Barnegat Bay Long Term Ambient Monitoring Program

New Jersey Department of Environmental Protection

Water Monitoring and Standards

July 2018

QUALITY ASSURANCE SAMPLING PLAN
Barnegat Bay Watershed, WMA 13

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Bruce Friedman, Director
Water Monitoring and Standards

1. **Project Name:** Barnegat Bay Long Term Ambient Monitoring Program

2. **Requesting Agency:** NJDEP, Water Monitoring and Standards

3. **Date of Project Requested:** June, 2018

4. **Date of Project Initiation:** July, 2018

5. **Project Officer:** Bruce Friedman, Director, WM&S,

6. **Project Duration:** July 2018 thru June 2023

7. Special Training Needs/Certification

This project utilizes the assistance of several partners to conduct sample collection and field analysis. Approval of project partners will be performed annually by the Office of Quality Assurance. The Project Officer (OQA) or designee will be responsible for providing any necessary training and facilitating the project approval process with OQA.

8. Project Description

8.1. Background: Barnegat Bay Ambient Water Monitoring Project

On June 6, 2011, DEP and its partners launched this comprehensive ambient monitoring project that measured both water quality and water quantity in ways never done before in the Bay. The Department had enlisted numerous Partners, including local and county governments, State and Federal agencies, a science high school, a university and other organizations to assist the Department in sampling and sample analysis. Water quality was measured with grab samples taken at 12 streams which enter the Bay, as well as at 14 locations within the Bay. Water flow into the Bay was measured at 12 streams, and water flows into and out of the Bay at the three inlets from the Atlantic Ocean. Also, water circulation within the Bay was measured at 3 locations. Continuous monitoring (at select locations), intensive summer season monitoring, continuous temperature monitoring around the Oyster Creek facility, sediment monitoring and a survey to map the bottom of the Bay (i.e. bathymetric survey) was carried out. On a given sampling day, the Department and its Partners sample water quality and measure flow at both stream and bay locations. The continuous and intensive monitoring components complemented the discrete sampling to capture the full range of daily, tidal and seasonal variations.

This project was conducted in three phases, over a 2 year period, which included 3 intensive events. While the development of the water quality and hydrodynamics models continues, the monitoring project was successfully concluded on June 30, 2013.

In July of 2013 Phase 1 of the Barnegat Bay Long Term Ambient Monitoring Program commenced. The purpose of the new program was to monitor the on-going quality of the bay and those tributaries with the most significant impacts/loadings to the bay, as well as different land uses.

October 4th 2017, the Department released the Barnegat Bay Restoration Enhancement and Protection Strategy (REP Strategy). **http://www.nj.gov/dep/barnegatbay/docs/BarnBay-REPS.pdf**
This strategy is built upon the data, modeling results and research generated by the Barnegat Bay 10-point Plan that was announced in 2010. DEP is building upon the accomplishments of the 10- point plan, by identifying restoration, enhancement and protections actions as part of the BB REP Strategy, with the continued goal of improving the ecological health of Barnegat Bay and its watershed. A major component of the REP strategy is Assessment and Effectiveness Monitoring. Science is the backbone of the strategy and monitoring is needed throughout the process to assess conditions and determine the efficacy of actions taken. Continuation of the Barnegat Bay Watershed Long-Term Water Quality Monitoring Program is an action item identified in the BB REP Strategy.

8.2 Objective and Coverage: Barnegat Bay Long Term Ambient Monitoring Program

Building on the success of the completed monitoring projects, the purpose of this new program is to continue to monitor on-going quality of the bay and those tributaries with the most significant impacts/loadings to the bay. This monitoring program will commence in July 2018.

The goals of the program are to:

1. Capture changes in water quality in the Barnegat Bay watershed over time.
2. Document changes resulting from restoration actions taken as part of the Barnegat Bay Restoration Enhancement and Protection Strategy, including actions guided by the water quality and hydrodynamic models underdevelopment, as well as other restoration actions.
3. Document changes in water quality related to the decommissioning of Oyster Creek Nuclear Generating Station which is schedule to occur in November 2018
4. Data will also be used for assessment purposes as part of the Integrated Water Quality Monitoring and Assessment Report process.
5. Superstorm Sandy: On October 25, 2012, Superstorm Sandy directly hit the New Jersey coast including Barnegat Bay. While the damage and some of the impacts are evident, it will be years before the full impact of the storm on the Bay are known. This long term monitoring program will help capture those changes that impact water quality over time. To be able to better characterize the normal fluctuations in water quality so that we can have a better definition of the uncertainty surrounding any given water quality measurement.
6. To provide water quality data that can be referenced to the biological research, which is occurring concurrently.
7. Interpretation of the narrative nutrient criteria requires water quality data to be collected at the same time as biological studies.

