LAKE & RESERVOIR ASSESSMENTS
FRENCH BROAD RIVER BASIN

Beetree Reservoir

Intensive Survey Unit
Environmental Sciences Section
Division of Water Quality
March 3, 2008

Overview

The French Broad River basin covers 2,842 square miles with 4,113 miles of streams and is the ninth largest river basin in the state. It is located in the Blue Ridge Mountains and includes part or all of Transylvania, Buncombe, Henderson, Madison, Haywood, Yancey, Mitchell and Avery counties. All waters from the basin drain to the Gulf of Mexico *via* the Tennessee, Ohio, and Mississippi Rivers. The French Broad River Basin includes Mount Mitchell (elevation 6,684 feet), the highest mountain east of the Rocky Mountains. Much of the basin lies within the 1.2 million acre Pisgah National Forest or Pisgah Game Lands. The northwest corner of Haywood County is in the Great Smoky Mountains National Park. Over one-half of the basin is forested and the steep slopes limit the area suitable for development and crop production. The basin is composed of three major drainages, the French Broad, Pigeon, and Nolichucky Rivers, that individually flow north into Tennessee.

Four lakes were sampled in this river basin by DWQ staff in 2007. These lakes were: Beetree Reservoir, Lake Julian, Kenilworth Lake and Lake Junaluska. Lake Junaluska was placed on the 303(d) List of Impaired Waters in 2006 due to water quality standard violations related to elevated pH values.

Following the description of the assessment methodology used for the French Broad River Basin, there are individual summaries for each of the lakes and a two-paged matrix that distills the information used to make the lakes use support assessments. For additional information on a particular lake (including sampling data), please go to http://www.esb.enr.state.nc.us/.

Assessment Methodology

For this report, data from January 1, 2003 through September 30, 2007 were reviewed. All lakes were sampled only during the summer of 2007 in May through September. Data were assessed for excursions of the state's class C water quality standards for chlorophyll *a*, pH, dissolved oxygen, water temperature, turbidity, and chloride. Other parameters discussed in this report include Secchi depth and percent dissolved oxygen saturation. Secchi depth provides a measure of water clarity and is used in calculating the trophic or nutrient enriched status of a lake. Percent dissolved oxygen saturation gives information on the amount of dissolved oxygen in the water column and may be increased by photosynthesis or depressed by oxygen-consuming decomposition.

On lakes without obvious segmentation or differences in hydrology and morphology between stations, all samples taken on a particular sampling date regardless of station are treated as replicates and the average concentration is used to determine if the standards are being met. Readings of pH are the only exception as it is inappropriate to average pH values. See the matrix at the end of this report for how the stations are grouped.

A water quality standard is exceeded (denoted by CE in matrix) if data values do not meet the state's water quality standard for more than 10% of the samples where the sample size consists of 10 or more observations for the basinwide assessment period. Ideally, ten observations are needed to provide sufficient data to reasonably interpret water quality conditions within the lake or reservoir. Fewer observations increase the possibility of misinterpreting random unusual conditions as representative of ongoing water quality trends. If the water quality standard is exceeded, either in less than 10% of the data collected during the assessment period or if the sample observation size is less than 10 for the basinwide assessment period, then the water quality standard for that parameter is designated exceeded (E in the matrix).

Additional data considered as part of the use support assessment include historic DWQ water quality data, documented algal blooms and/or fish kills, problematic aquatic macrophytes, or listing on the EPA's 303(d) List of Impaired Waters.

Lakes receive an overall rating of Supporting or Impaired when 10 or more samples per water quality criteria are collected for evaluation within the basinwide assessment period. Otherwise, the lake is considered as Not Rated. The exception is for a lake listed on the 303(d) List of Impaired Waters or where additional data indicates water quality problems not captured during sampling. These lakes are listed as Impaired along with the reason for the impairment.

For a more complete discussion of lake ecology and assessment, please go to http://www.esb.enr.state.nc.us/. The 1990 North Carolina Lake Assessment Report (downloadable from this website) contains a detailed chapter on ecological concepts that clarifies how the parameters discussed in this review relate to water quality and reservoir health.

