DIVISION OF WATER MONITORING AND STANDARDS
BUREAU OF FRESHWATER AND BIOLOGICAL MONITORING
P.O. Box 420; Mail Code 35-01 TRENTON, NEW JERSEY

Quality Assurance/Quality Control Project Plan
Ambient Lake Monitoring Network – Reference and Northwest Targeted Lakes
2017 – 2018

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1.0 Project Name: Ambient Lakes Monitoring Network – Reference and Northwest Targeted Lakes

2.0 Requesting Agency: United States Environmental Protection Agency

3.0 Date of Project: Sample collection April 2017- October 2018

4.0 Project Fiscal Information: Job Number 33340000, Activity Code V4PC

5.0 Project Manager: Johannus Franken, Project Manager, BFBM; Dean Bryson, Supervisor, BFBM

6.0 Special Training Needs/Certification

Assistants to the project will be trained in the operation and use of all sampling equipment. The training will entail calibration methods, deployment techniques and data retrieval from the equipment. The Project Manager or designee will be responsible for any necessary training.

BFBM is certified by the Office of Quality Assurance (certified lab ID # 11896) for the following parameters during field work for this project: temperature, pH, conductance, dissolved oxygen (DO), turbidity, and chlorophyll a.

7.0 Project Background

This Network was developed as a monitoring program that would address both the deficiencies cited in the 1999 USEPA's Office of Inspector General's Audit Report and the needs of the watershed management and water quality assessment {305(b)/303(d)} programs. This approach comports with the guidance provided in USEPA's publication, "Elements of a State Water Monitoring and Assessment Program," March 2003, which requires that states develop and implement long-term strategies that include monitoring of all state water body types including lakes.

8.0 Project Description

Project will collect ambient water quality information for NJ lakes. The Network consists of three components: a statewide statistical (probabilistic) survey, statewide reference lakes, and targeted regional lakes.

For the Statewide Statistical Survey, 50 lakes, referred to as a Panel, will be sampled over 2 years or 25 lakes per year. A total of 250 lakes were selected for sampling over a 10 year period. Individual Panels of 50 lakes will have sufficient statistical confidence to make an assessment of statewide status every two years. It is anticipated that statewide trends will be assessed after all 250 lakes are sampled. Lakes were selected using USEPA probabilistic site selection methodology {Generalized Random Tessellation Stratified (GRTS) survey design for a point resource with reverse hierarchical ordering (RHO), see (Taylor, 2015)[1]}. Potential sites included all lakes (public and private) on NJDEP Geographic Information System (GIS) Coverage “NJ National Hydrography Dataset,” greater than or equal to 5 acres, minimum one meter deep, including potable water supply reservoirs and unnamed lakes.

All potential candidate sites will be visited by BFBM staff to ascertain that the lake is suitable for sampling. Actual sampling sites in each lake will be determined during the first on-water site visit and will be selected based on actual morphometry, as determined by this on-site visit. At that time, each in-lake station will be recorded with a handheld Global Positioning System (GPS) and stored on the NJDEP GIS system. This will allow printing of aerial photography maps showing actual sample sites. If a lake cannot be sampled due to problems such as inadequate depth, access or safety issues, the lake will be eliminated. A replacement will be selected, in order, from the list of potential oversample lakes. Digital photographs will also be taken showing overview of the lake, outlet, and drainage pipes.

The Statewide Statistical Survey is on hold until 2018 due to BFBM participation in the 2017 USEPA National Lakes Assessment (NLA). BFBM will sample the full draw of 13 NLA lakes for New Jersey.

In addition to the statistical survey sites, statewide reference and targeted regional lakes will be selected. Eight (8) statewide reference lakes representing each Omernik Level 3 ecoregion will be sampled four times annually to establish reference conditions. See Appendix A, List of Reference Lakes. Ten (10) targeted regional lakes will be sampled three times annually. These lakes will be chosen by the Bureau of Environmental Analysis, Restoration, and Standards (BEARS) from the Water Region of interest Integrated Water Quality Monitoring and Assessment Report cycle (see Appendix B, List of Targeted Regional Lakes). The Northwest Water Region will be targeted for the present cycle.

[1] Taylor, Brian. 2015. "*New Jersey Lake Survey Design*". NJDEP BFBM.

9.0 Project Objectives

Statewide Statistical Survey

The Statewide Statistical Survey is on hold due to BFBM participation in the 2017 USEPA National Lakes Assessment (NLA). The NLA is a National Aquatic Resource Survey and is designed to assess the quality of the nation's lakes and reservoirs using a statistical survey design which provides nationally consistent data.

The Statewide Statistical Survey will resume in 2018. Data will be collected to evaluate the trophic state of selected lakes and assess the ecological health of the State's lentic water resources. Fifty lakes (designated as a Panel) are monitored every two years in order to develop baseline, statewide status, and eventually trend information for New Jersey lakes.

Statewide Reference Lakes

Data will also be collected for reference lakes from each Omernik level III ecoregion within the State. These lakes are intended to be minimally disturbed by human activity and preferably in an area protected from human-induced changes. BFBM and BEARS established the following criteria for selecting Reference lakes:

Manmade or natural lakes.

- 5 acres/ 1 meter depth minimum.

Surrounding land use.

- % Urban + Ag <20% , < 2% impervious cover.

No discharges into lake.
No regulated discharges upstream of lake inlet.
Shoreline Characteristics.

- Trees/Shrub > 75%
- Lawns/grasses < 25%
- Bare ground < 5%
- Shoreline anthropogenic disturbance (shoreline modifications/ development) < 5%

No significant change in diatom community structure from top to bottom layer of sediment core (if available).

Reference lake data will document baseline information on minimally or non-impacted water quality, ecological integrity, and the trophic state of lakes within each ecoregion. Reference lakes will be monitored every year and can be used to measure variations and trends resulting from climate change and land use. Data will also be compared to disturbed lakes within the same ecoregion to gauge the degree of impairment. Reference data will also serve to inform criteria development, specifically nutrients, to determine criteria that are attainable, appropriate for the ecoregion, and adequate to control nutrient enrichment.

Regionally Targeted Lakes

The Department has adopted a Regional Comprehensive Assessment Method for the Integrated Water Quality Monitoring and Assessment Report intended to produce a robust assessment of environmental conditions affecting water quality in a selected water region. This new Regional Comprehensive Assessment will incorporate one of five water regions (Atlantic Coastal, Lower Delaware, Northwest, Raritan, and Northeast) during each Integrated Report cycle. The rotating basin approach will result in a comprehensive assessment of the entire state every 10 years. This approach will encourage development of measures to restore, maintain and enhance water quality uses that maximize effectiveness and efficiency in achieving positive environmental outcomes that are tailored to the unique circumstances of each region. Lakes monitored for the Regional Comprehensive Assessment will adhere to the sampling frequency requirements as outlined in the 2014 Integrated Water Quality Monitoring and Assessment Methods Document. Targeted regional lakes were selected for the Integrated Report cycle in the Northwest by BEARS.

