Ohio Environmental Protection Agency

Quality Assurance Project Plan (QAPP) for the Biological and Water Quality Study of the Upper Scioto River and Olentangy River Watersheds, 2024

Ohio EPA Technical Report AMS/2024-USOMB-1
Division of Surface Water
Final June 2024

TMDL DEVELOPMENT

Group A: Project Management and Information/Data Quality Objectives

A1. Title Page

Quality Assurance Project Plan (QAPP)
for the Biological and Water Quality Study of the Upper Scioto River and Olentangy River Watersheds, 2024

Crawford, Delaware, Franklin, Hardin, Logan, Marion, Morrow, and Union Counties

June 2024

Version 2.0 - Effective 2024

Prepared by:
Ohio Environmental Protection Agency
Division of Surface Water
Lazarus Government Center
50 W. Town Street, Suite 700
Columbus, Ohio 43215

Ohio Environmental Protection Agency
Ecological Assessment Section
4675 Homer Ohio Lane
Groveport, Ohio 43125

Ohio Environmental Protection Agency
Central District Office
50 W. Town Street, Suite 700
Columbus, Ohio 43215

Mail to:
P.O. Box 1049
Columbus, Ohio 43216-1049

R. Mike DeWine
Governor, State of Ohio

Anne M. Vogel
Director, Ohio Environmental Protection Agency

A2. Approval Page

Quality Assurance Project Plan for the Biological and Water Quality Study of the Upper Scioto River and Olentangy River Watersheds, 2024

E-SIGNED by Erin Sherer on 2024-06-24 15:10:49 GMT — Date: _____

Erin Sherer, Division Assistant Chief

E-SIGNED by Marianne Piekutowski on 2024-06-24 16:56:32 GMT — Date: _____

Marianne Piekutowski, Assessment and Modeling Section Manager

E-SIGNED by Katherine Harris on 2024-07-03 20:13:18 GMT — Date: _____

Katherine Harris, DSW Quality Assurance Coordinator

E-SIGNED by Chloe Welch on 2024-06-24 15:32:21 GMT — Date: _____

Chloe Welch, Water Quality Manager

E-SIGNED by James Kiourtsis on 2024-06-24 16:06:18 GMT — Date: _____

James Kiourtsis, Modeling Unit Supervisor

E-SIGNED by Benjamin Rich on 2024-06-25 19:54:03 GMT — Date: _____

Ben Rich, Ecological Assessment Unit Supervisor

E-SIGNED by Murphy Coan on 2024-06-24 18:14:40 GMT — Date: _____

Murphy Coan, Ecological Assessment/Study Coordinator

List of Acronyms - (Glossary of Terms can be found ***here***)

2C	Priority Pollutant Analyte List Form
ALU	Aquatic Life Use
AMS	Assessment and Modeling Section
BNA	Base/Neutral and Acid
BOD	Biochemical Oxygen Demand
C	Celsius
cBOD	Carbonaceous Biochemical Oxygen Demand
CWA	Clean Water Act
DDAGW	Division of Drinking and Ground Waters
DES	Division of Environmental Services
DQO	Data Quality Objective
DSW	Division of Surface Water
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EA3	Ecological Assessment and Analysis Application
EPA	Environmental Protection Agency
FEG	Fish Evaluation Group
GFO	Groveport Field Office
GC/MS	Gas Chromatograph/ Mass Spectrometer
H_2SO_4	Sulfuric Acid
HNO_3	Nitric Acid
HUC	Hydrological Unit Code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
ID	Identification
IR	Integrated Report
ITS	Information Technology Services
MBI	Midwest Biodiversity Institute
Mlwb	Modified Index of well-being
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QHEI	Qualitative Habitat Evaluation Index
PCB	Polychlorinated Biphenyl
pH	Potential Hydrogen
PWS	Public Water Supply
RL	Reporting Limit
RM	River Mile
S-VOCs	Semi-volatile Organic Chemicals

USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
SM	Standard Method
SOP	Standard Operating Procedure
SO_4	Sulfate
SOCC	State of Ohio Computer Center
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSD	Technical Support Document
WAU	Watershed Assessment Unit
WQ	Water Quality
WQS	Water Quality Standards
WWTP	Wastewater Treatment Plant

A3. Table of Contents, Document Format, and Document Control

List of Appendices

List of Figures

List of Tables

Document Format

This Quality Assurance Project Plan follows the Quality Assurance Project Plan Standard, Directive Number ***CIO 2105-S-02.0***, effective July 18, 2023.

A4. Project Purpose, Problem Definition, and Background

Watershed Monitoring and Assessment History

As part of Ohio's statewide monitoring strategy, biological and water quality assessments will be performed during the 2024 field season in the Upper Scioto River and Olentangy River watersheds. The study area encompasses Crawford, Delaware, Franklin, Hardin, Logan, Marion, Morrow, and Union counties, spans one 8-digit hydrologic unit code (HUC) and is composed of forty-seven 12-digit watershed assessment units (WAUs). The WAUs and their descriptions are listed in Table 3, and Figure 2 is a map of the watershed with station IDs. Information collected as part of this survey will support the Data Quality Objectives (DQOs) listed in A7.

The Upper Scioto River Watershed is comprised of two subwatersheds and its mainstem, all of which were previously assessed by Ohio Environmental Protection Agency (Ohio EPA) as smaller, separate study areas. The first subwatershed, Mill Creek, includes Mill Creek mainstem and a tributary, Blues Creek. The Mill Creek subwatershed drains 179 mi^2 and is the southernmost of the two larger Upper Scioto River tributaries on the western edge of the study area. The biological, chemical, and physical water quality of this study area was last assessed by Ohio EPA in 2012-13 and found that over seventy-five percent of the sites assessed were meeting Clean Water Act (CWA) goals. Impairments in Mill Creek were due to various causes associated with urban/suburban and rural land use practices including organic enrichment, siltation, direct habitat alteration, and suspended solids. Most of the impairments were spread out across the study area but tended to be nearer to municipalities or in areas of heavy agricultural land use.

The second subwatershed, Bokes Creek, includes Bokes Creek mainstem and its principal tributaries: Brush, Smith, and Moors runs. The Bokes Creek subwatershed drains 83 mi^2 and is the northernmost of the two larger Upper Scioto River tributaries on the western edge of the study area. The biological, chemical, and physical water quality of this study area was last assessed by Ohio EPA in 2013 and found that fifty percent of the sites assessed were not meeting CWA goals. Impairments were due to various causes associated with rural land use practices including organic/nutrient enrichment, and siltation. Most of the impairments were spread evenly across the study area but tended to be nearer to areas of agricultural land use.

The Upper Scioto River mainstem and its tributaries drain 949 mi^2 and is both the centermost and largest stream in the study area. The biological, chemical, and physical water quality of this study area was last assessed by Ohio EPA in 2009 and 2011 and found that fifty percent of the sites assessed were not meeting CWA goals. Impairments were due to various causes associated with urban/suburban and rural land use practices including natural, organic/nutrient enrichment, siltation, sediment contamination, direct habitat alteration, and fish kills. Most of the impairments were spread evenly across the study area but tended to be nearer to municipalities or in areas of heavy agricultural land use.

The Olentangy River and its largest principal tributary, Whetstone Creek, drain 543 mi^2, occupy the eastern portion of the study area, and were last assessed by Ohio EPA in 2003 and 2004. Impaired sites were spread evenly across the study area but tended to be nearer to municipalities or in areas of

heavy agricultural land use and accounted for over 50% of sampling locations for the survey. These impairments were due to various causes associated with urban/suburban and rural land use including natural, bacteria, direct habitat alteration, flow alteration, siltation, and nutrient enrichment. Impairments within these study areas have either been incorporated into a multi-watershed Total Maximum Daily Load (TMDL) or are slated for follow-up monitoring in the 2024 watershed study. TMDL reports identify and evaluate water quality problems in impaired waterbodies and propose solutions to bring those waters into attainment with Water Quality Standards (WQS). In previous surveys, recommendations were made to improve water quality including stream restoration, habitat improvements, point source controls, and improvements to home sewage treatment systems.

To address the nonpoint source impairments in the Upper Scioto River and Olentangy River watersheds, Nine-Element Nonpoint Source Implementation Plans have been approved in the headwaters of Scioto River, Headwaters Olentangy River, Mouth Olentangy River, and Delaware Run-Olentangy River WAUs. Surface Water Improvement Fund (SWIF) and CWA Section 319 grants have also been awarded to projects in these watersheds to control stormwater and improve habitat in the Upper Scioto River, Olentangy River, and their tributaries since the last surveys were completed. The 2024 survey will, in part, evaluate the collective effectiveness of these projects as well as establish baseline conditions as the watersheds continue to experience increased population growth and development.

More information on previous studies conducted in the Upper Scioto River and Olentangy River watersheds can be found at Ohio EPA's TMDL page, published at: ***https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/total-maximum-daily-load-tmdl-program***

A5. Project Task Description

During the 2024 sampling year, the biological, physical, and chemical integrity of the Upper Scioto River and Olentangy River watersheds will be assessed at 148 locations (Figure 2; Appendix 2). The Upper Scioto River mainstem begins near Roundhead at River Mile (RM) 234.39 and extends to the confluence of Mill Creek at RM 155.40 just upstream of O'Shaughnessy Reservoir. The Olentangy River watershed begins near the city of Galion and flows approximately 93 miles to its confluence with the Scioto River at RM 132.33.

The Upper Scioto River watershed study area for the 2024 survey will focus on the Upper Scioto River mainstem and its two subwatersheds: Mill Creek and Bokes Creek. Mill Creek (tributary to Scioto River at RM 155.40) and Bokes Creek (tributary to Scioto River at RM 161.88) will be assessed. Several smaller tributaries that drain to the Scioto River mainstem will also be assessed, including the Little Scioto River (tributary to Scioto River at RM 177.38).

The Olentangy River watershed will also be assessed during the 2024 survey with focus on the Upper and Middle Olentangy mainstem and Whetstone Creek, a tributary entering Olentangy at RM 36.07. Due to extensive recent monitoring by Midwest Biodiversity Institute (MBI) in 2020 and 2022, as well as monitoring in 2021 by Ohio EPA as part of the 2020/2021 statewide Large River Assessment, the Lower

Olentangy mainstem and its tributaries will have fewer sampling locations in the 2024 study. MBI performs biological and water quality assessments on par with Ohio EPA's monitoring efforts via Level 3 certification by its scientists in the Ohio Credible Data Program. The results of MBI's 2020 study can be found online at ***https://midwestbiodiversityinst.org/publications/reports/biological-and-water-quality-assessment-the-middle-scioto-river-lower-olentangy-river-and-selected-olentangy-tributaries-2020*** and the results of their 2022 study can be found at ***https://midwestbiodiversityinst.org/publications/reports/scioto-olentangy-2022-biological-and-water-quality-assessment***.

Sampling will be focused largely on biological and habitat monitoring to determine achievement of the designated ALU (Aquatic Life Use) biocriteria. Water chemistry sampling will be conducted watershed-wide to determine whether water quality criteria, where applicable, are exceeded for a given parameter, as well as for generating statistical and weight-of-evidence relationships between the biological communities and ambient chemical concentrations. Water quality sondes and chlorophyll-*a* sampling will be co-located in areas of historical or suspected nutrient over-enrichment. Several public water supply intakes exist on streams in the study area and will be chemically assessed for the public drinking water supply use. Bacteriological monitoring (*Escherichia coli*) will be conducted in various streams to determine achievement of recreational use criteria. Sport fish will be collected at select locations and their tissues processed for bioaccumulated contaminants pursuant to the human health beneficial use in the Ohio Fish Tissue Consumption Monitoring Program.

Following the survey, the results of the Upper Scioto River and Olentangy River watersheds will be synthesized into a Technical Support Document (TSD). While the TSD is the primary support document for the TMDL program, the TSD also supports numerous additional Ohio EPA programs and regulatory actions including but not limited to Director's Orders, National Pollutant Discharge Elimination System (NPDES), WQS, Public Water Supply, Ohio Nonpoint Source Assessment, and the biennial Integrated Water Quality Monitoring and Assessment Report (The 305 [b] and 303[d] report).

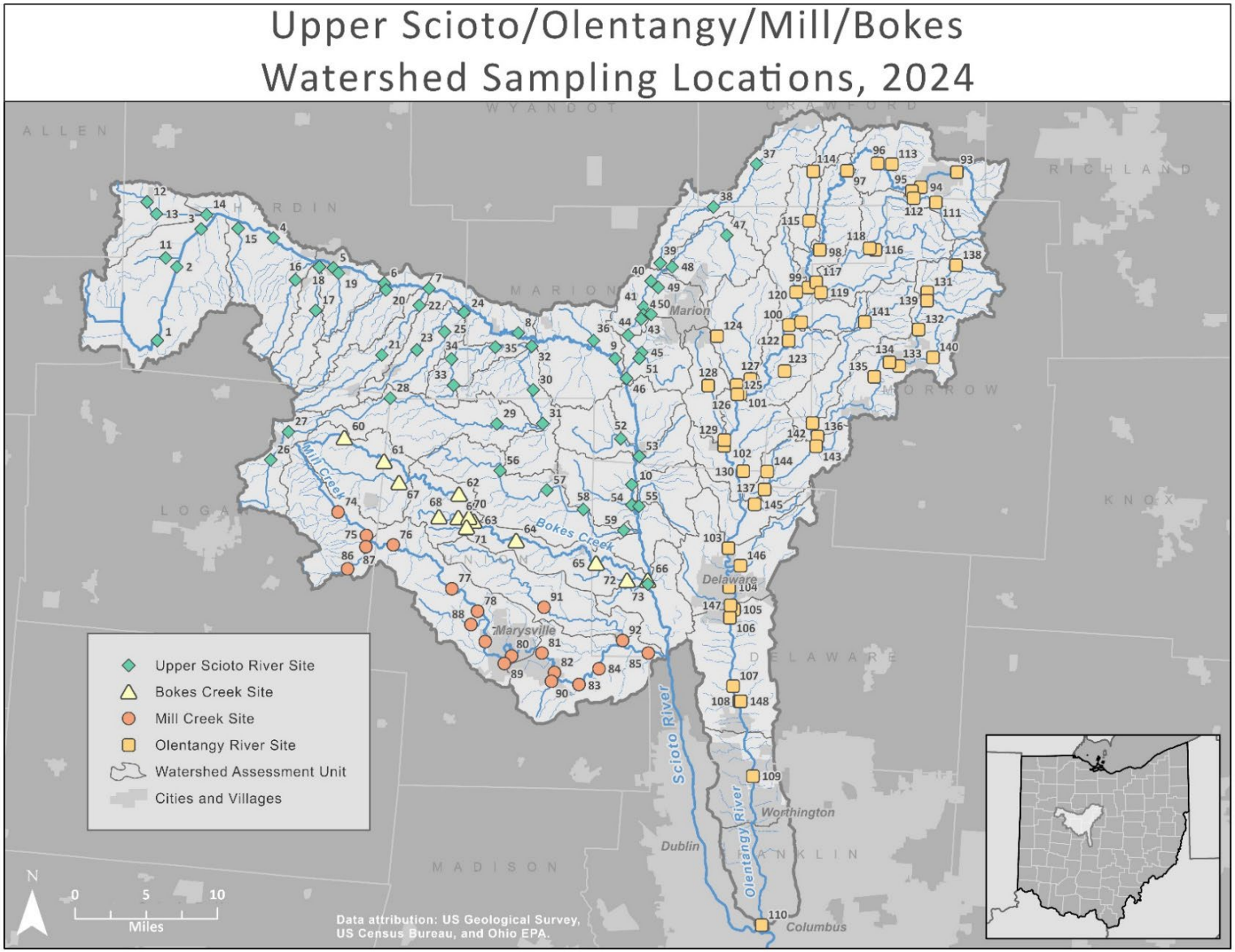
Depending on the sampling type, the field sampling season will run from May 1 to October 31, 2024. The index period for fish and nutrient sampling is during the summer low flow period of June 15 – October 15. The macroinvertebrate sampling index period is slightly shorter, from June 15 – September 30. Bacteria sampling to evaluate recreation use will be conducted within a 90-day period during the recreation season, May 1 to October 31. The draft TSD is usually completed within 2-3 years following the conclusion of field work.

