COMMONWEALTH OF VIRGINIA
Department of Environmental Quality
Division of Water Quality
Larry G. Lawson, P.E., Director

Subject: **Guidance Memo No. 04-2006**
2004 Water Quality Assessment Guidance Manual

To: Regional Directors

From: Larry G. Lawson, P.E., Director

Date: February 4, 2004

COPIES: Alan Pollock, Regional Water Quality Planning Managers and staff, Office of Water Quality Programs Managers, WQMA Staff

Summary:

EPA's 2003 Integrated Report Guidance recommended states submit an "Integrated Report" that will satisfy Clean Water Act (CWA) requirements for both Sections 305(b) water quality reports and 303(d) impaired waters lists. This Integrated Report will show the following information:

- delineation of water quality assessment units (AUs) based on National Hydrography Dataset (NHD);
- status of and progress toward achieving comprehensive assessments of all waters;
- Water Quality Standard attainment determination for every AU;
- additional monitoring that may be needed to determine Water Quality Standard attainment status and, if necessary, to support development of TMDLs for each pollutant/AU combination;
- schedules for additional monitoring planned for AUs;
- pollutant/AU combinations still requiring TMDLs; and
- TMDL development schedules reflecting the priority ranking of each pollutant/AU combination.
- Water Quality "Effluent Limited" Waters

DEQ has incorporated the Integrated Reporting guidance EPA developed in 2003 into the 2004 assessment guidance. It is substantially different from previous guidance and is designed to integrate or combine the 305(b) overall assessment of Virginia's waters and separate out those waters impaired and needing a TMDL as per 303(d). The EPA 2003 Integrated Report Guidance and Assessment Database (ADB V2.1) has 5 different categories with 1 category having 3 subcategories in which every segment or "assessment unit" (AU) will be placed. The US EPA Integrated Report Guidance allows the states to subdivide the federal Categories in order to address state programmatic needs.

Below are the US EPA defined Categories followed by associated Virginia defined subcategories:

FULLY SUPPORTING – Waters are supporting one or more designated uses

- **EPA Category 1**: Attaining all associated designated uses and no designated use is threatened.

- **EPA Category 2**: Some of the designated uses are met but there is insufficient data to determine if remaining designated uses are met.

Va. Category 2A - waters are attaining all of the uses for which they are monitored and there is insufficient data to document the attainment of all uses.

Va. Category 2B – waters are of concern to the state but no Water Quality Standard exists for a specific pollutant, or the water exceeds a state screening value.

INDETERMINATE – Waters needing additional information

- **EPA Category 3**: Insufficient data to determine whether any designated uses are met

Va. Category 3A - no data are available within the data window of the current assessment to determine if any designated use is attained and the water was not previously listed as impaired.

Va. Category 3B - some data exists but is insufficient to determine attainment of designated uses. Such waters will be a prioritized for follow up monitoring.

Va. Category 3C- data collected by a citizen monitoring or other organization indicating water quality problems may exist but the methodology and/or data quality has not been approved for a determination of attainment of designated uses. These waters are considered as having insufficient data with observed effects. Such waters will be a prioritized for follow up monitoring.

Va. Category 3D – data collected by a citizen monitoring or other organization indicate that designated uses are attained however the methodology and/or data quality has not been approved for such a determination.

IMPAIRED – Waters are impaired or threatened but a TMDL is not needed.

- **EPA Category 4A**: impaired or threatened for one or more designated uses but does not require a TMDL because the TMDL for specific pollutant(s) is complete and US EPA approved.

- **EPA Category 4B**: impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements (such as VPDES limits under a compliance schedule) are reasonably expected to result in attainment of the Water Quality Standard by the next reporting period or permit cycle.

- **EPA Category 4C**: impaired or threatened for one or more designated uses but does not require a TMDL because the impairment is not caused by a pollutant and/or is determined to be caused by natural conditions.

IMPAIRED – requiring a TMDL

- **EPA Category 5**: **Waters are impaired or threatened and a TMDL is needed.**

Va. Category 5A - the Water Quality Standard is not attained. The AU is impaired for one or more designated uses by a pollutant(s) and requires a TMDL (303d list).

Va. Category 5B –the Water Quality Standard for shellfish use is not attained. One or more pollutants remain requiring TMDL development.

Va. Category 5C – the Water Quality Standard is not attained due to suspected natural conditions. The AU is impaired for one or more designated uses by a pollutant(s) and may require a TMDL (303d list). Standards for these waters may be re-evaluated due to the effects of natural conditions.

Va. Category 5D - the Water Quality Standard is not attained where TMDLs for a pollutant(s) have been developed but one or more pollutants remain requiring TMDL development.

Va. Category 5E – effluent limited waters are not expected to meet compliance schedules by next permit cycle or reporting period.

Each State must develop a program to monitor the quality of its surface and ground waters and prepare a report every 2 years describing the status of its water quality. For 2004, Virginia will not declare any waters as threatened due to the inability to "predict" impairment as per the EPA definition of threatened waters. However, DEQ will identify waters of concern as having observed effects and will schedule additional monitoring if appropriate, for determine if designated uses are being met. The EPA issues guidelines for States to use during the reporting cycle. States are encouraged to use these guidelines to prepare these reports for EPA. EPA compiles the data from the State reports, summarizes them, and transmits the summaries to Congress, including an analysis of the water quality nationwide. This new 305(b)/303(d) integrated process is the principal means by which the EPA, Congress, and the public evaluate current water quality, the progress made maintaining and restoring water quality and the extent of remaining work to be done. Many States, including Virginia, rely on the 305(b)/303(d) process for information needed to conduct water quality planning. The 305(b)/303(d) process is an integral part of Virginia's water quality management program, requirements for which are set forth in 40 CFR 130.

Electronic Copy:

An electronic copy of this guidance in PDF format is available for staff internally on DEQNET, and for the general public on DEQ's website at: http://www.deq.state.va.us/water/.

Contact information:

If you have any questions regarding the guidance manual, you can contact Harry Augustine, Department of Environmental Quality, P.O. Box 10009, Richmond, Virginia 23240-0009. Telephone (804) 698-4037, FAX (804) 698-4116, or via e-mail hhaugustine@deq.state.va.us.

Disclaimer:

This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate any particular method nor does it prohibit any particular method for the analysis of data, establishment of a wasteload allocation, or establishment of a permit limit. If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

WATER QUALITY ASSESSMENT GUIDANCE MANUAL for Y2004

305(b)/303(d) Integrated Water Quality Report

February 4, 2004

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Preface

This guidance manual was produced to assist DEQ regional and central office staff in the production of the 2004 edition of the 305(b) Water Quality Assessment /303d Impaired Waters Integrated Report. The data window used in the development of the Integrated Report is January 1, 1998 through December 31, 2002. The manual uses excerpts from the "EPA 2004 Integrated Report Guidance", "EPA 1997 Guidelines for the Preparation of the 1998 State Water Quality Assessment 305(b) Reports", and "Assessment Data Base (ADB) Systems User's Manual" published by EPA, along with other State and Federal documents.

The Water Quality Monitoring, Information, and Restoration Act (WQMIRA) requires the 303(d) and 305(b) reports (now combined into the Integrated Report) be developed in consultation with scientists from State universities prior to the submission of these documents to the U.S. Environmental Protection Agency (EPA). In order to meet this directive, DEQ has updated this document containing water quality assessment guidance and/or procedures previously used to assist the scientists in the review of the 2002 305(b) report.

WQMIRA directs DEQ to develop and publish a procedure governing the process for defining and determining impaired waters. Additionally, DEQ shall provide for public comment on this procedure. The processes for defining and determining impaired waters are contained in this guidance document and these will be public noticed in the Virginia Register. Additionally, this draft guidance document can be found on the DEQ website at ***http://www.deq.state.va.us/waterguidance/***

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The guidance document will be updated and public noticed prior to the Integrated Report submittal to EPA to incorporate input from the review processes and any pertinent public responses. This guidance manual will be used to guide the water quality assessment process for the year 2004 305(b)/303(d) Integrated Report.

Purpose

Section 305(b) of the Clean Water Act requires each State to submit a biennial report to EPA describing the quality of its navigable waters. The 305(b) report provides DEQ's best overall assessment of water quality conditions and trends in the Commonwealth. The report is intended to be used as a tool in planning and management (40 CFR 130, page 4) of waters in Virginia. The report also directs continuous planning and implementation activities in coordination with the State Water Quality Management Plan and the Continuous Planning Process (CPP).

Primary objectives of the Integrated Report are:

1. To educate and inform citizens and public officials about Virginia's overall water quality.

2. To analyze water quality data in order to determine the extent to which Virginia's waters are supporting the designated uses for all state waters and to compare the results to Water Quality Standards and other appropriate criteria and guidelines.

3. To determine the causes for the "failure to support" the designated uses of the State's waters.

4. To determine the nature and recognizable extent of point and nonpoint source impacts in accordance with state and federal guidelines.

Section 303(d) of the Clean Water Act and the Environmental Protection Agency's regulation 40 CFR Section 130.7 (d) promulgated in July 1992, require each state to submit a Total Maximum Daily Load (TMDL) Priority List to EPA on April 1 of even numbered years. This list consists of two Categories (4 and 5) as identified in the EPA Integrated Reporting guidelines. The first Category (4) is a summary of the waters

identified in the 305(b) assessment process as impaired and not needing a TMDL. The second Category (5) is a summary of those waters that are impaired and need a TMDL. Category 4 includes the list of waters that are "water quality effluent limited" and other waters not needing a TMDL. Water Quality Limited waters are those waters where Water Quality Standards are not expected to be met with the application of technology based effluent control technology of secondary treatment and best practicable treatment. Waters receiving effluent from facilities with water quality based effluent limits in their Virginia Pollution Discharge Elimination System (VPDES) permits and schedules of compliance to meet these limits are considered Subcategory 4B (impaired but not needing a TMDL) due to the control requirements and compliance schedules associated with the VPDES permit. See the next section for additional Integrated Report Category descriptions.

Background

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PART I 305(b)/303(d) ASSESSMENT PROCESS

Virginia's biennial water quality assessment is conducted by the Department of Environmental Quality (DEQ), with the assistance of the Department of Conservation and Recreation (DCR), to determine the water quality conditions in the Commonwealth. The results of this water quality analysis are reported to the EPA in the 305(b) Water Quality Assessment Report submitted on April 1 of even numbered years. The 305(b) report describes the aggregated water quality conditions of the State. The 303(d) report contains the individual listing of those waters that have been identified as "impaired" for one or more designated uses and needing a Total Maximum Daily Load (TMDL). As per EPA guidance, the 305b assessment and the 303d list is now combined into a single Integrated Report. EPA compiles the data from all of the State reports into a national water quality status report that is presented to Congress.

In 2001, EPA made a number of changes to the water quality assessment process which continue to remain in effect. The primary change was combining the 305b report and the 303d impaired waters list into a combined Integrated Report. The integrated reporting process combines monitoring and assessment with the listing of impaired waters that need a TMDL in order to meet Water Quality Standards. Impaired waters needing a TMDL are those waters that do not meet Water Quality Standards due to a pollutant(s). *A pollutant, as defined in 40 CFR 122.2, means any dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.*

The assessment begins by analyzing all QA/QC approved data from DEQ ambient water quality, biological, sediment and fish tissue monitoring, other special studies and/or other non-DEQ water quality data for the 5-year assessment period. The results of these comprehensive data analyses are compared to both numeric and narrative criteria related to the designated uses contained in the Water Quality Standards (WQS). The WQS are provisions of State and/or Federal regulations that contain numeric and/or narrative criteria for protecting the designated uses of all waters in the Commonwealth.

There are two basic types of water quality data used in the assessment process. The first type of data is QA/QC approved "monitored" data. This data comes from the collection and analysis of chemical, biological, and/or physical samples taken by DEQ and/or any other DEQ approved data submitted during the reporting period. These data are considered the highest quality data. Normally, the 303(d) Impaired Waters list is comprised of only QA/QC approved monitored data due to the assessment confidence associated with the QA/QC monitoring requirements. Monitored data is obtained using EPA accepted methods and DEQ approved protocols. All non-DEQ monitoring submittals, except USGS chemical data submittals, must provide a sampling and analysis protocol and all field data for review. If data discrepancies or other suspect information is generated, a field verification audit will be conducted by DEQ monitoring staff. Partially approved monitoring data can be used to signify waters as insufficient but having observed effects where normal assessment methodologies show degradation and are will be prioritized for follow up monitoring (Category 3C). Partially approved monitoring data, where normal assessment methodologies show fully supporting results, are considered insufficient data with low priority for follow up monitoring (Category 3D). These data could include results from water quality test kits or other alternate biological methodologies that do not provide the quality assured accuracy needed to confirm Water Quality Standards exceedences but can provide an accurate indication of good water quality or other observed effects.

The second type of data used in the assessment is considered "evaluated" data. These physical, chemical and/or biological data are primarily obtained from sources where there is not an EPA accepted sampling protocol and/or DEQ non-approved sampling and analysis protocols. These data are considered to be of lower quality with little confidence in their results and normally are not used directly for listing waters as impaired or having observed effects. Segments, where lower quality data indicate chronic and recurring

water quality degradation, may be designated as insufficient but having observed effects on water quality for associated individual designated uses on a case by case basis. Additional DEQ monitoring efforts should be targeted for these waters as resources allow. Additionally, waters that were on previous 303d lists but do not have any additional monitoring data for the 2004 assessment period will reflect the results of the previous assessment for the associated designated uses. Additional information concerning the assessment and use of Citizen Monitoring and other non-DEQ data can be found in Part VI, Sections 6.3.1 and 6.3.2.

The following approval process will be used for non-DEQ "monitored" data protocol and QA/QC procedure review:

All ancillary data that have been received and reviewed by DEQ and found acceptable should be used for 305(b) and 303(d) assessment. The data are from two categories, state/federal agencies (other than DEQ) and the Citizen Monitoring Program. The approval process for data from the Citizen Monitoring Program is addressed in Part VI, Section 6.3.1. The following addresses the approval process for data from state and federal agencies.

All "monitored" chemical and biological data must be supported by EPA accepted monitoring protocols. QA/QC procedures must also be reviewed and approved by DEQ. As regional assessment staff becomes aware of data sources, those parties generating data for DEQ 305b/303d assessment consideration should be requested by the regional assessment staff to submit QA/QC plans, standard operating procedures (SOPs), and monitoring procedures to the DEQ 305(b) Coordinator. The 305(b) Coordinator will provide copies of supporting documentation for chemical data to QA/QC review staff in the Water Quality Monitoring and Assessment (WQMA) program and provide copies of all supporting documentation for biological monitoring of freshwater benthic macroinvertebrates to the Water Quality Standards staff.

The DEQ staff does not consider any non-agency free-flowing biological monitoring data other than benthic macroinvertebrate. Benthic information from non-DEQ sources may be independently assessed by regional biologists to determine their acceptability for 305(b) assessment purposes on an individual basis. Copies of the supporting documentation for freshwater benthic data should be provided to the regional offices where the surveyed sites are located for review by the regional biologists. The regional biologists are most familiar with the various ecoregions in the state and are knowledgeable with what constitutes appropriate reference sites, conditions or benthic metrics that are acceptable for assessing streams in these ecoregions. The regional biologists in consultation with the biological coordinator should review the sampling and analysis methodology and if practical or necessary, the available data and make a determination regarding the acceptability of the data for assessing the benthic community. The regional biologists will provide any comments or requests for additional information directly to the data generators and will copy such communications to the DEQ biological coordinator. Copies of the review results shall be distributed to the regional assessment staff and the DEQ 305(b) Coordinator. If the protocols involve estuarine toxics data and/or biological assessements in tidal environments, supporting documents should be provided to and reviewed by the Chesapeake Bay Program staff.

All comments concerning toxics data, chemical (SOPs) and/or QA/QC plans will be coordinated through the Water Quality Monitoring and Assessment (WQMA) QA/QC coordinator. WQMA QA/QC coordinator is responsible for providing comments to data generators and DEQ 305(b) Coordinator concerning the acceptability of SOPs and QA/QC documentation for chemical data.

If a chemical, biological or tidal waters data package cannot be used in the assessment process, the appropriate DEQ staff will provide the data generator an explanation for the data not being useable. A list of all data providers and the status of the QA/QC review will be included in an Appendix of the 2004 Integrated Report.

PART II WATER QUALITY MONITORING, INFORMATION AND RESTORATION ACT (WQMIRA)

In 1997, the General Assembly enacted the Water Quality Monitoring, Information and Restoration Act (WQMIRA). This legislation supplements the federal requirements for the 305(b)/303(d) process. The requirements of this legislation for State assessment procedures or processes are briefly outlined as follows:

1. The Act requires the 303(d) report to identify geographically defined water segments as impaired if monitoring or other evidence shows:

    a. violations of ambient Water Quality Standards for aquatic life or human health;

    b. fishing restrictions or advisories;

    c. shellfish consumption restrictions due to contamination;

    d. nutrient over-enrichment;

    e. significant declines in aquatic life biodiversity or populations; and/or

    f. contamination of sediment at levels which violate Water Quality Standards or threaten aquatic life or human health.

2. Waters identified as "naturally impaired", "fully supporting but threatened" or "evaluated" (without monitoring) as impaired shall be set out in the 303(d) report in the same format as those listed as "impaired".

3. The 303(d) report shall include an assessment, conducted in conjunction with other appropriate state agencies, for the attribution of impairment to point and nonpoint sources. The absence of point source permit violations on or near the impaired water shall not conclusively support a determination that impairment is due to nonpoint sources. In determining the cause for impairment, the Board shall consider the cumulative impact of 1.) multiple point source discharges, 2.) individual discharges over time, and 3.) nonpoint sources.

4. The Board shall develop and publish a procedure governing its process for defining and determining impaired water segments and shall provide for public comment on the procedure.

5. The 305(b) and 303(d) reports shall be produced in accordance with the schedule required by federal law and shall incorporate at least the preceding five years of data. Data older than five years shall be incorporated when scientifically appropriate for trend analysis.

6. The 305(b) and 303(d) reports shall be developed in consultation with scientists from state universities prior to submission by the Board to EPA.

7. The 305(b) and 303(d) reports shall indicate water quality trends for specific, easily identifiable, geographically defined water segments and provide summaries of the trends using available data and evaluations. This will allow the citizens of the Commonwealth to easily interpret and understand the conditions of the geographically defined water segments.

8. Based on the information in the 303(d) and 305(b) reports, the Board shall request the Department of Game and Inland Fisheries (DGIF) or the Virginia Marine Resources Commission (VMRC) to post

notices at public access points for all “toxic” impaired waters. The notice, prepared by the Board, shall contain the basis for the impaired designation and a statement of potential health risks. The Board shall coordinate with the DGIF and VMRC to assure that adequate notice of posted waters is provided to those purchasing hunting and fishing licenses.

The following proposed water quality assessment procedures have been designed to meet the federal 305(b) and 303(d) requirements in addition to the State requirements contained in WQMIRA.

PART III RULES FOR THE 2004 WATER QUALITY ASSESSMENT

Rule 1

Impaired waters are defined as those with chronic or recurring monitored WQ exceedences using QA/QC approved ambient monitoring data, special study data and/or other programmatic in-stream data collections. Predictive data generally refers to computer generated modeling data and may be used for assessment purposes on a case by case basis. Impaired waters are generally based on exceedences of the numeric Water Quality Standard (WQS) criteria using the guidelines described in Part V and VI of this guidance document and/or exceeding the narrative WQS.

Rule 1 applies to conventional parameters dissolved oxygen, pH, bacteria, nutrients, and temperature (except in tidal waters). EPA's guidance recommends States use a violation rate of > 10.5% of the total samples analyzed for classifying waters impaired. However, a single sample will not be assessed and will be placed in Category 3. For a single sample exceedence, additional monitoring should be continued until an assessment can be made. For small datasets of conventional parameters (2-9 samples), a single exceedence of the WQS results in assessment of the water as insufficient data. At least two exceedences and > 10.5% is required before a water is listed as impaired. This includes small datasets. Temperature in tidal waters will not be assessed due to the lack of a maximum WQS.

Rule 2

Waters classified as impaired based on biological data or restrictions placed on the designated uses (shellfishing and fish consumption advisories) by the Virginia Department of Health (VDH), are in violation of the narrative Designated Use Standard (9 VAC 25–260–10 A.) unless the designated use has been administratively removed due to the presence of a permitted discharge outfall or a consumption advisory that does not limit the designated use.

Rule 3

For swimming designated use, apply the geometric mean criterion of 200 fecal coliform bacteria per 100 milliliters to monitoring data sets generated from special monitoring programs or projects that produce 2 or more samples during a one-month period. Fecal coliform data will be assessed along with E.coli (freshwater) and enterococci (saltwater and transition zone) data where less than 12 E. coli/enterococci samples have been collected and monitoring data exists for both bacteria indicators. According to the new bacteria standard (9-VAC-25-260-170), where 12 or more E. coli/enterococci samples have been collected, the fecal coliform WQ Standard will no longer apply and only E.coli/enterococci data will be assessed. After June 30, 2008, the fecal coliform WQ Standard will no longer apply no matter how many E. coli/enterococci samples have been collected.

During the transition between the fecal coliform standard and the new E coli/enterococci bacteria standard, use the instantaneous maximum fecal criterion of 400 per 100 milliliters when the monitoring program is designed to provide one sample over a one-month period. No more than 10.5% of the total samples taken during any calendar month shall exceed the instantaneous standard. The E coli/enterococci instantaneous standard of 235 per 100 ml (E. coli in fresh water) and 104 per 100 ml (enterococci in saltwater and transition zone) applies at all times. Additionally, the geometric mean standard of 126 per 100 ml (E. coli) and 35 per 100 ml (enterococci) applies where 2 or more samples are collected during any calendar month. See 9 VAC 25-260-140-C for fresh water and transition zone delineation.