10.0 Monitoring Network Design

Water quality monitoring will take place at up to three in-lake stations that best represent the limnological aspects of the lake. If the lake is expected to exhibit relatively uniform water quality characteristics, then one sample station will be located approximately in the center of the lake. The other two stations, if needed, will be located in sections of the lake which may be expected to exhibit differing water quality. In the event an existing lake must be eliminated, water quality monitoring stations at the replacement lake will be selected in the same manner.

Statewide Statistical Survey

Every two years, the fifty probabilistically-selected lakes will be monitored in order to develop baseline, status, and trend information for New Jersey lakes. Sites are expected to be sampled one time per year (growing season, defined below in section 14.0).

Panel 7 Network lakes were sampled in 2015/2016
USEPA NLA in 2017
Panel 8 Network lakes will be sampled in 2018/2019
Panel 9 Network lakes will be sampled in 2020/2021
USEPA NLA in 2022
Panel 10 Network lakes will be sampled in 2022/2023
Panel 11 Network lakes will be sampled in 2024/2025

Statewide Reference Lakes
Statewide reference lakes will be monitored in order to document baseline, status, and trend information on minimally or non-impacted water quality, ecological integrity, and the trophic state of lakes within each ecoregion. Sites are expected to be sampled four times per year, April through October, over 2 years.

Targeted Regional Lakes
Targeted regional lakes will be monitored in order to produce an assessment of environmental conditions affecting water quality in a selected water region. Sites are expected to be sampled three times per year, April through October, over 2 years. A separate visit for an additional visual assessment will also be coordinated by BEARS during this timeframe.

See Appendix C, 2017-2018 Lake Sampling Parameters, for a table of the sampling frequency and associated parameters for each sampling type.

11.0 Sampling Procedures

11.1 General Procedures: Probabilistic lake sampling will take place once during the growing season (June through September). Reference lake sampling will take place four times and targeted regional lake sampling will take place 3 times from April through October. Sample bottles will be provided by the contracted New Jersey certified laboratory listed in section 16.1. Sample volume and container type will be as described in the respective laboratory's "Quality Manual" and/ or SOP, approved by NJDEP Office of Quality Assurance (OQA).

11.2 Cleaning Sample Equipment: Prior to field sampling, all sample collection equipment will be cleaned using the protocol outlined in Appendix D, Submerged Water Sampler Cleaning Method.

11.3 In-Lake Sampling Procedures and Parameters: Samples will be collected at multiple lake locations (up to three in-lake stations). Samples will be collected as per "NJDEP Field Sampling Procedures Manual", 2005. Samples will be collected using a submerged sampler, which will be cleaned at the BFBM laboratory prior to use at each lake. An equipment blank of PICO® water will be collected in the lab from the submerged sampler prior to the first sample for each lake. (PICO® water will be supplied from the BFBM laboratory water system which is analyzed twice per year at a NJ certified laboratory for applicable parameters.) The equipment blank will be analyzed for Total Phosphorus, Nitrite and Nitrate, ammonia and Total Kjeldahl Nitrogen (TKN). Reference lakes require collection of an additional equipment blank for ortho phosphorus analysis. The submerged sampler will be field rinsed with "water of interest" three times prior to collecting a sample

at each station or depth for the lake. Each individual lake will require one clean submerged sampler.

A top-to-bottom profile will be collected at each in-lake station for specific conductance, pH, water temperature, and dissolved oxygen. Readings for these parameters will be collected as stated below.

All stations require readings at 0.1 meters below the surface and at the determined sample depth.
Stations with total depths ≤ 1.0 meters require readings at half of the total depth.
Stations with total depths < 3.0 meters require readings at 0.5 meter intervals.
Stations with total depths ≥ 3.0 meters require readings at 1.0 meter intervals.
Stations with total depths ≥ 1.0 meters require a final reading at 0.5 meters above the bottom.

Readings and sample depths will not necessarily be recorded at whole numbers due to the high accuracy (±0.05m) of the depth sensor used.

Total depth and interval/sample depth will be determined using a Hydrolab MS5. The Hydrolab MS5 is a multi-parameter water quality system that combines depth, temperature, pH, conductance, and luminescent dissolved oxygen (LDO) probes into one meter that is submersible to the desired depth in the lake. A sample for Total Phosphorus, Nitrite and Nitrate, ammonia, TKN, hardness, alkalinity, turbidity and chlorophyll a will be collected from approximately one meter depth or mid-depth at stations < 1.5 meters. Turbidity will be measured at the sampled depth using a Hach 2100P Turbidity meter.

11.4 Aquatic vegetation (macrophytes): During the growing season, a gross estimate of total areal coverage of dominant type(s) of macrophytes will be made. This estimate will be made following the procedure outlined in Appendix E, Lake Macrophyte Areal Extent.

11.5 Chlorophyll a: A depth-dependent sample will be collected for chlorophyll a. Sample analysis will be performed by BFBM staff at BFBM Laboratory, 35 Arctic Parkway, Ewing. BFBM staff will use a modified version of EPA Method 445.0 for this analysis. Samples will be collected in 500 ml amber glass bottles and stored on ice to 4^{o} C.

11.6 Cyanotoxins: Cyanotoxins are algal toxins which are produced by freshwater cyanobacteria. Cyanotoxin analysis capability, specifically microcystin, anatoxin-a and cylindrospermopsin was developed as part of a USEPA 106 Monitoring Initiative Project. A depth-dependent microcytin sample will be collected at one representative station during the growing season. Anatoxin-a and cylindrospermopsin occur infrequently and will be analyzed only when Chlorophyll 'a' levels are > 10µg/l; samples will be collected for these analyses are necessary. Additional samples will be collected directly from the surface if there is an obvious bloom observed on the lake surface. If the presence of cyanobacteria taxa are confirmed through microscopic laboratory analysis, then testing for all three toxins will commence. If no taxa are noted, toxin analysis will not be performed.

A subsample will be taken from the lake sample(s) when a bloom is observed and analyzed with a Turner Designs Aquafluor handheld fluorometer. This device will measure the

phycocyanin and chlorophyll a pigments to detect the presence and abundance of cyanobacteria.

A formal response plan and communication strategy is currently under development by multiple NJDEP and NJDOH programs. In the meantime, an Interim Response Plan is being used for bloom response prior to finalization of the Comprehensive Strategy.

