COVER SHEET

FEDERAL ENERGY REGULATORY COMMISSION

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE YADKIN AND YADKIN-PEE DEE RIVER
PROJECTS
Docket Nos. P-2197-073 and 2206-030

Section 3
Environmental Effects
Pages 37 to 242
FEIS

3.0 ENVIRONMENTAL EFFECTS

In this section, we first describe the general environmental setting in the project vicinity and any environmental resources that could be cumulatively affected by relicensing the Yadkin and Yadkin-Pee Dee River Projects. Then, we address each affected environmental resource. For each resource, we first describe the affected environment—the existing condition and the baseline against which to measure the effects of the proposed project and any alternative actions—and then the environmental effects of the proposed projects, including the proposed measure discussed in section 2.2.3. Unless otherwise identified, the sources of our information are the license applications for the Projects (Alcoa Generating, 2006a; Progress Energy, 2006a). We provide citations for information obtained from subsequent filings related to the Projects.

3.1 GENERAL DESCRIPTION OF THE RIVER BASINS

The Yadkin River and its tributaries are part of the Yadkin-Pee Dee River Basin, which extends from the eastern slopes of the Blue Ridge Mountains to the Atlantic Coast near Georgetown, South Carolina. The Yadkin-Pee Dee watershed has a drainage area of 4,190 square miles above Falls dam (the most downstream Yadkin Project development). The Pee Dee River, which begins at the confluence of the Yadkin and Uwharrie rivers, flows through the coastal plain of South Carolina to the Atlantic Ocean at Winyah Bay.

The area immediately surrounding the Yadkin Project is predominantly rural and suburban, although several smaller cities, including Albemarle, Lexington, Salisbury and towns, including Badin, Mocksville and Troy, are located within 30 miles of the project. Several of North Carolina's largest cities, including Charlotte, Winston-Salem, and Greensboro, are located within an hour's drive. The predominant land use type around the reservoirs was historically agricultural or forested. Farms and timberland are still common in this area, but residential development in the region, particularly along the reservoir shorelines, has increased significantly since the mid-1990s.

The Yadkin-Pee Dee River Project area is characterized by a large network of generally east-flowing streams in terrain that is mostly gently rolling and hilly with narrow floodplains, low flat ridges, monadnocks, and high ridges. Topographic relief is generally greatest near the Uwharrie Mountains. The Yadkin River originates near the town of Blowing Rock, North Carolina, and flows northeasterly for about 100 miles from the Blue Ridge Mountains into the Piedmont physiographic region. As the river turns southeast, it enters an area in central North Carolina that has experienced considerable urban growth. This area, from Charlotte to Raleigh/Durham, is known as the Piedmont Crescent. Just to the south of the Piedmont Crescent, the region enters an area known as the Uwharrie Lakes Region. The Uwharrie River joins the Yadkin River at the upper end of Lake Tillery to form the Pee Dee River.

The Yadkin and Pee Dee river basins have hot summers and cool winters with precipitation distributed relatively evenly throughout the year. Summer high temperatures are normally near or above 90 degrees Fahrenheit (°F), and winter high

temperatures are near 50°F. Low temperatures are normally near 70°F in the summer and near 32°F in the winter. Average precipitation ranges from 40 to 55 inches, without a distinct wet and dry season although fall is normally the driest season. However, in the summer and fall, hurricanes or their remnants from the Atlantic Ocean and the Gulf Mexico can produce high flow events.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (50 CFR §1508.7), an action may cause cumulative impacts on the environment if its impacts overlap in space or time with the impacts of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time, including hydropower and other land and water development activities.

Based on information in the license applications, agency comments, other filings related to the Projects, and preliminary staff analysis, we identified the following resources that have the potential to be cumulatively affected by the continued operation of the Yadkin and Yadkin-Pee Dee River Projects, in combination with other activities: water quality and quantity, geology and soils, and aquatic resources.

The Projects are located one after another on the Yadkin and Pee Dee rivers, and Alcoa Generating and Progress Energy coordinate their operations. Operations are primarily based on prevailing hydrologic conditions, license requirements, and regional power needs. Flows released from the Blewett Falls dam, which are influenced by hydropower operations in the basin upstream of Blewett Falls, in turn influence the water level, water quality, and aquatic resources of the Pee Dee River downstream of the Projects. This influence extends into South Carolina.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the Proposed Action's effects on the resources. Because the Proposed Action would affect resources differently, the geographic scope for each resource may vary.

For geology, we include the Yadkin River upstream to the limit of the influence of the U.S. Army Corps of Engineers (Corps) W. Kerr Scott reservoir on the Yadkin River to downstream of the Blewett Falls dam on the Pee Dee River (within the limit of influence caused by operating the Yadkin-Pee Dee River Project). We chose this geographic scope because other activities, in combination with project operations, may influence erosion and sediment loads in the Yadkin and Pee Dee River basins. For water quality and quantity, we include the Yadkin River from W. Kerr Scott reservoir downstream to the Atlantic Ocean. We chose this geographic scope because other

activities such as water use, in combination with the project operations, may influence water quality (e.g., nutrient loads, DO concentrations, and salinity), and water quantity.

For aquatic resources, we include the Pee Dee River Basin, the Yadkin River, and other tributaries that are affected by project operations, from the W. Kerr Scott reservoir downstream to the Atlantic Ocean. We chose this geographic scope because the Projects, in combination with other activities in the basin, may influence upstream and downstream diadromous fish migration and spawning, and the spawning and rearing of resident fish species in affected reaches of the Yadkin and Pee Dee rivers.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in the EIS includes a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the terms of the new licenses, the temporal scope looks 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited by the amount of available information for each resource.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

The Projects are located within the Piedmont physiographic region, to the east and southeast of the Appalachian Mountains. The Piedmont region has a rolling and hilly topography with elevations that range from about 1,200 to 1,500 feet above sea level. The elevations of the Projects at full pond range between 623.9 feet for High Rock reservoir to 178.1 feet for Blewett Falls reservoir.

Soils in the Piedmont are generally fine-grained and readily eroded when exposed to wind and water (Normandeau and PB Power, 2005). Erosion rates depend on land use, specific soil type, and topography. Because the Yadkin River has some of the highest erosion rates in North Carolina, it carries high concentrations of sediment, particularly during high flow events. The source of the sediment is primarily soil erosion, but also streambank erosion and urban runoff.

The Yadkin River, upstream of the influence of the dams, appears to be in approximate geomorphic equilibrium with little evidence of systematic aggradation[20] or

[20]Aggradation is the process of shifting the equilibrium of stream deposition, with upbuilding due to sediment deposition approximately at grade of the stream. Aggradation results when the sediment load supplied to a reach of river from upstream exceeds its capacity to transport sediment.

degradation[21] (Doyle, 2007). Signs of aggradation would include mid-channel bars, stream braiding, substantial natural levees, and/or deposits on the floodplain after floods. Signs of degradation would include undermined bridge piers, mass-wasting of river banks, and incised stream or tributary channels.

Most of the sediment-laden inflow to High Rock reservoir is retained in the reservoir, resulting in lower storage capacity losses in the five downstream reservoirs. Table 3 shows estimated annual sediment accumulation in the Yadkin Project reservoirs.

Table 3. Estimated annual sediment accumulation and annual storage capacity loss for Yadkin Project (P-2197) reservoirs. (Source: Normandeau and PB Power, 2005)

Reservoir	Annual Sediment Accumulation		Annual Storage Capacity Loss (%)
	acre-feet	cubic yards	
High Rock	903	1,460,000	0.36
Tuckertown	86	139,000	0.20
Narrows	131	211,000	0.05
Falls	14	23,000	0.23

On the shoreline of the upper reaches of High Rock reservoir, where sediment deposition has occurred since the dam was constructed, there are two important infrastructure facilities. The city of Salisbury's water intake and pump station are located at RM 19.4[22] upstream of High Rock dam, and the Grant Creek wastewater treatment plant is located at RM 16.7.

Salisbury Water Intake and Pump Station

The Salisbury-Rowan Utilities Department Salisbury operates the water intake and pump station, located at the confluence of the South Yadkin and Yadkin rivers (figure 3). These facilities supply businesses and residents in Rowan County and the city of Salisbury with potable water; this is the only water supply for the city and county. The pump station and original intake were constructed in 1917, 10 years before High Rock dam was constructed. Construction occurred shortly after the large flood of July 1916, which reached an estimated discharge rate of 121,000 cfs in the vicinity of the station.

[21]Degradation, the opposite of aggradation, is the process of shifting the equilibrium of stream deposition, with lowering of the thalweg due to sediment erosion. Degradation results when the sediment load supplied to a reach of river from upstream is lower than its capacity to transport sediment.

[22]In this discussion of the sediment and flooding issues at High Rock reservoir, river miles are measured with the location of High Rock dam at RM 0.

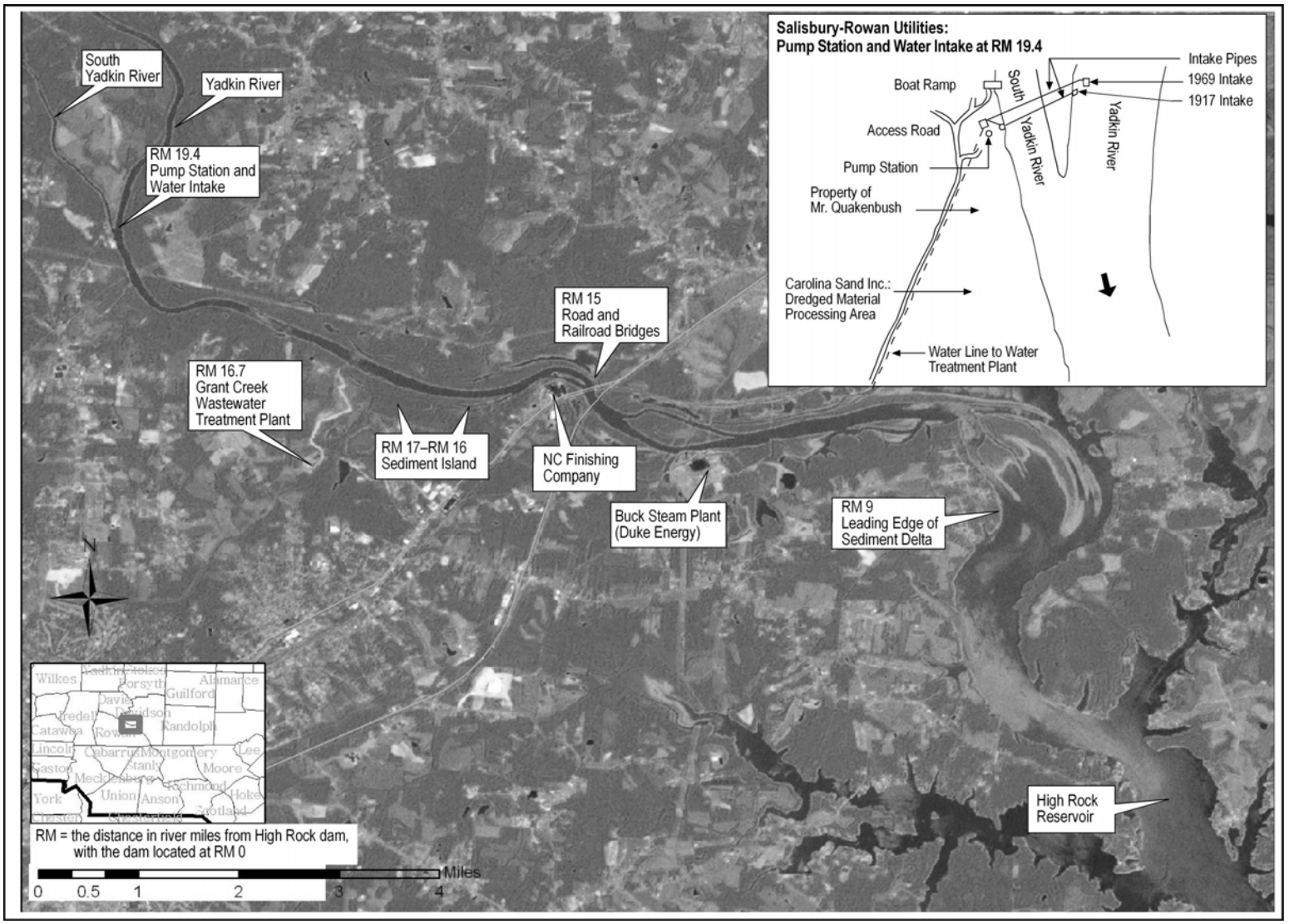

Figure 3. Aerial photograph of upper High Rock reservoir with detailed insert of the pump station. (Source: ESRI, 2007)

The pump station is located on the western shore of the South Yadkin River at its confluence with the Yadkin River. The station is designed so that flood water can surround the lower part of the structure, and the ground at the pump station is at elevation 630 feet. The top of the station's concrete platform (the base for pumps and electronic components) is at elevation 643 feet. Water elevations exceeding 643 feet would damage the pumping and electronic equipment resulting in the loss of water supply to the city and county. The original 1917 intake structure was built on the western shore of the Yadkin River adjacent to the shore of the peninsula between the Yadkin and South Yadkin rivers. The lowest elevation of the river channel adjacent to the intake as shown on a plan from 1927 was about 604 feet (Salisbury, 2007a). The gate within the intake structure was positioned between elevations 604.5 and 608.5 feet.

The original intake apparently was modified according to the 1927 plan (Salisbury, 2007a). The upper elevation of the intake gate was raised to an elevation just below the full pond elevation of High Rock reservoir of 623.9 feet. The exact upper and lower elevations for the modified intake gate are not shown on the plan.

In 1968, a new intake structure was built just upstream of the previous intake structure and further toward the center of the Yadkin River, since the original intake structure had silted in. The 1968 concrete structure draws water from two rectangular gates that are 6 feet high and 4 feet wide that are positioned between elevations 617.9 and 623.9 feet. At the time of the intake design, the river bottom was about 617.4 feet (Salisbury, 2007a). This elevation was about 13 feet higher than the elevation shown on the 1927 plan, indicating that aggradation had occurred in the river.

The original and new intake structures are connected with the pump station via intake pipes that extend underneath the South Yadkin River. The access road to the pump station is at elevation 628.3 feet, and thus is flooded intermittently (see section 3.3.2, *Water Resources*). When the road is flooded, the pump station operators access the pump station by boat.

Dredging for the extraction of sand from the river channel has been performed near the confluence of the Yadkin and South Yadkin rivers for many years. Specifically, between 1965 and 1984, sand was extracted from the Yadkin River just downstream of its confluence with the South Yadkin River (MBH, 2007) using a drag bucket. Dredging stopped between 1984 and 1988. For the period after 1988, sediment accumulation around the intake structure separated the intake gates from the river. This event required emergency dredging around the intake, and, since 1988, dredging has continued. Since 1988, sand has been extracted from the Yadkin River about 1,000 feet to the north (upstream) of the intake structure and about 2,000 feet downstream. The operation is conducted with a hydraulic dredge and a pipeline to a site on the western shore of the Yadkin River, just to the south of its confluence with the South Yadkin River near the pump station.

The dredge operator, Carolina Sand, Inc., indicates that the rate of extraction varies monthly and annually and is determined by the availability of the material and

market conditions for sand. Between 2002 and 2006, Carolina Sand, Inc. extracted an estimated 50,000 tons per year of sand (MBH, 2007, and references therein) and sold it for a profit. Alcoa Generating received $0.40 per ton for the first 50,000 tons of sand dredged, and $0.30 thereafter, according to the 2003 lease between Carolina Sand, Inc. and Alcoa Generating (SRU, 2006a).

Grant Creek Wastewater Treatment Plant

The Grant Creek wastewater treatment plant is located 16.7 miles above High Rock dam near the confluence of Grant Creek and the Yadkin River. The facility provides sewage treatment of wastewater to a large portion of the city of Salisbury and Rowan County. The facility was constructed in 1963, 36 years after High Rock dam was constructed, and consists of the following primary structures: preliminary treatment unit, main lift station, four primary clarifiers, two trickling filters, aeration basin, three final clarifiers, secondary lift station, chlorine contact tank, and ultraviolet disinfection (Pease, 2007). The facility would be flooded at an elevation of 634 feet at which flood water would enter the grit chamber and allow uncontrolled flow into the plant. This action would result in washout of biological mass and the release of untreated wastewater into the Yadkin River (Pease, 2007). In addition to the immediate effects, flooding of the wastewater treatment plant apparently would require several weeks to reestablish the necessary biological processes to allow for full wastewater treatment (SRU, 2007).

Sediment Deposition in High Rock Reservoir

High Rock reservoir extends about 19 miles upstream from High Rock dam, depending on water level, inflow, and reservoir operation. At present, from upstream to downstream, the reservoir is narrow to about 17 river miles above High Rock dam after which it widens considerably (Doyle, 2007).

Grain sizes of channel bed sediments, collected upstream of the water intake (RM 19.4) by Mobile Boundary Hydraulics, PLLC (MBH) (2007), consisted largely of medium to coarse sand. The finer sediment fractions (silt and clay) constituted less than 3 percent of the sediment grain sizes in the channel bed samples. The predominance of sand in the sediment dredged by Carolina Sand, Inc. from the river channel around the intake was also observed during our site visit on January 23, 2007.

The low concentrations of silt and clay in the channel bed sediment at RM 19.4 indicate that these grain sizes settle further downstream in High Rock reservoir where the reservoir is wider and flow velocities are lower. Particle settling in High Rock reservoir was shown by the total suspended solids (TSS) concentrations in the water column measured by Alcoa Generating. Specifically, Alcoa Generating found that between 1999 and 2003, the mean TSS concentrations within High Rock reservoir decreased from 46.9 percent at the upstream sampling station at RM 15 to 15.3 percent near the dam, a reduction of 68 percent. The TSS concentrations in reservoirs downstream of High Rock dam are even lower, indicating that High Rock reservoir is the primary sediment trap for the sediment supplied by the Yadkin River. The TSS concentrations measured by Alcoa

Generating between 1999 and 2003 at RM 15 also demonstrate that the highest TSS concentrations typically occur during high flow events, as expected.

Silt and clay particles are transported by the Yadkin River predominantly as wash load,[23] while the sand observed in the channel bed is transported primarily as bed material load during higher velocity flow events. The U.S. Department of Agriculture (1979) estimated that 20 percent of the total volume of sediment entering the river (1,660,000 tons per year) consisted of bedload (330,000 tons per year).[24] MBH (2007) estimates a bed material load of 200,000 tons per year. The bed material load sustains Carolina Sand, Inc.'s sand extraction operation at RM 19.4.

Deposition of Yadkin River sediment has resulted in the formation of a sediment delta in the upper reaches of High Rock reservoir. Aerial photographs provided by Doyle (2007) demonstrate the growth of the delta over time (see figure 3). For example, on the 1936 photo, sediment islands in the reservoir are visible at RMs 16 to 17, upstream of the railroad bridge at RM 15. By 2006, the leading edge of the delta had extended downstream of the large bend in the river at about RM 9. Furthermore, the delta had filled some of the wider areas of the upper reservoir, and some of the sediment islands have become fully vegetated. Sediments, sampled from a delta island at RM 15, consisted of medium to fine sand with up to 5 percent silt and clay (MBH, 2007).

As part of the sediment delta, an island has formed at the confluence of Grant Creek with the Yadkin River. Rather than flowing straight into the Yadkin River, Grant Creek now flows a few hundred yards alongside the western side of the island before it joins the Yadkin River.

Shoreline Erosion at Blewett Falls

Some erosion was observed on the eastern and western shores of Blewett Falls reservoir during the site visit, with the most severe erosion noted in the vicinity of the mouth of Buffalo Creek on the western shore. Significant bank undercutting was observed in that area, which has caused trees to fall into the reservoir. Some erosion was observed along the shoreline of the Blewett Falls reservoir during the site visit.

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[23]The relationship between wash load and bed material load is illustrated in Morris and Fan (1998, figure 8.7). The sum of these two loads represents the total sediment load transported by a river.

[24]We assume that bedload as used by the U.S. Department of Agriculture (1979) represents bed material load.

3.3.1.2 Environmental Effects

Because sediment transport issues pertain to High Rock reservoir, we focus our analysis on sediment dynamics upstream of High Rock dam. Progress Energy's proposals to survey sediment in Blewett Falls reservoir and gravel recruitment in Blewett Falls tail waters concern fish spawning. Therefore, we discuss these measures in section 3.3.3, *Aquatic Resources*.

Reservoir Sedimentation

Initial construction of High Rock development altered the sediment transport regime in the Yadkin River, effectively intercepting nearly all of the bed material load and much of the wash load. Most of the accumulation of sediment has occurred in the upper reaches of the reservoir, generally above RM 9, resulting in the formation of an extensive sediment delta. Aggradation of the river channel consequently means that channel bed sediments are transported by the river at higher elevations and can cause flood waters to reach higher elevations. These effects have implications for the Salisbury water intake and pump station, Grant Creek wastewater treatment plant, and other areas in the upper reaches of High Rock reservoir.

Alcoa Generating does not propose any measures to address the sedimentation in the reservoir.

In response to our ready for environmental analysis notice, the city of Salisbury recommends, in its May 14, 2007, filing, the following measures related to sediment in High Rock reservoir:

(1) removal of sand and sediment from the Yadkin River channel 1,000 feet upstream and 1,000 feet downstream of the original Salisbury water intake and from a 100-foot radius[25] surrounding the original intake,

(2) removal of the sand and sediment accumulation at the mouth of Grant Creek, and

(3) annual dredging or sand mining to maintain the conditions established at the water intake and Grant Creek during suggested measures 1 and 2 above.

Rowan County also raises concerns about the impact of sedimentation in High Rock reservoir on flooding of the pump station and Grant Creek wastewater treatment plant, sedimentation of the water intake, flooding of 3rd and 7th Street bridges in the town of Spencer, and flooding of about 25 structures in the eastern part of [the] county. In addition, Rowan County raises concerns about the effect of the sediment delta on boating

[25]We expect that this 100-foot radius applies to the river side of the intake, not the removal of the land from the spit between the Yadkin and South Yadkin rivers.

in High Rock reservoir. Rowan County recommends removal of the High Rock sediment delta and annual maintenance dredging or sand mining to remove new sediment accumulation as it occurs. Delta removal and subsequent maintenance operations should prioritize the mouth of Grant Creek and the river reach in the vicinity of the Salisbury-Rowan Utilities (SRU) drinking water intakes as well as flooding and boating concerns related to the sediment buildup in the reservoir.

Our Analysis

In addition to reports filed by Alcoa Generating as part of the license application, technical reports were filed by the city of Salisbury (Salisbury, 2007a). We find that the Salisbury reports (MBH, 2007; Doyle, 2007) use reasonable assumptions and techniques, and that their findings are applicable for the understanding of sedimentation processes. We use these reports to augment the information provided by Alcoa Generating in its license application on the impacts of sedimentation on municipal infrastructure.

Alcoa Generating (2005) concludes that the survey data for High Rock reservoir reveal that sedimentation has occurred since the dam was constructed in 1927. The bathymetry of the reservoir shows that sediment has accumulated in the upstream areas of the reservoir from Crane Creek upstream to the confluence of the Yadkin and South Yadkin rivers. However, as Doyle (2007) observes, while Alcoa Generating (2005) recognizes that sedimentation occurred in the vicinity of the Salisbury water intake, the report does not adequately analyze the effects of this sedimentation on the intake structure. In essence, the sediment investigations did not include a more detailed analysis of the bed material load predominantly found in the upper river channel, or an analysis of the growth of the sediment delta over time, along with its effect on flooding and sedimentation around the Salisbury drinking water intakes. The bed material load is the predominant fraction deposited in the upper reaches of High Rock reservoir.

MBH (2007) performed detailed modeling to determine the elevation of the thalweg[26] between 1928 and 2058 and changes in the cross-sectional area of the river channel. MBH used the Hydraulic Engineering Center (HEC)-6T numerical sedimentation model which is its proprietary version of the Scour and Deposition in Rivers and Reservoirs (HEC-6) computer model developed by the Corps' HEC. See appendix B for a more detailed discussion of the model.

The results of the MBH modeling show that the Yadkin River channel at the intake (RM 19.4) has aggraded. Specifically, the elevation of the thalweg of the river changed in the first few years of operations of the High Rock dam from 604 feet to over 610 feet. In 1968, the modeled thalweg was at about 616 feet (figure 4), which is similar to the elevation of 617 feet shown on the 1968 plan for the new intake structure

[26]Thalweg is defined as the line defining the lowest points along the profile of a river bed or valley.

(Salisbury, 2007a). The modeled elevation of the thalweg is currently at about 618 feet. These modeled elevations considered the effect of dredging in the area of the intake structure. Between current conditions and year 2058, the general elevation of the thalweg in this area is predicted to increase further by about 1 foot.

Other locations within High Rock reservoir downstream of the pump station have also aggraded since the dam was constructed (see figure 4). The different aggradation rates over time at the different locations along the river are a reflection of the leading edge of the sediment delta gradually advancing downstream toward High Rock dam as well as complex sediment transport and hydraulic relationships.

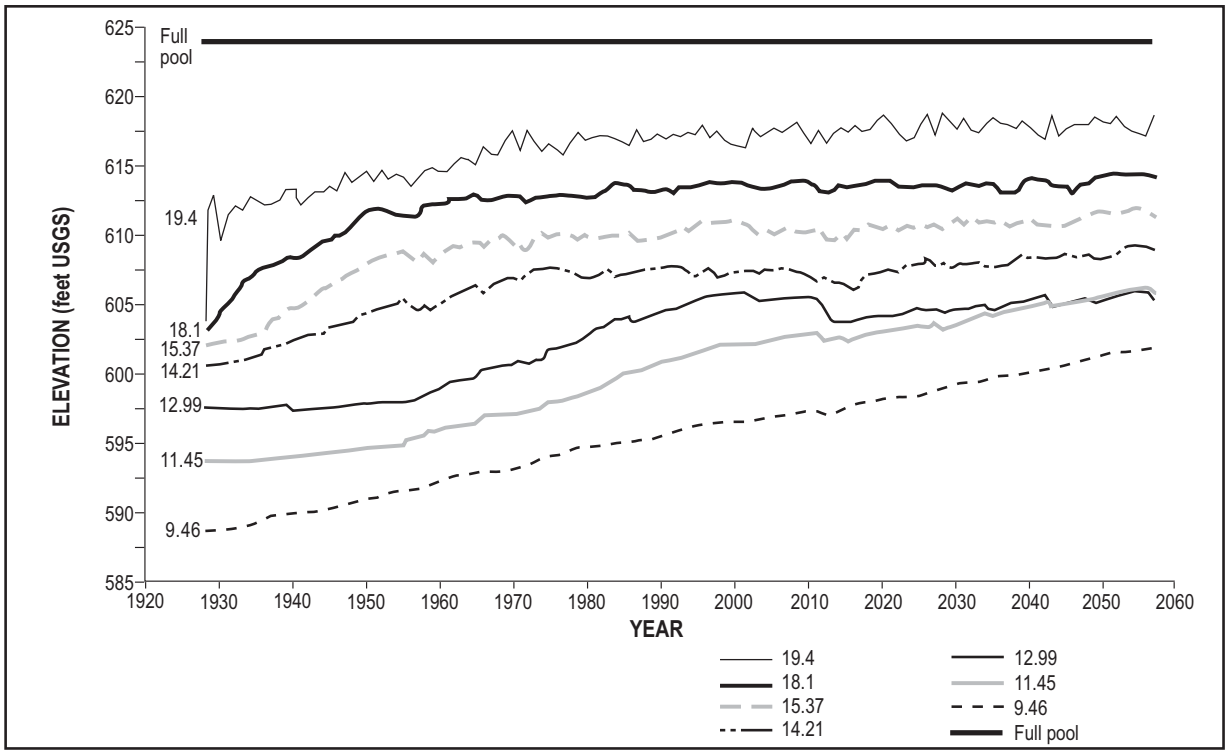


Figure 4. Thalweg elevations at specific river miles upstream of High Rock dam. (Source: MBH, 2007)

To develop hypothetical no-project conditions for the model to determine the natural aggradation in the Yadkin River, MBH also modeled changes in the thalweg elevation without High Rock dam in place (Salisbury, 2007b; figure 5). The modeled thalweg elevations increase only by about 1 foot within the modeled period from an elevation of 606 feet in 1927 to an elevation of 607 feet in 2058, well below the elevation with the dam in place.

This information suggests that without dredging the Yadkin River channel, similar to what is currently being done by Carolina Sand, Inc. near the intake structure, the intake gates would again become covered with sediment. Since these intakes are the sole source of potable water supply for the city of Salisbury, this potential loss represents a serious

concern for the Salisbury-Rowan Utilities Department, the citizens of Salisbury and Rowan County, and the area businesses.

As discussed in section 3.3.2.1, *Affected Environment,* the reservoir water elevations at the High Rock dam have only comparatively minor effects on the rate of accumulation of channel bed deposits near the pump station intake and on the location of the sediment delta in the upper reaches of the reservoir.

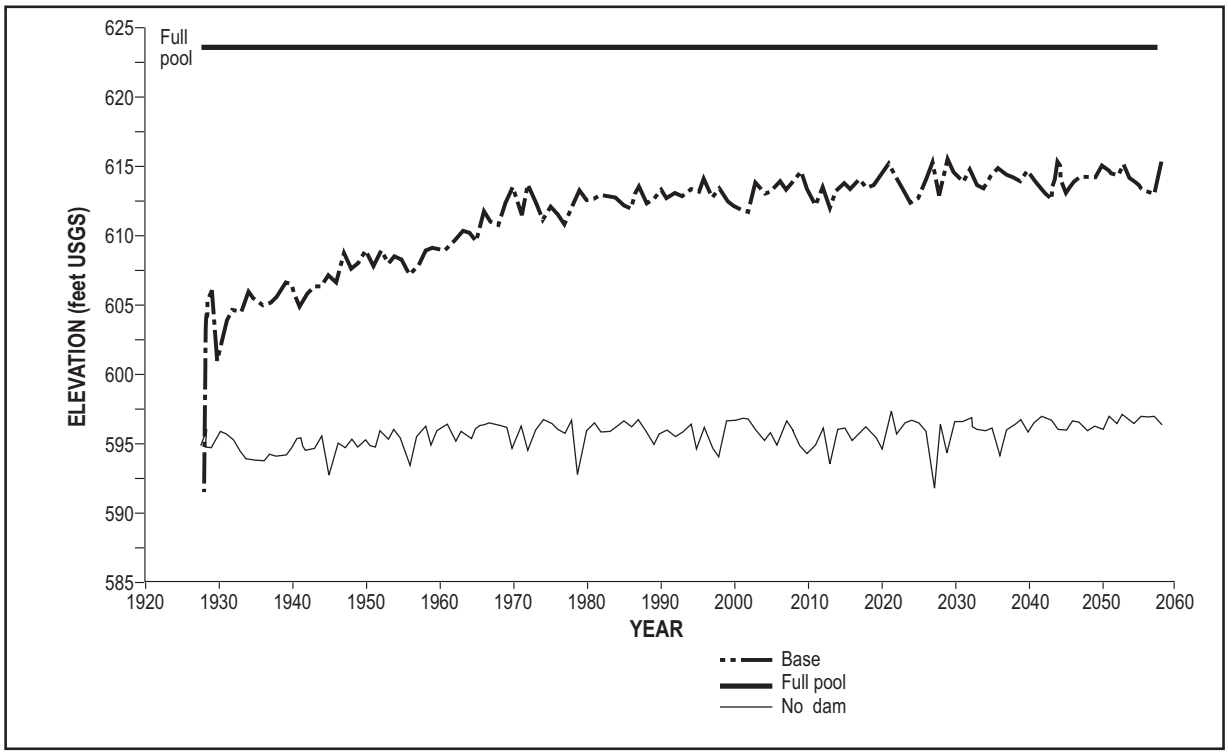


Figure 5. Calculated thalweg elevations for years 1928 to 2058 with High Rock dam in place and without the dam. (Source: Salisbury, 2007b)

The aggraded river channel and the development of an extensive sediment delta also have flooding implications. The aggradation of the river channel affects water surface elevations, especially during flood events and this issue is discussed in more detail in section 3.3.2, *Water Resources*.

Grant Creek Wastewater Treatment Plant

According to modeling by the city of Salisbury (MBH, 2007) in 1920, prior to the construction of High Rock dam, the 100-year flood (101,000 cfs) elevation was 628 feet at RM 16.7. Similarly, the flood of record (121,000 cfs, which occurred in July 1916) elevation was 630.1 feet at that location. These elevations are 6 feet and 3.9 feet, respectively, below the elevation of 634 feet at which the Grant Creek wastewater treatment plant, built in 1963, begins to flood.

Aggradation of the upper reaches of High Rock reservoir has also occurred in the vicinity of the wastewater treatment plant, as shown by the sediment accumulation over time on the aerial photographs (Doyle, 2007) and by the thalweg and cross section modeling results (MBH, 2007; see figure 4). According to the modeling by MBH, the 100-year flood elevation at RM 16.7, the location of the Grant Creek wastewater treatment plant, changed from 628 feet in 1920 to 634 feet in 1963, the year of construction of the wastewater treatment plant. The facility was constructed at an elevation just above that 1963, 100-year-flood elevation of 634 feet. Similarly, the flood of record elevation changed from 630.1 feet to 636.0 feet, which would have flooded the facility by 2 feet. By 2058, the 100-year flood elevation is predicted to reach 640.4 feet and the flood of record elevation is predicted to reach 642.9 feet, both well above the critical flooding elevation of 634 feet. Loss of wastewater treatment service and release of sewage into High Rock reservoir during major floods could potentially affect the water quality, public health, and public safety.

Although the basis of the design elevation selected for the Grant Creek wastewater treatment plant when it was constructed in 1963 is not known, we conclude that the design did not adequately take into account the rate of sediment build-up in High Rock reservoir. Modeling provided by the city of Salisbury indicates that the facilities would potentially have been overtopped by a 100-year flood event and would certainly have been overtopped by a flood comparable to the flood of record (121,000 cfs, which they now consider to be the design flow) at the time that they were constructed. The Salisbury modeling takes into account sediment deposition since the facility was constructed and into the future to the end of the projected license term and clearly indicates the potential for flooding events to affect treatment plant operations in the future, even if such events have not yet occurred.

Sedimentation Effects on Boating in High Rock Reservoir

Annually, an estimated 1.46 million cubic yards of sediment are transported into High Rock reservoir, especially during high flow events. Water elevations in the reservoir would likely rise to full pond elevation during many of the high flow events in the Yadkin River. This influence reduces the effect from Alcoa Generating's operational approach for the reservoir related to sedimentation patterns in the reservoir.

Coarser sediments settle in the upper reaches of the reservoir as part of the sediment delta. Due to continuing sediment influx over time, the delta gradually advances toward the dam. As a result, boat piers within the area of advancing sediment delta may eventually be silted in. In addition, the formation of the delta removes historic areas used for boating by creating wetland areas and shallow shoals.

Finer grained sediment particles (silt and clay) remain in suspension longer and are transported further downstream in the reservoir. These particles largely settle out. Fine-grained particles settle particularly in protected coves and other areas with reduced agitation of the water column by wind and currents. As a result, finer sediments may lead

to sediment buildup over time along the shore affecting boat piers. Siltation by finer sediments creates shoals is some areas, thereby also removing some areas previously available for boating, although the rate of siltation is considerably slower than the rate within the sediment delta.

Overall, the rate of loss of areas for boating is slow. The U.S. Department of Agriculture (1979) estimated a capacity loss for High Rock reservoir of 0.36 percent per year. Based on this rate, the capacity of the reservoir would be completely lost in 278 years. Therefore, during the life of the new license, an additional 20 percent of the storage capacity of the reservoir would be lost. Consequently, boating would be affected in some areas within the reservoir. However, the effect on boating due to sedimentation is offset by maintaining higher water elevations during the summer. Specifically, Alcoa Generating at present draws down typically up to 5 feet during the summer months. For the new license, it proposes to instead maintain the water level typically within only 4 feet of full pool. During the winter period, the drawdown typically is up to 13 feet from full pond. Alcoa Generating proposes to operate at typically 10 feet or less. It also proposes to extend the summer period by 3 months from the current period of mid-May to mid-September, to April 1 to October 31. Accordingly, the winter period would be 3 months shorter.

Shoreline Erosion at Blewett Falls

A landowner with land located at the north end of Buffalo Creek Drive expressed concerns that project operations may be causing erosion of her land. The area in question is on a point on the outside of a bend in the river, and the shoreline is oriented perpendicular to the flow of the river (letter from J. Hildreth, JMG Land and Timber, Inc., to the Commission, December 12, 2007). This area is located along the western shoreline of Blewett Falls reservoir, in the vicinity of the Spencer Pointe subdivision, which extends from the mouth of Buffalo Creek on the north end to the mouth of Smith Creek on the south end. This area represents one of the few areas along the reservoir where private development is in proximity to the water's edge.

The existing project boundary in this area generally follows the water line, although, in some areas, the project boundary is as much as 50 to 100 feet horizontally from the water's edge. In the vicinity of the land in question, the project boundary is nearly coincident with the water level corresponding to full pond (elevation 177.2 feet NAVD88 datum). The project ownership boundaries are not required to be shown on Exhibit G maps, and therefore it is not clear whether the erosion is occurring on Progress Energy lands or on lands owned by others, nor is it clear if the erosion is occurring within or beyond the project boundary in this area.

The identified shoreline erosion on Blewett Falls reservoir may be the result of normal water flow actions, wind action, project operations related to reservoir level fluctuations, and/or a variety of other factors. Project-related shoreline erosion could potentially occur as a result of project operations, recreational use at the project's

recreation access sites, or project-related activities. Shoreline erosion also could be the result of other factors that are not project-related, such as wind action or water flow.

A shoreline erosion plan designed to identify the location(s) and cause of erosion on shoreline lands within or adjacent to the project boundary would be necessary to determine whether the erosion is project-related and the extent of Progress Energy's responsibility for remediation or stabilization of erosion occurring along the reservoir shoreline.

Specifically, a soil erosion plan would include the following measures: (1) an erosion site inventory, including identification of the location and assessment of the cause of the erosion; (2) proposed measures to control soil erosion and to prevent slope instability for all identified project-related erosion sites; (3) functional design drawings of all soil erosion control measures; (4) a specific implementation schedule and details for monitoring; (5) a mechanism to identify and control future project-related soil erosion, if necessary; and (6) measures for consultation with North Carolina DENR, North Carolina WRC, and interested stakeholders in the development and implementation of the plan.

The shoreline erosion plan would provide the measures to identify the location(s), potential causes, mitigation measures, if needed, and provide measures for long-term monitoring of shoreline erosion at Blewett Falls reservoir. These measures along with the implementation of the shoreline management policy (see section 3.3.8, *Land Use and Aesthetics*) would provide the means for limiting shoreline disturbances resulting from project-related activities.

Summary

In summary, the existence of High Rock dam has affected the city of Salisbury water intake and pump station, as well as the Grant Creek wastewater treatment plant. Also, the capture of natural sediment carried by the river has long-term implications for boating in High Rock reservoir, although the proposed higher operational elevations for the reservoir would have an immediate positive effect on boating.

3.3.1.3 Cumulative Effects

The Yadkin River is expected to continue carrying high loads of sediment. While the total annual load may increase slightly with increased urbanization, decreased agricultural use, and/or as a result of the implementation of best management practices, the total load would remain large. Much of the sediment transported by the Yadkin River is captured by the reservoirs of the project, especially High Rock reservoir. This sediment is thus not available in reaches downstream of the reservoirs. However, additional sediment is supplied by downstream tributaries to the Yadkin and Pee Dee rivers. Less sediment in the river probably has a slightly positive effect for the spawning of fish. On the other hand, the removed sediment may have an adverse effect on the replenishment of sediment of the beaches along the Atlantic shore. Given the distance

between the Alcoa Generating and Progress Energy reservoirs and the Atlantic Ocean, the potential effect is considered comparatively small.

3.3.1.4 Unavoidable Adverse Effects

The U.S. Department of Agriculture estimates an annual load of 903 acre-feet (i.e., 1.46 million cubic yards) being deposited in High Rock reservoir. This load reduces the storage capacity in the reservoirs, specifically within High Rock reservoir. While dredging at the Salisbury water intake reduces the total load entering the reservoir, dredging the entire sediment load entering the reservoirs would be costly and complicated by the disposal of the large volume of sediment. Only the coarse-grained sediment fraction of the sediment (i.e., sand and gravel) is suitable as construction material, and could potentially be sold (to the extent that the construction aggregate market is able to absorb it). The predominant fine-grained fractions (silt and clay) are not suitable.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Quantity

The Yadkin and Yadkin-Pee Dee River Projects use water of the Yadkin River and Pee Dee River basins to generate electricity (see figures 1 and 6). The river basins drain a portion of the eastern slopes of the Blue Ridge Mountains and some of the Piedmont area of central North Carolina including the urban areas of Winston-Salem and Charlotte. The total drainage area at the furthest downstream development, Blewett Falls, is 6,839 square miles. Below the Blewett Falls development, the Pee Dee River flows for about 188 river miles to the Atlantic Ocean.

Table 4 summarizes the characteristics of the six project reservoirs considered in this EIS.

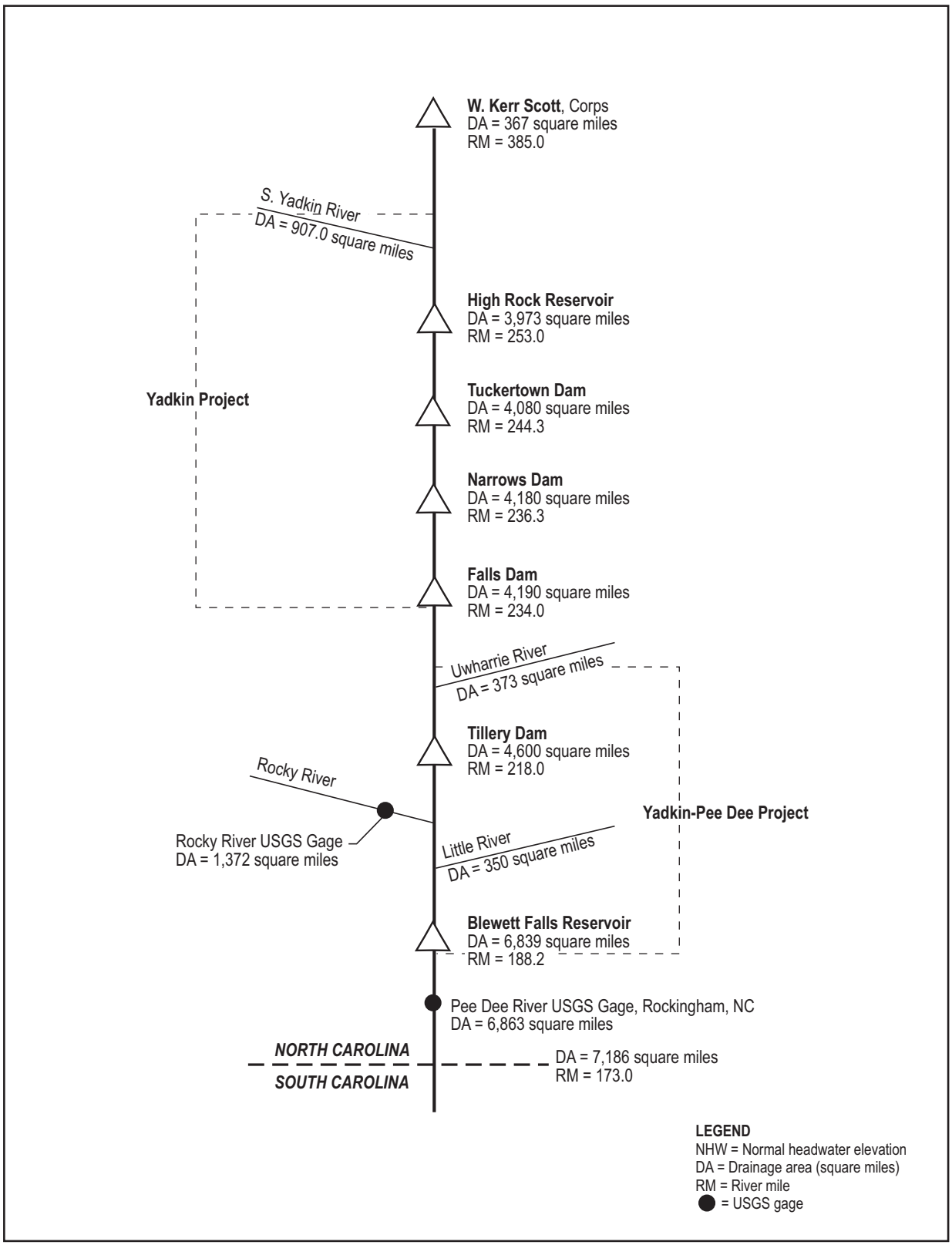


Figure 6. Yadkin (P-2197) and Yadkin-Pee Dee River (P-2206) Project facilities flow diagram. (Source: Alcoa Generating 2006a; Progress Energy, 2006)

Table 4. Reservoir characteristics for the Yadkin (P-2197) and Yadkin-Pee Dee River (P-2206) Projects. (Source: Alcoa Generating, 2006a; Progress Energy, 2006a)

Reservoir	River Mile of dam	Drainage Area (square miles)	Normal Maximum Water Surface Elevation (feet USGS)	Normal Minimum Water Surface Elevation (feet USGS)	Surface Area[a] (acres)	Average and Maximum Depths (feet)	Usable Storage[b] (acre-feet)	Typical Daily Elevation Changes (feet)
Yadkin Project								
High Rock	253	3,973	623.9	610.9	15,180[c]	17/62	136,000[d]	Less than 1
Tuckertown	244.3	4,080	564.7	561.7	2,560	16/55	6,700	Less than 1
Narrows	236.5	4,180	509.8	506.8	5,355	45/175	16,400[e]	1 to 2
Falls	234	4,190	332.8	328.8	204	27/52	2,440	0 to 2
Yadkin–Pee Dee River Project								
Tillery	218	4,600	278.2	274.2	5,697	NA/72	19,000[f]	1 to 1.5
Blewett Falls	188.2	6,839	178.1	172.1	2,866	NA/35	12,500[g]	2 to 4

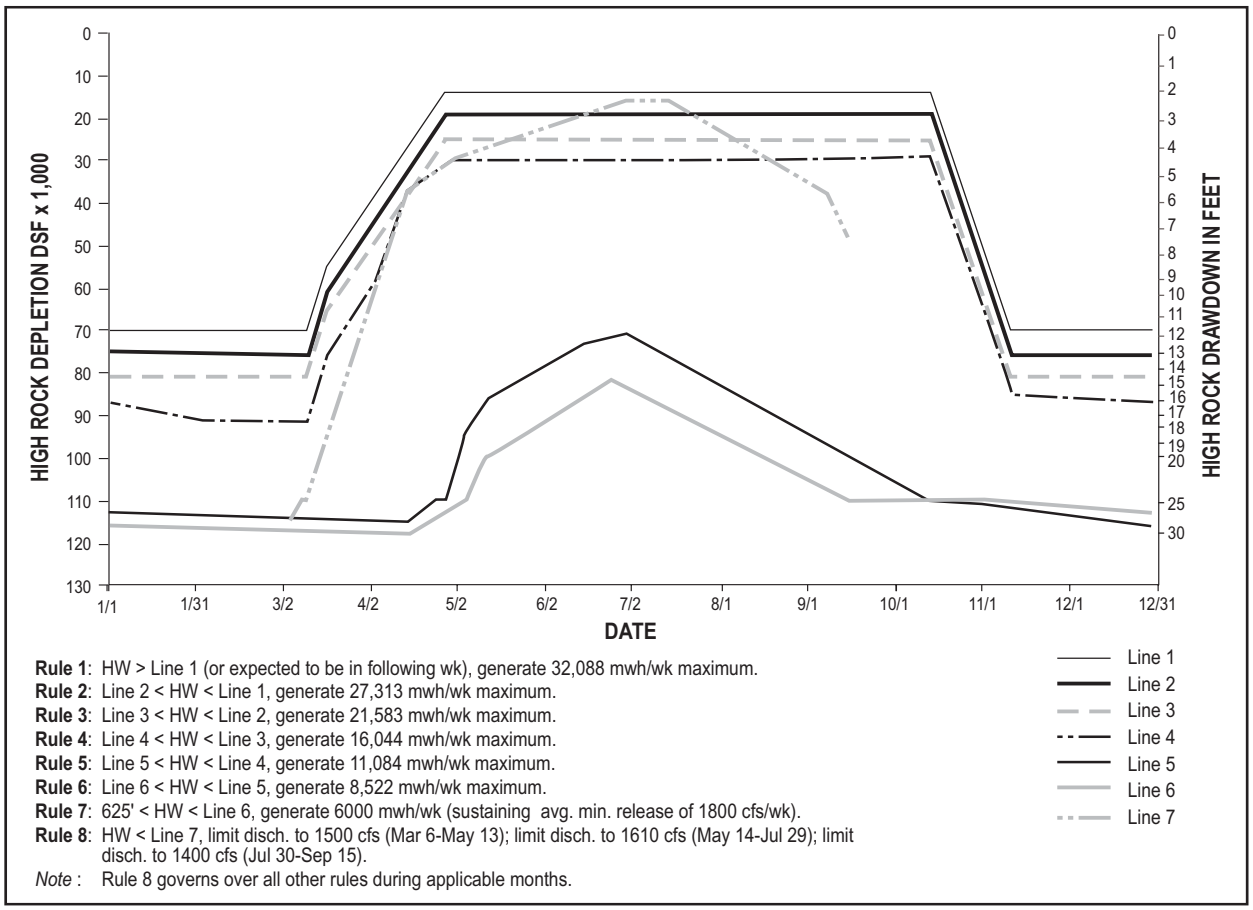
[a] At normal maximum water surface elevation.
[b] Between normal maximum and normal minimum water surface elevations.
[c] At a drawdown of 6 feet, the surface area is about 11,800 acres and at 10 feet of drawdown, it is about 10,200 acres.
[d] Usable storage of 217,400 acre-feet with a licensed 30-feet drawdown and gross storage of 237,900 acre-feet.
[e] Usable storage of 129,000 acre-feet with a licensed drawdown of 31.1 feet.
[f] Usable storage of 84,150 acre-feet with a licensed drawdown of 22 feet.
[g] Usable storage of 24,000 acre-feet with a licensed drawdown of 17 feet.

