## *Predictive Model Validation and Integration of Cyanobacteria Assessment Network (CyAN) Derived Satellite Products to Estimate Nearshore, Toxic Cyanobacteria Bloom Accumulation in USGS Midcontinent Region Lakes and Reservoirs—Inland Lakes in Ohio*

USGS
Grant Request: $105,918.50
Project Cost: $211,837.00

Statement of Problem
Limited scientific understanding of cyanobacterial harmful algal blooms (cyanoHABs) prevents prediction of blooms in lakes and reservoirs. Recreational and drinking water plant managers need tools to provide real-time estimates of cyanotoxin concentrations to aid in management decisions.

Proposed Research
A previous 2-phase study was funded by OWDA and USGS in 2020. Initial statistical models were developed for Caesar Creek Lake and will be published in 2023. The proposed research includes additional data collection at Caesar Creek Lake and Buck Creek Lake, using a multi-step approach:

1. Satellite flyover sampling
2. Water quality measurements
3. Discrete sampling
4. Site-specific statistical models

Statewide Benefit
The study will provide insight into the extent, frequency and severity of toxic cyanoHABs and measures useful in predicting their future occurrence and severity. This would allow more efficient sampling strategies that could lead to improved forecasts and real-time predictions of toxic cyanoHABs to help guide treatment processes for drinking water and swimming/recreation advisories for recreational water bodies.

## *Enhancing the Performance of Granular Activated Carbon Contactors for Contaminant Removal*

University of Toledo
Grant Request: $199,698
Project Cost: $399,414

Letters of Support: USEPA, Defiance WTP, City of Bowling Green WTP

Statement of Problem
Granular activated carbon (GAC) is a form of carbon that is highly effective in removing a wide range of contaminants from water, air, liquids and gases due to its exceptional adsorption capability. Recently, there has been a significant demand and price increase for GAC, due to supply chain issues and need for PFAS removal from drinking water (for which GAC is widely recognized as an effective treatment).

Proposed Research
The proposed research aims to develop optimal monitoring and control methods for GAC contactors in small drinking water treatment plants (DWTPs). Tasks include:

- Identification of optimal monitoring methods for biofilm formation in GAC contactors
- Conducting adsorption tests with natural organic matter and a model cyanotoxin
- Evaluation of the impact of different biofilm cleaning methods, including chlorinated backwashing and hydraulic backwashing
- Development of a concise operational manual for monitoring and controlling biofilm

Statewide Benefit
This research aims to develop optimized methods for monitoring and controlling biofilm formation, to reduce operational costs for GAC contactors. These results can then be applied to support numerous small drinking water treatment plants across Ohio that rely on GAC contactors for removal of various contaminants.

## *Assessing the Role of Underlying Sanitary Infrastructure in Drying of Hydrologically Sensitive Headwaters (HSH)*

Hamilton County Conservation District
Grant Request: $42,854
Project Cost: $98,877

Letters of Support: USEPA Center for Environmental Measurement and Modeling, USEPA Center for Environmental Solutions and Emergency Response

Statement of Problem
According to the Midwest Biodiversity Institute (MBI), baseflow impacts are the most widespread cause of biological impairment in Hamilton County. These baseflow impacts include streams completely or partially drying when they would not have in a predevelopment context. These impairments disproportionately impact smaller headwaters that have less flow coming from upstream to overcome local surface water losses.

One potential driver of stream drying is surface water draining or local water table lowering by underlying sanitary infrastructure (USI). Additionally, investigation of how graveled trenches within which underground pipe networks are installed may play a role in reducing local water table elevations. It is currently not known the degree to which USI contributes to baseflow impairments.

Proposed Research
The proposed research will have three phases:

1. Delineation of streams potentially impacted by USI, using a GIS analysis
2. Monitoring of surface flow and statistical analysis, aiming for 40 USI and 40 non-USI sites
3. Investigation of select sites exhibiting “unexpected drying”, estimated to be ten sites

Statewide Benefit
The proposed study would demonstrate the efficacy of a methods to assess potential contributions of USI to HSH drying using low-cost hand-installed piezometers instrumented with water level loggers. The research will also identify candidate USI sites to serve as locations to test potential mitigation strategies in the future.