The purpose of the New Jersey Harmful Algal Bloom Response Plan & Comprehensive Strategy is to provide a unified statewide approach to responding to these HABs in recreational waters and sources of drinking water and to protect the public from risk associated with these toxins. The Response Plan will be a component of the Comprehensive Strategy and is designed to identify:

- Entities responsible for response and actions
- Recreational risk thresholds
- Acceptable parameters and methods for assessing risk
- Appropriate monitoring and analysis for toxins
- Recommended Advisories and other appropriate communication mechanisms

NJDEP Division of Science Research and Environmental Health (DSREH) is currently reviewing EPA's newly released "Draft Human Health Recreational Ambient Water Quality Criteria and/or Swimming Advisories for Microcystins and Cylindrospermopsin". DSREH will make recommendations on action levels and health advisory guidelines for recreational exposure specific for New Jersey. DSREH will provide guidance on all toxin thresholds until final New Jersey thresholds are approved. DSREH will also provide technical support for any response and actions to protect human health.

11.7 Physical Habitat (PHab) Characterization: During the growing season, a PHab Characterization will be performed at all lakes. PHab Characterization method was utilized by the USEPA as part of the NLA. Procedures are outlined in: *USEPA. 2012 National Lakes Assessment: Field Operations Manual, Version 1.0, May 15, 2012. EPA 841-B-11-003. U.S. Environmental Protection Agency, Office of Water, Washington, DC.*

11.8 Sediment Diatoms: The Bureau will also collect lake sediment core samples. The core samples will provide diatom assemblages present in lake sediment cores to be used as biological indicators of nutrient and eutrophication status of lakes. The core samples will be collected at probabilistic, statewide reference and targeted regional lakes. One core will be collected from the deepest station in each lake and the surface and bottom sediments will be collected and retained for future analysis. See Appendix F, Lake Sediment Core Collection Protocol.

12.0 Data Quality/Quality Control Requirements

12.1 Testing by BFBM

BFBM is certified by the NJDEP-OQA (certified lab ID # 11896) for all parameters listed below:

Temperature, pH, Conductance and DO are measured using a Hydrolab MS5. The Hydrolab MS5 is a multi-parameter water quality system that combines temperature, pH, conductance, and LDO probes into one meter that is submersible to the desired depth of the lake.
Temperature: The probe is calibrated with a NIST certified thermometer on a quarterly basis. Records of the calibration shall be maintained by the BFBM.
pH: The probe is calibrated on a weekly basis per the manufacturer recommendations. The probe is also checked each day of use with a buffer which corresponds to the expected range of the values to be measured. After three hours of continuous use, the pH of the certified buffer will be checked. Records of all calibrations and calibration checks shall be maintained in the field log.
Conductance: The probe is calibrated on a weekly basis per the manufacturer recommendations. The probe is also checked each day of use with a certified standard which corresponds to the expected range of the values to be measured. Records of all calibrations and calibration checks shall be maintained in the field log.
DO: A Winkler check is performed on a weekly basis and the meter is barometrically compensated and checked at each sampling site. Records of all calibrations and calibration checks shall be maintained in the field log.
Turbidity: HACH Model 2100P turbidimeter is calibrated once a month per manufacturer recommendations. The meter is then checked with certified standards for accuracy within the calibration range during each day of use. Records of all calibrations and calibration checks shall be maintained in the field log.
Chlorophyll a: BFBM will follow the procedures and calibration requirements required by EPA Method 445.0

Bureau of Water Monitoring Certified SOP, for field measurements and calibrations.
NJDEP Field Sampling Procedures Manual (2005).

NJAC 7:18 - Regulations Governing the Certification of Laboratories and Environmental Measurements.

Other Parameters:
Barometer: Thommen TX Mechanical Barometer. Measured for LDO meter compensation only. Not used for project's data objectives.
Ambient Air Temperature: Fisher Brand Traceable Flip-Stick Thermometer is calibrated with a NIST-certified thermometer before the sampling run. Air temperature is measured for general information purposes only and not used for project's data objectives.
Forel-Ule Color: Forel-Ule Color Comparator. Forel-Ule Color is measured for general information purposes and not used for project's data objectives.
Cyanotoxins: BFBM will follow the procedures and calibration requirements required by the Abraxis ELISA method.

12.2 Additional Testing performed by a NJ Certified Laboratory

For samples delivered to a NJ certified laboratory, testing will be done by a method for which the laboratory has certification as listed in section 16.1. Quality control procedures (including required calibrations and quality control procedures required by regulation or by the method) shall be defined in the laboratory's Quality Manual (QM) or Standard Operating Procedures (SOPs). The QM and SOPs must be approved by the NJDEP-OQA.

13.0 Data Analysis

Data is collected to evaluate the trophic state of selected lakes and assess the ecological health of the State's lentic water resources in order to develop baseline, and eventually statewide status and trend information for New Jersey lakes using the probabilistic design. Reference lake data will document baseline information on water quality, ecological integrity, and the trophic state of minimally or non-impacted lakes within each ecoregion. Over time this data can be used to measure variations and trends resulting from land use and climate change and will also be used to compare to disturbed lakes within the same ecoregion to gage the degree of impairment. Reference lake data will also serve to inform nutrient criteria development. Data will be forwarded to staff of BEARS for additional analysis. However, BFBM will do an evaluation of the trophic state of each lake. This analysis will use Carlson's Trophic State Index, which quantifies the relationship between transparency (as measured by Secchi disk), Total Phosphorus and chlorophyll a (see Appendix I). BFBM staff will also evaluate water quality results as they relate to Surface Water Quality Criteria thresholds, historical data, and other sources. Microcystin results will be compared to the (WHO) Guidelines for Recreational Water. DSREH will provide guidance on all toxin thresholds until final New Jersey thresholds are approved. DSREH will also provide technical support for any response and actions to protect human health.

14.0 Sampling Schedule

Initial site selection has been completed. Field recons of 2017 sites will be conducted prior to initiation of sampling. Reference and Targeted Regional lakes will be sampled multiple times during between April and October. See Appendix C, 2017-2018 Lake Sampling Parameters. for a table of the sampling frequency for each component and associated parameters.

15.0 Resource Needs

BFBM will need one hourly staff, in addition to the existing full-time staff, to complete this project.

16.0 Quality Assurance

16.1 Laboratory Analysis: The following parameters will be analyzed by the qualified New Jersey certified laboratory listed below. Any laboratory used shall be certified by NJDEP's OQA for the requested parameters. The reporting levels, listed below, are **required** for this project.

