LAKE & RESERVOIR ASSESSMENTS
FRENCH BROAD RIVER BASIN

Beetree Reservoir

Intensive Survey Branch
Water Sciences Section
Division of Environmental Quality
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TABLE OF CONTENTS

GLOSSARY

Algae Small aquatic plants that occur as single cells, colonies, or filaments. May also be referred to as phytoplankton, although phytoplankton are a subset of algae.

Algal biovolume The volume of all living algae in a unit area at a given point in time. To determine biovolume, individual cells in a known amount of sample are counted. Cells are measured to obtain their cell volume, which is used in calculating biovolume

Algal density The density of algae based on the number of units (single cells, filaments and/or colonies) present in a milliliter of water. The severity of an algae bloom may be determined by the algal density as follows:

Mild bloom = 20,000 to 30,000 units/ml

Severe bloom = 30,000 to 100,000 units/ml

Extreme bloom = Greater than 100,000 units/ml

Algal Growth Potential Test (AGPT) A test to determine the nutrient that is the most limiting to the growth of algae in a body of water. The sample water is split such that one sub-sample is given additional nitrogen, another is given phosphorus, a third may be given a combination of nitrogen and phosphorus, and one sub-sample is not treated and acts as the control. A specific species of algae is added to each sub-sample and is allowed to grow for a given period of time. The dry weights of algae in each sub-sample and the control are then measured to determine the rate of productivity in each treatment. The treatment (nitrogen or phosphorus) with the greatest algal productivity is said to be the limiting nutrient of the sample source. If the control sample has an algal dry weight greater than 5 mg/L, the source water is considered to be unlimited for either nitrogen or phosphorus.

Centric diatom Diatoms are photosynthetic algae that have a siliceous skeleton (frustule) found in almost every aquatic environment including fresh and marine waters, as well as moist soils. Centric diatoms are circular in shape and are often found in the water column.

Chlorophyll *a* Chlorophyll *a* is an algal pigment that is used as an approximate measure of algal biomass. The concentration of chlorophyll *a* is used in the calculation of the NCTSI, and the value listed is a lake-wide average from all sampling locations.

Clinograde In productive lakes where oxygen levels drop to zero in the lower waters near the bottom, the graphed changes in oxygen from the surface to the lake bottom produces a curve known as clinograde curve.

Coccoid Round or spherical shaped cell

Conductivity This is a measure of the ability of water to conduct an electrical current. This measure increases as water becomes more mineralized. The concentrations listed are the range of values observed in surface readings from the sampling locations.

Dissolved oxygen The range of surface concentrations found at the sampling locations.

Dissolved oxygen saturation The capacity of water to absorb oxygen gas. Often expressed as a percentage, the amount of oxygen that can dissolve into water will change depending on a number of parameters, the most important being temperature. Dissolved oxygen saturation is inversely proportion to temperature, that is, as temperature increases, water's capacity for oxygen will decrease, and vice versa.

Eutrophic Describes a lake with high plant productivity and low water transparency.

Eutrophication The process of physical, chemical, and biological changes associated with nutrient, organic matter, and silt enrichment and sedimentation of a lake.

Limiting nutrient	The plant nutrient present in lowest concentration relative to need limits growth such that addition of the limiting nutrient will stimulate additional growth. In northern temperate lakes, phosphorus (P) is commonly the limiting nutrient for algal growth
Manganese	A naturally occurring metal commonly found in soils and organic matter. As a trace nutrient, manganese is essential to all forms of biological life. Manganese in lakes is released from bottom sediments and enters the water column when the oxygen concentration in the water near the lake bottom is extremely low or absent. Manganese in lake water may cause taste and odor problems in drinking water and require additional treatment of the raw water at water treatment facilities to alleviate this problem.
Mesotrophic	Describes a lake with moderate plant productivity and water transparency
NCTSI	North Carolina Trophic State Index was specifically developed for North Carolina lakes as part of the state's original Clean Lakes Classification Survey (NRCD 1982). It takes the nutrients present along with chlorophyll *a* and Secchi depth to calculate a lake's biological productivity.
Oligotrophic	Describes a lake with low plant productivity and high water transparency.
pH	The range of surface pH readings found at the sampling locations. This value is used to express the relative acidity or alkalinity of water.
Photic zone	The portion of the water column in which there is sufficient light for algal growth. DEQ considers 2 times the Secchi depth as depicting the photic zone.
Secchi depth	This is a measure of water transparency expressed in meters. This parameter is used in the calculation of the NCTSI value for the lake. The depth listed is an average value from all sampling locations in the lake.
Temperature	The range of surface temperatures found at the sampling locations.
Total Kjeldahl nitrogen	The sum of organic nitrogen and ammonia in a water body. High measurements of TKN typically results from sewage and manure discharges in water bodies.
Total organic Nitrogen (TON)	Total Organic Nitrogen (TON) can represent a major reservoir of nitrogen in aquatic systems during summer months. Similar to phosphorus, this concentration can be related to lake productivity and is used in the calculation of the NCTSI. The concentration listed is a lake-wide average from all sampling stations and is calculated by subtracting Ammonia concentrations from TKN concentrations.
Total phosphorus (TP)	Total phosphorus (TP) includes all forms of phosphorus that occur in water. This nutrient is essential for the growth of aquatic plants and is often the nutrient that limits the growth of phytoplankton. It is used to calculate the NCTSI. The concentration listed is a lake-wide average from all sampling stations.
Trophic state	This is a relative description of the biological productivity of a lake based on the calculated NCTSI value. Trophic states may range from extremely productive (Hypereutrophic) to very low productivity (Oligotrophic).
Turbidity	A measure of the ability of light to pass through a volume of water. Turbidity may be influenced by suspended sediment and/or algae in the water.
Watershed	A drainage area in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