## *Transforming Traditional Bioretention Cells into Smart Stormwater Infrastructure through Real Time Controls*

The Ohio State University
Grant Request: $199,914
Project Cost: $405,229

Letters of Support: Cleveland Metroparks

Statement of Problem

For centuries, urban drainage systems have been used in cities to prevent flooding and mitigate public health impacts of stormwater. Cities increasingly complement traditional grey stormwater control methods with green infrastructure measures, such as bioretention cells, to provide drainage and removal of anthropogenic pollutants. Bioretention cells are engineered, vegetated filters which rely on natural processes to manage the quantity and quality of stormwater. This is effective in mitigation of urban runoff at its source.

Real time control (RTC) technologies represent an opportunity to transform green initiative stormwater control measures from passive treatment into smart stormwater infrastructure.

Proposed Research

Twenty-four columns, constructed from 350 L open-topped polypropylene drums with a drainage port at the bottom, will be constructed. Each column will contain a cross section of hardwood mulch, media, washed sand and drainage rock, typical of bioretention designs. Half will be planted with coneflowers and half will remain unplanted.

Two different RTC strategies will be developed using automated ball valves and soil moisture sensors (VolRed and FieldCap). Synthetic runoff will be created using stock laboratory chemicals. Data will be collected for 12 events over the course of year-long testing, to simulate one year of local rainfall.

Statewide Benefit

Results from this research will serve as a demonstration for communities interested in implanting low-cost sensor networks to enhance stormwater treatment and mitigate potential impacts to downstream receiving waters,

These options can be a cost-effective solution without the need for intrusive and expensive efforts to upsize sewer network capacities.

## *Recycling Water Treatment Residuals to Improve Water Quality Endpoints*

The Ohio State University
Grant Request: $115,069
Project Cost: $231,722

Letters of Support: OEPA Division of Materials and Waste Management

Statement of Problem

Alum sludge is a significant solid waste product of drinking water treatment that is an increasing challenge for utilities to manage. Beneficial reuse options exist for alum sludge, but more is generated than can be accommodated in such applications.

Proposed Research
The research will evaluate the feasibility of recycling alum sludge as a coagulation amendment in the drinking water treatment process to improve removal of organic contaminants. Steps include:

- Evaluation of inclusion of alum sludge in the coagulation process by measuring changes in turbidity and total organic carbon (TOC) removal and disinfection byproducts (DBP) formation
- Measuring the removal and retention of PFAS by alum sludge bench-scale experiments
- Performing a cost analysis for reuse scenarios with focus on cost effectiveness and scale-up

Statewide Benefit

This research seeks to advance the understanding of alum sludge amended coagulation so that it can be applied in real practice, specifically with concerns to PFAS uptake and release by the sludge. Results will also quantify the technical and economic feasibility of alum sludge amended coagulation to determine if it is a viable and competitive treatment option for organic contaminants.

## *Field Validation of Stormwater Control Measures for Volume, Sediment, and Nutrient Load Reduction to Ohio Receiving Waters*

The Ohio State University
Grant Request: $199,953
Project Cost: $409,257

Letters of Support: Chagrin River Watershed Partners, Ohio Clean Marinas

Statement of Problem
Ohio EPA and other decision makers are interested in crediting stormwater controls for pollutant removal. Data is needed related to stormwater control measure (SCM) performance, so that regulators may properly credit the measures.

Little data exists on SCM nutrient removal in the climatic conditions found in Ohio. This proposed research will leverage existing relationships and SCMs to build an amalgamation of SCM monitoring projects to fill the large gaps in the data that must be relied on in light of a potential TMDL implementation in northwest Ohio.

Proposed Research
The proposed research would establish monitoring stations at the outlets to each stormwater basin at Cuyahoga Community College (Tri-C), similar to those installed at the basin inlets. Automated sampling equipment would also be established to monitor the performance of the underground detention system at Tri-C, the bioswale and permeable pavement at Mentor Lagoon and the Sand Filter in Franklin County.

A minimum of twenty stormwater runoff events over the course of 18 months will have samples collected and analyzed. Flow measurements will be used to determine runoff volumes and peak flow rates entering and discharging from each SCM. These parameters will be paired with pollutant concentration data to determine influent and effluent pollutant loading rates, which will be compared to determine the treatment efficiency of each system. This will create a robust dataset which will provide regulatory agencies with critical information needed to develop crediting criteria for SCMs and to ensure effective stormwater treatment strategies are implemented across the state.

Statewide Benefit

This research represents the first opportunity to monitor these SCMs and provides critical data to inform state government policy decisions. The data will demonstrate the performance of six commonly used SCMs and will plug critical holes to allow for appropriate crediting of SCMs for nutrient removal in Ohio.