Parameter	Laboratory	Detection Limit (mg/L)	Reporting Level (mg/L)	Holding Time	Preservative	Volume
Nitrite + Nitrate	DOH cert # 11036	0.0038	0.012	28 days	See Note 1	500ml
Ammonia (Non-distillation)	DOH cert # 11036	0.0038	0.010	28 days	See Notes 1 & 3	
Ammonia (Distillation)	DOH cert # 11036	0.0031	0.05	28 days	See Note 1	
Total Kjeldahl Nitrogen	DOH cert # 11036	0.055	0.100	28 days	See Note 1	
Total Phosphorus	DOH cert # 11036	0.0047	0.010	28 days	See Note 1	250ml
Ortho Phosphorus (see note 5)	DOH cert # 11036	0.0016	0.005	48 hours	Ice to 4ºC	250ml
Alkalinity	DOH cert # 11036	1	1	14 days	Ice to 4ºC	500ml
Hardness	DOH cert # 11036	0.069	0.662	6 months	See Note 2	250ml
Chlorophyll a	BFBM cert # 11896	0.05(µg/L)	N/A	24 hours	Ice to 4ºC	500ml
Cyanotoxins (see Note 4)	BFBM cert # NA	0.10 ppb	0.15 ppb	6 months	Ice to 4ºC in field. Freeze within 24 hours.	50ml

Note 1): Conc. H_2SO_4 to pH 2; ice to 4°C
Note 2): Conc. HNO_3 to pH of less than 2
Note 3): Samples with turbidity levels greater than 10NTU's must be distilled. The turbidity level determined by the BFBM will be noted on the chain of custody forms

and on the sample bottles relinquished to the NJ certified laboratory for ammonia testing.
Note 4): Not a NJ certified parameter. Samples can be analyzed by BFBM using a microtiter plate Enzyme-Linked Immuno-Sorbent Assay (ELISA) using the Abraxis kits for Microcystins, Anatoxin and Cylindrospermopsin .

BFBM has the capabilities to detect Microcystins, Anatoxin and Cylindrospermopsin. This method was utilized by the USEPA as part of the NLA. QA/QC procedures are outlined in: *USEPA. 2009 (Final). Survey of the Nation's Lakes: IntegratedQuality Assurance Project Plan. EPA/841-B-07-003. U.S. Environmental Protection Agency, Office of Water and Office of Research and Development, Washington, DC.*
Note 5): Reference sites only.

16.2 Equipment Blanks: This sample is collected by completely filling a clean submerged sampler (see cleaning protocol in Appendix C) with PICO® water. An equipment blank, of a volume necessary for analysis, is then taken from the submerged sampler by filling the bottle approximately halfway from the first nozzle and then the rest of the way with the second nozzle (if applicable). The equipment blank is preserved with concentrated H_2SO_4 to pH 2 and iced to 4°C. Analysis includes the same chemical parameters listed above with the exception of alkalinity, hardness, Chlorophyll **"**a", and Cyanotoxins.

16.3 Sample Containers: Analytical sample containers shall be dedicated, single-use. Sample containers shall be provided by the NJ certified laboratory.

16.4 Sample Retention: All samples must be retained by the laboratory until such time that the BFBM approves the reported results.

16.5 Chain of Custody: Chain of custody forms are required for all samples forwarded to a NJ certified laboratory for testing.Information to be recorded includes all information required by N.J.A.C. 7:18-5.6(d) and 8.5(c). For Chl "a" analysis performed by BFBM, chain of custody forms will not be used; details concerning sample collection and analysts will be recorded in field and lab records.

17.0 Data Validation

The Project Manager and the Supervisor are responsible for all initial data validation. If apparent anomalous data is suspected (e.g. dissolved values larger than total values; field blank values larger than ambient values), the Project Manager and/or the Supervisor will review the sampling procedures with the field sampler to make sure the proper collection and preservation procedures were followed. Additionally, for nutrient parameters (particularly Ammonia, TKN, Nitrate + Nitrite and Phosphorus), the field sampler, Project Manager and/or the Supervisor may perform further water quality logic tests on the suspect data, as described in the U.S. Geological Survey Open File Report 02/383; 2003, entitled, *"Methods for Quality Assurance Review of Water Quality Data in New Jersey."*

If the data is still suspect, the NJ certified laboratory will be contacted. An internal review of their laboratory procedures and/or calculations used in the analysis of the suspect sample, with

special emphasis on transcription of data to assure that no transposition of figures occurred will be conducted. The NJ certified laboratory will be asked to check on equipment calibration. They may be further requested to reanalyze the retained portion of the sample. If no problems are found in the analytical laboratory procedures, the data may then be compared to any historical data that might have been collected at the same site prior to the most recent sampling event to see if similar anomalies might have been found previously. The suspect data may also be compared to literature values or standard analytical treatises to verify whether or not the results are within the limits of accuracy of the test method.

If no obvious problems are found after these reviews, the complete data set will be reported with the suspect data identified as such. The BFBM will then conduct its own review of the data, as it relates to the objectives(s) and data accuracy required in this project.

18.0 Data Storage

Data will be stored locally in electronic format (MS Access). Water quality data will be entered into New Jersey's Water Quality Data Exchange (WQDE) and USEPA STORET Data Warehouse by June of the following year it is received from the analytical laboratory. All raw data records shall be maintained for a period of no less than five years.

19.0 Performance System Audits

All NJ certified laboratories are subject to audits and to the requirements of the NJDEP-OQA's Laboratory Certification Program as well as internal performance evaluations. NJDEP-OQA will be notified of field monitoring schedules for possible audits.

20.0 Data Reporting

20.1 Preliminary Reporting of Data

Preliminary analytical data will be reported to BFBM, from the laboratory employed for this project, in either hardcopy, electronic format or by verbal communication to the Project Manager, within 21 calendar days from receipt of sample. Samples which yield results considered anomalous by the Project Manager and/ or Supervisor will be validated as specified in section 17.0, Data Validation, before the holding time of the retained sample is expired. If the results remain suspect after an internal review of the laboratory procedures, calculations, and/or on transcription of data has been conducted, then the sample shall be reanalyzed by the laboratory using the retained portion of the sample. This reanalysis shall be performed within the parameter holding time.

20.2 Final Reporting of Data

Final analytical data will be reported to BFBM, from the laboratory employed for this project, in the form of electronic and hard copies of the lab sheets; or in a tabulated form within 40 calendar days from receipt of sample. All data shall be reported in a complete and concise fashion and shall meet the reporting requirements of NJAC 7:18. Routine quality control results must be retained on file for review by the BFBM and the OQA.

Data will be summarized and evaluated by the BFBM to assess the water quality and health of the lakes sampled using the analytical data, field measurements, and observations collected during this study. Data will evaluate the trophic state of selected lakes and assess the ecological health of the State's lentic water resources in order to develop baseline, statewide status and eventually trend information for New Jersey lakes using the probabilistic study design. Final data reporting will also include the evaluation of water quality results as they relate to Surface Water Quality Criteria thresholds, historical data, and other sources. Final data and evaluations will be forwarded to the NJDEP Bureau of Environmental Analysis, Restoration and Standards for use in the generation of the biennial New Jersey Integrated Water Quality Monitoring and Assessment Report [305(b) and 303(d)].
Summary data will be available on BFBM's website: http://www.state.nj.us/dep/wms//bfbm/.

