Quality Assurance Project Plan

for

Friends of the Bay
"Baywatch"
Open Water Body
Water Quality Monitoring Program

prepared by

Friends of the Bay
P.O. Box 564
Oyster Bay, NY 11771

prepared for

U.S. Environmental Protection Agency
Region 2

April 27, 2006

Revision 7

APPROVALS:

Patricia Aitken, Friends of the Bay QAPP Coordinator — Date
WQMP Coordinator

David [illegible] Friends of the Bay WQMP Quality Assurance Officer — Date 5/2/06

Kyle Rabin, Friends of the Bay QAPP Manager — Date
Executive Director

U.S. EPA QA Officer — Date

U.S. EPA QAPP Program Manager — Date

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1.	**Project Name:**	Baywatch
2.	**Organization Name:**	Friends of the Bay
3.	**Date of WQM Program Initiation:**	June 1993
4.	**QAPP Coordinator:**	Patricia Aitken
5.	**WQMP Quality Assurance Officer:**	David Relyea
6.	**QAPP Manager:**	Kyle Rabin

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Appendices

3.0 Distribution List

The following individuals and organizations will receive a copy of Friends of the Bay's approved Quality Assurance Project Plan and any subsequent revisions.

- Mark Tedesco, United States Environmental Protection Agency (US EPA)
- Paula Zevin, United States Environmental Protection Agency (US EPA)
- Deborah Long, United States Fish and Wildlife Service (US FWS)
- Megan Grubb, United States Army Corps of Engineers
- Susan White, National Oceanic & Atmospheric Administration
- Peter Scully, New York State Department of Environmental Conservation (NYS DEC) Regional Director, Region I
- Charlie de Quillfeldt, New York State Department of Environmental Conservation (NYS DEC)
- Rick D'Amico, New York State Department of Environmental Conservation (NYS DEC)
- Christine Olsen, Connecticut Department of Environmental Protection
- Greg Capobianco, New York State Department of State, Division of Coastal Resources (NYS DOS)
- Dennis Mildner, New York State Department of State, Division of Coastal Resources (NYS DOS)
- John Jacobs, Nassau County Department of Health (NCDH)
- Vito Mineo, Suffolk County Department of Health Services
- Kenneth G. Arnold, Nassau County Director of Public Works
- Thomas F. Maher, Nassau County Director of Environmental Coordination
- Michael J. Deering, Director of Environmental Affairs, Suffolk County
- Sherry Forgash, Nassau County Soil and Conservation Water District
- Richard Lenz, Town of Oyster Bay, Department of Environmental Resources, Commissioner
- James Byrne, Town of Oyster Bay, Department of Public Works
- Eric Swenson, Hempstead Harbor Protection Committee
- Kimberly Zimmer, New York State Sea Grant
- Ailene Rogers, Cornell Cooperative Extension of Suffolk County
- David Relyea, Co-Owner, Frank M. Flower and Sons Oyster Company
- Thomas Galasso, Commissioner, Oyster Bay Sewer District
- Jim Schultz, North Oyster Bay Baymen's Association

Detailed contact information for these individuals is included as Attachment G.

4.0 Project/Task Organization

The organizational chart prepared for this project, the Friends of the Bay Water Quality Monitoring Program (WQMP) (*Baywatch*), is presented in **Figure 1**. The Quality Assurance (QA) Officer, Program Manager, and Program Coordinator are responsible for the implementation of the QAPP. **Table 1** presents the responsibilities of the personnel that are involved with the project.

Table 1: Baywatch Program Personnel Responsibilities

Name	Responsibility
Deborah Long, U.S. Fish and Wildlife Service Charlie de Quillfeldt, New York State Department of Environmental Conservation (NYS DEC) Rick D'Amico, NYS DEC John Jacobs, Nassau County Department of Health (NCDH) Eric Swenson, Town Of Oyster Bay Department of Environmental Resources David Relyea, Frank M. Flower & Sons Company Ailene Rogers, Cornell Cooperative Extension of Suffolk County	Advisory Board
Kyle Rabin	QAPP Manager
Patricia Aitken	QAPP Coordinator
David Relyea	WQMP QA Officer
Patricia Aitken or David Relyea	Field Sampling Leader

The Friends of the Bay "*Baywatch*" WQMP (Baywatch) Advisory Board consists of representatives from federal, state and local governments, local businesses, data users, and other individuals committed to maintaining the health of the Oyster Bay/Cold Spring Harbor Estuary. The Advisory Board will oversee the development, implementation and subsequent revisions of the Baywatch program conducted by the Project Coordinator and volunteers.

The WQMP Coordinator is responsible for managing personnel, equipment, and laboratory needs related to the program. The Field Sampling Leader reports to the QAPP Coordinator and manages sampling trip-specific needs including volunteer availability, training, equipment care and calibration, and equipment preparation. The Field Sampling Leader will be either the QAPP Coordinator or the QA Officer.

The QA Officer is responsible for reviewing the data relative to the Data Quality Objectives (DQOs) presented in **Section 8**. The QA officer will revise the QAPP (if necessary), report any data quality problems related to the DQOs to the Program Coordinator, oversee data audits as mandated by this QAPP, assess whether laboratory and field sampling elements outlined in this QAPP are followed, and monitor laboratory compliance with the QAPP while overseeing verification activities.

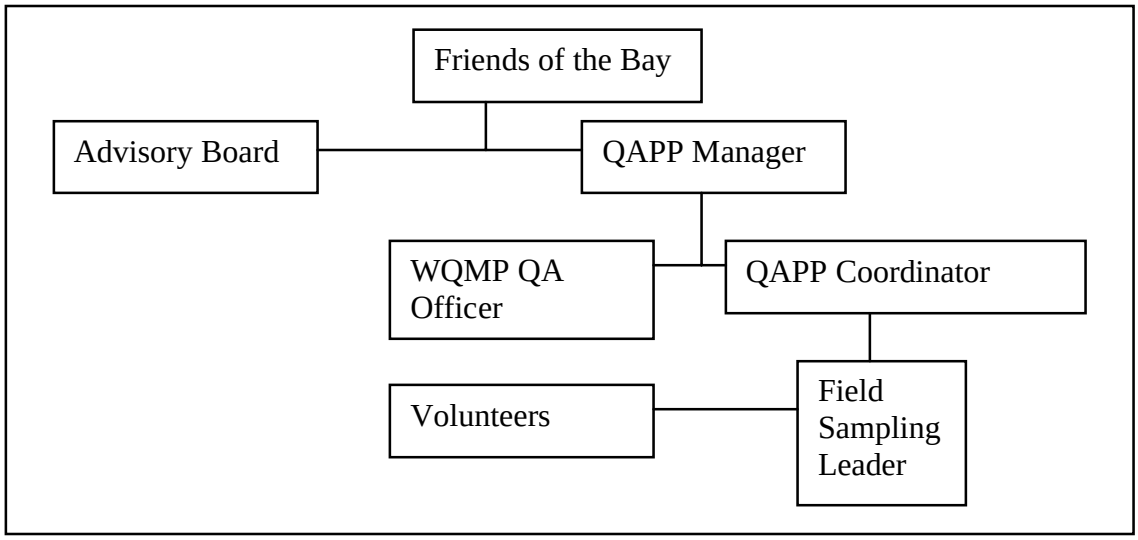
The QAPP Coordinator, WQMP Coordinator and the WQMP QA officer report to the QAPP Manager, who is responsible for correspondence with outside groups, including agencies responsible for approving the QAPP and the end users of the collected data. The QAPP Manager will resolve any procedural deficiencies identified during data audits.

The Advisory Board oversees the development, implementation and subsequent revisions of the Baywatch program and can recommend changes to any component of the sampling program.

Major responsibilities of non-management personnel are detailed in the Standard Operating Procedures presented in **Appendix A.**

The primary data users are the Long Island Sound Study (i.e. United States Environmental Protection Agency, New York State Department of Environmental Conservation, and Connecticut Department of Environmental Protection), U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Nassau County Department of Health, Suffolk County Department of Health Services, Town of Oyster Bay, Town of Huntington, and surrounding villages.

Figure 1: Baywatch WQM Program Organizational Chart



5.0 Special Training Needs/Certification

Training Logistical Arrangements

To become a "Baywatcher" interested individuals will participate in a training session conducted by the WQMP Coordinator with the assistance of the Advisory Board. The

training session will consist of an introduction to water quality monitoring explaining the goals and objectives of the monitoring program. This session will give individuals an opportunity to have their questions answered and determine if this program is for them before proceeding to the more technically involved training session.

The second part of the training session will be a hands-on technical explanation of boating safety, equipment calibration, collecting and recording data, and reporting. This session will be conducted immediately following the introductory session. Collection procedures and the proper usage of the equipment will be reviewed again with volunteers on the boat during monitoring events. The QAPP Coordinator will closely observe the procedures of the volunteers in collecting the samples during monitoring events. **Table 2** presents a volunteer training and evaluation schedule.

The WQMP Coordinator or Field Sampling Leader will evaluate Baywatchers on a monthly basis during the monitoring season by analyzing their technique. In addition, once each monitoring season, we will invite Nassau County Department of Health (NCDH) officials or leaders from the neighboring volunteer programs as a "technical exchange" to observe our volunteers. Outside professionals will keep the volunteers up-to-date and provide verification of our techniques. Individuals requiring additional instruction will receive instruction in the field at the time of sampling or will receive additional training prior to the next sampling event in which they participate. Deficiencies will be noted and the training program revised to improve future groupwide performance. A copy of the agenda for the volunteer training session is included in **Appendix A**. Additionally, a copy of the Volunteer Standard Operating Procedures Manual, included with this project plan, will be distributed to each volunteer and a copy will be kept aboard Friends of the Bay's boat, the *Baywatch.*

Table 2: Volunteer Training and Evaluation Schedule

Type of Volunteer Training	**Frequency of Training**
Introduction to Water Quality Monitoring (office presentation)	Annually, in March; additional sessions as needed
Monitoring Techniques (dockside and on-the-water hands on training session)	
Observation of Volunteer Techniques	Monthly
NCDH Observation	Annually
Consultant/Professional QA/QC	Several times per monitoring season
Corrective Re-Training	As needed

Description of Trainer Qualifications

Patricia Aitken, the Baywatch's QAPP Coordinator and Water Quality Monitoring Program Coordinator for Friends of the Bay will conduct volunteer training with the support of Dave Relyea, WQMP QA Officer, and our volunteer boat captains Hank

Kasven and Scott Sayer. Patricia Aitken has been the water quality monitor for the 2005 season and has been conducting the water quality monitoring every week. She has studied the procedures used by other groups, including QAPP reports prepared by other water quality monitoring groups. She is a life long resident of the Oyster Bay area, and is very familiar with the Oyster Bay/Cold Spring Harbor Estuary. Dave Relyea is the co-owner of Frank M. Flower and Sons, the state's largest traditional shellfish aquaculture business. He is intimately familiar with the waters and the life cycles of the oysters, clams and fish of the estuary. He is a respected expert in his field. Hank Kasven is a retired high school science teacher with over 30 years of teaching experience. He is also a dedicated fisherman, with extensive knowledge of the marine life in the estuary. Scott Sayer is a member of the United States Coast Guard Auxiliary, and is also an avid fisherman and boater.

6.0 Problem Definition/Background

6.1 Problem Definition

The Long Island Sound Study (LISS), a cooperative effort of the federal, state and local governments concluded, low dissolved oxygen (hypoxia) is the most serious threat to the health of the ecosystem. **Table 3** presents the New York State Water Quality Standards for dissolved oxygen in marine waters. **Table 4** presents the environmental consquences of low dissolved oxygen levels in marine waters. As a result of budget cuts, the Nassau County Department of Health (NCDH) eliminated dissolved oxygen testing from their water-testing program in 1993 to focus strictly on bacteria testing for bathing beach standards.

Table 3: Dissolved Oxygen Water Quality Standards

ID	Best Uses	Minimum DO Level
SA	Primary and secondary contact recreation and fishing, fish propagation and survival.	5.0 mg/L
SB	Shellfishing for market purposes, primary and secondary contact recreation and fishing, fish propagation and survival.	5.0 mg/L
SC	Fishing, fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.	5.0 mg/L
I	Secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.	4.0 mg/L
SD	Fishing, and suitable for fish survival. May be given to waters that, because of natural or man-made conditions, cannot meet the requirements for primary and secondary contact recreation and fish propagation.	3.0 mg/L

Source: 6 NYCRR 701 & 703

Table 4: Consequences of Low Dissolved Oxygen

Dissolved Oxygen	Consequences
> 5.0 mg/L	Few adverse effects on marine life.
4.0 mg/L	Reduce survival of some crab larvae by 30%.
3.0 mg/L	Reduced growth of crabs and lobsters. Some fish start to avoid the area.
2.5 mg/L	Growth reduced in grass shrimp, summer flounder and lobster. Most fish avoid the area.
2.0 mg/L	Sharply reduced growth. Lowest safe level for many juvenile organisms.
1.5 mg/L	Very high lethal effects on fish, shrimp and lobster.
1.0 mg/L	Total avoidance by bottom fish. Very high lethal effects.
0.0 mg/L	Anoxia – Intolerable environment for nearly all marine organisms.

Source: Zimmer (1996)

Friends of the Bay (FOB), a non-profit organization supported by thousands of members dedicated to preserving the Oyster Bay/Cold Spring Harbor Estuary, initiated a water quality monitoring program to fill the void left by County cutbacks. Friends of the Bay's mission is to "preserve, protect and restore the ecological integrity and productivity of the Oyster Bay/Cold Spring Harbor estuary and the surrounding watershed." Friends of the Bay believes the program is a necessary component in the effort to preserve the Oyster Bay/Cold Spring Harbor estuary and to increase public awareness of local threats to water quality.

The Baywatch program of Friends of the Bay:

1. Provides high quality data to continue the dissolved oxygen baseline established by the Nassau County Department of Health.
2. Screens for water quality impairments.
3. Determines long-term water quality trends
4. Documents effects of water quality improvement programs.
5. Educates and involves citizen and public officials in water quality protection.
6. Watchdogs harbor and coastline activities.
7. Assists local, state and federal agencies in harbor management.

Data collected each year by Friends of the Bay is available for use by federal, state and local government agencies, researchers and other interested parties by request or at our web site (www.friendsofthebay.org) in the form of our annual water quality report.

Low dissolved oxygen readings have been consistently recorded in Mill Neck Creek, Oak Neck Creek, and the lower portion of Cold Spring Harbor.

Impairments Within the Estuary

While it is sometimes difficult to determine the type of pollution and the source of pollution (i.e. urban runoff, storm sewers, sewage effluent associated with a failing on-site system) adversely impacting a waterbody, there is adequate understanding of the type of use impairments occurring within the estuary. Use impairments in Oyster Bay Harbor, Mill Neck Creek, Cold Spring Harbor and its tributaries are identified in the *2000 Atlantic Ocean/Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List (PWL),* a report compiled by the New York State Department of Environmental Conservation. The use impairments include shellfishing, public bathing, fish consumption, habitat/hydrology, aquatic life and recreation. Poorly thought-out development would exacerbate the existing impairments.

Source of Pathogens in Oyster Bay Harbor and Mill Neck Creek

According to *Pathogen Total Maximum Daily Loads for Shellfish Waters in Oyster Bay Harbor and Mill Neck Creek*, a September 2003 report by the New York State Department of Environmental Conservation, land use within the drainage area to Oyster Bay Harbor and Mill Neck Creek is "primarily urban with medium density residential development in the Hamlet of Oyster Bay and the Village of Bayville, and low density residential development in the remainder of the drainage area." The report goes on to state that "urban storm water is therefore the major source of pathogens (approx. 88% of total) to the Harbor." The report also points out that "the waters support a large recreational environment for boating which represents the second largest source of pathogens (approx. 11% of total) to these bodies."

6.2 Background

The Oyster Bay/Cold Spring Harbor estuary is nestled on the north shore of Long Island just twenty-five miles east of New York City, straddling the Nassau/Suffolk county border. This estuary, the cleanest embayment in western Long Island Sound, is a vital natural, economic and recreational resource. The Oyster Bay/Cold Spring Harbor estuary is comprised of approximately 6,000 acres.

The "commodious haven" Dutch voyagers named after its finest resource, the oyster, continues to play a vital role in the local economy. Today, the Frank M. Flower and Sons Company, a family owned and operated shellfish aquaculture business, supplies up to 90% of New York State's annual oyster harvest. Working along side dozens of independent baymen on Town of Oyster Bay-controlled bay bottom, approximately 50 million juvenile clams and 50 million oysters called "seed" from the Oyster company's hatchery are planted each year. Filter feeding by these shellfish remove nutrients and other pollutants from the waters of the bay, improving water quality within the bay while contributing to the local economy.

Theodore Roosevelt, the 26th President of the United States and pioneer conservationist, chose Oyster Bay as his home and "Summer White House" in large part because of the area's natural attributes. This area has attracted and sustained a variety of water dependent uses including the world renowned Cold Spring Harbor Laboratory, a publicly owned sewage treatment plant, a major oil storage facility, several marinas and bathing beaches.

The rich history and valuable natural resources of this area are recognized as a 3,200 acre National Wildlife Refuge (US FWS), two Significant Coastal Fish and Wildlife Habitats (NYS DEC), a Regionally Important Natural Area (NYS DOS), and an Important Bird Area (National Audubon Society).

The Long Island Sound Study (LISS), a cooperative effort of the federal, state and local governments concluded low dissolved oxygen (hypoxia) is the most serious threat to the health of the ecosystem. As a result of budget cuts, the Nassau County Department of Health (NCDH) eliminated dissolved oxygen testing from their water-testing program in 1993 to focus strictly on bacteria testing for bathing beach standards.

The Baywatch program serves to collect long term water quality data to evaluate the impact of changes in land use and environmental programs on the Oyster Bay/ Cold Spring Harbor estuary. Friends of the Bay uses the data to produce annual water quality reports that are available to the Public. The data, water quality reports, and volunteer involvement intend to raise public awareness regarding the sensitivity of the estuary's aquatic environment. The data collected by the program will be available to other groups, including LISS, US EPA, US FWS, and NYSDEC. FOB also proposes to use the data as the basis for a State of the Watershed report and subsequent development of a Watershed Action Plan consistent with EPA's watershed approach.

A fact sheet which summarizes background information on the Oyster Bay/ Cold Spring Harbor Estuary is attached as **Appendix B**.

7.0 Project/Task Description

Friends of the Bay recruits volunteers primarily in January and February, but it is a year round process. Volunteers are trained in March to sample for water temperature, salinity, dissolved oxygen, water clarity and to collect samples for bacterial and nitrogen analysis. **Table 5** summarizes Friends of the Bay's water quality monitoring program schedule consisting of fundraising and volunteer recruitment in the winter, volunteer and equipment preparation in the spring, water sampling during the late spring, summer, and early fall and preparation of the annual water quality report in early winter.

Friends of the Bay owns a nineteen foot Carolina Skiff that is used primarily for its open water body monitoring. Nineteen sites are tested from Friends of the Bay's boat each Monday beginning at 7:30 am from the first Monday in April until the last week of October. In this document, the term 'monitoring event' refers to activities associated

with weekly sampling and field data collection at all nineteen sites. A map of monitoring locations and a table of each location's coordinates are presented as an attachment to the Standard Operating Procedures in **Appendix A**.

The enterococci and coliform bacteria samples are collected in sterile 250 ml bottles supplied by the Nassau County Department of Health and transported to the Nassau County Department of Health Laboratory for analysis. Nitrogen testing is also conducted once each month during the first water quality monitoring event. Samples are collected in 250 mL bottles preserved with sulfuric acid is conducted at all nineteen sites. These samples are transported to South Mall Analytical Laboratories, a private lab certified by the New York State Department of Health. State accreditations for both South Mall Analytical Laboratories and the NCDH Laboratory are presented in **Appendix F**.

After each monitoring event, field data is entered into a Microsoft Excel spreadsheet formatted for this data (see **Appendix C**). The monitoring results are compared to the New York State standards for dissolved oxygen, presented in Table 3 in Section 6.1, historic data collected by Nassau County and Friends of the Bay and other areas being tested around Long Island Sound.

Table 5: Project Timetable

Activity	**Projected Start Date**	**Anticipated Date of Completion**
Volunteer Recruitment & Training	January/February	March
Equipment Preparation	March	late March
Test Monitoring Event	late March	late March
Water Quality Monitoring	April	through October
Data Processing/Analysis	May	December
End of Season Volunteer Event	October	December
Monitoring Report Preparation	November	January
Fundraising	Continuous	

Sampling is conducted at the same time (7:30 a.m.), and on the same day (Monday). The order is Cold Spring Harbor Cove South, Cold Spring Harbor Cove North Mooring Field, Cold Spring Harbor South, Cold Spring Harbor North, Plum Point, Seawanhaka Yacht Club PSTP outfall, Oyster Bay Cove, Whites Creek and OB-STP outfall, Roosevelt Beach, Beekman Beach and Mill Pond outfall, West Harbor, Turtle Cove, Mill Neck Creek East, Mill Neck Creek West, Mill Neck Creek South, The Birches STP, Mill Neck Creek North (Oak Neck Creek), Mill Neck Cove, and Flower and Son's Oyster Hatchery (Bayville) each week if tidal conditions allow. Mill Neck Creek is very shallow, and Friends of the Bay tries to conduct monitoring there when the tide is highest. Sometimes this means our sampling will begin in Mill Neck Creek rather than in Cold Spring Harbor.

The sampling team consists of the WQMP Coordinator, QAPP Coordinator, boat captain and at least one volunteer.

To detect vertical stratification at the sampling locations, dissolved oxygen is tested one-half meter above the bay bottom, one meter below the water's surface, and the third reading is taken one-half meter below the water's surface.

8.0 Quality Objectives and Criteria for Measurement Data

Data Quality Objectives

Data quality objectives (DQOs) specify the quality of environmental data required to support decision making processes. The generation and use of quality data is important to the assessment of water quality within the estuary. Specific data quality objectives are presented in this section. **Table 6** presents precision, accuracy and measurement ranges for Baywatch's assessment of temperature, salinity, dissolved oxygen, water clarity, coliform bacteria and enterococci, and nitrogen species parameters.

Table 6: Parameter Specific Measurement Performance Criteria

Matrix	Parameter	Units	Measurement Range or Report Limit	Precision	Resolution	Accuracy (CAC**)
Water	Salinity	Parts per thousand (ppt)	0 to 30 ppt	+/- 20%	0.1 ppt	+/- 2% or +/- 0.1 ppt
Water	Temperature	Degrees Celsius (°C)	0 to +65 ^{0}C	+/- 20%	0.1 ^{0}C	N/A
Water	Dissolved Oxygen (Winkler)	mg/L	0 to 50 mg/L	***	0.1 mg/L	***
Water	Dissolved Oxygen (Meter)	mg/L	0 to 20 mg/L	+/- 20%	0.01 mg/L	+/- 0.2 mg/L
		mg/L	20 to 50 mg/L	+/- 20%	0.01 mg/L	+/- 0.6 mg/L
Water	Total Coliform	Most probable number (mpn) per 100 ml	<2 to 160,000 mpn/100 ml	<2 mpn	NA	NA
Water	Fecal Coliform	mpn/100 mL	<2 to 160,000 mpn/100 ml	<2 mpn	NA	NA
Water	Enterococci	cfu/100 mL	0 to TNTC*	+/- 5%	1 colony	NA

Matrix	Parameter	Units	Measurement Range or Report Limit	Precision	Resolution	Accuracy (CAC**)
Water	Water clarity	Meters (m)	NA	NA	NA	NA
Water	Ammonia	mg/L	0.04 mg/L	+/-20%	0.01 mg/L	+/-20%
Water	Nitrate/nitrite	mg/L	0.010 mg/L	+/-20%	0.001 mg/L	+/-20%
Water	Total Kjeldahl Nitrogen	mg/L	0.020 mg/L	+/-20%	0.001 mg/L	+/-20%
Water	Organic Nitrogen	mg/L	NA	NA	NA	NA

** TNTC = Too Numerous to Count*
*** CAC = Calibration Acceptance Criteria*
**** EPA Method Cut Sheet (360.2) (See Attachment VIII of the SOPs) states that 'exact data are unavailable on the precision and accuracy of this technique; however reproducibility is approximately 0.2 mg/L of DO at the 7.5 mg/L level due to equipment tolerances and uncompensated displacement errors.'*
NA = Not Applicable

Measurement Performance Criteria

Data quality can be described in terms of precision, accuracy, completeness, representativeness, and comparability. Each of these terms is discussed in the following subsections.

8.1 Precision

Precision is defined as a measure of mutual agreement among individual measurements of the same type. In the case of laboratory analytical data, precision will be used to describe the reproducibility of the analytical data.

Sampling Measurement Systems

To assess precision in the field, a duplicate sample will be collected nominally for every 20 samples per matrix for all parameters. The collection of field duplicates measures a combination of field and laboratory precision, thereby exhibiting more variability than a laboratory duplicate.

A calculation to determine Relative Percent Difference (RPD) between the two sample results is performed. Relative Percent Difference (RPD) is used as a measure of precision. The laboratory will analyze duplicates on a one per 20 sample frequency. RPD limits are matrix and compound dependent. RPD is defined as follows:

$$RPD = \frac{|Conc(p) - Conc(d)|}{(1/2)(Conc(p) + Conc(d))} * 100$$

where,
Conc(p) = Primary Sample Concentration, the first sample collected at that location
Conc(d) = Duplicate Sample Concentration, the second sample collected at that location

Precision performance criteria for each parameter are included in **Table 6**. If a calculated RPD falls outside the criteria range, the discrepancy will be addressed on a case-by-case basis since the results are laboratory, parameter and matrix dependent.

Laboratory Measurement Systems

The objective concerning precision is to equal or exceed the precision demonstrated in the analytical methods on samples of a similar matrix. Relative Percent Difference (RPD) is used as a measure of precision. The laboratory will analyze matrix spikes/matrix spike duplicates for relative percent difference. RPD is defined as follows:

$$RPD = \frac{|MSR - MSDR|}{(1/2)(MSR + MSDR)} * 100$$

where,
MSR = matrix spike recovery
MSDR = matrix spike duplicate recovery
The absolute value of the recovery difference is used in the above equation.

Recovery limits are matrix and compound dependent. If necessary, corrective action by the laboratories will be performed according to the provisions of their Quality Assurance Plans. A summary of the South Mall Labs Quality Assurance Plan is provided in **Appendix E**. Nassau County Health Department Labs implements Quality Assurance Standard Operating Procedures (SOPs) presented in Standard Methods (See **Appendix D**).

8.2 Accuracy

Accuracy can be defined as the degree of agreement of a measurement with an accepted reference or true value. Accuracy is generally expressed as the ratio of the measured value to the true value, which gives a measure of bias inherent in the system. Accuracy can be assessed both in the field and in the laboratory.

Field Measurement Systems

Accuracy will be measured for field activities to assess the performance of the project measurement systems. On the day of each monitoring event before any field data is recorded, the Hydrolab Quanta Water Quality Monitoring System will be calibrated for dissolved oxygen and salinity/conductivity. The salinity calibration will be checked using the procedure presented in the Hydrolab Quanta manual (**Attachment III** to the SOPs) after each monitoring event. If the calibration check indicates that the instrument's calibration has drifted outside the calibration acceptance criteria, the data will be flagged and evaluated using the procedures presented in **Section 16**. Calibration acceptance criteria, where applicable, are defined in **Table 6.**

Additionally, a field dissolved oxygen kit based on the azide modification of the Winkler titration method will be used to validate the instrument's DO calibration on randomly-collected samples from 10% of the monitoring locations sampled during each monitoring event. A manual for the test kit to be used is presented in **Attachment VIII** of the SOPs included as **Attachment A.** Details regarding DO sample collection and validation are presented in **Section 11.1** and in the SOPs presented in **Appendix A**.

Laboratory Measurement Systems

Laboratory accuracy will be determined from laboratory control and surrogate samples, published historical data, method validation studies and experience with similar samples. The goal for spiked sample recoveries will be +/- 30%. These concentrations vary from one compound to another. A copy of the South Mall Labs Quality Assurance Program Overview is presented in **Appendix E**. The Nassau County Health Department Lab implements Quality Assurance SOPs presented in Standard Methods (See **Appendix D**)

8.3 Bias

Bias is the systematic or persistent distortion of a measurement process causing errors in one direction. Bias will be evaluated by considering factors associated with the sampling program design (i.e. time of sampling, weather conditions, choice of sampling sites) and through validation measurements using a modified Winkler titration method as described elsewhere in this plan.

Analyses performed at the laboratory record bias in same result through the analysis of a matrix spike sample. The recovery of the matrix spike sample may be used to indicate bias due to sample matrix interference

8.4 Representativeness

Baywatch tests the same six dissolved oxygen locations historically monitored by Nassau County Department of Health. We have expanded the program to monitor a total of 19 sites in the Oyster Bay/Cold Spring Harbor estuary. The sites were selected to monitor a variety of locations throughout the estuary complex. Sites were selected that are close to probable significant inputs of pollution (i.e. an outfall) or water (i.e. a tributary), or locations of poor flushing (i.e. Mill Neck Creek). Others were selected to represent open

water conditions removed from known pollutant sources (i.e. Plum Point, the entrance to Oyster Bay and Cold Spring Harbor).

Testing for the same parameters at these locations enables Baywatch to continue the baseline data created by the County and to observe any long-term trends. John Jacobs, the Director of Environmental Health from the Nassau County Department of Health has verified the locations of the six original NCDH monitoring locations using a Global Positioning System (see the SOPs in **Appendix A**). If a monitoring location is moved, the latitude and longitude of the new location will be included in the SOPs. Instances where data from the new and old location will be used together will be flagged and qualified. Please refer to **Section 10.1** of this Quality Assurance Project Plan, which explains how the Monitoring Process Design ensures a representative sample of the Oyster Bay/Cold Spring Harbor Estuary.

8.5 Data Comparability

Comparability is an expression of the confidence with which one data set can be compared to another. The comparability objective is to collect and analyze samples using methods which will demonstrate that current data are comparable to data collected in previous and future investigations for this study area. Another objective is for future data to be of sufficient quality for use by other agencies and monitoring groups throughout Long Island Sound. The comparability of data is addressed by using standard protocols for the collection of field samples and by using standard methodologies for analytical procedures which were used in past investigations. The standard protocols used by Friends of the Bay are the SOPs presented in **Appendix A**.

In developing the Baywatch program Friends of the Bay communicated extensively with other volunteer organizations and government agencies to coordinate our activities. Where possible we have duplicated parameters tested, equipment used, and sampling regimens. Consequently, we are testing the same parameters in the same way, using a Hydrolab Quanta Water Quality Monitoring System for temperature, salinity and dissolved oxygen, and using a Secchi Disk for water clarity. These tools are widely accepted methods for these parameters. To ensure comparability we are closely following the accepted monitoring protocol for this equipment.

Additionally bacterial samples are transferred to the Nassau County Department of Health laboratory for analysis. Nitrogen samples are analyzed by South Mall Analytical Labs. Both of these laboratories are certified by the State of New York, and all parameters are measured using standard methods. If it is determined that the laboratory used a different method than specified, the project coordinator and QA officer, in conjunction with the laboratories, will evaluate and document whether this has compromised the comparability of data.

8.6 Data Completeness

The data collected is primarily for basic research and education and is not intended to be used for legal or compliance issues. There is no fraction of the planned data that must be collected in order to fulfill statistical criteria. Friends of the Bay will complete all sampling unless weather, tidal, or other conditions become dangerous or otherwise preclude sampling. Field data will be recorded at three depths at each location if tidal conditions allow (i.e. sometimes the water is not deep enough to obtain three readings). During low tides, it may be necessary to take readings at fewer than three depths. Under these conditions, the Field Sampling Leader will determine whether recording data at one or two depths is appropriate. Bacterial and nitrogen samples will be collected at each inundated site regardless of water depth.

8.7 Data Sensitivity

Sensitivity is the lowest detection limit of the method or instrument for each of the measurement parameters of interest. Laboratory analyses have preset limits of detection for the nitrogen analyses as well as the coliform bacteria and Enterococci. **Table 7** presents detection limits for water quality parameters measured in this study.

Table 7. Methods and Reporting Limits for Parameters Measured in this Study

Parameter	Method	Units	Reporting Limit
Salinity	Electrometric	Parts per Thousand (ppt)	0 ppt
Temperature	Electrometric	°C	-5 ^{0}C
Dissolved Oxygen	Winkler Titration (azide modification)	mg/L	0 mg/L
Dissolved Oxygen	Electrometric	mg/L	0 mg/L
Water Clarity	Secchi Disk	m	NA
Total Coliform	Standard Methods 9221B	mpn/100mL	<2 mpn/100 mL
Fecal Coliform	Standard Methods 9221E	mpn/100mL	<2 mpn/100 mL
Enterococci	EPA 1600	cfu/100mL	0 cfu/100 mL to TNTC*
NH3 (Ammonia)	Lachat 10-107-06-1B	mg/L	0.04 mg/L
Nitrate/Nitrite	Lachat 10-107-04-1	mg/L	0.010 mg/L
Total Kjeldahl Nitrogen	Lachat 10-107-06-2	mg/L	0.020 mg/L
Organic Nitrogen	Calculated	mg/L	NA

NA = Not Applicable
TNTC = Too Numerous to Count

9.0 Non-Direct Measurement (Secondary Data)

No additional data sources have been identified that could be used in Friends of the Bay reports and analysis. If other data is identified, FOB will assess its usability and comparability. Any such assessment will be included in this section of the QAPP.

10.0 Field Monitoring Requirements

10.1 Monitoring Process Design

Friends of the Bay held a meeting prior to developing their monitoring program with representatives of potential data users including the US Environmental Protection Agency, US Fish and Wildlife Service, NYS Department of Environmental Conservation, Nassau County Department of Health, Town of Oyster Bay, and the Frank M. Flower and Sons Company to determine the water quality monitoring needs for the Oyster Bay/Cold Spring Harbor Estuary. It was agreed that dissolved oxygen will be monitored because it continues historic data collected by Nassau County Department of Health, addresses hypoxia (Long Island Sound's priority water quality problem) and can be measured accurately by volunteers. Fecal coliform sampling was added in 1999 to establish a baseline of current conditions and monitor changes following investment in pollution control (i.e. package sewage treatment plant, stormwater mitigation).

Friends of the Bay's *Baywatch* program monitors nineteen sites throughout Oyster Bay and Cold Spring Harbor for water temperature, salinity, dissolved oxygen, water clarity, coliform bacteria and Enterococci once a week from April through October. The sites monitored include the same six sites historically used by the Nassau County Department of Health. **Table 8** presents a summary of the sampling program. A map of the nineteen sites monitored by Friends of the Bay and a table showing the latitude and longitude of each site is included in the FOB SOPs in **Appendix A**.

Table 8: Sampling Design Logistics

Type of Sample	Parameter	Number of Samples	Sampling Frequency	Sampling Period
Biological	Total/Fecal Coliform Bacteria	19	19/day, 1 day/week	28 weeks
Biological	Enterococci	19	19/day, 1 day/week	28 weeks
Biological	Nitrogen Series	19	19 day, 1day/month	28 weeks
Physical	Temperature	57	57/day, 1 day/week	28 weeks
	Water clarity	19	19/day, 1 day/week	28 weeks
Chemical	Dissolved Oxygen	57	57/day, 1 day/week	28 weeks
	Salinity	57	57/day, 1 day/week	28 weeks

The sites sampled for the nitrogen series parameters include the analysis for the following analytes: Ammonia, Nitrate/nitrites, Total Kjeldahl Nitrogen and Organic Nitrogen. The Nitrogen series sample analyses are currently being performed by South Mall Labs.

10.2 Monitoring Methods

The Friends of the Bay Standard Operating Procedures (**Appendix A**) contains detailed information on all sampling protocols and equipment. **Table 9** this information.

Table 9: Sampling Method Requirements

Parameter	Method	Sampling Equipment	Preservation and Container	Sampling Method	Max. Holding Time
Total/Fecal Coliform	Standard Methods 9221B and 9221E	250 mL bottle	Cooler with Ice	Grab	6 hours
Enterococci	EPA 1600	250 mL	Cooler with Ice	Grab	8 hours
Temperature	Electrometric	Quanta	In-water	On-site	Immediate
Salinity	EPA 120.1 (electrometric)	Quanta	In-water	On-site	Immediate
Dissolved Oxygen	EPA 360.2 (Winkler)	LaMotte Kit	Mananous Sulfate, Potassium Iodide Azide, Sulfuric Acid	On-site	8 hours
Dissolved Oxygen	EPA 360.1 (electrometric)	Quanta	In-water	On-site	Immediate
Water clarity	Secchi Disk	LaMotte Secchi Disk	In-water	On-site	Immediate
Ammonia	Lachat 10-10-06-1B	250 mL bottle	Sulfuric Acid	Grab	28 days
Total Kjeldahl Nitrogen	Lachat 10-107-06-2	250 mL bottle	Sulfuric Acid	Grab	28 days
Nitrate/nitrite	Lachat 10-107-04-1	250 mL bottle	Sulfuric Acid	Grab	28 days
Organic nitrogen	TKN minus Ammonia	N/A	N/A	N/A	28 days

10.3 Field Quality Control (QC)

The majority of the measurements taken as part of the *Baywatch* program are recorded in the field. Bacterial samples are labeled with a specific site identifier and the conditions (i.e. weather, air temp., etc.) occurring at the time of sampling are recorded on a supplied data sheet. The collected samples, along with a temperature control sample supplied by the NCDH laboratory, are stored upright in a cooler with ice (for temperature control)

during the monitoring event and are immediately transported to the lab once sampling is completed. The samples are logged in once they arrive at the lab. The temperature control is checked to be sure the samples were maintained within the required temperature range (2-10°C). If the temperature control sample is out of range, the results are stamped with the qualifying statement: "Results Questionable Temperature Control Exceeded 10° C". **Section 16** presents procedures that FOB will follow if a temperature control sample exceeds the acceptable limits. Sample Water Quality Monitoring Data Sheets used to record field measurements are included in the SOPs included as **Appendix A**.

11.0 Analytical Requirements

Baywatch measures water temperature, salinity and dissolved oxygen using a Hydrolab Quanta Water Quality Monitoring System. Water clarity will be determined using a Secchi Disk. Each of these parameters will be measured according to the protocol detailed in the *Baywatch* Standard Operating Procedures, attached to this document. All bacteria samples are analyzed by the Nassau County Department of Health. A copy of the laboratory procedures used is contained in **Appendix D**. **Table 10** presents the analytical methods associated with the Hydrolab Quanta measurements and the analytical laboratories.

Table 10: Analytical Methods

Parameter	Type	Method	Description
Temperature	Field	Electrometric	Hydrolab Quanta Water Quality Monitoring System
Salinity	Field	EPA 120.1	Hydrolab Quanta Water Quality Monitoring System
Dissolved Oxygen	Field	EPA 360.2	LaMotte field DO kit
Dissolved Oxygen	Field	EPA 360.1	Hydrolab Quanta Water Quality Monitoring System
Enterococci	Laboratory	EPA 1600(a)	Membrane Filter Test
Total Coliform	Laboratory	Standard Methods 9221B(b)	Multiple Tube Fermentation
Fecal Coliform	Laboratory	Standard Methods 9221E(b)	Multiple Tube Fermentation
Ammonia	Laboratory	Lachat 10-107-06-1B	Colorimetric with phenylic chemistry
TKN	Laboratory	Lachat 10-107-06-2	Colorimetric with phenylic chemistry
Nitrate/nitrite	Laboratory	Lachat 10-107-04-1	Colorimetric with cadmium reduction
Organic nitrogen	Laboratory	Calculation	TKN minus Ammonia

Parameter	Type	Method	Description
Water clarity	Field	Secchi Disk	Secchi Disk

(a) U.S. EPA - 1979 Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020.
(b) APHA; AWWA; WEF (1998) Standard Methods for the Examination of Water and Wastewater, 20th Edition.
NA - not applicable

11.1 Analytical Quality Control

Field QC Checks

Sampling is conducted at each monitoring station with the Hydrolab Quanta Water Quality Monitoring System. On the day of each monitoring event before any field data is recorded, the Hydrolab Quanta Water Quality Monitoring System will be calibrated for dissolved oxygen and salinity/conductivity using the procedure presented in the Hydrolab Quanta manual (Attachment III to the SOPs). The salinity/conductivity calibration will be checked at the end of each monitoring event. If the check indicates that the calibration has drifted outside the calibration acceptance criteria, the instrument will be recalibrated and the data will be flagged and evaluated following procedures in **Section 16.0**. Calibration acceptance criteria, where applicable, are defined in **Table 6.** The thermometer used for air temperature is checked against the Nassau County Department of Health's calibrated mercury thermometer at the beginning of each season.

Additionally, a field dissolved oxygen kit based on the azide modification of the Winkler titration method will be used to validate the instrument's DO calibration on randomly-collected samples from 10% of the monitoring locations sampled during each monitoring event. A manual for the test kit to be used is presented in **Attachment VIII** of the SOPs included as **Attachment A.**

At each monitoring location that is randomly selected for DO validation, a sample will be collected in a 60 mL DO sample container supplied by the DO kit manufacturer immediately after the DO level is recorded at that location using the Hydrolab Quanta. The DO content of the sample will then be fixed following the procedures presented in the titration kit manual (**Attachment VIII** of the SOPs in **Appendix A).** The sample will then be labeled and stored in a cooler for transport. The sample will be analyzed for DO using the procedures presented in the titration kit manual.

