

# **Appendix III**

## **Use Support Methodology and Use Support Ratings**

## **Use Support: Definitions and Methodology**

### **A. Introduction to Use Support**

Waters are classified according to their best intended uses. Determining how well a waterbody supports its designated uses (*use support* status) is another important method of interpreting water quality data and assessing water quality. Use support assessments are presented in Section A, Chapter 3 and for each subbasin in Section B.

Surface waters (streams, lakes or estuaries) are rated as either *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are fully supported, partially supported or are not supported. For instance, waters classified for fishing and water contact recreation (Class C for freshwaters or SC for saltwaters) are rated as fully supporting if data used to determine use support (such as chemical/physical data collected at ambient sites or benthic macroinvertebrate bioclassifications) did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of exceedence.

An additional use support category, fully supporting but threatened (ST), was used in previous 305(b) reports. In the past, ST was used to identify a water that was fully supporting but had some notable water quality concerns. ST could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that are characterized by declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between US EPA's and North Carolina's definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the fully supporting category. However, the waterbodies and the specific concerns remain identified in the basin plans so that data, management and the need to address the identified concerns is not lost.

Waters that are either partially supporting or not supporting are considered *impaired* and are rated based on specific criteria discussed more fully below. There must be a specified degree of degradation before a waterbody is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad. Waters which have inconclusive or no data to determine their use support were listed as not rated (NR).

### **B. Interpretation of Data**

The assessment of water quality presented in this document involved evaluation of available water quality data to determine a waterbody's use support rating. In addition, an effort was made to determine likely causes (e.g., habitat degradation or nutrients) and sources (e.g., agriculture, urban runoff, point sources) of waterbody degradation. Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, and shellfish sanitation surveys from the NC Division of Environmental Health (as appropriate). Although there is a

general procedure for analyzing the data and determining a waterbody's use support rating, each waterbody is reviewed individually, and best professional judgment is applied during these determinations.

Interpretation of the use support ratings compiled by DWQ should be done with caution. The methodology used to determine the ratings must be understood, as should the purpose for which the ratings were generated. The intent of use support assessments by basin is to gain an overall picture of the water quality, to describe how well these waters support the uses for which they were classified, and to document the relative contribution made by different pollution sources.

The data are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Since the assessment methodology is geared toward general conclusions, it is important not to manipulate the data to support policy decisions beyond the accuracy of these data.

### **C. Assessment Methodology – Freshwater Streams**

Many types of information are used to determine use support assessments and to determine causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. In these files, stream segments are listed as individual records. All existing data pertaining to a stream segment are entered into its record. In determining the use support rating for a stream segment, corresponding ratings are assigned to data values where appropriate. The following data and the corresponding use support ratings are used in the process.

#### **1. Biological Data**

##### *Benthic Macroinvertebrate Bioclassification*

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The bioclassifications are translated to use support ratings as follows:

<u>Bioclassification</u>	<u>Rating</u>
Excellent	Fully Supporting
Good	Fully Supporting
Good-Fair	Fully Supporting
Fair	Partially Supporting
Poor	Not Supporting

##### *Fish Community Structure*

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The index

incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. The index is translated to use support ratings as follows:

<u>NCIBI</u>	<u>Rating</u>
Excellent	Fully Supporting
Good	Fully Supporting
Good-Fair	Fully Supporting
Fair	Partially Supporting
Poor	Not Supporting

Phytoplankton and Algal Bloom Data

Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of alga may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. An algal sample with a biovolume larger than 5,000 mm<sup>3</sup>/m<sup>3</sup>, density greater than 10,000 units/ml, or chlorophyll *a* concentration approaching or exceeding 40 micrograms per liter (the NC state standard) constitutes a bloom. Best professional judgment is used on a case-by-case basis in evaluating how bloom data should be used to determine the use support rating of specific waters. The frequency, duration, spatial extent, severity of blooms, associated fish kills, or interference with recreation or water supply uses are all considered.

**2. Chemical/Physical Data**

Chemical/physical water quality data are collected through the Ambient Monitoring System as discussed in Section A, Chapter 3. These data are downloaded from the ambient database, the Surface Water Information Management System, to a desktop computer for analysis. Total number of samples and percent exceedences of the NC state standards are used for use support ratings. Percent exceedences correspond to use support ratings as follows:

<u>Standards Violation*</u>	<u>Rating</u>
Criterion exceeded ≤10%	Fully Supporting
Criterion exceeded 11-25%	Partially Supporting
Criterion exceeded >25%	Not Supporting

\* Percentages are rounded to the nearest whole number. A minimum of ten samples is needed.