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.

Six lakes were sampled in this river basin by DWQ staff in 2012. One of these, Lake Junaluska, was placed on the 2014 303(d) List of Impaired Waters due to water quality standard violations related to elevated fecal coliform bacteria levels (http://portal.ncdenr.org/web/wq/ps/mtu/assessment).

On April 2, 2008, a state-wide fish consumption advisory was placed on fish caught in the state which may be high in mercury. These include largemouth bass, blackfish (bowfin), catfish, and jackfish (chain pickerel) See http://www.epi.state.nc.us/epi/fish/current.html for additional information on fish consumption advisories in the state.

Following the description of the assessment methodology used for the Lumber River Basin, there are individual summaries for each of the lakes.

Assessment Methodology

For this report, data from January 1, 2011 through December 31, 2016 were reviewed. Lake monitoring and sample collection activities performed by DWR field staff are in accordance with the Intensive Survey Unit Standard Operating Procedures Manual (http://portal.ncdenr.org/c/document_library/get_file?uuid=522a90a4-b593-426f-8c11-21a35569dfd8&groupId=38364) An interactive map of the state showing the locations of lake sites sampled by DWR may be found at http://www.arcgis.com/home/webmap/viewer.html?webmap=9dbc8edafb7743a9b7ef3f6fed5c4db0&extent=-87.8069,29.9342,-71.5801,38.7611.

All lakes were sampled during the growing season from 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 surface metals. 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.

For algae collection and assessment, water samples are collected from the photic zone, preserved in the field and taken concurrently with chemical and physical parameters. Samples were quantitatively analyzed to determine assemblage structure, density (units/ml) and biovolume (m^3/mm^3).

For the purpose of reporting, algal blooms were determined by the measurement of unit density (units/ml). Unit density is a quantitative measurement of the number of filaments, colonies or single celled taxa in a waterbody. Blooms are considered mild if they are between 10,000 and 20,000 units/ml. Moderate blooms are those between 20,000 and 30,000 units/ml. Severe blooms are between 30,000 and 100,000 units/ml and extreme blooms are those 100,000 units/ml or greater.

An algal group is considered dominant when it comprises 40% or more of the total unit density or total biovolume. A genus is considered dominant when it comprises 30% or more of the total unit density or total biovolume.

Quality Assurance of Field and Laboratory Lakes Data

Data collected in the field via multiparameter water quality meters are uploaded into the Labworks® Database within five days of the sampling date.

Chemistry data from the DWR Water Quality Laboratory are uploaded into Labworks®. If there are data entry mistakes, possible equipment, sampling, and/or analysis errors, these are investigated and corrected, if possible. Chemistry results received from the laboratory that are given a qualification code are entered along with the assigned laboratory code.

Information regarding the WSS Chemistry Laboratory Quality Assurance Program is available on the ISB website (https://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/microbiology-inorganics-branch/methods-pqls-qa).

Weather Overview for Summer 2017

May 2017 moderate temperatures were primarily due to frequent cloudy skies which held down daytime temperatures and prevented the loss of heat at night. The average statewide temperature was 67.1°F. Average rainfall was 6.5", making May 2017 the 6th wettest May on record. Cool temperatures continued into June with a statewide average temperature of 73.2°F. Rainfall in the French Broad River Basin in June ranged from 2.5" to 3.8".

Summer heat picked up in July with the statewide average temperature becoming 78.1°F. The central Piedmont region of the state received less than 50% of the normal July rainfall. The French Broad River Basin, however did not fall within the region of Abnormally Dry conditions as determined by the State Drought Monitor in July.

