CHAPTER 4

WATER QUALITY AND USE SUPPORT RATINGS IN THE FRENCH BROAD RIVER BASIN

4.1 INTRODUCTION

This chapter provides a detailed overview of water quality and use support ratings in the French Broad River Basin.

Water Quality Monitoring and Assessment

- **Section 4.2** presents a summary of seven water quality monitoring programs conducted by the Environmental Sciences Branch of the Division of Environmental Management's (DEM's) Water Quality Section including consideration of information reported by researchers and other agencies within the French Broad River Basin (NCDEM, 1994).
- **Section 4.3** presents a narrative summary of water quality findings for each of the nine subbasins based on all of the monitoring approaches described in Section 4.2 Also included are subbasin maps which show the locations of monitoring sites.

Use-Support Ratings

- **Section 4.4** provides a brief introduction to the use-support concept. Using this approach, water quality for specific surface waters in the basin is assigned one of four ratings: fully supporting, fully supporting but threatened, partially supporting or not supporting uses. A detailed description of the methodology for developing use-support ratings is presented in Appendix V.
- **Section 4.5** presents the use support ratings for most of streams and lakes in the French Broad basin through a series of tables and figures along with a color-coded use support map of the basin.

4.2 WATER QUALITY MONITORING PROGRAMS

DEM's monitoring program integrates biological, chemical, and physical data assessment to provide information for basinwide planning. Below is a list of the seven major monitoring programs, each of which is briefly described in the following text.

- Benthic macroinvertebrate monitoring (Section 4.2.1 and Appendix II),
- Fish population and tissue monitoring(Section 4.2.2 and Appendix II),
- Lakes assessment (including phytoplankton monitoring) (Section 4.2.3 and Appendix II),
- Aquatic toxicity monitoring (Section 4.2.4),
- Special chemical/physical water quality investigations (Section 4.2.5),
- Sediment oxygen demand monitoring (Section 4.2.6), and
- Ambient water quality monitoring (covering the period 1988-1992) (Section 4.2.7).

4.2.1 Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable water quality indicator, as these organisms are relatively immobile and sensitive to subtle changes in water quality. Since many organisms in a community have life cycles of six months to one year, the effects of short term pollution (such as an oil or chemical spill) will generally not be overcome until the following generation appears. The benthic community also responds to and shows the effects of a wide array of potential pollutant mixtures.

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 pollution-intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPTs). Likewise, ratings can be assigned with a Biotic Index (Appendix II). This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is poorly assessed by a taxa richness analysis. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina.

4.2.2 Fisheries Monitoring

To the public, the condition of the fishery is one of the most meaningful indicators of ecological integrity. Fish occupy the upper levels of the aquatic food web and are both directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food web will affect the abundance, species composition, and condition of the fish population. Two types of fisheries monitoring are conducted by DEM and described briefly below. The first involves assessing the overall health of the fish community. This information can be used as an indicator of the quality of the water the fish inhabit. The second involves analyzing fish tissues to determine whether they are accumulating chemicals. This information is also useful as an indicator of water quality and can be used to determine whether human consumption of these fish poses a potential health risk.

Fish Community Assessment

The North Carolina Index of Biotic Integrity (NCIBI) is a modification of Karr's IBI (1981) which was developed as 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. At this time there is no Index of Biotic Integrity calculated for fish populations in lakes.

The NCIBI summarizes the effects of all classes of factors influencing aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions). While any change in a fish community can be caused by many factors, certain aspects of the community are generally more responsive to specific influences. Species composition measurements reflect habitat quality effects. Information on trophic composition reflects the effect of biotic interactions and energy supply. Fish abundance and condition information indicates additional water quality effects. It should be noted, however, that these responses may overlap. For example, a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality.

Appendix II contains a more detailed discussion of the NCIBI as well as a listing of the community assessment sites and NCIBI ratings.

Fish Tissue Analysis

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Therefore, by analyzing fish tissue, determinations about what chemicals are in the water can be made. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species has been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be available for bioaccumulation either directly or through aquatic food webs and may accumulate in fish and shellfish tissues. Thus results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water. Fish tissue analysis results are also used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with Federal Food and Drug Administration (FDA) action levels and U.S. Environmental Protection Agency (EPA) recommended screening values for contaminants.

The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs and thus employ a "safe level" approach to fish tissue consumption. A list of fish tissue parameters accompanied by their FDA criteria are presented in Appendix II. At present, the FDA has only developed metals criteria for mercury. Individual parameters which appear to be of potential human health concern are evaluated by the N.C. Division of Epidemiology by request of the Water Quality Section.

4.2.3 Lakes Assessment Program (including Phytoplankton)

Lakes are valued for the multiple benefits they provide to the public, including recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lakes Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at all publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine the trophic state of each lake. The North Carolina Trophic State Index (NCTSI) is a relative measure of nutrient enrichment and productivity, and whether the designated uses of the lake have been threatened or impaired by pollution. This index is explained more fully in Appendix II.

4.2.4 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DEM's Aquatic Toxicology Laboratory. The Aquatic Toxicology Unit maintains a compliance summary for all facilities required to perform tests and provides a monthly update of this information to regional offices and DEM administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge. A list of all NPDES facilities required to conduct aquatic toxicity testing is provided in Appendix II.

4.2.5 Chemical/Physical Characterizations

Water quality simulation models are often used for the purpose of constructing wasteload allocations. These models must adequately predict water body responses to different waste loads so that appropriate effluent limits can be included as requirements in National Pollutant Discharge Elimination System (NPDES) permits. Where large financial expenditures or the protection of water quality is at risk, models should be calibrated and verified with actual in-stream field data. Because sufficient historical data are often lacking, intensive water quality surveys are required to provide the field data necessary to accomplish model calibration and verification. Intensive water quality surveys are performed on water bodies below existing or proposed wastewater dischargers and usually consist of a time-of-travel dye study, flow measurements, physical and chemical samples, long-term biochemical oxygen demand (BOD_{lt}) analysis, water body channel geometry, and effluent characterization analysis.

4.2.6 Sediment Oxygen Demand

If oxygen depletion is suspected due to the characteristics of benthic sediments then sediment oxygen demand (SOD) studies may be performed. Each stream reach is divided into a series of model segments. The number of stream segments that must be evaluated with an intensive survey depends on the individual study and the spatial resolution desired. Intensive surveys and SOD evaluations are reported as a series of field data tables and summaries of laboratory analysis reports.

4.2.7 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine (saltwater) water quality monitoring stations (about 380 statewide) strategically located for the collection of physical and chemical water quality data. The type of water quality data, or parameters, that are collected is determined by the waterbody's freshwater or saltwater classification and corresponding water quality standards. Table 4.1 summarizes the types of water quality data collection conducted at ambient stations. AMS data for the French Broad Basin are incorporated in the subbasin summaries.

Table 4.1. Ambient Monitoring System Parameters

C and SC WATERS (minimum monthly coverage for all stream stations)
- dissolved oxygen,
- pH,
- conductivity,
- temperature,
- salinity (SC),
- secchi disk (where appropriate),
- nutrients: total phosphorus, ammonia, total Kjeldahl nitrogen, nitrate+nitrite,
- total suspended solids,
- turbidity,
- hardness,
- fecal coliforms,
- metals: aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, zinc

NUTRIENT-SENSITIVE WATERS
- Chlorophyll *a* (where appropriate)

WATER SUPPLY
- chloride,
- total coliforms,
- manganese,
- total dissolved solids

PLUS any additional parameters of concern for individual station locations

4.3 NARRATIVE WATER QUALITY SUMMARIES BY SUBBASIN

4.3.1 Subbasin 01 - French Broad River Headwaters

DESCRIPTION

Subbasin 01 contains the headwater reaches of the French Broad River in Transylvania County and the headwater segment of the Little River (Figures 4.1a and b). The French Broad River originates at the confluence of the West and North Forks of the French Broad near the town of Rosman. The East Fork of the French Broad also flows into the French Broad River near Rosman. These major tributaries generally are unstressed, high gradient, streams which support viable trout populations. Approximately one half of the land within this subbasin is contained in the Pisgah National Forest and Pisgah Game Land. This portion of the catchment is therefore protected from most land disturbing activities and has a limited number of point source discharges. Below Rosman, the French Broad River is a much wider, lower gradient river which meanders through a mostly undeveloped watershed to the town of Brevard. Brevard is the largest urban area in the subbasin. Some agriculture and development are present in this reach of the French Broad River. There are 25 known point source dischargers in subbasin 01, eight of which are trout farms.

OVERVIEW OF WATER QUALITY

Ambient water quality data is currently being collected from two locations in this subbasin, the French Broad River at Rosman and the Little River near High Falls. These data have indicated good water quality, with very few violations of water quality standards at either site. Excesses were noted for pH and turbidity at the Rosman location and pH, turbidity, and metals at the Little River location. Long term observations of water quality data have noted a slight decline in pH values at the Rosman location.

Benthic macroinvertebrate samples have been collected from 29 locations in this subbasin since 1983. These investigations have generally found Excellent or Good water quality conditions. Excellent bioclassifications (based on benthic macroinvertebrates) have been consistly assigned to the ambient monitoring location at Rosman. Fish tissue samples from this location have detected organic compounds (PCB's) exceeding the EPA recommended screening value, but these values were below the FDA criteria for fish consumption.

Major sections of the North Fork, West Fork, and East Fork French Broad River and all of the Catheys Creek catchment have been designated High Quality Waters. Many small dischargers (especially trout farms) are located in some of these catchments and may cause localized enrichment and/or organic loading problems. For example, a joint study with the NC Agricultural Extension Service and the NC Wildlife Resources Commission to assess the effects of trout farm discharges on mountain stream ecology found these discharges degrade water quality in the upper section of the West Fork French Broad River.

POTENTIAL HQW/ORW STREAMS

Benthos data collected from this subbasin in 1992 did not suggest any "new" potential HQW/ORW streams. However, a review of the upper French Broad River HQW report (B-890510) indicated that the French Broad River from its source to SR 1129 was inadvertently overlooked for HQW designation. Data from the SR 1129 location continues to indicate Excellent water quality in this segment of the river, and it is DEM's intent to pursue reclassification of this stream reach.

