allocation for USEPA. 1985-1986. Project Manager.

Development of a Monte Carlo Dissolved Oxygen Model for Evaluation of Waste Load Allocation for Michigan DNR. 1985-1986. Project oversight.

Video Instructional Tape for Modeling Toxics as Training for USEPA and State Regulatory Staff. 1985. Project oversight.

Microcomputer Adaptation of a Geographic Database Management System for the Department of Defense. 1985. Project Manager.

Development of the DYNTOX Probabilistic Model for Toxic Waste Load Allocation for USEPA Technical Guidance. 1984-1985. Project Manager.

Modeling and Evaluation of PCB and PBB in Saginaw and Pine Rivers to Assess Needs for Sediment Remediation. 1983. Project oversight for cooperative study to evaluate potential remediation actions, including no action and dredging alternatives.

Concept Paper and Workshop for USEPA to Introduce Specialized Uncertainty and Probability Analysis in NPDES Waste Load Allocations. 1982-1983. Project Manager for review of alternative probabilistic modeling procedures for water quality assessment.

Studies of Phytoplankton and Dissolved Oxygen Kinetics in Onondaga Lake. 1982-1983. Technical Advisor and Reviewer for development and calibration of microcomputer eutrophication model for Onondaga Lake.

Training in Water Quality Modeling and its Use in Planning for Water Pollution Control in the Peoples Republic of China.

Modeling Assessment of Water Quality Impacts in Onondaga Lake, New York to Determine Needed Combined Sewer Overflow Controls. 1976-1978. Project Manager.