If the Winkler titration and the Quanta results deviate by more than 0.5 mg/L, the Quanta results will be flagged and the procedures presented in **Section 16** of the QAPP will be implemented. During evaluation of the DO levels obtained using the kit, it is important to note that high suspended solids and algal levels in water (indicated by low Secchi disk depths) may interfere with Winkler titration method results, although they do not interfere with membrane electrode (Quanta) results.

A duplicate sample for bacteria will be collected at one sampling site during each monitoring event, and a duplicate sample for nitrogen will be collected at one sampling

site on days when nitrogen samples are collected. The locations where duplicate samples are to be collected will be selected randomly.

The QAPP Coordinator and/or the QA Officer will be present during each monitoring event. Testing is conducted and/or reviewed by one or both of these supervisory members of Friends of the Bay. These supervisors will evaluate the data using the methods presented in the QAPP. If deficiencies are found in the results or in the manner in which samples were collected, the affected data will be excluded or marked conditional, the reasons for the deficiencies will be determined, and any necessary changes regarding the sampling program (i.e. the training plan, the SOPs, the QAPP) will be made.

Laboratory QC Checks
A temperature control sample will be obtained from the Nassau County Department of Health laboratory. A distilled water blank (Method Blank) will be included for analysis during each monitoring event to identify any contamination occurring at the laboratory. This distilled water sample is also used as a temperature control to assure the bacteria samples have been maintained within the appropriate temperature range (2-10°C). **Section 16** presents procedures that FOB will follow if a temperature control sample exceeds the acceptable range. The labs will also include lab control samples for each monitoring event. FOB will request this QA/QC data from the labs, which will be examined by the QAPP Coordinator or QA officer and included in FOB's records.

Data Analysis QC Checks
The QAPP Coordinator and/or the QA Officer will check the laboratory QA/QC data for any deviations from the Data Quality Objectives presented in **Section 8.0** of the QAPP, and will calculate the Relative Percent Difference for any field duplicates and their corresponding samples using the formula presented in **Section 8.1** of the QAPP if these calculations are not performed by the Labs. The QAPP Coordinator and/or the QA Officer will ensure that all field equipment is appropriately maintained and/or calibrated, and inspect data for any measurements indicating equipment or method malfunction.

12.0 Sample Handling and Custody Procedures

The majority of the measurements taken as part of the *Baywatch* program are recorded in the field. Bacterial samples are collected in sterile 250 mL bottles that are labeled with a specific site identifier and the conditions (i.e. weather, air temperature, etc.) occurring at the time of sampling on a supplied data sheet. The samples are stored upright in a cooler with ice (for temperature control) during the monitoring event and are immediately transported to the lab once sampling is completed. A temperature control vial is checked to assure the samples were maintained within the required temperature range (2°-10°C). If the temperature control sample is out of range, the results are stamped with the qualifying statement "Results Questionable Temperature Control Exceeded 10°C."

The monthly nitrogen series samples are collected in 250 mL bottles preserved with sulfuric acid and stored upright in coolers. These samples are then transported to South

Mall Analytical Laboratories for analysis. The samples are logged by the laboratory upon receipt.

A Chain of Custody (COC) document is completed to record the sample location/Site ID, data and time of sampling. This document remains with the field samples to document sample transfers. A field data sheet is completed on-site at the time of sampling (see the SOPs presented in **Appendix A**).

13.0 Testing, Inspection, Maintenance and Calibration Requirements

13.1 Instrument/Equipment Testing, Inspection and Maintenance

The Hydrolab Quanta and Secchi disk are the primary equipment we use and, in turn, are the equipment we must maintain. After each monitoring event the probes are inspected to ensure that the membranes on the dissolved oxygen probes are not wrinkled or damaged. The membrane will be changed every three to four weeks, regardless of its condition, according to the manufacturer's maintenance schedule.

13.2 Instrument Calibration and Frequency

Friends of the Bay will maintain and calibrate the Hydrolab Quanta. We will also use and maintain a Secchi disk. Implementation of this equipment for monitoring field parameters is discussed below. Calibration methods are presented in **Table 11**.

Salinity

Monitored with: Hydrolab Quanta Monitoring Sensor/Transmitter

Calibrated with: Manufacturer supplied and approved calibration standard before each monitoring event.

Validation: After each monitoring event, a calibration sample of known concentration will be measured with the rinsed probe to check the calibration.

Temperature

Monitored with: Hydrolab Quanta Meter

Calibrated with: Factory-set and no calibration required

Validation: Factory-set and no calibration or calibration checks required

Dissolved Oxygen

Monitored with: Hydrolab Quanta Dissolved Oxygen Meter with 15m cable.

Calibrated with: Method outlined in Hydrolab Operations Manual once per week before each sampling event.

Validation: A field kit based on the modified Winkler titration method will be used to validate the instrument DO calibration on samples from 10% of the monitoring locations following each monitoring event.

Water Clarity

Monitored with: Secchi disk, 20 cm diameter, black and white with stretch resistant line. LaMotte Chemical Products; Catalog No. 0171.

Calibration: Samplers will ensure that the disk is free of material that may reduce its visibility.

Table 11: Calibration Methods

Parameter	Method	Units	Measurement Range	Calibration Method
Salinity	Quanta	Parts per thousand (ppt)	0 to 80 ppt	Hydrolab Operations Manual Procedure
Temperature	Quanta	Degrees Celsius (°C)	-5 to +65 ^{0}C	NA
Dissolved Oxygen	Quanta	Milligrams per liter (mg/l)	0 to 50 mg/l	Hydrolab Operations Manual Procedure
Water Clarity	LaMotte Secchi Disk	Meters (m)	0 to 15 meters	NA

Laboratories utilized for analyses are responsible for calibration required for contracted analysis

13.3 Inspection and Acceptance Requirements for Supplies

A motorboat, safety equipment and a Secchi Disk are the only other supplies necessary for our program. Prior to each use the motorboat is inspected for the appropriate safety equipment required by the United States Coast Guard including personal floatation devices for each person aboard, a fire extinguisher, an anchor, and a paddle. The Secchi Disk is inspected prior to each use to ensure it is not damaged and that the line is secure. The QAPP Coordinator is responsible for ensuring the appropriate maintenance of our equipment and supplies.

14.0 Data Management

A *Baywatch* volunteer records the site name, the date and time the sample was collected. The *Baywatch* volunteers also records the name of all volunteers present. Field data sheets are reviewed by the QAPP Coordinator or Field Sampling Leader before leaving each sampling site to ensure that the sheet was properly completed. At the end of the

monitoring event, the sheets are reviewed once again. After each monitoring event, the completed field data sheets are returned to the Friends of the Bay office.

The QAPP Coordinator will enter the sample data into a Microsoft Excel spreadsheet (see **Appendix C**) from the office following the monitoring event. The Microsoft Excel spreadsheet was developed by the Long Island Sound Water Quality Monitoring Work Group and adapted to *Baywatch* by Friends of the Bay.

The Quality Assurance Officer reviews the QAPP Coordinator's data entry to ensure the data was transferred correctly from the data sheet to the spreadsheet and makes changes as necessary. The original field data sheets are stored in Friends of the Bay's files for five years. The spreadsheets are stored and backed up electronically.

15.0 Assessment and Response Actions

The Field Sampling Leader for our water quality monitoring program will be either the QAPP Coordinator, Field Sampling Leader, or the Quality Assurance officer for Friends of the Bay. Volunteers will always be accompanied by at least one of these individuals. As a result, volunteers will be under constant supervision. If performance improvement is needed, continued training will be conducted on site. Volunteer training and review procedures are presented in **Section 5.0**. Data quality audits will be conducted at least once per season by the QAPP Coordinator or the QA Officer. Audits will consist of inspecting the Field Data Sheets, laboratory QA/QC data, and field duplicate RPD calculation, if available. Any deficiencies will be reported to the QAPP Manager, who will oversee the resolution of deficiencies.

16.0 Data Review, Validation and Verification

To assure that volunteers, equipment or other variables are not adversely affecting water sampling, a quality assurance schedule has been designed to provide a system of checks. The goal is to collect the highest quality data each sampling day, saving time and frustration by discovering problems with equipment or procedures quickly. The importance of building confidence in data and volunteers is exhibited by Friends of the Bay's commitment to continuously improving its quality assurance plan.

This monitoring season Friends of the Bay will build on its previous years' efforts by performing scheduled calibrations of the Quanta, performing, DO data validation using a field DO test kit, hosting a volunteer training session, and increasing the number of self-checks with scheduled field duplicates to be collected. We will also use visits from guest monitoring groups to check our data and critique our techniques. The schedule (see **Table 2**) provides an overview of the volunteer training and evaluation schedule. The Nassau County Department of Health has expressed an interest to expand its participation.

16.1 Data Review, Verification and Validation

At the time of sample collection, the results are reviewed by the QAPP Coordinator. Any results that exceed the QC limits are re-taken to verify the reading. All readings are recorded on the field worksheets. Once all the data is collected for the monitoring event, it is then entered into the Excel spreadsheet by the QAPP Coordinator. The Quality Assurance officer will double check the data entered with the data sheets to ensure they were transferred correctly. Any errors found will be corrected. Observed data which seems to inconsistent with previously recorded data will be brought to the attention of the QAPP Coordinator.

16.2 Reconciliation with Data Quality Objectives (DQOs)

After each monitoring event the precision and accuracy of our data will be checked via procedures described in **Section 8.0**. If these indicators do not meet the programs description, data will be flagged. If a sample is incorrectly collected or handled (i.e. temperature control sample exceeds 10 ºC, a nitrogen sample is collected with no preservative), the error will be noted in the data management spreadsheet (**See Appendix C**) and the affected results will be flagged. For each flagged item, the severity and causes of the deviation from DQOs will be evaluated, and the data accepted, rejected, or marked as provisional as necessary.

Depending on the outcome of the data evaluation relative to DQOs, other actions may be taken. If equipment failure seems to be the reason for the problem, calibration or maintenance techniques will be reviewed and improved. If the problem developed from human error, team members will go through a retraining process and evaluation. If revisions occur within the project specifications (i.e. a change in data quality objectives), the state and EPA quality assurance officers will be notified in order to approve the new method. Data that does not meet DQOs will be discarded and will not be posted or included in water quality reports. If data does not consistently meet DQOs, the SOPs and QAPP will be reviewed and revisions suggested to correct the problem. Additionally, the DQOs will be evaluated and adjusted if they are unreasonably stringent.

17.0 Reporting of Results

In November, the end of the monitoring season, the data will be compiled into an annual water quality monitoring report. This annual report serves as the vehicle that translates hours of field work into a clear, concise text for data users including, but not limited to, citizens, government agencies and the media. Data, presented in easy to understand diagrams, is described in the accompanying text which includes sections covering materials and methods, results, discussion, conclusions, and a bibliography. An abstract or executive summary will precede the main body of the report.

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Appendix A Standard Operating Procedures Manual

Baywatch

Open Water Body
Water Quality Monitoring Program

Standard Operating Procedures Manual

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Attachments

Program Overview

Friends of the Bay is a widely respected, volunteer-based, not-for-profit environmental organization located in Oyster Bay. Our mission is to preserve, protect and restore the ecological integrity and productivity of the Oyster Bay/Cold Spring Harbor Estuary and the surrounding watershed.

Started in 1987 as a small group of citizens concerned about the deleterious effects of massive, proposed development on Oyster Bay's waterfront, Friends of the Bay has grown into a powerful voice representing thousands of area residents and businesses. As a representative of the local citizens, we have developed a wide range of programs that expand public knowledge concerning issues in the bay. One of our important programs is the "*Baywatch*" water quality-monitoring program.

The Long Island Sound Study (LISS), a cooperative effort of the federal, state and local governments concluded that low dissolved oxygen (hypoxia) is the most serious threat to the health of the ecosystem. As part of budgetary cutbacks, the Nassau County Department of Health eliminated all dissolved oxygen and bacterial testing from their water-testing program that was not required to monitor bathing beaches in 1993. The New York State Department of Environmental Conservation still monitors bacteria to ensure the safety of shellfishing areas.

Friends of the Bay initiated a water quality testing program to fill the void left by county cutbacks. This program was developed in cooperation with the United States Environmental Protection Agency, New York State Department of Environmental Conservation, local governments and other volunteer monitoring groups around Long Island Sound. Friends of the Bay considers the program a necessary component in the effort to preserve the Oyster Bay/Cold Spring Harbor Estuary, and hopes to increase public awareness of local threats to water quality. The *Baywatch* program of Friends of the Bay:

1. Provides reliable data to continue the dissolved oxygen baseline established by the Nassau County Department of Health.
2. Screens for water quality impairments.
3. Determines long-term water quality trends.
4. Documents the effects of water quality improvement programs.
5. Educates and involve citizens and public officials in water quality protection.
6. Watchdogs harbor and coastline activities.
7. Assists local, state and federal agencies in harbor management.

Water Quality Measurements

The coastal communities that are adjacent to the Oyster Bay/Cold Spring Harbor Estuary depend upon the health of this body of water and the surrounding watershed. *Baywatch* enables trained volunteers working along side environmental scientists, to monitor various components of the marine ecosystem. Volunteers track a number of features in the bay. In order to do so effectively they must understand what they are testing and why. The following explains why Friends of the Bay tests for water temperature, clarity, salinity, dissolved oxygen, coliform bacteria, and enterococci.

Dissolved Oxygen - Like humans, marine animals need oxygen to breathe. The less dissolved oxygen in the water, the more difficult it is for marine life to survive. Oxygen levels can become dangerously low (hypoxia), causing fish to leave the area or in extreme cases lead to mortality of fish and many other forms of marine life. Oxygen is depleted when nutrients such as nitrogen and phosphorous (found in road run-off, lawn fertilizers and pet wastes) run into nearby surface waters. Unnaturally high levels of nutrients lead to algae blooms. When this excessive amount of algae dies, it sinks to the bottom and is decomposed by bacteria. The bacteria consume large amounts of oxygen while decomposing the algal bloom thereby reducing the amount available for fish and other living organisms in bottom waters. Oxygen is measured using a dissolved oxygen meter and is recorded in milligrams per liter (mg/L) which is equivalent to parts per million (ppm). Table 1 explains the consequences of low dissolved oxygen levels.

Table 1: Consequences of Low Dissolved Oxygen

Dissolved Oxygen	Consequences
> 5.0 mg/L	Few adverse effects on marine life.
4.0 mg/L	Reduce survival of some crab larvae by 30%.
3.0 mg/L	Reduced growth of crabs and lobsters. Some fish start to avoid the area.
2.5 mg/L	Growth reduced in grass shrimp, summer flounder and lobster. Most fish avoid the area.
2.0 mg/L	Sharply reduced growth. Lowest safe level for many juvenile organisms.
1.5 mg/L	Very high lethal effects on fish, shrimp and lobster.
1.0 mg/L	Total avoidance by bottom fish. Very high lethal effects.
0.0 mg/L	Anoxia – Intolerable environment for nearly all marine organisms. (Zimmer 1996)

Water Temperature - The temperature of the water and salinity determines the amount of oxygen water can hold. Water temperature is measured in degrees Celsius. The warmer and/or more saline the water the less oxygen it can hold before it becomes saturated. The percent saturation is the amount of oxygen actually in the water compared to what the water can hold at that temperature and/or salinity (Dexter and Harris 1992). Algae growth is also affected by water temperature. Growth is more favorable as water temperatures rise. Temperature is measured with the dissolved oxygen meter.

Salinity - Salt content of water is the primary factor in determining the variety of marine organisms that can survive in a particular body of water. Salinity is measured in parts of salt per thousand parts of water (ppt or 0/00) (Fisher 1993). Salinity also contributes to stratification of the water; i.e., the colder more dense saline waters lie beneath the warmer less dense fresh water. This stratification can prevent oxygenated surface waters in the photic zone from replenishing bottom waters lacking dissolved oxygen. The salinity in Oyster Bay and Cold Spring Harbor is usually around 26 ppt and never above 30 ppt. In comparison, the open ocean has a salinity of 35 ppt. Fluctuations in salt content can be attributed to fresh water inputs (i.e. streams), runoff, precipitation, and tidal flushing.

Water Clarity - The clarity of the water determines the photic zone or how deep sunlight penetrates. This will determine the deepest point at which oxygen producing plants will grow. Low water clarity can also be indicative of an algae bloom. Algae blooms can reduce the amount of sunlight reaching plants attempting to grow lower in the water column. Alternatively, poor water clarity can also indicate the presence of suspended sediments, eroded soil, and/or microscopic organisms. These conditions can limit photosynthesis, inhibit the breathing of fish by clogging the gills, and adversely affect filter-feeding organisms (i.e. clams, oysters, mussels).

Coliform Bacteria - The Nassau County Department of Health and the New York State Department of Environmental Conservation use coliform bacteria levels to open or close swimming beaches and shellfish beds respectively. Coliform bacteria levels are used as an indicator of the presence of pollution and to gauge sanitary quality. Friends of the Bay, in partnership with the Nassau County Department of Health, collects samples and delivers them to the Nassau County laboratory to be analyzed.

Establishing baseline conditions will be particularly important to measure changes following the installation of a new package wastewater treatment plant for the approximately 40 homes in Oak Neck Creek and other efforts to improve water quality. The goal of this effort is to identify and correct pollution sources thereby obtaining a water quality level that supports a seasonally certified shellfishing area and improves the health of the estuary.

Enterococci – Enterococci are bacteria typically found in human and warm blooded animal feces. The presence of these bacteria in surface water is used as an

indicator of fecal contamination. Enterococci are the preferred indicator for contamination of brackish and salt water environments. Monitoring for Enterococci and coliform bacteria (the preferred indicator of fecal contamination for fresh water environments) in estuaries like Oyster Bay/Cold Spring Harbor, where salinity is variable, provides a comprehensive monitoring program for bacterial contamination.

Monitoring Locations

Friends of the Bay monitors nineteen sites throughout Oyster Bay and Cold Spring Harbor beginning at 7:30 every Monday from April through October. The locations tested are: Cold Spring Harbor Cove South, Cold Spring Harbor Cove North Mooring Field, Cold Spring Harbor South, Cold Spring Harbor North, Plum Point, Seawanhaka Yacht Club PSTP outfall, Oyster Bay Cove, Whites Creek and OB-STP outfall, Roosevelt Beach, Beekman Beach and Mill Pond outfall, West Harbor, Turtle Cove, Mill Neck Creek East, Mill Neck Creek West, Mill Neck Creek South, The Birches STP, Mill Neck Creek North (Oak Neck Creek), Mill Neck Cove, and Flower and Son's Oyster Hatchery (Bayville). Attachment I presents a map of the monitoring locations and a table containing the coordinates and descriptions of those locations. In this document, the term 'monitoring event' refers to activities associated with weekly sampling and field data collection at all nineteen sites.

Data for Each Station

Friends of the Bay measures the following parameters each week in the field at all nineteen sites: Dissolved Oxygen; Salinity; Water Temperature; and Secchi Depth. Additionally, Friends of the Bay collects samples to be analyzed for Coliform Bacteria and Enterococci each week, and for Organic Nitrogen; Total Kjeldahl Nitrogen; and Nitrate/Nitrite each month, on the first monitoring event of the month.

Water Quality Data Sheet

Volunteers will complete a water quality data sheet for each sampling location during every monitoring event. This section describes the data sheet and details regarding information to be recorded. A sample water quality data sheet is presented as Attachment II. An accompanying data sheet for calibration of the Hydrolab Quanta unit is also provided in Attachment II.

Section 1: Crew and Station

Fill in the names of the individuals doing the testing. Fill in the date of testing, station name, GPS reading, time of testing and rainfall data.

Section 2: Water and Weather Conditions

- Tidal stage information
- Water color: green, brown, etc.
- Observed surface conditions; algal bloom, oil slick, etc.
- Wave height and surface conditions: calm, white caps, etc – estimated from visual observations

- Percent of cloud cover – estimated from visual observations
- Wind speed – measured with handheld wind speed meter
- Wind direction – measured with a simple wind direction meter or estimated from visual observations
- Weather conditions – estimated from visual observations

Section 3: Water Quality Monitoring Data

Enter Dissolved Oxygen, Salinity, and Water Temperature information. Enter the depth at which the deepest measurement was recorded. The methods used to obtain this information are outlined in the Water Quality Monitoring Training Program presented in Attachment IV.

Section 4: Water Clarity Data

Measure by entering depth at which the Secchi Disk disappears and the depth at which it reappears. Average these two numbers to determine the Secchi Disk depth. Ensure that the disk does not enter the shadow of the boat. Have a different volunteer repeat this process, average the two results, and record this average as the final Secchi Disk depth.

Section 5: Comments

Any additional information about unusual conditions at the site being monitored (further explanation of surface conditions, etc)

Quality Control Procedures

Detailed Quality Control procedures for the Friends of the Bay Water Quality Monitoring Program are discussed in the program's Quality Assurance Project Plan (QAPP). Portions of these procedures are summarized below.

Equipment Calibration

Attachment III, the Hydrolab Quanta Water Quality Monitoring System Operating Manual (as revised), presents calibration procedures for the instrument. The Hydrolab Quanta will be calibrated before each monitoring event. The DO calibration will be checked via the modified Winkler titration method (See **Section 11.1** of the QAPP), and the salinity calibration will be checked following the monitoring event with the method presented in the Quanta manual (**Attachment A**).

Field QC Checks

Sampling is conducted at each monitoring station with the Hydrolab Quanta Water Quality Monitoring System. The Hydrolab Quanta will be calibrated at the beginning of each monitoring event. The salinity calibration will be checked at the end of each event. If the calibration check indicates that the instrument's calibration has drifted outside the calibration acceptance criteria, the data will be flagged and evaluated following the procedures in **Section 16** of the QAPP. The thermometer used for air temperature is checked against the Nassau County Department of Health's calibrated mercury thermometer at the beginning of each season.

DO samples will be collected and fixed in the field for 10% of the monitoring locations sampled during each monitoring event. The samples will be analyzed for

dissolved oxygen analysis via modified Winkler Titration Method. The fixed samples will be analyzed after the monitoring event via the test kit-specific procedures presented in **Attachment VIII**. An EPA document describing the Winkler Titration method for dissolved oxygen analysis is presented in **Attachment VIII**. The results of these analyses will be compared to the corresponding results from the Quanta. If this check indicates that the instrument's calibration has drifted outside the calibration acceptance criteria, the data will be flagged and evaluated following the procedures in **Section 16** of the QAPP.

A duplicate sample for bacteria will be collected at one sampling site during each monitoring event, and a duplicate sample for nitrogen will be collected at one sampling site on days when nitrogen samples are collected. The locations where duplicate samples are to be collected will be selected randomly.

The QAPP Coordinator and/or the WQM QA Officer will be present during each monitoring event. Testing is conducted and/or reviewed by one or both of these supervisory members of Friends of the Bay. These supervisors will evaluate the data using the methods presented in the QAPP. If deficiencies are found in the results or in the manner in which samples were collected, the affected data will be excluded or marked conditional, the reasons for the deficiencies will be determined, and any necessary changes regarding the sampling program (i.e. the training plan, the SOPs, the QAPP) will be made.

Laboratory QC Checks

A temperature control sample will be obtained from the Nassau County Department of Health laboratory. A distilled water blank (Method Blank) will be included for analysis during each monitoring event to identify any contamination occurring at the laboratory. This distilled water sample is also used as a temperature control to assure the bacteria samples have been maintained within the appropriate temperature range (2-10°C). The labs will also include lab control samples for each monitoring event. FOB will request this QA/QC data from the labs, which will be examined by the QAPP Coordinator or WQM QA Officer and included in FOB's records. FOB will also request nitrogen calibration data from South Mall Labs for each monitoring event.

Data Analysis QC Checks

The QAPP Coordinator and/or the WQM QA Officer will check the laboratory QA/QC data for any deviations from the Data Quality Objectives presented in Section 8.0 of the QAPP, and will calculate the Relative Percent Difference for any field duplicates and their corresponding samples using the formula presented in Section 8.1 of the QAPP if these calculations are not performed by the labs. The QAPP Coordinator and/or the WQM QA Officer will ensure that all field equipment is appropriately maintained and/or calibrated, and inspect data for any measurements indicating equipment or method malfunction.

Sampling Steps

Before leaving dock:

1. Calibrate the Hydrolab Quanta according to procedures presented the operating manual.
2. Make sure you have all required safety and monitoring equipment
3. Label 250 ml bottles for bacteria sampling with date and site number. Ensure that sterile bottles are used.
4. Label nitrogen collection bottles (if collecting nitrogen that day) with date and site number. Ensure that sulfuric acid preservative is present in nitrogen sample bottles. Be careful not to allow preservative to contact skin or eyes. Ensure that all preservative stays in the bottle.
5. Ensure that all samplers are trained according to the Water Quality Monitoring Training program presented in Appendix IV and are familiar with the "Things to Remember" document presented in Attachment VI and the Memo to Water Quality Monitors presented in Attachment VII.

When you arrive at the **first** sampling station:

1. Place temperature control sample into rack inside cooler and surround with ice

Steps for **first** and **all** subsequent sampling stations:

1. Fill in **all** weather and water condition related information on data sheet (see a sample Water Quality Data Sheet in Attachment II)
2. Remove the protective cap from the probe tip. Install probe guard.
3. Lower the probe to the bottom to measure depth of water.
4. Raise probe, making readings at ½ meter from the bottom, and 1.0 meter from the top. Make final reading at 1/2 meter below surface. Record readings at each depth after the parameter values stabilize (i.e. remain constant for several seconds).
5. Rinse the probe with distilled water, remove the guard and replace the cap, ensuring that it is filled with distilled water.
6. Lower Secchi disk into water. The measurement is taken with the sun at your back without sunglasses. Lower the disk until just after it disappears completely. Record this depth. Raise the probe until just after it becomes visible and record this depth. The average of these depths is the Secchi disk depth. Record this value. Have another volunteer repeat this process. Accept the average of these results as the Secchi Disk Depth. See the discussion at the end of this section regarding water clarity measurements.
7. Collect water sample in 250 ml bottle for bacteria testing. Samples are collected by partially immersing the sample bottle. Do not pour a sample into the sample bottle using another means. Do not touch the rim or the inside of the bottle.
8. Recap the sample bottle, making sure not to touch the inside of the cap or rim of the bottle. Place sample inside cooler and surround with ice.
9. If collecting nitrogen samples, rinse out an empty sample bottle that does not contain preservative using water from the monitoring location site, fill the empty bottle by immersing it in the water in a slightly

different spot at the monitoring location (e.g., the other side of the boat), and pour the water into the nitrogen sample bottle that contains the acid preservative. Do not overfill the empty collection bottle, which will reduce the potential for overfilling of the sample bottle and potential loss of the acid preservative. The empty sample collection bottle can be reused at each monitoring location, provided that it is rinsed out with water at each location prior to collecting the sample. Do not allow the sulfuric acid preservative to contact skin or eyes, or escape from the bottle. Recap the sample bottle and place inside cooler and surround with ice.

Make sure all required information is recorded on data sheets and proceed to the next sampling station.

At 10% of the monitoring locations, selected randomly:

1. Collect a sample to be analyzed for DO from the same location for which the Quanta was used to determine DO levels
2. Use a field dissolved oxygen kit that uses the modified Winkler Titration method to fix the dissolved oxygen content of the sample.
3. Place the sample in a cooler for analysis on shore.

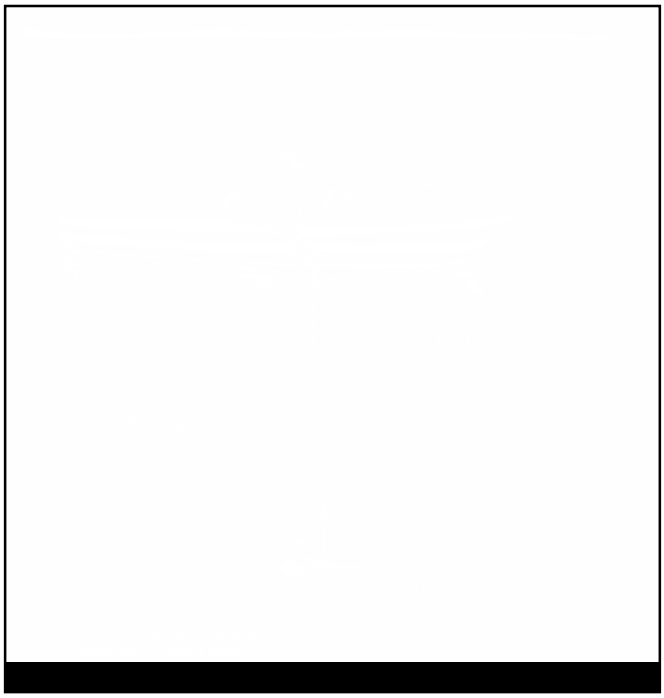
Following each monitoring event:

1. Check the salinity calibration
2. Rinse the Hydrolab Quanta with distilled water.
3. Inspect the probe DO membrane for any air bubbles, rips, wrinkles, or looseness.
4. Replace the DO membrane if necessary.
5. Allow the sensor to rest at least 4 hours (preferably overnight) before recalibrating.
6. Analyze the dissolved oxygen content of the field collected and fixed DO samples using the modified Winkler titration method.
7. If the Winkler titration and the Quanta results deviate by more than 0.5 mg/L, flag the Quanta results and implement procedures presented in **Section 16** of the QAPP.

Water Clarity

Water clarity will be monitored with: Secchi disk, 20 cm diameter, stretch-resistant line. LaMotte Chemical Products; Cat No. 0171.

Secchi disks with black and white quadrants are used to determine the limit of visibility. The lines are marked at 0.5 meter intervals up to 20 meters. Additional markings at 0.1 meter intervals (of a different color from the 1.0 meter marks) will be added by Friends of the Bay up to seven meters of line for measuring either water depth or Secchi depth. If a monitor reports that they are using more than seven meters of line, markings at 0.1 meter intervals will be added for the required length. The accuracy of the depth markings will be checked before initial use and during QA sessions thereafter.



Volunteer Responsibilities

Each monitoring event will consist of an FOB Volunteer boat captain, the water quality monitoring coordinator, QAPP coordinator (when different from WQMP coordinator) and at least one volunteer monitor. The responsibilities of each are described below.

Boat Captain

The boat captain is chiefly responsible for the safe operation of the boat. This entails:

- ✓ Maintaining the boat and engine according to the owner's manual. This includes, but is not limited to, checking the oil and re-fueling the boat.
- ✓ Checking to make sure all required safety equipment is on board before each monitoring event.
- ✓ Operating the boat in a safe manner while transporting the crew to the sampling stations. If the boat captain feels weather or water conditions are unsafe the monitoring event will be canceled or ended early.

Individuals using Friends of the Bay boat "*Baywatch*" must be approved by the organization's Executive Director. Criteria for approving boat captains is based on demonstrated experience operating an outboard motorboat and/or a certificate of completion of a safe boating course.

The WQMP Coordinator

The WQMP coordinator is chiefly responsible for the operation of the monitoring equipment. This entails:

- ✓ Checking that all necessary equipment is on board before the monitoring event. (see checklist below).

- ✓ Ensuring equipment is clean and in good working order.
- ✓ Operating the equipment and taking measurements.
- ✓ Recording the measurements (with the assistance of a volunteer or the boat captain).
- ✓ Assist with vessel operation as instructed by the boat captain.
- ✓ Collect bacteria samples.
- ✓ Collect Nitrogen samples (once a month).
- ✓ Take Secchi readings.

Volunteer Monitors

- ✓ Assist with the operation of the monitoring equipment.
- ✓ Assist with recording measurements.
- ✓ Collect bacteria samples.
- ✓ Collect nitrogen samples (once a month).
- ✓ Take Secchi readings.

Volunteer monitors do not require scientific experience, just a willingness to learn.

Equipment Checklist

Safety Equipment

The following safety equipment is required by the United States Coast Guard. Friends of the Bay has added additional safety features.

- o Personal Floatation Devices (PFD)
  - o One Type II (or equivalent) Personal Floatation Device (PFD or life jacket) for each passenger. *Baywatch II* should be equipped with 10 PFD's the boat's maximum capacity.
  - o One Type IV (throwable) PFD
- o Fire Extinguisher - One B-1 (hand-held portable) Fire Extinguisher
- o Sound Producing Device Air horn
- o Visual Distress Signals
  - o Flares for night
  - o Red or orange flags for daylight
- o Anchor and Anchor Line - *Baywatch II* has a Danforth Anchor with 60' of line
- o Alternate Propulsion - an oar is carried on *Baywatch II*
- o Dewatering Device - a scoop bucket as a back-up to a bilge pump
- o First aid kit - located in the bench aboard *Baywatch II*
- o Sunblock
- o Insect Repellant
- o Personal Identification
- o Emergency Contact Information Sheet
- o Cellular Phone
- o Rubber Gloves

Clothing

- o Appropriate footwear
- o Hat
- o Raingear

- Cold weather gear

Monitoring Equipment

- Copy of this Standard Operating Procedures Manual.
- Hydrolab Quanta Water Quality Monitoring System, including system operating manual.
- Winkler Titration field kit and sample bottles.
- Thermometer, measuring in °Centrigrade.
- Global positioning system to ensure accurate positioning.
- Secchi disk attached to non stretch line with 1.0 meter and 0.1 meter markings.
- Probe platform.
- Binder with 19 daily monitoring sheets and 2 bacteria sampling logs.
- 20 250-ml bottles for obtaining bacteria samples.
- 20 sulfuric acid-preserved bottles for Nitrogen Samples and 1 empty, unpreserved bottle for nitrogen sample collection , if necessary
- Trip Blank
- Distilled water.
- Calibration check solutions.
- Cooler with ice for storage and transport of bacteria samples.
- Writing utensils.
- "Sharpie" permanent marker
- Wildlife Guides
- Gauge for determining wind speed and direction.

Attachment I

Water Quality Monitoring Locations

Attachment I: Water Quality Monitoring Locations

	Site Number	Sampling Site/Name Identification	Site Descriptions	Latitude	Longitude
Cold Spring Harbor	FB-1	South Cold Spring Harbor Cove	50 yards off last dock in Cold Spring Harbor, just south of Whalers Yacht Club Slips.	40°51'45"	073°27'51"
	FB-2	CSH Cove North Mooring Field	Cove just north-east of Powell's Marina, east of large sand bar and small mooring field	40°52'09"	073°27'48"
	FB-3	CSH South	200 yards west of Cold Spring Harbor mooring field; mid channel between Mobil Oil Terminal and orange brick house	40°52'22"	73°28'25"
	FB-4	CSH North	Center of CSH, south-east of Plum Point; just north of Charles Wang's dock	40°53'47"	73°29'08"
Oyster Bay Harbor	FB-5	Plum Point	Off Plum Point, 110 yards south of Red Nun "4"	40°54'04"	73°30'23"
	FB-6	Seawanhaka Yacht Club PSTP outfall	Out fall is located at pink buoy. Station 200 years off boat yard dock.	40°54'05"	073°30'42"
	FB-7	Oyster Bay Cove	Center of cove 100 yards south-west of Mr. Yampole's pier	40°52'31"	073°30'25"
	FB-8	Whites Creek and OB-STP outfall	100 yards east of Commander Oil dock	40°52'31"	073°31'17"
	FB-9	Roosevelt Beach	Approx. 200 yards offshore and in line with flagpole at Roosevelt Park.	40°52'45"	073°31'53"
	FB-10	Beekman Beach and Mill Pond outfall	Mid Channel between mooring field and finger piers, 100 yards off shore.	40°52'40"	073°32'24"
	FB-11	West Harbor	Midway between east and west shores, off large white house on North western shore	40°53'52"	73°32'11"
	FB-12	Turtle Cove	110 yards west of canal	40°54'44"	073°31'41
Mill Neck Creek	FB-13	Mill Neck Creek-East	Mill Neck Creek, south of yellow house and wall	40°54'00"	73°33'43"
	FB-14	Mill Neck Creek -West	Confluence of Oak Neck Creek and Mill Neck Creek	40°53'56"	73°34'03"
	FB-15	Mill Neck Creek- South	As far south towards Beaver Dam in Oak Neck Creek as tidal stage allows.	40°53'32"	73°34'04"
	FB-16	Mill Neck Creek-North	As far North in Mill Neck Creek as tidal stage allows to steel pillared dock.	40°53'57"	073°34'18"
	FB-17	The Birches STP	North-west most channel past steel pillared dock in Mill Neck Creek.	40°54'10"	073°34'50"
	FB-18	Mill Neck Cove	North most point which tide will allow	40°54'20"	073°33'20"
	FB-19	Flowers Oyster Hatchery	10 feet south of warning buoy marking shellfish racks.	40°54'15'	073°33'04"

Attachment II

Water Quality Data Sheet and Hydrolab Quanta Calibration Sheet

Attachment III

Hydrolab Quanta Manual

Water Quality Monitoring System

Operating Manual
February 2002
(Revision C)

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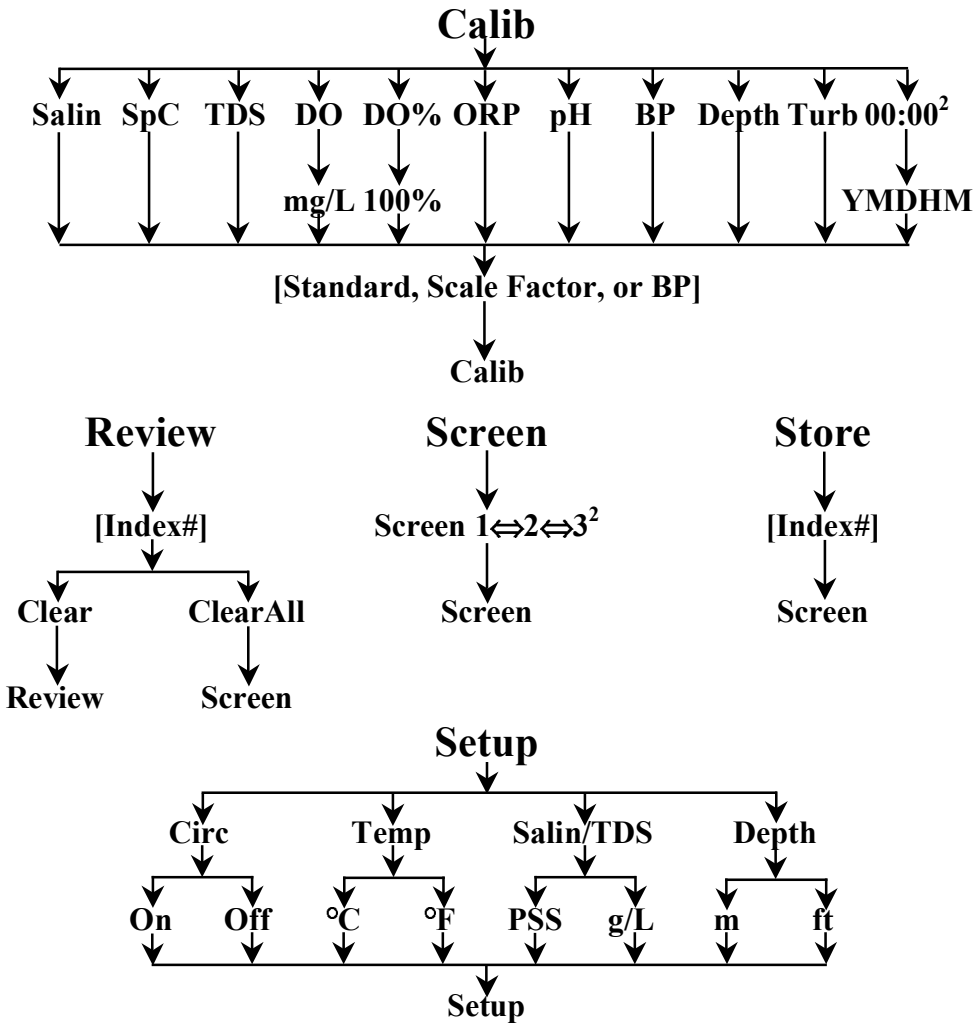
Quanta Display Operations Tree



***Notes*:**

1. Pressing the **Esc ∞** key always exits to the previous operation level except at the top level where it toggles the circulator on or off.
2. RTC calibration (**Calib ➔ 00:00**) and **Screen 3** are only available if the RTC/PC-Dump option is installed.
3. If the RTC/PC-Dump option is installed, pressing and holding the **Esc ∞** key down during power-up causes the Quanta Display to enter PC-Dump mode.

Table of Contents

1 INTRODUCTION

1.1 Foreword

The Hydrolab Quanta Water Quality Monitoring System includes a sensor package (the Transmitter) and an optional data package (the Display). For this manual, the Quanta System will refer to the combination of the Transmitter and the Display.

The Quanta Transmitter includes sensors for temperature, pH, dissolved oxygen (DO), specific conductance (SpC), depth, oxidation-reduction potential (ORP), turbidity, salinity, and total dissolved solids (TDS). In-situ measurements can be made in lakes, rivers, streams, process pipes, bays, estuaries, tanks, aquaria, sewers, or other large or small water bodies. Highly portable and field-worthy, it can be used for profiling, sampling, and long- or short-term monitoring. The Transmitter can be connected to the Display or any SDI-12 receiving device, including data loggers, data collection platforms, and other monitoring instruments.

The Quanta Display includes battery power and a liquid-crystal screen for viewing up to five parameters at one time. The Display is also used for configuring and calibrating the sensors and can store up to 200 data frames. The Display's RTC/PC-Dump option stamps each data frame with date-time and dumps all data frames in a comma-separated value (CSV) format for easy import into spreadsheet or database programs.

