

## **Appendix III**

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

# Multiple-Category Use Support Methods

DRAFT December 11, 2001

## A. Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The ratings refer to whether the classified uses of the water (i.e., aquatic life protection, primary recreation and water supply) are being met. For example, waters classified for fishing, aquatic life protection and secondary recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support meet certain criteria. However, if these criteria were not met, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR). More specific methods are presented in Part C of this appendix.

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and 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 demonstrate 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 the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

## B. Interpretation of Data and Information

Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classification from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with annual water supply reports from regional water treatment plant consultants.

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations. Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Refer to Part E for more information on the basis of assessments.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

### C. Assessment Methodology

#### Use Support Categories and Uses

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the development of use support ratings for six categories: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the six use support categories, as shown in the table below. For many waters, a use support category will not be applicable (N/A) to the use classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*.

Primary Classification	Use Support Categories					
	Ecosystem Approach	Human Health Approach				Other
		Aquatic Life/Secondary Recreation	Fish Consumption	Primary Recreation	Water Supply	
C	X	X	N/A	N/A	N/A	X
SC	X	X	N/A	N/A	N/A	X
B	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	N/A	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. All existing data pertaining to a stream segment for each applicable use support category are entered into its record and can include, but is not limited to, use support ratings, basis of assessment, biological data, ambient monitoring data, problem parameters and potential sources. The following describes the data and methodologies used to make use support assessments for the surface water classifications (described in Section A, Chapter 3 of each basin plan) using the six use support categories. These methods will continue to be refined, as additional information becomes available.

### Basis of Assessment

FS ratings are extrapolated up tributaries from monitored streams when no problematic dischargers or change in land use/cover are identified. The FS rating may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS ratings are not extrapolated to unmonitored tributaries. Refer to Part E for more information.

### Problem Parameters

Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database and use support summary table. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

### Potential Sources

General nonpoint sources (NPS) and point sources (PS) of pollution are identified where there is sufficient information.

### **Aquatic Life and Secondary Recreation Use Support**

The aquatic life and secondary recreation use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. The following is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life protection and secondary recreation.

### ***Biological Data***

There are two main types of biological data: benthic macroinvertebrate and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient monitoring data and biological data are available, biological data are given greater weight.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the use support rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be not rated.

Benthic Macroinvertebrate Bioclassifications

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera*, *Plecoptera* and *Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The benthic macroinvertebrate bioclassifications are translated into use support ratings according to the following scheme:

<u>Bioclassification</u>	<u>Use Support Rating</u>
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

<b>New Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings</b>				
<b>Pre-1999 Bioclassification</b>	<b>1<sup>st</sup> sample Bioclassification</b>	<b>Draft Use Support Rating</b>	<b>2<sup>nd</sup> sample Bioclassification</b>	<b>Final Use Support Rating</b>
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable    NR = Not Rated

The use of benthic macroinvertebrate data can be limited in some waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is not

appropriate for all swamp streams. Benthic macroinvertebrate data will not be used in waters characterized or classified by DWQ as swamp waters until the bioclassification criteria for these waters can be used with confidence. Benthic macroinvertebrate data are also not used to develop use support ratings for estuarine waters. Until bioclassification criteria for swamp and estuarine waters are developed, a designation of Not Rated (NR) will be used, and these waters will be listed as NR for aquatic life and secondary recreation use support assessments.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. The benthic macroinvertebrate data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthic macroinvertebrate and fish communities. For these reasons, the benthic macroinvertebrate bioclassifications provide a valuable assessment of the integrity of trout waters.

A designation of Not Impaired (NI) may be used for flowing waters that are too small to be assigned a bioclassification (less than 4 meters in width), but meet the criteria for a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria. This designation will translate into a use support rating of FS.

### Fish Community Bioclassification

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 NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The NCIBI is translated into use support ratings according to the following scheme:

<u>NCIBI</u>	<u>Use Support Rating</u>
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

The NCIBI was recently revised by DWQ (NCDENR, 2001b). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a).

NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamlico, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin – all waters except for those draining the Sandhills in Moore, Lee and Harnett counties and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, NC, except for the south and southwest portions of Johnston County and the eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, NC, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All non-wadeable and large streams and rivers throughout the state.

