

Mark R. Deutschman, Ph.D., P.E.
[Project Role]

Experience:

Mark Deutschman is a Vice President of Houston Engineering, Inc. and Manager of our Minneapolis office. His primary technical duties include environmental review, hydrologic and hydraulic design, watershed management in rural and urban settings, water quality monitoring and modeling, total maximum daily loads and waste load allocations, the development of water quality protection plans, and biological, ecological and natural resource planning and monitoring programs. Additional areas of responsibility include the policy aspects of wetland delineation, permitting and mitigation, NPDES permitting and water quality standards evaluation, stream stability and geomorphology and the ecological design of natural systems. A primary strength is the project planning and conceptual design as well as stakeholder involvement activities.

Dr. Deutschman is literate with many watershed and receiving water water quality, hydrology and hydraulics models, whether proprietary, or developed by various agencies including the Corps of Engineers, EPA, the NRCS or the academic community. He has formal training in wetland delineation and has applied natural resource models including the Habitat Evaluation Procedure (HEP) and Physical Habitat Simulation Model (PHABSIM). He is also adept at complex statistical analysis of field data using statistical programs including Statistical Analysis System (SAS), Minnitab, and EXCEL. Recent activities include the development of web-based Decisions Support Tools and applications.

Decision Support System, Web Applications and GIS

- **Near Real Time Flood Display Tool.** As Project Manager, responsible for developing a web-based tool capable of displaying National Weather Service deterministic flood forecasts using LIDAR data for the Fargo – Moorhead metropolitan area. Activities completed included concept design, pseudo-code development, tool testing and debugging, stakeholder involvement and project management. The project included working jointly with staff from the National Weather Service and the International Water Institute. MapServer served as the interactive mapping tool (see www.rrbdin.org).
- **Greenfield Irrigation District GIS and Water Demand Forecast Tool.** As Project Manager, developed a concept for an irrigation water demand forecast tool, using Geographic Information System, for the Greenfield Irrigation District in northwestern Montana. The tool is capable of estimated short and long-term water demands, shortages and provide automated water balance information. Provided direction on the development of a GIS system for managing the irrigation infrastructure of the District.
- **Phase II, Red River Basin Disaster Information Network, Red River Basin, US and Canada, U.S. Army Corps of Engineers Cold Regions Research Lab, Hanover, New Hampshire.** Project Manager for the development of an internet based decision information system related to water management within the more than 45,000 mi² Red River of the North Basin. Project activities included web page development, preparation of the system software and design requirements, concept design of water management applications, programming and implementation (www.rrbdin.org). MapServer served as the interactive mapping tool.
- **Phase I, Red River Basin Disaster Information Network, Red River Basin, US and Canada.** As Subconsultant Project Manger, developed concept design for hydrologic and hydraulic tools for the Disaster Information Network and the International Joint Commission. Prepared scenarios describing functionality of the hydrologic and hydraulic tools. Developed

and implemented MS Access database for water management people, organizations, policies and procedures.

- **Federal Geographic Data Committee Cooperative Agreements Projects, Red River Basin of the North, U.S. Geological Survey, Reston, Virginia.** Cooperative Canadian – US project intended to resolve international geo-spatial data issues, including differences in standards and formats, attributes, coordinate systems and datum. Completed MapServer applications for two model watershed crossing the Canadian – US border. Developed new seamless datasets for watershed boundaries and roads.
- **Red River Basin Virtual Database, Red River Basin, US and Canada.** As Subconsultant Project Manger, developed data standards and integration methods for virtual web-based search engine to access distributed databases.
- **Internet Permit Viewer, Sandhill River Watershed District, Fertile, Minnesota.** Project Manager for the development of an internet application using MapServer, which allows the display and printing of geo-spatial data. The application also allows for the entry and retrieval of permit data related to hydraulic structures remotely across the Internet. MapServer served as the interactive mapping tool.
- **Water Quality Report Card, Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager for the development of an internet application using MapServer, which allows the display of historic water quality and flow data collected by the Watershed District as well as geo-spatial data. Developed a water quality report card to quickly assess river and stream condition. MapServer served as the interactive mapping tool.
- **Red River Basin Virtual Database, Red River Basin, US and Canada.** As Subconsultant Project Manger, developed data standards and integration methods for virtual web-based search engine to access distributed databases.

Ecological Design, Restoration and Rehabilitation

- **Lake Ogechie Wild Rice Restoration, Onamia, Minnesota.** Project Manager and lead engineer / scientist for evaluating the feasibility of modifying the existing Buckmore Dam, to restore ecological function and native stands of wild rice within Lake Ogechie. Developed ecological design criteria, alternative concepts, impact assessment criteria, and stakeholder involvement activities. Completed an engineering feasibility report which formed the basis for an Environmental Assessment worksheet.
- **Lake Christina Ecological Restoration, Ashby, Minnesota.** Project Manager and lead engineer / scientist for evaluating the feasibility of using water level management to improve the ecological condition of famous Lake Christina and downstream Pelican Lake. Developed goals and technical objectives for lower the water level of Lake Christina, based upon ecological process within the lake. Developed and applied a dissolved oxygen model to evaluate the importance of water level drawdown for increasing the probability of fish mortality as a result of low oxygen. Evaluated submerged plant regeneration associated with drawdown. Developed and evaluated various engineering concept designs for the drawdown. Presented findings at several meetings.
- **Dalen Coulee Natural Waterway Ecological Enhancement, Clay and Norman Counties, Minnesota.** As Project Manager and lead technical person, worked with multiple stakeholder groups to resolve natural resource and water management issues along the 12.5 mi Dalen Coulee. Developed comprehensive list of possible alternatives for reducing flood damages and worked with Interagency Work Team to select preferred alternative. Preferred alternative consists of restoring approximately 4 miles of the coulee, establishing set-aside

along the coulee, removing culverts and reducing sediment load to the coulee. Implementation of the plan for the 25.0 mi² drainage area will reduce flood damage to agricultural land along the coulee and improve natural resources.