Sampling Network and Design Rationale

9.1 Continuous in-situ water quality monitoring

Continuous monitoring multi-parameter probes will be deployed at the proposed monitoring sites in the Barnegat Bay. Table 1 specifies the list of parameters, frequency of collection and the number of sites for each phase of sampling. Table 2 identifies the bay sampling locations and Figure 1 shows the location of all proposed sampling sites.

Table 1: Continuous Monitoring Plan: Monitoring Parameters and Frequency of Collection

Continuous Monitoring Plan*				
Bay				
Sampling Stations	**Sampling Type**	**Sampling Matrix**	**Parameters**	**Frequency**
4 buoy locations and 1 fixed station, as identified in Table 2 and Figure 1 below	Continuous monitoring probes at mid depth[1] using 4 buoy-located devices and 1 device housed within a fixed station (Mantoloking)	Aqueous	Dissolved Oxygen concentration (DO), pH, Temperature, Turbidity[3], Conductivity, Salinity[2], Chlorophyll-a[3]; (possible deployment of NO_3[3] probe at Mantoloking using a buoy provided by USGS)[3]	Measurements every 15 minutes.
Tributary				
Sampling Stations	**Sampling Type**	**Sampling Matrix**	**Parameters**	**Frequency**
Toms River near Toms River (USGS 01408500)	probes located within the existing gauging station	Aqueous	Dissolved Oxygen concentration (DO), pH, Temperature, Turbidity[3], Conductivity, Nitrate/Nitrite[3]	Measurements every 15 minutes.

*Separate QAPPs have been developed for the Department's continuous monitoring efforts and will be added to this document as an editorial revision.

[1] Sampling sites where depth is greater than 12 feet, two samples will be taken at 1/3 and 2/3 depth.
[2] Salinity to be calculated from conductivity.
[3] Requires the use of a NJ Certified laboratory.

9.2-Grab Water Quality Sampling

Grab samples will be collected once per month (Monday through Thursday) leaving at least 2 weeks between sampling events, at the Barnegat Bay locations listed on Table 2 and additionally at tributary sites listed on Table 3. Locations are shown in Figure 1. Samples will be collected in accordance with approved field sampling procedures and analyzed in certified laboratories. The water quality parameters to be sampled are those listed in Table 6.

All water quality grab samples will be collected following procedures found in "NJDEP Field Sampling Procedures Manual, August 2005". Sampling locations have been marked and verified with GPS. In addition NJDEP staff and project partners will utilize detailed site sketches to locate the sampling location on the first and subsequent visits. The freshwater tributary locations samples will be collected as center of flow grab samples. At tributary locations greater than 20 ft. wide, specific conductance measurements were made along a transect and it was determined that at all locations in the stream are well mixed and that a center of flow grab sample would be representative of the water quality at that location. Because the water depth at the tributary monitoring locations is never greater than 12 ft., samples will be collected at a depth of 1 ft. If the water depth is less than 1 foot, samples will be collected at mid-water level. Bay water quality samples will be taken as surface grab samples.

All sample containers are being supplied by the DEP and only these sample containers can be used for the project. All sample containers must be transported on ice in coolers to preserve the integrity of the samples and maintain sample temperature at greater then freezing and less than 6°C. Necessary preservatives will be added at Leeds Point Lab,

Field Parameters

Field parameters, pH, water temperature, dissolved oxygen and specific conductance, will be measured on site. Collected turbidity samples will be measured at a project field station by staff certified for turbidity measurements. At each sampling location, parameters requiring immediate analysis (i.e. pH, specific conductance, salinity (calculated from specific conductance), and dissolved oxygen,) will be taken using handheld meters or multi parameter sensors. The turbidity sample may be as a field measurement from the meter by BFBM staff or at the Bureau of Marine Water Monitoring Laboratory, Leeds Point