Due to the increased emphasis placed on Fair or Poor bioclassifications and the borderline nature of some bioclassification scores, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	1 <sup>st</sup> sample Bioclassification	Draft Use Support Rating	2 <sup>nd</sup> sample Bioclassification	Final Use Support Rating
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable      NR = Not Rated

### ***Ambient Monitoring Data***

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, for analysis. Total number of samples and percent of samples exceeding the NC water quality standards are evaluated for the development of use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the ambient data would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life/secondary recreation use support. These parameters include ammonia, dissolved oxygen, pH, chloride, arsenic, cadmium, chromium, nickel and lead. These parameters are measured against standards for a minimum of ten samples as follows:

<u>Standards Violation</u>	<u>Rating</u>
Criterion exceeded ≤10%	Fully Supporting (FS)
Criterion exceeded 11-25%	Partially Supporting (PS)
Criterion exceeded >25%	Not Supporting (NS)

Data for copper, iron and zinc are not used according to the scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. 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.

Metals data for copper and iron are screened at the 85<sup>th</sup> percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85<sup>th</sup> percentile of  $\geq 20$   $\mu\text{g/l}$  of copper and/or  $\geq 2000$   $\mu\text{g/l}$  of iron are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being developed for zinc. If a stream does not have biological data that would deem a FS rating, then the stream can be rated PS or NS for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Three fails result in a NS rating, and two fails result in a PS rating.

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

### ***NPDES Discharger Data***

#### *Aquatic Toxicity Data*

For facilities that perform Whole Effluent Toxicity (WET) tests according to state NPDES discharge permit requirements, a review of the results of a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for aquatic toxicity data would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data, or has no ambient data, and that facility has failed three or more WET tests in the most recent two years, the stream is not rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

#### *Discharge Effluent Data*

NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period of data ending on August 31 of the year of biological sampling. Prior to May 31, 2000, facilities were screened for criterion 40 percent in excess of state water quality standards for conventional pollutant limitations or 20 percent in excess of state water quality standards for toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters.

After May 31, 2000, facilities are screened for criterion 20 percent in excess of state water quality standards for both conventional and toxic pollutants for two or more months during two consecutive quarters, or chronic violations of either conventional or toxic pollutant limitations for four or more months during two consecutive quarters. Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available.

Therefore, streams will not be rated PS or NS based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

### **Fish Consumption Use Support**

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a water. This use support category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories issued by the NC Department of Health and Human Services.

If a limited fish consumption advisory is posted at the time of use support assessment, the water is rated PS. If a no consumption advisory is posted at the time of use support assessment, the water is rated NS.

The current statewide limited fish consumption advisory for bowfin due to elevated levels of mercury in fish tissue is an exception. It is recognized that bowfin only live and reproduce in waters of the piedmont and coastal plain. Therefore, the use support ratings will be based on the combination of the current statewide fish consumption advisory for bowfin and the documented presence of bowfin in each river basin as found in *Freshwater Fisheries of North Carolina* (Menhinick, 1991). In river basins where there are documented populations of bowfin (Roanoke, Chowan, Pasquotank, White Oak, Lumber, Neuse, Tar-Pamlico, Cape Fear, Yadkin and Catawba), all waters will be rated PS for the fish consumption category. In river basins where there are no documented populations of bowfin (Little Tennessee, Hiwassee, Savannah, Watauga, New, French Broad and Broad), the waters will be rated FS for the fish consumption category unless there is a site-specific advisory.

In order to separate this from other fish consumption advisories and to identify actual bowfin populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables of the basin plans. A review of the present methods for assessing the fish consumption use support category is being conducted, and methods may be modified in the future.

### **Primary Recreation Use Support**

In addition to the use support categories applicable to Class C and SC waters, the primary recreation use support category will be assessed for all Class B, Class SA and Class SB waters where data are available. This use support category is a human health approach to assess whether waters support primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact in an organized or frequent basis. The use support rating is based on swimming advisories issued by local health departments and by the NC Division of Environmental Health (DEH) beach monitoring program.

#### **Freshwaters**

Each January, the geometric mean for ambient stations in Class B waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request

is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

When reviewing fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. Monitored Class B waters are rated FS if the geometric mean over the five-year window is less than or equal to 200 colonies per 100 ml. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. Class B waters without fecal coliform data or swimming advisories are not rated.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments. County or local health departments are asked to list those waters with swimming advisories posted for at least two months in the previous five years (ending on August 31 of the year of biological sampling).

#### Estuarine waters

Each January, the geometric mean for ambient stations in Class SB and SA waters for the previous sampling year is obtained, and a screen is conducted for waters with geometric means greater than 200 colonies per 100 ml. If the geometric mean is greater than 200 colonies per 100 ml during the previous year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water 5 times within 30 days in June during non-runoff events, if possible. If this data, as required to assess the NC standard, indicate a geometric mean greater than 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times within 30 days during the months of July and August and send the data to DEH.

