Ohio Water Development Authority

Research and Development Grant Program

Surface Water Projects

Cuyahoga River Remedial Action Plan (RAP)

Evaluation of Technological Options for Adding Oxygen to the Waters of the Cuyahoga River Navigation Channel and the Potential for Aquatic Biological Enhancement as a Consequence. (1995, Grant Award - $104,925)

Cuyahoga River RAP completed the project in three elements – a feasibility study evaluating re-aeration of the navigation channel, findings from the Fisheries Advisory Panel examining the issue of re-aeration, and the larval fish survey. Cuyahoga River RAP presented the findings of this project at the Cuyahoga River Symposium on October 25, 2001.

City of Hamilton

Evaluation of Induced Infiltration Rate Variability (2003, Grant Award - $200,000)

The Hamilton to New Baltimore Ground Water Consortium (HNBGWC), whose members include the City of Hamilton, City of Cincinnati, City of Fairfield, Southwest Regional Water District, Southwestern Ohio Water Company and Smartpapers, LLC, oversees wellhead protection efforts in the southwestern region of the Great Miami River Buried Valley Aquifer (GMRBVA). The southwestern region of the GMRBVA has an estimated potential yield of 300 MGD, and serves a combined population of over 0.5 million people in Butler and Hamilton Counties. The GMRBVA is also designated as a Sole source Aquifer, indicating its importance as a drinking water supply to this area.

The Hamilton to New Baltimore Ground Water Consortium is interested in determining the amount of surface water recharging the aquifer as a result of induced infiltration within the current one-year ground-water time of travel zones at four of its six well fields. By doing this, the Consortium will be able to improve protection of the aquifer by including the surface water component of the hydrologic system.

The purpose of this project is two fold: first, to determine the amount of surface water infiltrating to the GMRBVA near several production wells for a one-year period; and second, to develop a relatively simple methodology to estimate the amount of infiltrated surface water on a continued multi-year basis.

The final report has not been completed

Ohio Environmental Protection Agency

Great Lakes Water Quality Initiative (1992, Grant Award - $25,000)

Since the Council of Great Lakes Governors believes that the Great Lakes Water Quality Initiative (GLWQI) regulations and guidance package are likely to create significant economic and environmental impacts on the Great Lakes Region, an independent economic analysis of the proposed package and a cost/benefit review and projection for the region are to be conducted.

This project included a 3-pronged approach to analyze the economic and environmental costs and benefits of the proposed regulations and guidance package:

- A comprehensive framework upon which to base the impact of the GLWQI will be provided.
- Costs of compliance and their impact will be calculated.
- Human health and environmental benefits will be described. The analysis will be as quantitative as possible; no attempt will be made to place monetary values on such things as cleaner water or improved human health.

Ohio Department of Natural Resources

Improving Stream Protection and Assistance to Phase II Communities through Advanced Storm Water Standards (2004, Grant Award - $310,000)

Over 540 local communities have been required to develop and implement storm water management plans to comply with the recently enacted Phase II NPDES regulations. Accordingly these communities and individual development site design engineers must implement practices limiting the impact of storm water runoff on Ohio's water resources. In order to address inadequacies of current methods of storm water management in Ohio, the ODNR Division of Soil and Water Conservation proposes to:

1. Prepare immediate additions to the standards and specifications for developing areas (*Rainwater and Land Development*) regarding how to integrate Ohio EPA water quality requirements with local storm water requirements. The project will provide practical examples of project designs and sample submissions to state and local agencies to meet current state and prevailing local criteria.

2. Prepare "Designing and Managing for Natural, Self-sustaining Streams" – materials, presentations and training. This objective provides training, assessment tools, design guidance and sample code text to enable cities, counties and individuals to assess streams, remediate degraded streams and protect healthy channels through practices such as stream setbacks, floodplain protection and channel rehabilitation.