1.2 Specifications

Performance Specifications

	Range	Accuracy	Resolution
Temperature	-5ºC to 50ºC	±0.2ºC	0.01ºC
Dissolved Oxygen	0 to 50 mg/L	±0.2 mg/L ≤ 20 mg/L ±0.6 mg/L > 20 mg/L	0.01 mg/L
Specific Conductance	0 to 100 mS/cm	±1% of reading ±1 count	4 digits
pH	2 to 12 units	±0.2 units	0.01 units
ORP	-999 to 999 mV	±25 mV	1 mV
Vented Depth (10m)	0 to 10 m	±0.003 m (±0.01 ft)	0.001 m
Depth (25m)	0 to 25 m	±0.1 m	0.1 m
Depth (100m)	0 to 100 m	±0.3 m	0.1 m
Turbidity	0 to 1000 NTU	±5% of reading ±1 NTU	0.1 NTU < 100 NTU 1 NTU ≥ 100 NTU
Salinity	0 to 70 PSS	±1% of reading ±1 count	0.01 PSS

Instrument Specifications

Quanta Transmitter

Diameter:	7.6 cm (3 in)
Length:	22.9cm (9 in)
Weight:	1.2 kg (2.6 lbs)
Maximum Submersion:	100 m (328 ft)
Operating Temperature (non-freezing):	-5ºC to 50ºC
Operating Voltage Range:	7 to 14 VDC

Quanta Transmitter

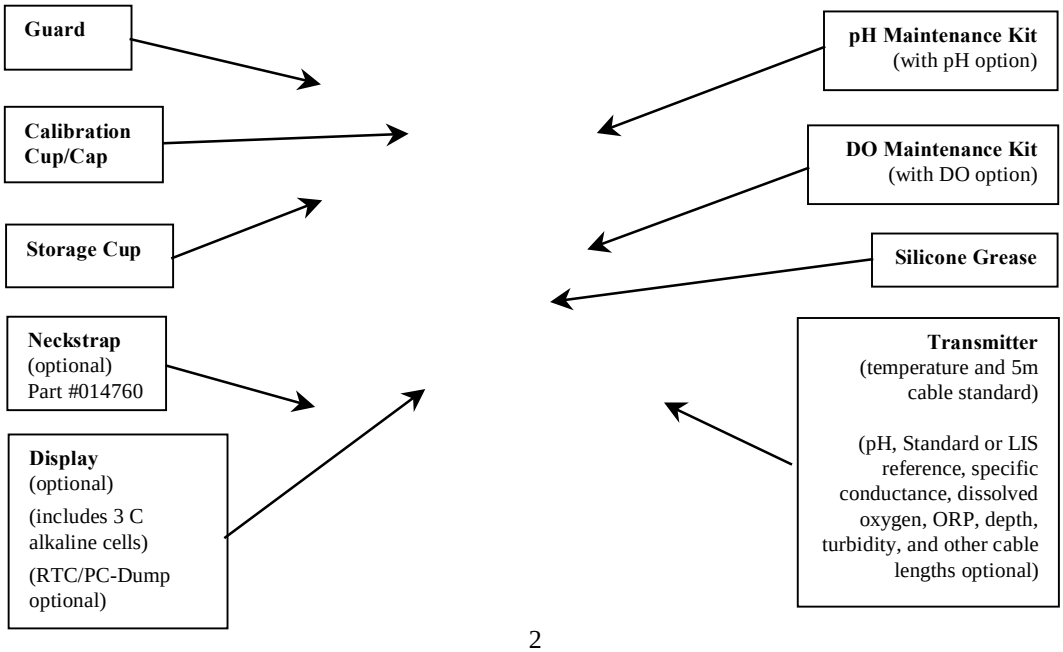
SDI-12 Standby Current (@+12VDC, without turbidity):	< 350 µA
SDI-12 Standby Current (@+12VDC, with turbidity):	< 700 µA
Operating Current (circulator off @+12VDC, without turbidity):	< 40 mA
Operating Current (circulator off @+12VDC, with turbidity):	< 90 mA
Operating Current (circulator on @+12VDC, without turbidity):	< 90 mA
Operating Current (circulator on @+12VDC, with turbidity):	< 140 mA

Quanta Display

Screen Size (diagonal):	8.9 cm (3.5 in)
Width (screen section):	12.7 cm (5 in)
Width (handle section):	6.4 cm (2.5 in)
Length:	26.9cm (10.6in)
Weight (with batteries):	0.95 kg (2.1 lbs)
Operating Temperature (non-freezing):	-5ºC to 50ºC
Batteries:	3 C Alkaline
Battery Life (circulator on, without turbidity):	> 20 hours
Battery Life (circulator on, with turbidity):	> 13 hours
Memory (1 frame stores all parameter values):	200 data frames (Non-volatile FLASH)
Waterproof Rating:	NEMA 6 (IP67)
Real-Time Clock Life	> 10 years
Real-Time Clock Accuracy (@ 25°C)	±2 minutes per month

1.3 Components

The following picture identifies the main components of a Quanta System. The Quanta System is a configurable product and not all components shown are included with every system.



The Quanta System ships in a custom reusable box and also includes this manual and MSDS datasheets. If the Transmitter includes the optional Vented Depth, the cable also includes a dryer assembly. If the Display includes the optional RTC/PC-Dump, the Quanta Display/PC Interface Cable is also included. Optional accessories, not shown, are a Secchi Disk (part #014180), a Backpack (part #014770), a FlowCell (part #014200), an SDI-12 Interface Adapter (part #014190), and Turbidity Quick-Cal Cube™ (part #014250).

1.4 Assembly

1.4.1 Quanta System Assembly

To assemble your Quanta System, simply uncap the Display connector and connect the Transmitter cable connector to the Display connector. These connectors are keyed for proper alignment (don't force them). The retaining ring will make a 'click' when rotated to the correct position to capture the connectors.

Press the Display's **O|I** key (on/off) and the LCD shows the Display and Transmitter software revisions. The LCD's index digits (see Section 2.1.2) count up from '*L0*' up to '*L9*' as the Display searches SDI-12 addresses for the Transmitter. After finding the Transmitter's SDI-12 address(es), the LCD's parameter digits show the Display and Transmitter software revisions and the index digits count up as the Display interrogates for Transmitter configuration. After a few seconds, the LCD begins showing current Transmitter data. If not, please refer to Section 7.

Notes:

- The Display and Transmitters software revisions show as '*d A.B*', '*S C.D*', and '*U E.F*' where '*d*' is the Display's software revision, '*S*' is the Transmitter's software revision for non-turbidity measurements, and '*U*' is the Transmitter's software revision for turbidity measurements.

1.4.2 Transmitter/SDI-12 Datalogger Assembly

To assemble your Transmitter to your SDI-12 datalogger, simply connect the Transmitter cable connector to the SDI-12 Interface Adapter connector. These connectors are keyed for proper alignment (don't force them). The retaining ring will make a 'click' when rotated to the correct position to capture the connectors. With power off, connect the bare wires at the end of the SDI-12 Interface Adapter to the appropriate connections on your SDI-12 datalogger. The label on the SDI-12 Interface Adapter shows its wire colors/SDI-12 functions. Please consult your datalogger manual for its connection details.

To test the SDI-12 communications, apply power to the datalogger and enter its transparent mode. Issue the '*a*I!' command, where '*a*' is the Transmitter's SDI-12 address, to request the identification of the Transmitter. A properly connected Transmitter will respond with its address, manufacturer name, product name, and SDI-12 revision. If not, please refer to Section 7. Section 6 contains complete details on the Transmitter's SDI-12 capabilities.

Notes:

- All five wires (three grounds) must be connected for correct SDI-12 operation.

- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.

1.5 Introductory Exercise

1.5.1 Calibrating Specific Conductance using the Display

Assemble the Quanta System as described in Section 1.4.1. Turn on the System by pressing the Display's **O|I** (on/off) key. If the circulator is on, press the **Esc** ∞ (escape/circulator) key (or **Esc** key on early production models) to toggle the circulator off, so that it doesn't splash your calibration standard.

Next, install the Calibration Cup on the Transmitter. With the Transmitter sensors pointing up (towards the ceiling), fill the Calibration Cup with a specific conductance calibration standard. Wait for the specific conductance readings to stabilize in the calibration solution, which may require one or two minutes.

After power-up, the Display's **Screen** icon, in the lower center of the screen, is blinking. Press either of the ◄▲ or ▼► (arrow) keys to cause **Calib** (calibrate) to blink instead of **Screen**. Press the ↵ (enter) key to select calibration. Use the ◄▲ or ▼► keys to cause **SpC** (specific conductance) to blink, and press the ↵ key.

Next, use the ◄▲ or ▼► keys to raise or lower the specific conductance reading to match the calibration standard in mS/cm. Press the ↵ key to finish calibration of specific conductance. If the Transmitter accepts the calibration, the Display returns to the **Calib** screen. If the Transmitter rejects the calibration, the Display LCD shows '**FAIL**' before returning to the **Calib** screen. Press **Esc** ∞ to return to the real-time data screen. Now, check the specific conductance value to confirm calibration.

1.5.2 Calibrating Specific Conductance with an SDI-12 Datalogger

Assemble the Transmitter and SDI-12 datalogger as described in Section 1.4.2. Using the datalogger's transparent mode, issue the '*a*X1!' command to turn the Transmitter's sensors on. If the circulator is on, issue the '*a*XSS0!' command to turn the circulator off, so that it doesn't splash your calibration standard.

Next, install the Calibration Cup on the Transmitter. With the Transmitter sensors pointing up (toward the ceiling), fill the Calibration Cup with a specific conductance calibration standard. Wait for the specific conductance readings to stabilize in the calibration solution, which may require one or two minutes. Monitor the current specific conductance value by issuing the '*a*R0!' command repeatedly. The specific conductance value is the third data value displayed in the SDI-12 response.

Issue the '*a*XCC+*value*!' command, with *value* being the numeric value of the calibration standard in mS/cm, to finish the calibration of specific conductance. Now, issue the '*a*R0!' command and

check the specific conductance value to confirm calibration. Finally, issue the '*a*X0!' command to turn the Transmitter's sensors off and, if needed, issue the '*a*XSS1!' command to turn the circulator back on.

Notes:

- Both the sensors and the circulator must be turned on for the circulator to operate.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.

1.6 Important Note

Although you have now performed the basic operations available on the Quanta System and/or Quanta Transmitter/SDI-12 datalogger, please read Sections 2 and 3 to discover the Quanta System's other features and Sections 3 and 6 to discover the Quanta Transmitter's other SDI-12 capabilities. Be sure to read Section 3, since only a well-maintained and carefully calibrated instrument will provide quality data.

2 QUANTA DISPLAY

2.1 Components

The following picture identifies the main components of a Quanta Display.

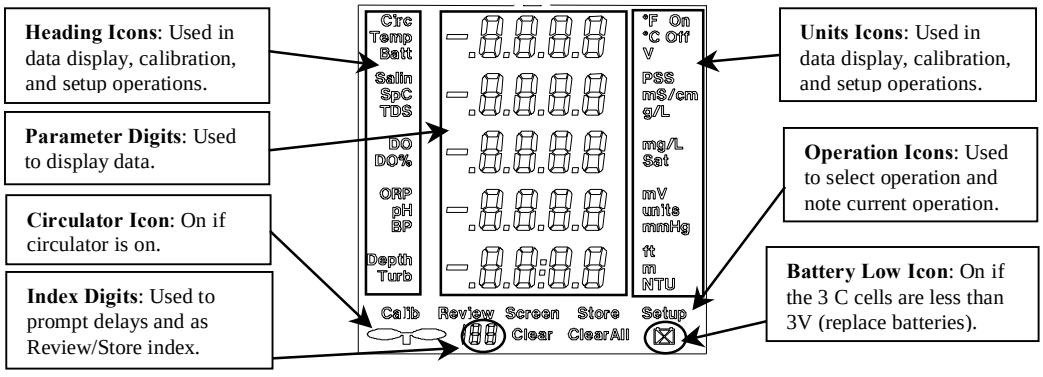
2.1.1 Contrast Control

The Contrast Control is accessed by pressing the Lens down slightly and twisting counterclockwise to disengage the bayonet. Adjust the Contrast Control to suit lighting conditions, thermal conditions, and personal preference. Reattach the Lens by first insuring the o-ring is in the groove around the outside of the Lens. Then align the bayonet, press down slightly, and twist clockwise until you feel the bayonet engage.

Warning: If the o-ring is on the main housing when the Lens is installed, the Display will not properly seal. Severe damage to the Display can occur if water leaks into the main housing.

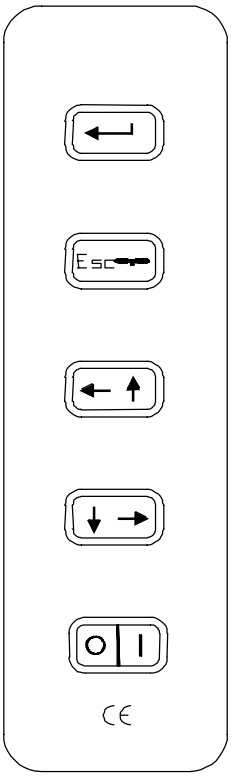
2.1.2 LCD

The Display's LCD provides all the visual information for the Quanta System. The following picture shows all the segments used in operating the Quanta Display.



2.1.3 Keypad

The Quanta Display only uses five keys and their functions are defined as follows:



↵ **Enter:** Pressing ↵ executes the action of the blinking icon.

Esc ∞ **Escape/Circulator:** Pressing **Esc** ∞ returns to the previous operation without executing anything. At the top level, pressing **Esc** ∞ toggles the circulator on or off. If the RTC/PC-Dump option is installed, pressing and holding the **Esc** ∞ key down during power-up causes the Quanta Display to enter PC-Dump mode.

◄▲ **Left/Up:** For menu operations, ◄▲ moves the blinking icon left or up as required by the current menu. For numeric operations, ◄▲ increments the number based on an acceleration algorithm.

▼► **Down/Right:** For menu operations, ▼► moves the blinking icon down or right as required by the current menu. For numeric operations, ▼► decrements the number based on an acceleration algorithm.

O|I **On/Off: O|I** will turn the display on if currently off. If currently on, pressing and holding **O|I** until the index digits count down to zero, will turn the display off. If turning off, the current operation is aborted.

Note: Each key press produces an audible tone for user feedback.

2.1.4 Batteries

To access the batteries, remove the Battery Cap using a coin. Tilt the Display and the three spent C cells will easily slide out. Inspect the o-ring and o-ring surface and clean if necessary. Insert three brand-new alkaline C cells, positive terminal first and reattach the Battery Cap using a coin. The Display may turn on as a result of battery installation, but this is normal.

Note:

- Changing batteries does not affect stored data frames or the real-time clock. Data frames are stored in non-volatile FLASH memory and do not require batteries for data retention. The RTC/PC-Dump option includes a lithium battery for maintaining the real-time clock.
- Hydrolab recommends high-quality alkaline batteries to provide the maximum operating time. Other C cells can be used (i.e., rechargeable NiCad, rechargeable NiMH, etc.), but

shorter operating time may result. All three C cells must be of the same type and brand and total battery voltage must not exceed 5V.

- Without turbidity installed, the Quanta System provides at least 20 hours of continuous operation at 20°C on one set of brand-new Duracell® brand alkaline C cells.
- With turbidity installed, the Quanta System provides at least 13 hours of continuous operation at 20°C on one set of brand-new Duracell® brand alkaline C cells.
- Derate 25% for operation at 0°C.
- Dispose of spent cells properly.

2.1.5 Neckstrap

The optional Neckstrap (part #014760) is installed on the Display using two 'D' rings in the 'ears' located on the back of the main housing. To install, place the 'D' rings in the strap loops and align with the holes in the 'ears' on the main housing. Squeeze shut with a pair of large needle-nose pliers. Wear the Display with Neckstrap and adjust the buckles until comfortable.

Warning: The 'D' rings and/or 'ears' may breakaway during a sharp tug on the Display. This breakaway is a safety feature. The operator must use extreme caution while using the Neckstrap to prevent injury to the neck or from loss of balance.

2.1.6 RTC/PC-Dump

The optional RTC/PC-Dump is factory installed inside the Display. If installed, the bottom row in the Parameter Digits shows "CL:PC" during display of the software revisions at power-up. The RTC/PC-Dump option stamps each data frame with date-time and dumps all data frames in a comma-separated value (CSV) format for easy import into spreadsheet or database programs.

Note:

- The real-time clock maintains date-time through 31-Dec 2099 23:59:59, including leap years.
- Daylight Savings Time is not supported.

If the RTC/PC-Dump option is purchased, the Quanta Display/PC Interface Cable is also included. During PC-Dump, the 4-pin male connector attaches to the connector on the Quanta Display and the 9-pin female 'D' connector plugs into PC RS232 port with a 9-pin male 'D' connector.

2.2 Operations

After power-up, the Heading Icons, Parameter Digits, and Units Icons display real-time data provided a Transmitter is connected. Also, the top row of Operation Icons is on with the **Screen** icon blinking. The Circulator and Battery Low icons show the circulator and battery status on this and all other operation screens. **Exception**: During data review, the Circulator icon shows the circulator state at the time the data was stored.

By pressing the ◄▲ or ▼► keys, the blinking moves to a different icon. If you press ↵ , you select the operation associated with the blinking icon. Using the ◄▲, ▼►, and ↵ keys, to move to and select an operation is called selecting the operation. If you accidentally select an undesired operation, press **Esc** ∞ to return to the previous operation.

Note:

- If no Transmitter is connected, the Parameter Digits show dashes.
- See the inside front cover of this manual for a graphical Operations Tree.
- The Display automatically powers off if no keys are pressed for 30 minutes.

2.2.1 Screen

After power-up, the Heading Icons, Parameter Digits, and Units Icons display real-time data containing temperature, specific conductance, DO (mg/L), pH, and depth. This screen is called **Screen 1**.

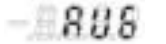
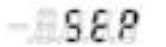
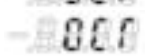
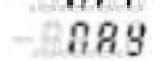
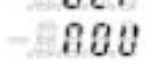
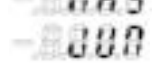
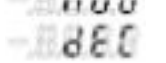
Selecting the **Screen** icon toggles the real-time display to show battery voltage, salinity or TDS, DO (%Saturation), ORP, and turbidity. This screen is called **Screen 2**.

Selecting the **Screen** icon again toggles the real-time display to show day, month, year, hours, and minutes. This screen is called **Screen 3**. Selecting the **Screen** icon again toggles the real-time display back to **Screen 1**.

Screen 1 can be configured to display temperature in °C or °F and depth in m or ft. **Screen 2** can be configured to display salinity or TDS. Section 2.2.2 describes these Setup operations.

Note:

- If no Transmitter is connected, the Parameter Digits show dashes.
- If the Transmitter was purchased without one or more parameters, then the missing parameters' heading, digits, and units are blank.
- If the Display was purchased without the RTC/PC-Dump option, **Screen 3** is not displayed and selecting the **Screen** icon from **Screen 2** toggles the real-time display back to **Screen 1**.
- **Screen 3** displays real-time clock data as day, month, year, hour, and minute. Seconds are not displayed, but are included with PC-Dump data. The hours and minutes are in 24-hour format (00:00 – 23:59). The months are represented as:

Month	Display	Month	Display
January		July	
February		August	
March		September	
April		October	
May		November	
June		December	

2.2.2 Setup

Selecting the **Setup** icon allows setup, or configuration, of circulator state, temperature units, salinity or TDS display, and depth units. After selecting **Setup**, only the **Setup** icon will remain lit from the Operation Icons and the Parameter Digits will blank. The Headings Icons display the configurable options and the Units Icons will display the current setup.

From the displayed Headings Icons, select the configuration to be changed. Now, all Headings and Units Icons except the selected one will blank. The Units icons show the configuration options available. After selecting the configuration desired, the Display returns to the **Setup** screen.

The following configurations are available:

Setup	Default	Alternate
Circulator	On	Off
Temperature	°C	°F
Salinity/TDS	Salinity in PSS	TDS in g/L
Depth	m	ft

Notes:

- All configurations are stored in the Transmitter and retrieved by the Display during power-up.
- Pressing **Esc** ∞ while displaying **Screen 1**, **Screen 2**, or **Screen 3** will toggle the circulator state without accessing **Setup**.

2.2.3 Calib

Selecting the **Calib** icon allows calibration of salinity, specific conductance, TDS scale factor, DO, ORP, pH, barometric pressure (BP), depth, turbidity, and date-time. After selecting **Calib**, only the **Calib** icon will remain lit from the Operation Icons and the Parameter Digits and the Units Icons will blank. The Headings Icons will display the items that can be calibrated.

From the displayed Headings Icons, select the item to be calibrated. Now, all Headings and Units Icons except the selected one will blank. The Parameter Digits show the current value for the item selected. Press the ◄▲ or ▼► keys to change the numeric value to match the calibration standard. Once the value is correct, press the ↵ key to send the updated calibration value to the Transmitter or Display. If the Transmitter or Display accepts the calibration, the Display returns to the **Calib** screen. If the Transmitter or Display rejects the calibration, the Display LCD shows '**FAIL**' before returning to the **Calib** screen. Press **Esc** ∞ to return to **Screen 1**. Now, review **Screen 1**, **Screen 2,** and/or **Screen 3** to confirm calibration.

Some calibrations require multiple values. After updating the first value and pressing ↵, the second value starts blinking. Update it and press↵ . Repeat for all values to complete calibration.

The following calibrations are available:

Calibration	First Value	Second Value	Third Value	Fourth Value	Fifth Value
Salinity	PSS	-	-	-	-
Specific Conductance	mS/cm	-	-	-	-
TDS	Scale Factor (0.64 default)	-	-	-	-
DO/BP	mg/L	mmHg	-	-	-
DO%/BP	100% (fixed)	mmHg	-	-	-

Calibration	First Value	Second Value	Third Value	Fourth Value	Fifth Value
ORP	mV	-	-	-	-
pH	units	-	-	-	-
Barometric Pressure (BP)	mmHg	-	-	-	-
Depth	m or ft	-	-	-	-
Turbidity	NTU	-	-	-	-
Date-Time	Year	Month	Day	Hour	Minute

Notes:

- Holding the ◄▲ or ▼► keys causes the numeric rate of change to accelerate.
- Calibrating salinity or specific conductance causes calibration of salinity, specific conductance, and TDS.
- Calibrating TDS only changes the TDS scale factor.
- Calibrating DO mg/L or DO %Saturation causes calibration of DO mg/L, DO %Saturation, and barometric pressure.
- Calibrating barometric pressure updates the barometric pressure used in calculating DO %Saturation without changing the DO calibration.
- pH is a two-point calibration. A pH standard between 6.8 and 7.2 is treated as the "zero" and all other values are treated as the "slope". First calibrate "zero", then calibrate "slope".
- Turbidity is a two-point calibration. A turbidity standard of 0.0 is treated as the "zero" and all other values are treated as the "slope". First calibrate "zero", then calibrate "slope".
- If the RTC/PC-Dump option was purchased, date-time calibration sets the real-time clock inside the Display and seconds are set to '00'.

2.2.4 Store

Selecting the **Store** icon causes the Display to capture the current real-time data frame for storage to its non-volatile FLASH memory. A data frame includes all current data values and circulator state on **Screen 1**, **Screen 2**, and **Screen 3**. After selecting **Store**, only the **Store** icon remains lit from the Operation Icons. The Headings Icons, Parameter Digits, and the Units Icons toggle between **Screen 1** and **Screen 2** and show the data frame to be stored. The Index Digits show the index of the location where the data frame is to be stored.

If the data frame is correct, note the index for later reference and press ↵ to store the data frame and return to **Screen 1**. Press **Esc** ∞ to return to **Screen 1** without storing the data frame.

Note:

- The Display can store up to 200 data frames ranging from index '00' to '199'.
- An index of '--' is displayed in the Index Digits if the memory is full.
- '**FAIL**' will be momentarily displayed in the Parameter Digits if the data frame could not be stored, most likely due to a full memory.
- If the RTC/PC-Dump option was not purchased, **Screen 3** is not stored with the data frame.
- **Screen 3** is not displayed during **Store** to allow easier data frame verification.

2.2.5 Review

Selecting the **Review** icon causes the Display to display data frames previously stored using the **Store** operation. After selecting **Review**, only the **Review** icon remains lit from the Operation Icons. The Headings Icons, Parameter Digits, and the Units Icons toggle between **Screen 1**, **Screen 2**, and **Screen 3** for the data frame with the lowest index. The blinking Index Digits show the index of the displayed data frame.

Press the ◄▲ or ▼► keys to review other data frames. Press **Esc** ∞ to return to **Screen 1**. Pressing ↵ selects the indexed data frame for erasure using the **Clear** operation. All data frames can be erased using the **ClearAll** operation.

Note:

- When at the highest or lowest index, pressing the ◄▲ or ▼► keys cause the Display to respectively "wrap-around" to the lowest or highest index.
- If no data frames are stored when **Review** is selected, '--' will appear in the Index Digits and the Parameter Digits will be blank.
- If the Display was purchased without the RTC/PC-Dump option, **Screen 3** is not displayed.

2.2.5.1 Clear and ClearAll

From the Review operation, pressing ↵ causes the Index Digits to stop blinking and the **Clear** and **ClearAll** icons to appear. Selecting the **Clear** icon causes the Display to erase the indexed data frame and return to the **Review** operation indexed to the next data frame. If the erased indexed data frame was the last data frame, the Display will return to **Screen 1**.

Selecting the **ClearAll** icon causes the display to erase all data frames and return to **Screen 1**.

Warning: Exercise extreme caution when accessing the **ClearAll** operation. There is no undo operation and up to 200 valuable data frames could be lost!

2.2.6 PC-Dump

The PC-Dump feature dumps all data frames in a CSV format for easy import into spreadsheet or database programs. A PC is required with an available 9-pin 'D' male RS232 COM port and must be loaded with serial communications software (e.g., HyperTerminal®).

Note:

- The PC-Dump feature is only available if the RTC/PC-Dump option was purchased.

To setup PC-Dump, turn the PC on and launch the communications software. Configure the communications software to use the available COM port and configure the COM properties to:

Port Settings	Value
Bits per second	1200
Data bits	7
Parity	Even
Stop bits	1
Flow-control	None

Connect the 9-pin 'D' female RS232 connector on the Quanta Display/PC Interface cable to the available 9-pin 'D' male RS232 COM port. With the Quanta Display off, connect the 4-pin male connector on the Quanta Display/PC Interface cable to the 4-pin female connector on the Quanta Display.

To enter PC-Dump mode, make sure the Quanta Display is off. Press and hold the **Esc ∞** key, then press the **O|I** key. When all segments on the LCD are on, release the **Esc ∞** key. The Parameter Digits display "OPEN CSV FILE PUSH ESC" confirming PC-Dump mode.

Start capture text in the serial communications software. To easily import into spreadsheets (e.g., Excel®), give the capture text file a ".CSV" extension.

Press the **Esc ∞** key to start the data transfer. The Parameter Digits display "DISP -- PC" to confirm transfer in progress. The Display transmits a header line containing column labels for all possible data values. Next, the Display transmits a data line for each data frame stored. If a data frame is empty, no data line is transmitted. During transmission, the Index Digits update to reflect the index of the data frame currently being transmitted. The Parameter Digits display "SAVE CSV FILE PUSH ESC" after all data has been transmitted.

Stop capture text in the serial communications software. Press the **Esc ∞** key and the Display powers down.

From the file manager, double-click the captured text file with the ".CSV" extension to launch your spreadsheet program and open the file. Alternately, within the spreadsheet's file open operation, select file type of text files (i.e., *.csv) and open the captured text file with the ".CSV" extension. The resulting worksheet contains a copy of the Quanta Display's memory and is ready for analysis.

If using Microsoft Windows® and HyperTerminal®:

- Microsoft Windows® includes serial communications software called HyperTerminal®. The HyperTerminal® folder can opened from the *Desktop* via *Start:Programs:Accessories: HyperTerminal*. Double-click on the *Hypertrm.exe* icon to launch HyperTerminal®.
- The available COM port is selected under the *File:Properties* menus and choosing the *Connect using* option. The port settings are accessed via the *Configure* button under the *Connect using* option.
- If you change COM port settings, you generally have to *Disconnect* and *Connect* for the new settings to take affect.
- The COM port selection and settings can be saved and opened under *File* menu.
- The text capture function is started and stopped under the *Transfer:Capture Text…* menu.

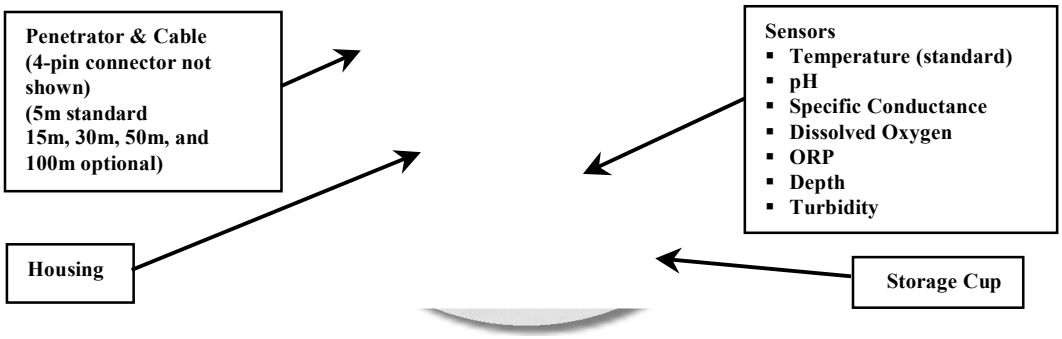
2.3 Display Care

The Display should be kept as clean as possible, especially of grit and grease. Wash the Display with soap and water as needed. The Display should be stored between –5°C and 50°C.

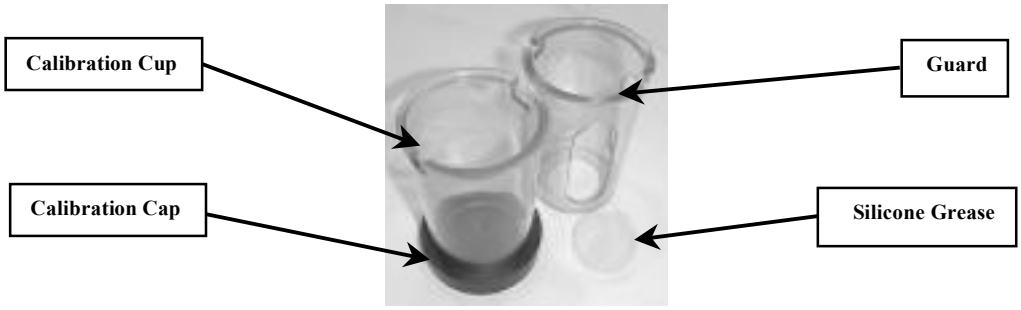
3 QUANTA TRANSMITTER

3.1 Components

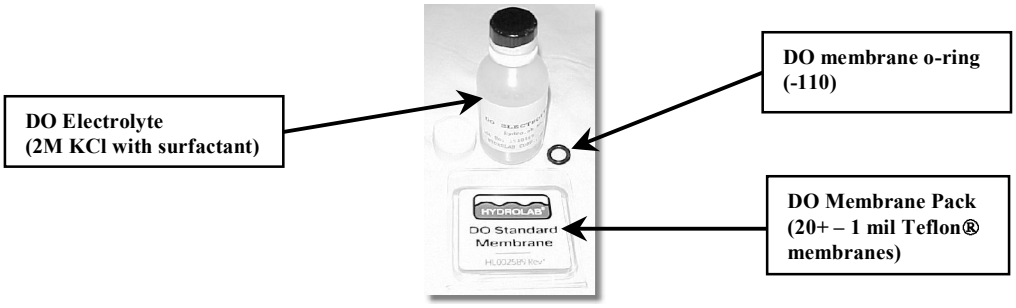
The following pictures identify the main components of a Quanta Transmitter and maintenance items supplied with each Quanta Transmitter.



Quanta Transmitter



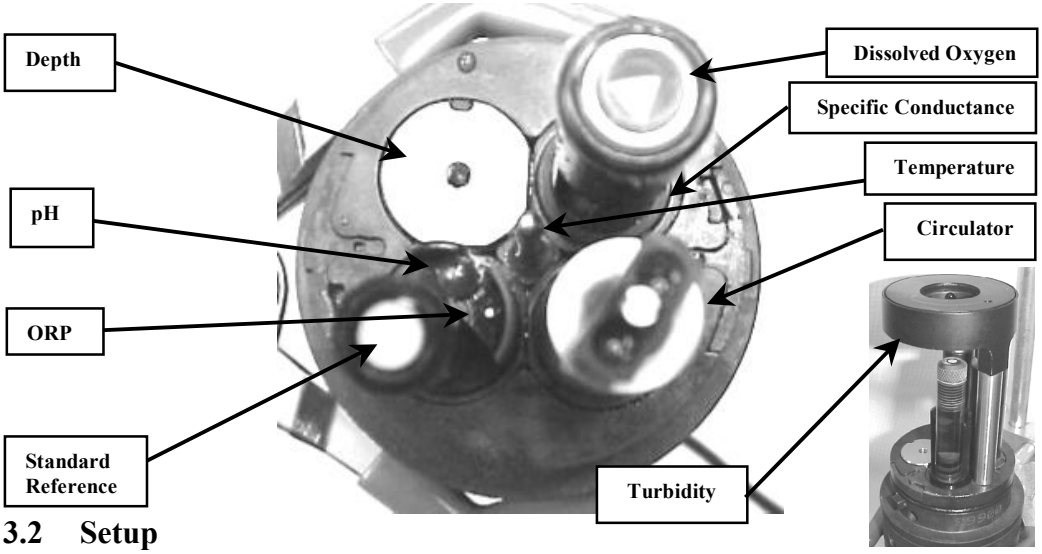
Standard Maintenance Items



Dissolved Oxygen Maintenance Items (only with DO option)

pH Maintenance Items (only with pH option)

Only temperature is standard on all Transmitters. All other sensors are optional and, if not purchased, are replaced with a sensor plug filling the unused locations. Please consult the following picture showing the sensor array for a fully configured Transmitter.



3.2 Setup

The Transmitter can be setup, or configured, for circulator state, temperature units, salinity or TDS output, depth units, SDI-12 address, and SDI-12 delay. The setup can be changed via the Display or an SDI-12 datalogger.

3.2.1 Setup with Display

See Section 2.2.2 for setup of the Transmitter with the Display.

Note:

- The SDI-12 address and the SDI-12 delay cannot be changed via the Display.

3.2.2 Setup with SDI-12 Datalogger

If using an SDI-12 datalogger for setup, you must enter transparent mode. Please see your datalogger manual for instructions on how to use transparent mode.

The following configurations are available:

Setup	Default	Alternate(s)
Circulator	On	Off
Temperature	°C	°F
Salinity/TDS	Salinity in PSS	TDS in g/L
Depth	m	ft
SDI-12 Address	0	1 to 9
SDI-12 Delay	30 seconds	5 to 994 seconds

Notes:

- All configurations are stored in a nonvolatile memory in the Transmitter.

Within the datalogger's transparent mode, issue the SDI-12 commands to the Transmitter from the following table:

Setup	Options	SDI-12 Command
Circulator	On	'*a*XSS1!'
	Off	'*a*XSS0!'
Temperature	°C	'*a*XTC!'
	°F	'*a*XTF!'
Salinity/TDS	Salinity in PSS	'*a*XSTS!'
	TDS in g/L	'*a*XSTT!'
Depth	m	'*a*XDM!'
	ft	'*a*XDF!'
SDI-12 Address	*c*	'*a*A*c*!'
	d (0 to 9)	'*b*A*d*!'
SDI-12 Delay	*ddd* (005 to 994)	'*a*XL*ddd*!'
		'*b*XL*ddd*!'

Notes:

- Both the sensors and the circulator must be turned on for the circulator to operate.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.

3.3 Circulator

The Transmitters are optionally equipped with a circulator to assist with reliable dissolved oxygen measurements. The circulator also continuously supplies fresh sample to all sensors, and tends to keep the sensors clean by sweeping debris away. The circulator also speeds sensor response by ensuring rapid temperature equilibration.

From **Screen 1** or **Screen 2** on the Display, press **Esc** ∞ to toggle the circulator state. Alternately, select **Setup**, **Circ**, and **On** or **Off** to set the circulator state. From an SDI-12 datalogger, issue the '*a*XSS0!' command to turn the circulator off and the '*a*XSS1!' command to turn the circulator on.

Remember to turn the circulator on during field deployment. Generally, the circulator should be on except during calibration.

Notes:

- The circulator's impeller (part #005306), impeller screw (part #005307), and impeller bearing (part #003594) are non-warranty consumables, which require regular replacement.
- In SDI-12 operation, both the sensors and the circulator must be turned on for the circulator to operate. The sensors are automatically turned on with standard SDI-12 measurement commands. The '*a*X1!' and '*a*X0' commands are available to force the sensors on and off through the transparent mode.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.

3.4 Calibration

Fundamentally, the Transmitter is calibrated by pouring a calibration standard into the calibration cup or by immersing the entire Transmitter in a bucket of standard. Then, watching the readings for the parameter to be calibrated. When the readings stabilize, send the calibration information to the Transmitter via the Display or SDI-12 datalogger. Then confirm the data calibration.

Note: You may notice that the Transmitter has built-in checks for calibration acceptance. If for any reason you cannot complete calibration for any parameter, the Transmitter will continue to use the calibration from the last time that particular parameter was calibrated successfully. However, you should try to determine why the Transmitter did not accept the new calibration (faulty sensor, bad standard, low battery, mistyped standard value, incorrect units, etc.).

3.4.1 Calibration with the Display

If the circulator is on, press the **Esc** ∞ key to toggle the circulator off, so that it doesn't splash your calibration standard. Place the sensors in the appropriate calibration standard for the parameter being calibrated. Monitor the parameter's stability on **Screen 1** and/or **Screen 2**, select **Calib**, then the item to calibrate. Enter the one or two values as required to complete calibration. If the Transmitter rejects the calibration, the Display LCD shows 'FAIL' before returning to the **Calib**

screen. Return to **Screen 1** and/or **Screen 2** to confirm calibration. See Section 2.2.3 for details on using the Display to perform calibrations.

The following table details what can be calibrated with the Display.

Calibration	First Value	Second Value
Salinity	PSS	-
Specific Conductance	mS/cm	-
TDS	Scale Factor (0.64 default)	-
DO/BP	mg/L	mmHg
DO%/BP	100% (fixed)	mmHg
ORP	mV	-
pH	units	-
Barometric Pressure (BP)	mmHg	-
Depth	m or ft	-
Turbidity	NTU	-

3.4.2 Calibration with an SDI-12 Datalogger

If using an SDI-12 datalogger for calibration, you must enter transparent mode. Please see your datalogger manual for instructions on how to use transparent mode.

Within the datalogger's transparent mode, issue the '*a*X1!' command to turn the Transmitter's non-turbidity sensors on and, if turbidity installed, issue the '*b*X1!' command to turn the turbidity sensor on. If the circulator is on, issue the '*a*XSS0!' command to turn the circulator off, so that it doesn't splash your calibration standard.

Repeatedly issue the '*a*R0!' and '*a*R1!' commands and, if turbidity installed, the '*b*R0!' command to monitor the stability of the parameter being calibrated. Once stable, issue the '*c*XC*d*+*value*!' command with '*c*' being the SDI-12 address, '*d*' the code letter of item to calibrate and '*value*' being the numeric value of the calibration standard. Again, issue the '*a*R0!' and '*a*R1!' commands and, if turbidity installed, the '*b*R0!' command to confirm calibration.

Finally, issue the '*a*X0!' command and, if turbidity installed, the '*b*X0' command to turn the Transmitter's sensors off and, if needed, issue the '*a*XSS1!' command to turn the circulator back on.

The following table details the SDI-12 calibration commands available.

Calibration	SDI-12 Command	Units for *value*
Salinity	'*a*XCS+*value*!'	PSS
Specific Conductance	'*a*XCC+*value*!'	mS/cm
TDS	'*a*XCt+*value*!'	Scale Factor (0.64 default)
DO (must calibrate BP first!)	'*a*XCO+*value*!'	mg/L

Calibration	SDI-12 Command	Units for *value*
DO%	'*a*XC%+*value*!'	mmHg
ORP	'*a*XCR+*value*!'	mV
pH	'*a*XCP+*value*!'	units
Barometric Pressure (BP)	'*a*XCB+*value*!'	mmHg
Depth	'*a*XCD+*value*!'	m or ft (per depth setup)
Turbidity	'*b*XCT+*value*!'	NTU

Notes:

- Both the sensors and the circulator must be turned on for the circulator to operate.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.

3.4.3 Calibration Preparation

The following is a general outline of the steps required to calibrate all the sensors:

- **Select a calibration standard whose value is near that of your field samples**.
- Remove the Storage Cup from the Transmitter.
- **Clean and prepare the sensors** as detailed in Sections 3.4.4 through 3.4.9.
- Attach the Calibration Cup.
- Using the Calibration Cap, thoroughly **rinse the sensors several times** by half-filling the calibration cup **with deionized water** and shaking the Transmitter to make sure each sensor is free from contaminants that might alter your calibration standard.

- In a similar manner, **rinse the sensors twice with a small portion of the calibration standard**, each time discarding the rinse.

- With the Transmitter sensors pointing up (toward the ceiling), **fill the Calibration Cup with the calibration standard**. See Sections 3.4.4 through 3.4.8 for sensor specific details.