The statewide average temperature in August dripped to 75.2°F. The French Broad River Basin experienced 1 to 3 days with temperatures above 90°F during the month. In September, the French Broad River Basin picked up a significant amount of rainfall from the remnants of Hurricane Irma. The statewide average temperature in September was 69.7°F. The moderate temperatures in September reduced the potential severity of the dryness which continued in the central portion of the state.

LAKE & RESERVOIR ASSESSMENTS

HUC 06010105

Beetree Reservoir

Ambient Lakes Program Name	Beetree Reservoir
Trophic Status (NC TSI)	Oligotrophic
Mean Depth (meters)	10.0
Volume ($10^6 m^3$)	1.90
Watershed Area (mi^2)	8.0
Classification	WS-I HQW
Stations	FRBBTR1
Number of Times Sampled	5

Beetree Creek was impounded in 1926 to form Beetree Reservoir, a water supply for the City of Asheville. The City of Asheville owns the 20 km^2 watershed which is undeveloped. Beetree Reservoir is designated as a High Quality Water (HQW), Water Supply-I and has a maximum depth of 25 meters. This lake is not used for recreation and public access is restricted.

Beetree Reservoir was monitored by DWQ staff in May through September 2017. Secchi depths ranged from 4.0 to 5.5 meters, indicating very good water clarity (Appendix A). Surface dissolved oxygen ranged from 8.1 to 8.4 mg/L and surface pH ranged from 6.8 to 7.9 s.u.

Concentrations of total phosphorus were below DWR laboratory detection levels and total organic nitrogen ranged from 0.09 to 0.38 mg/L. Chlorophyll *a* values ranged from 4.8 t0 7.3 *u*g/L. An Algal Growth Potential Test was run on a sample of lake water collected from Beetree Reservoir in August 2017 (Table 1). Results of this test indicated that phosphorus concentration levels in the lake were limiting the potential growth of nuisance levels of algae (i.e., the lake is phosphorus limited)

Table 1. Algal Growth Potential Test Results for Beetree Reservoir, August 29, 2017.

Station	Maximum Standing Crop, Dry Weight (mg/L)			Limiting Nutrient
	Control	C+N	C+P	
FRBBTR1	0.28	0.28	1.08	Phosphorus

Freshwater AGPT using *Selenastrum capricornutum* as test alga

C+N = Control + 1.0 mg/L Nitrate-N

C+P = Control + 0.05 mg/L Phosphate-P

Based on the calculated NCTSI scores, Beetree Reservoir exhibited low biological productivity (oligotrophic conditions) in 2017. This reservoir has been consistently oligotrophic since DWR monitoring of this lake began in 1990.

Burnett Reservoir

Ambient Lakes Program Name	Burnett Reservoir	
Trophic Status (NC TSI)	Oligotrophic	
Mean Depth (meters)	12.0	
Volume ($10^6 m^3$)	22.00	
Watershed Area (mi^2)	2.0	
Classification	WS-I HQW	
Stations	FRBBUR2	FRBBUR4
Number of Times Sampled	5	5

Burnett Reservoir (also known as North Fork Reservoir) was built in 1954 to provide drinking water for the City of Asheville. Maximum depth in this reservoir is approximately 121 feet (37 meters) and average depth is 39 feet (12 meters). Burnett Reservoir has a shoreline length of five miles. The undisturbed 15,000-acre watershed is drained by the North Fork Swannanoa River, Sugar Fork and several unnamed tributaries. Burnett Reservoir is classified as a Water Supply-I (WS-I) and as a High Quality Water (HQW).

DWQ field staff monitored Burnett Reservoir in May through September 2017. Surface dissolved oxygen ranged from 7.4 to 8.6 mg/L and surface conductivity was low, ranging from 13 to 14 *u*mhos/cm (Appendix A). Surface pH in May at FRBBUR2 (9.1 s.u.), located at the upper end of the reservoir, was greater than the state water quality standard of 9.0 s.u. Secchi depths for Burnett Reservoir indicated that the water clarity was very good (range = 5.5 to 10.0 meters). These readings agreed with turbidity values, which were below DWR laboratory detection levels.

Total phosphorus in Burnett Reservoir ranged from <0.02 to 0.02 mg/L and total organic nitrogen ranged from 0.09 to 0.22 mg/L. Chlorophyll *a* values were low, ranging from 1.2 to 4.0 *u*g/L. Analysis of phytoplankton samples indicated a diverse community of algae which included round diatoms, green algae, golden-brown algae and cryptomonads (an important food source for many aquatic organisms). An Algal Growth Potential Test was run on a sample of lake water collected from Burnett Reservoir in August 2017 (Table 2). Results of this test indicated that phosphorus concentration levels in the lake were limiting the potential growth of nuisance levels of algae (i.e., the lake is phosphorus limited).