Rule 4

Conventional parameter data, generated by probabilistic monitoring (prob mon) networks, will be used as a "general overview" of those waters and should be used to direct additional targeted monitoring into those areas that indicate potential water quality degradation. This is due to the fact that for most stations only one data point will be available from probabilistic monitoring and an assessment for the associated parameters will not be made on one data point unless that data point exceeds a human health standard. A single exceedence of "human health" criteria is assessed as fully supporting with an observed effect and followup monitoring should be conducted within a 3-year period to determine if the water is impaired. A single fish tissue or sediment sample with no exceedence is considered fully supporting the associated use because these two types of samples are generally associated with longer-term water quality conditions. For probabilistic stations with 2 conventional data points, assessment will be the same as any station with 2 or more data points. This rule does not apply to benthic data assessments. Benthic and habitat collections made within the free-flowing probabilistic monitoring program will not be assessed as no reference stations or reference conditions exist at this time for probabilistic sites. Reference conditions should be available for the next reporting period.

Rule 5

When assessing multiple sample data, as with a hydrolab, the worst case data-point will be used as the aggregate sample. This rule does not apply to depth profile sampling where each depth sample should be assessed as an independent sample. Where information indicates a pycnocline (density gradient in estuarine waters) or thermocline (temperature gradient in reservoirs) exist, surface and bottom waters will be vertically segmented by the estimated pycnocline/thermocline.

Rule 6

When data analysis reveals fully supporting or insufficient data but having observed effects, additional monitoring, relating to the observed effect designation should be continued. Observed effects are water quality observations where WQ Standards have not been exceeded due to the lack of a standard and/or lower quality and less reliable data indicates potential adverse water quality. This rule applies to conventional and/or toxic parameters (water column, sediment, nutrient and/or fish tissue) as well as biological monitoring.

Rule 7

Waters that are assessed as impaired and suspected to be naturally occurring, non-anthropogenic (not human related) conditions (such as low DO and/or pH in slow-flowing swamp waters or high temperature from thermal springs) will be included in Category 5C (possibly needing a TMDL) of the Integrated Report. See Section 6.6 for assessment of lakes and reservoirs to determine if natural conditions exist. If natural conditions are shown to be responsible for the impairment, the water will be listed in Category 4C (not needing a TMDL). For waters in Category 5 C, the WQS will be reviewed and possibly be updated to reflect variations caused by natural conditions for these waters. Once appropriate WQS are in place, data will be reviewed again to determine whether these waters should be de-listed or a TMDL is needed. It may be necessary to conduct a TMDL study or Use Attainability Analysis (UAA) prior to WQS modification in order to determine and/or verify the appropriate criteria based on natural pollutant loadings.

Rule 8

Waters that were on previous 303d lists, with no additional monitoring data for the reporting period will continue to be tracked in the Integrated Assessment Database (ADB). These waters will reflect the results of the previous assessment for all designated uses. These waters will be tracked until a TMDL is developed or additional monitoring and assessment reveals the waters are fully supporting the designated uses for which it was originally listed and approved for de-listing by EPA.

Rule 9

For effluent limited waters, if the VPDES permit has been issued with a scheduled compliance date that extends beyond the next 303d listing cycle, the water would be listed as Category 5E. If the compliance date falls within the next listing cycle, the water would be listed in Category 4B.

Rule 10

Duplicate and/or split samples collected for QA/QC purposes will not be used in the assessment. The primary sample (S1) will be assessed against the appropriate standard and the duplicate/split sample (S2) will be used only to document lab analysis quality control.

PART IV DESIGNATED USES of VIRGINIA'S WATERS

The 305(b) process assesses a total of six designated uses, as appropriate for a particular waterbody, based on the Water Quality Standards. Assessed designated uses may include wildlife use, aquatic life use, swimming use, fish consumption use, shellfish consumption use and drinking water use. Swimming use is assessed to represent the primary and secondary water contact recreational use. Drinking water use is based on attainment of public water supply criteria. Following are details relating to the assessment of the six designated uses of Virginia's waters.

1. Wildlife Use:

Support of wildlife use is determined by assessing Water Quality Toxic Standards for aquatic life found in 9 VAC-25-260-140 B. These criteria were developed to protect aquatic life as well as wildlife.

2. Aquatic Life Use:

Aquatic life use includes the propagation, growth, and protection of a balanced indigenous population of aquatic life (including game and marketable fish) which may be expected to inhabit the waters.

Support of aquatic life use can be determined by the assessment of conventional parameters (dissolved oxygen, pH and temperature, toxic pollutants in the water column (relative to the acute WQS), toxic pollutant analysis of sediments, toxicity testing, nutrient analysis and/or the biological assessment of benthic communities. All available data relative to aquatic life use shall be considered to determine if the aquatic life use is being met. The maximum temperature will not be assessed for aquatic life in tidal waters as no maximum temperature standard is applicable.

3. Fish Consumption Use:

Fish consumption use includes the propagation, growth and protection of a balanced population of aquatic life including game and marketable fish.

Support of this use is determined using two separate criteria. First, support or lack thereof, is based on human health related advisories and/or restrictions issued by the Virginia Department of Health (VDH). Impairment for fish consumption results when the public is advised by VDH that fish consumption is prohibited for the general population or there is an "advisory" that certain fish species should not be consumed by the general population or sub-populations at greater risk, such as children and/or pregnant women.

Second, the assessment methodology used for fish consumption use is a comparison of fish tissue data to Water Quality Standards (WQS) criterion based tissue values (TV's) and tissue screening values (TSVs) for toxic pollutants. Any single observation above the TV or TSV results in assessment of the water as fully supporting but having an observed effect. Two or more exceedences within or across species sampled of a particular TV listed in Section 6.5.2 Table 6(a) results in an impaired assessment of the water for the fish consumption designated use.

4. Shellfish Consumption Use:

Shellfish consumption use includes the propagation, growth and protection of a balanced population of aquatic life including marketable shellfish.

Support of this use is determined using the following criteria. The Division of Shellfish Sanitation (DSS) of the VDH bases support or lack thereof on a classification system designed for the harvesting and marketing of shellfish resources in accordance with Food and Drug Administration (FDA) guidelines. Four classifications are used to describe shellfish waters. They are approved, conditionally approved, restricted, and prohibited. ***Approved*** areas are waters from which shellfish may be taken for direct marketing at all

times. ***Conditionally approved*** (seasonal condemnation) areas are waters where the quality may be affected by a seasonal population increase or sporadic use of a dock or harbor facility. ***Restricted*** (condemnations) areas are waters where a sanitary survey indicates a limited degree of pollution which makes it unsafe to market shellfish for immediate consumption. Shellfish harvested in these areas must be moved to an approved area for a certain length of time to allow for depuration before marketing. ***Prohibited*** (condemnations) areas are waters where the DSS sanitary survey indicates dangerous numbers of pathogenic microorganisms or other contaminants that impact the area. Shellfish cannot be harvested or relayed for purification in prohibited areas.

Shellfish waters where restrictions or prohibitions are due solely to a discharge outfall and not due to water quality exceedences will not be included in the 303d list. In these cases, monitoring should not be conducted as the shellfish designated use has been administratively removed through the issuance of a discharge permit. Additional information relative to shellfish use assessment can be found in Appendix D of this guidance.

5. Swimming Use:

Swimming use assessment includes swimming and other primary and secondary water contact recreation uses such as water skiing and pleasure boating.

Normally, support or lack thereof of this use is based on a comparison of fecal coliform and/or E. coli and enterococci bacteria data to the instantaneous standard using the EPA percent assessment method. However, if a special study, designed to collect multiple bacteria data points within a one-month period is conducted, then these results should be compared to the geometric mean criterion described in the Water Quality Standards. Also, any VDH beach closures should be assessed according to Part V.

6. Public Water Supply Use:

Waters that are used for public drinking water supply are identified in the Water Quality Standards and are protected by additional health related standards that are applicable to these waters. Support or lack thereof of this use is based on VDH closures or advisories and/or a comparison of water column data to applicable public water supply criteria.

Table 1 is a summary of the designated uses and the criteria used to assess the individual uses.

Table 1 DESIGNATED USE MATRIX

NO.	DESIGNATED USE	SUPPORT OF USE ASSESSMENT CRITERIA
1.	Wildlife Use	Aquatic life toxics criteria in water column
2.	Aquatic Life Use	Conventional parameters (DO, pH, Temp.); Aquatic life toxics criteria in water column (relative to the acute WQS); toxicity testing; biological evaluation. Waters exceeding nutrient and/or sediment screening values (SV's) are considered to have observed effects
3.	Fish Consumption Use	Advisories, limiting consumption, or restrictions issued by VDH; Comparison of fish tissue data to WQS criterion based tissue values (TVs) for toxic pollutants found in Section 6.5.2, Tables 6(a) and tissue screening values (TSVs) found in 6(b).
4.	Shellfish Consumption Use	Restrictive actions for harvesting and marketing of shellfish resources made by Div. of Shellfish Sanitation of VDH
5.	Swimming Use	Conventional Pollutant (Fecal Coliform and/or E. coli and enterococci bacteria) and/or VDH beach closures.
6.	Public Water Supply Use	Closures or advisories by VDH; comparison of data to applicable public water supply standards.

PART V CRITERIA TO DETERMINE DEGREE OF USE SUPPORT

Virginia bases its water quality assessment on the ability of the waters to support the associated designated uses. Support is based on the waters meeting the criteria for each use based on the numeric and/or narrative Water Quality Standards. The following is a description of the criteria used to determine the quality of the waters relating to each of the designated uses, and thereby the degree of use support that will be presented in the 305b/303d reports. Waters that do not have water quality data for all designated uses will be designated as insufficient data (Category 3).

1. Not Assessed

Waters with no data for all uses or a single sample (conventional data only) and no exceedence relative to aquatic life will not be assessed (Category 3A).

2. Insufficient Information

Waters with non QA/QC approved data or conventional parameters (DO, pH, temperature, nutrients and bacteria) with a single sample and single exceedence are considered insufficient data for water quality determination (Category 3B). Additionally, waters that have a single exceedence in a small dataset (2-9 samples) are considered insufficient data (Category 3B). Waters where the data are not QA/QC approved but the assessment results from the data review indicate potential water quality problems are considered insufficient but having observed effects (Category 3C).

3. Fully Supporting

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting the designated uses. These waters would be placed in the federal Category 2 and Virginia subcategory of 2A unless all designated uses are fully supporting, upon which the water would be placed in Category 1.

- *Conventional Parameters*:

Waters fully supporting the designated uses can have up to 10.5% exceedences of Water Quality Standards for the conventional parameters fecal coliform and/or E.coli or enterococci bacteria, (swimming use) dissolved oxygen, temperature, nutrients and pH (aquatic life use) without negatively affecting the designated uses. This criteria is based on EPA guidance which recommends that the States use a violation rate of these standards in the 0-10% range and designate as fully supporting the aquatic life and swimming designated uses. Any single exceedence in a small dataset (2-9 samples) will be assessed as insufficient. All data assessed as fully supporting must be QA/QC approved.

The Water Quality Standards (9 VAC 25-260-50) criteria for D.O., pH and Temperature do **not** apply below (7Q10). 7Q10 is the lowest flow averaged (arithmetic mean) over a period of seven consecutive days that can be statistically expected to occur once every 10 climatic years (a climatic year begins April 1 and ends March 31). Data for these parameters that are from flow conditions below 7Q10 will not be used in the assessment.

- *Toxic Pollutants:*

For toxic pollutant assessment in free-flowing streams, waters where there are one or more samples and no exceedences of a Water Quality Standard aquatic life criteria within a running 3-year period are considered fully supporting for aquatic life and wildlife use. For public water supply and other human health related use (i.e. fish consumption), one or more samples and no exceedences of a Water Quality Standard human health criteria or a fish tissue TV or TSV are considered fully supporting for drinking water and fish consumption uses.

For toxic pollutant assessment in estuarine waters, where there are several types of toxic data available, a weight of evidence approach has been initiated. Additional information on the details of using this approach can be found in Part VI, Section 6.5.3

- *Fish Tissue/Sediment Contamination*

One or more samples and no exceedences of a toxic Water Quality Standard TV or TSV (fish tissue) or sediment (SV) are considered fully supporting.

- *Biological Evaluation*:

For free-flowing stream biological community assessment, data for the overall assessment period is rated as not impaired where no biological assemblage (e.g. macro invertebrates) has been modified beyond the natural range of reference conditions based on EPA Rapid Bioassessment Protocol (RBP) II methodology.

A project to refine the estuarine biological assessment methodology has recently been completed and approved for use by EPA. See Section 6.4.2.2 for additional information.

- *Fish Advisories:*

Waters where the VDH has not issued any fish advisories or prohibitions.

- *Shellfish Advisories*:

Those growing areas where no restriction or prohibition (condemnation) on shellfish harvesting is imposed as indicated by the Department of Shellfish Sanitation (DSS) summary dated January, 2003. Additional information on shellfish assessment and consumption use is contained in Part VI, Section 6.4.4 as well as Appendix D.

- *Beach Closures:*

No VDH beach closures during the assessment period.

- *Public Water Supply Source Closures:*

No VDH public water supply source closures during the assessment period.

2. Fully Supporting but Having an Observed Effect

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting but having an observed effect for a designated use(s). It is the intent of the agency to focus additional monitoring resources on the waters that are identified as having an observed effect, based on initial monitoring data analysis. These waters would be placed in the federal Category 2 and the Virginia Subcategory of 2B

- *Conventional Parameters*:

Waters that have > 10.5% and 2 or more SV exceedences for nutrients (Chl a and/or total phosphorus) and sediments are considered fully supporting but having an observed effect for aquatic life use due to the lack of a Water Quality Standard for these parameters (Category 2B).

- *Toxic Pollutants:*

For toxic pollutant assessment in free-flowing streams, a single exceedence from one or more samples of a Water Quality Standard aquatic life criteria within a running 3-year period is considered fully supporting but having an observed effect for aquatic life and wildlife. For public water supply use, a single exceedence of any human health criteria is considered fully supporting but having an observed effect.

For toxic pollutant assessment in estuarine waters, where there are several types of toxic data available, a weight of evidence approach has been initiated. If no additional toxic data is available, the water would be

assessed the same as the free-flowing waters. Additional information on the details of using this approach can be found in Part VI, Section 6.5.3.

- *Fish Tissue/Sediment Contamination:*

Waters with a single exceedence of a WQS based TV or TSV found in Part VI Section 6.5.3, Tables 6(a) or 6(b) from one or more samples for fish tissue , or an exceedence of a SV for sediment found in Part VI Tables 7 and 8, are fully supporting but having an observed effect for fish consumption and aquatic life, respectively.

- *Biological Evaluation*:

For free-flowing waters, biological community data for the assessment period with a single rating of moderately impaired using RBP-II methodology should be considered fully supporting but having an observed effect where professional judgement cannot confirm impairment. If the single moderate impairment was discovered from the last 2 samples, a documented justification for not assessing as impaired is necessary. For waters assessed as fully supporting but having an observed effect for aquatic life use, it is necessary for another biological assessment to be scheduled to make a final aquatic life use determination. Additional information can be found in Part VI Section 6.4.1.

A project to refine the estuarine (B-IBI) biological assessment methodology has recently been completed and approved for use by EPA. See Section 6.4.2.2 for additional information.

- *Fish Advisories:*

VDH fish consumption advisories, where a general advisory has been issued but fish consumption is not limited, are considered fully supporting but having an observed effect.

- *Shellfish Advisories:*

Those growing areas, as indicated by the DSS summary dated January, 2003, that have been classified as conditionally approved (seasonal condemnations) are considered fully supporting but having an observed effect. Additional information on shellfish assessment and consumption use is contained in Part VI, Section 6.4.4 and Appendix D.

- *Beach Closure*:

One, short term (less than one week in duration) VDH beach closure within the 5 year assessment cycle with a low probability, based on best professional judgement, that the pollution will recur is considered fully supporting but having an observed effect. Best professional judgement decisions could be based on the source of the pollution causing the closure being generally transient and there are no VDH plans to implement pollution reduction measures or other controls.

- *Public Water Supply Source Closure:*

One, short term VDH public water supply source closure during the 5 year assessment cycle with a low probability that the pollution will recur are considered fully supporting but having an observed effect. The source of the pollution is generally transient and there are no VDH plans to implement pollution reduction measures or other controls.

- *Other Criteria for Waters having Observed Effects*

Waters for which “evaluated” data, trend analysis, or other water quality indicators appear to indicate an apparent effect on designated use(s) or a potential for water quality problems are considered to have “observed effects”. Waters can be designated as having observed effects where there is a possible loss of a designated use documented by ancillary data such as fish kills with unknown causes and/or pollution potential documented by non QA/QC approved non-agency studies or reports. These waters are considered insufficient data with observed effects (Category 3C). For monitoring purposes, waters with observed effects

should be considered in the next regional monitoring plan for continued monitoring during the next reporting period as resources allow.

3 Pollutant Caused Impaired Waters Needing a TMDL

The following is a description of the types of QA/QC approved data and the acceptable criteria used to assess waters as impaired for the designated uses. Those waters impaired by pollutant(s) and needing a TMDL are included in the 303d list. These waters are placed in the federal Category 4A (TMDL complete for a specific pollutant) or 5 (needing a TMDL) and the Virginia subcategories of 5A, 5B, 5D and possibly 5C and 5E.

- *Conventional Parameters*:

Waters with long term or chronic pollutant related problems based on the assessment of monitored data are considered impaired and needing a TMDL. For conventional parameters, at least two exceedences of WQS and exceedences >10.5% range are considered a long term or chronic problem and are considered impaired and needing a TMDL.

- *Toxic Pollutants:*

For toxic pollutant assessment in free-flowing streams, waters where there are 2 or more exceedences of a WQS acute aquatic life toxic criteria in a running 3-year period are considered impaired for aquatic life use and wildlife use. For public water supply use, 2 or more exceedences of the same human health criteria within the reporting period is considered impaired and needing a TMDL.

For toxic pollutant assessment in estuarine waters, where there are several types of toxic data available, a weight of evidence approach has been initiated. Additional information on the details of using this approach can be found in Part VI, Section 6.5.3.

- *Fish Tissue Contamination:*

Waters exceeding the same toxic WQS criterion based tissue value (TV) listed in Table 6(a), for fish tissue 2 or more times are impaired for fish consumption. For example, both of the following situations would qualify as impaired under these criteria. Two or more fish samples from different species exceeding the same TV during one sampling event or two or more samples of the same or different species exceeding the same TV from different sampling events within the assessment period.

- *Biological Data*:

For free-flowing waters, the biological community survey data are confirmed to be moderately or severely impaired, are considered impaired and needing a TMDL. Based on professional judgement and/or other supplemental data, a second survey may be required to confirm moderate impairment and/or pollutant related causes. In this case, the initial assessment would be considered fully supporting but having an observed effect and follow-up monitoring scheduled.

A project to refine the estuarine biological assessment methodology has recently been completed and approved for use by EPA. See Section 6.4.2.2 for additional information.

- *Fish Advisories:*

Virginia Department of Health fish consumption prohibitions and/or advisories where fish consumption is limited are considered non attainment of the designated use WQS and therefore considered impaired and needing a TMDL.

- *Shellfish Advisories*:

Those growing areas, as indicated by the DSS summary dated January, 2003, that have been classified as prohibited and/or restricted (condemnations) based on bacteria data are considered impaired and needing a TMDL. Restricted areas that have been administratively condemned due solely to the presence of a VPDES

permitted out-fall or administrative closure where no data is available will not be assessed. Additional information on shellfish assessment and consumption use is contained in Part VI, Section 6.4.4 and Appendix D.

- *Beach Closures:*

One or more VDH beach closures of one-week or more duration within the assessment cycle with a medium to high probability, based on best professional judgement, the closure will recur. There are VDH plans to implement or have implemented pollution reduction measures or controls.

- *Public Water Supply Source Closure*:

One or more VDH public water supply source closures within the assessment cycle with a medium to high probability that the pollution will recur. There are plans to implement pollution reduction measures or controls.

Table 2 summarizes the designated use assessment criteria.

Table 2 **Designated Use Assessment Criteria**
(Sufficient Data to Assess)

	Fully Supporting **Category 2A**	**Fully Supporting or Insufficient data but Having Observed Effects** **Category 2B or 3C**	**Impaired Waters Needing a TMDL** **Category 5A,5B,5C,or 5D** **(TMDL Approved = Category 4A)**
Conventional Parameters Aquatic Life Use Support (ALUS) and Swimming Use (temperature will not be assessed in tidal waters)	2 or more samples and AR ≤10.5%	**Non QA/QC approved** with exceedences > 10.5% (2 or more exceedences in a small dataset (2-9 samples) **Nutrient** SV exceeded > 10.5% (2 or more exceedences in a small dataset (2-9 samples)	AR > 1 exceedence and > 10.5% (includes small datasets with approved QA/QC)
Toxic Pollutants in Water Column and/or Sediment Aquatic Life Use Support (ALUS) and Wildlife Use	One or more samples and no exceedences	A single exceedence of aquatic life criteria in a 3 year period (ALUS) A single exceedence of a aquatic life criteria in a 3-yr period (Wildlife Use) One or more SV exceed (sediment only) (ALUS)	2 or more exceedences of the same aquatic life criteria in a 3-yr period (water column only) (ALUS) 2 or more exceedences of the same aquatic life criteria in a 3-yr period. (water column only) (Wildlife Use)
Toxic Pollutants related to human health and aquatic life (PWS & Fish Consumption)	One or more samples and no exceedences	A single exceedence of a human health criteria (PWS) A single exceedence of any toxic WQS TV or TSV,listed in Table 6(a) or 6(b), for fish tissue	2 or more exceedences of the same human health criteria (PWS) 2 or more exceedences of the same toxic WQS TV, listed in Table 6(a) only, for fish tissue
Biological Data	Freshwater: Fully Supporting	Freshwater: Slightly Impaired or Unconfirmed, Moderately Impaired, Medium and/or lower quality benthic data show potential WQ problems. Estuarine: See Section 6.4.2.2 for additional information.	Freshwater: Confirmed or most recent Moderately or Severely Impaired Estuarine: See Section 6.4.2.2 for additional information.
Fish Consumption Advisories or Restrictions	No restrictions or prohibitions	A VDH advisory which does not limit consumption is in effect	A VDH advisory or restriction limiting or prohibiting consumption is in effect
Shellfish Advisories	No restrictions or prohibitions	Area classified as Conditionally Approved (seasonal condemnations)	Areas classified as Restricted or Prohibited: Excluding VPDES out-falls
Swimming Use (see Conventional Parameter criteria) **And** **Beach Closures**	No exceedences	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any control measures)	One or more VDH closure with medium or high probability of recurrence (VDH preparing or implementing controls measures)
Public Water Supply (PWS) Source Closures	No closures	One VDH closure with low probability of recurrence (no VDH plan to implement control measures)	One or more VDH closure with medium or high probability of recurrence (VDH preparing plans to implement or implementing controls measures)

AR = arithmetic exceedence rate
SV = screening value
ALUS = Aquatic Life Use Support
PWS = Public Water Supply

PART VI ASSESSMENT METHODOLOGY

Section 6.1 CONVENTIONAL PARAMETER METHODOLOGY

State and federal law requires DEQ to produce a biennial report to Virginia's citizens and EPA on the condition of its waters. The waters are evaluated in terms of whether the appropriate designated uses are met: These uses are: 1) wildlife, 2) aquatic life, 3) fish consumption, 4) shellfish harvest, 5) swimming (primary and secondary contact recreation) and 6) drinking water use. DEQ employs the EPA "Percent" Method to assess conventional pollutant impacts in waters for two uses: aquatic life use and swimming use.