- **Complete the calibration as per Sections 3.4.1 and/or 3.4.2**.
- Finally, **discard used calibration standards** appropriately. Do not attempt to reuse calibration standards.

Warning: **Sensor preparation is probably the most important action you can take to maintain or improve the quality of your field measurements.** A contaminated, worn-out, or damaged sensor simply will not produce a reliable reading. It is well worth your time to set up a routine in which all sensors are serviced frequently and then allowed to rest in tap water overnight before calibration.

Generally, you should calibrate all Quanta parameters as often as your accuracy requirements dictate. If you want exceptionally accurate data, you must calibrate frequently. Calibration requirements also vary with deployment conditions – in very turbid or biologically-active waters, for instance, generally require more frequent calibrations than do cleaner waters

Notes:

- The optional turbidity sensor has a rotating sealed shaft to make maintenance of other sensors easier. With the storage cup, calibration cup, and guard removed, the turbidity sensor rotates ≈135° in each direction before engaging the internal stop. This feature makes maintenance of the other sensors easier. After maintenance of these other sensors, insure the turbidity sensor is rotated back to the nominal position before reinstalling the storage cup, calibration cup, or guard. **Do not use excessive force or sensor will break!**

3.4.4 Temperature

Cleaning and Preparation

- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- Rinse with water.

Calibration Standard

- Factory-set and no recalibration required.

3.4.5 Specific Conductance, Salinity, and TDS

Cleaning and Preparation

- **Clean the oval measurement cell** on the specific conductance sensor with a small, non-abrasive brush or cotton swab.
- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- **Rinse with water**.

Calibration Standard

- Pour the specific conductance or salinity standard to within a centimeter of the top of the cup.
- Make sure there are **no bubbles** in the measurement cell of the specific conductance sensor.

Notes:

- TDS measurements are based on specific conductance and a user defined scale factor. For TDS calibrations, first calibrate specific conductance, then calibrate the Transmitter with a site-specific scale factor. The factory default scale factor is 0.64 g/L / mS/cm.

3.4.6 Dissolved Oxygen %Saturation and mg/L

Cleaning and Preparation

- Remove the o-ring securing the DO membrane.
- Shake out the old electrolyte and rinse with fresh DO electrolyte.
- Refill with fresh DO electrolyte until there is a perceptible meniscus of electrolyte rising above the entire electrode surface of the sensor.
- Make sure there are **no bubbles** in the electrolyte.

- Hold one end of a new membrane against the body of the DO sensor with your thumb and with a smooth, firm motion, stretch the other end of the membrane over the sensor surface and hold it in place with your index finger.
- Secure the membrane with the o-ring.
- Make sure there are **no wrinkles in the membrane or bubbles** in the electrolyte.
- Trim away the excess membrane extending below the o-ring.
- Ideally, let the sensor soak overnight to allow the membrane to relax to its final shape.

DO %Saturation Calibration Standard (Saturated-Air Method)

- Fill the Calibration Cup with deionized or tap water (specific conductance less than 0.5 mS/cm) until the water is just level with the o-ring used to secure the membrane.
- Carefully remove any water droplets from the membrane with the corner of a tissue.
- Turn the black calibration cup cover upside down (concave upward) and lay it over the top of the Calibration Cup.
- Determine the barometric pressure for entry as the calibration standard. See Section 5.1.3 for computation details on barometric pressure.

Notes:

- Calibration of DO %Saturation also calibrates DO mg/L.
- DO can also be calibrated in a well-stirred bucket of temperature-stable, air-saturated water. This situation more closely resembles the actual field measurement conditions, but is more difficult to accomplish reliably. Be sure the circulator is turned on when calibrating in a water bath.

DO mg/L Calibration Standard (Known Concentration Method)

- Immerse the sensor in a water bath for which the DO concentration in mg/L is known (for instance by Winkler titration). This calibration method is more difficult to perform than the saturated-air method.
- Make sure the circulator is turned on.
- Determine the barometric pressure for entry as the calibration standard. See Section 5.1.3 for computation details on barometric pressure.

Notes:

- Calibration of DO mg/L also calibrates DO% Saturation.
- If there is a change in barometric pressure after calibration (for instance, if barometric pressure drops as you move the calibrated Transmitter to a higher elevation for deployment), the readings for DO %Saturation will not be correct. You must enter a new barometric pressure. However, the readings for DO mg/L will be correct regardless of changes in barometric pressure.

3.4.7 pH and ORP (Redox)

Cleaning and Preparation of pH

- If the pH sensor is obviously coated with oil, sediment, or biological growth, clean the glass with a very clean, soft, non-scratching cloth wet with rubbing alcohol (a cotton ball will do).
- Rinse with tap water.

Cleaning and Preparation of ORP

- If the platinum band at the tip of the ORP sensor gets dirty and/or discolored, polish it with a clean cloth and a very mild abrasive, such as toothpaste; or use a fine polishing strip.
- Rinse with water.
- Soak the sensor overnight in tap water to allow the platinum surface to restabilize.

Cleaning and Preparation of Standard Reference

- Gently pull the entire reference sleeve away from the Transmitter. The reference sleeve is the clear blue tube with a porous Teflon® Reference Junction attached.
- Discard the old electrolyte from the reference sleeve.
- Drop two KCl salt pellets (#005376) or two KCl salt rings (#005309) into the reference sleeve.
- Refill the sleeve to the top with reference electrolyte.
- With the Transmitter sensors pointed toward the floor, push the full reference sleeve back onto its mount until the sleeve has just covered the first o-ring located on the mount (just behind the silver electrode).
- Turn the Transmitter so that the sensors point toward the ceiling and push the sleeve the rest of the way onto its mount.
- Rinse with tap water.




Notes:

- **<u>The porous Teflon® Reference Junction is the most important part of the pH and ORP performance</u>**. Make sure it is clean and passes electrolyte readily. If not, replace it with the spare provided with the pH option. Replacement Reference Junctions are part #003883.
- When seating the reference sleeve, **trapped air and excess electrolyte is purged**. This **<u>purging flushes and cleans the porous Teflon® Reference Junction</u>**.
- The Standard Reference is designed for waters with specific conductances ≥ 0.2 mS/cm. For measurements in waters with specific conductances < 0.2 mS/cm, Hydrolab offers the LISRef as a factory installed option to improve measurements in very low-ionic strength waters.

<u>Cleaning and Preparation of Low-Ionic Strength Reference (LISRef)</u>

- **Remove the plastic LISRef soaking cap. <u>Save the cap!</u>**
- Inspect the LISRef sensor tip.
- If necessary, rinse with soapy water to remove visible contamination and rinse with tap water.
- If necessary, wipe with a cloth soaked in rubbing alcohol to remove oils and grease and rinse with tap water.
- Following cleaning, fill the plastic LISRef soaking cap with reference electrolyte, reinstall over the LISRef tip, and soak overnight.
- **Remove the plastic LISRef soaking cap before calibration or field use. <u>Save the cap!</u>**

Notes:

- **<u>The LISRef Reference is the most important part of the pH and ORP performance.</u>**
- **<u>Whenever the Quanta Transmitter is not in use, fill the plastic LISRef soaking cap with reference electrolyte and reinstall over the LISRef tip.</u>**
- The LISRef Reference is designed for low-ionic strength waters. During normal use, the LISRef Reference is consumed and cannot be rebuilt. Replacement LISRef tips are part #003333.
- For measurements in waters with specific conductances ≥ 0.2 mS/cm, the Standard Reference is preferred due to lower purchase and maintenance costs. Hydrolab offers the Standard Reference as a factory installed option.

Calibration Standard

- Pour the pH or ORP standard to within a centimeter of the top of the cup.

Notes:

- pH is a two-point calibration. A pH standard between 6.8 and 7.2 is treated as the "zero" and all other values are treated as the "slope". First calibrate "zero", then calibrate "slope".

3.4.8 Depth

Cleaning and Preparation

- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- Rinse with water.

Calibration Standard

- Enter zero for the standard at the water's surface.

Notes:

- If the depth is known by another method, such as a carefully-marked cable, type the actual depth value as the standard when calibrating.
- The density of water varies with its specific conductance. Depth readings are corrected for specific conductance. See Section 5.3 for details.
- Recheck the 10m vented depth option for sensor drift with a precision pressure gauge at least once a month. A 'zero' drift is quickly corrected through calibration, but a 'slope' drift requires factory recalibration. Factory calibration includes characterization over temperature and pressure. Contact Hydrolab's Customer Service for the current recalibration price and scheduling of a factory recalibration.

3.4.9 Turbidity

Cleaning and Preparation

- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- Use a non-abrasive, lint-free cloth to clean the quartz glass tube. Scratched glass reduces the sensor's accuracy.
- Rinse with water.

Calibration Standards

- Calibrate turbidity with primary standards ('turbid-free' water, Formazin, and/or polystyrene beads) and check with a secondary standard (Quick-Cal Cube™).
- Use 'turbid-free' water to calibrate the "zero".
- Use Formazin and/or polystyrene beads to calibrate the "slope".
- Primary standards must completely fill the optical area of the turbidity sensor plus ¼" (6 mm) of standard on both sides of the PVC body by filling the calibration cup to the top. Alternately, pour ≈1-¼" (32 mm) of standard into the storage cup and place the inverted sensors into the standard with bayonets disengaged.
- After calibration with primary standards, the value of the optional Quick-Cal Cube™ secondary standard, if used, must be determined and recorded for each individual instrument. The Quick-Cal Cube™ value is determined by removing the storage/calibration cups, wiping the optical areas, both sensor and cube, clean and dry with a non-abrasive, lint-

free cloth, and placing the ceramic glass cube into the turbidity sensor's optical area. Align the Quick-Cal Cube™'s pin with the turbidity sensor's recessed hole and, for optimum repeatability, rotate the Quick-Cal Cube™ clockwise to remove mechanical play in the pin/hole.

- To test for drift between primary calibrations, reinstall the Quick-Cal Cube™.



Notes:

- 'Turbid-free' water is available for purchase from chemical supply houses. However, it is far less expensive to make by passing reagent-grade water through a 0.1 µm or smaller filter.
- Formazin and polystyrene beads are primary standards as defined by the EPA. Quick-Cal Cubes™ are secondary standards, which must be rechecked, and value recorded, after each primary standard calibration with each instrument. However, Quick-Cal Cubes™ save resources, both time and money, by allowing inexpensive and frequent calibration checks between permit and/or standard operating procedure required primary calibrations.
- Formazin requires daily preparation.
- Polystyrene beads are instrumentation specific and beads formulated for one instrument design often read differently on a different instrument design. Hydrolab has polystyrene beads formulated for the Quanta Turbidity sensor. Please contact Customer Service or www.hydrolab.com for ordering information.
- When using liquid standards, insure no bubbles in the optical area. The optical properties of bubbles affect the turbidity calibration. Gentle agitation easily dislodges bubbles.
- When using Quick-Cal Cube™ standards, insure no water droplets in the optical area. The optical properties of water droplets affect the calibration check. Remove droplets with a non-abrasive, lint-free cloth.
- Turbidity is a two-point calibration. A turbidity standard of 0.0 is treated as the "zero" and all other values are treated as the "slope". First calibrate "zero", then calibrate "slope".

3.5 Care of the Transmitter

In addition to normal sensor maintenance, clean the Transmitter with soap and water. **During storage or transportation, always use the calibration cup/cap or the storage cup filled with a ¼" of tap water to protect the sensors from damage and drying out.** Never deploy the

Transmitter without the guard protecting the sensors. Always rinse the Transmitter with clean water soon after returning from deployment.

3.6 Care of the Cable

Protect the cable from abrasion, unnecessary tension, repetitive flexure (fatigue), and bending over sharp corners (like the edge of the side of a boat). Excessive weight added to the Transmitter greatly increases the possibility of cable breakage.

When not in use, the cables should be clean, dry, and coiled at a 12" or greater diameter.

3.6.1 Dryer Assembly

With purchase of the optional Vented Depth, the Transmitter's cable upgrades to a vented cable with a dryer assembly. The dryer assembly uses a GORE-TEX® patch to reach equilibrium between the gases inside the dryer, vented cable, and Transmitter housing and the gases outside the dryer assembly. This equilibrium allows the vented depth sensor to remove measurement errors caused by changing barometric pressure.

The GORE-TEX® patch also prevents water from entering the dryer, vented cable, and housing. However, water vapor is also a gas and, if not removed, liquid water condensates within the dryer, vented cable, and housing. Water condensation prevents proper vent operation (inaccurate Vented Depth) and damages the Transmitter's internal circuitry (non-warranty).

To prevent water condensation, the dryer assembly includes desiccants to absorb water vapor. These desiccants have a limited capacity and require regular maintenance. An indicator is included inside the dryer and can be viewed through the clear dryer housing. If dark blue, the desiccants do not need to be replaced. However, if light pink or purple, the desiccants need to be replaced.

To replace desiccants:

- Unscrew dryer nut on the cable gland seal nearest the 4 pin connector.
- Unscrew the dryer cap and pull cap away from dryer housing. Take care not to stress wire connections to the terminal strip.
- Remove and properly discard spent desiccants.
- Install fresh desiccants.
- Reinstall dryer cap. Be sure to not pinch desiccants or wires or stress wire connections.
- Reinstall dryer nut.

3.7 Secchi Disk

The Secchi Disk is an option that can be added to the Transmitter. To install, simply thread the cable through the slot on the Secchi Disk, slide the Secchi Disk down to the top of the Transmitter, and thread onto the penetrator fitting.

3.8 FlowCell

For process or pump-through situations, the FlowCell is an option that can be added to the Transmitter so that the system does not have to be submerged in the water being studied.

To install, remove the storage cup and attach the FlowCell to the Transmitter. Connect ½" tubing to the inlet barb fitting (furthest from the Transmitter housing) and ½" tubing to the outlet barb

fitting (nearest to the Transmitter housing). Then connect the inlet and outlet as appropriate to the system being monitored. Filter debris from the inlet. Don't exceed a pumping rate of about 1.5 liters per minute. This maximum rate flushes the contents of the FlowCell about eight times per minute. If possible, lay the Transmitter on its side. Bubbles will tend to float away from the sensors and out the outlet on the side of the FlowCell.

Warning: **Do not pressurize the FlowCell or its feed line above 15 PSIG! Higher pressures could result in serious and/or fatal injury and/or damage to the FlowCell!** If pressures greater than 15 PSIG are possible, use an appropriate pressure regulator installed by qualified personnel.

Warning: **Remove pressure before disconnecting the Transmitter from the FlowCell!** Failure to do so could result in serious or fatal injury and/or damage to the Transmitter and/or FlowCell!

3.9 Additional Weight

The Transmitter has a negative buoyancy of approximately 1 pound. Some high flow conditions require additional weight to sink the Transmitter.

Three user methods to add weight are:

Location	Dimensions
Annular Ring around Cable/above Transmitter	1-¼" – 12UNF-2B thread or Internal ∅ > 1.25"
Fishing Line through main housing 'ears' (use 25 pound monofilament line)	Line ∅ < 0.1"
Baseball Bat Weight(s) (Slide down cable to top of Transmitter)	External ∅ < 3" Internal ∅ > 1.25"

Notes:

- **Do not add more than 10 pounds of weight** and use as small a weight as needed.
- Excessive and/or unnecessary tension on the cable will result in premature non-warranty cable failure.

4 DEPLOYMENT

4.1 Long-term

If using the Transmitter in open water, try to locate the Transmitter so that any available protection is utilized. For instance, in a swiftly flowing river, anchor the Transmitter to the downstream side of a bridge piling so that floating debris will strike the piling, not the Transmitter. Likewise, in a recreational lake deployment, use a marking buoy that will not attract the attention of vandals.

Try to fix the Transmitter in an upright or on-side position, and avoid areas that might see deep deposits of sand, gravel, or silt in the case of a heavy rainfall event. Being caught in water that is icing over can also cause the loss of the Transmitter.

Take similar precautions with the Cable to protect it from floating debris, navigation, and vandals.

Always make sure the sensors are protected with the Guard.

Some sensors cannot remain in calibration for long periods in certain situations. For instance, a DO sensor may become hopelessly fouled after just a few days in a warm, shallow, biologically-active lake. Likewise, a reference electrode's performance will begin to deteriorate quickly in a flowing stream of low ionic-strength water. On the other hand, if the only parameters being measured are temperature and conductivity, the Transmitter can be left for long periods. Deployment time can be judged by making periodic (i.e., daily) measurements of sensitive parameters with another instrument. The day on which the spot-measurements and the logged data begin to diverge significantly may be considered the maximum deployment time for that particular water and season.

The wrapping of the Guard with a fine mesh nylon material or fine copper mesh (.050") can prevent premature fouling of the sensors and should be tried on a case by case basis.

4.2 Short-term

Generally, short-term deployment implies hand-held operation. Just follow common sense; for instance, don't lower the Transmitter into the water without attaching a Guard. Watch out for hazards such as outboard motor propellers.

If necessary, add weight to the Transmitter for sinking in high flow situations. See Section 3.9 for more details.

4.3 Pressure Extremes

The Transmitter’s maximum depth depends on the depth sensor option purchased. The following table shows the maximum depths:

Depth Option	Maximum Depth
No Depth	100m (328 ft)
10m Vented	20m (65 ft)
25m	50m (164 ft)
100m	100m (328 ft)

The Display has a NEMA 6/IP 67 rating. Except during maintenance, keep the Lens and Battery Cap installed.

4.4 Temperature Extremes

The Quanta System's operating temperature range is -5°C to 50°C (23°F to 113°F) non-freezing. Exposure of the Transmitter or Display to temperatures outside of this range might result in mechanical damage or faulty electronic performance. The latter may be very subtle.

4.5 Data Transmission Lines

If you are adding transmission cable to your Transmitter Cable, the added cable must be large enough to carry the operating current and transmit data without distortion. For up to a total of 100m (328 ft) of cable, a pair of twisted shielded #26 AWG wires is suitable for data transmission and a pair of #18 AWG must be used for the power wires. The shield should be attached with the ground wire on pin 4.

The Transmitter cable pin-out is as follows:

Pin Number	Function	Internal Wire Colors
1	+12VDC	Brown
2	Ground	Red
3	SDI-12 Data	Orange
4	Ground	Yellow & Bare Wire

The Transmitter cable connector is Conxall part #3282-4PG-528. It mates to Conxall part #5282-4SG-5XX for cable-to-cable applications or Conxall part #4282-4SG-3XX for panel mount applications. Details on Conxall's Multi-Con-X® connectors can be found at *www.conxall.com*.

4.6 Quanta Display/PC Interface Cable

The Quanta Display/PC Interface cable is intended for indoor use only. The 4-pin male connector is Conxall part #3282-4PG-528 and the 9-pin 'D' female connector is compatible with RS232 industry standard 9-pin 'D' male connectors. The Quanta Display/PC Interface cable pin-out is as follows:

4-pin Male	9-pin Female	Function
Pin 1	-	Transmitter Power
Pin 2	Pin 5	Ground
Pin 3	Pin 2	RXD-
Pin 4	Shell	Shield
-	Pin 3	TXD-
-	Pins 1, 4, & 6 (tied together)	CD, DTR, & DSR
-	Pin 7 & 8 (tied together)	RTS & CTS
-	Pin 9	RI

5 TECHNICAL NOTES

5.1 Dissolved Oxygen

5.1.1 Oxygen Solubility in Water

The function used to calculate oxygen solubility is based on the oxygen solubility vs. temperature data from Table 4500-O found in the 19th Edition of *Standard Methods for the Examination of Water and Wastewater*.

5.1.2 Salinity Correction of DO mg/L

The function used to calculate oxygen solubility is based on the oxygen solubility vs. chlorinity data from Table 4500-O found in the 19th Edition of *Standard Methods for the Examination of Water and Wastewater*.

Note:

- DO %Saturation is not a function of solubility, and has no salinity or temperature correction.

5.1.3 Barometric Pressure Functions

Local barometric pressure, *BP*, in mmHg can be estimated using:

$$BP = 760 - 2.5(A_{ft}/100) \quad \underline{\text{or}} \quad BP = 760 - 2.5(A_m/30.5)$$

where 'A_{ft}' is the local altitude above sea level in feet and 'A_m' is the local altitude above sea level in meters.

If using the local weather bureau BP, remember these numbers are corrected to sea level. To calculate the uncorrected atmospheric pressure *BP'*, use one of the following functions:

$$BP' = BP - 2.5(A_{ft}/100) \quad \underline{\text{or}} \quad BP' = BP - 2.5(A_m/30.5)$$

Local barometric pressure in mbar (BP_{mbar}) can be converted to local barometric pressure in mmHg (BP_{mmHg}) using:

$$BP_{mmHg} = 0.75 \times BP_{mbar}$$

5.2 Specific Conductance, Salinity, and TDS

5.2.1 Specific Conductance Temperature Correction

Temperature correction of conductivity to produce specific conductance is based on the temperature correction formulas and factors of Table 3 in *ISO 7888-1985 Water Quality – Determination of Electrical Conductivity*. This temperature correction is normalized to 25°C

Because total dissolved solids (TDS) is calculated from the specific conductance reading, it also has the above correction.

5.2.2 Salinity Calculation

The method used to calculate salinity from conductivity is found in 2520B the 19th Edition of *Standard Methods for the Examination of Water and Wastewater*. This method is also commonly

referred to at the Practical Salinity Scale or UNESCO method. This method uses conductivity, not specific conductance, and includes its own temperature correction normalized to 15°C.

5.2.3 Total Dissolved Solids (TDS) Calculation

TDS is calculated from specific conductance as:

TDS = C x Scale Factor

where TDS is total dissolved solids in g/L,
C is specific conductance in mS/cm,
and Scale Factor is user defined.

The default scale factor is 0.64 from Water Chemistry, by Snoeyink and Jenkins. If more site-specific information is available, then enter the site-specific TDS scale factor as per Section 3.4.

5.3 Depth Correction for Specific Conductance

The density of water, and hence its ability to "create" pressure, increases with specific conductance. Therefore, if a depth transducer is calibrated for fresh water, the depth reading must be reduced for measurements made in salt waters. The raw depth readings are multiplied by the following correction:

$$F(C) = 1 - 0.03(C/52)$$

where C is the measured specific conductance in mS/cm.

In effect, no correction is made at zero specific conductance, and depth readings are reduced by 3% at 52 mS/cm, the specific conductance of sea water.

5.4 CE Testing

The Quanta System has been tested and complies with CE requirements in effect at time of manufacture. A copy of the Quanta's current Certificate of Compliance is available on request.

5.5 Turbidity

Hydrolab's Quanta Turbidity option is compliant with GLI Method 2, an EPA approved method, and ISO 7027:1999(E). GLI Method 2 is recognized by EPA as an approved method in Section 141.74 of the Federal Register Vol. 59 No. 232 (December 5, 1994). Reprints of both the GLI Method 2 documentation and the Federal Register reference are available on request.

The Quanta's turbidity sensor, circuitry, software, and Quick-Cal Cubes™ were developed as a joint venture between Hydrolab Corporation and GLI International, Inc. and are protected by U.S. Patents #5,059,811 and #5,140,168. Other patents are pending.

6 SDI-12 INTERFACE

SDI-12 is an industry-originated, serial digital interface bus designed to allow an operator to connect a wide variety of transducers (meteorological, hydrological, water quality, etc.) to a single SDI-12 datalogger with a single cable bus.

The Quanta Transmitter is compatible with SDI-12 V1.3 approved by the SDI-12 Support Group in November 1999. A copy of the specification can be found at *www.sdi-12.org*.

The optional SDI-12 Interface Adapter is required to operate the Transmitter with an SDI-12 Datalogger.

6.1 SDI-12 Interface Adapter

A label on the SDI-12 Interface Adapter contains the pinout repeated in the following table:

Pin Number	Wire Color	SDI-12 Function
1	Brown	+12VDC
2	Red	Ground
3	Orange	SDI-12 Data
4	Yellow	Ground
Shield	Bare Wire	Ground

Consult the SDI-12 datalogger manual for information on how to connect the SDI-12 Interface Adapter.

Note:

- All five wires (three grounds) must be connected for correct SDI-12 operation.

6.2 SDI-12 Command Summary

The following table is a summary of the SDI-12 user commands supported by the Transmitter. For more details on correct use, consult the SDI-12 V1.3 specification or the appropriate section of this manual.

Command	Response	Description
a! *b*!	*a*<crlf> *b*<crlf>	Address Acknowledge
*a*I! *b*I!	*a*13HydrolabQuanta2.2-*serial number*<crlf> *a*13HydrolabQTTurb1.2<crlf>	Identify
*a*A*c*! *b*A*d*!	*c*<crlf> *d*<crlf>	Change address from *a* to *c* or from *b* to *d*
*a*M! *b*M!	*adddn*<crlf> *bdddn*<crlf>	Measure: *n* values in *ddd* seconds.
*a*MC! *b*MC!	*adddn*<crlf> *bdddn*<crlf>	Measure: *n* values in *ddd* seconds. Report data with CRC.
*a*D*x*! *b*D*x*!	*aSvalueSvalue…CCC*<crlf> *bSvalueSvalue…CCC*<crlf>	Report data. CRC (CCC) added if MC or CC.

Command	Response	Description
*a*R*x*! *b*R*x*!	*aSvalueSvalue…*<crlf> *bSvalueSvalue…*<crlf>	Report continuous data.
*a*RC*x*! *b*RC*x*!	*aSvalueSvalue…CCC*<crlf> *bSvalueSvalue…CCC*<crlf>	Report continuous data with CRC.
*a*C! *b*C!	*adddnn*<crlf> *bdddnn*<crlf>	Concurrent Measure: *nn* values in *ddd* seconds.
*a*CC! *b*CC!	*adddnn*<crlf> *bdddnn*<crlf>	Concurrent Measure: *nn* values in *ddd* seconds. Report data with CRC.
*a*XT<C|F>!	*a*XT<C|F><crlf>	Change temperature units
*a*XT!	*a*<C|F><crlf>	Report temperature units
*a*XD<M|F>!	*a*XD<M|F><crlf>	Change depth units
*a*XD!	*a*<M|F><crlf>	Report depth units
*a*XST<S|T>!	*a*XST<S|T><crlf>	Set salinity or TDS
*a*XST!	*a*<S|T><crlf>	Report salinity or TDS
*a*XL! *b*XL!	*a*XL*ddd*<crlf> *b*XL*ddd*<crlf>	Report delay, *ddd* seconds
*a*XL*ddd*! *b*XL*ddd*!	*a*XL*ddd*<crlf> *b*XL*ddd*<crlf>	Change delay, *ddd* seconds
*a*X1! *b*X1!	*a*X1<crlf> *b*X1<crlf>	Sensors on
*a*X0! *b*X0!	*a*X0<crlf> *b*X0<crlf>	Sensors off
*a*XSS1!	*a*XSS1<crlf>	Circulator on
*a*XSS0!	*a*XSS0<crlf>	Circulator off
*a*XSS!	*a*<1|0><crlf>	Report circulator state
*a*XC<P|C|S|%|O|R|D|B|t>*Svalue*! *b*XCT*Svalue*!	*a*XC<P|C|S|%|O|R|D|B|t>*Svalue*<crlf> *b*XCT*Svalue*<crlf>	Calibrate parameter Calibrate turbidity
*a*XSN!	*aserialnumber*<crlf>	Report Transmitter serial number
*a*XSs!	*aserialnumber*<crlf>	Report depth serial number
*a*XSm!	*adate*<crlf>	Report date of manufacture (MMDDYY)
*a*XV! *b*XV!	*a+v+v+v+v+v+v+v+v+v+v+BP+ScaleFactor*<crlf> *b+v+v*<crlf>	Verify parameter: 0=OK, 1=Cal, 2=Ovr, 3=Udr, 4=ADC, 5=N/A

Notes:

- **If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses**. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- **The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity.** In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.
- **Data Format for D and R commands on SDI-12 address '*a*' is temperature, pH, specific conductance, salinity or TDS, DO %Saturation, DO mg/L, ORP, depth, and battery.**
- **Data Format for D and R commands on SDI-12 address '*b*' is turbidity and battery.**
- Previous measurements must be in the data buffer before running a parameter calibration.
- Total number of characters in a command must be less than 12.
- For calibrate command (XC) on SDI-12 address '*a*', P is pH, C is specific conductance, S is salinity or TDS, % is DO %Saturation, O is DO mg/L, R is ORP, D is depth, B is barometric pressure, and t is TDS scale factor.

7 TROUBLESHOOTING

7.1 The Display will not turn on.

- Are the batteries installed correctly? (See Section 2.1.4)
- Are the batteries good?

7.2 The Display will not show readings.

- Is the Transmitter connected?
- Is the contrast adjusted properly? (See Section 2.1.1)
- Are all connectors mated properly?

7.3 Measurements seem wrong.

- Are the sensors maintained and calibrated properly? (See Section 3.4.)
- Are the units (°C or °F, m or ft, Salinity or TDS) displayed correct? (See Section 3.2)

7.4 SDI-12 will not communicate.

- Recheck your connections. (See Section 6.1)
- Review the SDI-12 datalogger connection instructions.
- Is the SDI-12 address in the command correct? (See Section 6.2)
- Is the 12V battery good?

7.5 Water in the Transmitter

- Disassemble the Transmitter at an ESD workstation by removing the two flat blade retaining screws. As you remove the two retaining screws, be sure that the Bottom Cap is not pointed at anyone, since the internal pressure caused by the water leakage may blow the Bottom Cap out of the Transmitter body. Rinse the circuit board with distilled water and blow dry with a hair dryer. Clean and light grease o-rings before reassembly.
- Please contact Hydrolab Customer Service if you ever have a leakage problem, even if you are sure you have repaired the Transmitter.

7.6 Water in the Display

- Disassemble the Display at an ESD workstation by removing the Lens, Battery Cap, batteries, and four Phillips retaining screws above and below the LCD. Rinse the circuit board with distilled water and blow dry with a hair dryer. Clean and light grease o-rings before reassembly.
- Please contact Hydrolab Customer Service if you ever have a leakage problem, even if you are sure you have repaired the Display.

8 BILLS OF MATERIAL/EXPLODED DIAGRAMS

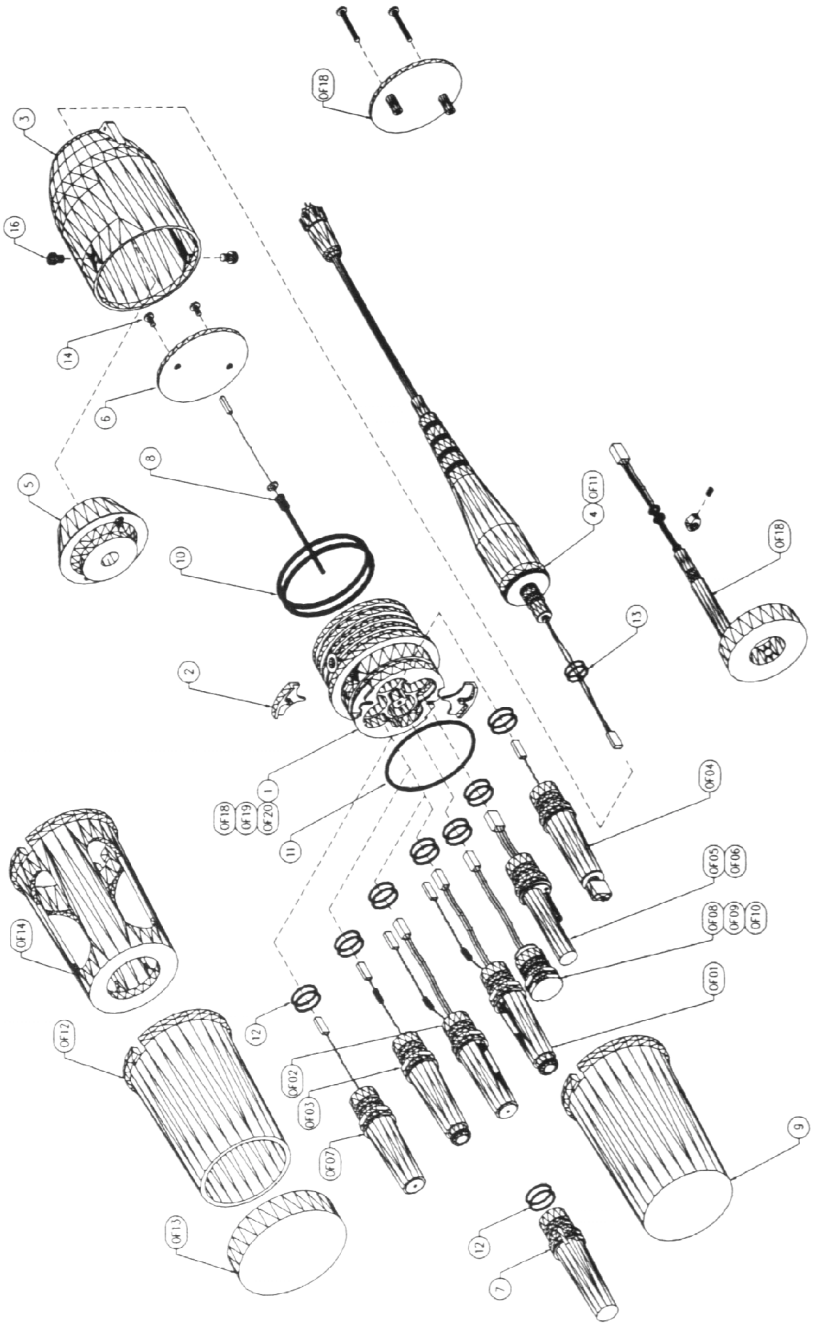
8.1 Quanta Display

ITEM #	QTY	PART #	DESCRIPTION
1	1	004489	Case Subassembly, Quanta Display
2	1	004497	Battery Cap Subassembly, Quanta Display (was 04490)
3	1	003894	Spring, Battery Cap, Quanta Display
4	1	003991	O-ring, 1-911, Silicone, 50 Durometer (was 003978, 0.118 x 0.866 Buna-N)
5	1	006316	Board Assembly, Quanta Display
6	1	004488	Panel/Label Subassembly, Quanta Display
7	4	003971	Screw, #6 x 5/8, Panhead, Sheetmetal
8	1	003968	O-ring, 3.984 x .156, Buna-N, 70 Durometer
9	1	003884	Lens, Quanta Display
10	3	000679	"C" Cell Battery
11	1	003906	Harness, Quanta Display
12	1	003873	Connector Cap, Quanta Display
OPTIONAL FEATURES			
OF1a	1	006320	Board Assembly, Quanta Display RTC (not shown)
OF1b	1	014230	Cable, Quanta Display/PC Interface (not shown)

8.2 Quanta Transmitter

ITEM #	QTY	PART #	DESCRIPTION
1	1	003963	Bottom Cap, Quanta Transmitter, Metric (was 003791, small bayonet&#10-32)
2	2	003793	Retainer, Probe, Quanta Transmitter
3	1	003788	Housing, Quanta Transmitter
4	1	018XXX	Penetrator, Non-Vented, Quanta Transmitter
5	1	003877	Nut/Weight, Quanta Transmitter
6	1	006310	Board Assembly, Quanta Transmitter
7	1	003880	Probe Plug, Quanta Transmitter
8	1	004165	Probe Assembly, Temperature
9	1	005200	Storage Cup, Quanta Transmitter (was 003795, small bayonet)
10	2	003860	O-ring, -230, Buna-N, 70 Durometer
11	1	000335	O-ring, -141, Buna-N, 70 Durometer
12	8	000085	O-ring, -016, Buna-N, 70 Durometer (was 003947, 77-614)
13	2	000467	O-ring, -013
14	2	003971	Screw, #6 x 5/8, Panhead, Sheetmetal (was 003988, #4-40 or 000078, #6-32)
15	2	-	- (was 000080, lockwasher)
16	2	003964	Screw, M4 x 0.7 x 7mm, 316SS (was 003878, #10-32)
17	1	003099	Quanta Manual (Not Shown)
18	1	002497	MSDS Packet (Not Shown)
19	1	014720	Quanta Basic Maintenance Kit (Not Shown)
20	1	003879	Box, Quanta (Not Shown)

ITEM #	QTY	PART #	DESCRIPTION
OPTIONAL FEATURES			
OF01	1	004484	Probe Assembly, Conductivity/DO, Quanta Transmitter
OF02	1	004451	Probe Assembly, Conductivity/pH Return, Quanta Transmitter
OF03	1	004486	Probe Assembly, Dissolved Oxygen Only, Quanta Transmitter
OF04	1	004508	Probe Assembly, Circulator, Quanta Transmitter (was 004450)
OF05	1	004453	Probe Assembly, pH/ORP/Reference, Quanta Transmitter
OF06	1	004452	Probe Assembly, pH/Reference, Quanta Transmitter
OF07	1	004487	Probe Assembly, pH Return, Quanta Transmitter
OF08	1	003901	Transducer, 10 Meter, Vented, Quanta Transmitter
OF09	1	003902	Transducer, 25 Meter, Quanta Transmitter
OF10	1	003903	Transducer, 100 Meter, Quanta Transmitter
OF11	1	019XXX	Penetrator, Vented, Quanta Transmitter
OF12	1	005202	Calibration Cup, Quanta Transmitter (was 003796, small bayonet)
OF13	1	000465	Calibration Cup Cap
OF14	1	005201	Sensor Guard, Quanta Transmitter (was 003885, small bayonet)
OF15	1	014740	Quanta Basic/DO/pH Maintenance Kit (Not Shown)
OF16	1	014750	Quanta Basic/pH Maintenance Kit (Not Shown)
OF17	1	014730	Quanta Basic/DO Maintenance Kit (Not Shown)
OF18	2	002295	O-ring, -009, Buna-N, 70 Durometer
	1	002935	Set Screw, #6-32 x 3/16, 18-8 SS
	1	004507	PA, Quanta Turbidity
	1	005272	Conn, 8PF, 2x4 Housing
	2	005292	Screw, #6 x 1, Self-tap, 18-8 SS
	1	005295	Bottom Cap, Mod Turb, Quanta
	1	005316	Retainer, Turbidity, Quanta
	1	006319	Board Assembly, Quanta Turbidity
OF19	1	006501	PA, Quanta LISRef (Not Shown)
			(Replacement LISRef sensor tip is 003333)
	1	006503	Bottom Cap, Mod LISRef, Quanta
OF19a	1	002896	Transducer, 25m, Quanta LISRef (Not Shown)
OF19b	1	002897	Transducer, 100m, Quanta LISRef (Not Shown)
OF19c	1	002899	Transducer, 10m, Vented, Quanta LISRef (Not Shown)
OF20	1	005296	Bottom Cap, Mod Turb/LISRef, Quanta (Not Shown)


QF18
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QF11
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QF18
QF18
QF19
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QF04
QF05
QF06
QF08
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QF10
QF14
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QF01
QF12
QF02
QF03
QF07
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QF13
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7

SERVICE and LIMITED 3-YEAR WARRANTY

THIS WARRANTY IS EXPRESSLY MADE BY HYDROLAB CORPORATION AND ACCEPTED BY PURCHASER IN LIEU OF ALL OTHER WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER WRITTEN OR ORAL, EXPRESS OR IMPLIED, OR STATUTORY. HYDROLAB DOES NOT ASSUME ANY OTHER LIABILITIES IN CONNECTION WITH ANY PRODUCT.

WHAT IS COVERED

This warranty statement applies to the Quanta Transmitter and Quanta Display.

All new Hydrolab Quanta Transmitters and Quanta Displays are warranted by Hydrolab against defects in materials and workmanship for 3 years from date of invoice. Our obligation to repair or to replace products, including dissolved oxygen sensors, does not apply to those that have been consumed through normal use.

WHAT IS NOT COVERED

This warranty does not apply to products or parts thereof which may be used or connected to Hydrolab equipment but which are not manufactured by Hydrolab. This warranty specifically excludes batteries of any type and all other items, such as calibration solutions, which carry shelf lives.

This warranty does not apply to products or parts thereof which have been altered or repaired outside of a Hydrolab factory or other authorized service center, or products damaged by improper installation or application, or subjected to misused, abuse, neglect or accident.

WHAT WE WILL DO

During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective provided that you return the product, shipping prepaid, to Hydrolab. Hydrolab's liability and obligations in connection with any defects in materials and workmanship are expressly limited to repair or replacement, and your sole and exclusive remedy in the event of such defects shall be repair or replacement.

Hydrolab's obligations under this warranty are conditional upon it receiving prompt written notice of claimed defects within the warranty period and its obligations are expressly limited to repair or replacement as stated above.

WHAT WILL WE NOT DO

Hydrolab shall not be liable for any contingent, incidental, or consequential damage or expense incurred by you or others due to partial or complete inoperability of its products for any reason whatsoever or due to any inaccurate information generated by its products. Hydrolab's obligations and your remedies are limited as described above.

Products are sold on the basis of specifications applicable at the time of sale. Hydrolab Corporation shall have no obligation to modify or update products once sold.

WARRANTY AND SERVICE INFORMATION

If you have any questions concerning this warranty, please call Hydrolab by telephone, fax, letter, or e-mail, at Hydrolab Corporation 8700 Cameron Road, Suite 100, Austin, Texas, 78754, USA; telephone: 800-949-3766 or 512-832-8832; fax: 512-832-8839; e-mail: techsupport@hydrolab.com.

Should you be advised by Hydrolab to return an item, a returned materials authorization number (RMA Number) will be issued. The RMA number must be shown on the Service Memorandum, the address label of each shipping carton, and any correspondence related to the equipment returned for repair.