Table 2. Algal Growth Potential Test Results for Burnett Reservoir, August 17, 2017.

Station	Maximum Standing Crop, Dry Weight (mg/L)			Limiting Nutrient
	Control	C+N	C+P	
FRBBUR2	0.46	0.40	1.01	Phosphorus
FRBBUR4	0.39	0.38	1.48	Phosphorus

Freshwater AGPT using *Selenastrum capricornutum* as test alga

C+N = Control + 1.0 mg/L Nitrate-N

C+P = Control + 0.05 mg/L Phosphate-P

Based on the calculated NCTSI scores, this reservoir was determined to have low biological productivity (oligotrophic conditions) in 2017. Historically, this has been the trophic state of this lake since DWR monitoring began in 1990.

Lake Julian

Ambient Lakes Program Name	Lake Julian		
Trophic Status (NC TSI)	Oligotrophic		
Mean Depth (meters)	20.0		
Volume ($10^6 m^3$)	2.60		
Watershed Area (mi^2)	5.0		
Classification	C		
Stations	FRBLJ2	FRBLJ4	FRBLJ6
Number of Times Sampled	5	5	5

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. Lake Julian's watershed is primarily residential and urban. 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, largemouth bass and tilapia.

DWQ staff monitored this reservoir in May through September 2017. Surface water temperatures ranged from 25.3 to 33.7 °C, reflecting its use as a source of cooling water for the steam electric plant (Appendix A). Surface dissolved oxygen ranged from 5.7 to 7.9 mg/L and surface pH values ranged from 7.1 to 7.8 s.u. Secchi depths for Lake Julian ranged from 1.1 to 7.2 meters, indicating water clarity ranging from good to very good.

Total phosphorus concentrations were below DWR laboratory detection levels and total organic nitrogen ranged from 0.19 to 0.29 mg/L. Concentrations of chlorophyll *a* ranged from 1.2 to 8.1 *u*g/L. An Algal Growth Potential Test was run on a sample of lake water collected from Lake Julian in August 2017 (Table 3). Results of this test indicated that phosphorus concentration levels in the lake were limiting the potential growth of nuisance levels of algae (i.e., the lake is phosphorus limited).

Table 3. Algal Growth Potential Test Results for Lake Julian, August 28, 2017.

Station	Maximum Standing Crop, Dry Weight (mg/L)			Limiting Nutrient
	Control	C+N	C+P	
FRBLJ2	0.25	0.27	1.82	Phosphorus
FRBLJ4	0.24	0.28	1.86	Phosphorus
FRBLJ6	0.32	0.33	1.02	Phosphorus

Freshwater AGPT using *Selenastrum capricornutum* as test alga

C+N = Control + 1.0 mg/L Nitrate-N

C+P = Control + 0.05 mg/L Phosphate-P

Lake Julian was determined to have low biological productivity (oligotrophic conditions) based on the monthly calculated NCTSI scores. This reservoir has been oligotrophic since monitoring by DWR began in 1990.

Allen Creek Reservoir

Ambient Lakes Program Name	Allen Creek Reservoir	
Trophic Status (NC TSI)	Oligotrophic	
Mean Depth (meters)	14.0	
Volume ($10^6 m^3$)	3.30	
Watershed Area (mi^2)	13.0	
Classification	WS-I Tr HWQ	
Stations	FRBACR2	FRBACR4
Number of Times Sampled	5	5

Allen Creek Reservoir (also known as Waynesville Reservoir) is a small water supply lake located in the western mountains of North Carolina and owned by the City of Waynesville. The maximum depth is 23 meters. Several tributaries flow into Allen Creek Reservoir, including Steestachee Branch, Bald Creek, Long Branch Creek and Allen Creek.

DWQ staff monitored this reservoir in May through September 2017. Secchi depths ranged from 4.1 to 2.7 meters, indicating good water clarity. Surface dissolved oxygen ranged from 8.4 to 9.30 mg/L and surface pH ranged from 7.2 to 8.0 s.u. Surface conductivity ranged from 14 to 20 *u*hmos/cm.

Total phosphorus was below DWR laboratory detection levels and total organic nitrogen ranged from 0.09 to 0.19 mg/L. In response to the low nutrient concentrations in this reservoir, chlorophyll *a* values were also low, ranging from <1.0 to 9.0 *u*g/L.

Allen Creek Reservoir was determined to have low biological productivity or oligotrophic conditions in 2017. Historically, this reservoir has been oligotrophic since DWR staff monitoring began in 1990.

