

**VIRGINIA CHESAPEAKE BAY**  
**TRIBUTARY WATER QUALITY MONITORING PROGRAM**  
**STANDARD OPERATING PROCEDURES MANUAL**  
**FOR**  
**TIME PERIOD JULY 01, 2006 THROUGH JUNE 30, 2007**

**Revised May 15, 2006**

**Chesapeake Bay Program**  
**Virginia Department of Environmental Quality**  
**629 E. Main Street**  
**Richmond, Virginia**



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## List of Acronyms

<b>CAR</b>	Corrective Action Request
<b>CBM</b>	Chesapeake Bay Monitoring
<b>CBO</b>	Chesapeake Bay Office
<b>CBP</b>	Chesapeake Bay Program
<b>CBPWQ</b>	Chesapeake Bay Water Quality
<b>CIMS</b>	Chesapeake Bay Information Management System
<b>CSSP</b>	Coordinated Split Sample Program
<b>DCLS</b>	Department of Consolidated Laboratories
<b>DEQ</b>	Department of Environmental Quality
<b>DI</b>	Deionized Water
<b>DO</b>	Dissolved Oxygen
<b>EDT</b>	Electronic Data Transferal
<b>ETMP</b>	Enhanced Tributary Monitory Program
<b>NRO</b>	Northern Regional Office
<b>ODU</b>	Old Dominion University
<b>OIS</b>	Office of Information Systems
<b>PCN</b>	Particulate Carbon and Nitrogen
<b>PP</b>	Particulate Phosphorus
<b>PRO</b>	Piedmont Regional Office
<b>PMTF</b>	Procedure Modification Tracking Form
<b>QA</b>	Quality Assurance
<b>QC</b>	Quality Control
<b>SOP</b>	Standard Operating Procedure
<b>TRO</b>	Tidewater Regional Office
<b>VDEQ</b>	Virginia Department of Environmental Quality
<b>WQAP</b>	Water Quality Assessments & Planning
<b>USGS</b>	U.S. Geological Survey
<b>WQM</b>	Water Quality Monitoring portion of the CEDS2000 database program

## 1.0 PROGRAM PLANNING AND REQUIREMENTS

### 1.1 SCHEDULING/RESCHEDULING OF CRUISES

Sampling cruises need to be scheduled into the Water Quality Monitoring Module of the CEDS2000 database (WQM) by the 25<sup>th</sup> of the month prior to the sampling event (refer to the OIS WQM operating manual for specific instructions). Once entered into WQM, the schedule may be modified as needed to accommodate changes due to weather disturbances or equipment malfunctions.

If necessary, cruises may be rescheduled to within 2 weeks of the next scheduled cruise for the rescheduled tributary run.

#### 1.1.1 2006-2007 Tributary Schedule

Month	York	Rappahannock	James	Elizabeth
January	3	4	17	18
February	6	8	21	22
March	6	8	20	22
April	3	5	17	19
May	1	3	15	17
June	12	14	26	28
July	10	12	24	17
August	7	9	21	23
September	11	13	25	27
October	10	11	23	25
November	6	13	15	8
December	4	11	13	6

#### 1.1.2 Rescheduling

**A sampling run that does not take place as scheduled must be rescheduled as soon as possible. Any sampling run that is rescheduled 2 days or closer to the scheduled date needs to have the lab notified both by WQM and via e-mail.**

1. DCLS needs to be notified both through WQM and via e-mail due to time restraints for chemical standards utilized with their equipment. Send the email to: [lyle.clark@dgs.virginia.gov](mailto:lyle.clark@dgs.virginia.gov), [debbie.paul@dgs.virginia.gov](mailto:debbie.paul@dgs.virginia.gov), [louis.baker@dgs.virginia.gov](mailto:louis.baker@dgs.virginia.gov) and cc [ed.shaw@dgs.virginia.gov](mailto:ed.shaw@dgs.virginia.gov). The text of the e-mail should include the region, the type of run (i.e. Chesapeake Bay), rescheduled date and the total number of bacterial samples collected during the run.
2. Phytoplankton and primary productivity samples are collected March through October. Plankton sample pickup needs to be coordinated with ODU during those months. TRO will need to coordinate the plankton sample drop-off with ODU or sample pickup with Central

Office in the event they are unable to deliver the samples to ODU. Central Office must coordinate PRO's sample drop-off with ODU.

3. Whenever possible, USGS will monitor the respective Fall Line stations on the same day as DEQ. CO will contact USGS in the event of any changes to the DEQ schedule.
4. Whenever possible VIMS will also conduct their continuous monitoring of the York River on the same day as DEQ and will be notified by Rick Hoffman of any changes as soon as possible.
5. Maryland zooplankton collections are scheduled to occur within 3 sampling days of PRO and TRO water quality monitoring collections. Willy Burton of VERSAR will be notified when either the Piedmont or Tidewater regional office reschedules due to weather or equipment failure.
6. The following is an outline of protocols, in order of preference, to be used in the event of a disruption in the sampling schedule:

I. Problems due to weather.

A. If occurring prior to sampling:

Option 1 - All regions reschedule the run to the first available day.

Option 2 - Unaffected regions complete sampling as scheduled, affected regions reschedule to the first available day.

B. If occurring during sampling:

Option 1 - All regions reschedule to run the first available sampling day.

Option 2 - Unaffected regions complete sampling as scheduled, affected regions reschedule to first available day.

II. Problems due to boat/engine malfunctions.

A. If occurring prior to sampling:

Option 1 - Affected region uses backup boat, if available.

Option 2 - Regions not experiencing a problem adjust their schedules to sample the stations missed by the affected region.

Option 3 - All regions reschedule the run to first available day.

Option 4 - Unaffected regions complete sampling as scheduled, affected region reschedule to first available day.

B. If occurring during sampling:

Option 1 - Unaffected regions sample missed stations on day of sampling.

Option 2 - Missed stations are sampled on first available day.

7. Notify CBO.

If disruptions in sampling occur for any reason, the RO should notify CBO and all labs as soon as

possible. Upon completion of scheduled runs, regional offices will report work completed via the Field Summary Sheets, Licor data sheets and WQM data sheets (all forms may be found in Appendix A). Any deviations from the SOP will be reported via the comment field in WQM and Field summary sheets (if only occurs during a single sampling event) or Procedure Modification Tracking Form (if occurs during multiple sampling events or permanent).

## 1.2 PERTINENT TELEPHONE NUMBERS

### **TRO (757)**

408-2718 Vessel cellular  
681-8739 Vehicle cellular  
518-2142 Warehouse  
518-2163 Dave Wolfram (o)  
482-2923 Dave Wolfram (h)  
518-2154 Wick Harlan (o)  
423-5263 Wick Harlan (h)  
482-2038 Roger Everton (h)  
518-2150 Roger Everton (o)

### **ODU (757)**

683-4994 Phytoplankton  
laboratory  
627-3430 Todd Egerton (h)  
481-0755 Dr. Marshall (h)

### **PRO (804)**

840-9578 cellular  
840-9527 cellular  
527-5065 Lou Seivard (o)  
741-3668 Lou Seivard (h)  
527-5113 Bill Shanabruch (o)  
233-1412 Bill Shanabruch (h)

### **CBP (804)**

698-4385 Cindy Johnson (o)  
562-5101 Cindy Johnson (h)  
698-4334 Rick Hoffman (o)  
935-0698 Rick Hoffman (h)

### **NRO (703)**

609-8663 Portable cellular  
609-8661 Vehicle cellular  
583-3911 Jean Classen (o)  
583-3892 Lynn Meadows (o)  
583-3843 Bryant Thomas (o)

### **DCLS (804)648-4480**

ext.328 Jay Armstrong (o)  
– NTNP and PP analyses  
ext.321 Bob Potts (o)  
PNC, solids and chlorophyll  
ext.141 Lewis Baker (o)

## 1.3 LAUNCH / RETRIEVAL SITES

**L** = launch site; **R** = retrieval site; **Note:** Prior to 1998 sample drop-off sites were utilized to deliver samples to the participating labs. The drop-off sites are listed in Appendix F and may be utilized in cases where a DCLS courier is unavailable.

### **A. York River**

#### **PRO:**

**L** - Pamunkey Indian reservation in King William Co. for station 8-PMK034.17

**R** - Pamunkey Indian reservation in King William Co. for station 8-PMK034.17

**L** - Department of Game and Inland Fisheries ramp on the end of RT 611 in King and Queen Co. for 8-MPN004.39

**R** - Department of Game and Inland Fisheries ramp on the end of RT 611 in King and Queen Co. for 8-MPN004.39

**L** - Private ramp off route 629, in Walkerton for 8-MPN029.08

**R** - Private ramp off route 629, in Walkerton for 8-MPN029.08

#### **TRO:**

**L** - Public ramp under Coleman Bridge in Gloucester

**R** - Game Commission ramp on the Mattaponi River in West Point

### **B. Rappahannock River**

**NRO:**

**L** - Little Falls off Route 3 in Stafford County.

**R** - Little Falls off Route 3 in Stafford County.

**PRO:**

**L\*\*** - Garratts Marina, Center Cross, Essex Co. for running upstream.

**or**

**R\*\*** - Leedstown Campground ramp, Westmoreland Co. for running downstream.

\* \*The direction of the Rappahannock run for Piedmont is dependent upon wind direction and speed. The run is usually made from Garratts Marina to the Leedstown Campground ramp but may be run from the Leedstown ramp to Garratts Marina if the wind is from the northwest and greater than 15 kn.

**TRO:**

**L** - Locklies Marina off Rt. 3 near Topping, VA.

**R** - Locklies Marina off Rt. 3 near Topping, VA

**C. James River**

**PRO:**

**L** - Private ramp, formerly Helen's Hideaway, off Rt. 623, Charles City Co.

**R** - Osbourne Department of Game and Fishery ramp in Henrico Co.

**TRO:**

**L** - Willoughby Bay Marina

**R** - Jamestown Marina, Powhatan Creek

**D. Elizabeth River**

**TRO:**

**L** - Jordan Bridge

**R** - Jordan Bridge

**1.4 STATION SAMPLING ORDER**

**Note: Sampling is to begin at the mouth of the tributary and proceed sequentially upstream.**

The order of priorities for sampling regime should be as follows:

1) Whole river same day,

Whole river sampled upstream low slack water sequence.

2) Whole river same day,

Whole river sampled upstream sequentially.

3) Whole river same day,

Each region sampling upstream sequentially.

4) Whole river same day,

Most regions (or stations) sampling upstream sequentially.

5) Whole river over several days,

Each day sampling upstream sequentially.

In general, it is understood that the regions sample in the following manner (recognizing the aforementioned sampling priorities):

On the James River # 2 is observed. Both TRO and PRO are able to sample in time sequencing fashion, sampling from downstream to upstream order.

On the York River # 4 is observed. Since the PMK and MPN station sampling involves 3 trailer launches, PRO also has always sampled them in downstream order to finish the runs before dark.

On the Rappahannock River # 4 is observed. Safety considerations prevent NRO from sampling their segment of the Rappahannock River sequentially to PRO but NRO does sample their segment of the Rappahannock sequentially upstream. Additionally PRO sometimes runs their portion of the Rappahannock sequentially downstream if the wind is greater than 15 kn out of the northwest.

### 1.5 STATION LOCATIONS (NAD83)

**Note: Station latitudes and longitudes listed in this table are those utilized by the regions for sample collections. Some may differ from the legacy Storet database latitudes and longitudes.**

#### A. PRO

River Basin	Station Name		Latitude (deg.,min.,sec.) NAD83	Longitude (deg.,min.,sec.) NAD83	Latitude (decimal deg.)	Longitude (decimal deg.)
	River Mile	CBP Format				
Rappahannock River	3-RPP031.57	RET3.2	37° 48' 41.7"	-76° 42' 43.0"	37.81158	-76.71195
	3-RPP042.12	RET3.1	37° 55' 02.3"	-76° 49' 19.9"	37.91730	-76.82220
	3-RPP051.01	TF3.3	38°01' 06.5"	-76° 54' 33.4"	38.01847	-76.90928
	3-RPP064.40	TF3.2A	38°06' 06.6"	-77° 03' 17.4"	38.11295	-77.05482
James River	2-CHK006.14 (Chickahominy River)	RET5.1A	37° 18' 44.3"	-76° 52' 36.2"	37.31230	-76.87672
	2-JMS055.94	TF5.6	37° 16' 21.8"	-76° 59' 26.1"	37.27272	-76.99057
	2-JMS069.08	TF5.5A	37° 18' 05.9"	-77° 07' 42.2"	37.30165	-77.12840
	2-JMS075.04	TF5.5	37° 18' 45.5"	-77° 13' 58.1"	37.31265	-77.23283
	2-APP001.53 (Appomattox River)	TF5.4	37° 18' 44.64"	-77° 17' 28.78"	37.31240	-77.29133
	2-JMS099.30	TF5.3	37° 24' 11.2"	-77° 23' 33.8"	37.40310	-77.39272
	2-JMS104.16	TF5.2A	37° 27' 00.0"	-77° 25' 07.8"	37.45000	-77.41883
	2-JMS110.30	TF5.2	37° 31' 49.8"	-77° 26' 02.4"	37.53050	-77.43400
York River	8-MPN004.39 (Mattaponi River)	RET4.2	37° 34' 16.5"	-76° 47' 49.7"	37.57125	-76.79715
	8-MPN029.08	TF4.4	37°43'22.1"	-77°01'32.38"	37.7228	-77.02566
	8-PMK034.17 (Pamunkey River)	TF4.2	37° 34' 48.0"	-77° 01' 16.6"	37.57999	-77.02128

#### B. NRO

River Basin	Station Name	Latitude	Longitude	Latitude	Longitude
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	River Mile	CBP Format	(deg.,min.,sec.)	(deg.,min.,sec.)	(decimal deg.)	(decimal deg.)
Rappahannock	3-RPP080.19	TF3.2	38° 10' 31.9"	-77° 11' 16.3"	38.17553	-77.18786
	3-RPP091.55	TF3.1B	38° 14' 46.5"	-77° 13' 59.9"	38.24625	-77.23331
	3-RPP098.81	TF3.1E	38° 14' 40.6"	-77° 19' 30.3"	38.24461	-77.32508

**C. TRO**

River Basin	Station Name		Latitude (deg.,min.,sec.)	Longitude (deg.,min.,sec.)	Latitude (decimal deg.)	Longitude (decimal deg.)
	River Mile	CBP Format				
Rappahannock River	3-RPP010.60	LE3.4	37° 37' 54.8"	-76° 26' 41.5"	37.63189	-76.44486
	3-CRR003.38 (Corrotoman River)	LE3.3	37° 41' 18.3"	-76° 28' 27.9"	37.68842	-76.47442
	3-RPP017.72	LE3.2	37° 40' 08.9"	-76° 33' 01.7"	37.66914	-76.55047
	3-RPP025.52	LE3.1	37° 45' 33.3"	-76° 36' 57.3"	37.75925	-76.61592
James River	2-ELI002.00 (Elizabeth River)	LE5.6	36° 54' 16.4"	-76° 20' 18.1"	36.90456	-76.33836
	2-JMS005.72	LE5.4	36° 57' 17.5"	-76° 23' 33.9"	36.95486	-76.39275
	2-JMS013.10	LE5.3	36° 59' 25.6"	-76° 28' 31.6"	36.99044	-76.47544
	2-JMS021.04	LE5.2	37° 03' 21.6"	-76° 35' 35.0"	37.05600	-76.59306
	2-JMS032.59	LE5.1	37° 12' 10.7"	-76° 38' 54.0"	37.20297	-76.64833
	2-JMS042.92	RET5.2	37° 12' 10.6"	-76° 46' 55.9"	37.20294	-76.78219
York River	8-YRK001.64	LE4.3	37° 14' 02.1"	-76° 25' 51.4"	37.23392	-76.43094
	8-YRK011.14	LE4.2	37° 17' 25.6"	-76° 34' 41.2"	37.29044	-76.57811
	8-YRK022.70	LE4.1	37° 25' 07.8"	-76° 41' 28.5"	37.41883	-76.69125
	8-YRK031.39	RET4.3	37° 30' 31.3"	-76° 47' 20.0"	37.50869	-76.78889
	8-PMK006.36 (Pamunkey River)	RET4.1	37° 31' 32.3"	-76° 52' 03.4"	37.52564	-76.86761
Elizabeth River	2-EBE002.98	EBB01	36°50'9.996"	-76°14'40"	36.83611	-76.24444
	2-ELI004.79	ELD01	36°51'56"	-76°19'44"	36.86556	-76.32899
	2-ELI006.92	ELE01	36°50'53.98"	-76°17'53"	36.84833	-76.29806
	2-LAF003.83	LFB01	36°53'21.7"	-76°16'53.2"	36.8894	-76.2814
	2-LAF001.15	LFA01	36°54'29.6"	-76°18'52.7"	36.9082	-76.3146
	2-WBE004.44	WBB05	36°49'45"	-76°23'45"	36.82917	-76.39583

## 1.6 PLANKTON PRODUCTIVITY SAMPLE PICKUP/DROP OFF PROCEDURES

### **Sample Delivery**

Samples collected by PRO are to be picked up by at O.D.U. on day of collection. TRO will delivers the samples to room 114, Mills Godwin Life Science Bldg on the day of collection. Access to the plankton lab is by the rear entrance (by loading dock), adjacent to parking lot, access from Elkhorn St. (Hampton Blvd., to 43<sup>rd</sup> St., to Elkhorn). All delivery times need to be confirmed with ODU Phytoplankton Lab personnel on that day. The Lab phone is 757-683-4994. In emergencies, and inability to deliver cooler on time, contact Phytoplankton Lab, if no answer contact Todd Egerton (757-627-3430), or Harold Marshall (757-481-0755).

PRO cell phones: (804) 840-9578  
(804) 840-9527

TRO coordinates their sample drop off directly with ODU.

PRO coordinates their sample drop off with CO personnel who coordinate sample drop off with ODU

Directions for PRO sample pickup/delivery are as follows:

### **Rappahannock River**

**ODU meets PRO at Leedstown Campground at 1:00 pm and returns with samples to ODU (approximate drop-off time 5:00-5:30 pm)**

Leedstown Campground is located on State Route 637 (Westmoreland County Map)

Total Driving time: approximately 3 hrs.

### **York River:**

**ODU meets PRO at the Pamunkey Indian Reservation at 11:30 am**

Directions (King William County Map):

The Indian Reservation camp is located at the end of State Route 1400.

Alternate pick up site is the public boat ramp at the end of State Route 672

Total Driving time: 2 hr. 15 min.

### **James River**

**ODU meets PRO at Hopewell City Ramp off Route 10 at 2:00 pm**

The Marina is straight across from the end of Riverside Loop Dr.

