C. Program Specific Monitoring

1. Chesapeake Bay Program (CBP)

A five-year study completed in 1982 identified declines in the water quality and living resources of Chesapeake Bay. The 1985 Restoration and Protection Plan identified the need for restoration activities and a monitoring program to measure the success of these activities. Subsequent Bay Agreements and plans have placed special emphasis on the restoration of Chesapeake Bay for the benefit of living resources and the need for accurate monitoring of nutrient inputs across the fall line. Thus the Bay monitoring approach includes not only traditional indicators such as chemical measures and commercially important species, but also other components of the Bay ecosystem like plankton and benthos, which support more prominent living resources. The Virginia Chesapeake Bay Monitoring Program is a multi-institution program that includes long-term studies conducted by the Virginia Department of Environmental Quality (DEQ), Old Dominion University (ODU), the Virginia Institute of Marine Science (VIMS - College of William and Mary), and the United States Geological Survey (USGS). Program management, oversight and coordination for the Chesapeake Bay monitoring projects are provided by DEQ personnel (DEQ contact is Cindy S. Johnson: (804) 698-4385).

On May 12, 2009 Executive Order 13508 (EO13508) established the Federal Leadership Committee for the Chesapeake Bay to be chaired by the Administrator of the Environmental Protection Agency and comprised of senior officials from several agencies including the Departments of Agriculture, Commerce, Defense, Homeland Security, the Interior, Transportation and others as needed. Amongst other things, key agencies were to "…strengthen scientific support for decision making to restore the Chesapeake Bay and its watershed, including expanded environmental research and monitoring and observing systems…" and "develop focused and coordinated habitat and research activities that protect and restore living resources and water quality of the Chesapeake Bay and its watershed." EO13508 was followed by the establishment of a Bay-wide total maximum daily load (TMDL) by the EPA in December 2010 that required Bay Program states to have all pollution control measures needed to fully restore the Bay and it's tidal tributaries in place by 2025 with at least 60% of the actions completed by 2017. Bay partners were expected to develop Watershed Implementation plans and two-year accountability milestones to track success.

The objectives of the Chesapeake Bay Monitoring Program are to characterize the present state of the Bay in terms of ecological health and designated use attainment, to determine long-term trends, and to achieve an understanding of the ecological relationships controlling conditions in the Bay. This provides information necessary to measure effectiveness of point and non-point source programs in reducing nutrient input to the Bay and determine progress toward achievement of living resource, water quality and habitat goals. Given the long-term requirements of a monitoring program such as this, the activities contained in this work plan will continue with relatively minor changes for the foreseeable future.

The Chesapeake Bay Office of DEQ performs overall program coordination and the tributary water quality monitoring components in Virginia. The mainstem water quality monitoring component is carried out under contract by Old Dominion University (ODU) as are the biological and phytoplankton monitoring components. The United States Geological Service (USGS) performs the River Input monitoring component, the Virginia Institute of Marine Science (VIMS) performs the shallow water habitat monitoring program and both USGS and the regional offices of DEQ conduct the CBP Non-tidal Trend Network monitoring. The technical approach of all these programs has been developed by and undergoes continuous review and enhancement through the subcommittee and workgroup structure of the Federal-Interstate Chesapeake Bay program.

The overall Chesapeake Bay Monitoring Program is currently divided into seven subprograms, each of which is discussed separately in the sections that follow.

(1) Mainstem Water Quality Monitoring Program,
(2) Benthic Monitoring Program,
(3) Phytoplankton Monitoring Program,
(4) River Input Monitoring Program,
(5) Tributary Water Quality Monitoring Program,
(6) Shallow Water Habitat Monitoring Program.
(7) Non-Tidal Trend Network Monitoring

The Commonwealth of Virginia has committed to conducting the monitoring of its portion of the Chesapeake Bay and its tributaries in a manner consistent with that of other states participating in the multi-state Chesapeake Bay Program. Specific objectives and priorities within and among the various subprograms are set by consensus of the participating states through committees of the Federal-Interstate Chesapeake Bay Program, and are discussed within the descriptions of the individual subprograms.

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(1) CBP Mainstem Water Quality Monitoring Program

The Chesapeake Bay Mainstem Water Quality Monitoring Program, initiated in 1984, is a multi-purpose program conducted by ODU. Water quality conditions are monitored at 27 stations in the Bay Mainstem.

(i) Objectives

The objectives are:

(1) To determine if water quality conditions satisfy the requirements necessary to protect living resources from nutrient and sediment impacts,
(2) To diagnose the likely causes of non-attainment and assess progress towards improvements still needed, and
(3) To support continued refinement, calibration and validation of the Chesapeake Bay Water Quality Model and multi-species management models.

The program also provides information necessary to measure effectiveness of point and non-point source programs in reducing nutrient input to the Bay.

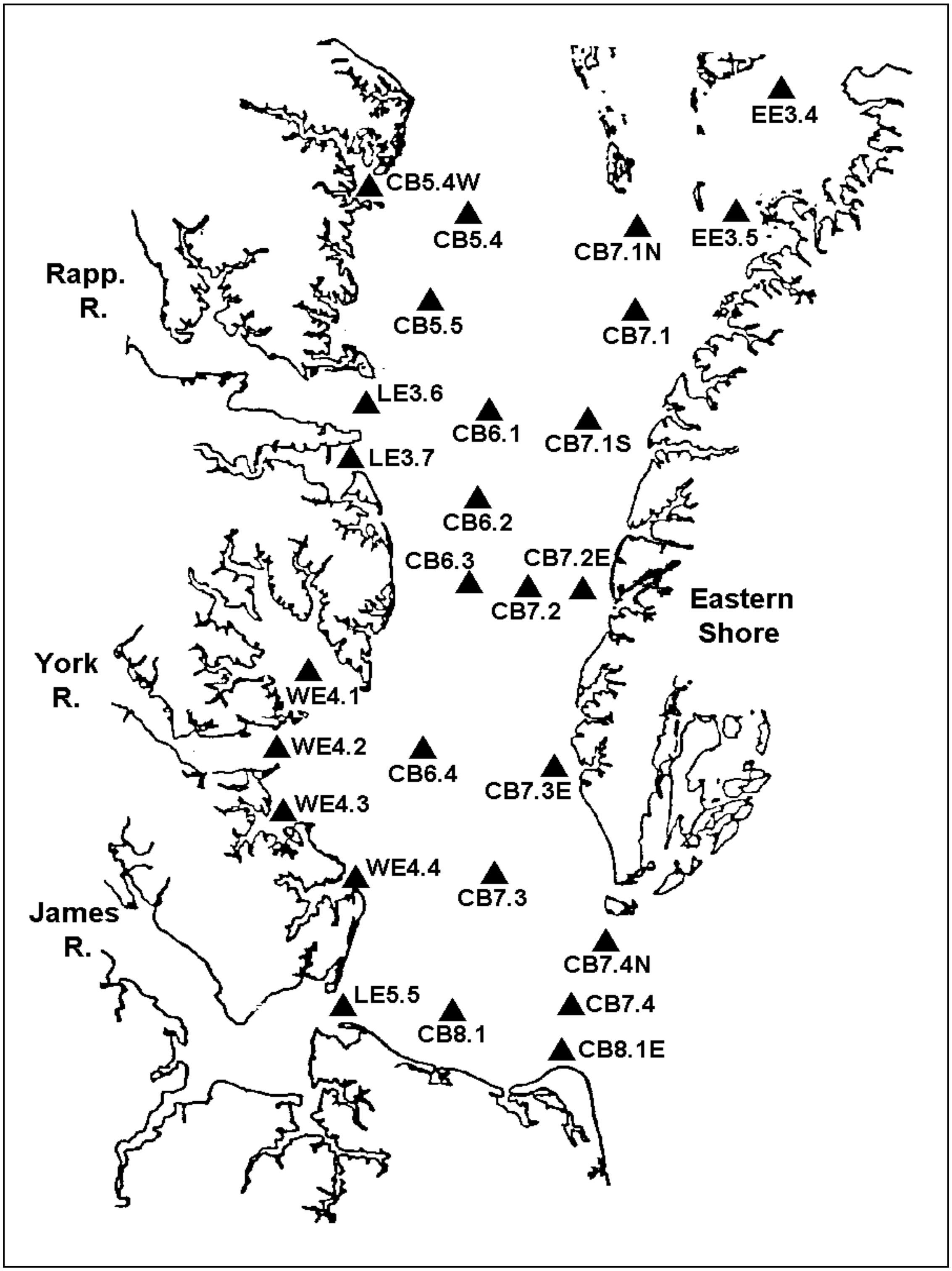
Ambient nutrient concentrations are relevant to the evaluation of phytoplankton habitat quality requirements as well as part of a set of diagnostic requirements for assessing suitability of water quality for survival and growth of Submerged Aquatic Vegetation Communities. Suspended sediments, measured as total suspended solids, have two principal impacts on aquatic organisms. Along with algae, they can significantly reduce light penetration, impacting survival of Submerged Aquatic Vegetation and disrupting light-dependent daily water column migrations of zooplankton. Elevated concentrations of total suspended solids can also affect feeding rates of organisms like oysters and clams, which filter their food from overlying waters. Finally, almost all tidal and non-tidal aquatic organisms require oxygen to survive; therefore, evaluations of dissolved oxygen conditions and criteria are an important monitoring goal.

The following scope of work represents a continuation of the long-term Chesapeake Bay Mainstem water quality monitoring program in the Virginia portion of the Chesapeake Bay. This program, initiated in July 1984, consists of the twenty-seven (27) stations within the Virginia portion of the Chesapeake Bay – see Figures “III-C-1-1 - Chesapeake Bay Program Mainstem Stations” and “III-C-1-2 - Mainstem Stations Map” below.

Figure III-C-1-1 - Chesapeake Bay Program Mainstem Stations

STATION GROUP 1			
STATION	LATITUDE (NAD83)	LONGITUDE (NAD83)	DESCRIPTION
EE 3.4	37.90833	-75.79167	Pocomoke Sound
EE 3.5	37.79638	-75.84472	Pocomoke Sound Channel
CB 5.4W	37.81332	-76.29508	Mouth of Great Wicomico
CB 5.4	37.80000	-76.17500	Deep Main Channel
CB 5.5	37.69193	-76.19027	Main Channel
CB 6.1	37.58833	-76.16250	Main Channel, Lower End off of Rappahannock River
CB 6.2	37.48667	-76.15667	Central Bay
CB 6.3	37.41243	-76.15782	Central Bay Channel (Wolftrap)
CB 7.1N	37.77512	-75.97492	Tangier Sound Channel
CB 7.1S	37.58117	-76.05833	Eastern Shore Channel
CB 7.2	37.41147	-76.08058	Eastern Shore Channel
CB 7.2E	37.41140	-76.02505	Eastern Shore, Side Channel
LE 3.6	37.59687	-76.28528	Mouth of Rappahannock
LE 3.7	37.53067	-76.30712	Mouth of Piankatank
WE 4.1	37.31167	-76.34667	Mobjack Bay
WE 4.2	37.24167	-76.38667	Mouth of York
WE 4.3	37.17667	-76.37333	Mouth of Poquoson
WE 4.4	37.11000	-76.29333	Mouth of Back River
CB 6.4	37.23638	-76.20833	Central Bay, Off York River
CB 7.3	37.11667	-76.12527	Lower Bay Channel
CB 7.3E	37.22850	-76.05417	Eastern Shore Channel, Southern End
CB 7.4	36.99550	-76.02083	Baltimore Channel, Bay Mouth
CB 8.1E	36.94717	-76.03517	Thimble Shoals, Bay Mouth
CB 7.4N	37.06217	-75.98333	North Channel, Bay Mouth
LE 5.5	36.99883	-76.31350	Mouth of James

Figure III-C-1-2 - Mainstem Stations Map



Parameters

Temperature, pH, Salinity, Specific Conductance and Dissolved Oxygen by probe every meter until 15 meters, then every two meters until 1 meter above bottom.
Secchi Disk depth: (20-cm disk)
Incident Radiation (onboard sensor)
Incident Radiation ("up" sensor)
**+ Silicate (filtered): surface and bottom
**+ Particulate Carbon: surface and bottom
**+ Total Suspended Solids: surface and bottom
**+ Chlorophyll a and Phaeophytin [(1)]: surface and bottom
**+ Particulate Nitrogen: surface and bottom
**+ Dissolved Persulfate Nitrogen: surface and bottom
**+ Nitrate + Nitrite (filtered): surface and bottom
**+ Nitrite (filtered): surface and bottom
**+ Ammonia (filtered): surface and bottom
**+ Particulate Phosphorus: surface and bottom
**+ Dissolved Phosphorus: surface and bottom
**+ Dissolved Orthophosphate: surface and bottom

[(1)] Report wavelengths 750b, 664b, 647b, 630b, 750a, 665a, (a, b = after/before acidification) extract volume, sample volume, spectrophotometer light path.

** See Special Condition 1, below
+ See Special Condition 6, below

Frequency of Sampling

Fourteen sampling events occur per year (monthly sampling with twice per month in July and August). Sampling dates will be established by the DEQ to insure that Bay-wide sampling occurs within the same reasonable time period and that water quality sampling occurs concurrently with sampling by the plankton monitoring component (see schedule in Table 1). All stations must be sampled within a four-day period during each sampling event. Exceptions to this shall be allowed in cases where weather causes unsafe sampling conditions. The contractor shall ensure compliance with the sampling schedule through the development and use of contingency plans.