LAKE & RESERVOIR ASSESSMENTS

Subbasin 040302

Lake Julian

Lake Julian is an impoundment of Powell's Creek, a tributary of the French Broad River. Constructed in 1963, this lake was created as a source of once-through condenser cooling water for the Asheville Steam Electric Plant, which is owned by Progress Energy. Lake Julian has a 12.4 km^2 watershed which is primarily residential and urban. The Lake Julian Park is a county recreational facility operated by Buncombe County Parks and Recreation Services near Skyland, NC. Recreational boating (electric motors, only) and fishing are allowed on the lake. Sport fish caught in Lake Julian include catfish, large mouth bass and tilapia (http://www.buncombecounty.org/GOVERNING/DEPTS/ParksAlive/facilities/parks/LakeJulian.htm).

DWQ staff monitored this reservoir in May through September, 2007. Turbidity values were low in 2007 and Secchi depths, a measurement of water clarity and light penetration into the water column, ranged from 1.7 to 3.5 meters. Nutrient concentrations ranged from low to moderate and chlorophyll *a* values were low.

Mean surface water temperatures in Lake Julian ranged from 25.6 °C in May to 36.5 °C in August. These temperatures are similar to those observed in 1990 and 2002 when Lake Julian were previously sampled by DWQ. The NPDES permit (NC0000396) requires temperature of the discharged water from Outfall 002 (once through cooling water) not to exceed a monthly average of 44.4°C based on daily temperatures. The

mixing zone for Outfall 002 is defined as all of Lake Julian (NPDES Permit NC0000396, November 16, 2005).

Based on the calculated NCTSI scores for 2007, Lake Julian was determined to be consistently oligotrophic (very low biological productivity). This reservoir has been determined to be oligotrophic since it was first monitored by DWQ in 1990. Lake Julian continued to support its designated uses in 2007.

Progress Energy routinely monitors the water quality of Lake Julian. This includes identification of any natural or power plant-induced water quality changes to the lake and any introductions or impacts from nonnative plant and animal species. The study conducted in 2004 determined that Lake Julian continued to have low nutrient concentrations and biological productivity as compared with previous sampling years. Water temperature and dissolved oxygen profiles were also similar to those observed in the previous 10 years. All measured values for arsenic and selenium in the lake were below lower reporting limits (<1 µg/L). Fishery habitat improvement efforts continued in 2002 with the placement of wooden pallet fish attractors in the lake as well as discarded Christmas trees (Progress Energy, June 2005).

Reference:
Progress Energy. June 2005. Asheville Stem Electric Plant, 2004 Environmental Monitoring Report. Environmental Services Section, Progress Energy Service Company. Raleigh, NC.

Beetree Reservoir

Beetree Creek was impounded in 1926 to form Beetree Reservoir, a water supply for the City of Asheville. The City of Asheville owns all of the 20 km^2 watershed which is undeveloped. The lake is not used for recreation, and access is restricted.

Beetree Reservoir was monitored by DWQ staff in May through September, 2007. Secchi depths ranged from 4.0 to 4.5 meters from May through August, but decreased to 2.6 meters in September. The decrease in water clarity in September follows the change in the chlorophyll *a* concentration that increased from 1 to 4 µg/L in May through August to 25 µg/L in September. An increase in algae in the lake water in September may have contributed to a decrease in water clarity. Field notes, however, did not indicate any noticeable color in the lake water.
Nutrient concentrations in Beetree Reservoir were low in 2007. Calculated NCTSI scores in May through August indicated that this reservoir was oligotrophic (very low biological productivity). This changed to

mesotrophic in September (moderate biological productivity) due to the decrease in Secchi depth and increase in chlorophyll *a* concentration. Beetree Reservoir continued to support its designated use as a water supply reservoir in 2007.

Kenilworth Lake

Kenilworth Lake is small reservoir located on Ross Creek in the French Broad River Basin. This lake is situated in the community of Kenilworth, which is part of the City of Asheville, NC. Land use in the upper watershed of Ross Creek consists predominately of established residential areas and pastureland. The mid-watershed consists of a heavily urbanized area along Tunnel Road. The lower watershed consists mainly of residential areas around Lake Kenilworth as well as an older warehouse area and inactive landfill downstream from the lake near Hwy 81, just prior to the confluence with the Swannanoa River.

Kenilworth Lake was monitored by DWQ Staff from April through September, 2007. Nutrient concentrations in this small reservoir ranged from low to elevated and chlorophyll *a* values ranged from low to moderate. Dissolved oxygen values at the sampling site near the dam (FRBLK1) were strongly stratified from June through September with elevated values near the surface and hypoxic conditions occurring at a depth of four meters.

