Environmental Protection Agency

Surface Water Field Sampling Manual

Division of Surface Water
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Version History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions are maintained by the Ohio EPA Division of Surface Water Modeling, Assessment and TMDL Section Manager.

History	**Effective Date**
Ohio EPA Surface Water Quality Sampling Manual version 10.0 Significant update of all contents and organization within document. Specifically, contents of main document and Appendix II organized to match workflow.	June 1, 2025
Ohio EPA Surface Water Quality Sampling Manual version 9.0 Section E: Added specific guidance for herbicide sampling regarding pH testing and preservation. Clarified type of collection vessel needed for organics collection. Appendix II: Updated Section F to include using field measurements collected by water quality sondes. Added language in Section G to include continuous temperature and water-detection loggers.	June 1, 2023
Ohio EPA Surface Water Quality Sampling Manual version 8.0 General: Formatting altered, table of contents updated, and acronyms table added Section A: Typos corrected, and clarifications added. Section B: Typos corrected, and clarifications added. Section C: Additional SSOPs added to health and safety section. Update of pre-sampling considerations and checklist. Section D: Formatting Altered, typos corrected, and clarifications added. Section E: Updated collection methods, preservatives, sample containers, and holding times based on latest information from the DES handbook. Section F: Updated based on recommendations in the 2016 Flow Measurement Training document. Section G: Laboratory sample scheduling procedures updated. Section H: Laboratory custody procedures updated. Section I: Update of references section. Section J: Other Resources added.	May 20, 2021
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Ohio EPA Surface Water Quality Sampling Manual version 6.0 Table of Contents: Updated to Remove Subsection E.6, revised Section titles for Appendix II, add New Appendix IV Section A: Minor wording changes and title updates. Section B: Minor wording changes and title updates. Section C: Replaced CyberIntern references with Sample Master®.	March 30, 2018

Section D: Remove note about field conductivity; remove information about collecting samples for methods 531 and 547; minor clarifications. Section E: Updated/revised QC samples subsection E5 to include previous E6, and renumbered remaining subsections; removed carbamate pesticide method paragraph; minor wording changes throughout. Section F: Minor edits/clarifications. Section G-H: Replaced CyberIntern references with Sample Master®, removed sample submission form information, minor edits/clarifications. Section I: Moved to Appendix IV Section A. Appendix II: Minor edits/clarifications to Section A. Moved EA3 Station Manual to Appendix IV and replaced it with Section C: Churn Splitter Protocol. Added Section D: Sampling Method for Documentation of Public Health Nuisances and Section E: Compliance and Whole Effluent Toxicity Sampling, and Section F: Water Quality Sonde Deployment. Appendix IV: Created Appendix with Section A: Data Management (moved from main manual Section I); Section B: EAS Station Manual (moved from Appendix II); Section C: EA3 Instruction Manual (Placeholder), and Section D: Sample Master® Instruction Manual.	
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Section F: Flow measurement section updated and references to equipment no longer used removed (e.g. Pygmy meters). Section G: Minor updates/revisions incorporated. Section H: No revisions. New Section I Data Management added. Appendix I and II added to link the documents within them to this manual	
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Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices, 2009 version	2009

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Acronyms

ADCP	Acoustic Doppler Current Profiler
ADV	Acoustic Doppler Velocimeter
AED	Automated External Defibrillator
APHA	American Public Health Association
BNA	Base-Neutral and Acid
COC	Chain of Custody
COD	Chemical Oxygen Demand
CSO	Combined Sewer Overflows
DES	Division of Environmental Services
DI	Deionized Water
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DQO	Data Quality Objective
DSW	Division of Surface water
EA3	Ecological Assessment and Analysis Application
ELISA	Enzyme-Linked Immunosorbent Assay
FRC	Fire Retardant Clothing
HAB	Harmful Algal Bloom
HDPE	High Density Polyethylene
ICP	Inductively Coupled Plasma
ICP/MS	Inductively Coupled Plasma Mass Spectrometry
LDPE	Low Density Polyethylene
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NP	Non-Preserved
NPDES	National Pollutant Discharge Elimination System
Ohio EPA	Ohio Environmental Protection Agency

PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PT	Proficiency Testing
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QAM	Quality Assurance Manager
QAR	Quality Assurance Record
QC	Quality Control
QMP	Quality Management Plan
RL	Reporting Limit
SRC	Sample Receiving Coordinator
SSF	Sample Submission Form
SSOP	Standard Safety Operating Procedures
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compounds

DISCLAIMER:

The mention of trade names or commercial products in this manual does not constitute endorsement or recommendation for use by the Ohio Environmental Protection Agency.

This internal guidance does not affect the requirements found in the referenced rules or statutes.

Introduction

In response to the need to coordinate the collection and reporting of water quality monitoring data, and to ensure the reliability of such data, the Ohio Environmental Protection Agency (Ohio EPA) Division of Surface Water (DSW) in conjunction with the Division of Environmental Services (DES) have developed these Surface Water Quality Sampling Procedures. This manual includes a statement of Ohio EPA's Quality Assurance (QA) policy, as well as a description of the management structure of the QA program. Laboratory elements to be used in support of the various monitoring activities are defined.

This procedural manual covers the pre, post and in-field activities for collection and handling of water quality samples regularly collected by Ohio EPA DSW, including river and lake water chemistry, compliance and complaint sampling, bacteriological monitoring, stream and lake sediment sampling, and field measurements including season-long temperature logging, flow logging, and vertical profile field data.

This document includes the following appendices, which may serve as stand-alone documents in many regards, but include references to this primary document:

Appendix II – Detailed Field Sampling Protocols

Appendix III – Sediment Manual

Appendix IV – Inland Lakes Sampling Manual

Appendix V – Lake Erie Nearshore Monitoring

Appendix VI – Data Management

QA procedures for field operations, laboratory methods, data reporting, and Chain of Custody (COC) are defined and addressed throughout these documents.

A. Quality Assurance Policy

The general objective of this manual is to promote greater standardization of procedures for all facets of sample collection, data generation, and reporting used in support of Ohio EPA DSW's efforts in water pollution control and abatement. Therefore, the methods and QA practices defined in this manual shall be used by all Ohio EPA DSW personnel when collecting data.

Specific objectives of this manual are to establish detailed and documented procedures for the collection and reporting of all water quality data and to define criteria for the acceptance or rejection of data generated by these methods. Where applicable, control limits on the precision and accuracy of these methods will be established and only data that falls within these limits will be reported without qualification. To achieve these goals, Ohio EPA will commit a minimum of 10 percent of its monitoring and assessment program to QA activities.

A1. DES Quality Control Policy

DES has developed QA policies defining the level of commitment toward the QA Progam. DES staff are responsible for ensuring the data generated meet the Data Quality Objectives (DQOs) within their Quality Management Plan (QMP). The QA program within DES is implemented by the QA section. The QMP is updated annually and is available from DES.

A2. Field Quality Control Policy

Ten percent of the field samples collected will be used for quality control (QC) purposes. Duplicate samples will be used to determine laboratory method precision. Replicate samples will be used to determine representativeness of sampling. Field samples may be split for inter-laboratory comparisons. Field blanks consisting of Nanopure™ water and preservative, where appropriate, are submitted with field samples to establish practicable detection limits and to monitor for levels of contaminants to which field samples may be exposed. All field instruments used in the measurement of physical, chemical, or biological parameters shall be properly calibrated and maintained. Records will be kept of these operations for each instrument. See Section G Quality Control Samples.

A3. Quality Assurance Program Management Structure

Responsibility for Ohio EPA's surface water and effluent monitoring programs are divided among several semi-independent work sections. Field operations are conducted by various Ohio EPA District and Central Office personnel. DES is responsible for analyses of samples collected for routine monitoring programs and ambient and compliance monitoring, as well as intensive and Total Maximum Daily Load (TMDL) water quality surveys. DSW staff collects samples for a variety of uses, including permit compliance, complaint response, in-stream chemical and biological monitoring programs, and lake monitoring. Fecal coliform, *E. coli*, and fecal strep analyses are performed at the DES laboratory as well as at contract laboratories in some of the districts. Bioassays are performed at contract laboratories.

DES QA staff will review and update laboratory Standard Operating Procedures, and the QMP at the end of each year. The QMP defines performance standards for all aspects of data collection activities. Laboratory QC and Method Detection Limits (MDLs) are evaluated annually or more frequently as is deemed appropriate. Reporting limits (RLs) are assessed annually to ensure programmatic DQOs are being met.

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

A4. Quality Assurance Project Plans

Organizations performing environmental information operations on behalf of the United States Environmental Protection Agency (USEPA) are required to participate in the USEPA Agency-wide Quality Program. USEPA's Quality Program supports USEPA's mission to protect human health and the environment and to ensure environmental information operations products and services are of known and documented quality for their intended use(s). All work performed by or on behalf of USEPA involving environmental information operations is implemented in accordance with an approved QAPP.

A QAPP is a formal planning document which describes how environmental information operations are planned, implemented, documented, and assessed during the life cycle of a project. QAPPs describe in comprehensive detail the necessary QA/QC requirements and other technical activities that must be implemented to ensure that the results of the environmental information operations performed will satisfy the stated performance and acceptance criteria (US Environmental Protection Agency, 2023).

Ohio EPA produces a QAPP for sampling projects funded by federal grant sources. Work funded with state sources may or may not include a QAPP.

B. General Considerations

Environmental field work must include considerations for health and safety of staff as well as logistics and coordination with multiple entities.

B1. Health & Safety

All samplers must comply with Ohio EPA Standard Safety Operating Procedures (SSOPs). In particular, the following SSOPs should be reviewed at least annually and adhered to:

SP08-6	Field Safety Orientation
SP10-7	CPR/First Aid/AED Training
SP10-12	Boating Safety
SP10-13	Personal Protective Equipment (PPE)
SP10-15	Chemical Hazard Communication
SP10-16	Intern Safety Program
SP10-17	Division/Office Field Safety Programs
SP11-1	Safety Management System
SP11-3	First Aid Kits for Field Activities

SP11-5	Work Zone Traffic Control
SP11-6	Seasonal Considerations for Field Work
SP11-19	Working Alone
SP13-3	Fire Retardant Clothing (FRC)
SP14-1	Safe Driver Training
SP14-2	Field Safety Training
SP14-4	Confined Space Entry
SP14-7	Safety Orientations at Regulated Facilities/Sites
SP16-2	Fall Prevention and Protection
SP16-5	Safety and Health Requirements for HAB Sampling

Before they begin work, samplers must have received any mandatory health and safety training, as outlined by their supervisor in the Ohio EPA Safety Management System assessment worksheet. These SSOPs can be found at ***Health and Safety*** (internal link).

B2. Safety Equipment

The sampler must have adequate protection, including protective clothing. They must wear gloves, as protection against chemical and/or bacteriological hazards, while they are sampling or handling samples that are known or suspected to be hazardous (for example, visible solids or sheens, downstream from combined sewer overflows (CSOs), etc.), or if hands have open wounds. The type of gloves worn shall be determined by the sampling circumstance and types of pollutants expected – for instance longer gloves are used during sediment sampling.

While working aboard watercraft or on/near the water, including docks, a personal floatation device shall be worn. Other protective measures shall be taken in accordance with the Ohio EPA Safety Management System assessment worksheet, or SSOPs. For sampling events on large bodies of water, daily field plans (i.e. float plans) should be prepared that identify who is going out on the boat, anticipated times of departure and return, who is responsible for verifying that crew returns as expected, etc. See Lake Erie or Inland Lake Sampling Manual for a sample float plan.

Upon arrival at a sampling site, safety equipment such as cones, lights, etc. shall be set out as appropriate as required per SP11-5. Vehicles shall be parked to minimize traffic disruption, minimize risk to staff and the public and avoid sample contamination (especially when sampling for organics).

B3. Pre-Sampling

Sample container labels should be printed using the DES lab order program in Sample Master® whenever possible. If not using preprinted labels, handwritten labels using indelible markers are acceptable. Writing should be easy to read and formatted to match standard printed labels.

A pre-sampling checklist is provided in Attachment 1 for a sample field preparation checklist.

Sample parameters are grouped in pre-populated “test groups” within SampleMaster®. These test groups allow for quick, accurate reproduction of an often-complex set of sample parameters across numerous projects and site types. Test group parameters are subject to change at DSW’s request or due to changes in DES analytical capabilities. The current list of parameters associated with each test group is available in SampleMaster® in the “Reports” menu.

B4. Scheduling

Sample receiving is scheduled with the DES Sample Receiving Coordinator (SRC). Samples should be scheduled by 11:00am the Friday before each week of planned field work. Prior arrangements must be made for samples requiring short holding time parameters (48 hours or less) if they will be delivered to the lab after 2:00 p.m. on Friday. There are no weekend or holiday deliveries unless special arrangements have been made prior to sampling. Samples that require an incubation period (i.e. Biochemical Oxygen Demand), must be scheduled to avoid conflicts with holidays.

For additional scheduling details, refer to the DES Field Sampling Handbook (see Section B5).

B5. DES Field Handbook

DES produces a Field Sampling Handbook annually. Sample collection and delivery logistics, container types, sample preservation, holding times, data qualifiers, and other relevant information is included in the handbook. DSW staff should receive an updated copy of the handbook annually.

B6. Site Access Approval

Ohio EPA uses an access permission process for both public and private lands. Some public lands may require special use permits for the duration of the sampling season, but often sites with public access points and work done within the public right-of-way along roads and other public improvements do not include site access needs. Work completed on private property will often require landowner contact. Site access requirements are determined by agency policy and are detailed in QAPPs as necessary.

C. Field Preparations & Sample Custody

Field preparations and sample custody are the result of coordinated work by both DES and DSW staff. DES SRC is the primary point of contact for DSW staff.

C1. Sample Containers

Most containers used are purchased and distributed by DES to sampling staff. Project staff are responsible for ensuring adequate quantities of containers are on hand, verifying containers are not expired (i.e. PETG), and that containers have not been compromised (i.e. cubitainers that arrive without a lid should be discarded). If containers are obtained from a contract lab, staff should work with the project QAM to ensure all QC needs are met prior to sampling.

C2. Container Labels

Sample containers must be labeled with the laboratory sample identification number, sampling location station number, station name (name includes stream or lake name and location description, i.e., river mile, crossroad, and/or other geographic features), type of sample preservation (acid type, filtration, or non-preserved (NP)), and date of collection.

Label information must be printed using the Sample Master software or neatly written (using indelible ink) on waterproof labels (or tape) and affixed to the containers. Volatile Organics Analysis (VOA) vials require the use of labels, not tape.

C3. Sample Submission Form and Chain-of-Custody

Ohio EPA staff will follow the instructions for sample submission found in the Sample Master® Instruction Manual (internal document, available upon request). The COC sample submission form (SSF) is required for all samples submitted. The sample location information must be on the sample containers and SSFs and must match exactly for DES to log in samples. Sample time must be recorded using a 24-hour clock.

A separate SSF is required for chlorophyll-a samples (See Appendix II).

Use blue or black ink on COC/SSF. COC is used for legal and lab receipt purposes. SSFs must be complete - time, date, name, division, bill to, etc. If there is a mistake on the forms, mark out the incorrect information with a single line and initial. Sample container counts should be corrected if needed, as Sample Master® may generate an incorrect count.

C4. Sample Custody

A written record that can be used to trace the possession and handling of the sample from the moment of its collection through its introduction as evidence is necessary. To ensure samples are analyzed within holding time, check the required holding time in the Ohio EPA DES Field Sampling Handbook and submit samples within the holding time or as soon as possible after collection. Samples analyzed after holding time will be qualified as such by DES.

C4a. Sample Custody – a sample is in your custody if:

- It is in your possession,
- It is in your view after being in your physical possession,
- It was in your physical possession, and you locked or sealed it in a tamper-proof container or storage area,
- It is placed in a designated secure area (USEPA (Science and Ecosystem Support Division), 2021).

C4b. Transfer of Sample Custody – a transfer occurs when:

- Sample(s) pass from the physical possession of one person to another,
- Sample(s) are removed from a tamper-proof container or storage area by a person other than the person who put the sample(s) in the container or area.

C4c. Shipment Services – sample(s) are not considered in custody of a courier or other shipment services so long as they remain sealed in a tamper-proof container (i.e. sealed with evidence tape).

C4d. Transfer of Custody – A signed COC/SSF must be transferred with samples. Each time the custody of a sample or group of samples is transferred, the person relinquishing custody of the sample(s) must sign, date, and record the military time on a DES “COC/SSF,” or similar. The form should indicate the number of samples being transferred, container count, the parameters to be analyzed, and a brief description of the origin of the sample(s). The person receiving custody of the samples must also sign, date, and record the military time on the DES COC.

C5. Sample Shipment

Samples should be packed with adequate ice to ensure they arrive at the lab at ≤6°C (0-4°C for drinking water parameters). Quantities of ice needed will vary with shipping schedules and weather conditions. Containers should primarily be shipped on wet ice. Do not use "blue ice" packs independently, they do not maintain proper temperature. Chlorophyll-a samples should be sandwiched between two blue ice packs and put on wet ice.

Known litigation samples must be in a separate cooler and sealed with evidence tape. Include all paperwork (COC and SSF) with the cooler. Wrap evidence tape around the side of the sample container lid.

It is the responsibility of field personnel to label biohazard samples if they are suspected of being biologically hazardous. Affix a piece of biohazard tape to the sample containers, SSFs and outside of the cooler. Do not write anything on sample container lids.

Take special care to pack glass containers to prevent breakage.