3. Evaluate storm water management methods, including those prevalent in Ohio, and more recently developed methods for their ability to accomplish comprehensive resource goals (reduced pollutants, channel erosion, flooding and hydrologic impacts). The proposal will use 3 or more watersheds to evaluate the methods and recommend changes to current criteria.

4. Establish a physical attribute monitoring protocol for stream stability. Evaluate current and emerging best management practices in regard to their effectiveness in achieving the

storm water management objectives under item 3 and make appropriate revisions to *Rainwater and Land Development*.

The final report has not been completed

Northeast Ohio Regional Sewer District (NEORSD)

Evaluate the Role of Lake Sediment in Storing the Redispersing Bacteria to Affect Lakefront Recreation Activities (1995, Grant Award - $231,050)

NEORSD determined in the study that higher concentrations of bacteria occurred during wastewater treatment plant overflows, wave heights exceeding 2 to 4 feet higher than normal, and after rainfall events. The study also showed a short-term storage (one week) of E-coli in lake bottom sediments and that turbidity levels indicate E-coli levels.

Due to the study, the relative elevated concentrations can be predicted much quicker (within five minutes) than the existing tests (24 hours). The results of the study were published as USGS Publication 98-4241, "Factors affecting Escherichia Coil Concentrations at Lake Erie Public Bathing Beaches."

Final Report available through USGS (www.usgs.gov)

Northeast Ohio Regional Sewer District (NEORSD)

Rapid Methods to Determine Water Quality at Public Beaches for the Protection of Public Health (1999, Grant Award - $150,000)

Through U.S. Geological Survey, NEORSD determined a quick method to predict bacteria levels at three Lake Erie Urban beaches and one inland lake beach in Ohio. A computer model uses current weather and environmental conditions to forecast E. Coli bacteria concentrations. Results can be provided within 2 hours of data collection, giving the public access to timely information on current water-quality conditions.

Current methods to determine levels of E. Coli take at least 18 hours to complete. During this period, E. Coli concentrations may change dramatically causing beach advisory postings to occur during safe levels.

The results of the study were published as USGS Fact Sheet FS-132-02, dated November 2002 and USGS Water-Resource Investigations Report 02-4285.

Final Report available through USGS (www.usgs.gov)

Northeast Ohio Regional Sewer District (NEORSD)

Regrowth of Chlorine-injured Fecal-indicator Bacteria in Receiving Waters (1993, Grant Award - $209,900)

Through U.S. Geological Survey (USGS), Northeast Ohio Regional Sewer District (NEORSD) measured and evaluated the regrowth of fecal-indicator bacteria resulting from reduced disinfection time. Varying temperatures, times and receiving water situations were studied.

The results of the study were published as USGS Publication Report 96-4199, 'Effects of Receiving-Water Quality and Wastewater Treatment On Injury, Survival, And Regrowth of Fecal-Indicator Bacteria And Implications for Assessment of Recreational Water Quality"

Final Report available through USGS (www.usgs.gov)

Northeast Ohio Regional Sewer District (NEORSD)

Understanding Fecal Contamination and Predicting Recreational Water Quality at Ohio Beaches (2003, Grant Award - $202,958)

The level of fecal contamination of recreational waters is assessed on the basis of measured concentrations of *Escherichia coli* (*E. coli*). Measurements of *E. coli*, however, take at least 18 hours for results, and water quality may change drastically during this time. In addition, collecting one or two samples for *E. coli*, as is commonly done, does not provide information on the sources of fecal contamination.

New technologies are needed for more rapid assessments of recreational water quality and for identifying sources of contamination. These include statistical models to predict recreational water quality and methods that identify sources by monitoring directly for indicators of human and (or) animal waste. The proposed work will test these technologies at three Lake Erie beaches—Edgewater and Villa Angela in Cleveland and Lakeshore Park in Ashtabula.