It is important to note that some waters may exhibit characteristics outside the appropriate standards due to natural conditions (e.g., many swamp waters are characterized by low pH). These natural conditions do not constitute a violation of water quality standards.

Data for copper, iron and zinc are not used according to the percent excess scheme outlined above. Because these metals are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility and stream characteristics, they have *action level* standards. In order for an action level standard to be violated, there must be a toxicological

test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc. Best professional judgement is used to determine which streams have metal concentrations at potentially problematic levels. Streams with high metal concentrations are evaluated for toxicity, and they may be rated as PS or NS if toxicity tests or biomonitoring (e.g., benthic macroinvertebrate communities) indicate problematic metal levels.

Fecal coliform bacteria data are not used alone to determine a partially or not supporting rating. The geometric mean is calculated using monthly samples, and if the geometric mean is above 200 colonies per 100 ml, fecal coliform bacteria are listed as a problem parameter. Because North Carolina's fecal coliform bacteria standard is 200 colonies per 100 ml for the geometric mean of *five samples taken in a thirty-day period*, fecal coliform bacteria are listed as a cause of impairment for the 303(d) list only when the standard is exceeded.

### **3. Source and Cause Data**

In addition to the above data, existing information is documented for potential sources and causes of stream degradation. It is important to note that not all impaired waterbodies have sources and/or causes listed for them. Additionally, fully supporting waterbodies may have sources and/or causes of stream degradation as well. Staff and resources do not currently exist to collect this level of information for all waterbodies. Much of this information is obtained through the cooperation of other agencies (federal, state and local), organizations and citizens.

#### Point Source Data

*Whole Effluent Toxicity Data:* Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Streams that receive a discharge from a facility that has failed its whole effluent toxicity tests may have that facility listed as a potential source of pollution.

*Daily Monitoring Reports:* Streams which receive a discharge from a facility significantly out of compliance with permit limits may have that facility listed as a potential source of pollution.

#### Nonpoint Source Data

Nonpoint sources of pollution (i.e., agriculture, urban and construction) are identified by monitoring staff, other agencies (federal, state and local), land use reviews, and public workshops.

#### Problem Parameters

Causes of stream degradation (problem parameters), such as habitat degradation and low dissolved oxygen, are also identified for specific stream segments where possible. For streams with ambient water quality stations, those parameters which exceed the water quality standard  $\geq 11$  percent of the time for the review period are listed as a problem parameter. Zinc, copper and iron are listed as problem parameters if levels are high enough to impact the biological community (see *Chemical/Physical Data* section). Fecal coliform bacteria are listed as a

problem parameter if the geometric mean is greater than 200 colonies per 100 ml. For segments without ambient stations, information from reports, other agencies and monitoring staff is used if it is available.

Habitat degradation is identified where there is a notable reduction in habitat diversity or change in habitat quality. This term includes sedimentation, bank erosion, channelization, streambed scour, lack of riparian vegetation, loss of pools or riffles, and loss of woody habitat.

#### **4. Outside Data**

DWQ actively solicits outside data and information. Data from outside DWQ, such as USGS ambient monitoring data, volunteer monitoring data, and data from academic researchers, are screened for data quality and quantity. If data are of sufficient quality and quantity, they are incorporated into use support assessments. A minimum of ten samples over a period of two years is needed to be considered for use support assessments. The way the data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data. Data of the highest quality are used in the same fashion as DWQ data to determine use support ratings. Data with lower quality assurance may be used to pinpoint causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

#### **5. Monitored vs. Evaluated**

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information that was available. Because a monitored rating is based on more recent and site-specific data, it is treated with more confidence than an evaluated rating.

Refer to the following summary for an overview of assigning use support ratings.

Summary of Basis for Assigning Use Support Ratings to Freshwater Streams		
Overall Basis	Specific Basis	Description
Monitored	Monitored (M)	Monitored stream segments <sup>1</sup> with data <sup>2</sup> ≤5 <sup>3</sup> years old.
	Monitored/Evaluated (ME)	Stream segment <sup>1</sup> is unmonitored, but is assigned a use support rating based on another segment of same stream for which data <sup>2</sup> ≤5 <sup>3</sup> years old are available.
Evaluated	Evaluated (E)	Unmonitored streams that are direct or indirect tributaries to monitored stream segments rated FS. Must share similar land use to the monitored stream segment.
	Evaluated/Old Data (ED)	Monitored stream segments <sup>1</sup> with available data <sup>2</sup> >5 <sup>3</sup> years old.
Not Rated	Not Rated (NR)	No data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.