The percent dissolved oxygen concentration near the surface of the lake was greater than 120% in August and September and pH values at the two lake sampling sites were greater than 8.0 s.u. These physical measurements suggest that the productivity of the reservoir increased during these months. The greatest algal growth may have been at a depth of two to three meters from the surface in August. At this depth, the value for dissolved oxygen was 13.7 mg/L and pH was 8.8 s.u. Field notes indicate that the water of the lake had a green color suggestive of an algal bloom. Chlorophyll *a* values ranged 10 µg/L in August to 26 µg/L in September.

Green algae and diatoms dominated the phytoplankton community in June. These algas are considered to be a beneficial food source for fish and other aquatic life. In July, the community shifted to blue-green algas, primarily *Anabaena sp*. and *Aphanizomenon sp*. Blue-green algae are considered to be an indicator of nutrient enrichment. Despite the availability of nutrients in Kenilworth Lake in July, the concentration of algae remained at very low bloom levels.

Based on the calculated NCTSI scores for 2007, Kenilworth Lake was determined to be eutrophic (elevated biological productivity). Nonpoint source nutrient loading from the urbanized watershed into the lake can be contributing to the increased biological productivity of this lake.

Subbasin 040305

Lake Junaluska

Lake Junaluska is a small reservoir located in the mountains of southwestern North Carolina. The lake is privately owned by the Methodist Church and was built by the Lake Junaluska Assembly as a meeting ground for southern Methodists. DWQ monitored this reservoir from April through September, 2007.

Due to drought conditions during the spring and summer of 2007, nonpoint source runoff into Lake Junaluska was reduced. Subsequently, turbidity values were lower than those previously observed by DWQ and Secchi depths were slightly greater. Lake productivity increased, as suggested by elevated dissolved oxygen, pH values and percent dissolved oxygen concentrations. Chlorophyll *a* values, an indicator of increased algae growth in the lake, were elevated on July 17th and August 14th. The chlorophyll *a* value on August 14th at the sampling site near the dam (FRB047C) was 46 µg/L, greater than the state water quality standard of 40 µg/L.

Analysis of algae samples collected from Lake Junaluska indicated the presence of an algal bloom (based on cell densities) in July. This bloom was dominated by the diatom, *Achnanthidium sp*. This alga is usually found attached to aquatic plant stems and leaves and is found in the water column only if it has been sheared away from the surfaces of these plants. Other algae found in water samples included green algae, cryptomonads and chrysophytes, all of which are considered to be beneficial as the base of the aquatic food web.

Lake-wide mean pH values were greater than the state water quality standard of 9.0 s.u. on June 12th and July 17th. Lake Junaluska was placed on the 303(d) List of Impaired Surface Waters in 2006 for elevated pH values. Agricultural, residential and commercial development upstream of Lake Junaluska has resulted in sediment entering the lake from Richland and Factory Creeks. In the past, the solution to this problem has been to lower the level of the lake and dredge out the accumulated sediment. In 2004, as a condition of the NCDENR permit to dredge Lake Junaluska, a three-quarter acre wetland was created on the lake's northwest shore. This wetland will improve the water quality of Lake Junaluska, enhance fish and wildlife habitat and increase citizen awareness of water quality protection by providing an educational element to the lake. In addition to the wetland, a 12 foot wide littoral shelf would be constructed and

planted with native plants and grasses. This structure would also serve to improve fish and wildlife habitat while controlling runoff into the lake (Don Hendershot, May 7, 2003).

Reference:
Hendershot, Don. May 7, 2003. Wetlands installation planned at Lake Junaluska. Smoky Mountain News.