- **Systems Approach to Water and Natural Resources Management, Wild Rice Watershed District, northwest Minnesota.** Developed unique approach to comprehensively addressing water management (flooding) and natural resource issues within 2,080 mi² area in northwest Minnesota. Approach consists of establishing water management and natural resource goals, translating the goals into indicators criteria, and using the indicators to evaluate resource gains and losses. Approach uses stakeholder groups consisting of landowners, local, state and federal government and environmental groups.
- **Heiberg Dam Fish Passage, near Twin Valley, Minnesota.** Reviewed Minnesota Department of Natural Resources proposed designs for providing fish passage through the Heiberg Dam in northwestern Minnesota. Reviewed issues associated with the proposed project. Made alternative design recommendations to the Department of Natural Resources for providing fish passage including a rocked passage structure over the existing structure.

Environmental Review and Permitting:

- **Lake Christina Ecological Restoration Environmental Assessment Worksheet, Ashby, Minnesota.** Prepared the Environmental Assessment Worksheet (EAW) for this lake level water management project (i.e., 70 cfs pump station) in accordance with Minnesota Department of Natural Resources (MnDNR) guidance, for issuance by the Division of Wildlife, MnDNR. Completed all sections of the EAW including compliance with agency policy, water quality, water quantity, wildlife and fisheries, and cultural resource impacts. Coordinated revisions with Ecological Services Division to complete the EAW.
- **Greenfield Wetland Banking, Corcoran, Minnesota.** Served as Project Manager for the completion of a wetland delineation and obtaining wetland credits from the Board of Soils and Water Resources and the U.S. Army Corps of Engineers.
- **Blue Heron Bay, 3rd Party Environmental Review, Perham, Minnesota.** Served as Project Manager for completing a independent review of an Environmental Assessment Worksheet, completed by Otter Tail County, for this cluster development. The review included an evaluation of marina and boating issues, storm water runoff, water quality impacts, transportation and water supply and wastewater. Provided written comments to the Dead Lake Association.
- **Echo Bay, 3rd Party Environmental Review, Pelican Rapids, Minnesota.** Completing a independent review of an Environmental Assessment Worksheet, completed by the Developer, for this cluster development. The review included an evaluation of marina and boating issues, storm water runoff, water quality impacts, transportation and water supply and wastewater.
- **Environmental Impact Statement, US Highway 2, northwestern North Dakota, North Dakota Department of Transportation.** Project Manager and Principal-in-Charge for draft and final EIS preparation for the construction of 100 miles of 4-lane roadway between Minot and Williston. Provided oversight of special studies including cultural resource surveys and eligibility testing, wetland delineations, threatened and endangered species and rare biological features. Ultimately responsible for project concept design. Completed scoping summary, conducted public hearings and prepared public involvement materials.
- **Maple River Dam Flood Control EIS, Maple River, North Dakota.** Project Scientist responsible for directing and providing oversight for the preparation and completion of water quality and ecological impact analysis for a proposed 50,000 acre-foot flood control reservoir

with an 85-foot high dam, in southeastern North Dakota. Material developed was incorporated into a U.S. Army Corps of Engineers Environmental Impact Statement.

- **McDonald Gold Mine, Helena, Montana.** Project Manager responsible for the preparation of water quality impact analyses for a federal Environmental Impact Statement for the proposed McDonald Gold Mine in western Montana. Reviewed CE-QUAL-W2 model results for a proposed mine pit lake, developed alternative technical evaluation procedures for determining lake water quality and prepared a technical report for use in preparing state and federal (U.S. Army Corps of Engineers) Environmental Impact Statement.
- **Red River of the North, Environmental Impact Statement for Flood Control Impoundments, Red River Valley, Minnesota.** Served as Project Manager and lead technical person in the areas of water quality and natural resources during the preparation of a Cumulative Environmental Impact Statement for 31 proposed flood control impoundments. Provided oversight for hydrologic and hydraulic issues as well as socioeconomic issues, on behalf of the Red River Watershed Management Board. The Minnesota Department of Natural Resources and the Corps of Engineers prepared the EIS.
- **Preliminary Design, Environmental Review and Permitting, RW-22 Flood Control Project, Marshall, Minnesota.** Served as Project Principal and Quality Assurance/Control Reviewer for the preliminary design and environmental permitting of the 32-foot earthen dam, 12,000 acre-foot reservoir proposed for southwest Minnesota. Prepared detailed Environmental Assessment for the project.
- **AB Lateral Hydropower Project, Montrose, Colorado.** As Project Scientist, prepared portions of an Environmental Report, assessing the environmental effects of a proposed hydropower project. The project consisted of the diversion of water from the Gunnison to Uncompahgre River. Areas of responsibility included water quality, wetlands, natural resources and fisheries, including the interpretation of PHABSIM results.
- **Nebraska Low-Level Radioactive Waste Disposal Facility, Boyd, Nebraska.** As Project Scientist, evaluated the potential water quality, wetland and aquatic resource impacts associated with the development of a low-level radioactive waste disposal facility near Boyd, Nebraska. Activities were performed on behalf of the State of Nebraska.

Storm Water, NPDES Permitting and Stream Stability and Geomorphology

- **MS4S NPDES Nondegradation Analysis, City of St. Cloud.** As Project Manager, responsible for directing and completing the technical and public involvement activities for the NPDES nondegradation requirement established by the Minnesota Pollution Control Agency for the MS4S NPDES permit. Developed a GIS based stormwater model using PondNET as the basis, to estimate annual TP and TSS loads (and runoff volumes) in 1998, 2005 and future conditions. Develop the mitigation strategy, revise SWPPP information and complete the nondegradation report.
- **Stormwater Standards Manual, South Washington Watershed District** As Principal in Charge, provide oversight, direction and quality control for the development of an urban stormwater standards manual for this 55 mi² watershed district. The manual provides guidance and assistance for complying with watershed district standards and development requirements. Manual content included topics related to hydrology, hydraulics, water quality, data management, and coordination with municipal development review.
- **Newport Ravine Urban Stormwater BMP Analysis, Washington County, Minnesota.** As Technical Advisor, assisted in establishing the direction to develop and apply a curve number based Monte Carlo spreadsheet model using Crystal Ball™ to evaluate Best

Management Practices to attain ravine channel stability. Conducted field work to obtain the necessary geomorphic data to evaluate and determine stability. Provided quality control oversight of the modeling and final work products.