Table 2: List of monitoring sites within the Barnegat Bay

Station ID	Site Description	Type: Grab/ Buoy/Fixed	Longitude	Latitude	Site Reference ID	Site Partner
1403A	Barnegat Bay at the Mouth of Metedeconk River	G	40.05373	-74.09792	BMWM1403A	NJDEP BMWM- Leeds Point
BB01 (1605A)	Barnegat Bay at Mantoloking	G,F	-74.054320	40.038320	USGS-01408168	
BB03 (1629B)	Barnegat Bay by Route 37 Bridge	G	-74.101530	39.9481700	BMWM1629B	
BB04a	Barnegat Bay near the Mouth of Toms River	G,B	-74.14069	39.93289	BMWM1502A	
BB05a	Barnegat Bay above Cedar Creek	G	-74.1094237	39.9157764	DEPMODELSITE	
BB06	Barnegat Bay below Cedar Creek and above Forked River	G	-74.102080	39.8526200	BMWM1651D	
BB07a	Barnegat Bay below Oyster Creek and above Barnegat Inlet	G,B	-74.1571172	39.8012861	DEPMODELSITE	
1661A	Forked River Mouth	G	-74.162022	39.825040	BMWM1661A	
1661F	Barnegat Bay at Station 1661F	G	-74.1018	39.80984	BMWM1661F	
1663A	Oyster Creek Mouth	G	-74.168436	39.811515	BMWM1663F	
BB08	Barnegat Bay by Barnegat Inlet	G	-74.108014	39.7633528	MU-Barnegat Inlet	
BB09 (1674B)	Barnegat Bay below Barnegat Inlet and close to Long Beach	G,F	-74.147920	39.7426200	BMWM1674B	
1707C	Manahawkin Bay at Station 1707C	G	-74.2051	39.6404	BMWM1707C	
1712	Manahawkin Bay at Station 1712	G	-74.2701	39.61679	BMWM1712	
BB12	Barnegat Bay in Little Egg Harbor	G	-74.268750	39.5815100	BMWM1834A	
1826A	Little Egg Harbor at Station 1826A	G	-74.2682	39.5354	BMWM1826A	
BB14	Little Egg Harbor Inlet near Beach Haven Heights	G,B	-74.297370	39.5112300	BMWM1824B	

Table 3: Tributary Sampling Locations

Station ID	Site #	Description	LAT	LONG	Flow-Measurement Type	Flow Site Partner	Water Quality Site Partner
01408100		North Branch Metedeconk River at Lakewood	40.109722	-74.219167	NA staff gage present	NA	NJDEP/BFBM
USGS-01408123	BT01	North Branch Metedeconk R near Laurelton	40.081648	-74.151811	Extrapolate from existing gage	NA	Brick MUA
USGS-01408152	BT02	SB Metedeconk River near Laurelton (Chambers Bridge Rd)	40.078763	-74.156729	Gage	USGS	Brick MUA
01408136		South Branch Metedeconk River at Bennetts Mills	40.126667	-74.277778	NA	NA	NJDEP/BFBM
01408260		Toms River near Van Hiseville	40.109722	-74.373611	NA	NA	NJDEP/BFBM
010408492		Ridgeway Brook at Route 70 near Lakehurst	40.020833	-74.273611	NA	NA	NJDEP/BFBM
USGS-01408505	BT03	Toms River near Toms River	39.976389	-74.218333	Gage	USGS	NJDEP/BFBM
USGS-01408640	BT04	Wrangle Brook near South Toms River	39.952854	-74.218515	Measure	NJDEP/BFBM	NJDEP/BFBM
01408830		Cedar Creek at Cedar Crest	39.897222	-74.316389	NA* staff gage present	NA	NJDEP/BFBM
USGS-01408950	BT06a	Cedar Creek (at RR)	39.871111	-74.173889	Gage1	USGS	MATES
USGS-01409055	BT07	NB Forked R at Forked River	39.836035	-74.196013	Measure	NJDEP/BFBM	MATES
BFBM000166	BT09	South Br Forked River (upstream Rt 9 @ JCPL)	39.820380	-74.203128	Measure	NJDEP/BFBM	NJDEP/BFBM
R14A		Oyster Creek on S Main St. Bridge	39.810990	-74.199550	NA	NJDEP/BFBM	NJDEP/BFBM
R14B		Forked River on S. Main St. Bridge	39.819992	-74.202464	NA	NJDEP/BFBM	NJDEP/BFBM
R14C		Forked River on Beach Blvd. Bridge	39.823209	-74.187011	NA	NJDEP/BFBM	NJDEP/BFBM
BFBM000167	BT10	Oyster Creek (upstream Rt 9 @ JCPL)	39.810584	-74.204626	Gage	USGS	NJDEP/BFBM
USGS-01409210	BT11	Mill Ck at Manahawkin (Bay Avenue)	39.695405	-74.259527	Gage (new)	USGS	BBP
USGS-01409281	BT12	Westecunk Ck at Railroad Ave at West Ck	39.640297	-74.307970	Measure	USGS	BBP

1Gage for this station is located slightly upstream of the water quality sampling location at: Lat 39.87917 Long -74.1906