6.1.1 Description of the EPA Fixed Rate (Percent) Method

National guidance issued by EPA recommends that states use an assessment method for the 305(b) report based on assumptions about the kind and frequency of data needed to support such an assessment. The object is to indicate whether waters are fully supporting or impaired for the designated uses and ultimately for the assessment unit (AU). EPA has proposed a 10.5% threshold for determining full support or impaired for conventional pollutants. A exceedence rate that is > 10.5% and has at least 2 exceedences is considered impaired.

In effect, the EPA assessment guidelines imply that an exceedence of a conventional numeric criterion is acceptable in 10.5% of the samples taken. This is due to many variables associated with sampling errors and/or weather factors. The rule of thumb is described in Table 3

Table 3 EPA Fixed Rate Assessment Guidelines

Violation Rate (AR) of Total Samples Analyzed	Assessment
AR ≤10.5%	Meets use (Category 2A or B)
AR > 10.5%	Fails to meet use (impaired) Categories 4A, 5A, 5B, 5C or 5D

In recent years, DEQ has been encouraged to spread its monitoring efforts over more of the State's waters. To achieve this goal with a fixed monitoring budget, the average collection frequency changed from monthly to bimonthly. This new monitoring frequency has been applied to a rotating watershed scheme with 1/3 of the watersheds being monitored within a 2-year cycle. The benefit from this change is that more streams and more stream miles can be assessed. The disadvantage is that the data collected from each station are fewer (12 samples). The data set has become wide geographically but shallow in frequency. This aspect concerns DEQ in that the EPA fixed rate method assumptions are based on a monthly sampling frequency. Further monitoring program review and possible update stems from the need for additional monitoring data for Total Maximum Daily Load (TMDL) development.

Section 6.2 MONITORING STATION DELINEATION and SITING METHODOLOGY

6.2.1 Monitoring Station Delineation

- **Ambient Water Quality Station Delineation**

DEQ has a vast network of active Ambient Water Quality Monitoring (AWQM) stations and a growing number of biological stations statewide. The AWQM stations are generally monitored bimonthly while the biological stations are monitored twice a year (usually in the spring and fall). Monitoring programs can be designed based on a "source targeted" (conventional) approach or a "probability based" approach or a combination of the two. Each monitoring program design has its advantages and disadvantages. Historically, most of DEQ's monitoring strategy has been based on the conventional approach. Many of the stations were located in proximity to (above and below) Virginia Pollutant Discharge Elimination System

(VPDES) facility outfalls. During this reporting cycle, DEQ has continued to use a rotating watershed approach where stations are sited for 2 years of bimonthly sampling. The number of stations per watershed is based on the drainage area of the watershed and the DCR nonpoint source potential rating of the watershed. In order to provide consistency between the regional planning staff and to get an accurate number of assessed stream miles in Virginia, the following stream delineation guidelines are the primary considerations used in the assessment and listing process. However, in certain cases, best professional judgement of the regional staff may be used if the delineation results are contrary to these guidelines. Where appropriate, documentation of these best professional judgement decisions should be included in the segment narrative.

1. Typically, no more than 10 miles of free-flowing stream should be assessed by the conventional pollutant data from one ambient monitoring station. Miles assessed for a toxic pollutant or biological impairment may vary from the miles assessed for conventional parameters.

2. One monitoring station should not be used to assess an entire watershed unless land use, source, and habitat are relatively homogeneous.

3. When determining the miles assessed for a free-flowing monitoring station, the following items need to be considered:

    a) Water Quality Standards Use Designations (i.e. Classes and/or Special Standards)

    b) point or nonpoint source input to the stream or its tributaries,

    c) changes in watershed characteristics such as land use,

    d) changes in riparian vegetation, stream banks, substrate, slope, or channel morphology,

    e) large tributary or diversion, or

    f) hydrologic change such as channelization or a dam.

4. For tidal and estuarine stations, EPA guidance suggests using a 4-mile radius for open water stations; a 2-mile radius for bay stations and a 0.5 mile radius for sheltered bay stations.

5. Segment delineation will be performed using EPA National Hydrography Dataset (NHD) coverage.

6. Spatial coverage for estuarine probabilistic monitoring stations should be identified in conjunction with the development of the monitoring plan and coordinated by regional monitoring and assessment staff and/or the Chesapeake Bay Program monitoring coordinator and Bay monitoring staff. Estuarine B-IBI data will be assessed according to methodology recently developed.

7. When assessing an impaired segment, it is understood via WQS that the existence of a VPDES permitted mixing zone lies within the impaired segment for a specific pollutant. If a mixing zone exists, the parameter specific mixing zone length is specifically understood as not part of the impaired segment even though map delineation may show the impairment as continuous.

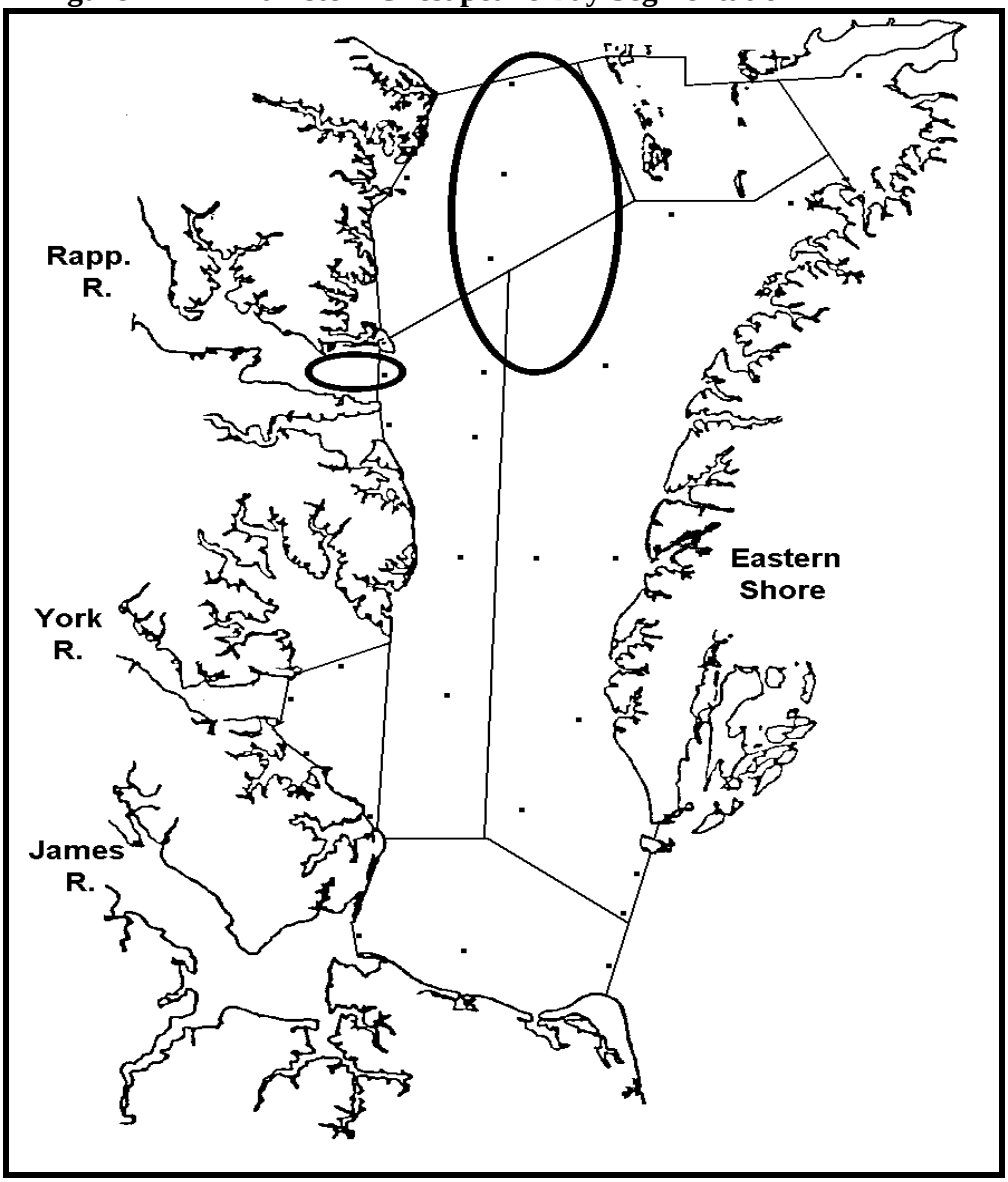
8. Single physical or chemical sample free-flowing probabilistic stations will not be delineated into segments. Probabilistic physical/chemical stations meeting Part III Rules 1 and 4 will be

delineated and assessed. Free-flowing probabilistic benthic and habitat samples will not be delineated or assessed.

- **Chesapeake Bay Monitoring Station Delineation**

Mainstem Chesapeake Bay will be segmented into assessment units according to the segmentation scheme of the Federal-Interstate Chesapeake Bay monitoring program as shown in Figure 1.

Figure 1 Mainstem Chesapeake Bay Segmentation



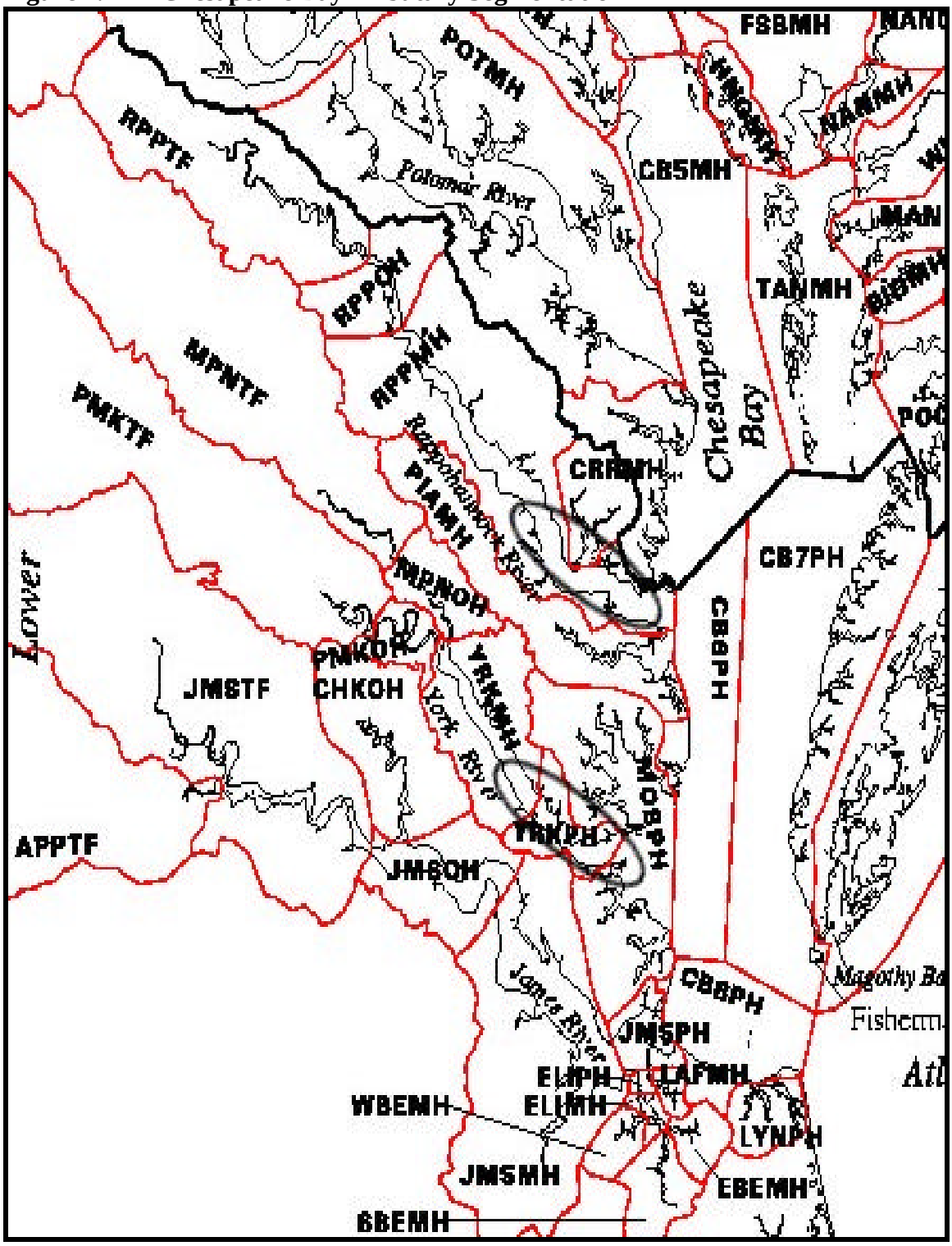
Vertical differences in salinity and temperature can form a pycnocline (i.e. density gradient) as a natural barrier to the mixing of dissolved oxygen (DO) in the water column and create a area where the surface waters can naturally be of significantly different quality than the deep waters, especially during warmer months. Areas where this is a significant factor have recently been defined during development of new criteria and designated uses for Chesapeake Bay and are shown encircled in Figure 1. In these areas, the DO data during summer months (defined as July through September) will be split into "surface" and "bottom" water layers based upon a pycnocline calculation protocol provided by the Federal-Interstate Chesapeake Bay Program. In absence of an observed pycnocline, the complete water column is considered as in the "surface" layer. All data collected above and below the pycnocline for the 5-year period (or in absence of a pycnocline, the complete water column) will be aggregated or pooled as a set of all individual profile

observation collected above and/or below the pycnocline and assessed as representing surface and/or bottom waters of each assessment unit. If an assessment unit is determined to be impaired in either the surface or bottom waters, then that whole assessment unit will be considered to be impaired. At least 2 sampling events must show exceedences > 10.5% before the assessment unit is listed as impaired. Assessment units sampled in only a single event and exhibiting >10.5% exceedences during that event will be designated as having observed effects and targeted for return monitoring as resources allow.

For the major tidal tributaries (James, York, Rappahannock), consideration will be given to salinity and the Chesapeake Bay tributary segmentation shown in Figure 2 when determining whether several water quality stations are comparable and should be aggregated into an assessment unit. Generally, hydrologic boundaries such as major tributaries, dams, etc., point and non-point source data, EPA guidelines, best professional judgement, and differences in actual assessments between water quality stations will be given stronger consideration and used to segment the tributaries around water quality stations. As in the mainstem Bay, some areas will be assessed separately for a “surface” layer and “bottom” layer and these are shown encircled in Figure 2. If an assessment unit in these areas is determined to be impaired in either the surface or bottom waters, then that whole assessment unit will be considered to be impaired. At least 2 sampling events must show exceedences > 10.5% before the assessment unit is listed as impaired. Assessment units sampled in only a single event and exhibiting >10.5% exceedences during that event will be designated as having observed effects and targeted for return monitoring as resources allow.

The minor tidal tributaries (e.g. Pagan R., Elizabeth R.) will be segmented based on delineation of water column areas hydrologically similar to those water column areas within which monitoring stations are located. Most of these minor tributaries are shallow in depth and usually well-mixed systems with little fresh water inflow. Where multiple monitoring stations indicate non-uniform water quality conditions, assessment units will be interpreted to extend one-half the distance between the stations displaying disparate assessment results. At least 2 sampling events must show exceedences > 10.5% before the assessment unit is listed as impaired. Assessment units sampled in only a single event and exhibiting >10.5% exceedences during that event will be designated as having observed effects and targeted for return monitoring as resources allow.

Figure 2. Chesapeake Bay Tributary Segmentation



Section 6.3 NON DEQ EVALUATION METHODOLOGY

6.3.1 Citizen Monitoring

For the purposes of this guidance document, a citizen water quality monitoring program, or citizen monitoring, is defined as water quality monitoring which uses volunteers to collect the data. Some of these programs are run by local governments, soil and water conservation districts, citizen organizations, community organizations or colleges. Generally, K-12 school monitoring is conducted for educational purposes and does not fall under "citizen monitoring" unless working in cooperation with existing citizen monitoring efforts. "Citizen monitoring" is not defined as monitoring conducted by all entities external to DEQ, such as colleges and local governments, unless volunteers are used in their efforts.

In 1997, *Water Quality Monitoring, Information and Restoration Act* (WQMIRA) was passed by the Virginia General Assembly. This bill charged DEQ with monitoring and assessing all the waters within the Commonwealth. During this same General Assembly session, the position of Citizen Monitoring Coordinator (CMC) was added into the operating budget of DEQ. The primary duties of the CMC are providing guidance and support to citizen water quality monitoring groups in the development of monitoring programs and quality assurance project plans, facilitating communication among citizen groups and other State agencies, sponsoring citizen monitoring seminars, promoting the use of citizen water quality data in a manner consistent with the data use goals of the organization and encouraging additional citizen monitoring efforts. In 2002, the Virginia General Assembly passed legislation that established the Virginia Citizen Water Quality Monitoring Program in the *Code of Virginia* (§62.1-44.19:11).

Assessment Process:

1. All citizen water quality data should be sent to the CMC at DEQ. The CMC and QA/QC review staff in the Water Quality Monitoring and Assessment (WQMA) program will review all standard operating procedures (SOPs), QA/QC plans, training manuals, and current monitoring procedures for each citizen monitoring group submitting chemical data. All supporting documentation for biological freshwater benthic macroinvertebrates citizen monitoring programs will be reviewed by the CMC and the biological program coordinator. Based upon the review of all procedures, the appropriate use of the data will be determined. Any changes in QA/QC and/or SOP methods and/or any additions or deletions of current monitoring sites should be brought to the attention of the CMC.

2. All data collected under documented and DEQ-approved SOPs, protocols, and QA/QC procedures should be included in the 305(b) assessment as follows:

    a) All approved conventional parameter data should be summarized by major watershed and characterized according to the procedures and considerations in Part V of this manual.

    b) Until biological programs are fully evaluated by the DEQ biological program coordinator, the biological monitoring sites characterized by citizen monitors as either "excellent," "good" or "acceptable" should be designated as "Area of low probability for adverse conditions" (Category 3D). Biological sites periodically characterized as "fair," "poor," "unacceptable" or "moderate" should be designated as "Area of medium probability for adverse conditions" and listed as insufficient data with observed effects and prioritized for follow-up monitoring (Category 3C). Likewise, biological sites that are consistently "poor" or "unacceptable" should be characterized as "Area of high probability for adverse conditions" and listed as insufficient data with observed effects with DEQ follow up monitoring to be prioritized (Category 3C).

c) The summaries of the citizen data will be placed under a separate Citizen Monitoring section of the 305b/303d Integrated Report.

d) Segment lengths represented by a monitoring site should be determined using the mileage delineation guidance found in Section 6.2.1. Specific monitoring site location, including latitude, longitude and a physical description of the site (i.e. Route 646 bridge crossing, 3 mile north of route 647) should be provided for each monitoring site. Each monitoring site should be identified with a unique station id using a system similar to the DEQ station id system. The CMC assigns this station id to each citizen monitoring site.

e) Data collected at sites that complement and are comparable (i.e. chemical to chemical comparisons and biological to biological comparisons) to DEQ monitoring sites, should be included in the major basin report. However, the final assessment of that river segment will be made using the DEQ monitoring data (found in the appropriate section of the Integrated Report). In this case, the data collected by the citizen monitoring organization would be used as background data.

f) The CMC should coordinate with each regional office regarding the final assessment of the citizen monitoring data. In coordination with the CMC and the 305(b) coordinator, each regional office should provide any appropriate final editing of the citizen monitoring assessment to be included in the Integrated Report.

3. The CMC will provide all data approved by DEQ for use in the Integrated Report in basic data tables. The tables will be posted on the DEQ website along with the final Integrated Report. These data tables should include each individual sample period as well as statistical results (number of observations, maximum and minimum).

4. The CMC will review data collected without SOPs and QA/QC plans. This data will be acknowledged in the appropriate river basin evaluation as appropriate.

5. Once the data is summarized into the data tables, they will be sent to each region for their review and comparison to similar DEQ data points.

6. If, during the regional review, a discrepancy between data from DEQ monitoring stations and data from similarly sited citizen monitoring station and/or a citizen monitoring technique is believed to be suspect, the CMC should be notified and an attempt to rectify the discrepancy initiated. The CMC should collaborate with the Water Quality Monitoring and Assessment (WQMA) (QA/QC) program coordinator to evaluate the potential causes for the data disparity and/or review the QA/QC plan and the monitoring techniques of the citizen group. After this evaluation is complete and a problem is confirmed, the CMC and QA/QC coordinator will recommend appropriate corrective actions to the citizen monitoring group for inclusion in the citizen monitoring organization's WQMA QA/QC plan and/or SOPs. Until the discrepancies with the data and/or methods are fully evaluated by the CMC and the WQMA QA/QC coordinator, the data (for either the specific parameter or for the group) should not be used in agency assessments. If corrective action is not initiated by the citizen monitoring group, the QA/QC plan for that parameter and/or for the group as a whole may no longer be considered valid by DEQ and the data will not be considered for state-wide water quality assessments.

