The Monmouth County Department of Health
Environmental Laboratory

QUALITY ASSURANCE PROJECT PLAN

AMBIENT COASTAL LAKES MONITORING

Microbial and Chemical Sampling Plan

For the Years 2017/2018

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DATE

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WORK/QUALITY ASSURANCE PROJECT PLAN

MONMOUTH COUNTY AMBIENT COASTAL LAKES MONITORING

MONMOUTH COUNTY HEALTH DEPARTMENT ENVIRONMENTAL HEALTH WATER POLLUTION CONTROL PROGRAM

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1.Project Name:

Monmouth County Ambient Surface Water Quality Monitoring Program

1. Project History:

Ambient stream monitoring has been performed since 1987 as part of the cooperative agreement between the NJDEP and Monmouth County Department of Health to provide surface water monitoring, as authorized in the County Environmental Health Act.

The purpose of this Quality Assurance Project Plan(QAPP) is to establish the performance criteria for providing ambient water monitoring data. This QAPP describes the frequency, location, type of samples, and method of collection for field and lab data. Data that is generated by this project will be submitted to the NJDEP.

2. Project Officer:

David A. Sorensen, Senior Environmental Health Specialist

3. Quality Assurance Officer:

Monmouth County Health Department Environmental Laboratory:
Lillian Charbonneau, Acting Laboratory Supervisor

4. Project Description:

4.1. Objective

The objectives of the ambient surface water quality monitoring program are to (1) support NJDEP and local watershed initiatives; (2) track water quality trends through time; (3) establish background water quality; (4) obtain water quality data which can be correlated with specific land uses; (5) provide data to NJDEP in support of the Integrated List; and (6) coordinate the collection of bacterial data with the Cooperative Coastal Monitoring Program.

4.2. Data Usage

The data submitted for this project will be as per New Jersey Register Notice (March 16, 2015) Water Quality Data Submittal to develop the Water Quality Limited Segments List. (Data is submitted to the NJDEP using the Water Quality Data Exchange to develop the Water Quality Limited Segments List). Data will be used for watershed assessments and countywide water quality characterizations. Data is available to the public on the County's website at http://co.monmouth.nj.us/ambients.asp. Every other year, a plan will be submitted for NJDEP approval for the next two project years. In addition, an updated plan will be submitted when significant changes are made to the plan.

Prior to submission to the website a review of the data will be performed by the Senior Environmental Health Specialist. to ensure there are no data transcription errors, correct values with proper units are reported, and there are no improbable values.

4.3. Monitoring Program Design

The Bacteriological component was designed by the NJDEP under the County Environmental Health Act (CEHA), NJSA 26:3 AZ-21 et seq. Parties entered into the agreement in 1987. The Monmouth County Health Department parameters are enterococcus, *E. coli*, pH, total phosphorous, turbidity, total ammonia, salinity (estuary sites), Nitrate-Nitrogen, and TKN. Dissolved oxygen or specific conductance, depending on whether a site is estuarine or freshwater, and temperature will be taken with bacteria samples.

Lake samples for water quality monitoring will take place at several 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. Other stations will be located in sections of the lake which may be expected to exhibit differing water quality. In the event an existing lake station must be eliminated (e.g. access issues), alternate water quality monitoring stations will be selected in the same manner.

Sampling events are not biased on weather or flow conditions, and all data obtained are considered representative of ambient "grab" samples. However, sites may be affected by drought, construction, or other factors beyond our control. In these instances, the reason a sample was not collected will be documented on the field sheet.

Sampling location data are gathered using Global Positioning System (GPS) instrumentation.

4.4. Monitoring Parameters and Frequency of Collection

4.4.1 Chemical/physical parameters:

Monitoring will occur during four sampling periods annually. The 8 week periods for sampling are February-March, May-June, August-September and November-December. NOTE: Should unusually harsh weather occur during the February-March monitoring period, sampling may be extended through the first 2 weeks of April.

During 2017-2018 a total of 10 sites will be sampled during each monitoring period (4 times). Ambient sampling sites have been categorized according to their classification in 2009 Surface Water Quality Criteria, 7:9B, Amended 2011. See Table 4.