Table 1 – List of Watershed Assessment Units (WAU) in Study Area

HUC8	HUC10	HUC12	
05060001	Upper Scioto River		
	05060001 01	Headwaters Scioto River	
		05060001 01 01	Cottonwood Ditch
		05060001 01 02	Headwaters Scioto River
		05060001 01 03	Taylor Creek
		05060001 01 04	Silver Creek-Scioto River
	05060001 02	Rush Creek	
		05060001 02 01	Headwaters Rush Creek
		05060001 02 02	McDonald Creek
		05060001 02 03	Dudley Run-Rush Creek
	05060001 03	Little Scioto River	
		05060001 03 01	Rock Fork
		05060001 03 02	Headwaters Little Scioto River
		05060001 03 03	City of Marion-Little Scioto River
		05060001 03 04	Honey Creek-Little Scioto River
	05060001 04	Panther Creek-Scioto River	
		05060001 04 01	Gander Run-Scioto River
		05060001 04 02	Panther Creek
		05060001 04 03	Wolf Creek-Scioto River
		05060001 04 04	Wildcat Creek
		05060001 04 05	Town of La Rue-Scioto River
		05060001 04 06	Glade Run-Scioto River
	05060001 05	Fulton Creek-Scioto River	
		05060001 05 01	Patton Run
		05060001 05 02	Davids Run-Scioto River
		05060001 05 03	Kebler Run
		05060001 05 04	Fulton Run
		05060001 05 05	Ottawa Creek-Scioto River
	05060001 06	Mill Creek	
		05060001 06 01	Upper Mill Creek
		05060001 06 02	Middle Mill Creek
		05060001 06 03	Blues Creek
		05060001 06 04	Lower Mill Creek
	05060001 07	Bokes Creek	
		05060001 07 01	Headwaters Bokes Creek
		05060001 07 02	Brush Run-Bokes Creek
		05060001 07 03	Smith Run-Bokes Creek
		05060001 07 04	Moors Run-Scioto River
	05060001 08	Headwaters Olentangy River	
		05060001 08 01	Headwaters Olentangy River

HUC8	HUC10	HUC12	
		05060001 08 02	Mud Run
		05060001 08 03	Flat Run
		05060001 08 04	Town of Caledonia-Olentangy River
	05060001 09	Whetstone Creek	
		05060001 09 01	Shaw Creek
		05060001 09 02	Headwaters Whetstone Creek
		05060001 09 03	Claypool Run-Whetstone Creek
	05060001 10	Grave Creek-Olentangy River	
		05060001 10 01	Otter Creek-Olentangy River
		05060001 10 02	Grave Creek
		05060001 10 03	Beaver Run-Olentangy River
		05060001 10 04	Qu Qua Creek
		05060001 10 05	Brondige Run-Olentangy River
		05060001 10 06	Indian Run-Olentangy River
		05060001 10 07	Delaware Run-Olentangy River
	05060001 11	Rush Run-Olentangy River	
		05060001 11 01	Deep Run-Olentangy
		05060001 11 02	Rush Run-Olentangy
		05060001 11 03	Outlet Olentangy River

Figure 1 – Sampling Locations Map. Site numbers correspond to those listed in Appendix 2.

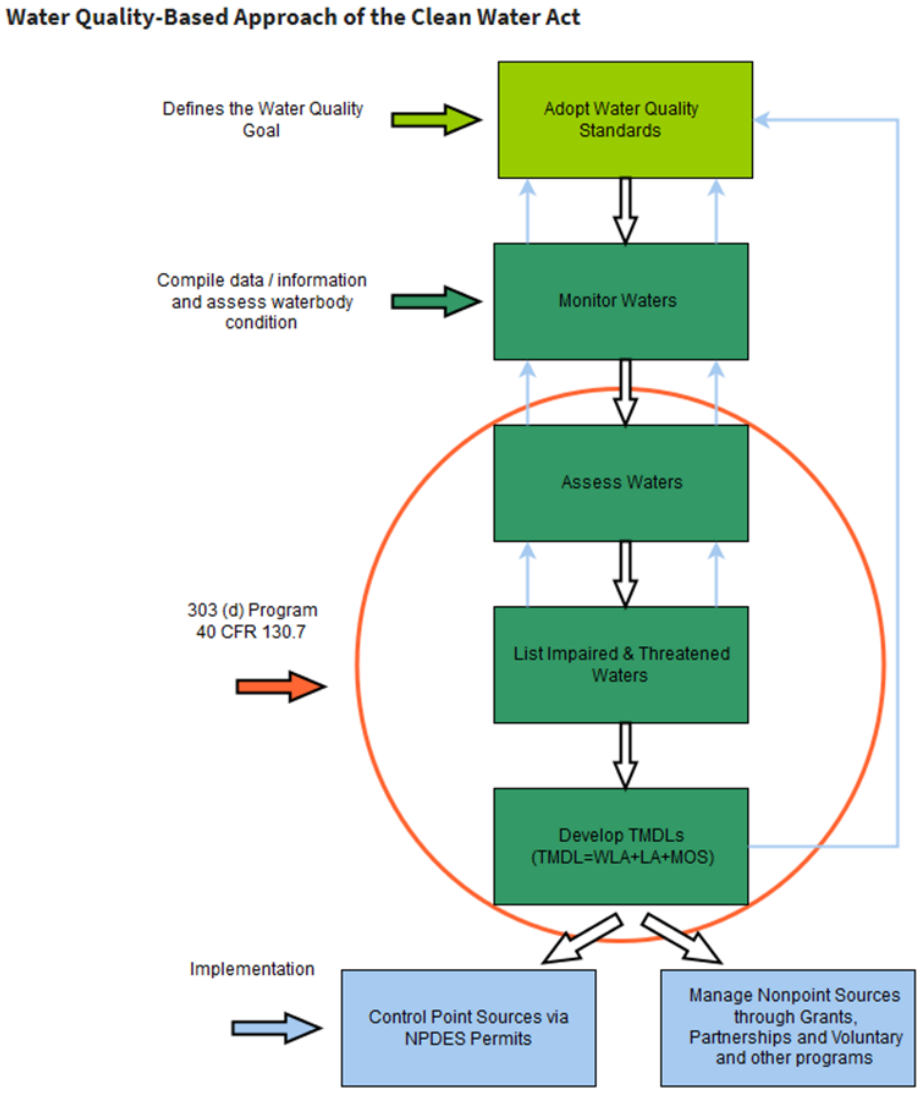


A6. Information/Data Quality Objectives and Performance/Acceptance Criteria

The data collected during this watershed survey fulfills multiple objectives:

- Assess and report on the status of WAUs as required by the CWA 305(b) and 303(d);
- Assess causes and sources of impairment;
- Support WQS development;
- Provide data for the Ohio Fish Tissue Consumption Monitoring Program;
- Support NPDES permitting;
- TMDL development and implementation;
- Determine and evaluate water quality trends at watershed, stream, and site-level scales.

Figure 2 - Water Quality-Based Approach of the Clean Water Act



Source: ***https://www.epa.gov/tmdl/overview-identifying-and-restoring-impaired-waters-under-section-303d-cwa***

Monitor and Assess Ohio's Waters

Under Section 305(b) of the CWA, Ohio EPA is required to assess and report on the quality of Ohio's waters. Ohio EPA determines attainment/non-attainment status of WQS in three main ways:

- Three aquatic community indices serve as the principal arbiters of ALU attainment or condition status of Ohio's lotic waters: Index of Biotic integrity (IBI), Modified Index of well-being (MIwb) and the Invertebrate Community Index (ICI). Where quantitative macrobenthos data are unavailable, corresponding narrative equivalents derived from qualitative sampling are used in lieu of ICI scores (Ohio EPA 2015). Further explanations of Ohio EPA's biocriteria can be found in Ohio Administrative Code (OAC) Chapter 3745-1-07 and additionally at ***https://epa.ohio.gov/static/Portals/35/rules/01-all.pdf***
- *Escherichia coli (E. coli)* is used as an indicator to determine attainment/non-attainment of recreational uses as codified in OAC 3745-1-07. Water quality must meet a 90-day geometric mean and a statistical threshold not to be exceeded more than 10 percent of the time. Each WAU will have at least 1 site sampled. Most effort will focus on streams with public access that are more highly used for recreation.
- Chemical concentrations in fish tissue are used to determine attainment/non-attainment of non-drinking water human health WQS and for the development of fish consumption advisories.

Under Section 303(d) of the CWA, Ohio EPA is federally obligated to list impaired and threatened waters by determining attainment/non-attainment status of WQS. To support this objective, the following data is planned to be collected: fish and macroinvertebrate community assemblages, physical stream habitat evaluation (Qualitative Habitat Evaluation Index, or QHEI), organic and inorganic water column chemistry (parameters in Appendix 4), continuous sonde measurements, continuous temperature measurements, *E. coli* bacteria, and fish tissue chemical concentrations.

Assess Causes and Sources of Impairment

Chemical and physical monitoring is a direct measure of the CWA goal and can be used to determine the factors that limit biologic attainment. Specific objectives for each planned measurement are included below:

- **Physical Habitat Assessments:** The Qualitative Habitat Evaluation Index (QHEI) (Rankin 1989, 1995, and Ohio EPA 2006) is a method that evaluates microhabitat necessary to support biological assemblages consistent with Ohio's tiered ALU designations. Channel morphology, lithography, gradient, and riparian conditions are fundamental components of riverine habitat, affecting the diversity, structure, organization, and viability of aquatic communities. Because the QHEI explicitly measures the presence, absence, or relative function of these key attributes, it serves as an important and cost-efficient monitoring tool to describe and rank macrohabitat quality, evaluate habitat effects in surface water assessments, and aid in establishing ALU potential for underperforming waters.
- **Inorganic Surface Water Chemistry:** A standard suite of inorganic surface water chemical parameters will be collected at every site listed in Appendix 2, except three sites designated as

"PWS" for the sampling type. Impairment due to chemical contaminants in the water column can be assessed by comparing water column chemical concentrations to numeric criteria in Ohio EPA's rules: aquatic life (Table 35-1), wildlife (Table 35-12), recreation/aesthetics (Table 37-1), water supply (Table 33-1) and human health (Table 34-1).

- **Nutrient Enrichment:** The water quality parameter sondes will be deployed to capture about 48 continuous hours of hourly diel dissolved oxygen flux, pH, temperature, and specific conductance measurements. Benthic and/or sestonic chlorophyll-α samples are to be collected during every sonde deployment if site conditions are appropriate. Continuous measurements will be evaluated against water quality criteria and, along with chlorophyll-α results, will be used to provide lines of evidence for causes of biological impairment such as nutrient or organic enrichment.
- **Organic Surface Water Chemistry**: Water column samples will be analyzed for organic constituents (see Appendix 4 for parameters) at a subset of sites. Sites were selected based on local knowledge of dischargers or legacy issues. Semi-volatile organic carbons (S-VOCs) (USEPA Method 625) testing will generally be focused on industrial facilities, municipal areas with categorical users of these constituents, and/or historic reference locations. Once one S-VOC pass is conducted, Ohio EPA WQ staff may evaluate the data to determine whether more passes are necessary. This evaluation should be based on parameters with results above method detection. Herbicide (USEPA Methods 515.1 and 525.2) testing will be focused in agricultural areas and used as an indicator of potential overall agrichemical impact to biology. Organochlorine insecticides (USEPA Method 608/8081) mostly are compounds that are no longer used and are typically not water soluble. For that reason, these constituents will generally only be sampled if there is evidence of legacy pollution or knowledge of current site conditions warrant an investigation. Each site where pesticides will be collected will be sampled a minimum of two times. The objective of two passes is to screen whether select organic constituents are present in the water column; a statistic evaluation or geometric mean does not need to be calculated for each site. Samples for agricultural chemicals such as herbicides will be collected early in the sampling season to coincide with typical timing of applications.
- **Sediment**: Sediment sampling is an important component of a pollution monitoring program. The analytical results serve as valuable lines of evidence for identifying impacted areas, determining the magnitude and extent of contamination, and elucidating probable causes and sources of beneficial use impairment that may not be detected in water column sampling alone. Sediment contaminant data can be used to locate historical, intermittent, point and nonpoint contaminant sources, or contaminant concentrations of concern, which include direct discharge, groundwater infiltration, soil erosion, aerial deposition, and sediment translocation and redeposition. Year 1 sediment sampling will occur at sites with historical documented impairment due to contaminated sediments, sites with suspected contaminated sediments, and at reference sites. Sediment sampling may be conducted in Year 2 on a follow-up basis if sediment contamination is suspected to contribute to biological impairment.

Support Water Quality Standards Development

- **Use Designations**: All data collected as part of this survey will form the basis of UAAs for unassessed waters, verify or reaffirm existing beneficial uses, or readjust the current aquatic life use designations as appropriate for updates to the WQS.
- **Antidegradation**: The collection of biological and habitat data will support updates to the State's list of special high-quality waters.

Provide Data for the Ohio Fish Tissue Consumption Monitoring Program

Fish tissue samples will be collected from 20 locations as part of the Ohio Fish Tissue Consumption Monitoring Program. Sampling locations may vary based on the availability of sport fish collected at each location. Fillet samples of regulation-size sport fish will be tested for organochlorinated pesticides, PCBs, mercury, lead, cadmium, arsenic, and selenium. Results will be used in the Ohio Sport Fish Consumption Advisory Program and used to determine attainment status of non-drinking water human health criteria in the Integrated Report (IR).

Support NPDES Permitting

A list of NPDES-permitted dischargers in the survey area is presented in Appendix 3. Survey data will be collected to provide the NDPES program with necessary biological and/or chemical sampling data. Eight entities will be bracketed (sampling upstream/downstream from the discharge outfall) in this survey, including Durez Corporation, Kenton, Logan County Eastern Regional Sewer District, Marysville, Galion, Marion County Sewer District #7, Upper Olentangy, and Marion.

TMDL Implementation

The TMDL program, established under Section 303(d) of the CWA, focuses on identifying and restoring polluted rivers, streams, lakes, and other surface water bodies. TMDLs are prepared for waters identified as impaired on the 303(d) list in the IR. A TMDL is a written, quantitative assessment of water quality problems in a water body and contributing sources of pollution. It specifies the amount a pollutant needs to be reduced to meet WQS, allocates pollutant load reductions, and provides the basis for taking actions needed to restore a water body. The objectives of the TMDL process are to estimate pollutant loads from the various sources within the basin, define or characterize allowable loads to support the various beneficial uses, and to allocate pollutant loads among different pollutant sources through appropriate controls (e.g., NPDES permitting, storm water management, 319 proposals, NPS controls or other abatement strategies). The components of the TMDL process supported by this survey are primarily the identification of impaired waters, verification (and re-designation if necessary) of beneficial use designations, gathering ambient information that will factor into the wasteload allocation, and ascribing causes and sources of use impairment. These data are necessary precursors to the development of effective control or abatement strategies.

A7. Distribution List

This QAPP will be distributed to the following division management and staff, saved on the Division of Surface Water (DSW) collaboration site, and posted on the DSW Biological and Water Quality Monitoring and Assessment webpage.

