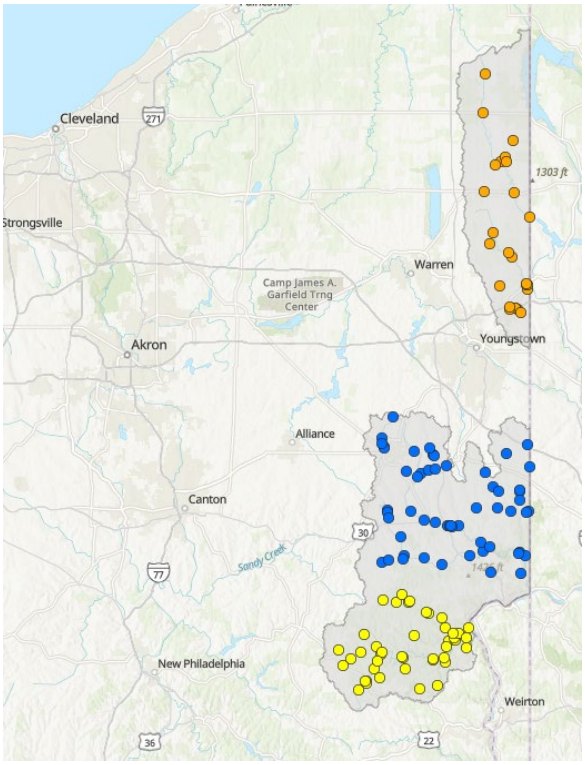
Quality Assurance Project Plan (QAPP) for the Biological and Water Quality Survey of the Pymatuning Creek, Yankee Run, Little Yankee Run, Little Beaver Creek, and Yellow Creek Watersheds

2022



Ohio EPA Technical Report AMS/2022-PYLBY-1
Division of Surface Water
July 2022

Quality Assurance Project Plan (QAPP) for the Biological and Water Quality Survey of the Pymatuning Creek, Yankee Run, Little Yankee Run, Little Beaver Creek, and Yellow Creek Watershed 2022

Version 1.0

July 2022

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Section A

A1. Title and Approval

Quality Assurance Project Plan for the Biological and Water Quality Study of the Pymatuning Creek, Yankee Run, Little Yankee Run, Little Beaver Creek, and Yellow Creek Watersheds, 2022

Archie L. Lunsey II — Date: July 27, 2022
Archie Lunsey, Division Assistant Chief

Date: July 20, 2022
Marianne Piekutowski, Assessment and Modeling Section Manager

Katherine K. Harris — Date: July 27, 2022
Katherine Harris, Quality Assurance Coordinator

Benjamin A Rich — Date: July 21, 2022
Benjamin Rich, Ecological Assessment Unit Supervisor

Bill Zawiski — Date: July 27, 2022
Bill Zawiski, NEDO District Water Quality Supervisor

Rachel Taulbee — Date: July 27, 2022
Rachel Taulbee, SEDO District Water Quality Supervisor

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

2C	Priority Pollutant Analyte List Form
AMD	Acid Mine Drainage
AMDAT	Acid Mine Drainage Abatement and Treatment
ALU	Aquatic Life Use
BLM	Biotic Ligand Model
Ca	Calcium
Cl	Chlorine
CWA	Clean Water Act
DES	Division of Environmental Services
DQO	Data Quality Objective
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
HUC	Hydrological Unit Code
IBI	Index of Biotic Integrity
ICI	Invertebrate Community Index
ID	Identification
IR	Integrated Report
ITS	Information Technology Services
K	Potassium
Mg	Magnesium
Na	Sodium
Mlwb	Modified Index of Well-being
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
OAC	Ohio Administrative Code
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
OSW	Outstanding State Water
QHEI	Qualitative Habitat Evaluation Index
pH	Potential Hydrogen
RL	Reporting Limit
SHQW	Superior High Quality Water
S-VOCs	Semi-volatile Organic Chemicals
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

A2. Table of Contents

List of Appendices

List of Figures

List of Tables

A3. Distribution List

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

Table 1 — Distribution List

Name/Title	Contact Email/Phone	
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Brian Alsdorf, Environmental Specialist 2	*brian.alsdorf@epa.ohio.gov*	(614) 721-8697
DSW Northeast District Office		
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DSW Southeast District Office		
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Rachel Taulbee, Environmental Supervisor	*rachel.taulbee@epa.ohio.gov*	(740) 380-5433
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Randy Spencer, Environmental Specialist 2	*randy.spencer@epa.ohio.gov*	(740) 380-5240
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Ruth Briland, Environmental Specialist 3	*ruth.briland@epa.ohio.gov*	(614) 369-4045
DES		
Jennifer Kraft, Environmental Manager	*jennifer.kraft@epa.ohio.gov*	(614) 644-3020
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

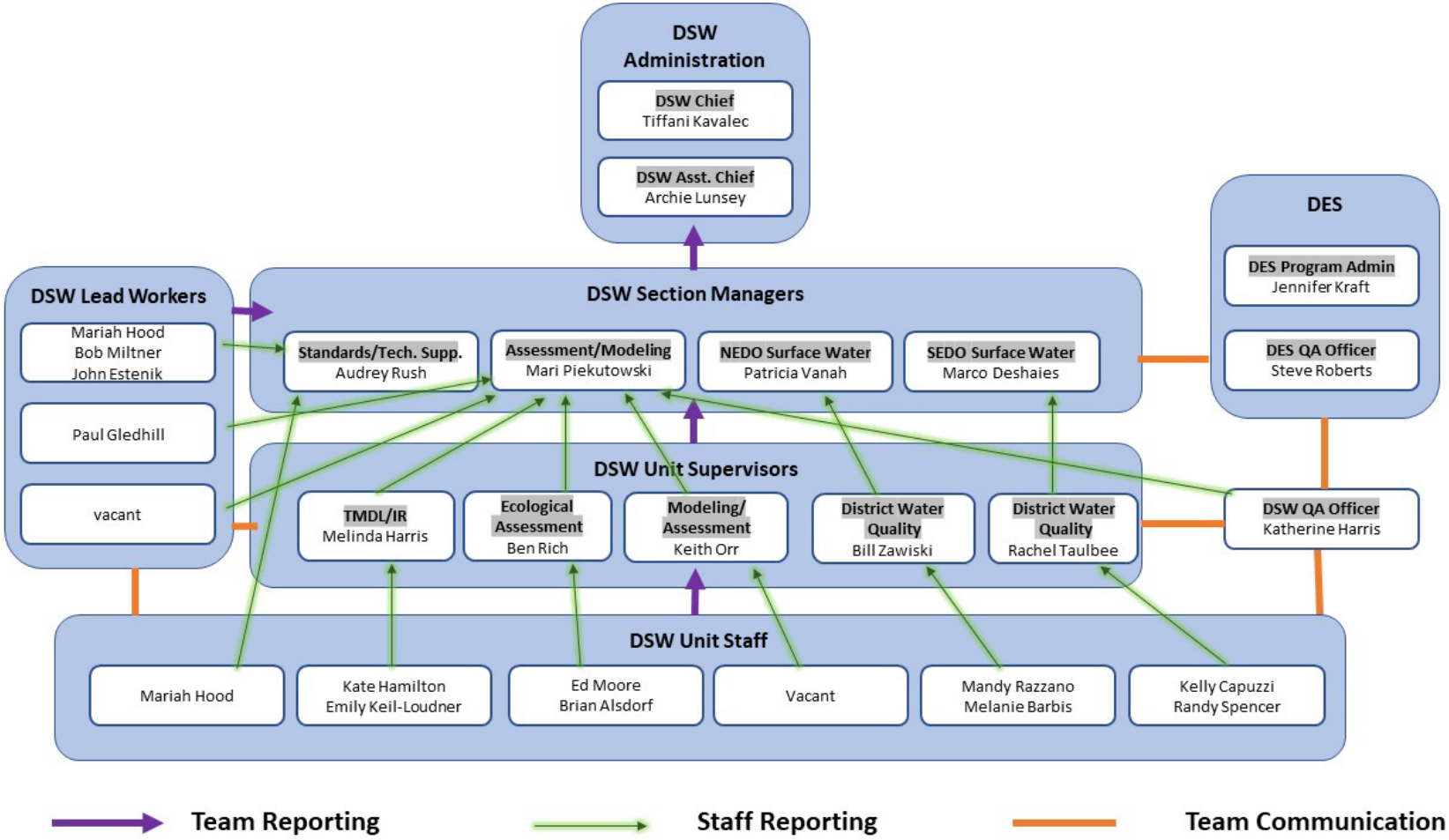
A4. Project Organization and Communication

Table 2 — Roles and Responsibilities.

Individual(s) Assigned:	Responsible for:	Authorized to:
Division of Surface Water		
Tiffani Kavalec/Archie Lunsey DSW Chief/Assistant Chief	Overall administration of division.	Confirm project existence; approve staff and capital resources; approve plans; edit reports.
Mari Piekutowski Assessment & Modeling Section Manager	Overall management of monitoring section.	Assign staff; approve plans; edit reports.
Melinda Harris TMDL and IR Unit Supervisor	Coordination of biennial Integrated Report update; TMDL program development.	Assign and support staff; edit reports.
Kathryn Hamilton TMDL Staff	Leading TMDL projects.	Write assigned TMDL sections.
Keith Orr Modeling & Assessment Unit Supervisor	Supporting modeling field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Paul Gledhill Modeling & Assessment Unit Staff	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.
Audrey Rush Standards and Tech Support Section Manager	Quality management (QAPPs, SOPs); staff training; water quality standard rules.	Approve plans and edit reports.
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.
Katherine Harris Standards and Tech QA Officer	DSWs quality management program.	Develop and implement field QA/QC guidelines. Track field QA/QC and staff training.
Mariah Hood Standards and Tech Support Lead Worker	Water quality standard criteria development and rule updates.	Help plan study. Make recommended beneficial use changes.
Vacant Standards and Tech Support Staff	Representing agency in fish and wildlife consumption and contact advisory matters.	Help plan study. Make waterbody specific consumption and contact advisory recommendations.
Ben Rich Ecological Assessment Unit Supervisor	Supporting biological field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Heidi Babos-Ford Ecological Assessment Unit Lead Worker	Assist with property access, track project progress, managing data and compiling information for Integrated Report.	Provide landowner information for access consent. Upload fish, bug, and chemistry data into EA3. Review and comment on reports. Write assigned Integrated Report sections.
Brian Alsdorf Ecological Assessment Unit Fish Crew Leader	Fish population and stream habitat assessments.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.