High Rock Development

The uppermost and main storage reservoir is High Rock reservoir. Water released from High Rock reservoir provides the majority of the inflow to the downstream Tuckertown, Narrows, Falls, and Tillery developments. The only major reservoir upstream of High Rock reservoir in the Yadkin River Basin is the W. Kerr Scott reservoir operated by the Corps for flood control, recreation, and water supply. W. Kerr Scott reservoir has a drainage area of 367 square miles and is located at RM 385. High Rock reservoir is a relatively shallow reservoir that, at full pool, extends about 19 river miles upstream to near the confluence of the South Yadkin and Yadkin rivers.

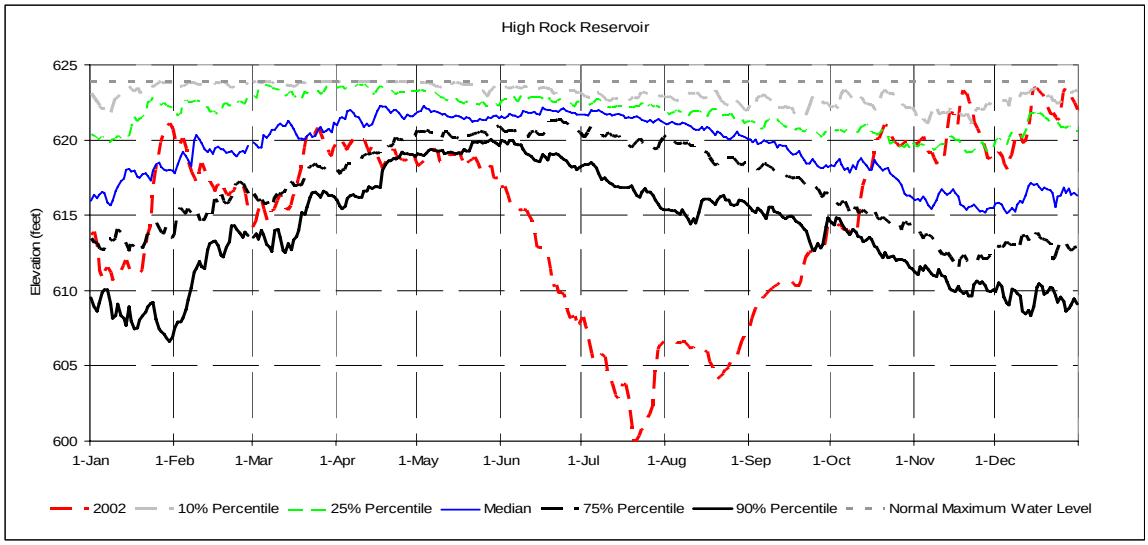
Alcoa Generating operates the High Rock development in a store-and-release mode in accordance with an operating guide effective since 1968 (figure 7). Within the limitations of available streamflow, it maintains higher water elevations in High Rock reservoir from mid-May to mid-September and draws down the reservoir in the fall-winter to allow for refill during the late winter and spring. From mid-May to mid-September, the reservoir surface elevation normally is within 5 feet of full pool or less and within 13 feet of full pool during the winter. During periods when water levels and streamflow are low in early March to mid-September, the operating guides have over-ride requirements for Alcoa Generating to discharge a minimum amount of water to satisfy downstream needs. An emergency drought protocol was established in 2002, when North Carolina and South Carolina were in the midst of a severe multi-year drought. Figure 8 shows the water levels for High Rock reservoir during 2002 and other years since 1969.

During high flows at High Rock dam, even during sizable flood events, Alcoa Generating releases water via 10 spillway gates to limit the peak water surface at High Rock reservoir near the dam to about 623.9 feet. However, during these high flow events, flooding occurs in the upper reaches of the reservoir generally above the I-85 bridge (RM 15), including the city of Salisbury pump station, the Grant Creek wastewater treatment plant, and other low lying areas. Table 5 provides monthly inflow exceedances, and table 6 describes several flood hazard levels at the pump station, as defined by the city of Salisbury. Table 7 provides the flood recurrence intervals near the city of Salisbury pump station in the upper reaches of High Rock reservoir. The city of Salisbury states that flooding of the Grant Creek wastewater treatment plant starts at elevation 634.0 feet. Since construction of the Grant Creek wastewater treatment plant in 1963 and the Salisbury pump station in 1917, neither facility has been damaged by flooding.



Rule 1: HW > Line 1 (or expected to be in following wk), generate 32,088 mwh/wk maximum.
Rule 2: Line 2 < HW < Line 1, generate 27,313 mwh/wk maximum.
Rule 3: Line 3 < HW < Line 2, generate 21,583 mwh/wk maximum.
Rule 4: Line 4 < HW < Line 3, generate 16,044 mwh/wk maximum.
Rule 5: Line 5 < HW < Line 4, generate 11,084 mwh/wk maximum.
Rule 6: Line 6 < HW < Line 5, generate 8,522 mwh/wk maximum.
Rule 7: 625' < HW < Line 6, generate 6000 mwh/wk (sustaining avg. min. release of 1800 cfs/wk).
Rule 8: HW < Line 7, limit disch. to 1500 cfs (Mar 6-May 13); limit disch. to 1610 cfs (May 14-Jul 29); limit disch. to 1400 cfs (Jul 30-Sep 15).
Note : Rule 8 governs over all other rules during applicable months.

Figure 7. High Rock reservoir existing rule curves. (Source: Alcoa Generating, 2006a)



Notes: Percentiles based on water levels for 1969-2005.

Figure 8. High Rock reservoir daily water surface elevations. (Source: Alcoa Generating, 2006c)

Table 5. Monthly exceedances of inflow (cfs) to High Rock reservoir.[a] (Source: Alcoa Generating, 2006a)

Month	Maximum	10%	25%	50%	75%	90%
Jan	85,521	10,610	6,324	4,376	3,100	2,323
Feb	76,318	11,361	7,323	4,946	3,723	2,710
Mar	100,601	12,319	7,631	5,388	4,005	2,993
Apr	80,046	11,040	7,012	4,700	3,381	2,574
May	43,298	7,959	5,527	3,766	2,698	2,125
Jun	112,051	6,815	4,613	3,300	2,254	1,510
Jul	24,125	5,717	3,741	2,653	1,870	1,331
Aug	89,816	5,752	3,610	2,458	1,755	1,266
Sep	85,205	4,965	3,050	2,101	1,553	1,182
Oct	82,312	6,235	3,401	2,138	1,594	1,114
Nov	42,430	6,307	4,001	2,605	1,957	1,463
Dec	43,216	7,765	5,152	3,638	2,516	1,912

[a] For 1930 to 2003.

Table 6. Flood hazard levels at the city of Salisbury pumping station. (Source: SRU-McGill, 2007)

Hazard Level	Flood Elevation (feet)	Description
1	628.0	Flooding of access road to the pump station.
2	630.0	Flooding of the land surface at the pump station.
3	643.0	Flooding of the elevated mechanical and electrical rooms at the pump station.

Note: The March 21, 2003, flood reached elevation 640.0 feet.

Table 7. Flood recurrence intervals near the Yadkin and South Yadkin River confluence. (Source: SRU, 2006b)

Flood Recurrence Interval (years)	Flow (cfs)
1.25	25,000
2	37,000
5	54,000
10	65,000
25	80,000
50	91,000
100	101,000
200	112,000
Design[a]	121,000

Note: cfs – cubic feet per second

[a] The city of Salisbury used the design flow stated as the design flood of record for the construction of the pump station and wastewater treatment plant. Calculations of this flood event in 1916 were based on a gage about 4 miles below the confluence of the South Yadkin and Yadkin rivers and before the construction of the upstream W. Kerr Scott flood control dam in 1962. Alcoa Generating questions the reliability of this flow value; however, the use of this value, which is larger than the 100-year flood event, appears reasonable as a general approximation for the 1916 flood. USGS (Bales, 2007) states that its calculation of the 100-year flow at the former gage site based on data collected from 1896 to 1927 is 166,000 cfs. USGS (Bales, 2007) also states that the methods used by Salisbury to calculate the 100-year flow shown in this table might result in an underestimation of the flow at the confluence of the Yadkin and South Yadkin rivers near the pump station.

Several studies, including FERC (2003), show that the operation of High Rock dam has a limited influence during flood conditions on the reservoir levels upstream near the Salisbury pump station and Grant Creek wastewater treatment plant. During flood conditions, riverine conveyance capacity becomes the dominant factor for determining flood level elevations upstream of RM 15 (about 80,000 feet from the dam). As figure 9 shows, the water level above RM 16 (about 85,000 feet from the dam) is not affected by the water level at High Rock dam at high flows such as 70,000 cfs. Table 8 shows the water level elevations at the Salisbury pump station at flows ranging from 5,000 to 70,000 cfs.

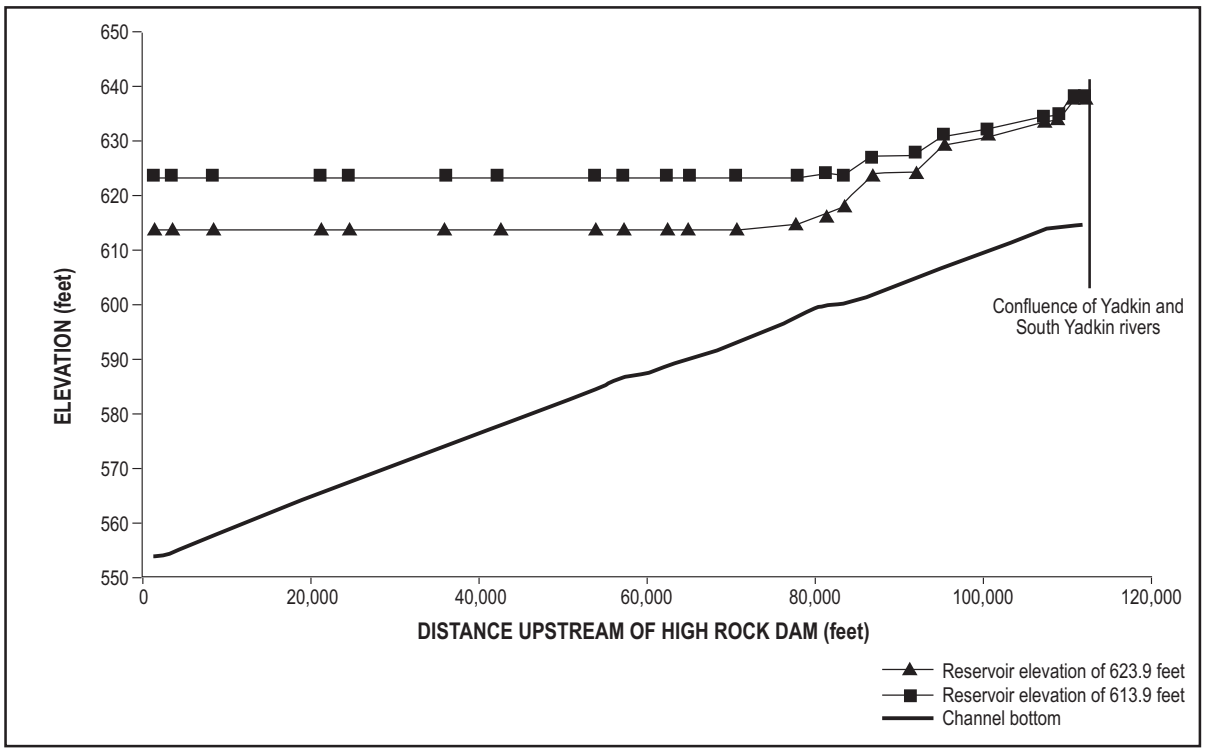


Figure 9. Water surface profiles for the Yadkin River at a discharge of 70,000 cfs. (Source: FERC, 2003)

Table 8. Water surface elevations near RM 19.4. (Source: FERC, 2003)

	Based on a Starting Reservoir Elevation of:		
Discharge (cfs)	**623.9 Feet**	**613.9 Feet**	**Difference (feet)**
70,000	638.98	638.81	0.17
40,000	633.47	632.97	0.50
20,000	628.56	627.46	1.10
10,000	625.68	623.52	2.16
5,000	624.44	620.77	3.67

Note: cfs – cubic feet per second

Tuckertown Development

The upstream limit of Tuckertown reservoir is immediately below High Rock dam, and inflow is almost totally controlled by outflow from High Rock. Median inflow to Tuckertown reservoir ranges from a low of 2,339 cfs in July to a high of 7,008 cfs in March (Alcoa Generating, 2006a), and the general trend in median flows mimics the inflow to High Rock reservoir shown in table 5. Daily inflow to Tuckertown reservoir during extremely dry years (exceeded 90 percent of the time) is substantially less than

inflow to High Rock reservoir, ranging from a low of 13 cfs in October to a high of 1,139 cfs during March. Alcoa Generating operates the Tuckertown development as essentially run-of-river, with a normal daily fluctuation of less than 1 foot and a maximum daily fluctuation of 1 to 3 feet. The current license requires limiting the drawdown of Tuckertown reservoir, except under emergency conditions or for maintenance, to no more than 3 feet below normal full pool elevation, for a range in elevation from 564.7 to 561.7 feet. Historically, the maximum annual drawdown at Tuckertown reservoir averaged 2 feet. Water released from the Tuckertown development flows immediately into Narrows reservoir.

Narrows Development

The Narrows development is also operated as a run-of-river facility, with a normal daily fluctuation of less than 1 foot and a maximum daily fluctuation of 1 to 2 feet. Historically, the normal drawdown here has been about 3 feet. Narrows reservoir has the second largest storage volume of the Yadkin Project developments, and Alcoa Generating uses this storage to meet the required minimum downstream releases from Falls reservoir. Table 9 shows the relationship between High Rock and Narrows reservoir drawdowns under the existing operating guide.

Table 9. Relationship between High Rock and Narrows reservoir drawdowns under the existing operating guide. (Source: Alcoa Generating, 2006a)

High Rock		Narrows		
Elevation (feet)	**Drawdown (feet)**	**Elevation (feet)**	**Drawdown (feet)**	**Approximate Storage (acre-feet)**
623.9	0.0	509.8 to 507.7	0 to 2.1	12,000
622.9	1.0	508.2 to 503.2	1.6 to 6.6	33,000
599.9	24.0	508.2 to 503.2	1.6 to 6.6	33,000
599.9	24.0	502.7	7.1	36,000
597.7	26.0	493.7	16.1	76,000
593.9	30.0	478.8	31.1	128,000

Falls Development

Similar to Tuckertown, Alcoa Generating operates the Falls development as a run-of-river facility with a normal daily fluctuation of 0 to 2 feet and a maximum daily fluctuation of 3 to 4 feet. There is no seasonal drawdown here because of its limited storage capacity. Table 10 shows the existing monthly outflow exceedances.

Table 10. Monthly exceedances of outflow (cfs) from Falls reservoir. (Source: Alcoa Generating, 2006a)

Month	10%	25%	50%	75%	90%
Jan	10,028	7,830	6,389	3,602	176
Feb	10,081	8,597	7,168	4,740	979
Mar	10,689	9,624	7,599	5,823	1,651
Apr	10,314	9,589	6,904	2,118	917
May	9,690	7,308	5,008	2,122	101
Jun	8,400	6,683	2,386	2,254	79
Jul	7,797	5,634	2,266	1,960	10
Aug	7,786	6,447	3,489	1,960	0
Sep	6,975	4,241	2,805	917	0
Oct	8,298	5,134	2,948	1,161	0
Nov	7,811	6,120	4,119	1,890	0
Dec	8,400	7,012	4,784	2,646	0

Under the existing license, Alcoa Generating does not have a minimum flow requirement at Falls dam. As part of an existing Commission Order from March 1968 that concerns headwater benefits, Alcoa Generating is required to release from Falls reservoir a weekly average streamflow during the 10-week period preceding the recreation period (May 15 through September 15) of no less than 1,500 cfs; during the period May 15 through July 1, of no less than 1,610 cfs; and during the period July 1 through September 15, of no less than 1,400 cfs. Flows released from Falls dam travel a very short distance through the Falls dam tailwaters into Lake Tillery, with the distance depending on the water surface elevation of Lake Tillery. Lake Tillery extends 16 miles upstream from the Tillery dam at RM 218 to the tailwaters of the Falls dam at RM 234.

Tillery Development

Other than the inflow from the unregulated Uwharrie River (drainage area of 373 square miles), inflows to Tillery are almost totally dependent on outflows from Falls dam. During the summer and fall months, inflows from the Uwharrie River frequently fall below 50 cfs.

The existing license allows drawdowns at Lake Tillery of up to 22 feet below the full pond elevation of 278.2 feet. However, Progress Energy voluntarily operates Lake Tillery within a 4-foot range under normal conditions, and typically operates within a 1- to 1.5-foot range. Based on an informal agreement with the North Carolina Wildlife Resources Commission (WRC), Progress Energy also attempts to maintain water levels

in Lake Tillery from April 15 to May 15 within about 1 foot of full pond to enhance largemouth bass spawning.

Progress Energy operates the Tillery development as a peaking and load-following facility, and typical operation includes daily generation during weekdays and load-following operations during peak demand hours (figure 10). The maximum turbine hydraulic capacity at the Tillery development is about 18,000 cfs, compared to 9,200 cfs at the Blewett Falls development. Progress Energy operates the Tillery development run-of-river roughly 10 percent of the time, when the inflow is at or above the hydraulic capacity. The Blewett Falls development reregulates the discharge from Tillery, and the difference in hydraulic capacities requires close coordination between the two developments.

Under its existing license, Progress Energy must provide a continuous minimum release of 40 cfs from the Tillery development at all times. Periodic measurements by USGS of the minimum release flow below Tillery show that the actual current minimum release below Tillery is roughly 70 to 80 cfs. This commonly results in a median daily flow of about 80 cfs on many days during July through October in dry years. The maximum median daily flow, 9,000 cfs, occurs during March. The flood of record (160,000 cfs) at Tillery occurred in September 1954 as a result of Hurricane Hazel.

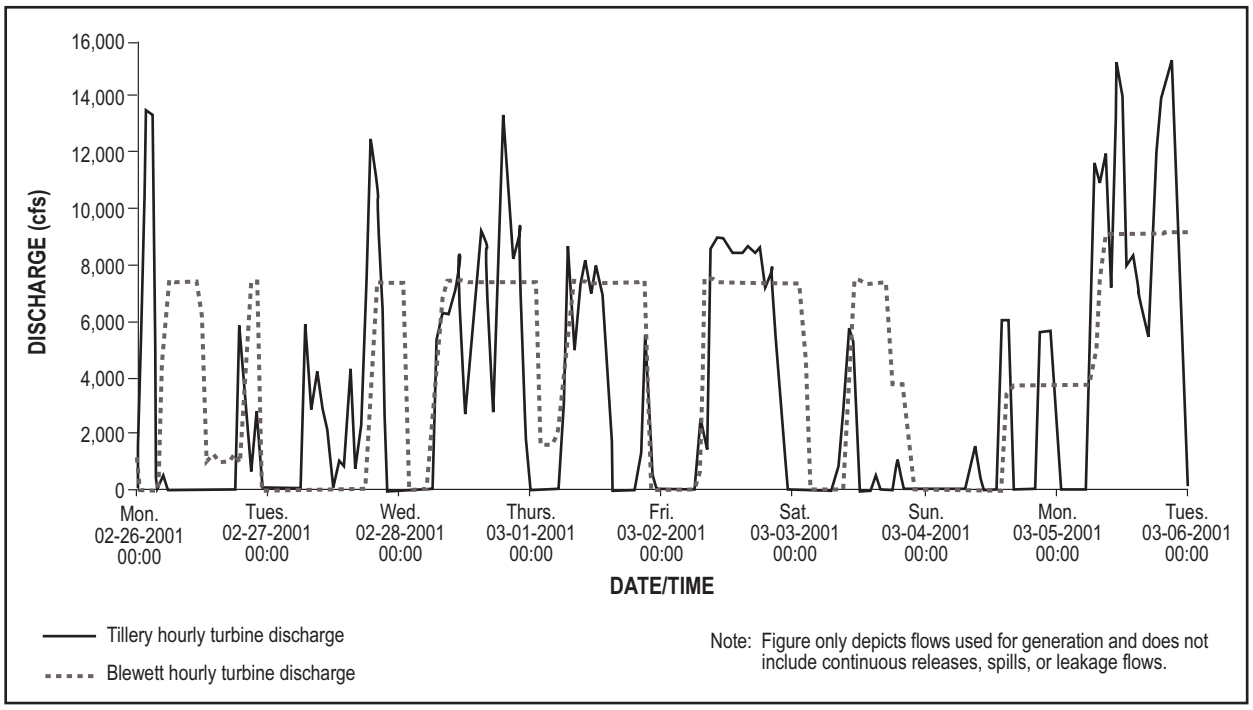


Figure 10. Example of the coordination of project operations between the Tillery and Blewett Falls developments. (Source: Progress Energy, 2006a)

Below Tillery dam, a 20.5-mile-long riverine reach extends between the Tillery tailwater and the upstream influence of Blewett Falls reservoir. Typical travel time for

flow in this reach is about 6 to 10 hours depending on the discharge rate. Rocky River enters the Pee Dee River about 5 river miles downstream of Tillery dam. Rocky River, the main source of accretion flows within the Tillery reach with a drainage area of about 1,457 square miles, is unregulated and has a flashy flow regime partly due to runoff from the urban areas near Charlotte. The minimum flow recorded from 1962 to 2006 at USGS gage no. 02126000 (Rocky River near Norwood) was 41 cfs, and the maximum flow was 55,100 cfs; both extremes were measured during October. Median monthly flow values measured at this gage range from 1,170 cfs in March to 154 cfs during October. A smaller tributary, Brown Creek (drainage area 176 square miles), enters the Pee Dee River about 12 river miles downstream from Tillery dam. Little River (drainage area 350 square miles) and Mountain Creek (drainage area 75 square miles) enter the Pee Dee River at locations where the water surface is normally controlled by Blewett reservoir.

Blewett Falls Development

Blewett Falls reservoir is located at RM 188.2 on the Pee Dee River, about 30 miles downstream from Tillery dam. Progress Energy's existing license allows maximum drawdowns here of 17 feet below the full pond elevation of 178.1 feet. However, operational concerns with the intakes can limit the drawdown to 11 feet. Under normal operations, when river flows are less than about 7,000 cfs, the daily drawdown is about 2 to 4 feet, with part of the drawdown to allow for inflow from Tillery and to limit the spillage of water at Blewett Falls dam (figure 11).

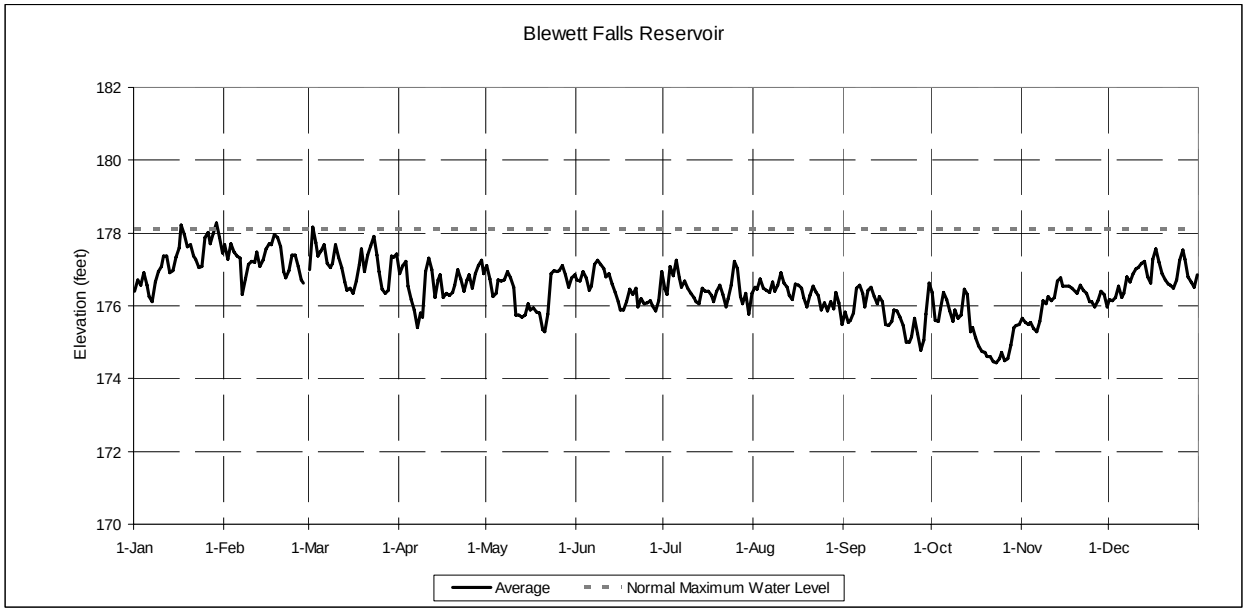


Figure 11. Blewett Falls reservoir daily water surface elevations. (Source: Progress Energy, 2006e)

Blewett Falls is normally operated once a day in a block-loaded mode with either a three-unit block load[27] (3,600 cfs), or a six-unit block load (7,200 cfs), depending on inflow. If inflow is greater than 7,200 cfs, the development is operated in a run-of-river mode up to the powerhouse hydraulic capacity of 9,200 cfs, above which excess flows are discharged over the spillway. Run-of-river operations occur at the Blewett Falls development about 50 percent of the time. Under low inflow conditions, the development is sometimes operated with a single generating unit. The existing license requires a minimum instantaneous stream flow of 150 cfs, as measured at USGS gage no. 02129000 (Pee Dee River near Rockingham, North Carolina), 3.6 miles downstream.

At Blewett Falls dam, the concrete gravity ogee-type spillway at elevation 174.1 feet is topped by 4 feet of wooden flashboards. By design, flashboard failure along the crest of the spillway commonly occurs when the water level exceeds a depth of 3 feet (elevation 181.1 feet). Following the failure, the reservoir must be drawn down to a few feet below the elevation of the concrete spillway to allow for the safe replacement of the flashboards. The flood of record at Blewett Falls is 276,000 cfs in August 1908, which slightly surpasses the 270,000 cfs from the Hurricane Hazel flood of September 1954. Table 11 shows the flow regime downstream of Blewett Falls dam.

Table 11. Monthly exceedances of flow (cfs) at USGS gage no. 02129000 Pee Dee River near Rockingham, NC, 3.6 miles downstream of Blewett Falls dam.[a] (Source: USGS, 2007)

Month	Maximum	10%	25%	50%	75%	90%	Minimum
Jan	100,000	21,700	12,500	9,320	5,640	2,960	239
Feb	124,000	21,100	13,900	10,000	6,930	3,840	275
Mar	124,000	27,160	15,000	10,400	6,525	4,038	240
Apr	140,000	20,220	12,000	8,255	4,373	1,966	277
May	63,600	12,600	9,365	5,500	3,135	1,178	147
Jun	93,400	11,410	8,020	4,825	2,820	1,139	190
Jul	89,500	9,696	6,405	3,930	2,370	689	158
Aug	69,500	9,826	6,015	3,610	2,030	625	197
Sep	81,400	9,162	5,560	3,415	1,590	514	146

[27]A block load is a set output or load (MW) scheduled for a period of time. The generation output graph would be a shaped like a block (e.g., 0 to 10 MW at the start of hour 1 and running for 3 hours at constant 10 MW output, then returning to 0 MW at the end of 3 hours).

Month	Maximum	10%	25%	50%	75%	90%	Minimum
Oct	127,000	10,000	6,255	3,870	1,740	506	120
Nov	51,800	9,973	7,415	4,540	2,373	776	202
Dec	77,600	13,200	9,900	6,920	3,950	1560	254

[a] For 1962 to 2006.

As figure 10 shows, with the current operation of Blewett Falls, flows normally change in the reach downstream of Blewett Falls dam once or twice a day, unlike the load-following operation at Tillery. Downstream of Blewett Falls, the Pee Dee River meanders along a low gradient course about 188 river miles to the Atlantic Ocean. Table 12 shows the annual and monthly median accretion at six points downstream of Blewett Falls dam along the Pee Dee River.

Table 12. Annual and monthly median accretion flows downstream of Blewett Falls. (Source: Progress Energy, 2006a)

RM	Annual Median (cfs)	Range of Monthly Median Flows (cfs)
186.3	21	11 to 48
181	139	74 to 317
170	293	156 to 667
150	725	387 to 1,651
119	991	529 to 2,255
107.5	1358	725 3,092

Note: cfs – cubic feet per second

During low and very low flow conditions, the flow released by Blewett Falls dam can account for a substantial portion of the flow in the Pee Dee River downstream to the Atlantic Ocean. Figure 12 shows the daily average flow at the Rockingham gage and at gage no. 02131000 [Pee Dee River at Pee Dee, South Carolina (RM 100.2)], which has a total drainage area of 8,830 square miles, roughly 2,000 square miles larger than at Blewett Falls dam. At flows during the 100-year flood event, the Pee Dee, South Carolina, gage would be 150,000 cfs, as compared to 225,000 cfs at the Rockingham gage, because of the attenuation caused by storage in wetlands and the flood plain. However, studies conducted by Progress Energy on the Pee Dee River downstream of Blewett Falls dam indicate that flows up to about 11,500 cfs are retained within the natural channel without reaching overbank areas.

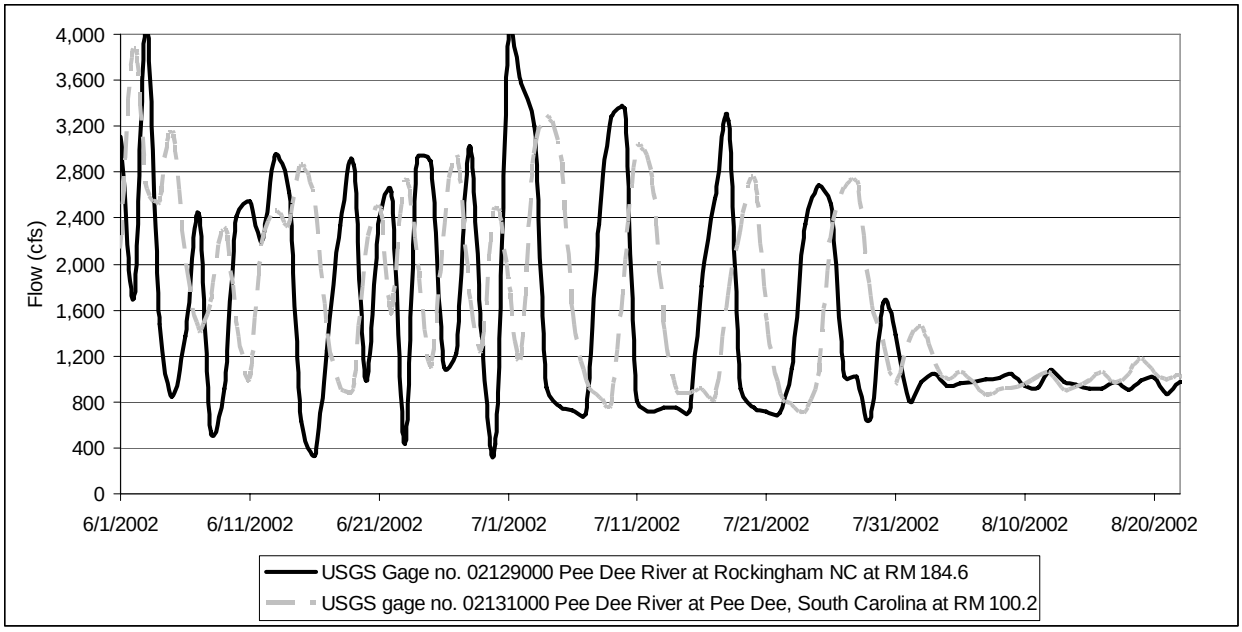


Figure 12. Daily flow during June, July, and August of 2002 downstream of Blewett Falls dam. (Source: USGS, 2007)

Water Use

While water in the project reservoirs is used primarily for hydropower production, the reservoirs are also used to provide water withdrawals for municipal and industrial purposes. Table 13 summarizes the major water withdrawals from the Yadkin Project reservoirs. Other users withdraw minor amounts of water from the reservoirs for agricultural and recreational uses.

Duke Energy operates the 369-MW coal-fired Buck Steam station on the shores of High Rock reservoir. Duke has a National Pollutant Discharge and Elimination System (NPDES) permit to withdraw up to 394.6 million gallons per day (MGD) for process operations and cooling. Based on data from 2004, Duke withdrew 233.3 MGD, of which 230.3 MGD were returned to the reservoir. The existing NPDES permit (issued in 2004 and expiring in 2009) states that, when High Rock reservoir is drawn down 10 feet or greater, as measured at the Buck Steam station site, Duke Energy shall use (a) no more than two-thirds of the stream flow for condenser cooling and (b) ensure that the minimum unheated daily average stream flow does not fall below one-third of the 7-day 10-year low flow value. During June 2002, because of severe drought conditions that resulted in low inflows and low reservoir levels, Duke was forced to shut down all generation. Duke states that operational restrictions start when High Rock reservoir is drawn down more than 6 feet below full pond elevation of 623.9 feet.

Table 13. Summary of major water withdrawals from the Yadkin Project (P-2197). (Source: Alcoa Generating, 2006a)

Water User	Type	Source of Withdrawal	Total Amount Withdrawn Annually	Average Annual Daily Withdrawal (MGD)
City of Salisbury[a]	Municipal	Confluence of Yadkin and South Yadkin rivers	2,279.7 million gallons	6.246 (total surface water supply available for regular use is 54)
City of Albermarle	Municipal	Tuckertown and Narrows reservoirs	2,762.363 million gallons (total)	7.568 total (3.524) from Tuckertown reservoir and 4.040 from Narrows reservoir)[b]
Town of Denton	Municipal	Tuckertown reservoir	503.492 million gallons	1.379 (total surface water supply available for regular use is 2.300)
Duke Power's Buck Steam station	Industrial cooling water	Upper Portion of High Rock reservoir		233.3[c] (daily withdrawal capacity is 394.6)

Notes: MGD = million gallons per day

[a] According to the city of Salisbury, it returns nearly the same amount of water at its Grant Creek wastewater treatment plant in the upper reaches of High Rock reservoir.
[b] Total contract with Alcoa Generating for water withdrawal is 18 MGD.
[c] The average daily amount of water returned to the reservoir was 230.3 MGD.

At Lake Tillery (normal full pool elevation of 278.2 feet), Montgomery County and the town of Norwood withdraw water from intakes at about elevation 258.2 feet, 20 feet below the normal full pool water surface. However, Progress Energy states that operational problems start when the water level is 6 to 8 feet below normal full pool. There are two municipal water withdrawals for Anson and Richmond counties at Blewett Falls reservoir (normal full pool elevation of 178.1 feet). The invert for the Anson County withdrawal is located at elevation 167.2 feet, and Progress Energy notifies Anson County if it plans to draw down the reservoir below elevation 171.6 feet, which is the elevation when impairment of the intake begins.

The prolonged drought of 1998-2002 (the most severe on record in this region) put the six North Carolina public water supply systems that withdraw water from the Yadkin

and Yadkin-Pee Dee reservoirs[28] at risk, since the downstream flow requirements for the reservoirs were greater than the inflow. Within the larger Yadkin-Pee Dee River Basin, there was one public water system in emergency status, 15 under mandatory conservation, 19 under voluntary conservation, and most of the other 70 public water systems were in a threatened or highly vulnerable status.

During the severe drought of 1998-2002, Alcoa Generating, Carolina Power & Light Company (now Progress Energy), North Carolina DENR, South Carolina DNR, and South Carolina Department of Health and Environmental Control entered into an the Emergency Drought Protocol of 2002 to manage streamflow in the basin. Recovery from this drought started in the last half of 2002.

A large portion of coastal South Carolina from near the North and South Carolina border to the city of Georgetown, SC including the Myrtle Beach area, relies on the Pee Dee River for its water supply from four water treatment plants: Myrtle Beach; Grand Strand Water and Sewer; city of Georgetown; and Georgetown County – Waccamaw Neck. Also, the city of Cheraw, which is further inland, draws its water from the Pee Dee River. Since October 2001, the Georgetown County plant had experienced numerous occasions when saltwater intrusion elevated chloride levels beyond the EPA secondary standard of 250 milligrams per liter (mg/L). This resulted in a change of operations to rely on (a) wells that are high in fluoride and sodium and (b) purchase of water from the Grand Strand water plant.

Computer modeling and related information indicates that, during this drought period, a daily average flow of 900 cfs at the USGS Rockingham gage should maintain the saltwater front at a close but safe downstream distance from the Grand Strand water plant's intake on Bull Creek. Bull Creek is a water course connecting the Pee Dee River with the Waccamaw River near Garden City Beach, South Carolina. This flow target at the Rockingham gage can be adjusted by consensus among the settlement parties, and approval of the Commission, based on monitoring of the saltwater interface, flow at the USGS gage in Pee Dee, South Carolina, or other environmental indicators.

Reservoir drawdown limits were developed as part of the Emergency Drought Protocol of 2002 to create a proportional drawdown of the reservoirs to minimize drought impacts and equalize the burden on reservoir users, as well as fish and wildlife. An immediate tier (tier 1, see table 14) was established and, if the drought continued for the rest of the summer and fall, tier 2 could be implemented. In addition, a reservoir refill protocol was developed to manage the reservoir storage in a conservative manner in case the drought extended past March 2003 and to recognize that it was in the interest of all parties to refill the reservoirs as quickly as feasible.

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[28]These six water supply systems do not include the city of Salisbury's withdrawal.

Table 14. Reservoir drawdown tiers for the Emergency Drought Protocol of 2002. (Source: Progress Energy, 2006a)

	Drawdown from normal full pool (feet)	
Reservoir	**Tier 1**	**Tier 2[b]**
High Rock	17.0[a]	24.0
Tuckertown	3.0	3.0
Narrows	22.0	25.0
Falls	5.0	5.0
Tillery	4.0	10.0
Blewett Falls	2.0	6.0

[a] Prior to the implementation of the Emergency Drought Protocol, the reservoir level was lower than 17 feet below normal full pool. Adoption of the protocol involved raising the current level of High Rock reservoir because of the fish kills experienced.

[b] If the drought continued and after additional discussions with the settlement parties on water conservation measures, reduction in the Rockingham gage target, operational constraints as well as minimizing the overall environmental and economic harm.

Water Quality

Water Quality Standards

The North Carolina DWQ regulates water quality under the North Carolina Administrative Code Subchapter 2B (15A NAC 02B.0100, .0200, and .0300). All surface waters are assigned classifications, which determine the water quality standards that apply to support designated best uses.

There are five classes of waters in the project area, C, B, WSIV, WSV, and CA. Class C waters are designated the best uses of aquatic life propagation and maintenance of biological integrity (including fishing and fish), wildlife, secondary recreation, agriculture, and any other usage except for primary recreation or as a source of water supply for drinking, culinary, or food processing purposes. Class B waters have the designated beneficial uses of primary recreation, which includes swimming on a frequent or organized basis, and the best usages specified for Class C waters. The study area includes two classes for water supply (WS-IV and WS-V). The best uses for WS-IV waters are sources of water supply for drinking, culinary, or food-processing purposes. WS-V waters are protected as water supplies which are generally upstream and draining to Class WS-IV waters or waters previously used for drinking water supply purposes or waters used by industry to supply their employees, but not municipalities or counties, with a raw drinking water supply source. Classifications for surface waters in the project areas include:

- C - Pee Dee River from the Blewett Falls dam to North Carolina/South Carolina state line.
- B - Yadkin River from a line across High Rock reservoir, extending from the downstream side of mouth of Crane Creek to the downstream side of mouth of Swearing Creek to the Blewett Falls dam and the Second Creek and Abbotts Creek arms of High Rock reservoir.
- WS-IV or WS-V - Yadkin/Pee Dee River from the mouth of South Yadkin River to the Blewett Falls dam.

In addition to these classes, the water quality regulations designate Class CA, critical areas. These are the areas adjacent to a water supply intake or reservoir where risk associated with poor water quality is greater than from the remaining portions of the watershed. The requirements for Class CA waters generally focus on limiting land use within 0.5 mile upstream, and draining to a water supply rather than setting numeric criteria for water quality parameters. Table 15 summarizes selected water quality criteria that are applicable to Class B, C, and WS waters.

Table 15. Selected water quality criteria. (Source: North Carolina DWQ, 2007a)

Parameter	Class C (Aquatic Life)	Class B (Primary Recreation)	Class WS (Water Supply)
Temperature	≤32.0°C and ≤2.8°C above natural temperature		
Total dissolved gas	≤110 percent of saturation		
DO	≥5.0 mg/L as daily average and ≥4.0 as instantaneous		
pH	Normal for waters in the area, generally between 6.0 and 9.0 standard units.		
Chlorophyll-*a*	≤40 μg/L		
Turbidity	≤25 in reservoirs, ≤50 NTU in streams		
Cadmium	≤2.0 μg/L		
Copper	7 μg/L Action level		
Lead	≤25 μg/L		
Mercury	≤0.012 μg/L		
Fecal coliform	geometric mean of ≤200/100 mL based upon at least 5 consecutive samples examined during any 30-day period, ≤400/100 mL in more than 20 percent of the	Geometric mean ≤200/100 mL (membrane filtration) based on at least 5 consecutive samples examined during any 30-day period and	Same as Class C

Parameter	Class C (Aquatic Life)	Class B (Primary Recreation)	Class WS (Water Supply)
	samples examined during such period; violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable nonpoint source pollution.	≤400/100 mL in more than 20 percent of the samples examined during such period.	
Nitrate nitrogen	---	---	≤10.0 mg/L
Total dissolved solids	---	---	≤500 mg/L
Total hardness	---	---	≤100 mg/L as $CaCO_3$

Notes: --- – no standard
µg/L – micrograms per liter
mg/L – milligrams per liter
mL – milliliters
NTU – nephelometric turbidity unit

North Carolina DWQ (2004) listed portions of High Rock reservoir, the upper portion of Tuckertown reservoir, and the Pee Dee River downstream of the Tillery and Blewett Falls dams as water-quality limited on the 2004 303(d) list. The list specified hydromodification as a potential source of the low DO conditions downstream of High Rock, Tillery, and Blewett Falls dams. In the draft 303(d) list for 2006, North Carolina DWQ (2006) does not propose adding or removing any listings for the subject area. To address the 303(d) listings for low DO and turbidity in High Rock reservoir, North Carolina DWQ began a scoping study for the High Rock total maximum daily load (TMDL) in 2005. The final TMDL is scheduled for completion in 2012 (North Carolina DWQ, 2007b). The reaches downstream of High Rock, Tillery, and Blewett Falls dams were categorized as 4b, which indicates that required pollution control mechanisms (e.g., NPDES permit limits, stormwater program rules, and buyout programs) are expected to attain water quality standards in a timely manner; therefore, no TMDL for those reaches is required.

General Water Quality

The upper end of High Rock reservoir and the Rocky River have higher concentrations of sediments (total solids, TSS) than the powerhouse tailraces. As discussed in section 3.3.1, *Geology and Soils*, much of the coarser grained sediment

entering High Rock reservoir is deposited in the upper part of the reservoir, and the leading edge of the delta has advanced to within 9 miles of the dam. Most of the fine-grained particles (silt and clay) are carried further downstream in the reservoir before they settle out of the water column. A small percentage of the fine-grained particles are carried beyond High Rock dam into the downstream reservoirs.

Deposition results in a substantial reduction of suspended sediments and an increase in water clarity as water flows through the reservoirs for the High Rock, Tuckertown, and Narrows developments. Because phosphorus is closely bound to sediments, deposition in the reservoirs also reduces total phosphorus concentrations in outflows from the reservoirs. Also, total nitrogen concentrations generally decrease as water flows through the reservoirs. The Rocky River has higher total nitrogen concentrations than the Tillery tailrace, which results in higher total nitrogen concentrations downstream of its junction with the Pee Dee River, including the Blewett Falls tailrace. The high productivity of High Rock reservoir results in greater chlorophyll-*a* and ammonia concentrations in releases from the reservoir than occur at the reservoir's upper end.

Reservoir water quality is determined by several factors including the water quality of inflows, hydraulic retention time, reservoir depth, and the level that water is withdrawn from it. Thermal stratification varies substantially, and it is strong in the two deepest reservoirs (Narrows and Tillery), generally weak in three reservoirs (High Rock, Tuckertown, and Blewett Falls), and negligible in Falls reservoir.

North Carolina DWQ (2002) reports that monitoring between 1981 and 2001 indicated that High Rock reservoir had elevated total phosphorus and total organic nitrogen concentrations resulting primarily from excessive sediment loads to the reservoir and municipal wastewater treatment facilities. Elevated nutrient concentrations result in eutrophic, highly productive conditions in High Rock, Tuckertown, and Blewett Falls reservoirs. Lower nutrient loadings to the Narrows and Falls reservoirs, as well as Lake Tillery, result in mesotrophic, intermediate productivity conditions. Small matts of nuisance blue-green algae (*Lyngbya woolei*) were observed in Narrows reservoir in spring 2001 (North Carolina DWQ, 2002). In late summer 2002, the reservoir experienced a moderate algae bloom dominated by two blue-green algae species, *Pseudoanabaena* and *Cylindrospermopsis*. These algae blooms resulted in supersaturated DO. Although near-surface waters sometimes become super-saturated in some of the reservoirs, oxygen depletion occurs seasonally throughout much of the water column of each reservoir. It is severe enough to frequently cause anoxic (DO of <1 mg/L) conditions at the water/sediment interface and further up in the water column of the High Rock, Tuckertown, and Narrows reservoirs. Decomposition of organic matter results in elevated ammonia concentrations near the bottom of these reservoirs.