D. Field Instrument Calibration and Maintenance

Surface water field measurements are taken using properly calibrated instruments. Equipment maintenance and recordkeeping is the responsibility of field crews using the equipment. Basic calibration guidance is provided below for equipment typically used by field crews, but it should not be considered exhaustive. Staff are responsible for reviewing manufacturer guidance on the specific equipment in use. Manufacturer guidance should be followed in instances where the information below is contradictory. This section outlines the field equipment most regularly used by Ohio EPA DSW and its calibration and maintenance.

D1. Field Instruments

Field crews primarily use the following equipment for field measurements:

D1a. YSI ProDSS Multiparameter Digital Water Quality Meter - The four-port bulkhead is typically outfitted with (1) 6903 - ProDSS pH Sensor with Module, (2) 6900 - ProDSS ODO Optical Dissolved Oxygen Sensor, and (3) 6902 - ProDSS Conductivity and Temperature Sensor. Optionally, a depth sensor may be included in the bulkhead.

D1b. YSI EXO1 Multiparameter sonde – Four-port bulkhead outfitted with (1) YSI sensor 599870 EXO Conductivity & Temperature Smart Sensor, (2) YSI sensor 599100-01 EXO Optical Dissolved Oxygen Smart Sensor, (3) YSI sensor 577601 EXO pH Smart Sensor *or* YSI sensor 577611 EXO pH & ORP Smart Sensor. Sondes are equipped with battery compartments allowing for short-term, typically three days, deployments.

D1c. YSI EXO2 Multiparameter sonde - Seven-port bulkhead outfitted with (1) YSI sensor 599870 EXO Conductivity & Temperature Smart Sensor, (2) YSI sensor 599100-01 EXO Optical Dissolved Oxygen Smart Sensor, (3) YSI sensor 577601 EXO pH Smart Sensor *or* YSI sensor 577611 EXO pH & ORP Smart Sensor, (4) (1) EXO central wiper 599090-01, (5) EXO Total Algae PC Smart Sensor 599102-01. Sondes are equipped with battery compartments allowing for short-term deployments, typically three days.

D1d. Onset HOBO logging probes. HOBO these probes are stand-alone and capable of long-term deployments.

D1di. HOBO U22 – Stand-alone, long-term deployable temperature logging probe.

D1dii. HOBO U20 - Stand-alone, long-term deployable level and temperature logging probe.

D1diii. HOBO TidbiT MX – Stand-alone, long-term deployable water detecting (i.e., dry or wet) and temperature logging probe.

D1div. HOBO U24 – Stand-alone, long-term deployable conductivity and temperature logging probe.

D1e. SBE 19plus V2 SeaCAT Profiler CTD - Multiparameter continuous profiler used solely on Lake Erie, outfitted with (1) SeaCAT 19plus V2 in 600m plastic housing, (2) 600m strain gauge pressure sensor, (3) SBE 5m pump, (4) SBE 43 DO sensor, (5) 27-1 pH sensor, (6) fluorometer, and (7) conductivity cell. Due to its exclusive use on Lake Erie, see Appendix V – Lake Erie Nearshore Monitoring, for all additional information.

D1f. Stream current and discharge measurement instruments- Ohio EPA exclusively uses acoustic Doppler-style stream current/velocity measurement devices. These fall into two categories.

D1fi. SonTek Flow Tracker Handheld Acoustic Doppler Velocimeter (ADV) and **SonTek Flow Tracker2 Handheld ADV**– Two generations of velocity meter devices to make wading measurements of stream discharge.

D1fii. Teledyne Marine StreamPro Acoustic Doppler Current Profiler (ADCP) and Teledyne Marine RiverRay ADCP – Two different models of tethered devices that allow for measurements of stream velocity and calculate stream discharge from bridges and/or stream banks.

D2. Recordkeeping

Calibration records are kept in a bound logbook. A sample field meter paper logbook form can be found in Attachment 4. All listed fields are considered required and should be completed during each calibration, except for the “Notes” section, which is optional.

D3. Calibration Solutions

Calibration of field instruments requires the use of solutions with known values. DES provides conductivity and pH buffer solutions to DSW. Conductivity solution is a potassium chloride (KCl) solution made in-house by DES and carries a six-month shelf life. pH buffer is commercially purchased and provided to DSW as needed. The solution carries a manufacturer listed expiration date. Buffer solutions may deteriorate from mold growth, evaporation, carbon dioxide absorption, extreme temperature exposure, or contamination. Use care in handling and storing buffers. Discard a buffer if there is a change in appearance (such as if sediment or mold appears) or if the performance cannot meet the criteria stated in Table 4500-H+ (40 CFR § 136.3 (2021)).

D4. ProDSS Calibration (or similar)

D4a. Meter Type – DSW WQ field staff primarily use ProDSS meters for field readings. Other meter types are in use in some instances. Guidance below is primarily based on ProDSS meter specifications. Additional details are provided as considered relevant for current field meter fleets. Always consult with manufacturer literature when necessary.

D4b. Barometric Pressure - If equipped, the barometer is factory calibrated and should rarely need to be recalibrated. Verify that the barometer is accurate and recalibrate as necessary. This can be accomplished using a barometer or cross-checking with other meters in the local fleet.

D4c. Temperature - To ensure optimal performance, it is important to keep the temperature sensor free of any deposits. Rinse the thermistor after each use. If deposits have formed, use mild soapy water and a soft bristle cleaning brush.

Sensors do not require calibration but should be verified against the available fleet at least monthly (see G11aii for guidance on Field Meter Fleet Comparisons). Staff should verify manufacturer guidance for their specific equipment's tolerances.

D4d. Dissolved Oxygen - Dissolved oxygen (DO) sensors include both optical and membrane type sensors. Sensors should be kept clean of fouling which can impact readings. Always store sensors in a wet or water-saturated environment. Membrane type sensors require more regular maintenance and replacement than optical sensors.

DO sensors are calibrated daily prior to use. This is primarily accomplished with a small volume of water in a calibration cup (water saturated air).

Record all calibration, use, and repair and maintenance information in the logbook including name/initials and date.

D4e. pH - pH sensors should be stored in a wet or water-saturated environment (tap water only, short term) or in a KCl solution (long-term, typically 30+ days). Contaminants on the bulb and/or junction can slow sensor response time. Clean the sensors when deposits, bio-fouling or other contamination appears on the glass or when the sensor response time is noticeably slow.

At the start of each sampling day, calibrate (or validate) using two reference buffers. If the expected sample reading is alkaline, use pH 7 and pH 10 buffers. If the expected sample reading is acidic, use pH 7 and pH 4 buffers. The acceptable range for validation of pH sensors is 0.2 units from the selected buffer. Validation should be done with pH 7 solution. If the reading is no more than 0.2 units different than the calibration solution, then record that the values have been validated. If the reading is greater than 0.2 units different than the calibration solution, continue through the full calibration procedure.

Record all calibration, use, and repair and maintenance information in the logbook including name/initials and date.

NOTE: The response of a pH electrode is temperature dependent. If a temperature compensating pH probe is not used, the instrument should be calibrated under field conditions. It may be necessary to store buffers in insulated containers to prevent them from freezing. Therefore, it is important that buffer solutions and unknown solutions *be at nearly the same temperature (*i.e. *within ±2˚C) prior to measurement. If this is not the case, the temperature of the buffer solution can be adjusted by submerging the closed bottle of buffer solution in the test water for several minutes prior to use. Since the actual pH of reference buffer solutions varies slightly with temperature, it will then be necessary to use the pH value of the buffer at the "adjusted" temperature when standardizing the instrument (see* Table 1). *Use of temperature compensating pH probes eliminates this variable.*

Table 1 Variation of standard pH buffer with temperature

Temp (°C)	pH		
	4.0	7.0	10.0
0	4.00	7.12	10.31
10	4.00	7.06	10.17
20	4.00	7.02	10.05
25	4.00	7.00	10.00
30	4.01	6.99	9.95

D4e. Conductivity - Conductivity sensors can be stored wet or dry when in regular use. Manufacturers may recommend dry storage long-term (i.e. month or more between uses). It is important to keep the conductivity channel clean and to remove any deposits or fouling on the electrodes.

Calibration is completed using DES provided KCl at a specific conductivity of 1413µS/cm. The acceptable range for validation of conductivity sensors is 2 µS/cm. Record all calibration, use, and repair and maintenance information in the logbook including name/initials and date.

D5. Deployable YSI Multiparameter sondes

The sensor calibration for these sondes is the same as outlined in Section D4 above.

Ohio EPA has developed a maintenance and calibration log that is maintained for each sonde. Each sonde's log consists of three parts: a sensor maintenance log (Attachment 5. Deployable YSI Multiparameter Sondes Sensor Maintenance Log), a maintenance log (Attachment 6. Deployable YSI Multiparameter Sondes Maintenance Log), and a calibration log (Attachment 7. Deployable YSI Multiparameter Sondes Calibration Log). For each sonde deployment the calibration is logged in the maintenance log and a calibration log filled out documenting the details of the calibration. Each form must be filled out completely.

During calibration, any instability in readings should be documented within the comments of the calibration log, as this is possibly a sign of sensor damage in the pH or DO components. Unusual sensor wear or other peculiarities noted during the calibration should be noted in the appropriate location. Any maintenance done to the sonde, such as changing sensors, sensor components, batteries or servicing the pH reference junction, should be documented in the sensor maintenance log (Attachment 5. Deployable YSI Multiparameter Sondes Sensor Maintenance Log) and the maintenance log (Attachment 6. Deployable YSI Multiparameter Sondes Maintenance Log) appropriately.

Maintenance on sondes and sensors should be performed according to manufacturer's specifications. Need for maintenance is continuously tracked in the calibration and maintenance logbook and the lab post-check process outlined in this procedure (see Section G.11). Malfunctioning equipment shall be evaluated for problems using manufacturer troubleshooting guides and in-house best professional judgment.

For long term storage of equipment, the equipment is stored according to the manufacturer's recommendations.

D6. Onset HOBO Logging Probes

Calibration of all HOBO loggers is normally unnecessary but consult the directions and specifications provided by the manufacturer to verify this for the specific model being used.

All Onset HOBO probes used by Ohio EPA have temperature probes. Temperature cannot be calibrated on HOBO probes. A pre- and post-deployment verification is carried out on the temperature parameter, see Section G.11.

No calibration is possible for the level logging parameter of the U20 HOBO probes. See Section G.11 for level logging accuracy QC.

The water sensing aspect of the TidbiT MX cannot be calibrated. See Section G.11 for water sensing accuracy QC.

Calibration of the conductivity sensor of the U24 HOBO probes requires temperature and conductivity calibration readings with a portable conductivity meter at both the beginning (launchtime) and end of a deployment (readout). These readings are necessary for data calibration and to compensate for any measurement drift during deployment. The conductivity calibration readings should be the actual conductivity, without temperature compensation (not in specific conductance at 25°C), and should be recorded in a notebook with the time and location of the reading. These readings are used in the HOBOware Conductivity Assistant to calibrate the readings for the corresponding data series offloaded from the logger

There is no routine maintenance necessary for HOBO probes. Equipment should be cleaned after retrieval to remove any debris, deposits, or algal growth.

HOBO probes should be stored according to the manufacturer's recommendations, which may vary slightly depending on the model. Storage outside of a range from 32-77 degrees F may reduce expected battery life.

D7. Stream Current and Discharge Measurement Instruments

Both the SonTeck ADV and Teledyne Marine ADCP units are operated according to manufacturer's instructions. Neither type of tool can be calibrated by the user. See Section G.11 for QC steps carried out.

E. Field Measurements

Field measurements with a YSI ProDSS Multiparameter Digital Water Quality Meter, or similar**,** are collected with most grab samples. The meter recorded time is uploaded to the Ecological Assessment and Analysis Application (EA3) database and serves as the sample collection time of record. Field measurements collected more than fifteen minutes before or after sample collection should not be associated with a given sample in most cases. Samples taken more than fifteen minutes apart from field readings are considered a separate, discrete sample.

E1. Field Reading Methods

Stream measurements can be taken either directly from a waterbody or from a bucket or similar containers. When taking readings from a secondary container, water should be collected in such a manner as to not introduce additional oxygen or otherwise alter the physical nature of the sample. Readings should be collected almost immediately. If sensors require flow, the meter head should be gently moved around the container to ensure water is constantly passing over the sensors without introducing additional air.

E2. Field Readings –Single Point Readings

Ensure the probe is fully submerged in the sample. Move the probe as necessary to release any air bubbles and to provide fresh water to the sensors. Once stabilized, log the reading.

Temperature sensors are typically quick to respond and accurate to conditions unless there is a significant change between the ambient air and the sample (i.e. warm vehicle vs cold stream in winter). Temperature readings can be taken (or verified in the field) with a thermometer.

DO is often the slowest parameter to respond and should be observed carefully before recording a value. Membrane sensors typically require one foot per second flow velocity.

pH readings should stabilize quickly, although values closer to the extremes may take longer. Once stabilized, log the reading.

Conductivity sensors are typically quick to respond and accurate. A temperature reading should accompany a conductivity reading to allow for the calculation of specific conductivity if the meter does not provide that parameter.

E3. Data Sondes

This sub-section outlines best practices for the deployment of auto-logging water quality sondes (sondes). Sonde can be outfitted with sensors to collect many parameters, but in normal circumstances commonly Ohio EPA staff collects the set of temperature, specific conductivity, pH, and DO. The resulting data are utilized in various analyses, including supporting the assessment of nutrient and/or organic enrichment and identifying the influence of intermittent non-point sources on conductivity. Details of the type of data collected and how it supports a project are documented in the QAPP for that project. The processes documented in this procedure are appropriate for deployments where equipment is deployed for less than two weeks and is returned to the central laboratory location. Most Ohio EPA sonde deployments are for three days at a time. Longer-term deployments that require field calibration and maintenance are outside the scope of this procedure. Ohio EPA DSW currently uses YSI EXO1 and EXO2 Multiparameter sondes for these measurements.

Sonde calibration is described above in Section D5.

E3a. Programming - Sondes are programmed by staff to begin taking readings at a certain time. This date, time, and interval is typically reflected on the sonde deployment request form. Staff are to write the sonde serial number on the deployment field sheet (Attachment 8. Deployable YSI Multiparameter Sondes Field Sheet), along with other related information.

E3b. Deployment - All sondes should be appropriately secured when deployed. Ohio EPA typically uses a stainless-steel sleeve to protect the body of the sonde as well as provide additional weight. The stainless-steel tubes slide over the body of the sonde and are secured when the deployment sensor guard is tightened. Other securing mechanisms can be appropriate if they provide adequate protection of the sonde against the field conditions.

Sondes are to be placed in a location that captures median stream character. For example, a sonde should not be placed in the only deep pool of the stream segment being assessed. However, if the stream is largely pooled and sluggish, water moving more swiftly should not be sought out. In streams with typical run-riffle-pool-glide structure, the most ideal location to place the sonde is within the run or glide. These segments have sufficient velocity to help prevent biofouling but have slower velocities than riffles, which may move coarser bed materials into the protective sleeve and sensor guard, making them difficult to remove. Large riffles and waterfalls can have substantial local impacts due to reaeration. Unless the entire sampling reach consists of rilles and/or waterfalls, such features should be avoided by deploying the sonde on the upstream end of them. Sonde deployment location needs to be representative of the conditions across the channel. This is typically accomplished by placing the sonde within the thalweg of the stream where most of the flow occurs. In general, eddies and peripheral areas should be avoided. In some streams, especially larger streams with wide channels, lateral variability can be a concern. If these concerns arise, they should be discussed in the QAPP for the project. The probes need to avoid sediment deposits at the stream bottom. If a sonde is being deployed in deep water, an empty cubitainer or similar device should be used to float the sensors into the water column. In the case of bracketing a point source, the downstream sonde needs to be deployed beyond the mixing zone.

For every sonde deployment, field sheets need to be filled out (Attachment 8. Deployable YSI Multiparameter Sondes Field Sheet). Sonde field sheets document the date, time, exact location of deployment, and qualitative environmental data (such as depth, velocity, substrate, flow regime, rainfall, and weather condition) at the time of deployment.

E3c. Equipment Retrieval - Upon retrieval, the sensors should be visually inspected, and any conditions with potential effects on data quality should be noted on the field sheet. Probes need to be maintained in the same condition as the deployment, to the extent possible, when the storage cap is put on. If substantial fouling occurs and is minimally disrupted, the post-check process can identify the impact on the data.

For every sonde retrieved, the remainder of the field notes need to be filled out on that sonde's field notes sheet. Sonde field sheets document the date, time, qualitative environmental data at the time of retrieval, and sonde inspection results. Additional notes should indicate the weather conditions throughout the deployment.

E3d. Data management – Upon return to the Ohio EPA facility, raw data files are downloaded from the sondes, typically during the QC post-check process (see Section G11). The files are saved in the Excel .csv format (comma separated value). The raw files are stored locally on the state of Ohio servers. Raw data is organized by year and project.

After QC is complete and data are adjusted as needed (see Section G11) the data are reorganized/graphed, assigned the staff person who collected the data, and uploaded to Ohio EPA's in-house developed relational SQL Server sonde database. At this point, the data is approved and can be used.

E4. Onset HOBO Logging Probes

This section outlines best practices for the deployment of Onset HOBO logging probes (loggers). All HOBO probes used by Ohio EPA log temperature, and temperature is the only parameter measured by the U22 loggers. Temperature loggers are used to collect temperature data in surface waters to document the ambient temperature profile over a long period, recorded at pre-programmed time intervals. The U20 loggers also measure water level. These data are most commonly paired with stream discharge measurements to establish a stage to stream discharge gage relationship. Once the relationship is made, the level logger data is used to determine the stream discharge throughout the period the logger was deployed. The TidbiT MX loggers can detect and record the presence of water. The U24 loggers measure water conductance.