Individual(s) Assigned:	Responsible for:	Authorized to:
Ed Moore Ecological Assessment Unit Bug Crew Leader	Macroinvertebrate population assessments.	Help plan study. Schedule and complete assigned field activities. Tabulate data and write discussion for technical report.
Patricia Vanah District Surface Water Section Manager	Implementing division goals at the district level.	Review documents and reports; suggest changes and edits; obtain approvals and signatures.
Joe Trocchio-NEDO **Rebecca Warner**-NEDO **Patrick Slattery**-NEDO Permits & Enforcement Lead Worker	NPDES permit related issues.	Obtain wastewater and storm water permit information needed for planning and reporting.
Bill Zawiski District Water Quality Unit Supervisor	Supporting water quality field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
Mandy Razzano **Melanie Barbis** 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.
Marco Deshaies District Surface Water Section Manager	Implementing division goals at the district level.	Review documents and reports; suggest changes and edits; obtain approvals and signatures.
Annika Gurrola Permits & Enforcement Lead Worker	NPDES permit related issues.	Obtain wastewater and storm water permit information needed for planning and reporting.
Kelly Capuzzi **Randy Spencer** 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.
Rachel Taulbee District Water Quality Unit Supervisor	Supporting water quality field crews with supplies, equipment, and training.	Obtain approvals and signatures; develop budgets; conduct field audits; edit reports.
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		
Ruth Briland (CO)	Harmful Algae Bloom program implementation.	Coordinate with DSW on drinking water intake and inland lake monitoring.

Figure 1 — Organization Chart.



A5. Problem Definition & Background

Watershed Monitoring and Assessment History

Biological and water quality studies were previously completed in Pymatuning Creek, Yankee Run, and Little Yankee Run in 1994 and 2008. Little Beaver Creek was previously studied in 1999. Yellow Creek was studied in 2005. Streams determined to be impaired in those studies were recommended for pollutant load reduction in Total Maximum Daily Load (TMDL) evaluations. The Little Beaver Creek TMDL was completed in 2005. The Yellow Creek TMDL was completed in 2010. A Loading Analysis Plan for Pymatuning Creek, Yankee Run, and Little Yankee Run was presented in 2020. Because natural conditions were responsible for most Pymatuning Creek impairment, a TMDL would be ineffective and was not developed. Impoundments, channel modification, and runoff from farms or home sites impaired some streams in previous Yankee Run, and Little Yankee Run studies. Where pollutants influenced that degradation a TMDL may be produced subsequent to the findings of this investigation.

Little Beaver Creek and reaches of principal tributaries, West, Middle, and North Forks were designated as National and State Scenic Rivers in 1974. Pymatuning Creek gained State Scenic River status in 2018. For inclusion in Ohio's Scenic River Program a stream must have outstanding natural or cultural features and a local constituency who advocate for maintaining those qualities. With forest covering 72 percent of the Yellow Creek basin (Little Beaver C.=45%, Pymatuning C.=34%, Yankee and Little Yankee Runs=44% forested), it also has impressive natural attributes.

Yankee Run and Little Yankee Run have less agricultural land (23%) compared to the other study basins (Little Beaver C.=47%, Pymatuning C.=50%, Yellow C.=26% agricultural). Located north, next to Youngstown and east, near Warren, the Yankee watersheds are the most developed (19%) of the study area basins. Interstate Route 80 bisects Little Yankee Run, facilitating access to numerous nearby wastewater injection wells and a proposed landfill.

In the 2005 Yellow Creek study, Town Fork downstream from Jefferson Lake State Park was impaired by organic loading derived from excessive algal growth in the impoundment. Harmful Algal Blooms (HABs) were recorded in Jefferson Lake in 2014. Non-motorized boats are permitted on the diminishing Lake; dammed since 1934/ 1946.

Stream sedimentation is a prevalent water quality issue throughout Ohio. Excessive fine silt settles along stream margins and within interstitial voids, effectively clogging the filtering capacity of the stream bed. Sedimentation effects are worse where stream flow is checked by impoundment and where low gradient is less conducive to aggregate transport. Thus, Pymatuning Creek is especially vulnerable to sediment pollution. But the high gradient streams of Yellow and Little Beaver Creek are also at risk. Needless infusion of sediment from poorly considered ATV trails, barren construction sites, and inadvisable agricultural practices are obvious sources. Those conditions will be observed and noted during the 2022 study.

As part of Ohio's statewide monitoring strategy, biological and water quality assessments will be completed during 2022 field season in the Upper Ohio River tributaries study area. The study area is situated along Ohio's eastern border. Portions of Ashtabula, Trumbull, Mahoning, Columbiana, Carroll, and Jefferson Counties are within the study area. Sub-basins within two 8-digit hydrologic unit codes

(HUCs) are within the study area: 05030101, Upper Ohio Watershed and 05030102, Shenango Watershed. The study area 12-digit watershed assessment units (WAUs) are listed in Table 3. Sample locations are listed in Appendix Table 2 and visually represented in Figure 2. Information collected as part of this survey will support the Data Quality Objectives listed in A7. See the ***Ohio EPA's TMDL Webpage*** for Information regarding previous Upper Ohio River tributary studies.

A6. Project Description

The study area encompasses five discrete watersheds: Pymatuning Creek, Yankee Run, Little Yankee Run, Little Beaver Creek and Yellow Creek. Previously, these basins were assessed in three different surveys.

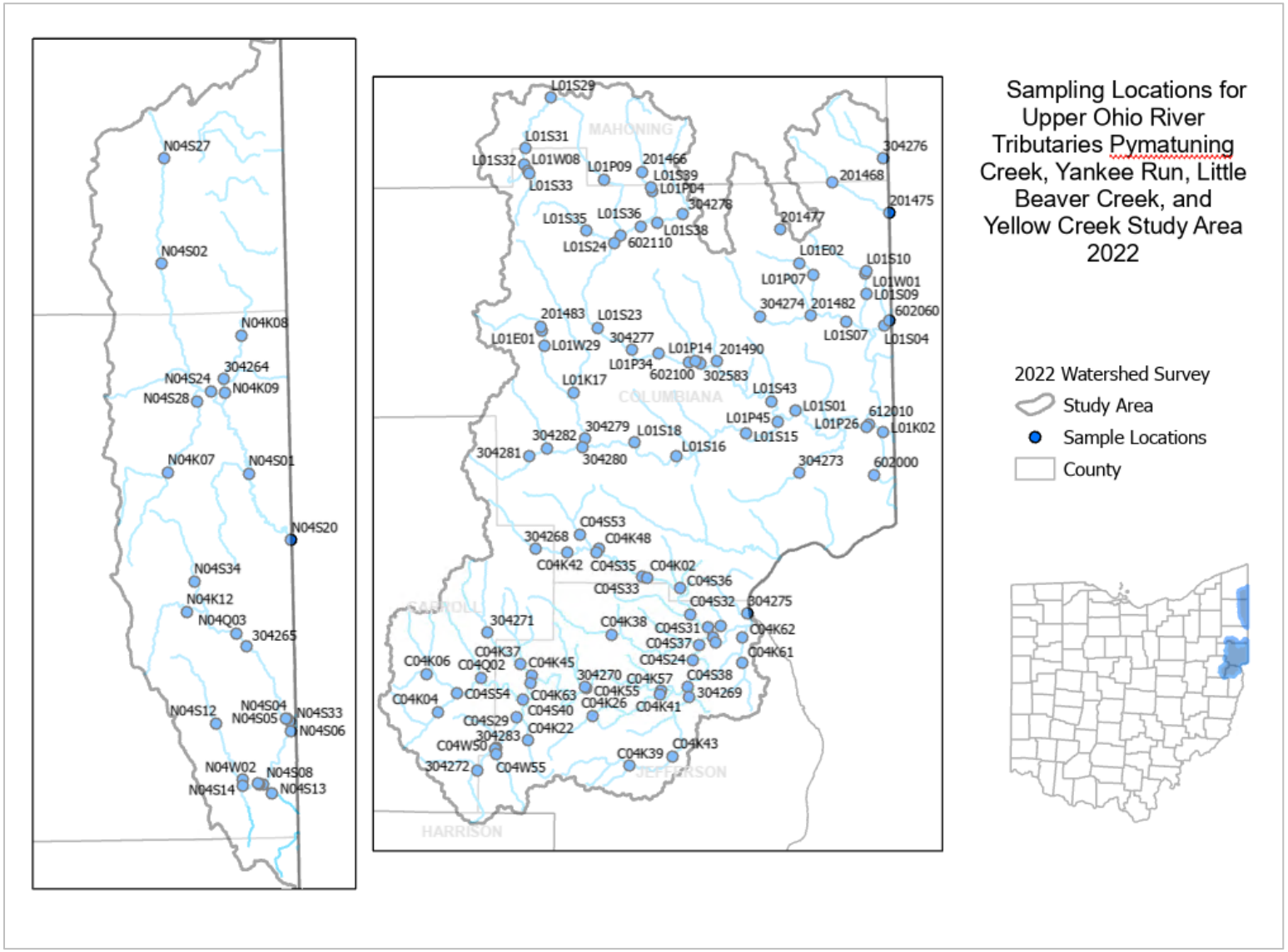
Nine sites in 1994 and seven sites in 2008 were utilized to evaluate the mainstem of Pymatuning Creek. Five mainstem Pymatuning Creek sample sites are anticipated in this study. Similar comparisons for other mainstems follow: Yankee Run 1994-3 sites, 2008-4 sites, and 2022-5 sites; Little Yankee Run 1994-5 sites, 2008-6 sites, and 2022-5 sites. Seven 2005 mainstem Yellow Creek sample sites are repeated in this study. Five similar Yellow Creek locations were monitored in 1983. Three mainstem Little Beaver Creek locations are also biological reference sites. Those sites are scheduled for sampling in 2022, duplicating the 1999 and 1985 prior assessments. The North Fork Little Beaver Creek arises in Ohio, flows through Pennsylvania, and returns to Ohio to join its parent stream near Fredricktown. Two upper reach sites sampled in 1999 will be repeated in 2022. Four sites in the seven-mile-long lower reach sampled in 1999 and 1985 will be supplanted by two of those locations in this study. The West Fork Little Beaver Creek was assessed at six locations in 1999. Before that, the most downstream 13 river miles were investigated at four to six sites in 1990, 1989,1987, and 1985. In 2022, sampling is planned at seven West Fork Little Beaver Creek sites. The Middle Fork Little Beaver Creek was evaluated at 15 sites in 1985 and 18 sites in 1999. Whereas 12 sites are slated in 2022.