Lake Junaluska

Ambient Lakes Program Name	Lake Junaluska		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	5.5		
Volume ($10^6 m^3$)	4.50		
Watershed Area (mi^2)	63.0		
Classification	B		
Stations	FRB047A	FRB047B	FRB047C
Number of Times Sampled	5	5	5

Lake Junaluska is a 200-acre reservoir located in the mountains of southwestern North Carolina. The lake is privately owned by the United Methodist Church and was built by the Lake Junaluska Assembly as a meeting ground for Southern Methodists in 1913. The lake was formed by impounding a segment of Richland Creek.

DWQ monitored this reservoir from May through September 2017. Secchi depths ranged from 0.7 to 1.8 meters, suggesting that the water clarity in this reservoir was fair (Appendix A). Surface dissolved oxygen ranged from 9.3 mg/L in May to 12.6 mg/L in September. Along with the high surface dissolved oxygen concentration, a pH value of 9.6 s.u. was also observed in September. In 2017, the number of surface pH values greater than the state water quality standard of 9.0 s.u. was 8 out of 15 observations or 53%. The lowest pH value was observed in May (7.1 s.u.).

Total phosphorus ranged from <0.02 to 0.03 mg/L and total organic nitrogen ranged from 0.19 to 0.61 mg/L. Chlorophyll *a* ranged from 3.4 *u*g/L in May to 49.0 *u*g/L in September, which was greater than the state water quality standard of 40.0 *u*g/L. Based on the calculated NCTSI scores in 2017, Lake Junaluska was determined to exhibit elevated biological productivity or eutrophic conditions. Historically, the trophic state of this lake has varied between moderately productive (mesotrophic) and eutrophic since monitoring by DWR began in 1981.

Waterville Lake

Ambient Lakes Program Name	Waterville Lake		
Trophic Status (NC TSI)	Eutrophic		
Mean Depth (meters)	23.0		
Volume ($10^6 m^3$)	31.60		
Watershed Area (mi^2)	455.0		
Classification	C		
Stations	FRBWL2	FRBWL4	FRBWL8
Number of Times Sampled	5	5	5

Built in the late 1920's, Waterville Lake (also known as Walters Lake) is an impoundment of the Pigeon River which drains most of Haywood County. This reservoir has a maximum depth of 35 meters. Waterville Lake was constructed to produce hydroelectric power for Asheville and the surrounding area. Access to this lake is restricted to the public.

DWQ field staff monitored this reservoir in May through September 2017. The secchi depths for this lake ranged from 0.3 to 3.7 meters (Appendix A). Surface dissolved oxygen varied from 5.1 to 13.2 mg/L and surface pH values ranged from 7.0 to 9.5 s.u. Four of 15 pH observations (27%) in 2017 were greater than the state water quality standard of 9.0 s.u. Surface conductivity values are greater than those commonly seen in a mountain lake, ranging from 141 to 591 *u*mhos/cm.

Total phosphorus concentrations for Waterville Lake ranged from 0.05 0.18 mg/L and total organic nitrogen ranged from 0.24 to 0.95 mg/L. The ready availability of nutrients supported chlorophyll *a* values (4 out of 10 observations) greater than the state water quality standard of 40.0 *u*g/L (range = 1.4 to 75.0 *u*g/L). Waterville Lake was determined to have elevated biological productivity in 2017 based on the calculated NCTSI scores. Historically, this lake has been predominantly eutrophic since monitoring by DWR field staff began in 1990.