These loggers are used to service various DQOs that are documented in project specific QAPPs. The procedures described within this document are intended for long-term deployments ranging from weeks to months.

E4a. Programming - The loggers are programmed by staff prior to field deployment to begin taking readings on a specified date and time and at prescribed time intervals. A measurement interval of 30 minutes is recommended but should be at least hourly to adequately characterize the thermal regime of the water body over the length of the deployment. The file name upon programing can include the station ID that logger will be deployed at or use a generic name that will be updated upon download. Record the programmer's name, programming date, the date and time the device is programmed to begin measurements, along with the programmed measurement interval on the field data sheet (Attachment 10) in the space provided in the "Lab Use Only" box. Update the deployment tracking spreadsheet as the loggers are deployed, recording the deployer's name and the deployment location and date.

E4b. Deployment - Loggers need to be placed, secured, and concealed to maximize the chance of obtaining a continuous record of ambient water temperature for an extended period, lasting from weeks to months. Place the logger as close to the biological sampling locations as possible. Avoid exposure to direct sunlight where possible while accounting for other factors such as water depth and concealment opportunities. Avoid placing the logger near or immediately downstream of road crossings or recently disturbed areas unless this is unavoidable.

For U22 and U24 logger deployment: Secure the pre-programmed logger to the inside hollow center of a half cinder block using a zip tie or similar fastener as shown in Figure 1 below. Place the logger in a location as close as practical to the collection of biological sampling. Consult Part C of the Volume III biocriteria manual updates (June 2015) for tips on qualitative macroinvertebrate sampling and the macrohabitats the biologists will look for when sampling.

Figure 1. Temperature Logger Affixed to a Cinder Block

Place the block with attached logger onto the stream bed with the long axis of the block parallel to the flow in a pool or other location that is likely to remain deep enough for the logger to remain submerged for the duration of the deployment. Choose a location out of direct sunlight, where possible, and within the main channel. Place in an area out of view from casual observation and where maximum concealment opportunities exist to minimize vandalism or theft. This could include log jams, root mats, boulder slabs, or undercut banks, for example. Secure the block to a stable object such as a log or tree using a wire cable and padlock. In some streams such as those completely dominated by bedrock or that are extremely shallow, it may be necessary to use alternative methods and some ingenuity to place and secure the logger, such as tightly wedging it into the crevice of the bedrock or cabling it directly to the underside of a large boulder or slab. Alternative methods not using a cinder block must: 1) sufficiently anchor the logger; 2) shield the logger from solar radiation; and 3) protect the logger from physical damage. Using a thermometer or field meter, measure and record the water temperature at the time of deployment. Take photos of the stream and deployment location, document the latitude/longitude of the deployment location, and record any field notes that may be useful in the recovery of the logger.

For TidbiT MX logger deployment: The following outlines some considerations of deployment methods for detecting water presence. Secure the pre-programmed logger to the top of a brick using a zip tie or similar fastener. Place the logger in the thalweg of a riffle. If a riffle is not present, the logger should be placed in the thalweg of the shallowest section of the stream. Place the brick with attached logger onto the stream bed with the long axis of the brick parallel to the flow. Choose a location out of direct sunlight, where possible, and within the main channel. Place in an area out of view from casual observation and where maximum concealment opportunities exist to minimize vandalism or theft. The block/brick the logger is affixed to should be buried deep enough so that the logger is level with the streambed. When possible, secure the block to a stable object such as a log or tree using a wire cable and padlock. In some streams such as those completely dominated by bedrock or that are extremely shallow, it may be necessary to use alternative methods and some ingenuity to place and secure the logger, such as tightly wedging it into the crevice of the bedrock or cabling it directly to the underside of a large boulder or slab. Alternative methods not using a brick must: 1) sufficiently anchor the logger; 2) shield the logger from solar radiation; and 3) protect the logger from physical damage. Using a thermometer or field meter, measure and record the water temperature at the time of deployment. Take photos of the stream and deployment location, document the latitude/longitude of the deployment location, and record any field notes that may be useful in the recovery of the logger.

Deployment Field notes: A field data sheet is completed for every temperature logger deployment (Attachment 10). The field data sheet is used to document the date, time, exact location of deployment, and qualitative environmental data (such as depth, flow type, velocity, substrate, stream shading, flow regime, and weather condition) at the time of deployment. The field data sheet is also used to document information regarding the location of the logger's placement so that it may be retrieved following a long duration deployment.

E4c. Retrieval - When possible, a periodic check of the logger is recommended during the deployment period to verify that the logger is fully submerged and that it has not been lost, stolen, damaged, or buried by fine materials such as muck, silt, or fine sand. Time permitting, these inspections are especially recommended shortly after a large storm event where higher flows have a greater chance of dislodging the logger. If any inspections are made of the logger while deployed, record any notes made along with the date(s) in the space provided on the field sheet. Upon retrieval, the logger should be visually inspected for any obvious damage and for battery operation with notes made to the field sheet in the "retrieval notes" section.

Using the same field sheet used for deployment, document the date, time, and qualitative environmental data at the time of retrieval along with any inspection notes. Measure and record the temperature when the logger is retrieved using a thermometer or field meter.

E4d. Data Management - Logger file names must be saved with the station ID the logger was deployed at and can include other information that will be useful such as survey project name. The raw data files are downloaded from the loggers and saved in a comma separated value (.csv) format. The raw files are stored locally on the state of Ohio servers. Raw data are organized by year and project. Ensure that the unit is turned off once the data have been successfully downloaded. Record the date the logger is returned along with associated information on the tracking spreadsheet.

Staff within the Assessment and Modeling Section at Ohio EPA review the raw data with regards to collected QC data. The raw data files are trimmed so the start and end time correspond to the deploy and retrieval times. Other anomalies in the data are considered and field notes are reviewed. If data are removed from the data set, a specific quality assurance record (QAR) note is developed. QARs are recorded in files stored on the state of Ohio's servers. Once all data for a site are reviewed, the field sheet is initialed and dated by the reviewer. At this point, the data are approved and are ready to be used.

E5. Stream Current and Discharge Measurement Instruments

Ohio EPA only measures stream discharge using instruments that utilize acoustic Doppler current meter technology. These tools have no moving parts like the spinning cups of older style current meters. The two main styles of these instruments Ohio EPA uses are SonTeck ADVs and Teledyne Marine ADCPs. These instruments differ in that the ADVs are used for wading measurements. The ADCPs are tethered to a rope allowing staff to be out of the stream on a bridge and/or stream banks. The "profiler" aspect of the ADCPs means that these tools measure the stream width from bank to bank and determine the stream depth. These are features that allow the staff to not be in the stream. Alternatively, the ADVs require staff to determine and enter into the instrument's computer each velocity measurement's width location and water depth.

Ohio EPA follows stream discharge measurement protocols, including specifics of the use of ADVs and ADCPs, as set forth by the United States Geological Survey. Refer to Turnipseed and Sauer (2010) for the detailed protocols. Ohio EPA staff that regularly measure stream discharge also interact with USGS staff from the Ohio Indiana Kentucky Water Science Center regarding measurement techniques.

F. Water Chemistry Sample Collection and Preservation

Samples must be: (a) representative of the material being examined; (b) uncontaminated by the sampling technique, container, or preservative; (c) of adequate size for all laboratory examinations; (d) properly and completely identified; (e) properly preserved, and (f) delivered and analyzed within established holding times. Samples that fail to meet these requirements may be rejected by the collector at any time from initial collection through the completion of the QC process.

F1. Sample Location

Water sampling locations should be far enough upstream or downstream of confluences or point sources so that the stream and effluent is well mixed. Natural turbulence can be used to provide a good mixture. The exception to this is sampling meant to evaluate effluent, a mixing zone, or other inputs or illicit discharges.

Samples should be collected at a location where the velocity is sufficient to prevent deposition of solids, and to the extent practical, should be in straight reach having uniform flow. All flow in the reach should be represented, so divided flow areas should be avoided, and samples should be taken towards the middle of the reach where feasible. Samples should not be collected from backwater or in areas otherwise impacted by growth or debris in the stream.

The sampler must always be downstream of the collection vessel (when standing in the stream) and sample "into the current." Ensure no one is upstream of the sample. Care must be taken to avoid introducing re-suspended sediment into the sample. If a sample is collected with a bucket and rope from a bridge, care should be taken not to allow sediment in the sample. In shallow conditions, it's recommended that the sampler wade in the water to collect the sample.

Sampling location should be selected based on DQO's and detailed in the project specific QAPP. See Appendix VI – Data Management, for details on site tracking.

F2. Sample Types

F2a. Grab Samples - A grab sample is defined as an individual sample collected over a period not exceeding 15 minutes. Grab samples represent only the condition that exists at the time the sample is collected (USEPA, 2017).

> **F2ai. Surface Grab Sample** - A sample collected at the water surface (i.e., skimming) directly into the sample container or into an intermediate container such as a clean bucket. A single or discrete sample collected at a single location.

F2aii. Subsurface Grab Sample - Includes any sample that is not a surface sample and is the most frequently used method for stream sampling by DSW. This includes samples taken from a bridge with a bucket or using a cubitainer and submerging below the water surface. A single or discrete sample collected at a single location.

F2aiii. Integrated Grab Sample - A sample comprised of one or more sub-samples collected from a water column or across a cross-section of a waterbody within a short period of time (less than 15 minutes). An example of the need for such sampling occurs in a river or stream that varies in composition across its width and depth.

- Vertical integration is accomplished by allowing the sampling container to fill continuously as it is dropped down or retrieved up through the water column (i.e. Plankton Tow in Appendix IV – Inland Lakes Field Manual).
- Integration may also be accomplished by collecting a series of grabs from multiple points across a stream or vertically in a lake. These samples should be collected and homogenized in a churn splitter as a single integrated grab, then dispensed into sample container(s). Integrated grab samples are used to collect stream grab samples when incomplete mixing exists or to create a representative sample of a lake through vertical integration. Conductivity, temperature, pH and DO measurements as well as visual observations can be utilized to determine if horizontal plumes and/or vertical stratification are present.

F2b. Composite Samples - A sample comprised of several sub-samples collected over an extended timeframe, usually 24 hours. Typically, time proportioned and collected with an automatic sampler, but may be flow proportioned in special circumstances. All composite samples should be identified as to the method of sampling collection, volume of sub-sample, duration of composite (e.g., 24 hours), and frequency of the sampling (e.g., every 2 hours).

F3. Sampling Equipment and Supplies

Sampling equipment listed below includes all devices in common use by DSW staff. Equipment should be selected based on the type of sampling being performed to ensure a representative and substantively unaltered samples are collected. Additional equipment may be utilized as necessary for specific projects, needs and circumstances.

F3a. Automatic Samplers – Unattended sampling (i.e. 24-hour time composite) necessitates the use of an automatic sampler. Generally speaking, an automatic sampler configuration consists of a stainless steel or high-density polyethylene (HDPE) weighted strainer, Teflon-lined tubing, peristaltic pump, and glass or HDPE collection container(s) sized to hold a single composite or multiple discreet samples. The device is calibrated prior to deployment to ensure proper volumes are collected for each subsample. Samples should be kept iced throughout the period of sample collection. DSW staff use multiple models of automatic samplers; manufacturer guidance should be followed for operational guidance.

F3b. Beta Bottle (Vertical and Horizontal) – A Beta Bottle (or Van Dorn), Kemmerer, or similar allows for discrete sample collection at a predetermined depth (Welch, 1948). DSW primarily uses acrylic, 4L bottles, although other sizes and materials may be acceptable. A horizontally oriented bottle is used for inland lakes and upground reservoirs while a vertically oriented bottle is used for Lake Erie.

F3c. Churn Sample Splitter – polyethylene vessel with a disc churn, handle, lid, and spigot. used for creating duplicate samples. Appropriately sized vessel should be used for each sampling type (i.e. 8L for smaller volumes and 14L for Lake Erie composite samples). When filled, sample should not touch the lid. Useable volume ends when the water level reaches the spigot inlet.

F3d. Ethanol (95%) – Laboratory grade ethanol, diluted to 70% with site water, is used for storage of zooplankton samples collected on inland lakes and mayflies collected on Lake Erie.

F3e. Gloves – Gloves provide protection against various hazards while sampling. The type of gloves worn shall be determined by the sampling circumstance and types of pollutants expected – for instance longer gloves may be used during sediment or cyanotoxin sampling. Nitrile gloves are commonly used in most circumstances.

F3f. Deionized (DI) Water – DI water used for cleaning sampling equipment can be either supplied by DES or produced by an installed properly designed and maintained system. After being received or produced, DI water does not expire. Storage is to be only in clean carboys or cubitainers. DI water is not appropriate for QC samples.

F3g. Eckman Dredge – Used for collection of sediment samples. It consists of a 6”x 6”x 6” collection bucket with spring-loaded jaws, an opening in the top to allow for viewing the sample before opening the jaws, and a weighted messenger to trigger the spring release mechanism that closes the jaws. This dredge is best suited for soft sediments but unsuitable for both coarse and compacted sediments because its light weight does not allow for good penetration in these sediment types. A Ponar dredge should be used for lake sediment sampling.

F3h. Chlorophyll-a Filter Apparatus – Consists of a filtering flask, clean graduated cylinder (when filtering water samples), funnel, 47 mm diameter Whatman® grade GF 6 filter, vinyl vacuum tubing, and a manual or powered vacuum pump with gauge. Following filtration, a clean tweezer is used to carefully fold and remove the filter for placement into a clean piece of aluminum foil that is folded to seal the filter before being placed in an unused sealable plastic bag. Bags are then placed between two freezer packs (frozen) and in a cooler with wet ice.

F3i. HDPE Amber Jug – At least 1-liter in volume, used for collection of whole water samples to be filtered for chlorophyll-a. Gentle mixing to homogenize the contents of the jar is required immediately prior to dispensing into subsequent containers.

F3j. HDPE Bucket – Primarily used for collection of samples from a bridge via rope. A bucket other than HDPE may be used in most instances. Organics must be collected with a stainless-steel bucket.

F3k. Integrated Tube Sampler – Polyvinyl chloride (PVC) construction 2” tube (1-piece or outfitted with a threaded joint in the center to aid in cleaning and storage) providing a 2-meter-deep fillable volume, quarter-turn ball valve at the bottom, and rubber stopper at the top. See Appendix IV – Inland Lakes Manual, for additional information.

F3l. Littoral Wash Bucket - heavy-duty plastic bucket with stainless wire cloth (#30 mesh) reinforced with a stainless-steel plate with 1/2″ drainage holes. Three-gallon (12-liter) capacity for washing Ponar grabs on site.

F3m. Lugol's Iodine - solution of potassium-iodide and iodine used as a fixative for microscopic analysis of phytoplankton on inland lakes.

F3n. Nanopure™ Water – Ultra-pure water used to create equipment blanks, field blanks, and trip blanks. Nanopure water is not to be used beyond the expiration date (30 days from being generated). It may be used as a substitute for DI water at any time.

F3o. Ponar (Standard and Petite) - Used for collection of most sediment samples. The standard-sized Ponar collects from a 9"x 9" sample area whereas the Petite Ponar collects from a 6"x 6" area. Ponar sediment samplers rely on their weight to penetrate sediment. A standard Ponar weighs 50 pounds empty and up to 75 pounds with sediment making use of a crane and winch necessary – especially for lake sediment sampling. The Petite Ponar weighs 24 pounds empty and 28 pounds full making it much easier to manage. Ponar dredges feature flappers on the top screens to allow water to pass through during descent (thereby minimizing sediment disturbance) and minimize loss of collected sediment during the retrieval process.

F3p. Sample Container – In some instances a sample must be collected directly into a sample container. These methods are detailed further in the sections that follow. Many samples may be collected directly into containers (i.e. stream grab samples) while others (i.e. pre-preserved containers for saxitoxin) require the use of an intermediate sampling vessel.

F3q. Secchi Disk – A 20 cm diameter plastic disk used to measure the transparency of fresh water. The disk may be affixed to a measuring tape or non-stretching rope which may be marked with 1-cm graduations. The disk should be repainted or replaced when it becomes worn and otherwise cleaned periodically to ensure there is good contrast between the white and black pattern.

F3r. Stainless Steel Bowl, Tray, Spoon, and Scoop – Used for processing sediment samples. See Appendix III Sediment Sampling for additional information.

F3s. Stainless-Steel Bucket – A stainless-steel bucket may be used instead of HDPE where necessary but should be otherwise avoided when collecting samples being analyzed for metals.

F3t. Syringe & Filter – Used for filtering samples to be analyzed for dissolved phosphorus and orthophosphate. A Whatman™ 0.45µ GM/F to filter is attached to a 60 ml polypropylene syringe with Luer-Lock™ tip. Syringes and filters are single use only. A new filter can be used when filtering becomes too difficult. For low-level orthophosphate samples, the syringe and filter require rinsing with Nanopure™ prior to filtering.

F3u. Teflon Pitcher – 2-liter Teflon pitcher may be used as intermediate container for dispensing samples collected with ITS or for scooping from an automatic sampler.

F3v. Wisconsin Net - Consists of an anterior reducing cone; a posterior conical filtering net; and Dolphin™ adapter with Wisconsin bucket. A stainless-steel net ring holds filtering net open where the reducing cone and filter net meet. Bridle and bucket are stainless steel. Mouth diameter: 13 cm, ring diameter 18 cm, 80 µm mesh.

F4. Method Selection

F4a. Selection of Grab Samples - Grab samples are appropriate for the characterization of a waterbody at a particular time, to provide information about minimum and maximum concentrations, to allow for the collection of variable sample volume(s), to comply with the National Pollutant Discharge Elimination System (NPDES) permit monitoring specifications, or to corroborate with a composite sample.