Ohio EPA's routine field season spans from May 1st to October 31st. Biological and nutrient sampling occurs from June 15 to October 15.

Table 3 – List of Watershed Assessment Units (WAU) in Study Area

HUC8	HUC10	HUC12	
05030101	Upper Ohio Watershed		
	05030101		
		050301010401	East Branch Middle Fork Little Beaver Creek
		050301010402	Headwaters Middle Fork Little Beaver Creek
		050301010403	Stone Mill Run-Middle Fork Little Beaver Creek
		050301010404	Lisbon Creek-Middle Fork Little Beaver Creek
		050301010405	Elk Run-Middle Fork Little Beaver Creek
		050301010501	Cold Run
		050301010502	Headwaters West Fork Little Beaver Creek
		050301010503	Brush Creek
		050301010504	Patterson Creek-West Fork Little Beaver Creek
		050301010601	Longs Run
		050301010602	Honey Creek
		050301010603	Headwaters North Fork Little Beaver Creek
		050301010604	Little Bull Creek
		050301010605	Headwaters Bull Creek
		050301010606	Leslie Run-Bull Creek
		050301010607	Dilworth Run-North Fork Little Beaver Creek
		050301010608	Brush Run-North Fork Little Beaver Creek
		050301010609	Rough Run-Little Beaver Creek
		050301010610	Bieler Run-Little Beaver Creek
		050301010701	Headwaters Yellow Creek
		050301010702	Elkhorn Creek
		050301010703	Upper North Fork
		050301010704	Long Run-Yellow Creek
		050301010801	Town Fork
		050301010802	Headwaters North Fork Yellow Creek
		050301010803	Salt Run-North Fork Yellow Creek
		050301010804	Hollow Rock Run-Yellow Creek
05030102	Shenango Watershed		
	0503010203		
		050301020301	Headwaters Pymatuning Creek
		050301020302	Sugar Creek-Pymatuning Creek
		050301020303	Stratton Creek-Pymatuning Creek
		050301020304	Booth Run-Pymatuning Creek
	0503010206		
		050301020601	Yankee Run
		050301020602	Little Yankee Run

Figure 2- Sampling Locations

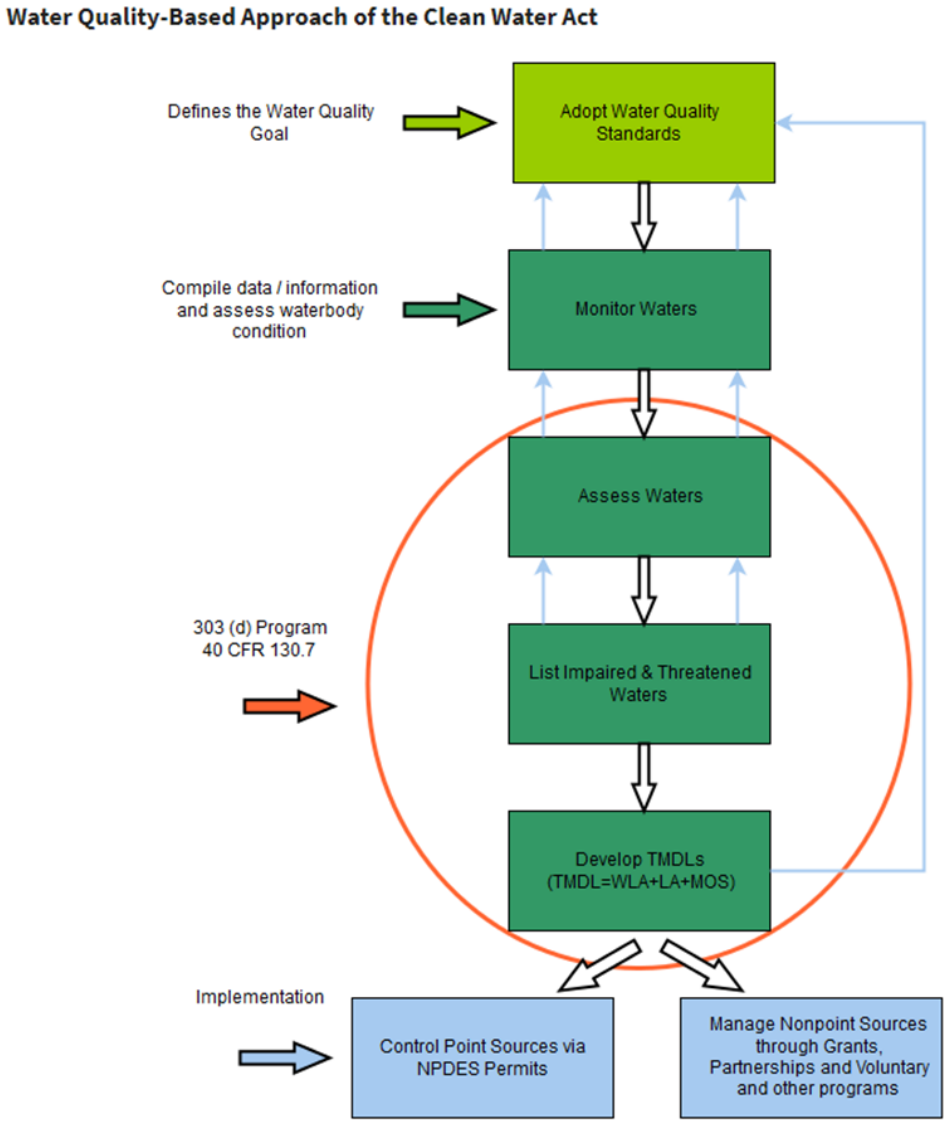


A7. Data Quality Objectives

The data collected during this watershed survey fulfills multiple objectives:

- Assess and report on the status of Water Assessment Units (WAUs) as required by the Clean Water Act (CWA) 305(b) and 303(d)
- Assess causes and sources of impairment
- Support water quality standards development
- Provide data for the Ohio Fish Tissue Consumption Monitoring Program
- Support the National Permit Discharge Elimination System (NPDES) permitting
- Total Maximum Daily Load (TMDL) development and implementation

Figure 3- 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 Clean Water Act (CWA), Ohio EPA is required to assess and report on the quality of Ohio's waters. Ohio EPA determines attainment/non-attainment status of water quality standards in three main ways:

- Biological assessments determine attainment/non-attainment of aquatic life uses (ALU) as codified in OAC 3745-1-07, Table 7-1. Numerical biological criteria are based on multi-metric biological indices including the Index of Biotic integrity (IBI) and Modified Index of Well-being (MIwb), indices measuring the response of the fish community; and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community. Performance expectations for the basic aquatic life uses (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH]) were developed using the regional reference site approach (Hughes et al. 1986, Omernik 1987).

- *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 water quality standards 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 water quality standards. To support this objective, at 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. 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 a minimum of 48 continuous hours of diel dissolved oxygen flux, pH, temperature, and specific conductance measurements. Benthic and/or sestonic chlorophyll *a* 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 *a* 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 SVOC pass is conducted district 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.

Support Water Quality Standards Development

- **Beneficial Use Designations**: The collection of biological, habitat, chemical and bacteria data is necessary to verify current designated uses and allows for updated recommendations as appropriate. Current beneficial use designations for the Upper Ohio River Tributaries can be found in the following Ohio Water Quality Standards Chapters: ***3745-1-13*** (Yellow Creek), ***3745-1-15*** (Little Beaver Creek), , ***3745-1-25*** (Pymatuning Creek, Yankee Run and Little Yankee Run). Streams that have a plus (+) symbol have been field verified and streams with and asterisk (*) symbol have not been field verified. Many smaller streams in the watershed are not listed in the water quality standards. While it would be difficult to sample all of these drainages, unverified and streams not listed in the water quality standards for the Upper Ohio River Tributaries have been identified in Appendix 6. These streams will be sampled as time allows or in future surveys.

- **Antidegradation**: The collection of biological, chemical and habitat data will be used to determine if existing uses are being protected and to also support updates to the State's list of special high-quality waters. Streams in the Yellow Creek watershed that are listed as Superior High Quality Water (SHQW) include Center Fork, Elkhorn Creek, Trail Run, Nancy Run, and Strawcamp Run. Yellow Creek was also proposed as SHQW during the previous survey, but the designation did not go through. Yellow Creek is designated EWH and has state endangered eastern hellbenders. Streams in the Beaver Creek watershed that are listed as Outstanding State Waters based on exceptional ecological value include Little Beaver Creek, Middle Fork Little Beaver creek - Middle run (RM 8.57) to the mouth, North Fork Little Beaver creek - Pennsylvania state line (RM 7.75) to the mouth and West Fork Little Beaver creek - Brush creek (RM 15.99) to the mouth. The Antidegradation rule can be found in the Ohio Water Quality Standards Chapter 3745-1-05: ***https://epa.ohio.gov/static/Portals/35/rules/01-05.pdf***.

Provide Data for the Ohio Fish Tissue Consumption Monitoring Program

Fish tissue samples will be collected from reach specific locations as part of the Ohio Fish Tissue Consumption Monitoring Program. The Middle Fork Little Beaver Creek is divided into upstream and downstream reaches at SR 14 (RM 26.6). Little Beaver Creek is a complete reach, separate from others. Fish from the most downstream part of Yellow Creek were the basis for an existing advisory. Other study area stream reaches may be defined pursuant to new fish tissue collections. For a particular sport fish species, three samples are desired from within the defined reaches to inform the existing advisory status. Fillet samples of edible-size sport fish will be tested for organochlorinated pesticides, PCBs, mercury, lead, cadmium, arsenic, and selenium. Results will be used for the Ohio Sport Fish Consumption Advisory Program and to determine attainment status of non-drinking water human health criteria presented in the Integrated Report. That attainment status is based on tissue samples from fish that represent different trophic levels. For a particular Watershed Assessment Unit (WAU /12-digit HUC) four tissue samples, two from each trophic level are minimally necessary. Often acquiring common carp and another game fish in the requisite triplicate samples per reach for the consumption advisory is also sufficient for the pertinent human health attainment status determination.