Driving time: 2 hrs 15 min.

## 2.0 PRE-CRUISE PREPARATIONS

In preparation for a sampling run where field measurements are to be taken, be sure that operating manual instructions have been followed concerning preventive maintenance and calibration for all equipment to be used. Where possible, backup instruments and/or sample collecting strategies should also be prepared and taken in the field (see Section 2.7)

### 2.1 PNC FILTER MUFFLING

**Note: To prevent re-contamination of the “muffled” filters do not carry them over from month to month. Muffle fresh 25-mm filters for the first cruise of each month and throw out any unused filters after the last cruise of the month.**

- 1) Pre-determine the number of 25 mm diameter, 0.7 um pore sized, Gelman type A/E glass fiber filters needed for the particular field event and place them on aluminum foil tray or in a porcelain crucible. One filter is required for each sample to be obtained and one to two additional dry muffled filters are required by DCLS for the determination of background carbon content.
- 2) Place the aluminum foil tray or crucible containing the filters in the muffle furnace, close and latch the door.
- 3) Set the temperature on the furnace to 500 Celsius degrees.
- 4) Bake the filters for 15 minutes.
- 5) After 15 minutes, remove the filters from the furnace and allow them to cool in a desiccator for several hours.
- 6) Place the filters in a plastic snap - lid box with dessicant.

**Replace dessicant as needed (usually when the blue color of the gel lightens).**

Important points regarding filters:

- ◆ Muffling time and oven temperature are critical - do not over-bake or under-bake the filters.
- ◆ It is advisable to muffle extra filters to allow the filtration of additional sample in the case of accidental loss.

### 2.2 HYDROLAB CALIBRATION

**NOTE: Be sure all components that will be used during field-testing are calibrated together. The sonde, cable and display unit must remain as a “unit”. If any components are changed after calibration, the system must be integrated by recalibrating before using.**

**Hydrolabs need to be calibrated on the morning of each run and checked for drift upon completion of each run.**

Also, hydrolabs may vary within a region and between regions and as such the assembly of the

**units may be somewhat different to those listed below. Follow the manufacturer's instructions for assembly if different from those listed below. However, follow the calibration procedure listed below as closely as possible.**

### **2.2.1 "Unit" Assembly**

#### 1. System Components

The four basic components of the Hydrolab water quality multiprobe are the probe, the display unit, the sample circulator and the auxiliary battery pack. The field data logger is an optional accessory.

- a. The multiprobe, in its sealed high pressure housing, contains all of the sensors for temperature, dissolved oxygen, conductivity, pH, depth, and all the electronic circuits that are required for their operation.
- b. The display unit operates at the opposite end of the data cable from the multiprobe. Depending upon the setting of its function key, the display unit sends signals down the cable directing the multiprobe to make a measurement of the selected parameter.
- c. The sample circulator is an electrically powered magnetic stirrer similar to laboratory magnetic stirrers. It is encased in a weighted, high-pressure housing, which permits underwater operation.
- d. The auxiliary battery pack boosts the voltage of the existing batteries (up to 12 volts) such that the entire system can perform.

#### 2. Assembly

##### a. Visually check equipment.

Ensure that the electrical connectors of the Display Unit, Cable and Sonde are free from grit, mud and moisture.

##### b. Connect cable to Sonde.

Connect Sonde (multi probe) to the data cable (50-m line) using the 6-pin black rubber plug on the line. The raised dot on the surface of the plug corresponds to the largest of the six pins on the Sonde. Align these for proper connection and make sure the connection is tight.

##### c. Connect cable to display unit.

Connect opposite end of data cable to the display unit where labeled "Multi probe/charger". Align corresponding teeth and grooves on the connectors. Once mated, twist outer lock ring until the plug "clicks" into place.

### **2.2.2 Operation Checks**

#### 1. Turn on display unit to ensure the unit is working properly.

Press the On/Off key on the display unit. After a few seconds, readings should appear on the LC display. If another message appears, "I or E" for example, refer to the troubleshooting portion of manufacturer's Operating Manual.

#### 2. Check battery level.

With the display unit on, press "Screen" to check battery level. If below 11 volts, replace the batteries or connect an auxiliary battery pack before calibrating the instrument.

#### 3. Check magnetic impeller rotation.

Ensure that the magnetically coupled impeller on stirrer base is properly lubricated and rotating freely on its shaft. Any obstruction to smooth rotation of the impeller may cause erratic D.O. measurements and excessive power drains to the battery.

4. Turn the display unit switch to OFF.

### 2.2.3 Preparation of Standards

**Note: Before preparing the standards, the desired conductivity range should be determined based on the expected range of ambient values. Dilute prepared 1 Molar KCl stock solution to desired molarity using appropriate volumetric glassware.**

#### A. Preparation of 1 Molar KCl Stock Solution

1. Carefully weigh out 74.557 grams of reagent grade KCl salt on the balance.
2. Transfer the salt to a 1000-ml volumetric flask and fill to the mark with DI water.
3. Gently agitate solution until the KCl is completely dissolved.
4. Label a 1000-ml rectangular storage bottle while waiting for the salt to dissolve. Write “1 M KCl Stock Solution”, your initials and the date prepared.
5. Transfer the prepared solution to storage container.

#### B. Preparation of Working Standards

1. *0.1 Molar KCl Standard Solution*
  - a. Measure out 100 ml of 1 Molar stock solution using a class A 100-ml volumetric flask.
  - b. Transfer to a 1000-ml volumetric flask.  
Rinse the 100-ml flask twice with DI water, pouring rinse into a 1000-ml flask.
  - c. Fill the 1000-ml flask to the mark with DI water.
  - d. Gently agitate the solution and transfer to a 1000-ml rectangular storage bottle
  - e. Label container with “0.1M KCl”, your initials, and the date prepared.
2. *0.05 Molar KCl Standard Solution*
  - a. Measure out 50 ml of 1 Molar stock solution using a class A 50 ml volumetric flask.
  - b. Transfer to a 1000-ml volumetric flask.  
Rinse the 50-ml flask twice with DI water, pouring rinse into a 1000-ml flask.
  - c. Fill the 1000-ml flask to the mark with DI water.
  - d. Gently agitate the solution and transfer to a 1000-ml rectangular storage bottle.
  - e. Label container with “0.05M KCl”, your initials, and the date prepared.
3. *0.01 Molar KCl Standard Solution*
  - a. Measure out 10 ml of 1 Molar stock solution using a class A 10-ml volumetric pipette.
  - b. Transfer to a 1000-ml volumetric flask.  
Rinse the 10-ml pipette twice with DI water, pouring rinse into a 1000-ml flask.
  - c. Fill the 1000-ml flask to the mark with DI water.
  - d. Gently agitate the solution and transfer to a 1000-ml rectangular storage bottle.
  - e. Label container with “0.01M KCl”, your initials, and the date prepared.

### 2.2.4 Calibration of Parameters

Note: DO NOT turn off the display unit at any time during the calibration procedure. The newly calibrated data will not be saved if the unit is turned off.

**Note: Follow the parameter calibration order as given below. The calibration order for the following sections follow the manufacturer recommendations and therefore differ between instruments accordingly.**

Note: Each region maintains a calibration log book in which all data pertaining to each calibration, post cruise calibration checks or maintenance procedures are entered. After the calibration of each parameter record the calibrated parameter value in the calibration logbook and be sure to store the data utilizing the display unit.

### **A. Hydrolab H20 and DS3 Dissolved Oxygen**

**Note: This is the most difficult and the most critical calibration to be performed.** Because other parameters are calculated based on the DO value, the DO calibration must be performed first.

1. Replace the multiprobe storage cup with the bottomless calibration cup.  
Take special care not to bump the probes with your hand or cup as this may result in damage to the probes.
2. Visually inspect the membrane on probe tip.  
Check the membrane for wrinkles, bubbles, tears, dirt or other damage. If present, service the probe in accordance with manufacturer's operation manual. It is, however, good practice to replace the membrane on a regular schedule, before trouble becomes visible. Also, frequent electrolyte changes will maximize the life of the sensor.
3. Fill calibration cup with DI water.  
Use only DI water that has been allowed to equilibrate to room temperature in a container. DO NOT USE DI WATER FROM THE TAP. This will greatly enhance the equilibration time for calibrations and post cruise calibration checks.  
With the multiprobe oriented so that the sensors are pointed toward the ceiling, fill the calibration cup with DI water until the water is just level with the o-ring used to secure the membrane. Lock the probe tightly into the calibration stand, making sure the probe unit top plug is not pressed into stand base.
4. Remove droplets of water from the membrane and cover calibration cup.  
Using the corner of a tissue, carefully remove any water droplets from the membrane (DO NOT apply pressure to surface) and cover the open top of the calibration cup to prevent air currents from affecting calibration.
5. Using a barometer, record the laboratory barometric pressure (in mm Hg) in the logbook.
6. Turn on unit with the "ON/OFF" button and wait for stabilization.  
Wait for 5 minutes to allow air in the cup to become water saturated. The sensor is ready for calibration once the readings have stabilized.
7. Record the temperature from the Sonde in the logbook.
8. Write the initial DO value shown on the display unit in the logbook.
9. Determine the Theoretical DO value.

Determine the oxygen solubility in the air according to temperature and pressure from the table in the Operator's manual (or use the Theoretical DO table in Appendix B) and record it in the logbook in the "Chart" column.

10. Calibrate the Sonde for DO.

Press "calibrate", right arrow over to "%" and press "enter". Use Up, down, right, and left arrows to key in the barometric pressure in mm Hg. Press "enter" and use left arrow key to choose "Y" (yes) to save calibration. The unit will send a DO value (mg/l) to display record this value in the logbook. **Note: to convert inches of Hg to mm Hg multiply the number of inches by 25.4.**

11. Check percent saturation.

Press "screen" and note that % Sat equals 100.0 for correct DO calibration.

12. Compare the value of the chart DO determined in step 8 from the Theoretical DO table (Appendix B) to the Sonde value of DO. They must compare within 0.5 mg/l.

13. Look at the previous post cruise calibration for the instrument. If the post cruise calibration was out of range by 0.5 mg/l and the maintenance was performed on the instrument then the DO saturation check must be conducted in the field that day to ensure the instrument problem was corrected and to confirm the instrument is performing properly (see step 6 in section 3.2.2 for vertical profile)

### Specific Conductance

**Note:** Readings are most accurate when they lie within the calibrated range. Determine the range of values expected in the field prior to calibration.

1. Rinse the sensors.

Without removing the calibration cup, invert the probe and drain the DI water completely.

Rinse the sensors twice with a small portion of the specific conductance standard chosen for calibration, discarding the rinse each time.

2. Fill the calibration cup with fresh standard.

With the multiprobe pointing toward the ceiling, fill the calibration cup with fresh standard solution to about one centimeter below the top. The standard solution should cover the entire sensor. Be sure no bubbles are trapped in the bores of the cellblock.

3. Allow specific conductance to stabilize.

The sensor is now ready for calibration.

4. 15. Record the specific conductance value currently displayed into the logbook.

5. Calibrate the Sonde to the specific conductance of the standard solution.

Press "calibrate", use left arrow key to choose "C" and press "enter". Use the up, down, left and right arrows to enter the value of the specific conductance standard. Press "enter". Use the left arrow key to choose "Y" (yes) to save calibration. The unit will send the standard value to display. Record the displayed value in the logbook.

6. Transfer the standard solution to a storage bottle.

Transfer the standard solution from the calibration cup to a storage bottle for use as a rinsing solution (for step 1) for the next specific conductance calibration or post cruise calibration check. Discard after use as a rinsing solution.

Note: The following table shows several potassium chloride solutions and their specific

conductance values.

KCl Molar Concentration	Specific Conductance (ms/cm)
0.5 M	58.640
0.1 M	12.900
0.05 M	6.668
0.01 M	1.413
0.005 M	0.718
0.001 M	0.147

## pH

Note: Calibrate the instrument with pH buffer that brackets the range of values anticipated in the field.

1. Rinse the cup and sensors with DI water.

Flush the calibration cup and sensors thoroughly 3 times with DI water.

2. Rinse sensors with zero (pH 7.00) buffer solution.

Rinse the sensors with fresh pH 7.00 buffer solution (or buffer solution saved from a previous pH calibration) to saturate sensors. Discard the buffer after each rinse.

3. Fill cup with sufficient **Fresh** pH 7.00 buffer to cover the sensor.

4. Allow two minutes for thermal equilibrium.

5. Write down the initial reading in the logbook.

6. Calibrate the sensor to the zero buffer solution.

Press “calibrate”, “enter” and “P”. Use up, down, left and right arrows to enter the pH of the zero standard (7.00) and press “enter”. Use left arrow to choose “Y” (yes) to save the calibration. The unit will send a zero pH value to the display. Record the displayed value in the logbook.

7. Transfer the remaining buffer to a storage bottle.

Transfer the buffer from calibration cup to storage bottle for use as a rinse (Step 2) in future pH calibrations. Discard the buffer after using it as a rinse.

8. Rinse the cup and sensors with DI water.

Thoroughly flush the calibration cup and sensors with DI water twice.

9. Rinse the cup and sensors with slope buffer (pH 10.00 or pH 4.00) solution.

10. Fill the calibration cup with **Fresh** buffer and wait for equilibrium.

Fill the calibration cup with enough slope buffer to cover the sensor and wait for thermal equilibrium.

11. Write down the initial reading in the logbook.
12. Calibrate the Sonde for the slope buffer.  
Press “calibrate”, “enter”, and “P”. Use the up, down, left and right arrows to enter the pH of the slope standard. Use left arrow to choose “Y” (yes) to save calibration. The unit will send a slope pH value to display.  
Record the displayed value in the logbook.
13. Pour buffer into a storage bottle for later use in the rinsing step of a pH slope calibration or post cruise calibration check
14. Flush calibration cup and sensors thoroughly three times with DI water.
15. Turn the instrument off.
16. Replace the storage cup.  
Place a sufficient amount of tap water in the storage cup to keep the DO membrane moist. Do not allow the water to come in contact with the sensors as an ionic gradient may develop resulting in dilution of the electrolyte solutions.

### **Depth**

Note: The depth needs to be calibrated in the field just prior to sampling the first station. See Chapter 3 for details.

### **Temperature**

Central office personnel will conduct temperature checks for multiprobes against an NIST certified thermistor annually when conducting site visits.

Regions should check the temperature probe against another multiprobe instrument's temperature probe semi-annually. If a discrepancy should occur (temperatures are not  $\pm 1$  °C) contact Central office so that the probes can be checked against an NIST certified thermistor as soon as possible. If there is good agreement between the instruments, then Central office personnel will check the instruments against an NIST certified thermistor as planned.

1. The temperature check should be conducted in an ice/water mixture (e.g. 4 °C) and at a warm water temperature that will best approximate the highest ambient temperature expected to be sampled (e.g. 25-30 °C). The probe(s) and/or NIST certified thermistor are lowered into the mixtures simultaneously and read.
2. Send the hydrolab unit back to the manufacturer for temperature calibration if the thermistor and Hydrolab values differ more than 0.5 °C.

### **B. Hydrolab Data Sonde 4, Datasonde 4a, and MiniSonde**

#### **Conductivity**

**Conductivity requires a two-point calibration.** Calibrate your sensor to “0” first, then to the value of the slope standard.

1. Rinse the sensors with DI water vigorously for 6 seconds.

- Discard the rinse water, and repeat.
2. Dry the conductivity probe opening with Q tip or soft cloth.
  3. Calibrate the sensor to zero.  
Select "setup/cal" then "calibrate" then "Sonde" then "SpCond:us/cm" then "Select".  
Select the number "0" using the arrow key and select "done". Press any key and select "go back". SpCond will read 0.0
  4. Rinse with the conductivity standard you are using for the slope calibration.  
Discard the rinse solution.
  5. Completely fill the calibration cup with this standard.  
The DO sensor must be covered. Allow the unit to equilibrate until the conductivity reading is stable.
  6. Record the initial value in the logbook.  
Calibrate the sensor to with the slope standard.  
Select "Sonde" then "SpCond: us/cm". Using the arrow key, enter in the value of the standard in use and press "done". Press any key and select "go back". SpCond for the 12.89 standard must be within 0.5 umhos/cm of the value of the standard and for the 58.6 within 1.00 umhos/cm of the standard.

## pH

9. Rinse the sensors with DI water vigorously for 6 seconds.  
Discard the rinse water, and repeat.
10. Rinse the sensors using the "zero" buffer.  
Rinse the sensors with a buffer solution between 6.8 and 7.2. Discard the rinse.
11. Fill the cal cup with **Fresh** buffer.  
Use enough zero buffer to ensure the pH sensor is covered. Allow readings to stabilize.
12. Record the initial reading in the logbook.
13. Calibrate the sensor to the zero buffer.  
Select "setup/cal", "calibrate", "sonde" then use the down arrow key to find "pH:units" and "select". Using the arrow key, enter the value of the standard being used and select "done".  
Press any key and select "go back". Allow the pH reading to stabilize.
14. Record the calibration pH value in the logsheet.  
The pH reading must be within 0.3 SU of the standard.
15. Rinse the sensor with DI water and discard.
16. Rinse the sensor the "slope" buffer.  
Rinse the sensor with the 4 or 10 buffer solution. Discard the rinse solution.
17. Fill the cal cup with **Fresh** slope buffer.  
Fill the calibration cup with sufficient slope buffer solution to completely cover the pH sensor and allow the readings to stabilize.
18. Record the value in the logbook.
19. Calibrate the sonde to the slope buffer.  
Select "setup/cal", "sonde" and then use the down arrow key to find "pH:units" and "select".  
Using the arrow key, enter the value of the standard being used and select "done". Press any key and select "go back". The pH reading must be within 0.3 SU of the standard and stable.
20. Record the calibration pH value in the logsheet.