Table 2 — Distribution List

Name/Title	Contact Email/Phone	
DSW Central Office Administration		
Mark Johnson, Environmental Administrator	***mark.johnson@epa.ohio.gov***	(614) 644-2274
Erin Sherer, Asst. Environmental Administrator	***erin.sherer@epa.ohio.gov***	(614) 644-2018
Ashley Ward, Asst. Environmental Administrator	***ashley.ward@epa.ohio.gov***	(614) 644-4852
Joby Jackson, Asst. Environmental Administrator	***joby.jackson@epa.ohio.gov***	(937) 285-6029
Standards and Technical Support		
Melinda Harris, Environmental Manager	***melinda.harris@epa.ohio.gov***	(614) 728-1357
Mariah Hood, Environmental Specialist 3	***mariah.hood@epa.ohio.gov***	(614) 644-2865
Bob Miltner, Environmental Specialist 3	***robert.miltner@epa.ohio.gov***	(614) 836-8796
Richard Budnik, Environmental Specialist 2	***richard.budnik@epa.ohio.gov***	(614) 644-2002
Katherine Harris (QA/QC Officer)	***katherine.harris@epa.ohio.gov***	(614) 644-2014
NPDES/Permitting		
Walter Ariss, Environmental Manager	***walter.arriss@epa.ohio.gov***	(614) 644-3075
John Owen, Environmental Specialist 3	***john.owen@epa.ohio.gov***	(614) 728-3849
Assessment and Modeling		
Mari Piekutowski, Environmental Manager	***marianne.mansfield@epa.ohio.gov***	(614) 644-2876
Heidi Babos-Ford, Environmental Specialist 3	***heidi.babos@epa.ohio.gov***	(614) 728-2385
Paul Gledhill, Environmental Specialist 3	***paul.gledhill@epa.ohio.gov***	(614) 644-2881
James Kiourtsis, Environmental Supervisor	***james.kiourtsis@epa.ohio.gov***	(614) 644-2148
Matthew Lane, Environmental Specialist 2	***matthew.lane@epa.ohio.gov***	(614) 644-2890
Ben Rich, Environmental Supervisor	***benjamin.rich@epa.ohio.gov***	(614) 836-8772
Angela Dripps, Environmental Specialist 2	***angela.dripps@epa.ohio.gov***	(614) 836-8798
Murphy Coan, Environmental Specialist 2	***murphy.coan@epa.ohio.gov***	(614) 836-8755
TMDL		
Joshua Griffin, Environmental Manager	***joshua.griffin@epa.ohio.gov***	(614) 644-2874
Ruth Briland, Environmental Supervisor	***ruth.briland@epa.ohio.gov***	(614) 644-2046
Shante Eisele, Environmental Specialist 2	***shante.eisele@epa.ohio.gov***	(614) 644-2001
Emily Keil-Loudner, Environmental Specialist 2	***emily.keil-loudner@epa.ohio.gov***	(614) 728-2384
Kathryn Hamilton, Environmental Specialist 2	***kathryn.hamilton@epa.ohio.gov***	(614) 644-4132
Water Quality		
Chloe Welch, Environmental Manager	***chloe.welch@epa.ohio.gov***	(614) 728-3852
Kelly Capuzzi, Environmental Supervisor	***kelly.capuzzi@epa.ohio.gov***	(740) 380-5283
Jenna Houdashelt, Environmental Specialist 2	***jenna.houdashelt@epa.ohio.gov***	(614) 728-3850
Lauren Woodgeard, Environmental Specialist 2	***lauren.woodgeard@epa.ohio.gov***	(614) 728-3847
Matthew Walbridge, Environmental Specialist 2	***matthew.walbridge@epa.ohio.gov***	(937) 285-6095
Michelle Waller, Environmental Specialist 2	***michelle.waller@epa.ohio.gov***	(937) 285-6028
Division of Environmental Services		
Jennifer Kraft, Environmental Manager	***jennifer.kraft@epa.ohio.gov***	(614) 644-3020

Name/Title	Contact Email/Phone	
Steve Roberts, Environmental Supervisor	***steven.roberts@epa.ohio.gov***	(614) 644-4225
Kristin Sowards, Sample Receiving Coordinator	***kristin.sowards@epa.ohio.gov***	(614) 644-4243
DDAGW Central Office		
Allison Reed, Environmental Manager	***allison.reed@epa.ohio.gov***	(937) 285-6447
Callie Nauman, Environmental Specialist 3	***callie.nauman@epa.ohio.gov***	(614) 644-2752

A8. Project Organization

Table 3 — Roles and Responsibilities.

Individual(s) Assigned:	Responsible for:	Authorized to:
DSW Central Office Administration		
Mark Johnson DSW Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Erin Sherer Assistant Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Ashley Ward Assistant Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Joby Jackson Assistant Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Standards and Technical Support		
Melinda Harris Standards and Tech Support Section Manager	Quality management (QAPPs, SOPs); staff training; water quality standard rules.	Approve plans and edit reports.
Mariah Hood Standards and Tech Support Lead Worker	Water quality standard criteria development and rule updates.	Help plan study. Make recommended beneficial use changes.
Bob Miltner Standards and Tech Support Lead Worker	Water quality standard criteria development and rule updates.	Help plan study. Review project actions and documents in relation to listed responsibilities.
Richard Budnik Standards and Tech Support Staff	Represent agency in fish and wildlife consumption and contact advisory matters.	Help plan study. Make waterbody specific consumption and contact advisory recommendations.
Katherine Harris Standards and Tech Support Staff	DSW quality management program.	Develop and implement field QA/QC guidelines. Track field QA/QC and staff training.
NPDES/Permitting		
Walter Ariss Municipal NPDES Section Manager	NPDES permitting guidance and rule development.	Ensure NPDES staff involvement in planning, provide technical guidance and communication assistance to project team, and coordinate with NPDES staff to review and edit reports.
John Owen Central District Permits & Enforcement Lead Worker	NPDES permit-related issues.	Obtain wastewater and storm water permit information needed for planning and reporting.

Individual(s) Assigned:	Responsible for:	Authorized to:
Assessment and Modeling		
Mari Piekutowski Assessment & Modeling Section Manager	Overall management of assessment monitoring section.	Assign staff; approve plans; edit reports.
Heidi Babos-Ford Ecological Assessment Unit Lead Worker	Track project progress, manage data, create EA3 database queries for reports, and compile information for Integrated Report.	Create and edit sampling stations in EA3 database. Upload fish, bug and chemistry data into EA3. Review and comment on reports. Write assigned Integrated Report sections.
Paul Gledhill Modeling and Assessment Unit Lead Worker	Modeling and assessment technical guidance and review. Dissolved oxygen surveys, stream flow measurements, and chemistry sampling.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
James Kiourtsis Modeling & Assessment Unit Supervisor	Support modeling field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Matthew Lane Modeling & Assessment Unit Staff	Conduct dissolved oxygen surveys, stream flow measurements and chemistry sampling.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Ben Rich Ecological Assessment Unit Supervisor	Support biological field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Angela Dripps Ecological Assessment Unit Macroinvertebrate Crew Leader	Macroinvertebrate population assessments.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Murphy Coan Study Coordinator/ Ecological Assessment Unit Fish Crew Leader	Fish population and stream habitat assessments and overall study coordination.	Plan and coordinate study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
TMDL		
Joshua Griffin TMDL and IR Unit Manager	Oversee coordination of biennial Integrated Report; TMDL program management.	Assign staff; approve plans; edit reports.
Ruth Briland TMDL and IR Unit Supervisor	Coordination of biennial Integrated Report update; TMDL program development.	Assign and support staff; edit reports.
Shante Eisele TMDL & IR Unit Staff	Develop TMDL reports. Oversee data collection and management.	Write assigned TMDL sections. Complete technical data management tasks associated with QA spreadsheet and EA3.

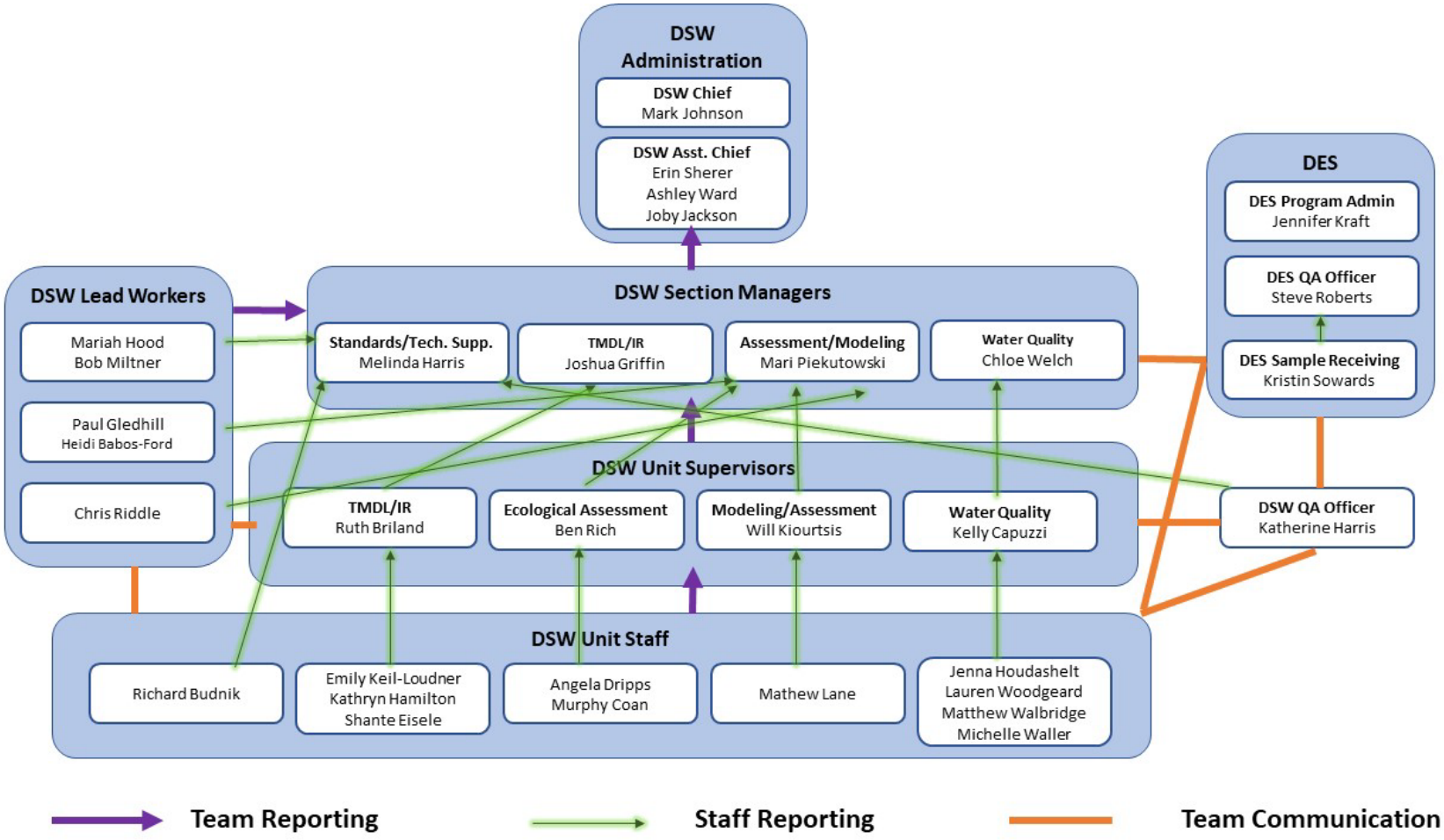
Individual(s) Assigned:	Responsible for:	Authorized to:
Emily-Keil Loudner TMDL and IR Unit Staff	Lead TMDL projects.	Write assigned TMDL sections.
Kathryn Hamilton TMDL and IR Unit Staff	Lead TMDL projects.	Write assigned TMDL sections.
Matthew Lane Modeling & Assessment Unit Staff	Conduct dissolved oxygen surveys, stream flow measurements and chemistry sampling.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Water Quality		
Chloe Welch Statewide Water Quality Manager	Implement division goals. Support water quality field crews with supplies, equipment, and training.	Review documents and reports; suggest changes and edits; obtain approvals and signatures; develop budgets; conduct field audits.
Kelly Capuzzi Statewide Water Quality Supervisor	Support water quality field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Jenna Houdashelt Central District Water Quality Unit	Water and sediment data collection, validation, and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Lauren Woodgeard Central District Water Quality Unit	Water and sediment data collection, validation, and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Matthew Walbridge Southwest District Water Quality Unit	Water and sediment data collection, validation, and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Michelle Waller Southwest District Water Quality Unit	Water and sediment data collection, validation, and management.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Division of Environmental Services		
Jennifer Kraft Program Administrator	Overall administration of laboratory activities.	Help solve laboratory information management system problems. Develop analytical methods and SOPs.
Steve Roberts QA Officer	DES quality management program.	Oversee data completeness, validation, and delivery.
Kristin Sowards Sample Receiving Coord.	Intake of laboratory samples, coordination with field staff	Help solve daily sample scheduling and sample submission issues.
Division of Drinking and Ground Waters		
Allison Reed Source Water Characterization and Protection Manager	Management of source water characterization and protection section.	Coordinate with DSW on drinking water intake and inland lake monitoring. Assign staff, approve plans, and edit reports.
Callie Nauman Central Office Emerging Contaminants	Harmful Algal Bloom program implementation	Coordinate with DSW on drinking water intake and inland lake monitoring.

A9. Project Quality Assurance Manager Independence

The Project Quality Assurance Manager (QAM) shall be independent of environmental information operations. The Project QAM's independence is ensured through separation of sections and reporting chains within Ohio EPA's Division of Surface Water. The Project QAM has oversight authority and responsibilities for planning, documenting, coordinating, and assessing effectiveness of the QAPP. The QAM has authority to access and discuss quality-related issues with senior management outside of the direct supervisory chain as necessary.

A10. Project Organization Chart and Communications

Figure 3 - Organization chart



A11. Personnel Training/Certification

All staff who conduct surface water sampling, whether from streams or lakes, receive initial training by someone experienced in the proper techniques required, usually a supervisor or veteran employee. Mandatory refresher training is done on an annual basis for all Agency surface water samplers. Annual boating safety refresher training is required by internal safety policy SP 10-12. Employees who operate watercraft must also demonstrate proficiency in boat operation to their supervisor on an annual basis. Supervisors should also conduct an annual field audit to verify standard operating procedures are followed.

A12. Documents and Records

Microsoft® SharePoint is used as a document library. Access is through Ohio EPA's SharePoint collaboration site.

https://ohiodas.sharepoint.com/sites/EPA-DSW/waterqual/SitePages/Home.aspx

Examples of documents posted to this location include:

Pre-sampling documents:

- Preliminary information sheets
- Property access forms
- Draft and final QAPP versions

Project documents:

- All data files
- Draft report sections
- Changes to sites, staff, parameters, etc. should be filed in the project folder by the study team leader
- Project photos will be moved to and stored in the Lynx Photo System. All files and original data sheets will be initially retained by Ohio EPA at the Groveport Field Office while the survey report is being finalized in accordance with established retention schedules.
- Long-term survey information and data storage will take place at the State’s Storage Facility in accordance with established retention schedules.

Changes in project leadership or major actions which might affect the DQOs require an updated QAPP and signoff sheet. The study team leader shall retain copies of all management reports, memoranda, and all correspondence between team members.

For analytical samples, the original chain of custody form is delivered to Ohio EPA’s Division of Environmental Services (DES) along with the samples and retained by the Laboratory. A copy of the form may be kept in a binder by the sample collector as well. After water samples are analyzed and the results are approved by the DES QA (Quality Assurance) Officer, the data will be released to Sample Master® and subsequently uploaded to DSW's Ecological Assessment and Analysis Application (EA3). The sample collector reviews laboratory sheets for completeness and accuracy, validates field Quality Control (QC), adds comments and completes edits if necessary, and approves the sheet. All data approved in EA3 is sent to the USEPA’s Water Quality Exchange.

Original fish and QHEI data sheets will be retained at the Groveport Field Office. Data from the field sheet is manually entered into the Oracle application on iPads or through the Oracle desktop application. The Oracle sheets are then uploaded to the EA3 database. Each collector checks each sheet in EA3 with the field sheet for error before final approval of the data.

Group B: Implementing Environmental Information Operations

B1. Identification of Project Environmental Information Operations

The site selection process for aquatic life beneficial uses is designed to systematically sample principal streams in the targeted study area with enough locations to ensure alignment with the DQOs listed in Section A7. Principal streams are roughly defined as those that drain a surface area >8 mi^2, though smaller drainages may be sampled as deemed necessary. Each WAU (or HUC 12) is independently evaluated to determine its existing, relevant characteristics that contribute to the fulfillment of study objectives. These characteristics include, but are not limited to historical biological impairment, active watershed TMDLs, known and suspected point and nonpoint discharges, land use changes (e.g., agriculture to urban, forest to agriculture, etc.), historical reference sites, unlisted/undesignated streams in the WQS, known restoration activities, and other miscellaneous local impacts that may contribute to beneficial use impairment.