APPENDIX A

FRENCH BROAD RIVER BASIN AMBIENT LAKES USE SUPPORT MATRIX FOR 10/1/2003 - 9/31/2007

	Subbasin	***040302***			***040305***
	Lakes Ambient Program Name	**Lake Julian**	**Beetree Reservoir**	**Kenilworth Lake**	**Lake Junaluska**
	Trophic Status (NC TSI)	Oligotrophic	Oligotrophic	Eutrophic	Mesotrophic
	Mean Depth (meters)	20.0	10.0		5.5
	Volume ($10^6 m^3$)	2.60	1.90		4.50
	Watershed Area (mi^2)	4.6	8		63
	Assessment Unit Name (Gray = changes to AU description)	**Powell Creek from source to French Broad River**	**Beetree Creek from source to Asheville Water Supply Dam**	**Ross Creek (Lake Kenilworth)**	**Richland Creek from Boyd Avenue in Waynesville to Lake Junaluska Dam**
	Classification	C	WS-I HQW	B	B
	Assessment Unit	6-62	6-78-15-(1)	6-78-23c	5-16-(1)f
	Stations in Assessment Unit	FRBLJ2, FRBLJ4, FRBLJ6	FRBBTR1	FRBKL1, FRBKL2	FRB047A, FRB047B, FRB047C
	Number of Sampling Trips	5	5	10	10
Water Quality Standards					
Chlorophyll *a*	>40 ug/L	NCE	NCE	NCE	NCE
Dissolved Oxygen	<4.0 mg/L	NCE	NCE	NCE	NCE
pH	<6 s.u. or > 9 s.u.	NCE	NCE	NCE	CE (20%)
Turbidity	>25 NTU	NCE	NCE	NCE	CE (10%)
Temperature	>29°C for Mountain Region	NCE	NCE	NCE	NCE
Metals (excluding copper, iron & zinc)	15A NCAC 2B .0211	NR	NR	NR	NR
Other Data					
% Saturation DO	>120%	N	N	Y (20%)	Y (30%)
Algae	Documented blooms during 2 or more sampling events in 1 year with historic blooms	N	N	Y	N
Fish	Kills related to eutrophication	N	N	N	N
Chemically/Biologically Treated	For algal or macrophyte control - either chemicals or biologically by fish, etc.	N	N	N	N
Aesthetics complaints	Documented sheens, discoloration, etc. - written complaint and follow-up by a state	N	N		Y
TSI	Increase of 2 trophic levels from one 5-yr period to next	N	N	N	N
Historic DWQ Data	Conclusions from other reports	N	N	Y	Y
303(d)	Listed on 303(d) [year listed]	N	N	N	Y (2006 -Elevated pH)
AGPT	Algal Growth Potential Test 5-9 mg/L = concern 10 mg/L or more = problematic	NR	NR	NR	NR
Macrophytes	Limiting access to public ramps, docks, swimming areas; reducing access by fish and other aquatic life to habitat	N	N	N	N
Taste and Odor	Public complaints or taste and odor causing algal species are dominant	NR	N	NR	NR
Sediments	Clogging intakes – dredging program necessary; Frequent public/agency complaints - visual observation	N	N		Y
	Rating:	**S**	**S**	**S**	**I** (Turbidity and elevated pH)

RATING KEY:
S = Supporting
I = Impaired
NR = Not Rated — Not rated is used where there are <10 samples and Other Data indicate potential problems

KEY:
E = Criteria is exceeded in less than 10% of the measurements **or** criteria exceeded but n<10
CE = Criteria Exceeded - parameter is problematic, highly productive or exceeds the standard in >10% of samples
NCE = No Criteria Exceeded
- = Standard not applicable based on Classification
ND = No Data - sample not taken for this parameter
Y = In Other Data portion, indicates that the parameter has exceeded target or has occurred

APPENDIX B

FRENCH BROAD LAKES 2007 USE SUPPORT DATA

MOUNTAIN/PIEDMONT	DO mg/L	Water Temp C	pH s.u.	Percent SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardness **Calculated** mg/L
C & B Criteria	**<4.0**	**29/32**	**<6 or >9**	**120%**	**40**	**-**	**25**	**0.0**	**50**	**25**	**88**	**7**	**50**	**2**	**50**	**-**	**1000**	**-**	**-**
Tr Criteria	**<6.0**				**15**		**10**												
WS II - WS V Criteria if different than C&B						**500**					**25**					**200**		**250**	**100**

* If not part of natural conditions (i.e., swamps)