To predict recreational water quality at all three beaches, investigators will refine or develop and validate multiple linear regression (MLR) and artificial neural network (ANN) models. This will involve the daily collection and analysis of water samples for *E. coli* and the measurement of explanatory variables (wave height, rainfall, current direction, etc.). To identify sources of fecal contamination at Edgewater and Lakeshore, investigators will identify the spatial distribution of *E. coli*, test the use of source-tracking techniques, and determine if the swash zone is a source of *E. coli* to bathing waters. (The swash zone is the zone of the shoreline that is constantly washed by waves.) This will involve the periodic sampling of lake- and interstitial-water samples for *E. coli*, human enteric viruses, and F-specific coliphage genotyping and the periodic sampling of lake-bottom and swash-zone sediment samples for *E. coli*.

The final report has not been completed

Northeast Ohio Regional Sewer District (NEORSD)

Rapid Determination of E. coli concentrations at Lake Erie Beaches using the IMS/ATP Rapid Method (2005, Grant Award - $132,651)

The goal of this project is to advance the technologies that are used in beach risk management. This grant will identify methods to adapt rapid test methods to determine bacteria concentrations at Lake Erie beaches.

The proposed work will take place at three beaches in Cleveland – Edgewater, Villa Angela, and Huntington and will consist of four goals:

1. Analyze samples using the IMS/ATP rapid method and compare these results to samples analyzed using the standard membrane filtration method.
2. Optimize the IMS/ATP rapid method.
3. Verify that the results from the rapid-method testing can be used as a variable in a predictive model.
4. Determine if analysis of a composite sample for E. coli is an accurate alternative to the current practice of analyzing two samples per beach and computing the mean.

The final report has not been completed

Ohio Department of Natural Resources

Relationship between Land Use, Ground Water Flow and Non-point Source Contamination in the Upper Mad River Watershed (2003, Grant Award - $155,970)

Ground water contributes more to stream flow in the Mad River Watershed than in any other river system in Ohio. Kings Creek, the largest sub watershed of the Mad River, has the highest base flow per square mile of any area within the Mad River System. Underlying the Mad River and Kings Creek are extensive buried valley deposits that the USEPA has declared a sole source aquifer.

Nitrate contamination of both surface and ground water is a documented problem within parts of the Mad River valley and throughout the Kings Creek sub watershed. Over the past eight years, nitrate contamination in Urbana's North Well Field has increased steadily, requiring the city to publish nitrate level alerts and severely curtail production.

This project proposes a multifaceted approach to identify critical regions that may contribute disproportionately large quantities of nitrate to the ground water flow system. The project will use Global Positioning System technology to locate the latitude, longitude, and elevation of select water wells in the area. These data will then be used to construct highly detailed ground water elevation and flow maps. The flow maps will be compared with detailed land use information; this comparison will point to the source of nitrate contamination for sites such as Urbana's North Well Field. Nitrate sampling along flow paths and the use of stable isotope (^{15}N and ^{18}O) samples will be used to further differentiate source areas and source types. Ground water flow modeling will be used to refine and confirm the flow paths and nitrate source areas defined by the other methods used in this study.

To summarize, the goal of the project is to define the source areas and types that contribute nitrate contamination to both Urbana's North Well Field and to the Mad River. Of equal importance to this project is developing a set of standard procedures to assist other communities in defining sources of nitrate contamination.

The final report has not been completed

Summit County

Water Quality Monitoring of the Cuyahoga River Basin (1991, Grant Award - $158,090)

Through U.S. Geological Survey (USGS), Summit County evaluated in field studies the decay, transport, division, and dispersion of fecal bacteria. The study estimated the change in concentrations of fecal bacteria based on time and distance downstream from bacteria sources. The study showed that complete disinfection of all wet-weather discharges of incompletely treated wastewater was the largest single improvement to prediction of bacteriological water quality.

