

Quality Assurance Project Plan Lake Classification and Inventory (LCI) Monitoring Program

New York State
Department of Environmental Conservation
Division of Water
Bureau of Water Assessment and Monitoring

Prepared by NYSDEC Division of Water

In consideration of the ongoing COVID-19 pandemic, please follow the Division of Water Guidance for Field Work During COVID-19 Pandemic (SOP #603-20).



LCI Program Manager – Karen Stainbrook, NYSDEC

6/3/2021

Date



LCI Program Coordinator– Alene Onion, NYSDEC

5/27/2021

Date



DOW Quality Assurance Officer, RoseAnn Garry, NYSDEC

05/26/2021

Date

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TABLE OF CONTENTS

TABLE OF CONTENTS	2
INTRODUCTION	5
I. Project Management.....	7
1. Organization/Responsibilities	7
2. Background– Description of Problem	12
3. Program / Task Description	12
4. Quality Objective and Criteria	13
5. Special Training/Certifications	18
6. Document and Records.....	18
II. DATA GENERATION AND ACQUISITION	21
1. Rationale of Monitoring Design.....	21
2. Sampling Methods.....	27
3. Sampling Handling and Custody	35
4. Analytical Methods	40
5. Quality Control	40
6. Quality Control Evaluation	41
7. Supplies and Consumables.....	41
8. Data Management.....	42
III. ASSESSMENT AND OVERSIGHT	43
1. Performance and System Audits	43
2. Corrective Actions	43
3. Reports to Management.....	44
4. Project Fiscal Information	44
5. Data Validation and Usability.....	44
6. Verification and Validation Methods	45
7. Reconciliation with use Requirements	45
8. Reporting	45

List of Tables

Table 1: Sampling schedule for all networks and sampling media.....	13
Table 2: Analytic Specifications and QA/QC Requirements - in Water Column	16
Table 3: Water Column Parameters	25
Table 4: Biological Indicators of Water Quality	26
Table 5: Water Chemistry Parameters by Class and Depth.....	27
Table 6: Volume of Water to be filtered for Chlorophyll <i>a</i> Analysis	29
Table 7: Water column sampling specification	36
Table 8: Analytical Laboratories	38

List of Figures

Figure 1: Organization Chart.....	11
Figure 3: Sample Container Label Examples	Error! Bookmark not defined.
Figure 4: Laboratory Chain of Custody Form	39

Prepared/Revised By:	Date:	Revision	Summary of Changes:
David Newman	05/2017	1.0	Removed Targeted Network, Modified data storage procedures updated personnel, and basin information.
Karen Woodfield Alene Onion	03/2019	2.0	Updates to QA/QC procedures Updates to Primary and Secondary Program Coordinators responsibilities Updates to site selection procedures Updates to include electronic forms and iPads Update to include Bathymetry
Karen Woodfield Alene Onion	10/2019	2.1	Updated to fix typo in Table 2 for microcystin quantitation limit
Alene Onion Matt Kraft	3/2020	3	Updates to Program Management Updates to intensive sampling procedures Updates to parameter lists Updates to Bathymetric Sampling Adding sediment core sampling Adding Random Probabilistic Sampling
Alene Onion	6/22/20	3.1	Added paragraph regarding COVID SOP's Added sequential duplicate sampling information and matrix spike sampling.
Alene Onion	3/2021	V21-1	Revised Project Management Added new BWAM sample labeling system

No substantive changes include updating references, correcting typographical errors, and clarifying certain language to make the document more useful and effective.

DISTRIBUTION LIST

Name	Title	Organization	Document Type
Karen Stainbrook	LCI Program Manager	NYSDEC	Electronic
Alene Onion	LCI Program Coordinator	NYSDEC	Electronic
Matt Kraft	LCI QA Officer		
Rebecca Gorney	LCI Field Sampling Coordinator	NYSDEC	Electronic
Rose Ann Garry	DOW QA Officer	NYSDEC	Electronic
Jason Fagel	Lab Coordinator	NYSDEC	Electronic
Janice Jaeger	Laboratory Manager	ALS Environmental	Electronic
Sampling personnel	Central and Regional Offices	NYSDEC	Electronic

INTRODUCTION

For 2021, special considerations will be taken into account regarding COVID-19 and associated health and safety concerns. Modifications have been made to Standard Operating Procedure: Lakes Sampling to reflect considerations regarding modifications to protocols to allow for social distancing (SOP #203-20.COV), Standard Operating Procedure: Calibration, Maintenance, and Storage of multiprobe meters used to measure water quality parameters ([SOP #211-2020.COV](#)), and Standard Operating Procedure: Sample Handling, Transport, and Chain of Custody (SOP #101-20.COV) are to be used in coordination with Division of Water Guidance for Field Work During COVID-19 Pandemic (SOP #603-20). Further reference to [SOP #203-21](#), [SOP #211-21](#), and [SOP #101-21](#) should be considered equivalent to versions modified to address sampling under COVID-19 ([SOP #603-20.COV](#)). All other sampling according to methodologies not explicitly modified under the COVID-19 pandemic should be conducted with consideration of social distancing recommendations.

Samplers may take one of two approaches to sampling under COVID-19; 1) Establish and maintain clearly defined job duties for individuals within a sampling crew and use of separate vehicles or 2) with consent of samplers and program manager, paired sampling crews may form a bubble and work together in close proximity where social distancing protocols in the field are difficult to maintain. If field work is conducted under option 2, sampling pairs should be maintained for as long as possible during field season to limit interaction of individuals.

This document has been prepared to meet the Quality Assurance/Quality Control (QA/QC) requirements for the Lake Classification and Inventory (LCI) monitoring program, which is a

component of the Statewide Waters Monitoring Program (SWMP) of the New York State Department of Environmental Conservation (NYSDEC) Division of Water. All component projects of this program are covered under the SWMP Quality Assurance Management Plan (NYSDEC, 2014). While the Management Plan covers goals, objectives, and procedures common to all component projects, this QAPP documents project goals and objectives, standard operating procedures, data review and evaluation procedures, and quality control methods specifically for implementation of the LCI monitoring program.

The LCI Monitoring Program uses a rotating strategy in which waterbodies in all major drainage basins in the state are monitored over a five-year cycle. The Year One Screening Network's focus is on screening of-interest lake segments. Each lake is sampled once during the most productive summer index period (July 15-September 15). Year One Screening as well as the historic data set (<10 year) will be used to identify lakes where more intensive monitoring is appropriate. Intensively monitored lakes are sampled three times, monthly, throughout the summer with at least one sample collected within and outside the summer index period. In 2021, the basins to be sampled are the Allegheny, Seneca-Oneida-Oswego basins (Year 1, Screening Sampling), and the Mohawk River, Lake Erie / Niagara River, and Lake Ontario basins (Year 2, Intensive Sampling).

I. Project Management

1. Organization/Responsibilities

The following outline describes the staff involved with the LCI Monitoring Program and their respective roles.

LCI Program Management

New York State Department of Environmental Conservation
Division of Water, Bureau of Water Assessment & Monitoring
Lake Monitoring and Assessment Section
Karen Stainbrook, Section Chief, 518-402-8095

Responsibilities

- Management of the LCI Program
 - Determine sampling strategy and overall monitoring network design, including site selection strategies, parameter selection, sampling frequency, etc.

LCI Program Coordinator

New York State Department of Environmental Conservation
Division of Water, Bureau of Water Assessment & Monitoring
Lake Monitoring and Assessment Section
Alene Onion, LCI Program Coordinator (518)-402-8166

Responsibilities

- Coordination of Sampling
 - Selects site locations, parameters for sampling according to the LCI sample design.
 - Conduct occasional and appropriate program reviews and implement modifications to enhance monitoring effort as necessary.
 - Respond to all inquiries concerning the LCI Monitoring Program.
 - Draft, maintain and modify (when necessary) the official signed copy of the QAPP
 - Train participating staff.
- Management of Analytic Data Results
 - Coordinate sampling logistics between sampling staff and the analytic laboratories.
 - Coordinate receipt of data from laboratory with laboratory staff and Division Quality Assurance officers
 - Provide water quality assessment and expertise in data evaluation.

LCI Quality Assurance Officer

New York State Department of Environmental Conservation
Division of Water, Bureau of Water Assessment & Monitoring
Lake Monitoring and Assessment Section
Matthew Kraft, LCI Quality Assurance Officer, (518)-402-8260

Responsibilities

- Coordination of Sampling
 - Assist Program Coordinator in drafting the quality assurance/quality control documents for the LCI Monitoring Program.
 - Assist program coordinator in the selection of locations, parameters to be sampled.
 - Coordinate with QA Officer annual field audits of sampling staff to ensure proper sample collection methods are used and discuss problems and/or needs.
 - Distribute electronic copies of this Quality Assurance Plan to all participating staff.

- Management of Analytic Data Results
 - Review, edit (if necessary), and store the data generated by the LCI Monitoring Program within Lake Monitoring and Assessment Section's database and/or other Division, Agency, State or Federal database.
 - Review all water quality and quality control data results for adherence to appropriate specifications.
 - Enter all data from sample collection electronic data field forms into the lakes monitoring databases.
 - Provide water quality assessment and expertise in data evaluation

Field Sampling Coordinators

New York State Department of Environmental Conservation
Division of Water, Bureau of Water Assessment & Monitoring
Lake Monitoring and Assessment Section
Karen Woodfield and Rebecca Gorney, LCI Field Sampling Coordinators, (518)-402-8196 and (518)-402-8258

Responsibilities

- Coordinate the purchase of equipment, and supplies.
- Manage float plans and staff communication during field sampling.

Central Office Primary Samplers

Alene Onion, 518-402-8166 (alene.onion@dec.ny.gov)
Matthew Kraft, 518-402-8260 (Matthew.Kraft@dec.ny.gov)
Stephanie June, 518-402-9255 (Stephanie.june@dec.ny.gov)
Annalee Tweitmann, 518-402-8255 (Annalee.Tweitmann@dec.ny.gov)
Rebecca Gorney, 518-402-8258 (Rebecca.gorney@dec.ny.gov)
Karen Woodfield, 518-402-8196 (Karen.Woodfield@dec.ny.gov)
Karen Stainbrook, 518-402- 8095 (Karen.Stainbrook@dec.ny.gov)

Responsibilities

- Sample Collection

- Collect lake samples in assigned geographic areas as scheduled following prescribed sampling procedures and quality assurance methods.
- Collect biological (harmful algal bloom, plant, etc.) samples following prescribed procedures and quality assurance methods.
- Process samples as scheduled following prescribed sampling procedures and quality assurance methods.
- Transport or secure proper shipping of samples to the appropriate laboratory following prescribed procedures and quality assurance methods.
- Maintain LCI Monitoring Program field equipment.