## Dissolved Oxygen

1. If the circulator is on, turn it off.  
Select "setup/cal", "setup" and "sonde". Using the arrow key to chose "circulator:Off/On", press "select". Select the number 0 using the arrow key, press "select" then "done".
2. Fill the cal cup with DI water.  
Fill the calibration cup to just below the O-ring of the DO probe.
3. Remove any water droplets from the DO membrane.  
Using a Kimwipe or other soft towel, carefully remove any water droplets from the DO membrane. Do not apply pressure to the membrane.
4. Allow instrument to stabilize.  
Cover the cal cup loosely with the plastic storage lid, and allow unit to equilibrate until temperature reading is stable. Record the temperature from the Sonde in the logbook.
5. Record the DO value from the display unit in the logbook.
6. Record the Barometric Pressure from the Sonde in the logbook.
7. Determine the Theoretical DO value.  
Determine the oxygen solubility in the air according to temperature and pressure from the table in the Operator's manual and record it in the logbook in the "Chart" column.
8. Check DO% Saturation.  
Select "Sonde" then "DO%: Sat". Enter the value of the current barometric pressure in mmHG. Press any key and select "go back". The DO% reading should be close to 100%.
9. Compare the value of the chart DO determined in step 8 from the Theoretical DO table (Appendix B) to the Sonde value of DO. They must compare within 0.5 mg/L.
10. Turn the power off.
11. Replace the storage cup.  
Place a sufficient amount of tap water in the storage cup to keep the DO membrane moist. Do not allow the water to come in contact with the sensors as an ionic gradient may develop resulting in dilution of the electrolyte solutions.
12. Look at the previous post cruise calibration for the instrument. If the post cruise calibration was out of range by 0.5 mg/l and the maintenance was performed on the instrument then the DO saturation check must be conducted in the field that day to ensure the instrument problem was corrected and to confirm the instrument is performing properly (see step 6 in section 3.2.2 for vertical profile)

## **Depth**

Note: The depth needs to be calibrated in the field just prior to sampling the first station. See Chapter 3 for details.

## **Temperature**

Central office personnel will conduct temperature checks for multiprobes against an NIST certified thermistor annually when conducting site visits.

Regions should check the temperature probe against another multiprobe instrument's temperature probe semi-annually. If a discrepancy should occur (temperatures are not +/-1 °C) contact Central office so that the probes can be checked against an NIST certified thermistor as soon as possible. If there is good agreement between the instruments, then Central office

personnel will check the instruments against an NIST certified thermistor as planned.

1. The temperature check should be conducted in an ice/water mixture (e.g. 4 °C) and at a warm water temperature that will best approximate the highest ambient temperature expected to be sampled (e.g. 25-30 °C). The probe(s) and/or NIST certified thermistor are lowered into the mixtures simultaneously and read.

2. Send the Hydrolab unit back to the manufacturer for temperature calibration if the thermistor and Hydrolab values differ more than 0.5 °C.

### **Barometric Pressure**

To check if the Minisonde or Datasonde Barometric Pressure should be calibrated compare the instrument value to the barometric pressure in mmHg read from a barometer.

If a barometer is not available it can be estimated using the following formula:  $BP = 760 - 2.5(A_{\#}/100)$  where 'A<sub>#</sub>' is the local altitude above sea level in feet.

If the BP value in the Surveyor differs  $\pm 10\%$  from either the barometer value or the estimated value, the sensor needs to be calibrated.

For calibration, a corrected barometric pressure should be obtained from a barometer (mm Hg) or from the local weather bureau (inches Hg). (convert the inches of Hg to mm Hg by multiplying it by 25.4). Plug the corrected barometric pressure from the barometer or local weather bureau in mm Hg into the following formula to obtain the uncorrected BP that will be used in the calibration:  
$$\text{uncorrected BP} = \text{corrected BP} - 2.5(A_{\#}/100)$$

#### **CALIBRATION:**

- 1) Disconnect the surveyor from the datasonde/minisonde.
- 2) Turn on the surveyor.
- 3) Select "setup/cal"
- 4) Select "calibration"
- 5) Select "BP Svr4: User cal" and press select
- 6) Using the arrow key, to enter the uncorrected BP in mmHg calculated above and press done

#### **PREPARATION FOR USE**

- 1) If the short calibration cable is used for calibration, switch the calibration cable to a longer cable.
- 2) Remove the storage cup from the sonde, screw on the sensor guard

### **2.3 CLEANING FILTRATION EQUIPMENT:**

**Note: Do not use detergent to clean any of the filter equipment or sample bottles utilized for filtrate as detergents can contain contaminants.**

1. Take down all towers, graduated cylinders and tweezers and put in the lab for cleaning.

2. Observe all safety precautions.  
All safety measures, necessary with the use of acid MUST be enforced. This includes the use of skin protection, such as rubber gloves, full-face shield, apron and footwear, as well as rinsing in an adequately ventilated area.
3. Clean one piece at a time.
4. Rinse and strip all towers and graduated cylinders.  
Rinse all towers with DI water, strip them with 25 ml of 10% HCl and rinse 3 times again with DI water. Rinse and strip the graduated cylinders in the same manner as the towers using approximately 10% of the total volume of the graduated cylinder of 10% HCl. A brush may be needed to remove any remaining sediment.
5. Rinse all utensils with DI water 3 times (e.g. forceps).
6. Water will be trapped in the filtering apparatus. Use the flexible tube from the water collection tank to suck up water from inside the towers.
7. Store the clean filtration equipment in a manner that prevents contamination (e.g. covered in aluminum foil or plastic)

#### 2.4 CLEANING THE LICOR SENSORS:

The Licor sensors must be kept clean from scum and hard water deposits. Prior to each cruise clean the LICOR sensors with a soft cloth or sponge, water and mild diluted detergent (such as Liquinox®). **Be sure not to scratch the surface of the sensor.** Vinegar can be used to remove hard water deposits from the diffusor element.

#### 2.5 FILTERS AND DI WATER:

1. 47 mm diameter, 0.7 um pore size glass Whatman GF/F filters (per station, 1 + will be needed per PP sample and 1-3 per chlorophyll sample depending on water turbidity).
2. 25 mm diameter, 1.0 um pore size Gelman type A/E glass fiber filters (pre-muffled) for PNC (one per sample). **Reminder:** PNC filters are to be prepared fresh at the beginning of each month.
3. Fill two 5-gallon Carboy bottles with fresh DI water for equipment blanks.
4. Fill at least 1 gallon with additional DI water for rinsing filtration equipment between samples.
5. Keep a spare container of DI water in the vehicle.

#### 2.6 SAMPLE BOTTLE PREPARATION:

**All 250 ml and 2 liter brown bottles (new and reused) need to be acid washed with 10% HCL and triple rinsed with DI water prior to their use in the field.**

1. Bottles needed per station:
  - 2 - acid washed and rinsed 250 ml NTNP bottles
  - 1 - 1 gallon cubitainer sample containers for surface solids analysis
  - 1 - 1 quart cubitainer sample container for bottom solids analysis
  - 2 - acid washed and rinsed 2 liter HDPE brown bottles
2. 1 - 2 complete extra sets of bottles in case of contamination or mishap.
3. Bottles needed for QAQC procedures:
  - a. *Equipment blanks:*
    - 1 - acid washed and rinsed 250 ml NTNP bottle

- 1 - gallon cubitainer for solid analyses
- 1 - 1 qt. sample container for solid analyses
- 1- acid washed and rinsed 2 L brown HDPE bottle for filters and filtrate analyses
- b. *Duplicate samples:*
  - 1 - acid washed and rinsed 250 ml NTNP bottle
  - 1 - 1 gallon cubitainer for solid analyses
  - 1 - 1 qt cubitainer for solid analyses
  - 1 - acid washed and rinsed 2 L brown HDPE bottle for all filter and filtrate analyses
- 4. Rinse, strip with 10% HCl and rinse 3 times with DI water all 250 ml NTNP bottles and all reusable large containers to be utilized in the collection of samples (e.g. ½ gallon containers and 2-liter HDPE bottles) and their caps. Replace the caps to seal bottles until their use.

## 2.7 PETRI DISHES, SHEETS AND TAGS:

### 1. Per station:

- 1 WQM Field sheet
- 9 sample tags
- 4 Petri dishes (Aluminum foil may be substituted for petri dishes.)
- 1 square Aluminum foil

### 2. QAQC:

#### *Equipment blanks*

- 2 Petri dishes (Aluminum foil may be substituted for petri dishes.)
- 5 sample tags
- 1 square Aluminum foil

#### *Duplicate samples*

- 4 Petri dishes (Aluminum foil may be substituted for petri dishes.)
- 5 sample tags
- 1 square Aluminum foil

- 3. For each sample to be collected fill out a sample tag with station, date, depth, unit code, collector's initials, group code and container #.
- 4. For each station where petri dishes are utilized label 2 Petri dishes with green tape and a sample tag and 2 Petri dishes with blue tape and a sample tag. If aluminum foil is utilized be sure each sample is clearly marked and the labels are placed on the foil such that the group code is clearly visible to central receiving personnel at DCLS.
- 5. Take 10 extra Petri dishes or aluminum foil squares, sheets and tags in case of contamination or mishap.

## 2.8 COOLERS AND TEMPERATURE TESTING BOTTLES

Be sure to take enough ice in coolers to cool samples to 4° Celcius and maintain them at that temperature. If necessary, place additional ice on the samples upon returning to the regional office. Sample temperatures must be 4° Celcius when processed by DCLS Central receiving personnel. A bottle of colored water as supplied by DCLS for temperature testing must be placed in each cooler prior to sample collection. Samples in coolers not containing the colored water bottles will be rejected. Samples will also be rejected if the colored water is found not to be at 4° Celcius upon arrival to DCLS.

## 2.9 BACKUP SAMPLING EQUIPMENT

Whenever feasible, backup equipment should be taken in the field for use in the event of problems with sampling gear, such as a Hydrolab or water pump failure. The following is a list of suggested equipment that should be available if problems occur:

- Backup Hydrolab unit (if available)
- Backup water pump system (if available)
- An alpha water sampling bottle with spare messenger.
- Thermometer.
- A Winkler sampling kit when a backup hydrolab unit is unavailable.
- Backup filtration unit
- Spare deep cycle batteries to run filtration unit.

Prior to the scheduled day of sampling, each region must also make sure that there are adequate supplies of coolers, ice, cubitainers, chlorophyll bottles, sample data sheets, sample tags, and indelible pens.

## 3.0 FIELD PROCEDURES

### 3.1 FIELD DOCUMENTATION

#### 3.1.1 Field Summary Sheet

1. One Field Summary Sheet will be filled out per sampling run.
2. The following information will be entered on the Field Summary Sheet.
  - Date
  - Stations sampled
  - Time vessel reached station
  - Comments, Problems or unusual events encountered on station
  - Hydrolab post cruise calibration check information (performed after sampling)

#### 3.1.2 WQM Field Data Sheet (EDT Data Sheets)

1. Each station will require one WQM data sheet.
2. All field measurements and water sample information are entered onto this sheet.
3. Field personnel must fill in the following items with indelible ink:

##### a. General Information:

**Be sure this matches sample tag!** (See Appendix A for sample WQM data sheet)

- Date (yymmdd)
- Time (24-hr military format)
- Station description - (Station name in river mile format. See pages 4-5).
- Group Code
- Container Number
- Sample depth (m)
- Volume filtered (for filtered parameters)

##### b. Field Parameters:

- Weather code: 1 = cloudy, 2 = precipitation, 3 = clear, 4 = fog
- Tide code: 1 = high, 2 = low, 3 = flood, 4 = ebb
- Secchi depth: in 0.1 increments. Do not list as > 3.0 or 3.0 +. Attach additional marked line if the visibility is greater than the length of line attached to your Secchi disk.
- Bottom depth (meters): In the upper right side of the Field Data sheet indicate the true depth of the station (e.g. 8.7 meters) as obtained from the Hydrolab/data sonde.

##### c. Vertical Profile:

Fill in the Hydrolab/datasonde probe values for temperature, specific conductance, salinity, pH and D.O. at each sampled depth, ensuring D.O. measurements are recorded last at each depth to allow sufficient time for probe stabilization.

#### 3.1.3 DCLS Laboratory Sheet

1. DCLS Laboratory Sheets will be completed for samples not included on WQM sheets.
2. Be sure the following information matches the sample tags exactly:
  - Station description
  - Date (yymmdd)
  - Time (24-hr military format)
  - Sample depth (m)
  - Group Code
  - Container Number
  - Unit code (207)
  - Collector's initials

### 3.1.4 LICOR Light Attenuation Sheet

This data sheet will be used to record all Licor measurements and comments pertinent to Licor readings obtained on a sampling run.

### 3.1.5 Field Filtration Log

**All nutrient parameters must be filtered within 2 hours of their collection.**

Regions not recording time filtered on their WQM field sheets should utilize this form to record individual sample filter times.

## 3.2 FIELD MEASUREMENTS

Field measurements to be obtained include the following:

### 3.2.1 Secchi Disk

1. Use a Secchi disk measuring 20 cm in diameter and attached to a line or chain marked in 0.1 m increments with paint or tape. **Note the marks need to be checked 1 time a year for accuracy.**
2. Lower the Secchi disk into the water on the shaded side of the boat until the black and white quadrants are no longer distinguishable. **Do not wear sunglasses while obtaining this reading.**
3. Note the depth at which the quadrants were no longer distinguishable and then raise the disk until the quadrants are again distinct.
4. The recorded Secchi depth is the average of the two depths to the closest 0.1 m.

### 3.2.2 Vertical Profile

A vertical profile of temperature, dissolved oxygen, conductivity, salinity and pH using a Multi-parameter water quality monitoring instrument (such as Hydrolab brand water quality monitoring system).

## Field Set-up and Operation

- Note:** - The instrument (e.g. H20 or datasonde) must be calibrated and the operation checks must be performed prior to using it in the field (See Section 2.2).
- While the unit is in operation aboard the vessel, the boat operator must maintain the boat's position and orientation with wind and tide movement to ensure that the Sonde hangs as vertically as possible.
  - While the unit is in operation aboard the vessel, **keep the probe away from the engine's propeller** to ensure the safety of the Sonde and data cable, and to prevent interference from the propeller wash with all water quality measurements.
  - Field personnel should wait as long as possible prior to collecting water samples after ships or barges pass to ensure they do not sample any bottom sediment that the ship may have suspended into the water column.

**Note: Regional personnel have agreed to conduct Steps 4, 5, 6 and 13 below whenever the previous DO post cruise calibration check for the instrument in use was out of range.**

1. At least 5 minutes prior to arriving at the first station remove unit from storage.
2. Screw on the Circulator (H20) or replace the storage cup with the sensor guard (datasonde).  
Remove the storage cup from the Sonde and screw on the circulator in its place. Caution should be taken to avoid any contact with the sensors.
3. Connect the two ends of the data cable to the probe and circulator.  
Ensure that the probe is attached to the data cable with the pin and clip ring.
4. Wrap the sensor guard or circulator in a moist towel so that area containing the sensors is completely covered and place in a bucket.
5. Turn the instrument on and allow it to stabilize.  
The power should stay on for the duration of the cruise.
6. If the previous post cruise calibration check for DO was out of range, confirm the DO calibration:  
Check the DO percent saturation prior to collecting the vertical profile at each station check the DO percent saturation. The probe unit should remain wrapped in the moist towel for this calibration check. Percent saturation should read between 95-105%. If not, the instrument should be calibrated for DO (while in the moist towel) before taking the profile.
7. Calibrate depth.
  - a. If utilizing a Datasonde or Minisonde:Point the sonde upward.
  - b. Turn the instrument on
  - c. Press "setup/cal", "calibrate", "sonde" and "depth"
  - d. Use the left, right, up and down arrows to calibrate to 0.0 depth.
  - e. Press "enter" and "Y" to save.

If utilizing an H20:

Check the depth on the Sonde once a month by measuring a known depth. In the field lower a line marked in meters such as the Secchi disk to a specific depth. Lower the Sonde to the same depth and compare the Sonde value with the marked depth on the line. The depths should be within 0.5 meters of each other. Record all information on cruise summary sheet.

8. Visually inspect the magnetic impeller on stirrer base.  
Make sure magnetic impeller is rotating freely on its shaft. Any obstruction to smooth rotation of the impeller may cause erratic DO measurements and excessive power drains to the battery.

9. Lower the Sonde to 1 meter above the bottom sediment.  
Lower the Sonde with cable and weighted nylon safety line (if utilized) through the water column. Continue lowering the Sonde until the weight touches the bottom (if a weight is utilized the Sonde sensors are 1 m above the bottom). Alternately, lower the Sonde until it touches the bottom. Record the true total depth in the upper right corner of the field sheet. Round the true depth to the nearest whole number and raise the Sonde 1 meter.
10. Wait for thermal equilibrium.  
Allow approximately one minute for thermal equilibrium, and then verify that the dissolved oxygen reading is stable. The D.O. sensor is the slowest of all the Sonde sensors to match its temperature to that of the water, therefore, after its reading has stabilized, it is time to read all of the required parameters.
11. Record each parameter reading on data sheets.  
View the display unit for each parameter (temperature, pH, D.O., conductivity, salinity and depth). Record each parameter on the WQM data sheet, recording D.O. last in order to give this parameter the most time to stabilize.
12. Record measurements at two meter intervals towards the surface.  
If the bottom sample depth is an even interval, record the parameter measurements at that depth and then go up one meter (to the first odd depth interval) for the next sample. Subsequent samples will be taken at two meter intervals.
13. Retrieve the Sonde and store in a cool place (i.e. in a bucket of water, in the shade or wrapped in a towel).  
If conducting the DO saturation check, place the sonde in a bucket with sensor guard completely wrapped in towel, leaving the display unit on.  
After all measurements have been collected at each required depth, retrieve the Sonde while coiling the cable around the storage bucket. When the Sonde has reached the surface, grasp the Sonde (with one hand) while holding the cable (with the other hand). Wrap the sensor guard with a towel such that the area containing the sensors is completely covered. Place the towel wrapped Sonde into the storage bucket. Rinse the weight at the surface, retrieve it, and place it on the deck.

### 3.2.3 Light Attenuation

**LICOR sensors need to be recalibrated every 2 years. Optimally, rotation of sensors should occur to allow only a single year of use in the field. However, no sensors will be utilized in the field for periods greater than 2 years. The Photo Diodes will degrade even when the sensors are not deployed in the field therefore each region will need to track purchases and recalibration dates accordingly. Additionally, regions need to track the dates sensors are utilized in the field. Purchases/recalibrations and utilization dates should be tracked for each sensor utilizing a LI-COR sensor tracking sheet (Appendix A). The tracking sheets should be kept in a logbook at each region.**

**The LICOR instrument requires an air or water multiplier for each sensor depending on the media it will be utilized in. The multiplier is the calibration coefficient for each sensor and is specified on the calibration documentation for each sensor. While the multipliers are stored in the data logger and do not need to be entered prior to each use, a new multiplier is required when the sensors are replaced and when the sensors are returned from the manufacturer after**

## recalibration.

### A. Entering multipliers/ initial set up for LI-1400:

1. With the front panel face up and the display at the top, connect the light sensor into the BNC connector I1 located on the top left of the LI-1400 unit and the underwater sensor into the BNC connector I3 located on the top right of the LI-1400 unit.
2. Turn on the instrument by pressing the key labeled **ON**.
3. Press the key labeled **SETUP** on the data logger.
4. Select **CHANNELS** and press **ENTER**.
5. Using the right or left arrow keys select **I1=light**. Press **ENTER**.
6. Pressing the shift key to access the alpha characters on the numeric key pad (press shift once for the upper character or twice for the lower character) type QUANTUM for the description. Press **?**.
7. Type in the multiplier for use in air from the tag attached to the air sensor or from the most recent certificate of calibration. Press **ENTER**.
8. Type SA for the label. Label is a two character alpha numeric code. **Channel 1 is SA** for surface air, **Channel 2 is UU** for underwater up. Press **?**.
9. The LED will display **ave=** number. **Ave** is the number of seconds that the data logger will calculate a running average. Use the number keys to set the averaging time to 5 seconds. Press **?**.
10. Use the right or left arrow to set the Log Routine to **none**.
11. Press **Esc** twice to return to the setup menu.
12. Complete steps 3-8 for channel 2 entering the water multiplier in step 7 for the depth sensor.
13. Press the **View key** and use the left and right arrow to toggle to New Data. Press **ENTER**.
14. Use the left and right arrow key to toggle the display until channel III is displayed. The LI-1400 is now configured to display the running average of the 5 previous seconds' instantaneous values of the quantum sensor and is now ready for use.