						SURFACE PHYSICAL DATA							SURFACE METALS											
Region	STORET	Lake Name	AU	Date m/d/yr	Sampling Station	DO mg/L	Water Temp C	pH s.u.	Percent DO SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardnes Calculated mg/L
MOUNTAIN	E2712000	Lake Julian	6-62	9-May-07	FRBLJ2	7.9	25.9	7.9	97.2%	7	2.8	1.8												
MOUNTAIN	E2713000	Lake Julian	6-62	9-May-07	FRBLJ4	7.6	25.6	7.8	93.0%	6	3.0	1.9												
MOUNTAIN	E2722000	Lake Julian	6-62	9-May-07	FRBLJ6	7.8	25.4	7.8	95.1%	5	2.5	2.0											8.1	35.1
						7.8	**25.6**	**7.8**	**95.1%**	**6.0**	**2.8**	**1.9**											**8.1**	**35.1**
MOUNTAIN	E2712000	Lake Julian	6-62	13-Jun-07	FRBLJ2	6.5	31.5	7.8	88.3%	9	3.1	4.4												
MOUNTAIN	E2713000	Lake Julian	6-62	13-Jun-07	FRBLJ4	6.1	31.9	7.7	83.4%	8	3.1	1.9												
MOUNTAIN	E2722000	Lake Julian	6-62	13-Jun-07	FRBLJ6	6.7	31.2	7.9	90.5%	7	3.1	1.8											9.0	35.8
						6.4	**31.5**	**7.8**	**87.4%**	**8.0**	**3.1**	**2.7**											**9.0**	**35.8**
MOUNTAIN	E2712000	Lake Julian	6-62	18-Jul-07	FRBLJ2	6.2	33.3	7.6	86.8%	7	3.1	1.9												
MOUNTAIN	E2713000	Lake Julian	6-62	18-Jul-07	FRBLJ4	6.2	33.7	7.6	87.4%	7	3.1	1.7												
MOUNTAIN	E2722000	Lake Julian	6-62	18-Jul-07	FRBLJ6	6.8	33.1	7.5	94.9%	7	3.1	1.8											9.2	34.9
						6.4	**33.4**	**7.6**	**89.7%**	**7.0**	**3.1**	**1.8**											**9.2**	**34.9**
MOUNTAIN	E2712000	Lake Julian	6-62	15-Aug-07	FRBLJ2	5.8	36.4	7.7	85.4%	5	3.1	1.9												
MOUNTAIN	E2713000	Lake Julian	6-62	15-Aug-07	FRBLJ4	5.6	36.9	7.7	83.1%	5	3.1	1.1												
MOUNTAIN	E2722000	Lake Julian	6-62	15-Aug-07	FRBLJ6	5.8	36.2	7.4	85.1%	6	3.1	1.1											10	35.4
						5.7	**36.5**	**7.6**	**84.5%**	**5.3**	**3.1**	**1.4**											**10**	**35.4**
MOUNTAIN	E2712000	Lake Julian	6-62	5-Sep-07	FRBLJ2	6.4	35.6	7.8	93.0%	6	3.1	1.3												
MOUNTAIN	E2713000	Lake Julian	6-62	5-Sep-07	FRBLJ4	6.5	35.8	7.8	94.8%	28	3.1	2.7												
MOUNTAIN	E2722000	Lake Julian	6-62	5-Sep-07	FRBLJ6	6.7	35.6	7.8	97.4%	5	3.1	2.1											10	37.7
						6.5	**35.7**	**7.8**	**95.1%**	**12.8**	**3.1**	**2.0**											**10**	**37.7**
					N=	5	5	5	5	5	5	5											5	5
Class = C					***% EXCEED =***	*NCE*	*NCE**	*NCE*	*NCE*	*NCE*	*NCE*	*NCE*											*NCE*	*NCE*

* Reservoir is used for discharge of heated water from a steam power generation facility