DEH fecal coliform data are used to assess estuarine (SA and SB) waters. Each January, DEH submits a letter to DWQ stating which coastal waters were posted with an advisory reporting an increased risk from swimming during the prior year. When reviewing DEH fecal coliform data and swimming advisories, a five-year window that ends on August 31 of the year of biological sampling is used. For example, if biological data are collected in a basin in 2000, then the five-year window for the DEH fecal coliform data and swimming advisories would be September 1, 1995 to August 31, 2000. If a water was posted with an advisory for at least two months within the five-year window, it is rated as PS unless DEH staff believes that the cause of elevated fecal bacteria is not persistent. Those waters posted as "Do Not Swim" for more than two months in the five-year window are rated NS. If DEH has no data on a water, that water will not be rated.

## **Shellfish Harvesting Use Support**

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters.

### *Department of Environmental Health (DEH) Shellfish Sanitation Surveys*

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH fecal coliform bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows:

<b>DEH Classification</b>	<b>DEH Criteria</b>
Approved (APP)	<p><b>Fecal Coliform Standard for Systematic Random Sampling:</b> The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90<sup>th</sup> percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test.</p> <p><b>Fecal Coliform Standard for Adverse Pollution Conditions Sampling:</b> The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.</p>
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data does not meet criteria for Approved, Conditionally Approved or Restricted Classification.

### *Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)*

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. Thus, the DWQ Class SA waters must be separated out and rated for shellfish harvesting use support. The acreage of FS, PS and NS waters are calculated using GIS showing DWQ and DEH classifications as attribute information. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from

the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as NS.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ Class SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as PS or NS. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are assessed and rated PS.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this procedure will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures-based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the frequency of closure-based methods for the 2005 Cape Fear River use support assessment and basin plan.

Interim Frequency of Closure-Based Assessment Methodology

The interim method will be used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

**Interim Frequency of Closure-Based Use Support Ratings**

<b>Percent of Time Closed within Basin Data Window</b>	<b>DEH Growing Area Classification</b>	<b>DWQ Use Support Rating</b>
N/A	Approved*	FS
Closed ≤10% of data window	Portion of CAO closed ≤10%	FS
Closed >10% to ≤25% of data window	Portion of CAO closed >10% to ≤25% of data window	PS
Closed >25% of data window	Portion of CAO closed >25% of data window	NS
N/A	CAC and P/R**	NS

\* Approved waters are closed only during extreme meteorological events (hurricanes).

\*\* CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ will work with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if biological data are collected in a basin in 2000, then the five-year window for closure data would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH and DWQ staff will define subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed will be determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to pre-emptive closures because of named storms is not counted. For example, all waters in growing area E-9 were pre-emptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for 10 days after the APP waters were reopened.

#### *Proposed Permanent Frequency of Closure-Based Assessment Methodology*

Over the next few years DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functional database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closure-based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH as CAO. PRO, RES and CAC areas will be rated NS and CAO areas will be rated FS, PS or NS based on the methodology outlined above in the interim methods. Growing areas that have been reclassified by DEH during the data window from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

#### **Water Supply Use Support**

This use support category is used to assess all Class WS waters and is a human health approach to assess whether a water can be used for water supply purposes. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated FS. Specific criteria for rating waters PS and NS are yet to be determined.

**Other Uses: All Waters in the State**

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that could fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered for aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

**D. Use of Outside Data**

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 60 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the draft 2000 303(d) report and shown in the table below. Level 1 data can be use with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream segment 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.

<b>Criteria Levels for Use of Outside Data in Use Support Assessments</b>			
<b>Criteria</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

## E. Monitored vs. Evaluated

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

FS ratings are extrapolated up tributaries to monitored streams where there are no dischargers with permit violations or changes in land use/cover. Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS are not applied to unmonitored tributaries. Refer to the following summary for the basis 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>a</sup> with data <sup>b</sup> ≤5 <sup>c</sup> years old.
	Monitored/Evaluated (ME)	Stream segment <sup>a</sup> is unmonitored, but is assigned a use support rating based on another segment of same stream for which data <sup>b</sup> ≤5 <sup>c</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.
Not Rated	Not Rated (NR)	Insufficient or no data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.

- a) 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).
- b) Major data sources include benthic macroinvertebrate and fish community bioclassifications and chemical/physical monitoring data.
- c) From the year that basin monitoring was done.

## F. Nutrient Enrichment Issues

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables 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.

Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. DWQ does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*).