Appendix A - French Broad River Basin Lakes Data

January 1, 2013 Through December 31, 2017

Lake	Date	Sampling Station	SURFACE PHYSICAL DATA DO mg/L	Temp Water C	pH s.u.	Cond. µmhos/cm	Secchi Depth meters	Percent SAT	PHOTIC ZONE DATA TP mg/L	TKN mg/L	NH3 mg/L	NOx mg/L	TN mg/L	TON mg/L	TIN mg/L	Chla µg/L	Solids Total mg/L	Total Solids Suspended mg/L	Turbidity NTU	Total Hardness mg/L
BEETREE RESERVOIR	September 28, 2017	FRBBTR1	8.4	21.9	7.9	25	4.5	105.7	<0.02	<0.20	<0.02	0.03	0.13	0.09	0.04	4.8	18	<6.2	<1.0	7.9
	August 29, 2017	FRBBTR1	8.1	22.6	7.0	21	4.0	103.0	<0.02	0.39	<0.02	<0.02	0.40	0.38	0.02	6.2	20	<6.2	<1.0	6.8
	August 1, 2017	FRBBTR1	8.1	24.8	7.2	20	5.5	106.5	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	4.8	22	<6.2	<1.0	6.8
	June 29, 2017	FRBBTR1	8.4	22.3	6.8	19	5.0	105.2	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02		17	<6.2	<1.0	6.8
	May 31, 2017	FRBBTR1	8.4	20.0	7.1	18	5.0	100.9	<0.02	<0.20	<0.02	0.07	0.17	0.09	0.08	7.3	17	<6.2	<1.0	4.9
BURNETT RESERVOIR	September 28. 2017	FRBBUR2	8.3	22.1	6.8	14	7.5	104.7	0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	2.6	35	14.0	7.2	
	September 28. 2017	FRBBUR4	8.3	22.4	7.0	14	8.5	104.4	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	2.4	14	<6.2	<1.0	5.0
	August 29, 2017	FRBBUR2	7.8	23.7	7.7	14	6.0	101.4	<0.02	0.21	<0.02	<0.02	0.22	0.20	0.02	4.0	21	<6.2	<1.0	
	August 29, 2017	FRBBUR4	7.4	23.9	7.2	14	9.5	103.8	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	2.0	16	<6.2	<1.0	4.9
	August 1, 2017	FRBBUR2	7.8	25.4	7.0	14	6.3	104.0	<0.02	<0.20	<0.02	<0.02	0.11	0.09	0.02	2.3	18	<6.2	<1.0	
	August 1, 2017	FRBBUR4	7.8	25.6	7.1	14	7.0	103.8	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	2.2	16	<6.2	<1.0	7.0
	June 29, 2017	FRBBUR2	8.2	23.5	6.6	14	6.2	104.4	<0.02	<0.20	<0.02	<0.02	0.11	0.09	0.02	1.6	14	<6.2	<1.0	
	June 29, 2017	FRBBUR4	8.2	23.3	6.6	14	10.0	104.1	<0.02	<0.20	<0.02	0.05	0.15	0.09	0.06	1.2	16	<6.2	<1.0	4.8
	May 31, 2017	FRBBUR2	8.4	20.6	9.1	13	5.5	101.5	<0.02	<0.20	<0.02	0.06	0.16	0.09	0.07	2.4	16	<6.2	<1.0	
	May 31, 2017	FRBBUR4	8.6	19.5	7.5	13	8.5	102.4	<0.02	<0.20	<0.02	0.08	0.18	0.09	0.09	2.4	16	<6.2	<1.0	4.9
LAKE JULIAN	September 27, 2017	FRBLJ2	7.7	28.1	7.2	76	4.5	106.0	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	5.3	42	<6.2	<1.0	
	September 27, 2017	FRBLJ4	7.1	28.1	7.2	73	4.5	97.7	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	4.9	42	<6.2	<1.0	
	September 27, 2017	FRBLJ6	7.6	27.8	7.5	78	4.5	104.3	<0.02	0.20	<0.02	0.03	0.23	0.19	0.04	3.4	43	<6.2	<1.0	13.0
	August 28, 2017	FRBLJ2	6.3	32.1	7.2	80	2.8	92.5	<0.02	0.22	<0.02	0.03	0.25	0.21	0.04	6.5	50	<6.2	1.3	