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. Stream water and effluent chemistry samples will be collected to specifically assess twelve wastewater

treatment plant (WWTP) discharges at Hubbard, Brookfield, Kinsman, New Waterford, East Palestine, Salem, Elkton, Leetonia, Washingtonville, Guilford Lake, Salineville, and Amsterdam WWTPs.

TMDL Implementation

The Total Maximum Daily Load (TMDL) program, established under Section 303(d) of the Clean Water Act, 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 Integrated Report. 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 Water Quality Standards (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.

A8. Special 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.

A9. Documents and Records

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

https://epaportal.sp.ohio.gov/dsw/waterqual/SitePages/Home.aspx?RootFolder=%2Fdsw%2Fwaterqual%2FShared%20Documents%2FWater%20Quality%20Studies%2F2019%2FAuglaize%20River%20%28upper%29%2F1%20%2D%20Study%20Plan&FolderCTID=0x0120004B0C401D7828204DAEDD6A7ADA6DD1A4&View=%7bCBC22BD2-C45C-4217-A97E-2F1B5DFD3D34%7d

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 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 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 QC, adds comments and completes edits if necessary and approves the sheet. All data approved in EA3 is sent to U.S. EPA's Water Quality Exchange.

Datalogger temperature data files will be created for each stream location. The district study team will download the data files from the dataloggers and transmit them to the Assessment and Modeling Section staff for data reduction and analysis.

Original fish and QHEI data sheets will be retained at the Groveport Field Office. Data from the field sheet is manually entered into the EA3 database using the appropriate data entry screen. The sheets are double entered to minimize mistakes.

Section B. Data Generation and Acquisition

B1. Sampling Process and Design

Coldwater habitat (CWH) aquatic life use designation recommendations based on the 2005 Yellow Creek study were not submitted for rulemaking. Coldwater conditions have been further characterized since then. Although Yellow Creek tributaries that were recommended for CWH had the associated aquatic assemblages and met, and still meet, the requisite criteria, the 2022 study is a propitious opportunity to obtain additional temperature data. However, as discussed in A6 above, most of the small coldwater streams assessed in 2005 will not be evaluated in this study.

Since the previous study, new technology in the form of small probes which continuously log temperature data have become widely available. Recognizing the opportunity to obtain cold stream temperature data from a multitude of suitable headwaters, these loggers will be deployed at unverified water bodies listed in Appendix Table A-6.

B2. Sampling Methods

See ***Technical Bulletins*** for Ohio EPA's Surface Water Field Sampling Manual.

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 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 sampling location using pulsed DC headwater, wading or boat electrofishing methods depending on watershed size at each sampling zone. Some larger drainage area locations will be sampled twice during the sampling index period. The number of passes will be adjusted to accommodate field crew logistics with preference to revisit sites near permitted entities or locations that may be subject to seasonal variability. 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.

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. 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 via overnight courier to Ohio EPA's Division of Environmental Services (DES) for analyses. Field measurements of dissolved oxygen, pH, temperature, and conductivity will be made using YSI Professional Plus 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

Continuous multi-parameter measurement sondes will be deployed at 31 locations. Sonde surveys should be done during stable, baseflow conditions. Ideally, each site targeted will have 2 surveys done. Water quality sondes will be placed at select locations (indicated in Appendix 2) to evaluate diel measurements of dissolved oxygen, pH, temperature, and conductivity. The sonde deployment goal is to capture a minimum of 48 continuous hours. 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 will have at least 5 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 Ohio EPA's DES within six hours of sample collection. All samples will be analyzed for *E. coli* bacteria using U.S. EPA-approved methods.

Temperature

Continuous temperature measurements will be co-located with the artificial substrates using Onset HOBO Water Temperature Pro v2 Data Loggers. The sampling will be conducted in accordance with procedures outlined in the Surface Water Field Sampling Manual Section G, Standard Operating Procedure for Continuous Temperature Data Logger Deployments. The loggers are accurate to approximately 0.2°C with an expected drift of approximately 0.1°C per year. Accuracy of the logger will be tested against a calibrated thermometer prior to deployment, ensuring the readings are within the accuracy range provided by the manufacturer. A stream temperature datapoint will be collected every 30 minutes from July 1 through August 31 to determine the temperature regime for the streams during this time.

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 Ohio EPA- DES for analyses.

Sediment

Sediment sampling will be conducted at 63 locations (Appendix Table 2). 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 Table 4. Collected sediment will be placed into appropriate containers, placed on ice (to maintain 4°C) and shipped to Ohio EPA-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 edible size. Species preferred for analysis include channel catfish, common carp, sauger, and smallmouth bass from Little Beaver Creek; common carp, flathead catfish, freshwater drum, sauger, smallmouth bass, and smallmouth buffalo from Middle Fork Little Beaver Creek; and freshwater drum from Yellow Creek. Any species are desired from Pymatuning Creek, Yankee Run, Little Yankee Run, or other study stream reaches. 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 Table 2 and the parameters to be analyzed are listed in Table 4. Fish used for tissue analysis will be filleted in the field using decontaminated stainless-steel fillet knives. Samples will be wrapped in aluminum foil, 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 2012). 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.

Lake Sampling

Lake sampling will be done once per month May through September for a total of five (5) sampling events. Grab samples of lake water will be collected at 0.5m below the surface and 0.5m above the bottom from the deepest portion of the lake and analyzed for the list of the parameters in Appendix 4. Algal biomass, algal toxin and atrazine testing will only be done in the surface sample. Three sets of surface samples (spring, summer, fall) will also be submitted for species level phytoplankton cell counts and bio-volume estimates. A water column field reading profile (temperature, DO, percent DO saturation, pH and conductivity) will be done at the chemistry station at either 0.5m or 1.0m intervals. All field practices will follow guidelines in the Appendix I of the Surface Water Field Sampling Manual (Ohio EPA 2019e).

B3. Sample Handling and Custody

Sample Master® software is used by DES to manage laboratory information. A guidance manual for use of the software is in Appendix IV of the Surface Water Field Manual (2019d). 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.

B4. Analytical Methods

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

B5. Quality Control

Stream Habitat Evaluation

To ensure technical proficiency and promote standardized observations between and among all Ohio EPA field staff tasked with habitat 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 is 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

Continuous multi-parameter measurement sondes will be deployed at 31 locations. Sonde surveys should be done during stable, baseflow conditions. Ideally, each site targeted will have two surveys done. Water quality sondes will be placed at select locations (indicated in Appendix 2) to evaluate diel measurements of dissolved oxygen, pH, temperature, and conductivity. The sonde deployment goal is to capture a minimum of 48 continuous hours. 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 (Ohio EPA 2021c). Section F of Appendix II outlines equipment preparation, deployment, equipment retrieval, data management, quality control testing, and maintenance.

Temperature Data

Battery-life and quality assurance of the loggers will be tested prior to deployment and upon retrieval. QA of the loggers will be tested by a method called herd calibration. This is done by placing groupings of the loggers into a homogenized water bath and recording the temperature every minute for approximately 15 – 20 minutes. The deviation of each individual logger should be within 0.5°C from the group average. Loggers that fail the QA test during the pre-deployment test will not be deployed.

Upon receipt of temperature data, the data will go through an initial review process to flag/remove anomalous data. Anomalous data could be a result of a malfunction of the probe or an indication that

the probe was not reading accurate information which could occur if the probe was not continuously submerged underwater, became buried under fine sediment, etc. Methods employed will take advantage of the ContDataQC R package developed by Tetra Tech, Inc (***https://github.com/leppott/ContDataQC***). Data will be evaluated in a manner consistent with Ohio EPA's Standard Operating Procedure for the Analysis of Continuous Temperature Data for Determining Coldwater Habitats. See Appendix II, Section G of the Surface Water Field Manual for guidelines

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 in 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

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 (Ohio EPA 2021) and delivered to Ohio EPA-DES for analyses.

Sediment

Ten percent of the number of sediment samples should be collected as quality control samples, approximately 5 percent should be duplicates and 5 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 procedures outlined in Appendix IV in the Surface Water Field Sampling Manual.

B6. Instrument/Equipment Testing, Inspection and Maintenance

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

B7. Instrument Calibration and Frequency

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 Section D and Appendix II of the Surface Water Field Sampling Manual. Other equipment used will follow specifications provided in the biological and habitat methods cited.

B8. Inspection/Acceptance of Supplies

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.

B9. Data Acquisition Requirements for Non-Direct Measurements

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

B10. Data Management

The data management process is shared by the Division of Surface Water (DSW) and Division of Environmental Services (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 IR reports. 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.

Section C. Assessment and Oversight of Data Collection

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 field 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.

The datalogger installations will be visited periodically over the summer to make sure the logger remains in place within the stream. The dataloggers will be checked as soon as possible after large storm events which may dislodge or bury a logger. It is critical to reset the logger as soon as possible to prevent the

loss of no more than several days of the entire data record. Weather and stream conditions will also be monitored if streams are at risk of going dry. Loggers may need to be relocated to deeper pools in the same area.

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.

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 quality assurance staff.

The TSD will report 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.

Section D. Data Validation and Usability

D1. Data Review, Validation and Verification Requirements

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 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 fish, macroinvertebrate, and habitat 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. Validation and Verification Methods

Biological and habitat field sampling results will be verified and validated based on field staff experience and qualifications and adherence to training and QA/QC procedures for current and new field staff 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 recently clarified DSW procedures available in Section I of 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 (defined below) 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.

D3. Reconciliation with Data Quality Objectives

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.