For WAUs with monotonous character (consistent land use, few/no known water quality issues, lack of development, etc.), one sampling location will be placed at or near the HUC outlet, preferably where biological sampling has been historically conducted. Larger, longer streams that flow across multiple WAUs are additionally evaluated holistically to ensure adequate longitudinal sampling coverage. Available USGS gage sites may be selected to obtain accurate stream flow data for load calculation purposes. The site selection process for the recreation beneficial use is designed to obtain a representative picture of conditions in an assessment unit as well as to evaluate areas of significant stream recreation. A minimum of one site per WAU is desired, though more sites may be included as recreation uses deem necessary.

A summary of the planned sampling effort is shown in Appendix 1. A detailed list of sampling sites and the type of sampling at each is shown in Appendix 2. A list of facilities regulated by individual NPDES permits is shown in Appendix 3.

B2. Methods for Environmental Information Acquisition

The 2023 version of the *Surface Water Field Sampling Manual* can be found at:
https://epa.ohio.gov/static/Portals/35/guidance/2023-DSW-FieldSamplingManual-Main.pdf

Stream Habitat Evaluation

Physical habitat is evaluated based on methods described in Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Rankin 1989, 1995, and Ohio EPA 2006). Various attributes of the available habitat are scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Habitat attributes scored include the type and quality of substrate, amount of instream cover, channel morphology, extent of riparian canopy, pool and riffle development and quality and gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site.

Biological Community Assessment

Fish and macroinvertebrate sampling protocols are detailed in Ohio EPA Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities (Ohio EPA 2015b). Published at:
https://epa.ohio.gov/static/Portals/35/documents/BioCrit15_Vol3.pdf

A combination of quantitative and qualitative methods will be employed to monitor benthic macroinvertebrate communities. Quantitative collections are made using modified Hester-Dendy multiple plate artificial substrate samplers, deployed at all biomonitoring sites draining more than 20 mi^2, or at reference sites regardless of size. Once deployed, artificial substrates are left to colonize, in-stream, for a minimum six-week period. Qualitative sampling will be conducted at all biomonitoring stations. This sampling method consists of a basic inventory of macroinvertebrate taxa from natural substrates, noting dominant taxa among major habitat types.

Fish will be sampled at each designated location using pulsed DC headwater, wading, backpack, or boat electrofishing methods depending on stream size at each sampling zone. Sites may be sampled once, twice, or more through the summer sampling season. Reasons why sites may be sampled twice (or even more) during the sampling index period could include: sites downstream from permitted dischargers, reference site locations, sites that did not meet goals during the first sampling pass, or areas that are prone to greater fluctuations or system instability. Typically, at least 4 weeks should elapse between sampling at a particular site. The number of passes may be adjusted as necessary based on best professional judgment of the Ohio EPA field staff. Reasons for a single pass monitoring at sites may include extremely difficult or time-consuming access, work delays related to weather, or the emergence of alterations (natural or otherwise) at points of access or sampling reach, rendering replication of the initial effort hazardous or costly. At least 10 percent of fish sampling locations will receive a second electrofishing sampling event. Fish are processed in the field, which includes identifying each specimen to species level, counting individuals at all sites, weighing individuals at wading and boat sites, and recording external abnormalities. Some specimens are preserved for further identification in the laboratory (if necessary) or to document new or noteworthy species records.

Surface Water

When feasible, surface water physical and chemical testing will be done to coincide with biological monitoring. Ideally, these samples will be collected across a variety of flow conditions. A minimum of five sets of samples will be collected. If this is not feasible, sites where n<3 will be noted in the report to question the validity of any arithmetic or geometric mean calculated.

Inorganic surface water chemical parameters will be collected at every site listed in Appendix 2, except three sites designated as "PWS" for the sampling type. Physical water quality measurements will be taken with a multimeter probe each time a grab sample is collected. Analytical methods and laboratory reporting levels for chemical and physical parameters for different media samples collected within the study are listed in Appendix 4.

Surface water grab samples will be collected and preserved using appropriate methods as outlined in the *Surface Water Field Sampling Manual* for water column chemistry, bacteria, and flows. This document is hereafter referred to as the *Surface Water Field Sampling Manual*. Samples are delivered to DES for analyses. Field measurements of dissolved oxygen, pH, temperature, and conductivity will be made using YSI EXO-1, EXO-2 or ProDSS meters.

Laboratory reporting limits are adequate to evaluate most pollutants. Potential exceptions include nitrate-nitrite and ammonia. It is common for nitrogen to become depleted during the summer in aquatic environments. In instances where a value is needed to calculate a mean concentration and the result is below reporting limit (RL), the reported "value" will be used in the calculation.

Water Quality Sonde Deployments

A subset of the stream assessment sites are designated as nutrient sites. Continuous multi-parameter measurement sondes will be deployed during stable, baseflow conditions for this assessment. Ideally, two sonde surveys will be carried out at each nutrient assessment site. Water quality sondes will be placed at select locations indicated as a nutrient site on Appendix 2 to evaluate diel measurements of dissolved oxygen, pH, temperature, and conductivity. The goal of each sonde deployment is to capture about 48 continuous hours of hourly measurements. Sestonic and benthic chlorophyll *a* samples are to be collected during each sonde deployment, as site conditions allow. All sampling, analysis and procedures adhere to those specified in the *Surface Water Field Sampling Manual – Appendix II for water quality parameters and flows*. Section F of Appendix II outlines equipment preparation, deployment, equipment retrieval, data management, quality control testing, and maintenance.

Bacteria

Attainment/non-attainment of recreational uses will be determined using *E. coli* criteria codified in OAC 3745-1-37, Table 37-2. Each WAU will have at least 1 site sampled. Water quality must meet a 90-day geometric mean and a statistical threshold not to be exceeded more than 10 percent of the time. Bacteria sampling to evaluate recreation use will be done within a 90-day period that falls from May 1st to October 31st. Each site with a "B" for the sampling type in Appendix 2 will have at least 4 sets of *E. coli* samples tested. Water samples will be collected into appropriate containers, cooled to 4°C, and

transported to a contract laboratory and/or DES within six hours of sample collection. All samples will be analyzed for *E. coli* bacteria using USEPA-approved methods.

Chlorophyll

Benthic and sestonic chlorophyll *a* will be collected and preserved using appropriate methods, as outlined in Appendix II of the *Surface Water Field Sampling Manual* and delivered to DES for analyses.

Sediment

Sediment sampling will be conducted at one location due to historical contamination that contributed to previous biological impairment, two locations due to suspected contamination from an oil spill, and sixteen reference sites. For the remaining sites, sediment sampling may be conducted in Year 2 if evaluation of biological, chemical and/or physical data indicate the need for sediment investigation as a potential cause of impairment. Fine-grained, multi-incremental sediment samples will be collected in the upper four inches of bottom material using either decontaminated stainless steel scoops or dredges. Potential sediment sampling parameters are listed in Appendix 4. Collected sediment will be placed into appropriate containers, placed on ice (to maintain <6°C) and delivered to DES for analysis. Sampling and decontamination protocols will follow those listed in Appendix III of the *Surface Water Field Sampling Manual.*

Fish Tissue

Tissue fillet samples will be collected from fish of regulation size and species preferred for analysis may include Spotted Bass *(Micropterus punctatus*), Largemouth Bass *(Micropterus salmoides*), Smallmouth Bass *(Micropterus dolomieu*), Flathead Catfish *(Pylodictus olivaris*), Walleye *(Sander vitreus vitreus*), Saugeye *(Sander vitreus vitreus* x *Sander canadensis*), White Bass *(Morone chrysops*), Common Carp *(Cyprinus carpio*), Freshwater Drum *(Aplodinotus grunniens*), buffalo and Channel Catfish *(Ichtalurus punctatus*). When possible, composite samples (by species) should include a minimum of three fish, yielding at least 150 grams of tissue. At each fish tissue sampling location, an attempt will be made to collect five fish species for analysis. Fish will be collected using standard electrofishing methods (Ohio EPA 2015b). Sampling locations are listed in Appendix 2 and the parameters to be analyzed are listed in Appendix 4. Fish used for tissue analysis will be filleted in the field or at the Ohio EPA Groveport Field Office using decontaminated stainless-steel fillet knives. Samples will be wrapped in aluminum foil and placed in a sealed plastic bag, along with necessary site documentation. Temporary storage in the field may take one of two forms. Samples may be stored on wet ice for a period not exceeding 48 hours. For longer periods of field storage, samples must be placed on dry ice. Collection, decontamination, and field processing of tissue samples will follow protocols listed in the *Ohio EPA Fish Tissue Collection Guidance Manual* (Ohio EPA 2021). From the field, fish tissue samples will be stored and inventoried in chest freezers at the Ohio EPA Groveport Field Office prior to delivery to DES. For more information on inland lakes sampling, please see the *Quality Assurance Project Plan (QAPP) for Inland Lakes Assessments – Statewide Project 2024 (draft, TBD)*.

B3. Integrity of Environmental Information

Sample Master® software is used by DES to manage laboratory information. The sample collector logs into the system and places an order by selecting the appropriate project, stations to be sampled, and test group(s) to be analyzed. The program creates a chain of custody form and container labels for each site.

The analytical methods to be used in this study are provided in Appendix 4 along with the preservatives, holding times, and reporting limits. Standard Operating Procedures (SOPs) for the analytical methods are available upon request.

B4. Quality Control

Stream Habitat Evaluation

To ensure technical proficiency and promote standardized observations between and among all Ohio EPA field staff tasked with macrohabitat assessment, participation in annual QHEI refresher training is required. The training pre-dates the onset of sampling activities by several weeks, is field-based, and typically organized and lead by a senior Fish Evaluation Group (FEG) biologist. Participants are asked to independently generate a QHEI from one or several target stream segments; this followed by a group discussion, on-site, where each component of each of the five metrics that comprise the QHEI are reviewed in detail. In this way, all investigators are obliged to revisit guidance material and reaffirm the various definitions, categories, and related classifications that underpin this key assessment tool. The annual refresher has proved an efficient method to discipline observations made by front-line field staff and as such has served as a practical check on investigator drift.

Water Quality Sonde Deployments

Sondes will be calibrated according to manufacturer specification prior to deployment. A calibration record is kept for all sondes at the Groveport Field Office (GFO). After each deployment, sondes undergo a precision quality control check. For more details, see Appendix II, Section F of the *Surface Water Field Sampling Manual*. All field quality control requirements and data validation methods are detailed in the *Surface Water Field Sampling Manual*.

Surface Water Chemistry

Ten percent of the total number of water samples will be submitted to the laboratory as field quality control samples. About five percent will be duplicates, including replicates if natural variability is a concern, and about five percent will be blanks, including field blanks and equipment blanks. Matrix spike duplicates will be collected for organic water samples at a minimum of five percent. Data will be validated based on the results of the field quality control samples as outlined in Appendix IV of the *Surface Water Field Sampling Manual*. The laboratory will validate data according to the requirements defined in the applicable analytical method (see Appendix 4). Field instruments will be calibrated according to manufacturer guidelines. Field instruments utilizing electrochemical sensors must be calibrated daily.

Chlorophyll-α

Ten percent of the total number of chlorophyll-α samples collected will be quality control samples. Approximately five percent will be blanks and five percent will be duplicates. Equipment blanks for benthic and sestonic samples are collected following two separate procedures that are each outlined in Appendix II of the *Surface Water Field Sampling Manual*. Duplicates are collected as two aliquots pulled from the same sample, designed to measure the variability in sample processing (not sample collection). Chlorophyll-α data will be validated based on the results of the blanks and duplicates as outlined in Appendix IV of the *Surface Water Field Sampling Manual*.

Sediment

Ten percent of the number of sediment samples should be collected as quality control samples, approximately five percent should be duplicates and five percent equipment blanks. Field duplicate samples are collected to determine laboratory analytical variability and/or field compositing techniques and of sediment heterogeneity within a single collected sample. Quality control sampling protocols will follow those listed in Appendix III of the *Surface Water Field Sampling Manual*. Sediment data will be validated based on the results of the equipment blanks and duplicates as outlined in Appendix IV of the *Surface Water Field Sampling Manual*.

B5. Instruments/Equipment Calibration, Testing, Inspection, and Maintenance

All instruments/equipment will be inspected prior to each use. All field meters are serviced annually by the manufacturer to verify that they are operating within specifications. Parts are repaired or replaced at this time if necessary.

The appropriate calibration procedure, as specified in the instrument's user manual, must be followed. All calibration solutions used will be checked for expiration dates before utilized. All equipment is assigned a logbook that will detail the equipment's calibration and maintenance history. For more details, see Appendix II, Section D of the *Surface Water Field Sampling Manual*. Other equipment used will follow specifications provided in the biological and habitat methods cited.

B6. Inspection/Acceptance of Supplies and Services

Supplies and consumables will be inspected upon receipt by the field sampling teams. Nearly all supplies utilized for this project are maintained and used during Ohio EPA's normal business operations. The field team leaders will be responsible for ensuring that all sample containers and all needed supplies and consumables are available in advance of all field work. It will be their responsibility to maintain and replenish stock when needed. Consumable supplies include, but are not limited to: sample containers, acid preservatives, Lugol's iodine solution, ethyl alcohol, buffers, filters and miscellaneous supplies such as distilled water, disposable gloves, and towels. Field personnel will confirm that all reagents are within applicable shelf life.

B7. Environmental Information Management

Data collected for this project and other data previously collected by Ohio EPA will be used to develop data summaries for each waterbody.

The data management process is shared by DSW and DES. DES uses Sample Master® software to manage laboratory information and DSW uses the Ecological Assessment and Analysis Application (EA3) to manage data. These programs are linked together to allow the transfer of information between the two systems. EA3 software is used to assign a permanent six-digit station ID number to each sampling location and to create a project name to associate locations so data can subsequently be exported and assessed in groups.

Field measurements are collected instantaneously using a multi-parameter meter and saved in an internal file storage system. These files are downloaded to the manufacturer's software, exported to Microsoft Excel® and then uploaded to Sample Master® so field data can be associated with chemistry data in the database.

Field and chemistry data tabulated in Sample Master® are eventually uploaded into EA3. Then, in EA3, the sample collector will review each data sheet for accuracy, validate field QC, add comments and complete edits, if necessary, before approving the sheet. This data is then available for use in IRs. All agency files are ultimately backed up and housed in the State of Ohio Computer Center (SOCC).

The project leader will maintain the project file in a dedicated folder on SharePoint. The goal or objective is to have a complete record of all decisions about modifications of data collection, validation, or interpretation between the QAPP signoff and project report completion. To achieve this, the project leader will need to be included on emails or otherwise receive summaries of all actions that meet the above description. Project photos should all be filed in the Lynx photo management system.

Group C: Assessment, Response Actions and Oversight

C1. Assessment and Response Actions

Assessments

Periodic assessment of field sites, field equipment, and laboratory equipment is necessary to ensure that data obtained meets project needs. This is an ongoing process that continues every day during project implementation, as well as on larger scale assessments that take place less frequently (*e.g.*, annually). The assessments generally focus on readiness and consistency of implementation but also are looking for continual improvement opportunities.

Daily assessments (for each day of project activities, as applicable) include assessment of field equipment and supplies, laboratory equipment and supplies, completeness of the day's samples and associated field notes, future needs, etc.

Response Actions

Despite best preparations, assessments may find situations requiring corrective actions. Small day-to-day level assessment findings are often addressed by the individual doing the assessment in the field or in the laboratory and are common enough to the process to not necessitate a formal response.

Laboratory personnel are aware that response may be necessary. Many of these will result in changes to the analytical reporting via data qualifiers and comments. For more information, see Appendix IV of the *Surface Water Field Sampling Manual* if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or relative percent difference (RPD) between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected by the laboratory and or project QA officers during any internal or external audits or from the results of performance evaluation samples;
- Inquiries concerning data quality are received.