Likewise, DWQ 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. Instead, the weight of evidence approach is used to determine use support 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 or aesthetic complaints, and taste and odor observations
- algal bloom reports
- macrophyte observations
- fish kill reports
- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission, lake associations and water treatment plant operators

### **References**

Fels, J. 1997. *North Carolina Watersheds Map*. North Carolina State University Cooperative Extension Service. Raleigh, NC.

Menhinick, E.F. 1991. *Freshwater Fishes of North Carolina*. North Carolina Wildlife Commission. Raleigh, NC.

North Carolina Department of Environment and Natural Resources (NCDENR). Basinwide Assessment Unit (BAU) 2000a. *Fish Community Metric Re-Calibration and Biocriteria Development for the Inner Piedmont, Foothills, and Eastern Mountains (Broad, Catawba, Savannah, and Yadkin River Basins)*. September 22, 2000. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. North Carolina Department of Environment and Natural Resources. Raleigh, NC

\_\_\_\_\_. BAU. 2000b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Outer Piedmont (Cape Fear, Neuse, Roanoke and Tar River Basins)*. October 17, 2000. *Ibid.*

\_\_\_\_\_. BAU. 2001a. *Standard Operating Procedure. Biological Monitoring. Stream Fish Community Assessment and Fish Tissue*. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. North Carolina Department of Environment and Natural Resources. Raleigh, NC.

\_\_\_\_\_. BAU. 2001b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Western and Northern Mountains (French Broad, Hiwassee, Little Tennessee, New and Watauga River Basins)*. January 05, 2001. *Ibid.*

***Aquatic Life/Secondary Recreation Use Support Summary – Hiwassee River Basin***

<b>Name</b>	<b>Description</b>	<b>Subbasin</b>	<b>Miles</b>	<b>Rating</b>	<b>Basis</b>	<b>Problem Parameter</b>	<b>Potential Source(s)</b>
HIWASSEE RIVER (Chatuge Lake)	From North Carolina-Georgia State line to Chatuge Dam	04-05-01	2.6	FS	M		
Shooting Creek	From source to Chatuge Lake	04-05-01	5.6	FS	M	Habitat degradation	Agriculture, Land Development Highway/Road/Bridge Runoff
HIWASSEE RIVER	From Hyatt Mill Creek to Tusquitee Creek	04-05-01	2.2	FS	ME	Habitat degradation	Urban Runoff/Storm Sewers, Agriculture
Tusquitee Creek	From source to Big Tuni Creek	04-05-01	4.1	FS	ME		
Tusquitee Creek	From Big Tuni Creek to Buckner Branch	04-05-01	5.8	FS	ME		
Big Tuni Creek	From source to Tusquitee Creek	04-05-01	6.1	FS	M		
Tusquitee Creek	From Buckner Branch to Hiwassee River	04-05-01	1.7	FS	M		
Fires Creek	From source to Rocky Cove Branch	04-05-01	5.7	FS	ME		
Fires Creek	From Rocky Cove Branch to Hiwassee River	04-05-01	8.6	FS	M		
HIWASSEE RIVER (Mission Reservoir)	From Tusquitee Creek to Calhoun Creek below Mission Reservoir	04-05-01	4.7	FS	ME		
HIWASSEE RIVER	From Calhoun Creek below Mission Reservoir to a point 0.6 mile upstream of McComb Branch	04-05-01	1.5	FS	ME	Habitat degradation	Hydromodification, Agriculture
Brasstown Creek	From North Carolina-Georgia State Line to Hiwassee River	04-05-01	8.7	FS	M	Habitat degradation	Sources Outside State Jurisdiction or Borders, Agriculture, Highway/Road/Bridge Runoff
HIWASSEE RIVER	From a point 0.6 mile upstream of McComb Branch to Town of Murphy water supply intake (located 0.1 mile downstream of McComb Branch)	04-05-02	0.6	FS	ME		
HIWASSEE RIVER	From Town of Murphy water supply intake to a point 0.3 mile downstream of Martin Creek	04-05-02	4.2	FS	M	Habitat degradation	Hydromodification, Agriculture
Peachtree Creek	From source to Hiwassee River	04-05-02	5.3	FS	M		