7. Regional DEQ planning and monitoring staff will be given a list of all stations classified as "Area of medium probability for adverse conditions" and "Area of high probability for adverse conditions".

The regional monitoring staff should review the station list results and consider including appropriate sites to their regional monitoring plan for future monitoring activities.

6.3.2 Other State and Federal Water Quality Data

After review and approval of monitoring and QA/QC protocols, DEQ will consider, for use in the Integrated Report, data generated by other State and Federal monitoring programs. DEQ has established a water quality data sharing agreement with the U.S. Forest Service (USFS) for the George Washington and Jefferson National Forests using the USFS Fisheries and Aquatic Ecology Program.

The USFS program collected macroinvertebrate data from numerous monitoring stations within the two National Forests. Sampling for macroinvertebrates are conducted utilizing the same collection methodology (Plafkin et al 1989) that DEQ biologists use in the ambient biomonitoring program. Therefore, the raw data collected by the USFS should be highly comparable with DEQ data. The USFS has used the Macroinvertebrate Aggregated Index for Streams (MAIS) to assess this raw data and make an initial water quality interpretation.

The DEQ regional biologist and planners may use the data, provided to DEQ by the USFS, in the Integrated Report if they find it acceptable for assessment purposes. If the regional biologist or planners have information which conflicts with the initial USFS assessment or for any other reason, question the final USFS stream assessment, they may elect to disregard the USFS assessment results until further verification can be obtained. **If the initial assessment is not used, documentation relating to this decision will need to be provided**. The regional Biologist may elect to reevaluate the raw data using the EPA RBP-II metrics to confirm consistent assessment methodology and conclusions. If differences become apparent, the regional biologists may decide not to use the assessment data in the Integrated Report until an on-site stream visit can be performed and conditions verified. Final assessment results of the USFS data should be consistent with the ambient biological assessment criteria described in Section 6.4.2 of this guidance. Any non-approved data will not be used directly in the assessment.

6.3.3 Non Point Source (NPS) Assessment

Non-point source assessment of hydrologic units is performed by the Virginia Department of Conservation and Recreation (DCR). As in the 2002 NPS assessments, the 2004 process will calculate net loadings of nitrogen, phosphorous, and sediment per watershed. Gross load calculations are done via modeling in a manner that closely approximates the results of the Chesapeake Bay Program water quality model in regards to loadings in the Bay watersheds, thereby diminishing if not removing the uncertainty of having conflicting assessment results for this portion of the state. This model is then employed to calculate similar values for non-Bay watersheds to develop consistent statewide loadings. Inputs to this process include:

A DCR modified land use / land cover layer
A DCR developed confined animal data set
Census of Agriculture animal numbers by jurisdiction
VDOF forest harvesting data
The USDA's Natural Resources Inventory
USDA statewide soil surveys
Chesapeake Bay Program Watershed Model output
A DCR developed table of dominant crop types by watershed
National Weather Service weather records for a multi state area
USGS stream flows from gage stations
Census of Population and Housing indicators of septic system use by block
Slopes developed by USGS DEMs
A DCR developed indicator of stream density by watershed
A DCR developed manure application schedule by manure type by region

Net loadings are formed by subtracting from calculated gross loads, the reductions in nitrogen, phosphorous, and sediment that are realized from both best management plan (BMP) installations and relevant grant projects. This includes BMPs funded and installed through DCR, CBLAD, VDOF, and the USDA.

DCR rates watersheds as high, medium, or low for potential non-point source (NPS) problems as indicated by the non-point source assessment. This categorization is performed so that approximately the highest 20% of the net loadings by watershed are assigned the high rank. The next highest 30% of the net loading values are assigned the medium rank. All other watersheds are assigned a low NPS rank. Rather then make a hard and true category split at these percentages, the category breaks are made where net loading differences occur nearest to the stated percentages.

Two variables used in the past NPS assessments for prioritizing watershed protection efforts will also be recalculated by watershed in 2004. An aquatic IBI score will be used to indicate watersheds in need of aquatic species health protection, and a source water population variable will highlight watersheds in need of human health protection.

All the information developed through the NPS model is used as ancillary information in the assessment/listing process. The NPS model results (ranking) and/or data generation (land use) is used directly in future monitoring site selection and within ongoing TMDL study development. No water shall be assessed impaired based solely on the predictive NPS model as the variables used in the model cannot reliably predict impairment. DEQ seeks conclusive data for listing a water as impaired.

Section 6.4 DESIGNATED USE EVALUATION METHODOLOGY

6.4.1 Wildlife Use Support

Determination of the degree of use support for wildlife is based on the aquatic life toxic criteria found in 9 VAC 25-260-140 B. Two or more exceedences of the same criteria within a 3-year period will result in the water being impaired for wildlife use.

6.4.2 Aquatic Life Use Support

Determination of the degree of use support for aquatic life is based on conventional physical parameters (DO, pH, temperature) and aquatic life toxic criteria along with biological monitoring data and best professional judgement, relying primarily on recent data collected during the current reporting period. Up to 5 additional years of data may be used if they reflect current conditions. Additional potential chemical pollutants with no Water Quality Standard criteria are examined as well. These include sediment and nutrients. These pollutants are reviewed in Section 6.5 of this document.

- Conventional parameters (Dissolved Oxygen (DO), pH, temperature)

Conventional pollutant data will continue to make up the bulk of free-flowing, estuarine and lake water quality assessments. The EPA Percent Method will be used to determine the degree of use support. The assessment is objective except where professional judgement indicates that natural causes are responsible for the exceedences or where there is reason to believe the quality of the data are suspect. Waters not meeting Standards considered due to natural conditions will be assessed as impaired and the source of impairment listed as “Unknown”. For DO, the instantaneous minimum standard for the specific WQS designated Class of water is used to assess exceedences. For estuarine and lake waters, all DO data will be assessed including depth profile data. See Section 6.6 for more information relative to DO assessment in lakes and reservoirs. Each DO measurement associated with the depth profile will be assessed as an independent data point. At least 2 sampling events must show exceedences > 10.5% of the independent data points before the water is listed as impaired.

6.4.2.1 Free-Flowing Biological Assessment

DEQ is currently working with the U.S. Environmental Protection Agency and their contractor Tetra Tech to develop a Stream Condition Index for use in evaluating the integrity of benthic macroinvertebrate data in Virginia freshwater non-coastal streams. This effort uses data from reference streams in Virginia to develop a numerical index to use for assessing the biological condition of these streams. The work to develop the new SCI for Virginia will not be finalized in time to allow the use of the new SCI in the 2004 assessment review. The 2004 Integrated Report will be assess the biological data using the same methods and metrics as have been used by DEQ in previous 305(b) reports. DEQ intends to finalize this Stream Condition Index and use this new index to review the benthic biological data and make assessments of the biological data for the next Integrated Report.

Evaluations of biological monitoring data from the DEQ biological monitoring program are used to assess support of the aquatic life use. Where ratings have changed during the 5-year reporting period and possibly between fall and spring, the regional biologist should determine the most appropriate rating for the assessment period. The following are considerations to be used when preparing bio-assessment results.

Consideration #1: Is a single biological survey sufficient data to make a water quality assessment?

The DEQ has been utilizing two different rapid bioassessment protocols, RBP-I and RBP-II. The RBP-II surveys follow a highly structured protocol that reaches an objective and repeatable ranking based on the raw data collected. The RBP-I final rankings are based on the field biologist's professional opinion after conducting a less formal survey. This type of survey is considered "evaluated" data. The validity of the results is dependent on the skill level of the biologist and is less quantitative in nature. These surveys should be utilized only to target waters for further in-depth monitoring or to make an evaluation that waters are not impaired. RBP-I level surveys should not be used without subsequent RBP-II confirmations to list waters as impaired in the Integrated Report. Some regions have conducted RBP-I surveys in order to have some preliminary monitoring coverage of waters previously not monitored. These results should be considered evaluated and given less credence from the more in depth RBP-II surveys.

Rankings, based on a single RBP-II survey, are the result of the data evaluation and reduction of numerous measurements and observations conducted during the sampling survey. The survey measures the response of the biological community to all perturbations it has experienced, integrated over time. A single, properly conducted, RBP-II survey is not a "single data-point" analogous to a single D.O. measurement or fecal coliform sample. It is proper to place a large degree of confidence in the results of a single well-conducted RBP-II survey, which shows no impairment or severe impairment. Slightly impaired or moderately impaired rankings are less certain and should be verified with further surveys or other ancillary data before complete confidence can be placed in the results. Slight impairment is considered fully supporting aquatic life due to the natural variability of the methodology. For the purpose of the 2004 305(b) and 303(d) reports, a~~n unconfirmed,~~ single moderately impaired RBP-II ranked water within the reporting period, will be listed as **"fully supporting but having observed effects for aquatic life use"** until further analysis can be conducted if the moderate impairment has not been detected in the most recent two samples. If the moderate impairment has been detected in the most recent two surveys, a justification for not listing the water as impaired must be provided. Otherwise, it should be listed as impaired. Further analysis should be given a high priority and an additional survey conducted as soon as possible. If additional surveys continue to show moderate or severe impairment, then the water will be listed as **"impaired"**.

If the Biologist has observed natural conditions, such as high or low flow conditions at time of sampling or recent extreme drought or flooding, etc, or believe that unusual natural conditions are responsible for a questionable ranking, they should note the lack of confidence in the survey and it should not be used for assessment purpose nor should it be reported.

Consideration #2: **Should Biological survey data be assessed like chemical data i.e. need more than 10% of the rankings to show impairment before it is listed as impaired?**

The frequency approach is not appropriate for interpretation of multiple biological survey results over time. Biological data reflect the impacts of water quality conditions over a period of time. These data are different from chemical/physical data, which represent only the water quality at that single point in time. The reason it is acceptable to have 10% exceedences of a conventional standard and still say the waters are not impaired is that a judgement has been made that the system can sustain that many exceedences without being damaged. It is based on the assumption that water quality can slip below the standard occasionally for short periods of time without damaging water quality and/or aquatic life. The RBP-II data however, is a direct measurement of the condition of the biological integrity of the system. If impairment is noted, it means that damage to the community already has occurred. If you have less than 10% exceedences of a standard, damage to the aquatic system may or may not occur, however, a single biological survey can indicate that you currently have or have had a problem.

Consideration #3: **How should five years of RBP-II surveys be interpreted for the 305(b) reporting period.**

The regional biologists should review the biological assessments for the five-year period and they should make a final biological assessment ranking based on these data. If you have spring/fall surveys each year for a 5-year period, this record can be used to describe any trend, which has occurred. Since RBP-II surveys are dependable records of the condition of the community at the time of the survey, the most recent survey should be the most accurate indicator of stream biological health at the time of report preparation. The older data indicate what conditions were at the time the surveys were completed, but if conditions have changed, they should be reflected in the more recent data. An attempt to average the data over a five year time period would weaken your ability to accurately predict current conditions. Aside from trend characterizations, the most recent ranking should be given the most consideration for the overall assessment of current conditions. Place the greatest validity in the last survey completed. If the last survey showed severely degraded conditions (and the biologist has confidence in their survey) but the previous samples showed only slightly impaired conditions, the stream should be considered severely impaired. If the last survey shows stream improvement, this should be given primary consideration.

A standardized fact sheet, as found in Appendix C of this manual, has been developed to help the regional biologists review and assess the data for the five-year period. The fact sheet includes a summary of the biological assessments for the five-year period and will be used to summarize and review all the information available for a site. The fact sheet allows for consideration of supplemental information about the watershed that is important in making the final assessment decision. In a case where the most recent biological assessment shows a significant change from previous rankings, special note should be made of any known recent changes to the watershed that may explain any changes in the more recent biological assessments

If a stream survey shows impairment based on old data (> 5 years), it should be monitored again to verify if conditions have improved, stayed the same or degraded. It should not be assumed that conditions have changed unless data are collected to validate that assumption.

6.4.2.2 Estuarine Biological Assessment

Based on EPA RIII direction, DEQ has been working with the State of Maryland to develop a new assessment methodology for estuarine biological data. This new methodology will assure Bay wide consistency in determinations of estuarine benthic impairments. The methodology proposed is based on the Stratified Wilcoxon Rank Sum test. A test is conducted to determine whether (a) the percentage of sites with low B-IBI scores (< 3.0) significantly exceeds the percentage of sites with low scores in the reference distribution. In the case of multiple habitats, a mixture distribution would be estimated using area-based weights for each habitat type.

Scope

Measuring the "health" of benthic macroinvertebrate communities is often considered as a measure of support for a balanced population of aquatic animals. This measure of "health" often is derived as an index based on species abundance, biomass, feeding guilds, life history strategies, and spatial community measures (Ranasinghe, et al., 1993).

Maryland and Virginia have sponsored an estuarine macrobenthic community sampling program in Chesapeake Bay and its tidal tributaries since the mid-1980's. Results of Baywide analyses of these data resulted in identification of seven habitat strata based principally on salinity and sediment types (tidal freshwater, oligohaline, low mesohaline, high mesohaline mud, high mesohaline sand, polyhaline mud and polyhaline sand) and helped to establish restoration goals to better manage this living resource. These findings also allowed for the development of a monitoring program employing both a fixed and probabilistic monitoring program to assess trends and overall conditions with a known level of confidence.

For this 2004 water quality assessment and listing of impaired waters, the States are interpreting aquatic life use support in their estuarine waters of the Chesapeake Bay and tributaries using benthic community data assessed with respect to key stressors (dissolved oxygen and toxic contaminants). This decision process is not applicable to benthic macroinvertebrate data States may have collected in free-flowing streams, lakes or along Atlantic coastal waters/embayments, all of which have a different analytical framework.

Criteria

Currently, Maryland and Virginia Water Quality Standards include narrative criteria to address support for aquatic life uses using benthic macroinvertebrate community data. The US Environmental Protection Agency's Chesapeake Bay Program established that a benthic macroinvertebrate Index of Biotic Integrity (IBI) score of 3.0 or higher meets that program's restoration goal for benthic communities (Ranasinghe, et al., 1993). Results are regularly reported to the public and are available on the Internet **(http://www.chesapeakebay.net/)**.

This Bay goal, however, was not designed to be a criterion for defining "impaired" waters in the regulatory sense – that is, to define waters that do not support a balanced population of aquatic life. Areas that meet or do not meet this Bay Program goal may or may not be "impaired" for aquatic life use by specific pollutants or causes.

The US Environmental Protection Agency (EPA) recognized that while neither Bay state had defined numeric criteria for assessing support of aquatic life uses using benthic macroinvertebrate data, there was a wealth of estuarine benthic data available for managers to try to make such a decision. Since August 2002, a workgroup comprised of Maryland Department of Natural Resources and Department of the Environment staff, Virginia Department of Environmental Quality staff and EPA staff with support from benthic monitoring and analytical staff at Old Dominion University and Versar, Inc. have worked together to try to define a process that could be used to reasonably define impaired waters of the Bay and its tributaries with recently collected estuarine benthic data.

Process

The evaluation of benthic community impairments in Chesapeake Bay segments was based on a Wilcoxon rank sum test (Lehmann, E. L. 1998. Nonparametrics. Statistical Methods Based on Ranks. Revised First Edition. Prentice Hall, Upper Saddle River, New Jersey), as implemented in Proc-StatXact 5 (Cytel Software Corporation 2002. Proc-StatXact 5 for SAS users. Statistical software for exact non-parametric inference). The Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) was calculated for each sample. The B-IBI scores for all samples were grouped into four categories (1 to 4) and the distribution of scores within a segment was compared to the reference distribution, treating the scores in each population of samples as ordered categorical responses. The four categories were B-IBI scores > 4.0, 3.1-4.0, 2.1-3.0 and ≤ 2.0. Under the null hypothesis (H_0) of no impairment, the two populations (segment and reference) can be

considered to have the same underlying multinomial distributions of samples among the ordered categories. The assessment of impairment was based on a one-sided exact test of H_0 against the alternative hypothesis that the segment had a distribution shifted towards lower B-IBI scores than for the reference condition. A segment was labeled impaired if the downward shift in B-IBI scores was significant at the $a = 0.01$ level, and with the additional condition that the test had a power of 0.9 or greater. This latter requirement controls for type II errors. Additional requirements for impairment were a minimum sample size of 10 and low B-IBI scores (<3.0) must have been observed during more than one year. When a segment had more than one habitat class, the stratified Wilcoxon rank sum test in Proc-StatXact was applied. In this case, we assumed that the samples in both populations were random samples within each habitat class (stratum). In the stratified Wilcoxon rank sum test, the ranking is done separately by habitat, and then combined across habitats. The strata weights are based on the frequency of samples in the habitats. Because samples in the benthic monitoring program are allocated randomly within each segment, the number of samples in each habitat is, on average, proportional to the area of each habitat.

Benthic community structure can be affected by anthropogenic stresses associated with toxic contaminants in the sediment, low oxygen and high sedimentation rates. Development of benthic restoration goals identified low oxygen levels and toxic contaminants as key parameters that differentiate expected reference from degraded sites (Ranasinghe et al. 1993). In this work, low oxygen levels identifying degraded sites were defined as having bottom oxygen levels during the summer index period (July 15-September 30). Also, toxic contaminant levels were defined as exceeding published ER-M (threshold contaminant) concentrations (Ranasinghe et. al, 1993). For this effort then, in addition to benthic results, Maryland and Virginia will evaluate the bottom layer dissolved oxygen levels of field data collected during each benthic sampling event as well as other, quality-assured bottom oxygen data collected during the summer index period (July 15-September 30) in these segments. The States also will evaluate toxic contaminants in sediments using currently accepted State protocols.

If a segment has insufficient or no benthic IBI results, aquatic life use support in the segment will be evaluated using other currently accepted State processes for evaluating dissolved oxygen and toxic contaminant results.

If there are sufficient data to evaluate benthic IBI condition, the segment will also be evaluated for dissolved oxygen and toxic contaminant stressors. If more than 80 percent of the bottom oxygen observations during the summer index period are less than 2 mg/L or if two or more observations during this period are below 0.3 mg/L, the area will be defined as "*not supporting aquatic life uses (benthos) due to impairments by low oxygen from eutrophication from excess nutrients*". Areas where less than 80 percent of bottom dissolved oxygen levels are below 2.0 mg/L during the summer index period, but overall oxygen levels remain below State criteria (in MD, 5.0 mg/L; in VA, 4.0 mg/L) aquatic life uses other than benthos are impaired and the area will be defined as "*not supporting aquatic life uses (nekton, plankton) due to impairments by low oxygen from eutrophication from excess nutrients*". In segments where the State's toxic contaminant evaluation identifies impacts on benthic communities, the segment area will be defined as "*not supporting aquatic life uses due to impairments by toxic contaminants from unknown sources*". A decision matrix showing the relationship between IBI, bottom layer dissolved oxygen and toxic contaminant summaries is provided in Table 4 below.

Table 4 **DECISION MATRIX** – Interpretation of other data affecting observed benthic IBI (Dissolved oxygen, Toxic contaminants)

BIBI results	Oxygen Results	No toxic contaminant data	Toxic contaminant data define no aquatic life use impact	Toxic contaminant data define aquatic life use impact	ROW
COLUMN		**A**	**B**	**C**	
Insufficient Data	Insufficient data	Aquatic life – unknown Cause - N/A Source - N/A List 3	Aquatic life – supported Cause - N/A Source - N/A Category 1 or 2	Aquatic life - fails Cause - toxics Source – unknown Category 5	**1**
	DO fails State criteria	Aquatic life – fails Cause – DO Source – eutrophication Category 5	Aquatic life – fails Cause – DO Source – eutrophication Category 5	Aquatic life - fails Cause – DO, toxics Source – eutrophication, unknown Category 5	**2**
	DO meets State criteria	Aquatic life supported Cause - N/A Source - N/A Category 1, 2 or 3	Aquatic life supported Cause - N/A Source - N/A Category 1 or 2	Aquatic life - fails Cause - toxics Source – unknown Category 5	**3**
Fails	Insufficient data	Aquatic life (benthos) – fails Cause - biology (BIBI) Source – unknown Category 5	Aquatic life (benthos) – fails Cause - biology (BIBI) Source – unknown Category 5	Aquatic life (benthos) – fails Cause – toxics Source – unknown Category 5	**4**
	Benthos Hypoxia Impacted *	Aquatic life – fails Cause – DO Source – eutrophication Category 5	Aquatic life – fails Cause – DO Source – eutrophication Category 5	Aquatic life - fails Cause –DO, toxics Source – eutrophication, unknown Category 5	**5**
	Benthos Not Hypoxia Impacted *	Aquatic life (benthos) – fails Cause – biology (BIBI) Source – unknown Category 5	Aquatic life (benthos) – fails Cause – biology (BIBI) Source – unknown Category 5	Aquatic life (benthos) fails Cause – toxics Source – unknown Category 5	**6**
Passes	Insufficient data	Aquatic life – supported Cause – N/A Source - N/A Category 3	Aquatic life – supported Cause – N/A Source - N/A Category 1 or 2	Aquatic life - fails Cause – toxics Source – unknown Category 5	**7**
	DO meets State criteria	Aquatic life supported Cause - N/A Source - N/A Category 1 or 2	Aquatic life supported Cause - N/A Source - N/A Category 1 or 2	Aquatic life - fails Cause – toxics Source – unknown Category 5	**8**

"Hypoxia Impacted Benthos" are defined as conditions where bottom oxygen levels during the summer index period are less than 2.0 mg/L more than 80 percent of the time or where two or more individual observations are less than 0.3 mg/L during the 5-year period of assessment

Natural conditions/assessment issues

Naturally-occurring conditions (no direct, indirect or accelerated anthropogenic impact) that exceed criteria are not considered violations of Water Quality Standards. The deep trough of the old Susquehanna River bed in the mid-Bay region is seasonally stratified and likely suffered from some level of hypoxia even in pre-colonial times. Proposed new designated uses and oxygen criteria for Chesapeake Bay recognize the seasonal environment of the Deep Trough as a designated use and define low oxygen criteria below current State criteria, but at levels considered protective of benthos. To date, the Chesapeake Bay benthic monitoring

program generally excludes samples from being collected in these deeper areas, assuming that benthos are impacted by hypoxia. When new Bay standards are adopted, it is likely that sampling will occur in these deeper zones. Until then, aquatic life use support can still be evaluated using other available data sources.