Sample Collection

Data will be collected and analyses run in order to supply measurements of the parameters listed above. All collections of water column grab samples and subsequent sample handling will be undertaken following the protocols described in "Work/Quality Assurance Project Plan for Chesapeake Bay Mainstem Water Quality Monitoring Program". At each station, grab samples will be collected and analyzed for the designated parameters. These grab samples will be collected at 1.0 meter below the surface and 1.0 meter above the bottom. Both grab samples will correspond with a physical profile sampling depth. Any changes in methods will be made only in accordance with the current protocol approved by the Tidal Water Quality Monitoring and Analysis Workgroup. Any significant emergency deviations will be reported to the EPA Chesapeake Bay Program Office (EPA-CBPO).

Quality Assurance

The DEQ will maintain an updated "Work/Quality Assurance Project Plan for Chesapeake Bay Mainstem Water Quality Monitoring Program". If any data discrepancies or errors in the original raw data are discovered by the users of the data base, DEQ, EPA CBP or ODU within five years of payment for the data, the DEQ agrees to rectify those problems within the 90 day period following notification by EPA-CBPO. DEQ's contractors will follow the protocols described in the "Work/Quality Assurance Project Plan for Chesapeake Bay Mainstem Water Quality Monitoring Program" when participating in the Coordinated Split Sample Program (CSSP).

DEQ will designate a Quality Assurance Officer who will oversee the implementation of the contractors' quality assurance programs for the Virginia Mainstem Monitoring Program. This individual will work with the Quality Control Officers for each laboratory and field operation to ensure that all elements of the Quality Assurance Project Plans and associated standard operating procedures are implemented.

In Vivo Fluorescence measurements

(a) Vertical Profiling

At each station, a vertical profile of *in vivo* fluorescence (IVF) will be collected. IVF readings will be taken at 1 m, 2 m, and 3 m, and at 3 m intervals thereafter to 1 meter above the bottom. As appropriate, water from the discharge hose of the fluorometer will be collected for calibration purposes. Vertical profiling will be conducted only when the vessel used is capable of performing vertical profiles.

(b) Horizontal Profiling

Between stations, a horizontal profile of chlorophyll fluorescence will be collected from a Hull pump located on the hull of the sampling vessel. The fluorescence will be recorded on either an analog or digital recorder. Beginning station location and time will be recorded. The boat will proceed on a straight path and at a constant speed to the second station with GPS readings recorded every five minutes. Ending station location and time will be recorded. This process will be carried out between all feasible stations dependent upon weather, time, and logistical constraints.

(c) Fluorescence calibration

Calibration will be undertaken by collecting and filtering water passing through the fluorometer and subsequently analyzing the filtered material for Chlorophyll A. This will be done for the surface and bottom sample depths at each station (note: these surface and bottom chlorophyll samples will also serve as the routine chlorophyll data collection for each station). Calibration samples will also be collected occasionally during horizontal profiling.

(d) Fluorescence Quality Assurance

All analyses will be performed according to standard operating procedures as described in the contractors Quality Assurance Project Plan(s).

(e) Parameters

VERTICAL PROFILE: Chlorophyll Fluorescence (Vessel permitting)
HORIZONTAL PROFILE: Chlorophyll Fluorescence
GRAB SAMPLES (i.e. calibration samples): Chlorophyll (wavelengths 750b, 664b, 647b, 630b, 750a, 665a, (a, b = after/before acidification), extract volume, sample volume, spectrophotometer light path)

Special Conditions

1. At stations CB5.4, CB5.5, CB6.1, CB6.2, CB6.3C, CB6.4, CB7.3 and CB7.4, two additional samples will be taken, one just above and one just below the pycnocline, for each indicated parameter. These additional samples should correspond with physical profiling samples. Actual depth of sample will be determined by calculations approved by CBP and DEQ. When a pycnocline is not detected, samples will be collected at one third and two thirds of the depth of the water column.
2. Sampling dates will be coordinated with the State of Maryland to insure that samples are collected within the same reasonable time period.
3. Any deviations from the prearranged sampling dates, or any problems that occur during a cruise, must be reported as soon as practicable to the Department of Environmental Quality Project Officer and will also be recorded in the CIMS data documentation files.
4. All analyses will be performed according to methods and protocols agreed to by the Chesapeake Bay Program. Any emergency deviations must be reported to the DEQ Project Officer and will also be recorded in the data documentation served via CIMS.
5. ODU will participate in a quarterly Mainstem CSSP split. The procedures followed will be those given in the CBP Coordinated Split Sample Program (CSSP) guidelines.
6. ODU participates in a quarterly tributary CSSP split. The procedures followed will be those given in the CBP Coordinated Split Sample Program (CSSP) guidelines.
7. ODU is certified by the Division of Consolidated Laboratory Services to perform work for the Commonwealth of Virginia to be utilized for assessment purposes.
8. ODU maintains up to date Quality Assurance Project Plan(s) and submits to the DEQ any changes in their plan(s) or standard operating procedures. The plan(s) must be implemented to the satisfaction of DEQ and EPA.
9. DEQ will participate in the Analytical Methods and Quality Assurance Workgroup (AMQAW), the Tidal Water Quality Monitoring and Analysis Workgroup (TWQMAW) and associated *ad hoc* meetings and workshops designed to assure Bay wide coordination of the collection and analysis of water quality data. The contractor will participate in at least 4 AMQAW meetings and 4 TWQMAW meetings annually. The contractor will participate in other associated Chesapeake Bay Program meetings and workshops as available funding allows.

Deliverables

1. Water quality data will be posted on an Internet server in CIMS ACCESS format every two months. The data will be delivered via FTP to CBPCC. This posting will occur within 60 days from the end of the second calendar collection month. The FGDC compliant CIMS Level 3 metadata will be updated as appropriate with each data submission.
2. Data served via CIMS must meet the data dictionary standards, documentation requirements, conform to the data set formats described in “Water Quality Database; Database Design and Data Dictionary, June 1998” and “Chesapeake Bay Program Relational Water Quality Database; Primary Table Descriptions And File Submission Formats, June 17, 1998”. The data will meet the quality assurance objectives for

measurement data as described in “Work/Quality Assurance Project Plan for Chesapeake Bay Mainstem Water Quality Monitoring Program” before posting via CIMS. These data must pass the established quality assurance range checks in order to be posted to CIMS.

3. ODU will attest to the quality of the data and to sign off on that data set. An electronic letter from ODU will be transmitted to the DEQ and EPA Monitoring Coordinators at the time of posting to CIMS stating that a particular data set has been judged to be free of known errors, detailing any minor exceptions still unresolved and assuring that the data set is of adequate quality for posting on CIMS. The contractor will continue to resolve any problems in the data sets within the following two-month period.

4. Quality Assurance (QA) data will be reported as requested by DEQ and also submitted to CBCC in computerized CIMS format. This QA data will include laboratory replicates, percent recovery, and field split data. A new QAPP is submitted by April 15 of each sampling year.

5. Data Analysis: DEQ and EPA/CBPO agree to jointly participate in the Bay-wide process of preparing and integrating information gathered under this scope of work into overall reports on the state of Chesapeake Bay as directed and negotiated by the Chesapeake Bay Program Tidal Water Quality Monitoring and Analysis Workgroup.

6. Horizontal and vertical fluorescence data will be submitted. Finished format, quality assured data will be submitted to the CBCC via tape or file. Data formats are as specified in “2000 User’s Guide to Chesapeake Bay Program Biological and Living Resources Monitoring Data”. The data, along with associated methodology, quality assurance documentation, and calibration regressions will be sent and verified by the CBCC.

7. Station location information (i.e. latitude and longitude coordinates in decimal degrees for all sites for which data are collected and accurate within 10-25 meters (5 decimal places in decimal degrees) will be posted via CIMS.

8. Va. DEQ and its contractors agree to adhere to the CBP policy that all data submitted to the CBP shall utilize the North American 1983 Datum (NAD83) horizontal reference and the North American Vertical Datum 1988 (NAD88) vertical reference.

(2) CBP Benthic Monitoring Program

Introduction

The 1987 Bay Agreement identified benthic monitoring as an important part of the Living Resources Monitoring Plan for the Chesapeake Bay. The newest Bay agreement, Chesapeake 2000: A Watershed Partnership, states that "The health and vitality of the Chesapeake Bay's living resources provide the ultimate indicator of our success in the restoration and protection effort. The Bay's fisheries and the other living resources that sustain them and provide habitat for them are central to the initiatives we undertake in this Agreement." This new agreement reaffirmed the prior commitments and also specified the following new commitments which are addressed by this monitoring component:

(1) By 2002, define the water quality conditions necessary to protect aquatic living resources and then assign load reductions for nitrogen and phosphorus to each major tributary
(2) By 2004, assess the effects of different population levels of filter feeders such as menhaden, oysters and clams on Bay water quality and habitat.
(3) By 2005, develop ecosystem-based multi-species management plans for targeted species.
(4) By 2007, revise and implement existing fisheries management plans to incorporate ecological, social and economic considerations, multi-species fisheries management and ecosystem approaches.

Benthic organisms are important secondary producers, providing key linkages between primary producers (phytoplankton) and higher trophic levels (crabs, bottom feeding fish, and water birds). Benthic invertebrates are among the most important components of estuarine ecosystems and may represent the largest standing stock of organic carbon in the Chesapeake Bay. Benthic organisms, such as hard clams and soft-shell clams, are economically important. Others, such as polychaete worms and shrimp-like crustaceans, contribute significantly to the diets of economically important blue crabs and bottom-feeding juvenile and adult fish like spot, croaker, striped bass, and white perch.

This component monitors benthic macrofauna and sediment (habitat) types in the lower Chesapeake Bay and in major tributaries (James, Rappahannock, York, and Pamunkey) that enter the lower Bay.

Objectives

The objectives are:

(1) To characterize the health of regional areas of the lower Chesapeake Bay as indicated by the structure of the benthic community. These characterizations will be based upon application of the benthic restoration goals to data collected by a probability based sampling design within the lower Chesapeake Bay. A probability based sampling design allows calculation of confidence intervals around estimates of condition of the benthic communities. Confidence intervals provide managers with full knowledge of the strength or weakness of the data upon which their decisions will be based. In addition, probability based data allows managers to estimate the actual area (number of acres) throughout the system (e.g., tributaries, areas of concern) in which ecological conditions differ from reference areas or goals.
(2) To conduct trend analyses on long term data at fixed point stations to relate temporal trends in the benthic communities to changes in water and/or sediment quality. Trend analyses will be updated annually as new data are available.

(3) To warn of environmental degradation by producing an historical data base that will allow annual evaluations of biotic impacts by comparing trends in status within probability based strata and trends at fixed point stations to changes in water and/or sediment quality.

Station Locations:

Twenty-one fixed-point monitoring stations correspond with Chesapeake Bay water quality monitoring stations as identified below and are shown in "Figure III-C-1-5 - CBP Fixed Benthic Stations" and "Figure III-C-1-6 - CBP Benthic Map" below. Other stations will be selected randomly as described in section V.

Sampling Frequency and Replication

Two sampling designs are employed:

(1) 21 fixed-point stations sampled once per year (mid-July to September) and
(2) One summer probabilistic sampling per year (same period) within each of four strata to supplement data collected at fixed-point stations.

The four strata that will be sampled are:

(1) The James River,
(2) The York River (including the tidal Pamunkey and Mattaponi Rivers),
(3) The Rappahannock River, and
(4) The Mainstem of the Bay.

Sampling design and methodologies for probability-based sampling are based upon procedures developed by EPA's Environmental Monitoring and Assessment Program (EMAP, Weisberg et al. 1993), and will allow unbiased comparisons of conditions (1) among strata (e.g. tributaries) of the lower Chesapeake Bay within the same collection year and (2) within tributaries for data collected among different years. The consistency of sampling design and methodologies for probability-based sampling between the Virginia and Maryland benthic monitoring programs will allow Bay-wide characterizations of the condition of the benthos for the Chesapeake Bay.

Field Sampling

Complete field sampling procedures are given in "Quality Assurance/Quality Control Plan, Benthic Biological Monitoring Program of the Lower Chesapeake Bay (July 1, 2012 to June 30, 2013)" [III-B-1c-5.pdf]. At each fixed point station four replicate box core samples are collected during the months of June and September. Box core samples are collected using a spade-type coring device consisting of a rectangular corer (10.5 cm X 17.5 cm X 35 cm) with a hinged cutting arm that seals the box sample *in situ*. Each box core sample has a surface area of 182 cm^2 and a minimum depth of penetration of 25 cm. One of the four replicate samples is archived and the other three replicates are analyzed to quantitatively characterize the macrobenthic community. A subsample of the surface sediment from the archived replicate is taken for sediment particle size analysis and for determination of total volatile solids. Bottom temperature, salinity and dissolved oxygen are measured at each sampling station.