The 2017-2018 ambient program is to perform tests and collect samples that are necessary to determine SWQS compliance and most correctly and adequately characterize the coastal lakes of Monmouth County which have suspected sedimentation and nutrient loading. The Site locations have been selected to best determine area of concern such as feeder streams and storm water influences. The analysis performed is aimed to locate point and non-point source of nutrient and bacterial loading.

Parameters are those in Table 1 at the frequency indicated.

Table 1.

	Lakes
# SITES	10
	FREQUENCY
SALINITY	8X/year-MCHD
PH	8x/year- MCHD
DISSOLVED OXYGEN	8x/year- MCHD
SPECIFIC CONDUCTANCE	8x/year- MCHD
TURBIDITY	8x/year- MCHD
NITRATE NITROGEN	4x/year-Contract Lab
TKN	4x/year-Contract Lab
TOTAL AMMONIA	4x/year-Contract Lab
TOTAL PHOSPHOROUS	4x/year-Contract Lab
PHYTOPLANKTON	Optional-MCHD
CHLOROPHYLL	As possible field test

Visual observations and information on current precipitation, precipitation in the last 48 hours, wind speed, wind direction, last high and low tides, and ambient temperature will also be collected.

Precipitation, wind speed and wind direction data is obtained from the station in closest proximity to the sampling site at Rutgers NJ Climate & Weather network at http://climate.rutgers.edu/njwxnet/dataviewer-stnpt.php.

Tide data is obtained at Tides and Currents for Windows, Version 2.5b from Nautical Software, Inc., again using the station in closest proximity to the sampling site.

Sampling location data are gathered using Global Positioning System (GPS) instrumentation.

4.4.2 Bacteriological/physical parameters:
Monitoring will occur over a 5 week timeframe, with 50 samples collected during the Cooperative Coastal Monitoring Program season per year.

Freshwater sites will be sampled for *E. coli* and saline/estuary sites (salinity ≥ 3.5 ppt) will be sampled for enterococcus.

Visual observations and information on current precipitation, precipitation in the last 48 hours, wind speed, wind direction, last high and low tides in saline/estuary sites, and ambient temperature will also be collected as above.

Precipitation, wind speed and wind direction data is obtained from the station in closest proximity to the sampling site at Rutgers NJ Climate & Weather network at http://climate.rutgers.edu/njwxnet/dataviewer-stnpt.php.

Tide data is obtained at Tides and Currents for Windows, Version 2.5b from Nautical Software, Inc., again using the station in closest proximity to the sampling site.

Specific conductivity/salinity, temperature and dissolved oxygen will be recorded with bacteria sampling

5. Laboratory Services Coordination:
Lillian Charbonneau, Monmouth County Health Department, Principal Laboratory Technician

6. Field Sampling Procedures:

6.1. Sample Collection:
All sampling and measurement of field parameters are by trained staff of the MCHD. Training records for use of meters and recording of measurements are kept by the laboratory.

All microbiological samples are “grab samples” collected in accordance with NJDEP Field Sampling Procedures Manual (2005) Chapter 6D, and are collected upstream of any obstructions, such as bridges. There are to be no intermediate sampling devices.

Samples for pH are collected in a churn splitter (Bel-Art 4-Liter), unless they can be directly collected from the waterbody. If the water flow is very fast, collected from a bridge or not easily accessed, the sample is withdrawn from the sample churn into a field rinsed collection vessel for

the pH measurement. The procedure for use and cleaning of the churn splitter is detailed in LABSOP0103, which is attached as Appendix A.

Field measurements have the time recorded for each discrete measurement (not just one time to cover all tests at that site).

6.2. Sample Handling and Custody Requirements:

Samples are labeled with inspector's name, sample location, date, time, and analysis requested, and placed into coolers in the field with ice to keep the temperature near to 4 degrees C. Chain of Custody forms are initiated by the sampler and completed by the laboratory. Chain of Custody forms are included as Appendices B& C (Chain of Custody form at attachment C is subject to change with the contract laboratory). Samples are transported directly to the Monmouth County Health Department Environmental Laboratory for transport to contract laboratories. A temperature control container is placed in each cooler and accompanies the samples. The temperature of this container is measured immediately upon return to the laboratory. Laboratory will verify that the sample was properly preserved upon sample receipt.