Finger Lakes Watershed Hub Primary Samplers

Aimee Clinkhammer, 315-426-7507 (aimee.clinkhammer@dec.ny.gov)

Lewis McCaffrey, 315-426-7507 (lewis.mccaffrey@dec.ny.gov)

Tony Prestigiaco, 315-426-7507 (tony.prestigiaco@dec.ny.gov)

Responsibilities

- Sample Collection
 - Collect lake samples in assigned geographic areas as scheduled following prescribed sampling procedures and quality assurance methods.
 - Collect biological (harmful algal bloom, plant, etc.) samples following prescribed procedures and quality assurance methods.
 - Process samples as scheduled following prescribed sampling procedures and quality assurance methods.
 - Transport or secure proper shipping of samples to the appropriate laboratory following prescribed procedures and quality assurance methods.
 - Maintain LCI Monitoring Program field equipment.

Central Office and Regional Office Secondary Samplers (must be accompanied by primary sampler)

Carrie Buetow, 518-357-2268 (carrie.buetow@dec.ny.gov)

Erik Posner, 518-402-8259 (erik.posner@dec.ny.gov)

Sarah Rickard, 518-402-8155 (sarah.rickard@dec.ny.gov)

Brian Duffy, 518-285-5682 (Brian.duffy@dec.ny.gov)

Gavin Lemley, 518-402-8202 (Gavin.Lemley@dec.ny.gov)

Keleigh Reynolds, 518-402- 8179 (Keleigh.Reynolds@dec.ny.gov)

Charles Stoll, 518-285-5699 (Charles.Stoll@dec.ny.gov)

Andrea Conine, 518-402-8267 (Andrea.Conine@dec.ny.gov)

Kathy Czajkowski, 518-402-8251 (Kathy.Czajkowski@dec.ny.gov)

Michaela Schnore, 518-408-5718 (Michaela.Schnore@dec.ny.gov)

Zach Smith, 518-402-8235 (Zach.Smith@dec.ny.gov)

- Responsibilities
- Sample Collection

- Assist primary sampling staff in the collection of lake samples following prescribed sampling procedures and quality assurance methods.

NYSDEC Staff Managing Laboratory Contracts

Stephanie June, UFI Laboratory coordinator, 518-402-9255 (Stephanie.june@dec.ny.gov)

Jason Fagel, ALS Laboratory coordinator, 518-402-8156 (jason.fagel@dec.ny.gov)

Responsibilities

Manage analytical laboratory contracts

Conduct as-needed technical laboratory audits

DOW Quality Assurance Officer

Rose Ann Garry, Division of Water Quality Assurance Officer, 518-402-8159

(roseann.garry@dec.ny.gov)

NYSDEC Standards & Analytical Support Section

Responsibilities

Review the QA project plan to verify that those elements outlined in the EPA Requirements for QA Project Plans (QA/R-5) were successfully discussed.

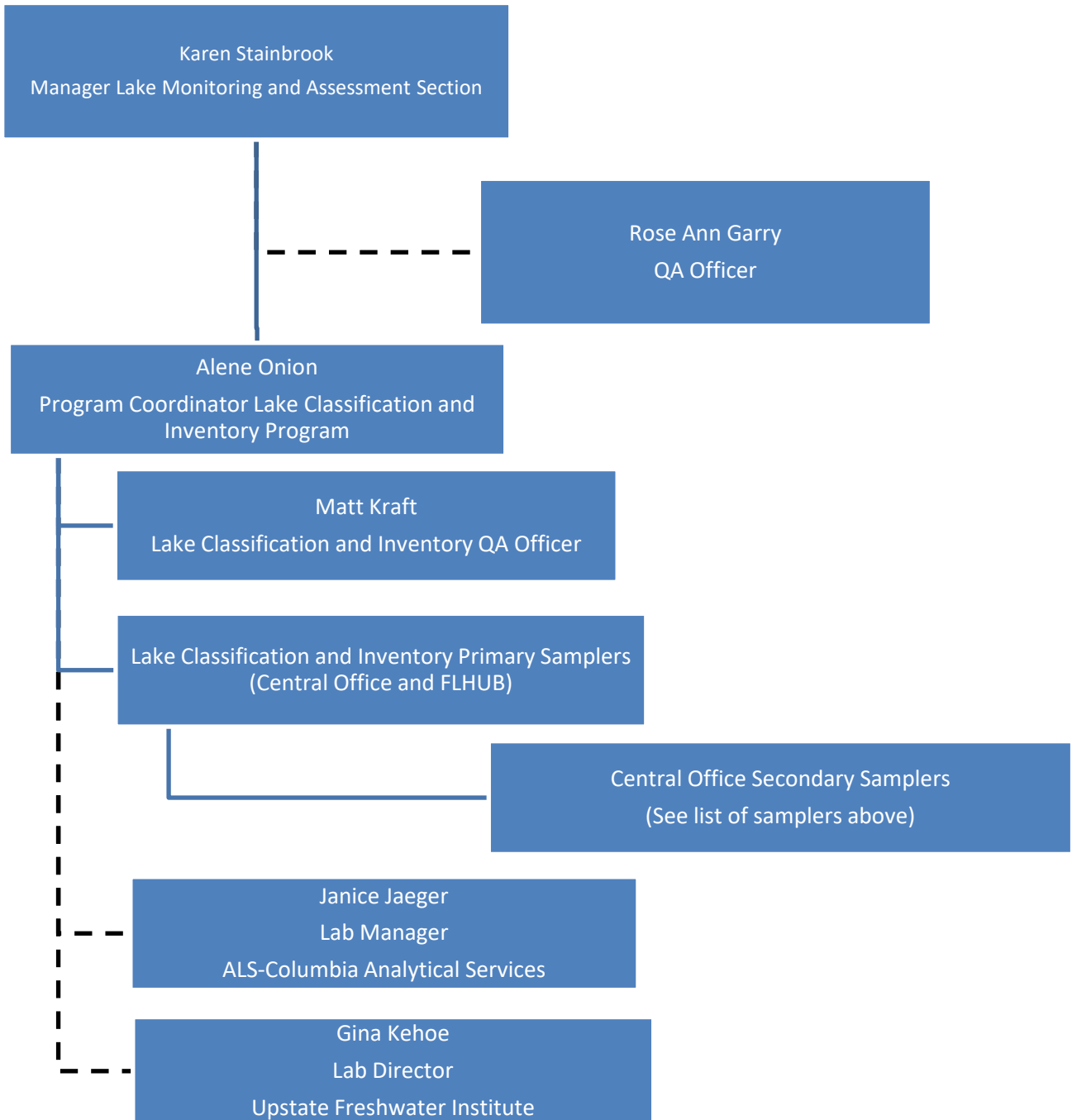
Analytical Laboratories

The complete list of laboratories that will be used in this monitoring program appears in Table 8 of Section II, Data Generation and Acquisition.

Responsibilities

- Provide sample containers and paperwork per requested list of parameter analysis.
- Maintain NYSDEC DOH ELAP accreditation for LCI selected parameters that NYSDOH ELAP issues certificates for.
- Provide expertise in sample collection protocols.
- Provide expertise in analytic methods.
- Analyze water quality samples and report results.
- Provide analysis of specified parameters for water column.
- Transmit analytic data to NYS-DEC via agreed upon media/format.
- Implement internal quality assurance/quality control procedures.

Figure 1: Organization Chart



2. Background– Description of Problem

New York State is mandated by the Clean Water Act to monitor the ambient water quality conditions within the state. This mandate originated in the mid-1960s and activities to fulfill this mandate have evolved over time. By the early 1980s an ambient lake monitoring program was developed to evaluate baseline water quality conditions in lakes throughout the state, utilizing a rotating monitoring cycle loosely patterned after the stream monitoring programs conducted by the Department. However, due to staff shortages, this ambient lake monitoring program (the LCI) was suspended in 1990. This left the NY Citizens Statewide Lake Assessment Program (CSLAP), a volunteer lake monitoring program overseen by NYSDEC, as the only statewide ambient lake monitoring program conducted by the NYSDEC.

In 1987 the Rotating Integrated Basin Studies (RIBS) Sampling Program was established within the NYSDEC's Division of Water, to bring together a variety of monitoring strategies into one program. In the years since, the program has undergone steady changes and growth, aimed at providing better monitoring and assessment of New York State's water quality. One component of this evolution was the coordination of efforts between the RIBS stream program and the re-establishment of the LCI Monitoring Program in the mid-1990s. By 1998, the rotating schedule developed through the RIBS stream program was adopted by the LCI Monitoring Program, with a further convergence between some site selection and logistics activities associated with each program. The LCI Monitoring Program outlined in this document is an integral component of the NYSDEC Division of Water Statewide Waters Monitoring Strategy 2019 – 2021 QA Management Plan.

The New York Strategy represents the foundation of the Division of Water's statewide water monitoring program. The primary goals of the LCI Monitoring Program component of the New York strategy include:

- water quality screening using a random probabilistic approach to document the conditions of NY State ponded waters in general;
- intensive sampling of selected waters to evaluate impairments, causes and sources and to characterize general water quality conditions;
- conduct sampling in support of other NYSDEC programs and initiatives;
- help identify water bodies not meeting their designated uses for inclusion on the New York State Section 303(d) List of Impaired Waters
- prepare the New York State 305(b) Water Quality Report, a biennial report to Congress on the quality of water resources in the state;
- support the development of Total Maximum Daily Load (TMDL) plans and water quality based SPDES permit limits;
- support development of nutrient criteria within the state and within selected NYS ecoregions;
- complete USEPA's Index of Watershed Indicators (IWI), the Unified Watershed Assessment (UWA) and other federal water quality initiatives.

3. Program / Task Description

The LCI Monitoring Program uses a rotating strategy in which waterbodies in all major drainage basins in the state are monitored over a five-year cycle.

The Year One Screening Network's focus is on screening of-interest lake segments. Each lake is sampled once during the most productive summer index period (July 15-September 15).

Sampling sessions will include water sample collections for parameters specified in Table 5, assessments of use impairments, visual observations and identification of submergent macrophytes (to genus level for indigenous species, and to species level for exotic species; voucher specimens of exotic species will be collected and bagged for laboratory identification), and observations about weather, in lake and shoreline conditions from a single site at the lake, corresponding to the deepest portion of the lake. Results of the Year One Screening as well as the historic data set (<10 year) will be used to identify lakes where more intensive monitoring is appropriate.