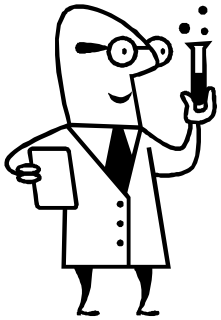
Please carefully pack your equipment in its original shipping case (or other protective package) to avoid in-transit damage. Such damage is not covered by warranty, so we suggest that you insure the shipment. We also recommend that the entire instrument, including the battery pack and charger (when applicable), be returned unless a particular faulty component has been clearly isolated.

Send the instrument and a complete Service Memorandum to Hydrolab, using the address shown on the Service Memorandum.

Whether or not the unit is under warranty, it is your responsibility to pay shipping charges for delivery to Hydrolab.

Attachment IV

Open Water Body
Water Quality Monitoring Training Program



OPEN WATER BODY
WATER QUALITY MONITORING
TRAINING PROGRAM

Equipment: Quanta III, Hydrolab
Measures: Temperature, Dissolved Oxygen, Salinity

Operation: The Quanta III Hydrolab is used at each of the 19 different stations within the estuary. The Quanta transmitter is attached to a white platform that is descended into the water. Depth, temperature, dissolved oxygen and salinity levels are taken at 0.5 meters above the bottom, 1.0 meter from the surface and 0.5 meter from the surface. This information will be transmitted from the probe and displayed on the Quanta display. Before the platform is descended, the storage cup should be taken off the transmitter and the guard should be put on in its place. As the platform is being descended, the power and circulator should be turned on by depressing the On/Off and Escape/Circulator buttons on the keypad. Both temperature and dissolved oxygen measurements are displayed on the first screen. To get to salinity, you must be certain to press the Enter button on the keypad. Record readings at each depth after the parameter values have stabilized (i.e. do not change significantly) after several seconds. After measurements have been taken, the platform is taken out of the water where the storage cup is placed back on the transmitter with water inside it. Both the circulator and power should be off in between traveling from station to station. All information is recorded on the data sheet.

Equipment Secchi disk
Measures: Turbidity or Clarity

Operation: The secchi disk is used to test for turbidity (how clear the water is) at each of the 19 stations. The secchi disk is a black and white circular disk attached to a rope. The disc is descended into the water until it is no longer visible. At that moment, the monitor should make a note of where on the rope (marked with black marks every meter) the secchi disappeared. The monitor should then lift the rope until the secchi becomes visible again and once again, make a note of where on the rope the secchi has reappeared. The average of these two marks, where noted, is what is recorded on the data sheet. This

procedure should be repeated by another volunteer. If the difference of the two values is less than 0.1 m, average those values as the Secchi Disk Depth. If the values deviate by more than 0.1 m, repeat the process until two values that deviate by less than 0.1 m are obtained.

Equipment: Bottles
Measures: Bacteria (Total and Fecal Coliform and Enterococci)

Operation: Bottles are used to collect water samples at each of the 19 stations to test for indicator bacteria. Samples are transported to the Nassau County Department of Public Health lab by the water quality monitoring coordinator. BE CERTAIN NOT TO PUT FINGERS INSIDE THE BOTTLE. Collect the sample by partially immersing the bottle in the water and slowly letting water pour in over the rim. Don't overfill the bottle. Don't use a bucket, cup, scoop, or any other means to pour water in the bottle. Immersing the bottle directly will prevent possible contamination of the sample.

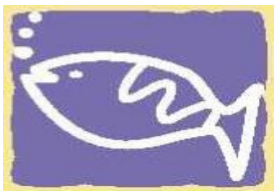
Equipment: Nitrogen bottles
Measures: Nitrite and nitrate, Total Kjeldahl Nitrogen, Ammonia

Operation: A sample of water is taken from each of the 19 stations to detect the amount of nitrite and nitrate, Total Kjeldahl Nitrogen, and Ammonia in the water. Some of the sample bottles contain an acid preservative. Do not allow the sulfuric acid preservative to contact skin or eyes, or escape from the bottle. Rinse out an empty sample bottle that does not contain preservative using water from the monitoring location site, fill the empty bottle by immersing it in the water in a slightly different spot at the monitoring location (e.g., the other side of the boat), and pour the water into the nitrogen sample bottle that contains the acid preservative. Do not overfill the empty collection bottle, which will reduce the potential for overfilling of the sample bottle and potential loss of the acid preservative. The empty sample collection bottle can be reused at each monitoring location, provided that it is rinsed out with water at each location prior to collecting the sample.

Attachment V

Wildlife Monitoring Datasheet

Friends of the Bay
Wildlife Monitoring



Date _____ *Volunteer:*_____

Cold Spring Harbor (sites 1, 2, 3, 4)
Oyster Bay Harbor (sites 5, 6, 7, 8, 9)
West Harbor (sites 10, 11, 12)
Mill Neck Creek (sites 13, 14, 15, 16, 17, 18, 19)

Attachment VI

‘Things to Remember’ Training Document

Things to Remember!

Make sure there is a radio or a cell phone on board! Bring a waterproof pouch for cell phone, radio and camera.

Conduct sampling in order of station numbering (start at #1 in Cold Spring Harbor), unless specifically requested to do otherwise.

Use Global Positioning System (GPS) navigator to locate the sampling stations.

Calibrate the Quanta before or after each monitoring event. If the Quanta is calibrated after a monitoring event, check the calibration prior to the next weekly monitoring event and recalibrate the instrument, if necessary, before use. Use the Quanta with care!

At each station, use Quanta to measure depth, oxygen, temperature, and salinity. Take the measurements ½ meter up from the bottom, 1 meter from the surface, and ½ meter from the surface. (Record the bottom depth, then take the first reading ½ meter up from there.)

Make sure to keep fingers out of the bacteria collection bottles. Label each bottle with a black sharpie pen. Label the bottles, not the lids. Each bottle should be marked with location site and date.

Make sure to collect a second bacteria sample at one location for lab quality control.

For Nitrogen sampling, take <u>three</u> samples at one site in Mill Neck Creek for lab quality control. Label them (for example) FB-14a, FB-14b, FB-14c. The sampling is done once monthly, try to keep it at regular intervals (first Monday of the month).

Keep the Quanta probe and membranes wet at all times. Between sampling stations, store the Quanta's probe in the storage cap with fresh distilled water . Rinse the probe with distilled water before each sample. At the end of the sampling day, rinse off the probe gently with distilled water, and then fill the probe cap with distilled water before attaching it for storage.

Two people should take Secchi disk readings; their initials should be at the top of the data column.

Transcribe data from the individual water quality monitoring data sheets onto the Chain of Custody Form prior to delivering the samples to the Nassau County Laboratory. The Chain of Custody Form accompanies the samples to the Lab.

The samples must be kept on ice. The bacteria samples must reach the Lab within six hours of the first sample being drawn.

Don't let nitrogen sample preservative get on your hands, and don't overfill bottle during sampling. Ensure that all preservative stays within the bottle.

Attachment VII

Memo to Volunteer Water Quality Monitors

Memo

To: Volunteer Water Quality Monitors

From: Pat Aitken, Volunteer Water Quality Monitoring Coordinator

Re: Volunteer Water Quality Monitoring, Training Session

The following is a list of a few key items that are important to know for water quality monitoring:

Water Quality Monitoring occurs every Monday at 7:30 am sharp beginning the first Monday in April until the end of October. If there is inclement weather, I will contact you to let you know if the monitoring day has been cancelled. Please be sure to let me know if your home or cel phone number changes.

Please sign up for water quality monitoring in advance. We want to avoid having an overcrowded boat one week, and not enough volunteers the next week. If you know you won't be able to attend a day of volunteering, please let me know ASAP.

Dress appropriately for the weather. It can get pretty chilly on board the *Baywatch*, even during the warmer months. Better to dress in layers and then remove some if it gets too warm. We usually have bug spray and sunscreen on board. There is no cabin or head on the Baywatch. There is a bathroom at the F.M. Flower and Sons hatchery.

We monitor 19 different sites within the estuary. Generally, we finish between 11 or 12 pm. Please be prepared to be on the boat until we have completed sampling. If you cannot be on the boat for that long, it is not a good idea to volunteer to be a water quality monitor. We do have other volunteer opportunities that might suit your schedule better.

Remember to rinse off the monitoring equipment with distilled water after all monitoring trips.

Our water quality monitoring display boards are located around the estuary in Bayville, Oyster Bay and Cold Spring Harbor. It would be very helpful to have some volunteers to update these boards on a weekly basis. Information will be provided to you by the Volunteer Water Quality Monitoring Coordinator.

Have fun. Although it is important that we do our sampling and monitoring efficiently, we want you to get the most out of your volunteering experience.

Thank you so much for all of your support!

Attachment VIII

LaMotte Winkler Titration Test Kit Manual
EPA Method 360.2 Cut Sheet

DISSOLVED OXYGEN TEST KIT

CODE 5860

For determining the dissolved oxygen content of water, this test kit uses the azide modification of the Winkler Method and employs a LaMotte Direct Reading Titrator in the final titration.

QUANTITY	CONTENTS	CODE
30 mL	*Manganous Sulfate Solution	*4167-G
30 mL	*Alkaline Potassium Iodide Azide	*7166-G
30 mL	*Sulfuric Acid, 1:1	*6141WT-G
60 mL	*Sodium Thiosulfate, 0.025N	*4169-H
30 mL	Starch Indicator Solution	4170WT-G
1	Direct Reading Titrator, 0 - 10	0377
1	Titration Tube, 20 mL, w/cap	0299
1	Bottle, Water Sampling, 60 mL, glass	0688-DO

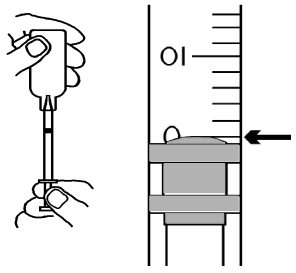
***WARNING:** Reagents marked with a * are considered hazardous substances. Material Safety Data Sheets (MSDS) are supplied for these reagents. For your safety, read label and accompanying MSDS before using.

To order individual reagents or test kit components, use the specified code number.

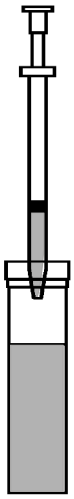
NOTE: A Check Standard is needed to perform an "EPA Accepted" test.

DIRECT READING TITRATOR INSTRUCTIONS

1. Fill the titration tube to 20 mL line with sample water.
2. Add the reagents as specified in the test procedure. Cap the tube with the special titration tube cap. Mix by swirling gently.
3. Depress the plunger of the Titrator to expel air.
4. Insert the Titrator into the plastic fitting of the titrating solution bottle.



5. To fill the Titrator invert the bottle and slowly withdraw the plunger until the bottom of the plunger is opposite the zero mark on the scale.



NOTE: A small air bubble may appear in the Titrator barrel. Expel the bubble by partially filling the barrel and pumping the titrating solution back into the inverted reagent container. Repeat this pumping action until the bubble disappears.

6. Turn the bottle right-side-up and remove the Titrator.

7. Insert the tip of the Titrator into the opening of the titrator tube cap. Slowly depress the plunger to dispense the titrating solution. Gently swirl tube to mix. A slight rotating or twisting motion may permit the plunger to move more smoothly.

8. Continue adding the titrating solution until the specified color change occurs. If no color change occurs by the time the plunger tip reaches the bottom of the scale, refill the Titrator to the zero mark. Continue the titration. Include both titration amounts in the final test result.

9. Read the test result directly from the scale opposite the bottom of the plunger tip.

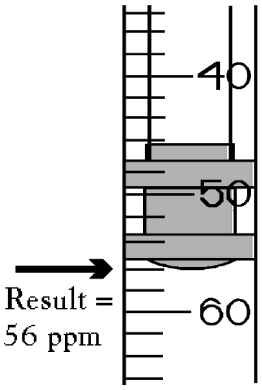
10. If no additional tests are to be made, discard the titrating solution in the Titrator. Thoroughly rinse the Titrator and the titration tube.

NOTE: The plunger tip should periodically be coated with silicon grease.

COLLECTION & TREATMENT OF THE WATER SAMPLE

Step 1 through 4 below describe proper sampling technique in shallow water. For sample collection at depths beyond arm's reach, special water sampling apparatus is required (e.g., the LaMotte Water Sampling Chamber, Code 1060; Model JT-1 Water Sampler, Code 1077; Water Sampling Outfit, Code 3103; or Code 3-0026 Water Sampling Bottle).

1. To avoid contamination, thoroughly rinse the Water Sampling Bottle (0688-DO) with sample water.
2. Tightly cap the bottle and submerge to the desired depth. Remove cap and allow the bottle to fill.
3. Tap the side of the submerged bottle to dislodge any air bubbles clinging to the inside. Replace cap while the bottle is still submerged.
4. Retrieve bottle and examine it carefully to make sure that no air bubbles are trapped inside. Once a satisfactory sample has been collected, proceed immediately with Steps 5 & 6 to "fix" the sample.



NOTE: Be careful not to introduce air into the sample while adding the reagents in Steps 5 & 6. Simply drop the reagents into sample. Cap carefully, and mix gently.

5. Add 8 drops of *Manganous Sulfate Solution (4167) and 8 drops of *Alkaline Potassium Iodide Azide (7166). Cap and mix by inverting several times. A precipitate will form. Allow the precipitate to settle below the shoulder of the bottle before proceeding.
6. Add 8 drops of *Sulfuric Acid, 1:1 (6141WT). Cap and gently mix until the precipitate has dissolved. A clear-yellow to brown-orange color will develop, depending on the oxygen content of the sample.

NOTE: Following the completion of Step 6, contact between the water sample and the atmosphere will not affect the test result. Once the sample has been "fixed" in this manner, it is not necessary to perform the actual test procedure immediately. Thus, several samples can be collected and "fixed" in the field, and then carried back to a testing station or laboratory where the test procedure is to be performed.

TEST PROCEDURE

1. Fill the titration tube (0299) to the 20 mL line with the "fixed" sample and cap.
2. Fill the Direct Reading Titrator (0377) with *Sodium Thiosulfate, 0.025N (4169). Insert the Titrator into the center hole of the titration tube cap. While gently swirling the tube, slowly press the plunger to titrate until the yellow-brown color is reduced to a very faint yellow.

   NOTE: If the color of the "fixed" sample is already a very faint yellow, skip to Step 3.
3. Remove the Titrator and cap. Be careful not to disturb the Titrator plunger, as the titration begun in Step 2 will be continued in Step 4. Add 8 drops of Starch Indicator Solution (4170WT). Sample should turn blue.
4. Replace the cap and Titrator. Continue titrating until the blue color just disappears. Read the test result where the plunger tip meets the scale. Record as ppm dissolved oxygen.

   NOTE: Each minor division on the Titrator scale equals 0.2 ppm.

   NOTE: If the plunger tip reaches the bottom line on the Titrator scale (10 ppm) before the endpoint color change occurs, refill the Titrator and continue the titration. When recording the test result, be sure to include the value of the original amount of reagent dispensed (10 ppm).

LaMOTTE COMPANY

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Visit us on the web at www.lamotte.com

3/98

Appendix B Oyster Bay/Cold Spring Harbor Estuary Fact Sheet

Friends of the Bay
Working to keep the oyster in Oyster Bay
Post Office Box 564 • Oyster Bay, NY 11771

Oyster Bay/Cold Spring Harbor Estuary Complex

Background Information

Located on the north shore of Long Island, the Oyster Bay/Cold Spring Harbor Estuary Complex – approximately 6,000 acres in size – is recognized as a vital natural, economic, cultural, historical and recreational resource.

And there is so much more to know about the Oyster Bay/Cold Spring Harbor Estuary Complex:

- The Oyster Bay/Cold Spring Harbor Estuary Complex is an embayment of Long Island Sound. (In 1987, the Sound was officially designated an Estuary of National Significance under the National Estuary Program.)

- The U.S. Fish & Wildlife Service maintains a National Wildlife Refuge (NWR) within the Oyster Bay/Cold Spring Harbor Estuary Complex. In fact, the Oyster Bay NWR – which encompasses part of Cold Spring Harbor – is the largest of the Long Island Complex's eight refuges. The NWR consists of 3,209 acres of bay bottom, saltmarsh, and a small freshwater wetland. Nationally, Oyster Bay NWR is one of the few bay bottom Refuges owned and managed by the U.S. Fish and Wildlife Service.[1]

  The Oyster Bay NWR – which was established in 1968 via land donation from the Town of Oyster Bay and several local villages under the Migratory Bird Conservation Act – consists of high quality marine habitats that support a variety of aquatic-dependent wildlife. The refuge's waters and marshes surround Sagamore Hill National Historic Site, home of Theodore Roosevelt - father of the National Wildlife Refuge System.[2]

  Subtidal (underwater up to mean high tide line) habitats are abundant with marine invertebrates, shellfish and finfish.[3] The Refuge is located off of the Long Island Sound and the sheltered nature of the bay makes it extremely attractive as winter habitat for a variety of waterfowl species, especially diving ducks.[4]

  In 2005, Defenders of Wildlife included the Oyster Bay NWR on their list of the ten most endangered Refuges in the country. The *Refuges at Risk: America's Ten Most Endangered National Wildlife Refuges 2005* report explains that the Oyster Bay NWR has become threatened by polluted stormwater runoff; non-sustainable development; habitat destruction; and human sewage associated with failing sewer infrastructure, inadequate on-site septic systems, and boat discharge.

- For almost two decades there have been three State-designated Significant Coastal Fish and Wildlife Habitats within the Oyster Bay/Cold Spring Harbor Estuary: Cold Spring Harbor, Oyster Bay Harbor, and Mill Neck Creek Wetlands (these habitat designations date back to 1987).[5] The New York State Department of State recently concluded a review involving proposed revisions to 25 designated Significant Coastal Fish and Wildlife Habitats (SCFWH) on the North Shore in Nassau and Suffolk counties. The

[1] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[2] http://refuges.fws.gov/profiles/index.cfm?id=52563
[3] http://refuges.fws.gov/profiles/index.cfm?id=52563
[4] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[5] http://www.nyswaterfronts.com/waterfront_natural_narratives.asp

habitat designations went into effect on October 15, 2005. Among the 25 habitats that have been revised are areas that fall within the OB/CSH Estuary. The three Habitats will now be consolidated into two: 1) Mill Neck Creek, Beaver Brook, and Frost Creek and 2) Oyster Bay and Cold Spring Harbor.

- OB/CSH Fish and Wildlife Facts:
  - More than 126 bird species have been documented at the Oyster Bay National Wildlife Refuge, including 23 species of waterfowl.[6]
  - Oyster Bay National Wildlife Refuge has the heaviest winter waterfowl use of any of the Long Island National Wildlife Refuges.[7]
  - According to the U.S. Fish and Wildlife Service (USFWS), species that rely on this ecosystem include Federal and State designated endangered and threatened species such as the bald eagle, peregrine falcon, osprey, northern harrier, and least tern.[8]
  - The northern diamondback terrapin is common at the Oyster Bay National Wildlife Refuge, particularly in the Frost Creek and Mill Neck Creek sections. The Refuge is considered to have one of the largest populations of diamondback terrapins on Long Island.[9]
  - The Harbor Complex hosts a productive marine finfishery. Oyster Bay has been designated by the National Marine Fisheries Service (NMFS) as Essential Fish Habitat (EFH) for 15 species of finfish across multiple life stages. The harbor serves as a nursery and feeding ground from early spring to late fall for these species and, as a result, contributes to the abundance of fisheries resources that are of regional significance.[10]

- In 1997, the New York State Department of State's Long Island Sound Coastal Management Program recognized the area as a Regionally Important Natural Area.[11] [More, below, on SCF&W Habitat and RINA]

- The Oyster Bay/Cold Spring Harbor Estuary Complex is also considered one of the most important shellfish producing areas in New York State. The majority of Oyster Bay is certified for commercial shellfish harvest, with economically important shellfisheries including oyster (*Crassotrea virginica*) and hard clam (*Mercinaria mercinaria*). The waters of Oyster Bay are classified SA - the highest and best water quality determination for shellfishing. This is an unusual distinction given the harbor complex's proximity to New York City and the fact that harbors to the west have been closed for more than 30 years.

- The F.M. Flower & Sons Company, along with more than 80 independent commercial baymen, annually harvests up to 90% of New York State's oyster crop[12] and 33% of hard clams[13] from the heart of the Oyster Bay National Wildlife Refuge.

- The Harbor Complex is home to the Cold Spring Harbor Fish Hatchery & Aquarium. The Hatchery is proud to have the largest living collection of New York State freshwater reptiles, fish and amphibians which are housed in the Julia F. Fairchild Building, the Walter L. Ross II Aquarium Building and in eight outdoor ponds. Brook, Brown and Rainbow trout are raised to stock private ponds.

- Renowned for its maritime legacy, Oyster Bay has been designated a "historic maritime area" by New York State.

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[6] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[7] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[8] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[9] http://refuges.fws.gov/profiles/WildHabitat.cfm?ID=52563
[10] National Marine Fisheries Service and Mid-Atlantic Fishery Management Council. 2000. *Guide to Essential Fish Habitat Designations in the Northeastern United States.* http://www.nero.noaa.gov/hcd/webintro.html
[11] http://www.nyswaterfronts.com/downloads/pdfs/lis_cmp/Chap6.pdf
[12] http://refuges.fws.gov/profiles/index.cfm?id=52563
[13] 2004 New York Annual Shellfish Landings, New York State Department of Environmental Conservation

What is a Significant Coastal Fish & Wildlife Habitat?

The New York State Department of Environmental Conservation evaluates the significance of coastal fish and wildlife habitats, and following a recommendation from the DEC, the Department of State designates and maps specific areas.

A habitat is designated "significant" if it serves one or more of the following functions: (a) the habitat is essential to the survival of a large portion of a particular fish or wildlife population; (b) the habitat supports populations of species which are endangered, threatened or of special concern; (c) the habitat supports populations having significant commercial, recreational, or educational value; and (d) the habitat exemplifies a habitat type which is not commonly found in the state or in a coastal region.

In addition, the significance of certain habitats increases to the extent they could not be replaced if destroyed.

What is a Regionally Important Natural Area?

Regionally important natural areas are defined geographic areas within the Long Island Sound coastal boundary and generally are composed of a variety of smaller, natural ecological communities that together form a landscape of environmental, social, and economic value to the people of New York. A regionally important natural area would meet the following three conditions:

1) The area contains significant natural resources.
2) The resources are at risk.
3) Additional management measures are needed to preserve or improve the significant resources, or sustain their use.

Appendix C Excel Spread Sheet

2004 Coliform levels

Site	Parameter mpn/100ml	5/5	5/12	5/19	6/2	6/9	6/16	6/23	6/30	7/7	7/14	7/21	7/28	8/4	8/11	8/18	8/25	9/1	9/15	9/22	10/6	10/13	10/27
FB-01	*Total Coliform*	80	80	230	N/A	80	300	800	160000	1300	3000	300	160000	2200	23	230	130	800	500	280	80	1300	80
FB-01	***Fecal Coliform***	50	22	50	N/A	23	230	280	160000	800	3000	70	9000	1100	23	130	130	130	300	50	14	800	80
FB0-2	*Total Coliform*	230	23	1300	N/A	30	230	80	5000	130	3000	300	1700	130	80	130	80	300	230	230	80	220	50
FB0-2	***Fecal Coliform***	130	4	230	N/A	23	130	50	2200	80	1300	300	500	50	80	80	23	70	50	30	30	80	4
FB-03	*Total Coliform*	23	23	230	N/A	130	230	70	300	80	500	50	800	50	4	13	30	50	30	80	23	130	50
FB-03	***Fecal Coliform***	23	13	30	N/A	30	230	70	300	30	300	50	300	22	2	2	23	30	23	30	8	30	13
FB-04	*Total Coliform*	13	8	230	N/A	8	50	50	8	4	23	4	30	4	80	23	4	2	13	13	2	4	22
FB-04	***Fecal Coliform***	2	2	23	N/A	4	14	30	4	4	8	2	17	4	80	2	2	2	8	8	2	2	11
FB-05	*Total Coliform*	8	2	23	N/A	8	30	13	8	22	130	4	4	23	8	30	13	17	8	2	2	2	8
FB-05	***Fecal Coliform***	2	2	8	N/A	2	2	8	2	11	4	4	2	2	8	23	2	11	4	2	2	2	4
FB-06	*Total Coliform*	2	2	4	N/A	30	30	8	7	30	80	8	130	23	2	17	2	27	13	13	2	2	23
FB-06	***Fecal Coliform***	2	2	2	N/A	2	8	2	7	23	8	4	2	8	2	4	2	22	4	13	2	2	23
FB-07	*Total Coliform*	2	23	23	N/A	300	30	230	50	230	800	110	500	80	11	300	130	170	300	80	130	500	230
FB-07	***Fecal Coliform***	2	2	23	N/A	13	7	230	50	50	230	17	110	23	4	80	130	50	130	50	23	300	50
FB-08	*Total Coliform*	13	22	23	N/A	50	30	170	8	50	5000	80	500	30	23	23	30	230	30	80	30	22	130
FB-08	***Fecal Coliform***	4	4	2	N/A	8	7	50	2	30	300	30	230	8	13	13	8	130	4	13	13	8	50
FB-09	*Total Coliform*	23	80	34	130	23	23	30	13	23	50	30	800	80	8	30	17	50	50	23	23	30	13
FB-09	***Fecal Coliform***	2	50	22	50	4	2	13	8	4	8	30	130	7	4	13	11	13	30	4	4	30	8
FB-10	*Total Coliform*	23	300	50	300	130	2300	300	130	230	1700	220	8000	230	11	80	23	130	1300	230	23	80	300
FB-10	**Fecal Coliform**	4	130	30	17	30	23	230	50	50	800	110	230	50	2	30	23	80	1300	22	8	50	50
FB-11	*Total Coliform*	8	8	30	130	23	2	23	2	13	80	2	80	8	230	80	13	13	N/A	30	2	1	8
FB-11	***Fecal Coliform***	2	2	23	30	8	2	4	2	8	23	2	30	4	80	50	2	13	30	13	2	13	8
FB-12	*Total Coliform*	23	8	50	300	30	30	23	11	23	30	4	30	2	14	14	7	22	23	8	8	8	8
FB-12	***Fecal Coliform***	17	4	50	230	4	8	23	7	8	13	2	30	2	14	2	4	6	8	2	4	8	4
FB-13	*Total Coliform*	230	30	80	500	80	30	230	300	70	500	80	50	800	13	130	13	2300	500	300	30	50	30
FB-13	***Fecal Coliform***	230	30	80	500	50	23	80	50	70	300	80	50	500	8	130	13	2300	300	170	17	22	23
FB-14	*Total Coliform*	230	30	300	130	130	23	300	70	500	800	300	300	3000	50	300	170	1700	500	230	130	230	50
FB-14	***Fecal Coliform***	130	8	50	30	50	23	230	30	300	500	170	230	3000	30	230	110	1700	500	230	50	230	30
FB-15	*Total Coliform*	230	N/A	80	2300	300	2300	N/A	5000	N/A	5000	N/A	24000	N/A	300	N/A	230	N/A	N/A	300	N/A	800	2300
FB-15	***Fecal Coliform***	80	N/A	30	2300	110	300	N/A	5000	N/A	3000	N/A	13000	N/A	170	N/A	130	N/A	N/A	170	N/A	800	500
FB-16	*Total Coliform*	230	30	N/A	800	50	300	N/A	300	N/A	5000	N/A	5000	N/A	80	N/A	230	N/A	N/A	800	N/A	300	50
FB-16	***Fecal Coliform***	130	30	N/A	500	30	80	N/A	230	N/A	2300	N/A	3000	N/A	17	N/A	80	N/A	N/A	230	N/A	130	8
FB-17	*Total Coliform*	130	N/A	N/A	2300	N/A	500	N/A	500	N/A	5000	N/A	13000	N/A	500	N/A	130	N/A	N/A	N/A	N/A	1300	80
FB-17	***Fecal Coliform***	30	N/A	N/A	500	N/A	80	N/A	300	N/A	2300	N/A	2300	N/A	220	N/A	80	N/A	N/A	N/A	N/A	230	30
FB-18	*Total Coliform*	170	N/A	23	500	30	N/A	300	130	130	500	50	300	50	80	230	23	300	130	30	30	30	23
FB-18	***Fecal Coliform***	30	N/A	23	300	2	N/A	80	50	80	500	13	80	50	80	80	23	300	80	23	30	23	8
FB-19	*Total Coliform*	130	23	30	2300	50	30	130	300	80	130	80	300	500	30	300	30	230	300	80	23	110	23
FB-19	***Fecal Coliform***	80	8	23	1300	8	13	80	50	13	130	80	30	80	30	30	13	230	130	50	23	80	4

2004 Coliform levels

N/A = data not available

Monthly Geomeans		May	June	July	August	Sept	Oct	
FB-01		114	1324	3699	197	482	203	*Total Coliform*
FB-01		38	698	1109	144	125	96	***Fecal Coliform***
FB-02		190	229	668	102	251	96	*Total Coliform*
FB-02		49	135	353	52	47	21	***Fecal Coliform***
FB-03		50	158	200	17	49	53	*Total Coliform*
FB-03		21	110	108	7	27	15	***Fecal Coliform***
FB-04		29	20	10	13	7	6	*Total Coliform*
FB-04		5	9	6	6	5	4	***Fecal Coliform***
FB-05		7	13	15	16	6	3	*Total Coliform*
FB-05		3	3	4	5	4	3	***Fecal Coliform***
FB-06		3	15	40	6	17	5	*Total Coliform*
FB-06		2	4	6	3	10	5	***Fecal Coliform***
FB-07		10	101	317	77	160	246	*Total Coliform*
FB-07		5	32	68	31	69	70	***Fecal Coliform***
FB-08		19	38	316	26	82	44	*Total Coliform*
FB-08		3	9	89	10	19	17	***Fecal Coliform***
FB-09		40	31	72	24	39	21	*Total Coliform*
FB-09		13	8	19	8	12	10	***Fecal Coliform***
FB-10		70	323	911	46	339	82	*Total Coliform*
FB-10		25	42	178	16	132	27	**Fecal Coliform**
FB-11		12	12	20	37	20	3	*Total Coliform*
FB-11		5	5	10	13	17	6	***Fecal Coliform***
FB-12		21	37	17	7	16	8	*Total Coliform*
FB-12		15	16	9	4	5	5	***Fecal Coliform***
FB-13		82	153	109	65	701	36	*Total Coliform*
FB-13		82	75	96	51	490	20	***Fecal Coliform***
FB-14		127	96	436	296	580	114	*Total Coliform*
FB-14		37	47	277	218	580	70	***Fecal Coliform***
FB-15		136	1678	10954	263	300	1356	*Total Coliform*
FB-15		49	785	6245	149	170	632	***Fecal Coliform***
FB-16		83	245	5000	136	800	122	*Total Coliform*
FB-16		62	129	2627	37	230	32	***Fecal Coliform***

2004 Coliform levels

FB-17		130	832	8062	255	N/A	322	*Total Coliform*														
FB-17		30	229	2300	133	N/A	83	***Fecal Coliform***														
FB-18		63	156	177	68	105	27	*Total Coliform*														
FB-18		26	39	80	52	82	18	***Fecal Coliform***														
FB-19		45	168	126	108	177	39	*Total Coliform*														
FB-19		25	56	45	45	114	19	***Fecal Coliform***														

2004 Coliform levels

Season GM	Bay wide GM			Bathing WQ Standards			GM/month			
							shellfishing	swim	shellfish	
			Cold Spring Harbor			coliform	70	2400	<10% >5000	8
						fecal	14	200	0, >1000	
			Oyster Bay		Open Waters fecal coliform					
					Coves of Oyster Bay					
					22					
			Mill Neck Creek							

2004 Season
Site 19 - Flowers Oyster Hatchery

Date	H20 Temp TOP (0.5m)	H20 Temp 0.5 m from BTM	Salinity TOP	Salinity BTM	Top DO	BTM DO	Secchi	Depth (meters)	Air Temp	H2O Temp BTM mothly AVG	Fecal Coliform Bacteria	Ammonia (NH3)	Nitrate/Nitrite (NO3-NO2)
5/5/2004	13.06	12.91	23.39	23.73	9.14	9.51	0.65	3.5	17	15.410	80.000		
5/12/2004	17.57	15.74	23.08	23.84	6.81	7.27	0.95	3.3	29		8.000		
5/19/2004	18.3	17.6	23.5	23.9	5.9	6.8	0.85	3.2	19.7		23.000		
6/2/2004	17.9	17.51	24.75	25.02	6.63	6.68	0.55	3.8	22	25.032	1300.000		
6/9/2004	20.09	19.69	24.91	25.24	6.84	6.67	0.6	2.5	28		8.000		
6/16/2004	21.95	21.39	25.33	25.45	6.08	5.92	1.05	4.1	30		13.000		
6/23/2004	20.91	20.71	24.08	25.21	5.52	5.45	0.9	2.2	24		80.000		
6/30/2004	20.19	20.83	25.79	25.92	5.38	5.58	1.1	3.9	29		50.000	0.085	<0.050
7/7/2004	22.81	22.57	25.57	25.71	4.21	4.36	1.1	2	25	22.207	13.000		
7/14/2004	21.1	20.89	25.44	25.85	4.42	4.67	1.15	3.7	21		130.000		
7/21/2004	23.54	23.01	25.53	25.86	4.46	4.42	1.1	2.1	28		80.000		
7/28/2004	22.42	22.36	25.42	25.7	4.74	5.58	1.55	3.8	19		30.000	0.163	<0.050
8/4/2004	25.52	25.17	25.6	25.66	3.78	3.4	1.1	1.8	30	23.920	80.000		
8/11/2004	23.95	23.67	26.11	26.17	4.01	3.97	1.4	3.6	30		30.000		
8/18/2004	23.39	23.25	25.03	25.45	3.09	3.02	1.1	3	25		30.000		
8/25/2004	23.72	23.6	26.1	26.1	3.41	3.36	1.5	3.3	26		13.000		
9/1/2004	24.29	24.2	26.12	26.26	2.89	3.26	1.25	2	25	22.036	230.000		
9/15/2004	22.08	22.16	25.83	26.18	3.98	3.18	1.1	2.5	19		130.000		
9/22/2004	19.67	19.75	25.95	26.02	3.92	4.31	1.5	3	21		50.000		
10/6/2004	18.13	18.07	25.67	25.67	4.99	4.79	1.3	2.8	15	15.433	23.000		
10/12/2004	15.11	15.42	25.34	25.56	4.11	4.36	1.3	3.7	15		80.000		
10/27/2004	12.79	12.81	25.79	25.93	4.48	4.5	2	4.5	15		4.000		

2004 Season
Site 19 - Flowers Oyster Hatchery

Total Kjeldahl Nitrogen (TKN)	Organic Nitrogen (N)	Rainfall in 24 hours	Tidal Stage	Surface Conditions	Water Color	Cloud Cover	Weather	Wind Speed	Wind Direction
		0	4	6	3	2	3	2	6
		0	2	6	3	0	1	0	0
		0	4	6	3	3	3	0	0
		0	4	6	3	1	1	2	6
		0	1	6	3	0	1	2	7
		0	4	6	3	1	1	1	n/a
		0	3	6	3	3	3	1	7
0.223	0.138	0	1	6	3	0	1	0	0
		0	3	5	3	0	1	0	0
		0	4	6	3	4	3	0	0
		0	3	6	3	0	1	0	0
0.507	0.344	0	1	6	3	4	3	0	0
		0	3	6	3	1	1	1	8
		0	2	6	3	2	2	1	5
		2	2	6	3	3	3	0	0
		0	1	6	3	1	2	2	3
		0	2	6	3	0	1	0	0
		0	4	6	3	3	3	0	0
		0	2	6	3	0	1	0	0
		0	2	6	3	0	1	0	0
		0	4	6	3	0	1	1	7
		0	4	6	3	3	2	0	0

Appendix D Laboratory Procedures

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Examir
results
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. Follow the precautions given above on portion sizes
s of tubes per dilution.

re solid or semisolid samples weigh the sample and
to make a 10^{-1} dilution. For example, place 50 g
erile blender jar, add 450 mL sterile phosphate buffer
itone dilution water, and blend for 1 to 2 min at low
speed (8000 rpm). Prepare the appropriate decimal dilutions of the homogenized slurry as quickly as possible to minimize settling.

3. Other Samples

The multiple-tube fermentation technique is applicable to the analysis of salt or brackish waters as well as muds, sediments,

9221 B. Standard Total Coliform Fermentation Technique

1. Presumptive Phase

Use lauryl tryptose broth in the presumptive portion of the multiple-tube test. If the medium has been refrigerated after sterilization, incubate overnight at room temperature (20°C) before use. Discard tubes showing growth and/or bubbles.

a. Reagents and culture medium:

1) *Lauryl tryptose broth:*

Tryptose	20.0 g
Lactose	5.0 g
Dipotassium hydrogen phosphate, K_2HPO_4	2.75 g
Potassium dihydrogen phosphate, KH_2PO_4	2.75 g
Sodium chloride, NaCl	5.0 g
Sodium lauryl sulfate	0.1 g
Reagent-grade water	1 L

Add dehydrated ingredients to water, mix thoroughly, and heat to dissolve. pH should be 6.8 ± 0.2 after sterilization. Before sterilization, dispense sufficient medium, in fermentation tubes with an inverted vial, to cover inverted vial at least one-half to two-thirds after sterilization. Alternatively, omit inverted vial and add 0.01 g/L bromcresol purple to presumptive medium to determine acid production, the indicator of a positive result in this part of the coliform test. Close tubes with metal or heat-resistant plastic caps.

Make lauryl tryptose broth of such strength that adding 100-mL, 20-mL, or 10-mL portions of sample to medium will not reduce ingredient concentrations below those of the standard medium. Prepare in accordance with Table 9221:I.

b. Procedure:

1) Arrange fermentation tubes in rows of five or ten tubes each in a test tube rack. The number of rows and the sample volumes selected depend upon the quality and character of the water to be examined. For potable water use five 20-mL portions, ten 10-mL portions, or a single bottle of 100 mL portion; for nonpotable water use five tubes per dilution (of 10, 1, 0.1 mL, etc.).

In making dilutions and measuring diluted sample volumes, follow the precautions given in Section 9215B.2. Use Figure 9215:1 as a guide to preparing dilutions. Shake sample and dilutions vigorously about 25 times. Inoculate each tube in a set of five with replicate sample volumes (in increasing decimal dilutions, if decimal quantities of the sample are used). Mix test portions in the medium by gentle agitation.

2) Incubate inoculated tubes or bottles at 35 ± 0.5C. After 24 ± 2 h swirl each tube or bottle gently and examine it for growth, gas, and acidic reaction (shades of yellow color) and, if no gas or acidic reaction is evident, reincubate and reexamine at the end of 48 ± 3 h. Record presence or absence of growth, gas, and acid production. If the inner vial is omitted, growth with acidity signifies a positive presumptive reaction.

c. Interpretation: Production of an acidic reaction or gas in the tubes or bottles within 48 ± 3 h constitutes a positive presumptive reaction. Submit tubes with a positive presumptive reaction to the confirmed phase (9221B.2).

9221:I. Preparation of Lauryl Tryptose Broth

Inoculum *mL*	Amount of Medium in Tube *mL*	Volume of Medium + Inoculum *mL*	Dehydrated Lauryl Tryptose Broth Required *g/L*
1	10 or more	11 or more	35.6
10	10	20	71.2
10	20	30	53.4
20	10	30	106.8
100	50	150	106.8
100	35	135	137.1
100	20	120	213.6

The absence of acidic reaction or gas formation at the end of 48 ± 3 h of incubation constitutes a negative test. Submit drinking water samples demonstrating growth without a positive gas or acid reaction to the confirmed phase (9221B.2). An arbitrary 48-h limit for observation doubtless excludes occasional members of the coliform group that grow very slowly (see Section 9212).

2. Confirmed Phase

a. Culture medium: Use brilliant green lactose bile broth fermentation tubes for the confirmed phase.

Brilliant green lactose bile broth:

Peptone	10.0	g
Lactose	10.0	g
Oxgall	20.0	g
Brilliant green	0.0133	g
Reagent-grade water	1	L

Add dehydrated ingredients to water, mix thoroughly, and heat to dissolve. pH should be 7.2 ± 0.2 after sterilization. Before sterilization, dispense, in fermentation tubes with an inverted vial, sufficient medium to cover inverted vial at least one-half to two-thirds after sterilization. Close tubes with metal or heat-resistant plastic caps.

b. Procedure: Submit all presumptive tubes or bottles showing growth, any amount of gas, or acidic reaction within 24 ± 2 h of incubation to the confirmed phase. If active fermentation or acidic reaction appears in the presumptive tube earlier than 24 ± 2 h, transfer to the confirmatory medium; preferably examine tubes at 18 ± 1 h. If additional presumptive tubes or bottles show active fermentation or acidic reaction at the end of a 48 ± 3- h incubation period, submit these to the confirmed phase.

Gently shake or rotate presumptive tubes or bottles showing gas or acidic growth to resuspend the organisms. With a sterile loop 3.0 to 3.5 mm in diameter, transfer one or more loopfuls of culture to a fermentation tube containing brilliant green lactose bile broth or insert a sterile wooden applicator at least 2.5 cm into the culture, promptly remove, and plunge applicator to bottom of fermentation tube containing brilliant green lactose bile broth. Remove and discard applicator. Repeat for all other positive presumptive tubes.