Within each stratum of concern a probability based sampling design is applied. The number of samples within each stratum will be 25 and sites will be selected by simple random sampling within each stratum. At each of the 25 randomly allocated sites a sample of the benthic community will be collected using a $0.04m^2$, Young modified Van Veen grab. A subsample of the surface sediment is collected from a second

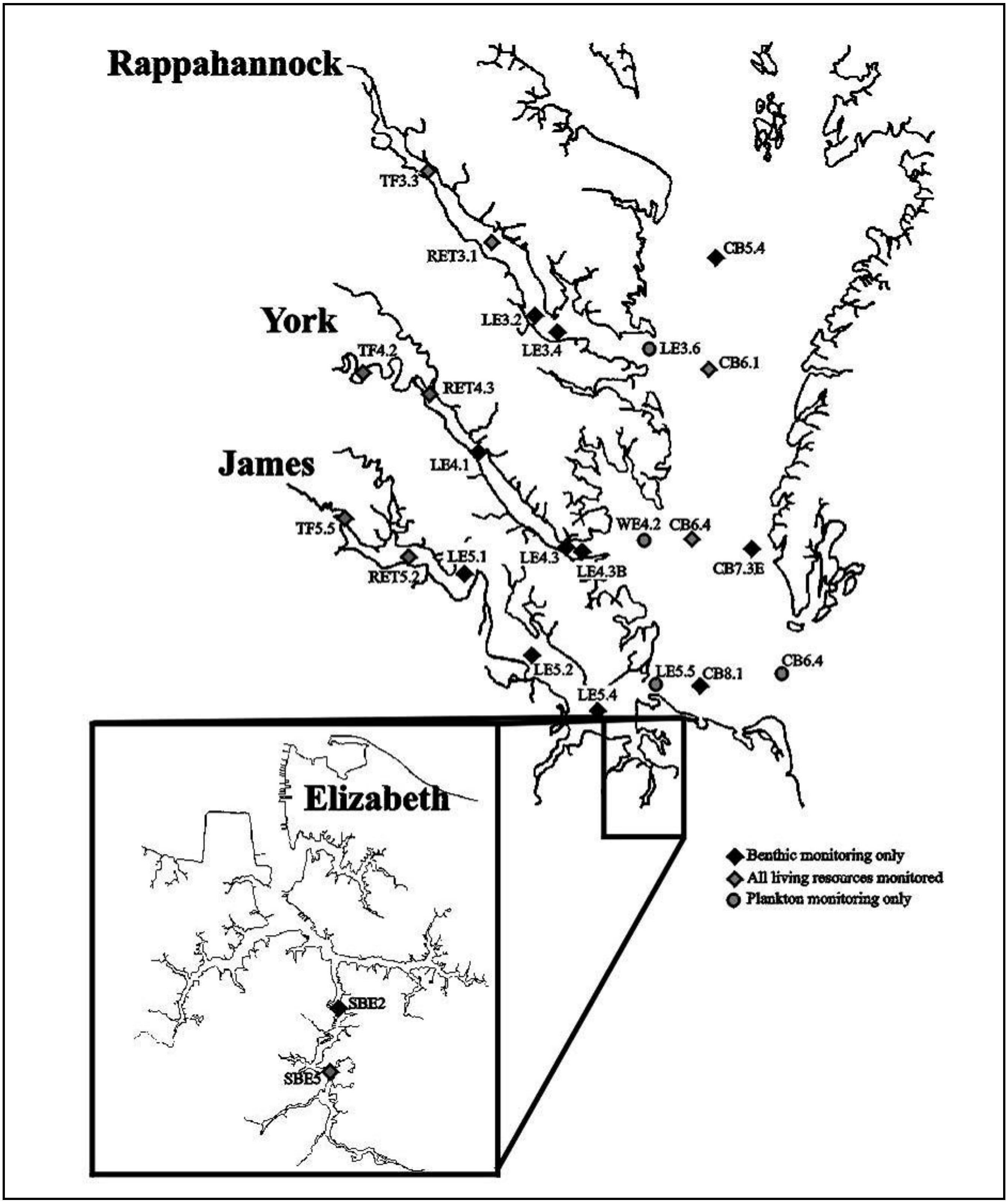
Figure III-C-1-5 - CBP Fixed Benthic stations

STATION	DESCRIPTION	LATITUDE (NAD83)	LONGITUDE (NAD83)
CB5.4	Main Bay, Upper	37.79990	-76.17420
CB6.1	Main Bay, Off Rappahannock R.	37.58930	-76.16020
CB6.4	Main Bay, Off York River	37.23700	-76.20210
CB7.3E	Main Bay, Off Old Plantation Fl.	37.25530	-77.94680
CB8.1	Main Bay, Off James River	36.98520	-77.83300
LE3.2	Rappahannock River Upstream Buoy R8	37.67010	-76.55510
LE3.4	Rappahannock River, Orchard Pt.	37.63350	-76.46520
LE4.1	York River, N44	37.41830	-76.69330
LE4.3	York River, off VIMS, shoal	37.24300	-76.48610
LE4.3B	York River, off VIMS, channel	37.23110	-76.47430
LE5.1	James River, Hog Point	37.21310	-75.29310
LE5.2	James River, Buoy C 12-13	37.05740	-76.59140
LE5.4	James River, Buoy 9	36.95340	-76.39160
RET3.1	Rappahannock River, Buoy 10	37.92090	-76.82040
RET4.3	York River, C57, Below West Point	37.51140	-76.78840
RET5.2	James River, Swann's Point	37.21290	-76.79300
SBE2	Elizabeth R. off Atl. Wood	36.81360	-76.28970
SBE5	Elizabeth R. off VEPCO	36.76900	-76.29830
TF3.3	Rappahannock River, N40	38.01850	-76.90890
TF4.2	Pamunkey River at White House	37.59640	-76.97430
TF5.5	James River, Red Buoy 10	37.31310	-77.23110

Van Veen grab sample for sediment particle size analysis and for determination of total volatile solids. Bottom temperature, salinity and dissolved oxygen are measured at each sampling station. Sampling within the probability based strata will occur between July 15 and September 30 of each year to allow the application of the Benthic Restoration Goals. The Benthic Restoration Goals were developed from data sets limited to the July 15 through September 30 time period.

Estimating areal extent of the benthic condition departs from traditional approaches to environmental monitoring which generally estimate average condition without known confidence intervals. Random sampling within a stratum allows the calculation of a known confidence interval for the stratum.

Figure III-C-1- 6 - CBP Benthic Map



Lab Analysis

Complete lab analysis procedures are given in "Quality Assurance/Quality Control Plan, Benthic Biological Monitoring Program of the Lower Chesapeake Bay (July 1, 2012 to June 30, 2013)" [III-Bb-1c-5.pdf]. Benthic community structural parameters that will be measured include:

Species diversity	Abundance of opportunistic species
Species richness	Biomass of opportunistic species
Species evenness	Abundance of equilibrium species
Community abundance	Biomass of equilibrium species
Community biomass	Depth distribution of species
Abundance of all species	Depth distribution of abundance
Biomass of all species	Depth distribution of biomass

Quality Assurance

The quality assurance procedures for field sampling, laboratory analysis and data management as outlined in the "Quality Assurance/Quality Control Plan, Benthic Biological Monitoring Program of the Lower Chesapeake Bay (July 1, 2012 to June 30, 2013)" [III-B-1c-5.pdf].will be followed. This document will be revised if any procedures change.

A 100% recount on ten percent of all benthic samples will be performed. Species lists will be exchanged with Maryland investigators on a regular basis, and any taxonomic identification problems will be coordinated with Maryland investigators.

IBI Assessment

During 2003 and 2004 the Virginia DEQ, Maryland DNR, Versar Inc. consulting firm (Columbia, MD) and Dr. Daniel M. Dauer of Old Dominion University (ODU), working in collaboration with the Interstate Chesapeake Bay Program (CBP) and the US-EPA, developed and approved a standardized methodology for 305(b) assessments of benthic invertebrates in the CBP Water Quality Monitoring Program. Although still subject to further refinements, the methodology, utilizing a Benthic Index of Biological Integrity (B-IBI) developed by Dr. Dauer and personnel from Versar, was applied by both states in the development of their 2004 305(b) Water Quality Assessment Reports. Versar produced a final report on this "Decision Process for Identification of Estuarine Benthic Impairments" [III-B-1b-1a.doc] in November of 2003.

In simplified terms, B-IBI scores are calculated individually for the results of sampling the benthic communities at randomly chosen sites in the Chesapeake Bay mainstem and tidal tributaries to the Bay. These individual scores are then aggregated for relatively large segments of the estuary that had previously been defined by the CBP. The distributions of scores by habitat type are subsequently compared to the distributions of scores observed among previously identified reference sites in similar habitats. If the distribution of scores for the segment of interest is significantly lower than that of the reference distribution, the segment is assessed as being 'impaired'.

One concern expressed by the Virginia DEQ was that the majority of randomly selected sites occurred in the more extensive mainstems of major tributaries, and relatively few in the smaller tributaries to those rivers. If the aggregation of B-IBI results for such a large 'segment' were to be assessed as impaired, doubts would still exist about the true condition of the minor tributaries. Under current Virginia environmental law, if a body of water has already been identified as impaired, then the level of protection defined in the subsequent licensing of permitted discharges there may be relaxed. If the smaller tributaries were to be classified and listed as impaired without sufficient justification, then the level of future protection for their waters would decline, also without justification. Virginia consequently defined sub-segments to the major segments defined by the CBP, and has developed a strategy for monitoring and assessment independently from that of the larger segments (see Section III.B.2 – "Probabilistic Monitoring Network – Estuarine" above).

In 2013 a recalibration of the B-IBI will be conducted as a result of findings by the Criteria Assessment Protocol workgroup (CAP) that assessments of a few segments did not reflect what would be expected due to B-IBI scores input to the Index (such as substrate sampled). The goal is to have the recalibration completed in time for the 2014 assessment.

(3) CBP Phytoplankton Monitoring Program

Objectives

The 1987 Bay Agreement identified phytoplankton monitoring as an important part of the Living Resources Monitoring Plan for the Chesapeake Bay. The newest Bay agreement, Chesapeake 2000: A Watershed Partnership, states that "The health and vitality of the Chesapeake Bay's living resources provide the ultimate indicator of our success in the restoration and protection effort. The Bay's fisheries and the other living resources that sustain them and provide habitat for them are central to the initiatives we undertake in this Agreement." This new agreement reaffirmed the prior commitments and also specified the following new commitments which are addressed by this monitoring component:

(1) By 2002, define the water quality conditions necessary to protect aquatic living resources and then assign load reductions for nitrogen and phosphorus to each major tributary
(2) By 2004, assess the effects of different population levels of filter feeders such as menhaden, oysters and clams on Bay water quality and habitat.
(3) By 2005, develop ecosystem-based multi-species management plans for targeted species.
(4) By 2007, revise and implement existing fisheries management plans to incorporate ecological, social and economic considerations, multi-species fisheries management and ecosystem approaches.

Phytoplankton are the food base for most of the Bay's filter feeding organisms, including zooplankton, oysters, many benthic macroinvertebrates, and a number of fish species at certain stages in the larval to adult life cycle. Due to their position at the base of the Bay's food web, restoring healthy phytoplankton assemblages is a critical part of restoring other living resources within the Bay. High levels of phytoplankton also contribute to the decline of submerged aquatic vegetation via shading and are the Bay living resource most directly linked to water quality conditions, responding rapidly during warmer months to changes in the availability of nitrogen, phosphorous, and light.

This monitoring component tracks the following aspects of phytoplankton.

(a) Phytoplankton Biomass and Productivity

Phytoplankton biomass is an important measure of the Bay's primary productivity. The distribution of this biomass and productivity in space and time determines whether it fuels anoxia or becomes incorporated into higher levels of the food web. For example, seasonal phytoplankton dynamics, such as the spring diatom biomass bloom that is an important food source for zooplankton and some fish, are influenced by weather and pollutant loading patterns. Phytoplankton primary production also is a major source of oxygen in open waters.

Biomass blooms occur when some phytoplankton species proliferate rapidly under certain water quality conditions. For example, a large pulse of nutrients into a poorly flushed embayment can lead to a local bloom. These biomass blooms have fueled the expansion of anoxia in bottom waters by providing excessive organic material for bacterial decomposers. Anecdotal observations suggest that the frequency of algal blooms has increased in some parts of the Bay.

(b) Phytoplankton Community Species composition

Different nutrient species (e.g., ammonia, nitrate) and nutrient ratios (e.g., Carbon:Nitrogen:Phosphorus: Silica, Dissolved Inorganic Nitrogen:Dissolved Inorganic Phosphorus, and Nitrate:ammonia) affect phytoplankton species competitive abilities, changing the species compositions of phytoplankton assemblages. Chemical contaminants, particularly heavy metals, can also directly affect phytoplankton assemblages. Some of the blooms mentioned above are formed by toxin-producing algal species that can seriously impact shellfish and fish populations, and cause human health problems. Anecdotal observations suggest that the prevalence of these potentially toxic species may be increasing. With the excessive standing crop of phytoplankton present in the Bay today, most phytoplankton-eaters are rarely limited by the abundance of their food source. However, changes in phytoplankton assemblages that result in dominance by less desirable species can stress the feeding abilities of phytoplankton-eaters. As existing nutrient and sediment reduction strategies are implemented, more desirable, higher quality fish food species are expected to dominate the phytoplankton assemblage. Also, if sediment and nutrient load reductions are implemented simultaneously, decreases in available nutrients should not be expected to cause food-limitation in phytoplankton consumers. Instead, a more balanced phytoplankton community species structure will pass more quickly and efficiently to filter-feeding organisms and the relationship between phytoplankton and their consumers will improve.

Station Locations

The seven tributary stations and seven mainstem stations for phytoplankton sampling correspond to water quality monitoring stations, as identified below and shown in "Figure III-C-1-7 - CBP Plankton Stations" and "Figure III-C-1-8 - CBP Plankton Map".

Sampling Frequency and Replication

Phytoplankton and picoplankton samples will be collected at mainstem stations once per month for a total of twelve collections per year. Phytoplankton and picoplankton samples will be collected at tributary stations once per month March through October for a total of eight collections per year. Sampling will be coordinated with water quality sampling, such that phytoplankton are sampled concurrently (i.e. within 60 minutes) with water quality conditions.