						SURFACE PHYSICAL DATA							SURFACE METALS											
Region	STORET	Lake Name	AU	Date m/d/yr	Sampling Station	DO mg/L	Water Temp C	pH s.u.	Percent DO SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardnes Calculated mg/L
MOUNTAIN	E4040000	Beetree Reservoir	6-78-15-(1)	09-May-07	FRBBTR1	9.6	16.5	7.6	98.3%	4	1.3	0.5											<1.0	6.3
						9.6	**16.5**	**7.6**	**98.3%**	**4.0**	**1.3**	**0.5**											**<1.0**	**6.3**
MOUNTAIN	E4040000	Beetree Reservoir	6-78-15-(1)	12-Jun-07	FRBBTR1	8.1	22.4	7.7	93.4%	2	3.1	0.5											<1.0	6.0
						8.1	**22.4**	**7.7**	**93.4%**	**2.0**	**3.1**	**0.5**											**<1.0**	**6.0**
MOUNTAIN	E4040000	Beetree Reservoir	6-78-15-(1)	17-Jul-07	FRBBTR1	6.8	24.2	7.7	81.1%	1	3.1	1.9											<1.0	6.2
						6.8	**24.2**	**7.7**	**81.1%**	**1.0**	**3.1**	**1.9**											**<1.0**	**6.2**
MOUNTAIN	E4040000	Beetree Reservoir	6-78-15-(1)	14-Aug-07	FRBBTR1	8.3	26.1	7.6	102.5%	4	6.0	1.6											<1.0	6.4
						8.3	**26.1**	**7.6**	**102.5%**	**4.0**	**6.0**	**1.6**											**<1.0**	**6.4**
MOUNTAIN	E4040000	Beetree Reservoir	6-78-15-(1)	06-Sep-07	FRBBTR1	8.2	23.2	6.2	96.0%	25	11.0	2.5											<1.0	6.8
						8.2	**23.2**	**6.2**	**96.0%**	**25.0**	**11.0**	**2.5**											**<1.0**	**6.8**
					N=	5	5	5	5	5	5	5											5	5
Class = WS-I HQW					***% EXCEED =***	*NCE*	*NCE*	*NCE*	*NCE*	*NCE*	*NCE*	*NCE*											*NCE*	*NCE*

APPENDIX B

FRENCH BROAD LAKES 2007 USE SUPPORT DATA

MOUNTAIN/PIEDMONT	DO mg/L	Water Temp C	pH s.u.	Percent SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardness **Calculated** mg/L
C & B Criteria	**<4.0**	**29/32**	**<6 or >9**	**120%**	**40**	**-**	**25**	**0.0**	**50**	**25**	**88**	**7**	**50**	**2**	**50**	**-**	**1000**	**-**	**-**
Tr Criteria	**<6.0**				**15**		**10**												
WS II - WS V Criteria if different than C&B						**500**					**25**					**200**		**250**	**100**

* If not part of natural conditions (i.e., swamps)

						SURFACE PHYSICAL DATA							SURFACE METALS											
Region	STORET	Lake Name	AU	Date m/d/yr	Sampling Station	DO mg/L	Water Temp C	pH s.u.	Percent DO SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardnes Calculated mg/L
MOUNTAIN		Kenilworth Lake	6-78-23c	April 10, 2007	FRBKL1	10.3	11.4	7.5	94.3%	4	4.0	3.4												
MOUNTAIN		Kenilworth Lake	6-78-23c	April 10, 2007	FRBKL2	10.1	13.0	7.2	95.9%	4	3.5	2.8												
						10.2	**12.2**	**7.4**	**95.1%**	**4.0**	**3.8**	**3.1**												
MOUNTAIN		Kenilworth Lake	6-78-23c	April 24, 2007	FRBKL1	9.9	18.0	7.4	104.6%	8	3.8	3.2												
MOUNTAIN		Kenilworth Lake	6-78-23c	April 24, 2007	FRBKL2	9.8	17.3	7.3	102.1%	5	5.8	3.9												
						9.9	**17.7**	**7.4**	**103.4%**	**6.5**	**4.8**	**3.6**												
MOUNTAIN		Kenilworth Lake	6-78-23c	May 9, 2007	FRBKL1	10.2	21.5	7.6	115.6%	14	4.5	3.3												
MOUNTAIN		Kenilworth Lake	6-78-23c	May 9, 2007	FRBKL2	9.6	21.7	7.4	109.2%	9	4.8	3.7												
						9.9	**21.6**	**7.5**	**112.4%**	**11.5**	**4.7**	**3.5**												
MOUNTAIN		Kenilworth Lake	6-78-23c	May 22, 2007	FRBKL1	10.6	21.9	7.8	121.0%	10	3.1	3.6												
MOUNTAIN		Kenilworth Lake	6-78-23c	May 22, 2007	FRBKL2	9.4	21.0	7.7	105.5%	7	3.1	3.7												
						10.0	**21.5**	**7.8**	**113.3%**	**8.5**	**3.1**	**3.7**												
MOUNTAIN		Kenilworth Lake	6-78-23c	June 13, 2007	FRBKL1	9.7	23.5	8.4	114.2%	18	3.1	2.1												
MOUNTAIN		Kenilworth Lake	6-78-23c	June 13, 2007	FRBKL2	9.3	23.4	8.3	109.3%	14	3.1	4.4												
						9.5	**23.5**	**8.4**	**111.8%**	**16.0**	**3.1**	**3.3**												
MOUNTAIN		Kenilworth Lake	6-78-23c	June 26, 2007	FRBKL1	8.9	25.3	8.1	108.3%	27	7.8	5.1												
MOUNTAIN		Kenilworth Lake	6-78-23c	June 26, 2007	FRBKL2	8.7	26.8	7.5	108.8%	10	3.1	6.1												
						8.8	**26.1**	**7.8**	**108.6%**	**18.5**	**5.5**	**5.6**												
MOUNTAIN		Kenilworth Lake	6-78-23c	July 17, 2007	FRBKL1	9.7	26.0	7.3	119.6%	15	3.1	4.5												
MOUNTAIN		Kenilworth Lake	6-78-23c	July 17, 2007	FRBKL2	9.5	26.1	8.3	117.3%	15	3.1	4.0												
						9.6	**26.1**	**7.8**	**118.5%**	**15.0**	**3.1**	**4.3**												
MOUNTAIN		Kenilworth Lake	6-78-23c	July 31, 2007	FRBKL1	8.6	28.0	7.5	109.9%	26	17.0	29.0												
MOUNTAIN		Kenilworth Lake	6-78-23c	July 31, 2007	FRBKL2	8.4	28.3	6.5	107.9%	9	14.0	23.0												
						8.5	**28.2**	**7.0**	**108.9%**	**17.5**	**15.5**	**26.0**												
MOUNTAIN		Kenilworth Lake	6-78-23c	August 14, 2007	FRBKL1	9.4	28.2	8.1	120.6%	8	3.1	5.0												
MOUNTAIN		Kenilworth Lake	6-78-23c	August 14, 2007	FRBKL2	9.9	27.9	8.3	126.3%	12	3.1	5.3												
						9.7	**28.1**	**8.2**	**123.5%**	**10.0**	**3.1**	**5.2**												
MOUNTAIN		Kenilworth Lake	6-78-23c	September 5. 2007	FRBKL1	10.9	25.0	8.9	132.0%	34	9.8	16.0												
MOUNTAIN		Kenilworth Lake	6-78-23c	September 5. 2007	FRBKL2	10.7	25.2	8.5	130.0%	18	8.2	12.0												
						10.8	**25.1**	**8.7**	**131.0%**	**26.0**	**9.0**	**14.0**												
					N=	10	10	10	10	10	10	10												
			Class = B		***% EXCEED =***	*NCE*	*NCE*	*NCE*	*E (20%)*	*NCE*	*NCE*	*E (10%)*												