Water quality conditions have caused several fish kills in the area (North Carolina DWQ, 2007c). In the summer of 2002, low DO resulted in fish kills in the Second Creek and Crane Creek arms of High Rock reservoir, totaling 3,000 shad, crappie, catfish, and

carp. In 2004 and 2005, a combination of low DO and high temperatures in Narrows reservoir caused fish kills totaling 1,750 to 2,250 largemouth bass, striped bass, bluegill, and redbreast sunfish. North Carolina DWQ (2003) reports that fish kills in Narrows reservoir during 2000 and 2001 appear to have been a result of fish being stressed by inadequate food supply (threadfin shad), along with elevated water temperatures and supersaturated DO. Although DO ranged from 118.5 to 138.5 percent of saturation in 2002, no fish kills were observed or reported. In the basinwide water quality plan, North Carolina DWQ (2003) stressed the need for reducing nutrient loads from the immediate watershed to protect the aquatic ecosystem.

Fecal coliform concentrations satisfied the geometric mean criterion at each of North Carolina DWQ's six Yadkin/Pee Dee river ambient monitoring locations sampled between 1994 and 2001 (North Carolina DWQ, 2002). Fecal coliform concentrations were less than 400/100 milliliters for most samples collected from project waters.

Metal concentrations in surface waters associated with the Projects have been monitored historically by North Carolina DWQ as part of the monthly water quality sampling studies conducted by Alcoa Generating and Progress Energy. Study results suggest that metal concentrations are generally within acceptable limits, although concentrations occasionally exceed criteria (see table 15) for lead, cadmium, mercury, and the action level for copper. The spatial pattern of exceedances of the copper criterion at the Pee Dee River mainstem sites along with copper concentrations measured by North Carolina DWQ (2002) in the Rocky River suggest that the Rocky River is likely the primary source of elevated copper to the Pee Dee River downstream of the Tillery powerhouse. Alcoa Generating conducted a study to determine bioaccumulation of mercury in fish collected from areas downstream of the Tuckertown powerhouse in September 2003. Mercury concentrations in fish fillets for 10 specimens each of largemouth bass, black crappie, and channel catfish were all below the detection limit of 0.145 milligrams per kilogram, which is below the U.S. Food and Drug Administration 1-milligram per kilogram action level set to protect human health (Normandeau, 2005a).

Temperature and Dissolved Oxygen in Tailwaters

Alcoa Generating and Progress Energy conducted studies to evaluate water temperature and DO conditions in project tailwaters. Studies included continuous monitoring of temperature and DO in multiple locations at both projects during 2000 through 2005 (Normandeau, 2005a); May through November 2004 (Progress Energy, 2005a); and in August 2004 (Progress Energy, 2005b). Alcoa Generating's studies showed that temperatures remain cooler than the 32 degrees Celsius (°C) criterion in all project tailraces, although they occasionally exceeded 32°C farther downstream from the Tillery and Blewett Falls developments. In the Tillery tailwater, temperatures reached a maximum of 35.6°C in a shallow open run area about 4.6 miles downstream of the Tillery dam, and then cooled to less than 32°C downstream of the Rocky River confluence. In the Blewett Falls tailwater, 32°C was only exceeded by more than 0.2°C at a single site that is about 7.1 miles downstream of the dam, which is 1.2 miles

downstream of Hitchcock Creek. However, when flows are increased, temperatures also increase although only marginally.

Each Yadkin Project tailrace has periods of low DO. The High Rock tailrace experiences low DO concentrations of less than 4 mg/L 20 percent of the time, in late spring and summer as a direct result of drafting low-DO water from High Rock reservoir. During the extreme drought conditions of 2002, High Rock reservoir's water elevation was lowered to a level that resulted in drafting water closer to the surface that had higher DO concentrations than in other years. High-flow periods tend to have higher tailrace DO concentrations due to faster routing through the reservoir, along with spills over the dam, which aerate water. The DO regime for the Tuckertown tailrace is very similar to that at High Rock, with values of less than 4 mg/L occurring 24 percent of the time, because of the short retention time through Tuckertown reservoir. It appears that this tailrace has elevated DO concentrations during some non-generation periods because of substantial production of oxygen by algae.

The Narrows tailrace shows low DO concentrations of less than 4 mg/L 17 percent of the time, in late spring and summer, which have no clear link to hydrometeorological conditions. In 2001, Alcoa Generating installed and began operating two air valves at Narrows Unit 4 to increase the unit's aeration capacity. The discharges from units 1, 2, and 3, which do not have air injection, may cause low DO concentrations just downstream of the Narrows powerhouse. Because the retention time in Falls reservoir is extremely short, operations and DO conditions at Narrows strongly influence DO conditions in the Falls tailrace. However, low DO concentrations occur much less frequently, less than 4 mg/L 5 percent of the time, in the Falls tailrace than in the other three Yadkin Project tailraces.

For the Yadkin Pee-Dee Project, DO concentrations between the Tillery powerhouse and Blewett Falls reservoir are influenced by discharges from the Tillery powerhouse, spills at Tillery dam, and inflows from several tributaries. Using the low-level intake results in (a) drafting water with low DO concentrations from Lake Tillery and (b) either the daily mean or instantaneous DO criteria not being satisfied about two-thirds of the time at a location 0.4 mile downstream of the Tillery powerhouse. DO concentrations increase with increased distance from the powerhouse. These improved DO conditions are largely due to re-aeration, as water flows through a series of shoals, and inflow from the Rocky River, which joins the Pee Dee River about 4.5 miles downstream of the powerhouse. Re-aeration continues to increase DO concentrations downstream of the Rocky River. However, inflows from several of the tributaries to this reach (i.e., Turkey Top, Brown, Cedar, and Savannah creeks) sometimes have low DO concentrations, which limit improvement in DO concentrations, particularly during low flow periods. Because of the configuration of the Tillery facilities, generation and/or spill at the dam cause spatial differences in DO, with lower DO concentrations typically occurring along the east side of the channel as far as 6 miles downstream of the powerhouse.

Unlike at the Tillery development, DO concentrations meet both the daily mean and instantaneous criteria more often in the powerhouse tailrace than in each of the other three Blewett Falls sites monitored. DO concentrations did not meet at least one criterion on 9 percent of the days in the tailrace, about 40 percent of the days at sites 0.7 and 3.5 miles downstream of the powerhouse, and on 10 percent of the days just downstream of Hitchcock Creek, which is about 6.3 miles downstream of the powerhouse. Lower DO concentrations at the Highway 74 bridge may be due to DO stratification in the large pool, with lower DO concentrations near the bottom where conditions were monitored. It appears that re-aeration in the shoals downstream of the Highway 74 bridge increases DO concentrations between the bridge and the confluence with Hitchcock Creek. Spills at the Blewett Falls dam increase DO concentrations downstream of the peninsula that separates powerhouse and spill flows.

Salinity

The salinity (salt concentration) of a bay, estuary, or coastal river is determined by the balance of water volume coming from freshwater river flows and ocean saltwater tides and currents. Between 1998 and 2002, low flows in the Pee Dee River combined with above-average tidal levels resulting from unusual meteorological conditions, led to high salinities that caused water supplies problems for the city of Myrtle Beach, South Carolina, and other public water supplies on the lower Pee Dee River. To address the prolonged drought conditions and protect public health and safety, Alcoa Generating requested, and received, temporary variances that allowed it to deviate from its license requirements for instream flows and drawdown/refill of its reservoirs. Reducing project outflows from 1,400 to 900 cfs allowed the added retention of water in storage for later release, during the summer and fall, the most critical time to stave off high salt concentrations at the water intakes of South Carolina public water suppliers.

3.3.2.2 Environmental Effects

Water Quantity

The Yadkin and Yadkin-Pee Dee settlements cover a wide range of measures related to reservoir level operations, proposed minimum streamflow schedules, and a Low Inflow Protocol for project-influenced reaches and reservoirs. Because measures related to streamflow primarily pertain to protecting and enhancing aquatic and riparian habitat and recreational opportunities, we discuss these measures in sections 3.3.3.2, *Aquatic Resources, Environmental Effects*; 3.3.4.2, *Terrestrial Resources, Environmental Effects*; and 3.3.7.2, *Recreational Resources, Environmental Effects*. In this section we discuss the effects of the proposed and alternative water level regimes, the ability to meet minimum streamflow requirements, and the needs of project operations, as well as measures to ensure compliance with the proposed minimum streamflow schedules and water level regimes. In addition, in this section we discuss the effects of High Rock reservoir project operations on flooding in the upper reaches of the reservoir. We provide a more detailed discussion of the models on which our analysis is based in appendix B.

High Rock Reservoir Flooding

Reservoirs alter the hydraulics and sediment transport functions of rivers on which they are located. Project operations at High Rock reservoir have been blamed for the flooding at several upstream locations along the upper reaches of the reservoir. In addition, High Rock property owners say that the extent of the flooding has increased in recent years as sediment deposition in the upstream reaches of the reservoir affects the height of the water surface during flood events. The 1998 (Stone and Webster, 1998) modeling and a study completed by the Commission (FERC, 2003) indicated that the water level in High Rock reservoir has little impact on water surface elevations at the Salisbury intake during periods of high flow. While this is true in the broad sense, these studies did not take into the account the effects of added sedimentation that has increased the river bed elevations in the upper portion of the reservoir. We detail project-related effects on sediment transport and deposition in section 3.3.1, *Geology and Soils.*

The Yadkin Settlement does not include any measures to address flooding. Alcoa Generating states that it has flood rights up to elevation 638.9 feet at the Grant Creek wastewater treatment plant, about 5 feet above the critical water elevation of this structure which was built about 36 years after the construction of High Rock dam and elevation 623.9 feet at the Salisbury pump station.

In response to our ready for environmental analysis notice, the city of Salisbury suggested that Alcoa Generating implement critical infrastructure flood hazard mitigation measures including (1) relocating the Salisbury pump station 2,200 feet away on the same access road as the present pump station by April 25, 2009; (2) completing a protective dike and access road improvements at the Grant Creek wastewater treatment plant by April 25, 2009, to protect the facilities up to a flood level of elevation 648.8 feet; and (3) completing measures to protect the 3rd and 7th Street Bridges over Grant Creek in Spencer by April 25, 2010.[29] In comments on scoping document 1, the city of Salisbury also suggested that constructing a flood wall, along with the pump station modifications and improvements to the access road (including raising the height of the access road), could address potential flooding. In effect, these additional comments from scoping raise the number of issues of concern for Salisbury from 3 to 4 for the flood hazard mitigation measures.

A private homeowner, Ron Qualkenbush raised concerns that his campground is flooded on a regular basis because of the effects of project operations at High Rock reservoir. Mr. Qualkenbush's property is located next to the Salisbury pump station at approximately the same ground elevation.

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[29]No parties submitted additional information other than recommended mitigation measures for these two bridges, located above the Grant Creek wastewater treatment plant.

Our Analysis

Our analysis focuses on the upstream reaches of High Rock reservoir. The city of Salisbury filed numerous documents in support of its position on flooding including the results of the HEC-RAS[30] and HEC-6T[31] modeling of High Rock reservoir and the Yadkin River upstream of the Salisbury pump station (see appendix B). As discussed in section 3.3.1.2, Alcoa Generating's sediment investigations did not include a more detailed analysis of the bed material load predominantly found in the upper river channel, or an analysis of the growth of the sediment delta over time, along with its effect on flooding and sedimentation around the Salisbury drinking water intakes. Table 16 provides the results and shows the modeled increase in water surface elevations based on the construction of the dam and subsequent sedimentation in the upper reservoir.

The city of Salisbury's modeling results shown in table 16 for the 1997 conditions are very close to the elevations produced by the 2003 FERC hydraulic study for discharges at 40,000 and 70,000 cfs, two flow values that were modeled in both studies.

Table 16. Water surface elevations near the city of Salisbury's water pump station based on the Salisbury 2006 HEC-RAS modeling. (Source: SRU, 2006b)

	Water Surface Elevation (USGS)				
Flow (cfs) near the Salisbury pump station (RM 19.4)	**No Dam/No Sediment (1918)**	**Dam/No Sediment (1927)**	**Dam/With Sediment (1997)**	**Increase in Water Surface (feet)**	
				1918 to 1997	**1927 to 1997**
30,000	622.73	626.64	631.41	8.68	4.77
40,000	625.51	628.16	633.47	7.96	5.31
70,000	631.73	632.64	638.38	6.65	5.74
117,700	638.04	638.33	644.25	6.21	5.92

Note: cfs – cubic feet per second

In February 2007, the city of Salisbury filed a report that presented the results using the HEC-6T model to evaluate potential effects on flooding attributed to the

[30]HEC-RAS is a public domain computer program or river analysis system developed by the Corps' HEC for modeling the hydraulics of water flow through natural rivers and other channels to determine flood plain extent, elevation and other aspects.

[31]HEC-6T is proprietary program owned by MBH Software, Inc., and is an enhancement of the Corps' public domain model, Scour and Deposition in Rivers and Reservoirs (HEC-6).

continuing delta sediment aggradation in the upper reaches of High Rock reservoir (MBH, 2007) (see appendix B). This analysis shows that, by natural sedimentation alone (a no-dam scenario) the 10- year, 100-year, and design flood water surface elevations at the Salisbury pump station and Grant Creek wastewater treatment plant would increase by about 1 to 2 feet between the year 1920 and 2058. With the dam in place, the modeling results presented in figures 13 and 14 show that at the pump station and Grant Creek wastewater treatment plant, the flood elevations have increased by about 9 to 10 feet since the dam was constructed. In the next 40 to 50 years, the same modeling indicates additional increases of about 2 to 3 feet for the 10 year, 100-year, and the design flow stages.

Flooding in the Yadkin River also affects the property of Mr. Qualkenbush which is located just downstream of the Salisbury pump station, within the floodplain of the Yadkin River. The elevation of his property is similar to the ground elevation of the pump station (630 feet) and slightly higher than the access road (628 feet) to the pump station. Even without High Rock dam, this property and the surrounding area would flood slightly during a 10-year flood and to a depth of more than 3 feet (5 feet for the access road) during a 100-year flood. This figure also shows that the property floods more frequently and to a greater depth under the with dam/sediment conditions.

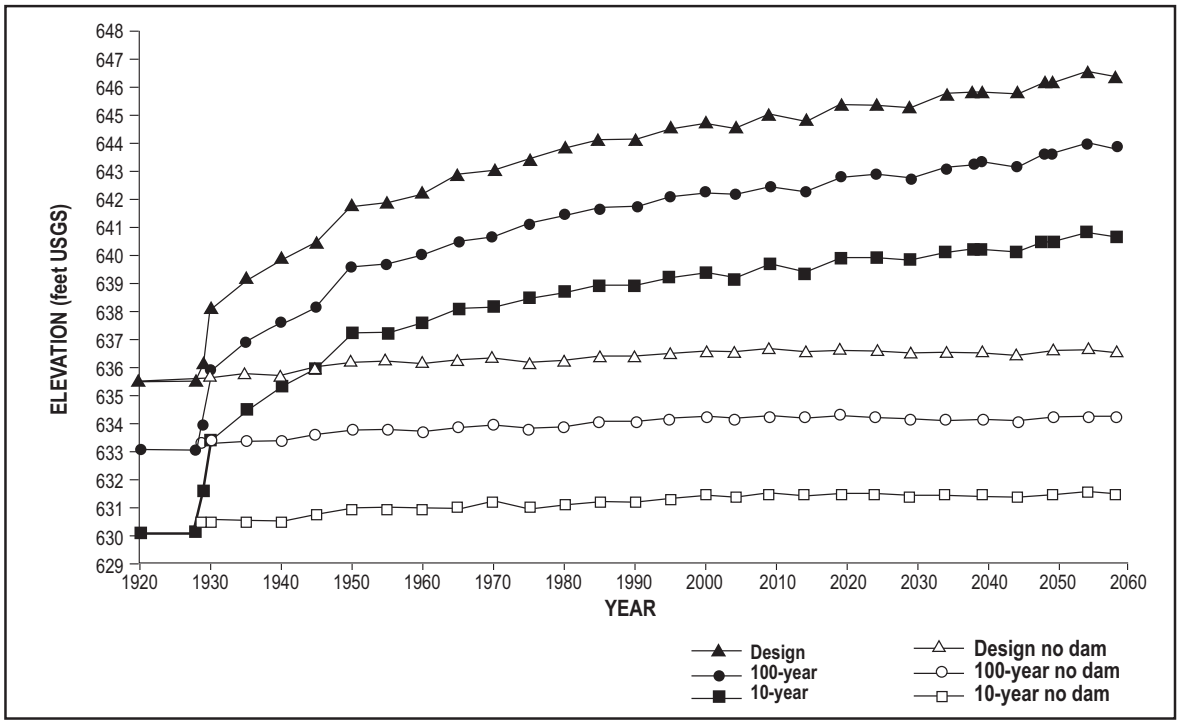

Figure 13. Calculated flood water surface elevation at the water intake structure (RM 19.4). (Source: Salisbury, 2007b; assumptions are taken from MBH, 2007)

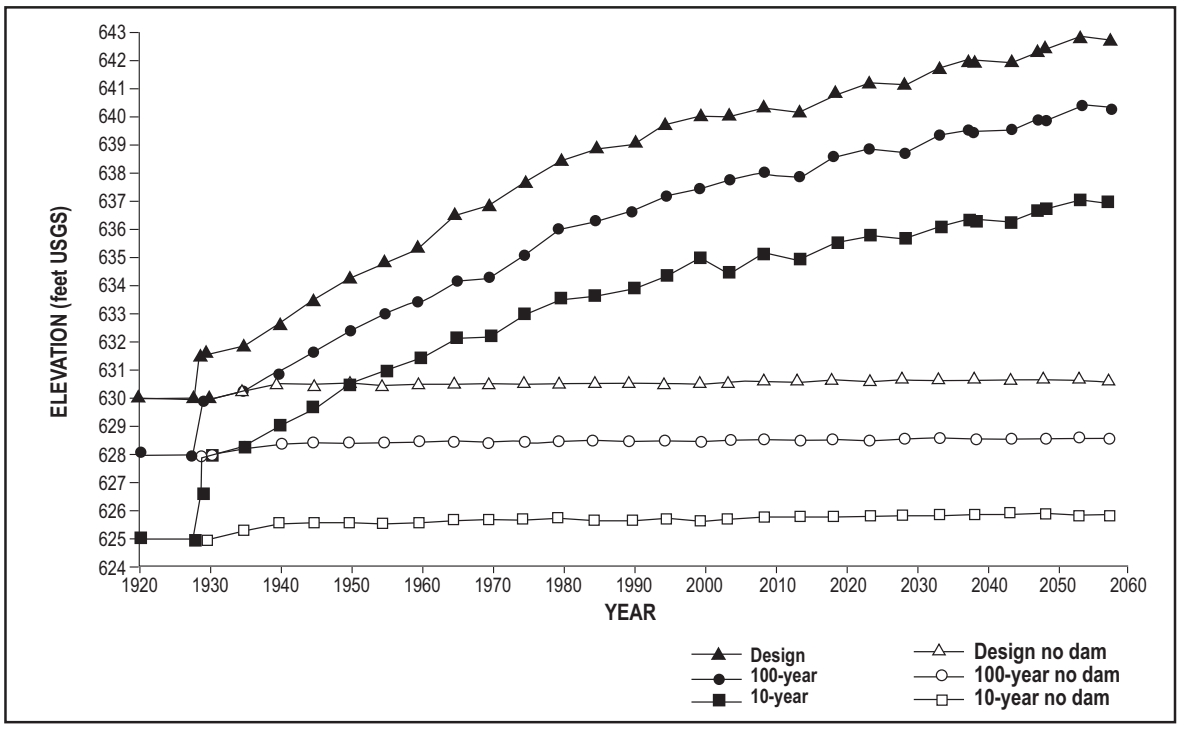

Figure 14. Calculated flood water surface elevation at the Grant Creek wastewater treatment plant (RM 16.72). (Source: Salisbury, 2007b; assumptions are taken from MBH, 2007)

The city of Salisbury considered the effects of the railroad and highway bridges at about RM 15 (earlier hydraulic studies also looked at these effects). However, it appears that more detailed modeling of these bridges and the effects of debris buildup at the railroad bridge may show more upstream flooding and sedimentation of the Yadkin River than envisioned in the modeling conducted by Salisbury or others.

The railroad bridge was designed and built in 1927 (Salisbury, 2007a) as mitigation for the original construction of the dam. The plans show the elevations of the base of the rail on the main track (i.e., top of the bridge) at 657.35 feet; the top of the bridge seat at 630.6 feet; and normal pond level at 623.9 feet. The base of the metal bridge structure is about 0.5 to 1 foot higher than the bridge seat, based on our visual observations, i.e., at about elevation 631 to 632 feet. According to the plans, at the time of bridge design, extreme flood waters were expected at the same elevation as the top of the bridge seat (i.e., at 630.6 feet). Examination of modeling conducted by MBH shows that the water under current conditions would be several feet above the bridge seat during a 100-year flood event.

In summary, because of the sediment aggradation in the upper reaches of High Rock reservoir, the elevation for extreme flood waters has increased. However, there is some uncertainty related to the limits of the existing information on sediment inflow, pre-

project topography, effects of the bridges, and the general dynamics of the very complicated sediment transport process.

Based on modeling data from the city of Salisbury (MBH, 2007) for the Yadkin River in the vicinity of the Grant Creek wastewater treatment plant (RM 16.72), the flood elevations of the design flood would be about 10 feet higher than would exist without the dam. In the next 40 years, the same modeling shows an additional increase of at least 2 feet over present conditions due to the increased sediment accumulation in the reservoir's delta. The design flood modeled (MBH, 2007) was about 2 feet higher than the 100-year flood, and between 4 and 5 feet higher than the 10-year flood. We would expect a similar relationship or slightly less at RM 15, which would submerge the invert of the metal truss of the railroad bridge by about 7 feet during a 100-year flood, and by about 3 to 5 feet during a 10-year flood. Additional increases in flood elevations would occur, and there would be structural concerns at the bridge, when flood debris is caught in the dense structure of metal beams of the bridge truss. Release of this debris and a sharp increase in the flow rates and velocities also could be a concern for the I-85 Bridge, located about 0.25 mile downstream.

Uncertainties in the modeling and natural factors can affect estimated flood elevations. The uncertainty associated with the calculated and actual flood elevations is at least 1.6 feet (see appendix B, table B-2). There is an additional 1 foot uncertainty associated with sediment inflow assumptions, and another 1 foot uncertainty associated with possible discontinuation of sediment mining operations. Other factors to consider are roughness of the vegetation in the floodplain, unexpected settlement of the flood control structure, erratic hydrological phenomena, future development of urban areas, and debris accumulation. To cover these uncertainties, the city of Salisbury suggests a freeboard allowance of 6 feet, which we find reasonable to represent the upper limit of the uncertainty level.

Reservoir Level Fluctuations

Alcoa Generating proposes to reduce seasonal limits on reservoir drawdowns and to maintain the water surface elevation to within 1 to 2 feet of the elevation on April 15 during the April 15 to May 15 fish spawning period reservoir (see Yadkin Settlement measures listed in table 1 in section 2.2.3.1). Progress Energy proposes to reduce the maximum drawdown at Tillery and Blewett reservoirs. The proposed drawdown limits would vary by reservoir (see Yadkin-Pee Dee Settlement measures listed in table 2 in section 2.2.3.2). These restrictions would apply at all times except under extreme operational scenarios, such as when the Low Inflow Protocol would be in effect.

Several entities recommend alternative maximum drawdowns at High Rock reservoir. Davidson County recommends a maximum drawdown of 7 feet from the full pool elevation of 623.9 feet. SaveHighRockLake.org and Mr. Evans recommend a maximum drawdown of 4 feet in the summer and 6 feet in the winter. Richard Martin recommends a maximum drawdown of 2 to 3 feet within normal full pool year round.

Any drawdown restrictions, especially on High Rock reservoir, would limit the amount of available water, especially during low inflow, that Alcoa Generating could use to maintain power generation at its four developments, and could affect the ability to meet minimum flow requirements downstream at the Falls development. Progress Energy relies on discharge from Alcoa Generating's Falls development to meet most of the minimum flow requirements at its Tillery and Blewett Falls developments during low inflow conditions. Therefore, in addition to the potential effects on aquatic, terrestrial, and recreational resources, the reservoir level management scenarios are directly tied into the ability to meet minimum flow requirements, especially at the High Rock, Narrows, Tillery, and Blewett Falls developments. See tables 1 and 2 in section 2.2.3 for proposed minimum flows outlined in the Yadkin and Yadkin-Pee Dee settlements.

There are no alternative minimum flow recommendations for the Yadkin Project. FWS and American Rivers recommend release from Tillery of a continuous minimum flow of 800 and 1,500 cfs during the spawning period (February 1 until May 15) and a continuous minimum flow of 1,000 and 1,800 cfs during the spawning period (February 1 until May 15). The city of Rockingham recommends a minimum flow of 1,200 cfs.

Our Analysis

Compared to existing conditions, the reservoir levels proposed in the Yadkin Settlement would result in a tighter range of water levels at High Rock reservoir. For other reservoirs, proposed limits on reservoir drawdowns are very similar to existing operations, although considerably more restrictive than existing drawdowns (table 17).

Table 17. Licensed, existing, and recommended drawdowns. (Source: Alcoa Generating, 2006a; Progress Energy, 2006a; Progress Energy, 2007a; and Alcoa Generating, 2007a)

	Licensed Drawdown (feet)	**Existing normal range of drawdown variation (feet)**	**Range of drawdown variation under the Settlements (feet)**
High Rock	30	5 to 13	4 to 10
Tuckertown	3	3	3
Narrows	31	3	5
Falls		4	4
Tillery	22	4	generally 3[a]
Blewett Falls	17	6	6

[a] December 15 to March 1: 3 feet, unless reservoir storage is needed for electric generation resulting in a maximum drawdown of 5 feet. Drawdown up to 8 feet during system emergencies and LIP periods. April 15 to May 15: 1.5 feet below the level measured on April 15. All other periods, 2.5 feet except for scheduled maintenance drawdowns once every 5 years.

Alcoa Generating modeled the ability to operate the Yadkin Project with the proposed minimum flow and reservoir level regime using the OASIS hydrologic model.[32] According to Alcoa Generating, the model predicted that releases from the Falls development, when combined with accretions from inflow tributaries and accounting for evaporation losses at Tillery and Blewett Falls reservoirs, would be able to support the minimum flows downstream of Blewett Falls.[33] Specifically, the model showed that a minimum flow of 1,800 cfs could be met more than 85 percent of the time, and a flow greater than or equal to 1,200 cfs could be met more than 87 percent of the time. Alcoa Generating states that this modeling did not account for contributions from storage at either the Tillery or Blewett Falls reservoirs. For remaining periods when a flow of 1,800 cfs is not provided, a 1-foot drawdown at Tillery could provide about 1,000 cfs additional flow for 2 days.

In addition, staff modeled the combination of reservoir levels and minimum flows to determine the effects of the more restrictive drawdown limits at High Rock reservoir on the Yadkin and Yadkin-Pee Dee system. We modeled three drawdown regimes: (1) the 4- and 10-foot drawdown regime proposed in the Yadkin Settlement; (2) the 4- and 6-foot drawdown regime recommended by SaveHighRockLake.org; and (3) the 2 -foot year-round drawdown regime recommended by Richard Martin. The proposed and two alternative drawdown regimes encompass the set of possible regimes suggested by stakeholders.

In addition to the minimum flows proposed in the Yadkin and Yadkin-Pee Dee Settlements, we also modeled the FWS-recommended minimum flows (continuous minimum flows of 800 to 1,000 cfs year-round, and 1,500 to 1,800 cfs during the spring spawning season). Figure 15 provides a simplified graph of the output for 1988 reservoir levels and flows at High Rock dam from our modeling. We chose 1988 because it represents a stressful month when flows during several months were below average, representative of a minor drought. We assumed that High Rock reservoir would provide 100 percent of the flow downstream of the Falls development.

The excess flow shown in the graph is flow that could be used to raise the water surface elevation above the minimum level and to provide peaking capability at High Rock. However, since the minimum flow requirement is downstream at Falls dam, peaking flows released from High Rock also could be used to supply the minimum flow requirement at Falls. The exception is when inflows to High Rock reservoir are near or

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[32]OASIS (Operational Analysis and Simulation of Integrated Systems) is proprietary software program used for modeling the operations of water resources systems including hydropower facilities.

[33]Minimum flows include a continuous minimum flow of 2,400 cfs at the Blewett Falls development from February 1 through May 15; 1,800 cfs from May 16 through May 31; and flows of 1,200 cfs from June 1 through January 31.

under the Falls minimum flow requirement, and sufficient storage volumes in High Rock and Narrows are not available to provide the needed volume. Based on the average excess flow shown in figure 15 and the minimum flow requirement during the months of May through September, an average daily peaking rate of about 5,000 cfs for 8 hours would be possible. This amount of daily peaking would correlate to a daily drawdown of less than 0.5 foot in High Rock reservoir.

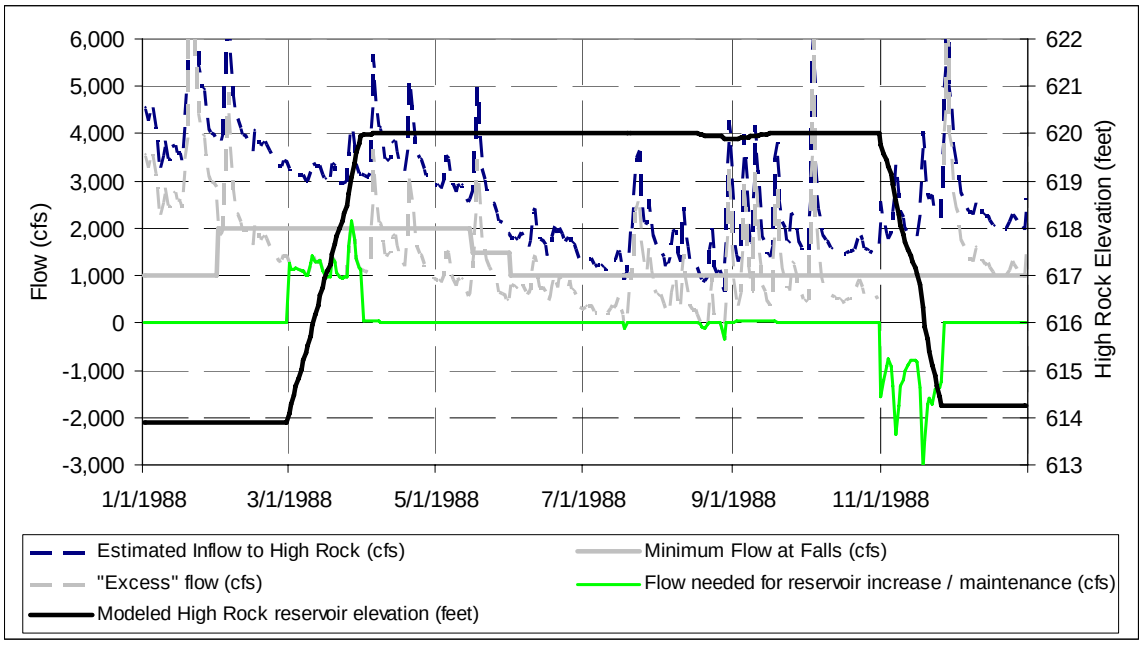

Figure 15. Modeling flows and water levels at High Rock dam in 1988. (Source: USGS, 2007; Alcoa Generating, 2006a)

The minimum flows are higher downstream from Blewett Falls dam than at Falls dam. Our modeling, which is similar to modeling conducted by Alcoa Generating, shows that accretion from tributaries would supply this increased flow, even without accounting for use of the storage at Tillery or Blewett Falls. Within Blewett Falls reservoir, tributaries, including Rocky River, Brown Creek, Little River, and Mountain Creek, add 2,239 square miles, about 50 percent more drainage area as compared to the total drainage area at Tillery.

In addition to our modeling, we looked at the database of calculated daily inflow to High Rock reservoir supplied by Alcoa Generating (Alcoa Generating, 2006c). Table 18 provides the monthly minimum flow values and the corresponding inflow percentile. This comparison shows that in September, the driest month, inflow to High Rock reservoir would be above the minimum flow requirement at Falls dam more than 92 percent of the time.

Table 18. Comparison of monthly minimum flows at Falls dam and inflow percentiles at High Rock reservoir. (Source: Alcoa Generating, 2006a)

Month	Minimum Daily Average Flow Requirement at Falls (cfs)	Corresponding Percentile Inflow to High Rock Reservoir
January	1,000	>99
February	2,000	97
March	2,000	>99
April	2,000	98
May	1,750[a]	95
June	1,000	97.5
July	1,000	95.5
August	1,000	94.5
September	1,000	92.5
October	1,000	>99
November	1,000	>99
December	1,000	>99

Note: cfs – cubic feet per second

[a] 2,000 until the 15th, and 1,500 cfs 16th and after.

Our modeling results show that the proposed combination of the proposed restrictions on drawdown and minimum flows would almost always be achievable. The exceptions are only during drought conditions. During these conditions, however, operations would be covered under the proposed Low Inflow Protocol, which are also part of the Yadkin and Yadkin-Pee Dee Settlements.

The two alternative drawdown regimes would result in generally more water being retained in High Rock reservoir, water that could be used to supply downstream flows during drought conditions. However the most likely months for limited inflow are the months of June, July, August, September, and October, which would limit the effective difference between the Yadkin Settlement and SaveHighRock.org. Therefore, there would not be a substantial difference between the two alternatives in the ability to meet the minimum flow requirements or the implementation of the Low Inflow Protocol.

These alternatives also would reduce flood storage capacity at High Rock reservoir, as well as diminish the ability to use High Rock reservoir to attenuate the incoming flood events. Many of the severe flood events in the Yadkin and Pee Dee River basin are the result of summer or early fall tropical storms and hurricanes, during which the storage at High Rock reservoir does not play a substantial role in flood control.

Therefore, the loss of storage capacity would only be noticeable in the months of November through February, and during small to medium flood events.

Water Use

Several municipalities and other users withdraw water from the project reservoirs. At High Rock reservoir, the city of Salisbury and Duke Energy withdraw water for public supply and process and cooling water, respectively.

Under the Yadkin Settlement, withdrawals from High Rock reservoir would continue as shown in table 13 (annual daily withdrawals of about 6.2 MGD)[34] (with a maximum of 54 MGD by the city of Salisbury and 233.3 MGD [daily capacity of 394.6 MGD] from Duke Power's Buck Steam station).

Many residents around High Rock reservoir in comments filed in response to the Yadkin Settlement oppose withdrawals from High Rock reservoir that they say are as high as 30 percent of the required project discharge when the reservoir level is at or below the normal minimum elevation. They request a limit of withdrawals of no more than 10 percent of the required project discharge.

Our Analysis

According to the city of Salisbury, its water use has historically included substantial consumptive use, but now it returns almost the same amount to High Rock reservoir via the Grant Creek wastewater treatment plant. Similarly, Duke indicates that, of the 233.3 MGD withdrawal from High Rock reservoir, all but approximately 3 MGD (representing evaporation and other process losses) is returned to High Rock reservoir. Duke also indicates that, when the level of High Rock reservoir is drawn down more than 6 feet below full pond, operation restrictions start on its withdrawal rates, not including limits on withdrawal rates during low inflow periods specified in its NPDES permit and the proposed Low Inflow Protocol. We also note that water withdrawals in excess of 1 MGD require Commission approval. In addition, any new withdrawals, excluding agricultural, over 0.1 MGD must be registered with the North Carolina Department of Water Resources (DWR). Therefore, consumptive use from water withdrawals is far less than the 10 percent over the required project discharge recommended by the residents.

Low Inflow Protocol

Operation of the Yadkin-Pee Project could affect the salinity levels in the Lower Pee Dee River near the Atlantic Ocean. During drought conditions, releases from the Blewett Falls development provide the majority of flow in the Pee Dee River through South Carolina and to the Atlantic.

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[34] 1 MGD is about 1.55 cfs per day.

Under the Yadkin and Yadkin-Pee Dee Settlements, Alcoa Generating and Progress Energy would implement the proposed Low Inflow Protocol during drought periods when there is not enough water flowing into the project reservoirs to meet the Projects' minimum flows while also maintaining the reservoir water elevations within the proposed drawdown restrictions. The Low Inflow Protocol contains trigger points and operating procedures that Alcoa Generating and Progress Energy would follow for the release of water from storage in the Projects' reservoirs to support hydroelectric generation and to provide minimum flows.

During periods when inflow is not adequate to provide minimum flows and maintain reservoir water elevations, Alcoa Generating and Progress Energy would reduce minimum flow releases (table 19). If reservoir storage continues to drop towards critical levels, as defined in table 20, and climatological or hydrological conditions worsen until trigger points defined in the Low Inflow Protocols are reached, Alcoa Generating and Progress Energy would meet with designated agencies; municipalities with potable water system withdrawals; homeowners organizations for High Rock and Narrows reservoirs and Lake Tillery; and other organizations (the Low Inflow Protocol Group) to discuss the need for action. If conditions worsen, the Low Inflow Protocol would allow reductions in minimum flows and water supply withdrawals, while conserving water storage volumes, as shown in table 21.

NMFS recommends the development of a drought contingency plan for the Tillery and Blewett Falls developments. This plan would address minimum flow releases and reservoir levels during low inflow and or drought conditions if any new license does not include the Low Inflow Protocol.

Table 19. Low Inflow Protocol flows (cfs). (Source: Progress Energy, 2007a; Alcoa Generating, 2007a)

	High Rock (daily average maximum target)			**Blewett Falls (continuous flow target)**		
Proposed Stage	**Feb 1 to May 15**	**May 16-31**	**Jun 1 to Jan 31**	**Feb 1 to May 15**	**May 16-31**	**Jun 1 to Jan 31**
0	2,000	1,500	1,000	2,400	1,800	1,200
1	1,450	1,170	900	1,750	1,400	1,080
2	1,080	950	830	1,300	1,150	1,000
3	770	770	770	925	925	925

Note: At Stage 4, additional measures would be determined by the LIP Group.

Table 20. Critical reservoir elevations. (Source: Progress Energy, 2007; Alcoa Generating, 2007a)

Reservoir	Critical Reservoir Water Elevation (feet) and Feet Below Full Pool	First Controlling Type
High Rock	599.9 (24 feet below full pool)	Hydropower Production[a]
Tuckertown	560.7 (4 feet below full pool)	Public Water Supply
Narrows	486.8 (23 feet below full pool)	Public Water Supply
Falls	322.8 (10 feet below full pool)	Hydropower Production
Tillery	268.2 (10 feet below full pool)	Public Water Supply
Blewett Falls	168.0 (10 feet below full pool)	Public Water Supply and Hydropower Production

[a] Operations at Duke's Buck steam plant are affected at 6 feet of drawdown and cease operations at 10 feet below full pool.

Table 21. Critical flow values. (Source: Progress Energy, 2007a; Alcoa Generating, 2007a)

Location	Critical Flow
Falls dam	770 cfs on a daily average basis
Tillery dam	The required minimum instream flow from Tillery as defined in the future new FERC license[a]
Blewett Falls dam	925 cfs on a continuous basis

[a] Although flow from Tillery dam has not been set, the critical flow value is flows that are necessary to prevent long-term or irreversible damage to aquatic communities and a basic level of water quality maintenance. Also, inflow from Falls dam is the controlling factor for releases from Tillery dam.

Our Analysis

The proposed Low Inflow Protocol is intended to balance the needs of hydropower generation, aquatic resources, terrestrial resources, and water supply, both within the project area and downstream near the Atlantic Coast, during drought conditions. One of the key trigger points for implementation of the protocol is the historical 3-month rolling average flow (cfs) (stage 1). Table 22 shows different monthly flow values at different stages of the Low Inflow Protocol.

Table 22. Monthly flow values during different stages of the Low Inflow Protocol. (Source: Alcoa Generating, 2007a)

Average Daily Flows During:	Historic 3-Month Rolling Average Flow (cfs)	Stage 0 Flows (cfs) (48%)	Stage 1 flows (cfs) 41%	Stage 2 flows (cfs) (35%)	Stages 3 and 4 flows (cfs) (30%)
Oct-Nov-Dec	4,000	1,920	1,640	1,400	1,200
Nov-Dec-Jan	5,200	2,496	2,132	1,820	1,560
Dec-Jan-Feb	6,250	3,000	2,563	2,188	1,875
Jan-Feb-Mar	7,700	3,696	3,157	2,695	2,310
Feb-Mar-Apr	7,550	3,624	3,096	2,643	2,265
Mar-Apr-May	6,850	3,288	2,809	2,398	2,055
Apr-May-Jun	5,350	2,568	2,194	1,873	1,605
May-Jun-Jul	4,200	2,016	1,722	1,470	1,260
Jun-Jul-Aug	3,600	1,728	1,476	1,260	1,080
Jul-Aug-Sep	3,200	1,536	1,312	1,120	960
Aug-Sep-Oct	3,300	1,584	1,353	1,155	990
Sep-Oct-Nov	3,550	1,704	1,456	1,243	1,065

Notes: LIP implementation occurs at stage 0, and stage 4 is a severe drought such as what occurred in 2002.

cfs – cubic feet per second

Based on the historical flow records and the proposed trigger points shown in table 22, stages 3 and 4 of the Low Inflow Protocol would have been implemented only during the severe drought in 2001-2002. Table 23 shows a summary of months and stage classification if the Low Inflow Protocol would have been in effect during 1974 to 2006. Our analysis shows that the protocol would help protect a wide range of resources within the project area, as well as in the reach below Blewett Falls, including important downstream water supply and water quality issues near the Atlantic Ocean.

Table 23. Historical months of Low Inflow Protocol implementation. (Source: USGS, 2007, as modified by staff)

	Stage 0	Stage 1	Stage 2	Stages 3 and 4
January			2001	2002
February	1981	2002	2001	
March	1981	2002	2001	
April	1986	1981, 2002		
May	1981, 1986, 1988, 1999, 2001	2006	2002	
June	1985, 1986, 1988, 2001	1981, 2006	2002	
July	1988	1986, 2001		2002
August	2000	1988, 2001	1986	2002
September	1986, 1988, 2001	2000	2002	2002
October	2001			
November		2001		
December		2001		2001

Monitoring Flow and Water Levels

Flow and water level gages are in place on many project-affected reaches and reservoirs. Alcoa Generating monitors and records the water levels at all four of its reservoirs, as well as the discharge from its developments on an hourly basis. Progress Energy similarly measures and records hourly reservoir levels and discharge from Tillery and Blewett Falls developments.[35]

Under the Yadkin Settlement, Alcoa Generating would maintain its water level gages on all four reservoirs and provide compliance monitoring for releases from the High Rock and Narrows developments. The Yadkin Settlement states that monitoring of releases from the High Rock development would be required when the High Rock and Narrows reservoirs are below their normal minimum elevations, as a result of implementing the Low Inflow Protocol or other maintenance or emergency operations.

[35]The official compliance point for discharge from the Blewett Falls development is real-time USGS gage no. 02129000 (Pee Dee River near Rockingham, NC), which is located about 3.3 miles downstream from the dam. Real-time data is typically recorded at 15-60 minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used and is then available on the Internet at http://waterdata.usgs.gov/nwis/rt.

Under the Yadkin-Pee Dee Settlement, Progress Energy would (a) include hourly readings on Tillery and Blewett Falls reservoirs and add to its public messaging service a projection of the expected daily water level for the day, (b) construct a real-time instream flow gage about 0.5 mile downstream of the Tillery development, near the Highway 731 Bridge, and (c) continue using the Rockingham USGS gage as the compliance point for releases from the Blewett Falls development. Progress Energy also plans to continue to fund the operation and maintenance of USGS gage no. 02126000 (Rocky River near Norwood, North Carolina).

Under the Yadkin Settlement, Alcoa Generation would develop a flow and reservoir elevation monitoring and compliance plan, within 6 months after license issuance and submit the plan to the Commission for approval. The plan would be developed in consultation with North Carolina DWR, North Carolina DWQ, South Carolina DNR, USGS, and Progress Energy, and would include detailed provisions for monitoring reservoir water elevations and for monitoring flows from both the Narrows and High Rock developments.

Under the Yadkin-Pee Dee Settlement, Progress Energy would provide annual reports on lake level compliance to the Commission, which would include hourly water level readings at both Tillery and Blewett Falls reservoirs and annual compliance reports for downstream flows.

Our Analysis

Continuing the existing hourly monitoring for reservoir levels and discharges would be sufficient to ensure compliance with the proposed drawdown restrictions at the Yadkin Project. When measurement of flows from the High Rock development is required, there is a 25 percent compliance buffer (flow within +25 percent of the applicable maximum flow), so existing measurement capabilities at High Rock would be sufficient. Our brief visual observations during the site visit of January 22, 2007, indicated that the area immediately downstream of Falls dam is too braided and turbulent to install a stream flow gage. However, later investigations by Alcoa Generating and USGS in an area slightly farther downstream of Falls development in the upper reaches of Tillery reservoir near Morrow Mountain State Park identified that area as a possible suitable location for the installation of a compliance gage.

Continuing the existing hourly measurement for the Yadkin-Pee Dee River Project reservoirs would be sufficient to measure reservoir level compliance at the Yadkin-Pee Dee River Project. Continuing the operation and real-time internet reporting of the Rockingham gage would be sufficient to ensure compliance with flows released from the Blewett Falls development. Compliance with minimum flows released from the Tillery development would require the construction of gaging facilities near the Highway 731 Bridge about 0.5 mile below Tillery dam. This bridge location was chosen because the upstream area nearer to the Tillery dam is much wider and shallower, which makes it unsuitable for a gage site.

Continuing to operate the Rocky River gage, while not required for compliance issues, would help Progress Energy manage the water levels within Blewett reservoir during high flow events. Operation of the real-time Rocky River gage provides advance warning to Progress Energy of high inflows from Rocky River so operational changes at the Blewett development can be made.

Alcoa Generating and Progress Energy already monitor reservoir water levels, and in some cases provide assistance to USGS for stream gaging sites in the Yadkin and Yadkin-Pee Dee River Project area. Daily and, in many cases, hourly or shorter interval data recording allows Alcoa Generating and Progress Energy to manage its facilities for hydroelectric generation and document environmental compliance within the terms of its existing license. The configuration of future flow and water level monitoring gages would depend on any operating conditions that may be included in new licenses issued for the Projects. Developing a coordinated gage installation plan, in consultation with resource and land management agencies mentioned above, as well as USGS, would ensure that any new gages that may be necessary to measure the flows and water levels stipulated in any new licenses issued would provide accurate data consistent with applicable USGS standards. It also would provide for documentation of the new gage (with or without real-time, telemetry capabilities) installed at each site and any needed modifications to existing streamflow or reservoir elevation gages. The coordinated plan also should include the plans and specifications for the new gaging stations below the Narrows and Tillery dams.

Recreational Boating Flows between Tillery Dam and Blewett Falls Reservoir

Under the Yadkin-Pee Dee Settlement, Progress Energy would provide an additional 1,750 acre-feet of water below Tillery dam to enhance recreational boating flows. However, Progress Energy proposes to release up to 1,950 acre-feet if the flow releases are made for at least 4 days between May 16 to May 31 or September 1 to September 15.