- **Indian Creek Improvement Project, Mankato Minnesota.** Managed and lead the technical work for this water quantity and water quality assessment project (a joint project between the City of Mankato and the Blue Earth County Environmental Services Department) with partial funding from a Section 319 grant. Completed a geomorphic assessment of streams in the basin including Rosgen classifications, monitoring sites, stability assessments and sediment transport. Performed GIS analyses and hydrology and water quality modeling as part of the watershed assessment. Developed a Master Plan to address the channel stability and storm water problems within the watershed, including water quality loads using P8.
- **City of Eden Valley Storm Water Plan, Eden Valley, Minnesota.** As Project Manager, provided oversight for the completion of open channel flow modeling using HEC-RAS, within the City of Eden Valley. Discharge estimates developed using USGS equations and HydroCad was used along with the HEC-RAS model to evaluate the adequacy of structures and channel capacity through the City as well as stream stability. The project included estimating the cost for repairs and improvements to the system, identifying jurisdictional responsibilities and funding sources. Stakeholder involvement meetings were conducted to describe the needed improvements.
- **Storm Water Finance Study, City of Bismarck, North Dakota.** Developed several White Papers related to present and possible storm water finance mechanisms. The White Papers included legal issues associated with a Storm Water Development Impact Charge (SWDIC), implementing a SWDIC, and the use of a Storm Water Utility. Completed a comparisons to other communities and used examples from the City to illustrate issues and cost.
- **Phase III, Hay Creek, Bismarck, North Dakota.** As Project Manager, provided technical oversight of the preparation of a water quality report describing storm water runoff quality. Phase IV project activities include additional monitoring, bioengineered design of the Capitol Avenue storm water outflow, development of a greenway ordinance and concept design for approximately 6,250 feet of channel restoration. Completed project reporting in accordance with the Section 319 grant.
- **Phase IV, Hay Creek, Bismarck, North Dakota.** As Project Manager, prepared technical information and provided oversight for several storm water related projects within the Hay Creek Watershed. These projects included the preparation of construction plans and specifications for the Capital Avenue Outfall, concept design for several wetland restorations and rehabilitation of the straightened Hay Creek Channel, and urban storm water master plan development for the Shannon Valley watershed. . Completed project reporting in accordance with the Section 319 grant.
- **Phase V, Hay Creek, Bismarck, North Dakota.** As Project Manager, prepared the final report necessary to satisfy the Section 319 grant requirements. The final report included a summary of all previous project phases.
- **Tyler Coulee Watershed Study and TMDL, Bismarck, North Dakota.** As Project Manager, responsibilities included directing the installation of surface water quantity and quality instrumentation, application of the SWMM model, data analysis and interpretation, developing watershed goals and the TMDL. The project resulted in an implementation plan for achieving the TMDL.

- **NPDES Storm Water Monitoring Quality Assurance Manual and Standard Operating Procedures, Sacramento County, Sacramento, California.** As Project Scientist, developed Quality Assurance/Quality Control Field Manual including Standard Operating Procedures for monitoring storm water runoff under their NPDES permit. Designed sampling procedures for the ten urban sites and five river sites.
- **City of Minneapolis Storm Water NPDES Part II Monitoring, Minneapolis, Minnesota.** Project Manager and Engineer responsible for project management, lead technical direction, and oversight for the collection of storm water quantity and quality data at eight locations. The data were used by the City of Minneapolis for the completion of their NPDES Part II application. Primary deliverables included: 1) Field Quality Assurance Manual 2) Evaluation of Storm Water Runoff Computer Models - Technical Memorandum; and 3) City of Minneapolis, Storm Water NPDES Part II Monitoring and Modeling Results. The study included the application of the continuous model P8 to estimate runoff quantity, quality and loads. Used modeling to evaluate the effectiveness of various urban BMPs.
- **Storm Water Planning Report, Metropolitan Airport Commission Alternative Environmental Document, Metropolitan Airport Commission, Minneapolis, Minnesota.** As Project Scientist, used SWMM to develop estimates of peak discharge and volume and storm water runoff quality from the proposed airport (22 mi² area), Dakota County, Minnesota. Prepared Technical Memorandum for the preliminary design of the Primary Storm Water Management System using XPSWMM. Activities included the evaluation of storm water policies of regulatory agencies, developing design criteria and performing preliminary design of the trunk system, detention basins, and flood control basins.
- **NPDES Storm Water Site Visit Reports for American Crystal Sugar Beet Processing Plants and Beet Piling Sites in Minnesota and North Dakota, American Crystal Sugar, Moorhead, Minnesota.** Project Manager and Scientist responsible for performing site visits and developed storm water pollution prevention plans for five sugar beet processing plants and a number of sugar beet transfer stations, in order to comply with NPDES storm water requirements. Plants were located in North Dakota and Minnesota.
- **Storm Water Management and Sediment Erosion Control Plan - Technical Memorandum No. 1, American Iron Supply, Minneapolis, Minnesota.** Project Scientist responsible for developing construction and site grading plans for expansion of the iron salvage yard. Prepared preliminary plans for a wet detention basin based on pollutant removal efficiencies using the P8 computer model and evaluate receiving water impacts to the Mississippi River.
- **Wheeling Corrugating Storm Water Sample Collection, Wheeling Corrugating, Minneapolis, Minnesota.** Project Manager responsibilities included collecting storm water quality samples for NPDES industrial permit application.

Environmental Aspects of Water Resources:

- **Instream Flow and Channel Loss Analysis, Sheyenne River and Red River of the North, Garrison Diversion Conservancy District, Carrington, North Dakota.** Project Manager and Scientist for the completion of technical evaluations to develop instream flow recommendations for the Sheyenne River and a portion of the Red River of the North and to estimate Sheyenne River channel losses. Developed innovative techniques and approach for performing the analysis. Summarized results by preparing white papers and presenting information to the District board.