Total phosphorous, Total Ammonia Nitrate-Nitrogen, and TKN will be subcontracted to Leeds Point Laboratory or ALS Laboratories, Inc in 2017. Bacteria will be subcontracted to Leeds Point Laboratory or JR Henderson Inc. in 2017. The contract laboratories are subject to change as the contracts are bid annually, with bids generally accepted in December. Should the contract laboratory change during the duration of the QAPP (i.e. 2013), an addendum reviewed, approved and signed by all project signatories, will be submitted. The addendum will include the name of the laboratory, testing methods and detection levels for the project.

Contract laboratories are NJ State Certified for the parameters they are contracted to analyze.

6.3. Field Measurements:

6.3.1. Salinity (parts per thousand) is measured using YSI Model 85 only on sites that are tidally influenced.

6.3.2. Specific Conductance: EPA 120.1 Wheatstone Bridge. Use YSI Model 85 probe with 25 ft cable or 50 ft cable. Specific Conductance is measured using instruments that are calibrated daily, before deployment, using Conductivity Standard in the appropriate range. Sample measurements are recorded on field sheets with time measured, and are input to the database.

6.3.3 Temperature is measured using YSI 85 digital probes that are checked quarterly against NIST traceable thermometer. (SOP0060A Dissolved Oxygen, Salinity, Temperature, and Conductance.) Meters have 25 and 50 foot cables so that in some cases, the probe is lowered from a bridge or can be used with a sampling pole so that the probe is dangled into the stream. Temperature measurements that are representative of the entire waterway are difficult to collect. At some sampling locations the temperature can be stratified and it will not be possible to reach the deeper center regions of some waterbodies. The temperature measurements will represent the general area of the sampling location. Temperature is never measured in an intermediate sampling device. Any special instructions for measurement of temperature at larger rivers and in lakes will be described as they are developed.

6.3.4 Measurements for pH are made in the field using Oakton pH Testr 3 units, which are calibrated at the Monmouth County Health Department Environmental Laboratory on the morning of use. Units are individually numbered and unit number is recorded on field sheets or sampling tablets. Calibration checks of pH buffer 7.0 are performed in the field prior to taking a pH reading at each site. Following 3 hours of field usage a calibration check of pH buffer 4.0 is performed and recorded on the field sampling tablet. Duplicate samples are performed in field at rate of 2 per 20 or fewer samples.

6.4. Sample bottles

Containers for contract lab parameters are ordered from the contract lab. Prompt arrangement is made for courier pick-up.

7. Field Sampling Table:

Field Sample Matrix: Water

Total number of sample stations: 10

Table 2.

Parameter	**Container/volume**	**Preservation**	**Holding time**
E. coli	250 ml HDPE, Sterilized	Cool 4C	6 hours
Total Ammonia(mg NH_3 + NH_4/L)	50 ml centrifuge tubes	2 ml 3.5% Phenol	14 days
Total Phosphorus(mg/L)	50 ml centrifuge tubes	Cool 4C	28 days
pH, standard units	____	Analyze immediately	Determined in field
Specific Conductance: Wheatstone Bridge umhos/cm	____	Analyze immediately	Determined in field
Nitrate-Nitrogen as N: Colorimetric, Brucine	50 ml centrifuge tubes	Cool 4C	28 days
Nitrogen, Kjeldahl, Total (mg/L)	50 ml centrifuge	Cool 4C	28 days

	tubes		
Oxygen (dissolved): Electrode (mg/L)	Determined in field	Analyze immediately	Determined in field
Temperature, C	Determined in field	Analyze immediately	Determined in field
Turbidity, NTU	Determined in field	Analyze immediately	Determined in field
Salinity, parts per thousand	Determined in field	Analyze immediately	Determined in field

8. Data Quality Requirements:

8.1. Field Measurement:

NJDEP Field Sampling Procedures Manual (2005)

Field duplicates will be collected at a rate of 2 per 20 or fewer samples, collected for the parameters of specific conductance, DO, temperature, salinity and pH in the field at a rate of 2 per 20 or fewer and recorded on data forms which are submitted to the laboratory.