Limitations and use of professional judgement
As with all statistical tests, assessment personnel must consider inherent properties of the data and the statistical test used to analyze the data:

- Reference conditions represent the "best of the best conditions" for several particular habitats (e.g. Polyhaline Sand and others) and thus may be an overly strict yardstick for determination of impaired conditions. Segments with a high percentage of samples in these particular habitat types may have a healthy benthic community and yet still be significantly different from the reference distribution (e.g. segment CB7PHa). This problem can be examined by comparing the area-weighted percentage of low IBI scores against the same percentage of the reference distribution.
- The stratified Wilcoxon rank sum test can be very sensitive to small changes between distributions, especially as sample sizes increase. This can lead to statistically significant differences that may not be ecologically or managerially significant.

For these reasons, other documented conditions and best professional judgement can be used to make final impairment decisions. Other best professional judgement considerations may include cases where naturally high tidal mixing forces may cause a segment to be different than reference conditions. It should be noted that due to these issues further refinement of benthic IBI assessment procedures are planned that may change future results.

Reporting
Waterbody segments identified as *"Not Meeting Criteria"* for benthic IBI, dissolved oxygen and/or toxic contaminants are reported as "**Not Supporting Aquatic Life Uses**". These areas are not identified as a public health threat unless fish consumption advisories are identified due to bioaccumulation of toxic contaminants.

Use of other data
This process is not applicable for other benthic macroinvertebrate data collected in waterbodies other than the Chesapeake Bay and its tidal tributaries. This process addresses the monitoring data from the program's probabilistic approach. Benthic macroinvertebrate data from fixed stations used for trend analysis in this Bay Program monitoring effort may be used if use of the data does not adversely affect error or confidence in the results.

6.4.3 Fish Consumption Use
The support of the fish consumption use will be based on two types of information. These include consumption advisories limiting consumption and restrictions (bans) issued by the VDH as per the Memorandum of Understanding (MOU) with DEQ and also the comparison of fish tissue data to Water Quality Standards criterion based tissue values (TVs) and tissue screening values (TSVs). Waters exceeding the same toxic WQS derived value (TV), listed in Table 6(a), for fish tissue 2 or more times are impaired for fish consumption. For example, both of the following situations would qualify as impaired under these criteria. Two fish samples from different species exceeding the same TV during one sampling event or two or more samples of the same or different species exceeding the same TV from different sampling events within the assessment period. See Section 6.5.2 for additional information on fish tissue analysis. Waters are assessed as impaired for fish consumption use if an advisory, limiting consumption, or a restriction has been enacted. For additional information, fish consumption use support will be determined according to criteria found in Part V.

6.4.4 Shellfish Consumption Use

Shellfish consumption use support is based on the determination of restrictions or condemnations on the harvesting and marketability of shellfish resources made by the VDH-Division of Shellfish Sanitation (DSS) as of the most recent condemnation list (January 2003) associated with the reporting period. The DSS is the State agency with the statutory authority to determine shellfish harvesting and marketability status. The DSS uses four classifications for describing the status of shellfish waters. They are approved, conditionally approved, restricted, and prohibited and these are assessed according to the considerations found in Part V. A description of these terms follows:

Approved area:	Growing areas from which shellfish may be taken for direct marketing at all times.
Conditionally Approved:	Growing areas where the water quality may be affected by seasonal or sporadic use of boat docks or harbor facilities are considered conditionally approved. Normally, this would occur during the boating season (April 30 through October 31).
Restricted Area:	Growing areas where a sanitary survey indicates a limited degree of pollution which makes it unsafe to market shellfish for direct marketing. Shellfish from such areas may be marketed after purifying or relaying activities in accordance with certain VDH-DSS requirements.
Prohibited Area:	Growing areas where the sanitary survey indicates dangerous numbers pathogenic microorganisms or other contaminants that might reach that area. The harvesting of shellfish from these areas for direct marketing, relaying, or depuration is prohibited.

Specific information regarding DSS assessment methodology and the listing/de-listing flowchart for shellfish waters can be found in Appendix D of this guidance document. For the 305b/303d Integrated Report, listing and de-listing will be based on data assessed for the reporting period. However, as the TMDL begins development, if new or more recent data shows the shellfish water is no longer impaired, a petition for de-listing will be crafted and submitted to EPA for their approval by the Watershed Program (TMDL) staff.

6.4.5 Swimming Use

Based on the requirements of Section 305(b), support of the swimming and secondary contact recreation uses are assessed together using the similar procedures used in past 305(b) reports. However, for the 2004 report, E.coli (freshwater) and enterococci (transition zone and saltwater) data will also be assessed along with fecal coliform data. Waters should be assessed as impaired for the swimming use if fecal coliform, E. coli and/or enterococci bacteria data or bathing area closure indicates less than full support: Assessment of swimming use is conducted as described in Part V.

6.4.6 Public Water Supply Use

Toxics in drinking water are assessed according to the Water Quality Standards criteria (9 VAC 25-260-140.B) for public water supply and support of this use will be based on methodology described in Part V.

Section 6.5 ADDITIONAL PARAMETER ASSESSMENT

6.5.1 Nutrient Screening Values

The 1985 Virginia General Assembly established a joint subcommittee to examine nutrient enrichment problems in Virginia's portion of the Chesapeake Bay. One of the recommendations of their report was to

direct the SWCB to develop standards to protect the Chesapeake Bay and tributaries from nutrient enrichment.

In 1986, the SWCB appointed a Technical Advisory Committee (TAC) to assist in the development of nutrient standards. The TAC recommended the following thresholds found in Table 5 for identifying nutrient impairment.

Table 5 TAC Recommended Nutrient Thresholds

Parameter	**Freshwater Lakes**	**Flowing Waters**	**Estuarine**	**Tidal Freshwater**
Chl (a)	25 ug/l monthly avg 50 ug/l MAXIMUM	Narrative Standard	120% of Background	120% of Background
Dissolved Oxygen	Narrative Std	24 hr fluctuation > 1/3 oxygen saturation	Standard related to background Chl (a)	Standard related to background Chl (a)
Total Phosphorus	50 ug/l	100-200 ug/l	No Standard Monitor only	No Standard Monitor only
Total Nitrogen	No Std	No Std	No Std	No Std

Ug/l = micrograms per liter

However, the SWCB did **not** adopt the recommendations of the TAC and these values will **not** be used unless specified below. The agency adopted two regulations to protect Virginias' waters from the effects of nutrient enrichment. The first regulation allows the Board to designate "nutrient enriched waters" where there has been degradation due to the presence of excessive nutrients. The second regulation allows the control of nutrient discharges from point sources into the designated "nutrient enriched waters".

In the absence of approved numerical Water Quality Standards nutrient criteria for chlorophyll a and total phosphorus or universally accepted nutrient criteria, the assessment process will not designate a segment impaired, based on nutrient data alone. However, these waters will be listed as fully supporting but having observed effects for aquatic life, where monitored nutrient screening values have been exceeded. It is recognized that other designated uses could be affected but the aquatic life use is considered the primary use affected by nutrient enrichment.

- Procedure for Assessing Nutrient Monitoring Data

For "free flowing" streams, total phosphorus will be assessed for the five-year period. The threshold is 200 ug/l. For assessment of lakes, the total phosphorus threshold is 50ug/l. In the absence of other monitored data related to aquatic life use, if at least two samples exceed the SV and these exceedences are >10.5% of the total samples, the water will be listed as fully supporting but having observed effects for aquatic life use. A single sample will not be assessed and a single exceedence will be considered not assessed. For phosphorus and chlorophyll (a) evaluation, the primary concern is the impact on dissolved oxygen concentrations as it relates to aquatic life.

For fresh and tidal fresh waters, estuaries and lakes, chlorophyll (a) will be assessed for the five-year period. The threshold is 50 ug/l. In the absence of other monitored data related to aquatic life use, if at least two samples are available and exceedences are >10.5% of the total samples, the water will be listed as fully supporting but having observed effects for aquatic life use. A single sample will not be assessed and a single exceedence from a small dataset (2-9 samples) is considered fully supporting. Once again, it is recognized

that other designated uses could be affected. However, for chlorophyll (a) evaluation, the primary concern is increased algae production and the corresponding impact on dissolved oxygen concentrations.

6.5.2 Fish Tissue and Sediment Toxics Assessment

- **Fish Tissue (fish consumption use)**

The Water Quality Standards and Biological Monitoring Programs (WQSBMP) collects fish tissue samples from designated monitoring stations for contaminant analysis. WQSBMP staff identifies the results of any analysis that exceeds the WQS criterion based tissue value (TV) (Table 6(a) or tissue screening value (TSV) (Table 6(b) for the toxic contaminants and provides this data to water quality assessment (WQA) staff. Older fish tissue data may be included where deemed appropriate.

Fish tissue data collected at stations during routine monitoring throughout Virginia represent Tier 1 monitoring data. These Tier 1 monitoring data are meant to identify sites where concentrations of contaminants in the edible portions of commonly consumed fish indicate a potential health risk to humans. Usually, three fish tissue composite samples are analyzed for chemical contaminants at each Tier 1 station. Each is a composite of edible fillets for one species of fish from a top-level predator, a mid-level predator, and a bottom feeder. If Tier 1 results reveal potential problems, a more intensive Tier 2 study is initiated by the Water Quality Standards and Biological Monitoring Program staff to determine the magnitude, geographical extent, and potential sources of contamination in the fish.

Analytical results for fish tissue are expressed in wet-weight and are compared to WQS TVs and TSVs for the toxic pollutants using EPA risk assessment techniques for noncarcinogen and carcinogen effects. WQS human health calculations use the 10^{-5} risk level adopted by the State Water Control Board in 1992, an average human body weight of 70 kg and a lifetime average fish consumption rate of 6.5 grams per day (general U.S. population). These same values are used to calculate the human health water quality criteria found in 9 VAC 25-260-140.B. Also included in the calculation, are toxicological data pertinent to human health effects. A reference dose (RfD) is used for non-carcinogen toxic effects and a cancer oral slope factor is used for carcinogen effects. Values shown in Table 6a are based on the same toxicological data (and body weight, fish consumption, and cancer risk level) that form the basis for the water quality criteria listed in 9 VAC-25-260-140.B, under the column labeled "Human Health, All Other Surface Waters". These water quality criteria are water column concentrations that are based on a specific fish tissue concentration, which were calculated to represent a safe or acceptable minimal human health risk level. The water quality criteria are designed to prevent the fish from bioconcentrating the toxic contaminants to levels greater than these fish tissue concentrations. The concentrations listed in Table 6(a) represent the same fish tissue concentrations that are the basis for the water quality criteria listed in 9 VAC-25-260-140.B and may be considered the fish tissue concentration equivalent of those water quality criteria. Table 6(a) contains TVs for all chemicals for which Virginia has adopted water quality criteria. However, many of the chemicals listed in Table 6(a) do not bioaccumulate and are not often found in fish tissue. They are included in Table 6(a) for completeness. All TVs are rounded to two significant digits.

Table 6(b) lists TSVs for additional toxic chemicals for which Virginia has not adopted water quality criteria that are based on fish tissue concentrations (those criteria listed under "All Other Waters" in 9 VAC-25-260-140.B). It includes chemicals recommended for monitoring by EPA or of special interest to DEQ as well as some chemicals that are based on recent changes to toxicological data and /or exposure assumptions that are different from those used to calculate the water quality criteria found in 9 VAC-25-260-140.B. The TSVs in Table 6(b) are updated using available data from the EPA IRIS database and/or recommendations from EPA or the VDH before each assessment effort.

If a fish tissue composite sample exceeds a single WQS TV or TSV in either Table 6(a) or Table 6(b), the water body should be delineated as fully supporting but having an observed effect for the fish consumption use. If the TV, listed in Table 6(a) for the same toxic pollutant, is exceeded in two or more samples from the same site, the water is considered impaired. For example, both of the following situations would qualify as impaired under this criterion: two different fish samples from different species during one sampling event or two or more different samples of the same or different species from different sampling events. Data from all Tier 1 and Tier 2 monitoring studies are evaluated by DEQ as well as provided to the VDH for their consideration of the need for establishing fish advisories. DEQ and VDH have signed a Memorandum of Agreement (MOA) that describes how the agencies exchange information regarding the results of all Tier 1 and Tier 2 fish tissue monitoring. If VDH issues a fishing ban or advisory, limiting consumption, the segment should be designated impaired for fish consumption use based on the advisory. The results of the Tier 2 study should be clearly communicated in the Integrated Report narrative.

RISK BASED WQS CRITERION BASED TISSUE VALUE (TVs) FOR FISH TISSUE BASED ON THE SAME TOXICOLOGICAL DATA USED FOR CALCULATING THE HUMAN HEALTH WATER QUALITY CRITERIA IN 9 VAC-25-260-140.B UNDER "ALL OTHER WATERS" FOR GENERAL POPULATION (ADULT)

BODY WEIGHT (KG)	70
RISK LEVEL	10^{-5}
CONSUMPTION RATE (KG/DAY)	0.0065

Table 6(a)

COMPOUND		**NON CARCINOGEN**	**CARCINOGEN**
		CRITERION BASED TISSUE VALUE (TV)	**CRITERION BASED TISSUE VALUE (TV)**
	CAS #	PPB	PPB
Acenaphthene	83-32-9	650,000	
Aldrin	309-00-2		6.3
Anthracene	120-12-7	3,200,000	
Antimony	7440-36-0	4,300	
Benzene	71-43-2		3,700
Benzo(a)anthracene	56-55-3		15
Benzo(b)fluoranthene	205-99-2		15
Benzo (k)fluoranthene	207-08-9		15
Benzo(a)pyrene	50-32-8		15
Bromoform	75-25-2		14,000
Butyl benzyl phthalate	85-68-7	2,200,000	
Carbon tetrachloride	56-23-5		830
Total Chlordane	57-74-9		310*
Chlorodibromomethane	124-48-1	220,000	
Chloroform	67-66-3		18,000
2-Chlorophenol	95-57-8	54,000	
Chrysene	218-01-9		15
Cyanide	57-12-5	220,000	
DDD	72-54-8		450
DDE	72-55-9		320
Total DDT	50-29-3		320

Dibenz(a,h)anthracene	53-70-3		15
Dibutyl phthalate	84-74-2	1,100,000	
Dichloromethane	75-09-2		14,000
1,2-Dichlorobenzene	95-50-1	970,000	
1,3-Dichlorobenzene	541-73-1	140,000	
1,4-Dichlorobenzene	106-46-7	140,000	
Dichlorobromomethane	75-27-4		1,700
1,2-Dichloroethane	107-06-2		1,200
1,1-Dichloroethylene	75-35-4	97,000	
2,4-Dichlorophenol	120-83-2	32,000	
Dieldrin	60-57-1		6.7
Diethyl phthalate	84-66-2	8,600,000	
Di-2-ethylhexyl phthalate	117-81-7		7,700
2,4-Dimethylphenol	105-67-9	220,000	
2,4-Dinitortoluene	121-14-2		350
Dioxin	1746-01-6		0.0062
Endosulfan (1 and II)	115-29-7	65,000	
Endrin	72-20-8	3,200	
Ethylbenzene	100-41-4	1,100,000	
Fluoranthene	206-44-0	430,000	
Fluorene	86-73-7	430,000	
Heptachlor	76-44-8		24
Hexachlorocyclohexane (lindane)	58-89-9	3,200	
Indeno(1,2,3-cd)pyrene	193-39-5		15
Isophrone	78-59-1	2,200,000	
Mercury (Methyl)	22967-92-6	1,100	
Monochlorobenzene	108-90-7	220,000	
Nickel	744-00-2	220,000	
Nitrobenzine	98-95-3	5,400	
PCB Total/congeners	1336-36-3		54*
Pentachlorophenol	87-86-5		900
Phenol	108-95-2	6,500,000	
Pyrene	129-00-0	320,000	
Selenium	7782-49-2	54,000	
Tetracholoethylene	127-18-4	110,000	
Toluene	108-88-3	2,200,000	
Toxaphene	8001-35-2		98
1,2,4-Trichlorobenzene	120-82-1	110,000	
Trichloroethylene	79-01-6		860
2,4,6-Trichlorophenol	88-06-2		9,800
Vinyl Chloride	75-01-4		72*

* These WQS criterion based tissue values are based on EPA recommended cancer slope factors for these compounds which have been updated since DEQ adopted the water quality criteria in 1997. In March 2003, the Virginia Water Control Board adopted up-dated water quality criteria for these compounds that are based on these cancer slope factors and thus have the same basis as these fish-tissue concentrations. These screening values have been used by DEQ in previous years in assessing fish tissue.

RISK BASED TISSUE SCREENING VALUE (TSVs) FOR FISH TISSUE UPDATED FROM INTEGRATED RISK INFORMATION SYSTEM (IRIS) FOR GENERAL POPULATION (ADULT)

BODY WEIGHT (KG) 70
RISK LEVEL 10^{-5}
CONSUMPTION RATE (KG/DAY) 0.0065

Table 6(b)

COMPOUND		**NON CARCINOGEN**	**CARCINOGEN**
		TISSUE SCREENING VALUE (TSV)	**TISSUE SCREENING VALUE (TSV)**
	CAS #	PPB	PPB
Arsenic (inorganic)	74440-38-2		72**
Barium	7440-39-3	750,000	
BHC alpha	319-84-6		20
BHC beta	319-85-7		60
BHC isomers	608-93-1		20
Brominated Diphenyl ethers (BDEs)		5,000	
Cadmium	7440-43-9	11,000	
Chromium III	16065-83-1	16,000,000	
Chromium VI	18540-29-9	32,000	
Chlorpyrifos	2921-88-2	32,000	
Diazinon	333-41-5	970	
Dicofol	115-32-2	11,000	
Dioxin	1746-01-6		0.003**
Disulfoton	298-04-4	430	
Ethion	563-12-2	5,400	
Heptachlor epoxide	1024-57-3		10
Hexachlorobenzene	118-74-1		70
Kepone	143-50-0	300	
Mercury (Methyl)	22967-92-6	300 (EPA2001) (500VDH)	
Methoxychlor	72-43-5	54,000	
Mirex	2385-85-5	2,200	
Oxyfluorfen	42874-03-3		830
PCB Total/congeners	1336-36-3	220	54
PAHs (sum PEC) ***			15
Terbufos	13071-79-9	1400	
Toxaphene	8001-35-2		100
Tributyltin	56-35-9	320	
Selenium	7782-49-2	54,000	

** These values are based on recent changes to the toxicological data used to calculate the screening values, or recent recommendations from U.S. EPA or the Virginia Department of Health. These screening values are not based on the same toxicological data that were used to develop the existing water quality criteria.

*** Mixtures of seven polynuclear aromatic hydrocarbons (PAHs) that are classed as probable human carcinogens were assessed based on a screening value concentration of 15 ppb calculated as a sum potency equivalency concentration (PEC) using methods described in EPA's Guidance for Assessing Chemical

Contaminant Data for Use in Fish Advisories, Vol. 1, (EPA 823-R-95-007) and Vol. 2 (EPA 823 B-00-008) using the following equation;

$$PEC = \sum_{i} (RP_i \times C_i)$$

where; RP_i = relative potency for the ith PAH
C_i = concentration of the ith PAH in fish tissue)

The relative potency estimates used for these PAHs were:

Benzo(a)pyrene	1.0
Benzo(a)anthracene	0.145
Benzo(b) fluoranthene	0.167
Benzo(k)fluoranthene	0.020
Chrysene	0.0044
Dibenz(a,h)anthracene	1.11
Indeno(1,2,3-cd)pyrene	0.055

- **Sediment (aquatic life use)**

Similar to the sediment monitoring and analysis conducted by Water Quality Standards and Biological Programs, the regional offices will assess the AWQM sediment data. For freshwater sediments above the fall-line, the Consensus Based Probable Effects Concentrations (PEC; MacDonald et al. 2000) should be applied. If a PEC is unavailable for a particular contaminant, the VA 99th percentiles should be used (Table 7). Estuarine sediment contaminant data collected during scheduled AWQM monitoring should be compared to National Oceanic and Atmospheric Administration (NOAA 1995) effects range-medium (ER-M) SVs for sediment. Once again, if the ER-M is not available, use the VA 99th percentiles where available (Table 8). One or more exceedences of an ER-M/PEC value results in a fully supporting but having observed effects status for aquatic life use support (must have at least 2 samples). In these cases, additional biological monitoring should be scheduled to assess actual aquatic life use support.

Table 7 Consensus Based Sediment Screening Values (SVs) for use in the assessment of freshwater aquatic life support.

Analyte	Consensus PEC **ug/kg (ppb) dry weight**	99th Percentile
Arsenic	33,000	
Cadmium	4,980	
Chromium	111,000	
Copper	149,000	
Lead	128,000	
Mercury	1060	
Nickel	48,600	
Silver	NA	2600
Zinc	459,000	
Acenaphthene	NA	170
Acenaphthylene	NA	121
Anthracene	845	
Benzo-a-pyrene	1,450	
Benz(a)Anthracene	1,050	
Chrysene	1,290	

Dibenz[a,h] Anthracene	NA	318
Fluoranthene	2230	
Fluorene	536	
Methylnaphthalene, 2-	NA	83
Naphthalene	561	
Phenanthrene	1,170	
Pyrene	1,520	
LMW PAHs	NA	
HMW PAHs	NA	
Total PAHs	22,800	
Chlordane	17.6	
DDD	28	
DDE	31.3	
DDT	62.9	
DDT, total	572	
Dieldrin	61.8	
Total PCBs	676	
Endrin	207	
Heptachlor Epoxide	16	
Lindane	4.99	

PECs taken from
MacDonald et al. 2000
NA = Not Available

Table 8 NOAA based ER-M Sediment Screening Values (SVs) for use in the assessment of estuarine aquatic life support.