Field Sampling

Phytoplankton and Picoplankton: Complete field sampling procedures are given in the "Work/Quality Assurance Project Plan for Monitoring Phytoplankton, Picoplankton and Productivity in the Lower Chesapeake Bay and Tributaries" [III-B-1c-6.doc]. Two hydro-casts will be made within a 30 min. period using a pump to obtain 15 L composite samples. 500-mL subsamples of the composite samples will be fixed with Lugol solution and preserved with buffered formalin for phytoplankton; 125-ml samples preserved in Gluteraldehyde will be used for picoplankton analysis.

Primary productivity: Two 15L composite samples will be collected at the same time monthly from above the pycnocline layer at each station. Three 1L subsamples from the composites will be placed in a cooler for transportation to the laboratory.

Other Associated Field Data: For the Mainstem stations, surface (2) samples for chlorophyll analysis will be made at all stations at the time of phytoplankton collections. Method of analysis will be compatible with the CBP Water Quality Monitoring Program.

Laboratory Analysis

Phytoplankton and Picoplankton: Laboratory analysis procedures are given in the "Work/Quality Assurance Project Plan for Monitoring Phytoplankton, Picoplankton and Productivity in the Lower Chesapeake Bay and Tributaries" [III-B-1c-6.doc].

Phytoplankton samples will be examined monthly under an inverted microscope following the Utermohl analysis procedure. Picoplankton samples and replicates will be examined monthly using an Epifluorescence microscope procedure. All phytoplankton samples will be identified to the lowest practical taxonomic level.

Primary productivity: Estimates of primary productivity for each station will be made using the laboratory procedures as outlined in the "Work/Quality Assurance Project Plan for Monitoring Phytoplankton, Picoplankton and Productivity in the Lower Chesapeake Bay and Tributaries" [III-B-1c-6.doc].

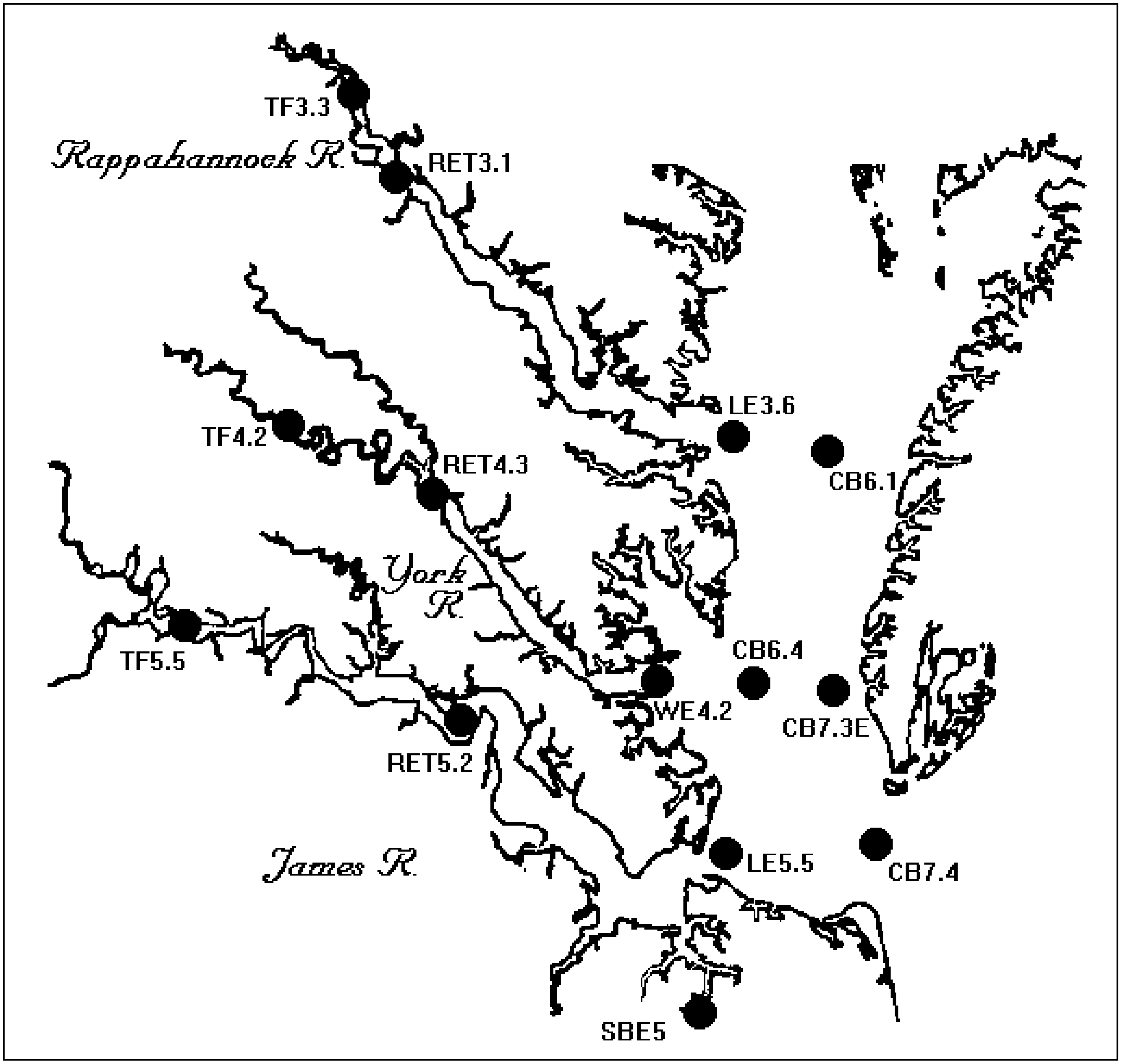
Figure III-C-1-7 - CBP Plankton Stations

CBP PLANKTON STATIONS				
STATION	LATITUDE (NAD83)	LONGITUDE (NAD83)	DESCRIPTION	
TF5.5	37.31308	-77.23245	James R., Red Buoy 107	TIDAL TRIBUTARY
RET5.2	37.21030	-76.79269	James R., Swann's Pt.	
SBE5	36.77002	-76.29572	S. branch Elizabeth off VEPCO	
TF4.2	37.58001	-77.02132	Pamunkey R. at White House	
TF3.3	38.01888	-76.90771	Rappahannock R., N40	
RET4.3	37.50696	-76.78770	York R., C57	
RET3.1	37.92027	-76.82104	Rappahannock R., N Buoy Rl0	
CB7.4	36.99570	-76.02049	Bay Mouth, Baltimore Channel	MAINSTEM
CB7.3E	37.22875	-76.05383	Eastern Shore Channel	
CB6.4	37.23653	-76.20799	Central Bay Area	
CB6.1	37.58847	-76.16216	Main Channel, Southern End	
LE5.5	36.99904	-76.31328	Mouth of James River	
WE4.2	37.24181	-76.38634	Mouth of York River	
LE3.6	37.59680	-76.28467	Mouth of the Rappahannock R.	

Quality Assurance

The quality assurance procedures given in "Work/Quality Assurance Project Plan for Monitoring Phytoplankton, Picoplankton and Productivity in the Lower Chesapeake Bay and Tributaries" [III-B-1c-6.doc] will be followed. Any changes to these procedures will be documented in the plan(s). A 100% recount will be performed on ten percent of all phytoplankton samples. Species lists and samples from similar salinity regimes will be exchanged with Maryland investigators, as needed, in order to resolve any identification problems. A split-sampling program coordinated by ICPRB will be performed with Maryland investigators, with resultant data submitted to CBCC.

Figure III-C-1-8 - CBP Plankton Map



(4) CBP River Input Monitoring Program (RIM)

River input loads reflect the cumulative amount of a pollutant entering a water body over time from all upstream sources. Information on delivered loads allows us to answer management questions like: What are the total delivered loads to the Bay and how are they changing over time? Which sub-watersheds contribute large amounts of pollutants to basin-wide loads? How are loads from sub-watersheds changing in response to management actions? In-stream monitoring for concentration and flow can answer these kinds of questions, but cannot estimate the contribution from different sources or determine how the load moved through different transport pathways. Because it is cost prohibitive to monitor all transport media continuously at all locations throughout the basin, key sampling points have been chosen to allow the application of models and other data extrapolation techniques. With adequate data for watershed model calibration and verification, models can be used to predict loads where data are absent, partition the load among contributing sources and transport pathways, and factor in transport lag times.

(1) Objectives

The Virginia River Input Water Quality Monitoring Program, initiated in 1988, provides the information necessary to determine progress towards achievement of the reduction goals.

(2) Stations

The Virginia River Input Monitoring program (RIM) involves the monitoring of nutrient and sediment concentrations at 24 monitoring locations throughout the State. The USGS Virginia Water Science Center and the Virginia Department of Environmental Quality (VADEQ) partner on the various operational tasks outlined in Figure III-C-1-9 – "CBP River Input Monitoring Stations" to operate the network (see also Figure III-C-1-10 – "CBP River Input Monitoring Map"). Loads and trends associated with nutrients and sediment are determined by USGS for each station, provided sufficient data are available. Additionally, three continuous water-quality (CWQ) stations are operated under the RIM program where pH, specific conductance, water temperature, and turbidity are continuously recorded in situ. These continuously monitored parameters will be used to understand basic watershed transport processes, and as surrogates for predicting continuous concentrations and loads of suspended sediment, total phosphorus and other water quality constituents, as appropriate.

(3) Frequency

The frequency of data collection is described below, and **Figure III-C-1-9** - CBP River Input Stations" identifies the agency responsible for the collection of each type of data at each monitoring station:

1. Discharge: At each monitoring station, a stream gage is maintained to provide a record of daily stream flow. Although continuous stream flow is usually available, the minimum data requirement is a daily time-step.
2. Routine water-quality monitoring: Monthly water quality samples are to be collected from all sites. Storm Samples: A minimum of eight water-quality samples also will be collected during storm events at each site; the 8 storm samples will be collected during no fewer than 4 independent storm flow periods.
3. Continuous Monitors: The in-situ continuous water-quality monitors will be serviced approximately monthly to clean the instruments and check calibration. Additional servicing of the continuous monitors will be performed as needed due to instrument fouling and malfunctioning.

(4) Parameters

Field parameters to be collected at all sites include (note DEQ does not collect Barometric Pressure or Turbidity field measurements):

Water Temperature
Air Temperature
Barometric Pressure
Dissolved Oxygen
Specific Conductance
pH
Turbidity

The Division of Consolidated Laboratory Services (DCLS), Virginia Department of General Services (DGS), will analyze each composite water sample for the following at select sites on the James, Appomattox, Mattaponi, Pamunkey and Rappahannock River sites (referred to as the extended sample analytes in Fig. III C-1-9):

Total Dissolved Nitrogen
Total Dissolved Phosphorus
Dissolved Nitrate
Dissolved Nitrite
Dissolved Ammonia
Total Phosphorus
Dissolved Orthophosphate
Dissolved Silica
Particulate Carbon
Particulate Nitrogen
Particulate Phosphorus
Total Suspended Solids
Volatile Suspended Solids
Fixed Suspended Solids
Sand/Silt/Clay (quarterly samples only)
Particulate Inorganic Carbon
Particulate Inorganic Phosphorus
Dissolved Organic Carbon
Chlorophyll and Phaeophytin

Suspended Sediment (To be analyzed at USGS sediment Lab in Kentucky)

The Division of Consolidated Laboratory Services (DCLS), Virginia Department of General Services, will analyze each composite water sample for the following at the remaining sites (referred to as the basic sample analytes in Figure III-C-1-9:

Total Nitrogen
Total Phosphorus
Total Nitrite plus Nitrate
Total Ammonia
Total Suspended Solids
Total Suspended sediment
Dissolved Orthophosphate

(5) Methods

1. USGS collected samples will be a composite of water collected with a vertical integrating sampler from ten points across the stream as width allows. When width does not allow for 10 points across a stream five points will be utilized. Typically five points are utilized on the Mattaponi and Pamunkey Rivers during routine sampling. Sample collection methods utilized by DEQ are described under the CBP Non-tidal Trend Monitoring Program in Section g.

2. USGS personnel will deliver samples to DCLS. DEQ schedules the samples in their CEDS database for DCLS to conduct the laboratory analysis.