The Year Two and Three Intensive sampling consists of six samples and field observations at intensive network sites. Three samples are collected in each year to calculate the summer average as per [SOP 203-21](#). As per [SOP 203-21](#), at least one of these samples is collected within and at least one sample is collected outside the summer index period (July 15-Sept 15). Two years of sampling resulting in two summer averages are necessary for assessment purposes as per the Consolidated Assessment and Listing Methodology (NYSDEC 2021). Sampling sessions will include water sample collections for parameters specified in Table 5 assessments of use impairments, visual observations and identification of submergent macrophytes (to genus level for indigenous species, and to species level for exotic species; voucher specimens of exotic species will be collected and bagged for laboratory identification), and observations about weather, in lake and shoreline conditions from a single site at the lake, corresponding to the deepest portion of the lake.

The LCI Monitoring Program schedule is given below.

Table 1: Sampling schedule for all networks and sampling media for the 2021 water quality sampling year. These are target sampling dates and are subject to change based on current weather conditions, stream flow conditions, and staff/resource availability.

Network	Week of					
	May	June	July	August	September	October
*Intensive Sampling						
Mohawk River Basin		21	26	23		
Lake Ontario Basin		21	26	23		
Lake Erie / Niagara River Basin		21	26	23		
Screening Surveys						
Allegheny River Basin				9		
Seneca-Oneida-Oswego Rivers Basin					13	
Upper Hudson River Basin				16		

* These are target sampling dates and are subject to change based on current weather conditions, and staff/resource availability. However, every effort should be made to remain within a one-two week window of the targeted weeks.

4. Quality Objective and Criteria

Data quality requirements including criteria for accuracy and precision for discrete and in situ water chemistry parameters are listed in Table 2. The application of the requirements in Table 2 are described below as well as additional data quality considerations. These data quality

requirements are consistent with those used in the NYSDEC Rotating Integrated Basin Studies Project (RIBS QAPP 2021) and are consistent with requirements provided by USEPA. These also satisfy the data requirements associated with the state water quality standards, 6 NYCRR Part 703.

Completeness is a measure of the number of samples intended to be collected and analyzed compared to the number of samples actually collected and analyzed, expressed as a percentage. All intensive samples must be collected to accurately calculate summer averages. Therefore, the completeness requirement for the intensive cycle is 100%. For the screening lakes, a lower threshold is acceptable since the purpose of this sampling is more general. For the LCI program, eighty-five percent (85%) of screening lake samples, overall, is considered the minimum acceptable level of completeness.

Accuracy will be measured using matrix spikes (MS) and matrix spike duplicates (MSD). The laboratory will spike these samples with a known aliquot of the parameter and clarify the sample through the entire analytical process. MS/MSD samples will be collected once per week which corresponds to at least 10% of the samples collected.

The laboratory will also run laboratory control samples (LCS), at a frequency of at least 1 per SDG, to assess recovery of target analytes absent any bias from the sample matrix.

For field measurements, multiprobes are calibrated to the manufacturer's specification at the intervals listed in Table 2.

Precision (laboratory duplicates) In addition to insight on matrix effects and laboratory performance, MS and MSD samples are used to provide an equivalent metric of precision to a laboratory duplicate. Parameters that are not amenable to spiking (e.g. Chlorophyll, Color, UV254) will still have laboratory duplicates performed and precision measured. The precision between the MS and MSD will be calculated and reported by the laboratory.

Precision (field replicates)

Field replicate samples are collected once per sampling week. This frequency corresponds to at least ten percent (10%) of the samples for each week.

The precision of field measurements will be measured by duplicating one complete vertical profile and a duplicate Secchi Disk reading per every 15 sampling events – sampling event is a unique date/lake combination.

Representativeness of samples in defining the sampled waterbodies is addressed by using standard limnological sampling protocols regarding sample location within the waterbody and water column (for spatial representativeness) and frequency of sampling (for temporal representativeness). These are addressed by complying with the existing [NYSDEC SOP 203-21: Collection of Lake Water Quality Samples](#). These are also discussed in Section II.

Comparability is a measure of how data results can be compared between different sampling events at the same location, how data can be compared between different sampling locations, and how data can be compared to water quality standards. For the LCI, comparability will be achieved by following consistent field sampling protocols (from site to site and year to year),

sampling at the same locations, and obtaining analytical data following standardized methods for chemical analyses of water.

Table 2: Analytic Specifications and QA/QC Requirements - in Water Column

Parameter	Analytic Lab	Method	Precision	Accuracy	Calibration	Blanks	Quantitation Limit
Field							
Temperature	In Situ	SM 2550 B	± 1°C	± 1.5°C	N/A		
Dissolved Oxygen, field		SM 4500-0 G	± 1%	± 6%	Daily	~	
pH, field		SM 4500-H + B	± 0.05 SU	± 0.2	Weekly	~	
Conductivity, field		SM 2510 B	± 0.001mS/cm	± 1%	Weekly	~	
ORP, field		SM 2580 B	± 1mV	± 20mV	Monthly	~	
Clarity, field		SOP 203-21	± 0.1 m	± 0.1 m	N/A	~	
Nutrients							
Ammonia	ALS Environmental- Rochester	ASTM D6919-09	^	± 25%	~	Every 10 Samples	0.01 mg/L
TKN		EPA 351.2					0.1 mg/L
Nitrate/Nitrite (NOx)		EPA 353.2					0.05 mg/L
Nitrite		E353.2					0.05 mg/L
Phosphorus, Total		EPA 365.1					0.005 mg/L
Phosphorus, Total Dissolved (field filtered filtrate)		EPA 365.1					0.005 mg/L
Minerals and Metals							
Arsenic	ALS Environmental- Rochester	EPA 200.8	^	± 25%	~	Every 10 Samples	1.0 ug/L
Calcium		EPA 200.7					1000 ug/L
Chloride		EPA 300.0					2.0 mg/L
Copper		EPA 200.8					20 ug/L
Iron		EPA 200.7					100 ug/L
Magnesium		EPA 200.7					1000 ug/L
Manganese		EPA 200.7					10 ug/L

Parameter	Analytic Lab	Method	Precision	Accuracy	Calibration	Blanks	Quantitation Limit
Potassium		EPA 200.7					2000 ug/L
Sodium		EPA 200.7					1000 ug/L
Sulfate		EPA 300.0					2.0 mg/L
Hardness		SM 2340C					0.05 mg/L
Other							
Chlorophyll <i>a</i> (field filtered filter)	ALS Environmental- Rochester	SM 10200H (Fluorometric)	^	± 25%	~	Every 10 Samples	0.4 ug/L
UV-254		SM 5910B					0.0063 cm ⁻¹
True Color		SM 2120B					1 CU
Total Alkalinity		SM 2320B					2.0 mg/L
Total Organic Carbon		SM20 5310C					1.0 mg/L
Dissolved Organic Carbon (field filtered filtrate)		SM20 5310C					1.0 mg/L
Microcystin*	UFI	EPA 546	N/A	N/A	~	Every 10 Samples	0.3 µg/l
Chlorophyll <i>a</i> , unextracted*	UFI	Bbe Moldaenke, 2014	± 0.01 µg/L	± 20%L	~	Every 10	0.02 µg/l

^ Precision is calculated using the following equation: %RPD > (0.9465x^{-0.344})100 +5, where: x = sample / detection limit %RPD = [diff(duplicate pair)/av(duplicate pair)]*100. See SOP 110-21: Data Verification and Validation for more details.

*HABs parameters are only run on HABs samples.

5. Special Training/Certifications

All Primary Samplers will meet the minimum job qualifications for the New York State Civil Service titles of “Environmental Engineering Technician 1”, “Research Scientist 1” and/or “Environmental Program Specialist Trainee 1” before they will be able to be a Primary Sampler. Primary and Secondary Samplers are required to attend Department of Environmental Conservation training on sample collection and processing. Primary Samplers must also attend Lake Monitoring and Assessment Section trainings specific to the Lake Classification and Inventory Program, referred to as our “Calibration Day”. Secondary samplers must always be accompanied by a Primary sampler for all sample collection activities. All samplers should read and understand fully the applicable SOPs for the sampling they will be conducting.

Program specific training is the responsibility of the LCI QA Officer and is required for all field staff involved in the current sampling program to ensure the proper collection of water samples and field data. The QA Officer will ensure that all individuals involved with the project receive and are familiar with this quality assurance document and to the relevant standard operating procedures, to ensure proper adherence to sampling procedures. DEC staff are required to sign a document certifying that they have read and understand the Quality Assurance Project Plan and the relevant Standard Operating Procedures.

In addition, all DOW staff conducting sampling through the LCI Monitoring Program, will be familiar with, and will follow the procedures outlined in the Health and Safety SOP and shall participate in health and safety training when these courses are offered by the Department. These courses include:

- US Coast Guard boating safety course offered through the DEC training program
- ECO Training Academy hands-on boating safety class
- Other recommended training provided through the DOW Health and Safety Program

6. Document and Records

Electronic Field Data Collection Forms and Physical Field Data Sheets

The LCI Program collects all field data using field data collection forms through ArcGIS Survey 123. These forms contain the fields to enter observational data. The submitted forms are sent to NYSDEC’s ArcGIS Online account and are saved in an LCI group accessible by the program coordinator, section chief, and LCI QA Officer. The actual survey form is accessible to anyone in the NYSDEC ArcGIS Online account, however the returned surveys with data are only available to the group members. Specifics regarding the ArcGIS Survey 123 data input procedures are outlined in [SOP 102-21 Data Handling and Archival](#).

The information collected in the electronic forms is stored locally on the iPad or smartphone device being used and is uploaded to the Department on Environmental Conservation ArcGIS Online account, a cloud-based service. Once the survey is completed on the electronic device, the collector is given the option to store the survey as a draft or to submit (“send”) the survey for upload to the ArcGIS Online server. If the survey is saved as a draft, it remains stored locally on the device and can be reopened and edited before being uploaded to the server. If cellular internet service is unavailable when the survey is submitted to be uploaded, the survey data is stored locally on the device until it is connected to a cellular or Wi-Fi internet connection. Once the device is reconnected to the internet, all surveys queued to be sent to the server are automatically uploaded.

Analytical Laboratory Results

Complete data packages are required for the LCI Monitoring Program to provide data validation capability. Data packages will be delivered to the respective Laboratory Coordinator, in accordance with the requirements of the NYSDEC Prescribed Analytical Protocols (PAP) -Volume 5 (2016), and to the LCI Program Coordinator. For parameters not covered by the PAP, data packages are delivered to the respective Laboratory Coordinator in accordance with the standing contract. The LCI QA Officer will review the results and discuss any irregularities with QA staff and the LCI Program Coordinator.