French Broad River Basin
040301

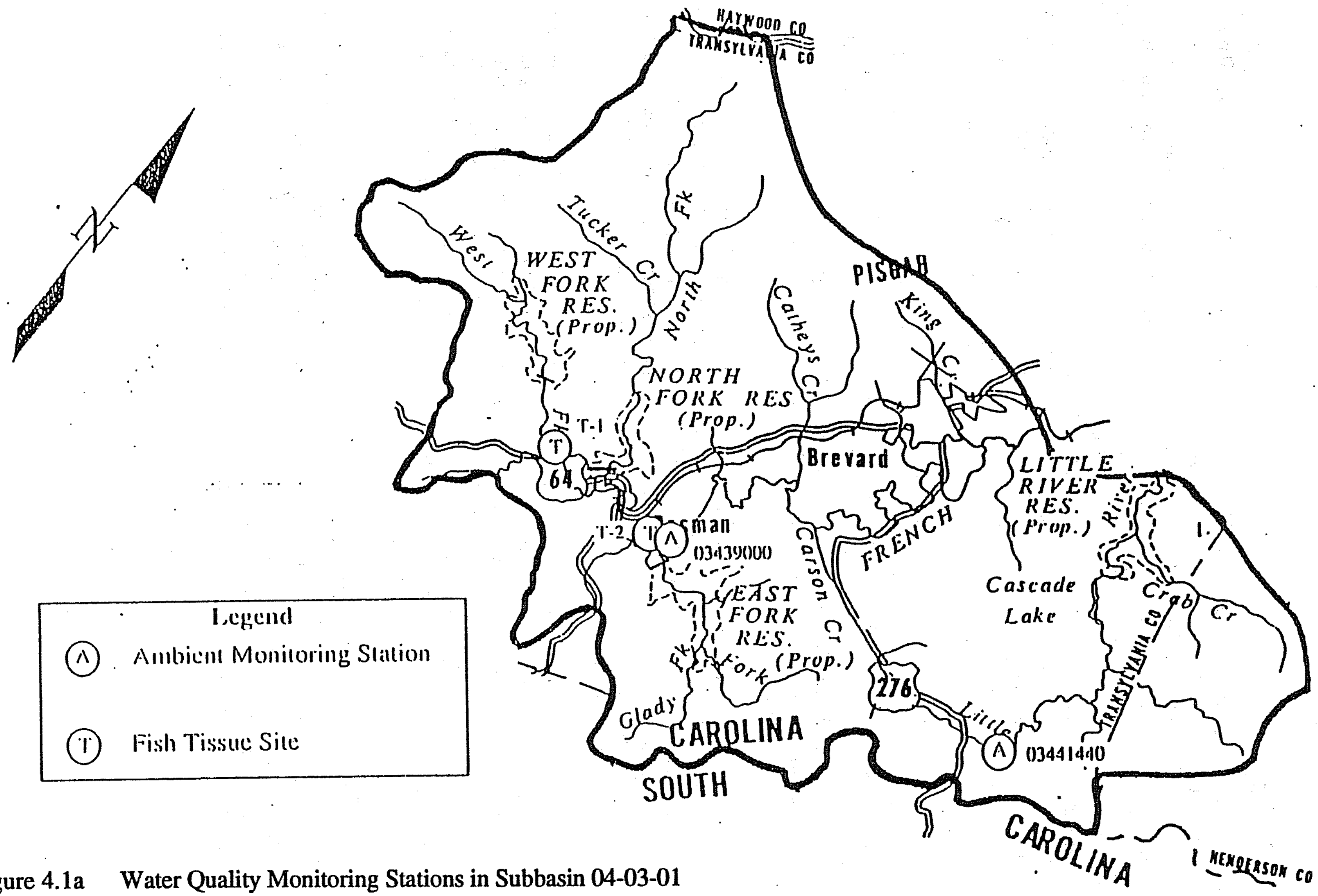


Figure 4.1a Water Quality Monitoring Stations in Subbasin 04-03-01

French Broad River Basin
040301

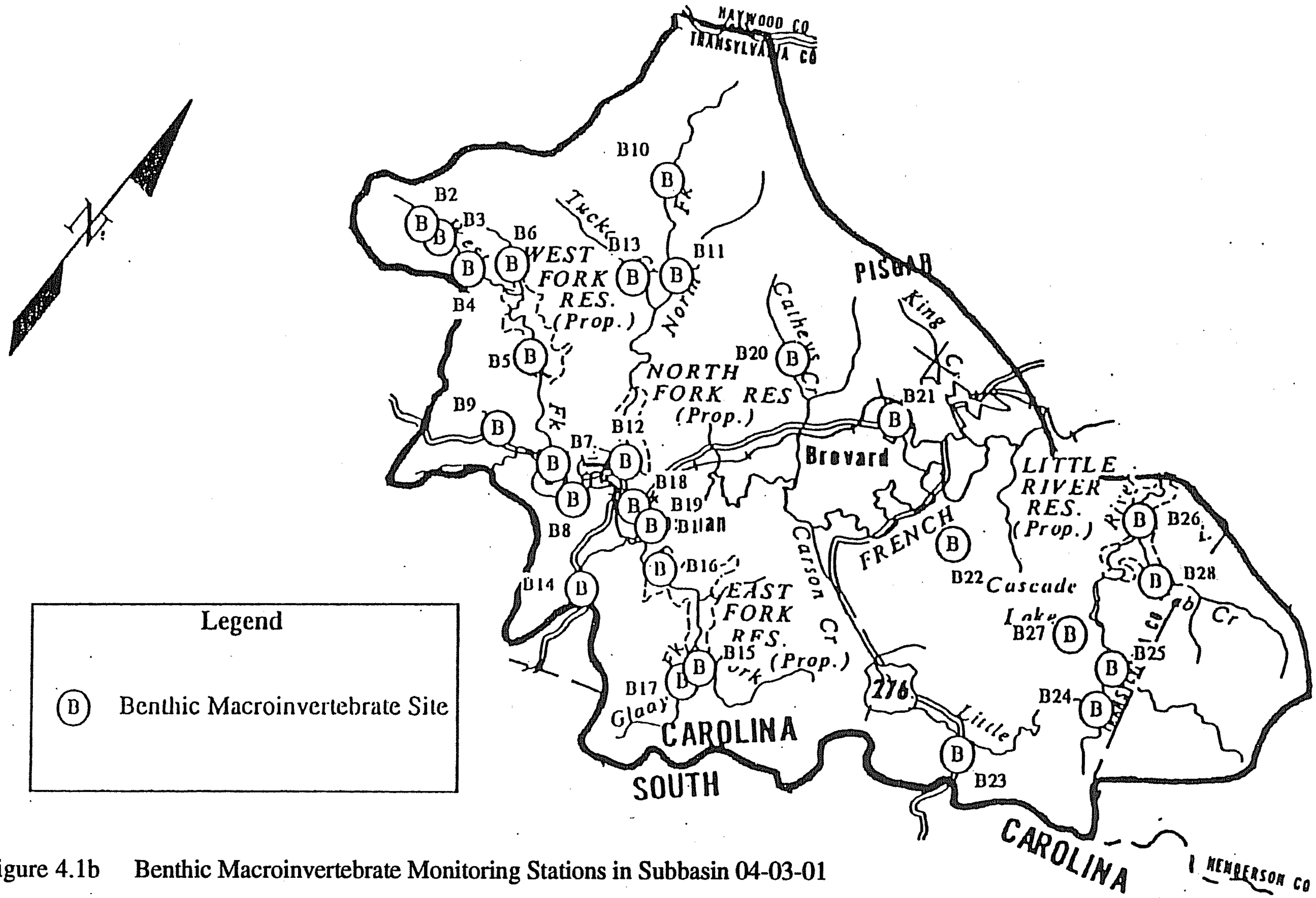


Figure 4.1b Benthic Macroinvertebrate Monitoring Stations in Subbasin 04-03-01

4.3.2 Subbasin 02 - Upper French Broad River

DESCRIPTION

French Broad subbasin 02 contains approximately 40 river miles of the French Broad River from the confluence of the Little River in Transylvania County to the confluence of Sandymush Creek in Buncombe County (Figure 4.2). The French Broad River in this subbasin is generally a very wide mountain river capable of supporting several warm water gamefish species. The major tributaries of the French Broad River in this subbasin include Mud Creek, Cane Creek, Hominy Creek, Swannanoa River, and Turkey Creek. Most tributaries in this catchment have unstressed, high elevation, headwaters. However, agriculture (orchards and row crops, including corn, tomatoes, and burley tobacco) and urbanization often affects the middle and lower portions of these streams This reach of the French Broad River contains the urban area of Asheville and Hendersonville. There are 153 known point source dischargers in this subbasin.

OVERVIEW OF WATER QUALITY

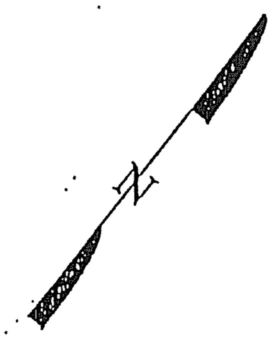
Ambient water quality monitoring information is currently being collected from eight locations in the subbasin with four of these locations located on the mainstem of the French Broad River. Benthic macroinvertebrate (Figure 4.2a) and fish community samples have been collected from 57 locations in this subbasin since 1983. These investigations were conducted to assess the effects of both point and nonpoint sources of pollution. The 1992 benthic macroinvertebrate collections at French Broad River sites generally showed a downstream decline in water quality: Good at Skyland (upstream of Asheville), Good/Fair at Asheville, and Fair at Alexander (below Asheville). This decline in water quality may be related to several large point source dischargers and nonpoint source runoff. Analysis of long-term changes in the benthos suggested a slight improvement in water quality at the Skyland site, a greater improvement at the Asheville site (Fair to Good-Fair), but no similar improvement for the Alexander site. Conductivity values showed a significant decline (improvement) at the former two sites from 1981 to 1993.

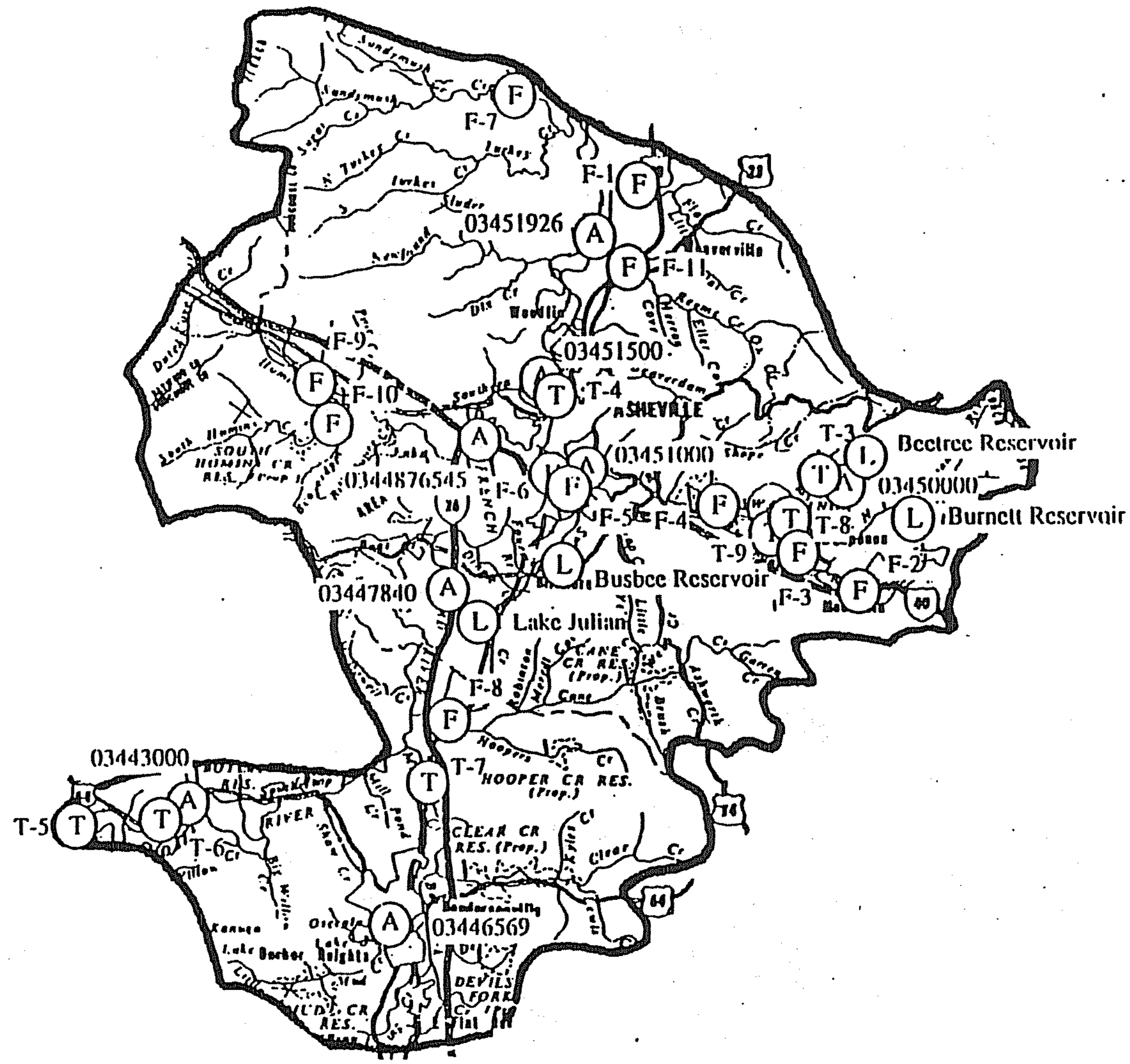
A similar downstream change was observed in the ambient water chemistry data from the French Broad River locations. For example, the frequency of fecal coliform numbers measured above the criteria of 200/100 ml (for the period 2/88 to 5/93) increased from 20% at Blantyre (upstream of this subbasin) to 38% at Skyland, 40% at Asheville, and 31% at Alexander. Median total phosphorus values were 0.04, 0.07, 0.07, and 0.14 mg/l for these sites respectively during the same time period. Long term observations in BOD and total phosphorus mimic these upstream to downstream trends.

Excellent water quality is primarily confined to the upper reaches of tributaries, with many point and nonpoint source problems in the lower reaches. Biological investigations have been conducted in several tributary stream systems in this subbasin. Mud Creek has consistently been given a Poor bioclassification due to point sources (Hendersonville WWTP, General Electric, Kyocera Feldmuehle, Inc.), urban runoff, and agricultural runoff. Seventy-nine percent of all fecal coliform samples (15/19) collected from the ambient location on Mud Creek from 9/91 to 5/93 had excesses of the water quality criteria. Runoff from apple orchards and multiple small dischargers were shown to cause severe water quality problems in Clear Creek.