- **Marsh Creek Site No. 6 Flood Control Project, Ada, Minnesota.** Project Scientist responsible for preparing technical information about the potential ecological impacts of this flood control project, in support of state and federal environmental review and Section 404 permit processes. Evaluations performed included the impact temporarily storing water on terrestrial and aquatic ecosystems.
- **Maple Lake Project, Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager and Scientist responsibilities included evaluating the water quality, wetland and wildlife impacts associated with this multipurpose water resource project. Analysis included the modeling of lake water quality, estimation of wetland impacts, and potential wildlife effects.
- **Gibson Dam Hydropower Project, Transmission Line Wetland Survey, Augusta, Montana.** As Project Scientist, performed a field survey to identify wetlands present in the route of nearly 30 miles of proposed transmission line. Prepared a project report for FERC submittal describing the results of the field survey.
- **Gibson Dam Hydropower Project, Transmission Line Endangered Plant Survey, Augusta, Montana.** As Project Scientist, performed a field survey to identify threatened and endangered plants (lady slippers) present in the route of a proposed transmission line. Prepared a project report for FERC submittal describing the results of the field survey.

Lake and Watershed Management and Water Quality:

- **Nutrient Criteria Development Plan, State of North Dakota.** As Project Manager, developed the Nutrient Criteria Development Plan, for the State of North Dakota, in accordance with EPA guidance. The plan included recommended processes to establish nutrient criteria for lotic and lentic systems, including large river systems (i.e., the Missouri River), evaluated data availability and gaps, and provided an milestone schedule for implementation.
- **Water Quality Modeling Analysis, Red River Valley Water Supply Project, Red River Basin, North Dakota and Minnesota.** Completed several water quality modeling analyses and water quality database / data interpretation tasks, in support of the Bureau of Reclamation's and State of North Dakota's draft Environmental Impact Statement. Developed steady and unsteady spreadsheet models for in excess of 50-miles of lake and canal system, to evaluate potential water quality impacts. Applied the U.S. Army Corps of Engineer's BATHTUB model to Lake Ashtabula to evaluate eutrophication impacts during the growing system. Assisted the USGS with the application of HEC-5Q to the Sheyenne and Red Rivers. Developed a large database for storing and retrieving discharge and water quality data for the project and used the data to describe existing water quality conditions. Prepared existing conditions and environmental consequences discussions for use in preparing the water quality portion of the draft Environmental Impact Statement.
- **South Washington Watershed District Watershed Management Plan, Washington County, Minnesota.** Acted as Project Manager for the completion of the watershed management plan, for the South Washington Watershed District, which is located within the Minneapolis – St. Paul metropolitan area. The plan utilized a unique, new format, resulting in a living and useful plan. Plan contents included design criteria and performance specifications for use by the member cities, assistance with NPDES MS4 compliance activities, a long-range workplan and budget, and new goals, policies and objectives for the District.

- **West Fork of the Des Moines River TMDL, Southwestern Minnesota.** Project Manager for this turbidity, dissolved oxygen and excessive nutrient TMDL. Responsible for review of existing water quality data, analysis of site-specific standards, HSPF modeling, implementation plan development and load allocations. Completed several reports which recommended additional monitoring needs, implementation of the margin of safety and the recommended modeling approach.
- **McDowell Dam TMDL, Burleigh County, North Dakota.** Acted in the capacity of Limnologist and Water Quality Modeler during the completion of this nutrient TMDL. Completed the hydrologic analysis and nutrient load determinations, modeled the lake using the BATHTUB model, estimated internal loading and evaluated restoration / implementation measures. Developed estimated costs for these measures.
- **Watershed Scale Water Quality and Sedimentation Analysis, Buffalo – Red River Watershed District, Barnesville, Minnesota.** Acted as Project Lead for the completion of this EPA Section 319 project. Developed and applied methods to estimate sediment sources and sinks at the watershed scale. Provided oversight for the completion of a water quality risk analysis using GIS and an inventory of erosion and sedimentation problems within the District. Analyzed and interpreted existing water quality data.
- **Buffalo – Red River Watershed District Plan Update, Barnesville, Minnesota.** As Project Manager and lead technical staff, completed an update of the comprehensive water management plan for this 1,189 mi² area in northwestern Minnesota. The area includes portions of Wilkin and Otter Tail County. Used innovative methods to establish problem priority areas and responsibility for problem resolution. Developed and applied flood damage, ecological and social metrics to evaluate and rank project priorities.
- **Lake Sakakawea Cold Water Fish Habitat Model and Computer Program, North Dakota Department of Transportation.** Developed a Cold Water Fish Habitat (CWFH) model for Lake Sakakawea. The model used more than 500 temperature and dissolved oxygen measured profiles. This pseudo 2-D model was used to assist the State with litigation issues over reservoir operation. Served as expert witness in Federal District Court. Created a customized computer program in MS Excel using Visual Basic, which automate the computation of CWFH, metalimnetic and hypolimnetic oxygen depletion rates, and the thermal mixing characteristics of Lake Sakakawea.
- **James River Travel Time and Reaeration, North Dakota State Department of Health, Bismarck, North Dakota.** Project Manager for the completion of field studies using Rhodamine dye and sulfur hexafluoride to determine travel time and dispersion coefficients and re-aeration coefficients for the use in QUAL2E model.
- **James River QUAL2E Model, North Dakota State Department of Health, Bismarck, North Dakota.** Project Manager for the completion of a QUAL2E model for dissolved oxygen and nutrients for the James River, from below Baldhill Dam downstream for in excess of 20-miles. Calibrated the model using a synoptic dataset collected by the State and subsequently verified the model.
- **Comfort Lake-Forest Lake Watershed District Watershed Management Plan, Forest Lake, Minnesota.** Served as Project Manager for the development of the District's plan under Minnesota Rule 103D for this 50 mi² area. Completed activities included identifying priority problems and capital improvement and implementation plans to resolve these problems. Plan developed also included developing a mission statement for the District, as well as preparing goals, objectives and identifying the action items needed to achieve the goals.