Linking Field Data to Analytical Laboratory Data

All sample handling, transport, and custody procedures are detailed in NYSDEC-DOW [SOP 101-21 Sample Handling, Transport, and Chain of Custody](#). Individual sample containers are labeled with pre-printed waterproof labels with a unique sample ID. The unique sample ID is assigned with the use of a FileMaker database, WaterSampleLabels2. The sample ID is composed of **YYP####**, where:

- **YY** represents the two-digit year within which the sample will be collected (e.g., “21” for “2021”);
- **P** represents the sampling program (e.g., “L” for “LMAS”);
- **####** represents a unique four digit number assigned sequentially to samples as they are added to the database (e.g., 0001, 0002).

Each sample container must contain the following elements:

- Unique sample ID
- Date
- Time
- Analytes to be analyzed
- Indication of the presence of a preservative

Field information

Within the FileMaker database, WaterSampleLabels2, each sample ID is associated with a unique combination of the following fields:

- Program – LMAS
- Year – 2021
- month – corresponding to the month the sample will be collected
- site_id – corresponding to the location ID in the LMAS database
- qc_type – specifies whether the sample is a matrix spike, sequential duplicate, or equipment blank
- info_type – specifies where in the water column a sample will be collected. OW is for the epilimnion and BS is for the hypolimnion
- matrix – specifies what materials will be sampled: water or sediment
- user_label – a combination of the keys above to inform the field sampler
- bottle_set – which combination of parameters are to be sampled
- cooler_set – a field to combine samples together to be sampled in the same day

Aquatic Macrophyte Identifications

The scientific name of any aquatic macrophytes that is submitted to Central Office for identification or identified in the field will be added to the corresponding electronic record that contains the field data collected in conjunction with the macrophyte.

Calibration Logbooks

A calibration/maintenance log book is kept with each multiprobe unit in accordance with [SOP 211-21: Use, Calibration, Maintenance and Storage of Multi-probe meters used to Measure Water Quality Parameters](#).

Records Retention

As specified by the NYS DEC Office of General Counsel Department Retention Schedules all records from the LCI Monitoring Program are to be retained for at least 10 years following the completion of the basin study.

All results will be summarized in a final report to be prepared by the LCI QA Officer. The final report will include all field and laboratory QA/QC results including any blanks, lab duplicate analyses, matrix spike analyzed during this study. An evaluation of the precision, accuracy, and completeness based upon replicate and spike analysis will be accomplished. A summary section on how QA/QC objectives were or were not met will be included in the final report. The final report will include a summary and discussion of analytical results for those parameters included in Table 2.

II. DATA GENERATION AND ACQUISITION

1. Rationale of Monitoring Design

Sample Distribution

Based on the objectives of the New York SWMP and contained in the program's Quality Assurance Management Plan (NYSDEC, 2014), the LCI Monitoring Program uses a rotating strategy in which waterbodies in all major drainage basins in the state are monitored over a five-year cycle. In 2021, waterbodies of six of the seventeen major drainage basins in New York State will be sampled. These basins are the Allegheny River, Seneca-Oneida-Oswego Rivers, and the Upper Hudson River basins (Year 1: Screening Sampling) and the Lake Erie/Niagara River, Lake Ontario, and Mohawk River basins (Year 2: Intensive Sampling). There will be no Year 3: Intensive Sampling in 2021 because this is the first year Intensive Sampling will be distributed over two years.

Sampling locations are selected according to criteria that ensure samples collected will meet the monitoring program's objectives (see below for criteria used). The population of waterbodies considered for monitoring includes waterbodies with both public and private access.

Year One: Planning and Screening

The Year One Screening Network's focus is on screening of-interest lake segments. Lake segments are first stratified for selection based on the following categories:

Stratification Category	Percent of Total
Regional Reference	10%
Long Term Trend	20%
Department Interest	30%
Random Probabilistic/Unassessed	40%

Regional Reference lake segments are selected to be representative of the highest water quality or best attainable condition in a basin. They are sampled each time a basin is monitored. If these lake segments happen to be included in the current year's CSLAP sampling, they are excluded from LCI monitoring. These lake segments are selected using landscape characteristics and historical datasets. For watersheds with minimal disturbance such as those within the Catskills and Adirondacks, Regional reference sites typically exceed 95% natural cover (forest, wetland, open water etc.). In regions with more extensive anthropogenic disturbance, a minimum of 75% natural and less than 2% impervious surface may be used to represent the best attainable regional reference site.

Long Term Trend lake segments represent the historical knowledge based on water quality trends in a given watershed. Trend lake segments are selected to be well represented in the historical database, including CSLAP and LCI samples. These lake segments typically have between 4 and 8 years of previous sampling records, with a minimum of 3 years. Geographic distribution among the ecoregions should also be considered when selecting trend lake segments, trying not to over emphasize the water quality information of a single ecoregion. Long term trend lake segments are sampled each time a basin is monitored by LCI. If these lake segments happen to be included in the current year's CSLAP sampling, they are excluded from LCI monitoring. Emphasis should be placed on retaining trend lake segments with the longest historic record.

It's important to note that NYSDEC cannot request specific lakes be included in the CSLAP program so this overlap cannot be guaranteed each time LCI cycles into a basin.

Department Interest lake segments are identified through meetings with Division of Water staff including Water Assessment and Management Section, Streams Section, Watershed Basin Programs, Bureau of Water Resource Management, Permits Bureau, Compliance Bureau, and Regional Offices. In addition, through the DOW Monitoring Program Kick Off meetings in the spring of each year, LCI Program Coordinator will meet with local parties to discuss water quality issues/problems in the basin, and where specific monitoring efforts may be directed.

The remaining sites are Random Probabilistic lake segments. Random Probabilistic lake segments are identified in collaboration with USEPA. To produce an unbiased dataset for making statewide determinations about water quality, a random set of sampling locations is selected. The majority of the locations are also unassessed, meaning they haven't ever been sampled by NYSDEC or haven't been sampled in 10 years. Therefore, this category of sampling locations satisfies both the goal of assessing statewide conditions as well as capturing unassessed lake segments. This set of sites is developed by the EPA in cooperation with LCI staff. Experts at the EPA produce a random draw of sampling locations statewide. These locations are restricted to non-wetland ponded waters above 6.4 acres. Once the draw is provided to LCI staff a "desktop recon" of each location is made to determine access feasibility, and habitat quality. If a site is inaccessible or habitat is not suitable the site may be dropped. An over-draw of sampling locations is generated by the EPA to provide additional sites in this event.

Year Two: Intensive

Results of the Year One Screening as well as the historic data set (<10 year) will be used to identify lakes where more intensive monitoring is appropriate. This includes candidates identified during the DOW Monitoring Program Kick Off meetings and meeting with Division of Water staff. The sampling of these Intensive lake segments is the primary LCI Monitoring Program activity during Year Two and Year Three of the study. The primary focus of the intensive monitoring cycle is to conduct enough sampling to characterize these waterbodies using criteria established in the NYSDEC DOW Consolidated Assessment and Listing Methodology (CALM) document (NYSDEC 2021). The CALM criteria are developed to determine if the designated uses for each waterbody are attained.

Selection of Lakes to be Sampled

One of the most important components of planning a monitoring network is site selection. The specific rationale for the selection of the lakes to be sampled varies for each of several component networks due to the different objectives of each.

Screening Network lakes are identified using the criteria described below

- Regional Reference, Long Term Trend, Department Interest and Random Probabilistic lake segments are selected based on the process described above.
- Lakes that are public water supplies are prioritized above all others in the screening network.

Intensive Network lakes are identified using the criteria described below:

- The data used to produce the ranked list for intensive sampling include the previous year's screening data as well as any data collected in the past 10 years

from lakes listed in the waterbody inventory as needs verification, unassessed, or having minor impacts.

- The above data are analyzed for water quality standard exceedances and violations.
- The list of lakes is ranked in order based on the following cascading criteria: presence of a public water supply > water quality standards violations > Harmful algal bloom detected at least once since 2012 > Indicators of eutrophic conditions.
- The lakes are selected sequentially from this list based on department needs and budgetary constraints.

Targeted Network lakes represent those waterbodies that fall outside of the RIBS rotational schedule but are sampled to meet some other NYSDEC objective, including TMDL or Nine Element (9E) Plan development, post-TMDL or -9E monitoring, source water protection, biomonitoring in support of HABs mitigation pilots or Division of Fish and Wildlife permitting, or other NYSDEC priorities.

Identification of Sampling Sites

Sampling sites are located at the “deep hole” of each lake and are chosen through bathymetry or an initial sounding survey using an electronic sounding device. Once the sampling site is chosen GPS coordinates are recorded, these coordinates entered into GPS devices (or physical triangulation using shoreline landmarks in the absence of available GPS devices) are used to locate the sampling site in any subsequent sampling sessions at the target waterbody.

Accessibility of Sampling Locations

Sampling sites are accessed through public or private boat launches or from gaining permission from local residents (including municipalities) with shoreline access to the lake, particularly if public boat launches are far from the primary sampling location. The LCI QA Officer with assistance from other Primary Samplers and/ or regional DEC staff will attempt to determine the most suitable access point with landowner permission (written or verbal) for all lakes two to six weeks before sampling is begun. Sampling locations not accessible, due to the inability to secure permission, are deferred until access can be secured.

Selection of Monitoring Parameters

User Perception Surveys

Samplers complete a field perception survey during each sampling session. These surveys are used to evaluate recreational and water quality perceptions and, when linked with water quality data collected at the same time, can tie water quality data to management objectives. The LCI user perception questions are identical to those used in the New York Citizens Statewide Lake Assessment Program (CSLAP) since 1992. These surveys also provide a permanent record of field ‘impressions’ that are particularly important for characterizing lake conditions not captured with routine water quality monitoring indicators. This portion of the electronic field data collection form is completed before all other measurements are taken. This eliminates bias based on water quality measurements.

Chemical Monitoring Parameters are selected based on several factors. Limited analytic budgets dictate that economy and efficiency are considered in parameter

selection and sampling frequency. Beyond that, the LCI Monitoring Program chemical sampling is designed to evaluate trophic status and characterize ambient water quality conditions in lakes using trophic or trophic-surrogate indicators (Table 3).

Bathymetric Mapping is only conducted in response to a department interest request such as for TMDL/9E model development.