Appendix 1. Summary of Sampling Effort*

Type of Sample	# of sites	# of passes	Total #
Biology			
Fish < 20 mi^2	69	1	69
Fish > 20 mi^2	47	1-2	66
Macroinvertebrate (Quantitative)	47	-	47
Macroinvertebrate (Qualitative)	69	-	69
Fish Tissue			
Fish Tissue	12	1-2	12+
Water Quality			
Inorganic Samples	127	5	635
Nutrient (sonde deployment & Chlorophyll-a)	31	-	31
Organics	4	-	4
Temperature Dataloggers	20	-	20
Sediment Quality			
Organics and Inorganics	55	1	55
Bacteria			
E. coli Cultures	93	5	465

* Numbers do not include the sampling at potential supplemental sampling locations. Including the supplemental sampling locations in the survey will be dependent on the availability of field staff resources

** If staffing resources allow, an additional chemistry pass will be conducted

Appendix 2. Streams, Sampling Locations, and Sampling Types

Station	Site Name	River Mile	Area (mi^2)	Stream Code	HUC12	Lat.	Lon.	Sampling (refer to key below)
304278	E. Br. M. Fk. L. Beaver Creek Sr 164 Kelly Park Rd.	4.75	8.5	08-206-000	50301010401	40.8777	-80.7262	F,M,C,B,L
L01S38 **R**	E. Br. M. Fk. L. Beaver Creek @ Leetonia Rd.	2.98	14.4	08-206-000	50301010401	40.8720	-80.7523	F,M,C,S, B,L
L01S36	Leetonia WWTP Outfall To E. Br. M. Fk. L. Beaver Creek	1.94	28.0	08-206-000	50301010401	40.8693	-80.7680	C, B
602110	E. Br. M. Fk. L. Beaver Creek At Mouth @ Lisbon-Canfield Rd.	0.02	31.0	08-206-000	50301010401	40.8629	-80.7890	N,F,M,C,S,B,L
201466	Cherry Valley Run @ Garfield Rd.	3.60	8.5	08-207-000	50301010401	40.9107	-80.7656	F,M,C,B,L
L01S39	Washingtonville WWTP 001 Outfall To Cherry Valley Run	2.40	9.0	08-207-000	50301010401	40.8985	-80.7576	C,B
L01P04	Cherry Valley Run Dst. Washingtonville WWTP	2.10	9.1	08-207-000	50301010401	40.8954	-80.7562	F,M,C,S,B,L
L01S33	M. Fk. L. Beaver Creek Upst. Salem WWTP	38.3	4.2	08-200-000	50301010402	40.9114	-80.8797	F,M,C,S,B,L
L01W08	Salem WWTP 001 Outfall To M. Fk. L. Beaver Creek	38.2	4.2	08-200-000	50301010402	40.9125	-80.8801	C,B
L01S32	M. Fk. L. Beaver Creek Upst. Allen Rd.	37.7	6.1	08-200-000	50301010402	40.9182	-80.8848	F,M,C,S,B,O1,O2,L
L01S31	M Fk L Beaver Crk NW Of Salem @ Pine Lake Rd (Upst Crossing)	36.7	8.3	08-200-000	50301010402	40.9301	-80.8831	N,F,T,M,C,S,B,O1,O2
L01S29	M. Fk. L. Beaver Creek N Of Salem @ St. Rt. 45	31.98	18.9	08-200-000	50301010402	40.9684	-80.8559	N,F,T,M,C,B

L01P09	M. Fk. L. Beaver Creek E Of Salem @ St. Rt. 14	25.57	33.0	08-200-000	50301010402	40.9054	-80.8046	F,T,M,C,S,B
L01S24	M. Fk. L. Beaver Creek At Franklin Square @ St. Rt. 558	20.92	73.0	08-200-000	50301010403	40.8568	-80.7951	N,F,M,C,B
L01S23	M. Fk. L. Beaver Creek At Coleman @ Kelch Rd.	15.06	96.0	08-200-000	50301010403	40.7926	-80.8134	F,M,C,B
304277	M. Fk. L. Beaver Creek, Willow Grove Park	12.60	103.1	08-200-000	50301010403	40.7750	-80.7799	F,T,M,C,B
L01S35 **R**	Stone Mill Run Dst Salem @ Cunningham Rd.	2.00	8.3	08-205-000	50301010403	40.8665	-80.8229	N,F,M,C,S,B
602100	M. Fk. L. Beaver Creek Dst. Lisbon @ Hutton Rd.	8.97	114.0	08-200-000	50301010404	40.7652	-80.7230	F,T,M,C,B
302583	Elkton WWTP 001 Outfall To M. Fk. L. Beaver Creek	8.42	125.0	08-200-000	50301010404	40.7640	-80.7111	C,B
201489	M. Fk. L. Beaver Creek W Of Elkton	8.40	125.0	08-200-000	50301010404	40.7645	-80.7131	F,T,M,C,B
L01P14	Middle Run E Of Lisbon @ St. Rt. 154	0.02	6.9	08-204-000	50301010404	40.7659	-80.7162	F,M,C
L01P34	Lisbon Creek @ Mouth	0.04	6.9	08-209-000	50301010404	40.7718	-80.7535	F,M,C,S,B
L01S43 **R**	M. Fk. L. Beaver Creek @ Bear Hollow Rd.	1.85	141.0	08-200-000	50301010405	40.7340	-80.6412	F,M,C,S,B,O1,O2
201490	Elk Run Near Mouth @ St. Rt. 154	0.30	9.8	08-203-000	50301010405	40.7652	-80.6952	F,M,C,B
304306	Cold Run @ Woodsdale Rd	9.78	2.0	08-307-00	50301010501	40.8436	-80.8768	C
304300	Cold Run @ Salem WTP Intake	4.96	8.06	08-307-000	50301010501	40.7940	-80.8432	D,S,B
L01K17	Cold Run @ Lisbon-Dungannon Rd.	0.30	13.7	08-307-000	50301010501	40.7435	-80.8390	F,M,C,S,B
201483	W. Fk. L. Beaver Creek Just Dst. Guilford Lake	24.10	11.1	08-300-000	50301010502	40.7943	-80.8706	N,F,M,C,S,B
L01E01	Guilford Lake WWTP 001 Outfall To W. Fk. L. Beaver Creek	23.75	11.4	08-300-000	50301010502	40.7912	-80.8692	C,B

L01W29	W. Fk. L. Beaver Creek @ Gas Tax Rd.	22.75	13.0	08-300-000	50301010502	40.7798	-80.8679	N,F,M,C,B
304279	W. Fk. L. Beaver Creek At Sr 518, Upst. Brush Creek	16.40	35.1	08-300-000	50301010502	40.7080	-80.8283	F,M,C
304281	Brush Creek AT Sr 644	4.04	11.1	08-305-000	50301010503	40.6957	-80.8850	F,M,C
304280	Brush Creek UST. W. Fk. L. Beaver Ck @ Sr 518	0.10	27.2	08-305-000	50301010503	40.7020	-80.8309	F,M,C,S,B
304282	Williard Run At Sr 518	0.10	6.2	08-306-000	50301010503	40.7017	-80.8664	F,M,C
L01S18 **R**	W. Fk. L. Beaver Creek Upst Chemlime Tributary	12.90	74.0	08-300-000	50301010504	40.7045	-80.7790	F,M,C,S,B
L01S16	W. Fk. L. Beaver Creek @ Mccormick Run Rd.	9.23	80.0	08-300-000	50301010504	40.6932	-80.7373	N,F,M,C
L01S15	W. Fk. L. Beaver Creek @ Pine Ridge Camp Rd.	4.08	105.0	08-300-000	50301010504	40.7098	-80.6670	F,M,C
L01P45 **R**	W. Fk. L. Beaver Creek NW Of E Liverpool @ St. Rt. 7	0.60	111.0	08-300-000	50301010504	40.7183	-80.6350	F,M,C,S,B
304273	Longs Run AT Cannons Mill Rd, Dst SR 11	4.41	9.3	08-005-000	50301010601	40.6788	-80.6152	F,M,C,S,B,L
304276	Honey Creek AT E. Garfield Rd., Upst Ohio/Pa State Line	6.28	9.3	08-114-000	50301010602	40.9172	-80.5238	N,F,M,C,S,B
L01S45	New Middletown WWTP Outfall 001 to Honey Creek	10.6	1.4	08-114-000	50301010602	40.95167	-80.575587	C
L01S41	Honey Creek SW of New Middletown @ Unity Rd	10.69	1.2	08-114-000	50301010602	40.95226	-80.576493	C,M
201468	N. Fk. L. Beaver Creek @ Poland Rd.	34.50	6.7	08-100-000	50301010603	40.8995	-80.5754	F,M,C,S
201475	N. Fk. L. Beaver Creek @ Ohio/Pa State Line	30.12	19.5	08-100-000	50301010603	40.8755	-80.5190	F,M,C,B
304274	L. Bull Creek Old Sr 154, Upst. Rogers	3.80	6.2	08-105-000	50301010604	40.7986	-80.6508	F,M,C

201482	L. Bull Creek Upst. Turkey Run	0.50	17.1	08-105-000	50301010604	40.7984	-80.5995	F,M,C,S,B
201477	Bull Creek @ Twp. Rd. 923	9.30	11.4	08-103-000	50301010605	40.8648	-80.6284	F,M,C,B
L01E02	New Waterford WWTP 001 Outfall To Bull Ck	7.08	13.7	08-103-000	50301010605	40.8387	-80.6097	C,B
L01P07	Bull Creek Se Of New Waterford @ St. Rt. 46	6.05	15.1	08-103-000	50301010605	40.8293	-80.5967	N,F,M,C,B
L01S07 **R**	Bull Creek W Of Negley, Adj. St. Rt. 154	1.90	39.4	08-103-000	50301010606	40.7929	-80.5648	N,F,M,C,S
L01S10	Leslie Run Upst East Palestine WWTP	3.30	10.8	08-104-000	50301010606	40.8315	-80.5431	N,F,M,C,B
L01W01	East Palestine New WWTP 001 Outfall To Leslie Run	3.10	11.2	08-104-000	50301010606	40.8297	-80.5444	C,B
602010	Leslie Run At Negley @ St. Rt. 154	0.09	14.3	08-104-000	50301010606	40.8139	-80.5434	F,M,C,S,B,O1,O2
L01S04 **R**	N. Fk. L. Beaver Creek Dst Confl Of Stateline Creek	7.26	109.0	08-100-000	50301010607	40.7895	-80.5262	F,M,C,S,L
602060 **R**	E. Fk. Stateline Creek Near Negley @ Twp. Rd. 1024	0.02	1.5	08-118-000	50301010607	40.7932	-80.5212	F,M,C,S,B
612010	N. Fk. L. Beaver Creek At Fredericktown @ Fredericktown Rd.	0.13	193.0	08-100-000	50301010608	40.7151	-80.5442	F,M,C,B
L01S01 **R**	L. Beaver Creek @ State Park Picnic Area	15.00	261.0	08-001-000	50301010609	40.7265	-80.6176	F,T,M,C,S,B
L01P26 **R**	L. Beaver Creek Near Fredericktown @ St. Rt. 170	7.95	294.0	08-001-000	50301010609	40.7129	-80.5465	F,T,M,C,S,B
602000 **R**	L. Beaver Creek Near East Liverpool @ Grimms Bridge Rd.	4.50	496.0	08-001-000	50301010610	40.6761	-80.5403	F,T,M,C,S,B
L01K02	Bieler Run SE Of Fredericktown @ Mouth	0.10	6.8	08-003-000	50301010610	40.7084	-80.5298	F,M,C,B
C04W50	Yellow Creek At Amsterdam @ St. Rt. 43	29.9	14.4	06-900-000	50301010701	40.4731	-80.9242	F,M,C,B
304283	Yellow Creek at Amsterdam WWTP Outfall	29.85	14.5	06-900-000	50301010701	40.4737	-80.9229	C,B