<sup>1</sup> A stream segment is a stream, or a portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (index number).

<sup>2</sup> Major data sources include benthic macroinvertebrate bioclassifications, fish community structure (NCIBI), and chemical/physical monitoring data.

<sup>3</sup> From the year that basin monitoring was done.

## 6. Assigning Use Support Ratings to Freshwater Streams

At the beginning of each assessment, all data are reviewed by subbasin with the monitoring staff. Discrepancies between data sources are resolved during this phase of the process. For example, a stream may be sampled for both benthic and fish community structure, and the benthic bioclassification may differ from the NCIBI (i.e., the bioclassification may be FS while the NCIBI may be NS). To resolve this, the final rating may defer to one of the samples (resulting in FS or NS), or it may be a compromise between both of the samples (resulting in PS).

After reviewing the existing data, use support ratings are assigned to the streams. If one data source exists for the stream, the rating is assigned based on the translation of the data value as discussed above. If more than one source of data exists for a stream, the rating is assigned according to the following hierarchy:

Benthic Bioclassification/Fish Community Structure  
 Chemical/Physical Data  
 Monitoring Data >5 years old  
 Compliance/Toxicity Data

This is only a general guideline for assigning use support ratings and not meant to be restrictive. Each segment is reviewed individually, and the resulting rating may vary from this process based on best professional judgment, which takes into consideration site-specific conditions.

After assigning ratings to streams with existing data, streams with no existing data are assessed. Streams that are direct or indirect tributaries to streams rated FS receive the same rating (with an evaluated basis) if they have no known significant impacts, based on a review of the watershed

characteristics and discharge information. Streams that are direct or indirect tributaries to streams rated PS or NS, or that have no data, are assigned a NR rating.

## **D. Assessment Methodology – Lakes**

The complex and dynamic ecosystem interactions that link chemical and physical water quality parameters and biological response variables must be considered when evaluating use support. In general, North Carolina assesses use support by determining if a lake's *uses*, such as water supply, fishing and recreation, are met; violations of water quality standards are not equated with use impairment unless uses are not met. In following this approach, use support for agriculture, aquatic life propagation, maintenance of biological integrity, wildlife, recreation and water supply can be holistically evaluated.

Nutrient enrichment, or eutrophication, is one of the main causes of lake impairment. Several water quality variables may help to describe the level of eutrophication. These include pH, chlorophyll *a*, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases, and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

North Carolina does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*). Likewise, North Carolina does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. The weight of evidence approach is most appropriate to determine use support in terms of nutrient enrichment in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll *a*)
- third party reports
- analysis of water quality complaints
- algal bloom reports
- macrophyte observations
- reports from water treatment plant operators
- reports from lake associations
- fish kill reports
- taste and odor observations
- aesthetic complaints
- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission

## **E. Assessment Methodology – Estuaries**

Estuarine waters are delineated according to Division of Environmental Health (DEH) shellfish management areas (e.g., Outer Banks, Area H-5) for use support assessment (for map of shellfish management areas, see 1996 305(b) report). As with the freshwater assessments, many types of information are used to determine use support ratings and to determine causes and sources of use support impairment for saltwater bodies. The following data sources are used when assessing estuarine areas:

### **1. DEH Sanitary Surveys**

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Growing areas are sampled continuously and reevaluated every three years to determine if their classification is still applicable. Classifications are based on fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

- *Approved Area* - an area determined suitable for the harvesting of shellfish for direct market purposes.
- *Conditionally Approved-Open* - waters that are normally open to shellfish harvesting but are closed on a temporary basis in accordance with management plan criteria.
- *Conditionally Approved-Closed* - waters that are normally closed to shellfish harvesting but are open on a temporary basis in accordance with management plan criteria.
- *Restricted Area* - an area from which shellfish may be harvested only by permit and subjected to an approved depuration process or relayed to an approved area.
- *Prohibited Area* - an area unsuitable for the harvesting of shellfish for direct market purposes.

### **2. Chemical/Physical Data**

Chemical/physical water quality data are collected monthly through the Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, to a desktop computer for analysis. The total number of samples and percent exceedences of the NC state standards are used for use support ratings (see methods for freshwater streams). Parameters are evaluated based on the salt waterbody classification and corresponding water quality standards.

Fecal coliform bacteria data from DWQ ambient monitoring are considered for SB and SC waters (saltwaters not classified by DWQ for shellfishing), but are not used alone to determine a partially or not supporting rating. The geometric mean is calculated using monthly samples, and if the geometric mean is above 200 colonies per 100 ml, fecal coliform bacteria are listed as a problem parameter. Because North Carolina's fecal coliform bacteria standard for SB and SC waters is 200 colonies per 100 ml for the geometric mean of *five samples taken in a thirty-day period*, fecal coliform bacteria are listed as a cause of impairment for the 303(d) list only when the standard is exceeded.