Grab samples may be collected directly into the sample container, or a clean decontaminated intermediate container. If an intermediate container is used, rinse the sampling device (bucket, automatic sampler) and any additional devices (churn splitter) with site water prior to collecting the sample and be sure to discard rinse water downstream of where sample will be collected. If samples are collected in a bucket and distributed to multiple cubitainers, use a churn splitter or similar device where practical, or at a minimum pour in back-and-forth pattern – e.g. 1-2-3-3-2-1 with a minimum of 500ml per aliquot. A churn splitter or similar should always be used in extremely turbid conditions. Do not pre-rinse sample containers unless specified for a given container.

Subsurface samples should be collected for most stream sampling. Surface grab samples are used only when collecting floating materials, such as oil and grease or a Harmful Algal Bloom (HAB) scum sample. Surface grab samples should be collected from enough horizontal locations to characterize the shore-to-shore distribution of the parameter(s) of interest as necessary.

Multiple subsurface grab samples may be appropriate to determine water quality at various discrete depths. A Beta Bottle (Kemmerer or VanDorn water sampler) (Welch, 1948) may be used for this type of sampling. Depth composite samples, while collected in the same manner, should always be well integrated in a churn splitter due to the natural variability of the lake profiles.

F4b. Selection of Composite Samples - Composite samples are required when a widely variable flow, or parameter concentration, is being sampled and “average” concentrations, or loadings, are desired. Twenty-four-hour composite samples are to be used in NPDES Compliance Sampling Inspections (except as noted in Part c below) to screen for compliance with concentration limits in NPDES Permits.

Automatic sampling equipment must be as free as possible of Tygon tubing and other potential sources of contamination. Teflon or Teflon-lined Tygon tubing is acceptable for use as organic sampling intake line. PVC/Tygon tubing is acceptable for use as conventional sampling intake line. The pump tubing can be organic chemical resistant Tygon peristaltic pump tubing or silicone tubing supplied by the manufacturer.

F4c. Sample Volumes - The size of the final sample is an important consideration. This must be more than required for all the tests to be made, thus providing for any duplicate or repeat examinations that may be necessary. Sample volumes needed are documented in the Ohio EPA Field Sampling Handbook, produced by DES annually. Sample type selection may be impacted by sample volumes. The use of a churn splitter may be beneficial in some instances where multiple grabs are composited to create a single, homogenous sample of greater volume.

F5. Container Type, Handling and Special Considerations

F5a. Cubitainers - Quart and gallon size disposable, soft, low-density polyethylene (LDPE) cubitainers with disposable polypropylene lids are used as the primary sample containers for most samples (see Tables 2 and 3). Cubitainers must be stored with lids on until samples are to be collected. Preservation varies with method and target analytes. Cubitainers are used for preserved, NP, and filtered samples.

Samples requiring analysis for acidity and alkalinity should be collected in cubitainers and must be iced or refrigerated to less than or equal to 6˚C. Samples for the analysis of these parameters should not be composited when sampling NPDES permit discharges whose effluent has a highly variable pH that might be expected to exceed the permit limits during a given 24-hour period.

Samples requiring analysis of cyanide should be collected in a quart cubitainer and preserved with 4-6 pellets (depending on pellet size) of sodium hydroxide (NaOH) transferred to the container without handling the preservative. The pH of the sample must be >10 but less than 12 standard units. If unsure of ability to meet pH requirements, a replicate sample may be collected, tested with a pH strip, and discarded.

> *Note: Cyanide Interference*
>
> *Carbonate: If a co-collected acid preserved sample effervesces when acid is added, it must be noted on the SSF.*
>
> *Sulfide: If sulfide is suspected to be present in the sample (rotten egg odor), test by placing a drop of sample on a lead acetate test strip that has been previously moistened with acetate buffer. If the test strip turns black, sulfide is present, and treatment is necessary.*
>
> *Sulfide treatment: diluting with Nanopure™ water until the test strip no longer turns black is the preferred method, with the dilution volume noted on the SSF.*
>
> *If this will raise the RL too high, instead add either powdered lead carbonate or lead acetate solution to the sample until no further black lead sulfide precipitates out. Retest with lead acetate paper, immediately filter the sample with coarse filter paper (5 um) and preserve with NaOH.*

F5b. Amber Glass Jars – One-quart amber glass jars with Teflon-lined screw caps are used as sample containers for most organics. Preservation varies with method. Amber 500 ml glass jars are used for most sediment parameters. Lid must be Teflon-lined for organics, sediment, and (base-neutral and acid) BNA analytes. Samples for polychlorinated biphenyls (PCBs) and pesticide analyses require, USEPA method 608, the collection of two additional jars. Jars must be stored with lids on until samples are to be collected.

Samples analyzed for the organic compounds Alachlor, Atrazine, Metolachlor, Simazine, and Metribuzin, using Ohio EPA Method 525.2, require two glass amber jars preserved in the field with 40-50 mg of sodium sulfite to reduce residual chlorine then 6 N HCl (hydrochloric acid) to adjust the pH to <2 are required. If Cyanazine is requested, an additional two NP glass amber jars are required (for a total of 4 jars). For the two preserved jars, sodium sulfite should be added first to the sample, the lid re-applied, and the sample inverted a couple of times prior to adding the 6 N HCl.

Since atrazine values change rapidly in streams, field staff may opt to use 525.2 during spring sampling runs rather than collecting screening samples. The decision to use the 525.2 method can be made during project planning and memorialized in the QAPP or may be the result of field crew best professional judgement.

F5c. Clear Glass Jars – Several types of glass jars are used across a range of parameters. These include 125 ml graduated glass (zooplankton), 125 ml clear glass (phytoplankton), and 32 oz clear glass (phenols). Jars must be stored with lids on until samples are to be collected.

Samples requiring analysis of phenols must be collected in glass laboratory issued containers. A white polypropylene cap with a foam polyethylene liner must be used. Black and green caps contain phenol and must be avoided. Also, avoid caps with cardboard liners. Phenols must be collected as grab samples.

Phenols for compliance monitoring require the collection of additional water (one 1-liter jar, preserved with H_2SO_4) to meet the volume requirements of manual distillation. Sample volumes exceeding 125 ml should be collected in one-liter glass container(s) with white polypropylene cap(s) with a foam polyethylene liner. Two ml of H2SO4 should be added per liter of sample as a preservative. Samples must be iced or refrigerated at less than or equal to 6˚C.

Samples for all metals but mercury should be collected in a 1-quart cubitainer. Mercury samples must be collected in a 125 ml glass jar and preserved with 0.75 mL HNO_3 (nitric acid). This container may also be filled from the metals cubitainer after preservation. Samples do not require refrigeration once they are preserved with HNO_3.

F5d. HDPE Bottles – Mayfly samples are stored in re-useable 32 oz HDPE bottles. Bottles should be cleaned between uses. Samples are only used for enumeration, so are not subject to critical cleaning methods.

F5e. Oil and Grease Jars - Two one-quart glass jars with Teflon-lined screw caps should be used as sample containers for this parameter. No intermediate container is allowed for sampling this parameter. Sample collection is via a surface skim in a calm location (not sub-surface). Sample may not overflow the container during collection, and volume must allow for addition of preservative. Jars must be stored with lids on until samples are to be collected.

F5f. PETG – Bottles are used for microcystins and cylindrospermopsin analysis. Must be rinsed three times with site water prior to filling.

F5g. Plastic Bags – Sediment particle size is collected in quart plastic bags. Samples should be placed in a labeled bag, with the top folded over, then in a second plastic bag to protect against leakage.

F5h. Sterile Bacteria Container - Samples are to be collected directly into a sterilized glass or polypropylene (or other autoclavable plastic) bottle. A clean intermediate container, namely a Teflon bucket, may be used where necessary. Samples should be collected by hand according to the following procedure:

Sampler must stand downstream of collection bottle, and sample “into the current.” Avoid contamination by surface films or debris by opening the container under water. This is accomplished by holding the container near the base with one hand and removing the cap with the other hand.

Sample containers should be opened at depth of about six inches with the mouth of the collection container down. The mouth of the bottle is then tilted upward into the current and allowed to fill. If there is no current, move the container through the water in a continuous and unbroken movement. Bottles should be filled above the 100 ml mark. Headspace is necessary to allow proper mixing of the sample during analysis, as such, a container should not be filled to the top. Add sodium thiosulfate crystals or 0.1 ml of a 10 percent sodium thiosulfate solution to the sample if residual chlorine is suspected.

For safety reasons, it may be impossible to collect a bacteria sample directly into the sterile container. If samples must be collected remotely, a clean bucket (well rinsed with site water) may be used to collect the sample and then the sample transferred to the sterile container by pouring the contents of the bucket into the sample container.

Bacteria samples collected to document unsanitary conditions in water bodies that are not listed in the water quality standards rules should follow procedures in Section E of Appendix II.

Bacteria samples must be maintained in the dark and iced or refrigerated at less than 6˚C but not frozen and must be delivered to the lab within six hours of collection.

F5i. VOA Vials – Volatile organic parameters must be collected in two 40 ml glass vials with septum seals and preserved with 2 drops 1:1 HCl. Vials must be stored with lids on until samples are to be collected, should be closed immediately upon preservation and may not be opened again. The sample vial must be filled (either directly or with an intermediate container) to form a meniscus, not overflowing the vial to avoid loss of preservative, and in such a manner that no air bubbles pass through the sample as the vial is being filled. Vial should be inverted multiple times for one minute. The addition of preservative extends the holding time from 7 to 14 days. The hermetic seal on the sample vial must be maintained until the time of analysis. Volatile organic compounds (VOC) samples containing residual chlorine must be treated with sodium thiosulfate. Use a spatula to add 3 mg of sodium thiosulfate per 40 ml of sample. VOC samples suspected to have high levels should have 4 vials submitted.

Atrazine is collected in a NP 40 ml glass vial, for enzyme-linked immunosorbent assay (ELISA) method analysis. Saxitoxin is collected in a 60 ml, pre-preserved clear glass vial. Vials must always be refrigerated (or on ice) and must not be overfilled when collecting a sample. Anatoxin-a is collected in a 60 ml, pre-preserved amber glass vial. Vials must not be overfilled when collecting a sample.

The ELISA method is ideal for the rapid screening of large numbers of samples. If results exceed 1.5 µg/l, confirmation samples using the more precise USEPA 525.5 method should be collected during the next scheduled sampling visit, or sooner if possible. (see Amber Glass section above).

F5j. Dissolved Parameters (Special Considerations) – Samples for dissolved parameters must be collected as grab samples, filtered immediately using a 0.45-micron filter, and chemically preserved (if appropriate) within 15 minutes of collection. Some parameters must be iced or refrigerated to less than or equal to 6˚C. Note on cubitainer and the SSF that the sample has been filtered. Samples can be collected directly from the waterbody or from an intermediate container. Do not use syringes to draw sample water from a sample container that will be submitted to DES. Algae or sediment laden samples may require the use of multiple filters.

Syringes and filters must be rinsed with 60 mL of Nanopure™ prior to filtering Dissolved Organic Carbon (DOC). Nanopure™ can be pulled into the syringe from a critically clean vessel prior to attaching the filter, or it can be poured into the back of the opened syringe with the filter already attached. Reagent water used to rinse the syringe and filter is discarded. When collecting the sample, the first few (5-10) drops through the filter are to be discarded to purge all reagent water prior to sample collection. Filters and syringes may be rinsed prior to field work but must be used or discarded at the end of the field day.

F6. Preservation and Holding Times

F6a. Preservatives Used – DES provides all preservatives used for sample collection methods. They include but may not be limited to re-distilled or spectrograde nitric acid (HNO_3), reagent grade or re-distilled sulfuric acid (H_2SO_4), sodium hydroxide (NaOH) as pellets stored in glass or polyethylene bottles, reagent grade or re-distilled hydrochloric acid (HCl), Ascorbic Acid ($C_6H_8O_6$), Sodium Thiosulfate ($Na_2S_2O_3$), and Sodium Sulfite (Na_2SO_3). Any preservatives not provided by DES should have acid blanks run prior to or in conjunction with sample collection. See Section G. Quality Control Samples.

F6b. Preservative Dosing – Preservatives are primarily provided in individually packaged, pre-measured doses. Refer to DES's Ohio EPA Field Sampling Handbook and Tables 2 and 3 for additional details on preservative volumes.

Chemical preservation of manually collected samples should be performed as soon as practical after sample collection, but no longer than 15 minutes after sample collection.

F6c. Refrigeration/Iced Preservation - All samples for bacteria or demand parameters (including nutrients) must be preserved (if required) and iced within 15 minutes of collection. Samples that do not meet these requirements should have a field comment on the SSF noting the time samples were iced and/or the preservative was added. Samples should be quickly cooled to less than or equal to 6˚C and maintained at that temperature until turned over to laboratory personnel. Samples for metals analyses do not require refrigeration after preservation with acid.

F6d. Ethanol – Ohio EPA maintains a single ATF Industrial Alcohol User Permit through the Groveport Field Office. Ethanol must be stored, transferred, and tracked in accordance with the permit conditions.

Table 2 Conventional Parameters Sample Preservation and Maximum Holding Times[1]

Parameter	Container Type(s)	Preservative(s)	Max Holding
Acidity	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	14 days
Alkalinity	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	14 days
Bacteria (Quanti-tray E. coli)	4 oz sterile glass or PPE container	10 mg $Na_2S_2O_3$ per 100 mL if chlorine suspected or present, cool to <6 ˚C	8 hours[2] (Delivery within 6 hrs)
Biochemical Oxygen Demand (BOD)	1 gal LDPE cubitainer	Cool to ≤6˚C	48 hours
Bromide	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	28 days
Carb/Bicarb	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	14 days
Chemical Oxygen Demand (COD)	1 qt LDPE cubitainer	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days

Chloride	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	28 days
Chlorophyll-a	Whatman filter folded in half and placed in aluminum foil, then in plastic bag	Filter within 6 hours, sandwich between two blue ice packs and put on wet ice	25 days
Conductivity, 25˚C (Lab)	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	28 days
Conductivity (Field)	None, probe, in-situ	Determine onsite	Immediate (<5 minutes)
Cyanide, All	1 qt LDPE cubitainer	4-6 pellets NaOH to pH >10, or >12 for DW matrix, cool to ≤6˚C, for DW ≤4˚C	14 days
Fluoride	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	28 days
Oil & Grease	(x2) 1 qt clear glass jars with green Teflon-lined screw caps	4 mL 6N HCl to pH <2, cool to ≤6˚C,	28 days
Laboratory pH	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	Immediate upon receipt at lab
Field pH	None, probe, in-situ	Determine onsite	Immediate (<5 minutes)
Dissolved Oxygen (DO)	None, probe, in-situ	Determine onsite	Immediate (<5 minutes)
Hardness (calc)	1 qt LDPE cubitainer	5 mL HNO_3 to pH <2	6 months
Organic Carbon, Total (TOC)	1 qt LDPE cubitainer	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Organic Carbon, Dissolved (DOC)	1 qt LDPE cubitainer (100 mL min)	Filter onsite, 0.5 mL H_2SO_4 per 100 mL to pH <2, cool to ≤6˚C	28 days
Sulfate	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	28 days
Temperature	None, probe, in-situ	Determine onsite	Immediate (<5 minutes)
Turbidity	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	48 hours
Algal Toxins			
Anatoxin-α	60 mL amber glass vial	Pre-preserved by DES	5 days
Cylindrospermopsin	125 mL square PETG bottle	10 mg $Na_2S_2O_3$ per 100 mL if chlorinated, cool to ≤6˚C	5 days

Microcystins	125 mL square PETG bottle	10 mg $Na_2S_2O_3$ per 100 mL if chlorinated, cool to ≤6˚C	5 days
Saxitoxin (STX)	60 mL clear glass vial	Pre-preserved by DES, 6 mg $Na_2S_2O_3$ per 60 mL vial if chlorinated. Cool to ≤6˚C	5 days
Metals			
Dissolved	1 qt LDPE cubitainer (150 mL minimum)	Filter onsite, 5 mL HNO_3 to pH <2	6 months
Suspended	1 qt LDPE cubitainer	Filter onsite, retain filter pad	6 months
Total	1 qt LDPE cubitainer	5 mL HNO_3 to pH <2	6 months
Chromium (VI)	1 qt LDPE cubitainer (100 mL min)	Filter onsite, cool to ≤6˚C	24 hours
Mercury, dissolved	125 mL glass jar	Filter onsite, 0.75 mL HNO_3 to pH <2	28 days
Mercury, total	125 mL glass jar	0.75 mL HNO_3 to pH <2	28 days
Nutrients			
Ammonia	1 qt LDPE cubitainer	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Total Kjeldahl Nitrogen (TKN)	1 qt LDPE cubitainer	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Nitrate[3]	1 qt LDPE cubitainer	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Nitrite	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	48 hours
Orthophosphate, dissolved	1 qt LDPE cubitainer (40 mL min)	Filter onsite. Cool to ≤6˚C	48 hours
Phosphorus, dissolved	1 qt LDPE cubitainer (60 mL min)	Filter onsite. 0.5 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Phosphorus, total	1 qt LDPE cubitainer	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Phenolics			
Survey	125 mL glass with white cap	1 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days
Compliance, manual distillation	1 L clear glass jar with white cap	2 mL H_2SO_4 to pH <2, cool to ≤6˚C	28 days

Residue			
Filterable	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	7 days
Nonfilterable	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	7 days
Total	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	7 days
Volatile Suspended	1 gal LDPE cubitainer	Cool to ≤6˚C	7 days
Total Volatile	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	7 days
Organic Carbon	1 qt/gal LDPE cubitainer	Cool to ≤6˚C	7 days
Solids (Sediment)			
Ammonia	500 mL amber jar with Teflon-lined cap	Cool to ≤4˚C	28 days
Laboratory pH	500 mL amber jar with Teflon-lined cap	Cool to ≤4˚C	Immediate upon receipt at lab
Metals (except Mercury)	500 mL amber jar with Teflon-lined cap	Cool to ≤4˚C	6 months
Mercury	1 qt plastic bag	Cool to ≤4˚C	28 days
Organic Carbon, Total (TOC)	500 mL amber jar with Teflon-lined cap	Cool to ≤4˚C	28 days
Particle Size	1 qt plastic bag	Cool to ≤4˚C	7 days
Percent Solids	500 mL amber jar with Teflon-lined cap	Cool to ≤4˚C	7 days
Phosphorus, total	500 mL amber jar with Teflon-lined cap	Cool to ≤4˚C	28 days

[1] A COC form must accompany the transfer of any samples to the testing laboratory in order to get samples into evidence in a legal proceeding.