Table 4: The Analytical Method

Org	Parameter	Matrix	Fraction	Code	Method	Container	Preservative	Holding Time
NJDEP BFBM	Turbidity	FwSw	Unfiltered	Turb	SM 2130 B-11	50mL centrifuge tube	Ice, ≤6°C	48 hours
NJDEP Leeds Point Lab	Total Suspended Solids	FwSw	Non-filterable	TSS	USGS I-3765-85	Amber 500mL HDPE	Ice, ≤6°C	7 days
	Chlorophyll a	FwSw	Non-filterable	Chla	SM 10200-H 1+2 MOD			
	Total Nitrogen	FwSw	Unfiltered	TN	USGS I-4650-03	50mL centrifuge tube	Ice, ≤6°C	28 days, Frozen, -20°C
	Total Phosphorus	FwSw	Unfiltered	TP	USGS I-4650-03			
	Nitrate + Nitrite	Fw Sw	Unfiltered	NO3	EPA 353.4			
	Orthophosphate	Fw Sw	Unfiltered	PO4	EPA 365.5			
	Ammonia	Fw Sw	Unfiltered	NH3	350.1 MOD	50mL centrifuge tube	2 ml 3.5% Phenol	14 days, Ice ≤6°C
	Biogenic Silica	FwSw	Non-Filterable	BSi	EPA 366.0 MOD			6 months
	Non-Purgeable Organic Carbon	FwSw	Unfiltered	NPOC	SM 5310 B			28 days
	Alkalinity	Sw	Unfiltered	Alk	SM 2320 B-11			1 day
	Enterococci	Sw	Non-filterable	ENT	EPA 1600-14	250mL HDPE	Ice, ≤10°C	8 hours

9.3 -Flow monitoring

The locations of existing gages are presented in Table 5 and shown in Figure 1. At selected tributary lcations where gages are absent, flow will be measured using hand held equipment such as SONTEK Flow Tracker (or equivalent). Flow measurement SOP is available in Flow Tracker Handheld ADV User's Manual (SonTek/YSI 2009 FlowTracker Handheld ADV User's Manual Firmware Version 3.7). Discharge measurements at higher stages that cannot be waded at the SB Metedeconk River at Chambers Bridge Road near Laurelton will be made from the bridge or a pulley system. A Teledyne RDI StreamPro Acoustic Doppler Current Profiler (ADCP) mounted to a tethered boat will be pulled across the stream from the downstream side of a bridge or on a pulley system from bank to bank (Gotvald and Oberg, 2009). A minimum of four transects are made across the channel. The ADCP transmits acoustic pings that record the velocity and depth of water. A Bluetooth wireless link from the ADCP transmits depth, distance and velocity data every second to a field computer. The field computer calculates the discharge for each transect. The discharge from the 4 transects are averaged. The USGS quality assurance plan for discharge measurements using ADCPs is published in Oberg and others, 2005. (Note: maintaining the existing gauging stations over the entire project term will depend on the availability of continuing funding.) References are available online at http://pubs.er.usgs.gov/usgspubs/sir/sir20055183 and **http://pubs.er.usgs.gov/usgspubs/fs/fs20083096**.

Table 5: Gauging Stations

Station Description	Latitude	Longitude	Type
Westecunk Creek at Stafford Forge NJ	39.666667	-74.320278	Tributary
Cedar Creek at RR	39.879170	-74.190600	Tributary
North Branch Metedeconk River near Lakewood NJ	40.091667	-74.152500	Tributary
Point Pleasant Canal at Point Pleasant, NJ	40.070278	-74.059722	Outlet/Inlet
Barnegat Bay at Mantoloking Bridge at Mantoloking	40.040000	-74.057222	In Bay
Barnegat Bay at Route 37 Bridge near Bay Shore,	39.946111	-74.103056	In Bay
Barnegat Inlet at Barnegat Light, NJ	39.766389	-74.099167	Outlet/Inlet
Barnegat Bay at Route 72 Bridge near Ship Bottom	39.663333	-74.206944	In Bay
Little Egg Harbor Inlet near Beach Haven Heights	39.507500	-74.307500	Outlet/Inlet
Oyster Creek near Brookville, NJ	39.798333	-74.250556	Tributary
S.B. Metedeconk River near Lakewood, NJ	40.085833	-74.185556	Tributary
Mill Creek at Manahawkin, NJ	39.695278	-74.260000	Tributary

10. Data Usage

Water quality data sampled under this project will be used to identify assess water quality assessment and other purposes discussed in Section 7.2. All sampling procedures must be in conformance with NJDEP or USGS (URL http://water.usgs.gov/owq/FieldManual/index.html) field sampling procedures as well as other applicable guidance. If a method or procedure requires change and is not contained in Table 4, this information must be brought to the attention of the signatories of this QAPP through writing and needs approval prior to being used. Data sampled outside of this project plan which have been collected under an approved QAPP and analyzed in a New Jersey certified laboratory may also be utilized.