Corrective action implementation will be determined by the likelihood that the situation may affect the quality of the data. Field corrective actions will be brought to the attention of the study team for consideration as to their impact on the data, their potential interest to other sampling teams/subcontractors, any future considerations for process improvement, and for their potential inclusion to the quarterly reports. Laboratory corrective actions will follow regular laboratory procedures and SOPs. Any laboratory corrective action with the potential to affect data quality will be conveyed to the study team leader by the laboratory.

Reporting and Resolution of Issues

Any audits or other assessments that reveal findings of practice or procedure that do not conform to the written QAPP will be corrected as soon as possible. The study team and QA coordinator will be notified regarding deviations.

Data Completeness

Success of the project will be judged by the resulting data fulfilling the needs outlined in the data objectives. Potential data gaps will be monitored as the project progresses and the project schedule will be revised to fill these gaps where they are determined to be significant or to potentially impact the fulfillment of project objectives.

C2. Oversight and Reports to Management

The project leader or district supervisor will receive regular updates from field staff throughout the sampling season and will report to division management during Senior Management Team meetings. Any problems that jeopardize completion of the project will lead to memorandum and consultation with program management and QA staff.

The final TSD will report all study results and findings. Aquatic life use attainment will be determined by biological criteria. Causes and sources of aquatic life use impairment will be identified and

supported by water chemistry, sediment chemistry, and stream habitat evaluations. Public water supply use will be determined on surface water chemistry and recreational use will be determined on bacteriological results.

Group D: Environmental Information Review and Usability Determination

D1. Environmental Information Review

Data verification will be conducted by the study team with assistance from other DSW staff. This process will confirm that sample results received are congruent with samples submitted and parameters requested from the laboratory. The process will also result in summaries of any differences between initial sampling and methods planned in the QAPP and results reported and available. Differences may result from samples not being collected (due to weather, scheduling, etc.), samples not being submitted (due to accidents like broken containers, or delays resulting in being past holding times, etc.), problems at the laboratory (methods changing, containers or equipment breaking), or other reasons. It is also possible that additional sampling would take place because of field observations/conditions. Documenting deviations from the QAPP is the responsibility of the project leader.

The DES laboratory does the initial validation on all data and may qualify data based on laboratory QA/QC (Quality Assurance/Quality Control) alone or with feedback from the sampler (regarding specific sampling procedures, variable sampling matrix, conditions, blank contamination, duplicate agreement, matrix spike recovery, etc.). The data user can evaluate the data given their knowledge of sampling conditions, expected variability given location and matrix, data uses, etc.

All macroinvertebrate data are hand-entered into the EA3 database using a double data entry method. This helps to minimize data entry errors. Final approval of data involves a reconciliation between the paper forms and the electronic data which is completed by the data collector or a database administrator in the Ecological Assessment Unit.

Upon approval in EA3, field and laboratory data cannot be revised without intervention from database administrators in the Agency's Office of Information Technology Services (ITS).

D2. Useability Determination

Biological and habitat field sampling results will be verified and validated based on field staff experience, qualifications, and adherence to training and QA/QC procedures available in Subsection 1, Part A (macroinvertebrates) and Subsection 2, Part A (Fish and Habitat) in *Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities*.

In addition to verifying data completeness, the study team will oversee data validation for the project that will include confirmation of sample holding times, proper preservatives, sample containers, analysis methods, QA/QC results (including assessment of results for blanks, spikes, and duplicates),

etc. This will be an ongoing effort, concluding in a data validation summary to be included in the final report.

The study team will make final decisions regarding validity and usability and will evaluate the sample collection, analysis, and data reporting processes to determine if the data is of sufficient quality to meet the project objectives. Data validation involves all procedures used to accept or reject data after collection and prior to use. These include screening, editing, verifying, and reviewing. Data validation procedures ensure that objectives for data precision and bias will be met, that data will be generated in accordance with the QAPP and SOPs, and that data are traceable and defensible. The process is both qualitative and quantitative and is used to evaluate the project.

The laboratory QA staff will conduct a systematic review of the analytical data for compliance with the established QC criteria using batch and sample QA/QC information including spike, duplicate, and blank results. All technical holding times will be reviewed, the laboratory analytical instrument performance will be evaluated, and results of initial and continuing calibration will be reviewed and evaluated.

Field QC sample results will be evaluated using procedures available in the *Surface Water Field Sampling Manual*. Much of this work is facilitated by a centralized automated QC data evaluation Excel file. Use of this file is explained in the document “QC Tracking and Data Qualification” available in SharePoint in DSW Quality Management/Documents/DSW Procedures.

For most DSW chemical water quality data, data validation is generally confined to evaluation of blank results, duplicate/replicate results, paired parameter results, and confirming that samples were properly preserved/prepared (including filtration, *etc*. - if indicated by the method). Standards for evaluation of analytical results of those QC sample types and general field samples are described in Appendix IV, Section A of the *Surface Water Field Sampling Manual*.

Issues related to biological and habitat data uncertainty, including any patterns of analytical or field QC uncertainties, will be assessed by field staff and their management. For most situations, issues can be addressed with acknowledgement of factors captured in the sample metadata which can confirm, explain, and document the data quality concern. Significant, persistent, or unresolved issues will be brought to the attention of the project study team, division QC personnel, and Ecological Assessment Unit and/or DSW management for further evaluation. This combination of personnel will assess how to best label affected data for storage in the EA3 database and how to eliminate or limit any similar problems going forward. Consideration will also be given on how best to memorialize data limitations or anomalies as the data is transferred to other databases, including the WQ Portal, so that future users of the sampling data are aware of any data quality issues or limitations.

References

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2015. Biological Criteria for the Protection of Aquatic Life: Volume III. Standardized Biological Field Sampling and Laboratory Methods for Assessing Fish and Macroinvertebrate Communities. Published at: ***https://epa.ohio.gov/portals/35/documents/BioCrit15_Vol3.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2006. *Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI).* Published at: ***https://epa.ohio.gov/static/Portals/35/documents/QHEIManualJune2006.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2021. *Fish Tissue Collection Manual*. Published at: ***https://epa.ohio.gov/static/Portals/35/tmdl/Study%20Plan/2021-FishFieldCollectionManual.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2019. *Surface Water Field Sampling Manual - Appendix I: Inland Lakes Sampling Procedure Manual*. Published at: ***https://epa.ohio.gov/static/Portals/35/inland_lakes/Inland_Lake_Sampling_Manual_2019_update_final_031819.pdf?ver=2019-11-26-142257-620***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2023. *Surface Water Field Sampling Manual: for Water Quality Parameters and Flows*. Published at: ***https://epa.ohio.gov/static/Portals/35/guidance/2023-DSW-FieldSamplingManual-Main.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2023. *Surface Water Field Sampling Manual - Appendix II: for Water Quality Parameters and Flows*. Published at: ***https://epa.ohio.gov/static/Portals/35/guidance/2023-DSW-FieldSamplingManual-AppendixII.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2023. *Surface Water Field Sampling Manual - Appendix III: Sediment Sampling*. Published at: ***https://epa.ohio.gov/static/Portals/35/guidance/2023-DSW-FieldSamplingManual-AppendixIII.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2023. *Surface Water Field Sampling Manual - Appendix IV: Data Management*. Published at: ***https://epa.ohio.gov/static/Portals/35/guidance/2023-DSW-FieldSamplingManual-AppendixIV.pdf***

Rankin, E.T. 1989. *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application.* Division of Water Quality Planning and Assessment, Columbus, Ohio.

Rankin E.T., 1995. Habitat Indices in Water Resource Quality Assessments, Davis W.S., T.P. Simon (Eds.), Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Press, Boca Raton, FL (1995), pp. 181-208.

United States Environmental Protection Agency. 2023. *EPA Begins Long-Term Cleanup of Little Scioto River.* Published at: ***https://semspub.epa.gov/work/05/982886.pdf***

Other Resources

DeShon, J.E. 1995. Development and Application of the Invertebrate Community Index (ICI),

Davis W.S. and T.P. Simon (Eds.), Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Press, Boca Raton, FL (1995), pp. 217-244.

Hughes, R.M., D.P. Larsen, and J.M. Omernik. 1986. *Regional reference sites: a method for assessing stream pollution*. Env. Mgmt. 10(5): 629-635

Karr, J.R. and D.R. Dudley. 1981. *Ecological perspective on water quality goals*. Env. Mgmt. 5(1): 55-68.

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 1987. *Biological Criteria for the Protection of Aquatic Life: Volume I: The Role of Biological Data in Water Quality Assessment*. Published at: ***https://epa.ohio.gov/static/Portals/35/documents/Vol1.pdf***

Ohio EPA (Ohio Environmental Protection Agency – Division of Surface Water). 2006. 2006 Updates to Biological Criteria for the Protection of Aquatic Life: Volume II and Volume II Addendum: Users Manual for Biological Field Assessment of Ohio Surface Waters. Published at:

https://epa.ohio.gov/static/Portals/35/documents/BioCrit88_Vol2Updates2006.pdf

Omernik, J.M. 1987. Ecoregions of the Conterminous United States. Ann. Assoc. Amer. Geogr. 77(1): 118-125.

Omernik, J.M. and A.L. Gallant, 1988. Ecoregions of the upper Midwest states. EPA/600/3-88/037. U. S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, Oregon. 56 pp.

Yoder, C.O. and E.T. Rankin, 1995. Biological Criteria Development and Implementation in Ohio, Davis W.S., T.P. Simon (Eds.), Biological Assessment and Criteria: Tools for Water Resource Planning and Decision Making. Lewis Press, Boca Raton, FL (1995), pp. 109-144

Appendices

Appendix 1. Summary of Sampling Effort

Type of Sample	# of sites	# of passes	Total #
Biology			
Fish	139	153 (approx.)	153 (approx.)
Macroinvertebrate (Quantitative)	72	1	72
Macroinvertebrate (Qualitative)	68	1	68
Fish Tissue			
Fish Tissue	19	1	19
Water Quality			
Inorganic Samples	143	5	715
Nutrient (sonde deployment & Chlorophyll-α)	53	≥1	53-106
Semi-volatile Organic Samples (BNA)	1	2	2
Herbicides/Insecticides	TBD in year 2		
Drinking Water Intake	5	5	25
Sediment Quality			
Metals	19	1	19
Pesticides/PCBs and Semi-volatile Organics	19	1	19
Bacteria			
E. coli Cultures	77	5	385

Appendix 2. Streams, Sampling Locations, and Sampling Types

Refer to key at the end of the table for sampling types.

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V01W19	02-001-000	SCIOTO R. AT ROUNDHEAD @ MADORY RD.	231.86	28.0	050600010102	Hardin	40.560610	-83.832500	F,QT,C	1
201834	02-001-000	SCIOTO R. SE OF MCGUFFEY, UPST. CO. RD. 130	226.30	49.0	050600010102	Hardin	40.635800	-83.807800	F,QT,C	2
V01W20**M**	02-001-000	SCIOTO R. SE OF MCGUFFEY @ CO. RD. 110	223.05	67.0	050600010102	Hardin	40.674700	-83.776100	F,QT,C,B,S	3
610770	02-001-000	SCIOTO R. W OF KENTON @ CO. RD. 106	216.67	117.0	050600010104	Hardin	40.666700	-83.679200	F,FT,QT,C,B	4
V01S04	02-001-000	SCIOTO R. JUST UPST. KENTON WWTP	211.50	162.0	050600010401	Hardin	40.636900	-83.598600	F,QT,C,B	5
V01W23	02-001-000	SCIOTO R. DST. KENTON @ TWP. RD. 199	207.26	178.0	050600010403	Hardin	40.621900	-83.530300	F,FT,QT,C,B	6
V01S11**R**	02-001-000	SCIOTO R. AT HEPBURN @ CO. RD. 227	203.36	223.0	050600010405	Hardin	40.617200	-83.470300	F,QT,C,S	7
V01W24	02-001-000	SCIOTO R. SW OF NEW BLOOMINGTON @ SCHOTTE RD.	192.21	262.0	050600010405	Marion	40.572800	-83.350300	F,FT,QT,C,B,N	8
304573	02-001-000	SCIOTO R N OF GREEN CAMP @ AQUA OHIO MARION PWS INTAKE	180.4	406.1	050600010406	Marion	40.55252	-83.219101	PWS	9*
V01K02**R**	02-001-000	SCIOTO R. N OF GREEN CAMP, UPST. B.F. GOODRICH LANDFILL	179.60	407.0	050600010406	Marion	40.547500	-83.220600	F,FT,QT,C,B,S,	9*
601280	02-001-000	SCIOTO R. NEAR PROSPECT @ HOSKINS RD.	169.25	567.0	050600010505	Delaware	40.419400	-83.197200	F,FT,QT,LR,B,N	10
300689	02-190-000	DUNLAP CREEK NEAR MOUTH @ END OF LANE, N OFF CO. RD. 130	1.01	8.3	050600010102	Hardin	40.644810	-83.822900	F,QL,C	11
V01S21	02-188-000	COTTONWOOD DITCH AT ALGER @ ST. RT. 235	5.33	5.1	050600010101	Hardin	40.701522	-83.848842	F,QL,C,B,N	12
V01S20	02-188-000	COTTONWOOD DITCH DST. ALGER, ADJ. TWP. RD. 100, DST C.R. 35	4.10	11.3	050600010101	Hardin	40.689400	-83.836100	F,QL,C,B,N	13
V01S08	02-188-000	COTTONWOOD DITCH DST. MCGUFFY WWTP @ RR BRIDGE	0.68	19.3	050600010101	Hardin	40.689390	-83.769000	F,QL,C,B	14
300690	02-186-000	MCCOY RUN @ RODGERS RD.	0.55	8.0	050600010104	Hardin	40.675880	-83.726600	F,QL,C,B,N	15
V01W27**R**	02-182-000	SILVER CREEK @ ST. RT. 67	2.32	11.3	050600010104	Hardin	40.624200	-83.649200	F,QT,C,S	16
V01S07**R**	02-181-000	TAYLOR CREEK S OF KENTON @ TWP. RD. 180	4.43	12.7	050600010103	Hardin	40.593300	-83.621400	F,QT,C,B,S	17

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V01P01	02-181-000	TAYLOR CREEK AT KENTON @ ST. RT. 67	0.76	16.3	050600010103	Hardin	40.637800	-83.617200	F,QL,C,B	18
V01P07	02-179-000	GANDER RUN S OF KENTON, 100 FT. DST CO. RD. 140	0.60	5.2	050600010401	Hardin	40.631700	-83.591700	F,QL,C	19
300691	02-177-000	WOLF CREEK @ TWP. RD. 199	0.51	12.0	050600010403	Hardin	40.615120	-83.527800	F,QL,C	20
300704	02-175-000	PANTHER CREEK @ ST. RT. 31 ROADSIDE PARK	7.80	11.0	050600010402	Hardin	40.548840	-83.532400	F,QL,C	21
V01W30	02-175-000	PANTHER CREEK SW OF HEPBURN @ CO. RD. 219	1.80	22.3	050600010402	Hardin	40.599700	-83.483100	F,QT,C,B,N	22
V01W31	02-172-000	WILDCAT CREEK NE OF MT. VICTORY @ TWP. RD. 217	6.72	4.3	050600010404	Hardin	40.554400	-83.485600	F,QL,C	23
V01W32	02-172-000	WILDCAT CREEK NW OF LARUE @ LARUE-KENTON RD.	0.49	22.2	050600010404	Hardin	40.593300	-83.423300	F,QT,C,B,N	24
304532	02-174-000	SOUTH WILDCAT CREEK W. OF LARUE @ CR 200	0.50	7.0	050600010404	Hardin	40.573190	-83.448800	F,QL,C	25
300693	02-165-000	RUSH CREEK UPST. RUSHVILLE @ TWP. RD. 118	39.45	11.8	050600010201	Logan	40.440840	-83.678900	F,QL,C,N	26
300964	02-165-000	RUSH CREEK DST. RUSHVILLE @ TWP. RD. 110	36.15	14.8	050600010201	Franklin	40.469520	-83.655800	F,QL,C,N	27
300695	02-165-000	RUSH CREEK @ WEST MANSFIELD-MT. VICTORY RD. (CO. RD. 139)	26.26	25.7	050600010201	Hardin	40.505110	-83.520500	F,QT,C	28
300696	02-165-000	RUSH CREEK @ WINNEMAC RD.	14.50	50.0	050600010201	Union	40.479950	-83.377800	F,QT,C,B	29
V01S01**R**	02-165-000	RUSH CREEK S OF NEW BLOOMINGTON @ MT. OLIVE-GREEN CAMP RD.	5.39	77.0	050600010203	Marion	40.515000	-83.329700	F,QT,C,B,S	30
300808	02-165-000	RUSH CREEK AT ESSEX, UPST ST. RT. 739	8.80	74.0	050600010203	Marion	40.480850	-83.316625	H	31
V01K04	02-165-000	RUSH CREEK @ LARUE-GREEN CAMP RD.	0.55	105.0	050600010203	Marion	40.559400	-83.332200	F,QT,C,B,N	32
V01K05	02-166-000	MCDONALD CREEK UPST. BUCKEYE EGG FARM @ CO. RD. 240	9.17	2.6	050600010202	Hardin	40.518900	-83.436300	F,QL,C,B,N	33
V01W34	02-166-000	MCDONALD CREEK SW OF LARUE @ CO. RD. 245	6.82	6.3	050600010202	Hardin	40.545600	-83.439200	F,QL,C,B,N	34
203089	02-166-000	MCDONALD CREEK S OF LARUE @ ST. RT. 37	2.70	12.3	050600010202	Marion	40.558100	-83.380800	F,QL,C,B	35
304533	02-194-000	GLADE RUN @ LARUE PROSPECT RD. W.	0.45	5.0	050600010406	Marion	40.565690	-83.249700	F,QL,C	36
V02G02	02-158-000	L. SCIOTO R. @ CALDWELL RD.	25.59	12.8	050600010302	Crawford	40.746400	-83.033400	F,QL,C	37
V02G01	02-158-000	L. SCIOTO R. @ CRAWFORD-MARION COUNTY LINE RD.	19.70	33.0	050600010302	Union	40.702600	-83.090800	F,QT,C	38
V02S01**R**	02-158-000	L. SCIOTO R. N OF MARION @ KENTON-GALION RD.	11.10	47.0	050600010302	Marion	40.645000	-83.161400	F,FT,QT,C,B,S	39