21.0 Assessment, Oversight, and Response

The Project Manager will be responsible for the oversight of all activities relating to this project. The Project Manager will assess field collection functions and make corrections when necessary to maintain the data accuracy as defined in this plan. If any changes or modifications are made to this plan regarding data collection, as it relates to the objectives(s) and data accuracy required in this project, all original signees of the QAPP will be notified.

Appendix A
List of Statewide Reference Lakes

Site ID	GNIS Name	County	Municipality
NJW04459-058	Mount Misery Lake	Burlington	Pemberton Twp
NJW04459-352	Hands Mill Pond	Cumberland	Maurice River Twp
NJLM-0028	Green Turtle Lake	Passaic	West Milford Twp
NJW04459-134	Silver Lake	Sussex	Hardyston Twp
NJW04459-097	Great Gorge	Sussex	Vernon Twp
NJW00459-233	Watchu Pond	Sussex	Byram Twp
NJW04459-339	Mashipacong Pond	Sussex	Montague Twp
NJW04459-009	Deer Park Pond	Warren	Allamuchy

Appendix B
List of Targeted Northwest Regional Lakes

Site ID	GNIS Name	County	Municipality
NJW04459-322	Mercer County Park Lake	Mercer	West Windsor Twp
NJLM-0027	Lake Aeroflex	Sussex	Andover Twp
NJLM-0918	Cranberry Lake	Sussex	Byram Twp
NJW04459-090	Lake Marcia	Sussex	Montague Twp
NJW04459-186	Heaters Pond	Sussex	Ogdensburg Boro
NJLM-1370	Lake Musconetcong	Sussex	Stanhope Boro
NJW04459-426	Swartswood Lake	Sussex	Stillwater Twp
NJW04459-295	White Lake	Warren	Hardwick Twp
NJW04459-262	Mountain Lake	Warren	Liberty Twp
NJLM-0662	Furnace Lake	Warren	Oxford Twp

Appendix C
2017-2018 Lake Sampling Parameters

Indicator Type	Indicator	Prob Lakes (On hold for 2017)	Statewide Reference (by Ecoregion)	Targeted Regional (Water Region)
Trophic Indicators	Vertical profile measurements (DO, Temperature, pH)	x	x	x
	Secchi Disk transparency	x	x	x
	Water chemistry	Conductivity Turbidity Alkalinity Hardness Color	Conductivity Turbidity Alkalinity Hardness Color	Conductivity Turbidity Alkalinity Hardness Color
	Nutrients	TP, NH3, TKN, NO2-NO3	TP, Ortho P, NH3, TKN, NO2-NO3	TP, NH3, TKN, NO2-NO3
	Chlorophyll-a	x	x	x
Ecological Integrity	Sediment diatom assemblage	x[1]	x[1]	x[1]
	Sediment dating (natural lakes only)	x[1]		
	Physical habitat characterization	x	x	x
	Visual Assessment	x	x	x
Human Use	Phytoplankton (cyanobacteria)	Checked during each visit with handheld fluorometer		
	Algal toxins (cyanotoxins) per section 11.6	x	x	x

Number of Lakes	Total Number of lakes sampled/ category	250; 5 panels of 50 lakes sampled over 10 years	8 (for 2017-18)	10 (for 2017-18)
Duration	Time period to sample all lakes	2 years/ 50 lake statewide panel	2 years/ statewide	2 years/ region
Frequency	samples /year	25 lakes per year, 1X June-Sept	4X April-Oct	3X April-Oct, 1X Visual Assessment by BEARS
Sites/lake	in-lake stations	1 to 3	1 to 3	1 to 3

[1]Sampled and retained for analysis

Appendix D

Submerged Water Sampler Cleaning Method

1. Fill small graduated cup with 1oz. of concentrated Liqui-Nox soap. Add this soap into a one-gallon plastic container. Fill container with PICO water and mix well. This makes an approximate 1% "Liqui-Nox solution".

2. Don a set of disposable gloves and rinse them thoroughly with PICO water.

3. With one end sealed and spout(s) in the closed position, fill dirty submerged sampler approximately halfway with Liqui-Nox solution.

4. Scrub the submerged sampler thoroughly, inside and out, using the dedicated submerged sampler cleaning brush. This includes scrubbing of both stoppers.

5. Close the open stopper and vigorously shake the submerged sampler with Liqui-Nox solution inside for approximately 10 seconds.

6. Open spout(s) and allow equal amounts of the contained solution to flow through each spout until the bottle is empty.

7. Put on a new set of disposable gloves and rinse them thoroughly with PICO water.

8. Open both stoppers and rinse bottle with PICO water a minimum of three times.

9. Re-seal one end of the bottle and fill sampler to capacity with PICO water. Close the other end and shake vigorously. Open spout(s) and allow rinsate to flow through spout(s) until empty.

10. Repeat step 9 two more times.

11. Place a new polyethylene bag into the submerged sampler carrying case. Place cleaned submerged sampler into bag and seal case with painters tape. Write "CLEAN, Date of cleaning, and INITIALS of cleaning person" on tape.

12. Rinse cleaning brush three times with PICO water,replace in bag and store in lakes cabinet.

If a trace nutrient problem arises upon analysis while using the above method, a final step will be added. This step will add an acid rinse, followed by several rinses with PICO water to ensure that all trace nutrients are eliminated from the submerged sampler.