Harmful Algal Bloom Parameters are collected from all Random Probabilistic Sites in order to determine statewide occurrence of HABs. These procedures are established in [SOP 212-21: Harmful Algal Bloom Sampling and Analysis](#) and the sampling event should be reported to the HABs Program immediately using the NYHABs online notification and reporting system, available on the NYSDEC website or email HABSInfo@dec.ny.gov. HAB sample names are provided on the field sheet, corresponding to the labels affixed to the HAB sample bottles

Biological Monitoring Indicators- a limited number of biological monitoring parameters have also been incorporated into the LCI Monitoring Program (Table 4). Specific biological monitoring activities include collecting integrated samples for chlorophyll *a* analyses, collecting macrophytes and diatoms for identification and integrated and/or grab samples for investigating harmful algal blooms.

Biological Sampling- To address potential swings in the biologic community structure, and to complete the trophic characterization of the lake, chlorophyll *a* samples are collected in conjunction with all surface (versus hypolimnion) water samples. Macrophyte specimens are collected during the first visit to each program lake and during each subsequent sampling event only if additional species are observed.

Specific Parameters

The specific parameters collected at each lake are selected based on the waterbody classification and where in the water column the sample is collected from. Table 5 outlines the parameters that will be collected.

Table 3: Water Column Parameters

Indicator	Description	Sampling Network
Field Parameters (Air and Water Temperature, pH, DO, Conductivity, ORP, chlorophyll a, Clarity)	to provide general characterization of lake	Intensive, Targeted and Screening Networks
Conventional Parameters (Nutrients & Color)	to indicate cultural eutrophication; determine sediment and nutrient load as impacting phytoplankton or macrophyte growth	Intensive, Targeted and Screening Networks
Common Minerals, Metals	to determine geologic contribution and evaluate potential human health impacts	Intensive, Targeted and Screening Networks
Heavy Metals or toxins	frequently detected priority toxics (naturally occurring/industrial use, including cyanotoxins)	Intensive, Targeted and Screening Networks

Table 4: Biological Indicators of Water Quality

Indicator	Description	Sampling Network
Phytoplankton standing crop (extracted chlorophyll a)	Used to estimate density of algal communities.	Intensive, and Screening Network
Macrophyte identification	Focuses on collection and identification of nuisance macrophyte species and/or endangered aquatic plant species; the former consists primarily of exotic submergent macrophytes.	Intensive Networks
HABs	Focuses on identification of a cyanobacteria HAB. Epilimnetic and shore bloom samples are analyzed for qualitative phytoplankton microscopy, fractional unextracted chlorophyll a and cyanotoxins.	Random Probabilistic Sites in the Screening Networks
Sediment Diatoms and radiometric dating	Focuses on collection and identification of diatoms from lake sediment at the water chemistry sampling location. Radiometric dating is used to estimate the date of the earliest diatom samples in the cores (for natural lakes only).	Random Probabilistic Sites in the Screening Networks

Table 5: Water Chemistry Parameters by Class and Depth

* On a site-specific basis additional parameter may be added to address specific questions such as harmful algal blooms.

** Only surface water samples are collected from unstratified waterbodies. A waterbody is considered stratified if a metalimnion is observed – a region in the vertical profile where temperature drops at least one degree with each 1m increase in depth.

	CLASS A SURFACE WATER	BOTTOM WATER	CLASS B, SURFACE WATER	CLASS B, BOTTOM WATER
ALKALINITY, TOTAL (AS CaCO ₃)	1	1	1	1
COLOR	1	1	1	1
NITROGEN, AMMONIA (AS N)	1	1	1	1
NITROGEN, KJELDAHL, TOTAL	1	1	1	1
NITROGEN, NITRATE-NITRITE	1	1	1	1
SOLUBLE PHOSPHORUS	1	1	1	1
TOTAL ORGANIC CARBON	1	1	1	1
PHOSPHORUS	1	1	1	1
Calcium	1	1	1	1
CHLORIDE (AS CL)	1	1	1	1
CHLOROPHYLL A	1		1	
DOC	1	1	1	1
SULFATE (AS SO ₄)	1	1	1	1
UV254	1	1		
ARSENIC	1	1	1	1
IRON	1	1	1	1
MANGANESE	1	1	1	1
TOTAL HARDNESS	1	1	1	1
NITRITE	1	1	1	1
MICROCYSTIN	1		1	

2. Sampling Methods

Sampling methods utilized in this Monitoring Program have been previously outlined in NYSDEC Division of Water Lake Sampling, [SOP 203-21: Collection of Lake Water Quality Samples](#), and in [SOP 212-21: Harmful Algal Bloom Sampling and Analysis](#). No variances from these standard operating procedures regarding sampling methodology, sampling equipment, and sample processing are expected for this monitoring program.

The following equipment will be utilized for *in-situ* data collection as part of this sampling program- the use of this equipment is outlined in [SOP 203-21: Collection of Lake Water Quality Samples](#).

Lake Water Sampling-

- Water Sample Collection:
 - Amber Wide-Mouth Sampling Bottle (surface monitoring for lakes less than 1.5 meters in depth)
 - Integrated sampling tube (surface monitoring for lakes 2 meters or greater in depth)
 - Van Dorn bottle (grab depth samples, primarily for hypolimnetic samples)
 - Field filtration (electric vacuum pump with disposable bottle insert for water chemistry indicator, hand pump for chlorophyll a filtrations)
- Field Measurements
 - Secchi disk
 - electronic multiprobe
- Macrophyte Sampling
 - Two-sided rake with tether line
- Lake Sediment Diatom Sampling
 - Gravity sediment core
 - Sediment core extruding apparatus
- Bathymetric Mapping
 - Chart-plotter
 - Transducer

The Screening and Intensive sites are monitored by NYSDEC staff using a NYSDEC sampling vessel. Hand-operated sampling boats- canoes and small john boats with oars and or an electric trolling motor- are generally used for the sites that are less than 200 hectares (500 acres) in surface area or for sampling sites that are less than 1 mile from the boat launching area. A larger Tracker boat with a gasoline powered motor is typically used for larger lakes, and for smaller lakes with boat ramp launches.

Split sampling will be conducted for QA purposes. Filtering, compositing, and splitting of samples are discussed in detail in [SOP 203-21: Collection of Lake Water Quality Samples](#). Samples are well mixed when the subsamples are drawn. The sample splitting churn or mixing carboy are designed to accomplish this. Sample splitting procedures are performed as described in the NYSDEC Sample Handling, Transport, and Chain of Custody SOP; [SOP 101-21: Sample Handling, Transport, and Chain of Custody](#). As per the SOP subsamples are filled in the order that will minimize possible contamination of the subsequent sample containers. Samples that require no preservative are filled first. Samples for nitrogen series parameters are filled before bottles that are preserved with nitric acid. Samples with sulfur as a target analyte are filled prior to bottles with sulfuric acid preservation. Filtered samples are drawn last unless their preservation method contravenes the above fill order guidance.

- Class A bottle set fill order
 - Color, Sulfate, Alkalinity*, UV-254
 - Total Nutrients
 - Dissolved Nutrients
 - Metals
 - DOC, Chlorophyll a*
- Class B & C bottle set fill order
 - Color, Sulfate, Alkalinity*
 - Total Nutrients
 - Dissolved Nutrients

- Metals
- DOC, Chlorophyll a*

*Chlorophyll a and Alkalinity are not collected in bottom samples.

Lake samples will be filtered for chlorophyll a, dissolved organic carbon, and soluble phosphorus. Filtered samples are prepared after the unfiltered sample (raw water) containers are filled. A known volume of raw water (see Table 6 below for volume guidance) from the surface sample is filtered through a glass fiber filter (0.7µm pore size) for chlorophyll a analysis (due to the lack of light penetration chlorophyll a is not analyzed for in hypolimnion samples). The chlorophyll a filter is folded in quarters and wrapped in aluminum foil and transferred to a glass vial and submitted for laboratory analysis. Samples for soluble phosphorus and dissolved organic carbon are filtered using a 0.45 µm Cellulosic filter and the filtrate is transferred to the subsample bottle and submitted for laboratory analysis. Samples for dissolved organic carbon may also be filtered using the 0.7µm pore size and the results are considered equivalent (Denis et al. 2017).

All filtrations are performed as described in the NYSDEC Lake Sampling SOP; [SOP 203-21: Collection of Lake Water Quality Samples](#).

Table 6: Volume of Water to be filtered for Chlorophyll a Analysis

Secchi Disk Depth	Volume of raw water to filter
< 1 meter	250 ml
>1 & < 2 meters	500ml
> 2 meters	1000ml

*This table provides only a guide to a reasonable compromise. If staff can filter more water without seriously increasing the filtering time they should do so. If the filter is noticeably green and staff has not filtered the specified amount, then less water may be filtered. The actual volume of filtered water needs to be recorded in the electronic field form and on the laboratory chain of custody form. This information is used in the calculation of chlorophyll a concentration.

Sample containers and preservatives used for the analytes measured in this sampling program are listed in

Table 7.

Field Sheets/Forms

The electronic field data collection form provides a record of each sampling event (sampling event is a unique date/lake combination). The electronic field data collection form is used to record: (1) field measurements of basic water quality parameters (water temperature, dissolved oxygen, pH, and conductivity), (2) other notable field observations, including water clarity, weather, aquatic macrophyte species observed or collected, and other information about the actual sample, (3) indicate semi-quantitative (ordinal scored) observations of lake perception; and (4) additional comments to evaluate analytical sampling results.

The data recorded in the electronic field data collection form is stored on ArcGIS online. At the end of the field season, the LCI QA Officer will collect and review this field data and submit it to the central database. An electronic record of each survey is stored on the Department of Environmental Conservation ArcGIS Online account.

All electronic field sheets include spaces for writing lake name and/or site description, sample identification number (linking it to the analytical results), sampling date, weather condition (wind, sky), macrophyte identification listings and qualitative assessment of densities/extent of aerial coverage, water clarity, water color (qualitative), volume of water filtered for chlorophyll *a* and sounding depth.

Field Observations/Lake Perception Survey

Samplers complete the field perception portion of the electronic field data collection form before collecting any samples or performing any field measurements, this is to prevent introducing bias into their perception of the lake. These assessments were developed as part of the Citizens Statewide Lake Assessment Program (CSLAP) and allow comparison of perception data across programmatic lines and to document perceived field conditions for future sample analysis. These surveys are used to evaluate perception of lake conditions (necessary to evaluate impairments to aesthetic and recreational use impacts that are not otherwise measurable through the LCI monitoring program).