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V02S13**R**	02-158-000	L. SCIOTO R. NW OF MARION @ HILLMAN FORD RD.	9.24	73.0	050600010303	Marion	40.626700	-83.173600	F,QT,C,S	40
V02K18	02-158-000	L. SCIOTO R. UPST. AMERICAN WATERWORKS DAM	7.09	76.0	050600010303	Marion	40.600300	-83.183100	PWS	41
300624	02-158-000	L SCIOTO R AT MARION, UPST MARION WWTP/DST N ROCKSWALE DITCH	6.50	86.0	050600010303	Marion	40.592353	-83.183619	F,QT,C,B,N	42
V02W16	02-158-000	L. SCIOTO R. @ LANDFILL/TWP. RD. 97-A	6.24	86.0	050600010303	Marion	40.588100	-83.186300	F,FT,QT,C,B,N	43
601070	02-158-000	L. SCIOTO R. W OF MARION @ KEENER PIKE	4.43	93.3	050600010304	Marion	40.571400	-83.203600	F,QT,C,N	44
610740	02-158-000	L. SCIOTO R. SW OF MARION @ ST. RT. 739	2.65	100.0	050600010304	Marion	40.553900	-83.185300	F,QT,C,N	45
V02P07	02-158-000	L. SCIOTO R. AT GREEN CAMP @ OWENS-GREEN CAMP RD. (CR 104)	0.39	113.0	050600010304	Marion	40.527500	-83.205300	F,FT,QT,C,B,N	46
V02G03	02-162-000	ROCK FORK @ MARSEILLES-GALION RD.	8.13	7.6	050600010301	Marion	40.673800	-83.072700	F,QL,C,N	47
V02P09	02-162-000	ROCK FORK N OF MARION @ ST. RT. 423	1.10	23.1	050600010301	Marion	40.641250	-83.145400	F,QT,C,B,N	48
V02S14**M**	02-158-004	N. ROCK SWALE DITCH NW OF MARION @ HILLMAN FORD RD.	2.55	7.3	050600010303	Marion	40.620300	-83.163900	F,QT,C,S	49
V02W15	02-158-004	N. ROCK SWALE DITCH W OF MARION @ HOLLAND RD.	0.55	10.0	050600010303	Marion	40.592800	-83.173300	F,QL,C,B,N	50
V02P11	02-159-000	HONEY CREEK SW OF MARION @ MOUTH	0.01	7.3	050600010304	Marion	40.547890	-83.188600	F,QL,C,B,N	51
300699	02-155-000	PATTON RUN @ BOUNDARY RD.	2.25	14.4	050600010501	Marion	40.466040	-83.212400	F,QL,C,B	52
V02G07	02-154-000	BATTLE RUN AT PROSPECT @ ELM ST.	0.25	9.4	050600010505	Marion	40.448200	-83.187500	F,QL,C	53
V02G06	02-149-000	OTTAWA CREEK @ ST. RT. 257	0.08	8.0	050600010505	Delaware	40.398700	-83.196800	F,QL,C,B	54
V02G05	02-148-000	KEBLER RUN S OF PROSPECT @ RIVER RD.	0.87	14.3	050600010503	Delaware	40.397400	-83.187400	F,QL,C,B	55
300700	02-145-000	FULTON CREEK W OF RICHWOOD @ MILLER RD.	16.30	12.5	050600010504	Union	40.432430	-83.372800	F,QL,C	56
V02S07**R**	02-145-000	FULTON CREEK UPST. RICHWOOD @ KINNEY PIKE	10.35	24.9	050600010504	Union	40.413100	-83.310300	F,QT,C,S,N	57
V02S04	02-145-000	FULTON CREEK DST. RICHWOOD, ADJ. FULTON CREEK RD.	6.44	40.0	050600010504	Union	40.393600	-83.261400	F,QT,C,B,N	58
V02S02	02-145-000	FULTON CREEK SE OF RICHWOOD @ FULTON CREEK RD. (UPPER)	1.20	46.4	050600010504	Delaware	40.372800	-83.207500	F,QT,C,B	59
V02K08	02-138-000	BOKES CREEK NW OF HORTON @ CO. RD. 292	36.30	4.7	050600010701	Logan	40.464200	-83.581100	F,QL,C	60

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V02K06	02-138-000	BOKES CREEK @ WEST MANSFIELD-MT. VICTORY RD.	31.80	11.4	050600010701	Logan	40.440600	-83.527800	F,QL,C,N	61
203100	02-138-000	BOKES CREEK E OF YORK CENTER @ BITLER RD.	23.20	44.0	050600010702	Union	40.408100	-83.427500	F,QT,C	62
V02K05	02-138-000	BOKES CREEK ADJ. S.R. 31, UPST BRUSH RUN/DST POWDER LICK RUN	20.20	51.0	050600010702	Union	40.380800	-83.407400	F,FT,QT,C,B	63
V02S21	02-138-000	BOKES CREEK @ TAYLOR-CLAIBOURNE RD.	14.73	60.0	050600010703	Union	40.361400	-83.350600	F,QT,C	64
V02S20	02-138-000	BOKES CREEK DST. MAGNETIC SPRINGS @ BROWN RD.	5.55	72.0	050600010703	Delaware	40.339200	-83.243900	F,FT,QT,C,B,N	65
V06P09	02-138-000	BOKES CREEK N OF WARRENSBURG @ ST. RT. 257	0.25	83.1	050600010703	Delaware	40.322100	-83.175000	F,FT,QT,C,B	66
V02K12	02-138-004	N. FK. WEST MANSFIELD DITCH @ JANUARY RD.	1.28	11.4	050600010701	Union	40.419200	-83.507500	F,QL,C,B	67
300019	02-138-002	POWDER LICK RUN @ ST. RT. 739	3.35	1.8	050600010702	Union	40.384700	-83.453800	C	68
V02K09	02-138-002	POWDER LICK RUN @ POWDER LICK RD. (LOWER CROSSING)	1.20	3.8	050600010702	Union	40.384021	-83.428025	C	69
V02W25	02-138-002	POWDER LICK RUN NEAR MOUTH, 100 YDS. DST. YEARSLEY RD.	0.17	4.3	050600010702	Union	40.384350	-83.413900	C,N	70
V02W27	02-138-001	BRUSH RUN S OF SOMERSVILLE @ YEARSLEY RD.	0.60	2.6	050600010702	Union	40.374400	-83.416900	F,QL,C,N	71
203120	02-139-000	SMITH RUN NW OF WARRENSBURG, UPST. BRINDLE RD.	0.80	5.5	050600010703	Delaware	40.321900	-83.202500	F,QL,C,B	72
302208	02-136-000	MOORS RUN N OF WARRENSBURG @ ST. RT. 257	0.32	5.6	050600010704	Delaware	40.318300	-83.174800	F,QL,C,B,N	73
V03W12	02-109-000	MILL CREEK N OF NORTH GREENFIELD @ CO. RD. 131	42.56	11.2	050600010601	Logan	40.388600	-83.588300	F,QL,C,B	74
V03K07	02-109-000	MILL CREEK NE OF EAST LIBERTY @ CO. RD. 142	39.20	21.9	050600010601	Union	40.365000	-83.550000	F,QT,C,B	75
V03W13	02-109-000	MILL CREEK S OF LUNDA @ BENNINGTON-NEWLAND RD.	36.05	38.0	050600010602	Union	40.355800	-83.514200	F,QT,C	76
V03S17**R**	02-109-000	MILL CREEK NEAR PEORIA @ WHEELER-GREEN RD.	28.13	53.0	050600010602	Union	40.311900	-83.435600	F,QT,C,S	77
V03P14**R**	02-109-000	MILL CREEK UPST. MARYSVILLE @ COTTON SLASH RD.	24.74	62.0	050600010602	Union	40.289200	-83.401100	F,FT,QT,C,S	78
301874	02-109-000	MILL CREEK UPST. MARYSVILLE @ INFLATABLE DAM WATER INTAKE	21.65	73.0	050600010602	Union	40.258420	-83.390500	B,PWS	79
301928	02-109-000	MILL CREEK AT MARYSVILLE @ CHERRY ST. (NO WWTP OR DAM UPST)	18.14	88.0	050600010602	Union	40.243890	-83.355200	F,QT,C,B,N	80
V03P19	02-109-000	MILL CREEK E OF MARYSVILLE @ U.S. RT. 36	14.54	94.7	050600010604	Union	40.247200	-83.315000	F,FT,QT,C,B,N	81

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V03P20	02-109-000	MILL CREEK DST. MARYSVILLE @ HINTON MILL RD.	12.17	102.0	050600010604	Union	40.227500	-83.298100	F,QT,C	82
203153	02-109-000	MILL CREEK UPST. BMY TRIB (9.30), ADJ. WATKINS RD.	9.42	109.0	050600010604	Union	40.215600	-83.265300	F,QT,C,N	83
V03P23	02-109-000	MILL CREEK NE OF WATKINS @ HINTON MILL RD.	6.89	118.0	050600010604	Union	40.231700	-83.238900	F,QT,C,B,N	84
601260	02-109-000	MILL CREEK UPST. BELLPOINT @ MILLS RD. U.S.G.S. GAGE	1.57	178.0	050600010604	Delaware	40.248100	-83.173600	F,FT,QT,C,B,N	85
304534	02-135-000	OTTER CREEK UPST. LOGAN CO. EASTERN REGIONAL WWTP @ CR 154	2.95	4.0	050600010601	Logan	40.330860	-83.574800	F,QL,C,N	86
203109	02-135-000	OTTER CREEK NEAR MOUTH, DST LAKE	0.70	11.0	050600010601	Logan	40.353600	-83.550600	F,QL,C,N	87
203128	02-134-000	OTTER RUN AT FARM OFF BARKER RD. @ FORD	1.70	6.5	050600010602	Union	40.275600	-83.409700	F,QL,C	88
V03G02	02-109-015	TOWN RUN AT MARYSVILLE @ 5TH STREET, DST. CULVERT	0.21	1.7	050600010602	Union	40.236300	-83.365000	H	89
V03W06	02-109-005	CROSSES RUN E OF MARYSVILLE @ WATKINS RD.	0.80	4.3	050600010604	Union	40.218600	-83.301900	F,QL,C,S	90
V03S10	02-109-001	BLUES CREEK @ LEEPER-PERKINS RD.	10.15	17.5	050600010603	Union	40.293900	-83.312800	F,QL,C	91
V03P25	02-109-001	BLUES CREEK DST. OSTRANDER @ OSTRANDER RD.	0.60	37.1	050600010603	Delaware	40.260800	-83.207800	F,QT,C,B,N	92
V04P19	02-400-000	OLENTANGY R. AT GALION @ CUMMINGS ST.	89.25	11.0	050600010801	Crawford	40.739260	-82.764900	F,QL,C	93
V04P21	02-400-000	OLENTANGY R. JUST UPST. GALION WWTP	86.00	15.1	050600010801	Crawford	40.723740	-82.813200	F,QT,C	94
V04P25	02-400-000	OLENTANGY R. NEAR GALION @ MONNETT-NEW WINCHESTER RD. (UPST)	85.15	15.5	050600010801	Crawford	40.719760	-82.825200	F,QT,C	95
V04P30	02-400-000	OLENTANGY R. NW OF GALION @ SHEARER RD.	79.66	45.0	050600010801	Crawford	40.747860	-82.871300	F,QT,C,B,N	96
V04G01	02-400-000	OLENTANGY R. N OF NEW WINCHESTER @ MONNETT CHAPEL RD (TR 34)	74.00	51.0	050600010804	Crawford	40.740230	-82.912200	F,QT,C	97
V04S43	02-400-000	OLENTANGY R. UPST. MUD RUN @ LYONS RD.	63.36	67.0	050600010804	Marion	40.659460	-82.948200	F,QT,C,B,N	98
V04S40	02-400-000	OLENTANGY R. S OF CALEDONIA @ ST. RT. 746	58.85	134.0	050600011001	Franklin	40.621210	-82.962900	F,QT,C,B,N	99
601020	02-400-000	OLENTANGY R. AT CLARIDON @ ST. RT. 95	54.74	157.0	050600011003	Marion	40.582860	-82.988800	F,FT,QT,C,N	100
V04S39	02-400-000	OLENTANGY R. UPST. GRAVE CREEK @ ST. JAMES RD.	45.55	181.0	050600011003	Franklin	40.512560	-83.053200	F,QT,C,B	101
V04P38	02-400-000	OLENTANGY R. AT WALDO @ WALDO-FULTON RD.	40.76	233.0	050600011005	Marion	40.459460	-83.074300	F,FT,QT,C,B	102