Figure III-C-1-9 - CBP River Input Monitoring Stations

Station name	Station number	Year started	Sample analytes	Routine samples	Storm samples	Stream flow	CQW
Rappahannock River near Fredericksburg, Va.	01668000	1988	Extended	USGS	USGS	USGS[4]	na
James River at Cartersville, Va.	02035000	1988	Extended	USGS	USGS	USGS[4]	USGS (2004)
Pamunkey River near Hanover, Va.	01673000	1989	Extended	USGS	USGS	USGS	USGS (2007)
Mattaponi River near Beulahville, Va.	01674500	1989	Extended	USGS	USGS	USGS	na
Appomattox River at Matoaca, Va.	02041650	1989	Extended	USGS	USGS	VADEQ[2]	na
S.F. Shenandoah River at Front Royal, Va.	01631000	2004	Basic	USGS	USGS	USGS[4]	na
N.F. Shenandoah River near Strasburg, Va.	01634000	2004	Basic	USGS	USGS	USGS[4]	na
Rapidan River near Culpeper, Va.	01667500	2004	Basic	USGS	USGS	VADEQ[2]	na
James River at Blue Ridge Parkway, Va.	02024752	2005	Basic	VADEQ[2]	USGS	VADEQ[2]	na
North Anna River at Harts Corner nr Doswell, Va.	01671020	2007	Basic	USGS	USGS	VADEQ[2]	na
James River at Blvd. Bridge at Richmond, Va.	02037618	2007	Extended[2]	USGS	USGS	VADEQ[2]	na
Chickahominy River near Providence Forge, Va.	02042500	2007	Basic	USGS	USGS	USGS[4]	na
Smith Creek near New Market, Va.	01632900	2010	Basic	USGS	USGS	USGS[3]	USGS (2010)
Muddy Creek at Mount Clinton, Va.	01621050	2011	Basic	USGS	USGS	USGS[4]	na
Difficult Run near Great Falls, Va.	01646000	2011	Basic	USGS	USGS	USGS[3]	na
Accotink Creek near Annandale, Va.	01654000	2011	Basic	VADEQ[2]	USGS	USGS[3]	na
S.F. Quantico Creek near Independent Hill, Va.	01658500	2011	Basic	USGS	USGS	USGS[3]	na
Dragon Swamp at Mascot, Va.	01669520	2011	Basic	USGS	USGS	VADEQ[2]	na
Rivanna River at Palmyra, Va.	02034000	2011	Basic	VADEQ[2]	USGS	VADEQ[2]	na
S.F. Shenandoah River at Lynnwood, Va.	01628500	2012	Basic	VADEQ[2]	USGS[3]	USGS[3]	na
Rappahannock River at Remington, Va.	01664000	2012	Basic	VADEQ[2]	USGS[3]	USGS[4]	na
Mattaponi River near Bowling Green, Va.	01674000	2012	Basic	VADEQ[2]	USGS[3]	USGS[3]	na
Appomattox River at Farmville, Va.	02039500	2012	Basic	VADEQ[2]	USGS[3]	USGS[3]	na
Polecat Creek	01674182	2012	Basic	USGS[3]	USGS[3]	USGS[3]	na

CQW: Continuous water-quality measurements
Extended: Indicates that water-quality samples at this site are analyzed for a greater number of constituents
Basic: Indicates that water-quality samples at this site are analyzed for a lesser number of water-quality constituents
Extended[1]: Indicates an extended collection of water-quality analytes, however, sediments are analyzed by DCLS (not USGS Kentucky Sediment Lab)
USGS: Indicates that USGS performs water-quality sampling and gage operation, and that the funding for this activity is included in this scope of work
VADEQ[2]: Indicates water-quality sampling or gage operation by VADEQ
USGS[3]: Indicates water-quality sampling or gage operation by USGS is funded by EPA through interagency agreement with USGS
USGS[4]: Indicates water-quality sampling or gage operation by USGS is funded, at least partially, by another partner outside of this scope of work
na: not applicable
TBD: To be determined

Figure III-C-1-10 - CBP River Input Monitoring Map

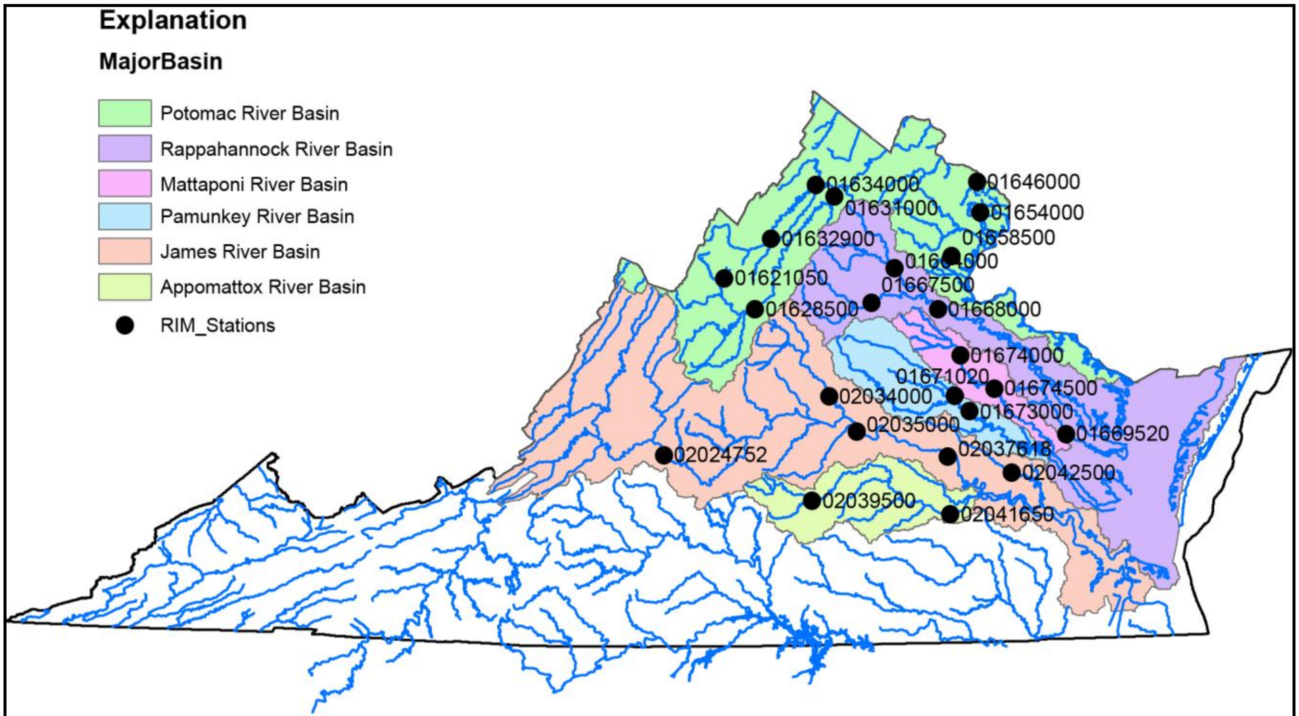


Figure 1. Map of the 24 River Input Monitoring Stations (Note Polecat Creek station not shown)

3. As part of a Quality Assurance program, USGS will periodically submit duplicate and audit samples to DCLS.

(6) Quality Assurance

The USGS will maintain an updated "Quality Assurance Project Plan for the Virginia River Input Monitoring Program (updated August 2012)" [III-B-1c-7.pdf]. If any data discrepancies or errors in the original raw data are discovered by the users of the database, DEQ, EPA/CBP or USGS within five years of payment for the data, the DEQ agrees to rectify those problems within the 90 day period following notification by EPA
Sample Program on a semi-annual basis.

(5) CBP Tributary Water Quality Monitoring Program

The Virginia Tributary Water Quality Monitoring Program (VTMP) was initiated in 1984. Water quality conditions are monitored at 32 stations in major tributaries to the Bay Mainstem and 12 stations on the Elizabeth River.

(1) Objectives

The objectives of the Tributary Water Quality Monitoring Program are:

> (1) To determine if water quality conditions meet requirements necessary to protect living resources from nutrient and sediment impacts,
> (2) To diagnose the likely causes of non-attainment and assess progress towards improvements still needed, and
> (3) To support continued refinement, calibration and validation of the Chesapeake Bay Water Quality Model and multi-species management models. The program also provides information necessary to measure effectiveness of point and non-point source programs in reducing nutrient input to the Bay.

Ambient nutrient concentrations are relevant to the evaluation of phytoplankton habitat quality requirements as well as part of a set of diagnostic requirements for assessing suitability of water quality for survival and growth of Submerged Aquatic Vegetation (SAV) Communities. Suspended sediments, measured as total suspended solids, have two principal impacts on aquatic organisms. Along with algae, they can significantly reduce light penetration, impacting survival of Submerged Aquatic Vegetation and disrupting light-dependent daily water column migrations of zooplankton. Elevated concentrations of total suspended solids can also affect feeding rates of organisms like oysters and clams, which filter their food from overlying waters. Finally, almost all tidal and non-tidal aquatic organisms require oxygen to survive, therefore, evaluations of dissolved oxygen habitat requirements are an important monitoring goal.

(2) Stations

Station descriptions for the VTMP stations are listed in “Figure III-C-1-11 - CBP Rappahannock Stations,” “Figure III-C-1-13 - CBP York River Stations,” and “Figure III-C-1-15 - CBP James River Stations,” below. Station maps for the same rivers (Figures III-C-1-12, III-C-1-14 and III-C-1-16, respectively) are collocated on the same pages.

Station locations in the Elizabeth River: Stations designated by a circle are sampled and analyzed by Old Dominion University (ODU) as a part of the Chesapeake Bay Mainstem program - see “Figure III-C-1-17 - CBP Elizabeth River Stations Map”. Stations designated with a square are sampled by DEQ personnel and analyzed by the Division of Consolidated Laboratory Services. Data collected by ODU is not retained in the Legacy STORET database or in DEQ’s CEDS2000 database.

Water quality data are collected over the tidal reaches of the James (including the Elizabeth River), York, and Rappahannock Rivers. The stations were selected to represent three different regions of each river based upon salinity.

(3) Sampling frequency

All stations will be sampled once each month. Sampling will be coordinated by the regional offices to attempt to sample entire tributaries on the same day. Weather permitting, sampling will occur on consecutive Tuesdays with the James River run conducted on the first Tuesday of the month, followed by the Rappahannock (Piedmont and Northern Virginia regional offices) and Elizabeth (Tidewater regional office) Rivers and then the York River.

(4) Sample Collection

Sample Collection: All collections of water column grab samples and subsequent sample handling will be undertaken following the protocols described in "Virginia Tributary Monitoring Program Quality Assurance/Quality Control Project Plan" [III-A-1b-3-7a.pdf]. At each station, grab samples will be collected at 1.0 meter below the surface and 1.0 meter above the bottom and analyzed for the designated parameters. . Both grab samples will correspond with a physical profile from the same sampling depth. For a detailed table of parameters, field collection, and lab protocols see "Figure III-C-1-18 - CBP Parameters and Associated Analytical Information" below.

(5) Field Measurements

Field Measurements: The field measurements obtained include the following:

1. Secchi disk.

2. A vertical profile of temperature, dissolved oxygen, pH, specific conductance, and salinity. The vertical profile starts at one meter above the bottom sediment (depth rounded to the nearest whole meter) and continues at one-meter intervals towards the surface.

3. Light Attenuation: An initial underwater light reading is just below the surface (approximately 0.1 meter) and with the deck sensor. Subsequent readings are taken in 0.5-meter increments. Rough sea conditions, strong tidal currents and light reflection off of the side of the boat adversely affect the determination of precise depths. As such, when conditions have become too rough, light attenuation measurements are not recorded.

All measurements except the Secchi and light attenuation readings are taken using a multi-parameter water quality monitoring instrument (such as Hydrolab brand water quality monitoring system).

(6) Laboratory Analyses

Laboratory Analyses: The analyses conducted by the Virginia Division of Consolidated Laboratory Services (DCLS) are also identified in "Figure III-C-1-18 - CBP Parameters and Associated Analytical Information", along with detection limits and the reference number for some of the analytical methods.

Figure III-C-1-11 - CBP Rappahannock Stations

RAPPAHANNOCK RIVER STATIONS						
RIVER	CBP Sta. No.	CIMS Sta No.	STORET NAME	Location Description	LATITUDE (NAD83)	LONGITUDE (NAD83)
Rappahannock	TF3.1E	TF3.1E	3-RPP098.81	Buoy 112	38.24461	-77.32508
Rappahannock	TF3.1B	TF3.1B	3-RPP091.55	Buoy 89	38.24625	-77.23331
Rappahannock	TF3.2	TF3.2	3-RPP080.19	Port Royal	38.17553	-77.18786
Rappahannock	TF3.2A	TF3.2A	3-RPP064.40	Blind Point	38.11294	-77.05483
Rappahannock	TF3.3	TF3.3	3-RPP051.01	Buoy 40 Plankton, Benthic	38.01847	-76.90928
Rappahannock	RET3.1	RET3.1	3-RPP042.12	Buoy 10 Plankton, Benthic	37.91731	-76.82219
Rappahannock	RET3.2	RET3.2	3-RPP031.57	Buoy 16	37.81158	-76.71194
Rappahannock	LE3.1	LE3.1	3-RPP025.52	Buoy 11	37.75925	-76.61592
Rappahannock	LE3.2	LE3.2	3-RPP017.72	Near Buoy 8 Benthic	37.66914	-76.55047
Corrotoman	LE3.3	LE3.3	3-CRR003.38	Buoy 6	37.68842	-76.47442
Rappahannock	LE3.4	LE3.4	3-RPP010.60	Orchard Point	37.63189	-76.44486