General Lake Assessment

The General Lake Assessment is completed at the sampling site before collecting any samples or performing any field measurements, this is to prevent introducing bias into their perception of the lake. This data is only collected at screening sites and intensive sites if the visit is within the summer index period.

Aquatic Macrophytes: Aquatic macrophytes are collected using tethered two-sided rakes or hand collected from the boat or shoreline, identified in the field if possible, and densities are qualitatively assessed by observation from sampling vessels or through shoreline observations. Plant identifications to genus and, where possible, species level, are limited to the littoral zone at the boat launch site, the major inlet, the outlet, and transit to and from the sampling areas. When an invasive non-indigenous species or a rare-threatened or endangered species is found or suspected a single specimen or two of these macrophytes are placed in a plastic sealable bag with a moist paper towel. Other plant specimen not identifiable by the Primary Sampler will also be collected and retained in the plastic bag for office identification. Sediment, algae, or other debris should be removed, but any flowers, leaves, stems, and other plant parts useful for identification should be included. The bag is labeled with the Lake Name and Date. Specimens are kept cool until they can be brought or shipped to the LCI Program Coordinators or designees. Plant samples shall be discarded or preserved within three months of collection.

Primary samplers confirm the identification of the species or consult with external botanists to confirm the identification of the species. After the identification is made the scientific name of the specimen will be entered into the corresponding electronic record that contains the field data collected in conjunction with the specimen. If a rare, threatened, or endangered plant species is found, information regarding the exact location and extent of the population will be submitted to the New York Natural Heritage Program at the NYSDEC offices in Albany by the Primary Sampler that observed the plant. If an invasive species is encountered, information regarding the exact location and extent of the population will be submitted to New York iMapInvasives.

Additional details about aquatic macrophyte data collection for the LCI Program can be found in [SOP 203-21: Collection of Lake Water Quality Samples](#).

Sediment Diatoms: Sediment diatoms are collected using a gravity corer at the deepest point of the waterbody. The sampling location will generally be where the water chemistry and vertical profile is collected. To maintain consistency with other national projects collecting lake sediment diatoms, the National Lakes Assessment Sediment Diatom collection method is used. The full method can be found in the 2012 National Lake Assessment Field Operations Manual (EPA, 2012) and a summary of the method is in [SOP 203-21](#).

Radiometric Dating of Sediment Cores: In natural lakes only, the bottom slice of the collected sediment cores will be analyzed using radiometric dating to determine the estimated date of this layer. Dating coupled with diatom analysis would allow us to reconstruct historic water chemistry conditions.

Water Clarity: Water clarity measurements are collected with the use of a Secchi disk, a black and white quartered 20cm disk connected to a non-stretch vinyl line with gradations at 0.1 meters. The Secchi disk is lowered over the shady side of the boat. The depths at which the disk disappears and reappears, respectively, from sight are averaged and recorded, to the nearest 0.1 meters, as the Secchi disk transparency. The sampler must note in the field sheet if the Secchi disk is still visible while resting on the lake bottom.

Field Parameter Measurements

Vertical profiles are taken with an YSI ProDSS probe (primary), YSI EXO2 Multiparameter probe (primary), or Hydrolab MS5/DS5 Multi parameter probe (secondary) - hereafter all three will be referred to as "multiprobe(s)" as per [SOP 211-21: Use, Calibration, Maintenance and Storage of Multi-probe Meters used to Measure Water Quality Parameters](#). In-situ data for dissolved oxygen, temperature, water depth, pH, chlorophyll, phycocyanin, specific conductivity, turbidity and ORP are collected at one-meter intervals from the surface throughout the thermocline and hypolimnion with a multiprobe. Calibration and calibration drift checks are conducted before and after each sampling trip and the multiprobes are standardized in the laboratory prior to the initiation of each sampling run. The multiprobes provide both digital readouts and data logging capabilities, with all parameters displayed simultaneously.

Dissolved Oxygen: D.O. measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the meter. With the multiprobe, D.O. is standardized against barometric pressure (measured in the unit).

Specific Conductance/Conductivity: Conductivity measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the multiprobe.

pH: pH measurements are collected after the equipment has been appropriately calibrated using standard buffers that reflect the expected pH of the lake (s). All multiprobes are standardized against pH 7 buffer; when acidic lakes are sampled, the units are also standardized against pH 4 buffer, while pH 10 buffers are used when alkaline lakes are sampled. The manufacturer's directions are followed when calibrating and using the multiprobe. Electrodes are rinsed well after each reading.

ORP: ORP measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the multiprobe.

Turbidity: If the turbidity sensor is present on the multiprobe, measurements are taken after the equipment has been appropriately calibrated. The manufacturer's directions are followed when calibrating and using the multiprobe.

Chlorophyll and phycocyanin: the probes are calibrated prior to the start of the sampling season using standards provided by the manufacturer and researchers. The manufacturer's directions are followed when calibrating and using these probes. YSI probes use a rhodamine dye solution to calibrate the Total Algae sensor (chlorophyll *a* and phycocyanin). For those probes with phycocyanin measurement capabilities, phycocyanin readings are recorded alongside chlorophyll *a*.

Hydrolab probes utilize a solid standard which is calibrated against extracted laboratory chlorophyll measurements.

Water Temperature: Water temperature measurements are collected with a multiprobe. The temperature is factory calibrated on all multiprobes used for LCI monitoring.

Air Temperature: Air temperature measurements are collected with either a multiprobe or an ASTM approved non-mercury glass bulb or dial thermometer. Air temperature measurements are taken in a shaded area that is protected from strong winds but open to air circulation. The calibration cup on multiprobe units are replaced with the sensor guard before air temperature readings are taken.

Sample Information

Water depth (depth range for integrated sample) and text descriptions of color, odor, and comments specific to the sample/the collection of the sample are recorded on the Field Sheet.

Aquatic plant sampling

Aquatic plant surveying sites are outlined in [SOP 203-21: Collection of Lake Water Quality Samples](#). This includes survey launch site, the major inlet, the outlet, and the littoral zone transiting from these locations to the reference water quality monitoring site as prescribed in [SOP 203-21: Collection of Lake Water Quality Samples](#). Relative aquatic plant densities are recorded in the electronic data collection form. Individual aquatic plant species are labeled on the map and form, and common and/or scientific names are cited on the form (if known); plant identifications in the office are transcribed to the electronic field data collection forms as needed.

Harmful algal bloom (HAB) sampling

HABs shore bloom samples are to be collected at the random probabilistic sampling sites only. Any other observed bloom will be documented using the NYHABs visual observation survey. These procedures are established in [SOP 212-21: Harmful Algal Bloom Sampling and Analysis](#) and the sampling event should be reported to the HABs Program immediately using the NYHABs online notification and reporting system, available on the NYSDEC website. Alternatively, a report can be sent by email to HABSInfo@dec.ny.gov. The email should include the date and time of the report, the name and county of the lake, the latitude/longitude, and the extent and location of the bloom. Attach a picture of the bloom to the email. HAB sample

names are provided on the field sheet, corresponding to the labels affixed to the HAB sample bottles.

Bathymetric Mapping (NOT BEING CONDUCTED IN 2021)

The protocol for bathymetric mapping is described in the BioBase EcoSound User Reference Guide (Navico, 2019). Bathymetric mapping will be completed for Department Interest requests only. High accuracy depth (bathymetric) maps are obtained using a hydroacoustic instrumentation interfaced with a global positioning system mounted on a vessel. The combined unit provides a high resolution and precision survey of the complex bathymetry and morphology of lakes and non-wadable streams. The data collected in the field is in x, y and z format – latitude, longitude, and depth. The sampling strategy involves bisecting the water body, at low speed (<10 mph), along its longest axis, then subsequent continuous transects are conducted parallel (lakes and rivers) and perpendicular (lakes only) to this initial transect along the longest axis. At each waterbody, manual depth measurements should be taken periodically to ensure the equipment is working properly and producing accurate measurements. Manual depth measurements be conducted with a weighted line/tap while the vessel is stationary. Samplers should record both the manually measured depth and the depth reading from the sonar unit to the nearest 0.1 m on a field data sheet. Using these data, yearly checks of measurement error will be conducted between manual and sonar measurements.

Notes and Remarks

Any conditions/observations, that the sampling team deems pertinent to making an informed assessment of the water quality status and/or designated uses, are noted on the electronic data collection form.

Sampling Equipment Cleaning and Rinsing

Cleaning and Rinsing of sampling equipment will be handled as per the [SOP 103-21: Sampling Equipment Cleaning](#).

3. Equipment Testing, Maintenance and Calibration Procedures

Field instruments and equipment testing, inspection and maintenance will be performed in this sampling program as per the most recent version of the NYSDEC [SOP 103-121: Sampling Equipment Cleaning](#), and per the manufacturer's instructions.

Contract lab instrumentation will be operated per NYSDOH ELAP certification requirements. Parameters for which NYSDOH ELAP does not issue certificates, contract lab instrumentation will be operated per the instructions in the NYSDEC Prescribed Analytical Protocol-Volume 5 (2016).

Storage

All sampling bottles and equipment related to sampling will be stored and maintained by LCI Monitoring Program sampling staff so that the results obtained from their use will not be questioned. Prior to use, all equipment will be checked to ensure good operating conditions and cleanliness. After sampling has been completed, the equipment will be cleaned (as described below) and kept ready for use. Manufacturer's specifications will be followed in carrying out routine maintenance.

Rinsing

All sampling equipment (buckets, churn, sampler, etc.) will be well rinsed with a distilled (de-ionized) water wash before and after each use. At each sampling location, field equipment will be rinsed with ambient water before a sample is collected and rinsed with distilled water after sampling is completed so equipment will be ready for use at the next monitoring location. Whenever possible, samples are collected from the least contaminated to the most contaminated site.

Cleaning

Equipment should be washed prior to and after a sampling week using a phosphate free detergent and water scrub followed by a distilled water rinse as needed. Whenever equipment is cleaned, the equipment is marked with a post-it with the date it was cleaned.

Calibration

When calibrating a multiprobe fresh reference buffers are used and the origins of each buffer are noted in the log book for the multiprobe.

Multiprobes are calibrated before each sampling week, and recalibrated if the type of waterbodies (acidic versus alkaline) change over the course of the sampling week. Specific instructions regarding the calibration of multiprobes are provided in the Operation Manuals for each instrument.

Multiprobe calibration procedures are described in the NYSDEC [SOP 211-21: Use, Calibration, Maintenance and Storage of Multi-probe Meters used to Measure Water Quality Parameters](#).