In addition, the city of Rockingham states that the proposed minimum flow of 330 cfs from Tillery as proposed in the Yadkin-Pee Dee Settlement is not suitable for boat navigation and especially not suitable for upstream motorized boating. Therefore, the city of Rockingham has requested recreational flows of 1,200 cfs on weekends during the recreation season.

Our Analysis

Progress Energy's proposed release of 1,750 acre-feet or 1,950 acre-feet could provide about 884 or 985 cfs, respectively, over one 24-hour period (1 cfs for one day = 1.98 acre-feet) or other release scenarios. Based on navigational studies conducted as part of Progress Energy's instream flow study, the shoals at the head of the Grassy Islands area above Blewett reservoir are the limiting factor for upstream motorized navigation in the Tillery reach. The criterion used in the instream flow study for two-way navigation was that a passage of a 14-foot motorized jon boat would require a depth of 2

feet for 20 percent of the total stream width with a minimum point of passage width of 10 feet. Using this criterion, more than 5,000 cfs is required to allow upstream motorized boat traffic through the Grassy Islands shoals area.

Access to the Tillery reach is also possible at the Route 109 bridge about midway between the Tillery dam and Blewett reservoir. In the reach above Grassy Islands shoals, Progress Energy studied two locations that would limit boat passage: the Leak Island area at RM 211 and the Old Mill Weir at RM 216.5. Progress Energy only analyzed one-way navigation, not two-way motorized navigation, consistent with the study plan. The criteria for one-way navigation is passage of a nonmotorized 14 foot jon boat in the downstream direction only, requiring a depth of 1 foot for 10 percent of the total stream width with a minimum point of passage of 10 feet. Based on the transect for the Leak Island area, the most restrictive of the two locations, an estimated flow of 900 cfs would be required to allow for two-way motorized boat traffic through this area or 671 cfs for one-way navigation. Because this location is below the confluence of the Rocky River, a portion of the flow for boat navigation could be from the natural inflow of this tributary. The median accretion flow from Rocky River ranges from 337 to 151 cfs from May through September. Assuming a base flow of 330 cfs and median inflows of 337 cfs in May and 151 cfs in September, from 4 to 190 cfs in additional recreational flow releases would be needed to provide the 671 cfs to allow downstream passage of jon boats at RM 211. In June through August, about 100 cfs in additional flow would be needed.

Because this measure is largely related to recreational opportunities, we discuss it in more detail in section 3.3.7.2, *Recreational Resources, Environmental Effects*.

Water Quality

Dissolved Oxygen

Under current operations, the tailwaters of each development have DO concentrations that do not meet applicable state water quality criteria during late spring to early fall. Operation of the Projects results in sediments being deposited in the reservoirs and reduced water transit rates through them, which leads to bacterial decomposition of organic matter depressing DO levels in reservoirs and subsequently tailwaters. These low DO conditions have the potential to cause adverse effects on many species of fish along with other aquatic species. Operating the Projects according to the Yadkin and Yadkin-Pee Dee Settlements would generally increase the rate of water moving through the system and lower the effects of biochemical oxygen demand on DO concentration in affected reaches of the Yadkin and Pee Dee rivers, although DO concentrations likely still would not meet the DO standards in many cases. Alcoa Generating and Progress Energy propose to increase DO concentrations in the tailwaters of each of the developments by installing and operating turbine aeration facilities and other facilities, if needed, to meet the DO standards.

In the Yadkin Settlement, Alcoa Generating proposes to operate the Yadkin Project in accordance with the conditions of a WQC, and implement any DO monitoring requirement that may be contained in the certificate.

The portion of the Yadkin Settlement that is not proposed for inclusion in a new license provides additional information as to how Alcoa Generating would address low DO conditions and development of a monitoring plan for DO. Alcoa Generating would install and implement measures designed to enhance Yadkin Project tailwater DO conditions as specified in a schedule that extends from 2007 to 2016. Under this approach, Alcoa Generating would monitor DO during each of the years from 2007 to 2016, install aeration facilities at Narrows and High Rock in 2008 through 2012, evaluate the need for additional aeration facilities in 2011 to 2015, and implement additional aeration technologies at Falls and Tuckertown, as needed, in 2014 to 2016.

As DO enhancement equipment or measures are installed/implemented, Alcoa Generating would operate the generating units with DO enhancement equipment added on a first-on-last-off basis, subject to unit availability, from no later than May 1 through November 30 of each year. If North Carolina DWQ notifies Alcoa Generating that the results of monitoring under the DO Monitoring Plan indicate that state water quality standards are not being met due to project operations, Alcoa Generating would consult with North Carolina DWQ to develop a plan to implement corrective actions.

The Yadkin Settlement includes a provision (that is not proposed to be included in any license issued for the project) to reduce the May 1 to November 30 period of DO enhancement operations, if at any time during the term of the new license, Alcoa Generating can demonstrate through studies and/or monitoring that DO conditions have improved. Should any such consultation result in an agreement between Alcoa Generating and North Carolina DWQ to modify the operation of the Yadkin Project for purposes of DO enhancement, Alcoa Generating would consult with North Carolina DWQ to develop a plan for implementing any identified measure to improve said DO conditions.

In the Yadkin-Pee Dee Settlement, Progress Energy proposes two measures that pertain to water quality. Progress Energy would meet state of North Carolina DO standards by December 2011. Although not specified in this proposed measure, Progress Energy has developed a detailed DO enhancement plan to accomplish this goal and included it in its application for a WQC (Progress Energy, 2007b). Under this plan and schedule, Progress Energy intends to complete field testing of DO enhancement options for both Tillery and Blewett Falls by December 2008, and implement the best suited DO enhancement technology by December 2011. In addition to these steps, the Yadkin-Pee Dee Settlement states that, if after all required water quality enhancement modifications have been completed, and state water quality standards are not being met as a result of Progress Energy's project operations, it would immediately consult with North Carolina DWQ to develop, if appropriate, a plan to implement corrective actions. Progress Energy

intends to implement the plan as approved by North Carolina DWQ and/or the Commission.

Progress Energy also proposes to monitor water temperature and DO immediately below the end of the Blewett Falls tailrace and below the Tillery plant with equipment installed in accordance with protocols approved by North Carolina DWQ. The final location for a DO monitoring station below the Tillery plant would be determined based upon further testing of DO enhancement technologies and resulting patterns of DO concentrations in the Tillery tailwater. Although this proposed measure does not specify the interval or seasons in which water temperature and DO would be monitored, the application for a WQC (Progress Energy, 2007b) proposes continuous monitoring from May through November. Finally, Progress Energy proposes to prepare annual compliance reports and submit these reports to North Carolina DWQ and the Commission by April 15 of the following year.

FWS recommends that Alcoa Generating develop and implement adequate provisions for water quality improvement and related schedules. Although FWS does not provide specific measures to accomplish this, it focuses on the low summer DO conditions and states that Alcoa Generating should coordinate with North Carolina DWQ and consider its recommendations in determining appropriate measures to be taken.

Our Analysis

Both Alcoa Generating and Progress Energy have been evaluating approaches to increase DO concentrations in project tailwaters. While upgrading the Narrows Unit 4 turbine in 2001, Alcoa Generating installed two air valves in it to increase the unit's aeration capacity. Subsequent tests indicate that this aeration system increases DO concentrations by differing magnitudes, depending on the generation flows of each of the Narrows units and whether the two air valves are open (Normandeau, 2002, 2005a). Even though DO concentrations were increased by the aeration system, some of the tests resulted in DO concentrations of less than 4 mg/L in the Narrows tailwater. Mimicking the typical operation of the Falls development resulted in the Falls tailwater following a similar pattern of changes in DO concentrations, though of lesser magnitude than the Narrows tailwater (Normandeau, 2005a). Therefore, the DO enhancement in the Narrows and Falls tailraces is not great enough to meet the instantaneous 4-mg/L DO criterion, and additional aeration measures are required.

Since Unit 4 was identical to Units 1, 2, and 3 prior to being upgraded in 2002, we conclude that upgrading, including installation of two air valves, Narrows Units 1, 2, and 3, as outlined in the Yadkin Settlement, would increase DO concentrations at each unit by roughly the same magnitude as the aeration system on Unit 4. Implementing Alcoa Generating's proposed approach of first-on-last-off basis would maximize attainable DO enhancements until aeration systems have been installed on all four Narrows units. Based on DO increases observed for the Unit 4 aeration system, we conclude that operating the planned aeration system on the four Narrows units would meet the DO

criteria in the Narrows tailrace, although it is not evident whether the DO criteria would be satisfied in the Falls tailrace. Under Alcoa Generating's agreed-upon approach, the effectiveness of the upgraded Narrows units would be evaluated after all aeration systems are installed. Such monitoring would help establish whether there is a need for additional aeration measures to enhance DO in the Falls tailrace. If needed, aeration measures would be implemented at Falls development during 2014-2016. We conclude that Alcoa Generating's approach to install aeration systems in the Narrows, and Falls developments if necessary (at the same time the units are upgraded), would meet the DO criteria in a reasonable period and avoid ineffective and/or unnecessary enhancements.

Alcoa Generating also conducted a test to evaluate the potential to increase DO concentrations in High Rock and Tuckertown tailwaters by using existing piping and valves on all three High Rock units. However, test results showed no measurable increase in DO concentrations (Normandeau, 2005a). As part of the Yadkin Settlement, Alcoa Generating proposes to install three new aerating turbines with through-the-blade aeration capability at the High Rock development and test the effectiveness of these improvements in the 2 years following installation of the units.

Aeration can be accomplished with through-the-blade aeration technology. However, it is difficult to quantify the effects that this measure would have on DO concentrations in the High Rock and Tuckertown tailwaters. Notwithstanding, Alcoa Generating's proposal to monitor DO would help determine the effectiveness of these enhancements, and identify any needs for further aeration measures at the Tuckertown development. Implementing Alcoa Generating's proposed approach of prioritizing use of the upgraded turbines by operating them as first-on-last-off would maximize DO enhancements that could be attained from them. We conclude that Alcoa Generating's approach to installing aeration systems in the High Rock, and, if necessary, Tuckertown developments, as part of the units would meet the DO criteria in a reasonable period and avoid ineffective and/or unnecessary enhancements.

Progress Energy (2007b; DTA, 2006) reports that results of turbine venting studies indicate that mechanically induced aspiration:

- does not measurably increase DO concentrations at Tillery Units 1, 2, and 3,
- increases DO concentrations at Tillery Unit 4, and
- increases DO concentrations at the Blewett Falls units to levels that meet the instantaneous and daily average criteria for state water quality levels for DO.

In its application for a WQC, Progress Energy indicates that it would further evaluate potential aeration measures for the Tillery and Blewett Falls developments in 2007. These evaluations would focus on compressed air injection into Tillery Units 1, 2, and 3, and the feasibility of using surface water pumps to destratify the water column in the forebay of both the Tillery and Blewett Falls developments. Progress Energy also intends to evaluate the effect of its proposed minimum flow releases on the DO regime in the tailwaters at both developments, including use of the bottom-drop sluice gate at

Tillery dam. We anticipate that these studies would help quantify the potential effects of Progress Energy's proposed minimum flows; as well as determine feasible approaches to ensure that Tillery and Blewett Falls tailwater DO concentrations meet water quality criteria. Progress Energy's planned approach to enhance DO conditions in the tailwaters of the Tillery and Blewett Falls developments would provide reasonable assurance that Progress Energy would meet the DO standard in a timely manner.

Temperature

The significantly warmer releases that were measured in the Tillery tailrace are likely due to drafting more near-surface water when operating at higher flows. Under proposed operations, Progress Energy would meet its minimum flow requirements, 330 cfs normally in the summer for Tillery, while avoiding skimming high temperature water from the surface of Lake Tillery, if high temperature gradients are found to occur in the upper 6 inches of the reservoir. Implementing Progress Energy's proposal would minimize the amount of warmer water drafted from the surface of the impoundment and, thereby, reduce the likelihood of exceeding the 32°C state water quality criterion for temperature.

Salinity

Outflows from the Yadkin-Pee Dee River Project can affect the extent of saltwater intrusion up the Pee Dee River system. It is estimated that it would take a flow of 900 cfs or more to protect the Myrtle Beach area water supply intakes from saltwater intrusion (North Carolina DWR, 2003). In 2002, releases of 900 cfs resulted in saltwater intrusion at the Grand Strand intake, which forced Georgetown County, South Carolina, to suspend its withdrawals from the river intake and rely on back-up wells for supply water (letter from A. Boozer, Chief, Bureau of Water, South Carolina Department of Health and Environmental Control, Columbia, SC, to G. Ellis, Environmental and Natural Resource Manager, Alcoa Primary Metals, Badin, NC, February 10, 2003).

Under proposed and recommended project operations, Blewett Falls daily average flows would typically exceed 1,170 cfs during normal years, as well as during Low Inflow Protocol stage 0 and stage 1 droughts. However, the proposed Low Inflow Protocol sets target flows of as low as 950 cfs for stage 2 droughts and 770 cfs for stage 3 droughts (see table 21). Based on conditions that occurred in 2002, saltwater intrusion would likely extend up the river far enough to limit use of the Grand Strand water intake in stage 3 and stage 4 droughts, and may limit use of the intake during at least some stage 2 droughts. In stage 3 and stage 4 droughts, there also would be potential for saltwater intrusion to limit the use of the Myrtle Beach intake. Under stage 4 droughts, consensus among Alcoa Generating, Progress Energy, and state agencies would determine whether any additional measures needed to be implemented. Although the proposed operations of the Yadkin Pee-Dee Project would not always prevent saltwater intrusion from stopping downstream river withdrawals at some of the water supply facilities in South Carolina, they would balance storing water in project reservoirs while providing releases for

downstream users. The plan allows Alcoa Generating and Progress Energy, in concert with resource agencies and stakeholder groups, to design and implement specific operational changes in an adaptive management approach to changing drought conditions (see previous discussion of Low Inflow Protocol under *Water Quantity* in this section).

Total Maximum Daily Load

Section 303(d) of the federal Clean Water Act requires states to identify and establish a priority ranking for waterbodies that do not attain applicable water quality standards. For each water quality limited segment impaired by a pollutant and identified in the 303(d) list, a TMDL must be developed. Waterbodies not listed as impaired, or listed as impaired but not included on the 303(d) list, are not required to have TMDLs developed.

Under the Yadkin Settlement in measures not to be included in any license issued for the project, Alcoa Generating agrees to participate in the High Rock TMDL process, which was initiated by the state of North Carolina in 2005. Alcoa Generating would contribute up to $50,000 for in-kind services for planned water quality sampling efforts, upon notification that the Yadkin-Pee Dee River Basin Association has received federal or state grants of at least $50,000, for which Alcoa Generating's contribution would be used as the required matching funds. If, during the term of the new license, other TMDL processes are required for the Yadkin River or its tributaries within the Yadkin Project boundary, Alcoa Generating would participate in these processes.

As part of the Yadkin-Pee Dee Settlement, Progress Energy proposes to participate in any TMDL processes required for the Yadkin-Pee Dee River (or its tributaries) within the project boundary of the Yadkin-Pee Dee River Project or on the Pee Dee River immediately downstream of either Tillery or Blewett Falls reservoirs. Progress Energy's participation would include providing any existing water quality sampling or flow release data obtained from the project and participating in relevant stakeholder technical teams.

Our Analysis

The most recent EPA-approved (2004) list of impaired waterbodies for North Carolina includes 303(d) listings for excessive turbidity and chlorophyll-*a*, and depressed DO conditions in portions of High Rock reservoir. The 2004 list of impaired waterbodies also includes Yadkin and Pee Dee river reaches affected by the Projects due to depressed DO. However, through its proposed DO enhancement measures, Alcoa Generating would generally meet the DO standards in these reaches (North Carolina DQW, 2007d) (see *Dissolved Oxygen* discussion earlier in section 3.3.2.2).

Neither project introduces substantial quantities of sediments or nutrients to the river or reservoirs. Although, the Projects' impoundments have substantially reduced velocities and thereby promoted deposition of suspended sediments and reduction in turbidity, they also have promoted growth of algae and subsequently increased diurnal swings in DO concentrations.

3.3.2.3 Cumulative Effects

Water Quantity—River flow in the Yadkin-Pee Dee River is regulated by the six project developments, as well as the upstream W. Kerr Scott dam. Of these reservoirs, Alcoa Generating's High Rock development, the uppermost project reservoir, plays the most controlling role in the watershed due to its storage capacity. Tributary inflow is limited between High Rock and Tillery dams. Downstream of Tillery dam, the substantial accretion from tributaries such as the Rocky and Little rivers enters the river before Blewett Falls, the most downstream of the Project reservoirs. The Project reservoirs tend to decrease flood flows during relatively small events, but are not a controlling factor during major floods. Upstream land management practices and urbanization add to an already heavy sediment load, much of which is captured in High Rock reservoir, which continues to reduce the storage capacity. Tributary inflow is limited between High Rock and Tillery dams. Downstream of the Tillery dam the substantial accretion from tributaries such as the Rocky and Little rivers enter the river before Blewett Falls, the most downstream of the Project reservoirs. However, their major effect is during low flow conditions when releases from the Blewett Falls development, fed mostly by releases from High Rock development, make up the majority of the flow within the Pee Dee River all the way to the Atlantic Ocean. Population growth in the vicinity of the Projects contributes to the increased demand for water withdrawals from the Projects' reservoirs.

Water Quality—Numerous factors affect water quality in the Yadkin/Pee Dee River system. The river's nutrient loads have been historically elevated by wastewater treatment plants, faulty septic systems, agricultural practices, and industrial discharges. Toxic pollutant loadings have been historically elevated by industrial discharges, mining, and urban runoff. However, upgrades to several wastewater treatment plants and closing of industries have improved water quality in the past decade by reducing loadings of nutrients and toxic contaminants. Creation of the projects impounded large sections of free-flowing river, which historically resulted in accumulation of sediments and contaminants associated with them, and depressed DO concentrations in portions of the reservoirs and the tailwaters of the projects. The high levels of nutrients and metals in the sediments in combination with anoxic conditions near the bottom of some reservoirs have elevated concentrations of ammonia and some metals.

Operating the projects under either the Proposed Action or Staff Alternative would result in a substantial incremental increase in DO concentrations in each of the two projects tailwaters. In addition, these operations would increase DO concentrations to a lesser extent in portions of some of the reservoirs, and thereby reduce ammonia production and mineralization of metals in them. The number of humans residing in the basin is expected to continue to grow substantially during any new license period, and could thereby increase the demands on wastewater treatment plants and roadways. However, we anticipate that planned upgrades to the existing wastewater treatment plants and roadways, along with improvements in technology, would minimize any incremental adverse effects that growth would have on loadings of nutrients and contaminants. The

cumulative effects of expected project and non-project actions would be an increase in DO concentrations in the tailwaters and portions of the reservoirs downstream of High Rock dam along with reduced production of ammonia and mineralization of metals.

3.3.2.4 Unavoidable Adverse Effects

Throughout much of the water column in most reservoirs, stratification of temperatures and DO concentrations would continue to occur. Near-bottom waters would continue to have elevated concentrations of ammonia and some metals, including mercury.

3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

Aquatic Habitat

Reservoirs

The six project reservoirs range in size and complexity and provide a range of aquatic habitat. Section 3.3.2.1, *Affected Environment*, table 4, presents reservoir characteristics such as surface area, depth, and water elevations.

At the Yadkin Project, the shoreline of High Rock reservoir is characterized by extensive coves and backwater. The predominant littoral habitat is mud/sand/clay, and about 68 percent of shoreline is undeveloped. At Tuckertown, there are some coves and backwaters, and the predominant littoral habitat is submerged and emergent aquatic vegetation and woody vegetation. About 98 percent of the reservoir shoreline here is undeveloped. Narrows reservoir has many coves, backwaters, and islands, and its predominant littoral habitat is mud/sand/clay. About 63 percent of the shoreline is undeveloped. The most downstream Yadkin Project reservoir, Falls, is small, has no coves or backwaters, and is riverine in nature. The predominant littoral habitat here is submerged and emergent aquatic vegetation and boulder. About 98 percent of the Falls reservoir shoreline is undeveloped.

Lake Tillery, one of two Yadkin-Pee Dee River Project reservoirs, has many coves and backwaters with most of the littoral habitat composed of submerged and emergent aquatic vegetation and woody vegetation. Only about 45 percent of the shoreline here is undeveloped. Blewett Falls reservoir has some coves, backwaters, and islands, and the predominant littoral habitat is submerged and emergent aquatic vegetation and woody vegetation. Blewett Falls is the most undeveloped of any of the six project reservoirs, and nearly 100 percent of its shoreline is undeveloped.

Riverine Reaches

There are essentially no riverine reaches associated with the Yadkin Project because the downstream reservoirs extend into the tailwaters of each development.

During project operations, however, the tailwaters exhibit some riverine conditions, with higher velocities and turbulence. Because of the higher velocities, these tailwaters have hard substrates of cobble, boulder, or bedrock. At the Yadkin-Pee Dee River Project, there are two riverine reaches: the 20.5-mile reach from the Tillery development to the upstream end of the Blewett Falls reservoir, and the 188-mile reach from the Blewett Falls development to Winyah Bay and the Atlantic Ocean. The reach below Tillery is considered to be in the Upper Piedmont (Reach 3 described in Progress Energy's instream flow studies), with channel complexity ranging from simple to moderate, and a substrate of cobble, boulder, and bedrock. This reach is influenced by poor water quality entering via the Rocky River about 5 miles downstream of Tillery.

The reach below the Blewett Falls development is divided into two reaches for study purposes. The 23.4-mile reach from Blewett Falls to the U.S. Highway 1/South Carolina Highway 9 bridge is in the Lower Piedmont (Reach 2), and is characterized by a rapid change in channel gradient, moderate to high channel complexity, and a substrate of cobble, boulder, and bedrock. This reach also has substantial shoal habitat throughout. Downstream of this reach is a 64.6-mile stretch of river situated in the Coastal Plain (Reach 1), which is entirely within South Carolina and ends at the U.S. Highway 76/South Carolina Highway 301 bridge. This reach has a lower gradient, a meandering channel of simple to moderate complexity, fluvial sediment, and more large woody debris. The 100 miles of the Pee Dee River downstream of Reach 1 was not investigated as part of Progress Energy's studies, but it is within the coastal plain, and, based on a review of aerial photographs, it has characteristics similar to Reach 1.

Biological Resources

Freshwater Mollusks

Several species of freshwater mussels occur within the project reaches of the Yadkin and Pee Dee rivers (table 24). Mussel surveys in the tailwater and free-flowing reaches of the river indicate relatively high diversity and numbers of native freshwater mussel species, and high numbers of the non-native invasive Asian clam (*Corbicula fluminae*). The Asian clam is a native of Southeast Asia and is believed to have been introduced to the United States in 1924. It has since spread to the Mississippi River Basin, the Gulf Coast, and the eastern United States up to about 40 degrees latitude. The Asian clam prefers flowing water over sand and gravel substrate, but also occurs in reservoirs (Balcom, 1994). In general, diversity of the native freshwater mollusks is higher at the downstream developments (Tillery and Blewett Falls) than at the four upstream developments, but longer free-flowing reaches are present below both Tillery and Blewett Falls, which provides more favorable habitat for mussels. No federally listed mussel species were observed, but several state-listed species were collected.

Table 24. Freshwater mussel species observed downstream of the Yadkin (P-2197) and Yadkin-Pee Dee River (P-2206) Projects and one snail species observed on the High Rock shoreline. (Source: Alcoa Generating, 2006a; Progress Energy, 2006a)

Species	High Rock	Tuckertown	Narrows	Falls	Tillery	Blewett Falls
Alewife floater[a]			●	●	●	●
Eastern elliptio				●	●	●
Pee Dee lance			●	●		
Eastern lampmussel[a]			●	●	●	●
Eastern floater			●	●		●
Paper pond shell	●	●	●	●		●
Eastern creekshell[a]				●	●	●
Roanoke slabshell[a]					●	●
Carolina lance					●	
Yellow lampmussel[a,b]					●	●
Pod lance[a]					●	●
Eastern pondmussel[a]					●	●
Creeper[a]					●	●
Carolina creekshell[a,b]					●	
Carolina slabshell[a]						●
Southern rainbow						●
Asian clam[c]	●	●	●	●		
Chinese mystery snail[c]						

[a] Species with North Carolina or South Carolina conservation status.
[b] Federal species of concern.
[c] Invasive exotic species.

One non-native invasive snail, the Chinese mystery snail (*Cipangopaludina chinensis*), was observed on the shoreline of High Rock reservoir. The Chinese mystery snail is an Asian species that was introduced to the United States through the aquarium industry, and now occurs throughout the United States. They typically occur in shallow,

slow-moving waters in mud or silt substrate, with some aquatic vegetation. The Chinese mystery snail and related species (the Japanese trapdoor snail) are popular in the aquarium industry because they are algae eaters (Gulf States Marine Fisheries Commission, 2007).

Resident Fish Species

The six project reservoirs and associated riverine reaches support a healthy warmwater fish community that in turn supports an important sport fishery in the river. A total of 83 species, both resident and diadromous (see below) were collected by Alcoa Generating and Progress Energy fisheries surveys in the project reservoirs, tailwaters, and associated riverine reaches. The number of recorded species is lower (50) at the four upstream Alcoa Generating developments, but the fish community recorded downstream of Blewett Falls includes several migratory and mobile euryhaline[36] species (such as striped mullet and Atlantic needlefish). The project's six reservoirs support an excellent sport fishery for largemouth bass, black and white crappie, striped bass, and several species of catfish. The forage base for these game species includes gizzard shad, threadfin shad, and landlocked populations of alewife and blueback herring. North Carolina WRC stocks the striped bass that occur in project waters for a put-grow-and-take fishery.

The species composition in the projects' tailwaters is similar to that of the reservoirs, although some differences were noted. Although most of the same species collected in the reservoir were also collected in the tailwaters, higher numbers of lower-DO tolerant species were observed in some of the tailwaters (bluegill, gizzard shad, white perch, carp, and quillback). There were also some differences in species composition and abundance among the tailwaters, which varied by season, with some tailwaters supporting higher abundance in the spring, and others having higher abundance in the fall. The species composition of the tailwaters and river reach downstream of Blewett Falls differed substantially from all the other development tailwaters because of the presence of the migratory and euryhaline species previously noted, and the higher habitat diversity, transitioning from the Piedmont to the Coastal Plain physiographic reaches.

Diadromous Species

Diadromous species, fish species that move during their life cycle between fresh and salt waters, currently occur only downstream of the Blewett Falls development, which is the most downstream dam on the Pee Dee River, at RM 188. The only exceptions are the American eel, which has been recorded as far upstream as the Tillery development tailwater, and alewife and blueback herring, which are believed to be

[36]Euryhaline species are defined as those fish species that can tolerate a wide range of salinity.

landlocked populations in some of the project reservoirs. Alewife have only been reported in Tuckertown reservoir, while blueback herring have been recorded in Tuckertown, Narrows, Falls, Tillery, and Blewett Falls reservoirs. Diadromous species that occur below Blewett Falls dam include American shad, hickory shad, blueback herring, striped bass, sea lamprey, shortnose sturgeon, and Atlantic sturgeon. American shad is an important commercial and sport species and was the most common species collected during spawning surveys in 1998 and 1999. Shad continue to support a sizable commercial gill net fishery in the lower Pee Dee River, although commercial fishing for shad has been closed in the North Carolina portion of the Pee Dee River since 2002. A portion of the Winyah Bay landings of American shad are those recruited from the Pee Dee River. The number of Pee Dee River commercial fishermen has ranged from 34 to 66 from 1999 to 2003. The number of shad that actually reach the Blewett Falls tailrace is not known, although NMFS reports that a significant recreational fishery for shad (and striped bass) occurs immediately below Blewett Falls dam.

Information on other anadromous species is limited because most do not support a directed fishery.[37] Although the striped bass does support a sport fishery in the Pee Dee River (commercial fishing for striped bass is not allowed), there is no information available on it. The catadromous[38] American eel, although not a commercial or sport species in the river, is a species of concern along the Atlantic coast and was a common species collected during the Progress Energy's fishery surveys. Boat electrofishing, although not an ideal sampling tool for eel, collected substantial numbers of eels downstream of the Blewett Falls dam and smaller numbers upstream of the dam (but downstream of the Tillery dam). This indicates that some eels are able to pass upstream over the Blewett Falls dam. Downstream of the dam, electrofishing catch rates ranged from less than 40 to greater than 160 eels per hour, while upstream of the dam, catch rates were less than 10 eels per hour. About 59 percent of the eels collected were elvers,[39] and locations with the highest catches were 12 to 23 miles and 72 miles downstream of Blewett Falls dam.

Both Atlantic and shortnose sturgeon occur in the Pee Dee River downstream of Blewett Falls dam. The federally listed endangered shortnose sturgeon is described in section 3.3.5, *Threatened and Endangered Species*. The Atlantic sturgeon is considered to be anadromous, and is a federal candidate species for listing. There are a few observations of this species downstream of Blewett Falls dam. Progress Energy's

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[37]A directed fishery is a fishery that targets a specific species or group of species.

[38]Catadromous refers to fish that migrate as adults from freshwater to saltwater to spawn, with juveniles returning to freshwater to rear.

[39]Elvers are juvenile eels that are ascending the river from the ocean, and once established in freshwater habitat will rear in that habitat for several years, eventually maturing into adult eels.

fisheries surveys collected one ripe male sturgeon at RM 133 in October 2003, and other large sturgeon (probably Atlantic sturgeon) were observed in the Coastal Plain part of the river in October 2002 and 2003. There are also historic accounts of the Atlantic sturgeon in the lower Pee Dee River nearly as far upstream as Blewett Falls dam.

State and federal resource agencies have developed a diadromous fish restoration plan for the Yadkin-Pee Dee River Basin (FWS, NMFS, North Carolina WRC, and South Carolina DNR, 2006). This plan identifies target species and general population goals, and provides both a general framework and more specific steps for restoring diadromous fish in the basin. The target species include American shad, hickory shad, blueback herring, striped bass, Atlantic sturgeon, shortnose sturgeon, and American eel. The plan proposes to set a target production rate of 50 shad per acre of aquatic habitat, and to further study what the production rate for blueback herring should be. The plan, however, does not state the specific population goals for shad or any of the other species.

The Fish Passage Agreement, which was signed in December 2007 by Progress Energy and the same agencies that developed the diadromous fish restoration plan, includes estimated adult shad production potential for aquatic habitat upstream of Blewett Falls dam, as follows:

- Blewett Falls to Tillery reach – 150,773 shad
- Above Tillery to the Falls development – 16,877 shad
- Total – 167,650 shad.

These estimates provide target numbers for sizing potential upstream fish passage facilities. The Fish Passage Agreement does not estimate target population sizes for the other diadromous species of interest, and states that the only other species of primary interest for upstream and downstream passage is the American eel. The blueback herring is also mentioned as an incidental species of interest that will be passed as long as that passage does not interfere with the safe and timely passage of the primary species of interest, shad and American eel.

Federal Species of Concern

There are six federal aquatic species of concern that occur in the Yadkin-Pee Dee River system, in the vicinity of the Yadkin-Pee Dee Project developments, with documented collections made as follows: Atlantic sturgeon (now a candidate species for listing, collected downstream of Blewett Falls), alewife (reported in Tuckertown reservoir as a landlocked population, but probably also occurs downstream of Blewett Falls dam), Carolina redhorse (at the Tillery and Blewett Falls developments), robust redhorse (downstream of Blewett Falls), yellow lampmussel (downstream of Tillery and Blewett Falls), and Carolina creekshell (downstream of Tillery). Other state-listed mussel species occur below both Alcoa Generating's and Progress Energy's developments (see table 24). The two federal species of concern that have the highest potential to occur in the Yadkin Project reach are the Carolina redhorse and robust redhorse. Both sucker species have

been collected downstream of Blewett Falls dam, and Carolina redhorse specimens have been collected in the Tillery development tailrace and reservoir, and could occur in the Falls development tailrace. Intensive surveys by Alcoa Generating, however, did not detect either of the species. Progress Energy reported that Carolina redhorse have been collected in Lake Tillery, Blewett Falls reservoir, and downstream of Blewett Falls dam, but the robust redhorse has only been collected downstream of Blewett Falls. A total of 15 robust redhorse were collected downstream of the dam, including both juveniles and adults. For Carolina redhorse, Progress Energy reported catching one fish in Lake Tillery, 10 fish in Blewett Falls reservoir, 9 fish downstream of Blewett Falls dam, and 60 fish in a tributary to Blewett Falls reservoir.

Essential Fish Habitat

EFH in the lower Pee Dee River includes all tidally influenced estuarine and freshwater wetlands, deepwater habitats, intertidal and subtidal bottoms in the lower Pee Dee River and Winyah Bay. Federally managed species, for which EFH is identified by the South Atlantic Fishery Management Council (Atlantic Council), include postlarval and juvenile red drum (*Sciaenops ocellatus*), white shrimp (*Litopenaeus setiferus*), and brown shrimp (*Farfantepenaeus aztecus)*. The lower Pee Dee River also serves as nursery and forage habitat for American shad, river herring, black drum *(Pogonias cromis)*, sheepshead *(Archosargus probatocephalus)*, Atlantic menhaden *(Brevoortia tyrannus)*, mullet *(Mugil spp.)*, and blue crab *(Callinectes sapidus)*. Some of these species also serve as prey for other species (e.g., mackerels, snappers, and groupers) that are managed by the Atlantic Council, and for highly migratory species (e.g., billfishes and sharks) that are managed by NMFS.

Postlarval and Juvenile Red Drum

Postlarval and juvenile red drum utilize estuarine nurseries and have been occasionally collected in the surf zone. Although larvae have little tolerance for low salinities, juveniles are very tolerant and this tolerance increases with age. They have been found in salinities ranging from 13 to 40 parts per thousand (Davis, 1990). In estuaries, they prefer shorelines, shallow water, and seagrass beds and have been found in both vegetated and unvegetated bottoms. Red drum postlarval and juveniles are highly mobile non-filter feeders. They feed on benthic organisms, all life stages of fish, macroalgae, and vascular plants (NOAA, 2007).

For postlarval and juvenile red drum, EFH includes (a) tidal freshwater, (b) estuarine emergent vegetated wetlands, (c) flooded saltmarshes, (d) brackish marsh, (e) tidal creeks, (f) estuarine scrub/shrub (mangrove fringe), (g) submerged rooted vascular plants (sea grasses), (h) unconsolidated bottom (soft sediments), and (i) ocean high salinity surf zones (FFWRI, 2007). Although EFH for this species occurs in the lower Pee Dee River/Winyah Bay, no EFH occurs in the immediate project area.

Penaeid Shrimp

The northern brown shrimp and northern white shrimp are two closely-related species in the family Penaeidae that inhabit the waters of the eastern United States. Juveniles of both species require estuarine habitats for development, and adults live and spawn offshore. Brown shrimp are less tolerant of low salinities and high temperatures than white shrimp. However, white shrimp recruit to the estuaries at warmer water temperatures, are more abundant in the estuaries in the winter, and are less cold tolerant than the brown shrimp (McMillen-Jackson and Bert, 2003). Brown shrimp larvae are drifting and white shrimp larvae are self-propelled as well as drifting; all other life stages of both species are bottom-dwelling (NOAA, 2007). Eggs of both species are non-mobile, and larvae are poor swimmers. Juveniles and adults are highly mobile. Larvae of both species prey on phytoplankton and zooplankton. Juvenile brown and white shrimp feed on zooplankton, while brown shrimp also prey on fish eggs and larvae (NOAA, 2007). Adult and juvenile brown and white shrimp eat on detritus, benthic organisms, and macroalgae. Adult white shrimp also eat on vascular plants. Adult brown and white shrimp live up to 5 years (NOAA 2007).

For these shrimp, EFH includes (a) inshore estuarine nursery areas, (b) offshore marine habitats used for spawning and growth to maturity, and (c) all interconnecting water bodies. Inshore nursery areas include (a) tidal freshwater (palustrine), estuarine, and marine emergent wetlands (e.g., intertidal marshes); (b) tidal palustrine forested areas; (c) mangroves; (d) tidal freshwater, estuarine, and marine submerged aquatic vegetation (e.g., seagrass); and (e) subtidal and intertidal non-vegetated flats (FFWRI, 2007). Although EFH for these species occurs in the lower Pee Dee River/Winyah Bay, no EFH occurs in the immediate project area.

Other Species

The other species cited by NMFS as having designated EFH of the lower Pee Dee River/Winyah Bay include American shad, river herring, black drum, sheepshead, Atlantic menhaden, mullet, and blue crab. Both shad and river herring use the lower Pee Dee River/Winyah Bay as a migratory corridor and as a nursery area, and these species migrate as far upstream as the Blewett Falls dam during their spring spawning migrations. The other species occur in estuarine areas with higher salinity, and do not occur in the immediate project area.

3.3.3.2 Environmental Effects

Reservoir Level Fluctuations

Reservoir level fluctuations associated with hydropower operations may have adverse effects on resident fish species, particularly if these fluctuations occur during the fish spawning period, or shortly thereafter when eggs or larvae are still present in spawning areas or spawning nests.. The Yadkin and Yadkin-Pee Dee settlements set

limits to reservoir drawdowns throughout the year and impose stricter drawdown limits during the spring spawning season (especially for largemouth bass). The proposed drawdown limits would vary by reservoir, as summarized in tables 1 and 2. These restrictions would apply at all times except under extreme operational scenarios such as when Low Inflow Protocols are in effect.

Our Analysis

Any drawdown restrictions would improve shoreline aquatic habitat in the reservoirs by limiting the dewatering of that habitat and providing more sustained habitat throughout the year. Drawdown restrictions during the spring spawning period would act to protect spawning areas, particularly for shoreline nest-building species such as largemouth bass, one of the most important sport fishes in the six project reservoirs.

Limiting spring (April 15 to May 15) drawdowns to no more than 1 foot below the level that occurs on April 15, as Alcoa Generating proposed to endeavor to do for their four Yadkin Project reservoirs, would afford good protection to shoreline spawners by maintaining adequate water levels over the nests during the spawning and egg incubation period. Such a drawdown restriction also should allow time for fry to disperse from the nests prior to commencement of deeper drawdowns.

Progress Energy proposes a reservoir drawdown of no more than 1.5 feet from the level occurring on April 15 at Tillery during the spring spawning period (April 15 to May 15), and to limit reservoir water level changes to 2 feet at Blewett Falls during this period. Although these drawdowns may provide somewhat less protection to spring spawners than a 1-foot drawdown as proposed for the Yadkin Project, most shoreline spawners still would be afforded protection. For example, largemouth bass typically spawn at depths of 1 to 4 feet (Scott and Crossman, 1973), so even a 2-foot drawdown would provide sufficient inundation for a large portion of the spawning areas. The topography of the shoreline spawning areas also would affect the level of protection provided by the proposed drawdown restrictions, and this topography does vary by reservoir and within each reservoir, with some areas having steeper or shallower shorelines than others. Areas with shallow topography would experience greater dewatering than areas with steeper shorelines, but the actual effects on shoreline spawners would depend on the extent of spawning occurring in specific areas, and the topography within the spawning areas. Detailed information on the location of spawning areas is not available to quantify the level of protection that would occur, but in general, restricting spring drawdowns to no more than 2 feet would offer a level of protection not currently provided in the project reservoirs.

The proposed year-round drawdown restrictions also vary by reservoir, but generally range from about 3 to 6 feet. Other parties (Davidson County, SaveHighRockLake.org, and two individuals) recommend specific alternative drawdown restrictions for High Rock reservoir (maximum drawdowns ranging from 2 to 7 feet), but they are in the general range of the restrictions provided by the Yadkin Settlement.

Although the specific basis for the various drawdowns proposed was not provided, it likely is associated with reservoir-specific topography and other factors such as the level of recreation and boating that occurs on each reservoir. However, outside of the spawning period, reservoir fish are more able to adapt to changing water levels, as long as these changes are not sudden. Fish will move out of areas that become less suitable habitat, either because of reduced depth, increased water temperatures due to warming, or other factors. Because these reservoirs have been experiencing similar (or greater) drawdowns for many years and continue to support excellent sport fisheries, the proposed drawdown restrictions appear adequate to protect fishery resources throughout the year.

Instream Flow Releases

Flow releases from operating hydroelectric stations affect aquatic habitat by regulating the volume and timing of flows downstream of the station, often modifying the normal seasonal periodicity that would occur in an unregulated river. For the Projects, Alcoa Generating and Progress Energy and other stakeholders focused their concerns related to instream flows on the two major free-flowing reaches of the Yadkin-Pee Dee rivers, downstream of the Tillery and Blewett Falls developments. All the instream flow studies conducted by Progress Energy concentrated on these two riverine reaches. As a result of the studies and negotiations leading to the Yadkin and Yadkin-Pee Dee settlements, the two settlements include minimum flow regimes for the projects; for the Yadkin developments, these minimum flows are daily average values, but for Tillery and Blewett Falls, they are instantaneous flows. Not all parties, however, agree to the flows proposed in the Yadkin and Yadkin-Pee Dee settlements.

There are differing flow recommendations at the Tillery development. Under the Yadkin-Pee Dee Settlement, the minimum flow would be 330 cfs year-round, with an increase to 725 cfs for 8 weeks to accommodate American shad spawning once they are passed upstream over the Blewett Falls development as part of the diadromous fish restoration program. The Yadkin-Pee Dee Settlement also provides for recreational flow releases totaling 1,750 acre-feet that would be distributed over weekends and holidays during the summer months.

FWS and American Rivers do not agree with the Yadkin-Pee Dee Settlement provisions and recommend higher continuous minimum flows from Tillery of 800 to 1,000 cfs year-round, and 1,500 to 1,800 cfs during the spring spawning season. In their comments on the draft EIS, FWS and American Rivers maintain their earlier recommendations for higher minimum flows than those proposed in the Yadkin-Pee Dee Settlement, as does the city of Rockingham.

Our Analysis

Our analysis focuses on the reaches of the Yadkin-Pee Dee River where there is disagreement on the minimum flows proposed, or where additional recommendations have been made related to minimum flows (such as ramping rates). There are no major issues related to the proposed minimum flows from the Yadkin Project. Flows from that

project (released from the Falls development) would be provided in sufficient volume on a daily average basis so that the downstream Tillery and Blewett Falls developments could provide continuous minimum flows to the free-flowing riverine reaches below those developments. Under the provisions of the Yadkin Settlement, the short tailwater reaches below the four Yadkin developments would continue to be exposed to fluctuating flow releases due to peaking operations, and periods of zero discharge and leakage from the developments. Notwithstanding these fluctuations, the backwater from the downstream reservoirs would prevent these tailwaters from being dewatered. Therefore, the primary effects on aquatic habitat would be changes in water surface elevations and velocities associated with variable powerhouse operations, which have occurred for many years under existing operations. These effects have likely resulted in some shifting of habitat usage by aquatic biota in the tailwaters in response to these operations, but probably have not resulted in adverse effects on these biota.

We analyzed the results of Progress Energy's instream flow study to assess an appropriate flow for the reach downstream of Tillery dam. In this 20.5-mile study reach, Reach 3, was further divided into three subreaches (table 25), and a total of 29 species/life stages/habitat types[40] were included for analysis. The study simulated weighted usable area (WUA – an index of habitat) for these 29 life stages at flows ranging from 70 (the approximate current minimum flow from Tillery) to about 17,000 cfs (the maximum flow varied somewhat depending on subreach and accretion flows). Because of the scale of the study and the number of simulations, Progress Energy reported the results as a habitat duration analysis,[41] specifically as Index C. The study defines Index C as the average of all daily habitat values for a month that are less than or equal to the median (50 percent exceedance) habitat value for the month. Index C is one method for examining the results of the habitat duration analysis for this complex instream flow study, and the study team, which included state and federal fishery agencies, chose this method. Index C provides an estimate of habitat availability at the lower end of the habitat duration curve, which was judged by the study team to be the more critical part of the curve.

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[40]The 29 species/life stages/habitat types included a range of anadromous and resident fish species (American shad, striped bass, sturgeon, golden and robust redhorse), their specific life stages (spawning, rearing), general and specific habitat types that could apply to several species (such as "deep slow generic cover"), and juvenile aquatic insects and other invertebrates (macroinvertebrates) including mayflies (ephemeroptera), stoneflies (plecoptera), and caddisflies (trichoptera), which are frequently used to gage stream health.

[41]A habitat duration analysis estimates the amount of habitat that would be available over time under alternative flow scenarios (typically expressed as percent exceedance).

Table 25. Stream reaches analyzed for the Yadkin-Pee Dee River Project (P-2206) downstream of Tillery. (Source: Staff)

Reach/Subreach Name	Description	From RM	To RM	Length (mi)	% of Study Area
Reach 1 – Coastal Plain	Florence at U.S. Highway 76/SC Highway 301 to Highway 1 at Cheraw	100.2	164.8	64.6	58.8
Subreach 1	U.S. Highway 76/SC to Cashua Ferry/S.C. Highway 34	100.2	116.1	15.9	14.5
Subreach 2	Cashua Ferry/SC Highway 24 to Cheraw/U.S. Highway 1	116.1	164.8	48.7	44.4
Reach 2 – Lower Piedmont	Cheraw/U.S. Highway 1 to Blewett Falls dam	164.8	188.2	23.4	21.3
Subreach 1	U.S. Highway 1 to NC/SC state line	164.8	173.0	8.2	7.5
Subreach 2	NC/SC state line to Highway 74	173.0	184.6	11.6	10.6
Subreach 3	Highway 74 to Blewett Falls dam	184.6	188.2	3.6	3.3
Reach 3 – Upper Piedmont	Upstream end of Grassy Islands/Blewett Falls Lake to Tillery dam	196.2	218.0	21.8	19.9
Subreach 1	Upstream end of Grassy Islands/Blewett Falls Lake to Brown Creek confluence	196.2	206.5	10.3	9.4
Subreach 2	Brown Creek confluence to Rocky River confluence	206.5	212.6	6.1	5.6
Subreach 3	Rocky River confluence to Tillery dam	212.6	218.0	5.4	4.9

Progress Energy selected key life stages and provided Index C values for those life stages at alternative minimum flow levels. As part of additional information filed December 13, 2006, Progress Energy presented Reach 3 Index C results for seven life stages/habitat types at three alternative flow levels from Tillery: the existing minimum flow of 70 cfs, the final license application proposed minimum flows of 200/750 cfs, and the Yadkin-Pee Dee Settlement minimum flows of 330/725 cfs. For these seven life

stages/types, the proposed minimum flows provided the highest Index C values of the three flow alternatives.

FWS and American Rivers' recommended flows (800/1,000 cfs year-round and 1,500/1,800 cfs during spring spawning) were not presented until their filing in response to the ready for environmental analysis notice. Therefore, no Index C analysis is available for those flows. As an alternative, we examined the flow versus WUA curves for the proposed flows compared to the FWS and American Rivers' recommended flows, as well as the existing minimum flow from Tillery dam. This analysis includes accretion flows at the head of subreaches 1 and 2, because of the major tributaries that enter those subreaches. There is no accretion flow estimated for subreach 3 because it starts at the base of Tillery dam. We added median accretion flows for the spring months (March, April, and May) and a median accretion flow for the remainder of the year. Because FWS and American Rivers recommend a range of flows, we use the midpoint of those ranges in our analysis (900 and 1,650 cfs). We examined the same seven life stages/types as included in the Index C analysis filed December 13, 2006.

The results of our analysis are presented in tables 26, 27, 28, 29, and 30, which show the modeled WUA for each life stage/habitat types, along with the percent of the maximum WUA available for that life stage. Percent of maximum WUA is used as an indication of the percentage of maximum habitat area that would be provided at each minimum flow, including the existing minimum flow. This statistic, however, does not show the duration (in time) of that habitat, or the habitat that would be temporarily available during higher project releases made during parts of the day.