[2] The sample shall be cooled to <6 ˚C and delivered to the laboratory for analysis within six hours. Do not freeze. According to American Public Health Association (APHA) *Standard Methods* 9060 A (2006), the maximum time from sample collection to laboratory analysis is eight hours. Make arrangements with your laboratory if transport time will exceed six hours to ensure that the eight-hour ultimate holding time is not exceeded.

[3] Calculated from nitrate-nitrite minus nitrite. Need to meet nitrite holding time, 48 hrs.

Table 3 Organic Parameter Sample Preservation and Maximum Holding Times

Parameter	Container	Preservative	Hold Time
Water			
Atrazine (ELISA Method)	40 mL clear or amber glass vial	Cool to ≤6˚C	14-day extraction 40-day analysis
Herbicides Method 525.2	(x2) 1 L amber glass jars with Teflon-lined caps	50 mg Na_2SO_3 (required regardless of the presence	14-day extraction 30-day analysis

		of chlorine), mix, add 4 mL 6N HCl, cool to ≤6˚C	
Cyanazine Method 525.2	(x2) 1 L amber glass jars with Teflon-lined caps	Cool to ≤6˚C	14-day extraction 30-day analysis
Organo-chlorine Insecticides Method 608, 8081	(x2) 1 L amber glass jars with Teflon-lined caps	80 mg $Na_2S_2O_3$ or 50 mg Na_2SO_3 per 1 L jar if chlorinated, cool to ≤6˚C	7-day extraction 40-day analysis
Polychlorinated biphenyl (PCB) Method 608, 8082	(x2) 1 L amber glass jars with Teflon-lined caps	80 mg $Na_2S_2O_3$ or 50 mg Na_2SO_3 per 1 L jar if chlorinated, cool to ≤6˚C,	7-day extraction 40-day analysis
Purgeable Aromatics Method 624, 8260	(x2-4) 40 mL glass vials with Teflon-lined septum seals	2 drops 1:1 HCl to pH<2, 10 mg $Na_2S_2O_3$ per 40 mL vial if chlorinated, cool to ≤6˚C	14-day extraction 40-day analysis
Purgeable Halocarbons Method 624, 8260	(x2-4) 40 mL glass vials with Teflon-lined septum seals	10 mg $Na_2S_2O_3$ per 40 mL vial if chlorinated, cool to ≤6˚C	14-day extraction 40-day analysis
Semi-Volatile Organics Method 625, 8270	(x2) 1 L amber glass jars with Teflon-lined caps	Cool to ≤6˚C	7-day extraction 40-day analysis
Volatile Organic Compounds Method 8260	(x2) 60 mL glass vial with Teflon-lined septum seal	10 mg $Na_2S_2O_3$ per 40 mL vial if chlorinated (pre-dose), 2 drops HCl (1:1), cool to ≤4˚C.	14-day extraction 40-day analysis
Solids (Sediment)			
Organo-chlorine Insecticides Method 8081	500 mL amber glass jar with Teflon-lined cap	Cool to ≤4˚C	14-day extraction 40-day analysis
Polychlorinated biphenyl (PCB) Method 8082	500 mL amber glass jar with Teflon-lined cap	Cool to ≤4˚C	14-day extraction 40-day analysis
Semi-Volatile Organics/ Polycyclic Aromatic Hydrocarbons (PAHs) (BNAs) Method 8270C	500 mL amber glass jar with Teflon-lined cap	Cool to ≤4˚C	14-day extraction 40-day analysis

G. Quality Control Samples

Duplicate and replicate samples are collected at a minimum frequency of 5 percent of total field samples for each sample type. Samples are collected and submitted to DES as blind samples using Ohio EPA district specific sampling stations. The time of sample collection for a blind duplicate is not included on the COC submitted to DES. The time of the first sample collection for the day must be noted in the comment section of the COC and is used to calculate holding time for the duplicate.

Blanks are used to evaluate the potential for contamination of a sample by contaminants from a source not associated with the water being tested. Blanks may be used to demonstrate that sample contaminants were not from equipment used, Nanopure™ water, preservatives, sample containers, ambient air, etc.

Blank QC samples should be submitted at a rate of about 5 percent of all field samples. This 5 percent is a combined total for Field Blanks and Equipment Blanks. This should not include extra blanks collected to resolve previous contamination issues.

G1. Field Duplicates

Field Duplicate samples, also known as Field Splits or simply Duplicates, are used to assess the variance of the total method of sampling and analytical procedures. Duplicate samples demonstrate the precision of the sampling system, from initial sample collection through analysis at the laboratory.

A water chemistry field duplicate is done by thoroughly mixing one sample in a churn splitter and dividing it into two separate sets of containers (*See Appendix II for churn splitter sampling and maintenance*).

A sediment field duplicate is collected through thoroughly mixing one sample in a mixing bowl or pan and dividing it into two separate sets of containers (See Appendix III for additional information).

QC samples are labeled and submitted to the laboratory as “blind” samples using the appropriate blind sampling station, so their identity is unknown to the analysts. The samples are independently analyzed using the same laboratory analytical procedure. The sample with the actual correct location on the label should be considered the “real” sample to be used for project data analysis (see also Data Management in Appendix VI).

G2. Field Replicates

Field replicate samples are used to measure sample representativeness and natural variability of the matrix sampled. The variability of replicates should be compared to duplicate variability (which is presumed to represent duplicate variability, i.e., precision). A field replicate is done by collecting two or more separate samples from the same site at approximately the same time using the same sampling method. QC samples are labeled and submitted to the laboratory as “blind” samples, so their identity is unknown to the analysts. The samples are independently analyzed using the same laboratory analytical procedure. The sample with the actual correct location on the label should be considered the “real” sample to be used for project data analysis in most cases (See also Data Management in Appendix VI).

Both sample results may be used for project data analysis in some situations since they are independent representatives of the sample population, although care should be taken to not double count a single point when calculating averages, etc. over a season.

A duplicate sample should be collected along with each replicate sample to determine if replicate variability (which is an indicator of media heterogeneity) exceeds duplicate variability (which is an indicator of sampling/analytical precision). As a matter of best practice, a replicate water column sample should be collected between 5 and 15 minutes after the original sample. Sediment replicates may be collected over a longer timeframe.

G3. Field Blanks

Field blanks are used to evaluate the potential for contamination of a sample by site contaminants from a source not associated with the sample collected (for example, air-borne dust, etc.). They should be collected at varying times throughout the day to represent different conditions (not always first thing in the morning or last action of the day). The Nanopure™ water is dispensed from a carboy (or similar clean container) into the sample container(s) and the chemical preservative(s) added if appropriate, while in the vicinity of a surface water being sampled. The containers are labeled as “Field Blank.” The same template selected for the test samples should be used. Field blanks are subject to the same holding time limitations as samples. The container identification number and fill date should be tracked in field notes to allow for further evaluation of sources of contamination, if necessary, during the QC process.

G4. Trip Blanks

Trip blanks are used to determine if samples were contaminated during storage and/or transportation back to the laboratory. A trip blank is only required when conducting VOC sampling and should accompany each cooler containing any VOC samples. A trip blank is prepared by sampling staff prior to the sampling event and is stored in the same cooler with the investigative VOC samples throughout the sampling event. A trip blank is collected in the same manner as a VOC sample, with one preserved vial of Nanopure™ being submitted. At no time after their preparation are trip blanks to be opened before they reach the laboratory. Trip blank VOC containers are labeled “Trip Blank.” Trip blanks must be kept refrigerated or immediately put on ice in the cooler once made. They must stay in the cooler that is used for VOC samples during the entire sampling run through delivery to the laboratory. Trip Blanks should be submitted to the lab in time to allow for laboratory analysis within 30 days of being filled.

G5. Equipment Blanks

Equipment blanks are collected to verify that cleaning techniques are sufficient, and that cross contamination does not occur between sites if an intermediate container is re-used (e.g., bridge-sampling bucket). At least one equipment blank per equipment type, per field season, is collected by each office using that equipment type. Equipment blanks for automatic samplers are collected after the completion of decontamination of sampling equipment. Nanopure™ water is cycled through the equipment Teflon-lined hose and into the storage container(s). Equipment blanks for intermediate containers are collected between sites after they have been used by rinsing at least once and filling the vessel with Nanopure™ water. Equipment blanks can be prepared in the field or in the laboratory (after completion of field sampling). One equipment blank container must be prepared for each type of preservative used. Use the same parameter template as the test samples. Equipment blanks may also serve as field blanks since the same water is used - but be aware that sorting out the source of contamination problems is confounded with this approach.

G6. Container Blanks

DES purchases most containers and completes blank tests prior to distribution of supplies as necessary. Any container used for sampling must have a blank test run per each lot. A container blank is prepared by filling a randomly selected container from each lot with Nanopure™ water and adding a dose of preservative, if appropriate. Cubitainers are tested for the following parameters by DES: alkalinity, aluminum, ammonia, arsenic, barium, cadmium, calcium, chloride, chromium, chemical oxygen demand (COD), conductivity, copper, total hardness, iron, lead, magnesium, manganese, nickel, nitrate, nitrite, potassium, selenium, sodium, strontium, sulfate, Total Kjeldahl Nitrogen (TKN), total dissolved solids, total suspended solids, total phosphorus, and zinc.

NOTE: Sampling staff may be responsible for container blank samples for each lot received in some instances (i.e. direct delivery from manufacturer).

G7. Acid Blanks

Acid Blanks are done to ensure that new lots of acid are free of contamination (prior to using any of the preservatives for field samples). Sulfuric acid blanks are tested for COD, nitrate-nitrite, ammonia, TKN and total phosphorus. Nitric acid blanks are tested for inductively coupled plasma (ICP-1) metals (Al, Ba, Ca, Fe, Mg, Mn, Na, K, Sr, and Zn), and inductively coupled plasma mass spectrometry (ICP/MS-1) metals (As, Cd, Cr, Cu, Ni, Pb and Se).

All acid supplied by DES is evaluated with an acid blank prior to distribution. Sampling staff should verify a blank was done and results are acceptable before using any preservative from an outside supplier.

G8. Matrix Spike Duplicates

Matrix Spike/ Matrix Spike Duplicates (MS/MSDs) are a type of duplicate samples that are collected in the field but does not count as a field duplicate as they are laboratory QC samples. They are used to document the precision and bias of a method in each sample matrix. Most DES internal QC analysis is performed by using aliquots from sample containers, as most containers hold adequate volume for multiple analyses. However, for some methods the entire sample container is used for one analysis. In these cases, DSW must collect MS/MSDs for use by DES. Laboratories need to demonstrate they can recover target compounds from actual water samples and not just Nanopure™ water. These samples are to be collected at a rate of 5 percent of organic samples only and do not count towards duplicate sampling rate.

For VOCs intended for use as MS/MSD, fill two extra 40 ml vials (4 total). For semi-volatiles, PCBs, or herbicides fill two extra amber jars (4 total). Four extra jars are needed if both PCB and BNA samples are submitted (8 total). The extra containers indicated are beyond the usual number of containers specified for sample analysis.

> *NOTE: **MS** is an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A MS is used to document the bias of a method in a*

sample matrix. ***MSDs*** *are intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a sample matrix.*

G9. Sediment Equipment Rinsate Blanks

Equipment blanks are collected to verify that cleaning techniques are sufficient, and that cross contamination does not occur between sites if an intermediate container is re-used (e.g., bridge-sampling bucket). Sediment Equipment Rinsate Blanks are similarly used to verify sampling equipment is not a source of contamination or cross contamination. A single sediment equipment rinsate blank should be completed with each type of equipment used by each sampling crew at least once per year. Nanopure™ should be poured over clean equipment prior to use, collected in a clean mixing bowl, then dispensed into appropriate containers. If equipment is used across multiple sites without standard critical cleaning in a controlled environment, at least one additional blank should be collected between two sites. The equipment should be cleaned per standard field practices between sites (i.e. site water rinsed), rinsed with Nanopure™, then a sediment equipment rinsate blank should be collected.

Table 4 Quality Control Sampling Frequencies

QC Sample Type	QC Sample Rate or Frequency
Field Duplicates and Field Replicates	5 percent of total samples (emphasizing duplicates, since the variability of duplicate data provides context for evaluating the variability of replicate data (i.e., is precision greater than with the duplicates?).
Field Blanks	5 percent of total water samples (may overlap with equipment blanks)
Trip Blanks (VOCs)	One per cooler with VOC samples
Equipment Blanks	Minimum of 1 per equipment, per crew, per year.
Acid Blanks	Once per acid lot (by DSW staff, unless DES tells them they have already done it).
Cubitainer Blanks	Once per lot (by DSW staff, unless DES tells them they have already done it).
MS/MSD (organics)	5 percent of organic samples only (track in each district office collected for lab QC, do not count as part of 10 percent minimum)
Sediment Equipment Rinsate Blank	Minimum of 1 per equipment, per crew, per year. Additional if equipment used b/w sites without critical cleaning.

G10. Quality Control Sample Tracking

QC samples are tracked with both internal sampling staff and external QAM oversight. Sampling staff are primarily responsible for scheduling, collecting, and tracking QC samples to meet guidelines above and in project QAPPs. Staff are expected to consult with management and the QAM when issues arise with QC evaluation or contamination. See Appendix VI – Data Management for additional information on QC evaluation.

G11. Quality Control of Field Instruments

The following outlines the QC procedures for the field instruments utilized by Ohio EPA DSW:

G11a. YSI ProDSS Multiparameter Digital Water Quality Meter - Evaluation of field meter accuracy can be verified in multiple ways.

G11ai. Post Field Verification – Staff should periodically check for drift in pH and conductivity sensors with a known solution at the end of a field day. It is recommended that this is done at least monthly, opposite fleet verification (resulting in meter QC checks every 2 weeks).

G11aii. Field Meter Fleet Verification – DO and temperature are best verified by comparison of multiple meters in a stable water bath. This allows for verification of all parameters, including pH and conductivity, across the entire fleet (or a subset). It is recommended that this is done at least monthly, opposite post-field verification (resulting in meter QC checks every 2 weeks). Any meter displaying drift from the herd should be evaluated by staff.

G11aiii. Pre- and Post-Field Season Verification – DSW WQ staff participate in twice annual gatherings, i.e. workshops and field training sessions. A statewide field meter fleet verification is completed at each of these events using a stable water bath.

G11aiv. Manufacturer Calibration – Field meters should be returned to the manufacturer or an approved third-party vendor for calibration and service on a regular basis. In most cases, this is annually, although it may vary by instrument and manufacturer.

G11b. YSI EXO1 and EXO2 Multiparameter sonde – Upon the return of sondes from the field, a post-check measurement is carried out. This must be done no later than one day after the return of the equipment. This process includes four sondes at a time placed in a bath of circulated aged tap water. Each sonde's sensors are run for at least 40 seconds after which a measurement is recorded. After the data are recorded from one sonde, it is taken out of the bath and replaced with another sonde until all deployed sondes have been recorded. The post-check data is logged electronically and stored on the state of Ohio servers.

A Modeling and Assessment section staff reviews the raw data with regard to collected QC data and transfers it to editable fields for adjustment/approval. The raw datafiles (.csv's) are moved into an Excel workbook and initially trimmed so the start and end time correspond to the deploy and retrieval times. Then, the post-check data for each parameter is fitted with a moving average trendline of the recorded data plotted against time. The trendline is bounded above and below by the specified accuracy of the sensor being evaluated. If the post-check data results for a given sensor lies outside of the accuracy range for a specific sensor, data collected with that sensor is not approved. The values are rounded to the appropriate significant units prior to making this assessment. For example, if a sonde DO sensor reads 8.62 mg/L, the average of the bath is 8.4 mg/L, and the specified accuracy is 0.2 mg/L the reading would be rounded to 8.6 and kept. If the value were above 8.65 it would be rejected.

Other anomalies in the data are considered and field notes are reviewed. If data is removed from the data set, a specific QAR note is developed. QARs are recorded in files stored on the state of Ohio's servers. Once all data for a site is reviewed, the field sheet is initiated and dated by the reviewer. Sensors that fail post-check are recorded on a tracking sheet, stored on the state of Ohio's servers, evaluated, and have maintenance performed as needed.

G11c. **Onset HOBO logging probes** – Temperature accuracy of all loggers should be approximately 0.2°C with an expected drift of approximately 0.1°C per year. Accuracy of the logger should be tested against a calibrated thermometer prior to each deployment, ensuring the readings are within the accuracy range provided by the manufacturer.

The internal clock is not expected to deviate more than about one minute per month. The internal battery should be checked prior to deployment of the logger to ensure there is enough remaining charge to last throughout the planned deployment. The battery check is usually conducted during programming.