Benthic macroinvertebrate and fish community structure indicated Good water quality in headwater reaches of Hominy Creek. However, both point and nonpoint sources contribute to the Poor bioclassification of the lower reaches of this catchment. Seventy-one percent of all fecal coliform samples (15/21) collected from the ambient location on Hominy Creek during 9/91 to 5/93 exceeded water quality criteria. In addition, Hominy Creek was one of nine monitoring locations that recorded excesses of total phosphorous (0.1 ppm, to prevent excess algal growth) as part of an independent monitoring program in Buncombe County (Maas, et al., 1993). Other streams in this monitoring network with high total phosphorus values in this subbasin included Reed, Newfound, Sandymush, Reems, and Turkey Creeks. DEM nonpoint source investigations also found Poor

French Broad River Basin
040302





Legend

- (A) Ambient Monitoring Station
- (T) Fish Tissue Site
- (F) Fish Community Site
- (L) Lake Monitoring Station

Figure 4.2 **Water Quality Monitoring Stations in Subbasin 04-03-02**

French Broad River Basin
040302

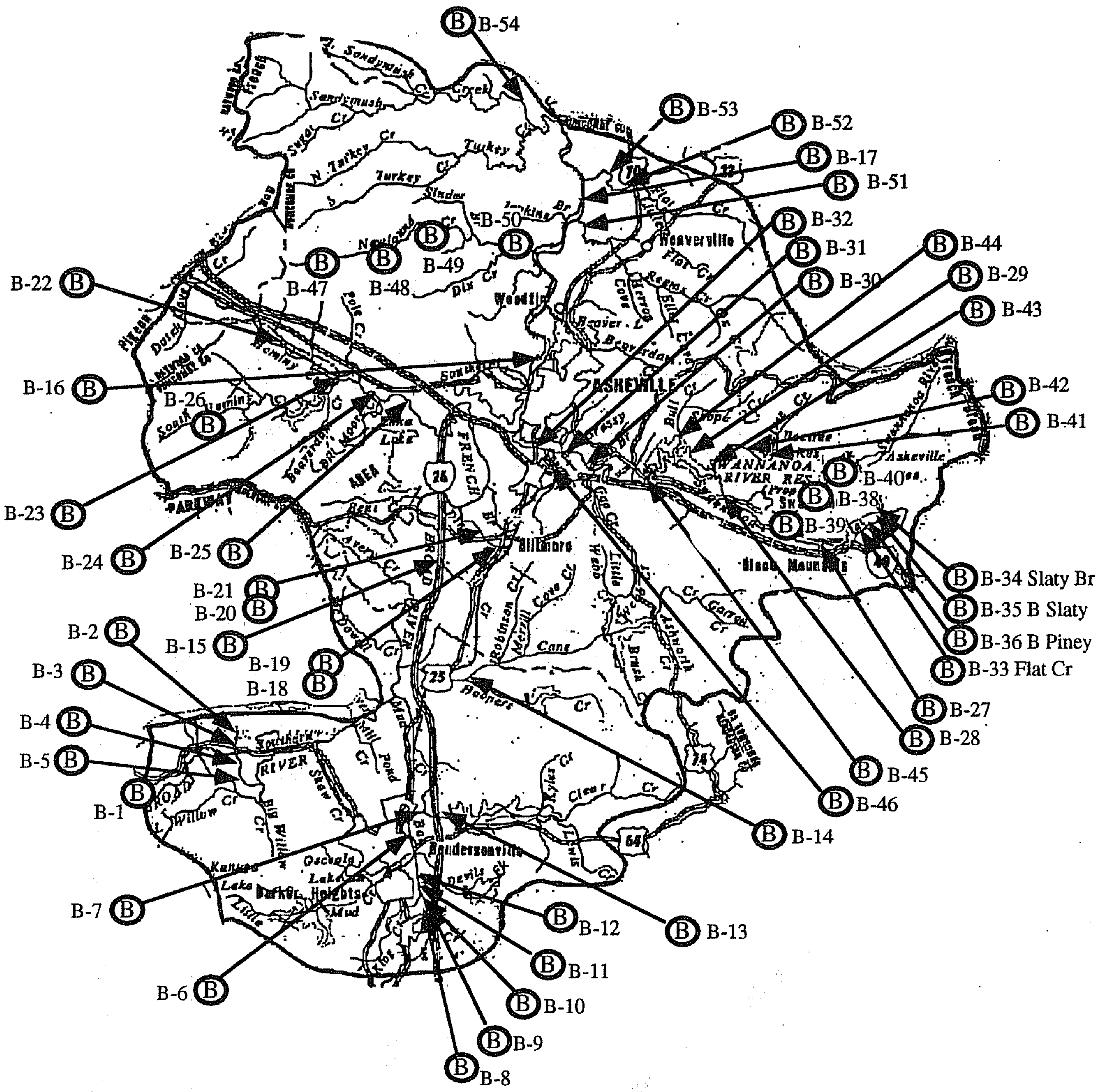


Figure 4.2 Benthic Monitoring Stations in Subbasin 04-03-02

water quality in the lower portion of Newfound Creek watershed due to runoff from numerous dairy operations in the catchment.

The lower section of the Swannanoa River has been shown to have severe water quality problems associated with spills, point source discharges and nonpoint source runoff. For example, 53% of all fecal coliform samples (16/30) collected from the ambient location (from 2/88 to 5/93) noted excesses of water quality standards. Ambient water chemistry data and benthic macroinvertebrate collections, however, have shown improvements in water quality conditions in the Swannanoa River since 1985. A site near Biltmore improved from Fair or Poor in 1987-1989 to Good-Fair in 1992. Improvements in upstream sewer systems and the closing of Sayles Biltmore Bleachery have probably contributed to the improved water quality at this site. The middle and upstream reaches of the Swannanoa River have had less severe problems; both fish and invertebrate collections indicate Good or Good-Fair conditions in this portion of the river.

Fish tissue samples have been collected from three locations on the French Broad River. Twenty samples were collected and analyzed for metals and four for organics from the French Broad River at the ambient station at Asheville. All metals were below FDA and EPA criteria, while three of the four organic samples contained dieldrin exceeding the EPA screening value (0.007 ppm) but were below the FDA criteria for fish consumption. Fish tissue samples were also collected from the French Broad River at Patton Bridge and near Crab Creek Road, both sites located below Ecusta plant in Brevard. Samples were collected for metals and dioxin from the Patton Bridge location. These tissue data noted one excess for mercury and three samples containing dioxin levels equal to or exceeding the recommended EPA screening value of 0.007 ppm. Ten dioxin samples were collected from the French Broad River near Crab Creek Road. All dioxin results were lower than EPA and North Carolina criteria. Therefore there are no fish consumption advisories in this area.

Water quality investigations have been conducted in four reservoirs in the subbasin. These four waterbodies are Lake Julian, Burnett Reservoir, Beetree Reservoir, and Busbee Reservoir. All four waterbodies are oligotrophic systems and are currently supporting all of their designated uses.

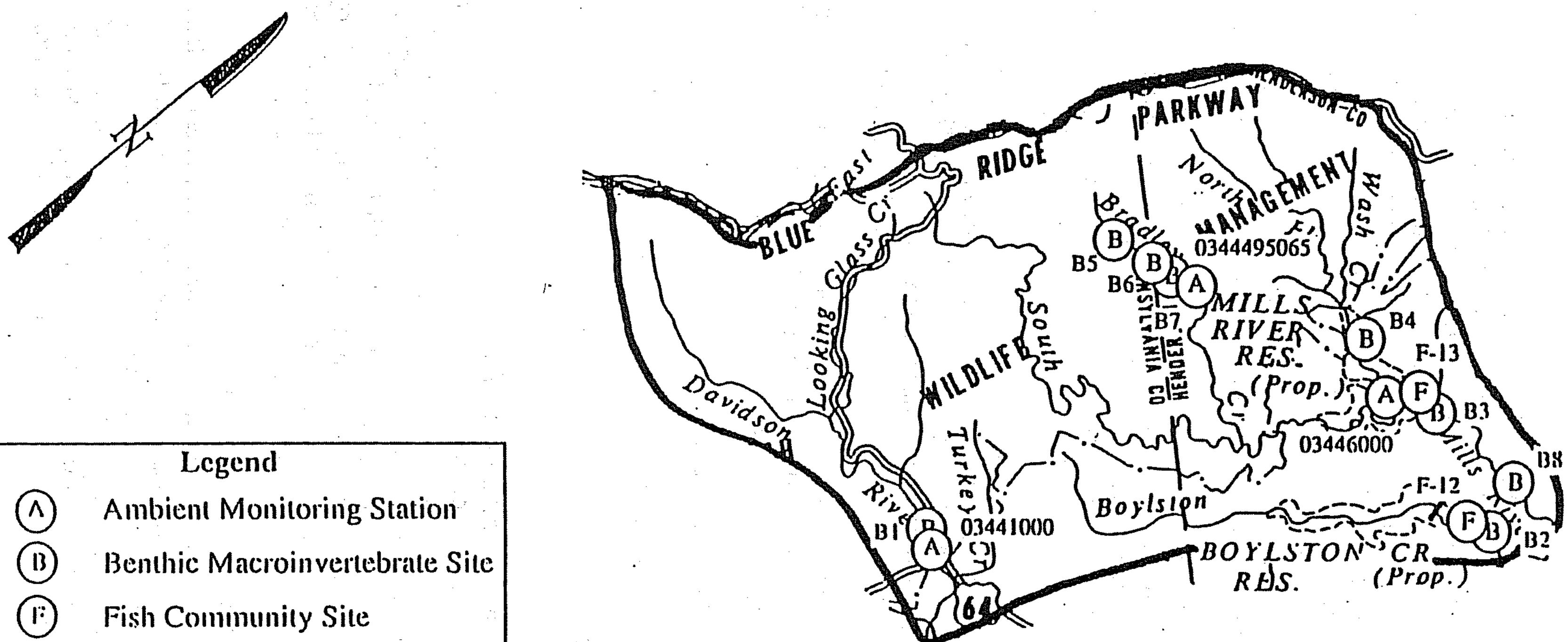
POTENTIAL HQW/ORW STREAMS
Based on DEM surveys in 1992, upper Sandymush Creek may be eligible for HQW designation. However, this stream is potentially affected by agricultural (primarily dairies) runoff.

4.3.3 Subbasin 03

DESCRIPTION
French Broad subbasin 03 contains the Mills River and Davidson River watersheds (Figure 4.3). The Mills River is formed by the confluence of the North and South Fork Mills River. From its source, the Mills River flows past the community of Mills River to the French Broad River. The Davidson River flows into the French Broad River near Brevard. Approximately three quarters of the land within this subbasin is contained in the Pisgah National Forest and Pisgah Game Land; this portion of the subbasin has a limited number of point source discharges and is protected from most land disturbing activities. Many streams in this subbasin are capable of supporting reproducing trout populations. There are 12 known point source dischargers in this subbasin.

OVERVIEW OF WATER QUALITY
Benthic macroinvertebrate and fish community samples have been collected from eight locations in this subbasin, generally indicating Excellent water quality conditions. Most of the South Fork Mills River and its tributaries are classified as Outstanding Resource Waters and most of the Davidson River and its tributaries are High Quality Waters. Ambient water quality data is currently being collected from three locations in the subbasin. Very few exceedances of water quality standards have been recorded with the exception of low pH values from the Davidson River and Bradley Creek.

French Broad River Basin
040303



Legend

- (A) Ambient Monitoring Station
- (B) Benthic Macroinvertebrate Site
- (F) Fish Community Site

Figure 4.3 Water Quality Monitoring Stations in Subbasin 04-03-03

Bolyston Creek is a low elevation tributary stream of the French Broad River and receives nonpoint source runoff from several dairy operations in the catchment. Good/Fair bioclassifications have been assigned to the lower portion of Bolyston Creek (SR 1314) in 1992 based on both benthic macroinvertebrate and fish community data. Earlier DEM studies (1977) had indicated Fair-Poor conditions at this site. Fish community structure data from Bolyston Creek showed an increase in the percentage of omnivorous fish species in 1992 compared to data collected in 1980, suggesting increased enrichment.

POTENTIAL HQW/ORW STREAMS
Based on DEM surveys in 1992 and prior data, the Mills River and North Fork Mills River may be eligible for HQW or ORW designation.

4.3.4 Subbasin 04 - Lower French Broad River and Ivy Creek

DESCRIPTION
This subbasin includes the French Broad River in Madison County and its tributaries including Ivy Creek (Figure 4.4). Much of the catchment is undeveloped land within the Pisgah National Forest. The largest towns in this area are Marshall and Mars Hill. There are no major dischargers in this subbasin.

OVERVIEW OF WATER QUALITY
Much of the subbasin lies within the Pisgah National Forest and most of the tributaries have Good or Excellent water quality. Hunter Creek has been classified HQW and portions of several other tributaries also may qualify.