Our analysis shows that both the proposed and recommended alternative minimum flows would result in a substantial improvement in aquatic habitat over the existing minimum flow (tables 29 and 30), but would have different effects on species/habitat types, varying by subreach. Overall, however, there does not appear to be a large difference in the percentage of the maximum habitat that would be available under the proposed flows when compared with the FWS and American Rivers' recommended flows.

Table 26. Comparison of WUA values (square feet/1,000 feet of linear stream) for 7 life stages/habitat types at a range of existing, proposed, and recommended minimum flows for Reach 3, subreach 1, downstream of Tillery dam. (Source: Staff)

Flow	Flow with accretion (cfs)[a]	Shad spawning		Golden redhorse adult		Golden redhorse juvenile		Shallow, fast, adult low velocity		Shallow, fast, generic mid. velocity		Deep, slow, generic cover		Deep, fast, coarse substrate	
		WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.
Spring															
Existing (70 cfs)	950	212,266	52	52,650	76	49,246	74	72,943	61	34,270	55	28,526	92	157,710	75
Yadkin-Pee Dee Settlement (725 cfs)	1,605	311,210	76	61,301	89	65,367	98	27,847	23	20,724	33	22,130	71	197,287	94
FWS (1,650 cfs)	2,530	383,653	93	66,588	97	63,063	94	14,425	12	14,366	23	19,547	63	210,926	100
Remainder of Year															
Existing (70 cfs)	557	NA	NA	41,817	61	30,095	45	113,490	95	35,101	56	17,795	57	116,611	55
Yadkin-Pee Dee Settlement (330 cfs)	817	NA	NA	49,829	72	43,522	65	87,050	73	35,710	57	27,294	88	145,419	69
FWS (900 cfs)	1,387	NA	NA	59,248	86	62,357	93	36,380	31	24,732	39	27,691	89	188,283	89

Note: cfs – cubic feet per second
WUA – weighted usable area

[a] A median accretion flow of 880 cfs is used for the spring months (March, April, May), and 487 cfs for the remainder of the year.

Table 27. Comparison of WUA values (square feet per 1,000 feet of linear stream) for 7 life stages/habitat types at a range of existing, proposed, and recommended minimum flows for Reach 3, subreach 2, downstream of Tillery dam. (Source: Staff)

Flow	Flow with accre-tion (cfs) [a]	Shad spawning		Golden redhorse adult		Golden redhorse juvenile		Shallow, fast, adult low velocity		Shallow, fast, generic mid. velocity		Deep, slow, generic cover		Deep, fast, coarse substrate	
		WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.	WUA	% of max.
Spring															
Existing (70 cfs)	841	169,727	49	28,312	75	25,403	68	84,911	82	45,439	92	26,766	70	99,109	60
Yadkin-Pee Dee Settlement (725 cfs)	1,496	282,912	81	34,924	92	36,550	98	52,490	51	48,288	98	37,395	97	128,879	78
FWS (1,650 cfs)	2,421	333,729	96	37,363	99	34,863	93	25,876	25	37,314	76	11,914	31	152,925	93
Remainder of Year															
Existing (70 cfs)	496	NA	NA	22,946	61	18,228	49	100,400	97	40,487	82	20,126	52	77,560	47
Yadkin-Pee Dee Settlement (330 cfs)	756	NA	NA	26,710	71	23,048	62	85,828	83	45,500	93	24,643	64	93,577	57
FWS (900 cfs)	1,326	NA	NA	33,944	90	35,192	94	62,888	61	49,105	100	38,143	99	122,117	74

Note: cfs – cubic feet per second
WUA – weighted usable area

[a] A median accretion flow of 771 cfs is used for the spring months (March, April, May), and 426 cfs for the remainder of the year.

Table 28. Comparison of WUA values (square feet per 1,000 feet of linear stream) for 7 life stages/habitat types at a range of existing, proposed, and recommended minimum flows for Reach 3, subreach 3, downstream of Tillery dam.[a] (Source: Staff)

	Shad spawning		Golden redhorse adult		Golden redhorse juvenile		Shallow, fast, adult low velocity		Shallow, fast, generic mid. velocity		Deep, slow, generic cover		Deep, fast, coarse substrate	
Flow	**WUA**	**% of max.**	**WUA**	**% of max.**	**WUA**	**% of max.**	**WUA**	**% of max.**	**WUA**	**% of max.**	**WUA**	**% of max.**	**WUA**	**% of max.**
Spring														
Existing (70 cfs)	6,434	1	29,324	25	12,567	10	111,864	43	22,213	18	8,739	9	22,515	7
Yadkin-Pee Dee Settlement (725 cfs)	222,133	48	91,776	77	83,538	68	237,899	92	118,960	97	68,947	70	122,202	39
FWS (1,650 cfs)	432,907	94	116,012	97	123,537	100	92,385	36	102,192	84	47,864	49	240,958	76
Remainder of Year														
Existing (70 cfs)	NA	NA	29,324	25	12,567	10	111,864	43	22,213	18	8,739	9	22,515	7
Yadkin-Pee Dee Settlement (330 cfs)	NA	NA	68,809	58	47,473	38	237,903	92	69,978	57	40,453	41	64,945	20
FWS (900 cfs)	NA	NA	102,294	86	101,190	82	231,152	90	110,562	91	87,670	89	151,205	48

Note: cfs – cubic feet per second
WUA – weighted usable area

[a] There is no accretion flow included because there are no major tributaries in this subreach, which begins at Tillery dam and extends about 5 miles downstream.

Table 29. Summary of percent of maximum WUA values for 7 life stages/habitat types at a range of existing, proposed, and recommended minimum flows, shown by subreach (SR) in Reach 3, downstream of Tillery dam. (Source: Staff)

Flow	Shad spawning			Golden redhorse adult			Golden redhorse juvenile			Shallow, fast, adult low velocity			Shallow, fast, generic mid. velocity			Deep, slow, generic cover			Deep, fast, coarse substrate		
	SR1	SR2	SR3	SR1	SR2	SR3	SR1	SR2	SR3	SR1	SR2	SR3	SR1	SR2	SR3	SR1	SR2	SR3	SR1	SR2	SR3
Spring																					
Existing (70 cfs)	52	49	1	76	75	25	74	68	10	61	82	43	55	92	19	92	70	9	75	60	7
Yadkin-Pee Dee Settlement (725 cfs)	76	81	48	89	92	77	98	98	68	23	51	92	33	98	97	71	97	70	94	78	39
FWS (1,650 cfs)	93	96	94	97	99	97	94	93	100	12	25	36	23	76	84	63	31	49	100	93	76
Remainder of Year																					
Existing (70 cfs)	NA	NA	NA	61	61	25	45	49	10	95	97	43	56	82	19	57	52	9	55	47	7
Yadkin-Pee Dee Settlement (330 cfs)	NA	NA	NA	72	71	58	65	62	38	73	83	92	57	93	57	88	64	41	69	57	20
FWS (900 cfs)	NA	NA	NA	86	90	86	93	94	82	31	61	90	39	100	91	89	99	89	89	74	48

Table 30. Summary of percent of maximum WUA values for 7 life stages/habitat types at a range of existing, proposed, and recommended minimum flows, for all of Reach 3, downstream of Tillery dam. (Source: Staff)

Flow	Shad spawning	Golden redhorse adult	Golden redhorse juvenile	Shallow, fast, adult low velocity	Shallow, fast, generic mid. velocity	Deep, slow, generic cover	Deep, fast, coarse substrate	Average for all life stages and habitat types
Spring								
Existing (70 cfs)	34	59	51	62	55	57	47	52
Yadkin-Pee Dee Settlement (725 cfs)	68	86	88	55	76	79	70	75
FWS (1,650 cfs)	94	98	96	24	61	48	90	73
Remainder of Year								
Existing (70 cfs)	NA	49	35	78	52	39	36	48
Yadkin-Pee Dee Settlement (330 cfs)	NA	67	55	83	69	64	49	65
FWS (900 cfs)	NA	87	90	61	77	92	70	80

The results by subreach (percent of maximum WUA for all species combined, derived from table 29) are summarized in table 31. These data indicate that, in subreach 1 during the spring, overall habitat would be similar for the three minimum flow alternatives, although tables 26 through 29 show that shad spawning WUA (the primary objective for the spring flow releases) is substantially higher at both the proposed and recommended flows. In subreach 2, the proposed flows provide somewhat better habitat conditions in the spring (85 percent of maximum WUA) than both the existing and FWS/American Rivers' recommended flows (71 and 73 percent of maximum WUA, respectively). For subreach 3 (the 5-mile reach below Tillery dam), the proposed spring flows would result in a substantial increase in habitat compared to existing flows, increasing from 16 to 70 percent of maximum WUA. For subreach 3, the FWS spring flow would increase habitat a small amount above that to 77 percent of maximum WUA. For the rest of the year, in subreach 1 there would be some increase in overall habitat from existing to either of the proposed or recommended alternative minimum flows (62 to 71 percent of maximum WUA), with similar increases in subreach 2, although the FWS flow shows the greatest increase at 86 percent of maximum WUA. For subreach 3, again the proposed flows show a substantial increase in overall habitat from existing flows (from 19 to 51 percent of maximum WUA), while the recommended flows would further increase habitat to 81 percent of maximum WUA in subreach 3.

Table 31. Summary of percent of maximum WUA for all species combined for the three subreaches (SR) of Study Reach 3 for the Progress Energy instream flow study. (Source: Staff)

Flow (cfs)	**SR1**	**SR2**	**SR3**
Existing	69/62	71/65	16/19
Proposed (Settlement)	69/71	85/72	70/51
Recommended (FWS/American Rivers)	69/71	73/86	77/81

For all species and habitat types combined for all of reach 3 (table 30), the proposed and recommended flows show a substantial improvement over existing flows during the spring period, but the proposed and recommended alternative minimum flows are nearly identical in habitat value (75 and 73 percent of maximum WUA). For the rest of the year, the proposed and recommended alternative minimum flows for reach 3 also show a substantial improvement over existing conditions, although the recommended flows provide somewhat better habitat protection than the proposed flows (80 and 65 percent of maximum WUA, respectively). Much of the differences in the percent of maximum WUA between the two alternative minimum flows, however, are in large part due to differences seen in subreach 3, the 5-mile subreach that does not receive any substantial tributary inflow immediately below Tillery dam. For the larger part of the 20-

mile study reach (subreaches 1 and 2 totaling about 15 miles), the proposed and recommended flows provide similar habitat value. These data indicate that accretion flows from tributaries act to minimize the differences between the minimum flows proposed in the more downstream reaches of the study area.

Differences were also seen among the subreaches for the two fish species selected for analysis. For shad spawning, which is one of the stated objectives for higher minimum flows in this reach (although shad do not currently spawn in the reach), the proposed flows would substantially improve shad spawning habitat over existing flows in all subreaches (table 29), but the greatest increase occurs in the 5-mile-long subreach 3 immediately below Tillery dam, where the percent of maximum WUA increases from 1 to 48 percent. In subreaches 1 and 2, the proposed flows would increase shad spawning habitat to 76 to 81 percent of maximum WUA, respectively. The recommended flows would further improve shad spawning habitat in all subreaches up to 93 to 96 percent of maximum WUA. No shad spawning, however, would occur downstream of Tillery dam until shad are trucked above Blewett Falls as part of the future anadromous fish restoration program. Initial trucking of shad above Blewett Falls would not begin until 5 years after license issuance.

For golden redhorse adults and juveniles, which were used as a surrogate evaluation species for the uncommon Carolina redhorse, a federal species of concern, the proposed flows would provide an increase in WUA over the existing flows, with the greatest increase observed in subreach 3 for both adults and juveniles (table 29). FWS recommended flows would provide somewhat more habitat than the proposed flows, although in subreaches 1 and 2 in the spring, the proposed flows would provide slightly more habitat for juvenile golden redhorse than the recommended flows. As with American shad, however, the Carolina redhorse is a species that is not common in this reach of river. Although a few Carolina redhorse have been collected downstream of Tillery, the species is currently not a major component of the fish community in this reach.

For the other habitat types, the results are mixed with some favoring the proposed minimum flows and some favoring the recommended flows. Table 30 shows that when the 7 species and habitat types are considered together, there is a substantial improvement in habitat over existing minimum flow releases, but much less of a difference between the proposed and the recommended minimum flows. If just the four habitat types in table 30 are averaged, the percent of maximum WUA in the spring increases from 55 percent for the existing minimum flow to 70 percent for the proposed flow, while the recommended flow would provide 56 percent of the maximum WUA, similar to the existing flow regime. For the remainder of the year, the proposed flow would increase WUA for these four habitat types from 51 to 66 percent of maximum WUA, while the recommended flow would provide some additional habitat at 75 percent of maximum WUA.

In response to comments made on the draft EIS, and to discussions made at the section 10(j) teleconference of December 5, 2007, in which FWS recommended that we

assess another minimum flow alternative, we further examined the instream flow study data to see whether there are intermediate flows between the proposed and recommended flows that offer better protection to aquatic resources than those proposed by Progress Energy. We examined four of the life stages/habitat types that had the highest differences in percent of maximum WUA between the proposed and recommended flows in subreach 3, which is the subreach with the greatest differences between the two flows because of the lack of accretion flows in that subreach. We plotted the WUA versus discharge curves for these four life stages/habitat types (American shad spawning, golden redhorse adults and juveniles, and deep, fast, coarse substrate habitat) to see if there is an intermediate flow between the two proposed flows that would provide good levels of WUA, while not substantially increasing discharge to reach that level of WUA (such as an inflection point on the curves).

This analysis did not reveal an alternative flow regime that would be an obvious alternative to either the proposed or recommended flows. In general, WUA for all life stages/habitat types increases as discharge increases, with some leveling off or reduction in WUA as flows increase to greater than the highest recommended flows. The exception is deep, fast, coarse substrate habitat, where WUA increases in essentially a straight line for the flows plotted. None of the curves had inflection points that would justify bringing forward an alternative flow regime for further consideration. So, after additional analysis of the instream flow study data, we conclude that there is no basis for analyzing another alternative minimum flow regime.

Some of the letters of comment on the draft EIS expressed support for the proposed minimum flows. The North Carolina WRC, in its December 3, 2007, letter of comment on the draft EIS, provides additional information that supports the proposed minimum flow of 330 cfs outside of the spring spawning period. The North Carolina WRC shows that a flow of 330 cfs provides nearly 100 percent of the wetted perimeter at three of the IFIM transects in subreach 3 below Tillery dam. The WRC also provides photographs that show fully wetted conditions with obvious depth and visible current, indicating that aquatic habitat would be protected at a flow of 330 cfs.

As we previously discussed, both the proposed and recommended alternative minimum flows would provide enhanced habitat conditions over current project operations, but we see no great advantages from a fish habitat perspective for the recommended flows for the 20.5-mile-long study reach downstream from Tillery dam. We also consider the degraded water quality in much of Reach 3, which is the result of poor water quality in the Rocky River, a large tributary that enters the Pee Dee River about 5 miles downstream of Tillery dam. At the December 5, 2007, 10(j) meeting, Commission and FWS staff discussed the relationship of discharges from Tillery dam and from the Rocky River, which drains the Charlotte suburbs. Commission staff mentioned that poor quality water from Rocky River could impair the Tillery reach to the point that the reach would be less valuable as habitat, arguing against releasing more water from Tillery dam. FWS staff pointed out, however, that the release of higher quality water from Tillery dam could dilute the Rocky River flows and improve habitat in the reach

downstream of Rocky River. While some improvement in water quality could occur if the quality of Tillery flow releases was to substantially exceed the water quality in the Rocky River, we currently do not have adequate data in the record to conduct a quantitative analysis of the potential dilution effect of additional Tillery flow releases.

FWS also recommends installation of a sluice gate or turbine capable of providing 800 to 1,000 cfs continuous year-round minimum flow below Tillery dam. Based on information obtained on our site visit, Progress Energy already has the capability to release up to 1,000 cfs through an existing trash gate, and it proposes to release the Tillery minimum flow through this gate. Although installation of a turbine unit to pass minimum flows would allow Progress Energy to generate additional energy, it would reduce the aeration effect and water quality benefits of the minimum flow provided by spillage through the trash gate, and would somewhat increase the potential for fish entrainment mortality through any new turbine unit. Because Progress Energy proposes to dedicate the trash gate for the passage of the minimum flow, there is no need for Progress Energy to construct a new sluice gate or a minimum flow unit.

The Yadkin-Pee Dee Settlement includes a provision for aquatic life monitoring downstream of the Tillery development (section 2.3.3.5), in accordance with the WQC. That section states that the purpose is to document the condition of the aquatic community, presumably to ensure that the required minimum flows are adequately protecting the aquatic community. Because there is disagreement on the level of minimum flow to be provided below Tillery, such a monitoring program would provide a means to ensure that acceptable minimum flows are being provided. This plan could include gathering data and performing analyses required to complete a dilution model of the relationship between Rocky River and releases from Tillery. The Yadkin-Pee Dee Settlement does not include any criteria for judging when the condition of the aquatic community would be considered inadequate, nor does it indicate what corrective measures should be implemented if that conclusion is reached. We concluded in the draft EIS that this monitoring program would be useful, although it would be appropriate that a study plan be developed in consultation with the agencies, and that specific evaluation criteria be identified in the plan. In comments in the draft EIS, Progress Energy disagrees with this approach and instead recommends a benthic macroinvertebrate monitoring plan conducted in cooperation with the North Carolina DWQ. We conclude that a benthic macroinvertebrate monitoring program, developed in consultation with the North Carolina DWQ, North Carolina WRC, and FWS, would be a suitable methodology for measuring the response of the aquatic community to increased minimum flows. In addition, we would support inclusion of specific evaluation criteria in such a program.

Stakeholders agree on minimum flow releases from the Blewett Falls development, and such flows are provided for in the Yadkin-Pee Dee Settlement. Based on our review of the instream flow studies, these flows would provide adequate protection and enhancement for aquatic habitat downstream of Blewett Falls. In the additional information filed by Progress Energy on December 13, 2006, Index C results were provided for nine life stages/habitat types for instream flow study reach 2, which is

the reach downstream of the Blewett Falls development. These results indicated that the proposed flows would provide the highest Index C values for robust redhorse spawning, sturgeon spawning and incubation, striped bass spawning, American shad spawning, golden redhorse adults and juveniles, "shallow fast generic medium velocity" habitat for 8 months of the year, and "deep slow generic cover" habitat for 7 months of the year. The only habitat type that was strongly favored by lower flows was "shallow fast – low velocity." These results indicate that the proposed flows would provide good habitat value for the primary species of management interest (anadromous and species of concern).

The Yadkin-Pee Dee Settlement also provides for a flow adjustment period during the spring months (February 1 to May 15) to enhance fish spawning. Progress Energy and the agencies would determine how best to operate the project during periods of changing project operations, but ramping rates are also provided: a minimum of 30 minutes from off-line to full gate for upramping, and a specific sequence of timing for shutting down the units during downramping. FWS supports this provision of the Yadkin-Pee Dee Settlement, which it calls the flow naturalization plan (also supported by American Rivers). However, FWS also recommends an interim downramping rate of no more than 1 foot per hour change in water surface elevation, until specific downramping rates are determined by the parties. It is not clear to us, though, that this additional downramping requirement is necessary. The Yadkin-Pee Dee Settlement provides the following downramping procedures:

1. After the first generating unit is taken off line, the second unit may not be taken off line until 2 hours after the first unit;
2. After the second generating unit is taken off line, the third unit may not be taken off line until 4 hours after the second unit; and
3. After the third generating unit is taken off line, the fourth unit may not be taken off line until 6 hours after the third unit.

This sequence of shutdowns may already result in a downramping rate similar to that recommended by FWS. Further hydraulic analysis of this shutdown sequence would be required at specific locations downstream of Blewett Falls to verify whether this is the case. This hydraulic analysis would be an appropriate investigation to include under the flow adjustment provision of the Yadkin-Pee Dee Settlement, which targets the spring spawning period.

Freshwater Mussel Monitoring

Mussel surveys conducted by Alcoa Generating document the presence of seven native mussel species downstream of the Falls development and six species downstream of the Narrows development (see table 24). In comparison, Progress Energy reported 11 native mussel species downstream of the Tillery development and 13 species downstream of Blewett Falls. The differences in diversity may reflect the different habitat conditions below the various developments. The Yadkin Project developments have little riverine

habitat downstream of each development, while both the Tillery and Blewett Falls developments have long stretches of downstream riverine habitat, which is the preferred habitat for most of the mussel species. While the species diversity is lower at the Yadkin Project developments, the reach below the Falls development still supports a relatively diverse mussel population, including three state-listed species. Two state-listed species occur downstream of Narrows.

Changes in minimum flows released into the tailraces could affect mussel populations within the project tailraces. Alcoa Generating proposes periodic monitoring of native freshwater mussels as part of an RTE species management plan, in the Yadkin Project tailwaters. The monitoring program would be a cooperative effort among Alcoa Generating, the North Carolina WRC, and other interested state and federal agencies. Alcoa Generating proposes (not to be included in any license issued for the project) to complete the proposed monitoring within the first 10 years of the effective date of any new license for the Yadkin Project and to limit the total cost of the monitoring to $50,000 (in 2008 dollars). Furthermore, if mussel recruitment below the Falls development tailrace is not sufficient to justify continued management efforts in this location, Alcoa Generating proposes to contribute $50,000 to North Carolina WRC for management efforts elsewhere in the basin. As part of the Yadkin Settlement, Alcoa Generating would also monitor for invasive exotic species, in cooperation with North Carolina WRC and North Carolina DWR, and would assist in control efforts when implemented by the agencies. Alcoa Generating would provide up to $25,000 annually, on a 50 percent cost-share basis, to support these efforts.

Our Analysis

The proposed minimum flow regime outlined in the Yadkin Settlement would likely provide somewhat more stable and enhanced aquatic habitat conditions downstream of the Falls development, compared to current operations, and should improve freshwater mussel populations in the reach. Periodic monitoring during the first 10 years of the license would allow any improvements (or any adverse effects) to be documented. Such monitoring would be an important part of the RTE species management plan.

The Yadkin Settlement provides that, if mussel recruitment is poor downstream of the Falls development (after the 10-year monitoring period), Alcoa Generating would contribute funding to North Carolina WRC for management efforts elsewhere in the basin. Although it may be appropriate for Alcoa Generating to provide other mussel enhancement measures downstream of the Falls development, should adverse effects be detected through monitoring, contributing funds for efforts elsewhere in the basin does not have an appropriate nexus to the project. The Yadkin Settlement does not specify the other measures that could be implemented to enhance mussel recruitment downstream of the Falls development. A more appropriate approach to mitigate any project-related effects would be for Alcoa Generating, as part of the proposed RTE species management plan, to consult with North Carolina WRC and FWS, after the completion of the 10-year

monitoring period, to identify appropriate measures that could be implemented downstream of the Falls development to improve mussel populations. Development of a plan to implement these measures would focus enhancement efforts in the reach of the Yadkin River directly affected by the project, instead of other areas in the basin that may not be affected by the project.

Two invasive exotic species have been documented in the Yadkin-Pee Dee River, the Asian clam and the Chinese mystery snail. The Asian clam is common in both the Yadkin and Yadkin-Pee Dee River Project areas. The Chinese mystery snail has only been reported from one location in High Rock reservoir. These exotic species, particularly the Asian clam, are widespread in the southeastern United States, and their introduction into the Yadkin-Pee Dee River is unrelated to project operations.

The presence of the reservoirs may provide favorable habitat conditions for these non-native species, particularly for the Chinese mystery snail, which prefers slow-moving waters over a mud/silt bottom. The Yadkin Settlement, however, provides for a monitoring program for these exotic species. Should their numbers reach a level where the North Carolina agencies begin implementation of control measures, Alcoa Generating would contribute funding to assist with these control efforts as provided in a measure that the Yadkin Settlement does not intend to be included in any license issued for the project. We expect, however, that any control efforts, which would be unrelated to project operations, would be of a localized nature.

Diadromous Fish Passage and Restoration

The Pee Dee River currently supports several diadromous species downstream of Blewett Falls. Historically some of these species migrated nearly 500 miles up the Yadkin and Yadkin-Pee Dee rivers.

No specific fish passage facilities have been prescribed or recommended for the Yadkin Project, but both NMFS and FWS reserve their authority to later prescribe fish passage facilities pursuant to section 18 of the FPA. The only involvement that the Yadkin Project would have with fish passage on the river is that fish may in the future be trucked from Blewett Falls to areas upstream of Falls dam, once the trap and truck facility at Blewett Falls is placed into operation, although current plans do not call for passage above the Yadkin Project dams.

Several stakeholders recommend the enhancement of the existing stocks of diadromous fishes by providing fish passage at the Blewett Falls development so that some of the historical spawning area upstream of Blewett Falls and other upstream projects can again be used by these fishes. Both NMFS and FWS filed preliminary fishway prescriptions pursuant to section 18 of the FPA.

On June 11, 2007, in response to the NMFS and FWS preliminary fishway prescriptions, Progress Energy filed copies of its Requests for Trial-Type Hearing and Submission of Proposed Alternative Prescriptions with NMFS and FWS, in accordance

with provisions of EPAct. However, on September 11, 2007, Progress Energy withdrew its request for trial-type hearing and its proposed alternative prescriptions, because the parties had reached agreement on fish passage measures at the project. Progress Energy's request for dismissal of the hearing requests was granted by order dated September 18, 2007. On December 17, 2007, FWS filed a modified prescription for fishways that is consistent with the Fish Passage Agreement, which was signed by Progress Energy, FWS, NMFS, North Carolina WRC, and South Carolina DNR on September 12, 2007. NMFS also filed a modified fishway prescription by letter filed February 5, 2008.

We consider this agreement to be Progress Energy's current proposal for fish passage at the Yadkin-Pee Dee River Project. Table 32 summarizes the major provisions of the Fish Passage Agreement.

Our Analysis

The Fish Passage Agreement outlines a phased approach to providing fish passage at the Yadkin-Pee Dee River Project, and for restoration of diadromous species to the basin upstream of Blewett Falls dam. The agreement resolves all major issues related to fish passage at the project, and we conclude that the agreement is a reasonable approach for providing fish passage at the project. Because the agreement resolves the fish passage issues that we discussed in detail in the draft EIS, we revised the final EIS by deleting that discussion that is no longer relevant, and instead provide a summary of the agreement (table 32), and our independent analysis of the provisions of the agreement.

Upstream Passage

The Blewett Falls development, at RM 188, is located at the extreme upstream limit of diadromous fish migration, which has been the limit since the dam was constructed nearly 100 years ago. Thus, the current fish populations have adapted to this available range of habitat, and although many of these species currently reach Blewett Falls dam (or in the case of American eel, some may pass upstream), the numbers may be lower than if habitat upstream of Blewett Falls had continued to be used for spawning and rearing over the years.

Attempts to restore passage at Blewett Falls may initially be met with limited success; relatively low numbers of fish may be available to pass upstream. This has been the case on other Atlantic coast rivers when fish passage was first installed at the terminal dam on the river (Susquehanna, Connecticut, Kennebec rivers). Several years of operation of fish passage at the terminal dam, or supplemental upstream stocking of adults, juveniles, or fry may be required before fish populations and passage begin to increase at the dam. It appears that the diadromous fish restoration plan for the river (FWS, NMFS, North Carolina WRC, and South Carolina DNR, 2006), and the Fish Passage Agreement recognize that this may be the case, and therefore are structured as a phased program, with future measures depending on the success of the initial measures. We conclude that this is a reasonable approach.

Table 32. Summary of the Fish Passage Agreement, which was signed by Progress Energy, FWS, NMFS, North Carolina WRC, and South Carolina DNR on September 12, 2007, and would provide for fish passage at the Yadkin-Pee Dee River Project. (Source: Fish Passage Agreement)

Agreement Provision	Summary of Provision
Section 18 considerations	-Any exercise of FPA Section 18 authority by NMFS and FWS will be consistent with the Fish Passage Agreement, and will guide the fish passage facilities and supportive monitoring programs contained in the agreement.
2006 Restoration Plan for the Diadromous Fishes of the Yadkin-Pee Dee River Basin, North Carolina and South Carolina	- Fish Passage Agreement fully supports the 2006 Restoration Plan, and is the final and complete expression of the agreement between the parties with respect to fish passage issues related to the relicensing of the Yadkin-Pee Dee Project.
Yadkin-Pee Dee River Project Diadromous Fishery Resource Management Team (Resource Team)	-Establishes a Resource Team that will make recommendations to Progress Energy for implementation of fish passage measures, monitoring, and research studies, during the term of the new FERC license.
Target species	-American shad and American eel upstream and downstream passage at the project, using a phased-in program over time so that the effectiveness of the technologies employed can be evaluated and adjusted as appropriate, based on the results of monitoring and the unique nature of the Pee Dee River. -Blueback herring will also be passed as an incidental species as long as that passage does not interfere with the safe and timely passage of the target species.
Progress Energy obligations	- Fish Passage Agreement represents the full obligation of Progress Energy for passage of American shad and American eel for the term of the new license for the Yadkin-Pee Dee River Project.

Agreement Provision	Summary of Provision
American shad passage	-Progress Energy will provide safe, timely and effective upstream and downstream passage for American shad at the Blewett Falls development, to be operational in the fourth spawning season after license issuance, but not before 2012. -Two distinct riverine spawning and maturation habitat reaches for initial passage of American shad have been identified: (1) above Blewett Falls Dam and (2) above Tillery Dam but below Falls Dam (inclusive of tributaries for both river reaches). -Beginning the fifth spawning year after license issuance, but not before 2013, Progress Energy will provide American shad access to the two reaches identified above, using a trap, sort and truck (Trap) facility, and for successive, four-year periods, will assess the reproductive and outmigrant recruitment success of each reach. -A downstream passage structure will be installed and operational at the Blewett Falls development concurrently with installation and operation of the Phase I upstream passage structure.
American shad population monitoring	-A monitoring plan and implementation schedule will be completed by Progress Energy for approval by the Resource Team within nine months after license issuance. The plan will include weekly monitoring in the Blewett Falls tailwater area downstream to U.S. Highway 74 and fish passage monitoring. -Monitoring will occur during the period of March 1 to May 31 and will begin when the fish begin to arrive upstream of Highway 74, as determined by the Resource Team. -The monitoring program will assess: 1) the relative abundance and population characteristics of American shad in the tailwater reach, 2) the location and congregation of fish in the tailwater reach, 3) the timing, peaks, and duration of the spawning run relative to water temperature, and 4) upstream and downstream passage effectiveness. -Progress Energy will provide annual reports on monitoring results. As determined by the Resource Team, Progress Energy will modify passage facilities and associated measures as practicable to ensure safe, timely and effective passage, based upon monitoring results and other new information.

Agreement Provision	Summary of Provision
Upstream passage facilities for American shad	-Phase I will include a Trap facility in the tailrace of the Blewett Falls powerhouse for the purpose of trapping pre-spawn American shad and transporting them via truck to the two reaches of the Yadkin-Pee Dee River watershed identified above. Progress Energy will hydraulically model the pumped attraction water supply system prior to installation. -The Phase I facility will have the capacity to trap and truck a spawning season minimum of 35,000-40,000 shad. Any material change in the preliminary design of the Trap facility must be approved by the Resource Team. -Phase II facilities will include an exit flume from a modified Trap facility and fish counting station at headpond level. Conceptual designs for the volitional exit flume will be due to NMFS and FWS for approval at least six weeks before a final prescription is due to be filed with FERC.
Phase I operations	-Operations to occur for 10 weeks during the period of March 1 to May 31, as determined by the Resource Team. -Interim target numbers of shad for passage are: 17,000 – 20,000 for Reach 2 (above Tillery dam) in 2013 – 2016 and 35,000 – 40,000 in Reach 1 (above Blewett Falls dam) in 2017 – 2020. Target numbers and locations for transport may be revised by Resource Team based on monitoring results. -Fish in excess of target numbers will be marked and released downstream of Blewett Falls Dam. If insufficient numbers of shad are available to meet targets, the Resource Team will prioritize the release location. -A Fishway Operations and Maintenance plan will be developed by Progress Energy for Resource Team approval prior to the first operational year of the Phase I fish passage program, and shall be updated annually as necessary. Required monitoring studies will include length, weight, sex, body condition, and age classes of spawning fish, and water temperature and dissolved oxygen monitoring. -Progress Energy will transport sufficient shad to the reach above Tillery Dam to provide for restoration of the fishery upstream of Falls dam, consistent with the Restoration Plan and with NMFS and FWS prescriptions for the upstream Yadkin Project, but not to exceed 100,000 fish.

Agreement Provision	Summary of Provision
	-Trap and truck operations will continue until 2025, when a comprehensive assessment of the fish passage program will be conducted.
Phase II implementation	-Progress Energy will provide for volitional passage at Blewett Falls by the installation of a fish exit flume from the modified Trap facility by 2025, or no sooner than 2022 if determined by the Resource Team. -The Trap facility will continue to operate for the life of the license, to provide for transport of fish to Reach 2 (upstream of Tillery dam).
Downstream American shad passage	-Progress Energy will install a downstream passage structure for American shad at Blewett Falls by 2012 or within 4 years of license issuance, whichever occurs first. The first year of operation of the downstream passage facility will coincide with the first year of upstream passage at Blewett Falls. - The downstream passage facility will be a mobile barge system (or "gulper")[a] that will be towed and anchored in place at the west wing dam abutment at the existing fish ladder structure during the outmigration season for juvenile American shad. Associated facilities will include a stilling basin located downstream of the dam to allow fish to re-orient and safely exit the structure, and an angled surface curtain with a depth of no less than 5 feet and no more than 9 feet to help guide outmigrating juveniles to the passage structure. -Expected period of operation will be late-summer (September) to early-winter (December), with the precise period to be determined by 3 years of operational monitoring, with concurrence by the Resource Team. -Progress Energy will prepare an annual report that will include an estimate of the number of juvenile American shad outmigrating each year, and population information (length, weight, and body condition) of a representative sub-sample of outmigrating juveniles.

Agreement Provision	Summary of Provision
Upstream American eel passage	-Upstream eel passage will initially focus on the reach between Blewett Falls and Tillery dam, allowing eels sufficient time to occupy that habitat prior to consideration of passage upstream of Tillery dam. -No later than one year following license issuance, Progress Energy will initiate a three-year monitoring study below Blewett Falls dam, approved by the Resource Team, to determine specific locations where American eel congregate, to allow effective placement of future passage devices. The study will include placement of standard eel ramps or traps for monitoring size, seasonality, and location of juvenile eels at the base of the dam and in tailrace areas. Any eels captured during the study will be passed upstream into Blewett Falls Lake. The study will be completed by 2011. - No later than the fifth year following license issuance, or by 2013, Progress Energy will design, construct, and operate an eel lift structure on the Blewett Falls dam spillway face to provide for upstream passage of American eel. Recommendations on the exact placement of the lift will be made by the Resource Team after a review of the results of a three-year monitoring study, with the final design approved by NMFS and FWS. -The operating season for the Blewett Falls eel lift is expected to be from March 15 through June 15 of each year, with actual period of operation to be adjusted by the Resource Team based on operating experience. Progress Energy will collect annual population information on numbers, lengths, and weights of migrating elvers, with an annual report prepared on the lift operation. - From 2022 through 2024, Progress Energy will conduct annual monitoring of the eel population in the river from Blewett Falls Lake to Tillery dam and also below Blewett Falls dam, to assess eel habitat utilization upstream of Blewett Falls dam relative to habitat availability. A report on the monitoring study will be issued by December 31, 2024. - In 2025, the Resource Team will assess the effectiveness of the eel passage program, including necessary measures to pass eels above Tillery dam, using results of the monitoring studies, and will provide a recommendation regarding eel passage above Tillery dam to Progress Energy.

Agreement Provision	Summary of Provision
Downstream American eel passage	-Five years after license issuance, Progress Energy will prepare and submit to the Resource Team for review and approval a study plan to evaluate a full range of options for safe, timely and effective downstream passage for American eels, which should consider existing information on cost, efficiency, survival, mortality, and other appropriate factors. -12 years following license issuance, the Resource Team will recommend one or more methods of downstream eel passage for Blewett Falls dam, which Progress Energy will immediately employ and continue to use for the duration of the license period, or until better methods are recommended by the Resource Team or prescribed by NMFS and FWS. -Monitoring of downstream eel passage will begin 6 – 10 years after initial upstream passage of juvenile eels. Downstream eel passage or sampling facilities will be operated during nighttime hours during the period of October 1 to December 15, with the precise operational period to be adjusted by Progress Energy with the concurrence of the Resource Team.
Comprehensive fish passage assessment	-Progress Energy and the agencies will conduct a comprehensive assessment of the progress of the Yadkin-Pee Dee River diadromous fish restoration and passage program in 2025. Progress Energy will modify passage facilities as needed based upon the results of the assessment, if directed by the Resource Team.
Other target species	-No later than 2013, the Resource Team will develop written protocols for handling other species in the Trap facility at Blewett Falls dam, including other diadromous species and federally listed species.
Resource Team organization & reporting	-The members of the Resource Team will include FWS, NMFS, North Carolina WRC, South Carolina DNR, and Progress Energy. Other individuals and organizations with relevant expertise may provide technical assistance as requested, and participate in the Resource Team meetings, but will not be members of the Resource Team and will not participate in making recommendations to Progress Energy. The Resource Team will meet at least once per year. -The Resource Team will be responsible for providing comprehensive guidance about restoration efforts including monitoring and adjusting the overall fish passage program and evaluating progress towards achieving the restoration plan goals, and will be responsible for making recommendations to

Agreement Provision	Summary of Provision
	Progress Energy regarding new or modified fish passage facility designs; operational details; and additional study needs based on the available scientific data and management experience. -Resource Team decisions will be by consensus, but if consensus can not be reached will be referred to the Policy Team, which are management level personnel for each Resource Team member. If the Policy Team is unable to make a decision, NMFS and FWS will resolve outstanding issues under their authority pursuant to Section 18 of the FPA. -Progress Energy will prepare an annual report for approval by NMFS and FWS in coordination with the Resource Team. The report will cover all aspects of the diadromous fish activities conducted by Progress Energy. The draft annual report will be due by March 31 of the following year, with the final report by May 31. An interim report on shad upstream passage, however, will be due by December 31. -Progress Energy will also be responsible for preparing a report on the 2025 comprehensive assessment of the progress of the Yadkin-Pee Dee River diadromous fish restoration and passage program, which will be filed with FERC by December 31, 2025.
Diadromous Fish Habitat Characterization and Assessment	- Subject to availability of federal funding, FWS, in coordination with the Resource Team, will conduct a field-based habitat characterization and assessment focusing on habitat suitability for the target diadromous and riverine species in the Yadkin-Pee Dee River upstream from Blewett Falls dam. This will assist in identification or adjustment of the desk-top derived interim target passage numbers; identification of priority habitats for fish passage/transport; identification of limiting factors to be further addressed over time; and opportunities for enhancement of the overall diadromous fish restoration effort. The proposed study timeframe is 2008-2010.

Agreement Provision	Summary of Provision
NMFS and FWS reservation of authority	- NMFS and FWS reserve their authority to modify their respective Section 18 fish passage prescriptions for the project. At any time prior to the 2025 assessment that material new information is obtained or developed, that demonstrates the need for an alteration to this Fish Passage Agreement or a fishway prescription, such information will be presented to the Resource Team for consideration prior to issuance of a fishway prescription by either of the federal agencies, and the Resource Team shall make a recommendation to Progress Energy.

[a] A type of downstream fish passage device that facilitates the collection of downstream migrating fish. The gulper consists of a surface collection barge with a pumping system that uses guide nets and pumps to attract and direct surface-oriented migrating fish into the barge, where they are collected and then moved by other means downstream of the dam. The surface collection system gets its nickname gulper from the sounds produced from the pumps used to create the fish attraction flows to the barge.

For American shad upstream passage, the Fish Passage Agreement calls for a two-phased development of fish passage facilities in the Blewett Falls tailrace. Phase I would be the construction of a trap, sort, and truck facility (Trap facility) by year 4 of the license (no sooner than 2012), with operation of that facility for upstream passage by year 5 of the license, or no sooner than 2013. Fish would be trucked to sites upstream of both Blewett Falls and Tillery dams for a minimum of 8 years of operation, during which time Progress Energy would monitor passage and assess the reproductive and outmigrant recruitment success of each reach. Phase II would entail the modification of the Trap facility and addition of a fish exit flume and counting station, which would allow fish to be passed directly over Blewett Falls dam into the forebay where they could continue "volitional" upstream migration. Phase II would be implemented by 2025, or as early as 2022, if determined by the Resource Team. The Trap facility would also remain functional during Phase II operations, to allow continued trucking of fish to upstream of Tillery dam.

This phased program would be a reasonable approach for providing upstream fish passage at the Yadkin-Pee Dee River Project, because the initial years of operation of a trap and truck facility may not result in the capture of large numbers of target species, and achievement of ultimate population goals may take several years. We further discuss two aspects of the upstream fish passage provisions of the Fish Passage Agreement: (1) the stated target species for passage and (2) the design of the upstream passage facilities for American shad.

The Fish Passage Agreement states that the two target species for passage at the project are American shad and American eel, but that passage for blueback herring will be provided as an incidental species as long as that passage does not interfere with the safe and timely passage of the target species. The two target species are obviously the species of highest management interest for the state and federal agencies, but we see no basis for excluding other migratory fishes from upstream passage. The 2006 Restoration Plan for the Diadromous Fishes of the Yadkin-Pee Dee River Basin, North Carolina and South Carolina, describes that shad and American eel are the primary species of interest that would likely benefit the most from upstream passage, but the plan also mentions hickory shad, blueback herring, striped bass, shortnose sturgeon, and Atlantic sturgeon as species of interest for restoration in the Yadkin-Pee Dee River basin. We understand that during Phase I of the program, when only trucking would be available for upstream fish passage, Progress Energy would need to limit the species to be trucked, because of the logistics of trapping and sorting through probably thousands of fish, loading them into trucks, and successfully transporting them upstream. There is a physical limit to this type of operation, so it would be logical to limit trucking to shad and some blueback herring, if logistics allow.

Once Phase II is implemented, it would be preferable for Progress Energy to lift all species for release into the fish exit flume for passage into the forebay. The Fish Passage Agreement includes a provision for determining how other species would be handled during Phase I operations, but is silent on how the Phase II fish lift would be

operated. Phase II operations would allow for the passage of all species that enter the fish lift, and attempting to sort through all the species for direct lifting would be logistically difficult, probably resulting in delay, stress, and mortality of fishes lifted. It would be more appropriate for Progress Energy to simply lift all species that enter the fish lift, except for those that would continue to be trucked under the continued operation of the Trap facility. Passage of all species through the Phase II lift would allow any fishes with the need to migrate upstream to fulfill that life history requirement.

Regarding the design of the proposed Phase I and II fish passage facilities, Progress Energy is proposing to install facilities constructed of steel, with a pumped attraction water supply from the tailrace, and a 517-foot-long, 6-foot-wide fish exit flume (Phase II). Although these design parameters are preliminary at this stage, they are somewhat non-standard. Essentially all in-water portions of major fish passage facilities at licensed hydroelectric projects are constructed of reinforced concrete, and facilities used for American shad passage typically utilize gravity attraction water supply. Steel facilities may not withstand the rigors of in-river forces 365 days per year. Pumped attraction water supply may be feasible for shad, although hydraulic modeling, as provided for in the Fish Passage Agreement, would be required before construction.

The proposed fish exit flume may be the longest flume of its type for American shad passage, and may be one of the narrowest at only 6 feet wide. Our concern regarding the flume is that shad may not successively traverse the full length and exit the flume, based on shad behavior observed by our staff at other fish passage facilities, where shad passage is often not successful in long or undersized fish ladders and exit flumes. Another potential deficiency of the proposed flume is that the 6-foot width extends to the point where the hopper discharges into the flume. The flume should be wider at this point to dissipate the energy of water and fish sluiced into the flume. If the flume is too narrow, fish would strike the flume wall and experience injury or mortality.

We conclude that the final Phase I and II fish facility designs will require additional development in consultation with NMFS, FWS, North Carolina WRC, and South Carolina DNR, and the designs filed with the Commission for approval, so that potential design deficiencies are eliminated prior to construction.

American eel is the second target species cited for passage at the Yadkin-Pee Dee River Project by the Fish Passage Agreement. American eels are currently approaching Blewett Falls dam in sufficient numbers that some are also passing upstream over the dam, based on the collection of eels upstream of the dam. Providing improved upstream passage at the dam would allow eels to more efficiently access the 30 miles of mainstem river and many miles of tributary habitat (on the Little and Rocky rivers). This would provide a substantial amount of additional rearing habitat for the eel, which has experienced a general population decline along the Atlantic coast in recent years (NMFS Preliminary Fishway Prescription filed May 11, 2007). FWS estimates that eel passage at Blewett Falls would provide 2,735 stream miles of habitat for the eel (FWS Preliminary Fishway Prescription filed May 14, 2007).

The Fish Passage Agreement calls for upstream passage of eels at Blewett Falls dam, but no passage above Tillery dam until after a comprehensive review of the results of eel passage in 2025. Eel passage facilities would not be installed at Blewett Falls dam until year 5 of the license or by 2013, and after completion of a 3-year monitoring survey below the dam to determine the best location for an eel fishway. The survey would begin within 1 year of license issuance and would include the placement of standard eel ramps and traps for monitoring size, seasonality, and location of juvenile eels at the base of the dam and in the tailrace areas. The decision on whether to provide eel passage at Tillery dam in 2025 would be based on a study to be conducted in 2022 to 2024 on eel habitat utilization in the river, and whether additional eel habitat should be made available. FWS estimates that passage at Blewett Falls would provide 2,735 stream miles of rearing habitat, but only 752 stream miles of habitat are available upstream of Tillery (FWS Preliminary Fishway Prescription filed May 14, 2007). Thus, passage at Blewett Falls would provide about 78 percent of the habitat that would be available above both dams. The habitat utilization study, however, would provide a mechanism for determining if additional passage into the reach upstream of Tillery dam would be appropriate. These provisions for upstream eel passage are reasonable and would allow American eel to access upstream habitat that is now generally not available to eels.

Downstream Passage

The Fish Passage Agreement calls for the installation of a gulper facility at Blewett Falls dam for downstream passage of juvenile American shad, which migrate downstream to the ocean in the late-summer and fall months. The facility would also include an angled surface curtain (from 5 to 9 feet deep) leading to a new spillway gate and a stilling basin located downstream of the dam to allow fish to re-orient and safely exit the structure. These facilities would be installed by 2012 or within 4 years of license issuance, whichever occurs first. The first year of operation of the downstream passage facility would coincide with the first year of upstream passage at Blewett Falls. Progress Energy would prepare an annual report that would include an estimate of the number of juvenile American shad outmigrating each year, and population information (length, weight, and body condition) of a representative sub-sample of outmigrating juveniles. We conclude that a gulper facility with a surface curtain would be a reasonable alternative for downstream shad passage, because shad are typically surface-oriented swimmers during their outmigration. However, some period of testing would be required to refine its operation, including experimenting with different depths for the surface curtain. Any studies that would evaluate the performance of the gulper facility, and options for its design and operation, would be filed with the Commission for approval.