Level logger accuracy is checked prior to deployment of the HOBO U20 probes. This can be carried out in a basin of water with a measurement tape. Several different water depths should be checked during such an accuracy check. The same procedure is repeated when the probe is recovered post-deployment.

The water sensing aspect of the TidbiT MX is verified prior to deployment. This procedure involves putting the probe in and out of water repetitively while tracking the time of each movement. Tap the probe with a dry towel each time is taken out of the water. The record of change should be near instantaneous.

QC of the conductivity sensor of the U24 HOBO probes is carried out by placing all deployed sensors in a basin of circulated water. The sensors should be programmed to record data every 5 minutes for one hour. The post-check data is fitted with a trendline and the trendline is bounded by the specified accuracy of the sensors being evaluated. If the post-check data lies outside of the accuracy range for a specific sensor, data collected with that sensor is not approved. The values are rounded to the appropriate significant units prior to making this assessment.

All these HOBO QC measures are tracked on an individual field sheet for each device per deployment (Attachment 11).

G11d. SBE 19plus V2 SeaCAT Profiler CTD – given the size and complexity of the SeaCAT profiler, field meter fleet verification is the most reliable way to quickly verify the accuracy of sensors. See Section G11aii above and the Lake Erie Sampling Manual for additional information.

G11f. Stream current and discharge measurement instruments- Both the ADV and ADCP style instruments that Ohio EPA utilize have built in QC checks. These checks are to be performed with each stream discharge measurement. The instruments save the checks with the measurement files. See Turnipseed and Sauer (2010) for additional detail.

H. Equipment Cleaning and Storage

Equipment used for sample collection must be properly cleaned and stored. QC practices (i.e. equipment blanks) outlined in Section G provide evaluation of cleaning effectiveness. Phosphate free soap (i.e. Liquinox™ or similar) and tap water, followed by a DI water rinse is sufficient in most cases. A soft-bristled brush or sponge may be used to remove dirt without damaging equipment. An HCl acid rinse

(10% ACS trace element grade in DI) is used on equipment constructed primarily of glass or plastic, followed by an additional DI rinse. A 30-minute soak in soapy water or 10% HCl may also be necessary in some instances.

More stringent cleaning requirements may be dictated by DQOs for specific projects. These are detailed in project specific QAPPs when appropriate and supersede guidance provided here.

Buckets, Van Dorn bottles, churn splitters, and similar water chemistry sampling equipment may be used across sites. If a significant source of pollution is expected, samplers should work up gradient from clean to dirty sites, or use multiple buckets, etc.

Most equipment can be stored dry on the shelf. If equipment has been in storage for a significant time between uses, it should be cleaned before the first sampling event. If stored in a dirty environment, equipment may be stored in plastic bags.

H1. Churn Splitter Cleaning Protocol

Churn splitter should be cleaned as detailed above in most cases. A 30-minute soak in soapy water is recommended, especially when significantly soiled. Attention should be paid to potential fouling when cleaning and thoroughly rinsing the spigot.

H2. Sediment Sampling Devices

Sediment sampling equipment requires the collection of additional equipment rinsate blanks if used across multiple sites without critical cleaning. Field cleaning may be appropriate in some instance (i.e. mayfly collection). See Appendix III for additional information.

I. References

Turnipseed, D.P., Sauer, V.B. (2010). *Discharge measurements at gaging stations: U.S. Geological Survey Techniques and Methods, Chapter 8 of Book 3, Section A*. Retrieved from https://pubs.usgs.gov/publication/tm3A8

US Environmental Protection Agency. (2023). *Quality Assurance Project Plan Standard (Directive No: CIO 2105-S-02.1).* Retrieved from https://www.epa.gov/system/files/documents/2024-04/quality_assurance_project_plan_standard.pdf

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USEPA. (2017). *NPDES Compliance Inspection Manual.* Retrieved from https://www.epa.gov/sites/default/files/2017-01/documents/npdesinspect.pdf

Welch, P. S. (1948). *Limnological Methods.* McGraw Hill Book Company.

J. Attachments

Attachment 1. Pre-Sampling Checklist

Attachment 2. COC/SSF Example

Attachment 3. Container Label Sample

Attachment 4. Water Quality Field Meter Calibration Log

Attachment 5. Deployable YSI Multiparameter Sondes Sensor Maintenance Log

Attachment 6. Deployable YSI Multiparameter Sondes Maintenance Log

Attachment 7. Deployable YSI Multiparameter Sondes Calibration Log

Attachment 8. Deployable YSI Multiparameter Sondes Field Sheet

Attachment 9. Field Survey Data Sheet (modeling)

Attachment 10. Onset HOBO Logging Probes Field Sheet

Attachment 11. Sample DES Sample Receiving Schedule

Attachment 12. Field Sampling Manual Table of Contents, App. II - VI

Attachment 1. Pre-Sampling Checklist

Logistics Checklist

- ☐ Hotel Reservations
- ☐ QAPP
- ☐ DES Receiving Scheduled
- ☐ Site Access Records

Vehicle Safety Equipment

- ☐ Bug Spray
- ☐ Cones
- ☐ First aid kit
- ☐ Flashlight
- ☐ Hard hat
- ☐ Jumper cables
- ☐ Life jackets
- ☐ Reflective vests
- ☐ Roadside emergency flares/lights
- ☐ Safety glasses
- ☐ Sunscreen
- ☐ Tool chest
- ☐ Waders

Field Prep

- ☐ Coolers & Ice
- ☐ Field Instruments
- ☐ pH buffers (4, 7, 10)
- ☐ KCl solution
- ☐ Tap water
- ☐ DI water
- ☐ Kim wipes
- ☐ Meter calibration log
- ☐ Nanopure

Sampling Equipment

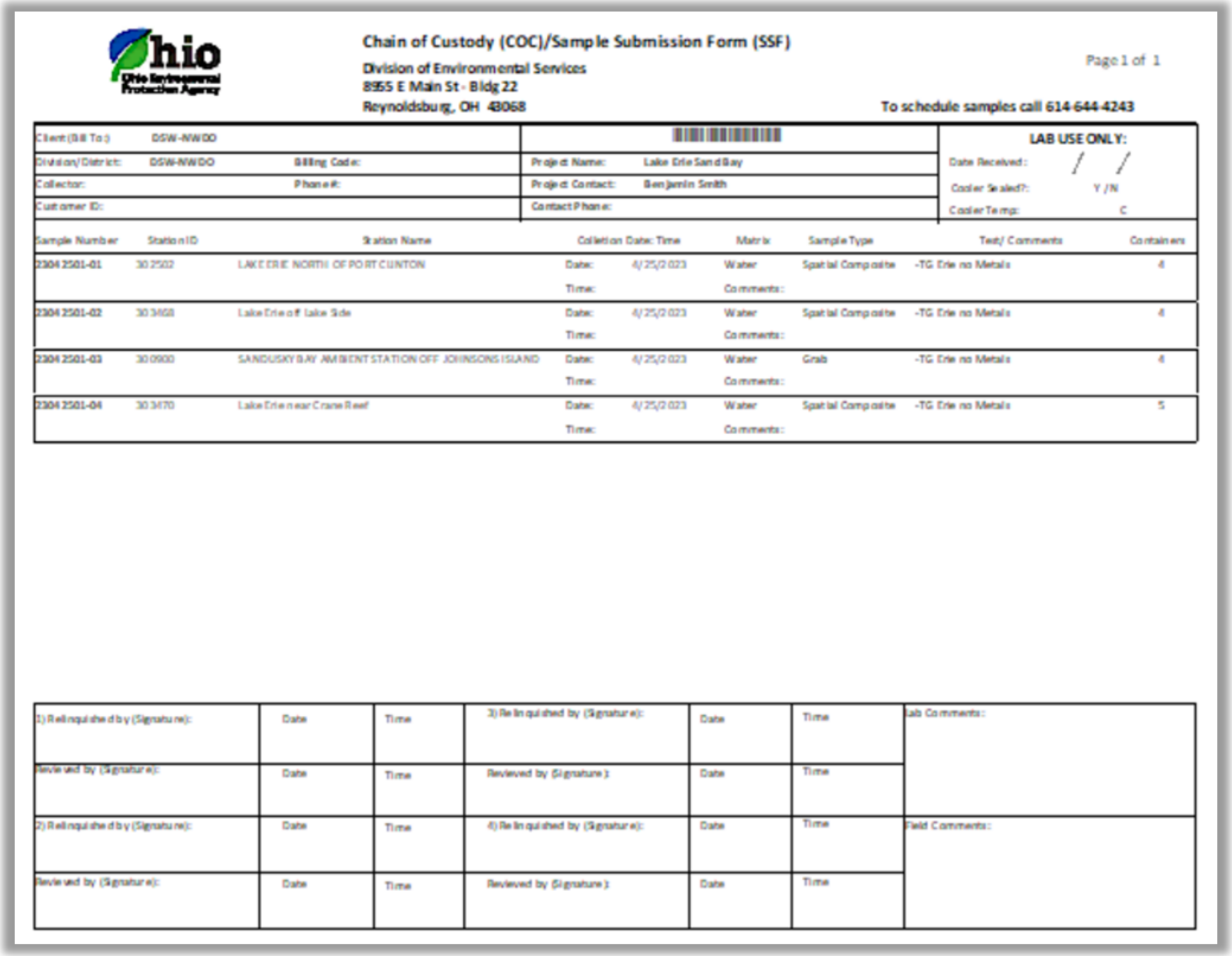
- ☐ Beta Bottle, Bucket(s), etc.
- ☐ Churn Splitter
- ☐ Disposable Gloves
- ☐ Eckman, Ponar, etc.
- ☐ Filter housing, filters, forceps (Chl-a)
- ☐ HDPE Amber Jug (Chl-a)
- ☐ Markers, Pens
- ☐ Nanopure™ Water
- ☐ Rope(s)
- ☐ Sample Containers & Labels
- ☐ SSF/COC (+ Chl-a COC)
- ☐ Shipping materials (tape, custody tape, etc)
- ☐ Syringe & Filter
- ☐ Trash bags

Personal Gear

- ☐ Electrolyte replacement drink
- ☐ Hat, sunglasses
- ☐ Personal Medications
- ☐ Tablet, iPad, phone
- ☐ Water

See App III for Sediment Sampling, App IV for Inland Lakes, and and App V Lake Erie Pre-Sampling Checklists

Attachment 2. COC/SSF Example



Chain of Custody (COC)/Sample Submission Form (SSF)

Page 1 of 1

Division of Environmental Services
8955 E Main St - Bldg 22
Reynoldsburg, OH 43068

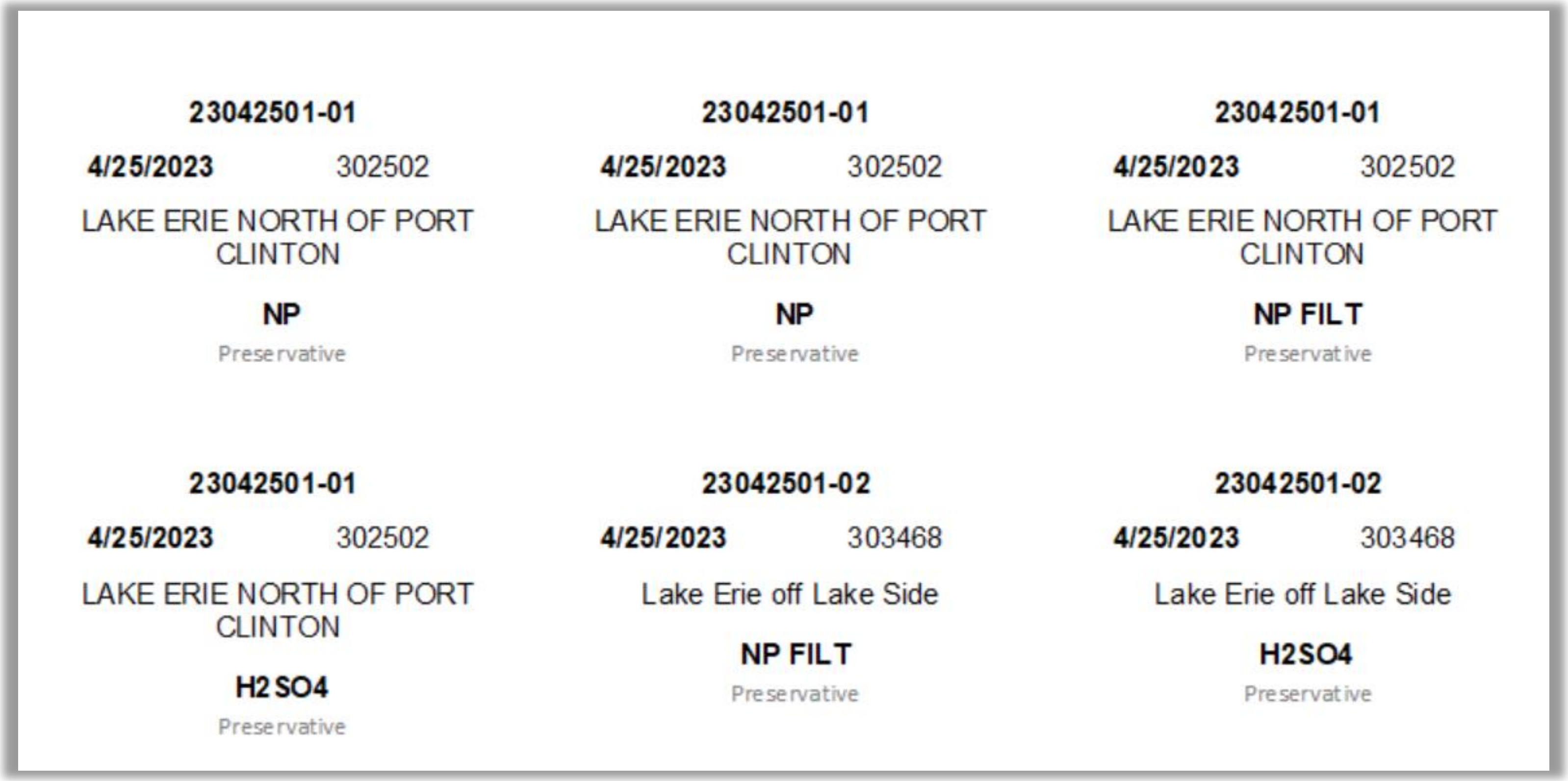
To schedule samples call 614-644-4243

Client (Bill To:) DSW-NWDO			**LAB USE ONLY:**
Division/District: DSW-NWDO	Billing Code:	Project Name: Lake Erie Sand Bay	Date Received: / /
Collector:	Phone #:	Project Contact: Benjamin Smith	Cooler Sealed?: Y / N
Customer ID:		Contact Phone:	Cooler Temp: C

Sample Number	Station ID	Station Name	Colletion Date: Time		Matrix	Sample Type	Test/ Comments	Containers
23042501-01	302502	LAKE ERIE NORTH OF PORT CLINTON	Date:	4/25/2023	Water	Spatial Composite	-TG Erie no Metals	4
			Time:		Comments:			
23042501-02	303468	Lake Erie off Lake Side	Date:	4/25/2023	Water	Spatial Composite	-TG Erie no Metals	4
			Time:		Comments:			
23042501-03	300900	SANDUSKY BAY AMBIENT STATION OFF JOHNSONS ISLAND	Date:	4/25/2023	Water	Grab	-TG Erie no Metals	4
			Time:		Comments:			
23042501-04	303470	Lake Erie near Crane Reef	Date:	4/25/2023	Water	Spatial Composite	-TG Erie no Metals	5
			Time:		Comments:			

1) Relinquished by (Signature):	Date	Time	3) Relinquished by (Signature):	Date	Time	Lab Comments:
Reviewed by (Signature):	Date	Time	Reviewed by (Signature):	Date	Time	
2) Relinquished by (Signature):	Date	Time	4) Relinquished by (Signature):	Date	Time	Field Comments:
Reviewed by (Signature):	Date	Time	Reviewed by (Signature):	Date	Time	

Attachment 3. Container Label Example



23042501-01
4/25/2023 302502
LAKE ERIE NORTH OF PORT CLINTON
NP
Preservative

23042501-01
4/25/2023 302502
LAKE ERIE NORTH OF PORT CLINTON
NP
Preservative

23042501-01
4/25/2023 302502
LAKE ERIE NORTH OF PORT CLINTON
NP FILT
Preservative