- **Kelly Creek Watershed 319 Study, Carrington, North Dakota.** Project Manager responsibilities included directing the installation of surface water quantity and quality instrumentation, sampling and analysis plan development, application of the SWMM model and design of the wetland treatment system.
- **Wild Rice/Marsh River Water Quality Basin Assessment, Wild Rice Watershed District, Northwestern Minnesota.** Completed a watershed inventory and assessment for the 2,080-mi²-drainage area. Developed unique (technical) metrics to assess and prioritize streams, lakes and groundwater resources for implementation activities. Developed a 10-year implementation plan for improving water quality within the Wild Rice Watershed District. Utilized stakeholder groups for problem identification and resolution. Joint project with County Water Planning staff.
- **Water Quality Basin Planning, Red River Valley, Minnesota.** Served as Committee Representative for the Red River Watershed Management Board, in the completion of a comprehensive basin water quality plan being completed by the Minnesota Pollution Control Agency.
- **Sand Hill River Watershed District Plan Update, Sand Hill River Watershed District, Fertile, Minnesota.** As Project Manager and lead technical staff, completed a comprehensive water management plan update for the 440-mi² drainage area in northwest Minnesota, in accordance with Minnesota Board of Water and Soil Resources rules. Developed the plan using sustainability concepts. Used innovative methods to establish problem priority and responsibility for problem resolution. Develop special policies for addressing natural waterway and man-made watercourses. Worked with multi-interest groups during completion of the plan update.
- **Upper Minnesota River Watershed District Plan Update, Upper Minnesota River Watershed District, Ortonville, Minnesota.** As Project Manager and lead technical staff, completed a comprehensive water management plan update for the 505-mi² drainage area in western Minnesota. The area includes Bigstone County, and portions of Lac Qui Parle and Traverse Counties. Plan completed in accordance with Minnesota Board of Water and Soil Resources rules. Developed the plan using sustainability concepts. Used innovative methods to establish problem priority and responsibility for problem resolution. Develop special policies for addressing natural waterway and man-made watercourses. Worked with multi-interest groups during completion of the plan update.
- **Rice Lake Diagnostic/Feasibility Study and TMDL, Ward County, North Dakota.** Completed a diagnostic/feasibility study of water quality problems for Rice Lake, which is located in Ward County, North Dakota southwest of Minot, North Dakota. Installed instrumentation for developing the hydrologic budget, including in-lake wells, continuous stage recorders and rain gages. Implemented a sampling program to characterize water quality from each of the sources. Used the technical data to estimate load reductions necessary for improving water quality and estimate cost for improvement. Interacted with lake homeowners during the successful completion of the project.
- **Good Lake Water Quality Monitoring, Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager and Scientist responsible for designing a water quality monitoring plans to evaluate the effects of a flood control reservoir on water quality.
- **Clearwater River Intensive Low Flow Survey, Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager and Scientist responsible for designing a water quality monitoring plans for low flow sampling of the Clearwater River. Purpose of the

monitoring plan is to calibrate QUAL2E model and validate nonpoint source wasteload allocation.

- **Turtle and Cross Lakes Hydrologic and Water Quality Monitoring, Red Lake Watershed District, Thief River Falls, Minnesota.** As Project Manager and Scientist, designed a hydrologic and water quality monitoring plan to develop a hydrologic budget and nutrient budgets for Turtle, Cross, North Connection and South Connection Lakes.
- **Quality Assurance Manual, Red Lake Watershed District Surface Water Quality Monitoring Program, Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager and Scientist responsibilities included developing a quality assurance/quality control manual for field and laboratory procedures. Manual developed for over 30 surface water quality monitoring sites.
- **Canyon Lake Management Plan, Rapid City, South Dakota.** As Project Scientist, evaluated one-year's monitoring and flow data, developed loads, applied the Corps of Engineers BATHTUB surface water quality model, and recommended implementation measures for 20-acre Canyon Lake. Report submitted to EPA Region VIII for Phase II Clean Lakes funding.
- **Restoration of Big Stone Lake - Evaluation of the Effectiveness of Lake Management Measures, Ortonville, Minnesota.** Project Manager and Scientist, completed an EPA Clean Lakes Phase II Final Report for the Upper Minnesota River Watershed District. The report evaluated ten years of stream chemistry and flow data and in-lake data. Developed nutrient budgets, applied the Corps of Engineers BATHTUB water quality model, and developed a restoration plan to continue water quality improvements within Big Stone Lake and its 700,000 acre plus watershed.
- **Longyear Lake Management Plan, Phase I Diagnostic/Feasibility Study Report, Chisholm, Minnesota.** Project Manager responsible for designing a water quality-monitoring program for this EPA Clean Lakes project. Implemented the water quality monitoring program, developed nutrient budgets, and prepared an implementation plan for improving the water quality of Longyear Lake. Modeled the lake using the Corps of Engineers BATHTUB and FLUX models. Project included the development of a volunteer monitoring program.
- **Restoration of Bailey and Silver Lakes, Virginia, Minnesota.** Project Manager and Scientist responsible for developing a study design for the collection of stream-flow and water quality data. Summarized data by developing water and nutrient budgets and providing statistical treatment of the data. The study included BATHTUB modeling to assess the technical feasibility of various restoration goals (in progress).
- **Clearwater River Nonpoint Study, Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager and Scientist, developed the grant application and monitoring program for monitoring flow and water quality within the 1,300 square mile Clearwater River watershed. The watershed included four river systems. The study consisted of providing input on the sampling of water quality at 26 monitoring locations, direction for the statistical analysis of the water quality data, developing load estimates, evaluating GIS land use data, and preparing an implementation strategy for improving water quality. The implementation strategy included the conceptual design for stream restoration. The project also included the preparation of Technical Memorandum - Evaluation of Water Quality Models and the application of the EPA QUAL2E model on over 100 miles of river. Presently responsible for developing bioengineering handbook for bank stabilization projects.