### B. Enter multipliers/initial set up for LI-1000:

1. With the front panel face up and the display at the top, connect the light sensor into the BNC connector located on the top left of the LI-1000 unit and the underwater sensor into the BNC connector located on the top right of the LI-1000 unit.
2. Turn on the instrument by pressing the key labeled **FCT ON**.
3. Press the key labeled **CFG** on the data logger.
4. The LED will display **Mode is INST**. If the LED displays **LOG**, press the arrow key until the LED displays **INST** then press enter.
5. The LED will display **Ch1 is LIGHT**. If not, press the arrow key until the LED displays **LIGHT** and press enter.
6. The LED will display **range=A**. Using **range=A**, the data logger automatically sets the range to cover the widest input signal range with the best resolution. If not, press the arrow key until the LED displays **A**, then press enter.
7. The LED will display **mult =** number. The multiplier is the calibration coefficient for each sensor and is specified on the calibration documentation for each sensor. Enter the correct air multiplier

number for the sensor that is attached to channel 1 (Deck sensor) using the number keys, then press enter.

8. The LED will display **Label = SA**. **Label** is a two character alpha numeric code. **Channel 1 is SA** for surface air, **Channel 2 is UU** for underwater up. Press enter after each code to confirm.
9. The LED will display **ave=** number. **Ave** is the number of seconds that the data logger will calculate a running average. Use the number keys to set the averaging time to 5 seconds then press enter.
10. The LED will display **ch 2 is LIGHT**. Complete steps 1-8 for channel 2 entering the water multiplier in step 6 for the depth sensor.
11. The LED will display **ch 3 is off**. Press enter until the LED displays **1A** followed by a series of numbers. The datalogger is now configured to display the running average of the 5 previous seconds' instantaneous values of the quantum sensor and is now ready for use.

### C. Data Collection:

1. Visually inspect Licor meter probes and connections.  
Check battery level and ensure probes are positioned properly on deck and subsurface mountings.
2. Connect the deck sensor cable to the BNC connection on the top left of the data logger.
3. Secure the small deck sensor in an unobstructed area on the vessel.
4. Run the end of the cable for the underwater sensor to the data logger and connect the end of the underwater sensor to the BNC connector on the top right of the data logger.
5. Attach sufficient weight to the underwater sensor frame such that the sensor remains upright as it is lowered to depth.
6. On the sunny side of the boat, lower underwater sensor to depth just below the surface ensuring that the probe will not rise out of the water with wave action (Note: the depth for this reading is recorded as 0.1 meter in WQM).
7. Turn the instrument ON.
8. Obtain profile. Report values in whole numbers except for the last depth of the profile, for this observation report values in tenths.
  - At each depth a light attenuation reading is obtained from the deck sensor as well as from the water sensor.
  - Take initial readings with the deck sensor and just below the surface with water sensor.
  - Take second water sensor reading at depth of 0.5 meters.
  - Take successive water sensor readings at 0.5 meter increments.
  - Continue the profile until the underwater sensor displays either a value of approximately 10 micro Einstiens or a depth value that is 20% of the surface depth value .
  - Allow a minimum of 5 seconds between readings (to create a 5-second average value).
  - If the Licor instrument is being used as a data logger, depress the "enter" key with each reading.
9. When profile is complete, turn the instrument OFF.
10. Record data on Licor Attenuation Sheet and transmit to CBO at the end of the month, along with the other field documentation sheets.

### 3.3 WATER QUALITY SAMPLE COLLECTION PROCEDURES

### 3.3.1 Sample Collections

#### A. Water Quality Samples

**Each region should have a pump and hose assembly permanently attached to their primary sampling boat. The intake hose must be long enough to collect bottom water samples from the deepest stations, and have enough weight attached to ensure vertical deployment even in strong currents.**

#### Hose Clearing Times:

**It is imperative that sufficient hose clearing time be allowed to ensure the water being sampled is obtained from the intended depth. This can be accomplished in either of two ways:**

1. Air Plug method:
  - a. Turn the pump on with the draw end of the hose above the water surface to place air into the hose.
  - b. Turn off the pump and lower the hose to the sample depth.
  - c. Turn on the pump and watch for the air to completely exit the hose then begin sampling.

2. Calculated clearing times:

Each time a new hose or pump is installed, a clearing time can be calculated in the following manner to ensure there is sufficient waiting time to clear the hose:

- a. Calculate the volume of the hose in gallons:  $(r/12)^2 * 3.14 * L * 7.48 = V$ , where
  - r = radius (inches) of hose inner diameter
  - L = length (feet) of hose
  - V = volume (gallons)
- b. Determine pump capacity (gallons per minute pumped) from the pump specifications.
- c. Calculate time to flush hose:  $V/(gpm) = \text{time}$ , where
  - Gpm = gallons per minute pumped
  - Time = minutes to flush hose
- d. Multiply the time by 1.25 as a minimum clearing time for the hose.

#### Sample Collection:

1. Samples will be collected approximately 1 m above the bottom sediment (i.e. the true bottom depth is rounded to the nearest whole meter and the sample is obtained one meter above the rounded depth) and 1 m below the surface.
2. Bottom samples will be obtained first.
3. Clear the hose using one of the two aforementioned methods at each sample depth prior to collecting any samples.
4. **Always rinse the container 1-2 times with sample before filling the container. This is especially important when containers are blown open by mouth.**
  - Containers are kept closed until immediately before filling. Do not use any container that appears dirty, or appears to have been previously used.
5. Fill all containers to nearly full and cap.
  - Four to five samples are taken at each station, they are:

Bottom: One Nutrient Sample (one 2-liter HPDE brown bottle previously acid washed and rinsed with DI water)  
One Solid Sample (one quart)

Surface: One 2-liter HPDE brown bottle previously acid washed and rinsed with DI water for filtered nutrient and chlorophyll parameters.  
One Solid Sample (one gallon cubitainer)  
One Two-liter container for chlorophyll (may also be utilized for nutrient sample)

- To avoid contamination, minimize contact with the container mouth, inside surfaces, and inside of cap.
- Grasp the cap and pull the neck portion of the cubitainer out to facilitate filling. An ample flow of water from the pump hose should help open the cubitainer.
- Leave some air in the containers to allow better mixing in the bottles

6. Attach the appropriate sample tag to the cubitainer before it is put on ice.

Place a sample tag on the sample with the following information:

- a) Station
- b) Date (yyymmdd) and time (24-hour military schedule) of collection (where all samples collected from a station will have the same collection times)
- c) Depth of collection (m)
- d) Unit code
- e) Collector's initials
- f) Catalog number
- g) Group code

7. Make sure the cap is tight enough to prevent ice water from contaminating the sample.

## **B. Plankton and Primary Productivity Samples**

SOP provided by Old Dominion University Phytoplankton Analysis Laboratory

### Collection gear and bottles:

- A. 2 large carboys, Pump with attached hose, Secchi disk, Cooler with ice.
- B. For each station:
  - 4 – 500 ml bottles with Lugols preservative
  - 4 – 125 ml bottles with glutaraldehyde
  - 3 – 1000 ml bottles without preservative.

### On Station: (Photic zone)

1. Take Secchi disk reading, and multiple by 3.5 to obtain photic zone depth.
2. The first set of water samples will be taken between this depth and the surface.
3. Divide this depth by 5 or use this number to determine from the chart (Appendix B) how far the hose will be pulled up after pumping water into each carboy.
4. Lower hose to the photic zone depth, allow water to be pumped through the hose for at least 1 minute. Then pump approximately 3 liters into each carboy.
5. Remove hose from carboy, raise hose one increment, and repeat the procedure.

6. When completed, agitate the carboys to mix the contents, fill 1 - 500 ml bottle (contain Lugols), 1 - 125 ml (contain glutaraldehyde), and 2 - 1000 ml bottles (no preservative), from one carboy, and 1 - 1000 ml sample from the second carboy.
7. Be sure to record station number and date on all bottles, add surface temperature to label of 1000 ml bottles.
8. Place 1000 ml and 125 ml bottles on ice in a cooler. The 500 ml bottles do not need to be on ice, but can be stored there.
9. Discard any water left in the carboys. Indicate on labels of all samples: **TOP** (collections in the photic zone); **BOTTOM** (collections below the photic zone)

On Station: (Below photic zone)

1. Establish depth range of zone to be collected. This equals the bottom third of the water column at each station. Divide into 5 equal increments.
2. Repeat procedures of collection as described above, but do not place hose directly over the bottom to prevent collecting sediment. Prior to collection, flush hose at this depth for at least 1 minute. If water is initially turbid, raise the hose a few feet, let water flush out any sediment, then begin the series of collections.
3. No 1000 ml bottles are used at these depths.
4. Repeat the bottle collection and labeling procedures as described above.
5. Flush the large carboys.

### 3.3.2 Filtering Procedures:

#### CHECKLIST FOR FILTRATION UNIT:

##### EQUIPMENT FOR PROCESSING SAMPLES

##### PER CRUISE:

- \_\_\_ 1 FILTRATION UNIT SETUP WITH 2 MAGNETIC GELMAN FILTER HOLDERS, TWO PCN TOWERS AND ONE CHLOROPHYLL TOWER
- \_\_\_ 1 BOX OF 47-mm WHATMAN GF/F FILTERS (PP AND CHLOROPHYLL)
- \_\_\_ 1 BOX OF 25- mm "MUFFLED" GLASS FIBER FILTERS FOR PCN
- \_\_\_ 1 10ml, 1 50-ml, 1 100-ml and one 250-ml GRADUATED CYLINDERS
- \_\_\_ 1 (- 2) ½ GALLON CONTAINERS
- \_\_\_ 1 BROWN HDPE 2 LITER CONTAINER

##### PER STATION:

- \_\_\_ 2 CUBITAINERS
- \_\_\_ 2 250-ml WHITE TAPE BOTTLES
- \_\_\_ 2 BLUE TAPED PETRI DISHES (PCN)
- \_\_\_ 2 GREEN TAPED PETRI DISHES (PP)
- \_\_\_ 1 ALUMINUM FOIL SQUARES (CHLOROPHYLL)

##### MISCELLANEOUS

- \_\_\_ DUCT TAPE
- \_\_\_ 3 FORCEPS
- \_\_\_ 3 SHARPIE PENS
- \_\_\_ 3 SQUIRT BOTTLES
- \_\_\_ DI WATER

- \_\_\_ 5 RUBBER STOPPERS FOR FILTERING SETUP
- \_\_\_ ZIPLOCK BAGS FOR PETRI DISHES
- \_\_\_ 1 ROLL EACH COLOR TAPE (BLUE, GREEN)

1. Rinse filtration equipment:

Clean bells (filtration towers) and frits (tower base) with de-ionized water (stored in a high-density polyethylene container) from the field office. Set up bell and frit for filtering. Ensure that there are catch flasks on line between the manifold and the vacuum source. Connect vacuum power pump to battery.

2. Place 2- 250 ml NTNP bottles under PP tower bases or under the Chlorophyll tower base(s).

Lift up base by the stopper and place acid washed and rinsed NTNP bottles in the bottom of the PP or Chlorophyll cylinder (s). Place the stem of the base inside the bottlenecks such that the filtrate from the PP or Chlorophyll process will be collected in the 250-ml bottle. If the Chlorophyll tower(s) are utilized to collect the NTNP filtrate, the NTNP bottles must be removed prior to adding MgCO<sub>3</sub> to the last 25 mls of sample.

3. Place filter pads on filtration unit:

Transfer a 47-mm Whatman 0.7 GF/F glass fiber filter onto the bases for PP and Chlorophyll filtration or a muffled 25-mm filter for PNC.

- Use only clean forceps and grip only the filter edge.

- **Note:** be sure that PNC filters are “muffled” prior to use and place them grid side down. Place PP and chlorophyll filters on the filter tower in the same direction as they come out of the box.

- Discard any filters if they are dropped or the surface is scratched.

Replace the filtration tower onto the base.

4. Rinse graduated cylinders:

Mix sample thoroughly by shaking or tilting the plastic sample container vigorously, then rinse graduated cylinders with sample 1-2 times.

5. Filter the samples:

**Note:** - The volume of sample filtered will depend on amount of particulate matter/algae in the sample.

- Sample water should be thoroughly mixed and transferred quickly from containers to graduated cylinders and from cylinders to filtration towers to prevent settling of contents.

- If filter pads are not “colored”, continue mixing, measuring and adding known volumes of sample water to each tower until the filters turn color.

- In cases where sample is turbid, start with a small volume and add 50 ml increments of sample until sample barely passes the filter (with pump on), or until the filter is well colored.

- All volumes **MUST** be recorded on the sample tag (or label) and the EDT field sheet.

***Chlorophyll samples:***

- a. Fill the graduated cylinder with approximately 50-300 ml sample then quickly transfer the water from the graduated cylinder to the tower to prevent settling of algae within the cylinder.

- **Keep the vacuum below 12 psi of Hg (10 psi of Hg is preferable).**

- **Limit filtration duration to 10 minutes or less.**

- **Remove filtration vacuum just prior to filter being completely dry but dry enough to ensure none of the filtered material will be lost when the filter is folded in the aluminum foil.**

**Note:** 1. This procedure must be followed to avoid cell damage during filtration and loss of

chlorophyll into the filtrate. If it will take longer than 10 minutes to filter the selected sample volume, discard filter and remaining sample in bell, rinse the filtration apparatus and start again using a lesser sample volume.

2. Because the laboratory has to have enough concentrated chlorophyll to obtain a spectrophotometric reading, the field crew may need to utilize more than 1 filter to achieve the desired amount of chlorophyll. The volume of sample filtered in combination with the color of the filter will determine how many filters should be utilized. In general, if you have filtered 300 ml – 1 L of sample and have green color on the filter, you may use just that 1 filter. If you have filtered less than 300 ml of sample and have color other than green, you will need to filter 1 to 2 more filters. Be sure to filter the same volume in each of the successive filters (e.g. if the first filter processed 50 ml of sample and was brown in color, you will need to filter 2 more filters using 50 ml of sample each).

- b. Add MgCO<sub>3</sub> at the end of filtration.

Be sure to remove any NTNP samples prior to this step. Shake to re-suspend the MgCO<sub>3</sub> and add approximately 1 ml of concentrated MgCO<sub>3</sub> - Laboratory grade - (prepared in a 1 g MgCO<sub>3</sub> to 100 ml of deionized water ratio) to the last 25 ml (approximately) of sample filtered in the filtration bell. This is equivalent to less than 1 mg of MgCO<sub>3</sub> per 15 ml extract.

#### ***PNC, PP, NTNP and Color Filtration:***

- The two magnetic towers with green tape are utilized for Particulate Phosphorus (PP) filtration.
- The two smaller towers with blue tape are utilized for the Particulate Carbon/Particulate Nitrogen (PCN) filtration.
- a. The usual volume filtered for PP is 250 mls (200 - 300 mls) and 100 mls (100 - 150 mls) are filtered for PNC. A greater or lesser volume may be filtered depending on sample turbidity. In general PNC volumes should measure 50% of the volume filtered for PP.
- b. Open the vacuum valve slowly.
  - After all the water has passed through the tower let run for a few seconds to pull off any water remaining on the filter.
- c. Close each valve after the sample filters through each tower. After filters are dry and colored, turn off pump.

**-Keep the vacuum below 12 psi of Hg.**

- d. The 250-ml NTNP bottle needs to be filled to a minimum of 250 ml of filtrate.

**Note: The filtrate should fill the bottle to the neck.**

- If there is not enough filtrate to fill the 250 ml NTNP bottle and to provide 75-125 ml for the color sample, more sample needs to be filtered. In such an event, the “used” filters must be removed, placed in a petri dish (only the first filter will be put in the petri dish and analyzed), a new filter must be placed on the tower, and additional sample (after mixing) must be filtered. If the filters are being clogged very quickly due to large amounts of solids in the sample, continue replacing the clogged filters and add sample water as necessary.
- Pour filtrate from the bottle to rinse the cap.
- The filled NTNP bottle receives the sample tag from the 2 L brown HDPE bottle (or ½ gallon jug). This bottle is delivered to DCLS.

e. Pour 75-125 mls of filtrate into the 125 ml glass amber jar for the color sample.

- Pour filtrate from the bottle to rinse the cap.
- Attach label and immediately place on ice.

**Note: There have been some problems with filling the filtrate bottles to the proper volume.**

**Common causes for these problems are:**

- The old filter was not removed, water would not flow through, water in the tower and filter pad had to be thrown away and the process started again (filtrate was not contaminated and could be saved).
- New filter was not placed in tower, so sample water just poured into filtrate bottle. Bottle was contaminated and filtrate had to be thrown away (used filter pad was already in petri dish and could be used).

6. Record the volume filtered.

Record the volume filtered on the sample tag (or label) and the WQM field sheet.

7. Package filter pad(s):

- Fold the filter in half using forceps, being careful not to touch or disturb the particulate material on the surface of the filter.
- Chlorophyll filter pads are placed folded on a square of aluminum foil.
- PP placed in Petri dishes sealed with green tape (aluminum foil may be substituted for the petri dish)
- PNC placed in Petri dishes sealed with blue tape (aluminum foil may be substituted for the petri dish)
- If multiple filter pads are used for chlorophyll analysis, they must be packaged as one sample. Either wrap all filter pads in one piece of foil or wrap all separate foil packages together with one piece of foil.

8. Remove NTNP bottle from PP cylinder and cap tightly.

9. Label sample.

- Place a label on the foil square marked with:

- Station
- Date (yymmdd) and time (24 hour military schedule) of collection
- Depth of collection (m)
- Unit code
- Collector's initials
- Group code (PNC, PP, NTNP, or FCHLR)
- Container number
- Volume of sample filtered (NOTE: When multiple filter pads are used, the volume recorded would be that used for each filter i.e. if 3 pads are used and 100 ml filtered through each pad, the filtered volume recorded should be 3 X 100 ml NOT 300 ml).