The Ivy Creek (River) catchment was surveyed in 1993 to determine if any areas were suitable for HQW classification. Excellent water quality was found in two headwater streams, Carter and Mineral Creeks. A Good bioclassification was found for Dillingham Creek, Stoney Creek, North Fork Ivy Creek and three Ivy Creek sites. Portions of Ivy Creek are very sandy, and this stream becomes very turbid after rainfall. Some tributaries also appeared to be affected by nonpoint source runoff. Fisheries information gave a slightly higher rating (Excellent) to Ivy Creek at SR 2150. In the French Broad River mainstem, data from all programs indicate Good-Fair water quality. Water chemistry from the ambient site at Marshall showed little change from the upstream Alexander site, although the bioclassification usually improves from Fair at Alexander (below the Asheville WWTP) to Good-Fair at Marshall. The Marshall site gives some indication of improvement since 1983, although the bioclassification also is influenced by annual changes in flow.

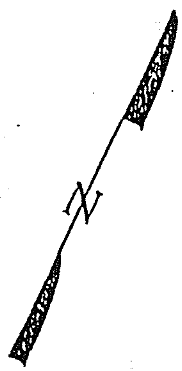
POTENTIAL HQW/ORW STREAMS
Based on recent biological investigations, portions of Ivy Creek (River), Big Laurel Creek, Hickory Fork (Hickey Creek) and their tributaries may qualify for HQW or ORW reclassification.

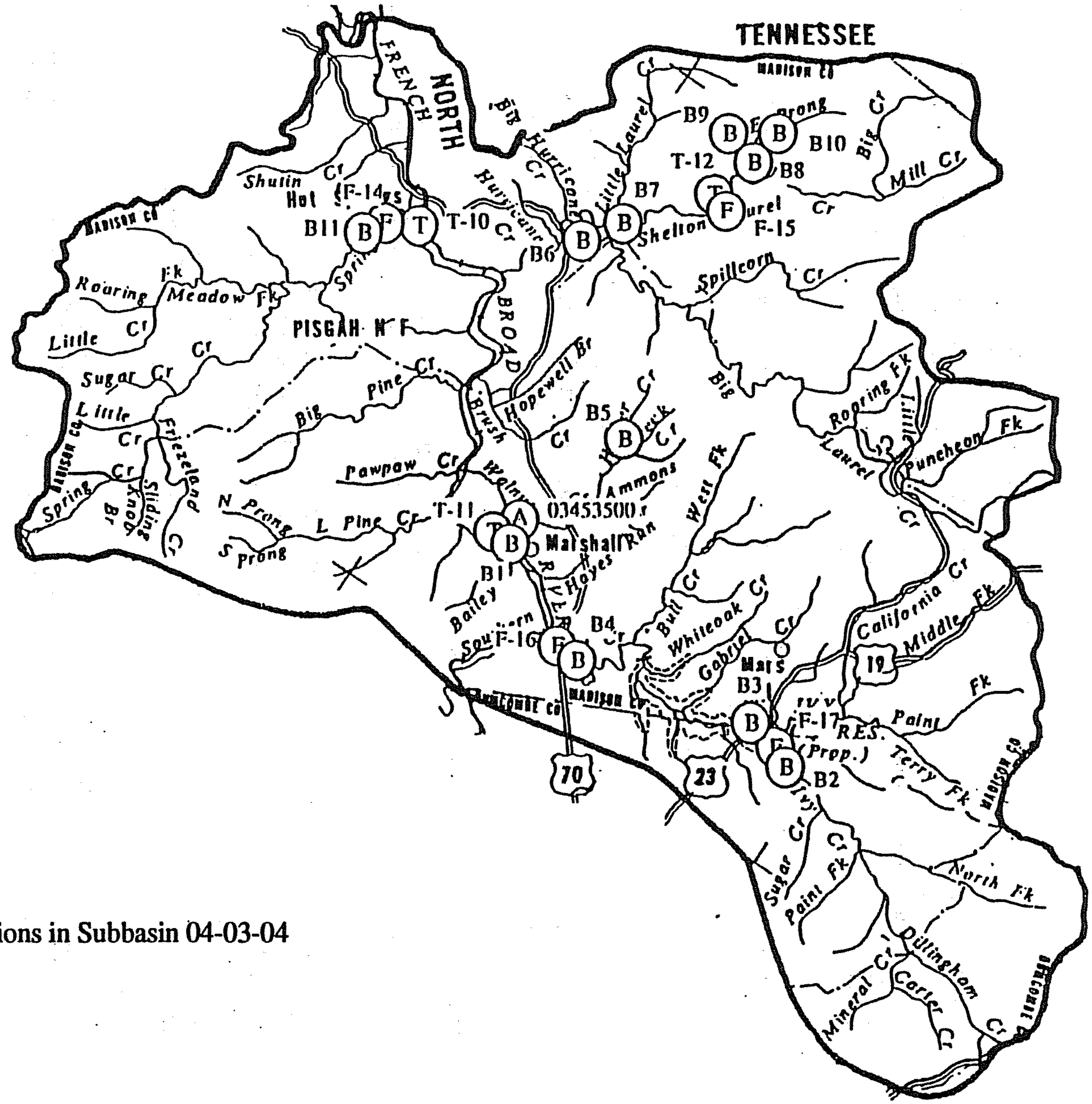
4.3.5 Subbasin 05 - Pigeon River Watershed

DESCRIPTION
This subbasin includes the Pigeon River and its tributaries (Figure 4.5). Much of the catchment is undeveloped land within the Great Smoky Mountains National Park, Pisgah National Forest and Pisgah Game Lands. The largest urban areas are Waynesville and Canton. There are four major dischargers in this subbasin: Dayco Corporation, Waynesville WWTP, Maggie Valley WWTP, and Champion International.

OVERVIEW OF WATER QUALITY
The discharge from Champion Paper has been the single most significant source of water pollution in this subbasin for many years. A survey in 1965 showed that pollution-intolerant organisms

French Broad River Basin
040304





Legend

- (A) Ambient Monitoring Station
- (B) Benthic Macroinvertebrate Site
- (T) Fish Tissue Site
- (F) Fish Community Site

Figure 4.4 Water Quality Monitoring Stations in Subbasin 04-03-04

French Broad
River Basin
040305

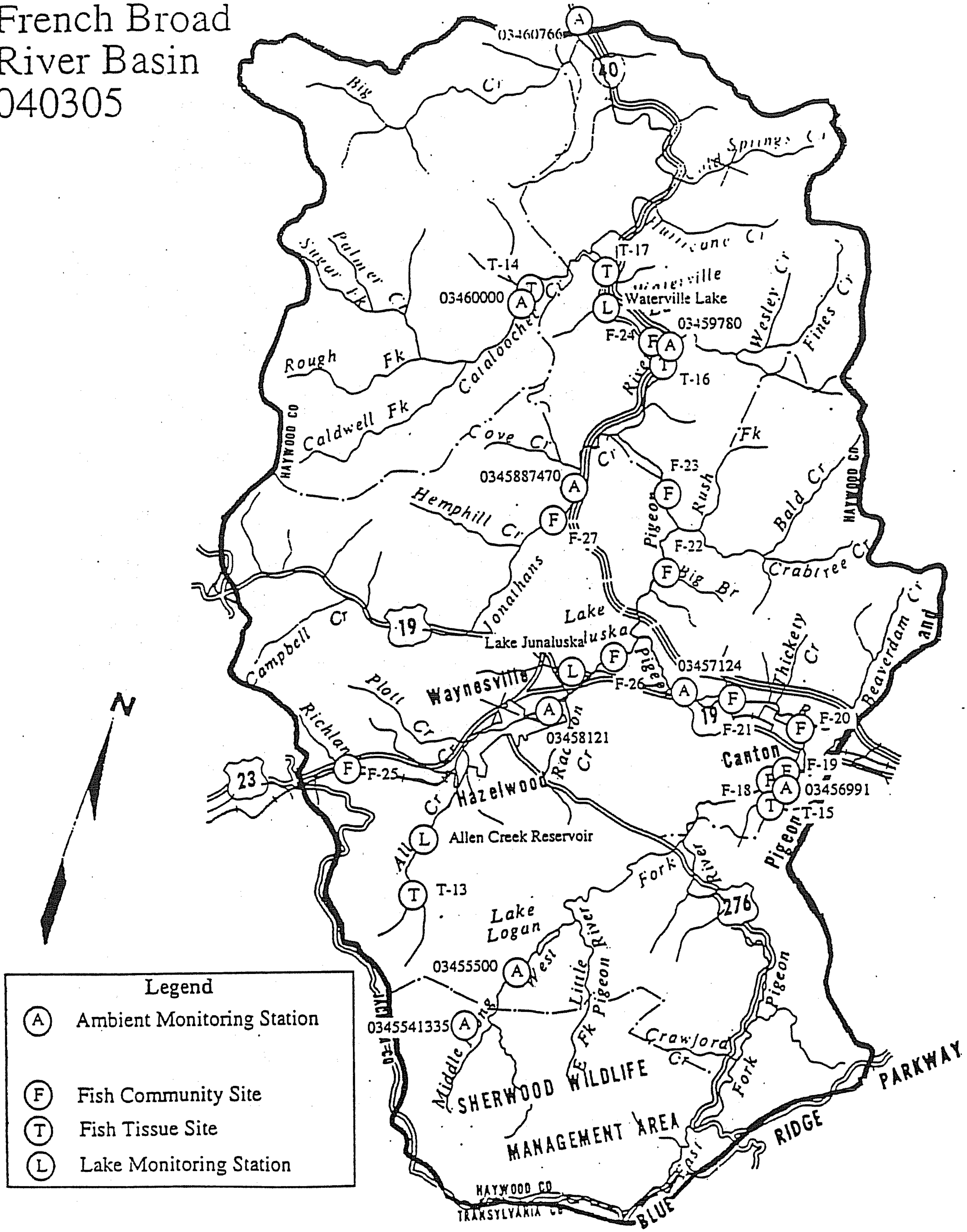


Figure 4.5 Water Quality Monitoring Stations in Subbasin 04-03-05

were not found in the Pigeon River below Champion Paper Company down to the state line. The survey found a biological community indicative of low dissolved oxygen and heavy organic loading. DEM conducted intensive surveys in 1978, 1979, 1980 and 1982, in addition to regular monthly or yearly monitoring at four ambient sites in the Pigeon River. This sampling strategy also has been supplemented by many special surveys (especially fish tissue studies) and surveys of major tributaries.

Data from the 1978-1982 period showed a clear improvement over the 1965 survey, particularly a decrease in the amount of organic loading. The amount of impact has been found to be a function of both stream flow and temperature, with higher flows and lower temperatures acting as mitigating factors. Water chemistry, benthic macroinvertebrate collections and fish collections prior to 1992 all showed a similar pattern in the Pigeon River: Good above Canton and Poor at Clyde (below Champion), with a gradual recovery to Good-Fair at the NC/TN state line. Both fish and macroinvertebrate data have indicated that toxicity has been a problem below Champion Paper. As discussed in Chapter 6, Champion has recently completed a $330 million modernization project which has resulted in substantial improvement in the quality of its effluent. While DEM has not conducted benthic sampling in the river since the improvements were completed, benthic macroinvertebrate collections were already showing some improvement at the Clyde site, improving from Poor in 1984-1989 to Fair in 1992.

Fish-tissue samples from the Pigeon River below Canton have shown elevated levels of dioxin. A "no consumption" advisory for all fish species was issued in 1988 for the Pigeon River (including Waterville Lake) from Canton to the Tennessee border. However, sampling of fish tissue in 1992-1993 in the lake and river have shown reduced dioxin levels in most fish species. As a result of these findings, the consumption advisory has been lifted for all fish species except for carp and catfish. Additional fish tissue monitoring will be conducted prior to updating the basin plan in the year 2000. Champion reports that the levels of dioxin in fish tissues it has sampled have been lower every year since 1990. The plant modernization project noted above included eliminating the use of chlorine in the paper bleaching process which was the source of dioxin in the effluent.

Development on both Jonathan Creek and Richland Creek has resulted in some water quality degradation. Historically, the problems have been much more severe in Richland Creek; however, improvements at Dayco Corporation have resulted in improved water quality in the creek. Benthos data indicated that Richland Creek at SR 1184 near Waynesville has improved in recent years, going from Poor in 1983, to Fair in 1985 and 1988, and to Good-Fair in 1992.

Three lakes in this subbasin have been evaluated: Allen Creek Reservoir, Lake Junaluska and Waterville Lake. Allen Creek Reservoir is oligotrophic; but both Lake Junaluska and Waterville Lake have enrichment problems. Waterville Lake is hypereutrophic from the effects of Champion Paper, several wastewater treatment plants and nonpoint sources.