23042501-01
4/25/2023 302502
LAKE ERIE NORTH OF PORT CLINTON
H2 SO4
Preservative

23042501-02
4/25/2023 303468
Lake Erie off Lake Side
NP FILT
Preservative

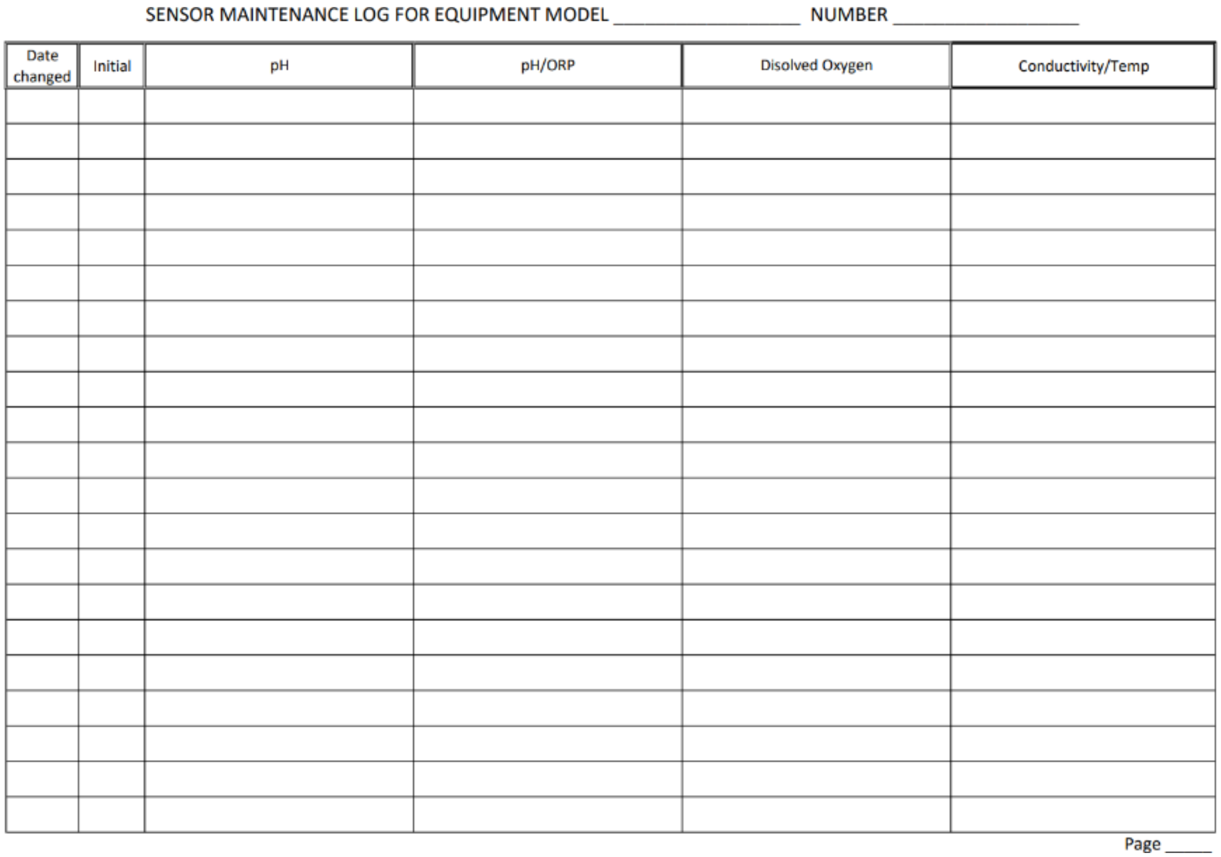
23042501-02
4/25/2023 303468
Lake Erie off Lake Side
H2SO4
Preservative

Attachment 4. Water Quality Field Meter Calibration Log

Date:	**Project:**		**Location:**
Start Time:	**Meter ID:**		**Staff:**
Specific Conductance	**pH 7**	**pH 4 ☐ or pH 10 ☐**	**DO % Saturation**
Calibrated ☐ / Verified ☐	Calibrated ☐ / Verified ☐	Calibrated ☐ / Verified ☐	*(5+ min for saturation)* ☐
Temp:	Temp:	Temp:	Temp:
Initial Value:	Initial Value:	Initial Value:	Initial Value:
Post Cal:	Post Cal:	Post Cal:	Post Cal:
Dry < 1 µS/cm? ☐	mV:	mV:	End Time:
Cond Cell Constant:	-50 mV to +50 mV? ☐	mV difference:	ODO Gain:
Acceptable: 4.5 to 6.50 ☐	pH slope:	*165 to 180 from pH 7* ☐	*Acceptable 0.75 to 1.50* ☐
Solutions Verified, OK? ☐	*Acceptable:55 to 60* ☐	Solutions Verified, OK? ☐	
Notes:			
Post Field Check: Cond Value:		pH 7.0 Value:	Time:

Date:	**Project:**		**Location:**
Start Time:	**Meter ID:**		**Staff:**
Specific Conductance	**pH 7**	**pH 4 ☐ or pH 10 ☐**	**DO % Saturation**
Calibrated ☐ / Verified ☐	Calibrated ☐ / Verified ☐	Calibrated ☐ / Verified ☐	*(5+ min for saturation)* ☐
Temp:	Temp:	Temp:	Temp:
Initial Value:	Initial Value:	Initial Value:	Initial Value:
Post Cal:	Post Cal:	Post Cal:	Post Cal:
Dry < 1 µS/cm? ☐	mV:	mV:	End Time:
Cond Cell Constant:	-50 mV to +50 mV? ☐	mV difference:	ODO Gain:
Acceptable: 4.5 to 6.50 ☐	pH slope:	*165 to 180 from pH 7* ☐	*Acceptable 0.75 to 1.50* ☐
Solutions Verified, OK? ☐	*Acceptable:55 to 60* ☐	Solutions Verified, OK? ☐	
Notes:			
Post Field Check: Cond Value:		pH 7.0 Value:	Time:

Attachment 5. Deployable YSI Multiparameter Sondes Sensor Maintenance Log

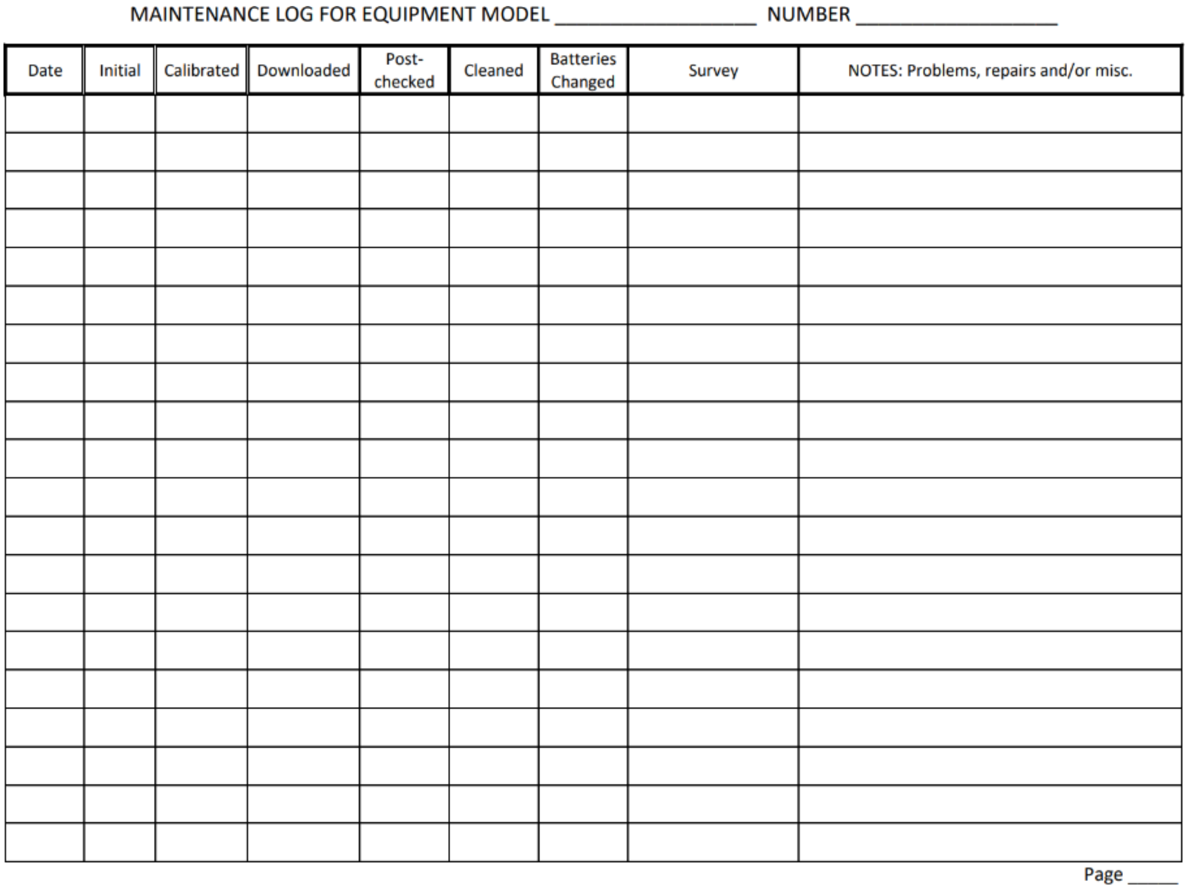


SENSOR MAINTENANCE LOG FOR EQUIPMENT MODEL ___________________ NUMBER ___________________

Date changed	Initial	pH	pH/ORP	Disolved Oxygen	Conductivity/Temp

Page _____

Attachment 6. Deployable YSI Multiparameter Sondes Maintenance Log

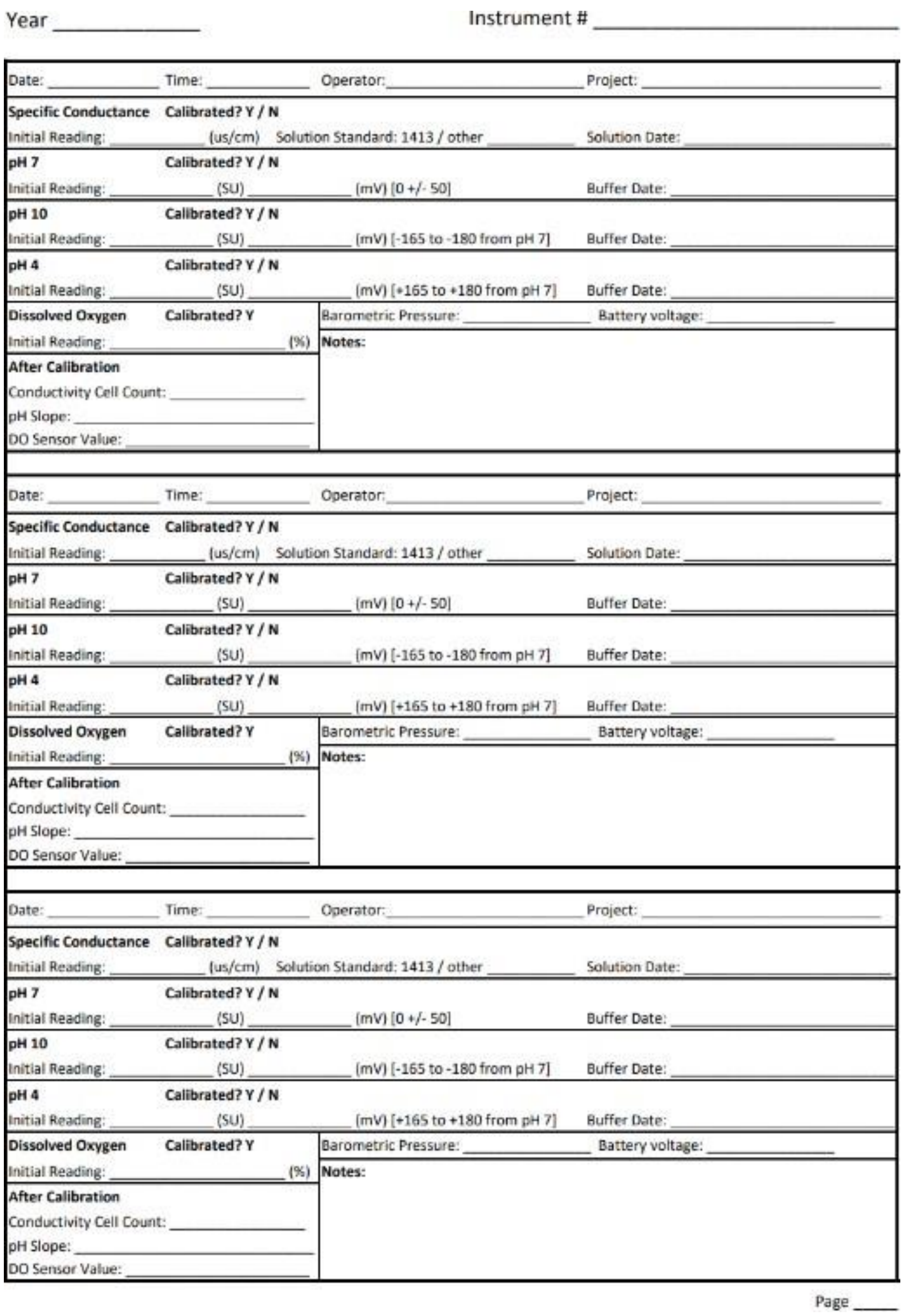


MAINTENANCE LOG FOR EQUIPMENT MODEL __________________ NUMBER __________________

Date	Initial	Calibrated	Downloaded	Post-checked	Cleaned	Batteries Changed	Survey	NOTES: Problems, repairs and/or misc.

Page _____

Attachment 7. Deployable YSI Multiparameter Sondes Calibration Log



Year ____________ Instrument # ________________________

Date: ____________ Time: ____________ Operator: ______________________ Project: ____________________________

Specific Conductance **Calibrated? Y / N**
Initial Reading: ___________ (us/cm) Solution Standard: 1413 / other __________ Solution Date: ________________________

pH 7 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [0 +/- 50] Buffer Date: ________________________

pH 10 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [-165 to -180 from pH 7] Buffer Date: ________________________

pH 4 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [+165 to +180 from pH 7] Buffer Date: ________________________

Dissolved Oxygen **Calibrated? Y**
Initial Reading: ____________________ (%)

Barometric Pressure: ______________ Battery voltage: ______________

Notes:

After Calibration
Conductivity Cell Count: ______________
pH Slope: ____________________________
DO Sensor Value: _____________________

Date: ____________ Time: ____________ Operator: ______________________ Project: ____________________________

Specific Conductance **Calibrated? Y / N**
Initial Reading: ___________ (us/cm) Solution Standard: 1413 / other __________ Solution Date: ________________________

pH 7 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [0 +/- 50] Buffer Date: ________________________

pH 10 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [-165 to -180 from pH 7] Buffer Date: ________________________

pH 4 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [+165 to +180 from pH 7] Buffer Date: ________________________

Dissolved Oxygen **Calibrated? Y**
Initial Reading: ____________________ (%)

Barometric Pressure: ______________ Battery voltage: ______________

Notes:

After Calibration
Conductivity Cell Count: ______________
pH Slope: ____________________________
DO Sensor Value: _____________________

Date: ____________ Time: ____________ Operator: ______________________ Project: ____________________________

Specific Conductance **Calibrated? Y / N**
Initial Reading: ___________ (us/cm) Solution Standard: 1413 / other __________ Solution Date: ________________________

pH 7 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [0 +/- 50] Buffer Date: ________________________

pH 10 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [-165 to -180 from pH 7] Buffer Date: ________________________

pH 4 **Calibrated? Y / N**
Initial Reading: ____________ (SU) ____________ (mV) [+165 to +180 from pH 7] Buffer Date: ________________________

Dissolved Oxygen **Calibrated? Y**
Initial Reading: ____________________ (%)

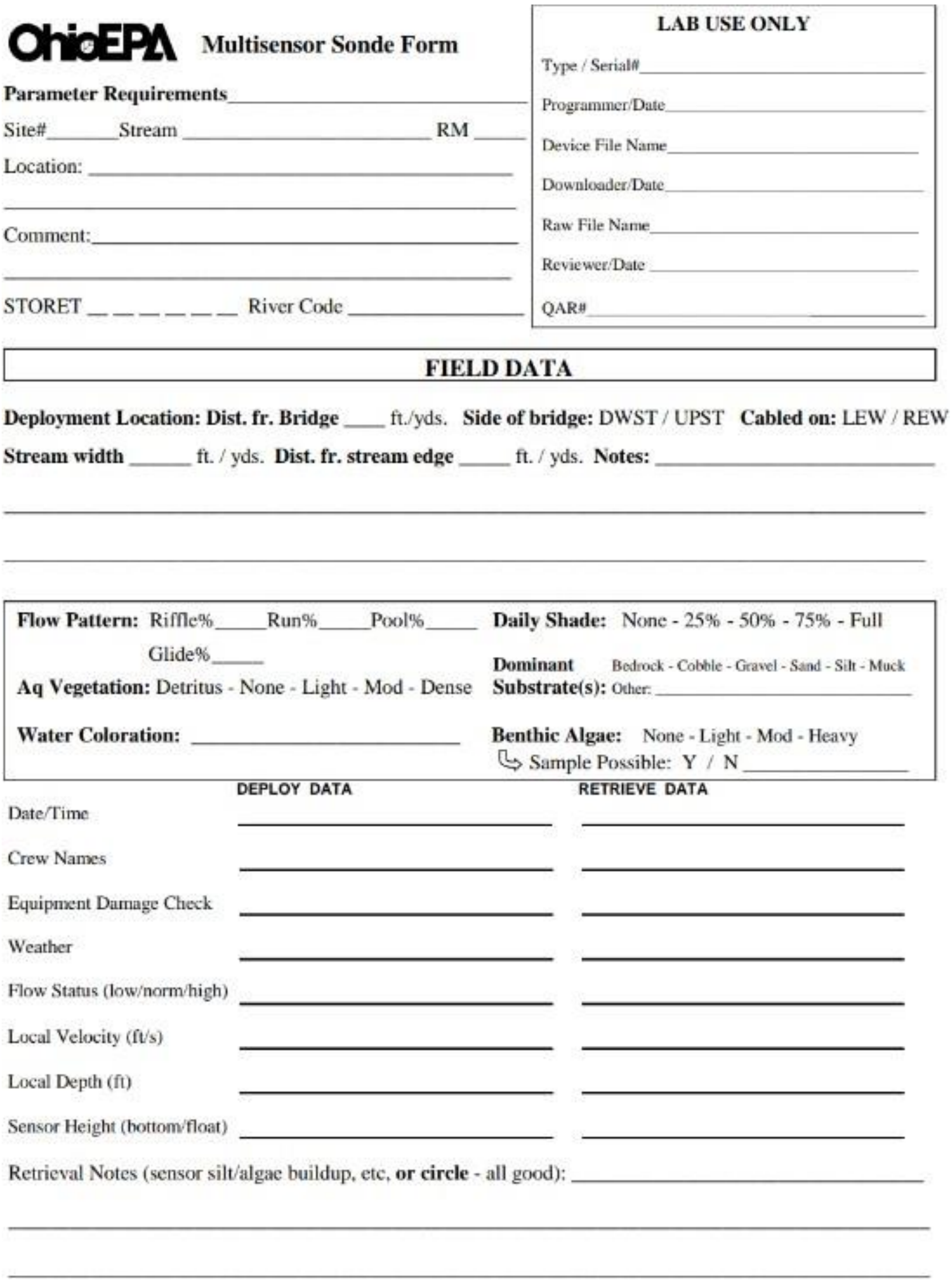
Barometric Pressure: ______________ Battery voltage: ______________