- **Trace Elements –parts per million (ppm), dry weight**

Substance	ER-M Value (dry weight)	99th %tile (dry weight)
Antimony (Sb)	NA	
Arsenic (As)	70	
Beryllium	NA	5.0
Cadmium (Cd)	9.6	
Chromium (Cr)	370	
Copper (Cu)	270	
Lead (Pb)	218	
Manganese (Mn)	NA	
Mercury (Hg)	0.71	
Nickel (Ni)	51.6	
Selenium (Se)	NA	20.0
Silver (Ag)	3.7	
Thallium	NA	13.5
Zinc (Zn)	410	

- **Pesticides and Other Organic Substances –parts per billion (ppb), dry weight**

CAS #	Substance	ER-M Value (dry weight)	99th %tile (dry weight)
1336363	Polychlorinated Biphenyls (PCBs)	180	
309002	Aldrin	NA	
57749	Chlordane	6	
NA	total DDT (include metabolites	46.1	
72548	DDD	20	
50293	DDT	7	
72559	DDE	27	
60571	Dieldrin (EPA proposed criteria)	8	
72208	Endrin	NA	
76448	Heptachlor	NA	
1024573	Heptachlor epoxide	NA	
118741	Hexachlorobenzene	NA	
608731	Hexachlorocyclohexane	NA	
58899	Lindane	NA	
2385855	Mirex	NA	
108952	Phenol	NA	
117817	Di (2-Ehtylhexyl) Phthalate	NA	
84742	N-Butyl Phthalate	NA	
83329	Acenapthene	500	LMW PAH
208968	Acenapthylene	640	LMW PAH
120127	Anthracene	1100	LMW PAH
50328	Benzo-A-Pyrene	1600	HMW PAH
191242	Benzo [GHI] Perylene	NA	HMW PAH
56553	Benz[A] Anthracene	1600	HMW PAH
218019	Chrysene	2800	HMW PAH
53703	Dibenz [A,H] Anthracene	260	HMW PAH
206440	Fluoranthene	5100	HMW PAH

86737	Fluorene	540	LMW PAH
193395	Indeno (1,2,3-CD) Pyrene	NA	HMW PAH
91576	Methylnaphthalene , 2	670	LMW PAH
91203	Naphthalene	2100	LMW PAH
85018	Phenanthrene	1500	LMW PAH
129000	Pyrene	2600	HMW PAH
NA	Low Molecular Weight (LMW) PAH's		3160
NA	High Molecular Weight (HMW) PAH's		9600
NA	Total PAH's		44,792

DEQ acknowledges the use of the ER-M or PEC may be limited (for several reasons) in their ability to accurately predict biological affects. Given that DEQ continues to employ the collection of bulk sediment with chemical analysis as a cost-effective way to monitor a great number of sediment sites, these thresholds are an appropriate tool for assessing sediment data relative to its potential harm to aquatic life.

Citation:

Freshwater PECs*:* MacDonald, D.D., C.G. Ingersoll, T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Arch. Environ. Contam. Toxicol.* 39:20-31.

Estuarine ER-Ms*:* MacDonald, D.D., Long, E.R., Smith, S.L., Calder, F.D. 1993. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments.

6.5.3 Additional Toxics Evaluation

- **Freshwater Toxics Evaluation**

For overall freshwater toxics evaluation, DEQ uses the Virginia Water Quality Standards for human health in surface waters, other than public water supplies (9 VAC 25-260-140.B). These same values are used to assess the fish consumption use in public water supplies as well as all other surface waters. (Please note, the criteria for human health in public water supplies will be used to assess the drinking water use in PWSs only). For metals assessment, only dissolved metals data will be used. In conformance with water quality management plans and VPDES permitting procedures, water column toxicant data collected up to 5 years prior to the current 305(b) period should be assessed along with current data if they reflect current conditions. When assessing the aquatic life and wildlife use support for toxic contaminants, compliance should be based on meeting the aquatic life acute Water Quality Standards found in 9 VAC 25-260-140 B. See Part V for additional information.

- **Estuarine Toxics Evaluation**

The weight-of evidence approach adopted by DEQ for assessing estuarine toxics data (see EPA 903-R-00-010, June 1999) has been developed through a consensual process between partners of the Chesapeake Bay Program (CBP) with oversight from the Bay Program's Scientific and Technical Advisory Committee (STAC). The CBP partners include the U.S. EPA Chesapeake Bay Program, the Bay jurisdictions, including Virginia, the private sector and several Virginia/Maryland academic institutions. It is suggested this approach be initiated only when a full suite of toxics related data are available. Generally, this includes ambient water column chemical data with ambient water toxicity test data, and /or sediment chemical data with sediment toxicity test data. The inclusion of benthic-IBI data collected from the same stations is also important in this approach. If available, other relevant toxicological data such as fish tissue and fish histopathological information may be considered within this approach.

This approach is based on a "weight of evidence" that takes into account data from all stations and media within a defined area, from which evidence can be compiled for or against toxics contamination. Four levels of data analysis have been created. Taken into consideration are exceedences and non-exceedences of thresholds, the varying degrees of confidence in thresholds (e.g., Water Quality Standard vs. an ER-M), and the magnitude of threshold exceedences. Please refer to Appendix B for further detail regarding this approach. As defined, data that fall into the **Level 1** category are indicative of probable contaminant effects within that medium at that station/water body and would placed into Va. Category 5A. **Level 2** data suggests possible contaminant effects and are applicable to Va. Category 2B while **Level 3** data are indicative of low probability for contaminant effects and would be placed in Va. Category 2A. **Level 4** has been created for stations/segments where the available data are insufficient to place it into one of the other three categories and would fall into Va. Categories 3A or 3B. By assigning all the data from the different media within the water body to these four levels, it is possible to establish an overall level ranking for that water body. In many cases the implementation of this approach entails professional judgement.

If applicable toxics data are available within estuarine waters, DEQ staff shall utilize the targeting approach presented in Appendix (B) of this document. Consensus among appropriate DEQ staff will be attained for the final assessment of these tidal areas. Documentation of these assessment results will be developed and included in the assessment database.

When toxic pollutants are considered as the likely cause of benthic impact and these data are used within the framework of the Benthic-IBI decision matrix (Table 4), the use of professional judgement may be necessary. Disparate data sets often have significant temporal variances in their collection dates. Since sediment can be a very dynamic habitat, it may be inappropriate for assessment purposes to compare 3-4 year old benthic data with current chemical contaminant or toxicity test data at a station/segment. Note this is only a single example of what could be many possible scenarios.

Section 6.6 LAKE and RESERVOIR ASSESSMENT

DEQ has completed the process of reviewing and revising the Lakes Monitoring and Assessment Program. A program to prioritize the many lakes and reservoirs has been developed. This prioritization allows the Department to focus on the most important lakes as they relate to designated uses. Limited resources will then be able to be utilized for these priority lakes and an intensive monitoring schedule can be conducted that will allow a thorough assessment of those priority lakes.

Meanwhile, for the 2004 assessment, the lakes and/or reservoirs, which meet the following definition of a "significant lake", will be reviewed as available resources allow. A list of current significant lakes is included at end of this section (Table 9).

1. All publicly accessible public water-supply lakes and/or;

2. All publicly accessible lakes 100 acres or more in size.

This definition includes the federally owned lakes, which meet these criteria, but all other federally owned lakes would be excluded from the agency lakes monitoring program.

At least one of these two criteria need to be met for the lake assessment consideration:

1. lakes and reservoirs should have exceedences of numerical Water Quality Standards, with actual data observations in DEQ files, as well as confirmation made by more than a single data point, or

2. for any parameters for which DEQ does not have a Water Quality Standard, a loss of designated use (fishable, swimmable, public water supply) documented by ancillary data (such as records of conditions preventing swimming and/or boating, recurrent fish kills, other QA/QC approved non-agency studies or reports, etc.)

6.6.1 Interpretation/Assessment Issues Unique to Lakes and Reservoirs

The assessor should provide a complete narrative documenting assessment decisions. If uses are impacted, document those uses impacted and how they are impacted. Name causes and sources where possible, (e.g. nuisance algal blooms preventing swimming during summer months, numerous complaints on file or aquatic weed growth preventing free navigation of lake and/or expensive mechanical or chemical clearing, etc).

Assessment should be performed and documented by the regional biologist or other appropriate staff. The regional 305(b) coordinator will be responsible for entering the data into the ADB (Assessment Data Base).

Background:

It is a natural condition for lakes to stratify in the summer due to the thermal gradient that forms because of surface heating and then acts to separate the warmer less dense upper layer (epilimnion) from the cooler denser lower layer (hypolimnion). If the lake is sufficiently deep for stratification to occur, the hypolimnion will become anoxic because there are no oxygen restoring processes taking place, while natural detritus settling from the epilimnion and sediment oxygen demand (SOD) continue to deplete the available oxygen. Excessive nutrients delivered to lakes can aggravate the problem by stimulating production, which feeds additional organic matter to the hypolimnion and can reduce the transmission of sunlight to the lower layers of the epilimnion. In the absence of sunlight, algae and phytoplankton in the bottom of the epilimnion begin to respire, removing oxygen from the epilimnion.

The natural dissolved oxygen (DO) depletion process of lakes can be compounded by anthropogenic activities that contribute significant amounts of nutrients or organic matter to the system. This guidance outlines the general approach for determining lake DO impairments and a logical process to determine if anthropogenic pollutants are exacerbating the natural DO depletion process. The general approach is to assess the water quality data from the lakes and evaluate antidotal information in the watershed. First, the temperature data will be evaluated to determine if the lake is stratified and determine the configuration or thermal zones of the lake. The, DO measurements will be assessed using Virginia's DO standard. Next, the Trophic State Index (TSI) will be calculated to determine if excessive nutrients are contributing to low DO concentrations in the hypolimnion. Finally, antidotal information such as fish kill data and land use information will be evaluated to determine if the natural conditions of the lake are possibly exacerbated by anthropogenic activity. Also, the guidance provides justification for proceeding with TMDL development or an alternate path such as revision of the water quality criteria for DO.

Monitoring Station Data:

If a lake monitoring station has more than one year of data, the data will be aggregated for the entire assessment period for the analysis. The 10% violation factor will not be applied to the TSI analysis since it is being used only as an indicator of anthropogenic pollutants. For large lakes having more than one monitoring station, each monitoring station will be assessed individually.

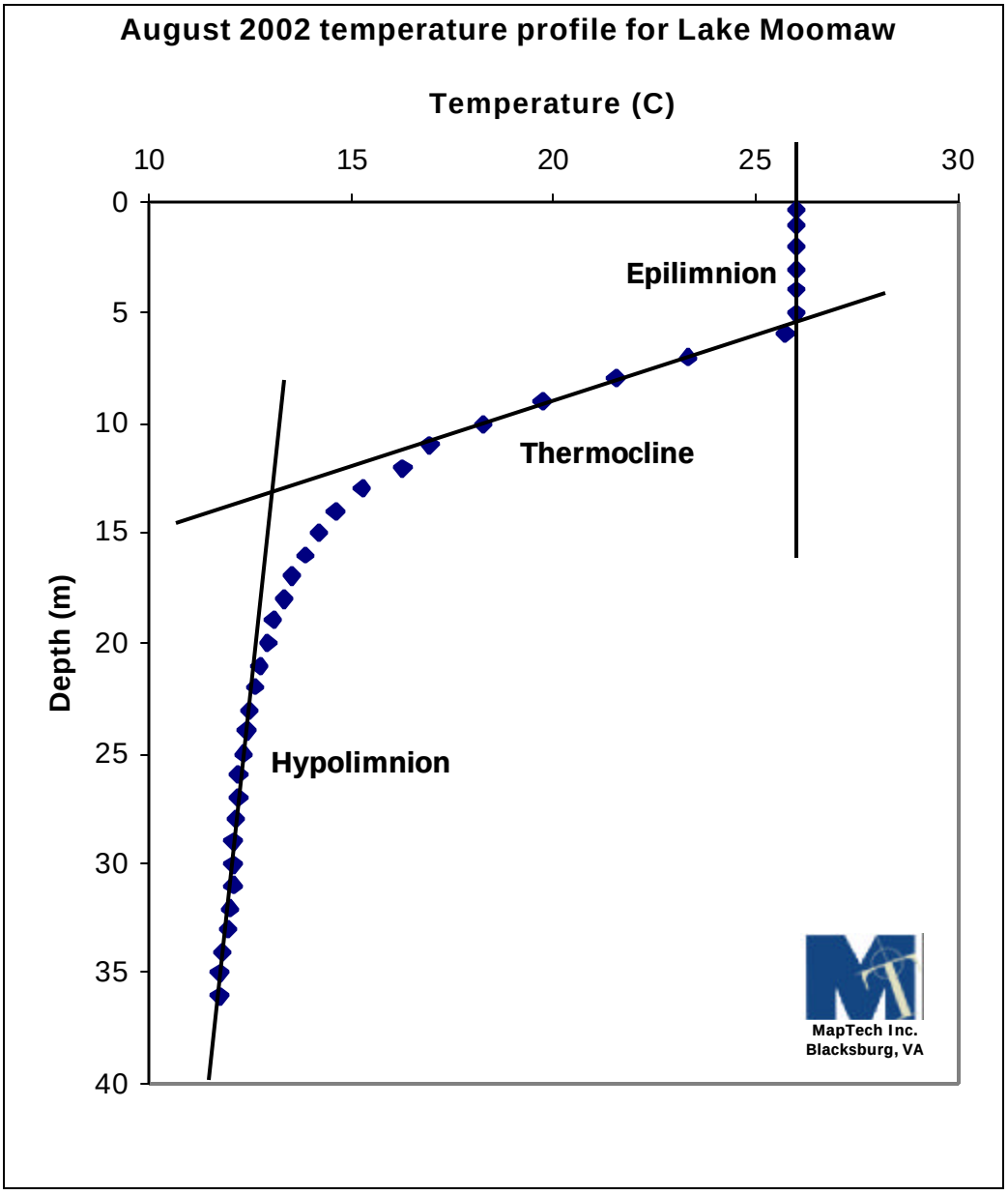
TMDL Development and Assessment Process:

The process for TMDL development and assessing lakes and reservoirs is described in the following 4 steps. This methodology applies to all lakes/reservoirs previously assessed as well as lakes/reservoirs being assessed for the first time in the 2004 assessment.

Step 1: Determine if Lake/Reservoir is Stratified

Temperature data collected in the summer months (June through September) is used to develop a temperature profile of the lake. A lake or reservoir is considered stratified if there is a difference of 4ºC or more between the surface-to-bottom temperature (June through September). If the differential between T_t and T_b is less than 4ºC the lake is not considered stratified and the entire water column will be treated as a homogenous unit

Stratified Lakes - 2 Methods to Delineate the Epilimnion and Hypolimnion
First, if a thermally stratified lake is sufficiently deep to develop a well-defined thermocline, the epilimnion and hypolimnion can be determined from a plot of the temperature profile. The thermocline (metalimnion) or transition zone separates the overlying epilimnion and the underlying hypolimnion. A temperature profile from Lake Moomaw is shown below to illustrate the delineation of the thermal layers.



Second, there are conditions in thermally stratified waters where the temperature profiles do not allow the thermocline and thermal layers to be clearly delineated due to shallow depths, unusual circulation patterns, or other problems. In cases where the layers cannot be clearly defined, assume the epilimnion is the upper 1/3 of the water column and the hypolimnion is the lower 2/3 of the water column.

Non-stratified Lakes
If the lake's temperature differential (T_t and T_b) for the summer months (June through September) is less than 4ºC, the lake is not thermally stratified and the entire water column will be treated as a homogenous unit.

Step 2: Apply DO criteria

Epilimnion:
For each monitoring station, all DO data collected in the epilimnion (delineated using temperature profile or assumed to be the upper 1/3 of the water column) will be aggregated and assessed. If the violation rate exceeds 10%, the assessment unit or entire lake/reservoir will be assessed as impaired partially due to one or more pollutants from anthropogenic sources and will be placed in category 5A for TMDL development. If the violation rate is less than 10%, assess the hypolimnion.

Hypolimnion:
For each monitoring station, all data collected in the hypolimnion (delineated using temperature profile or assumed to be the lower 2/3 of the water column) will be aggregated and assessed. If the violation rate exceeds 10%, the lake/reservoir will be assessed as impaired partially due to one or more pollutants. Go to Step 3 and calculate the Tropic State Indices to determine whether the violations are due to pollutants from anthropogenic sources or natural sources. If the violation rate is less than 10%, the assessment unit or lake will be assessed as fully supporting.

Non-stratfied Lakes - Water Column Treated as Homogenous Unit:
If the lake is not stratified (T_t and T_b differential <4ºC) all DO data in the water column will be aggregated and assessed). If the violation rate exceeds 10%, the assessment unit or entire lake/reservoir will be assessed as impaired partially due to one or more pollutants from anthropogenic sources and will be placed in category 5A for TMDL development. If the violation rate is less than 10%, the assessment unit or lake will be assessed as fully supporting.

Step 3: Apply Trophic State Indices (TSI)

Secchi Depths (SD), Chlorophyll *a* (CA), and Total Phosphorus (TP) will be calculated only on stratified lakes (T_t and T_b differential <4ºC) using aggregated station data in the epilimnion from mid-June through mid-September (at 0.3 m for TP and CA) .

A tropic state index value of 60 or greater for any one of the 3 indices will indicate that nutrient enrichment from anthropogenic sources are adversely interfering, directly or indirectly, with the designated uses. A TSI value of 60 corresponds to a CA concentration of 20 ug/l, a SD of 1 meter, and a TP concentration of 48 ug/l.

Following are the TSI equations:

$$TSI(SD) = 10(6 - (\ln SD / \ln 2))$$
$$TSI(CA) = 10(6 - ((2.04 - 0.68 \ln CA) / (\ln 2)))$$
$$TSI(TP) = 10(6 - ((\ln (48 / TP)) / (\ln 2)))$$

SD = meters
CA = ug/l
TP = ug/l

The following rules apply:

1. Do not calculate a chlorophyll a TSI in lakes that are treated with algaecides.
2. The Chlorophyll a TSI will normally be the preferred indicator in un-treated lakes.
3. Assume that typical Virginia freshwater lakes and reservoirs are phosphorus limited.
4. Do not use the secchi depth index in the assessment if it is much larger than the CA and TP indices in the same assessment unit (prevalence of inorganic matter).
5. The appropriate TSIs should be calculated based on all summer sample data collected in the segment using the spreadsheet that has been developed for easier data processing.

For each monitoring station, if one or more of the TSIs > or = 60*, the lake/reservoir will be assessed as impaired partially due to one or more pollutants from anthropogenic sources. The assessment unit or entire lake/reservoir will be placed in category 5A for TMDL development.

For each monitoring station, if each of the TSIs < 60, the lake/reservoir will be assessed as impaired due to pollution from natural sources and placed in category 4C. A TMDL is not needed for the assessment unit represented by the minitoring station(s) and appropriate DO criteria will be developed for the hypolimnion.

Step 4: Evaluate Antidotal Information

Fish Kill Data
If there are documented chronic (more than 1) fish kills in the lake caused by low DO , the assessment unit or entire lake/reservoir will be assessed as impaired partially due to one or more pollutants from anthropogenic sources and will be placed in category 5A for TMDL development.

Lakes with Algaecide Applications
When the algae is killed from chemical applications it may settle to the bottom taking phosphorous and particulate matter out of the epilimnion. Therefore, a lake subject to algaecide applications having a TSI for TP greater than 60 should be listed in category 5A for TMDL development if the land use or other information shows the probable presence of potential anthropogenic sources.

* A TSI value of 60 was chosen based on review of approved lake TMDLs for DO impairments.