8.2. Laboratory Measurements:

Total phosphorous, Total Ammonia Nitrate-Nitrogen, and TKN will be subcontracted to Leeds Point Laboratory or ALS Laboratories, Inc in 2017. Bacteria will be subcontracted to Leeds Point Laboratory or JR Henderson Inc. in 2017. The contract laboratories are subject to change as the contracts are bid annually, with bids generally accepted in December. Should the contract laboratory change during the duration of the QAPP (i.e. 2013), an addendum reviewed, approved and signed by all project signatories, will be submitted. The addendum will include the name of the laboratory, testing methods and detection levels for the project.

Contract laboratories are NJ State Certified for the parameters they are contracted to analyze.

9. Data Representativeness:

The Lake site samples are collected quarterly for physical/chemical parameters, which will be sufficient to assess ambient water quality.

Bacteria, specific conductance or dissolved oxygen, depending on salinity, and temperature will be collected weekly during 5 week time spans throughout the Coastal Cooperative Monitoring Program duration.

10. Data Comparability:

Results are comparable because the same field techniques, analytical methods, quality control and data reporting techniques are used throughout the project. Any changes to the sampling or analysis are evaluated thoroughly by project supervisors so that the comparability is not affected.

11. Data Completeness:

All samples are required to complete the project; however, occasionally sites may be affected by drought, construction, or other factors beyond our control. In these instances, the reason a sample was not collected will be documented on the field sampling tablet.

12. Data Validation:

12.1 Laboratory Data:

The laboratory has responsibility for full validation of report data. Validation of Laboratory data occurs within the laboratory in accordance with procedures set forth in each Laboratory Standard Operating Procedure. Additional samples are analyzed when results indicate that further sampling is required, i.e., too numerous to count, confluent growth, sample is contaminated by soil, turbidity, etc. Each laboratory manager is responsible for determining whether the data is acceptable.

Project data rejection shall occur should improper units or improbable values be reported. This will be performed jointly by the Project and Quality Assurance Officers.

12.2 Field Data:

Field data validation is in accordance with:

NJDEP, Office of Quality Assurance. Guidance for Review of Environmental Measurement QC Data for Water Monitoring Projects (Procedure 2.0). Trenton, NJ Revised December 1984.

The Project and Quality Assurance Officers will reject data with improper units or improbable values.

Data Storage:

In-Lake Data will be stored and managed by BMWM in electronic format (MS Access) until ready for WQDE data submission. BMWM will be responsible for entering, maintaining, and supporting the MS Access database system that holds this data. Data maintained will include water chemistry, nutrients, chlorophyll, and other related parameters. Data not maintained will be any metric or indices related data. BMWM will provide MCHD WQDE compatible data files based on templates created by BMWM for WQDE submission. These files will be sent to

Lillian Charbonneau for WQDE upload. MCHD will be responsible for verification that data uploaded correctly. . 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.

Data Reports:

The Ambient Monitoring Report is generated by the Water Pollution Control Program. Results are forwarded electronically to local health agencies only if requested.

Data is available on the Monmouth County Health Department's webpage at http://co.monmouth.nj.us/ambients.asp within 30 days of receipt of results.

Data is submitted to the NJDEP using the Water Quality Data Exchange quarterly within 30 days of receipt of results.

13. Corrective Action:

If corrective action is required during this project, the QAPP will be revised and redistributed to all project signatories, including the NJDEP Office of Quality Assurance for review and approval.

14. Data Usage:

Data is evaluated against N.J.A.C. 7:9B, 2009 (amended April 2011) Surface Water Quality Standards. Exceedances of standards may result in additional investigations of the waterway by conducting "stream walks", sanitary surveys, or additional sampling.

Data will be stored in NJDEP's Compass database and will be available through NJDEP's Data Miner (http://www.nj.gov/dep/opra/online.html). Data will also be available through USEPA's STORET database accessed through http://www.epa.gov/storet/dbtop.html.