Incubate the inoculated brilliant green lactose bile broth tube at 35 ± 0.5°C. Formation of gas in any amount in the inverted vial of the brilliant green lactose bile broth fermentation tube at any time (e.g., 6 ± 1 h, 24 ± 2 h) within 48 ± 3 h constitutes a positive confirmed phase. Calculate the MPN value from the number of positive brilliant green lactose bile tubes as described in Section 9221C.

c. Alternative procedure: Use this alternative only for polluted water or wastewater known to produce positive results consistently.

If all presumptive tubes are positive in two or more consecutive dilutions within 24 h, submit to the confirmed phase only the tubes of the highest dilution (smallest sample inoculum) in which all tubes are positive and any positive tubes in still higher dilutions. Submit to the confirmed phase all tubes in which gas or acidic growth is produced only after 48 h.

3. Completed Phase

To establish the presence of coliform bacteria and to provide quality control data, use the completed test on at least 10% of positive confirmed tubes (see Figure 9221:1). Simultaneous inoculation into brilliant green lactose bile broth for total coliforms and EC broth for fecal coliforms (see Section 9221E below) or EC-MUG broth for *Escherichia coli* may be used. Consider positive EC and EC-MUG broths elevated temperature (44.5°C) results as a positive completed test response. Parallel positive brilliant green lactose bile broth cultures with negative EC or EC-MUG broth cultures indicate the presence of nonfecal coliforms.

a. Culture media and reagents:

1) *LES Endo agar:* See Section 9222B. Use 100- × 15-mm petri plates.

2) *MacConkey agar:*

Peptone	17	g
Protease peptone	3	g
Lactose	10	g
Bile salts	1.5	g
Sodium chloride, NaCl	5	g
Agar	13.5	g
Neutral red	0.03	g
Crystal violet	0.001	g
Reagent-grade water	1	L

Add ingredients to water, mix thoroughly, and heat to boiling to dissolve. Sterilize by autoclaving for 15 min at 121°C. Temper agar after sterilization and pour into petri plates (100 × 15 mm). pH should be 7.1 ± 0.2 after sterilization.

3) *Nutrient agar:*

Peptone	5.0 g
Beef extract	3.0 g
Agar	15.0 g
Reagent-grade water	1 L

Add ingredients to water, mix thoroughly, and heat to dissolve. pH should be 6.8 ± 0.2 after sterilization. Before sterilization, dispense in screw-capped tubes. After sterilization, immediately place tubes in an inclined position so that the agar will solidify with a sloped surface. Tighten screw caps after cooling and store in a protected, cool storage area.

4) Gram-stain reagents:

a) Ammonium oxalate-crystal violet (Hucker's): Dissolve 2 g crystal violet (90% dye content) in 20 mL 95% ethyl alcohol; dissolve 0.8 g $(NH_4)_2C_2O_4 \cdot H_2O$ in 80 mL reagent-grade water; mix the two solutions and age for 24 h before use; filter through paper into a staining bottle.

b) Lugol's solution, Gram's modification: Grind 1 g iodine crystals and 2 g KI in a mortar. Add reagent-grade water, a few milliliters at a time, and grind thoroughly after each addition until solution is complete. Rinse solution into an amber glass bottle with the remaining water (using a total of 300 mL).

c) Counterstain: Dissolve 2.5 g safranin dye in 100 mL 95% ethyl alcohol. Add 10 mL to 100 mL reagent-grade water.

d) Acetone alcohol: Mix equal volumes of ethyl alcohol (95%) with acetone.

b. Procedure:

1) Using aseptic technique, streak one LES Endo agar (Section 9222B.2) or MacConkey agar plate from each tube of brilliant green lactose bile broth showing gas, as soon as possible after the observation of gas. Streak plates in a manner to insure presence of some discrete colonies separated by at least 0.5 cm. Observe the following precautions when streaking plates to obtain a high

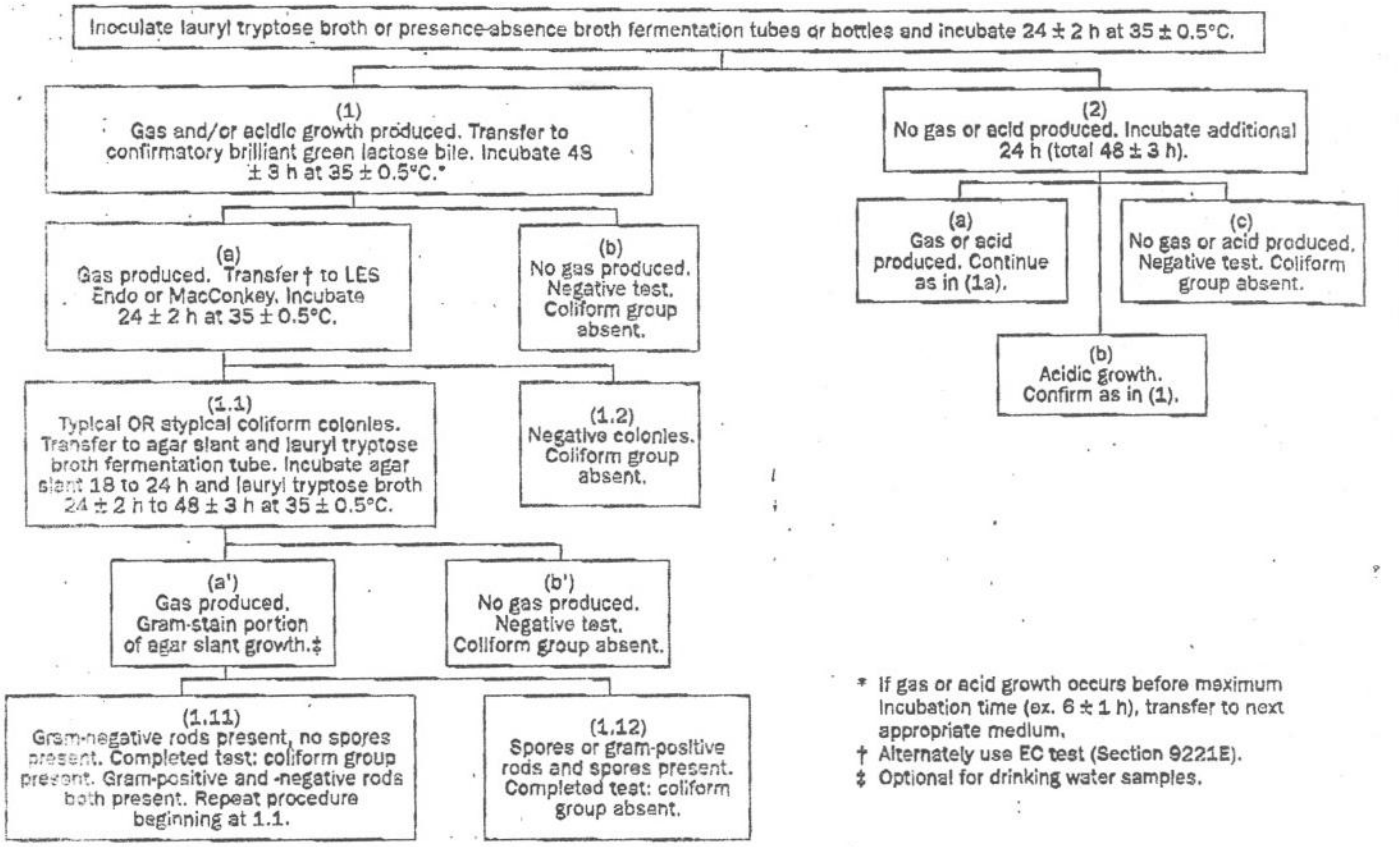

Figure 9221:1. Schematic outline of presumptive, confirmed, and completed phases for total coliform detection.

proportion of successful isolations if coliform organisms are present; (*a*) Use a sterile 3-mm-diam loop or an inoculating needle slightly curved at the tip; (*b*) tap and incline the fermentation tube to avoid picking up any membrane or scum on the needle; (*c*) insert end of loop or needle into the liquid in the tube to a depth of approximately 0.5 cm; and (*d*) streak plate for isolation with curved section of the needle in contact with the agar to avoid a scratched or torn surface. Flame loop between second and third quadrants to improve colony isolation.

Incubate plates (inverted) at 35 ± 0.5°C for 24 ± 2 h.

2) The colonies developing on LES Endo agar are defined as *typical* (pink to dark red with a green metallic surface sheen) or *atypical* (pink, red, white, or colorless colonies without sheen) after 24 h incubation. Typical lactose-fermenting colonies developing on MacConkey agar are red and may be surrounded by an opaque zone of precipitated bile. From each plate pick one or more typical, well-isolated coliform colonies or, if no typical colonies are present, pick two or more colonies considered most likely to consist of organisms of the coliform group, and transfer growth from each isolate to a single-strength lauryl tryptose broth fermentation tube and onto a nutrient agar slant. (The latter is unnecessary for drinking water samples.)

If needed, use a colony magnifying device to provide optimum magnification when colonies are picked from the LES Endo or MacConkey agar plates. When transferring colonies, choose well-isolated ones and barely touch the surface of the colony with a flame-sterilized, air-cooled transfer needle to minimize the danger of transferring a mixed culture.

Incubate secondary broth tubes (lauryl tryptose broth with inverted fermentation vials inserted) at 35 ± 0.5°C for 24 ± 2 h; if gas is not produced within 24 ± 2 h reincubate and examine again at 48 ± 3 h. Microscopically examine Gram-stained preparations from those 24-h nutrient agar slant cultures corresponding to the secondary tubes that show gas.

3) Gram-stain technique—The Gram stain may be omitted from the completed test for potable water samples only because the occurrences of gram-positive bacteria and spore-forming organisms surviving this selective screening procedure are infrequent in drinking water.

Various modifications of the Gram stain technique exist. Use the following modification by Hucker for staining smears of pure culture; include a gram-positive and a gram-negative culture as controls.

Prepare separate light emulsions of the test bacterial growth and positive and negative control cultures on the same slide using drops of distilled water on the slide. Air-dry and fix by passing slide through a flame and stain for 1 min with ammonium oxalate-crystal violet solution. Rinse slide in tap water and drain off excess; apply Lugol's solution for 1 min.

Rinse stained slide in tap water. Decolorize for approximately 15 to 30 s with acetone alcohol by holding slide between the fingers and letting acetone alcohol flow across the stained smear

until the solvent flows colorlessly from the slide. Do not overdecolorize. Counterstain with safranin for 15 s, rinse with tap water, blot dry with absorbent paper or air dry, and examine microscopically. Gram-positive organisms are blue; gram-negative organisms are red. Results are acceptable only when controls have given proper reactions.

c. Interpretation: Formation of gas in the secondary tube of lauryl tryptose broth within 48 ± 3 h and demonstration of gram-negative, nonspore-forming, rod-shaped bacteria from the agar culture constitute a positive result for the completed test, demonstrating the presence of a member of the coliform group.

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9221 C. Estimation of Bacterial Density

1. Precision of Fermentation Tube Test

Unless a large number of sample portions is examined, the precision of the fermentation tube test is rather low. For example, if only 1 mL is examined in a sample containing 1 coliform organism/mL, about 37% of 1-mL tubes may be expected to yield negative results because of random distribution of the bacteria in the sample. When five tubes, each with 1 mL sample, are used under these conditions, a completely negative result may be expected less than 1% of the time.

Consequently, exercise great caution when interpreting the sanitary significance of coliform results obtained from the use of a few tubes with each sample dilution, especially when the number of samples from a given sampling point is limited.

2. Computing and Recording of MPN

To calculate coliform density, compute in terms of the Most Probable Number (MPN). The MPN values, for a variety of planting series and results, are given in Tables 9221:II, III, and IV. Included in these tables are the 95% confidence limits for each MPN value determined. If the sample volumes used are those found in the tables, report the value corresponding to the number of positive and negative results in the series as the MPN/100 mL or report as total or fecal coliform presence or absence.

The sample volumes indicated in Tables 9221:II and III relate more specifically to finished waters. Table 9221:IV illustrates MPN values for combinations of positive and negative results when five 10-mL, five 1.0-mL, and five 0.1-mL volumes of samples are tested. When the series of decimal dilutions is different from that in the table, select the MPN value from Table 9221:IV for the combination of positive tubes and calculate according to the following formula:

$$\text{MPN value (from table)} \times \frac{10}{\text{largest volume tested in dilution series used for MPN determination}} = \text{MPN/100 mL}$$

When more than three dilutions are used in a decimal series of dilutions, use the results from only three of these in computing the MPN. To select the three dilutions to be used in determining the MPN index, choose the highest dilution that gives positive results in all five portions tested (no lower dilution giving any negative results) and the two next succeeding higher dilutions. Use the results at these three volumes in computing the MPN index. In the examples given below, the significant dilution results are shown in boldface. The number in the numerator represents positive tubes; that in the denominator, the total tubes planted; the combination of positives simply represents the total number of positive tubes per dilution:

Example	1 mL	0.1 mL	0.01 mL	0.001 mL	Combination of positives	MPN Index /100 mL
a	**5/5**	**5/5**	**2/5**	**0/5**	5-2-0	5000
b	**5/5**	**4/5**	**2/5**	0/5	5-4-2	2200
c	**0/5**	**1/5**	**0/5**	0/5	0-1-0	20

In *c*, select the first three dilutions so as to include the positive result in the middle dilution.

with the total time in the autoclave limited to 30 min or less. pH should be 6.8 ± 0.2 after sterilization. When the PA medium is sterilized by filtration a 6× strength medium may be used. Aseptically dispense 20 mL of the 6× medium into a sterile 250-mL dilution bottle or equivalent container.

2) *Lauryl tryptose broth:* See Section 9221B.1.

b. Procedure: Shake sample vigorously for 5 s (approximately 25 times) and inoculate 100 mL into a P-A culture bottle. Mix thoroughly by inverting bottle once or twice to achieve even distribution of the triple-strength medium throughout the sample. Incubate at 35 ± 0.5°C and inspect after 24 and 48 h for acid reactions.

c. Interpretation: A distinct yellow color forms in the medium when acid conditions exist following lactose fermentation. If gas also is being produced, gently shaking the bottle will result in a foaming reaction. Any amount of gas and/or acid constitutes a positive presumptive test requiring confirmation.

2. Confirmed Phase

The confirmed phase is outlined in Figure 9221:1.

a. Culture medium: Use brilliant green lactose bile fermentation tubes (see 9221B.2).

b. Procedure: Transfer all cultures that show acid reaction or acid and gas reaction to brilliant green lactose bile (BGLB) broth for incubation at 35 ± 0.5°C (see Section 9221B.2).

c. Interpretation: Gas production in the BGLB broth culture within 48 ± 3 h confirms the presence of coliform bacteria. Report result as presence-absence test positive or negative for total coliforms in 100 mL of sample.

3. Completed Phase

The completed phase is outlined in Section 9221B.3 and Figure 9221:1.

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9221 E. Fecal Coliform Procedure

Elevated-temperature tests for distinguishing organisms of the total coliform group that also belong to the fecal coliform group are described herein. Modifications in technical procedures, standardization of methods, and detailed studies of the fecal coliform group have established the value of this procedure. The test can be performed by one of the multiple-tube procedures described here or by membrane filter methods as described in Section 9222. The procedure using A-1 broth is a single-step method.

The fecal coliform test (using EC medium) is applicable to investigations of drinking water, stream pollution, raw water sources, wastewater treatment systems, bathing waters, seawaters, and general water-quality monitoring. Prior enrichment in presumptive media is required for optimum recovery of fecal coliforms when using EC medium. The test using A-1 medium is applicable to source water, seawater, and treated wastewater.

1. Fecal Coliform Test (EC Medium)

The fecal coliform test is used to distinguish those total coliform organisms that are fecal coliforms. Use EC medium or, for a more rapid test of the quality of shellfish waters, treated wastewaters, or source waters, use A-1 medium in a direct test.

a. EC medium:

Tryptose or trypticase	20.0 g
Lactose	5.0 g
Bile salts mixture or bile salts No. 3	1.5 g
Dipotassium hydrogen phosphate, K_2HPO_4	4.0 g
Potassium dihydrogen phosphate, KH_2PO_4	1.5 g
Sodium chloride, NaCl	5.0 g
Reagent-grade water	1 L

Add dehydrated ingredients to water, mix thoroughly, and heat to dissolve. pH should be 6.9 ± 0.2 after sterilization. Before sterilization, dispense in fermentation tubes, each with an inverted vial, sufficient medium to cover the inverted vial at least partially after sterilization. Close tubes with metal or heat-resistant plastic caps.

b. Procedure: Submit all presumptive fermentation tubes or bottles showing any amount of gas, growth, or acidity within 48 h of incubation to the fecal coliform test.

1) Gently shake or rotate presumptive fermentation tubes or bottles showing gas, growth, or acidity. Using a sterile 3- or 3.5-mm-diam loop or sterile wooden applicator stick, transfer growth from each presumptive fermentation tube or bottle to EC broth (see Section 9221B.2).

2) Incubate inoculated EC broth tubes in a water bath at 44.5 ± 0.2°C for 24 ± 2 h.

Place all EC tubes in water bath within 30 min after inoculation. Maintain a sufficient water depth in water bath incubator to immerse tubes to upper level of the medium.

c. Interpretation: Gas production with growth in an EC broth culture within 24 ± 2 h or less is considered a positive fecal coliform reaction. Failure to produce gas (with little or no growth) constitutes a negative reaction. If multiple tubes are used, calculate MPN from the number of positive EC broth tubes as described in Section 9221C. When using only one tube for subculturing from a single presumptive bottle, report as presence or absence of fecal coliforms.

2. Fecal Coliform Direct Test (A-1 Medium)

a. A-1 broth: This medium may be used for the direct isolation of fecal coliforms from water. Prior enrichment in a presumptive medium is not required.

Lactose	5.0 g
Tryptone	20.0 g
Sodium chloride, NaCl	5.0 g
Salicin	0.5 g
Polyethylene glycol *p*-isooctylphenyl ether*	1.0 mL
Reagent-grade water	1 L

Heat to dissolve solid ingredients, add polyethylene glycol *p*-isooctylphenyl ether, and adjust to pH 6.9 ± 0.1. Before sterilization dispense in fermentation tubes with an inverted vial sufficient medium to cover the inverted vial at least partially after sterilization. Close with metal or heat-resistant plastic caps. Sterilize by autoclaving at 121°C for 10 min. Store in dark at room temperature for not longer than 7 d. Ignore formation of precipitate.

* Triton X-100, Rohm and Haas Co., or equivalent.

Make A-1 broth of such strength that adding 10-mL sample portions to medium will not reduce ingredient concentrations below those of the standard medium. For 10-mL samples prepare double-strength medium.

b. Procedure: Inoculate tubes of A-1 broth as directed in Section 9221B.1*b*1). Incubate for 3 h at 35 ± 0.5°C. Transfer tubes to a water bath at 44.5 ± 0.2°C and incubate for an additional 21 ± 2 h.

c. Interpretation: Gas production in any A-1 broth culture within 24 h or less is a positive reaction indicating the presence of fecal coliforms. Calculate MPN from the number of positive A-1 broth tubes as described in Section 9221C.

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9221 F. *Escherichia coli* Procedure (PROPOSED)

Escherichia coli is a member of the fecal coliform group of bacteria. This organism in water indicates fecal contamination. Enzymatic assays have been developed that allow for the identification of this organism. In this method *E. coli* are defined as coliform bacteria that possess the enzyme β-glucuronidase and are capable of cleaving the fluorogenic substrate 4-methylumbelliferyl-β-D-glucuronide (MUG) with the corresponding release of the fluorogen when grown in EC-MUG medium at 44.5°C within 24 ± 2 h or less. The procedure is used as a confirmatory test after prior enrichment in a presumptive medium for total coliform bacteria. This test is performed as a tube procedure as described here or by the membrane filter method as described in Section 9222. The chromogenic substrate procedure (Section 9223) can be used for direct detection of *E. coli*.

Tests for *E. coli* (using EC-MUG medium) are applicable for the analysis of drinking water, surface and ground water, and wastewater. *E. coli* is a member of the indigenous fecal flora of warm-blooded animals. The occurrence of *E. coli* is considered a specific indicator of fecal contamination and the possible presence of enteric pathogens.

1. *Escherichia coli* Test (EC-MUG medium)

Use EC-MUG medium for the confirmation of *E. coli*.

a. EC-MUG medium:

Tryptose or trypticase	20.0 g
Lactose	5.0 g
Bile salts mixture or bile salts No. 3	1.5 g
Dipotassium hydrogen phosphate, K_2HPO_4	4.0 g

United States Environmental Protection Agency | Office of Water Washington, DC 20460 | EPA-821-R-97-004a May 1997

EPA

Method 1600: Membrane Filter Test Method for Enterococci In Water

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Disclaimer

This method has been reviewed and approved for publication by the Office of Science and Technology within EPA's Office of Water. This method is approved for use in ambient water monitoring, but not for wastewater analysis under 40 CFR part 136. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Questions concerning this method or its application should be addressed to:

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Introduction

EPA has been increasingly concerned with the public health risks of infectious diseases caused by microbial organisms in our nation's beaches. To counteract this problem, EPA has established the Beaches Evironmental Assessment Closure and Health (BEACH) Program. This analytical method is published for use in the BEACH Program.

In 1986, EPA issued a revision to its bacteriological ambient water quality criteria recommendations to include new indicator bacteria, *E. coli* and enterococci, which provide a better correlation with swimming-associated gastrointestinal illness than the previous criteria recommendations for fecal coliform bacteria. These revised criteria are useful to public health officials because they enable quantitative estimates of illness rates associated with swimming in polluted water.

This method is a revision of EPA's previous enterococci method, used since 1985 in ambient water quality monitoring. It reduces analysis time to 24 hours and improves analytical quality. The method has been validated in single- and multi-laboratory studies and has undergone peer review.

Requests for additional copies of this method should be directed to:

USEPA National Center for Environmental
Publications and Information (NCEPI)
11029 Kenwood Road
Cincinnati, OH 45242
Phone: 513-489-8190
Document No. EPA-821-C-97-004

Water Resource Center
Mail Code RC- 4100
401 M Street, S.W.
Washington, D.C. 20460
202-260-7786
Document No. EPA-821-C-97-004

Method 1600: Membrane Filter Test Method for Enterococci in Water

1.0 Scope and Application

1.1 This method describes a membrane filter (MF) procedure for the detection and enumeration of the enterococci bacteria in water. Enterococci are commonly found in the feces of humans and other warm-blooded animals. Although some strains are ubiquitous and not related to fecal pollution, the presence of enterococci in water is an indication of fecal pollution and the possible presence of enteric pathogens.

1.2 The enterococci test measures the bacteriological quality of recreational waters. Epidemiological studies have led to the development of criteria which can be used to promulgate recreational water standards based on the established relationship between health effects and water quality. The significance of finding enterococci in recreational water samples is the direct relationship between the density of enterococci in the water and swimming-associated gastroenteritis studies of marine and fresh water bathing beaches (1,2).

1.3 The test for enterococci can be applied to potable, fresh, estuarine, marine, and shellfish growing waters.

1.4 Since a wide range of sample volumes or dilutions can be analyzed by the MF technique, a wide range of enterococci levels in water can be detected and enumerated.

2.0 Summary of Method

2.1 The MF method provides a direct count of bacteria in water based on the development of colonies on the surface of the membrane filter. A water sample is filtered through the membrane which retains the bacteria. Following filtration, the membrane containing the bacterial cells is placed on a selective medium, mEI agar, and incubated for 24 h at 41°C. All colonies with any blue halo are recorded as enterococci colonies, regardless of colony color. Magnification and a small fluorescent lamp are used for counting to give maximum visibility of colonies.

3.0 Definition

3.1 In this method, enterococci are those bacteria which produce colonies with a blue halo after incubation on mEI agar,

4.0 Interferences

4.1 Water samples containing colloidal or suspended particulate materials can clog the membrane filter and prevent filtration, or cause spreading of bacterial colonies which could interfere with identification of target colonies.

5.0 Safety

5.1 The analyst/technician must know and observe the normal safety procedures required in a microbiology laboratory while preparing, using, and disposing of cultures, reagents, and materials, and while operating sterilization equipment.

5.2 Mouth-pipetting is prohibited.

6.0 Equipment and Supplies

6.1 Glass lens with magnification of 2-5X or stereoscopic microscope.

6.2 Lamp, with a cool, white fluorescent tube.

6.3 Hand tally or electronic counting device.

6.4 Pipet container, stainless steel, aluminum or borosilicate glass, for glass pipets.

6.5 Pipets, sterile, T.D. bacteriological or Mohr, glass or plastic, of appropriate volume.

6.6 Graduated cylinders, 100-1000 mL, covered with aluminum foil or kraft paper and sterile.

6.7 Membrane filtration units (filter base and funnel), glass, plastic or stainless steel, wrapped with aluminum foil or kraft paper and sterile.

6.8 Ultraviolet unit for sanitization of the filter funnel between filtrations (optional).

6.9 Line vacuum, electric vacuum pump, or aspirator for use as a vacuum source. In an emergency or in the field, a hand pump or a syringe equipped with a check valve to prevent the return flow of air, can be used.

6.10 Flask, filter, vacuum, usually 1 L, with appropriate tubing. A filter manifold to hold a number of filter bases is optional.

6.11 Flask for safety trap placed between the filter flask and the vacuum source.

6.12 Forceps, straight or curved, with smooth tips to handle filters without damage.

6.13 Ethanol, methanol or isopropanol in a small, wide-mouth container, for flame-sterilizing forceps.

6.14 Burner, Bunsen or Fisher type, or electric incinerator unit for sterilizing loops and needles.

6.15 Thermometer, checked against a National Institute of Standards and Technology (NIST) certified thermometer, or one that meets the requirements of NIST Monograph SP 250-23.

6.16 Petri dishes, sterile, plastic, 50 x 12 mm, with tight-fitting lids.

6.17 Bottles, milk dilution, borosilicate glass, screw-cap with neoprene liners, marked at 99 mL for 1-100 dilutions. Dilution bottles marked at 90 mL or tubes marked at 9 mL may be used for 1-10 dilutions.

6.18 Flasks, borosilicate glass, screw-cap, 250-2000 mL volume.

6.19 Membrane filters, sterile, white, grid marked, 47 mm diameter, with 0.45 + 0.02 μm pore size.

6.20 Inoculation loops, at least 3-mm diameter, and needles, nichrome or platinum wire, 26 B & S gauge, in suitable holders.

6.21 Incubator maintained at 41 ±0.5°C.

6.22 Waterbath maintained at 44-46°C for tempering agar.

6.23 Test tubes, 150 x 20 mm, borosilicate glass or plastic.

6.24 Caps, aluminum or autoclavable plastic, for 20 mm diameter test tubes.

6.25 Test tubes, screw-cap, borosilicate glass, 125 x 16 mm or other appropriate size.

7.0 Reagents and Standards

7.1 Purity of Reagents: Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society (3). The agar used in preparation of culture media must be of microbiological grade.

7.2 Whenever possible, use commercial culture media as a means of quality control.

7.3 Purity of Water: Reagent water conforming to Specification D1193, Reagent water conforming Type II, Annual Book of ASTM Standards (4).

7.4 Buffered Dilution Water

7.4.1 Composition:

Sodium Dihydrogen Phosphate	0.58 g
Sodium Monohydrogen Phosphate	2.50 g
Sodium Chloride	8.50 g

7.4.2 Preparation: Dissolve the ingredients in 1 L of reagent water in a flask and dispense in appropriate amounts for dilutions in screw-cap bottles or culture tubes and/or into containers for use as rinse water. Autoclave after preparation at 121 °C (15 lb pressure) for 15 min. The final pH should be 7.4 ± 0.2.

7.5 mEI Agar

7.5.1 Composition of Basal Medium (mE Agar, Difco 0333)

Peptone	10.0 g
Sodium Chloride	15.0 g
Yeast Extract	30.0 g
Esculin	1.0 g
Actidione	0.05 g
Sodium Azide	0.15 g
Agar	15.0 g

7.5.2 Preparation of mEI medium: Add 71.2 g of dehydrated basal medium plus 0.75 grams of indoxyl B-D glucoside to 1 L of reagent grade water in a flask and heat to boiling until ingredients dissolve. Autoclave at 121°C and 15 lb pressure for 15 min and cool in a 44-46°C water bath.

7.5.3 Reagents added after sterilization: Mix 0.24 g nalidixic acid in 5 mL reagent grade water, add a few drops of 0.1N NaOH to dissolve; add to the mEI medium. Add 0.02 g triphenyl tetrazolium chloride separately to the mEI medium and mix.

7.5.4 Preparation of mEI Agar Plates: Pour the mEI agar into 50 mm petri dishes to a 4-5 mm depth (approximately 4-6 mL), and allow to solidify. The final pH of medium should be 7.1 ± 0.2. Store in a refrigerator.

7.6 Brain Heart Infusion (BHI) (Difco 0037-02, BBL 11058)

7.6.1 Composition:

Calf Brain Infusion	200.0 g
Beef Heart Infusion	250.0 g
Peptone	10.0 g
Sodium Chloride	5.0 g
Disodium Phosphate	2.5 g
Dextrose	2.0 g

7.6.2 Preparation: Dissolve 37 g of dehydrated brain heart infusion in 1 L of reagent grade water. Dispense in 8-10 mL volumes in screw-cap tubes and autoclave at 121°C (15 lb pressure) for 15 min. If the medium is not used the same day as prepared and sterilized, heat in boiling water bath for several min to remove absorbed oxygen, and cool quickly without agitation, just prior to inoculation. The final pH should be 7.4 ± 0.2.

7.7 Brain Heart Infusion (BHI) Broth with 6.5% NaCl

7.7.1 Composition: Brain heart infusion broth with 6.5% NaCl is the same as BHI broth in 7.6 with additional NaCl.

7.7.2 Preparation: Add 60.0 g NaCl per liter of medium. Since most commercially available dehydrated media contain sodium chloride, this amount is taken into consideration in determining the final NaCl percentage above.

7.8 Brain Heart Infusion Agar (Difco 0418-02, BBL 11064)

7.8.1 Composition: Brain heart infusion agar contains the same components as BHI (see 7.6) with the addition of 15.0 g of agar per L of BHI broth.

7.8.2 Preparation: Heat to boiling until ingredients are dissolved. Dispense 10-12 mL of medium in screw-cap test tubes and sterilize for 15 min at 121°C (15 lb pressure). Slant after sterilization. The final pH should be 7.4 ± 0.2.

7.9 Bile Esculin Agar (BEA) (Difco 0879)

7.9.1 Composition:

Bacto Beef Extract	3.0 g
Bacto Peptone	5.0 g
Bacto Oxgall	40.0 g
Bacto Esculin	1.0 g
Ferric Citrate	0.5 g
Bacto Agar	15.0 g

7.9.2 Preparation: Add 64.5 g of dehydrated BEA to 1 L reagent water and heat to boiling to dissolve completely. Dispense in 8-10 mL volumes in tubes for slants or into flasks for subsequent plating. Autoclave at 121°C at 15 lb pressure for 15 min. Overheating may cause darkening of the medium. Cool to 44-46°C and dispense into sterile petri dishes. The final pH should be 6.6 ± 0.2. Store in a refrigerator.

8.0 Sample Collection, Preservation, and Storage

8.1 Sampling procedures are described in detail in the USEPA microbiology methods manual, Section II, A (5). Adherence to sample preservation procedures and holding time limits is critical to the production of valid data. Samples shall not be analyzed if these conditions are not met.

8.1.1 Storage Temperature and Handling Conditions

Ice or refrigerate bacteriological samples at a temperature of 1-4°C during transit to the laboratory. Use insulated containers to assure proper maintenance of storage temperature. Take care that sample bottles are not totally immersed in water during transit or storage.

8.1.2 Holding Time Limitations

Examine samples as soon as possible after collection. Do not hold samples longer than 8 h between collection and initiation of analyses.

9.0 Quality Control

9.1 See recommendations on quality control for microbiological analyses in the USEPA microbiology methods manual, Part IV, C (5).

10.0 Calibration and Standardization

10.1 Check temperatures in incubators daily to ensure operation within stated limits.

10.2 Check thermometers at least annually against an NIST certified thermometer or one that meets the requirements of NIST Monograph SP 250-23. Check mercury columns for breaks.

11.0 Procedure

11.1 Prepare the mEI agar as directed in 7.5.

11.2 Mark the petri dishes and report forms with sample identification and sample volumes.

11.3 Place a sterile membrane filter on the filter base, grid-side up and attach the funnel to the base; the membrane filter is now held between the funnel and the base.

11.4 Shake the sample bottle vigorously about 25 times to distribute the bacteria uniformly, and measure the desired volume of sample or dilution into the funnel.

11.5 For ambient surface waters and wastewaters, select sample volumes based on previous knowledge of the pollution level, to produce 20-60 enterococci colonies on membranes. Sample volumes of 1-100 mL are normally tested at half log intervals, for example 100, 30, 10, 3 mL, etc.

11.6 Smaller sample size or sample dilution can be used to minimize the interference of turbidity or high bacterial densities. Multiple volumes of the same sample or dilution of sample may be filtered and the results combined.

11.7 Filter the sample and rinse the sides of the funnel at least twice with 20-30 mL of sterile buffered rinse water. Turn off the vacuum and remove the funnel from the filter base.

11.8 Use sterile forceps to aseptically remove the membrane filter from the filter base and roll it onto the mEI agar to avoid the formation of bubbles between the membrane and the agar surface. Reseat the membrane if bubbles occur. Close the dish, invert, and incubate at 41 ± 0.5°C for 24 h.

11.9 After incubation, count and record colonies on those membrane filters containing, if practical, 20-60 colonies with any blue halo regardless of colony color as an enterococci colony. Use magnification for counting and a small fluorescent lamp to give maximum visibility of colonies.

12.0 Data Analysis and Calculations

Use the following general rules to calculate the enterococci count per 100 mL of sample:

12.1 Select and count membranes with ideally 20-60 colonies with any blue halo as an enterococci colony. Calculate the final value using the formula:

$$Enterococci/100mL = \frac{No.\ of\ enterococci\ colonies}{Volume\ of\ sample\ filtered(mL)} \times 100$$

12.2 See the USEPA microbiology manual, Part II, Section C, 3.5, for general counting rules (5).

13.0 Method Performance

13.1 Specificity - The specificity of the medium used in this method is 6.0% false positive and 6.5% false negative for various environmental water samples (6). The false positive rate was calculated as the percent of colonies which reacted typically, but did not verify as members of the enterococcus group. The false negative rate was calculated as the percent of all verified enterococcus colonies not reacting typically.

13.2 Bias - The persistent positive or negative deviation of the results from the assumed or accepted true value is not significant (6).

13.3 Precision - The precision among laboratories for marine water and surface water was 2.2% and 18.9% (6).

14.0 Reporting Results

14.1 Report the results as enterococci per 100 mL of sample.

15.0 Verification Procedure

15.1 Colonies with any blue halo can be verified as enterococci. Verification of colonies may be required in evidence gathering, and is also recommended as a QC procedure upon initial use of the test and with changes in sample sites or lots of commercial media. The verification procedure follows.

15.2 Using a sterile inoculating needle, transfer cells from the centers of at least 10 well-isolated typical colonies into a brain heart infusion broth (BHI) tube and onto a BHI slant. Incubate broth tubes for 24 h and slants for 48 h at 35 ± 0.5°C.

15.3 After 24 h incubation, transfer a loopful of material from each BHI broth tube to:

Bile Esculin Agar (BEA) and incubate at 35± 0.5°C for 48 h.
BHI Broth and incubate at 45 ± 0.5°C for 48 h.
BHI Broth with 6.5% NaCl and incubate at 35 ± 0.5°C for 48 h.

15.4 Observe for growth.

15.5 After 48 h incubation, apply a gram stain to growth from each BHI agar slant.

15.6 Gram positive cocci which grow in BEA, BHI Broth at 45°C, and BHI Broth + 6.5% NaCl, and hydrolyze esculin, are verified as enterococci.

16.0 Pollution Prevention

16.1 The solutions and reagents used in this method pose little threat to the environment when recycled and managed properly.

16.2 Solutions and reagents should be prepared in volumes consistent with laboratory use to minimize the volume of expired materials to be disposed.

17.0 Waste Management

17.1 It is the laboratory's responsibility to comply with all federal, state, and local regulations governing waste management, particularly the biohazard and hazardous waste identification rules and land disposal restrictions, and to protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Compliance with all sewage discharge permits and regulations is also required.

17.2 Samples, reference materials, and equipment known or suspected to have viable enterococci attached or contained must be sterilized prior to disposal.

17.3 Samples preserved with HCl to pH <2 are hazardous and must be neutralized before being disposed, or must be handled as hazardous waste.

17.4 For further information on waste management, consult "The Waste Management Manual for Laboratory Personnel" and "Less Is Better: Laboratory Chemical Management for Waste Reduction," both available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street N.W., Washington, D.C. 20036.

18.0 References

18.1 Cabelli, V. J. 1980. Health Effects Criteria for Marine Recreational Waters, EPA-600/1-80-031. Office of Research and Development, USEPA.

18.2 Dufour, A.P. 1984. Health Effects Criteria for Fresh Recreational Waters, EPA-600/1-84-004. Office of Research and Development, USEPA.

18.3 Reagent Chemicals, American Chemical Society Specifications, American Chemical Society, Washington, DC. For suggestions of the testing of reagents not listed by the American Chemical Society, see Analar Standards for Laboratory Chemicals, BDH Ltd., Poole, Dorset, UK and the United States Pharmacopeia.

18.4 Annual Book of ASTM Standards, Vol. 11.01, American Society for Testing and Materials, Philadelphia, PA 19103.

18.5 Bordner, R., J.A. Winter and P.V. Scarpino (eds.), Microbiological Methods for Monitoring the Environment, Water and Wastes, EPA-600/8-78-017. Office of Research and Development, USEPA.

18.6 Messer, J.W. and A.P. Dufour. 1998. A Rapid, Specific Membrane Filtration Procedure for Enumeration of Enterococci in Recreational Water. Applied and Environmental Microbiology 64:678-680.

The standard volume to be filtered for drinking water samples is 100 mL. This may be distributed among multiple membranes if necessary. However, for special monitoring purposes, such as troubleshooting water quality problems or identification of coliform breakthrough in low concentrations from treatment barriers, it may be desirable to test 1-L samples. If particulates prevent filtering a 1-L sample through a single filter, divide sample into four portions of 250 mL for analysis. Total the coliform counts on each membrane to report the number of coliforms per liter. Smaller sample volumes will be necessary for source or recreational waters and wastewater effluents that have much higher coliform densities.

Statistical comparisons of results obtained by the multiple-tube method and the MF technique show that the MF is more precise (compare Tables 9221:II and III with Table 9222:II). Data from each test yield approximately the same water quality information, although numerical results are not identical (see Section 9010B for drinking water).

3. Bibliography

CLARK, H.F., E.E. GELDREICH, H.L. JETER & P.W. KABLER. 1951. The membrane filter in sanitary bacteriology. *Pub. Health Rep.* 66:951.

KABLER, P.W. 1954. Water examinations by membrane filter and MPN procedures. *Amer. J. Pub. Health* 44:379.

THOMAS, H.A. & R.L. WOODWARD. 1956. Use of molecular filter membranes for water potability control. *J. Amer. Water Works Assoc.* 48: 1391.

MCCARTHY, J.A., J.E. DELANEY & R.J. GRASSO. 1961. Measuring coliforms in water. *Water Sewage Works* 108:238.

LIN, S. 1973. Evaluation of coliform test for chlorinated secondary effluents. *J. Water Pollut. Control Fed.* 45:498.

MANDEL, J. & L.F. NANNI. 1978. Measurement evaluation. *In* S.L. Inhorn, ed. Quality Assurance Practices for Health Laboratories, p. 209. American Public Health Assoc., Washington, D.C.

9222 B. Standard Total Coliform Membrane Filter Procedure

1. Laboratory Apparatus

For MF analyses use glassware and other apparatus composed of material free from agents that may affect bacterial growth.

a. Sample bottles: See Section 9030B.18.

b. Dilution bottles: See Section 9030B.13.

c. Pipets and graduated cylinders: See Section 9030B.9. Before sterilization, loosely cover opening of graduated cylinders with metal foil or a suitable heavy wrapping-paper substitute. Immediately after sterilization secure cover to prevent contamination.

d. Containers for culture medium: Use clean borosilicate glass flasks. Any size or shape of flask may be used, but erlenmeyer flasks with metal caps, metal foil covers, or screw caps provide for adequate mixing of the medium contained and are convenient for storage.

e. Culture dishes: Use sterile borosilicate glass or disposable, presterilized plastic petri dishes, 60 × 15 mm, 50 × 9 mm, or other appropriate size. Wrap convenient numbers of clean, glass culture dishes in metal foil if sterilized by dry heat, or suitable heavy wrapping paper when autoclaved. Incubate loose-lidded glass and disposable plastic culture dishes in tightly closed containers with wet paper or cloth to prevent moisture evaporation with resultant drying of medium and to maintain a humid environment for optimum colony development.

Presterilized disposable plastic dishes with tight-fitting lids that meet the specifications above are available commercially and are used widely. Reseal opened packages of disposable dish supplies for storage.

f. Filtration units: The filter-holding assembly (constructed of glass, autoclavable plastic, porcelain, or stainless steel) consists of a seamless funnel fastened to a base by a locking device or by magnetic force. The design should permit the membrane filter to be held securely on the porous plate of the receptacle without mechanical damage and allow all fluid to pass through the membrane during filtration. Discard plastic funnels with deep scratches on inner surface or glass funnels with chipped surfaces.