Back-up Equipment and Spare Parts

Duplicates of most of the sampling equipment are kept in the field vehicle. Spare parts for the multiprobes are kept either with the probes and or in the laboratory.

4. Sampling Handling and Custody

The collection method, sample container, preservative method, and holding time for all of the analytes are provided in

Table 7. Samples are either shipped overnight or hand-delivered to the laboratory.

Chain of Custody

All sample handling, transport, and custody procedures are detailed in NYSDEC-DOW [SOP 101-21 Sample Handling, Transport, and Chain of Custody](#). Individual sample containers are labeled with pre-printed waterproof labels with a unique sample ID. The unique sample ID is assigned with the use of a FileMaker database, WaterSampleLabels2. The sample ID is composed of **YYP####**, where:

- **YY** represents the two-digit year within which the sample will be collected (e.g., “21” for “2021”);
- **P** represents the sampling program (e.g., “L” for “LMAS”);
- **####** represents a unique four digit number assigned sequentially to samples as they are added to the database (e.g., 0001, 0002).

Each sample container must contain the following elements:

- Unique sample ID
- Date
- Time
- Analytes to be analyzed
- Indication of the presence of a preservative
- Field information

Within the FileMaker database, WaterSampleLabels2, each sample ID is associated with a unique combination of the following fields:

- Program – LMAS
- Year – 2021
- month – corresponding to the month the sample will be collected
- site_id – corresponding to the location ID in the LMAS database
- qc_type – specifies whether the sample is a matrix spike, field replicate or equipment blank
- info_type – specifies where in the water column a sample will be collected. OW is for the epilimnion and BS is for the hypolimnion
- matrix – specifies what materials will be sampled: water or sediment
- user_label – a combination of the keys above to inform the field sampler
- bottle_set – which combination of parameters are to be sampled
- cooler_set – a field to combine samples together to be sampled in the same day

A *Chain of Custody Record/Form* will be completed by sampling personnel and submitted to analytic laboratories with the samples (see Figure 3 for an example chain of custody form).

ALS Environmental’s Chain of Custody form also serves as a request for analysis (Figure 3). All sections of the Chain of Custody/Laboratory Analysis Request must be fully completed,

including project name (LCI), project contact (LCI Program Coordinator), sampler's name and signature, sample ID, date and time of sampling, sample matrix (water), the number of containers per sample analysis requested, lake name with location within the water column, and sample relinquished by. For HABs Samples a separate Chain of Custody is sent to the Upstate Freshwater Institute along with the shore bloom sample.

Table 7: Water column sampling specification

Parameter	Medium	Collection Method	Sample Container	Preservation Method	Holding Time
Alkalinity	Lake	Depth Integrated or Grab	120 ml plastic	Chill<6 ⁰ C	14 days
Harmful Algal Blooms	Lake	Depth Integrated or Grab	250 ml glass	Chill<6 ⁰ C	2 days
Major Anions (Cl, SO ₄)	Lake	Depth Integrated or Grab	250 ml plastic	Chill<6 ⁰ C	28 days
Total Phosphorus (TP), NO ₃ +NO ₂ ,	Lake	Depth Integrated or Grab	250 ml plastic	H ₂ SO ₄ Chill<6 ⁰	28 days
NO ₂	Lake	Depth Integrated or Grab	250 ml plastic	Chill<6 ⁰ C	2 days [#]
Total Dissolved Phosphorus (field filtered filtrate)	Lake	Depth Integrated or Grab, Filtered	250 ml Plastic	H ₂ SO ₄ Chill<6 ⁰	28 days
NH ₃ , TKN	Lake	Depth Integrated or Grab	250 ml Plastic	H ₂ SO ₄ Chill<6 ⁰	28 days
Major Cations (Na, K, Ca, Mg, Fe, Mn, As, Total Hardness)	Lake	Depth Integrated or Grab	500 ml Plastic	HNO ₃ Chill<6 ⁰	28 days
Total Organic Carbon/Dissolved Organic Carbon (field filtered filtrate)	Lake	Depth Integrated or Grab (filtered for DOC)	250 ml Plastic	H ₂ SO ₄ Chill<6 ⁰	14 days

True Color	Lake	Depth Integrated or Grab	150 ml Plastic	Chill<6 ⁰	2 days [#]
Chlorophyll a (field filtered filter)	Lake	Depth Integrated, Filtered	Filter (volume to be filtered see Table 6)	Chill<6 ⁰	24 days
UV-254	Lake	Depth Integrated and/or Grab	250 ml Plastic	Chill<6 ⁰	2 days [#]
Aquatic Macrophytes	Lake	Rake Sample	NA	Chill<6 ⁰	2 months
Sediment Diatoms and Radiometric Dating	Sediment	Core Sample	150 ml plastic	Chill<6 ⁰	Indefinitely (after freezing)

[#] The 2-day holding time for True Color, Nitrite, and UV-254 is recognized and every effort is made to have samples at the lab within the holding time although this may not always be possible. Results from samples analyzed past their holding time will be given a qualifier which will be maintained within the division's database

Sediment diatom and radiometric dating samples will be labeled using the corresponding water quality epilimnetic sample identifier with the addition of suffixes to identify the three distinct types of samples outlined in the sediment diatom sample collection protocols in [SOP 203-21: Collection of Lake Water Quality Samples](#).

- SEDD – Sediment dating
- SEDT – Sediment diatoms (top)
- SEDB – Sediment diatoms (bottom)

Transport and Shipping Procedures

All LCI water chemistry samples, except for parameters measured in the field and HAB samples are submitted to ALS Environmental- Rochester (address below). All LCI samples are shipped in large plastic coolers within the holding time of the included parameters. To safely ship chilled samples, the following guidelines are followed:

1. The cooler is carefully inspected. Broken and/or leaking coolers are replaced. Drain spouts are sealed.
2. All shipping coolers are lined with a plastic bag if using fresh ice.
3. All bottle caps are tightened.
4. To prevent breakage when samples are sent in coolers, all glass containers are placed in a foam sleeve, or its equivalent.
5. Generally, fresh ice is used to keep the sample chilled during shipping. Ice is placed in a plastic bag or otherwise contained.

6. During the summer, the coolers are pre-chilled. Then the samples are packed with fresh ice or ice packs.
7. The laboratory chain of custody sheets are placed in a plastic bag and fastened to the underside of the cooler's lid with tape.
8. All containers from the same site are grouped together in a plastic bag
9. The plastic liner bag is carefully sealed and the cooler taped shut.
10. All samples from a site are mailed in the same cooler

Table 8: Analytical Laboratories

LABORATORY NAME	LOCATION	LABORATORY SPECIALTY
ALS Environmental- Rochester (Former Columbia Analytical Services)	Rochester, NY	Dilute water systems
Upstate Freshwater Institute	Syracuse, NY	Harmful Algal Blooms
TBD	TBD	Sediment Diatoms and Radiometric Dating

Mailing addresses for LCI Monitoring Program analytical laboratories are:
 ALS Environmental- Rochester (Water column samples)

ALS Environmental, ATTN: Janice Jaeger
 1565 Jefferson Road
 Building 300, Suite 360
 Rochester, NY 14623
 Telephone: (585) 288-5380


UFI Upstate Freshwater Institute (HAB samples)
 UFI
 Attn: Gina Kehoe
 224 Midler Park Drive
 Syracuse, NY 13206
 Telephone: (315) 431-4962

All samples are either hand deliver to the laboratory or one of the laboratory service centers shipped overnight by UPS.

Sample Identification

Samples will be identified by a unique identification number assigned to each sample. See the Documents and Records section above for details on how Sample Identification numbers are assigned.

Figure 2: Laboratory Chain of Custody Form

CHAIN OF CUSTODY – ALS Rochester										Page _1_ of _1_	
 <p>NEW YORK STATE OF OPPORTUNITY</p> <p>Department of Environmental Conservation</p> <p>Division of Water</p> <p>(This COC for use with ALS Rochester only)</p>	Project Name: LCI			Project Number: LCI21			NYSDEC SDG:				
	Sampler Collector:			Sampler Signature:			Sampler Phone No.:				
	Project Manager: Alene Onion			X Report to Project Manager			Bill to Project Manager: Jason Fagel				
	Address: 625 Broadway, 4 th Floor Albany, NY 12233-3502			Address:			Address: 625 Broadway, 4 th Fl Albany, NY 12233-3502				
	Phone: (518) 402-8166			Phone:			Phone: 518-402-8156				
Email: alene.onion@dec.ny.gov			Email:			Email: jason.fagel@dec.ny.gov					
Matrix Codes: WW = Wastewater GW = Groundwater W = Ambient Water SE = Sediment SL = Sludge T = Tissue O = Other <u>DI WATER</u>	Collection Date (MM/DD/YY)	Collection Time (HH:MM)	Matrix Code	MS/MSD	# Containers	Analyses Ordered (list)				Preservative Codes:	
Sample Key						A Epi	A Hypo	B Epi	B Hypo	Chl A Volume (ml)	NYSDEC Sample ID
	05/___/2021		W					X			1701AGA0815_US1_N_OW_B
	05/___/2021		W					X			1701AGA0815_US2_N_OW_B
	05/___/2021		W					X			1701AGA0815_US3_N_OW_B
			</								

5. Analytical Methods

Analytical methods used in this sampling program are provided in the Table 2. Samples will be analyzed as per the NYSDOH ELAP certification and the NYSDEC Prescribed Analytical Protocol-Volume 5 (2016).

6. Quality Control

The objective of the LCI Monitoring Program quality control methodology is to establish and maintain standards sufficient to help ensure environmental data is of known and documented quality to meet LCI water quality assessment needs. An integral part of sample quality is collection of representative samples. The usefulness of the data obtained from any monitoring program depends upon how accurately that data describes the characteristics of the waterbody being studied. The samples that are collected for analyses must accurately represent the studied waterbody and be unaffected by collection procedures, sample preservation and sample handling.

To monitor the integrity of the LCI field sampling effort, field replicates, matrix duplicates, matrix spike duplicates, equipment blanks and field blanks are employed. Evaluation of laboratory performance is covered under the New York State Department of Health's Environmental Laboratory Approval Program (NYSDOH ELAP). The LCI Monitoring Program adheres to New York State Public Health Law (PHL) § 502 requiring environmental laboratory analyses of samples originating from New York State be performed by a laboratory certified by NYSDOH ELAP. For those LCI parameters that ELAP does not issue a certificate for, the analyzing laboratory must follow analytical method and laboratory quality control protocols including but not limited to method blanks, laboratory control samples and calibration standards.