Figure III-C-1-12 - CBP Rappahannock Map

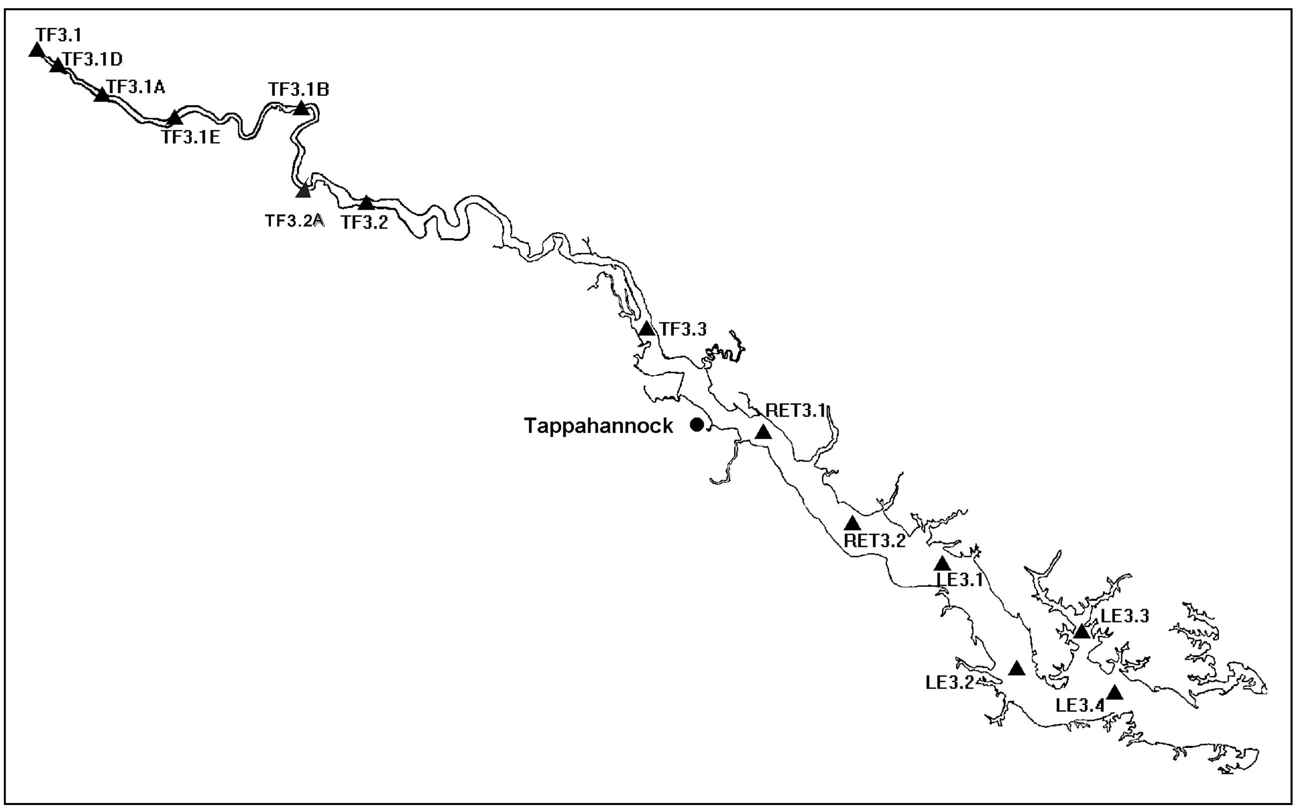


Figure III-C-1-13 - CBP York River Stations

YORK RIVER STATIONS						
RIVER	CBP Sta. No.	CIMS Sta No.	STORET NAME	Location Description	LATITUDE (NAD83)	LONGITUDE (NAD83)
Pamunkey	TF4.2	TF4.2	8-PMK034.17	Whitehouse Plankton, Benthic	37.57997	-77.02128
Mattaponi	TF4.4	TF4.4	8-MPN029.08	Walkerton	37.72281	-77.02578
Pamunkey	RET4.1	RET4.1	8-PMK006.36	South of Lee Marsh	37.52564	-76.86761
Mattaponi	RET4.2	RET4.2	8-MPN004.39	Muddy Point	37.57125	-76.79714
York	RET4.3	RET4.3	8-YRK031.39	Buoy 57 Plankton, Benthic	37.50869	-76.78889
York	LE4.1	LE4.1	8-YRK022.70	Buoy 44 Benthic	37.41883	-76.69125
York	LE4.2	LE4.2	8-YRK011.14	Buoy 34	37.29044	-76.57811
York	LE4.3	LE4.3	8-YRK001.64	Buoy 24 Benthic	37.23392	-76.43094

Figure III-C-1-14 - CBP York River Map

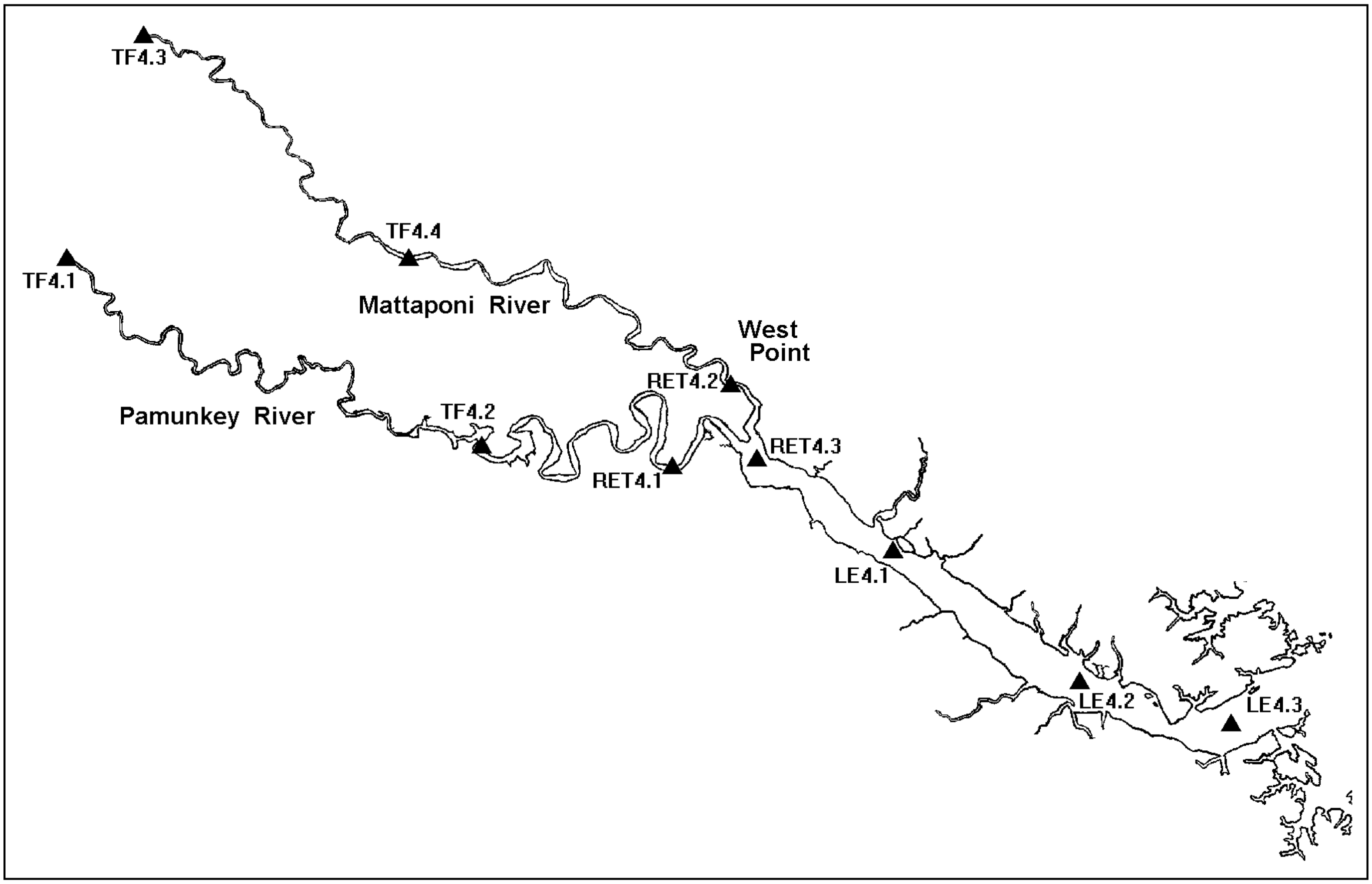


Figure III-C-1-15 - CBP James River Stations

River	CBP Sta. No.	CIMS Sta. No.	Storet Name	Location Description	NAD83 Latitude	NAD 83 Longitude
James	TF5.2	TF5.2	2-JMS110.30	Mayo's Bridge Head of Tide	37.53050	-77.43400
James	TF5.2A	TF5.2A	2-JMS104.16	Buoy 166	37.45000	-77.41883
James	TF5.3	TF5.3	2-JMS099.30	Buoy 157	37.40311	-77.39272
Appomattox	TF5.4	TF5.4	2-APP001.53	Buoy 8	37.31239	-77.29133
James	TF5.5	TF5.5	2-JMS075.04	Buoy 107 Plankton, Benthos	37.31264	-77.23281
James	TF5.5A	TF5.5A	2-JMS069.08	Buoy 91	37.30164	-77.12839
James	TF5.6	TF5.6	2-JMS055.94	Buoy 74	37.27272	-76.99058
Chickahominy	RET5.1A	RET5.1A	2-CHK006.14	Buoy 10	37.31231	-76.87672
James	RET5.2	RET5.2	2-JMS042.92	Swann's Point Plankton, Benthos	37.20294	-76.78219
James	LE5.1	LE5.1	2-JMS032.59	Buoy 36, Benthos	37.20297	-76.64833
James	LE5.2	LE5.2	2-JMS021.04	Buoy 12-13 Benthos	37.05600	-76.59306
James	LE5.3	LE5.3	2-JMS013.10	Buoy 15	36.99044	-76.47544
James	LE5.4	LE5.4	2-JMS005.72	Buoy 9 Benthos	36.95486	-76.39275
Elizabeth	LE5.6	LE5.6	2-ELI002.00	Buoy 18	36.90456	-76.33836
Elizabeth	LFB01	LFB01	2-LAF003.82	Granby St. Bridge	36.88936	-76.26478
Elizabeth	LFA01	LFA01	2-LAF001.15	Hermitage Pt.	36.90822	-76.31464
Elizabeth	ELD01	ELD01	2-ELI004.79	Degaussing St. (Confl. WB)	36.86556	-76.32889
Elizabeth	WBB05	WBB05	2-WBE004.44	Drum Point	36.82917	-76.39583
Elizabeth	ELE01	ELE01	2-ELI006.92	Nauticus Pier	36.84833	-76.29806
Elizabeth	EBB01	EBB01	2-EBE002.98	N&W RR. Bridge	36.83611	-76.24444
Elizabeth	ELI2	ELI2	None**	Off SE corner of Craney Is.	36.88164	-76.33867
Elizabeth	SBE2	SBE2	None**	Southern branch off Atlantic Wood	36.81336	-76.29025
Elizabeth	SBE5	SBE5	None**	Southern branch off Virginia Power	36.76514	-76.29992
Elizabeth	EBE1	EBE1	None**	Eastern branch, West side Berkley br.	36.90767	-76.28797
Elizabeth	WBE1	WBE1	None**	Western br., North side Hwy 17	36.84403	-76.36078

** These stations were sampled and analyzed for VADEQ by Old Dominion University until 2010 and by VADEQ beginning December 2010. The ODU generated data were never entered into Legacy STORET or VADEQ's CEDS2000 system.

Figure III-C-1-16 - CBP James River Map

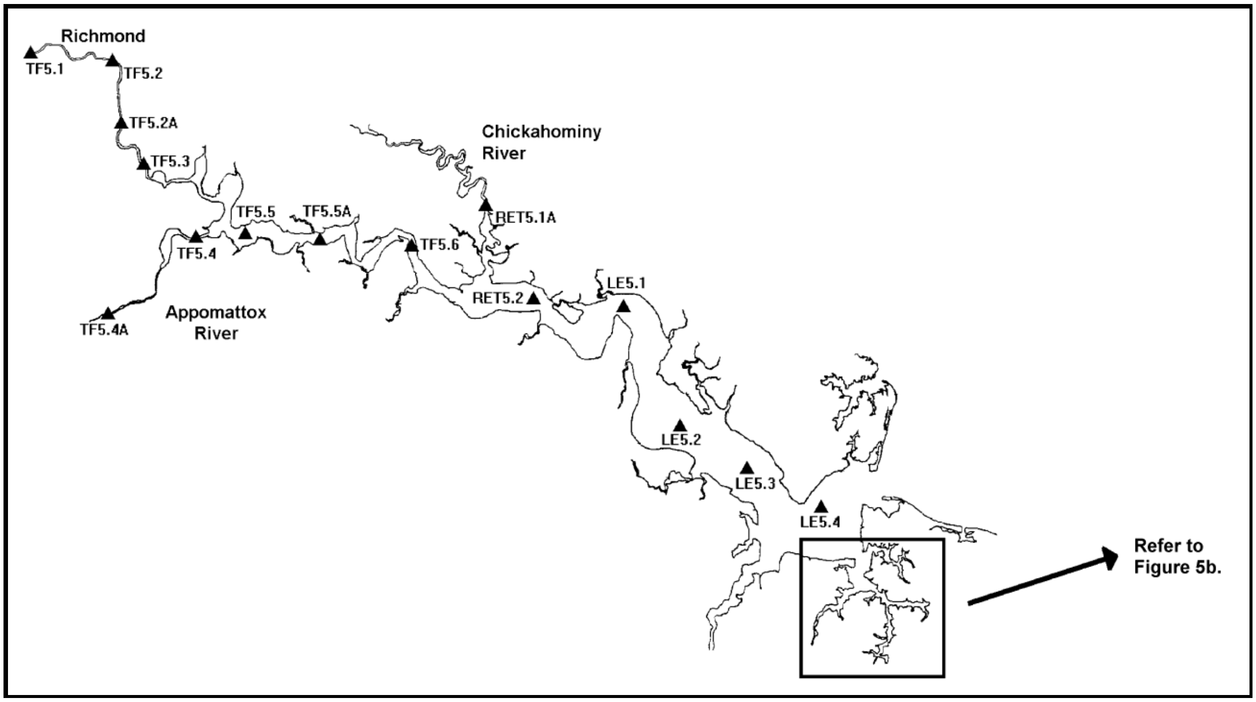


Figure III-C-1-17 - CBP Elizabeth River Stations Map
(Referred to as Fig 5B in Figure III-C-1-16 - CBP James River Map)