10. Place samples on ice.

- All filters may be placed together in one Ziplock bag if properly labeled.
- **Make sure no water from the cooler touches the Ziplock bags.**
- Place the 250 ml NTNP bottle in cooler and pack with ice to a level just below the bottom of the cap.

11. Completely rinse the empty filtration tower and base three times with deionized water prior to seating a new filter for the next sample.

12. Empty all ½ gallon jugs and/or 2 L HDPE bottles.

**NOTE: A few things to remember:**

- Always shake sample container thoroughly before pouring any aliquot.
- Be certain to rinse all filtering towers with DI water between samples.
- Double check each tag for completeness and clarity.

- Rinse graduated cylinders with DI water and then with sample water before processing each sample.
- Rinse 250-ml bottle with filtrate and rinse cap with sample before closing.
- Periodically the wastewater collection tank on the filtering units will require dumping. Make sure wastewater does not get into the overflow tank.
- Make sure all paper work is complete and matches the sample tags exactly.

### 3.3.3 QAQC Sampling

Note: QA samples should be obtained in this sequence:

1. Field samples and duplicates
2. Equipment Blanks

#### A. Equipment Blanks

Equipment blanks are used to ensure the sampling device has been effectively cleaned to prevent any carry-over from previous samples. Fill the sampling device with deionized water or pump deionized water through the device and transfer to sample bottles. Send the sample bottles to the laboratory for analysis.

#### 1) Samples to be collected using the methods as outlined in Section 3.0:

- 1) 1- 2 L brown HDPE bottle from which:
  - a) 300 ml of equipment blank water (DI water processed through the pump and hose apparatus) will be filtered through the filtration unit for a filter pad for chlorophyll analysis.
  - b) 100 ml of equipment blank water will be filtered through the filtration unit for a PNC filter pad.
  - c) 250 ml of equipment blank water will be filtered through the filtration unit for a PP filter pad. Keep the filtrate as NTNP.
- 2) 1 - quart sample container for solids analysis (i.e. TSS, VSS, FSS). This container will be NME\_.  
**Note:** NME group codes requiring larger volumes but including TSS, VSS and FSS may be substituted at CBP stations which are also AWQM sites when BOD5 or other additional parameters are desired.

#### 2) Frequency and Sites of Collection:

- a) Equipment blanks will be collected by TRO and PRO on a monthly basis and by NRO on a quarterly basis. Equipment blanks will be collected on the same days duplicate samples are obtained.
- b) Equipment blanks will be collected in the field during the run or at the regional offices at the end of the sampling day.

#### 3) Collection and Preservation Procedures:

- a) Clean containers at the regional office.
  - 1) Clean, acid wash with 10% HCL, and rinse 3 times with DI water the bucket used to hold the DI water. Do the same for the graduated cylinders, the ½ gallon container the 2 L HDPE bottles, the 250-ml NTNP sample bottle and the filtration unit stacks and bases.
- b) Rinse the outside of the hose and submersible pump with fresh water.  
Before placing the hose and pump into the bucket of deionized water, thoroughly rinse the outside of

the submersible pump and hose to prevent possible contamination of the deionized water by ambient water/particulate matter remaining from the sampling run.

c) Flush pump and hose equipment and filtration unit.

Flush or rinse the pump and hose apparatus with sufficient deionized water to completely remove any ambient water remaining in the hose from sampling ( the amount of DI water necessary for this step will vary depending on the length of hose utilized). Also rinse the filtration equipment with DI water 3 times (e.g. forceps, stacks, bases, graduated cylinders etc.)

d) Collect and label samples.

- 1) When ambient water has been completely flushed from the hose begin collecting the equipment blanks and process them as ambient samples.
- 2) Place a sample tag or label with the following information on each blank:
  - a) Station name in River mile format
  - b) Date and actual time of sample collection
  - c) Unit code - 207
  - d) Collector's initials
  - e) Group code
  - f) Volume of sample filtered (PNC, PP and chlorophyll)
  - g) The container number utilized for regular samples with the same group code but with a number 2 in front of it (e.g. if a region's regular container number for PNC is 4 the equipment blank for PNC will be 24).

**Note:**

**Some regions have dedicated pieces of equipment for Chesapeake Bay runs. In instances where there is no dedicated equipment or if any pieces of equipment other than those dedicated are utilized, write on field sheet what pieces of equipment are used.**

e. Store and Preserve Samples.

- 1) Filtered: Fold the filters in half such that the inside halves of the filters touch and place in labeled petri dishes (PP and PNC) or aluminum foil (chlorophyll). Put the petri dishes and foil into Ziplock bags and then place them on ice such that they may not be contaminated by water from the melting ice.
- 2) Unfiltered: Samples should always be stored at 4 degrees Celsius by packing the sample bottles in ice up to the level of the top of the sample but below the bottom of the sample bottle caps.

## **B. Field Duplicates**

Duplicates are independent samples collected as closely as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. Duplicates are useful in documenting the precision of the sampling process.

### **1) Samples to be collected (using the methods as outlined in Section 3.0)**

- 1) 2 - 2 L brown HDPE bottles. Using the filtration methods outlined in the Virginia Tributary SOP collect from each bottle:
  - a) 1 (to 3) - 47 mm chlorophyll pad(s)
  - b) 1 - 25 mm PNC filter pad

- c) 1 - 47 mm PP filter
  - d) 1 - 250 ml NTNP bottle will be obtained through the PP filtration process.
- 2) 2 - quart sample containers for solids analysis (i.e. TSS, VSS, FSS) following the procedures in Section 3.0 above. This container will be NME\_. **Note:** NME group codes requiring larger volumes but including TSS, VSS and FSS may be substituted at CBP stations which are also AWQM sites when BOD5 or other parameters are desired.

## 2) Frequency and Sites of Collection:

- a) Duplicate samples will be collected by TRO and PRO on a monthly basis and by NRO on a quarterly basis.
- b) Samples will be collected from both the surface and the bottom at the chosen site and sites will be rotated among stations and Rivers. (Note: Bottom duplicates will not include a chlorophyll sample).

## 3) Sample collection:

- a) Clean containers and filtration equipment at the regional office.
  - 1) Clean, acid wash with 10% HCL, and rinse 3 times with DI water the graduated cylinders, the 250 ml NTNP sample bottle, the ½ gallon container or 2 Liter HDPE sample bottle, and the filtration unit stacks and bases.
- b) Rinse containers in the field.

If appropriate (e.g. no preservative is present in the bottle), rinse the containers once with sample water and discard rinse prior to filling with sample.
- c) Rinse the filtration equipment with DI water 3 times.

**Always rinse the filtration stacks, bases, forceps and graduated cylinders with DI water between filtering samples and duplicates.**

- d) Fill containers.

Filling of bottles may be accomplished by either of the following methods:

  - Option 1 - A churn splitter may be filled with sample from pump and hose apparatus. While gently agitating the sample to assure homogenous subsampling fill both bottles simultaneously leaving approximately one inch of air space.
  - Option 2 - A “Y” fitting may be utilized such that both bottles may be filled simultaneously. Leave approximately one inch of air space in each of the sample bottles.
- e) Place filter pads on filtration unit.

Using clean forceps only, transfer a either a 47 mm Whatman 0.7 GF/F glass fiber filter (PP, Chlorophyll) or a muffled 25 mm filter (PNC) onto the base.
- f) Place one 250 ml NTNP bottle below the stack utilized for the PP filter pad.
- g) Filter and label samples.

Note: be sure to rinse all graduated cylinders, forceps and the filtration equipment with DI water between samples.

  - 1) Filter 250 ml of sample through PP filter(s) saving one pad for PP analysis and the filtrate for NTNP analysis.
  - 2) Filter enough sample to color the PNC filter pad.
  - 3) Filter at least 300 ml of sample on up to 3 chlorophyll filters.

- h) Make sure to attach an identical sample tag or label to each pair of duplicates the with the following information:
- 1) The duplicate samples will have station name in River mile format
  - 2) Date and time of sample collection (note: the date and time should match the corresponding regular sample's date and time).
  - 3) Depth
  - 4) Unit code - 207
  - 5) Collector's initials
  - 7) Group code
  - 8) The container number utilized for regular samples with the same group code but with a number 1 in front of it (e.g. if a region's regular container number for PNC is 4 the duplicate container number for PNC will be 14).
  - 9) Volume of sample filtered (PNC, PP and chlorophyll)

#### **4) Preservation and Storage**

- a) Filtered: Fold the filters in half such that the inside halves of the filters touch and place in labeled petri dishes (PP and PNC) or aluminum foil (chlorophyll). Put the petri dishes and foil into a Ziplock bag and then place them on ice such that they may not be contaminated by water from the melting ice.
- b) Unfiltered: Samples should always be stored at 4 degrees Celsius by packing the sample bottles in ice up to the level of the top of the sample but below the bottom of the sample bottle caps.

#### **C. DI Source Blank and Conductance check of DI system.**

##### **1) The DI Source blank sample is to be collected using the methods outlined previously.**

- a) 1 250 ml NTNP bottle will be filled directly from the tap in the laboratory.

##### **2) Frequency and Sites of Collection:**

- a) DI source blanks will be collected once a month as follows:  
PRO will collect this sample on the York River Run (PYRK1)  
TRO will collect this sample on the Elizabeth River run (TELRI)  
NRO will collect this sample on the Rappahannock Run (NCB)
- b) They will be collected at the regional office.
- c) All regions will routinely sample their DI system for conductance as this is a good indicator of filter problems.

##### **3) Collection and Preservation Procedures:**

- a) Collect, preserve and label samples.
  - 1) Fill the containers with DI water straight from the tap.
  - 2) Place a sample tag or label with the following information on the blank:
    - a) Station name in the river mile format
    - b) Date and time of sample collection

- c) Unit code - 207
- d) Collector's initials
- e) Group code
- f) The container number utilized for regular samples with the same group code but with a number 4 in front of it (e.g. if a region's regular container number for NTNP is 1 the equipment blank for PNC will be 41).

#### 4) Store and Preserve Samples

Samples should always be stored at 4 degrees Celsius by packing the sample bottles in ice up to the level of the top of the sample but below the bottom of the bottle caps.

##### **D. PNC Dry Filter Blanks (PNCDF)**

Two dry "muffled" filter blanks will be sent to DCLS after each sampling run. These filters will be used as a correction factor for PNC analyses.

- a. Collect, preserve and label samples.
  - 1. With clean forceps place the previously muffled dry filter into a petri dish sealed with blue tape.
  - 2. Place a sample tag or label with the following information on the blank:
    - a) Station will be the last station in which PNC filters are obtained in River mile format.
    - b) Date and time of sample collection
    - c) Unit code 207.
    - d) Collector's initials
    - e) Group code (PNCDF)
    - f) The container number utilized for regular samples with the same group code but with a number 3 in front of it (e.g. if a region's regular container number for PNC is 5 the dry filter blank for PNC will be 35).
  - 3. Place the Petri dish into a Ziplock bag and send with samples to DCLS.

##### **E. PP Dry Filter Blanks (PPDF)**

Two dry filter blanks will be sent to DCLS after each sampling run. These filters will be used as a check for possible factory/field contamination of filters while still in the box.

- a. Collect, preserve and label samples.
  - 1. With clean forceps place the dry filter into a petri dish sealed with green tape.
  - 2. Place a sample tag or label with the following information on the blank:
    - a) Station will be the last station in which PP filters are obtained in River mile format.
    - b) Date and time of sample collection
    - c) Unit code 207.
    - d) Collector's initials
    - e) Group code: PPDF
    - f) The container number utilized for regular samples with the same group code but with a number 3 in front of it (e.g. if a region's regular container number for PP is 6 the dry filter blank for PP will be 36).

3. Place the Petri dish into a Ziplock bag and send with samples to DCLS.

## 4.0 POST CRUISE ACTIVITIES

### 4.1 SAMPLE CUSTODY AND HANDLING

1. Drain and repack ice coolers.

- Using the drain plug on the coolers, remove any water from the coolers.
- Repack samples to the bottom of their caps with ice.
- Check to make sure the sample tags and Laboratory sheets (when utilized) and WQM Data sheets match and are completely filled out.

2. Place coolers where they will be picked up by the DCLS courier.

- There may be occasions when a DCLS courier is unable to pick up the coolers.

Should such a situation arise, deliver the samples to DCLS:

- DCLS is located at 600 North 4<sup>th</sup> St. in Richmond, VA.
- Parking is available in the loading dock or on 4<sup>th</sup> Street adjacent to the loading dock.

When delivering samples, contact the loading dock manager. If the overhead doors to the loading dock are closed, go to door on the side of the overhead doors and use the intercom to contact the loading dock manager. If the overhead doors to the loading dock are open, you will find the loading dock manager behind the glass window of the loading dock office. The dock manager will assist you checking the samples into the lab.

### 4.2 Hydrolab Post cruise calibration checks

**Note:** Perform a post cruise calibration check before cleaning/servicing the sensors. When checking the system for drift, it is extremely important that the room temperature, Sonde temperature, deionized water temperature, and all standard solutions are at thermal equilibrium. If thermal equilibrium is not reached in a reasonable amount of time or the observed values are outside the QC criteria, an additional postcruise calibration check should be conducted the next morning. When a post cruise calibration check is necessary the following morning, send those results to CBO with the field data sheets.

#### 4.2.1. Hydrolab H20 and DS3

##### Dissolved Oxygen

1. **Make sure hydrolab returns to ambient temperature prior to conducting the calibration check.**
2. Replace multiprobe storage cup with the bottomless calibration cup.  
Take special care not to bump probes with hand or cup as this may result in damage to the probes.
3. Visually inspect membrane on probe tip.  
Check membrane for wrinkles, bubbles, tears, dirt or other damage. If present, service probe in accordance with manufacturer's operation manual.
4. Fill calibration cup with DI water.  
Use only DI water that has been allowed to equilibrate to room temperature in a container. DO NOT USE DI WATER FROM THE TAP. This will greatly enhance the equilibration time. With the multiprobe oriented so that the sensors are pointed toward the ceiling, fill the

- calibration cup with D.I. water until the water is just level with the o-ring used to secure the membrane. Lock the probe tightly into the calibration stand, making sure the probe unit top plug is not pressed into stand base.
5. Remove water droplets from the membrane and cover calibration cup.  
Using the corner of a tissue, carefully remove any water droplets from the membrane (DO NOT apply pressure to surface) and cover the open top of the calibration cup to prevent air currents from affecting calibration.
  6. Using a barometer, record the laboratory barometric pressure (in mm Hg) in the logbook.
  7. Turn on unit with “ON/OFF” button and wait for stabilization.  
Wait for 5 minutes to allow air in the cup to become water saturated. The sensor is ready for calibration once the readings have stabilized.
  8. Record the temperature from the Sonde in the log book.
  9. Using chart calculate the correct DO saturation.  
Based on Hg reading and temperature chart find the correct DO saturation value and record in the logbook.
  10. Record the dissolved oxygen reading from the Sonde.
  11. Compare the instrument and chart values.  
Compare the Saturated DO values from the chart and the instrument values as recorded in the logbook. If the difference between the two is less than 0.5 mg/L the instrument is in calibration. If the difference between the Saturated DO value and the instrument indicates that the instrument is not in calibration, check again the next morning to make sure that the temperature was properly equilibrated (send these values to CBO). If the difference is still greater than or equal to 0.5 mg/L the data collected on that sampling cruise is suspect and will be removed from the database. Additionally, the instrument should not be utilized until more extensive cleaning/maintenance is conducted and the instrument calibrates well.
  12. After performing the required maintenance the field DO saturation check must be conducted during the next sampling event to ensure the instrument problem was corrected and to confirm the instrument is performing properly (see step 6 in section 3.2.2 for vertical profile).

### **Specific Conductance**

12. Rinse the sensors.  
Without removing the calibration cup, invert the probe and drain the DI water completely. Rinse the sensors twice with a small portion of the specific conductance standard saved from the calibration procedures. Discard the rinsate each time.
13. Fill the calibration cup with fresh standard.  
With the multiprobe pointing toward the ceiling, fill the calibration cup with fresh standard solution to about one centimeter below the top. Be sure no bubbles are trapped in the bores of the cellblock.
14. Allow specific conductance to stabilize.
15. Read the specific conductance value from the Sonde and record it in the logbook.
16. Transfer the standard solution from the calibration cup to a storage bottle.  
Transfer the standard solution from the calibration cup to a storage bottle for use as a rinsing solution (for step 1) for the next specific conductance calibration. Discard after use as a rinsing solution.
17. Compare the instrument and standard values.

Compare the conductance from the instrument as recorded in the logbook to the standard value. If the standard value and the instrument value are not in good agreement, perform an additional post cruise calibration check the following morning to insure the instrument was properly equilibrated (send these values to CBO). For specific conductance standard 12.89, the difference between the two is should be less than 0.5 ms/cm. If the difference is greater than 0.5 ms/cm the data collected on that sampling cruise is suspect and will be flagged. If the difference is greater than or equal to 0.7 ms/cm the data will be removed from the database. For specific conductance standard 58.6, the difference between the two should be less than 1.00 ms/cm. If the difference is greater than 1.00 ms/cm the data collected on that sampling cruise is suspect and will be flagged. If the difference is greater than or equal to 1.5 ms/cm the data will be removed from the database. The Hydrolab should not be utilized until more extensive cleaning/maintenance is conducted and the instrument calibrates well.

## **pH**

18. Rinse cup and sensors with DI water.  
Flush the calibration cup and sensors thoroughly 3 times with DI water.
19. Rinse sensors with zero (pH 7.00) buffer solution.  
Rinse the sensors with fresh pH 7.00 buffer solution (or buffer solution saved from a previous pH calibration) to saturate sensors. Discard buffer after each rinse.
20. Fill cup with sufficient **Fresh** pH 7.00 buffer to cover the sensor.
21. Allow two minutes for thermal equilibrium.
22. Record displayed value from the Sonde in the logbook.
23. Transfer buffer from calibration cup to storage bottle  
The buffer used in calibrations can be utilized as the rinse (Step 2) for future pH pre or post calibrations. Discard the buffer after using it for rinse.
24. Rinse cup and sensors with DI water.  
Thoroughly flush the calibration cup and sensors with DI water twice.
25. Rinse cup and sensors with slope buffer (pH 10.00 or pH 4.00) solution.
26. Fill the calibration cup with buffer and wait for equilibrium.  
Fill the calibration cup with enough slope buffer to cover the sensor and wait for thermal equilibrium.
27. Record the displayed value for pH into the logbook.
28. Pour buffer into a storage bottle for later use in rinsing step of pH slope calibration.
29. Flush calibration cup and sensors thoroughly three times with DI water.
30. Compare instrument value and the standard value.  
Compare the pH value displayed on the instrument to the standard value. If the difference between the two is less than 0.3 the instrument is in calibration. If the difference between the pre-calibration and post-calibration indicates that the instrument is not in calibration, check again the next morning to make sure that the temperature was properly equilibrated (send these values to CBO). If the difference exceeds 0.3 su the data will be deleted from the database. That Hydrolab should not be utilized until more extensive cleaning/maintenance is conducted and the instrument calibrates well.
31. Replace the storage cup.  
Place a sufficient amount of tap water in the storage cup to keep the DO membrane moist. Do not allow the water to come in contact with the sensors as an ionic gradient may develop

resulting in dilution of the electrolyte solutions.