The gulper, however, may not be an appropriate downstream passage facility for American eel, because eel are not necessarily surface-oriented during their outmigration. Although testing of the gulper, along with different depths for the surface curtain, may reveal that some eel passage could occur with the gulper, other methods may also be appropriate for testing. The Fish Passage Agreement recognizes that the gulper may not

be effective for downstream eel passage, so it includes a provision for evaluation of a full range of options for downstream eel passage. Other passage options for evaluation could include operational changes (such as seasonal nighttime shutdowns, or other changes); seasonal use of full depth screens and a bypass system; behavioral devices; and use of conventional weirs, fyke nets, or other trapping devices to capture silver eels in reservoir tributaries, or along the shoreline, upstream of the dam. Some of these methods, such as the use of behavioral devices like lights or sound generators, may also be appropriate for testing in conjunction with the gulper, to improve its efficiency.

The study plan for this eel passage evaluation study would be required 5 years after license issuance, and a report and recommendation on which passage option should be implemented would be due within 12 years of license issuance. That option would be immediately implemented by Progress Energy, and would be operated for the life of the license unless alternative measures are later recommended by the Resource Team or prescribed by NMFS or FWS.

The Fish Passage Agreement also states that monitoring of downstream eel passage would begin 6 to 10 years after initial upstream passage of eels, which would occur in year 5 of the license. So, if the recommended passage option is installed in year 12 or 13 (7 to 8 years after initial upstream eel passage), that would allow evaluation of the passage option when at least some downstream-migrating eels should be present. The downstream passage option would typically be operated during nighttime hours during the period of October 1 to December 15, with the precise operational period to be adjusted by Progress Energy with the concurrence of the Resource Team.

The Fish Passage Agreement does not include a specific schedule for downstream eel passage at the Tillery development. Upstream eel passage at Tillery, however, was not contemplated by the Fish Passage Agreement until at least 2025, after the comprehensive review of fish passage and restoration activities at the Blewett Falls development. The Fish Passage Agreement states that the goal of the eel passage evaluation study at Blewett Falls would be to identify a passage option that could also be implemented at Tillery dam, if required after eel are passed upstream over Tillery dam.

We conclude that the Fish Passage Agreement provisions for downstream eel passage at the project are reasonable and appropriate, considering that the technology for downstream eel passage is not well developed, and there are few, if any, hydroelectric projects that have successful downstream eel passage facilities. This approach of allowing a full evaluation of passage options would improve the potential for selecting an alternative that would be successful for downstream eel passage.

Other Fish Passage Agreement Provisions

The Fish Passage Agreement includes several other provisions and details regarding how the major provisions would be implemented. Some of these are

summarized in table 32, but many of the details are not included in the table because of space limitations. Some of the other provisions include: (1) the comprehensive fish passage assessment in 2025; (2) development of Trap facility handling protocols, particularly for shortnose sturgeon and other rare species, by the end of 2013; (3) the organization, and workings of, the Resource Team and reporting requirements; (4) a diadromous fish habitat characterization and assessment to be conducted in 2008-2010 by FWS, to identify priority upstream habitats for fish transport and refine target numbers of shad for passage; and (5) NMFS and FWS reservation of authority to modify their section 18 fishway prescriptions. As discussed below, all of these measures would be important as part of the fish restoration and passage program on the river and at the Yadkin-Pee Dee River Project.

We previously described that, in 2025, the parties to the Fish Passage Agreement would review the results of the diadromous fish restoration program to date, including the status of the populations and the results/success of the fish passage measures implemented at the project. This review would provide an opportunity for all the entities involved in program to review the progress to date, and to make adjustments to the program to improve passage efficiencies or other program aspects such as target areas for fish passage or modifications to monitoring studies. Progress Energy would be responsible for filing a report on this comprehensive review with the Commission by December 31, 2025. After this review, the Resource Team would make recommendations for modifications to the studies and programs, including any needed changes to the fish passage facilities. Any modifications to project fish passage facilities would require Commission approval.

Handling protocols would be essential in the event that the endangered shortnose sturgeon or other species of concern (Carolina redhorse, robust redhorse) are captured in the Trap facility at Blewett Falls. To prevent handling stress or mortality, Trap facility operators must have set procedures in place that would direct how these species should be handled and returned to the river.

The proposed Resource Team (Resource Management Team) would be similar to oversight committees established on other rivers, to guide the restoration program, and would be an important functional provision of the program. The Fish Passage Agreement describes the makeup and workings of the Resource Team, and states that an annual report would be prepared by Progress Energy for submittal to the Resource Team and for filing with the Commission. This annual report would be an important document to keep Commission staff informed about the progress of the fish passage and restoration efforts.

The purpose of the FWS habitat assessment study is to better survey and categorize the habitat that would be made available by any fish passage program implemented on the river. This would lead to a better estimate of the shad production potential associated with the additional habitat. The habitat assessment study would assist in determining the design population for any fish passage facilities that may be

built. The habitat assessment study would be a cooperative program funded by the FWS, so it would not be a Progress Energy responsibility or a requirement of the license.

As we described earlier, the Fish Passage Agreement is consistent with the FWS modified section 18 prescription. Both agencies, however, reserve their authority to further modify their prescriptions should new information become available prior to 2025 that would indicate that revisions to the fish passage plans or facilities should be made. Any such modifications would be coordinated with the Resource Team.

Fish Entrainment

Continued operation of the Projects would result in the entrainment of both diadromous (if passed upstream) and resident fish species, resulting in some injury and mortality to entrained fish. Both Alcoa Generating and Progress Energy calculated fish entrainment and mortality data for the Projects by analyzing and extrapolating fish entrainment and mortality data from similar studies conducted at numerous other hydropower projects to make reasonable comparisons. Alcoa Generating and Progress Energy found that the potential for entrainment would range from moderate to high for the six developments, while potential mortality would vary by species and by size of fish. Neither Alcoa Generating nor Progress Energy proposes any specific measures to prevent fish entrainment, except for the measures previously described for diadromous species (future use of a gulper). FWS, however, recommends that all the project developments be equipped with trashracks with spacing no greater than 2.5 inches, which would prevent many adult fishes from being entrained.

Our Analysis

Alcoa Generating and Progress Energy's computer generated entrainment studies provided results that are typical for projects where either desktop or field entrainment surveys have been conducted. Results indicate that (a) there is the potential for moderate to high entrainment at the projects and (b) survival rates typically would range from 70 to more than 95 percent, depending on species and size group. Thus the overall potential effect on fish populations would be low. There is also no indication that entrainment is having significant adverse effects on resident fish populations, because project reservoirs and riverine reaches support robust fish populations and an excellent sport fishery.

For diadromous fishes, once they are passed upstream of Blewett Falls, downstream fish passage measures would be provided by installation of a gulper and fish diversion curtain at Blewett Falls. This would help minimize the effect associated with entrainment and turbine morbidity. Although downstream fish passage is not proposed at upstream developments, fish passage above those developments (Tillery or Falls dams) would not occur until later in the diadromous fish restoration program. Downstream fish passage issues could be addressed at that time through the license amendment process, should it appear that adverse effects are occurring on migratory species.

Regarding trashrack replacement, as recommended by FWS, Progress Energy indicates that trashrack spacing is currently 2.6 inches at Tillery and 1.6 inches at Blewett Falls, already nearly meeting or exceeding FWS's recommendation. Alcoa Generating's developments do have wider trashrack spacing, as follows:

- High Rock – 4.125 inches
- Tuckertown – 5.625 inches
- Narrows – 4.375 inches
- Falls – 5.625 inches.

These wider spacings would theoretically allow more fish to enter the turbine generators. Notwithstanding the wider spacing, Alcoa Generating's computer generated entrainment analysis (Normandeau, 2005d) still concludes that the potential for adverse effects on fish populations at the four Yadkin Project developments is low. Because the Yadkin Project reservoirs contain a resident, warmwater fish community, that is likely concentrated in areas of the reservoirs away from the turbine intakes (such as in the coves and littoral areas away from the deeper areas near the intakes), the potential for entrainment would probably not be high. The turbine generators at the project developments are generally large, slow-speed units, where fish survival would be relatively high, for any fish that are entrained. Therefore, we conclude that the potential effects of entrainment on fish populations at the Yadkin Project developments would likely be minor. There appears to be little basis for requiring a change to narrower spaced trashracks at this time.

Federal Species of Concern

Few specific concerns were raised, or recommendations made, regarding listed aquatic species or species of concern. Habitat criteria for many such species were included in the instream flow studies conducted downstream of the Tillery and Blewett Falls developments.

Our Analysis

Most of the federal (and state) species of concern are located in the Tillery and Blewett Falls river reaches. These reaches would benefit from the proposed continuous minimum flows from both Tillery and Blewett Falls, particularly below Blewett Falls, which would receive the highest minimum flows and also has the greatest concentrations of listed and rare species. Any species found in these reaches should benefit from the improved flow regimes, including both the mussel species and fish species, as flows return to a more natural regime. There would continue to be some cycling of flow releases between the minimum flow and maximum powerhouse releases, resulting in changes in water surface elevation, wetted perimeter, and velocities. The range of flow and habitat fluctuations, however, would be less under the proposed flow regime, which should help protect any listed or species of concern. As evidence, the instream flow

studies indicated significant improvements in habitat duration (Index C) for sturgeon spawning and incubation, golden redhorse adult and juvenile (a surrogate species for the Carolina and robust redhorse), and other aquatic habitat suitable for the mussel species, downstream of both the Tillery and Blewett Falls developments.

Effects of Project Operations on EFH

Alteration of freshwater flows into coastal marine waters may result in changes in water temperature, salinity, and nutrient regimes that can lead to changes in the distribution, abundance, and reproductive success of federally managed species. For the Pee Dee River, the most downstream major flow control structure is the Blewett Falls dam, which is located at river 188, a significant distance upstream of the tidal waters of the lower Pee Dee River and Winyah Bay.

As discussed above, Progress Energy proposes to significantly increase the minimum flow regime from the Blewett Falls development, by providing a continuous minimum flow of 2,400 cfs from February 1 through May 15, 1,800 cfs from May 16 to May 31; and 1,200 cfs the remainder of the year. The proposed Low Inflow Protocol would also set downstream flow releases from Blewett Falls dam based on the level of drought. All state and federal agencies with conditioning authority are in general agreement with Progress Energy's proposed flows from Blewett Falls.

Our Analysis

Under current operations, variable flow releases from Blewett Falls dam result in water level fluctuations in the river downstream of the dam. These fluctuations are reduced by accretion flows, however, the greater distance from the dam, and in tidal areas of the lower river (180 miles downstream) fluctuations may not be detectable. Fluctuating river discharges may also affect salinity levels in the lower river during periods of higher and lower freshwater inflows, but these effects would also be minor if the fluctuations in river discharge are small. With the proposed increase in minimum flows, the daily fluctuations in releases from Blewett Falls dam would be reduced, resulting in reductions in flow effects downstream. On a daily and weekly basis, the total volume of flow entering the lower river and estuary would not change. Thus, there would be no net increase or decrease in overall flow in the lower Pee Dee River, with no expected change in water temperature or salinity conditions in the lower river, where the EFH occurs. We conclude that there would be no detectable effects on EFH in the lower Pee Dee River and Winyah Bay.

3.3.3.3 Cumulative Effects

The six project developments are the major water resource developments on the mainstem Yadkin and Pee Dee rivers. The only other mainstem water resource project is the W. Kerr Scott dam, which provides flood control and flow regulation of the Yadkin River and releases a minimum flow of 125 cfs. We determined through the scoping

process that instream flows, fish passage, and fish entrainment would have the potential to cumulatively affect aquatic resources in the Yadkin-Pee Dee River Basin.

Instream Flows

Flows in the mainstem of the Yadkin-Pee Dee River are regulated by a combination of W. Kerr Scott dam and the six project developments. Significant tributary inflow also occurs, however, which may tend to moderate the flow regulation from the Projects. Because of tributary inflow and the long reach of river (132 miles) between W. Kerr Scott dam and the High Rock development, the river upstream of High Rock essentially acts as a free-flowing river, but with a baseflow of 125 cfs. Aquatic resources within this reach likely experience few adverse effects from the flow regulation from W. Kerr Scott dam, and these resources are more characteristic of a free-flowing river. In the 54-mile reach occupied by the four Alcoa Generating developments and Progress Energy's Tillery development, the Yadkin River is transformed into five reservoirs of different sizes and characteristics (see table 4 in section 3.3.2, *Water Resources*) with no riverine reaches between the reservoirs. The aquatic resources within this reach are lacustrine (lake-like) in character and are minimally affected by instream flows in the Yadkin River, but instead are affected more by reservoir-level regulation. Immediately downstream of Tillery is a 20.5-mile-long riverine reach that receives major tributary inflow from the Rocky and Little rivers. This reach is subjected to fluctuating flow releases from Tillery, and the poor water quality from Rocky River, which enters the Pee Dee River about 5 miles below Tillery dam. The 10-mile-long Blewett Falls reservoir begins about 15 miles downstream of the Rocky River confluence. Downstream of the Blewett Falls development is 188 miles of free-flowing river to Winyah Bay and the Atlantic Ocean.

The primary effects of instream flows on the Yadkin-Pee Dee River occur in the 20.5-mile riverine reach downstream of Tillery and the 188-mile reach downstream of Blewett Falls, although the effects of Blewett Falls operations are moderated by tributary inflow well before Winyah Bay. As previously discussed, these reaches would receive continuous minimum flows under the Yadkin-Pee Dee Settlement, and any effects of project operations would be reduced. The range of flow fluctuations, with associated changes in water surface elevation, wetted perimeter, depth and velocity would be reduced, which is expected to provide more stable habitat for all aquatic species, including macroinvertebrates, mussels, and fishes. These instream flows would not entirely eliminate the effects of project operations, or degraded water quality from the Rocky River, but would have an overall positive cumulative effect on aquatic resources in the Pee Dee River.

The water withdrawals identified for the project areas are listed in table 13, and include municipal water supplies and the Duke Power Buck steam generating station. All of these withdrawals are located either upstream or within the Yadkin Project reach. Thus, instream flow releases from the Tillery and Blewett Falls developments would have no effect on these withdrawals and any aquatic resources affected by those

withdrawals. Reservoir operations at the Yadkin Project could affect those withdrawals located on the project reservoirs (table 13), but as long as reservoir levels remain within an appropriate operational range, there would be no effects on the withdrawals or associated aquatic resources. For any water users (municipal or industrial) downstream of Blewett Falls, the proposed higher minimum flows would result in more stable river flows for downstream users. This should benefit any aquatic resources in the vicinity of downstream users, because they would not be exposed to water withdrawals at flows as low as now occurs under existing Blewett Falls operations.

Fish Passage

There currently is no upstream fish passage on the Yadkin-Pee Dee River upstream of the Blewett Falls development at RM 188, except for some American eel elvers that are able to pass Blewett Falls and move as far upstream as the Tillery development. Under Progress Energy's proposal (the Fish Passage Agreement), a Trap facility would be constructed in the Blewett Falls tailrace, which would be used to move anadromous species (primarily American shad) to areas upstream of the Blewett Falls and Tillery developments. Phase II of the Fish Passage Agreement would include modification of the Trap facility and installation of a fish exit flume, allowing direct passage of fish over Blewett Falls dam without the use of trucks. This would allow shad to spawn and rear in upstream habitat that is currently unavailable. American eel elvers also would be provided passage at Blewett Falls, which would provide eels access to rearing habitat upstream of Blewett Falls, including upstream tributaries. Downstream fish passage facilities also would be provided for both shad and American eel. Thus, the proposed relicensing of the Projects would result in a positive cumulative effect on diadromous fish resources in the Yadkin-Pee Dee River.

Fish Entrainment

The presence of the six hydroelectric developments of the Projects currently results in some fish entrainment and associated mortality for resident species in the six reservoirs. However, our assessment is that this entrainment does not adversely affect resident fish populations, which currently support an excellent sport fishery. Under the proposed anadromous fish program, downstream fish protection measures (gulper and surface curtain) would be provided at the Blewett Falls development during the downstream migration period for American shad. Downstream passage facilities also would be provided for American eel, after an evaluation period for passage options. Undoubtedly, some resident fishes that are also moving downstream at the same time as American shad and eel also would use these measures, resulting in some reduction in entrainment of resident species. Overall, fish entrainment would continue at about the same level as is now occurring, so continued operation of the Projects would result in a minor cumulative effect on resident fish species.

Most of the freshwater mussel species rely on fish hosts as part of their life cycle, where glochidia (the larval form of mussels) attach themselves to the gills or fins of fish,

and eventually mature into juvenile mussels and then detach from the fish. This is a primary method for dispersal of the mussel population, as the glochidia are transported by the fish host. Fish that are entrained and killed during turbine passage also may be carrying freshwater mussel glochidia, which likely would also experience mortality. This has the potential to adversely affect the freshwater mussel population, but this effect is likely minimal because not all entrained fish would be carrying glochidia, and a high percentage of fish that are entrained would survive passage.

3.3.3.4 Unavoidable Adverse Effects

Although the relicensing of the Projects, as proposed with staff modifications, would improve conditions in the Projects' tailwaters and provide for a phased approach to implementing fish passage, some unavoidable adverse effects on aquatic resources would continue:

- The project dams would continue to fragment aquatic habitat in the river, and continue to block fish movement until fish passage is provided;
- Reservoir water levels and tailwater levels would continue to fluctuate, although at a reduced level at many of the developments, exposing aquatic biota to fluctuating habitat conditions; and
- Some level of fish entrainment mortality would continue.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

Vegetation

Alcoa Generating manages the vegetation found on the Yadkin Project lands around the dams and powerhouses and in the transmission line corridors through a combination of logging to remove tree fall risk, and mowing and herbicides to maintain visibility, appearance, and facility access. As a result, the predominant vegetative cover type in these areas is a mixture of grasses and shrubs. Around the dams and powerhouses, most lands are open areas used for parking and vehicle access that offer relatively low quality habitat.

The Falls and Narrows developments transmission line corridors are predominantly rolling upland with scattered rock outcrops and boulders. The vegetation found within the cleared portion of the corridors is generally a mix of herbaceous and shrub species. Grasses, sedges, and regenerating tree species are all common including bush clovers, beard grasses, sedges, foxtail grasses, meadow fescue, small white aster, ragweed, St. Johns worts, black-eyed susans, goldenrods, panic grasses, loblolly pine, water oak, shortleaf pine, black locust, and vines such as greenbrier and rose. Generally species that are adapted to direct sunlight and drought-like conditions are dominant over most of the managed corridors, while on either side of the transmission line corridors,

where trees provide some shading, there is a narrow band supporting species that prefer partial shade and more moisture. Several small, mostly intermittent streams drain from the transmission line corridors to the Narrows and Falls reservoirs, or Lake Tillery, and both the Falls and Narrows transmission line corridors cross narrow coves of their respective reservoirs. A segment of the Narrows development transmission line borders a narrow fringe of scrub-shrub habitat. In addition, the Falls development transmission line crosses two narrow wetland areas; a wet meadow, in which water is at or near the surface but rarely ponded; and an emergent marsh, in which the water ponds for a sufficient time to support aquatic species.

A large percentage of the area in the vicinity of the Yadkin-Pee Dee River Project is currently second growth forest, with a smaller percentage composed of commercial or residential development or agriculture. Many of the forested areas have clearings and roads present (i.e., primary, secondary, and logging), resulting in relatively few areas of unbroken forest in the area. Progress Energy conducted vegetation cover type mapping within the general project vicinity and identified cover types that include Grass/Pasture, Hardwood forest, Mixed Hardwood/Pine Forest, Pine Forest, Scrub/Shrub, Barren, Water, and Agriculture.

Wetlands/Riparian Habitat

Alcoa Generating mapped wetlands at the Yadkin Project as part of the Wetland and Riparian Habitat Assessment (Normandeau, 2005b). All of the wetlands located within the study area, which included all the Yadkin Project reservoirs and the shoreline within 200 feet of the reservoirs, were mapped (table 33). Wetland delineation and mapping was done using aerial photography in July 2003 and field surveys in late 2003 and 2004. Wetlands were categorized as forested wetland, forested floodplain wetland, scrub-shrub wetland, sparse scrub-shrub wetland, emergent marsh, and aquatic bed. The remainder of the study area was categorized into eight upland cover types: forest, shrub (including areas typically under powerlines, permanently maintained in the shrub/sapling stage), urban/recreational grasslands, agriculture-pasture, agriculture-crops, residential, commercial/industrial, and bare soil or rock.

The vast majority of the wetlands found at the High Rock development are concentrated in the upper end of the reservoir, where there are extensive areas of forested floodplain wetlands (2,194 acres of the total) and sizeable scrub-shrub wetlands, mainly composed of black willow, which have developed on deltas and islands formed by sediment deposits. Elsewhere in High Rock reservoir, wetlands are noticeably absent, and there are almost no stands of emergent marsh or aquatic bed wetlands.

Table 33. Existing wetland acres at the Yadkin Project (P-2197) reservoirs and tailraces. (Source: Alcoa Generating, 2006a)

Wetland Type	High Rock	Tuckertown	Narrows	Falls	Falls Tailrace	Project Total
Forested Wetland	234	64	51	<1	6	355
Forested Flood plain Wetland	2,194	86	40	0	<1	2,320
Scrub-Shrub Wetland	325	40	4	<1	<1	369
Sparse Scrub-Shrub Wetland	484	4	0	0	0	488
Emergent Marsh	28	45	179	3	2	257
Aquatic Bed	3	14	60	0	0	77
Reservoir Total	**3,268**	**253**	**334**	**3**	**8**	**3,866**

The wetlands at the Tuckertown development are a mix of all six wetland types. Forested floodplain wetlands and forested wetlands are the dominant types occurring in scattered stands at the mouths of most tributaries. Within each of the wetland types, the species composition is very diverse. Relatively stable water levels and fine, sloping substrates have allowed extensive and diverse emergent wetlands and aquatic beds to develop. Aquatic beds form in deeper water, and emergent marsh containing pickerel weed, water willow, and cattail occur within the full pond limit, often grading to shrub swamp above full pond (Normandeau, 2005b).

The most prevalent wetland type at the Narrows development is emergent marsh, which accounts for 179 acres of the total, followed by aquatic beds (60 acres of the total). There are no sparse scrub-shrub wetlands at the Narrows development. In contrast to Tuckertown, emergent marsh wetlands on the Narrows development are not species diverse but are instead dominated by water willow; some are made up entirely of water willow. The existence of large stands of water willow on Narrows reservoir suggests that growing conditions are very suitable for this species, which is particularly tolerant of alternating periods of inundation and exposure. Aquatic beds at Narrows reservoir are confined to four backwater ponds created by the railroad bed on the west side of the reservoir.

Falls reservoir is characterized by steep, rocky slopes and substrates and a riverine nature. These natural features, along with very frequent fluctuations in reservoir water levels, serve to limit additional wetland development. The dominant wetland type at the Falls development is emergent marsh, which accounts for about 3 acres. Like the Narrows development, emergent wetlands at the Falls development are dominated by water willow. Forested floodplain wetlands, aquatic beds, and sparse scrub-shrub wetlands are not present. The Falls development tailrace, which extends into Lake Tillery, is estimated to have 8 acres of wetlands. The most prevalent type of wetland in the Falls development tailrace is forested wetlands.

The Pee Dee River Basin covers nearly the entire western boundary of Richmond County and a portion of Anson County. Overall, this area is of statewide significance and contains some of the best remaining representatives of riverine communities on the North Carolina reach of the Pee Dee River. The sites in this complex within or adjacent to the Projects' boundaries are described below.

Yadkin-Pee Dee riparian habitat is present in large amounts due to the size and nature of both project developments. Large and contiguous tracts of relatively undisturbed riparian habitat are found below Tillery dam, along Blewett Falls reservoir, and downstream of Blewett Falls dam. Riparian habitat present in the Yadkin Pee-Dee Project area includes botanical species assemblages dominated by red maple, boxelder, sycamore, sweet gum, and various oak species. Evergreen species such as loblolly pine, Virginia pine, shortleaf pine, and longleaf pine are also present in the riparian areas, but in fewer numbers than deciduous species.

Wetland habitats present in the Yadkin-Pee Dee River Project area support wildlife and botanical species assemblages containing numerous species including those associated with black gum swamps such as water tupelo, red maple, water hickory, and a sparse shrub and herb layer and bottomland hardwood forests dominated by species including cherrybark oak, water oak, laurel oak, sycamore, green ash, red maple, muscadine, poison ivy, catbriar, Japanese honeysuckle, Chinese privet, black willow, sedge species, giant cane, smartweeds, lizard's tail, and southern wild rice.

Progress Energy conducted field assessments using field-verified National Wetland Inventory (NWI) maps as baseline information to classify and characterize a sub-set of the wetland communities. There are seven specific wetland study areas within the Yadkin-Pee Dee River Project boundary representing several wetland types, elevational locations, and site characteristics. Additionally, wetland acreages have been estimated for both Lake Tillery and Blewett Falls reservoir within the project boundary. These estimates were derived from the original NWI maps and verified or modified based on field assessments. The total amount of wetland area within a 2-mile-wide corridor from Blewett Falls dam upstream to the Uwharrie River confluence includes areas outside of the project boundary. Table 34 shows these acreages.

Table 34. Wetland types and acreages associated with Lake Tillery and Blewett Falls reservoir. (Source: Progress Energy, 2006a)

Wetland Type	Lake Tillery	Blewett Falls Reservoir	Pee Dee River Corridor
PEM dominated classes (includes water willow beds)	298	66	539
PSS dominated classes	8	26	567
PFO dominated classes	140	780	4,836
Total	**446**	**872**	**5,942**

The most extensive wetland habitat in the Yadkin-Pee Dee River Project area is located in the Grassy Islands Complex in the upper reaches of the Blewett Falls development. According to Sorrie (2001, as cited in Progress Energy [2006a]), this complex is the most important natural area within the Piedmont of Richmond County and includes a mix of habitats found nowhere else in the Piedmont (i.e., oxbow lake with water tupelo). This area supports a variety of floodplain and slope forests, extensive marshes, an oxbow lake, and the largest expanse of levee forest and bottomland hardwood forest along the Pee Dee River. Piedmont and Coastal Plain species are found together in this community.

This area supports a wide variety of communities on the numerous islands, sloughs, rocky slopes, vernal pools, and expansive bottomland floodplains that have formed naturally by river flows and sedimentation. The area has a mixture of managed loblolly pine plantation forests, slope forests, levee forests, emergent wetlands, and bottomland hardwood forests along the Pee Dee River shoreline. The complex is notable for its mixture of Coastal Plain and Piedmont/Mountain species co-existence. The Grassy Islands Complex is a natural area of Statewide Ecological Significance as designated by the North Carolina Natural Heritage Program, which states that very few intact bottomlands of any significant size remain in the Piedmont region. Thus, the Natural Heritage Program classified this system as rare (S3) in the Piedmont. Project lands incorporate all islands in the complex with greater acreage on the Richmond County side (east shoreline) and only a narrow flowage easement along the west shore on the Anson County side.

Noxious Weeds

Alcoa Generating conducted field searches for noxious weeds during the fall of 2003 and the spring, summer, and fall of 2004. In total, 32 species of noxious or invasive species, including both aquatic and terrestrial plants, were included on the initial noxious weed search list. Results of the field surveys found 20 species of noxious weeds in the Yadkin Project area, including 3 aquatic species and 17 terrestrial species (table 35).

About a dozen terrestrial noxious weed species were found in the primarily upland vegetation found in both the Falls and Narrows dam transmission line corridors. However, many of the noxious species appear to be well established in their respective plant communities, and in most cases, attempts to eliminate or control them would be infeasible without a concerted regional effort. Moreover, the Invasive Exotic Plant Pest Species Assessment (Normandeau, 2005c) found only one of the terrestrial noxious species, bush honeysuckle, to be of immediate management concern. On the Falls reservoir shoreline, just downstream of Narrows dam, this species is found growing in the upland forest in close association with two RTE species, piedmont indigo-bush (*Amorpha schwerinii*) and thick-pod white wild indigo (*Baptisia alba*). At this site, an area commonly referred to as the Yadkin River Scour Banks, the bush honeysuckle occupies most of the available space that appears to provide suitable habitat for the two RTE species. Two additional species, Japanese honeysuckle and mimosa, also have been raised as management concerns. As discussed in section 3.3.5, *Threatened and Endangered Species*, Japanese honeysuckle is found growing in proximity to the federally endangered Schweinitz's sunflower (*Helianthus schweinitzii*). Additionally, FWS, in its May 11, 2007, letter, indicated that mimosa is shading an RTE species, the Yadkin River goldenrod (*Solidago plumosa*), potentially competing for seed germination and seedling establishment sites.

Progress Energy catalogued 15 species of noxious weeds and other non-native or exotic species within the Yadkin-Pee Dee River Project boundary during relicensing studies (table 35). The majority of these plants have been widely introduced and dispersed by human activities and wildlife.

Table 35. Invasive exotic plant species observed in the Yadkin (P-2197) and Yadkin-Pee Dee River (P-2206) Project areas. (Source: Alcoa Generating, 2006a; Progress Energy, 2006a)

Species	Yadkin Project	Yadkin-Pee Dee Project
Aquatic		
Hydrilla	✔	
Uruguay waterprimrose	✔	
Water lettuce	✔	
Terrestrial		
Gill-over-the-ground	✔	
Moneywort	✔	
Japanese grass/Nepalese browntop	✔	✔
Chinese silvergrass	✔	
Small carpgrass/hairy joint grass	✔	
Chinese lespedeza	✔	
Garlic mustard		✔

Species	Yadkin Project	Yadkin-Pee Dee Project
Yellow thistle		✓
Japanese honeysuckle[a]	✓	✓
Kudzu	✓	✓
Chinese wisteria	✓	✓
Chinese yam		✓
Trifoliate orange		✓
Bush honeysuckle[a]	✓	
Multiflora rose	✓	✓
Memorial rose	✓	
Russian olive		✓
Thorny olive		✓
Japanese privet	✓	✓
Chinese privet	✓	✓
Tree-of-heaven	✓	✓
Silk tree/Mimosa [a]	✓	✓
Chinaberry	✓	

[a] Species growing in proximity to RTE plant species in the project area.

Special Status Plants

Alcoa Generating conducted RTE species surveys at the Yadkin Project in 2004. The surveys targeted habitats that were suspected to most likely support RTE species on the search list. Table 36 identifies the nine RTE species found at the Yadkin Project. Most of the rare plant species found occur in lightly forested to open, primarily herbaceous communities, often associated with steep slopes overhanging the water, or overhanging road cuts.

Table 36. RTE species recorded in the Yadkin Project (P-2197) study area, 2004. (Source: Alcoa Generating, 2006a)

Species	Common Name	State Status[a]	Federal Status[a]	Location
Plant Species				
Amorpha schwerinii	Piedmont Indigo-bush	SR-T		Falls, High Rock, Narrows, and Tuckertown reservoirs
Baptisia alba	Thick-pod White Wild Indigo	SR-P		Falls reservoir
Cirsium carolinianum	Carolina Thistle	SR-P		Falls reservoir
Helianthus	Smooth	SR-P		Tuckertown reservoir

Species	Common Name	State Status[a]	Federal Status[a]	Location
laevigatus	Sunflower			
Helianthus schweinitzii	Schweinitz's Sunflower	E	E	Falls reservoir
Lotus helleri	Heller's Trefoil	SR-T	FSC	Falls Transmission Line
Porteranthus stipulatus (=Gillenia stipulate)	Indian Physic	SR-P		Tuckertown reservoir
Ruellia purshiana	Pursh's Wild Petunia	SR-O		Falls Transmission Line
Solidago plumosa	Yadkin River Goldenrod	E	Candidate for federal listing, effective May 11, 2005	Falls reservoir

[a] SR-T = Significant Rare Throughout (NC)
SR-P = Significantly Rare Peripheral (NC)
SR-O = Significantly Rare Other (NC)
E = Endangered
SC = Special Concern (NC)
FSC = Federal Special Concern

The Piedmont indigo-bush is the most abundant and widespread of the nine plant species. The indigo-bush is found at all four reservoirs, mostly at forest edge locations and often on steep slopes overhanging the water. Steep bedrock slopes appear to promote favorable conditions for Piedmont indigo-bush, thick-pod white wild indigo, Carolina thistle, and the Schweinitz's sunflower. All four of these species are found along Falls reservoir. Steep bedrock with periodic current scouring below Narrows and Falls dams appears to promote favorable conditions for Piedmont indigo-bush and thick-pod white wild indigo. Smooth sunflower, Heller's Trefoil, and Pursh's wild petunia have been recorded only in unforested locations such as the Falls transmission line (Heller's trefoil and Pursh's wild petunia) and a mown roadway (smooth sunflower). Indian psychic has been found in only one place, a location of previous record constituting a steep, northwest-facing slope of young upland hardwoods bordering the Tuckertown reservoir.

The Yadkin River goldenrod is only known to occur along the Yadkin River, with the only two known locations of this species occurring along the shorelines and in rock shoals below Narrows and Falls dams. The species requirements for seed germination and seedling establishment are not known. According to the Yadkin River Goldenrod Survey Final Study Report (Alcoa Generating, 2006b); however, FWS indicated the species appears to persist in areas subjected to periodic scouring of a velocity sufficient to

prevent the establishment of other species without eliminating already established goldenrod plants. Because the goldenrod does not occur in frequently flooded habitats, it does not appear tolerant of prolonged inundation. The results of the Yadkin River goldenrod survey show that the existing known locations of the Yadkin River goldenrod are in areas that are inundated by river flows or subject to scour from river flows only during spill events.

Progress Energy documented nine RTE plant species within the Yadkin-Pee Dee River Project boundary during field surveys (table 37).

Table 37. RTE plant species and significant habitat areas documented in the Yadkin-Pee Dee River Project (P-2206) boundary. (Source: Progress Energy, 2006a)

Species	Common Name	State Status[a]	Federal Status[a]	Habitat/Location
Plant Species				
Amorpha schwerinii	Piedmont Indigo-bush	SR-T		Rocky River bluffs, rock outcrops, and woods/downstream of Falls dam and a rock outcrop near Morrow Mountain State Park
Baptisia alba	Thick-pod White Wild Indigo	SR-P		Open woodlands and clearings/west shoreline of Lake Tillery
Cardamine dissecta	Dissected Toothwort	SR-P		Rich woods and bottomlands/ along the Uwharrie River
Cypripedium pubescens	Large Yellow Lady's-slipper	W5B		Rich, mesic forests/along the Uwharrie River
Didiplis diandra	Water Purslane	SR-P		Vernal and ephemeral pools; ponds within bottomlands/Oxbow Lake
Euphorbia mercurialina	Cumberland Spurge	SR-P		Open thin woods with sandy soils/steep heath bluff adjacent to Blewett Falls reservoir
Eurybia mirablis	Piedmont Aster	SR-T	FSC	Wooded sloped and alluvial woods, usually on basic or circumneutral soils/steep heath bluff adjacent to Blewett Falls reservoir

Species	Common Name	State Status[a]	Federal Status[a]	Habitat/Location
Manfreda virginica	Eastern Agave	W7		Granite flatrocks, mafic glades, dry outcrops and dry woodlands/ west shoreline of Lake Tillery
Solidago plumose	Yadkin River Goldenrod	E	Candidate for federal listing, effective May 11, 2005	Open thin woods with sandy soils/rock outcrop in Morrow Mountain State Park

[a] SR-T = Significant Rare Throughout (NC)
SR-P = Significantly Rare Peripheral (NC)
SR-O = Significantly Rare Other (NC)
E = Endangered
SC = Special Concern (NC)
FSC = Federal Special Concern
The North Carolina Watch List:
Watch Category 5b (Exploited Plants)
Water Category 7 (W7 – rare and poorly known)

All RTE plant species located within the Yadkin-Pee Dee River Project boundary, except for water purslane, are outside the zone of operational influence and are not affected by project water elevation fluctuations. Water purslane is found in vernal pools associated with Oxbow Lake; however, because they are perched wetlands, the pools retain their hydrology despite project fluctuations.

Alcoa Generating rare plant surveys located one occurrence of the Yadkin River goldenrod within the Falls tailwater area in the Yadkin-Pee Dee River Project boundary. Surveys conducted by Progress Energy in 2004, 2005, and 2006 did not locate any Yadkin River goldenrod plants within the Yadkin-Pee Dee River Project boundary.

Wildlife

The various habitat areas associated with the Yadkin and Pee Dee River basins provide excellent breeding, migratory stopover, and wintering habitat for a high diversity of bird species including neotropical songbirds, resident species, waterbirds, and waterfowl. Species such as the prothonotary warbler, hooded warbler, yellow-throated warbler, red-eyed vireo, Acadian flycatcher, wood thrush, yellow-billed cuckoo, pileated woodpecker, red-bellied woodpecker, wood duck, barred owl, wild turkey, and red-shouldered hawk are indicative of the diverse habitats. Other species frequently observed along this river corridor include the northern rough-winged swallow, belted kingfisher, osprey, turkey vulture, and great blue heron. Common vertebrate wildlife using these areas are small mammals and small birds, including migratory songbirds. Species likely

to be encountered include gray squirrel, moles, shrews, lizards, snakes, Carolina chickadee, blue jay, and cardinal.

The Yadkin Project also provides breeding habitat for a significant number of great blue heron. For this reason, all breeding colonies of great blue herons are inventoried during the annual bald eagle nesting surveys. Since 2002, breeding colonies of great blue heron have been found on High Rock, Tuckertown, and Narrows reservoirs.

The Falls (about 2.8-miles long) and Narrows (about 1.5-miles long) transmission line corridors add to the diversity of habitat within the area that otherwise is characterized by large blocks of woodland, sections of which are under silvicultural management. Both transmission line corridors are characterized by a mix of herbaceous and shrub habitat abutting timber stands which provides structure (vertical and horizontal complexity), an important habitat element for wildlife usage. Because of this habitat diversity, many vertebrate species are found to use the transmission line corridor including neotropical migratory birds, resident songbirds and game birds, birds of prey, large and small mammals, and reptiles and amphibians. In addition, the Falls transmission line corridor contains rock outcroppings that provide reptile habitat and an emergent marsh, in which the water ponds for a sufficient time to support aquatic species. This ephemeral pool provides habitat to many amphibian species, such as spotted and marbled salamanders and upland chorus frogs, which may use it for breeding.

As opposed to the Yadkin Project area, which provides little suitable waterfowl habitat, the Pee Dee River corridor, including both Lake Tillery and Blewett Falls reservoir and adjacent wetlands, attracts a wide variety of waterfowl. Waterfowl species commonly observed in this area include the wood duck, green-winged teal, black duck, mallard, and Canada goose. These species are especially attracted to the flooded bottomlands and the southern wild rice stands within the larger coves. The Pee Dee National Wildlife Refuge, which is adjacent to the Pee Dee River between Lake Tillery and Blewett Falls reservoir, is known and managed for its large number of wintering waterfowl. In fact, the Pee Dee River is listed by the North American Waterfowl Management Plan (Atlantic Coast Joint Venture) as a North Carolina Focus Area.

The Lake Tillery tailrace provides high value foraging habitat for wading and waterbirds and is adjacent to the expanding great blue heron breeding colony. The nesting habitat (heronry) is located in a loblolly pine stand along the west shoreline overlooking the Tillery tailwater. The tailwater and adjacent shoreline below Tillery dam provide food, cover, and nesting habitat for both adults and juvenile birds through most of the year. The number of great blue heron and other wading and waterbirds in this tailwater area depends on the flow (no units or one unit in operation) and subsequent tailwater elevation. With a lower water level, more wading birds use this habitat area. During low flows, numerous pools and shallow areas are provided within the exposed rock outcrops and emergent vegetation which provide good foraging habitat for fish.

Progress Energy conducted visual encounter surveys to document mammals within the project area and observed 12 mammal species during the surveys and an

additional seven species listed through incidental observations. A total of 40 species have been observed in the general area of the Yadkin-Pee Dee River Project. The highest mammalian abundance and species richness during the surveys was found in the Grassy Islands Complex at the forest and water interface. Seven species were observed in this area including several semi-aquatic species such as beaver, muskrat, and otter. This high mammalian richness is likely due to the diverse habitats and large tracts of forest land located in this area.

Special Status Wildlife

Alcoa Generating conducted RTE species surveys at the Yadkin Project in 2004. The only non-plant species found in these surveys was the timber rattlesnake (*Crotalus horridus*), which is a state species of Special Concern and was observed along the Falls transmission line corridor. Bald eagles (*Haliaeetus leucocephalus*), a state threatened species, are also frequently observed throughout the project area.[42]

Beginning in 2001, Alcoa Generating initiated annual bald eagle nesting surveys to document nesting attempts and successes by eagles at the Yadkin Project. The specific objectives of the surveys were to (a) document the status, distribution, and productivity of nesting pairs of bald eagles in association with the Yadkin reservoirs and associated river corridors; (b) increase the understanding of bald eagle natural history in interior regions of North Carolina; and (c) determine the status and distribution of breeding great blue herons along the Yadkin Project reservoirs. Although two bald eagle territories were located in 2002 along High Rock reservoir, only one bald eagle territory was observed to be active from 2003 through 2005, because one nest was blown down from the tree in 2002 and has not been replaced. One nest has been active on Tuckertown reservoir since 2002. Although two nests have been documented in the surveys at Narrows reservoir, only the newer nest was active in 2003 through 2005. The nest located at Falls reservoir has not been active since 2002 and appears to have been abandoned.

Progress Energy identified six RTE species during the field surveys conducted in 2004 and 2005: three birds during the breeding season and three birds during migratory periods (table 38). Five of the six species were observed within the diverse habitats of the Grassy Islands Complex area.

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[42]The official bald eagle delisting notice was issued on July 9, 2007 (72 Fed. Reg. 37346), and became effective on August 8, 2007. Although delisted, the eagle is still protected by the Bald and Golden Eagle Protection Act (Eagle Act) and Migratory Bird Treaty Act.

Table 38. RTE terrestrial wildlife species identified in the Yadkin-Pee Dee River Project (P-2206) area, 2004-2005. (Source: Progress Energy, 2006a)

Common Name	Listed[a]	Location Identified	Preferred Habitat
Anhinga	SR	Grassy Islands Complex – Grassy Islands	Coastal wooded lakes or ponds, or open swamps
American Bittern	SR	Grassy Islands Complex – Mountain Creek southern rice beds, Lower Uwharrie River, Morrow Mountain State Park – Tater Top Mountain	Coastal/tidewater fresh or brackish marshes
Bald Eagle	ST	Lake Tillery dam, Grassy Islands Complex, Pee Dee River – Leak Island	Mature forests near large body of water
Hermit Thrush	SR	Grassy Islands Complex, Pee Dee River Gabbro Slopes Area	Mountain spruce-fir forests
Magnolia Warbler	SR	Grassy Islands Complex – Grassy Islands	Mountain spruce-fir forests, especially in mature stands
Northern Harrier	SR	Pee Dee River – Leak Island	Coastal/tidewater extensive brackish marshes

[a] Listed codes: ST = Threatened (NC), SR = NC Natural Heritage Program Significantly Rare

The bald eagle was recently delisted as federal threatened; however, it is still listed as threatened by the state of North Carolina. The mature forests along the Pee Dee River shoreline and the two impoundments within the project area provide suitable habitat for this species to nest, roost, perch, and feed. The species can be viewed year-round throughout the area. Adult and young bald eagles have been routinely observed in the project area for at least the past 5 years and were observed during most of the surveys in 2004 at several different locations. Nests have been documented near Tater Top Mountain at Morrow Mountain State Park at Lake Tillery, on the east shoreline of Lake Tillery, in the Lake Tillery dam tailrace area, and above Blewett Falls dam for the past several years. The four known active nests and occupied territories in the project area produced nine bald eagle chicks in 2005.

3.3.4.2 Environmental Effects

Reservoir Levels and Minimum Flows

Project operations can affect wetlands, riparian habitat, and wildlife habitat within both project areas. Reservoir fluctuations affect the distribution, species composition, and health of wetland and riparian habitat. Reservoir drawdowns during the growing and

nesting seasons can limit wetland development in the fluctuation zone, flood or strand nesting waterfowl, and reduce foraging and cover habitat for a variety of wildlife species. Winter drawdowns can freeze root systems of wetland plants and cause mortality in hibernating turtles and frogs. Minimum instream flows provide foraging habitat for wading birds such as great blue heron. Changing these flows could potentially affect this habitat.

Alcoa Generating's proposed water elevations at project reservoirs and minimum flows are presented in section 2.2.2, *Proposed Operations*, and described in section 3.3.2.2, *Environmental Effects*. FWS concurs with these measures. Several entities suggest alternative operating regimes for High Rock reservoir. We analyze two action alternatives in this EIS: (a) seasonal drawdowns of High Rock reservoir of 4 feet from April 1 through October 31 and 6 feet from December 1 through the end of February, as requested by SaveHighRock.org; and (b) a year-round elevation 2 feet below full pond, as requested by R. Martin.

Progress Energy's proposed reservoir operations and minimum flows are described in section 2.2.2, *Proposed Operations*, and described in section 3.3.2.2, *Environmental Effects*. To protect stream and riparian resources, Progress Energy also proposes to place restrictive covenants on project lands it owns in the Grassy Islands area along the upper reaches of Blewett Falls reservoir and on project lands it owns near the mouth of the Uwharrie River along the upper reaches of Lake Tillery. The restrictive covenants would establish a 100-feet wide buffer zone adjacent to the shoreline which would allow only selective clearing and controlled burning in accordance with a forest management plan approved by North Carolina DENR and unimproved foot trails no greater than 4-feet wide.

FWS recommends minimum flows from Tillery from 800 to 1,000 cfs year round except during spring spawning season when it recommends 1,500 to 1,800 cfs. Progress Energy in its response to FWS's recommendations disagrees with FWS's recommendations for minimum flows at Tillery. Progress Energy states that the higher minimum flows recommended by FWS would likely have a significant adverse effect on wading birds in the Tillery tailrace, including great blue herons.

Our Analysis

Within the Yadkin Project, wetlands are most prevalent at High Rock reservoir where they make up about 29 percent of the cover types within 200 feet of the reservoir, followed by about 13 percent at Tuckertown, 14 percent at Narrows, and 2 percent at Falls (Normandeau, 2005b). The majority of the wetlands at High Rock are found in the upper delta where the Yadkin River has deposited sediment loads and forested and scrub-shrub wetlands dominated by black willow have become established. These wetlands provide important fish spawning habitat. Currently, High Rock is operated to maintain higher water elevations in High Rock reservoir from mid-May to mid-September, followed by a fall-winter drawdown to allow for refill during the late winter and spring.

The normal maximum annual drawdown for High Rock is about 13 feet, with drawdowns of 5 feet or less typical during the summer months. The late growing season drawdown allows black willow to continue to grow; however, it limits the development of emergent marsh and aquatic beds because they cannot tolerate the extreme conditions created by spring flooding followed by drought in the fall and winter. The winter drawdown causes further stress to these wetland plants because of freezing and desiccation.

The proposed operating regime would limit fluctuations to within 4 feet of full pool from April 1 until October 31 and reduce winter drawdowns to 10 feet below full pool. Reducing the fluctuation zone by 1 foot and extending the near-full pool conditions for 3 months to include the entire growing season would likely result in changes in the distribution of wetland types. Water would inundate the black willow wetlands for essentially the entire growing season. Although black willows tolerate flooding for long periods of time, they cannot survive permanent inundation (Normandeau, 2005b). As a result, under the proposed operating regime, some of the black willow wetlands on the delta sediment bars would likely be lost, and emergent vegetation would become established. Water willow, an emergent species common at Narrows reservoir, would likely expand around High Rock reservoir because it is somewhat tolerant of water fluctuations and winter drawdown (Normandeau, 2005b). Emergent vegetation also would likely expand around the reservoir shoreline, increasing the amount of fish and wildlife habitat available. Limiting the winter drawdown to 10 feet would protect a 3-foot band around the reservoir from freezing and desiccation, limiting adverse effects on overwintering reptiles and amphibians.