	August 28, 2017	FRBLJ4	6.1	32.7	7.3	81	1.1	90.8	<0.02	0.21	<0.02	0.03	0.24	0.20	0.04	6.2	50	<6.2	2.1	
	August 28, 2017	FRBLJ6	6.1	31.0	7.7	80	2.8	88.9	<0.02	0.23	<0.02	0.03	0.26	0.22	0.04	5.8	46	<6.2	1.7	14.0
	July 31, 2017	FRBLJ2	5.9	33.7	7.3	82	2.7	82.0	<0.02	0.24	<0.02	<0.02	0.25	0.23	0.02	8.1	46	<6.2	1.3	
	July 31, 2017	FRBLJ4	5.8	34.5	7.3	80	2.8	80.0	<0.02	0.22	<0.02	0.03	0.25	0.21	0.04	5.6	48	<6.2	1.8	
	July 31, 2017	FRBLJ6	5.7	33.6	7.3	82	3.4	82.0	<0.02	0.22	<0.02	0.04	0.26	0.21	0.05	5.1	46	<6.2	1.4	18.0
	June 28, 2017	FRBLJ2		29.9	7.3	89	3.2	86.5	<0.02	0.22	<0.02	<0.02	0.23	0.21	0.02	3.5	56	<6.2	<1.0	
	June 28, 2017	FRBLJ4		30.2	7.1	89	3.2	82.7	<0.02	0.26	<0.02	<0.02	0.27	0.25	0.02	3.6	52	<6.2	<1.0	
	June 28, 2017	FRBLJ6		29.8	7.2	89	7.2	86.2	<0.02	0.30	<0.02	<0.02	0.31	0.29	0.02	4.0	36	<6.2	<1.0	19.0
	May 30, 2017	FRBLJ2	7.9	25.3	7.4	95	3.0	103.0	<0.02	0.23	<0.02	<0.02	0.24	0.22	0.02	1.8	38	<6.2	1.1	
	May 30, 2017	FRBLJ4	7.1	26.6	7.8	92	3.0	94.5	<0.02	0.20	<0.02	<0.02	0.21	0.19	0.02	1.3	52	<6.2	1.1	
	May 30, 2017	FRBLJ6	7.8	26.0	7.8	91	2.8	103.5	<0.02	0.24	<0.02	<0.02	0.25	0.23	0.02	1.2	54	<6.2	<1.0	23.0
ALLEN CREEK RESERVOIR	September 18, 2017	FRBACR2	8.9	17.5	7.8	15	2.7	103.1	<0.02	0.20	0.01	0.08	0.28	0.19	0.09	5.8	21	<6.2	1.5	
	September 18, 2017	FRBACR4	8.8	17.9	7.5	15	3.1	103.6	<0.02	0.20	0.01	0.08	0.28	0.19	0.09	4.2	18	<6.2	1.1	6.8
	August 28, 2017	FRBACR2	8.4	22.2	7.9	20	2.7	107.4	<0.02	0.20	<0.02	0.05	0.25	0.19	0.06	5.1	23	<6.2	<1.0	
	August 28, 2017	FRBACR4	8.4	22.2	7.4	17	3.4	108.2	<0.02	<0.20	<0.02	0.05	0.15	0.09	0.06	9.3	18	<6.2	<1.0	6.8
	July 10, 2017	FRBACR2	8.5	24.1	7.4	16	3.5	113.3	<0.02	<0.20	<0.02	0.07	0.17	0.09	0.08	7.6	26	<6.2	<1.0	
	July 10, 2017	FRBACR4	8.8	23.5	7.2	16	3.6	115.3	<0.02	<0.20	<0.02	0.05	0.25	0.19	0.06	9.3	24	<6.2	1.6	4.8
	June 27, 2017	FRBACR2	8.8	18.6	7.4	15	4.1	105.2	<0.02	0.20	<0.02	0.07	0.27	0.19	0.08	6.6	22	<6.2	<1.0	
	June 27, 2017	FRBACR4	8.7	15.0	8.0	15	3.4	106.0	<0.02	0.20	<0.02	0.07	0.27	0.19	0.08	4.1	24	<6.2	<1.0	4.8
	May 15, 2017	FRBACR2	9.1	16.9	7.7	15	3.6	105.4	<0.02	<0.20	<0.02	0.08	0.18	0.09	0.09	<1.0	13	<6.2	<1.0	
	May 15, 2017	FRBACR4	9.3	16.5	7.7	14	3.6	106.6	<0.02	<0.20	<0.02	0.08	0.18	0.09	0.09	1.2	6	<6.2	<1.0	4.8
LAKE JUNALUSKA	September 18, 2017	FRB047A	10.7	21.4	8.9	63	1.2	132.5	0.02	0.29	<0.02	0.28	0.57	0.28	0.29	15.0	48	<6.2	3.1	
	September 18, 2017	FRB047B	12.6	21.5	9.5	66	0.9	66.0	0.03	0.60	<0.02	0.08	0.68	0.59	0.09	38.0	48	<6.2	5.2	
	September 18, 2017	FRB047C	9.4	21.5	9.6	67	0.7	115.6	0.03	0.62	<0.02	0.03	0.65	0.61	0.04	49.0	46	<6.2	6.4	
	August 28, 2017	FRB047A	9.8	24.8	8.8	70	0.8	129.1	0.03	0.46	<0.02	<0.02	0.47	0.45	0.02	25.0	52	6.8	3.8	