11. Reports

Data will be stored locally in electronic format (MS Access). All raw data records shall be maintained for a period of no less than five years. All water quality data collected, locations of final sampling sites, and related field notes should be entered in the New Jersey Water Quality Data Exchange (WQDE) and USEPA STORET Data Warehouse. Data quality assurance will occur at NJDEP Bureau of Marine using protocols found in USGS open file Report 02-383 "Methods for Quality Assurance Review of Water Quality Data in New Jersey".

12. Project area

Watershed project area covered under this project is the Barnegat Bay Watershed in WMA 13 (see Figure 1 for the spatial extent of the study). The GIS map provided identifies proposed monitoring locations, and approximate head of tide.

13. Data Representativeness

The same methods and techniques will be used by all field collection staff. Technical assessments in the field and laboratory audits performed by NJDEP's Office of Quality Assurance will ensure that all samples are collected and analyzed per the QAPP. Any deviations from the QAPP will be documented and will be resolved prior to the next sampling event

14. Data Validation

Method blank (lab), equipment blank, duplicate, and replicate samples will add approximately 10 percent more to the total number of samples collected. The sample data is validated using the QC data. The QC sample must fall between two standard deviations at the 95th percentile confidence level to be valid. All laboratory and field spikes must be with between 80-120 %. Water quality results will be assessed against available, historical water quality data from the locations monitored. Data will also be assessed using USGS Open-File Report 02-383 "Methods for Quality Assurance Review of Water-Quality Data in New Jersey ". That report provides information on standard ranges of specific parameters in New Jersey streams and standard relationships between specific parameters. All data collected will be provided to NJDEP and WM&S staff. They will perform the data validation process. Data that cannot be confirmed by these reviews or explained by circumstances (i.e. heavy rain, drought) or project QA data will be classified as questionable by NJDEP. In addition, quality assurance protocols will be used by Leeds Point and BFBM for the data validations under the supervision of a quality assurance officer.

15. Data Quality Requirements

Field Quality Assurance and Quality Control

NJDEP and Partner groups field staff will be approved by DEP's Office of Quality Assurance for field measurements, which include: specific conductance/salinity (Wheatstone Bridge, SM 2510 B-11), dissolved oxygen (membrane electrode SM 4500-O G-11 or optical probe HACH 10360 or ASTM D888(09(C)), pH Electronic (SM 4500-H B-11) and temperature (Thermometric SM 2550B-10). Project staff will follow manufacture's manuals regarding calibration and operating procedures for specific meters. Results of daily pH calibrations, D.O. air calibrations, a DO Zero sample read, and specific conductance calibrations will be recorded on field calibration forms. Quarterly temperature ASTM-QC checks and weekly Winkler D.O. checks are also recorded. Turbidity samples will be analyzed at Leeds Point by NJDEP field staff who are certified for the measurement of turbidity (Nephelometric, SM 2130 B-11). The marine sample field quality control will consist of analyzing in the laboratory, the remaining sample not used for filtration for salinity; in addition, a dissolved oxygen Winkler titration sample will be collected at the time of sample collection and preserved immediately with manganous sulfate and alkaline-iodide-azide solutions. This data will be used to validate the data collected by the sondes in the field. The Winkler titration sample must be protected from the intrusion of atmospheric oxygen and needs to be analyzed prior to the validation for the salinity.

Leeds Point and/or BFBM Laboratory are certified to perform the parameters conducted for ambient water quality monitoring and will follow the Laboratory methods as outlined in Table 6. Any changes to the methods used must be pre-approved by the DEP before sample testing continues. 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 OQA.

The field meters or multi parameter meters will be calibrated using manufacturer specifications and the OQA requirements for accuracy and precision. Calibration and verification will be performed with the following:

Temperature

Temperature thermistors are factory calibrated. Thermistors must be checked against a National Institute of Standards and Technology (NIST)-certified/traceable thermometer on a quarterly basis, and an offset value will be applied to correct the reading or if drift is continuing to take place sonde/sensor will be

replaced. Any change will be noted in the calibration log and will be applied to all temperature measurements. Temperature units will be degrees Celsius (°C). On July 2, 2018, the temperature monitoring devices were calibrated by DEP personnel against a NIST certified thermometer. This calibration must be repeated quarterly thereafter through the duration of the program.