SaveHighRock.org's recommended High Rock operating regime of 4 foot drawdowns during the growing season and 6 foot winter drawdowns would affect wetlands similarly to the proposed operating regime. Because the winter drawdown would be less severe than the proposed drawdown with only a 2-foot difference between winter elevation and the elevation for the remainder of the year, some additional emergent and submergent wetland vegetation would likely become established within this drawdown zone.

The year-round 2-foot drawdown alternative would result in the greatest loss of forested and scrub-shrub black willow wetlands because the majority of them would be inundated permanently. There are an estimated 1,070 acres of wetlands in the delta sediment bars, the majority of which are black willow (Normandeau, 2005b). The study estimates that maintaining High Rock within 3 feet of full pond year round would result in the loss of an estimated 803 acres of these wetlands. It is likely that maintaining High Rock within 2 feet of full pond year-round would result in similar, if not greater wetland losses. This alternative would result in the loss of the vast majority of fish spawning habitat associated with the black willow wetlands. However, emergent marsh and aquatic bed wetlands would increase throughout the reservoir because of the stable water elevations. Maintaining High Rock within 3 feet of full pond year-round is estimated to increase wetlands around the main body of High Rock (most of which are emergent marsh) from 543 acres to 1,727 (Normandeau, 2005b). A year-round 2-foot drawdown

alternative would likely result in similar increases in emergent marsh and aquatic bed wetlands, increasing the amount of fish and wildlife habitat available.

The proposed operating regimes at Tuckertown and Falls reservoirs would stay the same as existing conditions. Therefore the project, as proposed, would not affect the wetlands and wildlife habitat at these reservoirs. Alcoa Generating proposes to increase reservoir fluctuations at Narrows reservoir from a normal operating drawdown of 3 feet below full pool to a normal operating drawdown of 5 feet below full pool. Currently, emergent vegetation, dominated by water willow, is the most prevalent wetland type at Narrows, encompassing more than 50 percent of the wetland acreage (Normandeau, 2005b). These emergent wetlands provide important resident and spawning fish habitat, as well as cover and foraging habitat for waterfowl and fish-eating wildlife. It is likely that water willow dominates the emergent vegetation at Narrows because, as discussed above, it tolerates greater water fluctuations than many emergent species. As such, it is likely that although the proposed operating regime increases the normal operating drawdown by 2 feet, water willow would continue to thrive around the reservoir.

Minimum flows released from the Yadkin Project would support proposed flows below Blewett. Wetlands are relatively uncommon at the Yadkin-Pee Dee River Project's Lake Tillery because of development and steep shorelines; however, those that exist have high species and wetland community structure (aquatic bed, emergent, scrub-shrub, and forested types) diversity. Water willow emergent wetlands fringe the reservoir out to depths of 3 to 5 feet of water. The majority of the forested wetlands are located near the Uwharrie River. This area provides breeding, migratory habitat, winter refuge, and foraging habitat for several waterfowl species. Water levels rising more than 2 feet during waterfowl nesting season (May through June) can flood nests. Reservoir elevations falling more than 1.5 feet for more than 4 hours during waterfowl brood season (June and July), the fall migratory period (September through November), and the wintering period (December through February) can reduce foraging and cover habitat for waterfowl (Progress Energy, 2006c). Under existing conditions, Progress Energy voluntarily operates Lake Tillery within a 4-foot fluctuation under full pond under normal circumstance, with fluctuations between 1 to 1.5 feet under typical daily elevation changes. Under existing conditions, effects on waterfowl are minimal.

Proposed operations would limit daily reservoir water level fluctuation at Tillery to within 1.5 to 3 feet of full pond except during peak electrical demand times (summer afternoons typically), when fluctuations would increase up to 5 feet on a short-term basis (typically daily). Because these fluctuations would be of short duration, wetlands would not be affected and waterfowl foraging and cover would only be reduced temporarily. Therefore, because the proposed operating regime would reduce typical daily fluctuations and larger fluctuations would be of short duration, the proposed operating regime would not affect wetlands and waterfowl habitat within Lake Tillery. Additionally, Progress Energy's proposal to place lands around the Uwharrie River into a restrictive covenant would restrict development and protect this important waterfowl area from disturbance.

Large and relatively undisturbed tracks of riparian habitat occur along the Pee Dee River below Tillery dam, with high value wading and waterbird foraging habitat in the tailrace. A great blue heron colony occurs adjacent to the tailrace and herons use the tailrace for foraging. Progress Energy proposes to increase the minimum flows released from Tillery from 40 to 330 cfs except for an 8-week period in the spring when it would release a minimum flow of 725 cfs. Great blue heron's optimal foraging is in clear water 0- to 1.6-feet deep (Short and Cooper, 1985). At 500 cfs, the tailrace would be wetted from bank to bank with an average depth of about 0.8 foot and at 2,000 cfs the tailrace would average about 1.4 feet deep with the depth varying across the river (Progress Energy, 2006d). Therefore, the proposed minimum flows would continue to provide optimum habitat for great blue heron and other wading birds. Also, FWS's recommended minimum flows between 800 and 1,800 cfs would result in average depths in the Tillery tailrace that are within the great blue heron's preferred foraging habitat depth. However, at these higher flows, more areas within the tailrace would be deeper than 1.6 feet, making some portions of the tailrace no longer suitable for heron foraging. Additionally, the higher minimum flows recommended by FWS would result in greater water velocity in the foraging area, which is likely to cause more turbulence and decreased water clarity than the proposed minimum flows. Because heron require clear water for foraging, FWS's recommended minimum flows would likely decrease heron foraging suitability year round, and the alternative minimum flows would decrease heron foraging suitability in the spring.

Wetlands at the Blewett Falls reservoir are more plentiful than at Lake Tillery, with the majority of wetlands occurring in the Grassy Islands area located about 5 miles upstream of Blewett Falls dam. The bottomland forests and emergent rice beds found in the Grassy Islands area, along with other wetlands at the Blewett Falls development, are productive and provide breeding and migratory habitat for waterfowl and vernal pools for amphibian breeding. Effects from water fluctuations on waterfowl nesting, brooding, migration, and wintering are the same as those described for Lake Tillery. Existing project operations allow up to a 17-foot drawdown, however Progress Energy normally draws down the reservoir up to 6 feet, with typical daily elevation changes of 2 to 3 feet – 1 to 3 feet during important waterfowl seasons. Four to 6 foot fluctuations occur when flashboards are out. Until flashboards are replaced, some waterfowl habitat and wetland functions are lost. Overall, however, because the flashboards go out relatively infrequently and typical daily elevation changes are of short duration, the existing operating regime only has temporary effects on wetlands and waterfowl habitat. These effects are less in the Grassy Islands area, because it is located so far upstream from the Blewett Falls dam.

The operating regime proposed by Progress Energy for Blewett Falls would limit reservoir fluctuations to no more than 6 feet below full pool except under low inflow or emergency conditions. Typical daily elevations changes, however, would be slightly reduced from the existing 2 to 3 feet because higher minimum flows would flow into and out of the Blewett Falls development. During peak electrical demand times and when

flashboards go out, the drawdown could be as much as 6 feet. Because the fluctuations would be of short duration except when flashboards are out, wetlands would not be affected, and waterfowl foraging and cover would only be reduced temporarily. Therefore, because the proposed operating regime would reduce typical daily fluctuations, the proposed operations would slightly benefit wetlands and waterfowl habitat within the Blewett Falls reservoir. Additionally, Progress Energy's proposal to place lands around the Grassy Islands area into a restrictive covenant would restrict development and limit disturbance in this important waterfowl area.

Under the existing license, Progress Energy is required to release at minimum flow 150 cfs at Blewett Falls dam; however the measured release is typically 200 cfs. Progress Energy proposes to release between 1,200 and 2,400 cfs. The proposed minimum flows would benefit aquatic species (see section 3.3.3.2, *Aquatic Resources, Environmental Effects*) and riparian habitat, which would benefit wildlife that feed on aquatic species and use riparian habitat for cover and den sites.

Rare Species Management

Several rare plant and wildlife species occur within the Yadkin and Yadkin-Pee Dee River Project areas. Some, such as the Yadkin River goldenrod and the bald eagle, have the potential to be affected by project operations, maintenance, or project-related activities. The Yadkin River goldenrod occurs below the Narrows and Falls dams, within both project boundaries. These populations occur in areas that are occasionally scoured and inundated by flows; therefore, changes to project operations could potentially affect this rare plant. Also there is potential for fishermen to trample the stems growing on the old foundation at the Falls tailrace. Vegetation management could affect the rare plant species occurring within the Yadkin Project transmission line corridors. Bald eagles occur throughout both project areas. Shoreline development and project recreation could potentially affect bald eagles by cutting nesting, roosting, or perching trees, or by creating disturbances close to bald eagle nests.

Alcoa Generating proposes to develop an RTE species management plan within 2 years of license issuance in consultation with FWS, North Carolina WRC, and other appropriate federal and state wildlife resource agencies. The RTE plan would address issues regarding the effect of the Yadkin Project or project operations on the bald eagle, Yadkin River goldenrod, and the Schweinitz's sunflower. Alcoa Generating also proposes to develop a transmission line corridor management plan within 2 years of license issuance in consultation with FWS, North Carolina WRC, and other appropriate federal and state agencies. The transmission line corridor management plan would establish vegetation and wetland management objectives for the two project transmission line corridors and would outline actions to be taken by Alcoa Generating to manage the corridors in a manner consistent with those objectives. In addition to these proposed measures, Alcoa Generating proposes to submit a revised SMP for the Yadkin Project to the Commission within 2 years of license issuance, as described in section 3.3.8, *Land Use and Aesthetics*.

FWS recommends that Alcoa Generating prepare management plans for RTE species within 2 years of license issuance. FWS recommends that Alcoa Generating prepare a bald eagle management plan that includes bald eagle annual monitoring and management provisions for the entire Yadkin Project. FWS also recommends Alcoa Generating develop a species management plan for the Yadkin River goldenrod that would address threats from encroaching vegetation and trampling from recreational users. FWS states that this plan should include a description of actions capable of mitigating these threats, a timeline for implementing these actions, and provisions for routine monitoring of status and trends in the population. In addition, the plan would include provisions to address the following issues: (1) controlling encroaching vegetation, (2) monitoring the effects of project operation on habitat, and (3) creating additional suitable habitat. FWS also states that project transmission line corridors provide openings that are preferred by some protected plant species. FWS recommends that protection and maintenance protocols be developed for maintaining the transmission line corridors. Such protocols should involve the exclusion of using pesticides or other detrimental practices to promote and protect native species.

Alcoa Generating, in response to FWS's recommendations, states that it is concerned by FWS's recommendations for several separate RTE management plans. Alcoa Generating believes that a single RTE species management plan is all that is necessary to efficiently and properly address the species-management issues.

The Yadkin-Pee Dee Settlement does not include any Progress Energy-proposed measures specifically for RTE species. However, it does include a shoreline management policy for the Blewett Falls reservoir and a mechanism to protect stream and riparian areas (i.e., placing restrictive covenants on project lands it owns in the Grassy Islands area in the upper reaches of the Blewett Falls reservoir and near the mouth of the Uwharrie River in the upper reaches of Lake Tillery). The shoreline management policy for the Blewett Falls reservoir would prohibit private access, except normal foot access, to the reservoir across project lands except at designated public access areas, focusing shoreline management on natural resource protection. As discussed above, the restrictive covenants would establish a 100-foot buffer zone adjacent to the shoreline, and allow only selective clearing and controlled burning in accordance with a forest management plan approved by North Carolina DENR and unimproved foot trails no wider than 4 feet.

Additionally, Progress Energy proposes in its response to the Commission's additional information request no. 17 (letter dated October 16, 2006, from P. Lucas, Hydro Relicensing Project Manager, Progress Energy, Raleigh, NC, to M.R. Salas, Secretary, FERC, Washington, DC), to conduct an aerial survey monitoring program for bald eagle nesting activity and fledgling success on project lands every 3 years during the term of the new license or until the bald eagle is delisted from the state and federal endangered species lists, at which time it would discontinue the monitoring. Progress Energy would use these surveys to provide information on active nesting territories associated with project lands which it would use in decision making regarding shoreline management.

FWS recommends that Progress Energy develop a bald eagle management plan and a Yadkin River goldenrod species management plan, similar to those recommended for the Yadkin Project.

Progress Energy, in its response to FWS's recommendations, disagrees with FWS's recommendations for a bald eagle management plan and for a Yadkin River goldenrod species management plan. Progress Energy restates its proposed aerial surveys every 3 years to monitor bald eagles within the entire project. Progress Energy states that it currently implements shoreline management guidelines regarding timber practices and disturbance of vegetation around active bald eagle nest sites at Lake Tillery that are revised periodically based on updated bald eagle population status. Progress Energy further states that the incorporation of its existing bald eagle management guidelines and shoreline management policies, along with its proposed bald eagle surveys provides a reasonable level of protection for the bald eagle. Progress Energy disagrees that a Yadkin River goldenrod management plan is needed because, after initially locating one small non-flowering plant within the project boundary, field surveys in 2004, 2005, and 2006 did not locate this plant within the project boundary. Progress Energy states that because the plant does not occur within the project boundary, project operations can not affect it. In its comments on the draft EIS, however, Progress Energy proposes to conduct an initial Yadkin River goldenrod survey 5 years after license issuance then conduct a periodic survey conducted on the same schedule for filing the updated Tillery SMP with the Commission (every 10 years). If the plant has established in new areas or appears to be expanding in range within the project boundary, Progress Energy proposes to develop and implement a Yadkin River goldenrod monitoring plan with surveys conducted every 5 years for the length of the license.

Our Analysis

Yadkin River Goldenrod

The Yadkin River Goldenrod Survey Report (Alcoa Generating, 2006b) indicates that 14 locations within the Projects' boundaries become wetted at flows ranging from 11,000 cfs (location downstream of Falls dam) to 280,000 cfs, with only three locations affected by flows less than 100,000 cfs. A flow event greater than 16,000 cfs would wet the lowest elevation located downstream of Narrows dam. Because the hydraulic capacity of the Narrows development is 10,000 cfs and the Falls development is 8,570 cfs, flows from both existing and proposed project operations, would not affect any known locations of this plant.

High flow events resulting in spills do occasionally inundate many of these locations, with a frequency dependant upon their elevation. Yadkin Project operations, however, have reduced the average annual number of flow events more than 16,000 cfs at Narrows dam from six, under unregulated conditions, to three, under existing conditions. Because scouring flows remove competing vegetation, including noxious weeds, they can be beneficial to the goldenrod; however, the known locations of the plant indicate that it

does not tolerate frequent inundation. It is undetermined whether the reduction in scouring events from project operations has benefited or adversely affected the Yadkin River goldenrod. Proposed Yadkin Project operations would continue to reduce the frequency of high flow events over unregulated conditions; however, the proposed operations would slightly increase the frequency of spill events throughout the Yadkin Project system because they would reduce the storage capacity at High Rock reservoir (see section 3.3.2.2, *Environmental Effects*).

Because the habitat and germination requirements of the Yadkin River goldenrod are still somewhat unknown, the effects of various flows are also unknown. As a result, an RTE species management plan, as proposed by Alcoa Generating, that addresses the effects of the project on the Yadkin River goldenrod would establish a program for population monitoring and identifying resulting actions as specific threats are identified. The measures recommended by FWS, if incorporated as part of the proposed RTE species management plan, would allow Alcoa Generating to continue gathering information on the effects of project operation on this species that it started in the Yadkin River Goldenrod Survey Report. This information would then be applied to identify potential options for creating additional suitable habitat, as recommended by FWS. Furthermore, as threats such as encroaching vegetation or excessive inundation are identified, the measures recommended by FWS would help identify protective actions that Alcoa Generating potentially could implement to address the issue. However, a separate Yadkin River goldenrod management plan, apart from the RTE species management plan, is unnecessary to achieve these results.

Alcoa Generating surveys identified one location of the Yadkin River goldenrod within the Yadkin-Pee Dee River Project boundary just downstream of Falls dam. Progress Energy was not able to locate any plants, however, in subsequent surveys. Although potential Yadkin River goldenrod habitat exists within the Yadkin-Pee Dee River Project boundary, the most suitable habitat is located just downstream of Falls dam in an area that is not affected by Yadkin-Pee Dee River Project operations. The location found by Alcoa Generating during 2004 surveys would only be inundated at flows greater than 74,000 cfs. Flows of this magnitude are very infrequent in the river system. Because the Yadkin-Pee Dee River Project does not affect the Yadkin River goldenrod, the measures recommended by FWS would not be necessary to protect this species from project operations. However, appropriately timed surveys conducted by Progress Energy 5 years after license issuance, then a periodic survey conducted on the same schedule for filing the updated Tillery SMP with the Commission (every 10 years), would identify any new populations that could become established in the project boundary. Additionally, if the plant is located within the project boundary, Progress Energy proposes to develop and implement a Yadkin River goldenrod monitoring plan with surveys conducted every 5 years for the length of the license. Increasing the monitoring frequency if the plant is found within the project boundary would ensure that any project-related effects are identified relatively quickly.

Bald Eagle

Bald eagles have nested at the Yadkin Project along High Rock, Tuckertown, Narrows, and Falls reservoirs and at the Yadkin-Pee Dee River Project along Lake Tillery, the Pee Dee River below Tillery dam, and Blewett Falls reservoir. Both Alcoa Generating and Progress Energy have conducted bald eagle surveys within the Project areas for several years. Survey results indicate successful nesting populations have been established in both Project areas. Although existing populations are nesting successfully, increased recreation and shoreline development could affect future nesting success.

Alcoa Generating currently implements a bald eagle management plan for the Yadkin Project which includes annual nesting surveys to document nesting attempts and success at the project. The bald eagle nest location information has been included in the project's SMP as Conservation Zone land which prohibits development and tree removal. Alcoa Generating, as stated in the license application, intends to continue annual bald eagle nest monitoring. Continuing to monitor would allow updated bald eagle nest location information to be included in the proposed update to the SMP. Alcoa Generating proposes to include the bald eagle in a RTE species management plan, which would consolidate project-wide bald eagle information, monitoring results, and management and protection guidelines for the term of the new license. The proposed RTE species management plan and its provisions would be consistent with FWS's recommendation for Alcoa Generating to conduct annual bald eagle monitoring and provide management provisions for the entire project for the term of the new license. However, creating a separate plan, as opposed to including the provisions in a RTE species management plan, is not necessary for the protection of the bald eagle.

Progress Energy currently implements bald eagle management guidelines and a SMP at Lake Tillery. These measures regulate timber practices and vegetation management around active nest sites. Additionally it proposes a shoreline management policy at the Blewett Falls reservoir, which would protect shoreline areas from development. These shoreline management policies would help protect bald eagles, as development could cause increased human disturbance around nest sites or the cutting of nest, perch, or roost trees. Although Progress Energy proposes to conduct bald eagle survey monitoring within the Yadkin-Pee Dee River Project every 3 years for the length of the new license, it also states it would discontinue the program when the bald eagle is delisted from the state and federal lists. The bald eagle has been delisted from the federal endangered species list and could potentially be removed from the state endangered species list sometime during the term of the new license. The bald eagle management guidelines, Lake Tillery SMP, the Blewett Falls reservoir shoreline management policy, and triennial bald eagle surveys would all be beneficial to the protection of bald eagles. The most appropriate and efficient avenue for implementing the measures (including the triennial bald eagle survey) is to incorporate them into one bald eagle management plan. Developing such a plan would provide a comprehensive way of protecting the bald eagle for the length of the new license. Additionally, placing project lands under restrictive covenant (i.e., land adjacent to Lake Tillery near the Uwharrie River and adjacent to the

Pee Dee River in the Grassy Islands area) would help protect potential bald eagle nesting, perching, and roosting trees.

Yadkin Project Transmission Lines

Two rare plants, Heller's trefoil and Pursh's wild petunia, and one rare animal, timber rattlesnake, are known to occur along the Yadkin Project transmission line corridor. Currently, Alcoa Generating lacks a formal written vegetation management plan for the two transmission line corridors, and performs vegetation management on an as-needed basis. The proposed transmission line corridor management plan would establish vegetation and wetland management objectives. Managing the transmission line corridors to protect known rare species locations and habitat would benefit rare species within the Yadkin Project.

Sediment Removal

Several entities have requested sediment removal from High Rock reservoir. Depending upon the extent and location of this sediment removal, wetland vegetation could be affected.

Sediment has accumulated in High Rock reservoir forming several vegetated islands (see section 3.3.1.2, *Geology and Soils, Environmental Effects*). As sediment has built up in the Yadkin River and High Rock reservoir, vegetation has become established resulting in extensive islands of forested, scrub-shrub, and emergent wetlands. These wetlands provide fish and wildlife habitat to numerous species. Removal of the entire sediment delta, as requested by Rowan County (see section 3.3.1.2), would remove hundreds of acres of valuable wetlands and wildlife habitat, about 60 percent of the wetlands within the High Rock development area. The loss of this amount of wetlands would significantly affect wildlife in the project area. Additionally, the actual removal of sediment is likely to require dewatering which would adversely affect additional wetlands and wildlife habitat around the reservoir. The sediment removal requested by the city of Salisbury would affect a much smaller area than that recommended by Rowan County. Clearing a 100-foot radius around the intake would require the removal of a small portion of the land west of the intake, resulting in some loss of forested and scrub-shrub wetlands. It is likely that an additional small amount of forested wetland would be lost in the removal of sediment 1,000-feet upstream and downstream of the intake. Carolina Sand, Inc.'s request to remove sand from a few designated areas in the reservoir would be unlikely to affect wetlands or wildlife habitat because these areas would likely be in open water areas as opposed to vegetated sediment islands.

Recreation Enhancements

Both Alcoa Generating and Progress Energy propose recreation enhancement measures that could have secondary effects on terrestrial resources. Specifically,

proposed recreation enhancements could result in the disturbance or removal of vegetation and wildlife habitat.

As described in section 3.3.7.2, *Environmental Effects*, Alcoa Generating proposes to improve several existing recreation sites to provide toilet facilities, make them Americans with Disabilities Act (ADA) compliant, and improve portage trails. Additionally, Alcoa Generating would construct a new public recreation site with a swimming area and beach on High Rock reservoir, as well as construct up to 10 campsites throughout the Yadkin Project area. The improvements to existing sites would likely require the removal of only small amounts (less than 1-acre) of vegetation that would not affect wildlife habitat. Construction of the new facilities, however, would likely require the removal of larger amounts of vegetation. Although the specific location of the proposed new public recreation site on the Rowan County side of High Rock reservoir is unknown, it is likely it would require the removal of some shoreline vegetation and wildlife habitat.

Progress Energy proposes to make improvements to the public access areas at Lake Tillery and on Blewett Falls reservoir, as well as upgrade the existing canoe portage at Blewett Falls dam. Additionally, Progress Energy would relocate an unimproved boat access site to Clarks Creek and provide funds to North Carolina WRC to construct a new shoreline public fishing area in Stanly County. The improvements to existing sites would likely require only the removal of small amounts of vegetation that would not affect wildlife. New recreation sites, such as the recommended new boat access site in the high-value Grassy Islands Complex, and new shoreline public fishing area, however, would likely require the removal of larger areas of vegetation and result in the loss of some wildlife habitat. These sites are likely to be located in areas that have current recreational use, which minimizes the effect of the new facilities on wildlife. However, improving these sites would also increase human use and therefore disturbance to wildlife and vegetation in these areas. The proposed restrictive covenant on the Grassy Islands Complex would limit the extent of recreation enhancements in this area and establish vegetative management measures to limit adverse effects on the complex. Five species of RTE birds were located in the Grassy Islands area; however, with the proposed restrictive covenant in place, only minor effects are likely.

3.3.4.3 Unavoidable Adverse Effects

There would continue to be some localized adverse effects on terrestrial wildlife and wetland habitats from the continued operation of both projects under a frequently fluctuating water level regime in some of the reservoirs. Until new vegetation and RTE species management plans are developed and implemented, RTE plant species would continue to be at risk of adverse effects associated with recreational activities, invasive plant encroachment, and current land management practices.

3.3.5 Threatened and Endangered Species

3.3.5.1 Affected Environment

Carolina Heelsplitter

FWS states that the Carolina heelsplitter, a federally listed endangered mussel species, occurs in the Pee Dee River Basin downstream of Blewett Falls dam. Monitoring studies conducted by both Alcoa Generating and Progress Energy, however, did not collect any Carolina heelsplitter (see table 24).

Shortnose Sturgeon

The only federally listed endangered fish species that occurs in the Yadkin-Pee Dee River is the shortnose sturgeon, which currently only occurs downstream of Blewett Falls dam. Progress Energy's studies did not collect any shortnose sturgeon, but South Carolina DNR studied the sturgeon in the South Carolina Coastal Plain portion of the Pee Dee River in 2002 and 2003. South Carolina DNR collected and radio tagged five adult sturgeon and followed their migrations through and after the spring spawning migration. These fish migrated extensively in the lower river and reached as far upstream as RM 158, about 30 miles downstream of Blewett Falls dam. During the non-spawning period, these fish were mostly located in the lower reaches of the river close to the saltwater/freshwater interface in Winyah Bay. Progress Energy also reports that the shortnose sturgeon was documented in the lower Pee Dee River in the 1980s and 1990s.

Schweinitz's Sunflower

The Schweinitz's sunflower (Helianthus schweinitzii), a federally endangered plant, occurs within the Yadkin Project boundary. The sunflower is endemic to North and South Carolina. There are 63 occurrences known in North Carolina, most of them along roadsides (NatureServe, 2007). It is known to occur along roadsides and in power line clearings, old pastures, woodland openings, and other sunny to semi-sunny situations (FWS, 1994). It is generally located in poor, clayey or rocky soils (FWS, 1994). The species has lost much of its native habitat to forest succession due to the elimination of natural disturbances, and to conversion to pine plantations, and urbanization. The sunflower requires fire or other vegetation management to maintain an open canopy. Additionally, land-use conversion and habitat fragmentation, particularly roadwork, has limited its habitat since this species occurs in the vicinity of the rapidly growing metro Charlotte, North Carolina, area (NatureServe, 2007).

Alcoa Generating located one population of the plant on the eastern shore of the river and Falls reservoir during relicensing surveys in 2004. There were two stands. One stand containing five plants in 2004, showed evidence of reproduction and is located on a steep slope with thin, dry soils and a relatively sparse canopy of hickory, oak, and pine. This stand is located in proximity to several trails, including the existing portage trail around the dam. The second stand consisted of about 25 seedlings and two mature

plants, with a sparser canopy of similar plant species and a denser herbaceous community. Both sites contain the invasive exotic vine Japanese honeysuckle; however, it is more abundant at the second stand. This species is not known to occur within the Yadkin-Pee Dee River Project boundary.

3.3.5.2 Environmental Effects

Carolina Heelsplitter

No specific concerns were raised or recommendations made regarding the Carolina heelsplitter, except that the species should be evaluated during project relicensing.

Our Analysis

Although FWS reported that this species may occur in the Pee Dee River, none were collected by Alcoa Generating or Progress Energy during their pre-application surveys. This does not indicate that the species does not occur in the river; rather, it may still be present in small numbers but was missed by the survey efforts. If the species does occur, the most likely locations would be in the riverine reaches downstream of the Tillery and Blewett Falls developments, areas that exhibited the highest species diversity for the freshwater mussel species (see table 24). If the Carolina heelsplitter does occur in these reaches, it would benefit from the proposed instream flows from the Tillery and Blewett Falls developments. Continuous instream flow releases are proposed from both developments, and instream flow studies have indicated that improvements in aquatic habitat would occur, which would benefit both mussel and fish species that occur in the reaches. Thus, we conclude that continued operation of the Yadkin-Pee Dee River Project (where the Carolina heelsplitter likely occurs) is not likely to adversely affect the species, and in fact, would likely improve its habitat compared to existing conditions.

Shortnose Sturgeon

Few specific concerns were raised or recommendations made regarding the shortnose sturgeon, except that instream flow releases should encompass the species' habitat needs. Also, NMFS comments that fish passage facilities designed for the Blewett Falls development should consider possible future fish passage needs for both shortnose and Atlantic sturgeon. Passage of these species, however, is not a management objective at this time.

Our Analysis

The closest recent documented report of the shortnose sturgeon to the projects was 30 miles downstream of Blewett Falls during a South Carolina DNR radio-telemetry study. It is likely, however, that some sturgeon do migrate as far upstream as the project and would be subjected to project operations more so than fish that remain farther downstream. Project operations, however, should have minimal effects on the sturgeon

because of proposed minimum flows, flow adjustment period, and interim ramping rates during the spring spawning period. As we describe in section 3.3.3.2, *Aquatic Resources*, *Environmental Effects*, habitat duration (Index C) for sturgeon spawning and incubation would improve substantially downstream of Blewett Falls as a result of the proposed instream flow regime. Progress Energy also proposes handling protocols for sturgeon and other rare species that may be collected in its trap and truck operation at Blewett Falls. These protocols would help protect these species by minimizing handling stress and mortality, which may occur in a trap and truck operation if specific protocols are not in place. Continued operation of the Yadkin-Pee Dee River Project, as proposed, is not likely to adversely affect the endangered shortnose sturgeon.

Schweinitz's Sunflower

Invasive species such as the Japanese honeysuckle could outcompete the endangered Schweinitz's sunflower. These invasive species, as well as natural succession with native species, could limit sunflower habitat by creating shade and closing vegetative openings. Additionally, human disturbance from trails or vegetation management could affect this species. To address these potential effects, Alcoa Generating proposes to develop an RTE species management plan within 2 years of license issuance in consultation with FWS, North Carolina WRC, and other appropriate federal and state wildlife resource agencies. The RTE plan would address issues regarding the effects of the Yadkin Project or project operations on the bald eagle, Yadkin River goldenrod, and the Schweinitz's sunflower. Alcoa Generating also proposes to develop a transmission line corridor management plan within 2 years of license issuance in consultation with FWS, North Carolina WRC, and other appropriate federal and state agencies. The transmission line corridor management plan would establish vegetation and wetland management objectives for the two project transmission line corridors, as well as outline actions to be taken by Alcoa Generating to manage the corridors in a manner consistent with those objectives.

In its February 8, 2008, letter (letter from G. Ellis, Licensing and Property Manager, Alcoa Generating, Badin, North Carolina, to K.D. Bose, Secretary, FERC, Washington, DC), Alcoa Generating proposes additional conservation measures to protect the Schweinitz's sunflower population within the Yadkin Project boundary. Alcoa Generating proposes to establish a roped off portage trail and post signs to direct the recreating public to stay on the trail while portaging Falls dam, monitor the population on an annual basis, and address other threats to this population through the RTE plan.

FWS states that project transmission line corridors provide openings that are preferred by some protected plant species. Therefore, FWS recommends that some protection and maintenance protocols be developed for maintaining the transmission line corridors, and the protocols should exclude the use of pesticides or other detrimental practices to promote and protect native species. In its November 1, 2007, letter (letter from P. Benjamin, Field Supervisor, Raleigh Field Office, FWS, Raleigh, North Carolina,

to K.D. Bose, Secretary, FERC, Washington, DC), FWS states that, if Alcoa Generating implements the Schweinitz's sunflower protection measures described above in Alcoa Generating's February 8, 2008, letter, FWS would be able to concur with a "not likely to adversely affect" finding by the Commission.

Our Analysis

Direct Effects

Within the Yadkin Project boundary, both known stands of the Schweinitz's sunflower face threats. The northern stand is threatened by human disturbance from trails used for portage around Falls dam. During field surveys, direct effects on this stand from human traffic were not observed; however, the proximity of the plants to trails could limit the expansion of this population, or adversely affect it in the future. The southern stand is located on a ledge, so is more protected from human disturbance; however, this stand is threatened by competition from the invasive Japanese honeysuckle and competition from other shrubs and herbaceous vegetation.

Of the two stands of sunflowers, the northern stand is more vulnerable to trampling, collection, or other recreation-related impacts because of its proximity and accessibility from the canoe portage and other nearby trails. Although this stand is composed of only 5 individual plants, it shows evidence of reproduction while the ledge-bound southern stand with 27 individuals does not. It is not clear what factors, if any, may be inhibiting reproduction in the southern stand, since it reportedly includes two mature individuals. However, protecting both stands would be consistent with the objectives of the Schweinitz's sunflower Recovery Plan, which calls for emergency protective management of known remnant populations (FWS, 1994).

The RTE species management plan proposed by Alcoa Generating would address the effects Yadkin Project operations are having on the Schweinitz's sunflower. Roping off the canoe portage trail and posting signs along the trails adjacent to the northern stand to direct the recreating public to stay on the trails near the northern stand of sunflowers would help to contain recreation-related impacts to a smaller area. Annual monitoring of the population would allow Alcoa Generating to gage recreationists' use of the area and determine, in consultation with FWS, if additional protection is needed. In concert with other conservation efforts, as part of the proposed RTE species management plan, this measure may promote the spread of the sunflower stand along the protected edge habitat within the project boundary.

Both sunflower stands are experiencing competition with Japanese honeysuckle; however, this invasive exotic vine is more abundant and may currently pose a greater threat to the southern stand. Some characteristics of Japanese honeysuckle that are problematic, in terms of coexistence with native herbaceous species such as the Schweinitz's sunflower, include its (a) similar habitat preferences, (b) semi-evergreen nature, (c) twining growth pattern and tendency to climb adjacent plants and other

structures, and (d) typical vigorous growth throughout the growing season (Swearingen et al., 2004; Miller, 2003).

Both the sunflower (FWS, 1994) and Japanese honeysuckle prefer open habitat, full sun conditions (Miller, 2003), and both can tolerate nutrient poor, compacted soils (FWS, 1994). The sunflower appears to lose vigor when heavily shaded or growing in densely vegetated areas. This loss in vigor is thought be a result of insufficient access to light, water, and nutrients (FWS, 1994). Regular ecological disturbances such as fire, tree falls that create gaps in the forest, or mowing are needed to maintain open habitats. While Japanese honeysuckle could thrive after any of the above disturbances, the sunflower is sensitive to mowing and it is thought that regular controlled burning could be a more effective means of maintaining open habitat and reducing competition with other vegetation (FWS, 1994).

Many native herbaceous species, including the sunflower, are dormant during the winter. In contrast, semi-evergreen plants like Japanese honeysuckle may keep their leaves and continue to grow throughout the year, especially in areas with relatively mild winters. This characteristic constitutes a competitive advantage over the sunflower because the honeysuckle will have a head start on canopy coverage and nutrient consumption at the beginning of each growing season.

In the spring and summer the competition intensifies as Japanese honeysuckle uses its twining growth pattern to climb other plants and structures in its vicinity, as it seeks the full-sun conditions that it prefers. Japanese honeysuckle could use the stems of the sunflowers occurring in the Yadkin Project area, as well as the proposed roped fences along the trail and recreation signage, as a lattice for climbing. If the roped fences or signs are placed too close to the sunflower stands, vines may be able climb them and then reach the sunflowers' long branching stems from the air. Any Japanese honeysuckle vines growing on the sunflower individuals would likely decrease its productivity by shading or bending the sunflower's narrow leaves and causing the stems to fall or bend towards the ground under the added weight.

The vigorous growth of Japanese honeysuckle alone poses a threat to the sunflower, especially to the sunflower's seedlings, because they grow at a slow rate under some natural field conditions and the mature plants do not flower until late in the growing season (FWS, 1994). The sunflower's flowering season is from late August/mid-September to frost (FWS, 1994; North Carolina DNR, 2008), which puts it at a disadvantage, because Japanese honeysuckle vines may have already enveloped individual plants or the entire remnant stands by August. This smothering could affect the sunflower in a manner similar to mowing, which is known to cause stress and limit reproduction in stands occurring along highways in North and South Carolina because it preempts individuals from flowering and producing fruits (FWS, 1994).

Recovery of the Schweinitz's sunflower requires active management at the sites of the remaining stands (FWS, 1994). The proposed annual monitoring of the two sunflower stands at the Yadkin Project would help to identify any potential detrimental

effects associated with recreational activities and the encroachment of Japanese honeysuckle, as well as any competition with other vegetation. Additionally, the proposed RTE species management plan could establish protocols for addressing impacts related to recreation and for treating Japanese honeysuckle and other vegetation growing in proximity to the sunflower stands, the rope fences, trail signs, and any other nearby structures. If such protocols are followed diligently throughout the term of any new license, the proposed conservation measures would provide adequate protection for, and likely encourage the spread of, the Schweinitz's sunflower stands at the Yadkin Project.

Indirect Effects

Although this species is not currently known to occur in either of the two project transmission line corridors, the open habitat found there could provide potential future habitat for the Schweinitz's sunflower. Therefore, the proposed transmission line corridor management plan, which we expect to include protection and maintenance protocols recommended by FWS, also could benefit the overall health of the Schweinitz's sunflower.

The proposed measures at the Yadkin Project would benefit the Schweinitz's sunflower by monitoring and protecting known populations from project-related recreation and invasive species. Therefore, issuing a new license for the continued operation of the Yadkin Project would be not likely to adversely affect the Schweinitz's sunflower. The Yadkin-Pee Dee River Project would have no effect on the Schweinitz's sunflower.

3.3.5.3 Unavoidable Adverse Effects

Any Carolina heelsplitter mussels or shortnose sturgeon that may occur in the area would still be exposed to habitat fragmentation due to the presence of the dams, and fluctuations in habitat quality due to variable flow releases from the dams. Until new vegetation and RTE species management plans are developed and implemented, RTE species would continue to be at risk of adverse effects associated with recreational activities, invasive plant encroachment, and current land management practices.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Area of Potential Effects

The APE for relicensing of a hydroelectric project encompasses all the lands affected by project operations including lands inundated by the projects' reservoirs, the shoreline of the reservoirs, access areas required by the licensee, the land surrounding the project structures, such as the powerhouse(s) and dam(s), and other lands within the project boundary. The APE includes lands permanently inundated by the project, areas subject to erosion due to project operations, and lands containing recreational areas

required by the project license. The APE of the Yadkin Project, developed in consultation with the North Carolina State Historic Preservation Officer (SHPO), is specifically described as all lands within the project boundary and areas within 100 feet of the normal full-pool elevation of each of the project reservoirs. The APE of the Yadkin-Pee Dee River Project, also developed in consultation with the SHPO, is specifically described as the licensed project boundary.

Archaeological Resources

The APE of the Yadkin Project contains one site (the Talbert Site) eligible for inclusion in the National Register. This site is located on the eastern shore of Narrows reservoir. Archaeologists believe that prehistoric use of this site may be associated with the nearby Hardaway Site (31 St 4). The latter, also located on Alcoa Generating property but outside the project's APE, was designated a National Historic Landmark for its contribution to definition of prehistoric cultural sequences for the Paleo-Indian and Early Archaic periods, and for its artifacts, which have aided the dating of sites of similar age throughout the eastern United States.

At the request of the U.S. Department of Agriculture, Forest Service (Forest Service), in 2005, Alcoa Generating commissioned archaeological field investigations at four locations along the Narrows Reservoir at the interface with Uwharrie National Forest. This archaeological survey, conducted in consultation with the Forest Service, SHPO, and Catawba Indian Nation, relocated three previously recorded archaeological sites and identified one new site. Of the four sites examined in this study, one site in the area designated Area C was determined eligible for the National Register due to its size, diversity and density of materials and artifact types. Intact soils also suggest the potential for intact subsurface deposits. The other three sites were evaluated as not eligible for the National Register.

In association with development of its SMP, Alcoa Generating developed a cultural probability model to predict where archaeological sites are most likely to exist in the APE of the Yadkin Project. The model, developed in consultation with the SHPO, combined existing site data with generalized site characteristics to classify all project shorelines into archaeological probability zones. The model also identified those shoreline areas that have been developed or otherwise disturbed. Alcoa Generating uses the resulting Cultural Resources Probability Zone Maps in its management of the project shorelines.[43]

The Yadkin-Pee Dee River Project APE contains a portion of the National Register-listed Doerschuk Site (31 Mg 22). Occupied by Native Americans from before

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[43]In addition to the project boundary, the Cultural Resources Probability Zone maps include areas within 100 feet of the normal full pool elevation of each of the four project reservoirs.

7000 BC until the 18th century, it yielded type materials that contributed to the definition of prehistoric cultural sequences for several Archaic and Woodland complexes.

In 2003, Progress Energy began development of an archaeological sensitivity model for use in management of shoreline recreation and development at the Blewett Falls and Tillery developments. This model, prepared in consultation with the SHPO and Catawba Indian Nation, compiled information on known archaeological resources within approximately 650 feet of the project shorelines to identify and map specific locations and areas to be considered sensitive for archaeological resources. Thirty-six recorded sites were found to lie wholly or in part within the APE; some 250 additional sites lay outside the APE but were within the model's study area. Although many of the site forms for these resources were incomplete or inaccurate, the preparers of the model were able to determine that most of the previously recorded prehistoric sites consisted of small upland lithic scatters, while historic-period sites generally consisted of former house or tenant farm locations with poor preservation of archaeological materials.

The SHPO and Catawba Indian Nation commented on the draft Archaeological Sensitivity Report in 2005. Progress Energy revised the report to address their comments, and filed the final report with its application in 2006.

Historical Resources

At the Yadkin Project, the Narrows Dam and Power Plant Complex was listed in the National Register in 1983 as part of the Badin Multiple Resource Area. The listed complex includes not only the existing Narrows dam and powerhouse, but also foundations of the original L'Aluminum Francais powerhouse (early 1910s).

Alcoa Generating commissioned National Register evaluations of project facilities in association with its application for new license. The National Register-eligibility report was prepared in consultation with the SHPO, Trading Ford Historic District Preservation Association, Badin Historic Museum, and the Forest Service. This report concluded, and the SHPO concurred, that the Yadkin Project facilities at the Falls, High Rock, and Tuckertown developments are eligible for the National Register for their association with North Carolina industrial development and their representation of 20th century hydroelectric power engineering and construction. This study also included a cultural landscape assessment within the project boundary, from the Beard's Bridge ruins in the Trading Ford vicinity south to the Falls development. This portion of the study examined properties 50 years or older along the shoreline or readily visible from the shoreline. As a result of the cultural landscape assessment, the following properties in the APE are eligible for inclusion in the National Register:

Whitney Dam and Canal, c. 1900—a granite dam and canal associated with an unsuccessful attempt to develop the Narrows region for industrial purposes

L'Aluminum Francais area, 1910s—a railroad line, sites of workers' housing and foundations of a large aluminum smelter and support buildings that lie outside the boundaries of the National Register-listed Narrows Dam and Power Plant Complex but

are historically and functionally associated with the L'Aluminum Francais venture here in the early 20th century.

Bald Mountain Quarry Conveyor Ruins, early 20th century—remains of the conveyor and loading buildings from a large quarrying enterprise that produced slate and gravel commercially for many decades, and supplied stone for High Rock dam and powerhouse.

Section of Trading Ford Road—an 0.08-mile section of road lying west of the Duke Steam Plant along the southern shoreline of High Rock reservoir; this is a clearly defined section of a historic road originally used by Native Americans and subsequently as a major Euro-American settlement and transportation route.

The Trading Ford area lies at the north end of High Rock reservoir along the Yadkin River. By accidents of geology and hydrology, this was a place where the Yadkin River was fordable. First used by Native Americans, the "trading ford" was adopted by Euro-Americans to their own various transportation needs over time, with ferries and then bridges for roads, highways, and railroads spanning the river on one of North Carolina's oldest and most important transportation routes. Despite its centuries of use, however, the Trading Ford area, as a whole, has never been systematically surveyed for cultural resources. Instead, overlapping portions of the area have been investigated at various times, but chiefly in association with specific projects, such as bridge construction, railroad yard construction, and relicensing of the Yadkin Project.

In association with the Federal Highway Administration's proposed replacement of the I-85 bridge over the Yadkin River, the North Carolina Department of Transportation surveyed a portion of the Trading Ford area. Two resources from that survey, the 18-span concrete arch Wil-Cox Bridge (US 29/70 Bridge No. 1) (1922), and the partial remains of Civil War-era fortification known as Camp Yadkin or Fort York, were determined eligible for the National Register. Asked to review information about four other resources surveyed by North Carolina Department of Transportation (Trading Path Ford and Roads; Yadkin Ford and Ferry; Greene's Crossing at the Trading Ford; and Battle at Camp Yadkin site), the Keeper of the National Register in 2004 responded that based on the information presented, the four sites are not eligible for listing under criterion A, B, or C, and that there was insufficient information to determine whether any of these four resources were eligible for the National Register under criterion D. In 2005, however, consultations between FHWA and the SHPO resulted in a consensus determination of eligibility for a Yadkin River Crossings Historic District composed of seven resources: the previously mentioned Wil-Cox Bridge and Camp Yadkin, plus the Beard's Bridge/Piedmont Bridge Toll Bridge site, US 29/70 Bridge No. 2, North Carolina Railroad Bridges 1 and 2, and Trading Path Road Trace. With the exception of Fort York or Camp Yadkin, all of these contributing elements of the Yadkin River Crossings Historic District are located wholly, or in part, within the Yadkin Project's APE.

The cultural landscape survey conducted in association with relicensing of the Yadkin Project recommended a 1.5–mile section of the Yadkin River area as a potentially

eligible historic district, extending from Beard's Bridge to the site of the Trading Ford, but provided neither possible district boundaries nor comprehensive enumeration of contributing elements. Despite the limits of that survey, and of surveys in the Trading Ford area in general, the collective record indicates that the Trading Ford area remains sensitive for cultural resources.

No historical resources in the APE of the Yadkin-Pee Dee River Project have been previously listed in, or determined eligible for, the National Register. Progress Energy commissioned National Register evaluations of project facilities in association with its application for new license. The National Register-eligibility report was prepared in consultation with the SHPO and filed with the application in 2006. This report concluded, and the SHPO concurred, that the project facilities at both the Lake Tillery and Blewett Falls developments are eligible for the National Register, for their association with hydroelectric development in North Carolina.

Traditional Cultural Properties

Although traditional cultural properties have not been formally recorded in either project's APE, both Alcoa Generating and Progress Energy have invited interested Native American tribes to participate in the relicensing process.

Alcoa Generating consulted with the Catawba Indian Nation in development of its cultural probability model for project shorelines and during the archaeological survey of four areas on Forest Service land on Narrows reservoir. The Catawba Indian Nation expressed interest in archaeological site management, management of inadvertent discoveries of human remains or Native American burials, artifact curation, endangered flora and fauna, the Trading Ford area, and development of the HPMP.

Progress Energy has consulted, and will continue to consult, with the Catawba Indian Nation (as well as with the SHPO) regarding the archaeological sensitivity model, integration of the model into its SMPs, and development of an HPMP. Progress Energy also contacted the Eastern Band of the Cherokee Indians. On September 11, 2006, the Eastern Band of Cherokee Indians' Tribal Historic Preservation Office filed a letter stating that both Projects are outside their traditional, aboriginal territory. Therefore, they defer all section 106 consultation rights to the Catawba Indian Nation.

3.3.6.2 Environmental Effects

Alcoa Generating proposes to develop, in consultation with the SHPO; Forest Service; Catawba Indian Nation THPO; Badin Historic Museum, Inc.; and other interested parties, an HPMP for the Yadkin Project, which would include details of any specific survey or salvage measures recommended by the SHPO, agencies, or the Catawba Indian Nation. The HPMP would be filed with the Commission within 1 year of license issuance. Alcoa Generating also proposes to update its cultural probability zone maps to incorporate new information on significant historic sites and cultural landscapes identified during the relicensing process. Alcoa Generating also proposes to revise the

project's SMP to specifically require a review of cultural landscapes when a cultural resource review is required under the SMP.

For the Yadkin-Pee Dee River Project, Progress Energy proposes to integrate the archaeological sensitivity model into either the proposed HPMP and/or the existing SMP, as needed, during section 106 consultation for the development of the HPMP. Progress Energy also proposes to develop and file with the Commission separate HPMPs for the Lake Tillery and Blewett Falls developments within 12 months of license issuance. Each HPMP would specify the historic properties protection, mitigation, and enhancement measures to be implemented over the term of the new license.