	August 28, 2017	FRB047B	9.9	24.4	9.0	70	1.0	129.4	0.02	0.34	<0.02	<0.02	0.35	0.33	0.02	20.0	13	<6.2	1.9	
	August 28, 2017	FRB047C	10.5	24.5	9.2	71	1.2	137.1	0.03	0.50	<0.02	<0.02	0.51	0.49	0.02	22.0	50	<6.2	<1.0	
	July 10, 2017	FRB047A	11.0	28.1	9.3	63	0.8	153.7	0.02	0.41	<0.02	<0.02	0.42	0.40	0.02	16.0	52	<6.2	2.8	
	July 10, 2017	FRB047B	11.0	27.3	9.3	63	0.8	151.3	0.02	0.37	<0.02	<0.02	0.38	0.36	0.02	18.0	50	<6.2	3.6	
	July 10, 2017	FRB047C	9.4	28.3	9.2	30	0.9	131.9	0.02	0.37	<0.02	<0.02	0.38	0.36	0.02	18.0	51	<6.2	5.3	
	June 27, 2017	FRB047A	10.6	22.2	9.0	57	0.9	132.2	0.02	0.37	<0.02	0.03	0.40	0.36	0.04	22.0	50	<6.2	2.1	
	June 27, 2017	FRB047B	11.1	22.5	9.2	58	0.9	139.6	0.02	0.40	<0.02	<0.02	0.41	0.39	0.02	24.0	48	<6.2	1.5	
	June 27, 2017	FRB047C	11.7	22.8	9.3	59	1.0	147.7	<0.02	0.42	<0.02	0.02	0.44	0.41	0.03	25.0	45	<6.2	1.5	
	May 15, 2017	FRB047A	10.0	21.4	7.6	52	1.4	123.9	<0.02	0.25	<0.02	0.30	0.55	0.24	0.31	3.4	38	<6.2	<1.0	
	May 15, 2017	FRB047B	10.0	21.6	7.5	51	1.7	124.5	<0.02	0.27	<0.02	0.30	0.57	0.26	0.31	3.4	36	<6.2	1.3	
	May 15, 2017	FRB047C	9.3	22.0	7.1	50	1.8	116.7	<0.02	0.20	<0.02	0.31	0.51	0.19	0.32	5.3	35	<6.2	1.2	
WATERVILLE LAKE	September 19, 2017	FRBWL2	8.2	21.2	7.3	276	1.9	99.1	0.09	0.40	0.02	0.31	0.71	0.38	0.33		175	<6.2	1.7	
	September 19, 2017	FRBWL4	9.5	21.0	7.8	284	1.3	115.5	0.10	0.55	<0.02	0.31	0.86	0.54	0.32	22.0	183	<6.2	2.7	
	September 19, 2017	FRBWL6	6.7	20.6	7.4	395	2.7	80.1	0.07	0.50	<0.02	0.40	0.90	0.49	0.41	9.7	198	<6.2	1.3	
	August 29, 2017	FRBWL2	7.3	21.6	7.9	591	1.2	89.4	0.18	0.50	0.05	0.48	0.98	0.45	0.53		381	<6.2	2.7	
	August 29, 2017	FRBWL4	5.1	24.5	7.6	441	1.2	66.6	0.10	0.52	<0.02	0.20	0.72	0.51	0.21		277	<6.2	1.6	
	August 29, 2017	FRBWL6	6.5	24.4	8.2	415	1.9	84.7	0.07	0.64	0.08	0.03	0.67	0.56	0.11	12.0	153	<6.2	1.3	
	July 12, 2017	FRBWL2	12.8	27.2	9.2	364	0.9	173.2	0.12	0.70	<0.02	0.05	0.75	0.69	0.06	48.0	231	<6.2	2.6	
	July 12, 2017	FRBWL4	12.8	26.6	9.3	323	0.6	300.0	0.10	0.69	<0.02	<0.02	0.70	0.68	0.02	54.0	195	<6.2	2.8	
	July 12, 2017	FRBWL6	13.2	25.8	9.5	305	0.8	305.0	0.10	0.94	<0.02	<0.02	0.95	0.93	0.02	75.0	190	6.3	3.9	
	June 28, 2017	FRBWL2	7.7	24.2	8.0	300	0.7	98.8	0.10	0.96	<0.02	0.04	1.00	0.95	0.05	64.0	172	7.9	2.6	
	June 28, 2017	FRBWL4	13.2	23.2	9.4	277	1.5	166.2	0.07	0.42	0.05	0.20	0.62	0.37	0.25	19.0	190	<6.2	1.7	
	June 28, 2017	FRBWL6	5.9	24.5	7.5	268	1.6	75.7	0.08	0.52	0.05	0.29	0.81	0.47	0.34	20.0	178	<6.2	2.2	
	May 16, 2017	FRBWL2	7.9	20.2	7.0	205	2.3	94.5	0.07	0.30	0.06	0.27	0.57	0.24	0.33		104	<6.2	1.7	
	May 16, 2017	FRBWL4	8.9	20.1	7.2	141	2.2	105.7	0.07	0.46	0.03	0.27	0.73	0.43	0.30		44	<6.2	1.5	
	May 16, 2017	FRBWL6	7.9	20.2	7.0	205	3.7	94.5	0.05	0.34	0.06	0.24	0.58	0.28	0.30	1.4	65	<6.2	<1.0	