						SURFACE PHYSICAL DATA							SURFACE METALS											
Region	STORET	Lake Name	AU	Date m/d/yr	Sampling Station	DO mg/L	Water Temp C	pH s.u.	Percent DO SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardnes Calculated mg/L
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	April 10, 2007	FRB047A	10.4	9.6	7.3	91.3%	1	2.8	2.9												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	April 10, 2007	FRB047B	10.0	11.6	7.4	92.0%	7	3.5	3.0												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	April 10, 2007	FRB047C	9.8	12.1	7.4	91.2%	7	2.8	2.3												
						10.1	**11.1**	**7.4**	**91.5%**	**5.0**	**3.0**	**2.7**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	April 24, 2007	FRB047A	10.2	13.5	7.1	97.9%	1	4.0	2.2												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	April 24, 2007	FRB047B	10.6	15.6	7.7	106.5%	10	2.5	2.5												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	April 24, 2007	FRB047C	10.7	15.9	7.9	108.2%	12	2.8	2.4												
						10.5	**15.0**	**7.6**	**104.2%**	**7.7**	**3.1**	**2.4**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	May 10, 2007	FRB047A	10.0	20.2	7.8	110.5%	12	36.0	7.8												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	May 10, 2007	FRB047B	10.4	20.2	8.0	114.9%	8	3.2	2.8												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	May 10, 2007	FRB047C	10.2	19.7	8.1	111.6%	8	1.3	2.2												
						10.2	**20.0**	**8.0**	**112.3%**	**9.3**	**13.5**	**4.3**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	May 22, 2007	FRB047A	10.4	22.6	8.8	120.4%	12	3.1	2.0												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	May 22, 2007	FRB047B	9.8	22.2	8.8	112.6%	11	3.1	2.3												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	May 22, 2007	FRB047C	10.9	22.6	8.7	126.1%	9	3.1	3.1												
						10.4	**22.5**	**8.8**	**119.7%**	**10.7**	**3.1**	**2.5**												