## 4.2.2. Hydrolab Data Sonde 4, Datasonde 4a, and MiniSonde

### Conductivity

1. Rinse the sensors with D.I. water vigorously for 6 seconds.  
Discard rinse water, and repeat.
2. Dry conductivity probe opening with Q tip or soft cloth.
3. Rinse with the conductivity standard you are using for the slope calibration.  
Discard the rinse solution.
4. Completely fill the calibration cup with this standard.  
DO sensor must be covered. Allow the unit to equilibrate until the conductivity reading is stable.
5. Wait for the specific conductance value to stabilize and record it in the logbook.
6. Transfer the standard solution from the calibration cup to a storage bottle.  
Transfer the standard solution from the calibration cup to a storage bottle for use as a rinsing solution (for step 1) for the next specific conductance calibration. Discard after use as a rinsing solution.
7. Compare instrument value and the standard value.  
Compare the conductance from the instrument as recorded in the logbook to the standard value. If the standard value and the instrument value are not in good agreement, perform an additional post cruise calibration check the following morning to insure the instrument was properly equilibrated (send these values to CBO). For specific conductance standard 12.89, the difference between the two is should be less than 0.5 ms/cm. If the difference is greater than 0.5 ms/cm the data collected on that sampling cruise is suspect and will be flagged. If the difference is greater than or equal to 0.7 ms/cm the data will be removed from the database. For specific conductance standard 58.6, the difference between the two should be less than 1.00 ms/cm. If the difference is greater than 1.00 ms/cm the data collected on that sampling cruise is suspect and will be flagged. If the difference is greater than or equal to 1.5 ms/cm the data will be removed from the database. The Hydrolab should not be utilized until more extensive cleaning/maintenance is conducted and the instrument calibrates well.

### pH

8. Repeat step 1.
9. Rinse sensors using the “zero” buffer (buffer solution between 6.8 and 7.2). Discard rinse and fill the cal cup with this zero buffer. pH sensor must be covered. Allow readings to stabilize and record value in the logbook.
10. Rinse the sensor with DI water and discard.
11. Rinse with the pH buffer that will be used as a “slope” buffer (buffer solution 4 or 10).  
Discard rinse solution. Fill the cal cup with the slope buffer until the pH sensor is covered. Allow the readings to stabilize and record the value in the logbook.
12. Compare pre-calibration and post-calibration values.  
Compare the pH value displayed on the instrument to the standard value. If the difference between the two is less than 0.3 the instrument is in calibration. If the difference between the pre-calibration and post-calibration indicates that the instrument is

not in calibration, check again the next morning to make sure that the temperature was properly equilibrated (send these values to CBO). If the difference data collected on that sampling cruise is suspect and will be deleted from the database. That Hydrolab should not be utilized until more extensive cleaning/maintenance is conducted and the instrument calibrates well.

## **Dissolved Oxygen**

13. If the circulator is on, turn it off  
Select "setup/cal", "setup" and "sonde".  
Use the arrow key to choose "circlor: Off/On"  
press "select". Select the number 0 using the arrow key and select "done".
14. Fill the cap cup with DI water  
fill the cup to just below the O-ring of the DO probe.
15. Using a Kimwipe or other soft towel, carefully remove any water droplets from the DO membrane. Do not apply pressure to the membrane.
16. Cover the cal cup loosely with the plastic storage lid, and allow unit to equilibrate until temperature reading is stable.
17. Record the Barometric Pressure and temperature in the logbook.
18. The DO% reading should be close to 100%.
19. Using chart calculate the correct DO saturation.  
Based on Hg reading and temperature chart find the correct DO saturation value and record in the logbook in the "Chart" column.
20. Record the dissolved oxygen reading from the Sonde in the logbook in mg/l.
21. Compare pre-calibration and post-calibration values.  
Compare the Saturated DO values from the chart and the instrument values as recorded in the logbook. If the difference between the two is less than 0.5 mg/L the instrument is in calibration. If the difference between the Saturated DO value and the instrument indicates that the instrument is not in calibration, check again the next morning to make sure that the temperature was properly equilibrated (send these values to CBO). If the difference is still greater than or equal to 0.5 mg/L the data collected on that sampling cruise is suspect and will be removed from the database. Additionally, the instrument should not be utilized until more extensive cleaning/maintenance is conducted and the instrument calibrates well.
22. Replace the storage cup.  
Place a sufficient amount of tap water in the storage cup to keep the DO membrane moist. Do not allow the water to come in contact with the sensors as an ionic gradient may develop resulting in dilution of the electrolyte solutions.
23. After performing the required maintenance the field DO saturation check must be conducted during the next sampling event to ensure the instrument problem was corrected and to confirm the instrument is performing properly (see step 6 in section 3.2.2 for vertical profile).

## **4.3 ACID WASH ALL REUSABLE BOTTLES**

All sample bottles and coolers should be returned to the regions from DCLS via the courier on a regular

basis. Contact the Lab Liaison Officer (OWRM), if there is a problem in getting coolers or sample bottles back from DCLS. All 250 ml NTNP and 2 liter brown bottles need to be acid washed between runs. This step may be performed as a pre-cruise preparation or in the afternoon as a post-cruise activity.

1. Rinse, strip with 10% HCL and rinse 3 times with DI all 250 ml NTNP bottles and all large reusable containers and their caps. Replace the caps to seal bottles until their use.

#### **4.4 HOSE MAINTENANCE**

1. Because of the danger of contamination by bacteria and other particulate matter, the hoses utilized in the Chesapeake Bay's Virginia Tributary Monitoring Program (VTMP) are to be replaced annually.  
Hoses consisting of 3/4" ID by 1 1/8 inch clear vinyl tubing are currently being utilized by the VTMP.
2. To deter bacterial and algal growth in the tubing between purchase and replacement, the following cleaning should be conducted:

##### **AT THE END OF EACH SAMPLING RUN:**

Rinse the hoses with 5 gallons of freshwater and completely drain.

##### **ONCE PER MONTH:**

- a. Pump 5 gallons of a 5-10 % solution (a 5 % solution consists of 1 quart of vinegar mixed with 4 3/4 gallons of water) of white vinegar mixed with tap water through the hose and pump apparatus.
- b. Rinse with 5 gallons of pure fresh water and drain.

#### **4.5 LICOR SENSOR MAINTENANCE:**

##### **SIX MONTHS AFTER MANUFACTURE'S RECALIBRATION:**

**The air and water sensors should be compared to each other at the regional office. Program the air multiplication factor into the display unit for the underwater sensor following the instructions on p.22 and obtain a simultaneous reading from the air and water sensors. The air and water sensors should be within 5% of each other. If not, try to determine which sensor is not functioning properly by comparing the air and water sensors to another unit's sensors. Non-functioning sensors should be sent back to the manufacturer for repair.**

##### **EVERY YEAR:**

Return the sensors to the manufacturer (LI-COR) for calibration. Send a copy of the calibration drift report to CBO upon receipt.

#### **4.6 ELECTRONIC DATA TRANSFER (EDT) OF SAMPLE INFORMATION**

**Note: Secchi depth, weather code and tide stage for each station should be entered WQM only once with the 1 meter depth profile information.**

#### **4.6.1 Regular run information**

1. CBM WQM data sheets are filled out at each station.
2. Send the WQM data sheet information via WQM to DCLS prior to 9:00 A.M. on the day following the sampling cruise.
  - Record each sample sent to DCLS at each station and depth profile
  - Check data
3. Make copies of the WQM field sheets and send them along with the Li-Cor and Field Summary sheets to CBO (CBO will do QC on the data entry).
4. If technical problems arise during the data shipment and the 9:00 am deadline will not be met call Charlie Morgan (804-698-4473) or another appropriate OIS/WQA staff member (see call list in Appendix E). If the problem cannot be resolved, fax the WQM field sheets to DCLS Central Receiving (804-786-4270) and call Cindy Johnson at CBO (804-698-4385)

#### **4.6.2 QA/QC run information**

1. Entering QA/QC data into the Oracle database requires special steps not normally performed during a regular run. See Appendix D for details.

### **4.7 CORRECTIVE ACTION REQUEST**

The corrective action request (CAR) form is used to document problems and the steps needed, or taken, for correction. CAR forms may originate in regions, headquarters, or the labs. The main reason to use a CAR is the need to permanently change any procedure. This may be due to:

- Procedures are causing possible contamination to samples.
- Procedures need to be clarified.
- Methodology is inconsistent with new analysis/studies.

The corrective action form is utilized to identify problems that could affect data validity and possible courses of action to correct them (See Appendix A for form). In order for the corrective action plan to work, all personnel associated with the program must report all suspected abnormalities. This is especially important to field personnel because identification and correction of problems in sample collection and handling is essential for an effective program.

- Identify the problem.
- List possible causes (if known).
- Note the date the problem was identified.
- Identify samples or field data that may be invalid as a result of the problem.
- Make recommendations for corrective action (if possible).



**APPENDIX A**  
**LAB SHEETS AND FORMS**

Revised 01/10/2005



FIELD SUMMARY

River: \_\_\_\_\_ Date: \_\_\_\_\_

Field Chief: \_\_\_\_\_

Field Crew:

Weather:

Station	Time	Tide	Comments/Problems/Unusual Events

Calibration Check (Performed after sampling)

Hydrolab # \_\_\_\_\_

Notes:

Date/Time			
Conductivity	S.V.		
	I.V.		
pH	S.V.		
	I.V.		
D.O.	S.V.		
	I.V.		

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S.V. = Standard Value.

I.V. = Instrument Value.

Signature: \_\_\_\_\_ Send original to Chesapeake Bay Office after complete monthly sampling

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY  
W Q M DATA SHEET

PROGRAM CODE  
**CB**

COLLECTOR  
**DJW**

UNIT CODE  
**710-207**

DATE COLLECTED  
(YY/MM/DD)

\_ / \_ / \_.

STATION  
**8-YRK001.64**

LOCATION  
**Buoy 24**

BOTTOM DEPTH (meters)

\_\_\_\_\_

Special Study Number

**845101**

00116

WEATHER

00041

00067

Tide

Secchi Depth (m)

00078

D E P T H(m)	FIELD DATA				
	TEMP(°C) 00010	D.O.PROBE (mg/l) 00299	COND. (uMHOS/CM) 00094	SALINITY (ppt) 00096	pH (SU) 00400
1					
3					
5					
7					
9					
11					
13					
15					
BOTT.					

TIME FILTERED	Filtered by	Vol. filtered	DEPTH (m)	TIME COLLECTED	CATALOG NUMBER	GROUP CODE	CONTAINER NUMBER
			1		190-258	NME12	1
			1		190-268	NTNP	2
			1		190-037	FCLR	3
			1		190-232	PNC	4
			1		190-236	PP	5
			1		190-301	FCHLR	6
					190-021	NME7	1
					190-268	NTNP	2
					190-232	PNC	4



DEPARTMENT OF ENVIRONMENTAL QUALITY  
LI-COR LIGHT ATTENUATION

Collected By \_\_\_\_\_

Date \_\_\_\_\_

**Light attenuation measurements are taken at one half meter intervals until a reading of 10 uE is reached.**

STATION						
TIME						
SECCHI						
DEPTH (M)	AIR/WATER	AIR/WATER	AIR/WATER	AIR/WATER	AIR/WATER	AIR/WATER
SURFACE	/	/	/	/	/	/
0.5	/	/	/	/	/	/
1.0	/	/	/	/	/	/
1.5	/	/	/	/	/	/
2.0	/	/	/	/	/	/
2.5	/	/	/	/	/	/
3.0	/	/	/	/	/	/
3.5	/	/	/	/	/	/
4.0	/	/	/	/	/	/
4.5	/	/	/	/	/	/
5.0	/	/	/	/	/	/
5.5	/	/	/	/	/	/
6.0	/	/	/	/	/	/
6.5	/	/	/	/	/	/
7.0	/	/	/	/	/	/
WEATHER						

Notes: Sunrise:

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**DEPARTMENT OF ENVIRONMENTAL QUALITY  
CORRECTIVE ACTION REQUEST FORM (CAR)**

**Section I - Completed by originator**

Date:

Submitted By:

Region:

A. Nature of Problem:

B. Possible cause (if known):

C. Date problem identified:

D. Samples that may be invalid:

E. Recommended Corrective Action (optional):

**D.E.Q. CAR con't.**

**Section II - Completed by Regional Technical Services Supervisor**

A. Recommended Corrective Action:

Technical Services Supervisor, Signature:

Date:

**Section III - Completed by CBO Monitoring Project Coordinator**

A. Recommended Corrective Action:

B. Follow up action required: YES / NO

C. Implementation will begin on:

CBO Project Coordinator Signature:

Date:

**Section IV - Completed by Headquarters QA/QC (optional)**

A. Recommendations / Comments:

QA/QC Signature:

Date:

# Hydrolab Calibrations and Post Cruise Calibration Checks

Hydrolab # \_\_\_\_\_

Cal. Type	Date	Time	Temp.	Press. (mm Hg.)	Theor. (chart) DO	Meter initial DO	Meter Cal. DO	pH 7 init./ calib.	pH 4 or 10 init./ calib.	Cond. init./ calib.	Batt. Volt.	Init./R un ID
Pre												
Post												
Pre												
Post												
Pre												
Post												
Pre												
Post												
Pre												
Post												
Pre												
Post												
Pre												
Post												
Pre												
Post												



# CBP Tributary Site Visit Summary

Date: \_\_\_\_\_

Field personnel: \_\_\_\_\_

River: \_\_\_\_\_

Region: \_\_\_\_\_

Site visit by: \_\_\_\_\_

## A. Precruise Procedures:

**A1. Hydrolab Precalibration:**

	<u>Yes</u>	<u>No</u>
1. Precalibration normal and in accordance with SOP.	<input type="checkbox"/>	<input type="checkbox"/>
2. All expected parameters calibrated.	<input type="checkbox"/>	<input type="checkbox"/>
3. Expiration date not exceeded on pH buffer, 1.0 Molar stock solution less than 1 year old.	<input type="checkbox"/>	<input type="checkbox"/>
4. Utilized fresh Standards to calibrate conductivity.	<input type="checkbox"/>	<input type="checkbox"/>
5. Instrument operation good, in accordance with SOP.	<input type="checkbox"/>	<input type="checkbox"/>
6. Regional office maintains calibration/maintenance logbook.	<input type="checkbox"/>	<input type="checkbox"/>

**A2. Sample Container and Filtration Equipment Preparation:**

	<u>Yes</u>	<u>No</u>
1. Filtration equipment (towers, bases, 250 ml bottles, graduated Cylinders and 2 L HDPE brown bottles ) acid washed, DI water rinsed 3 times.	<input type="checkbox"/>	<input type="checkbox"/>
2. Filtration utensils/new sample bottles DI water rinsed 3 times.	<input type="checkbox"/>	<input type="checkbox"/>

**A3. Licor Unit Preparation:**

	<u>Yes</u>	<u>No</u>
1. Sensors washed with mild detergent such as Liquinox® prior to cruise	<input type="checkbox"/>	<input type="checkbox"/>
2. Averaging time set to 5 seconds	<input type="checkbox"/>	<input type="checkbox"/>
3. Multipliers entered correctly	<input type="checkbox"/>	<input type="checkbox"/>
4. Calibration log maintained	<input type="checkbox"/>	<input type="checkbox"/>

**A4. NIST Thermistor Check**

	<u>Yes</u>	<u>No</u>
1. Temperature difference between probe and NIST certified thermistor at 25-30 °C is +/- 0.5 °C probe value : _____ Nist certified thermistor value : _____	<input type="checkbox"/>	<input type="checkbox"/>
2. Temperature difference between probe and NIST certified thermistor at 4°C is +/- 0.5 °C probe value : _____ Nist certified thermistor value : _____	<input type="checkbox"/>	<input type="checkbox"/>

Comments: \_\_\_\_\_



## B. Field Collection Procedures:

### B1. Water Sample Collection:

- |  | <u>Yes</u>               | <u>No</u>                |
|--|--------------------------|--------------------------|
| 1. Stations sampled according to original schedule.              | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. All stations sampled during daylight hours.                   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Obtained samples 1 m above bottom sediment/1 m below surface. | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Samples collected via pump and hose apparatus.                | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Pump adequately cleared/flushed.                              | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Sample bottles sample rinsed prior to collection.             | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Sufficient sample volume collected for all parameters.        | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Samples properly labeled using ink.                           | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Samples iced immediately/preserved according to SOP.          | <input type="checkbox"/> | <input type="checkbox"/> |

### B2. Hydrolab Procedures:

- |   | <u>Yes</u>               | <u>No</u>                |
|---|--------------------------|--------------------------|
| 1. Magnetic impeller works properly; DO membrane normal.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Readings in 2 m increments from 1 m above bottom sediment (raised to 1st whole odd interval) to 1 m below surface. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Hydrolab readings stabilized prior to recording information on data sheets. D.O. readings recorded last.           | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Instrument left on all day.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Field parameters recorded to tenths place and not rounded based on the hundredths place.                           | <input type="checkbox"/> | <input type="checkbox"/> |

### B3. Light Attenuation Procedures:

- |  | <u>Yes</u>               | <u>No</u>                |
|--|--------------------------|--------------------------|
| 1. Initial readings obtained with deck sensor/ 0.1 meter with water sensor, subsequent readings in 0.5 meter increments. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Sensor position minimized surface reflection.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Deck/water profiles continued to depth value of 10 micro Einsteins or less.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Minimum 5 second waiting period prior to each reading.  | <input type="checkbox"/> | <input type="checkbox"/> |

### B4. General Filtration Procedures:

- |  | <u>Yes</u>               | <u>No</u>                |
|--|--------------------------|--------------------------|
| 1. DI water rinsed filtration towers, bases, tweezers, graduated cylinders prior to use /between samples according to SOP. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Filters stored properly prior to use.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Only clean forceps used for filter transfers.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Filters handled properly.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Sample resuspended by shaking for filtration.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Volumes filtered recorded on tags and data sheets.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. All sample filters kept in Ziplock storage bags, iced immediately after collection.                                     | <input type="checkbox"/> | <input type="checkbox"/> |