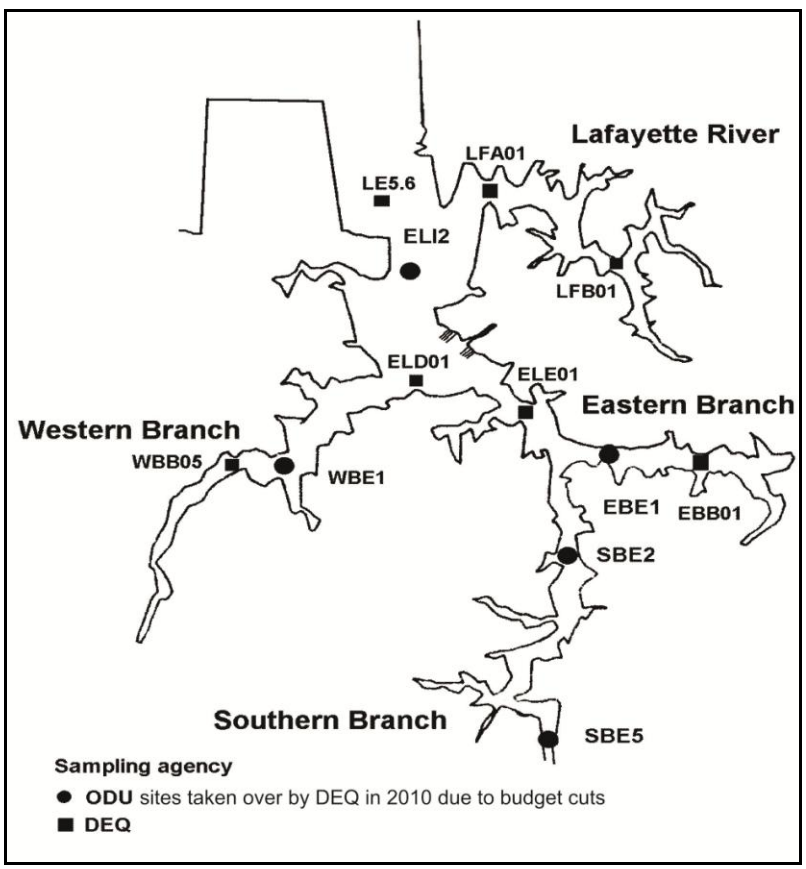


Figure III-C-1-18 - CBP Parameters and Associated Analytical Information

PARAMETER	STORET PARAMETER	COLLECTION PROCEDURE	PRESERVATION	PREFORMS ANALYSIS	DETECTION LIMITS	CBPMETHOD (unless noted otherwise)
Temperature	00010	Multi-probe		Field		F01
pH	00400	Multi-probe		Field		F01
Dissolved Oxygen	00299	Multi-probe		Field		F01
Conductivity	00094	Multi-probe		Field		F01
Salinity	00096	Multi-probe		Field		F01
Secchi Depth	00078	Secchi Disk		Field		F01
PAR Light Attenuation	N/A	LiCor		Field		F01
Nitrate Nitrogen (NO3 as N)	Not submitted Calculated	Filtrate	ICE	DCLS	0.004 ppm	L01
Nitrite Nitrogen (NO2 as N)	00613	Filtrate	ICE	DCLS	0.002 ppm	L01
Nitrate + Nitrite (NO2+NO3)	00631	Filtrate	ICE	DCLS	0.002 ppm	L01
Ammonium (NH4 as N)	00608	Filtrate	ICE	DCLS	0.003 ppm	L01
Particulate Nitrogen	49570	Filter 25mm	ICE	DCLS	0.076 mg/l	L01
Total Dissolved Nitrogen	49571	Filtrate	ICE	DCLS	0.004 mg/l	L01
Total Phosphorus	00665	Whole water	ICE	DCLS	0.01 ppm	L01frsh/L04sal
Total Dissolved Phosphorus	49572	Filtrate	ICE	DCLS	0.001 mg/l	L01
Particulate Phosphorus	49567	Filter 47mm	ICE*	DCLS	0.001 mg/l	L01
Orthophosphate (PO4 as P)	00671	Filtrate	ICE	DCLS	0.002 ppm	L01
Dissolved Silicon (Si as SiO4)	00955	Filtrate	ICE	DCLS	0.1 ppm	L01
Particulate Organic Carbon	49569	Filter 25mm	ICE*	DCLS	0.064 mg/l	L01
Fixed Suspended Solids	00540	Whole water	ICE	DCLS	3 mg/l	L01
Total Suspended Solids	00530	Whole water	ICE	DCLS	3 mg/l	L01
Volatile Suspended Solids	Not submitted Calculated	Whole water	ICE	DCLS	3 mg/l	L01
Chlorophyll a	Calculated	Filter GF/F	ICE*, 3ml MgCO3	DCLS	0.5 ug/L	L01
Phaeophytin a	Calculated	Filter GF/F	ICE*,3 ml MgCO3	DCLS	0.5 ug/L	L01
* If stored over 24 hours filters must be frozen.						

(7) Quality Assurance

The primary QA\QC mechanism currently utilized in the tributary monitoring effort is the use of equipment blanks, field duplicates, source blanks and a CBP Coordinated Split Sample Program (CSSP). The Virginia Tributary Monitoring Program (VTMP) collects one complete set of equipment blanks per month, one set of filtered blanks each cruise, and two complete sets of duplicate samples per month. Duplicate samples are submitted to DCLS from each tributary for field quality control samples. Stations are rotated and duplicate samples are collected from both surface and bottom depths (where applicable) to obtain a duplicate for a total of approximately 10% of the samples collected. Complete current quality assurance procedures are described in the "Virginia Tributary Monitoring Program Quality Assurance/Quality Control Project Plan" [III-A-1b-3-7a.pdf].

Samples are collected, preserved and transported according to accepted SOP methods to DCLS' Sample Receiving and Management (SRM) by a DCLS selected courier. SRM (DCLS) personnel log in samples and distribute them to the appropriate laboratory for analysis. After analysis, the data results are transformed into the correct concentration units, keyed into the Laboratory Information Management System (LIMS) by the chemist completing the analysis and reviewed by the appropriate laboratory personnel. Upon approval the results are shipped back to DEQ via FDT transfer and entered into the CEDS2000 database. In the event data sheets are utilized to submit the samples to DCLS (e.g. due to a CEDS/WQM system failure) the results are printed out onto laboratory sheets and given to the DEQ Laboratory Liaison. Results returned on paper are keyed into the CEDS2000 system by personnel in the Office of Water Programs Division and forwarded to the appropriate region or the Central office project manager. Data go through a series of screens and reviews to identify invalid, qualified or QA supported data. The qualified and QA supported data are then submitted to the EPA-CBPO (Annapolis, MD) Data Bases via Quality Assurance Tool (QAT) which produces a quality analysis report that is reviewed by the CBPO water quality database manager who imports the data into the official CBP database for access by users.

(6) CBP Shallow Water Habitat Monitoring Program

The "Chesapeake 2000: A Watershed Partnership" agreement, states that "Improving water quality is the most critical element in the overall protection and restoration of the Chesapeake Bay and its tributaries…" and further it commits to "By 2010, correct the nutrient- and sediment-related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal portions of its tributaries from the list of impaired waters under the Clean Water Act." In pursuit of this goal, the Bay partners agreed that "By 2003, the jurisdictions with tidal waters will use their best efforts to adopt new or revised water quality standards consistent with the defined water quality conditions" and in April 2003 the Chesapeake Bay Program published "Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries" (U.S. EPA, 2003) and refinements to that document were published as addenda in 2004, 2007, 2008 and 2010.

Objectives

The development of these new water quality standards for turbidity, chlorophyll, and dissolved oxygen, has placed new requirements on accurate measurements of the temporal and spatial variability of water quality constituents. Until recently our capacity to measure, monitor, and evaluate water quality constituents in detail over ecologically relevant regions and time scales was limited. However, there has been recent application in Virginia of a new state-of-the-art DATAFLOW Surface Water Quality Mapping System for high speed, high resolution mapping of surface water quality from small vessels capable of sampling shoal and littoral areas. Such a mapping system has been demonstrated to have practical application in the determination of attainment of water quality criteria constituents in shallow water designated use areas. In addition, continuous measurements of similar water quality constituents can be taken from fixed, shallow water monitoring stations using Yellow Springs Instrument (YSI) underwater data sondes and to assess temporal variability and weekly or instantaneous criteria. This project has begun implementing these new technologies for the monitoring of the new water quality standards.

This project also collects data relevant to the goal to "Restore, enhance and protect the finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem" by addressing the following issues as secondary objectives.

Temporally intensive water quality studies (*e.g.*, Moore et al. 1995, 1996) in vegetated and un-vegetated shallows and adjacent channel areas in the Bay have demonstrated that differences in water quality between the two can be significant, and predictions of SAV transplant growth and survival using the closest available mid-channel, water quality monitoring data, have had poor success. Our measurement of the spatial variability of water quality constituents, especially between channel and shoal regions and how this variability is related to SAV, remains incomplete.

Reduced abundance of Submerged Aquatic Vegetation (SAV) in the Chesapeake Bay over the past 30 years has been related to sub-optimal water quality conditions. Conditions and processes that influence water quality within the shallow littoral zones of the Chesapeake Bay and its tidal tributaries can be distinctly different from those in channel zones and can vary over reduced temporal and spatial scales. Recent EPA-funded studies and their resultant peer-reviewed publications for high salinity regions of the Chesapeake Bay have demonstrated that water quality in vegetated shallows may be distinctly different from adjacent channel or un-vegetated shoal areas.

Suspended particles (both sediment and phytoplankton) are of particular concern as they can dominate light attenuation in the shallows and can be the principal factor limiting natural SAV recovery and SAV transplantation success in many formerly vegetated areas. Phytoplankton levels are principally related to nutrient and light availability while fine-grained suspended sediments originate from river inputs as well as from shoreline and bank erosion. Once they have entered the body of an estuary, however, sediments may be deposited and re-suspended many times through natural processes (tidal currents and wind generated waves).

The structure of the SAV community and its capacity to modify local conditions may provide a key to their continued survival or recovery in some areas where water quality is marginal for growth, or stresses are seasonal or pulsed in nature. Current modeling efforts include density dependent relationships between SAV density and particle loads and therefore water clarity. However, many estimates of statistically derived water quality conditions needed for SAV recovery are obtained from water quality measurements in areas adjacent to existing beds. In some cases they may underestimate the levels of water quality improvements required for recovery into non-vegetated areas, given sufficient capacity of SAV beds to improve conditions within the beds.

Segments

The segments to be sampled will be determined by joint agreement between VIMS and DEQ.

Sampling Frequency

The overall field sampling period will be April - October. Sampling frequency will be monthly for the DATAFLOW mapping system. Sampling frequency for the fixed station continuous monitoring units will be as determined by the Tidal Monitoring and Assessment Workgroup of the Federal-Interstate Chesapeake Bay Program.

Field Sampling

DATAFLOW Mapping System: DATAFLOW is a compact, self-contained surface water quality mapping system, suitable for use in a small boat operating at speeds of about 25 knots. The system collects water through a pipe ("ram") mounted on the transom of the vessel, pumps it through an array of water quality sensors, and then discharges the water overboard. The entire system from intake ram tube to the return hose are shielded from light to negate any effect high intensity surface light might have on phytoplankton in the flow-through water that is being sampled. A blackened sample chamber is also used to minimize any effect of light on measurements by the fluorescence probe.

DATAFLOW has an YSI 6600 Sonde equipped with a flow-through chamber. The sensors include a Clark-type YSI 6562 DO probe, a YSI 6560 conductivity/temperature probe, a 6026 turbidity probe, and a 6025 chlorophyll probe. The sonde transmits data collected from the sensors directly to a ruggedized laptop computer (Toughbook 28, Panasonic, Inc.) using a data acquisition system created with LabView software (National Instruments, Inc.).

The DATAFLOW system is equipped with a Garmin GPSMAP 168 Sounder. This unit serves several functions including chart plotting, position information, and depth. The unit is Wide Area Augmentation System (WAAS) enabled providing a position accuracy of better than three meters 95 percent of the time. The NEMA 0183 data sentence containing all pertinent position and depth information is output to the single board computer (SBC) data acquisition system.

The DATAFLOW system utilizes a SBC data acquisition system for data collection and storage. The system is based on an 800 MHz Pentium processor with Windows 2000 for an operating system. Custom software written in a LabView environment provides for data acquisition, display, control, and storage. Real-time graphs and indicators provide feedback to the operator in the field, ensuring quality data is being collected. All data is collected simultaneously in one file, removing the chore (and possible errors) of merging separate files into one.

Complete field sampling procedures will be documented in the "Work/Quality Assurance Project Plan for the Water Quality Monitoring for Bay Water Quality Standards Assessment" [III-B-1c-1.pdf].

Fixed Station Continuous Monitoring System: The specific goal of the fixed station continuous monitoring system is to quantify short-term variability and long-term changes in water quality constituents in specific shallow water areas. Currently four such areas are being monitored in the York River in Virginia at 15-minute intervals for: water temperature, conductivity, salinity, percent saturation, dissolved oxygen concentration, water depth, pH and turbidity. All water quality data loggers (YSI 6600 Datasondes) are deployed from a known depth from the bottom at each site. These sensors are identical to those used in the DATAFLOW system.

Laboratory Analysis

Complete laboratory analysis procedures will be given in the "Work/Quality Assurance Project Plan for the Water Quality Monitoring for Bay Water Quality Standards Assessment" [III-B-1c-1.pdf]. Approximately five discreet, subsurface water samples will be taken during each DATAFLOW cruise and upon return to the VIMS laboratory the water samples will be processed by the Analytical Services Center for chlorophyll, suspended sediments, and dissolved oxygen using EPA approved procedures. Additionally, light attenuation will be measured from in situ light profiles using EPA approved Licor, underwater quantum sensors, at each verification station.