***Aquatic Life/Secondary Recreation Use Support Summary Table – Hiwassee River Basin***

<b>Name</b>	<b>Description</b>	<b>Subbasin</b>	<b>Miles</b>	<b>Rating</b>	<b>Basis</b>	<b>Problem Parameter</b>	<b>Potential Source(s)</b>
HIWASSEE RIVER (Hiwassee Lake below elevation 1525)	From a point 0.3 mile downstream of Martin Creek to Laurel Creek	04-05-02	2.4	FS	M		
Valley River	From source to Gipp Creek above Andrews	04-05-02	8.2	FS	ME	Habitat degradation	Highway/Road/Bridge Runoff, Agriculture
Valley River	From Gipp Creek above Andrews to Venegeance Creek near Marble	04-05-02	9.8	FS	M	Habitat degradation, Fecal coliform	Highway/Road/Bridge Runoff, Urban Runoff/Storm Sewers Agriculture
Valley River	From Venegeance Creek near Marble to Marble Creek above Murphy	04-05-02	7.7	FS	M	Habitat degradation, Fecal coliform	Highway/Road/Bridge Runoff, Agriculture
Valley River	From Marble Creek above Murphy to the Hiwassee River	04-05-02	3.2	FS	ME	Habitat degradation, Fecal coliform	Highway/Road/Bridge Runoff, Urban Runoff/Storm Sewers Agriculture
Junaluska Creek	From source to Valley River	04-05-02	6.5	FS	M		
Webb Creek	From source to Valley River	04-05-02	1.6	FS	M		
HIWASSEE RIVER (Hiwassee Lake below elevation 1525)	From Laurel Creek to Hiwassee Dam	04-05-02	18.8	FS	M		
Hanging Dog Creek	From source to Hiwassee Lake	04-05-02	13.3	FS	M		
Nottely River	From North Carolina-Georgia State Line to Hiwassee Lake	04-05-02	18.7	FS	M	Low DO, Thermal modifications	Hydromodification
Persimmon Creek (Lake Cherokee)	From source to Hiwassee Lake	04-05-02	7.1	FS	M		
Beaverdam Creek	From source to Hiwassee Lake	04-05-02	6.7	FS	M		
HIWASSEE RIVER (Apalachia Lake below elevation 1281)	From River Mile 75, 0.8 mile downstream from Hiwassee Dam at Hiwassee Reservation Boundary to Apalachia Dam	04-05-02	8.9	FS	M		
South Shoal Creek	From source to Apalachia Lake	04-05-02	12.1	FS	M		
Shuler Creek	From source to Hiwassee River	04-05-02	11.9	FS	M		

**Primary Recreation Use Support Summary – Hiwassee River Basin**

<b>Name</b>	<b>Description</b>	<b>Subbasin</b>	<b>Classification</b>	<b>Miles</b>	<b>Primary Recreation Rating</b>	<b>Basis</b>
HIWASSEE RIVER (Chatuge Lake)	From North Carolina-Georgia State line to Chatuge Dam	04-05-01	B	2.6	FS	M
HIWASSEE RIVER (Hiwassee Lake)	From Laurel Creek to Hiwassee Dam	04-05-02	B	18.8	FS	M
HIWASSEE RIVER (Apalachia Lake)	From River Mile 75, 0.8 mile downstream from Hiwassee Dam at Hiwassee Reservation Boundary to Apalachia Dam	04-05-02	B	8.9	FS	M

**Water Supply Use Support Summary – Hiwassee River Basin**

<b>Name</b>	<b>Description</b>	<b>Subbasin</b>	<b>Classification</b>	<b>Miles</b>	<b>Water Supply Rating</b>	<b>Basis</b>
HIWASSEE RIVER	From Hyatt Mill Creek to Tusquitee Creek	04-05-01	WS-IV	2.2	FS	M
Tusquitee Creek	From Buckner Branch to Hiwassee River	04-05-01	WS-IV Tr HQW	1.7	FS	M
Fires Creek	From Rocky Cove Branch to Hiwassee River	04-05-01	WS-IV Tr ORW	8.6	FS	M
HIWASSEE RIVER (Mission Reservoir)	From Tusquitee Creek to a point 0.6 mile upstream of McComb Branch	04-05-01	WS-IV	6.2	FS	M
Brasstown Creek	From North Carolina-Georgia State Line to Hiwassee River	04-05-01	WS-IV	8.7	FS	M
HIWASSEE RIVER	From a point 0.6 mile upstream of McComb Branch to a point 0.3 mi downstream Martin Cr	04-05-02	WS-IV CA & WS-V	4.8	FS	M
Dan Holland Creek	From source to a point 0.5 mile downstream of Sunk Branch	04-05-02	WS-II Tr	1.9	FS	ME
Dan Holland Creek	From a point 0.5 mile downstream of Sunk Branch to dam at Andrews Water Supply Reservoir	04-05-02	WS-II Tr CA	0.6	FS	M
Brittian Branch (Fain Mountain Reservoir)	From source to dam at Fain Mountain Reservoir	04-05-02	WS-I	0.3	FS	M