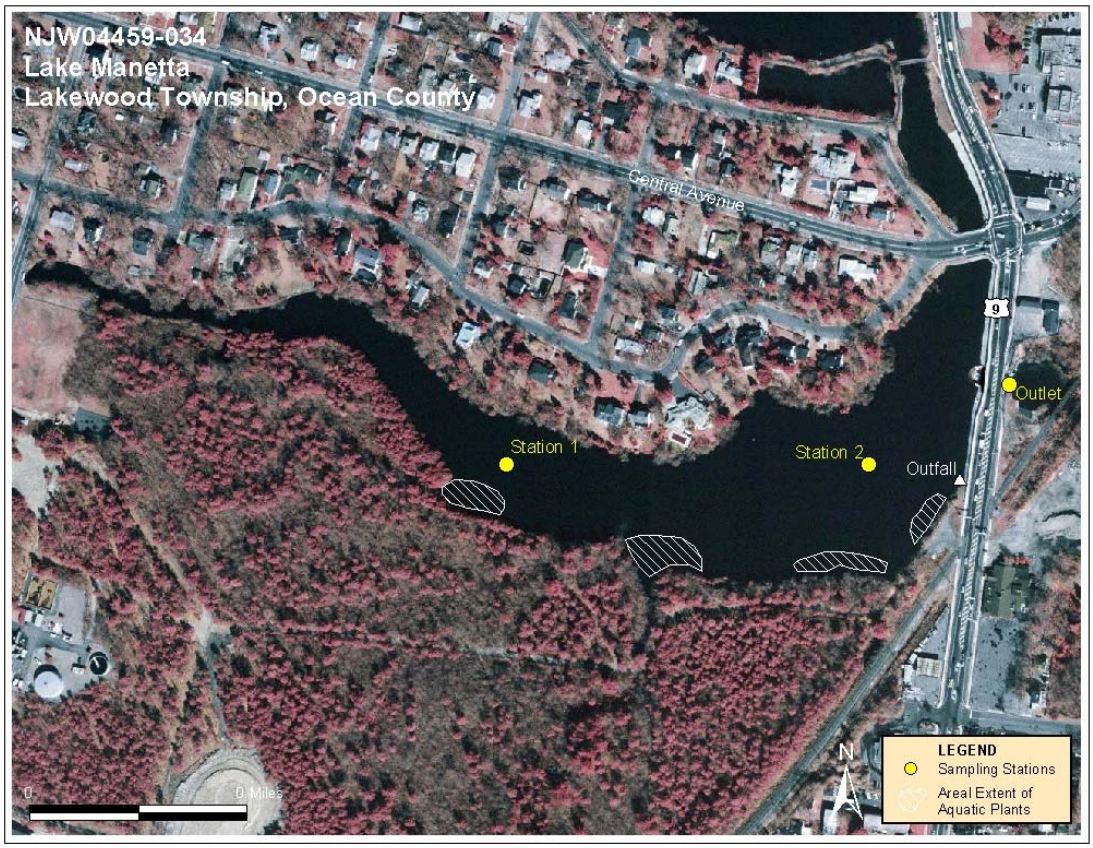
Appendix E

Lake Macrophyte Areal Extent

Lake macrophyte areal extent is determined by preparing an aerial photograph map of each lake prior to the sampling date. This is done using the latest version of aerial photography available and using GIS shapefiles for lake identification. The map should include the entire area of the lake so that it can be used for navigation/identification while on the lake.

During the lake visit, all macrophytes observed should be marked on the aerial photograph map. This is done using a combination of landmarks (such as houses, bridges, etc.), lake shoreline features and estimated distances to these features. Areal extent should be marked as accurately as possible so it can be transcribed to GIS maps for use in reports.

Upon return to the office, the aerial photograph map can be modified with the polygon that best represents the areal extent of the macrophytes present in each lake. This is done by creating the polygon using the graphics tool and the fill/shading that will represent macrophyte cover.



Appendix F

Lake Sediment Core Collection Protocol

Step 1: Corer Preparation
Ensure top of core tube (flat end, not tapered) and inside of housing have been lubricated with vacuum grease (needs to be done once per coring day). Attach core tube to corer and tighten band clamp on tube housing using screwdriver. Core tube should not move within housing. Make sure rubber band is properly positioned and add weight to core tube to aid in sediment penetration. Raise plunger of corer to "loaded" position.

Step 2: Testing Corer for Proper Seal
Test to see if corer is properly sealed. Completely lower the corer into the water, trigger the corer, and lift it out of the water ensure the tube is filled with water and holds it. (If not, re-check seals, vacuum grease and ensure band clamp is tight). Release water and re-set corer to "loaded" position.

Step 3: Lowering of Corer
Extend arm and lower corer at a *constant rate* until corer penetrates into sediment. Send messenger down line to trigger corer. After plunger on corer is triggered, raise *slowly* to surface.

Do not allow top of core tube to break surface of water!

Step 4: Retrieval of Corer
Keep corer vertical and while core tube is still submerged at least six inches, insert rubber stopper into bottom of tube to form a lower seal.

Step 5: Retrieval of Corer II
While holding rubber stopper into bottom of core tube, lift corer slowly out of water while keeping it vertical. *Be careful not to disturb the sediment-water interface.* Check for clarity of water directly above sediment and presence of chironomids or green algal mats. At this point, measure the length of the sediment core (in centimeters) and take a digital picture of the core sample. If the sample does not contain a clear sediment-water interface or is very cloudy, discard the sample into a plastic bin for disposal upon the return to shore.

Step 6: Separating Core Tube from Corer
Set bottom of core tube onto a stable surface. Firmly holding onto the corer, use the screwdriver to loosen the band clamp on the tube housing. Rotate corer slightly to ensure band clamp is loosened sufficiently.

Step 7: Separating Core Tube from Corer II
Holding onto the core tube with one hand, use the other hand to slowly remove the corer from the top of the tube. Some back and forth rotation of the corer may be necessary. *Be careful not to disturb the sediment-water interface.*

Step 8: Removal of Excess Water
Place core tube in the wooden frame. Use the turkey baster to begin removing water above the sediment. If quick removal of water is necessary, push the core tube firmly but slowly against the wooden dowel. This will raise the sediment toward the top of the core tube. When sediment approaches top of the core tube, remove last bit of water using only the turkey baster.

Step 9: Sediment Collection
If a small bit of water remains, it may be removed using the turkey baster. Holding turkey baster on an approximate 30° angle from horizontal, remove first 0.5cm layer of sediment. Rotate core tube slightly to ensure a collection of all the top sediment layers. Collect about 10ml (1/4 oz. of watery sediment). Open a Whirl-Pak bag and hold close to top of core tube.

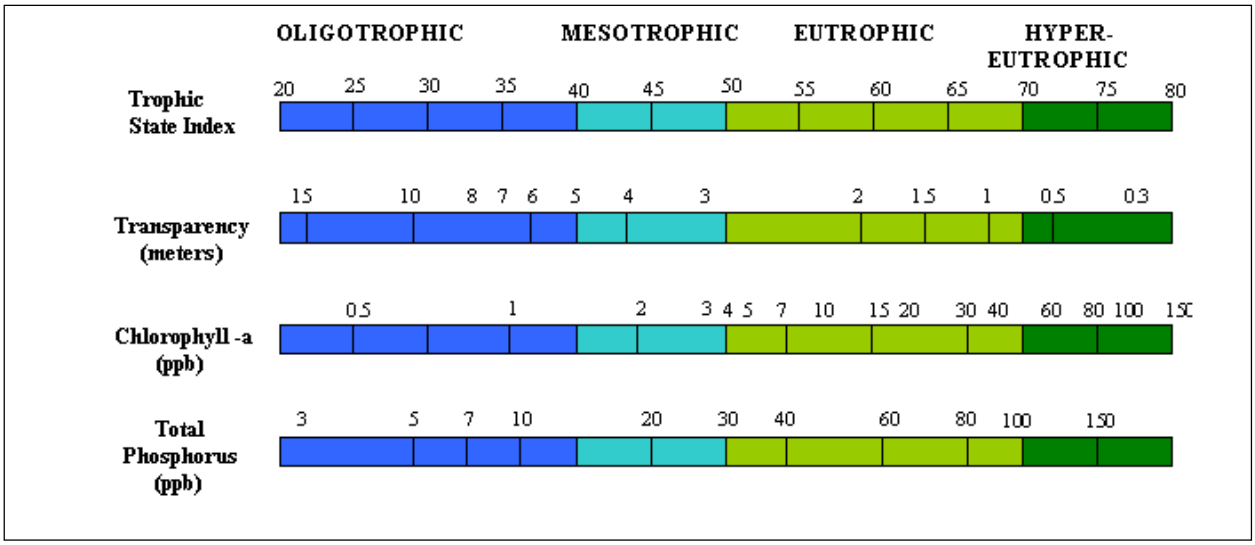
Step 10: Sediment Collection II
Empty the sediment collected in the turkey baster into a Whirl-Pak bag. Label bag accordingly (if not already done) and ensure label on bag is correct. Close top of bag, push out excess air and spin a few times around top twist tie. Tie off bag.