Wrap the assembly (as a whole or separate parts) in heavy wrapping paper or aluminum foil, sterilize by autoclaving, and store until use. Alternatively expose all surfaces of the previously cleaned assembly to ultraviolet radiation (2 min exposure) for the initial sanitization before use in the test procedure, or before reusing units between successive filtration series. Field units may be sanitized by dipping or spraying with alcohol and then igniting or immersing in boiling water for 2 min. After submerging unit in boiling water, cool it to room temperature before reuse. Do not ignite plastic parts. Sterile, disposable field units may be used.

For filtration, mount receptacle of filter-holding assembly on a 1-L filtering flask with a side tube or other suitable device (manifold to hold three to six filter assemblies) such that a pressure differential (34 to 51 kPa) can be exerted on the filter membrane. Connect flask to a vacuum line, an electric vacuum pump, a filter pump operating on water pressure, a hand aspirator, or other means of securing a pressure differential (138 to 207 kPa). Connect a flask of approximately the same capacity between filtering flask and vacuum source to trap carry-over water.

g. Membrane filter: Use membrane filters (for additional specifications, see Section 9020) with a rated pore diameter such that there is complete retention of coliform bacteria. Use only those filter membranes that have been found, through adequate quality control testing and *certification by the manufacturer*, to exhibit full retention of the organisms to be cultivated, stability in use, freedom from chemical extractables that may inhibit bacterial growth and development, a satisfactory speed of filtration (within 5 min), no significant influence on medium pH (beyond ± 0.2 units), and no increase in number of confluent colonies or spreaders compared to control membrane filters. Use membranes grid-marked in such a manner that bacterial growth is neither inhibited nor stimulated along the grid lines when the membranes with entrapped bacteria are incubated on a suitable medium. Preferably use fresh stocks of membrane filters and if necessary store them in an environment without extremes of temperature and humidity. Obtain no more than a year's supply at any one time.

Appendix E Laboratory Quality Assurance Documentation

ELAP Laboratory ID #10950

LABORATORY QUALITY ASSURANCE SYSTEMS MANUAL

Approved: Joseph P. Shaulys 12/30/05
Laboratory Director – Joseph P. Shaulys Date

Approved: Renee Cohen 12/30/05
Quality Assurance Officer – Renee Cohen Date

Departmental Distribution List:

Organics ..... ☐
Inorganics ..... ☐
Quality Assurance/Quality Control ..... ☐
Administrative Personnel ..... ☐

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Appendix B	Employee Statement Re:Laboratory SOP's

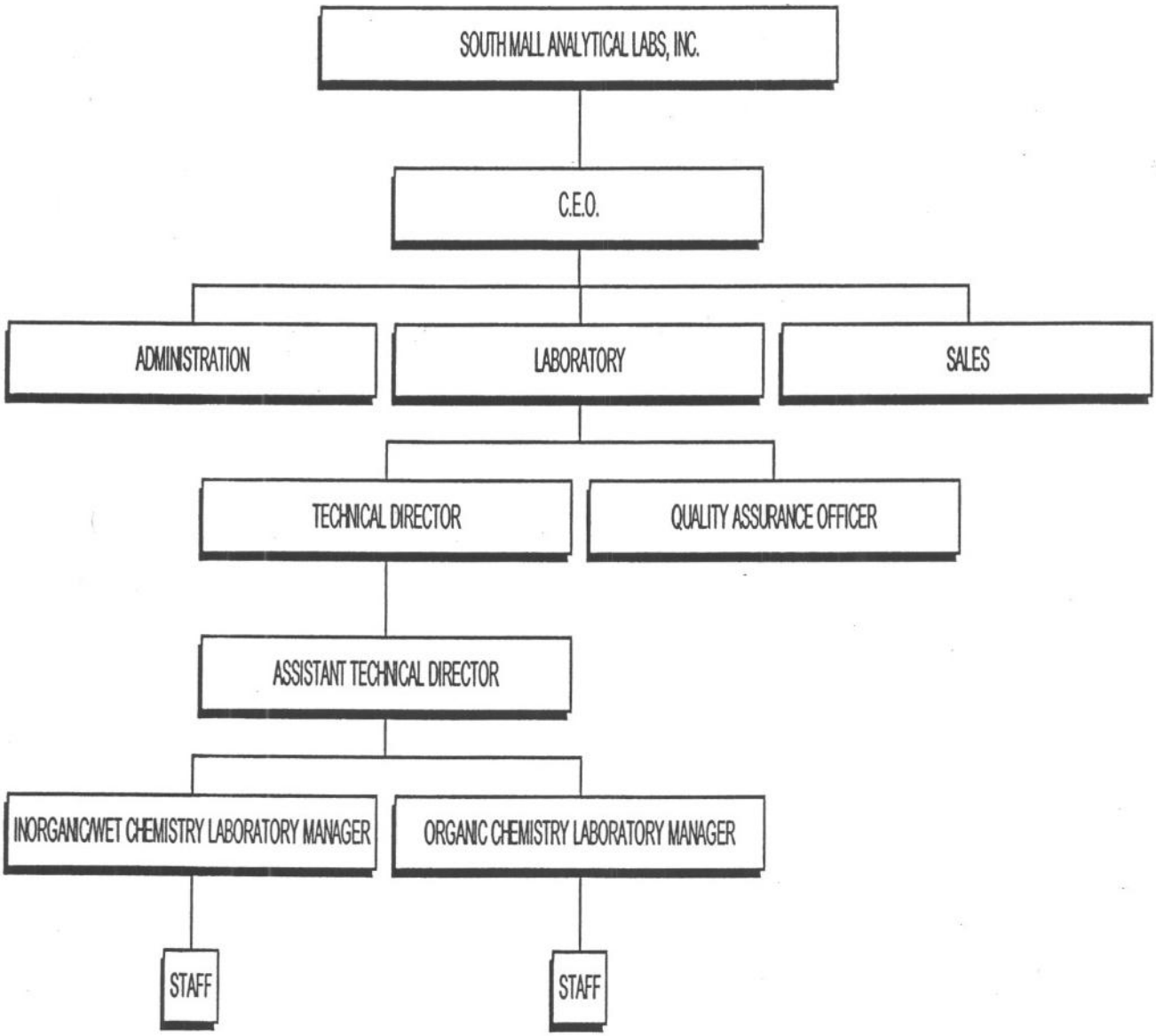
Section 1.0 Quality Policy Statement

It is the goal of South Mall Analytical labs to generate technically defensible laboratory results that are precise and accurate. The laboratory is committed to routinely producing quality results, which are in conformance with NELAC standards. This will be accomplished by providing:

A) Laboratory results that are supported by quality control data and documented laboratory testing methods.
B) Adequately staffed and equipped laboratory facility.
C) Complete implementation of a NELAC compliant quality assurance system.
D) Successful participation in the ELAP proficiency testing operated by the New York State Department of Health.
E) Annual internal audits with management review.
F) Successful biennial inspections by the New York State Environmental Laboratory Approval Program.
G) Successful participation in the New Jersey DEP Proficiency Test Program.

This quality policy is explained to all employees. It is understood, implemented and maintained by all employees. It is demonstrated by management through the employee evaluation process, training procedure, internal audit process and the document control process. It reflects our philosophy of total integrity.

Section 2.0 Organizational Chart



Section 3.0 Job Description of Laboratory Personnel

The Technical Director is a full-time member of the staff who exercises day-to-day supervision of laboratory procedures and reporting results. The Director has overall responsibility for the technical operation of the laboratory. The Director must be capable of monitoring standards of performance in quality control and quality assurance, as well as the validity of the analyses performed and data generated in the laboratory to ensure reliable data. The Director must ensure that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory, as well as provide educational direction to laboratory staff. The Director must certify through documentation that personnel with appropriate educational and technical background perform all tests for which the laboratory is accredited. The Director shall meet the requirements specified in the NELAC Accreditation Process (4.1.1.1).

The Assistant Technical Director assists the Director in the accomplishment of all responsibilities. In the absence of the Technical Director, the Assistant Director assumes all of the responsibilities of the Technical Director.

The Quality Assurance Officer shall have direct access to the highest level of management at which decisions are made on laboratory policy or resources and to the Technical Director. The Officer is the focal point for quality assurance/quality control and is responsible for the oversight and/or review of quality control data. The Officer must be able to evaluate data objectively and perform assessments independent of influence. The Officer must have documented training and/or experience in quality assurance/quality control procedure and be knowledgeable in the quality system as defined by NELAC, as well as have a general knowledge of the analytical test methods for which data review is performed. The QA Officer must arrange for and conduct internal audits of the entire technical operation on an annual basis and notify laboratory management of deficiencies in the quality system as well as monitor corrective action procedures associated with these deficiencies.

The Laboratory Manager is responsible for the daily routine operations of the laboratory. The Manager is responsible for supervising the laboratory, maintaining rigid quality control and ensuring the validity of all reported data.

The Laboratory Staff shall have the necessary education, training, technical knowledge and experience for their assigned functions. They shall be responsible for complying with all quality assurance/quality control requirements that pertain to their technical function. They must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular function, and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management.

Section 4.0 Relationship of Management to Technical Operations, Support Services and the Quality System

The function of management is to provide all of the required resources and to enable the laboratory to provide analyses that are accurate, precise and incorporate the highest standards of quality assurance/quality control.

The Technical Director has overall responsibility for the technical operation of the lab. The Director is responsible for arranging and overseeing all support services, tecnical services including instrument service contracts, subcontracting sample analyses and physical maintenance of the laboratory. The Director provides supervision to all laboratory personnel to ensure adherence to all of the laboratory's documented procedures. The Director shall ensure that the laboratory's policies and objectives for quality of testing are documented in the Quality Systems Manual. The Director shall ensure that the Quality Manual is communicated, understood and implemented by all personnel concerned. The Director reports to the CEO, but interacts and is available to all laboratory personnel.

The Quality Assurance Officer has responsibility for the laboratory quality system and its implementation. Although working with and guiding all laboratory personnel, including the Technical Director, the Quality Assurance Officer is completely independent of laboratory production. The Quality Assurance Officer has direct access to the highest levels of management including the Technical Director and CEO who make decisions on laboratory policy and/or resources.

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Section 5.0 Document Control

All Standard Operating Procedure (SOP) manuals and documents are subject to document control. The purpose of the document control is to ensure that only the most recent revisions are available to the appropriate personnel and that revisions are timely and receive the required approval.

The Quality Assurance Officer is responsible for the document control system and keeps a master list of the location of all documents and their current revision. This includes document control of Laboratory SOP's, Laboratory Policies and the Quality System Manual. The Technical Director and Quality Assurance Officer approve all released and revised documents. The Quality Assurance Officer is responsible to remove all obsolete SOPs and documents from the laboratory work area. Only the original document controlled copy will be retained in the files.

SOP's are revised as needed. The original controlled copy of the SOP will be printed on yellow paper. All non-controlled copies will be printed on white paper. Uncontrolled copies of laboratory SOP's will be distributed to the laboratory areas and to the analysts responsible for the procedures. A copy of all SOP originals will be maintained by the laboratory QA Officer.

The Laboratory Quality Assurance Systems Manual (QASM) is updated as necessary. Each section of this document is issued with a date and revision number. This will allow for the update of an appropriate section without reissuing the entire document. The QASM Table of Contents will list the section number, revision number and date of revision to insure that the correct sections are in use.

Each page of SOP documents and QASM documents produced by the laboratory will contain the effective date, revision number, document number, document title and number of pages. Controlled documents will have an approval signature page, revision record page and a distribution list.

The laboratory will maintain a record system in order to reproduce both laboratory test reports and laboratory associated data for a minimum of five (5) years. All records associated with laboratory sample receipt and analyses are maintained on-site at the laboratory. Current data logbooks and associated instrument printouts are stored in the laboratory area in a series of file cabinets and laboratory bench storage areas. Current data associated with instrumentation is stored in the work area of the instrument. Older records/data are stored in either file cabinets or "Bankers Boxes" in the second floor storage area. Records that are stored in this second floor storage area include, but are not limited to; sample receiving logs, chain of custody records, laboratory reports, calibration data, logbooks and instrument generated logs. This area is secure and provides storage of data in an order that will protect the data records from damage or deterioration over time.

Additional length/time of data/record storage will be maintained based on a specific clients needs. This specific need must be in writing by the client and maintained in a client folder.

During the discard step of outdated laboratory data records, greater than five (5) years old the analyst will remove all paper records. All paper records will be sent to a paper recycling plant for reuse. No additional steps will be taken.

In the event that the laboratory changes ownership or goes out of business, the laboratory plan is to transfer all laboratory records to the new owner. In the event that the laboratory goes out of business or in the event of a closure of the laboratory the owner will maintain storage of all laboratory records. This record retention by the laboratory owner will be for a period of five (5) years from the date the data was generated.

Section 6.0 Traceability of Measurements

Verification and/or validation of equipment such as ovens, refrigerators, pH meters and conductivity meters shall be performed prior to use. The thermometers and or weights used are traceable to the National Institute of Standards and Technology (NIST). Calibration standards must indicate NIST traceability along with measured results. South Mall Laboratories utilizes class "S" weights and a NIST traceable thermometer when verifying annual calibration of the thermometers that are utilized prior to use or on daily basis. The laboratory will maintain records of all calibration certificates and reference standard measurements.

The laboratory contracts an outside service to come verify the analytical balance on an annual basis. Automatic Eppendorf Pipettes are calibrated by laboratory personnel on a quarterly basis. Thermometers that are used in refrigerators ovens and incubators are checked on an annual basis. Records of thermometer checks and pipette checks are recorded in a logbook maintained by the QA officer.

Section 7.0 Accredited Test Methods

Non-Potable Water		
Analyte	Method	Source
Acidity	305.1	7
Alkalinity	310.1	7
Ammonia	10-107-06-1 B	6
Biochemical Oxygen Demand (BOD)	405.1; 5210 B	1; 2
Bromide	320.1	2
Chemical Oxygen Demand (COD)	410.1	2
Chloride	4500-Cl B	2
Chromium, Hexavalent	3500-Cr D	2
Color	110.2	1
Cyanide, Total and Amenable	335.2; 9010B;10-204-00-1-A	1; 3,6
Dissolved Solids, Total (TDS)	2540 C	2
Fluoride	340.2	1
Hardness	130.2	1
Kjeldahl Nitrogen, Total (TKN)	351.3	1
Mercury	245.2; 7470A	1; 3
Metals	200.7; 6010B	1; 3
Nitrate	10-107-04-1	6
Nitrite	10-107-04-1	6
Oil & Grease	1664A; 413.1	4; 1
Organic Carbon, Total	415.2	1
pH	150.1, 9040	1,2
Phenol, Total	10-210-00-1-A	6
Phosphorus	365.3	1
Silica	200.7; 370.1; 6010B	1; 1; 3
Solids, Total (TS)	160.3,2540 B	2
Specific Conductance	2510 B	2
Sulfate	375.4	1
Sulfide	376.1	1
Surfactant (MBAS)	5540 C	2
Suspended Solids, Total (TSS)	160.2,2540 D	2
Temperature	2550 B	2
Purgeable Aromatics	624; 8260B	1; 3
BTEX (Benzene, Ethylbenzene, Toluene, Xylenes)	624; 8260B	1; 1; 3; 3
Benzidines	625; 8270C	1; 3
Chlorinated Hydrocarbons	625; 8270C	1; 3
Haloethers	625; 8270C	1; 3

Non-Potable Water		
Analyte	Method	Source
Nitroaromatics/Isophorone	625; 8270C	1; 3
Nitrosamines	625; 8270C	1; 3
Phthalate Esters	625; 8270C	1; 3
Polynuclear Aromatic Hydrocarbons	625; 8270C	1; 3
Priority Pollutant Phenols	625; 8270C	1; 3
PCBs (Polychlorinated Biphenyls)	608; 8082	5; 3
Chlorinated Hydrocarbons Pesticides	608; 8081A	5; 3
Chlordane	608; 8081A	5; 3
Chorophenoxy Acid Pesticides	6640 B; 8151A	2; 3
Total Dissolved Solids	160.1	1; 3
Ortho Phosphate (as P)	4500-P E	2

[1]"Part VIII Environmental Protection Agency, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Proposed Rule," *40 Code of Federal Regulations*, Part 136, October 26, 1984.
[2]*Standard Methods for the Examination of Water and Wastewater*, 19th edition.
[3]"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," *SW-846*, 3rd edition, U.S. Environmental Protection Agency, September, 1986.
[4]"Method 1664: N-Hexane Extractable Method (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) By Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons," *EPA-821-B-94-004b*, U.S. Environmental Protection Agency, April, 1995.
[5]"Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol and Pesticides in Water and Wastewater," U.S. Environmental Protection Agency, September, 1978.
[6]"Lachat Flow Injection Analysis (FIA) Methods Manual
[7]Methods for the Chemical Analysis of Water and Waste (MCAWW), EPA-600/4/79-020

Accredited Test Methods

Solid Waste		
Analyte	Method	Source
Chromium Hexavalent	7196A	1
Corrosivity Towards Steel	1110	1
Cyanide (Total and Amenable)	9010 B	1
Ignitability	1010	1
Lead in Dust Wipes	6010B	1
Lead in Paint	6010B	1
Mercury	7471A	1
Metals	6010B	1
pH	9040B; 9045C	1; 1
Reactivity – Cyanide	Chap. 7, Sec. 7.3	1
Reactivity – Sulfide	Chap. 7, Sec. 7.3	1
Reactivity – Water	Chap. 8, Sec. 7.3	1
TCLP Extraction	1311	1
Purgeable Aromatics	8260B	1
BTEX (Benzene, Ethylbenzene, Toluene, Xylenes)	8260B	1
Purgeable Halocarbons	8260B	1
TCLP Compounds – Methyl ethyl ketone (2-butanone)	8260B	1
Benzidines	8270C	1
Chlorinated Hydrocarbons	8270C	1
Haloethers	8270C	1
Nitroaromatics/Isophorone	8270C	1
Nitrosamines	8270C	1
Phthalate Esters	8270C	1
Polynuclear Aromatic Hydrocarbons	8270C	1
Priority Pollutant Phenols	8270C	1
TCLP Compounds – Cresol	8270C	1
TCLP Compounds - Pyridine	8270C	1
PCBs (Polychlorinated Biphenyls)	8082	1
Chlorinated Hydrocarbon Pesticides	8081A	1
Chlordane	8081A	1
Chorophenoxy Acid Pesticides	8151A	1

[1]"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," *SW-846*, 3rd edition, U.S. Environmental Protection Agency, September, 1986.

Section 8.0 Review of All New Work

All new work/testing methods are initiated and accepted by the Technical Director. He then delegates the work according to available resources. Appropriate staff will meet prior to the initiation of new work to ensure that appropriate facilities and resources are available. A designated employee shall write the Laboratory Standard Operating Procedure (SOP) for the method and demonstrate capability to perform these tests. Demonstration of capability includes the preparation and analysis of a method detection limit (MDL) study to determine a laboratory reporting limit. All this should take place prior to reporting results of this new work.

Section 9.0 Calibration and/or Verification of Test Procedures

Each laboratory method/SOP (where applicable) includes a section that describes the details of instrument calibration and/or test verification procedures, including calibration range, standardization, calculations and acceptance criteria. Each analyst is responsible to check/verify that calibration QC criteria are met prior to field sample analysis.

South Mall Laboratories retains sufficient raw data to reconstruct the calibration used to determine the sample result. This information is maintained for a period of five (5) years. All calibrations are verified with a second source standard which is traceable to NIST when available. Second source standards are to be from a second vendor, or the same vendor, different lot number. When neither of the above is available the same manufacturer/lot number may be used, however the second solution must be prepared by a different analyst. All standard preparations are documented in the standard preparation logbook. Effective September, 2005 the laboratory purchased and implemented the use of Promium/Element . This is a Laboratory Information Management System (LIMS). This system maintains calibration standard information based on an assigned lot number. The preparation information including, but not limited to the solvent, sample volumes, lot numbers and manufacturer information is maintained in a bound logbook that is stored in the work area.

All reported sample results must be within the calibration range. No data is to be reported above the calibration range of any instrument. Calibration standards include a concentration at or below the regulatory level but above the method detection limit. No data associated with an out-of-control calibration should be reported. Promium/Element has information to report a Minimum Reporting Limit (MRL). This MRL is above the method detection limit or is known as the Limit of Quantification (LOQ). South Mall reports all results at the MRL/LOQ. Data is not qualified "J" to indicate a result at the MDL or between the MDL and the LOQ.

The Method Detection Limit (MDL) is established and documented for each method/analyte/matrix. The MDL is determined using the procedure outlined CFR Part 136, Appendix B. The standard deviation of the analysis of a minimum of seven (7) aliquots of a clean matrix spiked reagent is calculated. The spiked reagent is an estimated concentration between the estimated MDL and five times the estimated MDL. The actual MDL is 3.14 times the calculated standard deviation. When more than seven points are used to determine the standard deviation the method lists the number the standard deviation is to be multiplied by. Method Detection Limits (MDL) files are filed in the QA office. The laboratory analyzes annual MDL's for each of the methods reported. The MDL is not used to report sample data. The MDL is used to insure that the MRL that is reported is justified by the annual MDL.

Section 10.0 Sample Handling

Sample Collection

South Mall Analytical Labs has trained field technicians on staff to collect samples when clients request this service. Collection is performed using approved plastic or glass containers of sufficient volume containing any necessary preservatives. All sample bottles are one-time use bottles. Sample bottles are not washed and reused. All field samples are placed in coolers containing ice and are immediately transported to the laboratory following collection. Each container has a water-resistant label on which is recorded the sample site location and the date and time of sample collection. Chain of custody forms are prepared and submitted by all sample collectors.

Sample Receipt Protocol

Samples are received from South Mall Analytical Labs collectors as well as directly from clients. Samples are received at the laboratory by courier, Federal Express, UPS and others. Upon receipt, the condition of the samples, including all items specified in the sample collection requirements of the Chain of Custody documents are checked and recorded. Acid-preserved and alkaline-preserved samples are tested with pH paper meter to ensure pH is below 2 and or greater than 12 respectively. Samples vials (40 ml) that are to be analyzed for Volatile Organics are not checked for pH preservation in the sample receiving room. These samples have the pH check performed prior to the sample analysis at the bench.

Effective September, 2005 South Mall Laboratories implemented the use of the Promium/Element LIMS software. All samples are entered into this software system. This system includes client and project information. The LIMS software documents sample condition, preservative, custody seals and temperature. Original Chain of Custody documents are maintained in the front office so that they are available for the final report. Any abnormalities or discrepancies are noted, a non-compliance report is generated and the client immediately notified.

Secondary review of the project information is performed by the Technical Director or the QA Officer. Client ID, project ID, sample collection, sample receipt date, sample ID and test requests are checked for accuracy. After this review the sample status is changed from Received to Available.

Sample/Waste Disposal

South Mall Laboratories generates non-hazardous waste as a result of laboratory analyses and data reporting. The laboratory attempts to recycle as much as possible. All paper and cardboard wastes are picked up by a local paper recycler. The laboratory currently uses Ed's Salvage for this task.

All glass and plastic containers are emptied and tripled rinsed with water. All bottles are labeled to indicate a triple rinse has been performed. These glass and plastic containers are collected in plastic garbage pails and are picked up by the Town of Oyster Bay. These containers are treated as regular trash, the plastic and glass containers are recycled by the local town authority.

Soil samples are emptied into 50-gallon drums. These soil samples are non-hazardous and are removed by an approved waste hauler. The laboratory currently uses Triumvarate to remove the non-hazardous soil and non-aqueous waste samples. Triumvarate is also used to dispose of the laboratories fluorescent light bulbs. These are collected at the lab and disposed of when a sufficient quantity is collected.

Inorganic, organic, waste solvents and aqueous wastes from the laboratory are emptied into the laboratory pH neutralization tank that is located at the laboratory. This tank is used to neutralize all metal wastes, mineral acid wastes and wet chemistry reagents. Once these are pH neutralized they are rinsed into the local sewer system. This is acceptable by the local authorities.

Sample Collection Requirements

ANALYTE	CONTAINER	PRESERVATION	MAX. HOLDING TIME
INORGANIC TESTS:			
Acidity	P, G	Separate bottle completely filled to the exclusion of air, Cool, 4°C	14 days
Alkalinity	P, G	Separate bottle completely filled to the exclusion of air, Cool, 4°C	14 days
Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical oxygen demand	P, G	Cool, 4°C	48 hours
Bromide	P, G	None	28 days
Biochemical Oxygen Demand, Carbonaceous	P, G	Cool, 4°C	48 hours

ANALYTE	CONTAINER	PRESERVATION	MAX. HOLDING TIME
Chemical Oxygen Demand	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride	P, G	None	28 days
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C, NaOH to pH>12, 0.6g ascorbic acid	14 days
Fluoride	P	None	28 days
Hardness	P, G	HNO_3 to pH<2; H_2SO_4 to pH<2	6 months
Hydrogen Ion (pH)	P, G	None	Analyze immediately
Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Metals, except Boron, Chromium VI and Mercury	P, G	HNO_3 to pH<2	6 months
Boron	P, Quartz	HNO_3 to pH<2	6 months
Chromium VI	P, G	Cool, 4°C	24 hours
Mercury	P, G	HNO_3 to pH<2	28 days
Nitrate	P, G	Cool, 4°C	48 hours
Nitrate-Nitrite	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrite	P, G	Cool, 4°C	48 hours
Oil and Grease	G	Cool, 4°C, HCl or H_2SO_4 to pH<2	28 days
Organic Carbon	P, G	Cool, 4°C, HCl or H_3PO_4 or H_2SO_4 to pH<2	28 days
Orthophosphate	P, G	Filter immediately, Cool, 4°C	48 hours
Phenols	G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Phosphorus (Elemental)	G	Cool, 4°C	48 hours
Phosphorus, Total	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable	P, G	Cool, 4°C	7 days
Residue, Nonfilterable	P, G	Cool, 4°C	7 days
Residue, Volatile	P, G	Cool, 4°C	7 days
Silica	P, Quartz	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days
Sulfide	P, G	Cool, 4°C, add $Zn(Ac)_2$ plus NaOH to pH>9	7 days
Surfactants	P, G	Cool, 4°C	48 hours
Temperature	P, G	None	Analyze immediately
ORGANIC TESTS:			

ANALYTE	CONTAINER	PRESERVATION	MAX. HOLDING TIME
Purgeable Halocarbons plus Benzyl Chloride and Epichlorohydrin	G, Teflon-Lined Septum	Cool, 4°C, Ascorbic Acid (25 mg/40 ml) for Residual Chlorine	14 days
Purgeable Aromatics	G, Teflon-Lined Septum	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine; Preserve as above and HCl to pH<2	14 days
Acrolein and Acrylonitrile	G, Teflon-Lined Septum	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine; Preserve as above and pH to 4-5	3 days for Acrolein, 14 days for Acrylonitrile
Phenols	G, Teflon-Lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine	7 days until extraction, 40 days after extraction
Benzidines	G, Teflon-Lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine	7 days until extraction, 7 days after extraction if stored under inert gas
Phthalate Esters	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Haloethers	G, Teflon-Lined Cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ for residual chlorine only	7 days until extraction, 40 days after extraction
Chlorinated Hydrocarbons	G, Teflon-Lined Cap	Cool, 4°C	7 days until extraction, 40 days after extraction

Section 11. Laboratory Environment/Equipment

Calibration and testing occur within the facility that was designed and built as laboratory space. Smoking and eating are prohibited in the laboratory work areas. Work areas include entries to laboratories, sample receipt area, sample storage area and data-handling and storage area.

All equipment used for testing, calibration and sampling are maintained to comply with the specification relevant to the processing and testing of environmental samples.

Electronic balances are located away from drafts and doorways where vibrations might occur. Good housekeeping is monitored to avoid the possibility of contamination. Mercury is analyzed by the Cold Vapor Atomic Absorption (CVAA) technique using a spectrophotometer. All other metals are analyzed using an ICP. Several Gas Chromatographs (GC) and GC Mass Specs (MS) are used to analyze for organic analytes. The laboratory maintains stills, heating baths, ovens and incubators for other environmental analyses that the laboratory is certified to perform. A TOC analyzer is used for the analysis of Total Organic Carbon. A variety of wet laboratory equipment and Class "A" glassware are used for various analyses. An Equipment List is maintained and updated. This lists all major equipment used in the laboratory area. A copy of the Equipment list is located in Appendix A if this Quality Systems Manual.

All equipment used during the analysis of environmental samples are maintained and in proper working order. Instrument maintenance logs are kept for the major equipment used in the laboratory. Preventative maintenance as well as major repair work is recorded on these logs. When major equipment is taken out of service due to repair a notation is made on the maintenance log. When equipment does not meet QC criteria, it is taken out of service. It is repaired or replaced as necessary.

Support equipment is calibrated on an annual basis. Support equipment includes analytical balances and thermometers. The laboratory maintains a NIST traceable thermometer on site. When equipment does not meet QC criteria, it is taken out of service. It is repaired or replaced as necessary.

Eppendorf pipettes (or equivalent) or mechanical volumetric dispensing devices are checked for accuracy on a quarterly basis. These records are maintained in a logbook in the QA office.

Section 12.0 Procedures for Calibration, Verification and Maintenance of Equipment

Laboratory equipment is maintained, inspected and cleaned according to Equipment Maintenance procedures. Each piece of major equipment in the laboratory has a discreet preventative maintenance logbook. This logbook is used to record preventative maintenance for the specific instrument. All data relating to maintenance, inspection and cleaning are maintained in a logbook. The logbook lists the item of equipment, manufacturer, serial number, details of maintenance and history of damage, repair or modification. If professional service is called a copy of the service report is included in the PM logbook.

Support equipment is calibrated using NIST-traceable standards. These are calibrated in accordance with the frequency indicated in the SOP. Balances, ovens, refrigerators, freezers, pH meters and conductivity meters are checked with NIST-traceable references prior to use or daily when used. Mechanical volumetric dispensing devices Eppendorf pipettes are checked quarterly.

Section 13. Proficiency Testing Participation and Reference Materials Procedure

South Mall Laboratories participates in the semiannual New York State Department of Health ELAP proficiency test program. The results are used to evaluate the ability of the laboratory to produce accurate data. Proficiency results, along with all raw data necessary to reconstruct the analyses, are retained at the laboratory. Laboratory results are submitted electronically to the Department of Health. The New Jersey Department of Environmental Protection (NJ DEP) also requires the analysis of a second source of Pt samples. These Pt samples are purchased by the laboratory analyzed and submitted to NJ for review. These sample analyses are performed twice a year. These Pt samples are used to maintain South Mall Laboratories NJ certification.

The laboratory purchases external reference samples. Reference samples are used by the laboratory to verify calibration curves and act as the Laboratory Control Sample (LCS) for most analytical methods. All reference samples are certified by the commercial vendor. The laboratory retains the manufacturer's Certificate of Analysis. The laboratory LIMS system maintains the Lot # of the LCS sample used for each analysis.

The laboratory plans to begin a single blind proficiency test program. The program will be initiated by the QA Officer to insure that QC samples are handled and reported properly. This single blind proficiency test program will also insure that QC samples are handled in the same manner as standard client samples.

Section 14.0 Testing Discrepancies

Specific corrective actions for handling out-of-control quality control is available in each of the laboratory method SOP's. In addition, general procedures are followed to determine when departures from quality control have occurred. Laboratory policy is not to report sample data when quality control exceeds criteria unless the QC outlier is due to sample matrix interference. When necessary, provisions are made for such deviations and are documented in the data report to the client where necessary. Raw data and logbooks are also notated when discrepancies occur.

Section 15.0 Exceptionally Permitted Departures from Documented Policies and Procedures

Occasionally, arrangements for known and controlled departures from documented policies and laboratory procedures may occur. This is only permitted by permission of both the Technical Director and the Quality Assurance Officer. The departure will be fully documented on both the Chain of Custody (COC) documents as well the laboratory report pages. The client must be aware of any deviation from standard operating procedures prior to the deviation.

Section 16.0 Procedures for Dealing with Client Inquires and Complaints

A complaint file will be maintained by the laboratory to document complaints about the laboratory's activities received from clients. The file will contain the date of the inquiry, the actual inquiry as well as the client name. The log will record the South Mall Laboratory person receiving the complaint as well as a record of any follow-up action (correspondence).

The complaint is given to the Quality Assurance Officer, who will investigate the complaints and/or inquiry. An audit of the lab area or lab data will be performed. The written results of the investigation including actions taken by the laboratory are reviewed by the Technical Director. The results of the investigation are signed and dated by the Technical Director and Quality Assurance Officer and forwarded to the client.

Section 17.0 Internal Audit

The Quality Assurance Officer arranges for an internal quality system audit of each laboratory area on an annual basis. Each laboratory area is audited and a written report generated. The audit will be carried out by either the QA Officer or trained personnel who are independent where possible of the activity being audited. The Quality Assurance Officer will compare the requirements of the ELAP manual to laboratory operations. In addition the auditor will utilize the NELAC Quality Audit checklist to insure all main QA areas are reviewed. The laboratory operations will also be compared to the Laboratory Quality Manual and current SOPs.

The results of each laboratory area audit will be documented in writing. The laboratory audit report will be submitted within two (2) weeks of the audit. Deficiencies will be noted and documented. The laboratory audit report will be submitted to the Laboratory Director who will delegate responsibility to the analyst and prepare a Correction Action (CA) to each of the deficiencies noted. The response to the deficiencies cited in the audit report are to be finalized within two (2) weeks of the audit report date. A plan for corrective action and the time frame for implementation of any corrective actions must be stated in the lab response to the audit report. The plan for corrective action must include the update/revision of any associated laboratory SOP's. The QA Officer then is responsible for reviewing the corrective action items to insure that they are being followed.

The annual audit schedule for January 2005-December 2005 is posted in the QA office. Each main lab area is scheduled for an audit. Additional audits of laboratory areas will be performed when deficiencies in test results, PE results or changes to methods are noted.

Copies of each laboratory area audit are distributed to senior laboratory management and are incorporated into the annual management review.

When deficiencies from an internal audit may have affected client data results, the QA Officer must review the effected data and inform the client of this sample result bias.

Section 18.0 Data Review

All data including original observations, calculations, derived data, calibration records, quality control records and a written copy of the test report are maintained and stored for five years at. Storage is on-site on the second floor of the laboratory building. Data is not stored at an off-site facility. All data reports are reviewed by either the Technical Director or Laboratory Director before the final report is sent to the client. The data report is reviewed to ensure that sample ID's, collection and receipt dates, units and methods are correct. This final review is performed to detect transcript errors that may have been missed. Errors detected in the review process are referred to the analyst or typist for corrective action.

The laboratory implemented the use of the Promium/Element LIMS computer system in September, 2005. This LIMS system is used to track all standard information, batch designations, QC data and final result reporting. When data review is performed by the Quality Assurance Officer the LIMS system highlights all line items that have data results outside the specified QC criteria. These criteria were set by the manufacturer and have been updated to include in house QC limits.

Data is reviewed on line by either the QA Officer or Technical Director. After this step is completed the data is made available for report generation. An audit trail of all updates and changes to the data is maintained by this LIMS system.

The Quality Assurance Officer is responsible for review of a percentage of the raw data/reported data to verify that results are determined in accordance with the laboratory SOP's.

Section 19. Management Review

In accordance with a predetermined schedule the laboratories Technical Director shall review the laboratory quality system, its testing and calibration procedures to insure that the suitability of test results meets the standards of NELAC. This review of systems is to be performed on an annual basis. This review may lead to changes and/or improvements based on the result of this review. The review will consist of the following:

Review of Policies and Procedures
Review of Reports from the QC officer and staff
Review of recent internal audits
Review of corrective and preventative actions
Review of external/client/agency audits
Results of Proficiency Test Results
Review of the volume and type of work received
Review of client complaints and client feedback
Review of staffing levels and staff training

Section 20.0 Training and Review of Personnel Qualifications

Laboratory management reviews an applicant's level of experience, qualifications and skill set prior to assigning an employee to a specific task. Each analyst has adequate experience and knowledge of their function prior to performing sample analysis. They are trained and under supervision for a minimum of one month with an experienced analyst for each method they perform. They must have knowledge of laboratory operations including safety, test methods, quality control procedures and record management.

The Quality Assurance Officer maintains the following personnel records:

A) Training File:
   1) A Demonstration of Capability Statement from each employee that they have read, understood and are using the latest version of the Laboratory Manual and SOPs. This statement will be signed and dated. A copy of this document is enclosed in appendix B of this Quality Systems Manual (QSM)
   2) A statement from each employee that they have read, acknowledged and understood their personal, ethical and legal responsibilities, including the potential punishments and penalties for improper, unethical or illegal actions. This statement will be signed and dated.
   3) Documentation of any training courses, seminars and/or workshops.
   4) Documentation of each employee's continued proficiency to perform each test method by one of the following annually:

      a) Acceptable performance of a blind sample for each accredited method.
      b) Another Demonstration of Capability.
      c) A minimum of four consecutive Laboratory Control Samples with acceptable levels of precision and accuracy.

   5) College Diploma, if applicable
   6) College transcripts, if applicable

B) Demonstration of Capability (DOC) for each accredited method the employee performs.

   A DOC must be performed prior to using any test method and at any time there is a change in instrument type, personnel or method. The procedure will follow ELAP Certification Manual Section 233, and the DOC Certificate will be completed for each analyst for each accredited method.

Section 21. Education and Training in Ethical and Legal Responsibilities

Each South Mall Laboratory employee/analyst is educated in the laboratory's expectation of high commitment to ethics involving every step, from accepting the chain of custody form to providing the final analytical results and final disposition of the sample. They are instructed in the proper way to conduct operations as well as improper techniques to avoid.

Each employee is instructed in legal responsibilities that include everything from accepting the chain of custody form to submitting the final analytical results to insure that the data generated is defendable. They are made aware that any departure from legal or ethical actions may result in penalties. This can be anything from internal suspension or removal to the possibility of external internment.

South Mall Laboratories has implemented QA Policies to address Quality Control documentation issues with respect to data corrections and data edits. In addition the laboratory has generated a QA Policy to address integrity and ethics. All employees have read/reviewed and understand these QA Policies.

The QA Officer attended an Ethics Training Course and has prepared an in-house program to mimic the course that was given. This ethics training has been provided to employees. Attendance is documented by the attendance sheet for the session.

Section 22.0 Reporting Analytical Results

The results of each test carried out by the laboratory are reported accurately, clearly, unambiguously and objectively. Data is checked and rechecked to ensure that this occurs. All test reports are reviewed and signed by the Laboratory Director or his designee. All data reports include the following information; name, address, phone number and contact person at the laboratory. The samples that are tested are given a discreet/unique sample identifier. The client name and address are listed on the test result page. The sample test result is reported in the correct units of the method, the method name/reference as well as the date of analysis. A complete copy of the data report is maintained by the laboratory.

Effective September, 2005 the laboratory implemented the use of Promium/Element Laboratory Information Management Software (LIMS). This system is used for all aspects of data handling beginning with the sample login, bench sheet prep, sample analyses, QC analyses and data reporting. This LIMS system is also used to archive all data and report information. Raw data from the majority of laboratory instruments can be electronically transferred into this LIMS system. All data reports are generated from this system. A software package (Crystal) is used to generate all reports. The reporting format may be edited to meet a client specific reporting format.