- **Lonetree Wetland Restoration, Heron Lake Watershed District, Heron Lake, Minnesota.** Project Manager and Design Engineer for this 30-acre wetland restoration. Activities included developing a SWMM model of the drain tile system and impoundment, conceptual design of the embankment and outlet works and cost-estimation.
- **Water Quality Impacts of Rahr Malting Expansion on the Minnesota River, Minneapolis, Minnesota.** As Project Scientist, reviewed waste load allocation results prepared by the Minnesota Pollution Control Agency, for a possible new discharge to the Minnesota River, a water quality limited river system. Ran RMA water quality model.
- **San Joaquin River Modeling, California.** As Project Scientist, used a number of analytical one-dimensional equations for estimating chlorine concentrations as a result of a spill in this tidally influenced river.
- **Brennan Reservoir Water Quality, Rapid City, South Dakota.** As Project Scientist, used a completely mixed water quality model to evaluate the effects of a final polishing, wetland treatment system, on the proposed reservoir located near Rapid City, South Dakota.
- **Lake Tahoe Water Quality Modeling, Lake Tahoe, California.** Quality Control Reviewer responsible for providing technical direction and oversight for the mathematical modeling of dilution using a two-dimensional steady-state analytical equation.
- **Water Quality Impacts of Monmouth Waste to Energy Facility, Monmouth, New Jersey.** As Project Scientist, evaluated the possible receiving water impacts associated with the construction of the Monmouth Waste-to-Energy facility. Analysis consisted of the review of existing water quality and flow data.
- **Hydrodynamic Modeling of the McDonald Gold Mine, Lincoln, Montana.** Project Engineer and Manager responsible for reviewing the applicant's two-dimensional hydrodynamic and water quality model (Corps of Engineers CE-QUAL-2W), to ensure proper application to the proposed 725 foot deep McDonald Gold Mine. Develop a potential energy - kinetic energy spreadsheet model to estimate the mixed layer depth and toxic conditions for the proposed post-closure mine pit lake. Determined trophic status for the post-closure mine pit lake.

Hydrology, Hydraulic Design and Flood Control:

- **Dakota County Hydrologic Boundary Determinations.** Project Manager, Used several methods and sources of information to delineate the Vermillion River watershed boundary within areas of controversy. Data sources included reports, GIS data, infrastructure data and conversations. Completed an analysis of depressional storage to review the potential for interbasin transfers. Determined that the hydrologic boundary of the Vermillion River Watershed should be adjusted from that previously detailed by the Corps of Engineers.
- **Pope County Drainage System 29, near Glenwood, Minnesota.** Served as Project Manager for the establishment of this legal drainage system under Minnesota Rule 103E. Primary technical activities completed include sedimentation analysis and water quality modeling using MINLEAP to predict eutrophication impacts to Lake Emily.
- **Lonetree Wetland Restoration, Nobles County, Minnesota.** As Project Manager and Engineer, completed the hydrologic and hydraulic design for a 30-acre wetland restoration in Nobles County, Minnesota. Used XP-SWMM hydrology and hydraulics model to route (pressured) flow through the tile drainage system. Sized the principal and emergency spillways and evaluated pre- and post-project downstream affects to agricultural lands.

Project was a joint effort between the Minnesota Department of Natural Resource and the Heron Lake Watershed District.

- **Sheyenne River Transmission Losses, Sheyenne River Basin, eastern North Dakota.** Developed and implemented methods to estimate transmission losses along the Sheyenne River. Project purpose was to evaluate the potential losses associated with proposed Garrison Diversion Water Supply Completion Project. Used theoretical and hydrologically based methods to estimate volumetric loss by river reach.
- **Emardville Bioengineering, Clearwater River, Northwestern Minnesota.** Assisted with the preparation of plans and specifications for the construction of a bendway weir and willow live staking bioengineering project. Project incorporated unaltered stream geometry as a template for the project design.
- **Red Lake Falls Bank Protection Project, Clearwater River, Northwestern Minnesota.** Assisted with the preparation of plans and specifications for the construction of a bendway weir project for the 250-foot wide Clearwater River in northwestern Minnesota. Project was used to protect infrastructure in an area where regrading streambank was not possible.
- **Public Drainage System Establishment, Pope County System No. 29.** Completed the engineering and environmental analysis, including the preparation of the Preliminary Engineer's Report, for the establishment of Pope County System No. 29 in central Minnesota. Performed hydrologic and hydraulic calculations to design the channel and size structures. Determine easement requirements and estimated project cost. Performed eutrophication and sedimentation analysis to determine the potential impacts to Lake Emily. Evaluated wetland impacts, sequencing needs and mitigation cost.
- **Sedimentation Analysis of Lake Okabena, Nobles County, Minnesota.** Developed bathymetric map, sediment accumulation map and evaluated sedimentation rates and removal efficiencies for Lake Okabena in southwestern Minnesota. Evaluated sediment removal efficiency of Sunset Bay and remaining time needed prior to dredging. Prepared letter report to Soil and Water Conservation District staff.
- **Warroad Harbor Concept Design and Permitting, Lake of the Woods, Minnesota.** Prepared engineering concept design for improvements to the Warroad Harbor, a U.S. Army Corps of Engineer's harbor. Concept design included boat size and draft requirements, dredging depths, areas to be dredged, docking facilities, turning areas, vegetation removal, jetty design and sediment transport considerations. Determined permit requirements and identified environmental issues. Presented information to Park and Recreation Board, City Council and at public informational meetings.
- **Bioengineering Bank Stabilization Projects (Project 82b), Red Lake Watershed District, Thief River Falls, Minnesota.** Project Manager responsible for surveying and completing the design of bioengineered bank stabilization projects along the Clearwater River in northwestern Minnesota. Unique methods were used to stabilize banks including the use of bendway weirs, natural channel restoration, willow live staking, and brush packing.
- **LQP-25 ("Lazarus Creek") Floodwater Control Project, Canby, Minnesota.** Project Coordinator and Scientist, served as client liaison between Houston Engineering, Area II Minnesota River Basin Projects, Inc., and the Lac Qui Parle-Yellow Bank Watershed District. Assisted with the hydrologic and hydraulic design for the 1,500 acre-foot, 65 foot high dam. Developed agency permit applications and design criteria for passing fish through the principal outlet and directed sedimentation analysis.