Notes:

After Calibration
Conductivity Cell Count: ______________
pH Slope: ____________________________
DO Sensor Value: _____________________

Page _____

Attachment 8. Deployable YSI Multiparameter Sondes Field Sheet



OhioEPA **Multisensor Sonde Form**

LAB USE ONLY

Type / Serial#____________________

Programmer/Date____________________

Device File Name____________________

Downloader/Date____________________

Raw File Name____________________

Reviewer/Date ____________________

QAR#____________________

Parameter Requirements____________________

Site#_______Stream ________________________ RM _____

Location: ____________________________________

____

Comment:____________________________________

____

STORET __ __ __ __ __ __ River Code _________________

FIELD DATA

Deployment Location: Dist. fr. Bridge ____ ft./yds. **Side of bridge:** DWST / UPST **Cabled on:** LEW / REW

Stream width ______ ft. / yds. **Dist. fr. stream edge** _____ ft. / yds. **Notes:** ____________________________

____

____

Flow Pattern: Riffle%_____Run%_____Pool%_____ Glide%_____

Daily Shade: None - 25% - 50% - 75% - Full

Aq Vegetation: Detritus - None - Light - Mod - Dense

Dominant Substrate(s): Bedrock - Cobble - Gravel - Sand - Silt - Muck Other: ____________________

Water Coloration: ____________________________

Benthic Algae: None - Light - Mod - Heavy

↳ Sample Possible: Y / N _______________

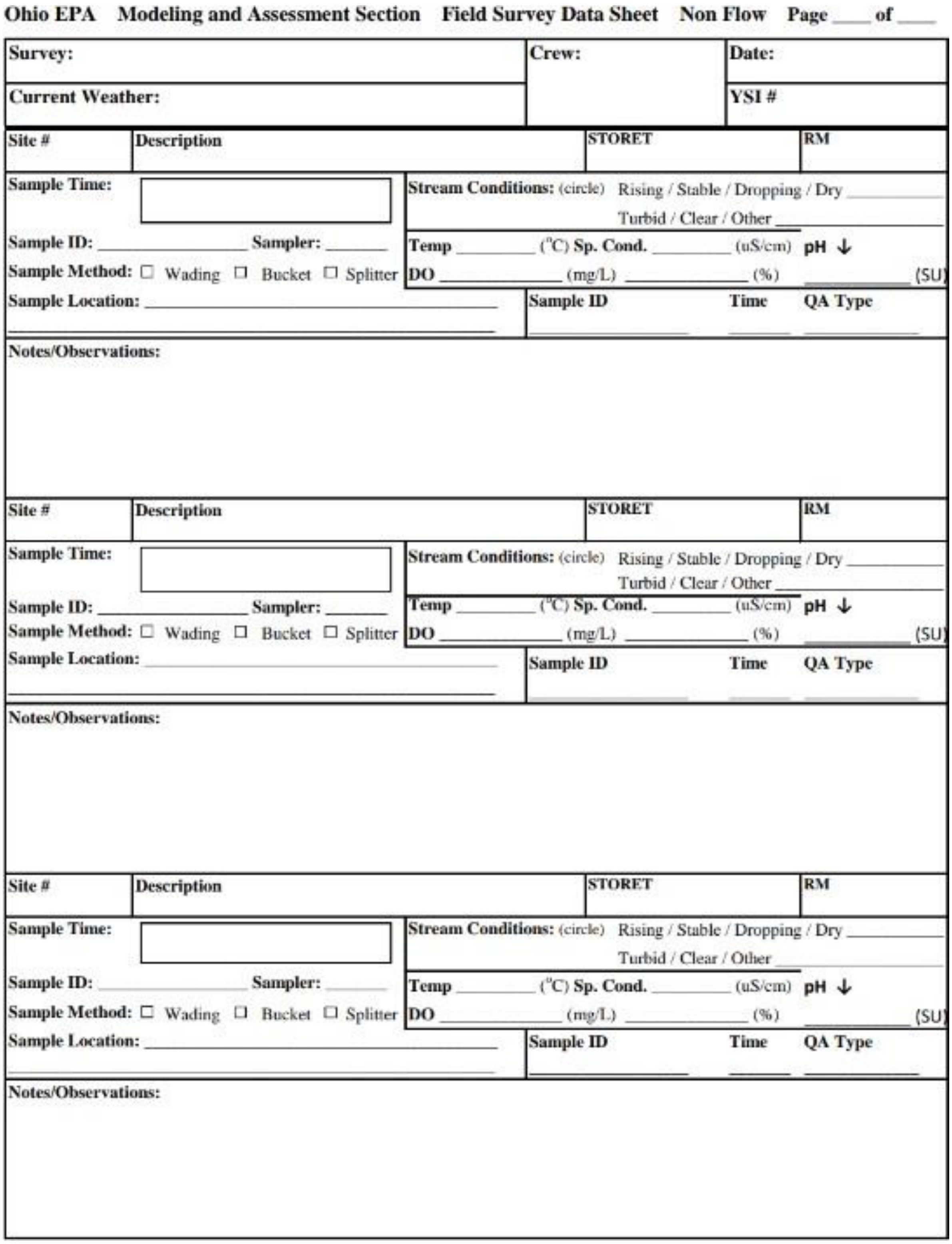
	DEPLOY DATA	RETRIEVE DATA
Date/Time		
Crew Names		
Equipment Damage Check		
Weather		
Flow Status (low/norm/high)		
Local Velocity (ft/s)		
Local Depth (ft)		
Sensor Height (bottom/float)		

Retrieval Notes (sensor silt/algae buildup, etc, **or circle** - all good): ____________________________

____

____

Attachment 9. Field Survey Data Sheet (modeling)



Ohio EPA Modeling and Assessment Section Field Survey Data Sheet Non Flow Page ____ of ____

Survey:	**Crew:**	**Date:**
Current Weather:		**YSI #**

Site #	**Description**	**STORET**	**RM**

Sample Time:

Sample ID: ________________ **Sampler:** _______

Sample Method: ☐ Wading ☐ Bucket ☐ Splitter

Sample Location: ____

Stream Conditions: (circle) Rising / Stable / Dropping / Dry __________

Turbid / Clear / Other __________________

Temp ________ (°C) **Sp. Cond.** ________ (uS/cm) **pH** ↓

DO _____________ (mg/L) _____________ (%) ___________ (SU)

Sample ID	**Time**	**QA Type**

Notes/Observations:

Site #	**Description**	**STORET**	**RM**

Sample Time:

Sample ID: ________________ **Sampler:** _______

Sample Method: ☐ Wading ☐ Bucket ☐ Splitter

Sample Location: ____

Stream Conditions: (circle) Rising / Stable / Dropping / Dry __________

Turbid / Clear / Other __________________

Temp ________ (°C) **Sp. Cond.** ________ (uS/cm) **pH** ↓

DO _____________ (mg/L) _____________ (%) ___________ (SU)

Sample ID	**Time**	**QA Type**

Notes/Observations:

Site #	**Description**	**STORET**	**RM**

Sample Time:

Sample ID: ________________ **Sampler:** _______

Sample Method: ☐ Wading ☐ Bucket ☐ Splitter

Sample Location: ____

Stream Conditions: (circle) Rising / Stable / Dropping / Dry __________

Turbid / Clear / Other __________________

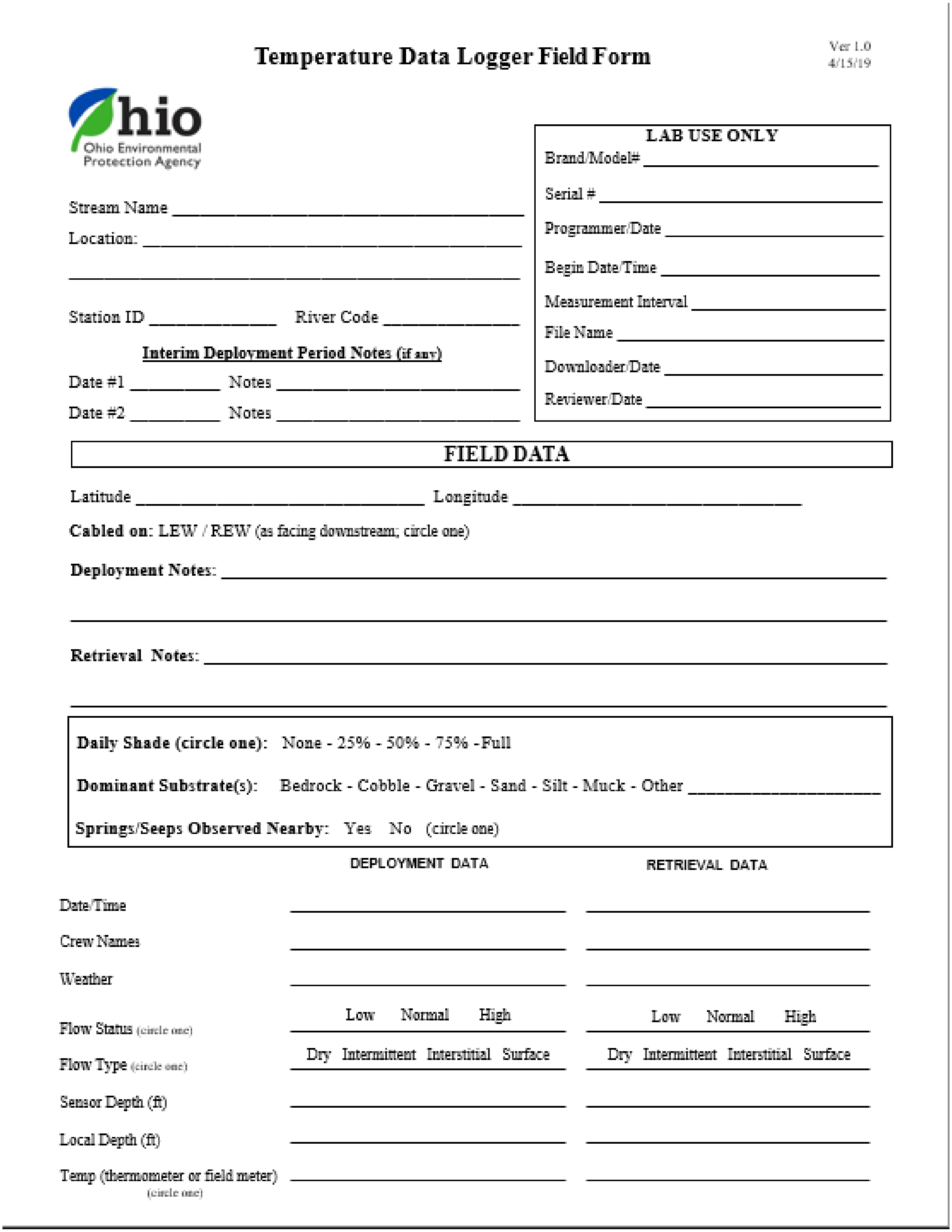
Temp ________ (°C) **Sp. Cond.** ________ (uS/cm) **pH** ↓

DO _____________ (mg/L) _____________ (%) ___________ (SU)

Sample ID	**Time**	**QA Type**

Notes/Observations:

Attachment 10. Onset HOBO Logging Probes Field Sheet



Temperature Data Logger Field Form

Ver 1.0
4/15/19

Ohio Environmental Protection Agency

LAB USE ONLY

Brand/Model# ______________________

Serial # ______________________

Programmer/Date ______________________

Begin Date/Time ______________________

Measurement Interval ______________________

File Name ______________________

Downloader/Date ______________________

Reviewer/Date ______________________

Stream Name ______________________

Location: ______________________

____

Station ID ____________ River Code ____________

Interim Deployment Period Notes (if any)

Date #1 ________ Notes ______________________

Date #2 ________ Notes ______________________

FIELD DATA

Latitude ______________________ Longitude ______________________

Cabled on: LEW / REW (as facing downstream; circle one)

Deployment Notes: ______________________

____

Retrieval Notes: ______________________

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Daily Shade (circle one): None - 25% - 50% - 75% -Full

Dominant Substrate(s): Bedrock - Cobble - Gravel - Sand - Silt - Muck - Other ______________

Springs/Seeps Observed Nearby: Yes No (circle one)

	DEPLOYMENT DATA	RETRIEVAL DATA
Date/Time		
Crew Names		
Weather		
Flow Status (circle one)	Low Normal High	Low Normal High
Flow Type (circle one)	Dry Intermittent Interstitial Surface	Dry Intermittent Interstitial Surface
Sensor Depth (ft)		
Local Depth (ft)		
Temp (thermometer or field meter) (circle one)		

Attachment 11. Sample DES Sample Receiving Schedule

Analytical parameters that have a holding time of 48 hours or less are subjected to a restricted submission schedule. The schedule for 2025 specifies blackout dates below. If an emergency arises necessitating the submission of samples during the blackout dates, please contact Sample Receiving Coordinator at (614) 644-4243 to arrange for sample submission. As noted below, the restrictions dictated by holidays is applicable each year.

January

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

February

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

March

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

April

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

July

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24/31	25	26	27	28	29	30

September

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

October

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24	25	26	27	28	29

December

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

DES Laboratory Closed	01/01 01/20, 02/17, 05/26, 06/19, 07/04, 09/01, 10/13, 11/11, 11/27, 12/25.
Shipping restrictions	06/18, 07/03, 11/10, 11/26, and 12/24. These restrictions all apply to Friday each week. Samples must be delivered to the laboratory no later than 1:00 p.m. and should NOT be shipped overnight by courier. Do NOT submit microbiological samples (i.e., Fecal Coliform, E. Coli, etc.).
Do not submit BOD or CBOD	01/13, 02/10, 05/19, 08/25, 10/06. BOD and CBOD should not be shipped on a Monday one week prior to a Monday when DES is closed.

Attachment 12. Field Manual TOC for Appendix II – Appendix VI

Appendix II – Detailed Sampling and Equipment Procedures
A. Appendix II Introduction
B. Compliance Sampling Objectives
C. Effluent Sample Collection
D. Whole Effluent Toxicity (WET) Sampling
E. Sampling Method for Documentation of a Public Health Nuisance
F. Sestonic Chlorophyll-a Sampling Procedure
G. Benthic Chlorophyll-a Sampling Procedure
H. Complaint Sampling
I. Churn Splitter Sampling and Maintenance
J. References
K. Attachments
Attachment 1. Sonde Calibration Log
Attachment 2. Sonde Maintenance Log
Attachment 3. Sonde Deployment Form
Attachment 4. Temperature Data Logger Field Form
Attachment 5. Public Health Nuisance Form
Attachment 6. Chlorophyll-a COCs
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A. Purpose
B. General Considerations
C. Field Preparations and Sample Custody
D. Sampling Methodologies and Considerations
E. Field Readings
F. Sample Collection and Preservation
G. Quality Control Samples
H. Equipment Cleaning and Storage
I. Data Storage and Reporting
Attachment 1. Pre-Sampling Checklist
Attachment 2. Sediment Data Collection Sheet
Attachment 3. Table of Sediment Sampling Equipment
Attachment 4. Sediment Sample Volume and Container Type for DES
Attachment 5. Sediment Sampling Locations
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Appendix IV – Inland Lakes
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B. General Considerations
C. Field Preparations & Sample Custody
D. Field Instrument Calibration and Maintenance
E. Field Measurements
F. Sample Collection and Preservation

G. Quality Control Samples
H. Equipment Cleaning and Storage
I. Inland Lakes Chlorophyll-a Sampling Procedure
J. Shoreline Public Drinking Water Supply Sampling
K. References
L. Attachments
Attachment 1. Pre-Sampling Checklist
Attachment 2. Sample Float Plan
Attachment 3. COC/SSF Example
Attachment 4. Sestonic Chlorophyll-a COC
Attachment 5. Container Label Sample
Attachment 6. Plankton Container Label Sample
Attachment 7. Operating Instructions for Horizontal Beta™
Attachment 8. Inland Lakes Field Sheet
Appendix V – Lake Erie Nearshore Monitoring
A. Quality Assurance Policy
B. General Considerations
C. Field Preparations & Sample Custody
D. Field Instrument Calibration and Maintenance
E. Field Measurements
F. Sample Collection and Preservation
G. Quality Control Samples
H. Equipment Cleaning and Storage
I. Lake Erie Chlorophyll-a Sampling Procedure
J. References
K. Attachments
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Attachment 2. Sample Float Plan
Attachment 3. COC/SSF Example
Attachment 4. Chlorophyll-a COC
Attachment 5. Container Label Sample
Attachment 6. Mayfly Label Sample and Enumeration
Attachment 7. Operating Instructions for Vertical Beta Bottle
Attachment 8. Sea-Bird Storage and Maintenance
Attachment 9. Real-time Seabird Data
Attachment 10. Post Cruise Seabird Data Recovery
Appendix VI – Data Management
A. Quality Assurance Policy
B. Data Management
C. QC Tracking and Data Qualification
D. References