15. Project Plan Audits:

Field sampling audits have been conducted on an in-house basis, following initial field training technique training by NJDEP at the conception of the CEHA contract.

Laboratory audits are performed by NJDEP Office of Quality Assurance as part of laboratory certification program.

16. Sample Custody and Label Procedures:

A Chain of Custody form is used in this project for all samples. Field sheets are used to record the field parameters and the time of each individual test measurement is recorded. The field test meter identification is recorded on the field sheet to link the measurements with calibration records.

17. Analytical method requirements:

All field methods referenced are available from The Monmouth County Department of Health Environmental Laboratory. Laboratory analytical methods are specified in our annual contracts with laboratories. Laboratory method detection limits, estimated accuracy and precision are received from the laboratory at the beginning of each contract year.

Table 3. Microbiological parameters

Analyte/ Parameter	Sample Matrix	Analytical Method Reference	Reporting Limit	Estimated Accuracy	Estimated Precision	Required Action Levels or Standards
E. coli*	Surface water	Modified Thermo-tolerant E. coli USEAP 1603-09	3 cfu/100ml	NA	False pos <1% False neg 4%	E. Coli levels shall not exceed a geometric mean of 126/100 ml or a single sample maximum of 235/100 ml. for FW2

*If available and approved, the method HACH 10029, m-Coli-blue 24 may be utilized.

Table 4. Chemical/physical parameters

Analyte/ Parameter	Sample Matrix	Analytical Method Reference	Method Detection Limit	Estimated Accuracy	Estimated Precision	Required Action Levels or Standards
pH, (SU)	Surface water	SM 4500 H B		NA	+/- 0.16 SU	6.5 - 8.5 for FW2 and all SE
Temperature	Surface water	SM 2550 B	NA	+/- 0.1 C	NA	No thermal alterations that cause temp to exceed 20° C (68° F). Daily max 31 ° C or 7-day max average 28 ° C for FW2-NT Max summer seasonal average 26.7 ° C for SE
Salinity	Surface water	Standard Method 20th 2520B	NA	+/- 0.1 ppt	NA	NA
Total Ammonia(mg NH3 + NH4/L)	Surface water	350.1 MOD	0.01 mg/L	+/- 10%	+/- 10%	NA

Phosphorus-total (mg/L)	Surface water	USGS I-4650-03	0.01 mg/L	+/- 10%	+/- 10%	0.05 mg/L
Specific Conductance: Wheatstone Bridge umhos/cm	Surface water	SM 2510 B	NA	99% REC (Multi Laboratory)	3.9 RSD (Multi Laboratory)	
Nitrate-Nitrogen as N: Colorimetric, Brucine Sulfate (mg/L)	Surface water	EPA 353.4	0.01 mg/L nitrate-N/L.	+/- 10%	+/- 10%	10 mg/L
Nitrogen, Kjeldahl, Total (mg/L)	Surface water	USGS 1-4650-03	0.5 mg/l	+/- 10%	+/- 10%	NA
Oxygen (dissolved): Electrode (mg/L)	Surface water	Standard Method 18/19ed 4500-O G Electrode	NA	TO WITHIN 0.2 mg DO/L	TO WITHIN 0.2 mg DO/L	24 hr average not less than 5.0 mg/l and not less than 4.0 mg/l at any time for FW2-NT and SE1
Turbidity (NTU)	Surface water	Standard Method	NA	0.03-1.26 NTU	NA	Max 30 day avg 15 NTU, max 50 NTU at any time FW2, SE3.Max 30 day avg 10 NTU, max 30 NTU at any time SE1, SE2

18. Instrument, Equipment, and Supplies Testing and Maintenance Requirements:

18.1. Temperature (Celcius): USEPA Method 170.1 Thermometric. Use YSI Model 85 probe with 25 ft cable or 50 ft cable. Temperature is measured using instruments that are calibrated quarterly against a precision thermometer that is NIST traceable. Sample measurements are recorded on field sheets and submitted to the laboratory for data entry.