### B5. Chlorophyll Filtration Procedures:

- |   | <u>Yes</u>               | <u>No</u>                |
|---|--------------------------|--------------------------|
| 1. Vacuum pressure during filtration between 10-12 psi. | <input type="checkbox"/> | <input type="checkbox"/> |

- |   |                          |                          |
|---|--------------------------|--------------------------|
| 2. Sufficient sample volume filtered to color filter pad, if less than 300 ml of sample filtered through the first pad, filtered one/ two more filter pads to obtain a total of at least 150 ml of sample filtered. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Filtration duration limited to 10 minutes or less.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Added MgCO <sub>3</sub> to last 10-25 mls of sample being filtered.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Removed filtration vacuum prior to filter being completely dry/ but dry enough to ensure no sample losses during filter folding.   | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Wrapped filters containing chlorophyll samples in aluminum foil/ immediately iced them according to SOP.   | <input type="checkbox"/> | <input type="checkbox"/> |

**B6. Nutrient Filtration Procedures:**

- |  | <u>Yes</u>               | <u>No</u>                |
|--|--------------------------|--------------------------|
| 1. Vacuum pressure kept 10-12 mm Hg or below.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Muffled PNC filters prior to use, placed filters grid side down according to SOP. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Filtered sufficient volume of sample to obtain color.                             | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Rinsed 250 ml NTNP bottle with filtrate prior to collecting the sample.           | <input type="checkbox"/> | <input type="checkbox"/> |

**B7. Miscellaneous:**

- |  | <u>Yes</u>               | <u>No</u>                |
|--|--------------------------|--------------------------|
| 1. Secchi depth measured during daylight hours on shady side of vessel without using sunglasses. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Duplicate samples obtained according to SOP.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Equipment blank samples obtained according to SOP.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Is PMTF required?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. A temperature bottle has been placed in the cooler  | <input type="checkbox"/> | <input type="checkbox"/> |

Comments:

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**C. Phytoplankton and Productivity Sample Collections**

**C1. Photic zone**

- |   | <u>Yes</u>               | <u>No</u>                |
|---|--------------------------|--------------------------|
| 1. Photic zone composites consisted of 5 equal subsamples determined by multiplying the Secchi depth, depth by 3.5 (or from chart based on Secchi depth) and dividing that by 5 | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. The hose was cleared adequately between depths   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. The carboys were mixed thoroughly prior to pouring the samples   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Bottles were not overfilled  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. The water temperature was clearly written on the tops of the productivity samples  | <input type="checkbox"/> | <input type="checkbox"/> |

6. Samples were labeled properly and the 1000 ml and 125 ml samples were immediately iced

**C2. Below Photic Zone** Yes No

1. Carboys were rinsed thoroughly prior to obtaining the composite

2. Composite sample consisted of 5 equal subsamples from the bottom third of the water column

3. The hose was cleared adequately between depths

4. The carboys were mixed thoroughly prior to pouring the samples

5. Samples were not overfilled

6. Samples were labeled properly and the 125 ml samples were immediately iced

**C3. Sample delivery** Yes No

1. Delivery times were confirmed with ODU ahead of time

2. Samples were properly iced and delivered same day to ODU

**D. Post Cruise Procedures:**

**D1. Field Personnel Post Cruise Procedures:** Yes No

1. Hydrolab post cruise calibration check conducted according to SOP/normal.

2. Hose cleaning/draining procedures completed according to SOP.

**D2 Data Entry Audit**

1. Three months of field sheets were selected randomly by CO personnel to review.

2. Percent errors found equaled 10 percent or less

a. Total number errors found = \_\_\_\_\_

b. Total number data points reviewed = \_\_\_\_\_

Percent error = step a/step b\*100% = \_\_\_\_\_

**VIRGINIA TRIBUTARY MONITORING PROGRAM  
PROCEDURE MODIFICATION TRACKING FORM**

This form is used to document modifications made to the Virginia tributary Monitoring Program's procedures or methods. A detailed method description including the proposed modification should be completed prior to submittal to DEQ's Chesapeake Bay Program at the Central office.

DATE SUBMITTED		DATE APPROVED	
REQUESTOR NAME		ORGANIZATION	
NEWLY PROPOSED MODIFICATION [ ]		FIELD APPROVED MODIFICATION [ ]	
APPROVED BY:		DATE:	
TYPE OF PROCEDURE/METHOD	SAMPLING [ ] ANALYTICAL [ ] FIELD MEASUREMENT [ ] OTHER [ ] SPECIFY:		
DURATION	PERMANENT [ ] EFFECTIVE DATE: TEMPORARY [ ] START DATE: END DATE:		
PROCEDURE/METHOD DESCRIPTION			
MODIFICATION DESCRIPTION			
JUSTIFICATION FOR MODIFICATION			
ANALYTICAL PARAMETERS THAT MAY BE AFFECTED BY THIS CHANGE			
AFFECTED QA PLAN(S) (INCLUDE TITLE, REVISION AND DATE)			
PMTF COMPLETED BY			

CBO REVIEW/APPROVAL: NAME: \_\_\_\_\_  
TITLE: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

DATE: \_\_\_\_\_

**Field Filtration Log**

Initials \_\_\_\_\_

RO	Station	Date	Sample Type	Depth (m)	Time Collected	Time Filtered	Volume Filtered (ml)		
							Chla	PNC	PP
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			R/S1	1					
			R/S1						
			S2	1					
			S2						
			EB	0					





**Appendix B**  
**Saturated DO Table**  
**and**  
**Primary Productivity Sample Increment Chart**

Revised 04/08/2002



## Saturated DO Table

Temp in °C	O <sub>2</sub> concentrations in mg/l									
	0	.1	.2	.3	.4	.5	.6	.7	.8	.9
5	12.75	12.71	12.68	12.65	12.61	12.58	12.55	12.52	12.48	12.45
6	12.42	12.39	12.36	12.32	12.29	12.26	12.23	12.20	12.17	12.14
7	12.11	12.08	12.05	12.02	11.99	11.96	11.93	11.90	11.87	11.84
8	11.81	11.78	11.758	11.72	11.69	11.67	11.64	11.61	11.58	11.55
9	11.53	11.50	11.47	11.44	11.42	11.39	11.36	11.33	11.31	11.28
10	11.25	11.23	11.20	11.18	11.15	11.12	11.10	11.07	11.05	11.02
11	10.99	10.97	10.94	10.92	10.89	10.87	10.84	10.82	10.79	10.77
12	10.75	10.72	10.70	10.67	10.65	10.63	10.60	10.58	10.55	10.53
13	10.51	10.48	10.46	10.44	10.41	10.39	10.37	10.35	10.32	10.30
14	10.28	10.26	10.23	10.21	10.19	10.17	10.15	10.12	10.10	10.08
15	10.06	10.04	10.02	9.99	9.97	9.95	9.93	9.91	9.89	9.87
16	9.85	9.83	9.81	9.79	9.76	9.74	9.72	9.70	9.68	9.66
17	9.64	9.62	9.60	9.58	9.56	9.54	9.53	9.51	9.49	9.47
18	9.45	9.43	9.41	9.39	9.37	9.35	9.33	9.31	9.30	9.28
19	9.26	9.24	9.22	9.20	9.19	9.17	9.15	9.13	9.11	9.09
20	9.08	9.06	9.04	9.02	9.01	8.99	8.97	8.95	8.94	8.92
21	8.90	8.88	8.87	8.85	8.83	8.82	8.80	8.78	8.76	8.75
22	8.73	8.71	8.70	8.68	8.66	8.65	8.63	8.62	8.60	8.58
23	8.57	8.55	8.53	8.52	8.50	8.49	8.47	8.46	8.44	8.42
24	8.41	8.39	8.38	8.36	8.35	8.33	8.32	8.30	8.28	8.27
25	8.25	8.24	8.22	8.21	8.19	8.18	8.16	8.15	8.14	8.12
26	8.11	8.09	8.08	8.06	8.05	8.03	8.02	8.00	7.99	7.98
27	7.96	7.95	7.93	7.92	7.90	7.89	7.88	7.86	7.85	7.83
28	7.82	7.81	7.79	7.78	7.77	7.75	7.74	7.73	7.71	7.70
29	7.69	7.67	7.66	7.65	7.63	7.62	7.61	7.59	7.58	7.57
30	7.55	7.54	7.53	7.51	7.50	7.49	7.48	7.46	7.45	7.44
mm Hg.	Corr.Factor	mm Hg.	Corr.Factor	mm Hg	Corr.Factor	mm Hg	Corr.Factor	mm Hg	Corr.Factor	
775	1.02	750-746	0.987	725-721	0.953	700-696	0.92			
770-766	1.014	745-741	0.98	720-716	0.947	695-691	0.914			
765-761	1.007	740-736	0.973	715-711	0.94	690-686	0.907			
760-756	1.0	735-731	0.967	710-706	0.934	685-681	0.90			
755-751	0.993	730-726	0.96	705-701	0.927	680-676	0.893			

## Primary Productivity Sampling Increment Charts

### A. TOP SAMPLE

Secchi Depth (m)	Sampling Start Depth (m)	Sampling Increment (m) 5X
0.1	0.35	.07
0.2	0.7	.14
0.3	1.05	.21
0.4	1.4	.28
0.5	1.75	.35
0.6	2.1	.42
0.7	2.45	.49
0.8	2.8	.56
0.9	3.15	.63
1.0	3.5	0.7
1.2	4.2	0.84
1.4	4.9	0.98
1.6	5.6	1.12
1.8	6.3	1.26
2.0	7.0	1.4

### B. BOTTOM SAMPLE

Depth (m)	Total Sampling Area (m)	Sampling Increment (m) 5X
4	1.3	.26
5	1.7	.34
6	2.0	.4
7	2.3	.46
8	2.7	.54
9	3.0	.6
10	3.3	.66
11	3.7	.74
12	4.0	.8

## **APPENDIX C**

# **COMMONLY USED GROUP CODES, CONTAINER NUMBERS AND CATALOG NUMBERS**

Revised 01/10/2005



**NRO**

DEPTH	GROUP CODE	CONTAINER NUMBER
<b>S</b>	BST	1
	TPLL*	2
	TNME7	3
	NTNP	4
	PNC	5
	PP	6
	FCHLR	7
	CDOM	8
	TSS	9
<b>B</b>	NTNP	4
	PNC	5
	PP	6
	NME7	8

**PRO**

DEPTH	GROUP CODE	CONTAINER NUMBER
<b>S</b>	NME12	1
	NTNP	2
	FCMFENT4*	3
	(HTIT)*	(4)*
	PNC	5
	PP	6
	FCHLR	7
<b>B</b>	NME7	1
	NTNP	2
	PNC	5
	PP	6

**TRO**

DEPTH	GROUP CODE	CONTAINER NUMBER
<b>S</b>	NME7	1
	NTNP	2
	FCMFENT4*	3
	PNC	4
	PP	5
	FCHLR	6
<b>B</b>	NME7	1
	NTNP	2
	PNC	4
	PP	5

\* Group codes collected on stations that are sampled for the AQ program.



## **APPENDIX D**

# **ENTERING QA/QC INFORMATION INTO WQM**

Revised 03/13/2003



## QA/QC Checklist for WQM

**(note: If problems occur during data entry use the call list on the next page to attempt to identify the cause and find a solution. Detailed instructions for WQM data entry can be found in the CEDS manual and following the call list.)**

### **A. In \_QACB Run (e.g. PQACB for PRO; NQACB for NRO and TQACB for TRO):**

1. Put in correct station ID.
2. Change Blank/Dup designation from R to S2 for containers 11-20.
3. Change Blank/Dup designation from R to EB for containers 21-27.
4. Change Bottom Depth from 10 to actual depth and dummy time to actual time **after data collection.**

### **B. In Regular Run:**

1. Change Blank/Dup from R to S1 for containers 1-9 for station chosen for QA/QC.

## CALL LIST FOR SAMPLE RELATED ISSUES

04/26/05

This is a list of persons, listed in order of priority, to call for help to the listed problems.

### **EMERGENCY LABORATORY SERVICES (all area code 804)**

After Hours Emergency Services Officer      418-9923 (pager)

Ed Shaw – DCLS Asst. Bureau Dir. of Analytical Services & DEQ Coordinator  
648-4480 x152      371-7973 (fax)  
[ed.shaw@dgs.virginia.gov](mailto:ed.shaw@dgs.virginia.gov)

Dr. Thomas York - DCLS Deputy Director  
641-7071 (cell)      378-8203 (home)

Dr. James L. Pearson - Director  
648-4480

### **ROUTINE SAMPLE DELIVERY PROBLEMS (all area code 804)**

Charlie Morgan	698-4473	837-1526 (C) 748-2415 (H)	FAX 698-4116
Roger Stewart	698-4449	370-8043 (C) 739-5995 (H)	FAX 698-4116
Cindy Johnson	698-4385		
Darryl Glover	698-4321	304-6752 (C)	FAX 698-4522
Melody Morton-DCLS	648-4480 ext. 140	418-9932 (pager)	FAX 786-4270
Lewis Baker-DCLS	648-4480 ext. 141		FAX 786-4270

### **PROBLEMS SPECIFIC TO DATA TRANSFER**

Charlie Morgan	698-4473*	837-1526 (C) 748-2415 (H)	FAX 698-4116
Roger Stewart	698-4449*	370-8043 (C) 739-5995 (H)	FAX 698-4116

Rupesh Bharad 698-4398\*

DEQ Help Desk      698-4100

Cindy Johnson      698-4385\*

D. Scott Wagner      698-4548 takes care of FTP site.

\* Can perform manual download of WQM data to ship to DCLS.

## **SAMPLE COLLECTION INFORMATION & SCHEDULING WITH DCLS**

This numbers are provided for non-routine sample collection and scheduling. Please make certain when scheduling bacteria samples that you confirm that one of the following persons know when and how many samples will be arriving and what services will be requested.

Charlie Morgan      804-698-4473 (O)      837-1526 (C)      804-748-2415 (H)      698-4116(fax)  
[chmorgan@deq.virginia.gov](mailto:chmorgan@deq.virginia.gov)

Ed Shaw - Asst. Bureau Dir. of Analytical Services & DEQ Coordinator  
804-648-4480      804-641-7056 (Blackberry)      804-371-7973 (fax)  
[ed.shaw@dgs.virginia.gov](mailto:ed.shaw@dgs.virginia.gov)

Deborah Paul - Group Manager      Bacteria sample scheduling only  
804-648-4480 x310      (804) 997-3555 (pager)      804-371-0666 (fax)  
[debbie.paul@dgs.virginia.gov](mailto:debbie.paul@dgs.virginia.gov)

## **ORDERING SAMPLE KITS AND CONTAINERS**

Thomas Lindfors, DCLS Customer Service – Planning Group  
804-648-4480      804-418-9924 (pager)

Mattie Jones, DCLS Customer Service Support Technician  
804-648-4480 ext. 104

## **ORDERING CLEAN METALS KITS**

Norma Roadcap, Metals & Radiochemistry  
804-648-4480 x 350  
[norma.roadcap@dgs.virginia.gov](mailto:norma.roadcap@dgs.virginia.gov)

## **COURIER SERVICE**

Thomas Lindfors, DCLS Customer Service – Planning Group  
804-648-4480      804-418-9924 (pager)

## **ORDERING CHAIN OF CUSTODY EQUIPMENT**

Lewis Baker, DCLS Sample and Records Management  
804-648-4480 ext. 141

## ***PRIORITY CODES***

Every priority code other than the standard 7 (the usual turnaround time (TAT), as listed in the catalog of services) has a cost multiplier associated with it.

Code 7 – standard TAT, listed price

Code 6 – Chain of custody, standard TAT, 1.1 X listed price

Code 5 – 1/2 standard TAT, 1.5 X listed price

Code 4 – 7 day TAT, 2 X listed price

Code 1 – Emergency sample. Pricing will be determined after completion of analysis. Since this requires lab employees to work around the clock to complete the analysis, these samples must be approved by a RD or agency director.

Bear in mind that timed analysis (BOD<sub>30</sub>) cannot be run any faster and samples requiring immediate analysis (bacteria) will be done immediately anyway.

## Entering QA/QC data into WQM:

March 02, 2001

**Note: Advance scheduling of sampling runs must be completed by the 25<sup>th</sup> day of the month prior to the month of sample collection.**

### A. Collection of QA/QC samples:

The types and frequency of collection of QA/QC samples is described in each individual program's SOP.

### B. QA/QC Run IDs:

QA/QC Run IDs consists of the first letter of the region conducting the sampling followed by the letters QA and the 2-letter program code under which the samples are collected (e.g. TQAAQ for the Tidewater regional QA run for the Ambient Monitoring Program).

### C. Blank/Dup designations (Note: all QA/QC samples are stored under the QA/QC Run ID except FB and S1).

**CRM** - Certified Reference Material

**CB** - Container Blank

**FB** - Filter Blank

**R** - Regular Sample (default designation)

**S1** - First subsample of a field split sample (these data are stored in the regular run id)

**SRM** - Standard Reference Material

**H** - Horizontally integrated composite sample

**HV** - Horizontally and Vertically integrated sample.

**C** - Composite Sample

**EB** - Equipment Blanks

**M** - Multiple Samples

**RB** - Reagent Blank

**S2** - Second subsample of a field split sample (these data are stored in the QA/QC run ids)

**TB** - Trip Blank

**V** - Vertically integrated composite sample

### D. Container number designations:

**1 - 9** Regular sample containers and/or **S1** sample containers

**11 - 19** **S2** sample containers (note the ones place of a S2 container is the same as the corresponding S1 container e.g. if S1 for PNC is container number 5 then S2 for PNC is container number 15)

**21-29** Equipment Blanks (the ones place for equipment blanks also correspond to the S1 containers for the same sample types e.g. S1 for PNC is 5 then the EB for PNC is 25).

**31-39** Filter Blank (the ones digit must correspond to the S1 or R sample container for the group code utilizing that type of filter e.g. PNC)

**41-43** DI Blanks

**51-53** Reagent Blanks

### E. Lab Proc Code designations:

**D** - indicates to the lab to perform Laboratory splits

**DM** - indicates to the lab they should perform a lab split and a matrix spike

**M** - indicates to the lab they should perform a matrix spike

### F. Scheduling QA/QC into WQM: (Note: the following instructions assume the regular Run IDs have

**already been established in the Yearly Scheduling Screen for WQM. If the runs have not previously been established in WQM, please consult the Water Media Monitoring portion of the CEDS manual for instructions on how to do so.)**

Figure 1. Yearly Run Schedule

**Yearly Runs Schedule:**

1. In CEDS click on **Applications/Environmental Monitoring/Water/Yearly Runs Schedule**.
2. In the Yearly Run Schedule set up a generic QA/QC Run ID (e.g. TQACB).
3. Use **QA** as the **Station ID** (Note: this already exists in the Station List) and **Survey Program**.
4. Enter the **Lab Proc Code** for NTNP and HTIT containers as **M** (Figure 1).
5. Enter the appropriate depths (0 for **EB**), Container IDs, Parameter Group Codes, and Save. Once this is completed, the QA/QC Run ID can be used for all QA sampling events. When appropriate add additional lines with 0 depths for reagent blanks and container blanks (**RB** and **CB**) using the group codes in which the reagents are utilized (e.g TNUTL for sulfuric acid and HTIT for nitric acid).