Table 9 SIGNIFICANT LAKES BY REGION

Northern Regional Office – 13 Lakes

Able Lake	Stafford Co.	185 (Acres)	PWS (Public Water Supply)
Lake Anna	Louisa Co.	9,600	
Aquia Reservoir (Smith Lake)	Stafford Co.	219	PWS
Beaverdam Reservoir	Loudoun Co.	350	PWS
Burke Lake	Fairfax Co., VDGIF	218	
Goose Creek Reservoir	Loudoun Co.	140	PWS
Lake Manassas	Pr.William Co.	741	PWS
Motts Run Reservoir	Spotsylvania Co.	160	PWS
Mountain Run Lake	Culpeper Co.	75	PWS
Ni Reservoir	Spotsylvania Co.	400	PWS
Northeast Creek Res.	Louisa Co.	49	PWS
Occoquan Reservoir	Fairfax Co.	1700	PWS
Pelham Lake	Culpeper Co.	253	PWS

Piedmont Regional Office – 12 Lakes

Airfield Pond	Sussex Co., VDGIF	105	
Amelia Lake	Amelia Co., VDGIF	110	
Brunswick Lake	Brunswick Co., VDGIF	150	
Lake Chesdin	Chesterfield Co.	3196	PWS
Chickahominy Lake	Charles City Co.	1500	PWS
Diascund Reservoir	New Kent co.	1700	PWS
Emporia Lake	Greensville Co.	210	PWS
Falling Creek Reservoir	Chesterfield Co.	110	
Lake Gaston	Brunswick Co.	20300	PWS
Great Creek Reservoir (Bannister Lake)	Lawrenceville	305	
Swift Creek Lake	Chesterfield Co.	156	
Swift Creek Reservoir	Chesterfield Co.	1800	PWS

South Central Regional Office – 21 Lakes

Briery Creek Lake	Pr. Edward Co., VDGIF	850	
Brookneal Reservoir	Campbell Co.	25	PWS
Cherrystone Lake	Pittsylvania Co.	105	PWS
Georges Creek Res.	Pittsylvania Co.	1	PWS
Gordon Lake	Mecklenburg Co., VDGIF	157	
Graham Creek Res.	Amherst Co.	50	PWS
Halifax Reservoir	Halifax Co.	410	PWS
Holiday Lake	Appomattox Co.	145	
Kerr Reservoir	Halifax Co., ACOE	48968	PWS
Keysville Lake	Charlotte Co.	42	PWS
Lake Conner	Halifax Co., VDGIF	111	
Lunenburg Beach Lake	Town of Victoria	13	PWS
Modest Creek Reservoir	Town of Victoria	29	PWS
Nottoway Falls Lake	Lunenburg Co.	60	PWS
Nottoway Lake	Nottoway Co.	188	
Nottoway Pond	Nottoway Co.	65	PWS
Pedlar Lake	Amherst Co.	75	PWS
Roaring Fork	Pittsylvania Co.	19	PWS
Stonehouse Creek Res.	Amherst Co.	125	
Thrashers Creek Res.	Amherst Co.	110	
Troublesome Creek Res. (SCS Impoundment #2)	Buckingham Co.	58	PWS

Southwest Regional Office – 9 Lakes

Appalachia Res.	Wise Co.	17	PWS
Big Cherry Lake	Wise Co.	76	PWS
Byllsby Reservoir	Carroll Co.	335	
J. W. Flannigan Res.	Dickenson Co., ACOE	1143	PWS
Hungry Mother Lake	Smyth Co.	108	PWS
Lake Keokee	Lee Co., VDGIF	100	
Laurel Bed Lake	Russell Co., VDGIF	300	
North Fork Pound Res.	Wise Co., ACOE	154	PWS
South Holston Res.	Washington Co., TVA	7580	PWS

Tidewater Regional Office – 18 Lakes

Lake Cahoon	Suffolk City	508	PWS

Lake Burnt Mills	Isle of Wight Co.	610	PWS
Harwood Mill Pound	York Co.	300	PWS
Lake Kilby	Suffolk City	226	PWS
Lee Hall Reservoir	Newport News	230	PWS
Little Creek Res.	Norfolk City	185	PWS
Little Creek Res.	James City Co.	860	PWS
Lone Star Lake F	Suffolk City	20	PWS
Lone Star Lake G	Suffolk City	50	PWS
Lone Star Lake I	Suffolk City	39	PWS
Lake Meade	Suffolk City	511	PWS
Lake Prince	Suffolk City	775	PWS
Lake Smith	Norfolk City	222	PWS
Speights Run Lake	Suffolk City	94	PWS
Stumpy Lake	Virginia Beach	210	PWS
Waller Mill Res.	York Co.	315	PWS
Lake Whitehurst	Norfolk City	458	PWS
Lake Wright	Norfolk City	35	PWS

Valley Regional Office – 12 Lakes

Beaver Creek Res.	Albemarle Co.	104	PWS
Mount Jackson Res.	Shenandoah Co.	0.7	PWS
Coles Run Res.	Augusta Co., USFS	9	PWS
Elkhorn Lake	Augusta Co. USFS	55	PWS
Lake Frederick	Frederick Co. VDGIF	120	
Ragged Mount Res.	Albemarle Co.	54	PWS
Rivanna Res.	Albemarle Co.	390	PWS
Staunton Dam lake	Augusta Co.	30	PWS
Strasburg Reservoir	Shenandoah Co.	5.3	PWS
Switzer Lake	Rockingham Co.USFS	110	
Sugar Hollow Res.	Albemarle Co.	47	PWS
Totier Creek Res.	Albemarle Co.	66	PWS

West Central Regional Office – 15 Lakes

Beaverdam Creek Res.	Bedford Co.	123	PWS
Bedford Reservoir	Bedford Co.	28	PWS
Carvin Cove Reservoir	Botetourt Co.	630	PWS
Claytor Lake	Pulaski Co.	4483	PWS
Clifton Forge Res.	Alleghany Co., USFS	16	PWS
Fairystone Lake	Henry Co.	168	
Gatewood Res.	Pulaski Co.	162	
Hogan Lake	Pulaski Co.	40	PWS
Leesville Res.	Bedford Co.	3400	PWS
Little River Res.	Montgomery Co.	113	
Martinsville Res.	Henry	220	PWS
Lake Moomaw	Bath Co., USFS	2430	
Philpott Res.	Henry Co., ACOE	2879	
Smith Mountain Lake	Bedford Co.	19992	PWS
Talbott Reservoir	Patrick Co.	165	

Total 100 Lakes statewide

Section 6.7 COASTAL ASSESSMENT

Virginia has 120 miles of Atlantic Ocean coastline and approximately 2,500 square miles of estuary. This resource has a prominent place in Virginia's history and culture. It is valued for its commercial fishing, wildlife, sporting, and recreational opportunities, as well as its commercial values in shipping and industry. In the 1970's adverse trends in water quality and living resources were noted and prompted creation of the Federal-Interstate Chesapeake Bay Program (CBP). The coastal assessment is conducted in the same manner as the estuarine assessments previously described in Sections 6.4.1.2 and 6.5.3.2.

PART VII 303 (d) LISTING/DE-LISTING and TMDL PRIORITY RANKING

Section 7.1 "EFFLUENT LIMITED" WATERS (Category 4 B)

Rule 1

When reviewing waters receiving effluent from facilities with water quality based effluent limits in VPDES permits, the following should be considered in developing the 303(d) list;

- If the permit has been issued with no compliance schedule and the limits are to be met upon permit issuance, then listing is not necessary.

- If the permit for a previously listed water has since been issued with no compliance schedule and the limits are required to be met upon permit issuance, then re-listing is not necessary. EPA must be provided a verification package for de-listing waters (see Section 7.1 Rule 2).

- If the permit has been issued with a scheduled compliance date that extends beyond the next 303d listing cycle, the water would be listed as Category 4B. If the compliance date falls within the next listing cycle, the water would not be listed.

Rule 2

The verification process for removing or de-listing effluent limited waters must consider the following;

- The removal or de-listing process applies only to waters impacted by a single point source discharge. TMDLs will have to be developed and approved by EPA prior to de-listing waters impacted by multiple discharges or a single point source with a significant nonpoint source "load allocation" component. A water listed in Part II for NH3-N discharging into a segment listed for nonpoint source fecal coliform bacteria could be removed since the bacteria problem is unrelated to the NH3-N.

- If compliance with the Water Quality (WQ) based effluent limits is not met by the compliance date, the waters should not be removed from the list or should be re-listed in Category 4B if previously removed. If post operational water quality data shows that Water Quality Standards are not being met, the water should remain on the list or be re-listed in Category 5.

If the above conditions are met, the following information should be submitted to EPA for de-listing those waters identified in Category 4B of the 2002 303d Report. Waters that do not meet the above conditions should be listed or remain in Category 4B of the 2004 303d Report.

Verification Packet for VPDES Permits:
Hydrologic Unit Code (HUC), Watershed Identity Number, Stream Name, Parameter, and VPDES Permit Number and recent DMRs showing compliance.

- A statement identifying the basis for de-listing the water. The statement should confirm that water quality based effluent limits were in place by the compliance date, and these effluent controls are sufficient to attain or maintain Water Quality Standards. If the facility will meet the water quality based effluent limits within the listing cycle required by federal law and Water Quality Standards are expected to be attained or maintained, the verification should describe the

facility's progress in meeting the effluent requirements and the expectation that the compliance date in the permit will be met.

- Copy of water quality analysis modeling conducted as part of permit development that shows the level of controls necessary to implement Water Quality Standards.

- Copy of permit page (and/or any State compliance order and associated interim limits and schedule to achieve the final limit) that contains the required control levels.

- Copy of permit page that provides the compliance date for water quality based controls.

Section 7.2 IMPAIRED WATERS (Category 5)

Rule 1

Waters listed as impaired in the 303(d) report will remain on the list and tracked in subsequent 305(b) in reports until:

- An EPA approved TMDL is developed for all pollutants causing impairment

OR

A subsequent assessment of the monitoring data or in special cases, modeling results shows that the water is no longer impaired and EPA approves the de-listing of the water from the impaired list. (see Section 7.2 Rule 2 for necessary de-listing documentation)

Rule 2

Documentation required by EPA for de-listing previously listed impaired waters:

Scenario # 1: when new data demonstrates a previously impaired waterbody is currently attaining Water Quality Standards (WQS), based on the EPA 10.5% method or new, fully supporting benthic assessment information, DEQ should submit the following documents to justify the removal of this segment from the next 303d list.

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- Hydrologic Unit Code (HUC), Watershed Identity Number, Stream Name and Parameter
- Rationale for the decision to remove the previously impaired segment from the next 303d list
- Copies of the data that are being used to justify the removal of the segment
- Copies of the previous data which were used to list the segment
- Any differences between the sampling techniques should be documented and submitted
- A description of the water including but not limited to: stream name, river mile, impairment, watershed identification code and hydrologic unit code (HUC)

Scenario # 2: when new water quality modeling determines the stream is now attaining WQS, DEQ should submit the following documents to justify the removal of this segment from the next 303d list.

- Hydrologic Unit Code (HUC), Watershed Identity Number, Stream Name and Parameter
- Rationale for the decision to remove the previously impaired segment from the next 303d list
- Submission of any new data that were used in the modeling

- A copy of the EPA approved model that was used. A summary of the differences between the new and the old models. The reasons why the stream attains WQS's under the new model opposed to the former model (data, modeling assumptions, modeling applications, etc)
- A description of the water including but not limited to: stream name, river mile, impairment, watershed identification code and hydrologic unit code (HUC)

Scenario # 3: when new management practices from point and/or nonpoint sources lead to the attainment of WQS, DEQ should submit the following documents to justify the removal of this segment from the next 303d list. This scenario has been merged with scenario 5 (*Using the "Proactive Approach*") in the 2000 Listing and Assessment Guidance.

- Hydrologic Unit Code (HUC), Watershed Identity Number, Stream Name and Parameter
- Rationale for the decision to remove the previously impaired segment from the next 303d list
- Submission of the most recent 2 years of water quality data that indicate the water is a candidate for delisting and
- A description of the new management practices and other changes that have occurred in the watershed to explain the change in water quality.
- A description of the water including but not limited to: stream name, river mile, impairment, watershed identification code and hydrologic unit code (HUC)

The TMDL staff should apply the Proactive Approach any time a TMDL is scheduled for development. Appendix E contains additional procedural information on this approach.

Scenario # 4: when errors are detected in the rationale for the initial listing of the segment or WQS have been modified and the segment is attaining WQS, DEQ should submit the following documents to justify the removal of this segment from the next 303d list.

- Hydrologic Unit Code (HUC), Watershed Identity Number, Stream Name and Parameter
- Rationale for the decision to remove the previously impaired segment from the next 303d list
- Documentation of the errors in the initial listing
- A copy of the data and/or modeling that demonstrates the segment attains WQS at least 90% of the time
- A description of the water including but not limited to, stream name, river mile, impairment, watershed identification code and hydrologic unit code (HUC).

In certain cases EPA may request additional documentation to justify the removal of the segment from the 303d list.

Rule 3

Section 303(d) requires States to "establish a priority ranking" for the waters it identifies on the impaired waters list, taking into account the severity of the pollution and the uses to be made of such waters, and to establish TMDLs "in accordance with the priority ranking." Federal regulations provide that "schedules for submissions of TMDLs shall be determined by the Regional Administrator and the State" (40 CFR 130.7(d)(1)). Other reasonable factors such as the State's use of a rotating basin approach or commitments specified in court orders or consent decrees may also be considered when States develop priorities and schedules.

For the waters covered by the June 1999 Consent Decree pertaining to Virginia's TMDL program, DEQ has developed a TMDL development schedule ending on May 1, 2010. Specific TMDL development schedules for the periods ending on May 1, 2004 and May 1, 2006 respectively are posted on the DEQ web site, as is an overall schedule through 2010. The schedules are also presented to the public as part of the 305(b)/303(d)

report. For waters listed as impaired subsequent to the Consent Decree, (e.g. 2002 or 2004) TMDLs are expected to be completed within 12 years of the first listing date. If subsequently listed waters are within a Consent Decree watershed, every effort should be made to address the impairments at the same time. This may result in TMDL development much sooner than the 12 years generally anticipated. Also, in response to concerns raised by the United States Fish and Wildlife Service during the development of the 2002 303(d) List, certain impaired waters of concern to them have accelerated TMDL development dates.

In developing the TMDL development schedule, Virginia does not specifically identify each TMDL as high, medium or low priority. Instead, DEQ uses the TMDL schedule itself to reflect Virginia's priority ranking. The CWA does not prescribe a particular method of expressing a priority ranking, and DEQ believes a TMDL schedule is a reasonable, efficient way to demonstrate priority ranking.

In scheduling TMDLs for development, every effort should be made to address all related impairments in a watershed at the same time. If endangered species are affected by an impairment listing, TMDL development should be scheduled as expeditiously as possible. If a public water supply is affected by an impairment listing, TMDL development should be scheduled as expeditiously as possible. In the absence of impacts to public water supplies or endangered species, a watershed approach should be used for TMDL development scheduling. Other factors that may impact TMDL scheduling include public interest and support, locally available funding to implement controls, or coordinating TMDL development efforts with an adjoining state.

After the TMDL development schedule has been developed, the order in which TMDLs are established might be subject to some modifications to accommodate logistical efficiencies or data availability. The process is a dynamic process and any priority ranking may be changed if substantial factors change or become apparent during the scheduling process.

APPENDIX A

Clean Water Act Sections

Sec.305. WATER QUALITY INVENTORY

(b) (1) Each State shall prepare and submit to the Administrator by April 1, 1975, and shall bring up to date by April 1, 1976, and biennially thereafter, a report that shall include—

(A) a description of the water quality of all navigable waters in such State during the preceding year, with appropriate supplemental descriptions as shall be required to take into account seasonal, tidal, and other variations, correlated with the quality of water required by the objective of this ACT (as identified by the Administrator pursuant to criteria published under section 304(a) of this Act) and the water quality described in subparagraph (B) of this paragraph;

(B) an analysis of the extent to which all navigable waters of such State provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water;

(C) an analysis of the extent to which the elimination of the discharge of pollutants and a level of water quality which provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water, have been or will be achieved by the requirements of this Act, together with recommendations as to additional action necessary to achieve such objectives and for what water such additional action is necessary;

(D) an estimate of (1) the environmental impact, (ii) the economic and social costs necessary to achieve the objective of this Act in such State, (iii) the economic and social benefits of such achievement, and (iv) an estimate of the date of such achievement; and

(E) a description of the nature and extent of nonpoint sources of pollutants, and recommendations as to the programs which must be undertaken to control each category of such sources, including an estimate of the costs of implementing such programs. (2) The Administrator shall transmit such State reports, together with an analysis thereof, to Congress on or before October 1, 1975, and October 1, 1976, and biennially thereafter.

GRANTS FOR SEC. 106. POLLUTION CONTROL PROGRAM

(e) Beginning in fiscal year 1974 the Administrator shall not make any grant under this section to any State which has not provided or is not carrying out as a part of its program—

(1) the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, and to compile and analyze data on (including classification according to eutrophic condition), the quality of navigable waters and to the extent practicable, ground waters including biological monitoring; and provision for annually updating such data and including it in the report required under section 305 of this Act;

SEC. 204 LIMITATION AND CONDITIONS

(a) Before approving grants for any projection for any treatment works under section 201(g)(1) the Administrator shall determine—

"that (A) the State in which the project is to be located (1) is implementing any required plan under section 303(e) of this Act and the proposed treatment works are in conformity with such plan, or (ii) is developing such a plan and the proposed treatment works will be in conformity with such plan, and (b) such State is in compliance with section 305(b) of this Act;"

SEC. 314. CLEAN LAKES

(a) Each State shall prepare or establish, and submit to the Administrator for his approval—

"(A) an identification and classification according to eutrophic condition of all publicly owned lakes in such State;
"(B) a description of procedures, processes, and methods (including land use requirements), to control sources of pollution of such lakes;
"(C) a description of methods and procedures, in conjunction with appropriate Federal agencies, to restore the quality of such lakes;
"(D) methods and procedures to mitigate the harmful effects of high acidity, including innovative methods of neutralizing and restoring buffering capacity of lakes and methods of removing from lakes toxic metals and other toxic substances mobilized by high acidity;
"(E) a list and description of those publicly owned lakes in such State for which uses are known to be impaired, including those lakes which are known not to meet applicable Water Quality Standards or which require implementation of control programs to maintain compliance with applicable standards and those lakes in which water quality has deteriorated as a result of high acidity that may reasonably be due to acid deposition; and
"(F) an assessment of the status and trends of water quality in lakes in such State, including but not limited to, the nature and extent of pollution loading from point and nonpoint sources and the extent to which the uses of lakes is impaired as a result of such pollution, particularly with respect to toxic pollution.

"(2) SUBMISSION AS PART OF 305(b) (1) REPORT. – The information required under paragraph (1) shall be included in the report required under section 305(b) (1) of this Act, beginning with the report required under such section by April 1, 1988.

APPENDIX B

Adopted from "Targeting Toxics: A Characterization Report, A Tool for Directing Management and Monitoring (Actions in the Chesapeake Bay's Tidal Rivers", EPA 903-R-99-010, CBP/TRS 222/106, June 1999).

Weight of Evidence Targeting Protocol – Decision Steps for Interpreting Estuarine Toxics Data

Sediment Chemistry

Thresholds

- Set 1: SQCs – EqP-based thresholds – generally highest
- Set 1a: SQALs – EqP-based – generally highest
- Set 2: Lowest of ERM/PELs – medium to high - - 50^{th} %-tile for effects
- Set 3: Lowest of ERL/TELs – generally quite low - - 10^{th} %-tile for effects
- Set 4:TOC-selected thresholds (for chemicals without Thresholds in sets 1-3) – low

Note: freshwater values used only when saltwater values not available

Decision Rules

Level 1
A. Exceedence of Set 1 threshold for any chemical.
B. Exceedence of Set 1a threshold for any chemical.
C. Exceedence of Set 2 threshold for any chemical, Toxic Unit ≥ 2.

Level 2
A. Exceedence of Set 2 threshold for any chemical, Toxic Unit < 2
B. Exceedence of Set 3 threshold for any chemical, Toxic Unit ≥ 2.
C. Exceedence of Set 3 threshold for any chemical, Toxic Unit < 2.
D. Exceedence of Set 4 threshold for any chemical, Toxic Unit ≥ 2.
E. Exceedence of Set 4 threshold for any chemical, Toxic Unit < 2.

Level 3
A. No exceedences of any threshold.

Level 4
A. Above detection limit data without thresholds for comparison.
B. Below detection limit data without thresholds for comparison
C. No data collected at station.

Water Column Chemistry

Thresholds

- EPA/State Chronic Water Quality Criteria
- EPA/State Acute Chronic Water Quality Criteria
- ACQUIRE thresholds – for chemicals without EPA criteria

Decision Rules

Level 1
A. Exceedence of acute WQC for any chemical.
B. Exceedence of chronic WQC for any metal.
C. Exceedence of chronic WQC for organic contaminant.

Level 2
A. Exceedence of AQUIRE for any chemical, Toxic Unit ≥ 2
B. Exceedence of AQUIRE threshold for any chemical, Toxic Unit < 2.

Level 3
A. No exceedences of any WQC or AQUIRE thresholds for any chemicals.

Level 4
A. Above detection limit data without thresholds for comparison.
B. Below detection limit data without thresholds for comparison.
C. No data collected at station.

Fish Tissue Levels

Thresholds
- FDA Action Levels
- EDA Levels of Concern
- EPA screening levels
- Is station located in current fish consumption advisory/ban area ?

Decision Rules

Level 1
A. Exceedence of FDA Action Level for any chemical
B. Station located in current fish consumption advisory/ban area.

Level 2
A. Exceedence of FDA Levels of Concern A.2 EPA screening levels for any chemical.

Level 3
A. No exceedences of any FDA or EPA thresholds for any chemicals and no fish consumption advisory ban.

Level 4
A. Above detection limit data without thresholds for comparison
B. Below detection limit data without thresholds for comparison
C. No data collected at station.

Benthic Community Data

Thresholds
- Use the interpreted benthic characterization (B-IBI)

Decision Rules

Level 1
A. Severely Degraded (B-IBI ≤ 2), sufficient DO.

Level 2
A. Degraded (B-IBI: 2-2.6), sufficient DO
B. Marginal (B-IBI: 2.6-3), sufficient DO.

Level 3
A. Meets Goal (B-IBI: $\geq$ 3)

Toxicity Test Data

Thresholds
- For DEQ Ambient Toxicity Study (AT) results: reported "degree of toxicity."
- For other available toxicity test results: percentages of endpoints significantly different from reference.

Decision Rules

Level 1
A. "Greatest" sediment AND water column toxicity (AT) or at least 2 significant sediment and water tests each (non-AT).
B. "Greatest" sediment OR water column toxicity (AT) or at least 2 significant sediment or water tests (non-AT).

Level 2
A. "Low to Moderate" sediment AND water column toxicity (AT) or any one significant sediment and water test each (non-AT).
B. "Low to Moderate" sediment OR water column toxicity (AT) or any one significant sediment or water test each (non-AT).
C. "Significantly Different from Reference but Ecologically Insignificant" sediment AND water column toxicity (AT).
D. "Significantly Different from Reference but Ecologically Insignificant" sediment OR water column toxicity (AT).

Level 3
A. "No Significant" sediment AND water column toxicity observed.
B. "No Significant" sediment OR water column toxicity observed.