Quality Assurance

The quality assurance procedures are documented in "Work/Quality Assurance Project Plan for the Water Quality Monitoring for Bay Water Quality Standards Assessment" [III-B-1c-1.pdf] (for the corresponding period: *e.g.*, Effective 2011). Any changes to these procedures will be documented in the plan. This plan was submitted to and approved by DEQ before data collection began.

Special Conditions

All data collection, data analysis, and data management will be performed according to methods and protocols discussed, developed and approved through the Tidal Monitoring and Assessment Workgroup of the Federal-Interstate Chesapeake Bay Program. These protocols and methods need to be compatible and consistent with those used in other Bay tidal waters to ensure Bay-wide comparability of monitoring information.

The principal investigator or appropriate designee will participate in all meetings, conference calls and discussions of the Tidal Monitoring and Assessment Workgroup during which this project is scheduled to be discussed.

VIMS will participate in the quarterly Mainstem Coordinated Split Sample Program (CSSP) split for water quality analyses. The procedures followed will be those given in the CBP CSSP guidelines.

The YSI Datasondes purchased for this project shall be the property of DEQ. These will be tagged with a DEQ property tag to be provided by DEQ.

(7) CBP Non-Tidal Trend Monitoring Program

In the Chesapeake 2000 Agreement, the CBP committed to correct the nutrient and sediment-related problems in the Bay and its tidal tributaries to remove them from the impaired water list. To achieve improved water-quality in the Bay, nutrient and sediment loading allocations have been developed for tributary basins in the Bay watershed. Information, including both modeling predictions and monitoring assessments, is needed by the jurisdictions in the Bay watershed to assess progress in meeting the nutrient and sediment allocations and the water-quality criteria in the Bay.

Objectives

The specific objective of the non-tidal trend network is to measure and assess the concentration, load, and trends of nutrients and sediment in the Bay watershed. The information will be analyzed to help evaluate progress toward, and factors influencing, the reduction of nutrients and sediment to attain the water-quality criteria in the Bay. The objective will be met through a network that provides data for:

(1) Estimating nutrient and sediment loads,
(2) Computing trends in the loads, concentrations and stream flow,
(3) Providing information to improve calibration and verification of the watershed model, and
(4) Providing information that will be integrated with other data (such as changes in nutrient sources) to determine the factors affecting the concentrations, loads, and trends.

Site Selection

Site selection was based on (a) the presence of an operating stream gage to measure flow, (b) some existing sample collection (quarterly or monthly), and (c) the completeness of parameters currently being collected at each site. All stations in the network have stream gages and sample-collection sites co-located. Stations were prioritized according to the following factors:

(1) Sites established at the outlets of rivers draining the previously defined Tributary Strategy Basins,
(2) Sites at the outlet of basins that deliver the largest amounts of nutrients and sediment to the Bay and
(3) Sites of importance to watershed modeling efforts, especially in regards to areas of large data gaps such as sites in the Coastal Plain.

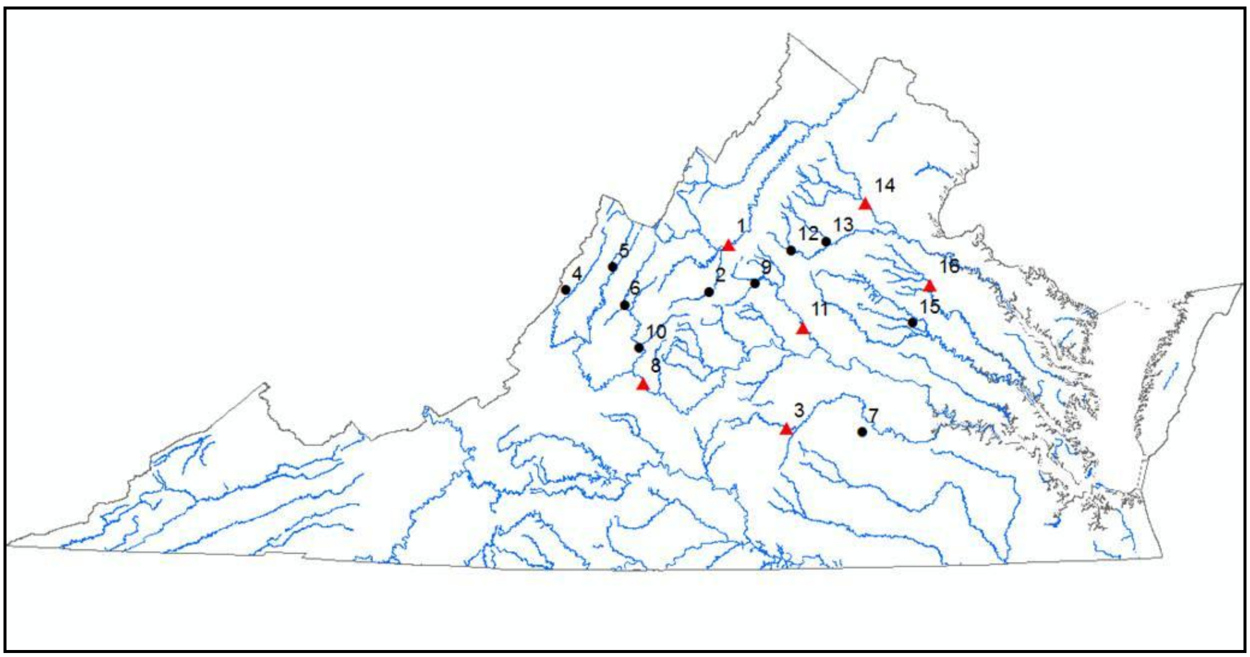
Stations in the non-tidal network are classified as primary or secondary sites. Primary sites are collected using modified USGS equal width incremental sampling procedures and depth integration equipment. Additionally, primary site collections include targeted storm event sampling. Secondary sites are also sampled using equal width sampling procedures and depth integration equipment but do not have storm events targeted.

The non-tidal network consists of 7 primary and 11 secondary sites. Station descriptions are listed in “Figure III-C-1-19 - Non-Tidal Network Stations” and their locations are shown in “Figure III-C-1-20 - Virginia Non-Tidal Network Monitoring Stations Map”, both on the following page.

Figure III-C-1-19 - Non-Tidal Network Stations.

	CBP NON-TIDAL NETWORK STATIONS				
Site No.	STATION	LATITUDE (NAD83)	LONGITUDE (NAD83)	DESCRIPTION	Network Station Type
1	1BSSF100.10	38.31306	-78.77103	Rt. 708 Br.	Primary
2	1BSTH027.85	38.05736	-78.90780	137 ft downstream of Rt 664 Br. City of Waynesboro	Secondary
3	2-APP110.93	37.30740	-78.38897	Rt.45 Br. at Farmville	Primary
4	2-BCC004.71	38.06986	-79.89764	Rt. 39 at Gaging Station	Secondary
5	2-BLP000.79	38.19528	-79.57072	Rt. 614 Br. at gaging station	Secondary
6	2-CFP004.67	37.98717	-79.49408	Downstream of Rr. 42 Br.	Secondary
7	2-DPC005.20	37.28404	-77.86861	Rt. 153 Br.	Secondary
8	2-JMS279.41	37.55546	-79.36701	Blue Ridge Pkwy Br. above Big Island	Primary
9	2-MCM005.12	38.10269	-78.59293	Rt. 614 Bridge at gaging station	Secondary
10	2-MRY014.78	37.75222	-79.39194	Rt. 60 at Ben Salem Wayside	Secondary
11	2-RVN015.97	37.85806	-78.26694	RT. 15 Bridge	Primary
12	3-RAP066.54	38.27985	-78.34084	Rt. 29	Secondary
13	3-ROB001.90	38.32513	-78.09528	Rt. # 614 Br.	Secondary
14	3-RPP147.49	38.53012	-77.81360	Rt. # 15/29 Br.	Primary
15	8-LTL009.54	37.87292	-77.51332	Rt. 685 Br.	Secondary
16	8-MPN094.94	38.06181	-77.38600	Rt. # 605 Br.	Primary
17	8-POR008.97	38.17131	-77.59456	Rt. # 208 Br.	Secondary

Figure III-C-1-20 - Virginia Non-Tidal Network Monitoring Stations Map
(Refer to the site numbers in Figure III-C-1-19 for station information.)



Sampling frequency

All sites are sampled monthly and should include samples collected over a range of flow. Primary sites will also have samples collected from 4 – 8 targeted storm events.

Sample Collection, Field measurements, and Laboratory Analyses

A list of the field and analytical parameters to be collected from each site is listed in "Figure III-C-1-21 - Non-tidal Network Parameters and Associated Analytical Information". Water samples are collected using equal width sampling procedures as described in the Virginia CBP Non-tidal Network Monitoring Program Quality Assurance/Quality Control Project Plan. [III-B-1c-4.pdf]

Figure III-C-1-21 - Non-tidal Network Parameters and Associated Analytical Information.

PARAMETER	STORET PARAMETER	COLLECTION PROCEDURE	PRESERVATION	PREFORMS ANALYSIS	DETECTION LIMITS	CBPMETHOD (unless noted otherwise)
Temperature	00010	Hydrolab Meter		Field		F01
pH	00400	Hydrolab Meter		Field		F01
Dissolved Oxygen	00299	Hydrolab Meter		Field		F01
Specific Conductance	00094	Hydrolab Meter		Field		F01
Total Nitrate + Nitrite (NO2+NO3)	00630	Whole water	ICE	DCLS	.04 mg/l	L01
Total Ammonium (NH4 as N)	00610	Whole water	ICE	DCLS	.04 mg/l	L01
Total Phosphorus	00665	Whole water	ICE	DCLS	0.01 mg/l	L01frsh/L04sal
Total Nitrogen	00600	Whole water	ICE	DCLS	0.01 mg/l	L01
Orthophosphate (PO4 as P)	OPWLF	Whole water Lab filtered	ICE	DCLS	.002 mg/l	L01
Fixed Suspended Solids	00540	Whole water	ICE	DCLS	3 mg/l	L01
Total Suspended Solids	00530	Whole water	ICE	DCLS	3 mg/l	L01
Total Suspended Sediment	SSC-Total	Whole water	ICE	DCLS/USGS KY sediment lab		L01
Suspended sediment >0.62	SSC-Course	Whole water	ICE	DCLS		L01
Suspended sediment <0.62	SSC-Fine	Whole water	ICE	DCLS		L01

At the primary sites the number of transects is determined by the width of the stream, but consists of 1- 9 transects. An odd number of transects are utilized as field parameters and water collections are collected simultaneously at each transect across the stream and the median value for each field parameter is entered into the database. At the primary stations sand-fine splits will be collected during storms to measure the percentage of sand in transport and determine if existing Total Suspended Sediment (TSS) data are appropriate for trend and load computations. Sand-fine splits of the sediment will be collected during selected storms to determine if the fine-grained sand content is high enough (over 90 percent of the sample) to require Suspended Sediment Concentration (SSC) in addition to TSS concentrations for trend and load analyses. Depth/width integrated, isokinetic suspended sediment sampling will be performed at each Loading Station during four to eight storm events annually.

Quality Assurance

The primary QA\QC mechanisms currently utilized in the non-tidal network are the use of equipment blanks, field duplicates, source blanks and a CBP Coordinated Split Sample Program (CSSP). The Non-tidal network collects duplicates and equipment blanks quarterly. Complete current quality assurance procedures are described in the Virginia CBP Non-tidal Network Monitoring Program Quality Assurance/Quality Control Project Plan. [III-B-1c-4.pdf]

Samples are collected, preserved and transported according to accepted SOP methods to DCLS Central Receiving by a DCLS-selected courier. Central Receiving (DCLS) personnel log in samples and distribute them to the appropriate laboratory for analysis. After analysis, the data results are transformed into the correct concentration units, keyed into the LIMS system by the chemist completing the analysis and reviewed by the appropriate laboratory personnel. Upon approval the results are shipped back to DEQ via FDT transfer and uploaded into the CEDS 2000 database. In the event data sheets are utilized to submit the samples to DCLS (*e.g.*, due to a CEDS/WQM system failure) the results are printed out onto laboratory sheets and given to the DEQ Laboratory Liaison. Results returned on paper are keyed into the CEDS 2000 system by personnel in the Office of Water Programs Division and forwarded to the appropriate region or the Central office project manager. Data go through a series of screenings and reviews to identify invalid, qualified or QA supported data. The qualified and QA supported data are then submitted to the EPA-CBLO (Annapolis, MD) Data Bases via the Quality Assurance Tool (QAT) which produces a quality analysis report that is reviewed by the CBPO water quality database manager who imports the data into the official CBP database for access by users.

Compiling, managing, and submitting the data

Raw data will be verified and assured using quality-control procedures currently in place for the Chesapeake Bay Tributary Water Quality Monitoring Program. The data will be stored in the DEQ CEDS database as well as submitted to the CBP for inclusion in the Non-tidal Water-Quality database and the Chesapeake Information Management System (CIMS). The Non-tidal Water Quality Work Group (NTWQWG) is working with the CBP to improve data-submission procedures for the Non-tidal Water-Quality database and CIMS. Once the data is in the CBP non-tidal database, it will be available for use in further analyses. The data will increase the number of sites in the watershed for load and trend computations conducted by the USGS and other investigators (CBP project: Long-term Analysis of Water-Quality, Habitat, and Living Resource Data). The data will also be used to improve the CBP environmental indicators for loads and trends to help inform the jurisdictions and public about progress in reducing nutrients and sediment in the Bay watershed.

For more detailed information about DEQ monitoring within the Interstate Chesapeake Bay Program, contact:

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