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V04P39	02-400-000	OLENTANGY R. 0.3 MI. DST DELAWARE RESERVOIR @ MAIN RD.	32.00	393.0	050600011007	Delaware	40.353961	-83.068010	F,QT,C,B,PWS	103
V04G22**R**	02-400-000	OLENTANGY R. ADJ. HUDSON RD, AT BEND	27.50	411.0	050600011007	Delaware	40.315800	-83.066400	F,FT,QT,C,B,S	104
V04K01	02-400-000	OLENTANGY R NR JCT RIVER ST & HAYES ST, UPST WWTP	25.40	431.0	050600011101	Delaware	40.292900	-83.059900	F,QT,C,B,S	105
610810	02-400-000	OLENTANGY R. AT DELAWARE @ OLENTANGY AVE.	24.51	435.0	050600011101	Delaware	40.284590	-83.065400	F,QT,C,O1,B,S	106
V04S30**R**	02-400-000	OLENTANGY R. E OF HYATTS @ HYATTS RD.	19.42	460.0	050600011101	Delaware	40.214970	-83.060400	QT,C,B,S,N	107
304535	02-400-000	OLENTANGY R. AT DEL-CO PWS INTAKE	18.20	462.0	050600011101	Delaware	40.199653	-83.052188	B,PWS	108
V04P05	02-400-000	OLENTANGY R. DST. MT. AIR, BEHIND SHOPPING CENTER	12.41	490.0	050600011102	Franklin	40.123360	-83.033500	F,FT,QT,C,B,N	109
V04S25	02-400-000	OLENTANGY R. AT COLUMBUS @ RR DST GOODALE ST.	0.65	543.0	050600011103	Franklin	39.971960	-83.020700	F,FT,QT,LR,B	110
V04G05	02-400-030	ROCKY FORK @ ATKINSON RD.	2.85	8.7	050600010801	Morrow	40.708360	-82.793000	F,QL,C	111
V04G06	02-400-030	ROCKY FORK @ CRAWFORD/MORROW COUNTY LINE RD.	0.40	11.2	050600010801	Crawford	40.712560	-82.822700	F,QL,C	112
V04W15	02-400-028	HOOKER DAPPER DITCH (CO. DITCH #877) JUST DST THATCHER DITCH	0.68	8.1	050600010801	Crawford	40.747060	-82.852000	F,QL,C	113
V04G08	02-429-000	MUD RUN @ MONNETT CHAPEL RD. (WHETSTONE TWP. RD. 34)	6.56	8.1	050600010802	Crawford	40.739460	-82.957400	F,QL,C	114
V04G09	02-429-000	MUD RUN N OF CALEDONIA @ MORRAL-KIRKPATRICK RD. (CO. RD. 67)	2.65	15.3	050600010802	Marion	40.688960	-82.962400	F,QL,C,B	115
V04G11	02-425-000	FLAT RUN @ ST. RT. 309	7.26	14.4	050600010803	Morrow	40.659760	-82.873700	F,QL,C	116
V04S46	02-425-000	FLAT RUN SE OF CALEDONIA @ WEST CANAAN RD.	0.55	42.6	050600010803	Morrow	40.626600	-82.952600	F,QT,C,B	117
304536	02-428-000	MUD RUN (FLETCHER DITCH) @ EMAHISER RD.	0.10	6.0	050600010803	Morrow	40.661470	-82.881500	F,QL,C	118
V04G13	02-426-000	THORN RUN @ M0RROW CO. RD. 61	1.11	9.3	050600010803	Morrow	40.616160	-82.946300	F,QL,C	119
V04Q21	02-400-026	BEE RUN SW OF CALEDONIA, NEAR MOUTH	0.30	6.8	050600011001	Marion	40.616460	-82.979300	F,QL,C	120
V04G14	02-423-000	OTTER CREEK E OF CLARIDON @ ST. RT. 95	1.10	9.0	050600011001	Marion	40.585860	-82.972400	F,QL,C	121
304537	02-421-000	BEAVER RUN @ MOUTH	0.01	4.7	050600011003	Marion	40.566900	-82.989000	F,QL,C,B	122
300653	02-420-000	MCKIBBEN DITCH NW OF CARDINGTON @ ST. RT. 529	1.25	4.3	050600011003	Marion	40.535830	-82.994200	F,QL,C	123

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
300657	02-418-000	GRAVE CREEK AT MARION @ MARION-EDISON RD.	4.82	5.1	050600011002	Marion	40.571150	-83.084800	F,QL,C,N	124
V04P36	02-418-000	GRAVE CREEK SE OF MARION @ ST. RT. 98	0.79	12.3	050600011002	Marion	40.521460	-83.058200	F,QL,C	125
V04S45	02-418-000	GRAVE CREEK SE OF MARION @ WHETSTONE RIVER RD.	0.03	28.7	050600011002	Marion	40.511960	-83.057100	F,QT,C,B,N	126
V04P37	02-418-001	RIFFLE CREEK SE OF MARION @ FIRSTENBERGER RD.	1.44	15.8	050600011002	Marion	40.527560	-83.039900	F,QL,C	127
V04P32	02-417-000	QU QUA CREEK S OF MARION @ OWENS RD.	4.62	6.8	050600011004	Marion	40.520660	-83.096300	F,QL,C,N	128
V04P35	02-417-000	QU QUA CREEK NEAR WALDO @ ST. RT. 98	0.12	17.1	050600011004	Marion	40.465360	-83.074100	F,QL,C,B,N	129
V04G20	02-415-000	BRONDIGE RUN SE OF WALDO @ ST. RT. 229	0.60	12.0	050600011005	Delaware	40.433960	-83.048800	F,QL,C,B	130
V04G27	02-450-000	WHETSTONE CREEK @ MT. GILEAD-WEST POINT RD.	29.33	13.3	050600010902	Morrow	40.616820	-82.804100	F,QL,C,B	131
V04S09**R**	02-450-000	WHETSTONE CREEK UPST. MT. GILEAD @ MCKIBBEN RD.	25.53	27.0	050600010902	Morrow	40.578960	-82.815500	F,QT,C,S	132
V04S08**R**	02-450-000	WHETSTONE CREEK UPST. MT. GILEAD WWTP @ WWTP BRIDGE	21.71	40.0	050600010902	Morrow	40.541760	-82.841300	F,QT,C,B,S,N	133
610790	02-450-000	WHETSTONE CREEK @ MT. GILEAD-CARDINGTON RD.	20.85	40.0	050600010902	Morrow	40.545360	-82.854300	F,QT,C,B,N	134
V04W07	02-450-000	WHETSTONE CREEK S OF EDISON @ BENNETT RD.	18.20	42.0	050600010902	Morrow	40.530660	-82.874500	F,QT,C	135
V04S37	02-450-000	WHETSTONE CREEK @ WALDO-FULTON-CHESTERVILLE RD.	9.17	62.0	050600010902	Morrow	40.469460	-82.949900	F,QT,C,B,N	136
V04P45	02-450-000	WHETSTONE CREEK SE OF WALDO @ ST. RT. 229	2.55	113.0	050600010903	Delaware	40.415360	-83.020200	F,QT,C,B	137
V04G31	02-450-001	TRIB. TO WHETSTONE CREEK (33.71) E OF WEST POINT @ S.R. 19	0.42	2.0	050600010902	Morrow	40.644400	-82.765800	F,QL,C	138
V04G39	02-458-000	EAST BRANCH WHETSTONE CREEK	0.40	6.3	050600010902	Morrow	40.608300	-82.804400	F,QL,C	139
V04G38	02-457-000	SAMS CREEK E OF MT. GILEAD @ SUNFISH RD.	1.40	7.8	050600010902	Morrow	40.550500	-82.796400	F,QL,C	140
V04G32	02-453-000	SHAW CREEK NW OF EDISON @ THATCHER RD.	13.20	11.8	050600010901	Morrow	40.586400	-82.887500	F,QL,C	141
V04S10	02-453-000	SHAW CREEK SE OF CARDINGTON @ BEATTY RD.	1.56	26.0	050600010901	Morrow	40.483160	-82.956800	F,QT,C,B	142
V04G36	02-452-000	MITCHELL RUN N OF ASHLEY @ DELAWARE-CARDINGTON RD.	0.20	5.4	050600010903	Morrow	40.459700	-82.951700	F,QL,C	143
V04G35	02-451-000	CLAYPOOL RUN NW OF ASHLEY @ PROSPECT-MT. VERNON RD.	1.06	3.8	050600010903	Morrow	40.433600	-83.016700	F,QL,C,B,N	144

Station	River Code	Site Name	River Mile	Area (mi^2)	HUC12	County	Lat.	Lon.	(refer to key in footnote) Sampling	Map #
V04G40	02-414-000	INDIAN RUN SW OF ASHLEY @ HORSESHOE RD.	1.05	4.0	050600011006	Delaware	40.400210	-83.033100	F,QL,C,B	145
V04Q27	02-412-000	HORSESHOE RUN NE OF DELAWARE @ PANHANDLE RD.	0.30	11.3	050600011007	Delaware	40.337560	-83.051600	F,QL,C,B	146
201442	02-409-000	DELAWARE RUN AT DELAWARE @ HENRY ST.	0.20	10.1	050600011007	Delaware	40.297260	-83.064600	F,QL,C,B	147
V04G45	02-400-014	BIG RUN (OLENTANGY 18.19) @ TAGGERT RD.	0.10	5.7	050600011101	Delaware	40.199700	-83.050200	F,QL,C,B	148

**Replicate map number due to proximity and consequent map overlap.*

M – modified reference site. R – reference site.

Code	Sample Type	Code	Sample Type	Code	Sample Type
F	Fish – 1 Pass	B	*E. coli* bacteria	S	Sediment
FT	Fish Tissue	C	Inorganic Chemistry	N	Nutrient Site
QL	Macroinvertebrate – Qualitative	O1	Organics – S-VOCs (semi-volatile organic compounds)	PWS	Public Water Supply
QT	Macroinvertebrate – Quantitative (HD)	O2	Organics -- herbicides and insecticides		
H	QHEI Only	LR	Chemistry – Large River Site		

Appendix 3. NPDES-Permitted Facilities

Nested Sub-watershed	Ohio Permit Number	Facility Name	Design Flow[1] (MGD)	Average Flow[2] (MGD)	Type of Waste	Stream and River Mile at Discharge	County
05060001-							
01-01	2PB00064*MD	Alger WWTP	0.15	0.1252	Public	UNT to Cottonwood Ditch at RM 5.1	Hardin
01-01	2PA00006*GD	McGuffey STP	0.12	0.0598	Public	Cottonwood Ditch at RM 1.10	Hardin
01-02	2PG00004*ID	Reed Road WWTP	0.0072	0.0009	Public	Scioto River at RM 231.0	Hardin
01-03	2IF00002*PD	Durez Corporation	0.355	0.0809	Industrial	Taylor Creek at RM 2.10	Hardin
01-03	2PY00041*ED	Green Hills Coach Park Ltd	0.002	0.0013	Public	UNT to Taylor Creek at RM 5.12	Hardin
01-04	2IN00168*FD	Central Ohio Farmers Co-Op- (Kenton Bulk Plant)	0.00035	0.0045	Industrial	Railroad tributary to the Scioto River	Hardin
02-01	1PB00025*ID	Rushsylvania WWTP	0.1	0.0901	Public	UNT to Rush Creek at RM 37.1	Logan
02-02	2IK00032*BD	Trillium Farm Holdings LLC - Layer Site 5	0	0.049	Industrial	McDonald Creek at RM 8.12	Hardin
03-01	2PG00036*HD	Grandview Estates SD 2A	0.28	0.0431	Public	UNT to Rocky Fork (4.15) at RM 6.0	Marion
03-01	2IJ00027*KD	National Lime & Stone Co Marion Plant	5.76	1.7	Industrial	Harvey Ditch	Marion
03-02	2IN00242*CD	Phoenix Bucyrus Industrial Investors LLC	---	---	Industrial	UNT to the Little Scioto River & Sandusky River	Crawford
03-02	2PT00049*DD	Ridgedale Elementary School	0.034	0.0038	Public	Little Scioto River via storm tile	Marion
03-03	2IW00322*AD	Aqua Ohio Water - Marion	1.73	0	Industrial	Little Scioto River	Marion
03-03	2PD00011*RD	Marion WPC	10.5	9.242	Public	Little Scioto River at RM 6.39	Marion
03-03	2IF00025*FD	POET Biorefining Marion LLC	0.3	0.1089	Industrial	Rock Swale Ditch at RM 2.75 and Little Scioto River	Marion
03-04	2PW00026*BD	Apple Lane Subdivision	0.0032	0.0043	Public	Honey Creek	Marion
03-04	2IN00170*FD	Central Ohio Farmers Co-Op Marion Bulk Plant	0.00073	0.0031	Industrial	Rock Swale Ditch	Marion
03-04	2PR00303*BD	Cruiser's Pizza Subs and Suds	0.0035	0.0003	Public	Honey Creek	Marion
03-04	2PG00072*HD	Harmony Subdiv SD 5B	0.01	0.0129	Public	Honey Creek at RM 1.8	Marion
03-04	2PW00004*ED	North Quarry Subdivision	0.02	0.0297	Public	Honey Creek at RM 3.4	Marion
03-04	2ID00017*ED	Nucor Steel Marion Inc	0	0.0171	Industrial	UNT to the Little Scioto River	Marion
03-04	2PR00040*FD	Pleasant Acres MH Community LLC	0.02	0.0159	Public	Honey Creek	Marion
03-04	2PT00048*DD	Pleasant Local Schools	0.035	0.018	Public	UNT to Honey Creek	Marion

Nested Sub-watershed	Ohio Permit Number	Facility Name	Design Flow[1] (MGD)	Average Flow[2] (MGD)	Type of Waste	Stream and River Mile at Discharge	County
03-04	2IN00052*ID	Sims Brothers Inc	0.009	0.3414	Industrial	UNT to Columbia Ditch	Marion
03-04	2II00104*ED	Whirlpool Corp - Marion Div	0.38	0.0576	Industrial	Rock Swale Ditch at RM 2.17	Marion
04-01	2IN00215*DD	Jumpin Jim's	0	0	Industrial	UNT to the Scioto River	Hardin
04-01	2PD00020*MD	Kenton WWTP	2.4	3.2088	Public	Scioto River at RM 211.40	Hardin
04-01	2PR00233*DD	Morton Buildings Inc WWTP	0.005	0.0367	Public	UNT to Gander Run at RM 1.94	Hardin
04-01	2PG00012*ID	Roots Fairwayview Subdiv	0.033	0.0445	Public	UNT to the Scioto River at RM 209.9	Hardin
04-02	2PA00046*GD	Mt Victory WWTP	0.09	0.2733	Public	Panther Creek at RM 6.8	Hardin
04-03	2PG00005*HD	Eldridge Station Hills WWTP	0.008	0.0009	Public	Scioto River at RM 204.9	Hardin
04-05	2PA00051*FD	LaRue WWTP	0.1	0.0863	Public	Scioto River at RM 194.5	Marion
04-06	2PA00065*GD	New Bloomington WWTP	0.125	0.0439	Public	UNT to the Scioto River	Marion
05-04	4PB00018*KD	Richwood WWTP	0.38	0.3085	Public	Fulton Creek at RM 9.6	Union
05-05	4IJ00111*CD	National Lime & Stone Co - Radnor Fac	3.6	---	Industrial	Scioto River via county tile	Delaware
05-05	2PA00041*KD	Prospect WWTP	0.24	0.1077	Public	Scioto River at RM 170.95	Marion
05-05	4IW00121*HD	Richwood Plant	0.025	---	Industrial	Fulton Creek at RM 9.5	Union
05-05	4PG00009*ID	Tawa Estates WWTP	0.0075	0.002	Public	UNT to Ottawa Creek (0.5) at RM 4.15	Union
06-01	1PZ00023*GD	Benjamin Logan High School	0.03	0.0613	Public	UNT to Mill Creek at RM 46.75	Logan
06-01	1PK00022*AD	Logan County Eastern Regional Sewer District WWTP	2.0	---	Public	Otter Creek at RM 2.73	Logan
06-02	4PH00037*DD	Liberty Twp Regional Treatment Facility	0.1	0.0184	Public	Mill Creek at RM 28.44	Union
06-02	4IM00102*FD	MAI Mfg	0.0025	0.0005	Industrial	Phelps Run via field tile	Union
06-02	4PG00006*HD	Parrott Village WWTP	0.02	0.0178	Public	Phelps Run at RM 4.07	Union
06-03	4PA00007*HD	Ostrander WWTP	0.09	0.0446	Public	Mill Creek at RM 3.95	Delaware
06-04	4PE00002*DD	Marysville WRF	8	4.3788	Public	Mill Creek at RM 9.25	Union
06-04	4PG00036*HD	Mill Creek Estates WWTP	0.105	0.054	Public	Mill Creek at RM 12.57	Union
06-04	4PV00014*HD	New Dover Estates MHP	0.035	0.0212	Public	UNT to Dun's Run (0.6) at RM 3.9	Union
06-04	4IJ00013*JD	Shelly Materials Inc - Ostrander	8.64	3.4954	Industrial	UNT to Mill Creek (3.55) at RM 2.70	Union
06-04	4IF00000*KD	The Scotts Company	---	---	Industrial	North Branch Crosses Run and Crosses Run	Union
07-02	4IK00005*FD	New Day Farms LLC - Mad River Facility	---	---	Industrial	UNT to Powderlick Run	Union