Lake Junaluska has historic problems with sedimentation and eutrophication. It is dredged about every ten years. Poor land use practices in the watershed have been identified as a potential sources of sediment and nutrients. Lake Junaluska is a small reservoir located in Haywood County near Waynesville, North Carolina. The lake is privately owned by the Methodist Church and was built in 1914. Inflows into the lake come predominantly from the Richland Creek drainage, while smaller amounts enter from Factory Branch, and from the hillsides surrounding the lake itself (Yurkovich 1984). The lake has a very high ratio of drainage area to volume making the lake very suseptable to sediment loading with little sediment storage capacity. The mean depth of the lake is only 17 feet which is shallow compared to other mountain lakes (NCDEHNR, 1992).

Traditionally, land in the watershed was mainly forested, however the land is increasingly becoming more urban with private home-building. Private homes are replacing orchards, pasture land and forests. Ken Futrell (pers. com. 1994) of the Natural Resources Conservation Service believes that home construction is a large contributor of sediment that ends up in Lake Junaluska. Agriculture in the watershed is minimal; some tobacco is grown, but the watershed is mostly urban and forested. Streams that drain the watershed flow within channels that have high gradients. These high gradient streams produce turbulence which enables the streams to become effective erosional agents, consequently, transporting sediments to Lake Junaluska (Yurkovich 1984).

Richland Creek flows through Waynesville. In addition to the above mentioned nonpoint sources, all runoff from the town of Waynesville is deposited in Lake Junaluska via Richland Creek. Several cleanups have been initiated on Richland Creek and there are buoyed skimmers to prevent trash from entering Lake Junaluska, but these have little or no effect on sediment (Futrell, K. pers. com. 1994).

Lake Junaluska has historically had problems with sedimentation and eutrophication. It took fifty years for the lake to fill with sediment the first time. The lake was dredged in 1964, in 1973, and again in 1982. Sedimentation rates in the watershed have increased greatly over the past thirty years and can be attributed to highway construction and residential and industrial growth within Haywood County (Yurkovich 1984). The lake was most recently dredged in 1992 or 1993. A considerable amount of sediment was removed and the dredging process took almost one year to complete.

Concurrent with sediment influx to the lake, chemical and solid waste have also entered, occasionally resulting in fish kills. Sources could originate from septic system bypasses, street cleaning operations, agricultural chemicals and trash and garbage (Yurkovich 1984).

There are several high quality streams in this subbasin, including the upper part of the Pigeon River catchment, Cataloochee Creek and Big Creek. Cataloochee Creek has been designated as Outstanding Resource Waters while the Middle Prong West Fork Pigeon River, East Fork Pigeon River, Little East Fork Pigeon River, Big Creek and portions of Rough Creek and Rocky Branch have been designated High Quality Waters. Low pH may become a concern in some of these streams, with values of less than 5.5 already recorded in the upper portions of the Pigeon River catchment (West Fork, Right Prong).

POTENTIAL HQW/ORW STREAMS
Based on recent biological investigations, Cold Springs Creek and upper portions of Jonathan Creek may qualify for HQW or ORW.

4.3.6 Subbasin 06 - Nolichucky, North Toe and South Toe River Watersheds

DESCRIPTION
This subbasin includes the Nolichucky, the North Toe River and the South Toe River (Figure 4.6). Much of the land in this area is undeveloped and lies within the Pisgah National Forest. The largest town is Spruce Pine and several major dischargers are located near this city, including the Spruce Pine WWTP and three mine processors: Feldspar, Unimin and K-T Feldspar. Many of the streams in this subbasin have a supplemental trout water classification.

OVERVIEW OF WATER QUALITY
Water chemistry data is available from two sites on the North Toe River (bracketing the Spruce Pine area), two sites on the South Toe River and a single site on the Nolichucky River. Low pH values (<6.0) have been observed at the South Toe River sites since 1991, with some values of less than 5.0 during fall and winter months. Long term records suggest a steady decline in pH at the South Toe River near Celo. The North Toe River at Penland (below the Spruce Pine dischargers) shows elevated conductivity values, as well as elevated fluoride values. The South Toe River sites appear to be the least affected sites, consistently having low conductivities and lower concentrations of nutrients and solids.

French Broad River Basin
040306

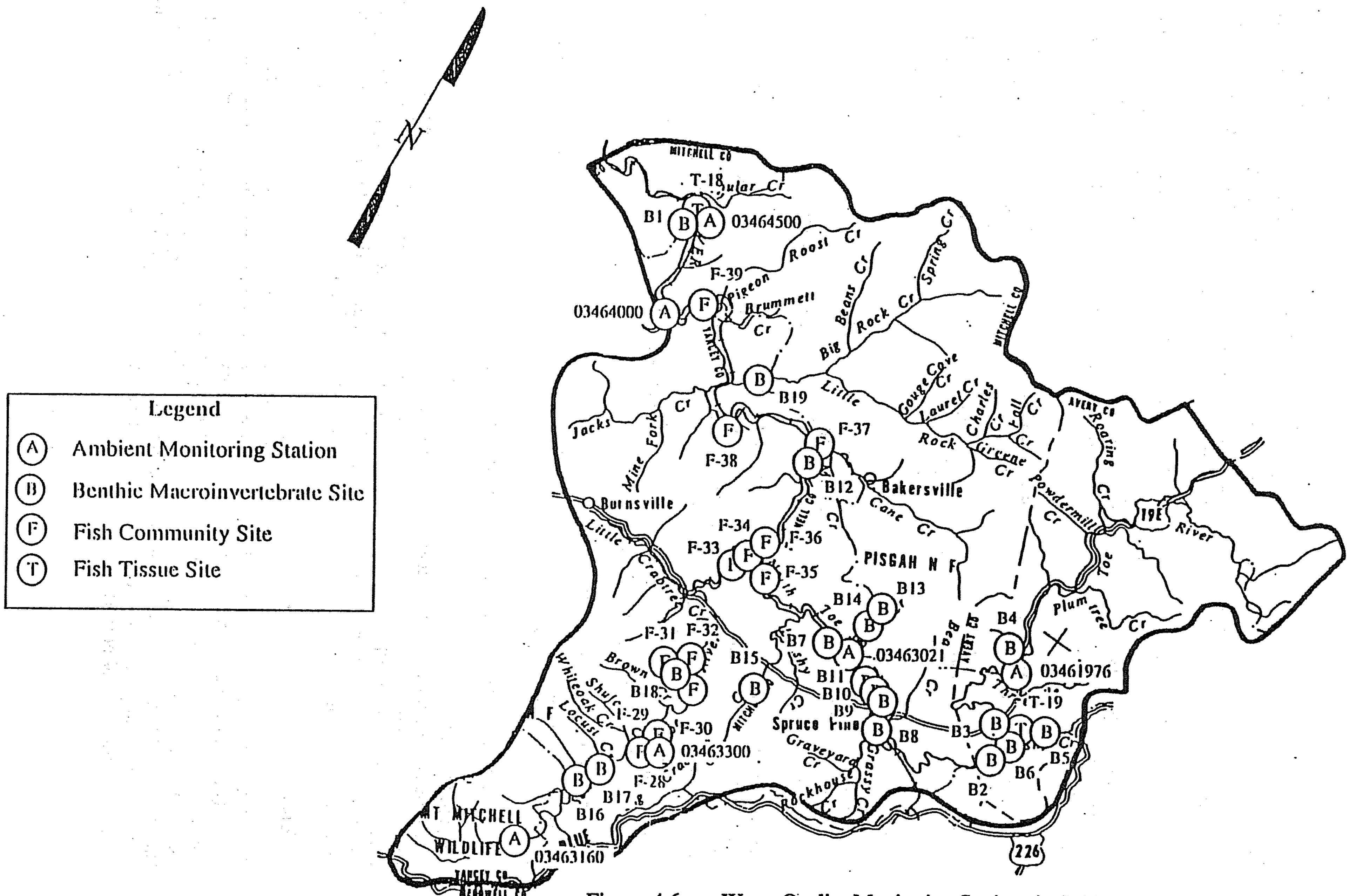


Figure 4.6 Water Quality Monitoring Stations in Subbasin 04-03-06

Benthos collections have indicated Good or Excellent water quality in most streams, but some problems are associated with dischargers in the North Toe River near Spruce Pine. Degraded areas include the North Toe River at Penland (Fair or Good-Fair), Little Bear Creek (Poor), and Brushy Creek (Good-Fair). Some improvement has been observed at the Penland site, going from Fair in 1985-1987 to Good-Fair in 1989 and 1992. The proposed endangered mussel *Alasmodonta raveleniana* has been found in the Nolichucky and North Toe Rivers.

Most of the South Toe River watershed has been designated as Outstanding Resource Waters, but the upper North Toe River and the Nolichucky River both appear to have some problems with sedimentation. Fisheries information suggested that the South Toe ORW section might be extended to include the lower seven miles, and benthos collections suggested that Big Rock Creek may qualify for ORW or HQW classification.

Two specimens of the blotched logperch, Percina burtoni, were collected in the lower portion of the South Toe River which is currently classified C-Tr. All of the South Toe River upstream of US-19E is classified ORW. Only the lower seven miles of this river are not. The South Toe River is the only known location of the blotched logperch in North Carolina. The site where this species was collected also received an Excellent ecological health rating.

POTENTIAL HQW/ORW STREAMS
Based on recent biological investigations, Big Rock Creek and its tributaries may qualify for HQW or ORW.

4.3.7 Subbasin 07 - Cane River Watershed

DESCRIPTION
This subbasin includes the entire Cane River catchment. About two-thirds of this subbasin is within the Pisgah National Forest, including most of the subbasin south of NC 19, plus the area north of Bald Mountain Creek. Minor development is located in the middle of the subbasin near the Town of Burnsville. Burnsville's WWTP is the only major discharger. Major tributary streams in subbasin 07 include Bald Mountain Creek and Bald Creek. Cane River and its tributaries are classified as WS-II upstream of the Town of Burnsville water supply intake. Below the water intake, most stream segments are classified as C-Tr. Bowlens Creek is classified as HQW based on its native and special native trout waters status.

OVERVIEW OF WATER QUALITY
Chemical and biological collections have been limited to the downstream portion of the Cane River subbasin. These collections include chemistry at a single ambient site (Cane River near Sioux), two invertebrate sites (Cane River and Bald Mountain Creek), and fish collections at four Cane River sites.The proposed endangered mussel *Alasmodonta raveleniana* has been found in the Cane River at US-19W.

Water chemistry data has shown few violations of water quality criteria, although the river is frequently turbid. The biological information, however, shows a clear improvement in water quality likely reflecting the improvements at the Burnsville WWTP. Benthic macroinvertebrate collections showed a change in bioclassification from Good-Fair (1983-1985), to Good in 1987 and 1989, and to Excellent in 1992. Fish collections in 1992 and 1993 also indicated Excellent water quality in the lower part of the Cane River.