- **Grand Marais Outlet, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the preliminary design of a grade stabilization project intended to correct lateral erosion and degradation on 1.5 miles at the terminus of a legal ditch system. Solution consisted of two-sheet pile drop structures and selected revetment.
- **Grand Forks Erosion Control, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the concept design of bank stabilization measures for 1.8 miles along the Red Lake River and the Red River of the North. Problem resulted from rotation of unstable bank. Alternatives evaluated included traditional hardening methods and a bio-engineered approach.
- **Red Lake Watershed Ditch No. 1, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the preliminary and final design of 3 miles of agricultural drainage system improvements and 0.5 miles of new system.
- **Polk County Ditch No. 32, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the preliminary and final design of agricultural drainage system improvements to approximately 12 miles of Polk County Ditch No. 32.
- **Red Lake Watershed District Project 60, Thief River Falls, Minnesota.** Served as Project Manager for the preliminary design of ~30 miles of agricultural drainage system improvements and new system along Polk County Ditch No. 126, No. 66 and No. 2 (in progress).
- **Red Lake Watershed District Project 119, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the design of agricultural drainage system improvements and new system (~12 miles).
- **Parnell Impoundment, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the preliminary and final design of a 4,000 acre-foot off-channel flood control reservoir located in Sections 3 and 4, Parnell Township. Project stores overflow and breakout water from a legal drainage system. Design included multiple inlets and outlets. Unsteady hydraulic problem modeled use EPA's SWMM (EXTRAN) model.
- **Gonvick Lost River Park, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Manager for the conceptual and final design of a park located along the Lost River in Gonvick, Minnesota.
- **Project Manager, Baatz Ditch Establishment, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as the Project Manager for the preliminary design of a 1.8 mile agricultural drainage system (in progress).
- **Canyon Lake Design, Rapid City, South Dakota.** Served as Project Manager for the preliminary design of a jetty, intended to enhance flow within Canyon Lake. Project consisted of the use of RMA-2, a two-dimensional hydraulic model.
- **Scour Analysis for MNDOT Bridge No. 9007, Minnesota Department of Transportation, St. Paul, Minnesota.** Project Manager responsible for the preparation of bridge scour analysis report using FHWA procedures for the Minnesota Department of Transportation.
- **Louisville-Parnell Flood Control Impoundment, Red Lake Watershed District, Thief River Falls, Minnesota.** Served as Project Principal for the preliminary engineering design of the proposed Louisville-Parnell Flood Control Impoundment.

- **Red River Valley Flood Damage Assessment, Red River Watershed Management Board, Ada, Minnesota.** Served as Project Manager while inventorying flood damages within Red River Watershed Management Board, member watershed districts. Determined flood damage categories, sources of flood damage information, and methods for collecting flood damage data, and correlated flood damage data to gauging station frequency analysis. Used a FoxPro database for storage of flood damage information.
- **Root River Railway Bridge Hydraulic Analysis, Canadian Pacific Railway, Minneapolis, Minnesota.** As Project Manager, developed a methodology to determine the effect of raising Trunk Highway 26 on a downstream bridge owned by CP Rail. Task completed include the review of RMA-2 modeling performed by the Corps of Engineers, field review of stream stability, and calculating scour depths. Future activities may include the application of the 2-dimensional model FESWM.
- **Bridgeway Acres Landfill Mixing Zone Analysis, Department of Solid Waste Operation, Pinellas County, Florida.** Quality Control Reviewer responsible for providing review of mixing zone results using the CORMIX environment. Assisted with the development of discharge and ambient input parameters and defined scenarios to be modeled. Reviewed and interpreted model output and final project documents.

Human Health Risk Assessment and Air Quality:

- **Monmouth County Resource Recovery Facility, Monmouth County, New Jersey.** As Project Scientist, participated in developing and reviewing the human health risk assessment for the Monmouth County, Resource Recovery Facility.
- **Environmental Permitting, Mayo Foundation Medical Waste Incinerator, Rochester, Minnesota.** Task Leader responsible for the completion of the air quality, water appropriation, land use, and solid waste disposal permits for this medical waste incinerator. Also prepared environmental review documents including a human health risk assessment.
- **Spokane Resource Recovery Facility, Spokane, Washington.** As Project Scientist, provided direction to the county in the development of a request for proposal (RFP). The RFP pertained to performing a field study to determine the background levels of trace metals and organic contaminants and the use of these data in preparing a human health risk assessment.
- **Mecklenburg County Waste-to-Energy Facility, Mecklenburg County, North Carolina.** As Project Scientist, prepared a screening level human health risk assessment, for evaluating the potential health risk to humans.
- **Ashland Chemical, Santa Fe Springs, California.** Project Scientist responsible for preparing a human health risk assessment associated with catastrophic events, for this chemical transfer facility.

Survey and Land and Site Development:

- **International Joint Commission and Red River Basin Hydraulic Survey.** Served as Project Manager for the completion of a hydraulic survey within the Pembina River Basin, along the U.S. – Canada border, to assist with resolving international water issues. Completed hydraulic survey along the border dike and prepared drawings for more than 25 structures, affecting the direction of flow between the U.S. and Canada.

Mark R. Deutschman, Ph.D., P.E.

Page 15

- **Development Projects, MEER LLC, Minneapolis – St. Paul, Minnesota.** Served as Client Liaison for more than 10 residential and commercial development project within the metropolitan area of Minneapolis – St. Paul. Provide oversight for the municipal approval process and permitting.

Education:

Ph.D., Civil Engineering, University of Minnesota, 1997
M.S., Zoology, North Dakota State University, 1984
B.A., Zoology, University of Montana, 1982

Registration:

Professional Engineer in Minnesota (#41259)

Professional Experience:

Houston Engineering, Inc., 1997 - Present
HDR Engineering, Inc., 1987 – 1997
St. Anthony Falls Hydraulic Laboratory, University of Minnesota, 1990 – 1997
North Dakota Department of Health, 1984 – 1987

Professional Organizations:

American Society of Civil Engineers
American Water Resources Association
North American Lake Management Society

Recent Presentations and Papers:

Deutschman, M.R., and C. Fritz. February 7, 2007. Developing a Flood Forecast Display Tool - A Non-Profit, Public and Private Partnership. National Weather Service, Washington, DC.

Deutschman, M.R., and N. Stowe. October 25, 2006, Establishing Hydrologic and Hydraulic Design Criteria for Shallow Lakes. Minnesota Joint Water 2006 and Annual Water Resource Conference. Earle Brown Center, Brooklyn Park, Minnesota.

Deutschman, M.R., Lauer, W., Wong, M., and M. Mohseni. July 24, 2006. Annualized AGNPS Sediment Modeling within the South Branch of the Buffalo Red River Watershed District & Section 319 Completion Report. Red River Basin Water Quality Team. Moorhead, Minnesota.

Deutschman, M., Heidt, K., and C. Shostal. March 3, 2006. Geographic Information System Workshop. Family Farm Alliance Annual Meeting and Conference. Las Vegas, Nevada.