Salinity/Specific Conductance

Specific conductance is calibrated using a factory prepared conductivity standard with a value of 50 mS/cm or a 35 ppt salinity standard for the marine samples and 1.412 mS/cm for the fresh water locations, although alternative mS/cm solutions can be utilized as long as they are in the range of expected sample results. Specific conductance units will be uS/cm, Salinity will be expressed in parts per thousand (ppth). For sonde/sensor verification, another standard from a different source will be analyzed. The calibration must be checked in the measure mode with a standard. The required accuracy is that the calibration check data must be within 1% of the true value of the standard used to be acceptable for analysis. Duplicate testing is required daily or once every 20 samples tested.

Dissolved Oxygen

Calibration of a DO meter at 100 percent oxygen saturation is made by adjusting the meter reading for air saturated with water vapor, as per the manufacturer's instructions. Sonde/Sensors will record both Dissolved Oxygen (DO) milligrams/liter (mg/l) and DO percent saturation (%). Samples for the Winkler titration will be collected at the marine water sites for sonde/sensor verification. Each week of use the DO meter must be verified against a Winkler titration procedure. The accuracy required between the reading from the DO meter and the results of the Winkler test must be within +/- 0.3 mg/L of each other to be acceptable. A DO Zero solution is read after every calibration. Duplicate testing is required daily or once every 20 samples tested.

pH

A three point calibration is the preferred approach to a quality calibration using pH buffers at 4, 7, and 10, with a read of pH7 as a calibration check. All calibrations must meet the accuracy requirement of being within 0.05 s.u. of the true value of the buffer used to be considered acceptable. The required calibration check result must be within 0.10 s.u. of the true value of the buffer used. Every three hours of use the meter must be checked with the calibration check buffer and must be accurate to 0.2 s.u. of the true value to be considered acceptable for continued use. The field staff may also recalibrate the meter at each site as an alternative to the three hour calibration check requirement. All readings for pH must be made in standard units. Duplicate testing is required daily or once every 20 samples tested. Millivolt readings are also taken as a check of probe performance. For sonde/sensor verification, another certified pH buffer from a different source will be analyzed.

Turbidity

Turbidity samples will be analyzed in the field or at the Leeds Point Laboratory using a Hach model 2100P turbidimeter. Calibration of the turbidity meter will be accomplished by a 4 point method using HACH produced microbead synthetic turbidity primary standards every 3 months. The calibration is checked against HACH Gelex secondary standards and deionized water (0NTU) each day of use. Turbidity units will be (NTU). Duplicate testing is required daily or once every 20 samples tested. A formazin standard or a standard from a different source will be analyzed for sonde/sensor verification.

Table 6: Lab Methods

Lab	Parameter	Matrix	Fraction	Code	Lab Reporting Limit	Method	Holding Time
Leeds Point	Turbidity	FwSw	Unfiltered	Turb	0.1 NTU	SM 2130 B-11	48 hours
	Total Suspended Solids	FwSw	Non-Filterable	TSS	1.0 mg/l	USGS I-3765-85	7 days
	Chlorophyll a	FwSw	Non-Filterable	Chla	0.42 ug/l	Modified SM 10200-H 1+2	24 hours
	Total Nitrogen	FwSw	Unfiltered	TN	0.100 mg/l	USGS I-4650-03	28 days
	Total Phosphorus	FwSw	Unfiltered	TP	0.010 mg/l	USGS I-4650-03	28 days
	Ammonia	FwSw	Unfiltered	NH3	0.010 mg/l	350.1 MOD	14 days
	Nitrate + Nitrite	FwSw	Unfiltered	NO3	0.010 mg/l	EPA 353.4	28 days
	Orthophosphate	FwSw	Unfiltered	PO4	0.005 mg/l	EPA 365.5	28 days
	Alkalinity	Sw	Unfiltered	Alk	1.0 mg/l	SM 2320 B-11	1 day
	Biogenic Silica	FwSw	Non-Filterable	BSi	0.1mg/l	EPA 366.0 MOD	6 months
	Non-Purgeable Organic Carbon	FwSw	Unfiltered	NPOC	1.0 mg/l	SM 5310 B	28 days
	Enterococci	Sw	Non-Filterable	ENT	3 cfu/100mL	EPA 1600-14	8 hours

16. Chain Of Custody

Chain of custody procedures will be instituted for this project. Chain of custody procedures will be employed until samples reach the appropriate laboratory. Once samples reach the laboratory the laboratories internal sample tracking procedures will be utilized. (See Appendix A for sample forms)