French Broad River Basin
040307

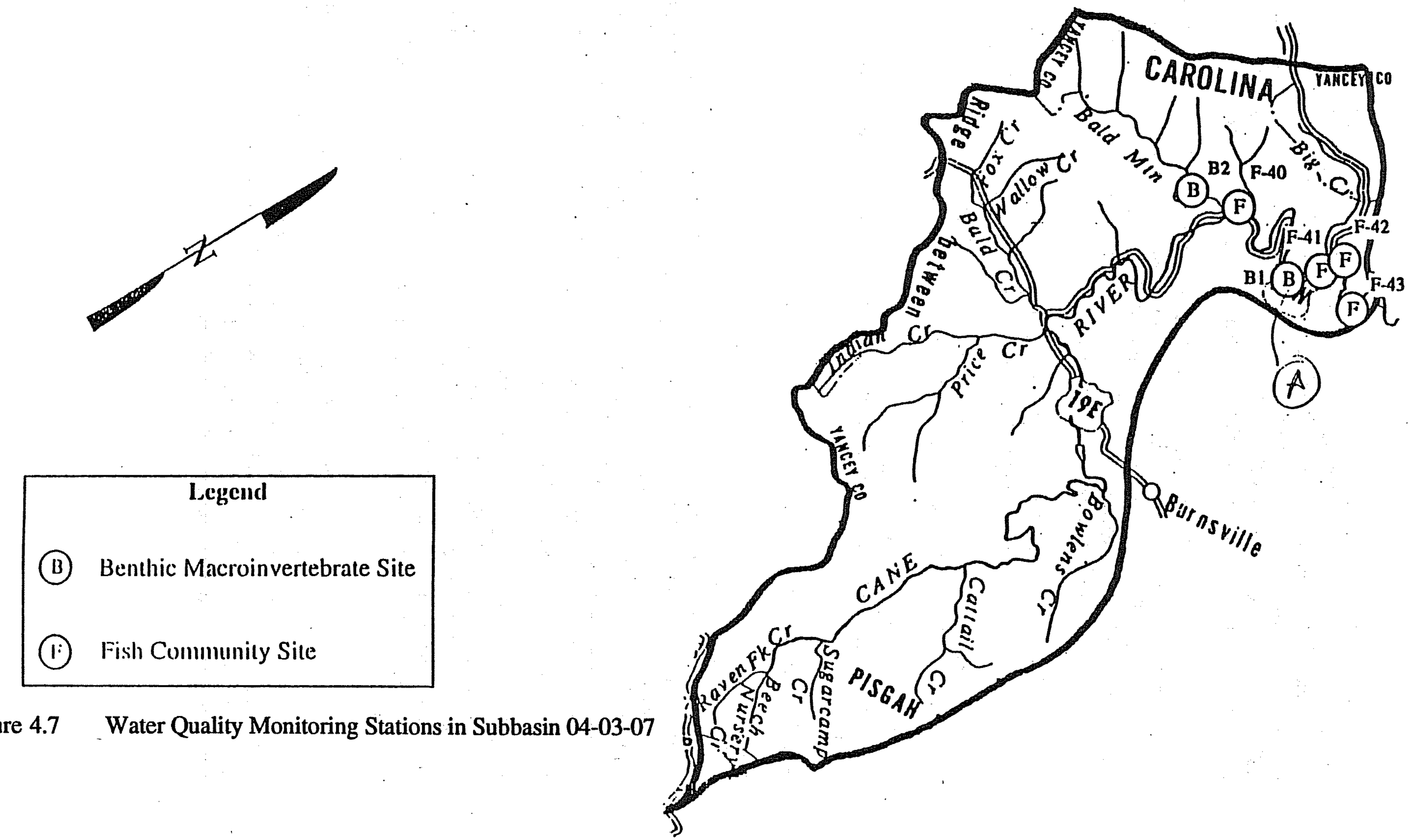


Figure 4.7 Water Quality Monitoring Stations in Subbasin 04-03-07

4.4 USE-SUPPORT: DEFINITIONS AND METHODOLOGY

Determining the *use support* status of a waterbody, that is how well a waterbody supports its designated uses, is a method of interpreting water quality data and assessing water quality. Use support assessments are presented in Section 4.5 using figures, tables and maps for freshwater streams and lakes within the French Broad River Basin. The methodology used in determining use support is presented in Appendix V.

Surface waters (e.g. streams, lakes and impoundments) are rated as either *fully supporting* (S), *support-threatened* (ST), *partially supporting* (PS), or *nonsupporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life support and swimming) are being fully supported, partially supported or are not supported based on assessment of water quality. The support-threatened category for freshwater rivers and streams refers to those waters classified as Good-Fair based on water quality data, in contrast to Excellent or Good which are considered fully supporting. An overall support rating, however, does include <u>both</u> fully supporting and support-threatened waters. Streams which had no data to determine their use support were listed as non-evaluated (NE).

It should be noted that the use support ratings are most directly applicable to assessing the aquatic life support capabilities of the rated water bodies and less applicable toward assessing potential human health concerns. There are two reasons for this. First, most of the ratings are based on either biological data collection or on "evaluated" information from workshops held in the late 1980s (much of the evaluated data was based on best professional judgement which addressed sedimentation concerns). Water chemistry data (which measures heavy metals and other parameters) and fecal coliform data (an indicator of disease organisms) are collected at just 29 locations throughout the basin (locations are shown in Figures 4.1 through 4.7). Sites where fecal coliform bacteria levels have been found to be higher than the state standard of 200/100 ml are shown under the problem parameters column in Table 4.2 (the number in parentheses indicates the percent of samples that are above the standard). Second, in assigning an overall use support rating to a stream, biological data are weighted more heavily than fecal coliform or chemical data. As an example, the French Broad River near Skyland in subbasin 03 (station number 3447840) is assigned a fully supporting rating because the biological rating is Good even though the fecal coliform levels were measured above the standard 43% of the time. In summary, the use support ratings provide a reasonable indication of the overall biological health of a water body, while the potential health risk for human body contact and drinking water can only be inferred from these ratings (except in areas in close proximity to ambient water quality monitoring stations where more definitive information is available).

For the purposes of this document, the term *impaired* refers to waters that are rated as either partially supporting or not supporting their uses based on specific criteria discussed more fully in Appendix V. There must be a specified degree of degradation before a stream is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad.

4.5 USE SUPPORT RATINGS FOR THE FRENCH BROAD BASIN

Use support ratings and background data for all monitored stream segments are presented in Table 4.2. Ratings for all monitored and evaluated surface waters are presented on color-coded maps in Figure 4.8. Stream use-support ratings are summarized by subbasin in Table 4.3 and Figure 4.9

4.5.1 Freshwater Streams and Rivers

Of the 4116.6 miles of freshwater streams and rivers in the French Broad basin, use support ratings were determined for 86% or 3522 miles with the following breakdown: 51% were rated

Table 4.2 Summary of Use Support Ratings for Monitored Stream Segments - French Broad River Basin (page 1 of 3)

Station Number	Station Location	Classification	Supple. Class.	Index Number	Miles	Chemical Rating 89-93	1988	1989	1990	1991	1992	Problem Parameters	Overall Use Support	Source
							<---------Biological Rating----------->							
SUBBASIN 40301														
3439000	French Broad River at Rosman, US Hwy 168	C TR		6-(1)	20.2	PS	Excellent	Excellent	Excellent		Excellent	pH(11.4),Turb(10.2)	S	
	West Fork French Broad above trout farms, off NC 281,	C TR		6-2-(0.5)a	2.8				Excellent/Excellent				S	
	West Fork French Broad, below Trout Farms at 1306, t	C TR		6-2-(0.5)b	0.5				Fair				PS	
	West Fork French Broad at NC 281, Transylvania Co.	C TR		6-2-(0.5)c	0.6			Good-Fal	Good/Good				S	
	West Fork French Broad at SR-1312, Transylvania Co.	C TR		6-2-(0.5)d	4.3						Excellent		S	
	Parker Creek, SR 1310, Transylvania	C Tr		6-2-4	4.4			Good					S	
	West Fork French Broad at NC 64, Transylvania Co.	C Tr HQW		6-2-(7.5)a	3.7			Excellent			Excellent		S	P
	West Fork French Broad at NC 64, Transylvania Co.	C Tr HQW		6-2-(7.5)b	1.1						Excellent		S	
	North Fork Flat Creek, source to Flat Creek SR 1319	C Tr		6-2-10-1	3.6			Good					S	
	North Fork French Broad at NC 215	C Tr		6-3-(6.5)a	0.4			Excellent					S	
	North Fork French Broad at SR-1324, Transylvania Co.	C Tr		6-3-(6.5)b	0.9			Good					S	
	North Fork French Broad at SR-1322, Transylvania Co.	C Tr		6-3-(6.5)c	9.0			Excellent			Excellent		S	
	Tucker CreekSR 1325, Transylvania	C Tr		6-3-10	5.4			Good-Fair					ST	NP
	Middle Fk French Broad Rv NC 178, Trans.	C Tr		6-5	4.2			Good					S	
	East Fork French Broad at SR-1105 & 1007, Transylvan	C Tr HQW		6-6-	11.5			Excellent/Excellent					S	NP
	Catheys Creek at SR-1338, Transylvania Co.	WS-II Tr (HQW)		6-16-(0.5)	4.3			Excellent				Sed	S	NP
3443000	French Broad River at Blantyre, SR-1503	C		6-(27)	26.9	PS						Fecal (21.7)	PS	NP
3441440	Little R from NC 276 to nr Cedar Mt, be High Falls, ab B	C Tr		6-38-(1)b	10.1	PS		Good				pH(24.1)	S	NP
	Little River at SR 1533 Transyl.	C		6-38-(20)	4.8						Good -Fair	Sed	ST	NP
SUBBASIN 40302														
3446363	Mud Creek at SR-1508 above & below WWTP, Henderso	C		6-55-(1)	15.2	NS					Poor	Fecal(78.9),Turb(10.5)	NS	P
	Bat Fork at SR-1807, NC 176 , SR-1809, SR-1803, SR ·	C		6-55-8-1	4.8			Poor					NS	NP,P
	Clear Creek, SR 1513, Henderson Co.	C		6-55-11-(5)	6.3						Poor		NS	NP
3451500	French Broad River near Asheville, SR-1348	C		6-(67.5)a	11.5	NS					Good-Fair	Fecal(57.1)	ST	
3451926	French Broad River at Alexander, SR-1634	C		6-(67.5)b	9.6	NS			Good-Fair		Fair	Fecal(45.5),Turb(18)	PS	
3453500	French Broad River at Marshall, NC Hwy 213	C		6-(67.5)c	33.9	NS	Fair		Good-Fair		Good-Fair	Fecal(56.8),Turb(16)	ST	P
	Hominy Cr., SR 1141, Luther , Buncombe Co.	C		6-76a	6.4			Good-Fair				Sed	ST	NP
	Hominy Cr., NC 151 @ Candler, Buncombe Co.	C		6-76b	3.3						Good	Sed	S	NP
	Hominy Cr., NC 112 ab. Enka Lake, Bumcombe Co.	C		6-76c	3.1						Fair	Sed	PS	NP
344876545	Hominy Cr., SR 3412 @ Sand Hill, Buncombe Co.	C		6-76d	8.7	NS					Poor	Sed, Fecal(71.4)	NS	NP, P
	S Hominy NC 151 at Cndler, Buncombe	C Tr		6-76-5	6.4						Good-Fair		ST	
	Swannanoa River, NC 81/240, Buncombe Co.	C		6-78d	10.6		Fair						PS	NP
	Swannanoa River US 25 nr Biltmore	C		6-78e	0.2		Fair						PS	NP
3451000	Swannanoa River at Biltmore	C		6-78f	1.3	NS	Poor	Fair			Good-Fair	Fecal(47.6), Hg(19.4)	ST	NP
	Flat Cr, nr Hwy 9 ab Big Piney Cr, Buncombee	C HQW		6-78-6-(1)	2.4					Excellent			S	P
	Big Slaty Br, nr Hwy 9 ab Slay Br. Bun	C HQW		6-78-6-2	0.8					Excellent			S	
	Little Slaty Br, nr Hwy 9 ab Big Piney Cr, Buncombe	C HQW		6-78-6-3	1.1					Excellent			S	
	Big Piney Cr, nr Hwy 9 nr Montreat, Bun.	C HQW		6-78-6-5	1.0					Excellent			S	
	Laurel Br, nr mouth, Buncombe	B Tr		6-78-8-(2)	1.5						Excellent		S	
		C HQW		6-78-10-(1)	1.0					Excellent			S	
3450000	Beetree Creek near Swannanoa	WS-I (HQW)		6-78-15-(1)	4.3	PS						pH (12.2)	PS	
	Newfound Creek at SR-1296 Buncombe Co	C		6-84a	3.9		Excellent	Excellent				Sed	S	NP
	Newfound Creek at SR-1297 and Vickle Lane	C		6-84b	1.3			Fair				Sed	PS	NP

Table 4.2 Summary of Use Support Ratings for Monitored Stream Segments - French Broad River Basin (page 2 of 3)