APPENDIX B

FRENCH BROAD LAKES 2007 USE SUPPORT DATA

MOUNTAIN/PIEDMONT	DO mg/L	Water Temp C	pH s.u.	Percent SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardness **Calculated** mg/L
C & B Criteria	**<4.0**	**29/32**	**<6 or >9**	**120%**	**40**	**-**	**25**	**0.0**	**50**	**25**	**88**	**7**	**50**	**2**	**50**	**-**	**1000**	**-**	**-**
Tr Criteria	**<6.0**				**15**		**10**												
WS II - WS V Criteria if different than C&B						**500**					**25**					**200**		**250**	**100**

* If not part of natural conditions (i.e., swamps)

						SURFACE PHYSICAL DATA							SURFACE METALS											
Region	STORET	Lake Name	AU	Date m/d/yr	Sampling Station	DO mg/L	Water Temp C	pH s.u.	Percent DO SAT	Chla µg/L	TSS mg/L	Turbidity NTU	Hg µg/L	Zn µg/L	Pb µg/L	Ni µg/L	Cu µg/L	Cr µg/L	Cd µg/L	As µg/L	Mn µg/L	Fe µg/L	Chloride mg/L	Total Hardnes Calculated mg/L
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	June 12, 2007	FRB047A	9.4	25.8	8.8	115.5%	8	3.1	3.9												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	June 12, 2007	FRB047B	10.1	25.4	9.2	123.2%	9	3.1	2.5												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	June 12, 2007	FRB047C	10.3	25.0	9.3	124.7%	8	3.1	2.2												
						9.9	**25.4**	**9.1**	**121.1%**	**8.3**	**3.1**	**2.9**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	June 26, 2007	FRB047A	8.4	25.1	7.9	101.9%	14	8.2	10.0												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	June 26, 2007	FRB047B	9.4	26.1	8.4	116.1%	12	3.1	3.5												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	June 26, 2007	FRB047C	9.4	26.2	8.5	116.3%	19	3.1	7.1												
						9.1	**25.8**	**8.3**	**111.4%**	**15.0**	**4.8**	**6.9**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	July 17, 2007	FRB047A	11.3	26.5	9.3	140.6%	17	8.8	4.1												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	July 17, 2007	FRB047B	12.3	25.9	9.6	151.4%	36	8.2	4.8												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	July 17, 2007	FRB047C	12.5	26.1	9.7	154.4%	36	8.2	5.6												
						12.0	**26.2**	**9.5**	**148.8%**	**29.7**	**8.4**	**4.8**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	July 31, 2007	FRB047A	8.6	27.7	8.2	109.3%	6	3.1	7.0												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	July 31, 2007	FRB047B	8.3	26.4	8.1	103.1%	5	3.1	2.8												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	July 31, 2007	FRB047C	8.2	26.2	7.3	101.5%	8	3.1	3.4												
						8.4	**26.8**	**7.9**	**104.6%**	**6.3**	**3.1**	**4.4**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	August 14, 2007	FRB047A	10.6	28.3	8.7	136.2%	2	3.1	3.1												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	August 14, 2007	FRB047B	9.4	27.4	8.6	118.9%	35	3.1	4.8												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	August 14, 2007	FRB047C	8.9	27.4	8.3	112.5%	46	3.1	5.1												
						9.6	**27.7**	**8.5**	**122.5%**	**27.7**	**3.1**	**4.3**												
MOUNTAIN	E6120000	Lake Junaluska	5-16-(1)f	September 5, 2007	FRB047A	9.2	27.2	7.9	115.9%	3	3.1	4.8												
MOUNTAIN	E6122000	Lake Junaluska	5-16-(1)f	September 5, 2007	FRB047B	9.3	26.5	8.0	115.7%	2	3.1	1.6												
MOUNTAIN	E6126000	Lake Junaluska	5-16-(1)f	September 5, 2007	FRB047C	9.8	25.9	8.1	120.6%	28	3.1	4.2												
						9.4	**26.5**	**8.0**	**117.4%**	**10.9**	**3.1**	**3.5**												
					N=	10	10	10	10	10	10	10												
			Class = B		***% EXCEED =***	*NCE*	*NCE*	*E (20%)*	*E (30%)*	*NCE*	*NCE*	*NCE*												