C04S29 **R**	Yellow Creek Upst. Wolf Run @ Co. Rd. 75a (Aka Cr 60)	27.6	25	06-900-000	50301010701	40.4969	-80.9022	N,F,M,C,S,B
C04K22	Wolf Run @ Wolf Run Rd (Cr 75)	1.48	3.3	06-936-000	50301010701	40.4791	-80.8909	F,M,C, L
C04W55	Goose Creek At Amsterdam @ Ridgewood St.	0.29	5.8	06-938-000	50301010701	40.4689	-80.9231	N,F,M,C,S,B, L
304272	Elk Lick, Driveway From Cr 60	0.1	6	06-940-000	50301010701	40.4572	-80.9422	F,M,C,S,O1,O2, L
C04K04 **R**	Elkhorn Creek @ St. Rt. 43	6.8	7.4	06-931-000	50301010702	40.5019	-80.9803	F,M,C,S,B,L
C04S40 **R**	Elkhorn Creek Near Mouth @ St. Rt. 164	0.11	33.5	06-931-000	50301010702	40.5103	-80.8958	F,M,C,S,B,L
C04Q02 **R**	Strawcamp Run W Of Bergholz @ Bay Rd.	0.1	5.2	06-932-000	50301010702	40.5272	-80.9361	F,M,C,S,B, L
C04S54 **R**	Center Fork W Of Bergholz @ Carry Rd.	0.1	12.5	06-933-000	50301010702	40.5158	-80.9611	F,M,C,S,B, L
C04K06 **R**	Trail Run Near Mouth @ Bay Rd. (Co. Rd. 27)	0.3	3.3	06-934-000	50301010702	40.5314	-80.9903	F,M,C,S,B
304271	Upper North Fork Adj Sr 524	4.1	8.01	06-926-000	50301010703	40.5619	-80.9296	F,M,C, L
C04K45	Upper North Fork @ St. Rt. 524, Lane Near Mouth	0.25	18.8	06-926-000	50301010703	40.5286	-80.8853	F,M,C,S,B
C04K37	Hump Run @ St. Rt. 524	0.03	7	06-927-000	50301010703	40.5373	-80.8972	F,M,C
C04K63	Yellow Creek At Bergholz, Upst. St. Rt. 164 & Upper N Fork	24.3	66	06-900-000	50301010704	40.5233	-80.8867	N,F,M,C,B
C04K55	Yellow Creek Upst. Ralston Run @ Co. Rd. 54	17.93	94	06-900-000	50301010704	40.5181	-80.8317	F,M,C
C04K57	Yellow Creek At 1st Bridge Upst. Long Run @ Co. Rd. 53	11.77	119	06-900-000	50301010704	40.5149	-80.7574	F,T,M,C,B
C04K26	Long Run @ Co. Rd. 54	4.29	4.1	06-909-000	50301010704	40.4973	-80.8260	F,M,C, L
C04K41	Long Run @ Co. Rd. 218	0.04	10.4	06-909-000	50301010704	40.5127	-80.7579	F,M,C,S,B
304270	Ralston Run Adj Cr 53	0.1	5.6	06-924-000	50301010704	40.5189	-80.8336	N,F,M,C,B

C04K39	Town Fork @ Ballfield Dst. Jefferson Lake, Upst. Culp Run	8	7.9	06-920-000	50301010801	40.4583	-80.7908	F,M,C
C04K43	Town Fork @ Shane Rd. (Co. Rd. 56)	5.15	16.1	06-920-000	50301010801	40.4649	-80.7471	F,M,C.L
304269	Town Fork Adj TR 285b	1	25.6	06-920-000	50301010801	40.5098	-80.7289	F,M,C
C04S38	Town Fork Near Mouth @ Co. Rd. 53	0.05	26	06-920-000	50301010801	40.5174	-80.7310	F,M,C,S,B
C04S53 **R**	Nancy Run N Of Salineville @ Twp. Rd. 740 (Foundry Hill Rd)	1.02	7.7	06-915-000	50301010802	40.6353	-80.8350	F,M,C,S,B
304268	Riley Run AT Avon Rd., Dst. Rm 3.75 Trib	3.7	9.8	06-917-000	50301010802	40.6250	-80.8802	N,F,M,C,B, L
C04K42	Riley Run @ St. Rt. 39	1.84	15.2	06-917-000	50301010802	40.6220	-80.8478	F,M,C, L
C04S35	N. Fk. Yellow Creek Just Upst. Salineville WWTP	10.35	26.4	06-910-000	50301010803	40.6211	-80.8190	F,M,C,B, L
C04K56	Salineville WWTP Outfall To N. Fk. Yellow Creek	10.32	26.4	06-910-000	50301010803	40.6212	80.8189	C,B
C04K48	N. Fk. Yellow Creek @ Haiti Rd.	10.1	26.4	06-910-000	50301010803	40.6241	-80.8159	N,F,M,C,B
C04S33 **R**	N. Fk. Yellow Creek Adj. Twp. Rd. 879	6.4	38	06-910-000	50301010803	40.6024	-80.7741	F,M,C,S,B
C04S32 **R**	N. Fk. Yellow Creek At Irondale @ Twp. Rd. 299	2.18	56	06-910-000	50301010803	40.5731	-80.7269	N,F,M,C,S,B
C04S31	N. Fk. Yellow Creek Dst. Irondale	0.84	58	06-910-000	50301010803	40.5625	-80.7092	N,F,M,C,B
304267	Dry Run AT Tr 306	0.7	1	06-910-000	50301010803	40.5639	-80.6959	M,C,B
200186	N. Fk. Yellow Creek Near Mouth, Dst. St. Rt. 213	0.2	59	06-910-000	50301010803	40.5547	-80.7044	F,M,C,S
C04K02 **R**	Trib. To N. Fk. Yellow Creek (6.08) @ Hazel Run Rd.	0.08	4	06-910-001	50301010803	40.6017	-80.7688	F,M,C,S,B, L
C04S36	Salisbury Run Near Mouth @ Twp. Rd. 776	0.13	2.3	06-913-000	50301010803	40.5928	-80.7364	N,F,M,C,B

C04S24	Yellow Creek Near Hammondsville @ Gage	5.51	147	06-900-000	50301010804	40.5379	-80.7250	F,T,M,C
304308	Yellow Creek adj. SR 213	1.9	224	06-900-000	50301010804	40.5509	-80.6967	N,F,T,M,C,S,B
304275	Rocky Run AT Tr 307	0.05	2.9	06-901-000	50301010804	40.5727	-80.6690	F,M,C
C04K61	Hollow Rock Run Adj Hollow Rock Rd @ Power Lines	2.1	6.4	06-902-000	50301010804	40.5356	-80.6753	F,M,C
C04K62	Hollow Rock Run @ Hollow Rock Rd	0.65	9.3	06-902-000	50301010804	40.5546	-80.6750	F,M,C,S
C04K38	Brush Creek @ Twp. Rd. 290	6.23	7.4	06-905-000	50301010804	40.5586	-80.8048	F,M,C
C04S37	Brush Creek Near Mouth @ Co. Rd. 72	0.05	15.3	06-905-000	50301010804	40.5492	-80.7183	F,M,C,S,B
N04S27	Pymatuning Creek W Of West Andover @ U.S. Rt. 6	30.38	11.8	18-550-000	50301020301	41.6069	-80.6297	N,F,M,C
N04S02 **R**	Pymatuning Creek @ U.S. Rt. 322	24.5	35.0	18-550-000	50301020301	41.5339	-80.6342	F,M,C,S,B
N04K07	Sugar Creek E Of Johnston @ St. Rt. 88	5.72	9.0	18-556-000	50301020302	41.3886	-80.6318	N,F,M,C,B
N04S28	Sugar Creek SW Of Kinsman @ Burnett Rd.	0.92	19.9	18-556-000	50301020302	41.4375	-80.6036	N,F,M,C,S,B,L
304285	Kinsman WWTP Outfall Sugar Creek	o.5	26.5	18-556-000	50301020302	41.4419	-80.6067	C,B
N04S24	Pymatuning Creek Upst. Kinsman, Upst. St. Rt. 7	16.1	96.0	18-550-000	50301020303	41.4444	-80.5911	F,T,M,C,S,B
N04K08	Stratton Creek NE Of Kinsman @ Webber Rd.	4.21	9.1	18-554-000	50301020303	41.4828	-80.5613	F,M,C,S,L
304264	Stratton Creek Dst Park Ave. Former Impoundment	1.3	12.3	18-554-000	50301020303	41.4527	-80.5783	F,M,C,L
N04K09	Stratton Creek Near Kinsman @ Kinsman-Nickerson Rd.	0.7	17.1	18-554-000	50301020303	41.4436	-80.5779	N,F,M,C,S,B,L
N04S01	Pymatuning Creek Near Vernon @ St. Rt. 88	8.4	135.0	18-550-000	50301020304	41.3869	-80.5575	F,T,M,C,B