Station Number	Station Location	Classification	Supple. Class.	Index Number	Miles	Chemical Rating 89-93	Biological Rating 1988	1989	1990	1991	1992	Problem Parameters	Overall Use Support	Source
	Newfound Creek at SR-1378, Buncombe Co.	C		6-84c	2.3		Fair					Sed	PS	NP
	Newfound Creek at SR-1622, Buncombe Co.	C		6-84d	6.6		Poor	Fair				Sed	NS	NP
	Reems Creek, NC 251, Buncombe Co.	C		6-87-(10)	4.2						Good-Fair		ST	
	Flat Creek, Hwy. 70, Buncombe Co.	C		6-88a	12.3		Fair					Sed	PS	NP
	Flat Creek, SR 1741 Buncombe	C		6-88b	0.1		Good-Fair					Sed	ST	NP
	Sandymush Cr, SR 1114 Madison/SR1607 Buncombe	C		6-92-(9)	11.1						Excellent	Sed	S	NP
SUBBASIN 40303														
3441000	Davidson River near Brevard, US Hwy 64/B1 is at 276 c	WS-V Tr		6-34-(17)	2.3	PS					Excellent	pH (25)	S	
3447840	French Broad River near Skyland, NC Hwy 280	WS-IV		6-(51.5)	13.2	NS			Good		Good	Fecal (42.9)	S	P
	Boylston Cr, SR 1314, Henderson	WS-IV		6-52-(10.5)	4.2						Good-Fair		ST	
3446000	Mills River near Mills River, SR-1337	WS-II Tr		6-54-(1)	2.8	S	Excellent		Excellent		Excellent		S	
344495065	Bradley Creek off SR 1345 nr Yellow Gap (3 sites)	WS-I ORW		6-54-3-17	2.6	NS				Excellent		pH (31.6)	S	
	Mills R, SR 1353	WS-IV		6-54-(5)	2.6						Good		S	NP
SUBBASIN 40304														
	Ivy Creek (River), SR 2150, Buncombe	WS-II (HQW)		6-96-(0.5)	7.7						Excellent	Sed	S	NP
	Little Ivy Cr, SR 1610, Madison	WS-II (HQW)		6-96-10	4.7						Good	Sed	S	NP,P
	Ivy Cr NC 25/70 Bus, Madison	C		6-96-(11.7)	10.2						Good	Sed	S	NP
	Hunter Cr nr Hunter Cr R nr Marshal, Madison	C HQW		6-106-2-(1)	1.3					Excellent			S	NP
	Big Laurel Cr NC 208 Madison	C Tr		6-112	33.1						Excellent		S	P
	Shelton Laurel Creek at NC 212, Madison Co.	C Tr		6-112-26	17.2				Excellent		Good		S	
	Hickory Fork at SR-1310, Madison Co.	C Tr		6-112-26-7	1.1				Excellent				S	
	West Prong Hickory Fork at SR 1310, Madison Co.	C Tr		6-112-26-7-1	2.8				Excellent				S	
	East Prong Hickory Fork at FR 465, Madison Co.	C		6-112-26-7-2	3.6				Excellent				S	
	Spring Cr, NC 209, Madison	C		6-118-(27)	1.8						Good-Fair	Sed	ST	NP
SUBBASIN 40305														
3456991	Pigeon R at NC HWY 215 near Canton, NC Haywood	WS-III Tr		5-(1)	4.2	S	Good-Fair				Good		S	
3455500	West Fork Pigeon River Burnett Siding, and UT W Fk Plg	WS-III Tr		5-(2)	18.2	PS			Excellent	Excellent		pH (18)	S	
	Tom Creek at NC 215, Haywood, Co.	WS-III Tr		5-2-5	1.5					Excellent			S	
	Middle Prong West Fork Pigeon River at mouth, Haywoo	WS-III Tr HQW		5-2-7	3.9				Excellent	Excellent			S	
345541335	Right Hand Prong,Site #2 , 91 BMAN Haywood, Co.	WS-III Tr HQW		5-2-7-7	3.0	PS			Excellent	Excellent		pH(16.7)	S	
	UT Little E Fk Pigeon R, nr Shining Rock. Haywood	WS-III Tr HQW		5-2-12-(0.5)	4.0					Excellent			S	
	Little East Fork Pigeon River, SR 1129 ab camp, Haywo	WS-III Tr HQW		5-2-12-(5.5)	4.2					Excellent			S	
3456991	Pigeon R at NC HWY 215 near Canton, NC Haywood	WS-III Tr HQW		5-(6.5)	0.6	S	Good-Fair				Good		S	
3457124	Pigeon River at Clyde, SR-1642	C		5-(7)a	7.0	NS	Fair/Poor	Fair			Fair	Dioxin, Fecal(31.8)	PS	P
	Pigeon River at Crabtree Ck nr Crabtree Haywd B-12	C		5-(7)b	7.9		Fair					Dioxin	PS	P
3459780	Pigeon River near Hepco, SR-1338	C		5-(7)c	7.0	NS	Fair					Dioxin, Fecal (52.4)	PS	P
	Pigeon River at Hurrican Cr, Haywood	C		5-(7)d	8.7						Good-Fair	Dioxin	PS	P
	Pigeon River at Counterfeit Br, Haywood	C		5-(7)e	5.4						Good	Dioxin	PS	P
3460766	Pigeon River at Waterville, SR-1184	C		5-(7)f	2.6	S	Good	3ood/Fair	Good-Fair			Dioxin	PS	P
	Bus 23 above Dayco, Haywood Lake Junaluska Dam/SR	B		5-16-(1)a	8.0						Fair		PS	
3458121	Richland Creek near Waynesville, SR-1184	B		5-16-(1)b	6.7	NS	Fair				Good-Fair	Fecal (57.8)	ST	
	Rocky Br, SR 1219 haywood	C HQW		5-16-7-9-(1)	2.3					Excellent			S	
	Richland Cr SR 1519, Haywood	C		5-16-(16)	2.4						Fair	Sed	PS	NP

Table 4.2 Summary of Use Support Ratings for Monitored Stream Segments - French Broad River Basin (page 3 of 3)

Station Number	Station Location	Classification	Supple. Class.	Index Number	Miles	Chemical Rating 89-93	Biological Rating 1988	1989	1990	1991	1992	Problem Parameters	Overall Use Support	Source
	Jonathons Creek at SR 1306	C Tr		5-26-(7)a	1.2						Excellent	Sed	S	NP,P
	Jonathons Creek at SR 1322 Haywood	C Tr		5-26-(7)b	8.0						Good	Sed	S	NP
345887470	Jonathons Creek at US HWY 276 (or SR 1350) nr Cove	C Tr		5-26-(7)c	5.3	PS					Good-Fair	Sed, Turb (14.3)	ST	NP,P
	Fines Cr, SR 1355 nr I 40 Haywood	C		5-32	10.4						Good-Fair		ST	NP
3460000	Cataloochee Creek near Cataloochee at SR-1395, Hay	C Tr ORW		5-41	8.5	S		Excellent	Excellent	Excellent	Excellent		S	
	UT Rough Br, nr SR 1395, Haywood	C Tr ORW		5-41-1	4.6					Excellent			S	
	Palmer Creek nr SR 1395, Haywood Co.	C Tr ORW		5-41-2	3.2					Excellent			S	
	Pretty Hollow Creek nr SR 1395, Haywood Co.	C Tr ORW		5-41-2-4	3.7					Excellent			S	
	Lower Double Creek at SR-1397, (ab Cataloochee Cr nr	C Tr ORW		5-41-6	1.2				Excellent				S	
	Little Cataloochee Creek at SR-1397, Haywood Co.	C Tr ORW		5-41-10	1.7				Excellent				S	
	Cold Sprs Cr, Gov Rd nr cmpg Haywood	C Tr		5-45	6.2						Excellent	Sed	S	NP
SUBBASIN 40306														
3464500	Nolichucky River at Poplar SR-1321	C		7	10.0	S	Good		Good		Good		S	
3461976	North Toe River near Ingalls, US Hwy 19E, Avery Co.	WS-III Tr		7-2-(0.5)a	23.8	PS	Good	Good			Good	Turb (16.1)	S	P
	North Toe River 19E, below Brushy Creek, Avery Co.	WS-III Tr		7-2-(0.5)b	15.8			Good/Fair					ST	
	Above and Below the Landfill, Avery Co.	WS-III Tr		7-2-29-	3.6			Good/Fair				Sed	ST	NP,P
3463021	North Toe River at Penland , SR-1162, Mitchell Co.	C Tr		7-2-(38.5)d	1.3	NS	Poor	Good/Fair			Good/Fair	Turb(32.3),Fecal(22.7)	ST	NP
	North Toe River SR 1314, Yancey	C Tr		7-2-(38.5)e	28.0						Good		S	NP
	Crabtree Cr at SR 1002, Mitchell	C Tr		7-2-48	15.5						Good		S	
3463160	South Toe River near Deep Gap	B Tr ORW		7-2-52-(1)a	1.3	NS						pH(26.8),Hg(10.7)	*S	NP
	South Toe River above and below NC 80 bridge	B Tr ORW		7-2-52-(1)b	9.0				Excellent		Excell/Good		S	
3463300	South Toe River near Celo, SR-1168	B Tr ORW		7-2-52-(1)c	15.0	PS	Excellent				Excellent	pH(20.8)	S	
	Big Rock Cr, NC 197, Mitchell	C Tr		7-2-64	14.6						Excellent		S	
SUBBASIN 40307														
3464000	Cane R SR 1417, nr 19W, nr Ramseytown, Yancey	C Tr		7-3-(13.7)	23.9	NS		Good			Excellent	Turb(33.3), Temp(13.3	S	P
	Bald Mt Cr, SR 1408, Yancey	C Tr		7-3-32	8.4						Good-Fair		ST	

Explanation of Column Headings

Station Number	Refers to sites where ambient water quality data (physical and chemical data) are collected monthly
Station Location	Locations for all monitoring sites (biological and chemical). See Section 4.2 for descriptions.
Classification	Water quality classification of monitored stream segment. See Section 2.5 (Chapter 2) and Appendix II.
Supple. Class.	Supplemental Classifications. See Section 2.5 (Chapter 2) and Appendix II.
Index Number	Reference number used by DEM to identify specific stream segments
Chemical Rating	Lists the use-support rating for that station based on chemical monitoring data. See Table 4.1 for types of data collected. Ratings are explained in Section 4.4.
Biological Rating	These ratings are based on sampling and evaluation of bottom-dwelling aquatic insect larvae (benthic macroinvertebrates) and fish. There are five ratings: Excellent, Good, Good-Fair, Fair and Poor. See Appendix II for further details.
Problem Parameters	Causes of water quality impairment are listed if either the chemical rating is PS (partially supporting) or NS (not supporting) The numbers in parentheses refer to the percentage of samples which exceed the water quality criteria at that station.
Overall Use Support	Provides the use support rating based on weighing the chemical and biological ratings. The biological ratings are given more weight. See Section 4.4 for further explanation

Key to Abbreviations

Fecal	Fecal Coliform Bacteria
Hg	Mercury
NP	Nonpoint Sources
NS	Not Supporting
P	Point Sources
PS	Partially Supporting
Sed	Sediment
ST	Support-threatened
Temp	Temperature
Turb	Turbidity

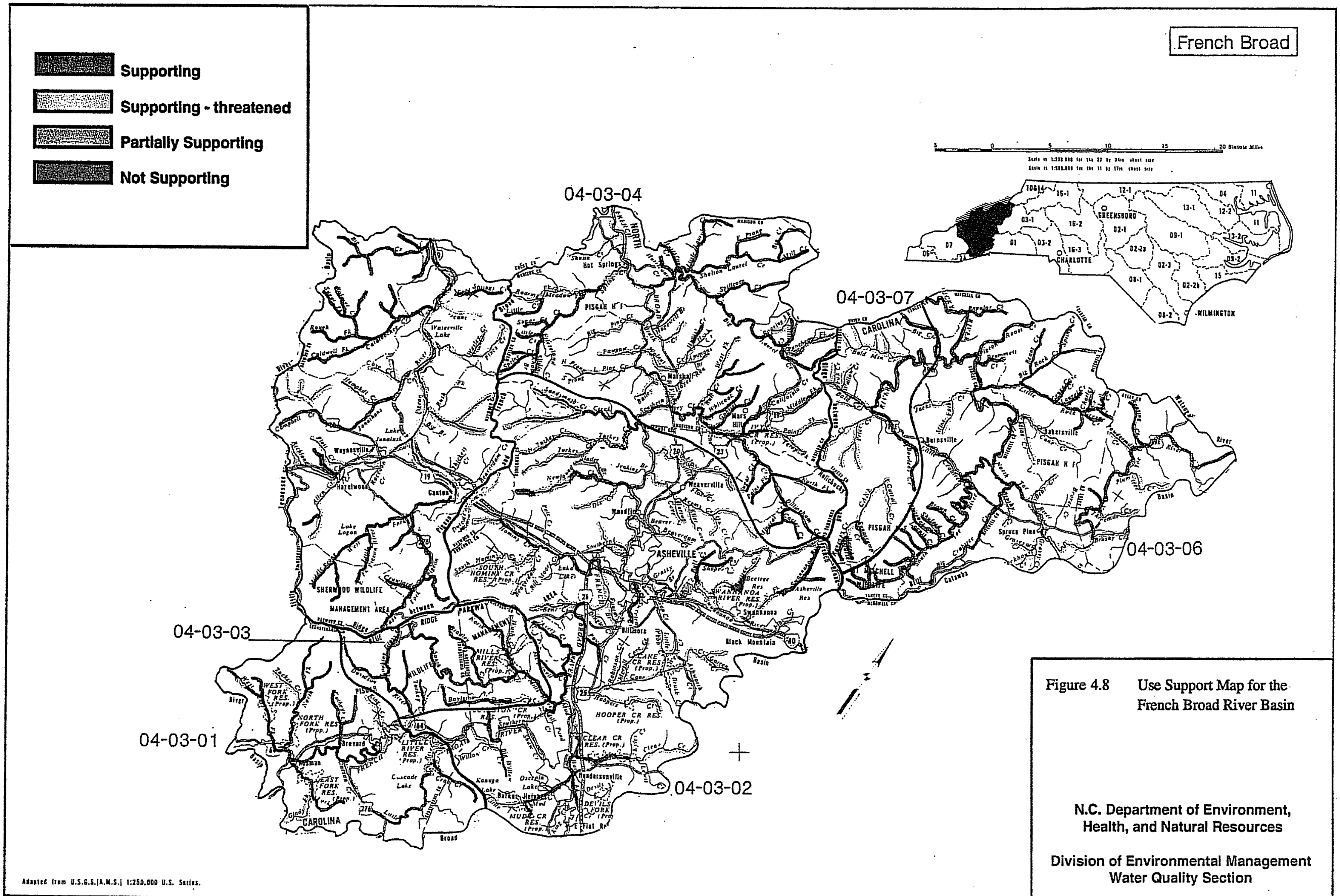


Figure 4.8 Use Support Map for the French Broad River Basin

N.C. Department of Environment, Health, and Natural Resources

Division of Environmental Management
Water Quality Section

Table 4.3 Use Support Ratings for Freshwater Streams by Subbasin

USE SUPPORT STATUS FOR FRESHWATER STREAMS (MILES) (1988-1992)						
Subbasin	S	ST	PS	NS	NE	Total Miles
40301	327.7	52.3	34.6	0.4	25.3	440.3
40302	132.8	298.2	179	53.5	306.2	969.7
40303	223.6	6.2	4.2	0	2.8	236.8
40304	433	132	77.9	0	111.9	754.8
40305	409.4	158.8	71.6	3.5	133.8	777.1
40306	474.3	206.8	26.5	0.5	9.6	717.7
40307	97.8	113.7	3.9	0	4.8	220.2
TOTAL	2098.6	968	397.7	57.9	594.4	4116.6
PERCENTAGE	51	24	10	1	14	100