Deutschman, M.R. November 15, 2005. Integrating GIS to Improve Decision Making and Data Management. Greenfield Irrigation District, Fairfield, Montana.

Ell, M. and M. Deutschman. October 12, 2005. A Water Quality Model for the James River, North Dakota.. North Dakota Water Supply and Pollution Control Conference, Bismarck, North Dakota.

Deutschman, M.R. August 30, 2005. The Indian Creek Improvement Plan – A Model for Comprehensive Stormwater Planning. Lorman Seminar. Fargo, North Dakota.

Deutschman, M.R. March 30, 2005. Decision Support for the Red River Basin, USA – Sharing Data and Tools. U.S. Committee of Irrigation and Drainage, Third International Conference on Irrigation and Drainage, San Diego, CA.

Deutschman, M.R. December 8, 2004. Web & Desktop GIS Technology for Improved Data Management, Sharing and Decision-Making. 41st Annual Joint North Dakota Water Convention, Irrigation Expo and Upper Missouri Water Association Convention, Bismarck, North Dakota.

Deutschman, M.R. November 16, 2004. Web Technology for Improved Data Sharing and Decision-Making. Department of Natural Resources and Conservation and NRIS User's Group, Helena, Montana.

Deutschman, M.R. October 25, 2004. An Empirical Water Quality Model for Cold Water Fish Habitat and the Mixing Characteristics of Lake Sakakawea, North Dakota. 37th Annual Water Resources Conference. Earle Brown Center, Brooklyn Park, Minnesota.

Deutschman, M.R. May 6, 2004. Decision Support for Red River Basin Watershed and Floodplain Management: Issues and Opportunities for Sharing Data and Tools. River Voices, River Choices. River Management Society 2004 Symposium. Lake Tahoe, California.

Deutschman, M.R., B. Fischer and K. Heidt. January 15, 2004. Geographic Information System Workshop. Four States Irrigation Council Annual Meeting. Fort Collins, Colorado.

Deutschman, M.R. October 2003. The Dalen Coulee Experience, Rehabilitation of a Rural Watershed. 36th Annual Water Resources Conference. Brooklyn Park, MN.

Deutschman, M.R. July 2003. Decision Support for the Red River Basin, USA – Sharing Data and Tools. American Water Resources International Conference: Watershed Management for Water Supply Systems. New York City, USA.

Deutschman, M.R. March 2003. Red River Basin Decision Information Network. 2003 International Water Conference – Water, Science and Decision Making. Moorhead, Minnesota.

Deutschman, M.R. January 2003. Red River Basin Decision Information Network. 20th Annual Red River Basin Land and Water International Summit Conference. Winnipeg, Manitoba.

Deutschman, M.R. November 2002. Ecological and Flood Damage Reduction Indicators for Watershed Decision Analysis. Flood Damage Reduction Workgroup, Crookston, Minnesota

Deutschman, M.R., B. Fischer and C. Shostal. 2002. Integrating GeoSpatial Data for Decision Making in the Red River Basin. National Geographic Society's Geography Awareness Week (GIS Day). November 2002. Bismarck, North Dakota.

Deutschman, M.R. October 2002. Ecological and Flood Damage Reduction Indicators for Watershed Decision Analysis. Water Resources Conference, St. Paul, Minnesota

Deutschman, M.R. July 2002. Red River Basin Decision Information Network. International Red River Basin Board & International Joint Commission Meeting. Detroit Lakes, Minnesota.

Deutschman, M.R. July 2002. Decision Support for Red River Basin Watershed and Floodplain Management. Joint EWRI/U COWR Conference on Integrated Trans-Boundary Water Management. Traverse City, Michigan.

Deutschman, M.R. July 2002. Ecological and Flood Damage Reduction Indicators for Watershed Decision Analysis. American Water Resources Specialty Conference, Salt Lake City, Utah.

Deutschman, M.R., R. Halliday, D. Greenlee and R. Saper. 2002. Joint Canada/US Framework for the Red River Basin. Presentation to Spatial Data Infrastructure Workshop. June 25, 2002. Denver, Colorado.

Deutschman, M.R. 2002. Using a Systems Approach for Watershed Management. 2002 River Management Symposium. Boise, Idaho.

Deutschman, M.R. December 2000. ABC of Drainage Design. Minnesota Association of Watershed Districts Annual Conference, Alexandria, Minnesota

Deutschman, M.R., M. Bender, R. Oswald, M. Vandersluis, S. Simonovic. , July 31, 2000. Red River Basin Canadian Flood Management Virtual Database. ASCE General Conference – Management of Floods in the Red River Basin.

Deutschman, M.R. March 2000. Use of Indicators in the Watershed Planning Process. Red River Watershed Management Board Annual Conference, Crookston, Minnesota.

Deutschman, M.R. February 3, 2000. Emerging Mapping and Information Technologies, Annual Drainage, Wetland and Land Use Conference, St. Cloud, Minnesota.

Deutschman, M.R. 1999. Environmental Considerations in Modern Drainage Design, Farmland Water Management Workshop. Southwest State University, Marshall, Minnesota.

Deutschman, M.R. 1999. Establishing Regional Instream Flow Recommendations for the Shyenne River, North Dakota, U.S. Committee on Irrigation and Drainage, Park City, Utah.

Deutschman, M.R. July 1998. Systems Approach to Water Management, Board of Water and Soil Resources. St. Paul, Minnesota.

Deutschman, M.R. 1998. Water Quality of the Clearwater River - Affect of Nonpoint Sources and Strategy for Improvement, Engineering Approaches to Ecosystem Restoration. Wetlands Engineering and River Restoration Conference, American Society of Civil Engineers, Denver, Colorado.

Deutschman, M.R. 1998. A Watershed Approach to Solving Water Management Problems, Minnesota River Joint Powers Board Summer Conference, New Ulm, Minnesota.

Deutschman, M.R. 1998. Establishing Regional Instream Flow Recommendations for the Shyenne River, North Dakota, U.S. Committee on Irrigation and Drainage, Salt Lake City, Utah.

Deutschman, M.R. July 1997. Wild Rice Marsh River Basin Assessment, Minnesota County Water Planners Conference, Crookston, Minnesota.

Deutschman, M.R. 1997. Systems Approach to Water Management, Red River Basin Board Meeting, Ada, Minnesota.