Step 11: Sediment Collection III
Push the core tube down on the wooden dowel to bring the sediment to the top of the tube. Repeat Steps 8 and 9 for the next 0.5cm layer of sediment.

Step 12: Sediment Collection IV
Push the core tube down on the wooden dowel and remove all sediment until there is 1cm of sediment left in the tube. This will be the deepest layer of sediment obtained in the sample. Collect the 1cm layer (with spatula or butter knife) and place into a Whirl-Pak bag. Retain the unsampled sediment in the plastic bin for disposal upon return to shore.

Step 13: Rinsing Equipment
Place the collected samples in a cooler. Upon return to shore, discard unsampled sediments on shoreline.

Carlson's Trophic State Index



Appendix H

Data Management Tables

For Data Management purposes, Water Chemistry is defined as parameters analyzed by a lab; Field measurements are defined as analyze immediately parameters.

Inventory

Geographic Regions	Statewide
Counties	Burlington, Cumberland, Mercer, Passaic, Sussex, Warren
Dates	April 2017 to October 2018
Status	Future/Planned
Sample Frequency	Periodic
Seasons Sampled	Spring, Summer, Fall
Waterbody Type	Lakes, Reservoirs
Salinity Category	Fresh
Tidal Influence	Non-tidal
Project Description	Statewide reference lakes will be monitored in order to document baseline, status, and trend information on minimally or non-impacted water quality, ecological integrity, and the trophic state of lakes within each ecoregion. Targeted regional lakes will be monitored in order to produce a robust assessment of environmental conditions affecting water quality in a selected water region according to the Integrated Water Quality Monitoring and Assessment Report cycle.
Parameters analyzed type	Biological - Algae; Chemical/physical: Nutrients

Data Management Supplement

QAPP network path file location?	V:\LUM\BFBM\Bfbm\Quality Assurance Plans\Calendar Year 2017 QAPPs
Where will data be recorded in field (media)	Field data sheet and Hydrolab Surveyor 4
If on tablet or phone, will download occur at office or wirelessly?	N/A
If on tablets or phones, who will do the download?	N/A
If data collected electronically, where will it be stored?	V:\LUM\BFBM\Lakes and Fishibi\Lakes Monitoring\LakesLog2010
Format to be received from Lab	DOH Text File
Method of receipt from lab/s	Citrix
Personnel receiving outside lab data	Leigh Lager
Is data expected to go to WQDE/STORET?	Yes
Data manager - (Bureau and Name)	BFBM Leigh Lager

Table 1. Sample locations

Station ID (WQDE compliant & referenced)	Waterbody/ Location	Latitude-dd	Longitude-dd	County	Site exists in WQDE?	Location Type
NJW04459-058-1	Mt. Misery Lake	39.925783	-74.526095	Burlington	Yes	Lakes
NJW04459-058-2	Mt. Misery Lake	39.924246	-74.523682	Burlington	Yes	Lakes
NJW04459-352-1	Hands Mill Pond	39.243287	-74.901574	Cumberland	No	Lakes
NJW04459-352-2	Hands Mill Pond	39.245199	-74.90433	Cumberland	No	Lakes
NJLM-0028-1	Green Turtle Lake	41.143351	-74.329651	Passaic	Yes	Lakes
NJLM-0028-2	Green Turtle Lake	41.148516	-74.329033	Passaic	Yes	Lakes
NJW04459-233-1	Watchu Pond	40.928053	-74.770434	Sussex	Yes	Lakes
NJW04459-233-2	Watchu Pond	40.930143	-74.769398	Sussex	Yes	Lakes
NJW04459-233-3	Watchu Pond	40.931352	-74.767907	Sussex	Yes	Lakes
NJW04459-134-1	Silver Lake	41.121719	-74.532404	Sussex	Yes	Lakes
NJW04459-097-1	Great Gorge Lake	41.161202	-74.523444	Sussex	Yes	Lakes
NJW04459-097-2	Great Gorge Lake	41.161322	-74.518986	Sussex	Yes	Lakes
NJW04459-339-1	Mashipacong Pond	41.269306	-74.726483	Sussex	No	Lakes
NJW04459-339-2	Mashipacong Pond	41.26544	-74.729664	Sussex	No	Lakes
NJW04459-009-1	Deer Park Pond	40.903843	-74.796497	Warren	Yes	Lakes
NJW04459-009-2	Deer Park Pond	40.9062	-74.794777	Warren	Yes	Lakes
NJW04459-090-1	Lake Marcia	41.317392	-74.667011	Sussex	Yes	Lakes
NJW04459-186-1	Heaters Pond	41.071818	-74.585414	Sussex	Yes	Lakes
NJW04459-186-2	Heaters Pond	41.069209	-74.584734	Sussex	Yes	Lakes
NJW04459-186-3	Heaters Pond	41.072986	-74.583378	Sussex	Yes	Lakes
NJLM-0662-1	Furnace Lake	*	*	Warren	No	Lakes
NJW04459-295-1	White Lake	*	*	Warren	No	Lakes
NJLM-0027-1	Lake Aeroflex	*	*	Sussex	No	Lakes
NJLM-0027-2	Lake Aeroflex	*	*	Sussex	No	Lakes
NJLM-0027-3	Lake Aeroflex	*	*	Sussex	No	Lakes
NJW04459-262-1	Mountain Lake	40.860113	-74.983509	Warren	Yes	Lakes
NJW04459-262-2	Mountain Lake	40.855824	-74.98607	Warren	Yes	Lakes
NJLM-0918-1	Cranberry Lake	40.94599	-74.74696	Sussex	Yes	Lakes
NJLM-0918-2	Cranberry Lake	40.949977	-74.746416	Sussex	Yes	Lakes
NJLM-0918-3	Cranberry Lake	40.953264	-74.73735	Sussex	Yes	Lakes
NJW04459-322-1	Mercer Co. Park Lake	*	*	Mercer	No	Lakes
NJW04459-322-2	Mercer Co. Park Lake	*	*	Mercer	No	Lakes
NJW04459-322-3	Mercer Co. Park Lake	*	*	Mercer	No	Lakes
NJLM-1370-1	Lake Musconetcong	*	*	Sussex	No	Lakes
NJLM-1370-2	Lake Musconetcong	*	*	Sussex	No	Lakes
NJLM-1370-3	Lake Musconetcong	*	*	Sussex	No	Lakes
NJW04459-426-1	Swartswood Lake	*	*	Sussex	No	Lakes
NJW04459-426-2	Swartswood Lake	*	*	Sussex	No	Lakes
NJW04459-426-3	Swartswood Lake	*	*	Sussex	No	Lakes