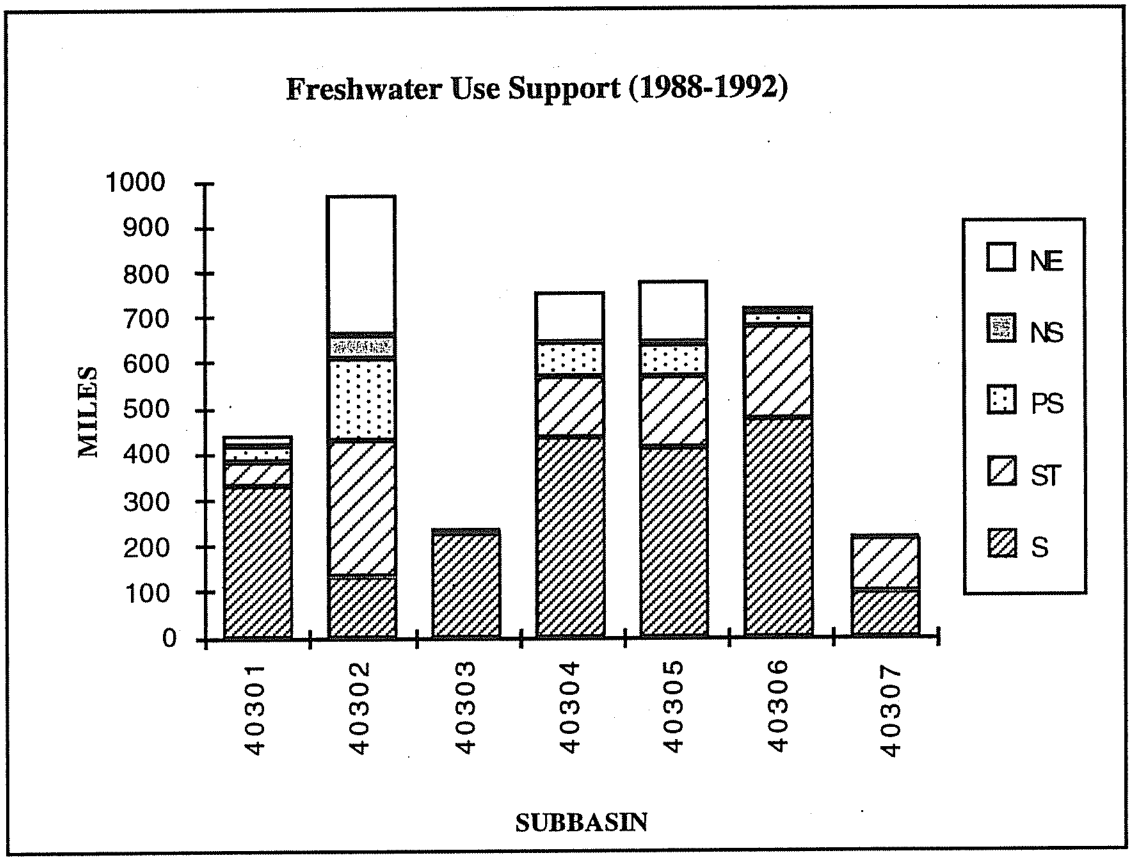


Figure 4.9 Bar Graph Showing Freshwater Use Support Distribution by Subbasin

fully supporting, 24% support-threatened, 10% partially supporting, one percent not supporting, and 14% nonevaluated. Table 4.3 and Figure 4.9 present the use support determinations by subbasin. In general, subbasins 01 and 03 through 07 had a majority of their streams which were either supporting or support-threatened. Subbasin 02, which includes the Asheville and Hendersonville urban areas, had a larger percentage of streams which were partially supporting or not supporting.

Probable causes and sources of impairment were determined for about 78% of the impaired streams with the information summarized in Tables 4.4 and 4.5. When a stream segment had more than one cause or source listed, the total stream segment information was added to each cause or source. This means that the miles of stream impaired by the combination of all sources or all causes may be more than the total miles of partially and not supporting streams presented in Table 4.3. As an example, if a 10-mile long stream segment was determined to be impaired as a result of both point sources and urban development, then 10 miles would be entered under both the urban

Table 4.4 Sources of Use Support Impairment in Freshwaters of the French Broad Basin

PROBABLE SOURCES OF USE SUPPORT IMPAIRMENT (MILES)									
Subbasin	Non-Point Source	Point Source	Agriculture	Forestry	Constr.	Urban	Mining	Land Disposal	Unknown
40301	34.5	27.3	28.9	0	4.2	26.9	0	0.4	1
40302	182.9	53.6	138	0	55.3	40	0	22.6	6.9
40303	4.2	0	0	0	0	4.2	0	0	0
40304	77.3	0	53.2	0	0	0	0	0	24.1
40305	28.5	0	17.6	4.9	0	2.4	0	0	10.9
40306	24.6	0	18	5.8	1.1	1.1	3.6	0.5	3
40307	3.9	0	0	0	0	0	0	0	3.9
Total Miles	355.9	80.9	255.7	10.7	60.6	74.6	3.6	23.5	49.8
% of PS and NS	78	18	56	2	13	16	1	5	11

* **Total Miles** = miles of impaired streams where a probable source has been identified.
** **PS** = Partially supporting; **NS** = Not supporting; PS and NS = Impaired streams.
Total miles of impaired streams (PS+NS) = 455.6 miles (from Table 4.4)

Table 4.5 Major Causes of Use Support Impairment in Freshwaters in the French Broad Basin

CAUSES OF USE SUPPORT IMPAIRMENT (MILES)					
Subbasin	Sediment	Fecal	Dioxin	Turbidity	pH
40301	4.2	26.9	0	0	0
40302	155.1	33.5	0	24.8	4.3
40303	4.2	0	0	0	0
40304	77.3	0	0	0	0
40305	20.4	14	38.6	0	0
40306	1.1	0	0	0	0
40307	3.9	0	0	0	0
Total Miles	266.2	74.4	38.6	24.8	4.3
% of PS and NS	58	16	8	5	1

column and point source column in Table 4.4. Where the sources of impairment could not be identified, no mileage for that segment was entered into the table. Sediment was the most widespread cause of impairment, followed by fecal coliform bacteria, dioxin, turbidity and pH.

Information on sources of impairment for stream miles rated partially or not supporting indicated that 356 stream miles were impaired by nonpoint sources, and 81 stream miles were impaired by point sources. Agriculture was the most widespread nonpoint source, followed by urban runoff, and construction. Subbasins 02 and 04 had the highest number of streams thought to be impaired by agriculture and subbasins 01 and 02 had the highest number attributed to urban runoff.

4.5.2 Lakes

Seven lakes in the French Broad Basin, totaling 1,373 acres, were monitored and assigned use support ratings (Table 4.6). Of these 7, six are fully supporting their uses and one is partially supporting its uses.

Four of the seven lakes are located in subbasin 02. Lake Julian, Burnett Reservoir, and Beetree Reservoir are all designated as water supplies, and all have been found to be oligotrophic. The fourth lake, Busbee Reservoir, is classified as C and is also oligotrophic. All four lakes fully support all of their designated uses.

In subbasin 05 (Pigeon River watershed), Allen Creek Reservoir is classified as WS-I and is fully supporting. This lake was selected to be evaluated as a potential regional reference lake in 1991. Extensive monitoring during the last three years have shown nutrients, chlorophyll *a*, algae biovolume and density all to be low. Lake Junaluska is classified B and supports its designated uses. It is mesotrophic and has had historic problems with sedimentation and eutrophication. The sedimentation has increased primarily due to highway construction and residential growth in the watershed.

Waterville Lake is classified as C, and it has been rated as partially supporting its designated uses based on a fish consumption advisory for carp and catfish (due to elevated dioxin levels) and on high nutrient levels in the lake. Champion mill and several other wastewater treatment plants discharge to waters upstream of Waterville Lake. In 1988, DEM and EPA collected fish from the Pigeon River and Waterville Lake and analyzed the tissue for dioxin. Elevated dioxin levels were found in the fish tissues of all species and an advisory was issued by the state not to consume any fish from the river and lake. The lake was rated as not supporting its uses. Champion implemented a dioxin minimization plan in the mid to late 1980s and completed a plant modernization project in April 1994 which has essentially eliminated dioxin in its effluent. More recent fish tissue analyses found reduced dioxin levels. In response to the most recent tissue sampling data, the State Health Director adjusted the advisory to state that it would apply to just carp and catfish. The current advisory reads as follows:

> "Carp and catfish in the Pigeon River may contain low levels of dioxins and should not be consumed. Consumption of all other fish species is not considered to present a health risk and are not affected by this advisory. Swimming, boating and other recreational activities present no health risk."

Monitoring for dioxin in carp and catfish tissue will continue at Waterville Lake annually. Champion also reports substantially reduced discharges of ammonia nitrogen, orthophosphate and organic nitrogen and phosphorus resulting from its plant improvements. DEM is recommending that a nutrient budget be developed for the lake and that a nutrient management plan addressing both point and nonpoint pollution sources be developed. The use-support rating for Waterville

Lake and the other lakes in the basin will be reevaluated based on upcoming monitoring in preparation for the French Broad River basin plan update in 2000.

Table 4.6 Lakes Use Support Status and Causes and Sources of Impairment

LAKE NAME	County Name	Size Acres	Class	Over-all Use	Fish Adv	Aq. Life & Secondary Contact	Swim-ing	Drink-ing Water	Trophic Status	Problem Parameters
Subbasin 02										
LAKE JULIAN	Buncombe	320	C	S	S	S	n/a	n/a	Oligo.	
BURNETT RESER	Buncombe	330	WS	S	S	S	n/a	S	Oligo.	
BEETREE RESER	Buncombe	41	WS	S	S	S	n/a	S	Oligo.	
BUSBEE RESER	Buncombe	8	C	S	S	S	n/a	n/a	Oligo.	
Subbasin 05										
WATERVILLE LK	Haywood	340	C	PS	PS	PS	n/a	n/a	Eutro.	Priority Organ-ics, Nutrients
LAKE JUNALUSKA	Haywood	200	B	S	S	S	S	n/a	Meso.	(sediment)
ALLEN CREEK RES	Haywood	120	WS	S	S	S	n/a	S	Oligo.	

REFERENCES - Chapter 4

Futrell, Ken. United States Department of Agriculture, Natural Resources Conservation Service. personal communication, 1994.

Maas, R.P., D.J. Kucken, and S.C. Patch. 1993. Water Quality of Buncombe County Streams: Year 3 Results of Volunteer Water Information Network Sampling. UNC-Asheville, Environmental Quality Institute. Technical Report No. 93-002.

North Carolina Department of Environment, Health, and Natural Resources, Division of Environmental Management. 1992. North Carolina Lake Assessment Report. Report No. 92-02.

North Carolina Division of Environmental Management, 1994. Basinwide Assessment Report Document for the French Broad River Basin (Final Draft), Water Quality Section, Environmental Sciences Branch, Raleigh, NC.

Yurkovich; S.P. 1984. Non-Point Sources of Pollution in the Lake Junaluska Watershed. Center for Improving Mountain Living, Western Carolina University.