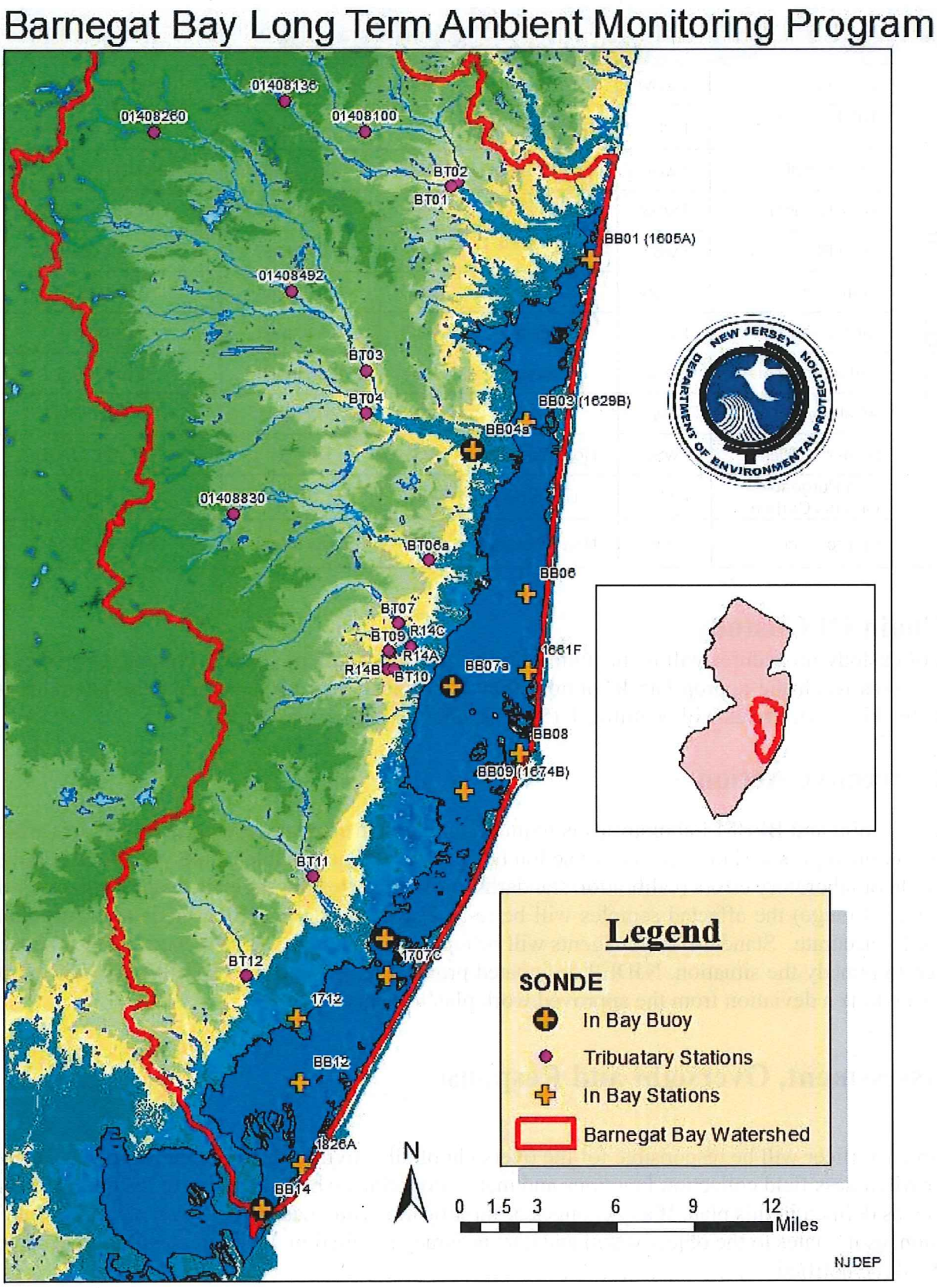
17. Corrective Action

The Leeds Point and BFBM Laboratories is required to maintain standard operating procedures which outline specific action to pursue should corrective action be necessary. If acceptable results cannot be obtained due to: either field or laboratory errors (calibration standards, proficiency testing samples, blanks, spikes, or duplicates falling out of range) the affected samples will be re-analyzed and steps will be taken to ensure that the data produced is accurate. Standards and reagents will be replaced, equipment will be checked, or other action, will be taken to remedy the situation. NJDEP designated project officers and the NJDEP QAO will be notified in writing anytime a deviation from the approved work plan has occurred.