APPENDIX A

Laboratory Instrumentation/Equipment								
Item	Model Number	Serial Number	Location	Software	Instruction Location	Maintenance Info	Date In Service	Condition as Received
Cole-Parmer DigiSense pH/mV/ORP meter	5938-00	L92001845	Receiving Lab	N/A	N/A	Calibrate daily	Prior to 1999	New
Orion pH/ISE meter	710A	2696	Wet Lab	N/A		Calibrate daily	Prior to 1999	New
Sper Scientific Advanced pH meter	840035	L304911	Wet Lab	DataLab	ICP Lab File Cabinet	Calibrate daily	2002	New
Omega pH Recorder	CT485B-110V	CT586PH210106600	2nd Floor Storage	N/A		Calibrate daily	2002	New
Oakton pH Testr 3	35624-30	N/A	ICP Lab	N/A	ICP Lab File Cabinet	Calibrate daily	2000	New
Beckman Conductivity Bridge	Out of Service						Out of Service	
Bradley-James Conductivity Meter	10528	B5144/10/1	Wet Lab	N/A	N/A	Calibrate daily	Out of Service	Used
Denver Instruments Analytical Balance	AA-160	B027626	Extraction Lab	N/A	N/A	See Maintenace Log	Prior to 1999	New
Ohaus Triple-Beam Balance	700	14	Extraction Lab	N/A	N/A	See Maintenace Log	Prior to 1999	Used
AND Pocket Balance	PV-100	9060126186	GC Lab	N/A	GC Lab	See Maintenace Log	2003	New
Spectro ICP-OES	Ciros CCD	112791-01	ICP Lab	Smart Analyzer 3.20	ICP Lab Shelf	See Maintenace Log	2001	New
Dohrmann TOC Analyzer with UV/Persulfate and High Temperature oxidation modules	DC-85 DC-80	Furnace - HE2004 UV Module - HH3561	ICP Lab	N/A	ICP Lab Shelf	See Maintenace Log	2000	Used
PE IR Spectrophotometer	1320	105606	ICP Lab	N/A	ICP Lab Shelf	See Maintenace Log	2000	Refurbished
Parr Oxygen Bomb Calorimeter		394812 50A 102500	Back Lab	N/A	ICP Lab File Cabinet	See Maintenace Log	2001	New
ICM pH Controller with strip chart recorder	Out of Service							
ICM Dissolved Oxygen Meter	Out of Service							
ICM Turbidity Meter	108467	11520	ICP Lab	N/A	ICP Lab File Cabinet	Calibrate daily	2000	New
CSC Sieve Shaker	012708	18480	Back Lab	N/A	ICP Lab File Cabinet	None	2001	New
Sieves (Assorted Sizes)	Various	N/A	GC Lab	N/A	N/A	None	2001	New
Midi-Vap Cyanide Distillation Apparatus	MCVK96284	MCV-103	2nd Floor Storage	N/A	ICP Lab File Cabinet	See Maintenace Log	Out of Service	New
Hach UV-Vis Spectrophotometer	DR4000U	9509U0000248	Wet Lab	HachLink	ICP Lab Shelf	See Maintenace Log	Prior to 1999	New
Leeman Labs Hydra AA Mercury Analyzer	010-0073-1	62459	Wet Lab	WinHg rev. 1.224	ICP Lab Shelf	See Maintenace Log	2001	New
Environmental Express HotBlock Digestion Block	SC100	526CEC0727	Wet Lab	N/A	ICP Lab File Cabinet	Check Temp Daily	2000	New
Organomation Nitrogen Evaporator	Out of Service							
Orion Dissolved Oxygen Probe	97-08-99	N/A	Wet Lab	N/A	ICP Lab Cabinet	See Maintenace Log	Prior to 1999	Refurbished
Orion Temperature probe	917005	N/A	Wet Lab	N/A	ICP Lab Cabinet	See Maintenace Log	Prior to 2000	Used
Orion Fluoride Probe	94-09	N/A	Wet Lab	N/A	ICP Lab Cabinet	See Maintenace Log	Prior to 2001	Used
Orion ORP Probe	97-78-00	N/A	Wet Lab	N/A	ICP Lab Cabinet	See Maintenace Log	Prior to 2002	Used
Orion Ammonia Probe	Out of Service	N/A	Wet Lab	N/A	ICP Lab Cabinet	See Maintenace Log	Prior to 2003	Used
Gra-Lab Universal Timer	171	129438	Wet Lab	N/A	N/A	None	Prior to 1999	Used
Zymark Benchmate	Out of Service							
SSI model 300 LC pump	300	T2906428	Back Lab	N/A	N/A	See Maintenace Log	Prior to 1999	Used
ISCO UA-6 UV-Vis Detector	UA-6	188367	Back Lab	N/A	N/A	See Maintenace Log	Prior to 1999	Used
Foxy 200 X-Y Collector	Out of Service							
Hamilton Bell Centrifuge	1505	4566	Wet Lab	N/A	N/A	None	Prior to 1999	Used
Lab-line L-C Oven	3512	0396-0159	Extraction Lab	N/A	N/A	Check Temp Daily	Prior to 1999	Used
Lab-line Ambi-Lo-Hi Chamber	3550	1085-003	Extraction Lab	N/A	N/A	Check Temp Daily	Prior to 1999	Used
Avanti Refrigerator	863-YW	10936	Wet Lab	N/A	N/A	Check Temp Daily	Prior to 1999	
Kenmore Refrigerator	564.8932520	50900994	GC Lab	N/A	N/A	Check Temp Daily	Prior to 1999	New
Kenmore Freezer	N/A	N/A	GC Lab	N/A	N/A		Prior to 1999	New
Dionex Ion Chromatograph	Out of Service							
Varian Flame AA	Out of Service							
Eberbach Dual Electroanalyzer	Out of Service							
American Scientific Lab Refrigerator	N/A	N/A	Receiving Lab	N/A	N/A	Check Temp Daily	Prior to 1999	Used
Buck Scientific Mercury Analyzer	Out of Service							
Envirochem Thermal Stripper	Out of Service							
Tekmar Automatic Desorber	Out of Service							
Neytech Lab Oven	Out of Service							
Neytech Muffle Furnace	85A	AGB10110	GC Lab	N/A	N/A	None	Prior to 1999	Used
Environmental Express TCLP Tumbler	N/A	N/A	Back Lab	N/A	N/A		Prior to 1999	Used
Environmental Express TCLP Filter - Metals	N/A	24-910484	Wet Lab	N/A	N/A		Prior to 1999	New
Environmental Express TCLP Filter - Volatiles	ZHE-1000	N/A	Wet Lab	N/A	N/A		Prior to 1999	New
Miele Stainless Steel Lab Washer	N/A	G7733	Wet Lab	N/A	N/A	None	Prior to 1999	Used
Heron Groundwater Measuring Tape	H.2OL	899	Receiving Lab	N/A	N/A	None	Prior to 1999	New
Sigma Automatic Water Sampler	800 SL	G089410483	Receiving Lab	N/A	ICP Lab File Cabinet	See Maintenace Log	Prior to 1999	New
Spec 20 Spectrophotometer	Out of Service							
Schuco Vacuum Pump	5711 130	0585150	Wet Lab	N/A	N/A	None	Prior to 1999	Used
Schuco Vacuum Pump	5711 130	04891024	Wet Lab	N/A	N/A	None	Prior to 2000	Used
Environmental Express StepSaver	Various	N/A	Extraction Lab	N/A	ICP Lab File Cabinet	See Maintenace Log	2002	New
Eppendorf Micropipet	20uL	01135	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 2004	New
Eppendorf Micropipet	1mL	054085	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 2004	New
Eppendorf Micropipet	100uL	N/A	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 2004	New
Eppendorf Micropipet	50uL	62164	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 2004	New
Eppendorf Micropipet	500uL	N/A	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 2004	New
Eppendorf Micropipet	200uL	1015113	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 2004	New
Brinkmann Macropipet	N/A	N/A	Wet Lab	N/A	N/A	See Pippette/Thermometer Log	Prior to 1999	Used
Millipore Water Treatment System	N/A	N/A	GC Lab	N/A	GC Lab	See Maintenace Log	Prior to 1999	Used
Ultrasonic Bath	FS14H	N/A	Extraction Lab	N/A	N/A	None	Prior to 1999	New
4 Position SS Steambath	Out of Service							

Item	Model Number	Serial Number	Location	Software	Instruction Location	Maintenance Info	Date In Service	Condition as Received
Pensky-Martens Flashpoint Tester	13-497-5	1619	Wet Lab	N/A	N/A		Prior to 1999	Used
Hach COD Reactor	Out of Service							
Christian Becker Class A Weight Set		701193	Extraction Lab	N/A	N/A	Check Calibration Annually	Prior to 1999	New
Tensiometer	Out of Service							
Chantillion Tensile Strength Tester	Out of Service							
NIST Traceable Thermometer		22747	ICP Lab	N/A	N/A	Check Calibration Annually	Prior to 1999	New
NIST Traceable Thermometer		1Y5102	ICP Lab	N/A	N/A	Check Calibration Annually	Prior to 2000	New
Fisher Traceable Thermometer	14-648-44	240043429	BOD Incubator	N/A	GC Lab	Check Calibration Annually	2004	New
Fisher Traceable Thermometer	14-648-44	240043435	Lab Frige #2	N/A	GC Lab	Check Calibration Annually	2004	New
Fisher Traceable Thermometer	14-648-44	240175888	Org. Std. Fridge	N/A	GC Lab	Check Calibration Annually	2004	New
Fisher Traceable Thermometer	14-648-44	240043436	Glass Front Fridge	N/A	GC Lab	Check Calibration Annually	2004	New
Fisher Traceable Thermometer	14-648-44	240175886	Rcv. Lab Fridge	N/A	GC Lab	Check Calibration Annually	2004	New
Fisher Traceable Thermometer	14-648-44	240043576	Receiving Lab	N/A	GC Lab	Check Calibration Annually	2004	New
Corning Stirrer	PC-410	3.504E+11	Wet Lab	N/A	N/A	None	2000	New
Corning Stirrer/Hotplate	PC-351	N/A	Extraction Lab	N/A	N/A	None	Prior to 1999	Used
Corning Stirrer/Hotplate	PC-351	N/A	Extraction Lab	N/A	N/A	None	Prior to 1999	Used
Buck Scientific Personal Air Sampler	A9100UL	28421	2nd Floor Storage	N/A	In Box	Calibrate prior to use	Prior to 1999	New
Equimeter Dry Air Meter	T-110	30614	2nd Floor Storage	N/A	N/A	None	Prior to 1999	New
Gast Air Sampling Pump	0523-V3-G582DX	971101429	2nd Floor Storage	N/A	N/A	Calibrate prior to use	Prior to 1999	New
Humboldt Soil Hydrometer Analysis Set	H-4265	335701	Wet Lab	N/A	N/A	None	Prior to 1999	New
Humboldt Liquid Limits Test Set	H-4228	2104228	Wet Lab	N/A	N/A	Calibrate prior to use	Prior to 1999	New
Oakton Conductivity Meter	510	137093	Receiving Lab	N/A	ICP Lab File Cabinet	See Maintenace Log	2003	New
SRI 8610 Gas Chromatograph with PID/FID/DELCD and P&T	Out of Service							
Lachat Micro Distillation System	1700-000	2000-278	Wet Lab	N/A	ICP Lab File Cabinet		2004	New
Zymark TurboVap II	103187/0	TV0313N11597	Extraction Lab	N/A	GC Lab	See Maintenace Log	2004	Used
Tecator Soxtec System HT	1043	1748	Extraction Lab	N/A	GC Lab	See Maintenace Log	2004	Used
Tecator Service Module	1046	1039	Extraction Lab	N/A	GC Lab	See Maintenace Log	2004	Used
Lachat Quickchem	8500	470000024	Wet Lab	Omnion rev. 3.0.219F	ICP Lab Shelf	See Maintenace Log	2004	New
HP Gas Chromatograph w/EPC (SVOA-2)	5890 Series II	2921A23412	GC Lab	Chemstation G1701AA v. A.03.00	GC Lab	See Maintenace Log	2003	Refurbished
HP Mass Selective Detector (SVOA-2)	5972	N/A	GC Lab	Chemstation G1701AA v. A.03.01	GC Lab	See Maintenace Log	2003	Refurbished
HP Gas Chromatograph (SVOA-1)	5890 Series II	2938A2471	GC Lab	Chemstation G1701AA v. A.03.02	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
HP Mass Selective Detector (SVOA-1)	5971A	8W17-365RR	GC Lab	Chemstation G1701AA v. A.03.03	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
HP Gas Chromatograph (GC-ECD)	5890A	2843A20952	GC Lab	Chemstation G1701AA v. A.03.04	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
HP Gas Chromatograph (GC-FID)	5890A	2750A16710	GC Lab	Chemstation G1701AA v. A.03.05	GC Lab	See Maintenace Log	2000	Used
HP Gas Chromatograph w/EPC (VOA-1)	5890 Series II	3336A61094	GC Lab	Chemstation G1701AA v. A.03.06	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
HP Mass Selective Detector (VOA-1)	5972	2W42D-25	GC Lab	Chemstation G1701AA v. A.03.07	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
Tekmar 3000 Purge and Trap Concentrator	14-3000-00T	95112007	GC Lab	Teklink 3000 v. 1.09	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
Tekmar ALS2016 Autosamplers	14-2962-200	92102003	GC Lab	Teklink 3000 v. 1.09	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
HP Gas Chromatograph (VOA-2)	5890 Series II	3140A39485	GC Lab	Chemstation G1701AA v. A.03.08	GC Lab	See Maintenace Log	2001	Used
HP Mass Selective Detector (VOA-2)	5971A	4W12-138R	GC Lab	Chemstation G1701AA v. A.03.09	GC Lab	See Maintenace Log	2001	Used
HP Purge and Trap Concentrator	G1901-60500	3529 A 10387	GC Lab	Teklink 3000 v. 1.09	GC Lab	See Maintenace Log	Prior to 1999	Refurbished
Tekmar ALS2016 Autosamplers	14-2962-200	91345003	GC Lab	Teklink 3000 v. 1.09	GC Lab	See Maintenace Log	2001	Used
Tekmar Heater Socks for ALS2016			GC Lab	Teklink 3000 v. 1.09	GC Lab	See Maintenace Log	2001	Used
Tekmar 2000 Purge and Trap Concentrator	Out of Service		GC Lab	N/A	GC Lab	See Maintenace Log	2001	Used
Frigidaire Refrigerator	FRT18B1BW2	BA40309228	Receiving Lab	N/A	N/A	Check Temp Daily	2004	New

APPENDIX B

SOUTH MALL
ANALYTICAL LABS, INC.™

26 NORTH MALL • PLAINVIEW, NY 11803
(516) 293-2191 • FAX (516) 293-3152
Email: Info@SouthMallLabs.com
Website: www.SouthMallLabs.com

Date:

Demonstration of Capability

This document identifies that the analyst has read and understands the latest version of the analytical method cited and has read and understands the latest version of the Laboratory SOP for the analytical method. This requirement is stated in NELAC 2002 (5.6.2.c.4)

Analytical Method:

Laboratory SOP:

Analyst Name:

Analyst Signature:

Appendix F Laboratory Accreditations

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H.

Expires 12:01 AM April 01, 2007
Issued April 1, 2006

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOSEPH SHAULYS
SOUTH MALL ANALYTICAL LABS
26 NORTH MALL
PLAINVIEW, NY 11803

NY Lab Id No: 10950
EPA Lab Code: NY01292

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 624
	EPA 8260B
Acrylonitrile	EPA 624
	EPA 8260B
Amines	
2-Nitroaniline	EPA 8270C
3-Nitroaniline	EPA 8270C
4-Chloroaniline	EPA 8270C
4-Nitroaniline	EPA 8270C
Carbazole	EPA 8270C
Diphenylamine	EPA 8270C
Pyridine	EPA 8270C
Benzidines	
3,3' -Dichlorobenzidine	EPA 625
	EPA 8270C
Benzidine	EPA 625
	EPA 8270C
Chlorinated Hydrocarbon Pesticides	
Aldrin	EPA 608
	EPA 8081A
alpha-BHC	EPA 608
	EPA 8081A
Chlorinated Hydrocarbon Pesticides	
beta-BHC	EPA 608
	EPA 8081A
Chlordane Total	EPA 608
	EPA 8081A
delta-BHC	EPA 608
	EPA 8081A
Dieldrin	EPA 608
	EPA 8081A
Endosulfan II	EPA 608
	EPA 8081A
Endosulfan sulfate	EPA 608
	EPA 8081A
Endrin	EPA 608
	EPA 8081A
Endrin aldehyde	EPA 608
	EPA 8081A
Endrin Ketone	EPA 8081A
Heptachlor	EPA 608
	EPA 8081A
Heptachlor epoxide	EPA 608
	EPA 8081A
Lindane	EPA 608
	EPA 8081A

Serial No.: 29219

Property of the New York State Department of Health. Valid only at the address shown. Must be conspicuously posted. Valid certificates have a raised seal. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify laboratory's accreditation status.

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Chlorinated Hydrocarbon Pesticides	
Methoxychlor	EPA 608
	EPA 8081A
Toxaphene	EPA 608
	EPA 8081A
Chlorinated Hydrocarbons	
1,2,4,5-Tetrachlorobenzene	EPA 8270C
1,2,4-Trichlorobenzene	EPA 625
	EPA 8270C
1-Chloronaphthalene	EPA 8270C
2-Chloronaphthalene	EPA 625
	EPA 8270C
Hexachlorobenzene	EPA 625
	EPA 8270C
Hexachlorobutadiene	EPA 625
	EPA 8260B
	EPA 8270C
Hexachlorocyclopentadiene	EPA 625
	EPA 8270C
Hexachloroethane	EPA 625
	EPA 8270C
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
Chlorophenoxy Acid Pesticides	
2,4,5-T	SM 18-20 6640B
2,4,5-TP (Silvex)	EPA 8151A
	SM 18-20 6640B
2,4-D	EPA 8151A
	SM 18-20 6640B
Dicamba	EPA 1978, p.115
	EPA 8151A
Demand	
Biochemical Oxygen Demand	EPA 405.1
	SM 18-20 5210B
Carbonaceous BOD	SM 18-20 5210B
Chemical Oxygen Demand	EPA 410.1
Fuel Oxygenates	
Ethanol	EPA 8260B
Methyl tert-butyl ether	EPA 8260B
t-Butyl alcohol	EPA 8260B
Haloethers	
4-Bromophenylphenyl ether	EPA 625
	EPA 8270C
4-Chlorophenylphenyl ether	EPA 625
	EPA 8270C
Bis (2-chloroisopropyl) ether	EPA 625

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Haloethers	
Bis (2-chloroisopropyl) ether	EPA 8270C
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270C
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270C
Microextractables	
1,2-Dibromo-3-chloropropane	EPA 8260B
1,2-Dibromoethane	EPA 8260B
Mineral	
Acidity	EPA 305.1
Alkalinity	EPA 310.1
Chloride	SM 18-20 4500-Cl B
Fluoride, Total	EPA 340.2
Hardness, Total	EPA 130.2
Sulfate (as SO4)	EPA 375.4
Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	EPA 625
	EPA 8270C
2,6-Dinitrotoluene	EPA 625
	EPA 8270C
Isophorone	EPA 625
	EPA 8270C
Nitroaromatics and Isophorone	
Nitrobenzene	EPA 625
	EPA 8270C
Nitrosoamines	
N-Nitrosodiethylamine	EPA 8270C
N-Nitrosodimethylamine	EPA 625
	EPA 8270C
N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270C
N-Nitrosodiphenylamine	EPA 625
	EPA 8270C
Nutrient	
Ammonia (as N)	LACHAT 10-107-06-1-B
Kjeldahl Nitrogen, Total	LACHAT 10-107-06-2
Nitrate (as N)	EPA 353.3
	LACHAT 10-107-04-1
Nitrite (as N)	EPA 354.1
	LACHAT 10-107-04-1
Orthophosphate (as P)	SM 18-20 4500-P E
Phosphorus, Total	EPA 365.3
Phthalate Esters	
Benzyl butyl phthalate	EPA 625
	EPA 8270C

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Phthalate Esters	
Bis(2-ethylhexyl) phthalate	EPA 625
	EPA 8270C
Diethyl phthalate	EPA 625
	EPA 8270C
Dimethyl phthalate	EPA 625
	EPA 8270C
Di-n-butyl phthalate	EPA 625
	EPA 8270C
Di-n-octyl phthalate	EPA 625
	EPA 8270C
Polychlorinated Biphenyls	
PCB-1016	EPA 608
	EPA 8082
PCB-1221	EPA 608
	EPA 8082
PCB-1232	EPA 608
	EPA 8082
PCB-1242	EPA 608
	EPA 8082
PCB-1248	EPA 608
	EPA 8082
PCB-1254	EPA 608
	EPA 8082
Polychlorinated Biphenyls	
PCB-1260	EPA 608
	EPA 8082
Polynuclear Aromatics	
Acenaphthene	EPA 625
	EPA 8270C
Acenaphthylene	EPA 625
	EPA 8270C
Anthracene	EPA 625
	EPA 8270C
Benzo(a)anthracene	EPA 625
	EPA 8270C
Benzo(a)pyrene	EPA 625
	EPA 8270C
Benzo(b)fluoranthene	EPA 625
	EPA 8270C
Benzo(ghi)perylene	EPA 625
	EPA 8270C
Benzo(k)fluoranthene	EPA 625
	EPA 8270C
Chrysene	EPA 625
	EPA 8270C
Dibenzo(a,h)anthracene	EPA 625
	EPA 8270C

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Polynuclear Aromatics	
Fluoranthene	EPA 625
	EPA 8270C
Fluorene	EPA 625
	EPA 8270C
Indeno(1,2,3-cd)pyrene	EPA 625
	EPA 8270C
Naphthalene	EPA 625
	EPA 8270C
Phenanthrene	EPA 625
	EPA 8270C
Pyrene	EPA 625
	EPA 8270C
Priority Pollutant Phenols	
2,4,5-Trichlorophenol	EPA 625
	EPA 8270C
2,4,6-Trichlorophenol	EPA 625
	EPA 8270C
2,4-Dichlorophenol	EPA 625
	EPA 8270C
2,4-Dimethylphenol	EPA 625
	EPA 8270C
2,4-Dinitrophenol	EPA 625
	EPA 8270C

Priority Pollutant Phenols	
2-Chlorophenol	EPA 625
	EPA 8270C
2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270C
2-Nitrophenol	EPA 625
	EPA 8270C
4-Chloro-3-methylphenol	EPA 625
	EPA 8270C
4-Nitrophenol	EPA 625
	EPA 8270C
Cresols, Total	EPA 8270C
Pentachlorophenol	EPA 625
	EPA 8270C
Phenol	EPA 625
	EPA 8270C
Purgeable Aromatics	
1,2-Dichlorobenzene	EPA 624
	EPA 8260B
	EPA 8270C
1,3-Dichlorobenzene	EPA 624
	EPA 8260B
	EPA 8270C
1,4-Dichlorobenzene	EPA 624

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Purgeable Aromatics	
1,4-Dichlorobenzene	EPA 8260B
	EPA 8270C
Benzene	EPA 624
	EPA 8260B
Chlorobenzene	EPA 624
	EPA 8260B
Ethyl benzene	EPA 624
	EPA 8260B
Styrene	EPA 624
	EPA 8260B
Toluene	EPA 624
	EPA 8260B
Total Xylenes	EPA 624
	EPA 8260B
Purgeable Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260B
1,1,1-Trichloroethane	EPA 624
	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 624
	EPA 8260B
1,1,2-Trichloroethane	EPA 624
	EPA 8260B
1,1-Dichloroethane	EPA 624

Purgeable Halocarbons	
1,1-Dichloroethane	EPA 8260B
1,1-Dichloroethene	EPA 624
	EPA 8260B
1,1-Dichloropropene	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B
1,2-Dichloroethane	EPA 624
	EPA 8260B
1,2-Dichloropropane	EPA 624
	EPA 8260B
2,2-Dichloropropane	EPA 8260B
2-Chloroethylvinyl ether	EPA 624
	EPA 8260B
Bromochloromethane	EPA 8260B
Bromodichloromethane	EPA 624
	EPA 8260B
Bromoform	EPA 624
	EPA 8260B
Bromomethane	EPA 624
	EPA 8260B
Carbon tetrachloride	EPA 624
	EPA 8260B
Chloroethane	EPA 624
	EPA 8260B

Serial No.: 29219

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H.

Expires 12:01 AM April 01, 2007
Issued April 1, 2006

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOSEPH SHAULYS
SOUTH MALL ANALYTICAL LABS
26 NORTH MALL
PLAINVIEW, NY 11803

NY Lab Id No: 10950
EPA Lab Code: NY01292

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Purgeable Halocarbons	
Chloroform	EPA 624
	EPA 8260B
Chloromethane	EPA 624
	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B
cis-1,3-Dichloropropene	EPA 624
	EPA 8260B
Dibromochloromethane	EPA 624
	EPA 8260B
Dibromomethane	EPA 8260B
Dichlorodifluoromethane	EPA 624
	EPA 8260B
Methylene chloride	EPA 624
	EPA 8260B
Tetrachloroethene	EPA 624
	EPA 8260B
trans-1,2-Dichloroethene	EPA 624
	EPA 8260B
trans-1,3-Dichloropropene	EPA 624
	EPA 8260B
Trichloroethene	EPA 624
	EPA 8260B
Trichlorofluoromethane	EPA 624

Purgeable Halocarbons	
Trichlorofluoromethane	EPA 8260B
Vinyl chloride	EPA 624
	EPA 8260B
Purgeable Organics	
2-Butanone (Methylethyl ketone)	EPA 8260B
2-Hexanone	EPA 8260B
4-Methyl-2-Pentanone	EPA 8260B
Acetone	EPA 8260B
Carbon Disulfide	EPA 8260B
Vinyl acetate	EPA 8260B
Residue	
Solids, Total	SM 18-20 2540B
Solids, Total Dissolved	SM 18-20 2540C
Solids, Total Suspended	SM 18-20 2540D
Wastewater Metals I	
Barium, Total	EPA 200.7
	EPA 6010B
Cadmium, Total	EPA 200.7
	EPA 6010B
Calcium, Total	EPA 200.7
	EPA 6010B
Chromium, Total	EPA 200.7

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All approved analytes are listed below:

Wastewater Metals I	
Chromium, Total	EPA 6010B
Copper, Total	EPA 200.7
	EPA 6010B
Iron, Total	EPA 200.7
	EPA 6010B
Lead, Total	EPA 200.7
	EPA 6010B
Magnesium, Total	EPA 200.7
	EPA 6010B
Manganese, Total	EPA 200.7
	EPA 6010B
Nickel, Total	EPA 200.7
	EPA 6010B
Potassium, Total	EPA 200.7
	EPA 6010B
Silver, Total	EPA 200.7
	EPA 6010B
Sodium, Total	EPA 200.7
	EPA 6010B
Wastewater Metals II	
Aluminum, Total	EPA 200.7
	EPA 6010B
Antimony, Total	EPA 200.7

Wastewater Metals II	
Antimony, Total	EPA 6010B
Arsenic, Total	EPA 200.7
	EPA 6010B
Beryllium, Total	EPA 200.7
	EPA 6010B
Chromium VI	EPA 7196A
	SM 18-19 3500-Cr D
Mercury, Total	EPA 245.1
	EPA 7470A
Selenium, Total	EPA 200.7
	EPA 6010B
Vanadium, Total	EPA 200.7
	EPA 6010B
Zinc, Total	EPA 200.7
	EPA 6010B
Wastewater Metals III	
Cobalt, Total	EPA 200.7
	EPA 6010B
Gold, Total	EPA 231.2
	SM 18-20 3111B
Molybdenum, Total	EPA 200.7
	EPA 6010B
Palladium, Total	SM 18-20 3111B

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PLAINVIEW, NY 11803

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All approved analytes are listed below:

Wastewater Metals III	
Platinum, Total	SM 18-20 3111B
Thallium, Total	EPA 200.7
	EPA 6010B
Tin, Total	EPA 200.7
Titanium, Total	EPA 200.7
Wastewater Miscellaneous	
Bromide	EPA 320.1
Color	EPA 110.2
Cyanide, Total	EPA 335.2
	EPA 9010B
	LATCHAT 10-204-00-1-X
Hydrogen Ion (pH)	EPA 9040B
	SM 18-20 4500-H B
Oil & Grease Total Recoverable	EPA 1664A
	EPA 413.1
Organic Carbon, Total	EPA 415.2
Phenols	EPA 420.1
	LACHAT 10-210-00-1-A
Silica, Dissolved	EPA 200.7
	EPA 370.1
	EPA 6010B
Specific Conductance	SM 18-20 2510B
Sulfide (as S)	EPA 376.1

Wastewater Miscellaneous	
Surfactant (MBAS)	SM 18-20 5540C
Temperature	SM 18-20 2550B

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26 NORTH MALL
PLAINVIEW, NY 11803

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EPA Lab Code: NY01292

is hereby APPROVED as an Environmental Laboratory for the category
ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved subcategories and/or analytes are listed below:

Wastewater Miscellaneous

Cyanide, Total	LACHAT 10-204-00-1-A

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26 NORTH MALL
PLAINVIEW, NY 11803

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EPA Lab Code: NY01292

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 8260B
Acrylonitrile	EPA 8260B
Amines	
2-Nitroaniline	EPA 8270C
3-Nitroaniline	EPA 8270C
4-Nitroaniline	EPA 8270C
Diphenylamine	EPA 8270C
Benzidines	
3,3' -Dichlorobenzidine	EPA 8270C
Benzidine	EPA 8270C
Characteristic Testing	
Corrosivity	EPA 1110
Ignitability	EPA 1010
Reactivity	SW-846 Ch7, Sec. 7.3
TCLP	EPA 1311
Chlorinated Hydrocarbon Pesticides	
4,4'-DDD	EPA 8081A
4,4'-DDE	EPA 8081A
4,4'-DDT	EPA 8081A
Aldrin	EPA 8081A
alpha-BHC	EPA 8081A

Chlorinated Hydrocarbon Pesticides	
beta-BHC	EPA 8081A
Chlordane Total	EPA 8081A
delta-BHC	EPA 8081A
Dieldrin	EPA 8081A
Endosulfan I	EPA 8081A
Endosulfan II	EPA 8081A
Endosulfan sulfate	EPA 8081A
Endrin	EPA 8081A
Endrin aldehyde	EPA 8081A
Endrin Ketone	EPA 8081A
Heptachlor	EPA 8081A
Heptachlor epoxide	EPA 8081A
Lindane	EPA 8081A
Methoxychlor	EPA 8081A
Toxaphene	EPA 8081A
Chlorinated Hydrocarbons	
1,2,4-Trichlorobenzene	EPA 8270C
2-Chloronaphthalene	EPA 8270C
Hexachlorobenzene	EPA 8270C
Hexachlorobutadiene	EPA 8270C
Hexachlorocyclopentadiene	EPA 8270C
Hexachloroethane	EPA 8270C

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All approved analytes are listed below:

Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dicamba	EPA 8151A
Haloethers	
4-Bromophenylphenyl ether	EPA 8270C
4-Chlorophenylphenyl ether	EPA 8270C
Bis (2-chloroisopropyl) ether	EPA 8270C
Bis(2-chloroethoxy)methane	EPA 8270C
Bis(2-chloroethyl)ether	EPA 8270C
Metals I	
Barium, Total	EPA 6010B
Cadmium, Total	EPA 6010B
Calcium, Total	EPA 6010B
Chromium, Total	EPA 6010B
Copper, Total	EPA 6010B
Iron, Total	EPA 6010B
Lead, Total	EPA 6010B
Magnesium, Total	EPA 6010B
Manganese, Total	EPA 6010B
Nickel, Total	EPA 6010B
Metals I	
Potassium, Total	EPA 6010B
Silver, Total	EPA 6010B
Sodium, Total	EPA 6010B
Metals II	
Aluminum, Total	EPA 6010B
Antimony, Total	EPA 6010B
Arsenic, Total	EPA 6010B
Beryllium, Total	EPA 6010B
Chromium VI	EPA 7196A
Mercury, Total	EPA 7471A
Selenium, Total	EPA 6010B
Vanadium, Total	EPA 6010B
Zinc, Total	EPA 6010B
Metals III	
Cobalt, Total	EPA 6010B
Molybdenum, Total	EPA 6010B
Silica, Dissolved	EPA 6010B
Thallium, Total	EPA 6010B
Tin, Total	EPA 6010B
Titanium, Total	EPA 6010B
Minerals	
Chloride	EPA 9251

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Minerals	
Sulfate (as SO4)	EPA 9036
Miscellaneous	
Cyanide, Total	EPA 9010B
	EPA 9012A
Hydrogen Ion (pH)	EPA 9040B
	EPA 9045C
Lead in Dust Wipes	EPA 6010B
Lead in Paint	EPA 6010B
Oil & Grease Total Recoverable	EPA 9071
Phenols	EPA 9066
Sulfide (as S)	EPA 9030B
	EPA 9031
Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	EPA 8270C
2,6-Dinitrotoluene	EPA 8270C
Isophorone	EPA 8270C
Nitrobenzene	EPA 8270C
Pyridine	EPA 8270C
Nitrosoamines	
N-Nitrosodimethylamine	EPA 8270C
N-Nitrosodi-n-propylamine	EPA 8270C
N-Nitrosodiphenylamine	EPA 8270C
Phthalate Esters	
Benzyl butyl phthalate	EPA 8270C
Bis(2-ethylhexyl) phthalate	EPA 8270C
Diethyl phthalate	EPA 8270C
Dimethyl phthalate	EPA 8270C
Di-n-butyl phthalate	EPA 8270C
Di-n-octyl phthalate	EPA 8270C
Polychlorinated Biphenyls	
PCB-1016	EPA 8082
PCB-1221	EPA 8082
PCB-1232	EPA 8082
PCB-1242	EPA 8082
PCB-1248	EPA 8082
PCB-1254	EPA 8082
PCB-1260	EPA 8082
Polynuclear Aromatic Hydrocarbons	
Acenaphthene	EPA 8270C
Acenaphthylene	EPA 8270C
Anthracene	EPA 8270C
Benzo(a)anthracene	EPA 8270C
Benzo(a)pyrene	EPA 8270C
Benzo(b)fluoranthene	EPA 8270C
Benzo(ghi)perylene	EPA 8270C

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All approved analytes are listed below:

Polynuclear Aromatic Hydrocarbons	
Benzo(k)fluoranthene	EPA 8270C
Chrysene	EPA 8270C
Dibenzo(a,h)anthracene	EPA 8270C
Fluoranthene	EPA 8270C
Fluorene	EPA 8270C
Indeno(1,2,3-cd)pyrene	EPA 8270C
Naphthalene	EPA 8270C
Phenanthrene	EPA 8270C
Pyrene	EPA 8270C
Priority Pollutant Phenols	
2,4,5-Trichlorophenol	EPA 8270C
2,4,6-Trichlorophenol	EPA 8270C
2,4-Dichlorophenol	EPA 8270C
2,4-Dimethylphenol	EPA 8270C
2,4-Dinitrophenol	EPA 8270C
2-Chlorophenol	EPA 8270C
2-Methyl-4,6-dinitrophenol	EPA 8270C
2-Methylphenol	EPA 8270C
2-Nitrophenol	EPA 8270C
3-Methylphenol	EPA 8270C
4-Chloro-3-methylphenol	EPA 8270C
4-Methylphenol	EPA 8270C
4-Nitrophenol	EPA 8270C

Priority Pollutant Phenols	
Pentachlorophenol	EPA 8270C
Phenol	EPA 8270C
Purgeable Aromatics	
1,2,4-Trimethylbenzene	EPA 8260B
1,2-Dichlorobenzene	EPA 8260B
1,3,5-Trimethylbenzene	EPA 8260B
1,3-Dichlorobenzene	EPA 8260B
1,4-Dichlorobenzene	EPA 8260B
2-Chlorotoluene	EPA 8260B
4-Chlorotoluene	EPA 8260B
Benzene	EPA 8260B
Bromobenzene	EPA 8260B
Chlorobenzene	EPA 8260B
Ethyl benzene	EPA 8260B
Isopropylbenzene	EPA 8260B
n-Butylbenzene	EPA 8260B
p-Isopropyltoluene (P-Cymene)	EPA 8260B
sec-Butylbenzene	EPA 8260B
Styrene	EPA 8260B
tert-Butylbenzene	EPA 8260B
Toluene	EPA 8260B
Total Xylenes	EPA 8260B

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All approved analytes are listed below:

Purgeable Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260B
1,1,1-Trichloroethane	EPA 8260B
1,1,2,2-Tetrachloroethane	EPA 8260B
1,1,2-Trichloroethane	EPA 8260B
1,1-Dichloroethane	EPA 8260B
1,1-Dichloroethene	EPA 8260B
1,1-Dichloropropene	EPA 8260B
1,2,3-Trichloropropane	EPA 8260B
1,2-Dibromo-3-chloropropane	EPA 8260B
1,2-Dichloroethane	EPA 8260B
1,2-Dichloropropane	EPA 8260B
1,3-Dichloropropane	EPA 8260B
2,2-Dichloropropane	EPA 8260B
2-Chloroethylvinyl ether	EPA 8260B
Bromochloromethane	EPA 8260B
Bromodichloromethane	EPA 8260B
Bromoform	EPA 8260B
Bromomethane	EPA 8260B
Carbon tetrachloride	EPA 8260B
Chloroethane	EPA 8260B
Chloroform	EPA 8260B
Chloromethane	EPA 8260B
cis-1,2-Dichloroethene	EPA 8260B

Purgeable Halocarbons	
cis-1,3-Dichloropropene	EPA 8260B
Dibromochloromethane	EPA 8260B
Dibromomethane	EPA 8260B
Dichlorodifluoromethane	EPA 8260B
Tetrachloroethene	EPA 8260B
trans-1,2-Dichloroethene	EPA 8260B
trans-1,3-Dichloropropene	EPA 8260B
Trichloroethene	EPA 8260B
Trichlorofluoromethane	EPA 8260B
Vinyl chloride	EPA 8260B
Purgeable Organics	
2-Butanone (Methylethyl ketone)	EPA 8260B
2-Hexanone	EPA 8260B
4-Methyl-2-Pentanone	EPA 8260B
Acetone	EPA 8260B
Carbon Disulfide	EPA 8260B
Ethylene Glycol	EPA 8260B
Methyl tert-butyl ether	EPA 8260B
Vinyl acetate	EPA 8260B

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26 NORTH MALL
PLAINVIEW, NY 11803

NY Lab Id No: 10950
EPA Lab Code: NY01292

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Metals I

Lead, Total	EPA 200.7

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DR. PEDRO J. FRANCO
NASSAU COUNTY DEPT OF HEALTH
209 MAIN STREET
HEMPSTEAD, NY 11550

NY Lab Id No: 10339
EPA Lab Code: NY00010

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Purgeable Halocarbons	
Carbon tetrachloride	EPA 8260B
Chloroethane	EPA 624
	EPA 8260B
Chloroform	EPA 624
	EPA 8260B
Chloromethane	EPA 624
	EPA 8260B
cis-1,3-Dichloropropene	EPA 624
	EPA 8260B
Dibromochloromethane	EPA 624
	EPA 8260B
Dichlorodifluoromethane	EPA 624
	EPA 8260B
Methylene chloride	EPA 624
	EPA 8260B
Tetrachloroethene	EPA 624
	EPA 8260B
trans-1,2-Dichloroethene	EPA 624
	EPA 8260B
trans-1,3-Dichloropropene	EPA 624
	EPA 8260B
Trichloroethene	EPA 624
	EPA 8260B
Purgeable Halocarbons	
Trichlorofluoromethane	EPA 624
	EPA 8260B
Vinyl chloride	EPA 624
	EPA 8260B
Residue	
Solids, Total	EPA 160.3
Solids, Total Dissolved	EPA 160.1
Solids, Total Suspended	EPA 160.2
Wastewater Bacteriology	
Coliform, fecal	SM 18-20 9221E
	SM 18-20 9222D
Coliform, Total	SM 18-20 9221B
	SM 18-20 9222B
Wastewater Metals I	
Barium, Total	EPA 200.7
Cadmium, Total	EPA 200.7
Calcium, Total	EPA 200.7
Chromium, Total	EPA 200.7
Copper, Total	EPA 200.7
Iron, Total	EPA 200.7
Lead, Total	EPA 200.9
	EPA 7421

Serial No.: 28862

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Appendix G Distribution List for QAPP Recipients

DISTRIBUTION LISTS

LIST # 1 - The following individuals and organizations will receive a copy of Friends of the Bay's approved Quality Assurance Project Plan and any subsequent revisions:

Mark A. Tedesco
Director
Long Island Sound Office
United States Environmental Protection Agency
Stamford Government Center
888 Washington Blvd.
Stamford, CT 06904-2152
203-977-1541
tedesco.mark@epa.gov

Paula Zevin
Regional Volunteer Monitoring Coordinator
US EPA - Region 2
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LIST # 2 - The following individuals and organizations will receive a copy of Friends of the Bay's annual water quality monitoring report and other WQM reports:

Everyone in list #1 plus…

The Honorable Charles Schumer
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Long Island Regional Office
145 Pine Lawn Road #300
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The Honorable Hillary Rodham Clinton
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The Honorable Steve Israel
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The Honorable Peter King
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The Honorable George E. Pataki
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The Honorable Carl Marcellino
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The Honorable Charles Lavine
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The Honorable Judith Jacobs
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The Honorable Diane Yatauro
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The Honorable Jon Cooper
Suffolk County Legislature
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The Honorable Leonard Genova
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The Honorable Chris J. Coschignano
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Jack L. Libert, Commissioner
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Leslie Maccarone, Deputy Commissioner
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Oyster Bay, New York 11771

Local Mayors

WQM-related reports will be shared with the Mayor of each of the following Villages of Bayville, Centre Island, Cove Neck, Lattingtown, Laurel Hollow, Lloyd Harbor, Matinecock, Mill Neck, Muttontown, Oyster Bay Cove, and Upper Brookville.

The Honorable Victoria Siegel
Mayor
The Incorporated Village of Bayville
34 School Street
Bayville, NY 11709

The Honorable John M. Williams
Mayor
The Incorporated Village of Centre Island
303 Centre Island Road
Oyster Bay, NY 11771

The Honorable Thomas R. Zoller
Mayor
The Incorporated Village of Cove Neck
21 Tennis Court Road
Oyster Bay, NY 11771

The Honorable Denise R. DeVita
Mayor
The Incorporated Village of Laurel Hollow
1492 Laurel Hollow Road
Syosset, NY 11791

The Honorable Clarence Michalis
Mayor
The Incorporated Village of Lattingtown
299 Lattingtown Road, P.O.Box 488
Lattingtown, NY 11560
676-6920

The Honorable Leland M. Hairr
Mayor
The Incorporated Village of Lloyd Harbor
32, Middle Hollow Road
Huntington, NY 11743

The Honorable John F. Johnston, II
Mayor
The Incorporated Village of Matinecock
63 Midway Ave., P.O. Box 706
Locust Valley, NY 11560

The Honorable Richard H. Murcott
Mayor
The Incorporated Village of Muttontown
1763 Route 106
Muttontown, NY 11791

The Honorable Theodore B. Smith
Mayor
The Incorporated Village of Mill Neck
Frost Mill Road
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922-6722

The Honorable Rosemary Bourne
Mayor
The Incorporated Village of Oyster Bay Cove
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The Honorable Letice Hertwick
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The Incorporated Village of Upper Brookville
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Larry Weiss
Oyster Bay Power Squadron

Richard Werner
Oyster Bay Auxillary Coast Guard

FOB will share the results and its experience with other members of the Long Island Sound Study's Citizens Advisory Committee.