Sediment Thresholds

For Weight of Evidence

Ng/g or ppb dry weight

Analyte	*SQCs (Now referred to as ESGs)	SQALs	ER-L	ER-M	TEL	PEL
Arsenic			8,200	70,000	7,240	41,600
Cadmium			1,200	9,600	676	4,210
Chromium			81,000	370,000	52,300	160,400
Copper			34,000	270,000	18,700	108,200
Lead			46,700	218,000	30,240	112,180
Mercury			150	710	130	696
Nickel			20,900	51,600	15,900	42,800
Silver			1,000	3,700	730	1,700
Zinc			150,000	410,000	124,000	271,000
Di-N-Butyl Phthalate		22,000				
Butyl Benzyl Phthalate		22,000				
Di(2-ethylhexyl)phthalate					182.16	2,646.51
Diethyl phthalate		1,260				
Dibenzofuran		4,000				
Acenaphthene	FW=2,600; SW = 4,600		16	500	6.71	88.90
Acenaphthylene			44	640	5.87	127.87
Anthracene			85.3	1,100	46.85	245.00
Benzo-a-pyrene			430	1,600	88.81	763.22
Benz(a)Anthracene			261	1,600	74.83	692.53
Chrysene			384	2,800	107.77	845.98
Dibenz[A,H]Anthracene			63.4	260	6.22	134.61
Fluoranthene	FW=12,400; SW=6,000		600	5,100	112.82	1,493.54
Fluorene			19	540	21.17	114.35
Methylnaphthalene, 2-			70	670	20.21	201.28
Naphthalene		940	160	2,100	34.57	390.64
Phenanthrene	FW=1,800; SW=4,800		240	1,500	86.68	543.53
Pyrene			665	2,600	152.66	1,397.60
LMW PAHs			552	3,160	311.70	1,442.00
HMW PAHs			1,700	9,600	655.34	6,676.14
Total PAHs			4,022	44,792	1,684.06	16,770.40
Chlordane			0.5	6	2.26	4.79
DDD			2	20	1.22	7.81
DDE			2.2	27	2.07	374.17
DDT			1	7	1.19	4.77
DDT, total			1.58	46.1	3.89	51.70
Dieldrin	FW=220; SW=400		0.02	8	0.72	4.30
Total PCBs			22.7	180	21.55	188.79
Endrin	FW=84; SW=15.2					
Malathion		1.34				
Methoxychlor		38				
Toxaphene		200				
Diazinon		3.8				
Biphenyl		2,200				
Endosulfan Mixed Isomers		11				
Endosulfan Alpha		5.8				
Endosulfan Beta		28				
BHC Delta		260				
Lindane		7.4				

SQCs = Sediment Quality Criteria, EPA 1993; now referred to as ESGs or Equilibrium Partitioning Sediment Guidelines (above SQCs based on 2% TOC)

SQALs = Sediment Quality Advisory Levels, EPA 1996; (above SQALs based on 2% TOC)

ER-Ls & ER-Ms, Long et al. 1995
Effects Range-Low (ER-L)
Effects Range-Medium (ER-M)

TELs & PELs, MacDonald, 1994
Threshold Effects Level (TEL)
Probable Effects Level (PEL)

SQC and SQAL Site Specific Threshold based on Organic Carbon

Formula = EPA criteria (expressed as ug/g organic carbon) x % TOC/100 = site specific threshold in ug/g

Worksheet for calculating site specific SQCs or SQALs based on % Total Organic Carbon (TOC)

		EPA Derived value ug/g oc	Calculation based on 2% TOC (ug/g)	Threshold concentration in ng/g or ppb
Di-N-Butyl Phthalate	SQAL	1100	22	22000
Butyl Benzyl Phthalate	SQAL	1100	22	22000
Di(2-ethylhexyl)phthalate				
Diethyl phthalate	SQAL	63	1.26	1260
Dibenzofuran	SQAL	200	4	4000
Acenaphthene	SQC	230	4.6	4600
Acenaphthylene				
Anthracene				
Benzo-a-pyrene				
Benz(a)Anthracene				
Chrysene				
Dibenz[A,H]Anthracene				
Fluoranthene	SQC	300	6	6000
Fluorene	SQAL	54	1.08	1080
Methylnaphthalene, 2-				
Naphthalene	SQAL	47	0.94	940
Phenanthrene	SQC	240	4.8	4800
Pyrene				
LMW PAHs				
HMW PAHs				
Total PAHs				
BHC Delta	SQAL	13	0.26	260
Biphenyl	SQAL	110	2.2	2200
Chlordane				
DDD				
DDE				
DDT				
DDT, total				
Diazinon		0.19	0.0038	3.8
Dieldrin	SQC	20	0.4	400
Endosulfan Alpha	SQAL	0.29	0.0058	5.8
Endosulfan Beta	SQAL	1.4	0.028	28
Endosulfan Mixed Isomers	SQAL	0.54	0.0108	10.8
Endrin	SQC	0.76	0.0152	15.2
Lindane	SQAL	0.37	0.0074	7.4
Malathion	SQAL	0.067	0.00134	1.34
Methoxychlor	SQAL	1.9	0.038	38
Total PCBs				
Toxaphene	SQAL	10	0.2	200

*** For site specific threshold, replace 2 in equation with site specific %TOC (if available)**

Weight of Evidence Matrix

Classification Criteria	**Level 1** (Probable adverse effects)	**Level 2** (Potential for adverse effects)	**Level 3** (No effects)	**Level 4** (Insufficient Information)
Water Column Contaminant Concentration				
Water Column Toxicity				
Bottom Sediment Contaminant Concentration				
Sediment Toxicity				
Benthic Community (B-IBI)				
Tissue Contamination				
Fish Histopathology				

Appendix C

Virginia Department of Environmental Quality
Biological Monitoring Program
305(b) Assessment Fact Sheet

Regional Office:
Regional Biologist's Signature: _____
Review Date:
River Basin:
Stream Name and Site Location:
Station ID #:
Reference Station ID #:
Assessment Method:
EPA RBP-II
Coastal Plain

Biological Assessments for the Last Five Years

Year	spring score	Spring assessment	Fall score	fall assessment
1998				
1999				
2000				
2001				
2002	0.0		0.0	
Seasonal avg 5-yrs	0.0		0.0	
Seasonal avg last 2-yrs	0.0		0.0	
Final 5-yr average	0.0		0.0	
Final 2-yr average	0.0		0.0	

Note, because of the long, five-year time frame covered by this review and for a variety of reasons, some sites may not have been sampled during every year or season and/or an assessment ranking or score may not be available for every "cell" in the above table. The above table is intended to be a convenient method to summarize and review all the data available for the reporting period. The final assessment ranking for each site should be based on a review of all the available rankings shown in the above table and any pertinent supplemental data described below. For the purpose of 305(b) report preparation, if more recent bioassessment rankings differ significantly from earlier rankings, primary consideration should be given to the more recent assessment data. This is described in more detail of section 6.4.1 of the 305(b) Guidance Manual.

Supplemental Information (if applicable):

Are any seasonal differences noted?

Summary of any comments associated with assessments.

Have any factors been observed in watershed that may be affecting the benthic community? Have there been any recent changes in activity in the watershed that may have affected the more recent bioassessments. Are these changes likely to affect the benthic community for a short or long term basis?

Final Assessment Rating:

Appendix D

Classification of Virginia's Shellfish Growing Areas
Robert E. Croonenberghs, PhD

The Division of Shellfish Sanitation (DSS) follows the requirements of the National Shellfish Sanitation Program (NSSP), which is regulated by the U.S. Food and Drug Administration. The NSSP classification uses the shoreline survey as its primary tool for classifying shellfish growing waters. Fecal coliform concentrations in seawater samples collected in the immediate vicinity of the shellfish beds function to verify the findings of the shoreline survey, and to define the border between approved and condemned (unapproved) waters.

DSS uses the shoreline survey to locate as many sources of pollution as possible on the watersheds of shellfish growing areas. DSS conducts a property-by-property inspection of the onsite sanitary waste disposal facilities of most properties on unsewered sections of watersheds, and investigates other sources of pollution such as wastewater treatment facilities (WWTF), marinas, livestock operations, landfills, etc. The information is compiled into a written report with a map showing the location of the sources of real or potential pollution found, and sends it to the various state agencies that are responsible for regulating these concerns and the city or county. The local health departments (LHDs) of the Virginia Department of Health (VDH) play a major role in the process by obtaining correction of the onsite sanitary waste disposal problems. Most of the Division's effort is focused on locating fecal contamination, and in this manner we prevent significant amounts of human pathogens from getting into shellfish waters. I believe that this is the primary reason why we have not had a confirmed shellfish-borne disease outbreak due to Virginia-grown shellfish in over 35 years. VDH is reducing the input of these pathogens to back yards, waterways, unofficial swimming areas and shellfish waters. The shoreline survey work is the heart of the shellfish program.

In addition to the shoreline survey, the NSSP requires that DSS collect seawater samples in the growing areas as part of the classification procedure. States must use the most recent 30 samples, collected randomly with respect to weather (scheduled one month in advance), to classify a station. The two part standard for fecal coliforms in waters for direct shellfish harvest to market is a geometric mean no greater than 14 MPN fecal coliforms/100 ml and an estimated 90^{th} percentile no greater than 49. Exceeding either number requires closure of that station.

To a lesser degree, the Division collects shellfish samples from sentinel growing areas and has them analyzed for heavy metals and chlorinated hydrocarbons (pesticides and PCBs). Such toxic substances are not a public health threat in Virginia's waters, with the potential exception of the Elizabeth River and perhaps Little Creek, both of which are located in the Hampton Roads area.

Thus, classification based on fecal pollution is a multi-layered and multi-step process. Initially one uses the shoreline survey to determine if there are any actual or potential sources of fresh fecal pollution to the growing area. If so, then the area cannot be used for the direct harvest of shellfish for marketing. Hampton Roads is an example. Most of Hampton Roads is permanently closed, due to the tremendous amount of shipping and the concern of runoff from the urban watershed. However, microbiological results are generally acceptable.

Another example of actual or potential pollution that requires closure is a discharge, such as from a WWTF or the potential discharge from boats in marinas. DSS uses relatively simple computer models developed by VIMS, which employ fairly sophisticated mathematics, to determine the size of buffer zones around these sources. These models use inputs of fecal coliforms (from NPDES permits, or factors related to the number and size of boats in marinas), die off factors, and readily available tidal current and channel configuration information. Buffer zones around marinas are only in effect during the warmer boating months (April 1 - Oct 31). Once these buffer zones are determined, they do not change in size unless the capacity of the WWTF or the marina changes.

Our third layer of classification, and our most common in Virginia, consists of evaluating areas that are not affected by urban runoff or significant wastewater discharges. One must evaluate the watershed for the potential impacts of known failing onsite sanitary waste facilities to estimate whether their input could be of such a magnitude as to require closure, even if the water quality data is acceptable. If the impact from these failing systems does not appear to pose an undue threat, then the water quality data can be used to *verify* whether the waters should be classified as approved or not.

Since DSS collects samples monthly, this means that our geometric mean incorporates data reaching back 2.5 years. Heavy rainfall or very high tides due to winds or moon phase can wash unusually high concentrations of fecal coliforms into shellfish growing areas that can increase the geometric mean or the 90^{th} percentile beyond the allowed standard. As more data is collected and the unusually high concentrations fall off the trailing end of the data set, the water quality then appears to improve. This is one of the factors that causes a continual fluctuation in the classification of the water quality at the interface between impacted upstream waters and the relatively unaffected downstream water body.

Since DSS is not a research organization, we cannot do much to determine the cause of water quality deterioration in areas. However, the Division has tried over the years to do so, and we have encouraged the State to put resources into determining those causes. The Division has found that *obviously* failing septic systems are almost never the cause of deteriorating water quality in a *large* body of water. We have seen areas where impacts on fecal coliform concentrations in smaller bodies of water occur due to failing onsite sanitary waste disposal systems, but these seem to be rare. This should not be taken to downplay the concern from such failing onsite sanitary waste disposal systems, since even small inputs of fecal coliforms from these systems are quite likely to contain significant concentrations of human pathogens. Indeed, failing onsite sanitary waste disposal systems are one of the types of pollution sources of greatest concern with regard to the consumption of bivalve molluscan shellfish. New data indicates that drainfields located in seasonally high water tables may contribute significant numbers of fecal coliforms to impact water quality, and research into this potential source is needed and ongoing.

In Virginia's urban suburban watersheds like the Lynnhaven River in Virginia Beach are clearly impacted by the flushing action of rapid runoff from storm drains. Water quality in the Lynnhaven River has deteriorated over the years right along with development, and high counts after runoff events are predictable.
Other areas are much less predictable. Sometimes heavy rainfalls cause elevated counts in rural areas and sometimes they do not. Part of this is due to spotty thunderstorms that are not reflected by the relatively few rain gauge sources.

In more rural areas the wildlife component of fecal coliform inputs is significant, as can be the human input. Wildlife living near the intertidal zone, such as raccoons, muskrats and deer have been shown to have dramatic local impacts on fecal coliform concentrations in the adjacent shellfish waters. Wildlife on the watershed are a potential for *Cryptosporidium* and *Giardia* inputs, though the NSSP has not decided how to handle these problems specifically. New data indicates that wildfowl can have significant impacts on water quality too. Wildlife inputs of fecal material are basically accounted for by the seawater sampling data.

The Division is not seeing a steady increase in the number of acres of condemned in the state. Instead, what we see are fluctuations in the location of the border between acceptable and unacceptable water quality measurements moving up and down tributaries over time. Again, these fluctuations seem to be due largely to changing factors on the watershed, chance weather events (rain, high tides), changes in wildlife populations near shore or unknown factors (perhaps movement of livestock from one field to another, migratory bird flocks, or runoff from recently plowed fields that later contribute little when crops stabilize the soil).

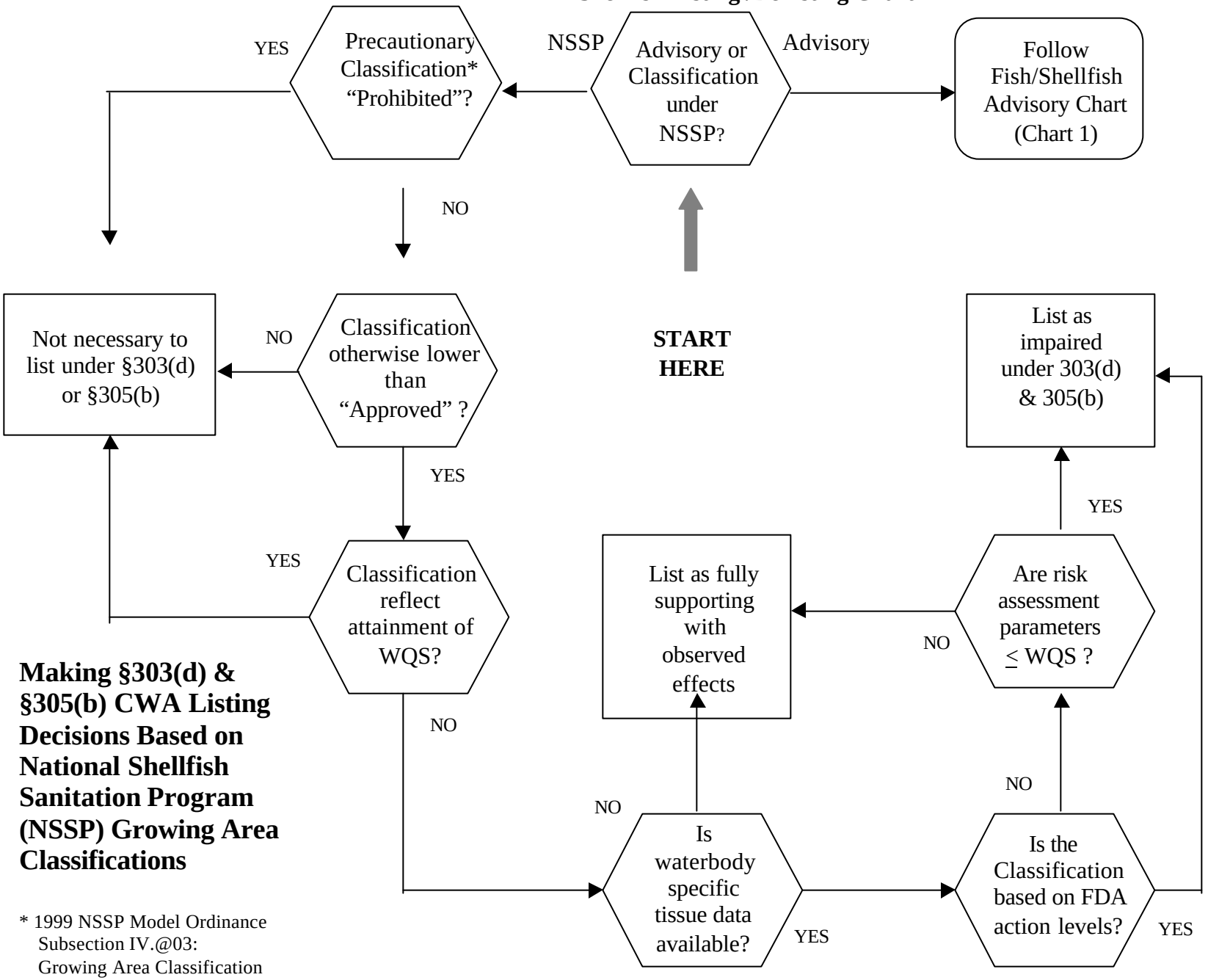
Man does directly impact the fecal coliform counts in the waters. The headwaters of smaller streams are impacted by development due to the loss of the filtering and detention of runoff waters through upland swamps and other slow moving water areas. These natural detention areas provide the extended time element so that

predators (rotifers and ciliates) and sunlight can reduce the numbers of fecal coliforms. When these are replaced with drainage systems the fecal coliforms are directly discharged into the shellfish waters.

In the past, without gene probes or other advanced tools to determine the type of animal/human source of fecal coliformsS, the State has been thoroughly frustrated in trying to effect a change in the water quality of shellfish waters. Fortunately, this lack of "typing" is changing due to EPA's Total Maximum Daily Load (TMDL) requirement that pertains to fecal coliforms (along with other pollutants). The Department of Environmental Quality is developing TMDLs for shellfish waters, and DSS is collecting samples and actively working with DEQ and other State agencies to try to determine the types of sources of fecal coliforms to individual shellfish areas. This new data is exactly what has been needed for years to help in finding and correcting sources of fecal coliforms to shellfish waters.

Figure 3

EPA Shellfish Listing /De-listing Chart



Making §303(d) & §305(b) CWA Listing Decisions Based on National Shellfish Sanitation Program (NSSP) Growing Area Classifications

* 1999 NSSP Model Ordinance
Subsection IV.@03:
Growing Area Classification

Appendix E

Incorporating the *Proactive Approach* to delisting 303(d) listed segments into the 2004 Water Quality Assessments

Issue

For the 1998 assessment cycle, EPA changed the data analysis period for the 305(b) assessment from two to five years. Virginia's water quality assessments and the subsequent 303(d) list have since been based on a 5-year data window. For the 2002 assessment, the data window is January 1, 1996 through December 31, 2000.

In August 2001, the Office of Water Quality Programs negotiated with EPA an approach, termed the *Proactive Approach*, which results in the proposed delisting of waters on the Section 303(d) list through assessment of less than 5-years of data. Correspondence and information related to the issue is attached to this memorandum. In short, EPA Region III has consented that Virginia can delist a segment on the 303(d) list if the following requirements are met:

1) For conventional parameters, no more than one of twelve samples taken over a two-year period exceeds the water quality criteria (10 percent or less exceedence for larger data sets).
2) For biological impairment, a minimum of 2 consecutive samples, taken over a one to two year period, show attainment of the applicable standard.
3) The samples are taken at the same location (monitoring station) which demonstrated the impairment.
4) A rationale document is submitted to EPA justifying why the State believes the waters are achieving Water Quality Standards. It is my understanding that this rationale document can consist of a description of measures taken in the watershed which are considered to be responsible for improvement of the water quality.

The Guidance Manual does not currently address how to assess segments where the *Proactive Approach* is being implemented; that is, where the data window can be truncated. This creates for a potential conflict between an assessment performed in conformance with the Guidance Manual and an assessment made in conformance with the *Proactive Approach*.

Eligibility and Water Quality Assessment

The following procedure is to be used to consider the eligibility of, and to subsequently assess, any particular waterbody segment submitted for consideration for delisting under the *Proactive Approach*.

Locations where proactive measures are being taken to improve water quality through the TMDL or Water Quality Management Plan program such that the *Proactive Approach* is eligible for consideration are to be provided by the DEQ TMDL program. Assessment staff can recommend segments for consideration, but only those locations provided by the DEQ TMDL program as candidates for the *Proactive Approach* are to be considered for assessment under the *Proactive Approach*. Notification must be made in writing through memorandum to the affected regional assessment manager, copied to the DEQ 305(b) coordinator, and must include the required documentation supporting consideration of the *Proactive Approach*. At a minimum, this is to include documentation of those implementation measures considered to be responsible for improvement in water quality and subsequent achievement of Water Quality Standards.

Regional assessment staff are responsible for assessment of water quality in their respective regions and for the defense of their assessments. Therefore, the decision for delisting consideration is to be made by regional assessment staff based on the analysis of the proactive measures being taken, available monitoring data, any ancillary information collected, and their professional knowledge of site specific influences on water quality in the affected segment.

Where there is agreement between TMDL program and assessment staff that it is appropriate to pursue delisting based on implementation of the *Proactive Approach*, the assessment must be performed based on the requirements outlined in 1, 2 and 3 above. For a scheduled 305(b)/303(d) assessment, only the last two years of the assessment window are to be used for assessment of eligible segments. For delisting assessment at any other time, the most recent two years of data must be used.

Assessment Documentation and Delisting Procedure

ADB Database	A segment meeting the above criteria is considered monitored, fully supporting. The assessment comments section should include the phrase *Proactive Approach Assessment*. The *Proactive Approach* data window used must be specifically identified.
303(d) Database	The TMDL phase field should state DELIST-PA. The comments section of the fact sheet must start with the phrase *Proactive Approach Assessment* and should include the justification for delisting. Again, the data window used must be specifically identified, consistent with ADB.
Appendix B	Appendix B should include only the results of the assessment using the *Proactive Approach*. The acronym *PA* and the data window used must be entered into the comments field.
Delisting Documentation	Documentation must include the information provided by the TMDL program related to control measures implemented using the *Proactive Approach* (requirement 4, above), and the results of data analysis related to requirements 1, 2, and 3 above.
EPA Review, Approval and Public Participation	Fulfillment of EPA review and approval requirements, and fullfilment of public participation requirements for removal of waterbody segments (delisting) at EPA required 303(d) list submittal dates, is the responsibility of the Monitoring and Assessments Program. At other times, fulfillment of these requirements in an effort to delist waters not needing TMDLs is the responsibility of the TMDL program. Final documentation for segments delisted by the TMDL program staff must be provided to the regional assessment manager and copied to the DEQ 305(b) coordinator at least five months prior to any EPA required 303(d) list submittal date, if time permits.