N04S20	Pymatuning Creek At Orangeville @ State Line	1.94	148.0	18-550-000	50301020304	41.3400	-80.5194	F,T,M,C,S,B
N04S34	Yankee Run W Of Hartford @ St. Rt. 305	11.34	14.8	18-506-000	50301020601	41.3125	-80.6097	F,M,C,B
N04Q03	Yankee Run Upst. Yankee Lake @ Co. Rd. 361a	6.5	33.0	18-506-000	50301020601	41.2758	-80.5719	F,M,C,L
304265	Yankee Run in Former Impoundment	5.6	33.3	18-506-000	50301020601	41.2672	-80.5628	F,M,C
N04S05	Yankee Run Upst. Brookfield WWTP	0.55	45.5	18-506-000	50301020601	41.2161	-80.5283	F,M,C,B
N04S04	Brookfield WWTP 001 Outfall To Yankee Run	0.42	45.5	18-506-000	50301020601	41.2162	-80.5274	C,B
N04S33	Yankee Run Dst. Brookfield WWTP	0.3	45.7	18-506-000	50301020601	41.2142	-80.5250	F,M,C,S,B
N04K12	S. Br. Yankee Run SW Of Hartford @ Warner Rd.	1.54	9.0	18-507-000	50301020601	41.2916	-80.6173	N,F,M,C,B,L
N04S12 **R**	L. Yankee Run Upst. Hubbard @ Stewart-Sharon Rd.	9.56	11.0	18-504-000	50301020602	41.2136	-80.5922	N,F,M,C,S,B,L
N04W02	L. Yankee Run At Hubbard @ St. Rt. 62	5.9	21.5	18-504-000	50301020602	41.1742	-80.5687	F,M,C
N04S10	L. Yankee Run Upst. Hubbard WWTP @ Mill St.	4.7	30.8	18-504-000	50301020602	41.1711	-80.5550	F,M,C,B
N04S09	Hubbard WWTP 001 Outfall To L. Yankee Run	4.59	30.8	18-504-000	50301020602	41.1708	-80.5538	C,B
N04S08	L. Yankee Run @ 1st Rr Bridge Dst. Hubbard WWTP	4.4	30.9	18-504-000	50301020602	41.1703	-80.5500	N,F,M,C,B
N04S06	L. Yankee Run Near Mouth @ Sharon-Bedford Rd.	0.3	43.6	18-504-000	50301020602	41.2075	-80.5233	F,M,C,S
N04S14	Mud Run At Hubbard @ N. Main St.	0.07	8.1	18-504-001	50301020602	41.1697	-80.5692	F,M,C,S,B
N04S13	L. Deer Creek E Of Hubbard @ St. Rt. 304	0.4	7.6	18-505-000	50301020602	41.1642	-80.5422	F,M,C,B

204673	Salem Reservoir L-1	0.6	0.7	08-200-002	50301010403	40.8131	-80.8358	IL,S,B
304301	Spring Valley Lake L-1	9.4	3.03	05-307-000	50301010501	40.8388	-80.8388	IL,S,B

TBD – to be determined

*** -- Potential supplemental sampling locations. Sampling and the level of assessment at these stations is dependent on the availability of field staff resources**

M – modified reference site. **R** – reference site.

Code	Sample Type
F	Fish – 1 or 2 Passes
T	Fish Tissue
M	Macroinvertebrate (HD sets at >20mi^2 and reference sites)
C	Chemistry
N	Nutrient site
IL	Inland Lake

Code	Sample Type
O1	Organics – VOCs (volatile organic compounds) SVOCs (semi-volatile organic compounds)
O2	Organics -- herbicides and insecticides
B	*E. coli* bacteria
S	Sediment
L	Temperature datalogger
D	Drinking Water Intake

Appendix 3. NPDES Permitted Facilities

HUC12	Ohio Permit #	Facility Name	Design Flow	Avg Flow*	Waste Type	Discharge Location	County
50301010401	3PR00538*BD	Greenford Bobcats LLC WWTP	0.0062	0.00042	Public	UNT Cherry Valley Run (6.82) RM	Mahoning
50301010401	3PR00737*AD	Angels for Animals	0.0025	0.001734	Public	UNT EB MF LBC (10.74) RM 0.65	Mahoning
50301010401	3PB00051*KD	Washingtonville WWTP	0.12	0.07365	Public	Cherry Valley Run RM 2.3	Columbiana
50301010401	3PB00017*JD	Leetonia WWTP	0.34	0.278	Public	EB MF LBC RM 1.93	Columbiana
50301010401	3IE00035*FD	Zarbana Aluminum Extrusion LLC Buckeye Transfer Realty LLC)	N/A	0.00994	Industrial	EB MF LBC RM 5.67	Columbiana
50301010402	3IN00223*GD	County Land Development Landfill LLC	N/A	0.01729	Industrial	UNT MF Little Beaver Creek (28.14) RM 0.6; 0.63	Mahoning
50301010402	3PR00346*DD	Chaparral Family Campground	0.02625	0.00093	Public	WF Little Beaver Creek RM 30.7	Mahoning
50301010402	3PR00544*BD	BOC Water Hydraulics Inc	0.0015	4.7E-10	Public	UNT MF Little Beaver Creek (34.9) RM 0.8	Mahoning
50301010402	3PV00018*GD	Colonial Villa MHC LLC	0.047	0.04	Public	MF Little Beaver Creek RM 35.61	Mahoning
50301010402	3PD00027*KD	City of Salem - Wastewater Plant	4	2.4305	Public	MF Little Beaver Creek RM 38.2	Columbiana
50301010402	3PV00110*ED	Penn Star MHP	0.005	0.0014	Public	MF Little Beaver Creek RM 39.38	Columbiana
50301010402	3IQ00001*HD	Ventra Salem, LLC	N/A	0.008	Industrial	UNT MR LBC RM 38.85	Columbiana
50301010403	3PV00107*DD	Breezeway Mobile Manor	0.02	0.00085	Public	MF Little Beaver Creek RM 20.9	Columbiana
50301010403	3PA00034*CD	Lisbon WWTP (CSO monitoring)	N/A	N/A	Public	MF Little Beaver Creek RM 11.3 - 12.4	Columbiana
50301010404	3IV00250*FD	Lisbon Brd of Public Affairs WTP	0.004	0.01	Industrial	UNT MF Little Beaver Creek (10.78) RM 1.01	Columbiana
50301010404	3PG00162*CD	Roseview Acres WWTP	0.02	0.012	Public	UNT MF Little Beaver Creek (10.78) RM 3.35	Columbiana
50301010404	3PK00016*ED	Elkton WWTP	1.14	0.786	Public	MF Little Beaver Creek RM 8.35	Columbiana

HUC12	Ohio Permit #	Facility Name	Design Flow	Avg Flow*	Waste Type	Discharge Location	County
50301010404	3IV00180*GD	Salem WTP	0.154	0.0872	Industrial	Salem Reservoir - UNT MF LBC RM 17.05	Columbiana
50301010501	3PG00163*CD	County Home Road WWTP	0.33	0.019	Public	Cold Rin RM 3.6	Columbiana
50301010501	3PR00352*ED	Salem-Lisbon KOA	0.0175	0.00144	Public	Cold Run RM 7.8	Columbiana
50301010502	3PH00043*ID	Gilford Lake STP	0.4	0.272	Public	WF Little Beaver Creek RM 23.74	Columbiana
50301010504	3PB00070*CD	Beaver Local WWTP & Pump Station	0.1	0.013	Public	UNT WB LBC (2.1) RM 0.55	Columbiana
50301010504	3IN00247*FD	Westpoint Renewables LLC	N/A	0.12	Industrial	UNT WF LBC (6.50) RM 0.7	Columbiana
50301010602	3IJ00018*JD	Honey Creek Stone Co	N/A	0.436	Industrial	Harmen Run RM 0.25	Mahoning
50301010602	3IJ00060*FD	Shelly Co - Petersburg Quarry Facility	N/A	---	Industrial	UNT Honey Creek (7.45) RM 0.2	Mahoning
50301010602	3PH00016*JD	New Middletown - Springfield Twp WWTP	0.55	0.368	Public	Honey Creek RM 10.7	Mahoning
50301010602	3IJ00059*FD	East Fairfield Coal Co Petersburg Limestone Plt	N/A	0.0216	Industrial	Honey Creek RM 6.85	Mahoning
50301010603	3IJ00063*ED	Subtropolis Mining Co - Subtropolis Mine	N/A	0.0216	Industrial	UNT NF Little Beaver Creek (31.42) RM 2.55	Mahoning
50301010603	3IN00175*FD	Mahoning Landfill Inc	0.0507	---	Industrial	NF Little Beaver Creek RM 36.12	Mahoning
50301010603	3PV00090*FD	Deer Meadows MHP	0.02	0.013	Public	NF Little Beaver Creek RM 8.13	Mahoning
50301010604	3PR00436*AD	Roger Foods & Fuel (Andi's Convenience Store LLC)	0.0001	0.002142	Public	Little Bull Creek RM 2.25 via storm sewer	Columbiana
50301010604	3PR00751*AD	Columbiana ACE Hardware	0.0002	0.00003	Public	UNT Bull Creek (7.3)(via storm ditch) RM 1.25	Columbiana
50301010604	3PT00059*DD	Crestview Local Sch Dist Jr & Sr HS	0.03	0.007	Public	UNT Little Bull Creek (6.61) RM 1.1	Columbiana
50301010604	3IH00111*AD	Hays Orchard and Cider Mill, LLC	0.01	0.0054	Industrial	UNT Little Bull Creek (6.61) RM 1.3	Columbiana
50301010605	3IW00022*HD	Columbiana WTP	0.065	---	Industrial	UNT Bull Creek (10.76) RM 3.54	Columbiana
50301010605	3PB00059*MD	New Waterford WWTP	0.18	0.164	Public	Bull Creek RM 7.03	Columbiana

HUC12	Ohio Permit #	Facility Name	Design Flow	Avg Flow*	Waste Type	Discharge Location	County
50301010606	3PD00042*LD	East Palestine WWTP	1.4	0.6735	Public	Leslie Run RM 3.1	Columbiana
50301010606	3IN00364*BD	JaSar Recycling Inc	N/A	0.0072	Industrial	UNT Leslie Run (3.57) RM 0.23	Columbiana
50301010607	3IN00360*BD	PennOhio Waste LLC	N/A	---	Industrial	Leslie Run RM 0.22 & NFLBC RM 7.0	Columbiana
50301010701	0PJ00010*AD	Amsterdam Area Wastewater Treatment Plant	0.05	---	Public	Yellow Creek RM 29.8	Jefferson
50301010702	3IN00386*BD	Carroll Co Landfill	N/A	0.054	Industrial	Center Fork Elkhorn Creek RM 5.4	Carroll
50301010702	3PR00454*CD	Elkhorn Valley Christian Service Camp	0.008	---	Public	Elkhorn Creek RM 2.9	Carroll
50301010803	3PT00098*DD	Southern Local HS	0.02	0.001	Public	UNT NF Yellow Creek (6.08) RM 3.8	Columbiana
50301010803	3PB00026*GD	Salineville WWTP	0.2	0.0915	Public	NF Yellow Creek RM 10.72	Columbiana
50301010804	0IL00136*FD	Sterling Mining Corp-South Mine Complex/Disp Site	N/A	0.108	Industrial	Brush Creek RM 9.7	Jefferson
50301010804	0IN00261*CD	FirstEnergy Generation LLC - Hollow Rock Facility	0.004	---	Industrial	Hollow Rock Run RM 4.5	Jefferson
50301010804	0IN00100*HD	Wellsville Ash & Dredging Disposal Site (Orin R/E Holding LLC)	001 -0.0333 & 002 - 0.11189	---	Industrial	Yellow Creek RM 1.0	Jefferson
50301010804	0IN00100*HD	Wellsville Ash & Dredging Disposal Site (Orin R/E Holding LLC)	003 - 0.01857	---	Industrial	UNT Yellow Creek (1.4) RM 0.2	Jefferson
50301010804	0IN00100*HD	Wellsville Ash & Dredging Disposal Site (Orin R/E Holding LLC)	004 - 0.002	---	Industrial	Rocky Run RM 0.45	Jefferson
50301010804	0PP00056*FD	ODOT Park No 11-2		0.000417	Public	Yellow Creek RM 0.3	Jefferson
50301011103	3PV00094*DD	SunRise MHP	0.01	0.0024	Public	UNT Little Yellow Creek (1.4) RM 0.47	Columbiana
50301011103	3PG00123*HD	Columbiana Co Skyview Acres WWTP	0.02	0.009	Public	UNT Little Yellow Creek (4.08) RM 1.08	Columbiana
50301011103	3IV00031*CD	Buckeye WTP	0.037(001) & (002)	001 - 0.014	Industrial	UNT Little Yelow Creek (2.75) RM 0.78	Columbiana
50301011106	3PV00113*DD	Farr Hill MHP Inc	0.01	0.0065	Public	UNT Ohio River (935.5) RM 0.7	Columbiana