18.2. Salinity: Standard Method 18/19ed 2520B. Electrical conductivity method Use YSI Model 85 probe with 25 ft cable or 50 ft cable. Salinity is measured using instruments that are calibrated daily in the laboratory, before deployment, using Conductivity Standard. Sample measurements are recorded on field sheets and submitted to the laboratory for data entry.

18.3. pH(standard pH units): Method electrometric SM 4500 H B. pH is measured using instruments that are calibrated in the laboratory on the day of use with buffers 4 and 7 and 10. A QC check standard is employed in the field to measure the performance of the meter. Sample measurements and QC checks are recorded on field sheets and submitted to the laboratory for data entry.

18.4. Specific Conductance: SM 2150 B Wheatstone Bridge. Use YSI Model 85 probe with 25 ft cable or 50 ft cable. Specific Conductance is measured using instruments that are calibration checked daily, before deployment, in the laboratory using 0.01M Conductivity Standard. Sample measurements are recorded on field sheets and submitted to the laboratory for data entry.

18.5. Oxygen (dissolved): Standard Method 18/19ed 4500-O G Electrode Use YSI Model 85 probe with 25 ft cable or 50 ft cable. The dissolved oxygen probe is calibrated against the Winkler Titration weekly before deployment. A saturated air check is performed daily in the field and recorded on field sheets
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18.6. Turbidity: SM 2130 B-11 Nephelometric HACH Model 2100P meter is calibrated once per sampling event(day) as recommended in the instrument manual for this meter. Diluting samples that are >40NTU is performed as necessary as per instructions in LABSOP 0100 Procedure for using Hach Model 2100P Portable Turbidimeter. 3 to 5 turbidity measurements are recorded on Field Data Reporting Sheet. Measurements are made from the first draws of the churn splitter. The median value of the 3 sequential values that fall within 10% of each other is final value. The Blank is measured and recorded after each sample.

Table 5. Ambient Monitoring Program Sampling Sites January 2017
Footnotes in Table 5 may be found below, and denote type of sampling location

BOTTLE	SITE	STREET	TOWN	WATERSHED	Area	Type	SWQS_Cat	LAT27	LONG27
101a	Deal Lake	Wanamassa Rd.	Ocean	Deal Lake	12	Lake(3)	FW2NT	40 13’ 54.18”N	74 01’ 9.44”W
102a	Deal Lake	Sunset Ave.	Asbury Park	Deal Lake	12	Lake(5)	FW2NT	40 13’ 45.72”N	74 01’ 6.28”W
103a	Deal Lake	Westra St.	Interlaken	Deal Lake	12	Lake(5)	FW2NT	40 14’ 12.52”N	74 00’ 49.49”W
104a	Deal Lake	Corlies Rd.	Allenhurst	Deal Lake	12	Lake(5)	FW2NT	40 14’ 14.80”N	74 00’ 30.24”W
105a	Deal Lake	Main St.	Loch Arbour	Deal Lake	12	Lake(5)	FW2NT	40 13’ 50.74”N	74 00’ 29.52”W
1a	Deal Lake	Ocean Ave	Asbury Park	Deal Lake	12	Lake(2)	FW2NT	40 13’ 49.65”N	74 59’ 52.38”W
106a	Wesley Lake	Emory St. (Footbridge)	Asbury Park	Wesly,Fletcher,Sylvan	12	Lake(5)	FW2NT	40 12’ 54.00”N	74 00’ 35.34”W
107a	Fletcher Lake	Pilgrim Pathway (footbridge)	Ocean Grove	Wesly,Fletcher,Sylvan	12	Lake(5)	FW2NT	40 12’ 24.54”N	74 00’ 34.35”W
108a	Sylvan Lake	Bradley Blvd.	Bradley Beach	Wesly,Fletcher,Sylvan	12	Lake(2)	FW2NT	40 11’ 43.88”N	74 01’ 2.69”W
50a	Lake Takanassee	Lake Drive	Long Branch	Whale Pond Brook	12	Lake(5)	FW2NT	40°16' 37.70"N	73°59' 30.56"W