Equipment Blanks are collected after sampling equipment has been rinsed following standard operating procedures. Deionized/distilled water is processed through the sample collection equipment and preserved following established sample handling protocols. The sample is submitted for analysis to identify possible contamination from the sampling procedure (equipment, sample containers, preservatives and handling) and to document the effectiveness of rinsing of sampling equipment to prevent cross contamination.

Equipment blanks are collected at one site per team during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the collected samples. Equipment Blank Samples are analyzed for each of the sampled analytes.

Field Replicates are an independent sample collected as close as possible to the same point in space and time as the sample and treated exactly as the sample for sample processing transport and analysis. These are collected at one site per team during each week of sampling. This frequency corresponds to between five percent (5%) and (10%) of the samples collected. Field replicates are analyzed for each of the sample analytes.

Matrix Duplicates additional volume of the sample matrix is collected and analyzed independent of the sample but by the same analytical laboratory following the same procedures. Matrix duplicate samples are collected at one site per team during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the samples collected. Matrix duplicates are analyzed for each of the sample analytes.

Matrix Spike Duplicates are run for those parameters that are routinely recovered below method reporting levels (e.g. organic parameters) to determine percent recovery of the parameter in the sample matrix. Additional volume of the sample matrix is collected and spiked in the analytical laboratory with a known concentration of an analyte. The volume is split and run in duplicate to determine precision. Matrix Spike Duplicate samples are collected at one site per team during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the samples collected.

Matrix Spikes additional volume of the sample matrix is collected and spiked in the analytical laboratory with a known concentration of an analyte. This sampling is used to determine the accuracy (percent recovery) of the analytical method for a specific matrix.

Parameters that are not amenable to spiking (e.g. Chlorophyll, UV254, color) will have laboratory duplicates performed and precision measured.

Matrix spike samples are collected at one site per team during each week of sampling. This frequency corresponds to between five percent (5%) and ten percent (10%) of the samples collected. Matrix spikes are analyzed for each of the sampled analytes.

For those LCI parameters that NYSDOH ELAP does not issue a certificate for, the analyzing laboratory must follow routine laboratory control protocols as outlined in 40 CFR Part 136.7 (2017).

Analysis of internal analytical laboratory quality control samples are to be conducted as prescribed per analytical method and when not defined in the method by an equivalent approved method. Each analytical laboratory is responsible for maintaining internal quality control as a part of their quality assurance plan. Each laboratory provides LCI Monitoring Program personnel with an evaluation of their internal quality control for each batch of analysis.

7. Quality Control Evaluation

The quality control results for water chemistry samples are evaluated according to [: Data Validation](#).

When QC samples fail to comply with the criteria established above, the Program Coordinator will initiate an investigation of the laboratory with the NYSDEC Division of Water Quality Assurance Officer and the corresponding laboratory manager to conduct procedures necessary to correct the problems contributing to violating these criteria. If these procedures prove inadequate to solve the problems, the Program Coordinator and DOW Quality Assurance Officer will determine if this laboratory needs to be replaced by an alternative laboratory that has successfully completed these QC checks as part of a recent monitoring program.

8. Supplies and Consumables

Inspection of supplies and consumables must be made upon arrival of new materials and immediately before their use in the field or laboratory. For newly arrived supplies and consumables all materials must be in their original packaging and free of noticeable damages. For materials already obtained and about to be used no noticeable defects will be allowed. The Primary Samplers are responsible for assuring the quality of all supplies and consumables for each of their sampling trips.

9. Data Management

Sample collection information (station, collection date, time) and field parameter measurements (temperature, dissolved oxygen, pH, conductivity, -ORP, water clarity, water depth) will be transferred from the electronic field data collection form into an Excel data sheet by NYSDEC staff or downloaded into CSV files from the logging device associated with the Hydrolab or YSI field probes.

Bathymetric data will be loaded by the LCI QA Officer into a single ArcGIS project which is stored on the LMAS folder in the L: Drive.

Analytic results from contract laboratories will be emailed or sent by FTP to NYSDEC Laboratory Coordinators in a complete data document (Sample Delivery Group, or SDG, package) that includes summaries of data validation conducted by the analytic lab. Any inconsistencies in the data files are flagged for review and correction by the LCI Project Coordinator. Once the sample collection information (station, date, time, and parameter) has been verified, the water quality result values are reviewed. Values are compared against assessment criteria, including established parameter-specific limits. If reported values exceed the established limit, the result is flagged for further investigation.

III. ASSESSMENT AND OVERSIGHT

Program assessments will be conducted to evaluate the validity of the field data collection and analytical activities conducted as part of this monitoring program. All field staff will be provided training by one of the Primary Samplers at the onset of the monitoring program, likely during the initial sampling run at one of the program lakes. A calibration day is held before the start of field season to ensure that primary field staff are sampling in a consistent manner. During the calibration day, all primary samplers collect one sample and discuss the specifics of each step. The purpose is to clarify and resolve different perceptions and opinions about the sampling procedures.

Random field audits of field staff may be conducted by the LCI QA Officer, NYSDEC QA Officers and/or the Lakes Monitoring and Assessment Section Chief and will be used to assess the performance of the sampling operations. Results for these assessments will be reported to the Program Coordinator, who will provide recommendations for any necessary corrective actions (from retraining and modifying procedures to replacing staff associated with the sampling team to modifying the choice of contract laboratories) to the Section Chief of the Lakes Monitoring and Assessment Section who will inform the Bureau Director of the Bureau of Water Assessment and Management. The responsibility for ultimately approving these corrective actions lies with these identified staff.

1. Performance and System Audits

As required by NYS Public Health Law 502, environmental samples must be analyzed by laboratories accredited by the New York State Department of Health Environmental Laboratory Approval Program (ELAP). This program involves performance evaluation samples and annual on-site audits. For laboratories performing analysis on parameters not covered under NYSDOH ELAP, the DOW Contractor Laboratory Coordinator (CLC) may conduct audits to meet demonstration of competency requirements. The NYSDEC DOW CLC may conduct laboratory audits for laboratories directly under contract with DOW solely to determine compliance with the Prescribed Analytical Protocols (PAP) and non NYS DOH ELAP DOW program requirements. Any DOW audit findings will be addressed by implementation of appropriate corrective actions. Audit reports are retained and available for US EPA review upon request.

2. Corrective Actions

Revisions to the Quality Assurance Project Plan are to be approved by the Program Coordinator who will notify those on the distribution list of the revision.

Major sources of errors may include analytical and equipment problems and those resulting from the deviation from intended plans and procedures. If these problems occur in the field, corrective actions should be taken as described in [SOP 203-21: Collection of Lake Water Quality Samples](#). For contract laboratories, the PAP and applicable analytical methods contain the procedures the laboratory is to follow when problems are encountered in the chemical analysis of samples.

Deviation from intended plans and procedures should be noted by the person observing the deviation and reported to project staff responsible for the operation or analysis in question. The appropriate project personnel shall (1) develop a corrective action plan to ensure that future sampling, analyses, etc. are conducted in accordance with the QA procedures presented in this QAPP; (2) rerun procedures in the appropriate manner and re-analyze samples, if sufficient sample material is available and holding times are not exceeded; and (3) report all problems and deviations to the LCI Program Manager, who will also be consulted

during the development of any proposed corrective action plans. All deviations from intended plans and procedures are to be recorded in the appropriate field or laboratory notebooks.

3. Reports to Management

The Quality, Standards & Analytical Management Section will perform a full data validation review on a minimum of 5% of all SDG packages from the LCI program. Additional SDG data validation reviews will be performed as identified by LCI staff in their initial review of the data. This evaluation together with the analysis of the completeness, precision, and accuracy of the LCI program will provide a level of confidence to the data set and to the interpretations and conclusions drawn from the data.

A summary of these findings will be written by the LCI Coordinator and retained on the LMAS folder in the L: Drive.

Individual lake reports are generated automatically using R scripts and are made available to members of the Division of Water through arcgis Online.

4. Project Fiscal Information

The budget for the LCI project is maintained as part of the overall spending plan of the NYSDEC Division of Water SWMP.

5. Data Validation and Usability

Water Chemistry Parameters

Water Chemistry results generated by the analytical laboratories for the LCI Monitoring Program, are reviewed at three separate stages. First, analytic laboratory staff will follow specific laboratory protocols to ensure the quality and validity of the data. For additional information, see NYSDEC Prescribed Analytical Protocols (PAP, 2016). Second, the LCI Program Coordinator reviews all data results during the input and processing of data files. As previously discussed, this review includes confirmation of suspect values and the possible qualification of data results. And third, the LCI QA Officer evaluates all the quality control data results for the LCI Monitoring Program to quantify the overall precision, accuracy, completeness and validity of the LCI sampling data.

HABs Parameters

Results for Harmful Algal Bloom parameters are reviewed in two stages.

1. Although HABs parameters are not covered by the NYSDEC PAP (PAP 2016), analytic laboratory staff conduct analyses according to the NYSDOH ELAP certification program.
2. The LCI Program Coordinator reviews all data results during the input and processing of data files. As previously discussed, this review includes confirmation of suspect values and the possible qualification of data results.

Harmful Algal Bloom parameters are novel parameters and are not currently included in LCI's quality control analysis.

Field Parameters

Field results generated by the LCI Monitoring Program are reviewed at two separate stages. First, the LCI Project Staff reviews field data results during the input of the data into an electronic format. As previously discussed, this review includes confirmation of suspect values and the possible qualification of data results. Second, the LCI QA Officer evaluates quality control data results for the LCI Monitoring Program to quantify the overall precision, accuracy, completeness and validity of the LCI field sampling data.

Bathymetric Data

Bathymetric data generated by the LCI Monitoring Program are reviewed according to the BioBase EcoSound User Reference Guide (Navico, 2019).

6. Verification and Validation Methods

Data in this monitoring program will be verified and validated by the LCI QA Officer. Data for each of the parameters will be compared with the detection limits and precision/accuracy data provided in Section I; the analytical laboratory performs these comparisons on results that they generate. In general, data verification and validation methods were discussed in the Data Management section (above).

If data validity cannot be verified, these data will be qualified in the database according to SOP 110-21: Data Validation and Verification. This information will be noted in the final QA/QC report.

7. Reconciliation with use Requirements

As noted in Section III, uncertainty in the data allowed for use in the monitoring programs end-product will be limited to that found acceptable in the data verification and validation process.

8. Reporting

After the QC calculations and examinations have been performed for all media, the results will be summarized in a final report. The QA/QC section of the final report will include a discussion and summary of the accuracy, precision, completeness, comparability, and representativeness observed during the study.

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