The results of the study were published as USGS Publication Report 98-4089, "Effects of Hydrologic, Biological, and Environmental Processes on Sources and Concentrations of Fecal Bacteria in the Cuyahoga River, With Implications for Management of Recreational Waters in Summit and Cuyahoga Counties, Ohio."

Final Report available through USGS (www.usgs.gov)

Toledo Metropolitan Area Council of Governments (TMACOG)

Paired Watershed Demonstration (1991, Grant Award - $6,520)

The purpose of the study was to compare two neighboring watersheds: one (Bayou Ditch) with a high rate of conservation tillage (installation of buffer strips), and the other (Lacarpe Creek) with conventional tillage. Data was collected on nutrients and herbicides applied to fields and those same nutrients and herbicides in adjacent creeks.

The Bayou Ditch watershed showed improved water quality. Due to the success in the Bayou Ditch watershed, property owners in the Lacarpe Creek watershed also installed the buffer strips for conservation tillage.

The study concluded that conservation tillage could be successful in the clay soils of northwest Ohio and that buffer strips controlled sediment loadings to streams.

Final Report

Toledo Metropolitan Area Council of Governments (TMACOG)

Identification of Proximate Sources of Fecal Contamination to Maumee Bay by Determining Concentrations of E. Coli in Sediments (2002, Grant Award - $200,000)

The goal of this study was to determine the sources of fecal contamination to Maumee Bay so that future corrective measures can be taken and/or accurate and timely predictions of recreational water quality can be made. Planned work included development of the sampling plan, analyze data from past studies, and begin periodic sampling of water and sediments for E. Coli concentrations.

The results of the study were published as USGS Publication Report 2005-1386, "A Spatial, Multivariable Approach for Identifying Proximate Sources of Escherichia coli to Maumee Bay, Lake Erie, Ohio

Final Report available through USGS (www.usgs.gov)

University of Cincinnati

Fate of Bio-Available Phosphorus in the Little Miami River (1998, Grant Award – $14,750)

The objectives of this project are to carry out runoff, sediment and biota sampling at three locations to more precisely identify and quantify the assimilation of phosphorus in the Little Miami River and to investigate whether the inverse SRP-Q relation observed at Milford exists elsewhere in the watershed.

This project will enable regulatory agencies to control soluble reactive phosphorus (SRF) load in rivers. Results of studied were presented in the University of Cincinnati student's master theses entitled "Zone of Influence for Soluble Reactive Phosphorus in an Effluent Dominated River".

Executive Summary from Master's Theses

United States Geological Survey

Emerging Contaminates in Tinkers Creek (2005, Grant Award – $131,250)

This grant will examine the organic wastewater contaminants (OWC) in Tinkers Creek, a tributary to the Cuyahoga River. Over 70% of the base flow in Tinkers Creek is from the effluent of 7 WWTPs.

Tinkers Creek does not meet the Ohio EPA water quality standards established for fish communities. Despite excellent habitat in the stream and suitable recruitment areas the lower section of the stream fail to meet the Index of Biotic Integrity (IBI) and modified index of well being standards.

The U.S. EPA approved a Total Maximum Daily Load (TMDL) for the Lower Cuyahoga River. The TMDL identified unknown sources of impairment in Tinkers Creek and recommended that a Stressor Identification Study be conducted to determine the sources of impairment.

A working group was formed to conduct the study. The group identified a data gap involving a group of compounds known as pharmaceuticals and person care products (PPCPs) also know as organic wastewater contaminants (OWCs). This study will provide the needed information to complete the stressor identification.

The U.S. Geological Survey will determine the presence and concentration of OWCs using polar organic chemical integrated samplers (POCIS). A total of 18 study sites will be positioned to sample the effluent from seven WWTPs discharging into Tinkers Creek.

Because PPCPs are a growing concern, scientists are exploring new methods to identify these compounds and study the effects of long-term exposure. Little is known about these chemicals and what happen to them after their intended use and at what concentrations they persist in the environment.

The final report has not been completed