Nested Sub-watershed	Ohio Permit Number	Facility Name	Design Flow[1] (MGD)	Average Flow[2] (MGD)	Type of Waste	Stream and River Mile at Discharge	County
07-02	4IK00032*CD	New Day Farms, LLC (Farm 3 Facility)	---	---	Industrial	UNT to Powderlick Run	Union
07-02	4IJ00107*DD	Shelly Materials Inc - York Center Quarry	0.57	0.5695	Industrial	Bokes Creek at RM 25.2	Union
07-04	4IJ00103*ED	National Lime & Stone Co - Warrensburg Plt	2.41	0.4238	Industrial	Scioto River via culvert	Delaware
07-04	4IJ00029*ID	National Lime and Stone Co Delaware Plant	3	1.3	Industrial	UNT to Scioto River at RM 157.42	Delaware
08-01	2PD00030*QD	Galion WWTP	2.7	2.4862	Public	Olentangy River at RM 85.96	Crawford
08-01	2PW00013*DD	Sugar Grove Lake WWTP	0.01	0.0008	Public	Olentangy River at RM 75.25	Crawford
08-03	2IJ00074*LD	Glen-Gery Corp - Iberia Plant	2.99	0.1442	Industrial	Flat Run at RM 7.90	Marion
08-04	2PA00035*GD	Caledonia WWTP	0.0759	0.0508	Public	Olentangy River at RM 59.6	Marion
08-04	2IH00106*GD	Martel Bakery Mix LLC	0.015	0.0222	Industrial	Shumaker Ditch	Marion
09-02	4IN00212*BD	Asphalt Materials Inc - Edison Plant	0.0001	0.0896	Industrial	Whetstone Creek at RM 19.96	Morrow
09-02	4PU00005*JD	Candlewood Lake WWTP	0.149	0.0851	Public	Whetstone Creek at RM 30.25	Morrow
09-02	4PA00100*KD	Cardington WWTP	0.5	0.4344	Public	Whetstone Creek at RM 13.70	Morrow
09-02	4PA00000*ED	Edison WWTP	0.08	0.8918	Public	Whetstone Creek at RM 18.6	Morrow
09-02	4PB00102*JD	Mt Gilead WWTP	0.82	0.5818	Public	Whetstone Creek at RM 21.6	Morrow
09-02	4IN00201*CD	Mt. Gilead Petroluem Bulk Plant	0.003761	0.0026	Industrial	Whetstone Creek	Morrow
09-03	4IN00204*BD	Emerald BioEnergy	---	---	Industrial	No discharge - Biosolids storage/transfer facility	Morrow
10-01	2PY00015*ED	United Mobile Homes of Ohio - Wood Valley MHP	0.03	0.0257	Public	UNT to Olentangy River (0.17) at RM 57.82	Marion
10-02	2PR00039*FD	Blue Willow MHP	0.015	0.006	Public	Ulsh Ditch at RM 4.1	Marion
10-02	2PJ00002*ID	SD No 7 Water Reclamation Plant	1.75	1.3704	Public	Grave Creek at RM 3.16	Marion
10-03	2PR00189*ED	Riverbend Campground	0.0125	0.0025	Public	Olentangy River at RM 52.8 and 53.2	Marion
10-04	2PG00035*ID	Fountain Place WWTP SD 5A	0.1	0.0387	Public	Qu Qua Creek at RM 5.2	Marion
10-04	2PW00015*DD	Groves at Newmans Crossing POTW	0.022	0.0039	Public	Qu Qua Creek at RM 2.86	Marion
10-05	2PA00101*DD	Waldo WWTP	0.06	0.012	Public	Olentangy River at RM 39.76	Marion
10-06	4PP00022*AD	Delaware State Park	0.025	---	Public	Delaware Lake at RM 32.80	Delaware
10-07	4PX00001*ED	Berachah Church Waste Water Plant	---	---	Public	UNT to Olentangy River	Delaware
10-07	4PT00107*FD	Buckeye Valley Middle & High Schls	0.035	0.0031	Public	UNT to Olentangy River (2.27) at RM 28.79	Delaware
10-07	4PV00010*GD	Crystal Lake MHP	0.024	0.0371	Public	Horseshoe Run at RM 1.85	Delaware
10-07	4PV00106*FD	Delaware MHP	0.01	0.0048	Public	Olentangy River at RM 29.6	Delaware

Nested Sub-watershed	Ohio Permit Number	Facility Name	Design Flow[1] (MGD)	Average Flow[2] (MGD)	Type of Waste	Stream and River Mile at Discharge	County
10-07	4IZ00054*DD	Delaware WTP 2	1.73	0.9817	Industrial	Olentangy River at RM 30.96	Delaware
10-07	4PV00095*GD	Shroyers Homes MHP	0.0202	0.0172	Public	Olentangy River at RM 28.3	Delaware
10-07	4PN00001*HD	USDA Forest Service	0.012	0.0013	Public	Olentangy River at RM 32.12	Delaware
10-07	4IN00168*FD	Verity Enterprises	0.000103	0.0011	Industrial	Olentangy River via storm drain	Delaware
11-01	4IW00052*ID	Del-Co Water Co Inc	0.308	0.0506	Industrial	Olentangy River at RM 18.20	Delaware
11-01	4PD00004*PD	Upper Olentangy Water Reclamation Center	10	4.641	Public	Olentangy River at RM 25.27	Delaware
11-01	4PV00093*HD	Worthington Arms MHP	0.039	0.03	Public	UNT to Olentangy River (2.1) at RM 18.19	Delaware
11-02	4IW00021*HD	Aqua Ohio Water Co Inc - Worthington Hills WTP	0.097	0.0902	Industrial	Olentangy River at RM 12.57	Franklin
11-02	4PX00012*FD	Nissan North Inc	0.002	0.0014	Public	UNT to Olentangy River	Delaware
11-02	4IN00177*ED	ODOT Office of Aviation Fuel Farm Facility	0.0288	0.0004	Industrial	UNT to Olentangy River at RM 8.59	Franklin
11-02	4PK00001*MD	Olentangy Environmental Control Center	6	4.0665	Public	Olentangy River at RM 13.4	Delaware
11-02	4PR00001*BD	Speedway LLC #9247	0.00035	0.0003	Public	UNT to Olentangy River at RM 12.15	Delaware
11-03	4IN00012*ID	Battelle Memorial Institute	0.313	0.0175	Industrial	Olentangy River at RM 1.88	Franklin
11-03	4IN00099*GD	Evans Adhesive Corporation	0.010545	0.0118	Industrial	Olentangy River via storm drain and drainage ditch	Franklin
11-03	4IS00012*HD	Rail Products Intl - National Electric Coil Inc	0.0015	0.0214	Industrial	Olentangy River at RM 2.08	Franklin
11-03	4IN00051*FD	SunSprout Farms of Central Oh LLC	0.01	0.011	Industrial	UNT to Olentangy River via storm sewer	Franklin

1 Design flows that are greater than 1.0 million gallons per day (MGD) classify a facility as a major discharger.
2 Average flows are displayed for January 2019 through January 2024 unless otherwise noted.

Appendix 4. List of Physical/Chemical Parameters and Reporting Limits

Parameter	Method	Water (RL)	Sediment (RL)	Fish Tissue
Oxygen Demand				
BOD, 5 day	SM 5210B	2 mg/L		
cBOD, 20 day	OEPA 310.2	2 mg/L		
COD	SM 5220D	20 mg/L		
Physical Properties				
Alkalinity	USEPA 310.1	5 mg/L		
Hardness	USEPA 200.7	10 mg/L		
Dissolved Oxygen (mg/l and % saturation)	Field Meter/Sonde	0 mg/L 0% sat		
pH	Field Meter/Sonde	0 s.u.		
pH		0 s.u.	0 s.u.	
Specific Conductance	SM 2510B	1 µmhos/cm		
Specific Conductance	Field Meter/Sonde	1 µS/cm		
Temperature	Field Meter/Sonde	0 °C		
Total Dissolved Solids	SM 2540C	10 mg/L		
Total Suspended Solids	SM 2540D	5 mg/L		
% Solids	SM 2540G		0%	
% Lipids	OEPA 581.5			0%
Nutrients				
Ammonia-N	USEPA 350.1	0.05 mg/L	7 mg/kg	
Nitrate-Nitrite	USEPA 350.1	0.1 mg/L		
Nitrite	USEPA 353.2	0.02 mg/L		
Total Kjeldahl Nitrogen	USEPA 351.2	0.3 mg/L		
Total Phosphorus	USEPA 365.4	0.02 mg/L	50 mg/kg	
Orthophosphate (as P)	USEPA 365.4	0.01 mg/L		
Total Organic Carbon	SM 5310B	2 mg/L	0.1%	
Dissolved Organic Carbon	SM 5310C	2 mg/L		
Anions				
Carbonate/Bicarbonate	SM 2320B			
Chloride	USEPA 325.1	5 mg/L		
Sulfate	USEPA 375.2	10 mg/L		
Cations				
Aluminum	USEPA 200.7	200 µg/L	200 µg/L	
Barium	USEPA 200.7	15 µg/L	15 µg/L	

Parameter	Method	Water (RL)	Sediment (RL)	Fish Tissue
Calcium	USEPA 200.7	2 mg/L	2 µg/L	
Iron	USEPA 200.7	50 µg/L	50 µg/L	
Magnesium	USEPA 200.7	1 mg/L	1 µg/L	
Manganese	USEPA 200.7	10 µg/L	10 µg/L	
Potassium	USEPA 200.7	2 mg/L	2 µg/L	
Sodium	USEPA 200.7	5 mg/L	5 µg/L	
Strontium	USEPA 200.7	30 µg/L	30 µg/L	
Metals				
Zinc	USEPA 200.7	10 µg/L	8 mg/kg	
Arsenic	USEPA 200.8/SM 3113B	2 µg/L	0.8 mg/kg	0.05mg/kg
Beryllium	USEPA 200.8		20 µg/L	
Cadmium	USEPA 200.8/SM 3113B	0.2 µg/L	0.08 mg/kg	.004 mg/kg
Chromium	USEPA 200.8	2 µg/L	0.8 mg/kg	
Cobalt	USEPA 200.8		2 µg/L	
Copper	USEPA 200.8	2 µg/L	0.8 mg/kg	
Lead	USEPA 200.8/SM 3113B	2 µg/L	0.8 mg/kg	0.04 mg/kg
Nickel	USEPA 200.8	2 µg/L	0.8 mg/kg	
Selenium	USEPA 200.8/SM 3113B	2 µg/L	0.8 mg/kg	0.05 mg/kg
Silver	USEPA 200.8		0.08 mg/kg	
Titanium	USEPA 200.7		50 µg/L	
Vanadium	USEPA 200.7		50 µg/L	
Mercury	USEPA 245.1/SM 3113B		0.02 mg/kg	0.02 mg/kg
Bacteria				
Escherichia coliform	USEPA 1603	2 CFU		
Algal Biomass				
Chlorophyll-*α*	USEPA 445.0	1 µg/L		
Anatoxin	OEPA 706.0	0.4 µg/L		
Cylindrospermopsin	OEPA 703.0	0.05 µg/L		
Microcystin	OEPA 701.0	0.24 µg/L		
Saxitoxin	OEPA 702.0	0.022 µg/L		
Organic Compounds				
Chlorinated Herbicides	USEPA 515.1	40 µg/L		
Acid Herbicides	USEPA 525.2	200 µg/L		
Semi-volatile organics	USEPA 625	2-20 µg/L		
Semi-volatile organics	USEPA 8270C	2 – 10 mg/l	0.4-2 mg/kg	
Organochlorine Pesticides	USEPA 8082A/OEPA 590.1	1-10 µg/L	4 µg/kg	10 µg/kg

Parameter	Method	Water (RL)	Sediment (RL)	Fish Tissue
PCBs	USEPA 8082A/OEPA 590.1		20 µg/kg	50 µg/kg

Appendix 5 – Safety Contacts and Hospital Locations

Safety:	
County Wildlife Officers:	**County Sheriff:**
Crawford County – (419) 429-8380 Delaware County – (614) 902-4221 Franklin County – (614) 902-4212 Hardin County – (419) 429-8385 Logan County – (937) 441-5224 Marion County – (614) 902-4217 Morrow County – (614) 400-0756 Union County – (614) 315-4999	Crawford County – (419) 562-7906 Delaware County – (740) 833-2810 Franklin County – (614) 525-3360 Hardin County – (419) 673-1268 Logan County – (937) 592-5731 Marion County – (740) 382-8244 Morrow County – (419) 946-4444 Union County – (937) 645-4100
OEMA:	**State Highway Patrol:**
Crawford County – (419) 562-6009 Delaware County – (740) 833-2180 Franklin County – (614) 794-0213 Hardin County – (419) 674-2276 Logan County – (937) 593-5743 Marion County – (740) 223-4142 Morrow County – (419) 947-4041 Union County – (937) 645-3174	Crawford County – (419) 562-8040 Delaware County – (740) 548-6011 Franklin County – (614) 799-9241 Hardin/Hancock County – (419) 423-1414 Logan/Union County – (937) 644-8811 Marion County – (740) 383-2181 Morrow County – (419) 768-3955
Hospitals:	
Avita Health System - Bucyrus Hospital 629 N Sandusky Ave Bucyrus, OH 44820 (419) 562-4677	OhioHealth Lewis Center Health Center 7853 Pacer Dr Delaware, OH 43015 (614) 788-9000
OhioHealth Grant Medical Center 111 S Grant Ave Columbus, OH 43215 (614) 566-9000	OhioHealth Hardin Memorial Hospital 921 E Franklin St Kenton, OH 43326 (419) 673-0761
Mary Rutan Hospital 205 E Palmer Road Bellefontaine, OH 43311 (937) 592-4015	OhioHealth Marion General Hospital 1000 McKinley Park Dr Marion, OH 43302 (740) 383-8400
Morrow County Hospital 651 W Marion St Mt Gilead, OH 43338 (419) 946-5015	Memorial Hospital 500 London Ave Marysville, OH 43040 (937) 644-6115

Appendix 6 – Chemistry Sample Type/Parameter Crosswalk

Parameter	Chemistry	Nutrient Site	Large River Chemistry	Streams - PWS	Streams - O1	Streams - O2
SampleMaster Test Group	TG Stream Survey	TG Stream Survey Nutrient	TG Large River Summer	TG DSW Reservoir 4DW	sVOCs	Herbicides Pesticides
Alkalinity	X	X	X			
Aluminum	X	X	X			
Ammonia	X	X	X			
Anatoxin-a				X		
Arsenic	X	X	X			
Atrazine (ELISA)				X		
Barium	X	X	X			
BOD-5			X			
Bromide						
Cadmium	X	X	X			
Calcium	X	X	X			
Chloride	X	X	X			
Chlorophyll *a*			X			
Chromium	X	X	X			
COD	X	X	X			
Conductivity (Lab)	X	X	X			
Copper	X	X	X			
Corrected Conductance	X	X	X	X		
Cylindrospermopsin				X		
Dissolved Oxygen	X	X	X	X		
DOC						
Hardness, Total	X	X	X			
Herbicides (multiple analytes)						X
Insecticides (see Pesticides)						
Iron	X	X	X			
Lead	X	X	X			
Magnesium	X	X	X			
Manganese	X	X	X			
Microcystins				X		
Nickel	X	X	X			
Nitrate + nitrite	X	X	X	X		
Nitrite	X	X	X			

Parameter	Chemistry	Nutrient Site	Large River Chemistry	Streams - PWS	Streams - O1	Streams - O2
Orthophosphate, dissolved		X	X			
Pesticides (multiple analytes)						X
pH	X	X	X	X		
Potassium	X	X	X			
Saturation	X	X	X	X		
Saxitoxin				X		
Selenium	X	X	X			
Sodium	X	X	X			
Strontium	X	X	X			
Sulfate	X	X	X			
sVOCs - Organics (81 analytes)					X	
Temperature	X	X	X	X		
TKN	X	X	X	X		
TOC	X	X	X			
Total Dissolved Solids	X	X	X			
Total Phosphorous	X	X	X	X		
Total Suspended Solids	X	X	X			
Turbidity						
Uncorrected Conductance	X	X	X	X		
Zinc	X	X	X			