18. Assessment, Oversight and Response

The Project Officer will be responsible for the oversight of all activities relating to this project. The Project Officer 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.

Figure 1: Barnegat Bay sampling sites



Appendix A:Sample Chain of Custody Form

Barnegat Bay Long-Term Ambient Monitoring Program Chain of Custody Form (July2018)

General Information					Lab Only
Site Name		Site Description		Sample #	
Sample Collection Date (mm/dd/yyyy)		Sample Collector		Sample Type (circle one)	Sample Blank Replicate
Sample Collection Time (hh:mm)		Collector Organization			

Field Measurements/Observations						
	Surface	Bottom (Bay samples only)		Surface	Bottom (Bay samples only)	Site Notes
Field Measurement Time (hh:mm)			Specific Conductance (uS/cm)			
Sample Depth (ft)			Salinity (ppth)			
Uncorrected Water Temperature (deg C)			pH			
Corrected Water Temperature (deg C)			Turbidity (NTU)			
Dissolved Oxygen Saturation (%)			Air Temperature (deg C)			
Dissolved Oxygen (mg/L)			Barometric Pressure (mmHg)			

Raw Sample					
Container ID	Container	Matrix	Parameter	Fraction	Preservative
	Amber HDPE, 500 mL	Freshwater/Saltwater	Chlorophyll a	Non-filterable	Ice, <6°C
	HDPE, 1L	Freshwater/Saltwater	TSS, NH3, NO3, PO4, TN, TP, Turbidity, NPOC, BSi, Alkalinity	Total	Ice, <6°C
	HDPE, 250mL	Saltwater	Enterococci	Non-filterable	Ice, <6°C

NJDEP Leeds Point Laboratory (NJ Lab Certification #: 01179)				
Container	Matrix	Parameter	Fraction	Preservative
Amber HDPE, 500 mL	Freshwater/Saltwater	Chlorphyll a	Non-filterable	Ice, <6°C
HDPE, 1L	Freshwater/Saltwater	TSS	Non-filterable	Ice, <6°C
50 mL HDPE centrifuge tube	Freshwater/Saltwater	TN, TP, NO3, PO4	Total	Ice, Frozen
50 mL HDPE centrifuge tube	Freshwater/Saltwater	NH3	Total	2 ml 3.5% Phenol, <6°C
50 mL HDPE centrifuge tube	Freshwater/Saltwater	BSi	Total	Ice, <6°C
HDPE, 125 mL	Freshwater/Saltwater	NPOC	Total	conc H_2SO_4 pH<2, <6°C
50 mL HDPE centrifuge tube	Freshwater/Saltwater	Turbidity	Total	Ice, <6°C
HDPE, 250 mL	Saltwater	Alkalinity	Total	Ice, <6°C
HDPE, 250 mL	Saltwater	Enterococci	Non-filterable	Ice, <6°C

Chain of Cusody				
Container ID	Relinquished	Received	Date/Time	Reason
			Date: Time:	Sample drop off at LEEDS
			Date: Time:	Placement in coolers for lab transfer (runner signs received)
			Date: Time:	Transfer to lab for analysis

Revision 5, January 2018

Appendix B: Example Field Calibration

Field Calibration Record-Barnegat Bay Monitoring Project

pH Meter Calibration
Required Accuracy: ± 0.05 standard units (su) of the true value for the calibration buffers used, ± 0.10 for the mid-range calibration check buffer. The temperature of the buffers must be recorded (if available).

Buffer	Temp	"As Found" Meter Reading	Set Meter Reading	Time	Date	Tech
4.00						
7.00						
10.00						

Buffer used for Calibration Check:_____Temp of Buffer:_____
Calibration Check Buffer result (performed in measure mode):_____
Time of Calibration Check and Tech:_____

Conductivity Meter Calibration
Required Accuracy: Within 1% of the true value for the standard used.
Meter is calibrated according to manufacturer's instructions. Standard check is required each day of use.
mS/cm Standard used for Calibration Check (performed in measure mode):_____
Date of Calibration Check: _____
Tech:_____

DO Meter Calibration
Meters are to be calibrated each day of use against air or water saturated air.
Meters also require a Winkler test each week of testing.
Required Accuracy between the Winkler titration and meter: ± 0.3 mg/L
Normality of Titrant (from container of sodium thiosulfate):_____
Beginning mls:_____
Ending mls:_____
Change in mls:_____
DO reading from Meter for the sample used for Winkler:_____
Tech:_____
Date:_____

Temperature Calibration
Thermometer calibrations must be performed on a quarterly basis prior to use for any sampling events. Records of the calibration will be retained.