### 3. Phytoplankton and Algal Bloom Data

Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of algae may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality, causing fish kills, anoxia, or taste and odor problems. An algal sample with a biovolume larger than 5000 mm<sup>3</sup>/m<sup>3</sup>, density greater than 10,000 units/ml, or chlorophyll *a* concentrations approaching or exceeding 40 micrograms per liter (the NC standard) constitutes a bloom. Best professional judgment is used on a case-by-case basis in evaluating how bloom data should be used to determine the use support rating of specific waters. The frequency, duration, spatial extent, severity of blooms, associated fish kills, or interference with recreation or water supply uses are all considered.

### 4. Assigning Use Support Ratings to Estuarine Waters

Saltwaters are classified according to their best use. When assigning a use support rating, the waterbody's assigned classification is used with the above parameters to make a determination of use support. The following table describes how these factors are combined in use support determination.

DWQ Classification	DEH Shellfish Classification	Chemical/ Physical Data <sup>1</sup>
<b>Fully Supporting</b>		
SA	Approved or Conditionally Approved-Open	standard exceeded ≤10% of measurements
SB & C	Does not Apply	standard exceeded ≤10% of measurements
<b>Partially Supporting</b>		
SA	Prohibited <sup>2</sup> , Restricted or Conditionally Approved-Closed	standard exceeded 11-25% of measurements
SB & SC	Does not Apply	standard exceeded 11-25% of measurements
<b>Not Supporting</b>		
SA	Prohibited <sup>2</sup> or Restricted	standard exceeded >25% of measurements
SB & SC	Does not Apply	standard exceeded >25% of measurements

<sup>1</sup> Percentages are rounded to the nearest whole number. A minimum of ten samples is needed.

<sup>2</sup> DEH classifies some SA waters as prohibited, because DEH does not sample them due to the absence of a shellfish resource. DEH is federally required to prohibit harvesting in such areas, although actual fecal coliform bacteria concentrations are unknown. These waters are not rated (NR) for use support.

It is important to note that DEH classifies all actual and *potential* growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting, but different DWQ use classifications may be assigned to separate segments within DEH management areas. In determining use support, the DEH classifications and management strategies are only

applicable to those areas that DWQ has classified as SA (shellfish harvest waters). This will result in a difference of acreage between DEH areas classified as conditionally approved-closed, prohibited or restricted, and DWQ waterbodies rated as PS or NS. For example, if DEH classifies a 20-acre waterbody as prohibited, but only 10 acres have a DWQ use classification of SA, only those 10 acres classified as SA will be rated as partially supporting their uses based on DEH information. DWQ areas classified as SB and SC are rated using chemical/physical data, phytoplankton data, and algal bloom and fish kill data.

## **5. Cause and Source Data**

See methods for freshwater streams.

## **6. Outside Data**

See methods for freshwater streams.

## **F. Revisions to Methodology Since 1992-1993 305(b) Report**

Three significant changes to use support methodology have been made since the 1992-1993 305(b) report pertaining to the use of older information and fish consumption advisories.

Methodology for determining use support has been revised to more accurately reflect water quality conditions. In the 1992-1993 305(b) report, information from older reports and workshops was included in making use support determinations. Streams assessed using this information were rated on an evaluated basis, because the reports were considered outdated, and the workshops relied on best professional judgment since actual monitoring data were not available. In place of these older reports and workshop information, DWQ is now relying more heavily on data from its expanded monitoring network. These changes resulted in a reduction in streams rated on an evaluated basis. The basinwide process allows for concentrating more resources on individual basins during the monitoring phase. See the discussion above for more information on how 'monitored' versus 'evaluated' is defined.

The rating fully supporting but threatened (ST) is no longer used. Instead, three categories are now used, including fully supporting (FS), partially supporting (PS) and not supporting (NS). Waters that are fully supporting but have some notable water quality problems are discussed in the subbasin chapters of the basinwide plan.

Mercury levels in surface waters are primarily related to increases in atmospheric mercury deposition from global/regional sources, rather than from local surface water discharges. As a result, fish consumption advisories due to mercury have been posted in many areas (primarily coastal areas) of the state. Waters with fish consumption advisories (mercury, dioxin, etc.) are no longer considered for use support determination. However, these waters will continue to appear on the 303(d) list, and management strategies will be developed for these waters as required by the Clean Water Act.