*Lat/Long will be updated after evalution of field conditions on first site visit

Table 2. Sample types

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection	Habitat	Metrics	Indices
NJW04459-058-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-058-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-352-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-352-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0028-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0028-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-233-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-233-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-233-3	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-134-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-097-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-097-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-339-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-339-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-009-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-009-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0662-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-295-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0027-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0027-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0027-3	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-262-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-262-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0918-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0918-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-0918-3	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-322-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-322-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-322-3	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-1370-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-1370-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJLM-1370-3	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-426-1	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-426-2	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO
NJW04459-426-3	YES	NO	YES	NO	NO	YES	NO	YES	NO	NO

Table 3. Partners

STATION ID	Field Msr/Obs	Flow	Water Chemistry	Continuous Monitoring	Biological Sampling	Sediment Collection	Bacteria Collection
NJW04459-058-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-058-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-352-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-352-2	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0028-1	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0028-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-233-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-233-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-233-3	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-134-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-097-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-097-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-339-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-339-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-009-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-009-2	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0662-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-295-1	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0027-1	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0027-2	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0027-3	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-262-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-262-2	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0918-1	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0918-2	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-0918-3	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-322-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-322-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-322-3	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-1370-1	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-1370-2	DEP	NO	DEP	NO	NO	DEP	NO
NJLM-1370-3	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-426-1	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-426-2	DEP	NO	DEP	NO	NO	DEP	NO
NJW04459-426-3	DEP	NO	DEP	NO	NO	DEP	NO

* sediment sample is for diatom community analysis (biological) once funded

Table 4. Field measures

Field Name	WQDE Name	Media	Units
Barometric Pressure	Barometric pressure	Air (Weather)	mmHg
Total Depth	Depth, bottom	Water	m
Secchi Depth	Depth, Secchi disk depth	Water	m
Secchi Depth	Depth, Secchi disk depth (choice list)	Water	m
Dissolved oxygen	Dissolved oxygen (DO)	Water	mg/l
Dissolved oxygen saturation	Dissolved oxygen saturation	Water	%
pH	pH	Water	None
Specific Conductivity	Specific conductance	Water	uS/cm
Air Temp	Temperature, air	Air (Weather)	deg C
Water Temp	Temperature, water	Water	deg C
Turbidity	Turbidity	Water	NTU

Table 5. Chemistry

Analysis (lab name)	EPA Characteristic Name	Method Speciation Name	Result Sample Fraction	Result Measure Unit	Result Value Type	Sample Collection Type	Sample Collection Equipment
Nitrite + Nitrate as N	Inorganic nitrogen (nitrate and nitrite)	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
Total Kjeldahl Nitrogen	Kjeldahl nitrogen	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
Ammonia as N	Ammonia-nitrogen	as N	Total	mg/l	Actual	Grab	Water Sampler (Other)
Phosphorus, Total	Phosphate-phosphorus	as P	Total	mg/l	Actual	Grab	Water Sampler (Other)
Orthophosphate as P	Orthophosphate	as P	Total	mg/l	Actual	Grab	Water Sampler (Other)
Total Alkalinity	Alkalinity, total		Total	mg/l	Actual	Grab	Water Sampler (Other)
Hardness, Total	Hardness, carbonate	as CaCO3	Total	mg/l	Calculated	Grab	Water Sampler (Other)
Chlorophyll a	Chlorophyll a		Total	ug/l	Actual	Grab	Water Sampler (Other)
Microcystins	Microcystins		Total	ug/l	Actual	Grab	Water Sampler (Other)
Cylindrospermposin	Cylindrospermposin		Total	ug/l	Actual	Grab	Water Sampler (Other)
Antatoxin-A	Antatoxin-A		Total	ug/l	Actual	Grab	Water Sampler (Other)

Table 6. Laboratory

Parameter	Laboratory	Lab Number	Method	Method ID Context	Lower Reporting Limit	units	Method Detection Limit	units	Upper Reporting Limit (MPN/100 ml)	units	Holding Time	Preservative
Nitrite + Nitrate, as N	NJ DEPARTMENT OF HEALTH - 11036	11036	4500-NO3(F)	APHA	0.012	mg/l	0.0038	mg/l			28 days	pH<2, Ice to 4ºC
Total Kjeldahl Nitrogen	NJ DEPARTMENT OF HEALTH - 11036	11036	351.2	USEPA	0.1	mg/l	0.055	mg/l			28 days	pH<2, Ice to 4ºC
Ammonia as N	NJ DEPARTMENT OF HEALTH - 11036	11036	4500-NH3(H)	APHA	0.01	mg/l	0.0038	mg/l			28 days	pH<2, Ice to 4ºC
Phosphorus, Total	NJ DEPARTMENT OF HEALTH - 11036	11036	365.1	USEPA	0.01	mg/l	0.0047	mg/l			28 days	pH<2, Ice to 4ºC
Orthophosphate as P	NJ DEPARTMENT OF HEALTH - 11036	11036	365.1	USEPA	0.005	mg/l	0.0016	mg/l			48 hours	Ice to <4 ºC
Total Alkalinity	NJ DEPARTMENT OF HEALTH - 11036	11005	2320-B	APHA	1	mg/l	1	mg/l			14 days	Ice to <4 ºC
Hardness, Total	NJ DEPARTMENT OF HEALTH - 11036	11036	200.7(W)	APHA	0.662	mg/l	0.069	mg/l			14 days	Ice to <4 ºC
Chlorophyll a	NJDEP - ENVIRONMENTAL MONITORING LABORATORY - 11896	11896	445	USEPA	*	ug/l	*	ug/l			24 hours	Ice to <4 ºC
Microcystins	NJDEP - ENVIRONMENTAL MONITORING LABORATORY - 11896	11896	546	USEPA	0.1	ug/l	0.1	ug/l			24 hours	Ice to <4 ºC
Cylindrospermposin	NJDEP - ENVIRONMENTAL MONITORING LABORATORY - 11896	11896	ELISA	ABRAXIS	0.04	ug/l	0.04	ug/l			24 hours	Ice to <4 ºC
Antatoxin-A	NJDEP - ENVIRONMENTAL MONITORING LABORATORY - 11896	11896	ELISA	ABRAXIS	0.1	ug/l	0.1	ug/l			24 hours	Ice to <4 ºC

* To be determined when spectrophotometer is calibrated