HUC12	Ohio Permit #	Facility Name	Design Flow	Avg Flow*	Waste Type	Discharge Location	County
50301020104	3IY00013*FD	Andover WTP	0.016	0.012	Industrial	UNT Wade Creek (0.8) RM 3.0	Ashtabula
50301020104	3PB00000*MD	Andover WPCF	0.5	0.16	Public	Wade Creek RM 2.73	Ashtabula
50301020104	3PH00029*GD	Holiday Camplands STP	0.15	0.056	Public	Gravel Run Creek RM 0.7	Ashtabula
50301020104	3PP00013*FD	ODNR Pymatuning State Park	0.08	0.012	Public	UNT to Pymnatuning Reservior (67.6) RM 0.2	Ashtabula
50301020104	3PR00199*DD	Pymatuning Adventure Resort LLC	0.0115	0.00168	Public	McMichael Creek RM 0.85	Ashtabula
50301020104	3PR00428*CD	J Wade Inc DBA Scooter's Bar and Grill	0.005	0.0007975	Public	Wade Creek RM 1.4	Ashtabula
50301020104	3PR00512*BD	Causeway Lounge	0.005	--	Public	Wade Creek RM 1.3	Ashtabula
50301020104	3PR00626*BD	Beachcomer 's Tavern	0.0035	0.000453	Public	UNT to Pymnatuning Reservior RM 0.2	Ashtabula
50301020301	3PR00303*DD	Jeffco Lakes Campground	0.013	0.0035	Public	UNT Pymatuning Creek (27.16) RM 0.45	Ashtabula
50301020301	3PR00427*ED	The Inn of West Andover LLC	0.001	0.0003	Public	UNT Pymatuning Creek (30.46) RM 0.7	Ashtabula
50301020301	3PR00657*AD	Gustavus Assisted Living WWTP	0.0088	0.000145	Public	UNT Pymatuning Creek (19.01) RM 2.9	Trumbull
50301020302	3PH00060*CD	Kinsman WWTP	0.125	0.0333	Public	UNT Sugar Creek (0.61) RM 0.3	Trumbull
50301020302	3PR00186*DD	Bailes Commercial Bldg	0.0015	--	Public	Berry Creek RM 1.60	Trumbull
50301020302	3PR00216*DD	Sonnys Family Restaurant	0.0002	0.000138	Public	Berry Creek RM 1.66	Trumbull
50301020302	3PR00462*CD	Rock of Grace Church	0.0035	0.000011	Public	Sugar Creek RM 4.0	Trumbull
50301020302	3PT00070*ED	Maplewood Elementary K-6	0.005375	0.0009	Public	Berry Creek RM 2.67	Trumbull
50301020304	3PR00198*ED	Homestead	0.02	0.0022	Public	UNT Pymatuning Creek (2.94) RM 1.09	Trumbull
50301020304	3PR00257*FD	Camp Sugarbush	0.01	0.0013915	Public	UNT Mill Creek (1.9) RM 0.1	Trumbull
50301020304	3PT00122*ED	Joseph Badger Local School	0.025	0.002	Public	Pymatuning Creek RM 12.01	Trumbull
50301020601	3IN00343*CD	Mack Industries: Vienna Site	NA	NA	Industrial	UNT South Branch(4.8)RM 0.20	Trumbull
50301020601	3PJ00001*MD	Brookfield WWTP	1.3	1.5395	Public	Yankee Run RM 0.42	Trumbull

HUC12	Ohio Permit #	Facility Name	Design Flow	Avg Flow*	Waste Type	Discharge Location	County
50301020601	3PR00166*ED	Briarfield of Cortland	0.0116	0.003	Public	UNT Yankee Run (12.58) RM 1.2	Trumbull
50301020601	3PR00250*ED	Meadowbrook Manor Nursing Home	0.009	0.001886	Public	UNT South Branch (2.97) RM 1.33	Trumbull
50301020601	3PR00741*AD	Owens Residence His & Hers Beauty Salon & Barber	0.00042	NA	Public	UNT South Branch (2.97) RM 1.33	Trumbull
50301020601	3PR00755*AD	Fowler Center Land Company, LLC	0.002	0.000567	Public	UNT South Branch (2.97) RM 1.32	Trumbull
50301020601	3PV00019*GD	Wyngate Manor MHP	0.0558	0.034	Public	UNT Yankee Run (4.45) RM 1.45	Trumbull
50301020601	3PV00025*FD	Four Seasons MHC LLC	0.035	0.014	Public	UNT South Branch (6.43)RM 0.20	Trumbull
50301020601	3PV00040*FD	Fowler MHP	0.012	0.0034	Public	South Branch RM 3.2	Trumbull
50301020602	3IG00040*GD	Truck World Hubbard Food Mart	NA	NA	Industrial	Little Yankee Run RM 6.0	Trumbull
50301020602	3IM00002*GD	Ellwood Engineered Castings Co	NA	NA	Industrial	Little Yankee Run RM 5.7	Trumbull
50301020602	3PD00028*LD	Hubbard WPCF	2.1	1.63	Public	Little Yankee Run RM 4.59	Trumbull
50301020602	3PP00042*DD	ODOT Brookfield Maintenance Outpost	0.015	0.000096	Public	UNT Little Yankee Run (7.75) RM 0.5	Trumbull
50301020602	3PR00262*DD	Bellwick Bowling Lanes	0.0025	0.00001	Public	UNT Little Yankee Run (5.50) RM 1.9	Trumbull
50301020602	3PV00056*FD	Brookfield Acres MHP	0.065	0.037	Public	UNT Little Yankee Run (11.15) RM 0.3	Trumbull
50301020602	3PW00026*ED	Ron Co Rentals	0.001	0.001	Public	UNT Little Yankee Run (7.75) RM 1.5	Trumbull
50301020602	3PW00031*CD	Baldauf 4-Plex Apts	0.001	0.0006	Public	Little Yankee Run RM 13.5	Trumbull

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 1/1 2017 thru 12/31/2021.
3 Storm water indicates that this facility is only designed to treat storm water associated with an industrial activity and therefore does not have a design flow rate.
4 Controlled discharge

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 µS/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	0.5 mg/L		
Nitrite	USEPA 353.2	0.02 mg/L		
Total Kjeldahl Nitrogen	USEPA 351.2	0.2 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 & Toxins				
Chlorophyll a	USEPA 445.0	2 µg/L		
Microcystin	OEPA 701.0			
Cylindrospermopsin	OEPA 703.0			
Organic Compounds				
Chlorinated Herbicides	USEPA 515.1	40 µg/L		
Acid Herbicides	USEPA 525.2	200 µg/L		
Volatile Organic Compounds	USEPA 624	40 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
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:**
Ashtabula - Jason Warren (330) 802-9171 Trumbull - Marty Cisine (330) 245-3037 Mahoning - Tom Frank (330) 245-3038 Columbiana - Jesse Janosik (330) 245-3039 Jefferson - Craig Porter (330) 245-3050 Carroll - Scott Cartwright (330) 802-9163	Ashtabula – William R. Niemi (440) 576-0055 Trumbull – Paul S. Monroe (330) 675-2508 Mahoning – Jerry Greene (330) 480-5000 Columbiana - Brian McLaughlin (330) 424-7255 Jefferson – Fred Abdalla (740) 283-8600 Carroll - Dale Williams (330) 627-2170
Emergency Management Association of Ohio:	**State Highway Patrol:**
Ashtabula - Mike Fitchet (440) 576-9148 Trumbull – Kayla Grizer (330) 675-2666 Mahoning - Andrew Frost, III (330) 740-2200 Columbiana - Peggy Clark (330) 424-9725 Jefferson - John Parker (740) 264-4646 Carroll - Tom Cottis (330) 627-0003	Ashtabula - (440) 969-1155 Trumbull - (330) 898-2311 Mahoning - (330) 533-6866 Columbiana - (330) 424-7783 Jefferson - (740) 264-1641 Carroll - (330) 339-1103
Hospitals or Urgent Care:	
Trumbull Regional Medical Center 1350 E. Market St. Warren, OH 44483 (330) 841-9011	
Trinity Express Clinic Toronto – Jefferson County 1800 Franklin St. Toronto, OH 43964 (740)537-3898	

Appendix 6. Additional Unverified Streams

Unverified in *3745-01-13* (Yellow Creek)				
Rocky Run	Dry Run	Carroll Run	Trib to Yellow (RM 30.22)	Elk Fork
Tarburner Run	Culp Run	Hazel Run	Roach Run	Elk Lick
Carter Run	Rippy Run	Frog Run	Lowery Run	Goose Creek
Dry Run	Hildebrand Run	Cox Creek	Mathews Run	Burgett Run
Salt Run	Roach Run			
Unverified in *3745-01-15* (Little BeaverCreek)				
Pine Run	Honey Creek	Harman Run	Patterson Run	
Unverified in (Pymatuning Creek)				
Mill Creek	Maple Creek	Berry Creek	Clear Creek	

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