Run ID	Station ID	Stat. Order	Survey Program	Depth Desc	Depth	% FRB	Container ID	Lab Proc Code	Special Study #	Parameter Group Code
TQACB	QA	1	QA	S	0	50	21		845101	NME21
TQACB	QA	1	QA	S	0	50	22		845101	NTNP
TQACB	QA	1	QA	S	0	50	24		845101	PNC
TQACB	QA	1	QA	S	0	50	25		845101	PP
TQACB	QA	1	QA	S	0	50	26		845101	FCHLR
TQACB	QA	1	QA	S	1	50	11	D	845101	NME21
TQACB	QA	1	QA	S	1	50	12	DM	845101	NTNP
TQACB	QA	1	QA	S	1	50	13		845101	FCLR
TQACB	QA	1	QA	S	1	50	14		845101	PNC
TQACB	QA	1	QA	S	1	50	15		845101	PP
TQACB	QA	1	QA	S	1	50	16		845101	FCHLR
TQACB	QA	1	QA	B	10	50	11	D	845101	NME7
TQACB	QA	1	QA	B	10	50	12	DM	845101	NTNP
TQACB	QA	1	QA	B	10	50	14		845101	PNC
TQACB	QA	1	QA	B	10	50	15		845101	PP

Figure 2. Get Yearly Run Data tab

**Monthly scheduling:**

1. Click on **Applications/Environmental Monitoring/Monthly run schedule**.
2. Click on the **Get Yearly Run Data** tab.
3. Enter the regular Run ID (e.g. TRAP1) and the date to be collected on the first line of the pop-up screen. On the next line enter the QA/QC Run ID (e.g. TQACB) and the date to be collected (Figure 2).
4. Click on the **Get Yearly Run Data** button. The database will be automatically updated with the runs chosen and will be displayed in the **Monthly Run Schedule** screen.
5. Click on the **Query** button.
6. Enter the regular Run ID, the station chosen for QA/QC and the date as scheduled in step 5.
7. Change the **Blank/Dup** designation for all containers to **S1** (Figure 3a).
8. **Save**.
9. Click on the **Query** button.
10. Enter the QA/QC Run ID (TQACB) and the date scheduled in step 3.
11. Change the **Station ID** from QA to the name of the station chosen for QA/QC sampling for all samples (e.g. 3-RPP010.60).
12. Change the **Blank/Dup** designation for all containers numbered 11-17 (depending on how many samples

Run ID	Sample Collect Date
TRAP1	04/21/2001
TQACB	04/21/2001

are being collected) to **S2** (Figure 3b). (Make **S2** containers are the same as **S1** containers).

13. Change the **Blank/Dup** designation for all containers numbered 21-27 (depending on how many samples are being collected) to **EB** (Figure 3b).
14. Save the information and **Exit** CEDS.

**Figure 3. Completed Monthly run Schedules.**

**a. Completed QA station in regular Run ID**  
(middle depths and Licor excluded)

The screenshot shows a software window titled "Virginia Department of Environmental Quality - [Monthly Run Schedule]". The main area displays a table with the following columns: Run ID, Station ID, Survey Program Desc, Depth, Depth, % FRB, Blank / Dup, Cont ID, Lab Proc Code, Special Studies #, Parameter Group Cd, and Sample Collect Date. The data rows show runs for station 3-RPP010.60 with various depths (29, 1, 29, 1, 1, 29, 1, 29, 1) and container IDs (S1, S1, S1, S1, S1, S1, S1, S1, S1). Parameters include NME7, NME21, NTNP, FCLR, PNC, and PP. The status bar at the bottom indicates "RUN ID (CRUISE) SAMPLING Record: 1/10".

Run ID	Station ID	Survey Program Desc	Depth	Depth	% FRB	Blank / Dup	Cont ID	Lab Proc Code	Special Studies #	Parameter Group Cd	Sample Collect Date
TRAP1	3-RPP010.60	CB	B	29	50	S1	1	D	845101	NME7	04/21/2001
TRAP1	3-RPP010.60	CB	S	1	50	S1	1	D	845101	NME21	04/21/2001
TRAP1	3-RPP010.60	CB	B	29	50	S1	2	D	845101	NTNP	04/21/2001
TRAP1	3-RPP010.60	CB	S	1	50	S1	2	D	845101	NTNP	04/21/2001
TRAP1	3-RPP010.60	CB	S	1	50	S1	3		845101	FCLR	04/21/2001
TRAP1	3-RPP010.60	CB	B	29	50	S1	4		845101	PNC	04/21/2001
TRAP1	3-RPP010.60	CB	S	1	50	S1	4		845101	PNC	04/21/2001
TRAP1	3-RPP010.60	CB	B	29	50	S1	5		845101	PP	04/21/2001
TRAP1	3-RPP010.60	CB	S	1	50	S1	5		845101	PP	04/21/2001
TRAP1	3-RPP010.60	CB	S	1	50	S1	6		845101	FCHLR	04/21/2001

**b. Completed QA/QC Run ID**

The screenshot shows a software window titled "Virginia Department of Environmental Quality - [Monthly Run Schedule]". The main area displays a table with the following columns: Run ID, Station ID, Survey Program Desc, Depth, Depth, % FRB, Blank / Dup, Cont ID, Lab Proc Code, Special Studies #, Parameter Group Cd, and Sample Collect Date. The data rows show runs for station 3-RPP010.60 with depths of 10, 1, 10, 1, 1, 10, 1, 10, 1, 10, 1, 1, 10, 1, 10, 1, 10, 1, 0, 0, 0, 0, 0. Container IDs include R, R. Parameters include NME7, NME21, NTNP, FCLR, PNC, and PP. The status bar at the bottom indicates "STATION NAME - list of values available Record: 15/15".

Run ID	Station ID	Survey Program Desc	Depth	Depth	% FRB	Blank / Dup	Cont ID	Lab Proc Code	Special Studies #	Parameter Group Cd	Sample Collect Date
TQACB	3-RPP010.60	QA	B	10	50	R	11	D	845101	NME7	04/21/2001
TQACB	3-RPP010.60	QA	S	1	50	R	11	D	845101	NME21	04/21/2001
TQACB	3-RPP010.60	QA	B	10	50	R	12	DM	845101	NTNP	04/21/2001
TQACB	3-RPP010.60	QA	S	1	50	R	12	DM	845101	NTNP	04/21/2001
TQACB	3-RPP010.60	QA	S	1	50	R	13		845101	FCLR	04/21/2001
TQACB	3-RPP010.60	QA	B	10	50	R	14		845101	PNC	04/21/2001
TQACB	3-RPP010.60	QA	S	1	50	R	14		845101	PNC	04/21/2001
TQACB	3-RPP010.60	QA	B	10	50	R	15		845101	PP	04/21/2001
TQACB	3-RPP010.60	QA	S	1	50	R	15		845101	PP	04/21/2001
TQACB	3-RPP010.60	QA	S	1	50	R	16		845101	FCHLR	04/21/2001
TQACB	3-RPP010.60	QA	S	0	50	R	21		845101	NME21	04/21/2001
TQACB	3-RPP010.60	QA	S	0	50	R	22		845101	NTNP	04/21/2001
TQACB	3-RPP010.60	QA	S	0	50	R	24		845101	PNC	04/21/2001
TQACB	3-RPP010.60	QA	S	0	50	R	25		845101	PP	04/21/2001
TQACB	3-RPP010.60	QA	S	0	50	R	26		845101	FCHLR	04/21/2001

## Field Data entry Screen Changes

(Note: If the date or samples scheduled in the Monthly schedule screen was different from that collected, make the changes in the Monthly schedule screen before following the steps below):

Figure 4. Get Monthly Run Data tab.

1. Click on **Applications/Environmental Monitoring/Field Data**.
2. Click on the **Get Monthly Run Data** tab (Figure 4).
3. Enter the regular Run ID, Collector's initials, sample Collect Date and Collecting Agency. then click on **Get Monthly Run Data**. This will automatically populate the Database with the information for the run and display it in the **Field Data Samples** screen.
4. Change the time(s) of collection and enter the field information for all stations sampled (Figure 5a) **Save**.
5. Repeat steps 2 through 4 for the QA/QC Run ID (note field information is not repeated with the QA/QC run) (Figure 5b).
6. **Save and Exit**.

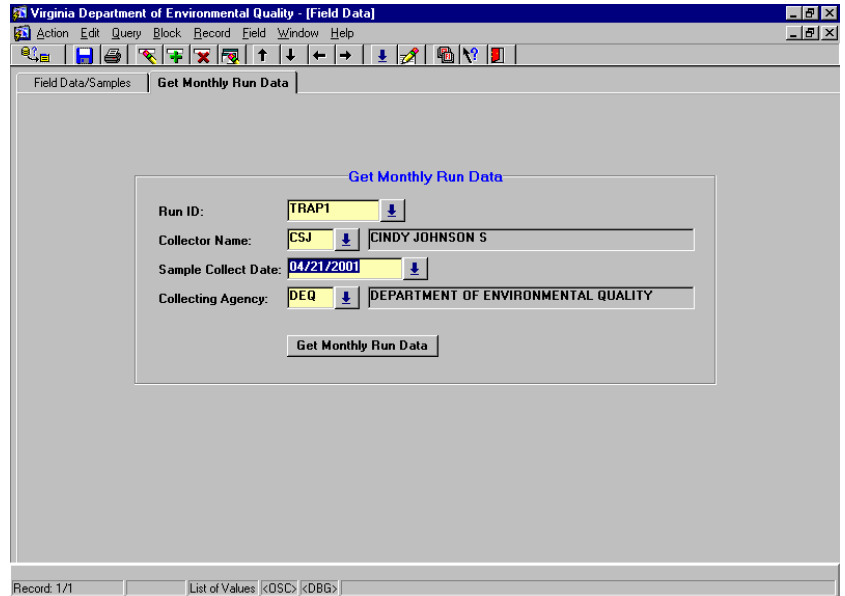


Figure 5. Completed changes in Field Data screen.

### a. Completed changes in regular Run ID.

### b. Completed changes in QA/QC Run ID.

Run ID	Collector	Collecting Agency	Survey Program	Special Study #	Shipping Seal No.	Chain of Custody Shipped Date
IAPP010.60	CSJ	DEQ	CB	84510		

Station ID	Date Time	Depth Desc	Depth	% FRB	Wx	Tide	Temp C	pH	DO	Specific Conduct	Salinity	Flow CFS
IAPP010.60	04/21/2001 1000	S	1	50	3	Ebb	21.5	8.5	8.76	23000	8.1	
IAPP010.60	04/21/2001 1000	M	3	50			21.45	8.75	23000	8.3		
IAPP010.60	04/21/2001 1000	M	5	50			21.45	8.75	23000	8.2		
IAPP010.60	04/21/2001 1000	M	7	50			21.40	8.73	23000	8.1		
IAPP010.60	04/21/2001 1000	M	9	50			21.40	8.73	23000	7.8		
IAPP010.60	04/21/2001 1000	M	11	50			21.40	8.73	23000	7.8		
IAPP010.60	04/21/2001 1000	M	13	50			21.37	8.71	22998	7.7		
IAPP010.60	04/21/2001 1000	M	15	50			21.37	8.71	22995	7.6		
IAPP010.60	04/21/2001 1000	M	17	50			21.37	8.71	22995	7.6		

Run ID	Collector	Collecting Agency	Survey Program	Special Study #	Shipping Seal No.	Chain of Custody Shipped Date
3-RPP010.60	CSJ	DEQ	QA	84510		

Station ID	Date Time	Depth Desc	Depth	% FRB	Wx	Tide	Temp C	pH	DO	Specific Conduct	Salinity	Flow CFS
3-RPP010.60	04/21/2001 1000	S	0	50								
3-RPP010.60	04/21/2001 1000	B	10	50								

## **APPENDIX E**

# **BACKUP SAMPLE DROP-OFF PROCEDURES**

Revised 04-01-2004



**Note: In December 1998 DCLS contracted a courier to pick up samples from all the regions. The following sample drop-off procedures will be utilized only in cases where DCLS courier is unavailable.**

**I. Schedule**

Tributary sampling occurs once each month for each river:

**II. General Procedures**

As far as possible in advance, contact the appropriate personnel at each region affected to coordinate the time of day you will meet and pick up the samples. Drop off samples at DCLS at 8:00 am to the sample receiving area out front. If you arrive after 4:30 you will have to take the samples to the front door, take them in to the reception area and place them in the refrigerator. Sign the samples in at the desk.

**York River:**

Nothing. TRO will either deliver samples to PRO who will take the samples to DCLS or TRO will leave the sample coolers at boat dealership adjacent to public ramp of Coleman Bridge and PRO will transport to DCLS.

**Non-general procedures for York River:**

If PRO and TRO do not go out on the same day, a pick up has to be made for the TRO samples at West Point. A car needs to be reserved and after you drive through West Point on Rt.33, just before the Mattaponi on the left hand side is a road going to the boat ramp. Either meet TRO there or they will drop off the samples (there is a fenced in boat building near the boat ramp and the samples are left just inside the fence). Samples are taken to DCLS.

**James River:**

**TRO:** Meet TRO at Jamestown at 11:00 (drive time 1 hr, 15 min.). Directions to Jamestown are:

Take 64 East to exit 242A (Rt.199 West, Williamsburg, Busch Gardens). Take left on 31 south, left on 359 (Jamestown), left into parking lot, through lot turn right into marina. TRO samples will need to be transferred into the cooler and TRO will supply a cooler for the chlorophyll samples. Return to Richmond, take samples to DCLS

**Rappahannock River:**

**TRO:** Meet TRO at Locklies marina at 10:00 - 10:30 (drive time 1 - 1 1/2 hours). Directions - Take 64 east to 33 East (West Point). Take 33 to Rt.17 North. Take 17 North about 2 miles to 17 Business into Saluda. Continue on 17 Business into town, turn right at red light (Rt.33) Take 33 to

Rt.3 West (turn left). Turn right onto Rt.621 (just after small airport.  
Locklies is at end of 621.

**NRO:** Note: In 2003 NRO changed their launch/retrieval ramp to one behind the Little Falls Sewage Treatment Facility on Route 3. The following directions are for the Fredericksburg city dock and are provided for documentation purposes only. Meet NRO at Fredericksburg at 12:30 - 1:00 (drive time from Locklies 1 1/2 hours). Directions - retrace back 621, 3, and onto 33. When into Saluda, go straight through red light. A mile further down the road will be Rt.17. Turn right (north) on 17. Go through Tappahannock (PRO launches at Hoskins Creek - Dock St., you may want to contact them at this time). Go into Fredericksburg (Rt 2 & 17 Business), Turn left on Rt.17 Truck. Go under Railroad bridge and turn right at light (Laffayette). Go to end of road (two blocks) and turn right (Sophia). Go under railroad bridge and you will be at the public boat launch area. If NRO has finished, they will be eating lunch at Arby's on Rt. 17. To get there, go back out boat launch area, turn left and then make first right (should be Rt.1 Business) follow to Rt.1, turn right go over Rappahannock River. Turn left on Rt.17. Up hill on right hand side is Arby's.

**PRO:** For PRO you can do one of three things.

- 1) Let them deliver the samples to DCLS.
- 2) Meet PRO at the Hoskins Creek boat landing in Tappahannock.  
Directions: Travel south from Fredericksburg on Rt.17 to Tappahannock. Just before Hoskins Creek is a 7-11 store/gas station on the left, turn there, PRO should be finished around 3:00).
- 3) Meet PRO at Texaco station.  
Directions: Go south on 95 (you can get gas at Atlee if you need gas). Take 295 East (towards Norfolk), then take 360 West. There is a Texaco station just over the overpass on the left. Wait for PRO there. Take samples to DCLS.

**Rappahannock River: (If only one region is sampling)**

**TRO:** Meet at Locklies, take one extra cooler (for DCLS samples), deliver samples to DCLS.

**PRO:** Meet at Texaco station at Rt.295 and Rt.360 (they can call when leaving Hoskins Creek, it will take them a little longer to get to the Texaco station then for you to get there from downtown). Pick up DCLS samples or have PRO take samples to DCLS.

**APPENDIX F**

**CBP Required Parameter list**

Revised 05-15-06

## Field Parameters:

Storet Code	Description
00010	Temperature in Celcius Deg.
00078	Secchi in Meters
00094	Specific Conductance (umhos/cm at 25 C)
00299	Dissolved Oxygen via probe (mg/L)
00096	Salinity
EPARS	Photosynthetically Active Radiation obtained at surface with Licor Unit
EPARD	Photosynthetically Active Radiation obtained below surface with Licor Unit

## Analytical requirements:

32211	Chlorophyll a, corrected, monochromatic
32218	Pheophytin , corrected, monochromatic
630BX	Optical Density obtained Before addition of HCl
647BX	Optical Density obtained Before addition of HC]
664BX	Optical Density value obtained Before addition of HC]
665AX	Optical Density value obtained After addition of HC]
71994	Volume filtered in L
750AX	Optical Density value obtained After addition of HC]
750BX	Optical Density obtained Before addition of HC]
CELLP	Cell path length in cm
EXTVO	extraction volume in ml
00530	Total Suspended Solids
00535	Volatile Suspended Solids – not submitted to CIMS
00540	Fixed Suspended Solids
00608	Dissolved Ammonia (mg/L as N)
00613	Dissolved Nitrite (mg/L as N)
00618	Dissolved Nitrate (mg/L as N) – not submitted to CIMS
00631	Dissolved Nitrite plus Nitrate (mg/L as N)
00671	Dissolved Orthor phosphorus (mg/L as P)
00955	Dissolved Silica (mg/L as SiO <sub>2</sub> ) – value divided by 2.14 prior to submittal to CIMS
49571	Total Dissolved Nitrogen (mg/L)
49572	Total Dissolved Phosphorus (mg/L)
49569	Particulate Carbon (mg/L)
49570	Particulate Nitrogen (mg/L)
49567	Particulate Phosphorus (mg/L)
CDOMA	Chromophoric Dissolved Organic Matter Slope ABS COEF @ 440NM M-1
CDOMS	Chromophoric Dissolved Organic Matter Slope