By letter dated November 1, 2006, Alcoa Generating requested comment from the SHPO, Catawba Indian Nation, Forest Service, Trading Ford Historic District Preservation Association, and Badin Museum regarding its proposed APE and potential effects of continued project operation on the contributing elements of the National Register-eligible Yadkin River Crossings Historic District that lie within its proposed APE. The SHPO, Catawba Indian Nation, and Badin Museum had no objections to the proposed APE, and generally agreed, as did Forest Service and the Trading Ford Historic District Preservation Association, that the project would not adversely affect elements of the Yadkin River Crossings Historic District. The Forest Service recommended that the APE include the actual limits of the lake at full level and all facilities and roads, all areas with evidence of use impacts, all areas within 300 feet beyond full pool, and all portions of archaeological sites for which some part of the site lies within these areas. The Trading Ford Historic District Preservation Association recommended that the APE include whatever areas flood with a "reasonable degree of frequency" (not further defined), and also include Alcoa Generating- owned and -managed recreational areas, game lands, and other public access areas.

By letter to the Commission, filed May 20, 2005, the Trading Ford Historic District Preservation Association also expressed its opinion that the cultural resources studies conducted by Alcoa Generating have not fully identified all properties in the APE that may be eligible for the National Register.

Our Analysis

Continued operation of the Yadkin and Yadkin-Pee Dee River Projects would maintain the historic facilities at both projects in productive use for the purpose for which they were originally designed and built, and would therefore, be beneficial. However, operating the Projects under the protections afforded by section 106 does not ensure that there would be no adverse effects. Adverse effects could occur to licensed historic project features due to repairs and modifications that may be necessary during the course of project operation. Also, adverse effects could inadvertently occur during routine daily activities at project facilities.

Continued project operations, including both ongoing and proposed recreational activities, could affect archaeological resources at both the Yadkin and Yadkin-Pee Dee

River Projects. Ground disturbance in association with construction and/or maintenance of access roads and recreational facilities could adversely affect any archaeological materials present at those locations. Additionally, public use of project lands and waters presents the potential for inadvertent or purposeful damage or destruction of archaeological resources. Significant undiscovered prehistoric and/or historic-period archaeological resources may exist along the shorelines of any of the Projects' reservoirs, which could be adversely affected by future changes in project operation or by project-related activities. On the other hand, applicant-proposed restrictions on reservoir fluctuations could benefit cultural resources, including but not limited to resources in the Trading Ford area, by reducing potential for erosion of shorelines containing such resources.

The Yadkin-Pee Dee Settlement includes measures that could affect cultural resources. For example, Progress Energy's shoreline management practice for Blewett Falls reservoir would prohibit private access, except normal pedestrian access, to the lake across project lands except at designated public access areas. In addition, for conservation and stream protection purposes, Progress Energy would place restrictive covenants on certain parcels of undeveloped land owned by Progress Energy adjacent to project waters, and would also donate or lease selected parcels of land to the state of North Carolina.

Programmatic Agreement and Historic Properties Management Plan

Because issuing licenses for the Projects could adversely affect historic properties included in, or eligible for inclusion in, the National Register, the development and implementation of an HPMP for each project, in consultation with the SHPO, would ensure that adverse effects on historic properties arising from project operations or project-related activities over the term of a new license would be mitigated, lessened, or avoided. To resolve any potential adverse effects arising from license requirements, the HPMPs for each project would include principles and procedures to address the continued use and maintenance of properties that are listed or may be eligible for listing on the National Register; principles and procedures for ensuring that significant archaeological resources are identified, and any adverse effects arising from project operations resolved; as well as principles and procedures to respond to accidental discovery of cultural resources during project operations. Such principles and procedures would ensure that cultural resources would be afforded proper treatment and, as appropriate, protection, over the term of the license.

In anticipation of license issuance, the Commission plans to execute separate programmatic agreements (PAs) for the Yadkin Project and the Yadkin-Pee Dee River Project with the SHPO, and invite the Advisory Council on Historic Preservation to participate. The Commission would invite Alcoa Generating, the Forest Service, the Catawba Indian Nation, Trading Ford Historic District Preservation Association, and Badin Historic Museum to be concurring parties to the PA for the Yadkin Project. Similarly, the Commission would invite Progress Energy and the Catawba Indian Nation

to be concurring parties to the PA for the Yadkin-Pee Dee River Project. Each PA would require the licensee to develop and to implement its HPMP. If a license is ultimately issued to either or both applicants, the applicable PA(s) would be incorporated into the respective license(s) by reference.

Regarding effects of the Yadkin Project (particularly, but not limited to, the effects on the Trading Ford area), the proposed APE properly encompasses those lands in which adverse effects on historic properties could be reasonably attributable to project operations or project-related activities (e.g., lands that may be potentially flooded by project operations or lands used for recreational purposes). If any previously unidentified properties or effects are discovered, the HPMP would contain procedures to lessen, avoid, or mitigate for adverse effects, if any occurs.

Land Conveyance

As noted in section 3.3.8, *Land Use and Aesthetics*, under the Yadkin-Pee Dee Settlement, Progress Energy would donate and lease certain lands owned by Progress Energy to the state of North Carolina. None of these lands are located within the existing Yadkin-Pee Dee River Project, and the Commission has no jurisdiction over disposition of land outside the licensed project's boundary.

3.3.6.3 Unavoidable Adverse Effects

None.

3.3.7 Recreational Resources

3.3.7.1 Affected Environment

Regional Recreation Resources

Recreational resources in the region provide a full range of activities, including boating, canoeing, swimming, fishing, water sports, hiking, camping, hunting, biking, horseback riding, and nature viewing. The lakes and reservoirs in the region, which include the project reservoirs, provide a variety of recreational opportunities and varying levels of developed facilities for camping and day-use activities. Paved roads and boat launches in the area provide opportunities for motorized boat use. The varying physical characteristics of the area provide for diverse recreational opportunities.

The Uwharrie National Forest, totaling 50,189 acres, is located along portions of the eastern shoreline of the Narrows reservoir and extends south to the northeast of the Tillery development, which is part of the Yadkin-Pee Dee River Project. This area provides a variety of recreational opportunities such as camping, fishing, hunting, mining, off-road vehicle areas, mountain biking, and more than 50 miles of hiking trails. There are more than 120 camp sites at designated areas, and primitive camping is permitted anywhere in the national forest, except where no camping is posted. The Uwharrie National Forest hosts more than 240,000 visitors yearly.

The Pee Dee National Wildlife Refuge, totaling 8,443 acres, is located between Tillery and Blewett Falls, in Anson and Richmond counties. The goals of the refuge currently include resource protection, habitat restoration, resource management, environmental education and interpretation, and wildlife recreation. Public use recreation opportunities include wildlife viewing, hiking, and hunting. There is a 0.25-mile ADA-accessible nature trail, a 3-mile nature trail, and a 2.5-mile interpreted wildlife drive. Fishing is open from March 15 to October 15 on six of the ponds within the refuge boundaries, Brown Creek, and the Pee Dee River. Largemouth bass, bluegill, crappie, and catfish are some popular species of interest. In addition to fishing, the refuge offers a hunting season from early September to late February. A free permit is required for hunting mourning doves, squirrels, raccoon, quail, rabbit, and deer by archery. A special quota permit is required for youth deer hunts and hunting deer with firearms.

The Yadkin-Pee Dee River Canoe Trail is a 230-mile river (water) trail on the Yadkin and Pee Dee rivers that extends from Wilkesboro, North Carolina, to the South Carolina border. The 230-mile trail has 41 access points and passes through all six of the project reservoirs, as well as free-flowing sections of the Yadkin and Pee Dee rivers. At each impoundment, there is a portage trail. The Yadkin-Pee Dee River Trail map lists 31 of the inventoried public recreation areas on the Yadkin Project reservoirs as either providing boat access or other facilities (bathroom, picnic tables, camping). At each public recreation area, a Yadkin-Pee Dee Lake Project River Canoe Trail sign identifies the area as part of the water trail. The Pee Dee River Canoe Trail, located within the southern leg of the larger Yadkin-Pee Dee River Canoe Trail, begins at the Lake Tillery boat access at Morrow Mountain State Park in Stanly County and ends at the Blewett Falls dam between Anson and Richmond counties. The journey is a 37-mile paddle with several side rivers that provide a number of interesting variations and trip options.

Morrow Mountain State Park is located in the northwestern section of Lake Tillery, outside the Yadkin-Pee Dee River Project boundary. The park is about 4,742 acres and offers recreational opportunities including boating, fishing, camping, and hiking. No hunting or trapping is permitted inside park boundaries. The facility has a boat ramp, boat docks, parking, and boat or canoe rentals at the end of the park road. There are more than 100 campsites for tents and recreational vehicles with restrooms, showers, and pump-out facilities. Primitive camping is available via a 2-mile hike from the park office. The Morrow Mountain State Park has more than 15 miles of trails including to the top of Morrow Mountain. This park also has a swimming pool, equestrian trails, picnic areas, a natural history museum, and an outdoor amphitheater.

The riverine reach between Lake Tillery and Blewett Falls was rated by the National Park Service as having an outstanding remarkable value designation for recreation. The National Park Service designation indicates that the recreation opportunities are, or have the potential to be, popular enough to attract visitors from throughout or beyond the region or are unique or rare within the region.

Project Recreation Facilities

At the Yadkin Project, there are 40 major public recreation access sites, including 26 boat ramps, 15 boat docks, 40 bank fishing areas, 15 picnic areas, fishing piers, swimming areas, and campgrounds. The High Rock and Falls reservoirs currently have no fully accessible public recreation access areas. The Tuckertown reservoir currently has one fully accessible recreation area, Flat Creek boat access area, and Narrows reservoir currently has three fully accessible recreation areas: Circle Drive boat access area and the Uwharrie National Forest Cove boat landing and Kings Mountain Point day-use area (see figure 16).

Alcoa Generating identified five commercial recreation areas within the project, including four on High Rock reservoir: High Rock Marina and Campground, the High Rock Boat Dock Marina, Tamarac Marina, and the High Rock Boat and Ski Club; and one on the Narrows reservoir, Lake Forest Campground/Fish Tales Marina. The five commercial areas provide four marinas, including five boat ramps and five boat docks, one fishing pier, one campground, and two picnic areas. As commercial recreation areas, these sites are generally available to the public for a fee.

There are numerous privately owned and operated recreation facilities located around the project reservoirs, including private boat clubs, campgrounds, day use areas and facilities for private organizations, and private facilities that are maintained by homeowner associations. There are also numerous private individual and shared recreation facilities on High Rock and Narrows reservoirs, composed primarily of individual piers. According to permit records, Alcoa Generating identified about 2,700 private piers on High Rock reservoir and about 1,084 on Narrows reservoir. While private individual boat houses and boat ramps are no longer allowed under the Yadkin SMP, some of the older shoreline properties already have these facilities.

Alcoa Generating identified 41 dispersed recreation sites (where recreation occurs outside the boundaries of established public recreation area) that are receiving routine recreation use, including: five on Falls reservoir, 12 on Narrows reservoir, 12 on Tuckertown reservoir, and 12 on High Rock reservoir. At these areas, bank fishing and camping are the only activities known to occur.

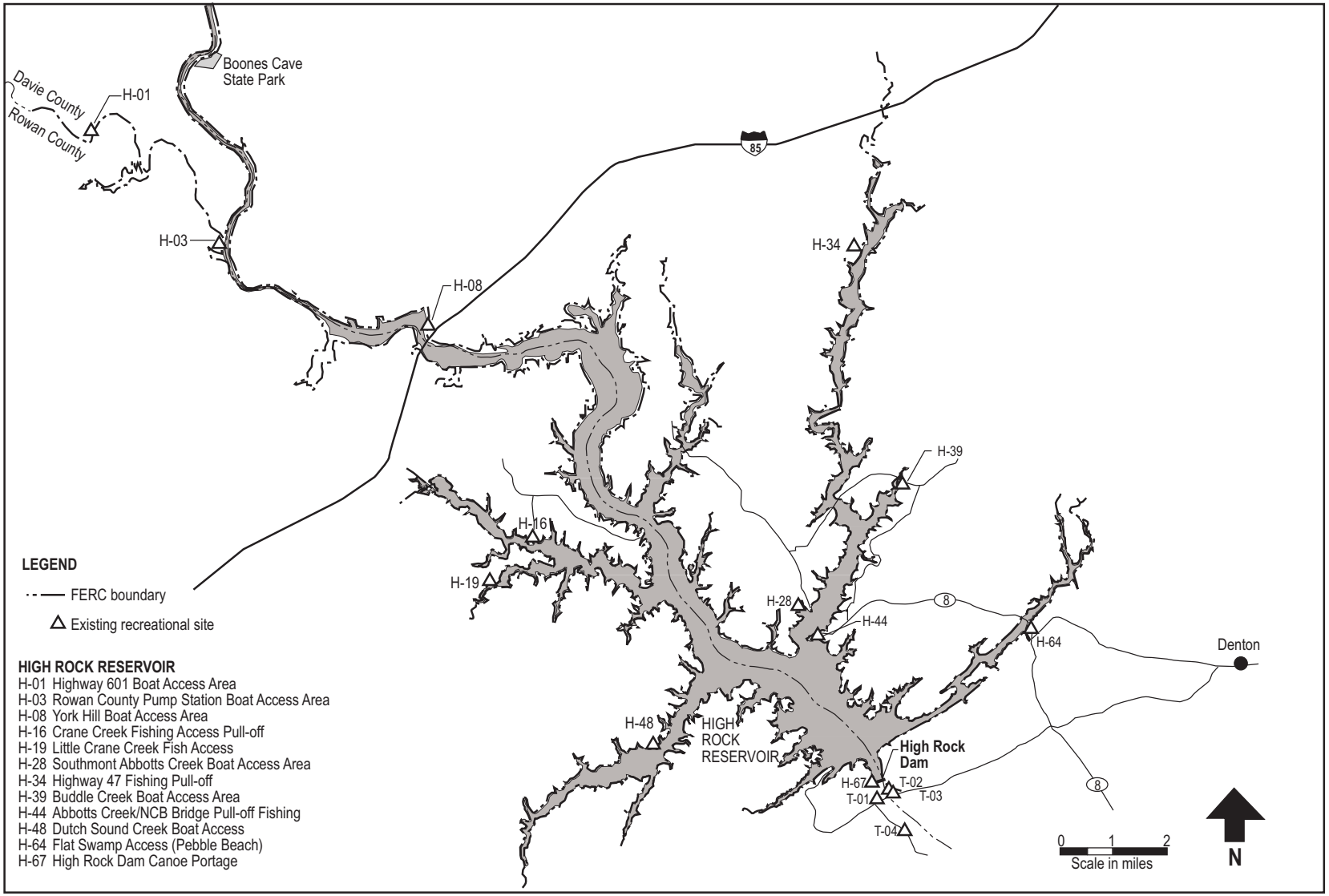

Figure 16. Yadkin Project (P-2197) recreation facilities (page 1 of 2). (Source: Alcoa Generating, 2006a)

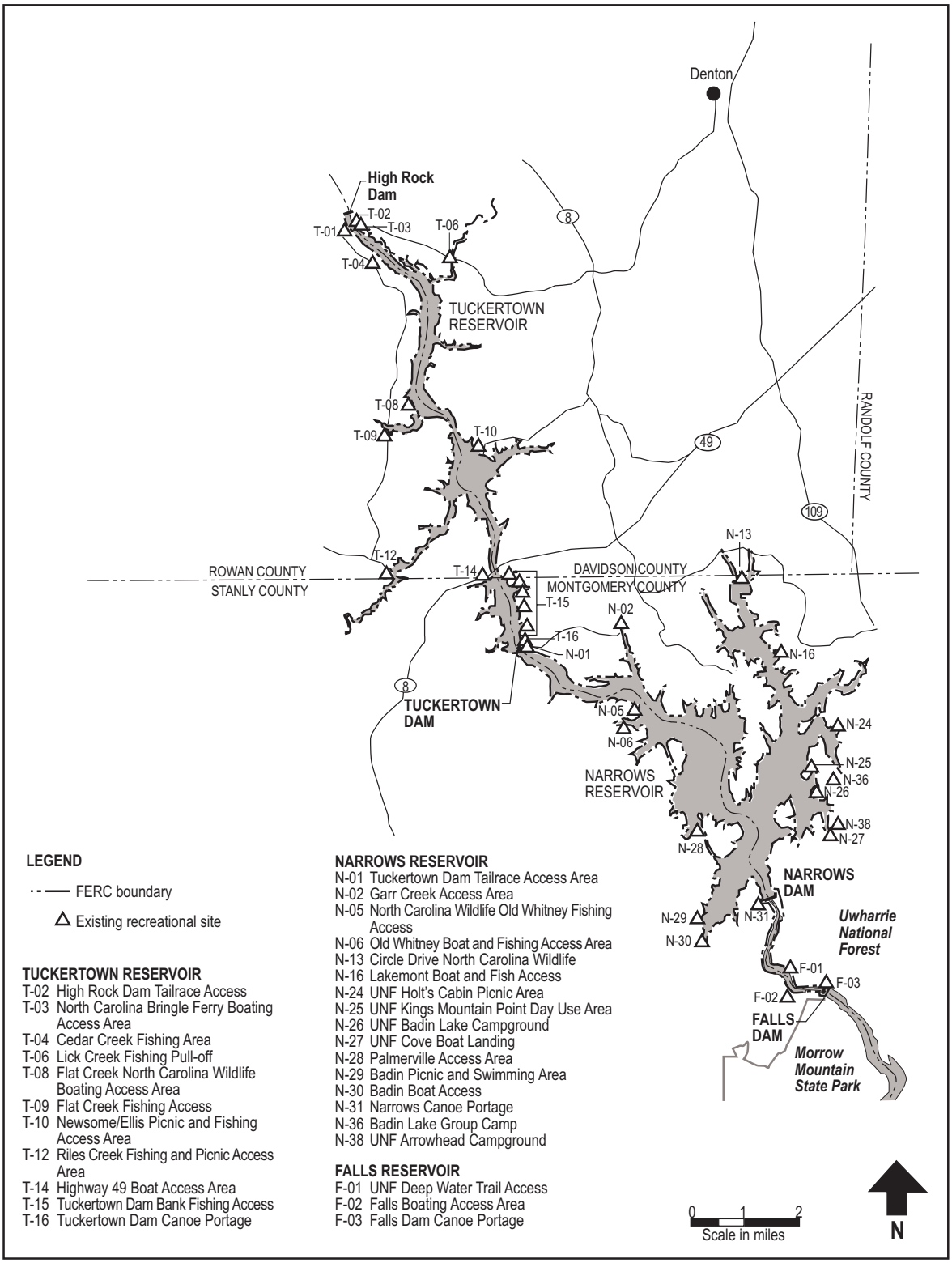

Figure 16. Yadkin Project (P-2197) recreation facilities (page 2 of 2). (Source: Alcoa Generating, 2006a)

On High Rock reservoir there are 10 public and 4 commercial recreation areas that provide direct access to the reservoir (figure 16 and table 39). There are major recreation facilities at seven of these public recreation areas, including eight boat ramps, four boat docks, two swim areas, and four picnic areas. Crane Creek fishing pull-off and Abbotts Creek/NC 8 bridge pull-off have historically been reported in FERC Form 80 Reports, but are currently considered closed due to safety concerns associated with vehicular/pedestrian interactions. The Eagle Point Nature Preserve, a 200-acre area, on High Rock reservoir includes about 100 acres of publicly owned land and more than 80 acres of land leased from Alcoa Generating. The preserve has several recreational opportunities such as hiking trails, canoe access, and wildlife observation points.

Alcoa Generating owns the majority of the project-related recreational facilities; however, several sites are managed by North Carolina WRC. Alcoa Generating, as part of the recreation facility inventory, assessed the boat ramp accessibility related to water elevations at the public recreation access areas at High Rock reservoir. Table 40 provides a summary of this assessment.

Table 39. Recreational facilities at the Yadkin Project (P-2197). (Source: Alcoa Generating, 2006a; and staff)

Site Name	Facilities
High Rock Reservoir	
Highway 601 Access Area	concrete boat ramp and small parking area part of the Yadkin-Pee Dee Trail
Rowan County Pump Station (Rowan County)	concrete boat ramp and small parking area 150 feet of shoreline for fishing part of the Yadkin-Pee Dee Trail
York Hill Boat Access	large gravel parking lot and two concrete boat ramps shoreline fishing access area part of the Yadkin-Pee Dee Trail
Crane Creek Fishing Access Pull-off (North Carolina Department of Transportation)	small pull-off bank fishing area
Little Crane Creek Fishing Access	small parking area and two gravel boat ramps 750 feet of shoreline for bank fishing part of the Yadkin-Pee Dee Trail
Southmont Boat Access Area	large parking area 2 boat ramps and a boat dock picnic tables and bank fishing access part of the Yadkin Pee Dee Trail

Site Name	Facilities
Highway 47 Fishing Pull-off	small pull-off parking area 700 feet of shoreline access for bank fishing
Abbotts Creek/NC 8 Bridge Pull-off	Closed due to safety reasons
Buddle Creek Boat Access Area	Boat ramp, boat dock, picnic facilities a swim beach and shoreline fishing large parking area part of Yadkin-Pee Dee River Trail
Dutch Second Creek Boat Access[a]	1 boat ramp and boat dock shoreline fishing access and a parking area access to the Yadkin-Pee Dee Trail
Flat Swamp Boat and Swim Access	1 boat ramp and boat dock a swim area, beach area, and picnic area bank fishing access and large parking area access to the Yadkin-Pee Dee Trail
High Rock Dam Canoe Portage	Path located on the west side of the dam
Tuckertown Reservoir	
High Rock Dam Tailrace Access (Rowan County)	a picnic area, shoreline fishing access area a large parking area access to the Yadkin-Pee Dee Canoe River Trail
High Rock Dam Tailrace Access (Davidson County)	pull-off parking area More than 1,000 feet of bank tailrace fishing access
Bringle Ferry Boat Access[a]	boat ramp, boat dock, and shoreline fishing area a parking area at this site. part of the Yadkin Pee Dee River Trail.
Cedar Creek Fishing Pull-off	pull-off parking area shoreline fishing area
Lick Creek Fishing Pull-off	pull-off parking area shoreline fishing access
Flat Creek Boat Access Area[a]	2 boat ramps, a boat dock, shoreline fishing access, and a parking area
Flat Creek Fishing Access Area[a]	shoreline fishing area, small picnic area, and a small parking lot

Site Name	Facilities
Newsome Road Access	2 boat ramps, a picnic area, shoreline fishing access, and a parking area access to the Yadkin-Pee Dee Trail
Riles Creek Recreation Area	1 picnic area, shoreline fishing access, and a parking lot part of the Yadkin Pee Dee Trail
Highway 49 Boat Access Area	2 boat ramps, 2 boat docks, and large parking lot part of the Yadkin-Pee Dee Trail
Tuckertown Pull-off Fishing Access	4 separate shoreline fishing access sites
Narrows Reservoir	
Tuckertown Dam Canoe Portage	a well marked and maintained trail with the takeout approximately 100 yards before the dam leading to the Tuckertown Dam Tailrace Fishing Access Area
Tuckertown Dam Tailrace Access	new improved cement fishing area, tailwater fishing access, and 2 small parking lots
Garr Creek Access Area	2 boat ramps, shoreline fishing area, and a small parking area part of the Yadkin-Pee Dee Trail
Old Whitney Fishing Pier[a] (North Carolina WRC)	fishing pier, picnic area, shoreline fishing area, and a large parking lot
Old Whitney Boat Access Area	boat ramp, boat dock, picnic area, shoreline fishing area, and large parking area part of the Yadkin-Pee Dee Trail
Circle Drive Boat Access Area[a] (with North Carolina WRC)	3 ADA-accessible boat ramps and 3 ADA-accessible boat docks shoreline fishing area and a large parking area part of the Yadkin-Pee Dee River Trail
Lakemont Access Area[a] (North Carolina WRC)	2 concrete boat ramps and gravel parking area part of the Yadkin-Pee Dee River Trail
Holt's Cabin Picnic Area (Uwharrie National Forest)	shaded picnic area, shoreline fishing access, and a parking area
Kings Mountain Point Day Use Area (Uwharrie National Forest)	small parking area, shoreline fishing area, and a walk-in fishing pier

Site Name	Facilities
	There is also some primitive camping available at King's Mountain Point
Badin Lake Campground (Uwharrie National Forest)	Provides access to the Badin Lake Hiking Trail and part of the Yadkin-Pee Dee River Trail, 34 campsites, 3 bathhouses
Cove Boat Landing (Uwharrie National Forest)	Part of the Yadkin Pee Dee River Trail, parking lot, boat launch, trash bins
Palmerville Access Area	1 small picnic area and 1 gravel boat ramp limited parking area Part of the Yadkin-Pee Dee River Trail
Badin Lake Swim/Picnic Area	Swim beach, picnic areas, shoreline fishing access, a large parking area part of the Yadkin-Pee Dee River Trail
Badin Boat Access	1 boat ramp and 2 boat docks several picnic areas, a shoreline fishing access, a large parking area included in the Yadkin Pee Dee River Trail
Narrows Dam Canoe Portage	A steep and narrow trail
Badin Lake Group Camp	Three different sites including facilities such as tent pads, picnic tables, grills, benches, lantern poles, water spigots, restrooms, trash receptacles, an information board, and a well house
Arrowhead Campground (Uwharrie National Forest)	50 campsites and a large bath house
Falls Reservoir	
Deep Water Trail Access (Uwharrie National Forest)	1 unimproved parking area a steep path leading to the dirt boat launch Included in the Yadkin-Pee Dee River Trail
Falls Boat Access	1 boat ramp and limited shoreline fishing access, 2 small (one paved, one gravel) parking areas Part of the Yadkin Pee Dee River Trail
Falls Dam Canoe Portage	Steep trail with uneven terrain

Note – unless otherwise noted (in parentheses) the site is owned by Alcoa Generating.

[a] Sites managed by North Carolina WRC.

Table 40. Summary of boat ramp accessibility at High Rock reservoir public access areas. (Source: Alcoa Generating, 2006a)

Access Area	Boat Ramp Accessibility Related to Water Elevation
Highway 601 Access Area	Riverine portion of the reservoir and is therefore generally unaffected by reservoir operations.
Rowan County Pump Station Boat Access	Riverine portion of the reservoir and is therefore generally unaffected by reservoir operations.
York Hill Boat Access	Evidence of shoreline access being affected by varying water levels (changing footpath routes). The smaller of the two boat ramps was covered in mud at the time of the inventory.
Southmont Boat Access Area	Boat ramp at head of cove boat ramp is not usable when High Rock reservoir is more than 5-feet below normal full pool; other triple-lane divided boat ramp generally remains usable up to a 15-foot drawdown.
Buddle Creek Boat Access Area	Water depth at the end of the boat ramp during full-pool water elevation is 12 feet, generally keeping it usable for motorized boats up to a drawdown of 9 feet.
Dutch Second Creek Boat Access	Water depth at end of boat launch ramp during normal full-pool is 13.9 feet, generally keeping it usable for motorized boats to a drawdown of up to 10.9 feet.
Flat Swamp Boat and Swim Access Area	Water depth at the end of the boat launching ramp during normal full-pool elevation is 15.6 feet, generally keeping the ramp usable for motorized boats during drawdowns of up to 12.6 feet.

The Tuckertown reservoir has 11 major public and no commercial recreation access areas that provide direct access to the reservoir (see figure 16 and table 39). Of the 11 recreation areas, six have major facilities and five do not. The Tuckertown Road pull-off fishing areas consist of four separate pull-off areas used for bank fishing. Lick Creek fishing pull-off has historically been represented in FERC Form 80 Reports, but is currently considered closed due to unsafe vehicle/pedestrian interactions. At Tuckertown reservoir, there are a total of seven boat ramps, four boat docks, and three picnic areas.

Narrows reservoir has 16 public recreation areas and one commercial recreation area that provide direct access to the reservoir (see figure 16 and table 39). Fourteen of the 16 public recreation areas have major facilities; the only two areas without major facilities are the Tuckertown dam tailrace access area and the Narrows dam canoe

portage. The Uwharrie National Forest borders the reservoir on the east, and the Forest Service maintains five of the public recreation access areas within the Forest Service lands. The Lake Forest Campground and Fish Tales Marina have about 325 feet of shoreline and includes parking, a boat dock, launch ramp, restaurant and trailer campground.

The Falls reservoir has three public and no commercial recreation access areas. These include Uwharrie National Forest Deep Water Trail access, Falls boat access, and the Falls dam canoe portage (see figure 16 and table 39). Facilities include a boat launch ramp at Falls boat access in Stanly County.

At the Yadkin-Pee Dee River Project, there are seven public access sites on Lake Tillery and five on Blewett Falls lands (table 41 and figure 17). North Carolina WRC owns several of the boating access area sites around the Yadkin-Pee Dee River Project, which include the Norwood, Red Hill (Highway 109), Grassy Island, and the Pee Dee Boating access areas. Informal unmarked recreation opportunities are located around Lake Tillery and frequently occur on Progress Energy land. The major areas consist of those properties leased to North Carolina WRC in the Gamelands Program. The predominant activity at these sites is bank fishing (see figure 17).

More than 1,500 private homes and seasonal cottages are located on Lake Tillery. Private recreation facilities are located at major subdivisions on the lake, including Woodrun, Holiday Shores, Sugar Loaf Shores, Carolina Forest, and Twin Harbor. Developers of these facilities and, subsequently, the homeowner associations, operate and maintain recreation facilities including boat ramps and docks.

On the Blewett Falls reservoir, there are six public recreation access areas (see figure 17). Two additional access areas are located outside of the project: Highway 109 access area, upstream between the Tillery and Blewett Falls developments and the U.S. Highway 74 site, downstream of the Blewett Falls dam. Informal camping occurs along much of the Blewett Falls undeveloped shoreline.

Table 41. Recreational facilities at the Yadkin-Pee Dee River Project (P-2206). (Source: Progress Energy, staff)

Site Name	Facilities
Lake Tillery	
Norwood Access Area	2 large parking areas, a boat ramp, boat dock, gravel parking lot, and grass parking area
Stony Mountain Access	1 gravel parking area, long access road with shoulder parking, and a 2-lane boat ramp
Swift Island Access	Largest public recreation site on Lake Tillery. 1 large parking area including accessible spaces, 4 concrete boat lanes for launching and 2 boat docks

Site Name	Facilities
Lilly's Bridge Access	2 access sites on SR 1110, 1 gravel parking are, 1 grass parking area, 4 concrete accessible parking spaces, and 1 two-lane boat ramp, 1 fish platform
Informal SR 1740 & SR 1745	Very small with 2 dirt and grass parking areas. No access for motorized boats or other recreational amenities. 1 small dirt clearing leading to the water
Informal Tailwater Access Area	River access down a narrow dirt/gravel pathway. 1 parking area off main road for cars or trucks without trailers
Tillery Canoe Portage	Signed access for canoeists around Tillery dam
Blewett Falls Reservoir	
Blewett Tailwater Access Area	1 large paved parking area with 7 accessible spaces a wooden and paved walkway providing access, 1 ADA accessible fishing platform
Pee Dee Access Area	1 large gravel parking area, 2 concrete boat ramps, one of which has two wooden boat docks Access point for the Yadkin Pee Dee River Canoe Trail
Grassy Islands Access Area	Boat ramp, a lighted, gravel parking lot with delineated parking; six regular parking spaces and one handicapped accessible parking space
Blewett Falls Canoe Portage	Paved and informal parking areas, and a trail leading to the lake
U.S. Highway 74 Site	1 gravel parking lot with a concrete single lane boat ramp and a boat dock Access point for the Yadkin Pee Dee River Canoe Trail
Informal Tailwater Access Area	1 informal parking area off of a dirt road, 2 access ramps, foot trails at this site to the water. Canoe trail access point for the Yadkin Pee Dee River
Informal SR 1744 Site	A dirt road leading to an unpaved boat ramp, trash receptacles, and fire rings
Highway 109	1 unpaved parking area, 1 one lane boat ramp, 1 boat dock, and 1 grass area for parking

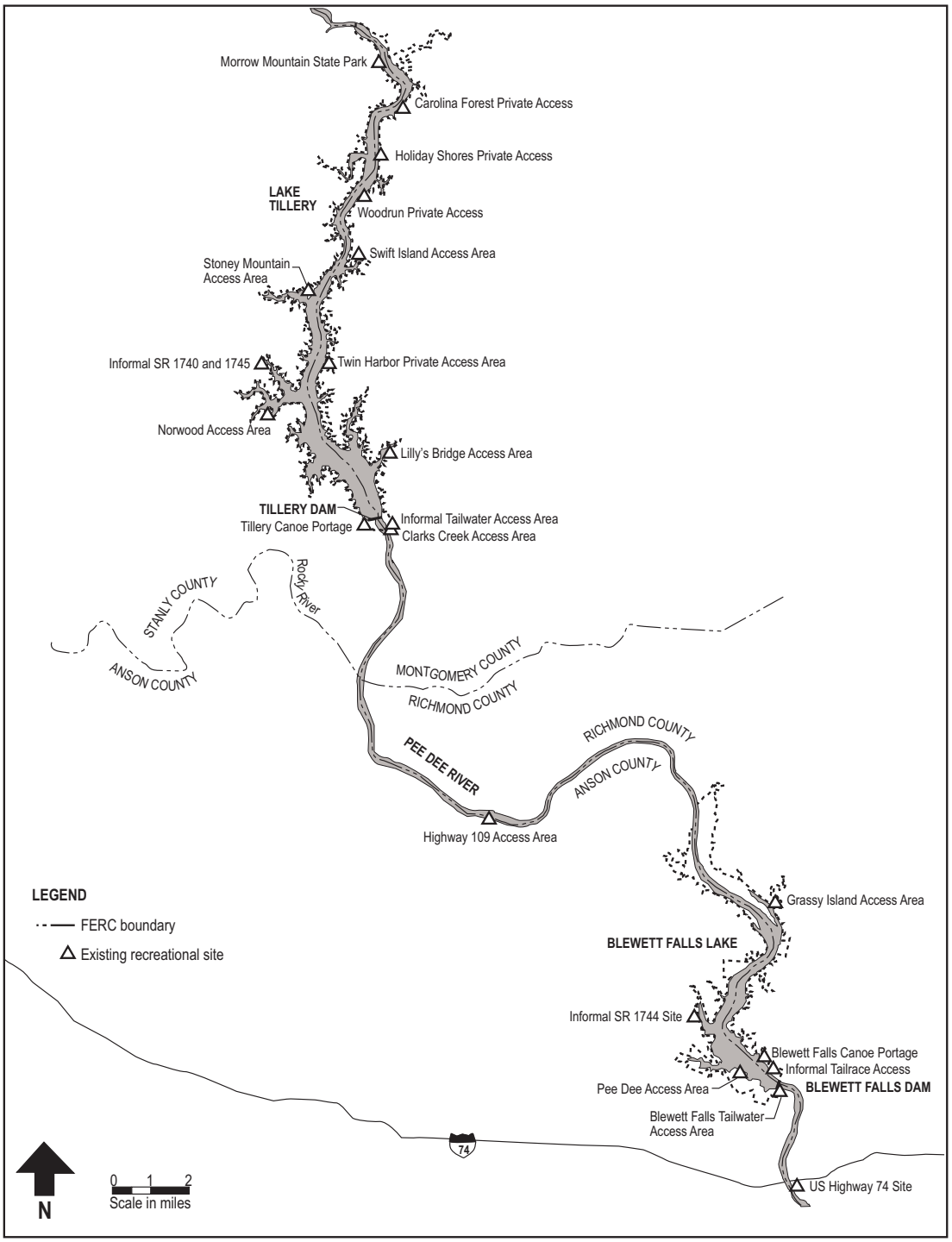

Figure 17. Yadkin-Pee Dee River Project (P-2206) recreation facilities. (Source: Progress Energy, 2006a)

Recreational Use

Alcoa Generating estimates that the entire Yadkin Project had more than 2.5 million recreation days from May 2003 through April 2004. The greatest use occurs at High Rock (60 percent) and Narrows reservoirs (37 percent). The Tuckertown and Falls reservoirs received about 2 and 1 percent of the project's total recreational use, respectively (table 42).

Table 42. Recreational use at the Yadkin Project (P-2197). (Source: Alcoa Generating, 2006a)

Reservoir	Visitor Use	Waterfront Resident Use	Non-Waterfront Resident Use	Business and Organization Use	Portage Use	Total Use	% of Total
High Rock	82,846	1,058,585	269,448	132,982	30	1,543,891	60%
Tuckertown	51,887	0	0	2,465	0	54,352	2%
Narrows	127,561	285,993	450,009	95,570	20	959,153	27%
Falls	4,159	0	0	0	20	4,179	<1%
Total	266,453	1,344,578	719,457	231,017	70	2,561,575	100%
% of Total	10%	52%	28%	9%	<1%	100%	

Table 43 shows the monthly distribution of recreational visits by reservoir and summarizes the total Yadkin Project recreational use by month for the 2003-2004 study period. Most use occurred during July (18 percent). Almost 60 percent of use occurred during the peak recreation period (May through August). Recreational use of the High Rock and Narrows reservoirs, with large resident populations that participate in diverse recreational activities, primarily occurred between Memorial Day and Labor Day, with fairly high use during the May and September shoulder months. These five months (May through September) represent 71 percent of the total recreation days at High Rock reservoir and 67 percent at the Narrows reservoir. Tuckertown and Falls reservoirs do not have any waterfront residents, are smaller, and are primarily destinations for fishing and camping. Recreational use at these reservoirs picks up earlier in the year (early April) than at High Rock and Narrows (late May), which may be attributable to fishing and the generally mild temperatures that are conducive for camping.

Table 43. Summary of recreation visitation by month at the Yadkin Project (P-2197). (Source: Alcoa Generating, 2006a, as modified by staff)

	High Rock		Tuckertown		Narrows		Falls		Total Project	
Month	Visitation	% of Total Use	Visitation	% of Total Use	Visitation	% of Total Use	Visitation	% of Total Use	Visitation	% of Total Use
January	25,507	2%	98	0%	32,029	3%	17	0%	57,651	2%
February	25,423	2%	408	1%	32,609	3%	76	2%	58,516	2%
March	63,971	4%	1,820	3%	41,036	4%	242	6%	107,069	4%
April	113,838	7%	6,624	12%	56,972	6%	410	10%	177,844	7%
May	164,293	11%	9,053	17%	71,613	7%	608	15%	245,567	10%
June	242,909	16%	8,941	16%	138,232	14%	671	16%	390,753	15%
July	251,761	16%	11,503	21%	193,067	20%	614	15%	456,945	18%
August	251,987	16%	8,063	15%	134,562	14%	534	13%	395,146	15%
September	188,442	12%	2,846	5%	99,976	10%	344	8%	291,608	11%
October	145,225	9%	2,243	4%	72,198	8%	216	5%	219,882	9%
November	43,677	3%	1,801	3%	54,471	6%	352	8%	100,301	4%
December	26,858	2%	952	2%	32,388	3%	95	2%	60,293	2%
Total	1,543,891	100	54,352	100%	959,153	100%	4,179	100%	2,561,575	100%

At the High Rock reservoir, boating (motor boating and boat fishing) is the primary recreation activity representing about 38 percent of recreation days. Bank fishing represents about 15 percent of recreation days; swimming and sunbathing also are popular. The Tuckertown reservoir is primarily a fishing destination, with 59 percent of recreation visitors bank fishing and 36 percent boat fishing. Picnicking is also popular. Only 9 percent of respondents indicated that they were simply "motor boating." At the Narrows reservoir, motor boating represents about 22 percent of recreation days, boat fishing and bank fishing each represent about 15 percent, swimming represents 14 percent, and sunbathing 7 percent. At the Falls reservoir, nearly half of the recreation visitors are camping at Uwharrie National Forest. While camping, they also engage in bank fishing (47 percent), boat fishing (41 percent), and hiking, swimming, and picnicking (all 29 percent).

At the Yadkin Project, overall recreation use increased about 69 percent since 1991. Use at High Rock and Narrows public access areas increased, although use at Tuckertown and Falls public access areas has decreased since 1991. As part of the recreation study (ERM, 2005c), Alcoa Generating estimated that future maximum boats at one time (BAOT) approaches do not exceed the physical carrying capacity at the Tuckertown and Falls reservoirs of 264 and 18 boats, respectively. At High Rock and Narrows the study found that current boating use is approaching the reservoirs' carrying capacities of 981 and 494 boats, respectively. In addition, significant increases in both waterfront and non-waterfront residences, combined with regional trends for increased boating could result in use levels that would result in a physical carrying capacity of 119 percent for High Rock reservoir and a 150 percent carrying capacity for the Narrows reservoir by the year 2030.

Alcoa Generating estimates that the population of the Yadkin Project region would increase by 44 percent by 2030, and that this population increase would primarily affect the number of visitors to the project who use the public access recreation areas. The study indicates that since more than 63 percent of the visitors to the Yadkin Project come from the 5-county region, a proportional increase in visitor recreational use could be anticipated at the project. Furthermore, based on regional recreational trends, a 33 percent increase in the participation rate and 5 percent increase in the frequency of recreational use is anticipated. In terms of changes in waterfront and non-waterfront resident use, the following increases in resident population are likely to occur: High Rock reservoir, 20 percent for waterfront and 20 percent for non-waterfront; Tuckertown reservoir, no increase in either waterfront or non-waterfront populations; Narrows reservoir, 10 percent for waterfront and 20 percent for non-waterfront; and Falls reservoir, no increase in either.

As part of the recreation study, recreational facilities at the public access recreation areas were evaluated in terms of their capacity to meet recreational demand. In terms of boat launch lanes, the recreation study found that most boat access areas were adequate to accommodate even peak day boat launch demand. Parking at 13 of the public access recreation areas exceeded parking capacity during the study period, but

most only exceeded capacity once or twice during the study period, usually on holidays. The number of trash receptacles and toilets was also evaluated at public boat access areas. The analysis indicated that several relatively heavily used recreation areas lacked trash receptacles and toilets, including the Dutch Second Creek and York Hill boat access areas at High Rock reservoir, the Circle Drive and Lakemont boat access areas at Narrows reservoir, the Bringle Ferry and Flat Creek boat access areas and Riles Creek Recreation Area at Tuckertown reservoir, and the Falls boat access at Falls reservoir.

Progress Energy estimates that the Yadkin-Pee Dee River Project receives the most visitor use in April through August. During these summer months, visitation at Lake Tillery averages from 5,000 to nearly 9,000 visitors per month. Table 44 shows the number of visitors per month at the Tillery development for the 2004-2005 year. The most popular activities at Lake Tillery are wildlife viewing, motor boating, swimming, bank fishing, sunbathing, jet skiing, boat fishing, waterskiing, and picnicking.

Table 44. Summary of recreation visitation by month at the Yadkin-Pee Dee River Project (P-2206). (Source: Progress Energy, 2006a, as modified by staff)

	Tillery		Blewett Falls	
Month	**Visitation**	**% of Total Use**	**Visitation**	**% of Total Use**
January	1,089	2%	161	1%
February	920	2%	168	1%
March	2,137	4%	668	4%
April	7,644	15%	3,680	21%
May	8,060	15%	3,940	22%
June	7,786	15%	2,193	12%
July	8,899	17%	2,914	16%
August	5,066	10%	1,723	10%
September	2,693	5%	780	4%
October	4,077	8%	844	5%
November	2,968	6%	463	3%
December	1,362	3%	294	2%
Total	52,701	100%	17,828	100%

Blewett Falls reservoir is much smaller and less developed and receives fewer visits (see table 44). The most popular activities at Blewett Falls are wildlife viewing, bank fishing, picnicking, boat fishing, hiking, motor boating, lake canoeing, and river canoeing.

On Lake Tillery, the physical carrying capacity is 633 boats and this capacity has been exceeded during the summer months. Each recreation facility has a carrying capacity for parking. The Norwood access area, Stony Mountain access area, and the Informal Tailwater access area have exceeded the carrying capacity at different times throughout the year. Swift Island and Lilly's Bridge access areas, Tillery canoe portage, and the Informal access SR 1740/1745 have not reached full capacity levels. The carrying capacity at Blewett Falls is 318 boats, except when water surface level decreases by 3 feet, when the carrying capacity decreases to 259 boats. The carrying capacity of boats on the Blewett Falls reservoir has not been surpassed by users during any month. Parking capacity levels at the Blewett Falls recreation sites are also rarely reached or exceeded. Grassy Islands, the Blewett Falls canoe portage, and the Pee Dee access have on occasion reached the full capacity level. The informal access area and the SR 1744 site have reached 50 percent capacity occasionally. Based on the survey results, recreation visitors to Blewett Falls reservoir indicated they have experienced minimal levels of crowding.

3.3.7.2 Environmental Effects

Reservoir Elevations

Alcoa Generating proposes to modify project operations to maintain the High Rock reservoir elevation within 4 feet of full pool (not below elevation 619.9 feet) from April 1 to October 31 of each year and within 10 feet of full pool from November 1 to March 31 of each year. Alcoa Generating proposes to continue to operate the Tuckertown and Falls developments with the existing 3-foot and 4-foot drawdowns, respectively, and proposes to increase the drawdown at the Narrows development to 5 feet or 2 feet lower than under existing operations. At Lake Tillery, Progress Energy proposes to operate, in response to winter peaking needs from December 1 through March 1, a maximum fluctuation of 3 feet. Progress Energy also proposes to modify project operations to further limit drawdown restrictions.

Davidson County opposes the proposed 10-foot drawdown at High Rock and recommends a 7-foot maximum drawdown. The county states that the drawdown would result in drying 63 percent of the lake, the lake being unsafe to travel, limit recreational access to the lake, and have a negative effect on fish, vegetation, water quality, and sedimentation. Several parties requested that the applicant install hazard marking and lighting, particularly for bridges and other hazards more than 200 feet from shore.

Numerous individuals commenting on the Yadkin Settlement state that the proposed 10-foot drawdown at High Rock reservoir under the Proposed Action would make nearly all of the access points at the reservoir either unusable or unsafe. These individuals ask that Alcoa Generating limit the drawdowns to no more than 6 feet and be required to improve navigation and hazard markings, including lighted buoys at bridges and hazards more than 200 feet from shore. Richard Martin states that, under the Proposed Action, the ability to drop the level of the lake during the boating season by 4

feet would result in 2 feet of water or less at the private piers making their use marginal. Mr. Martin requests that the summer drawdowns be limited to 2 feet (or a maximum of 3) below full pond. David Evans requests that summer drawdowns be limited to no more than 4 feet and winter drawdowns to no more than 6 feet.

Our Analysis

Alcoa Generating's proposal would reduce High Rock reservoir elevation fluctuations to only 4 feet during the late spring, summer, and fall recreational period, and to 10 feet during the remainder of the year. There would be no change to the typical reservoir elevations and associated effects on recreational use and access at Tuckertown and Falls reservoirs. At the Narrows reservoir the proposed operations would allow for an additional 2-foot drawdown, except as needed to maintain minimum flows.

Most of the comments regarding concerns with reservoir elevations at High Rock were provided by shoreline resident landowners, not by visitors at the public access areas. This is evidenced in the survey responses from the recreation study where the visitor use (public access areas) survey respondents indicated that it was not a problem (average score of 3.8 from a range of 1 being a big problem to 4 being not a problem), as compared to the residential use survey respondents (average score of 2.3) and private commercial use survey respondents (average score of 2.0) who indicated it was a moderate to big problem.

The period when the proposed greater drawdowns (i.e., up to 10-feet) would occur would be during the time of year when there is reduced recreational activity at the project. Based on recreational use estimates during the 2003-2004 study period, 87 percent of recreational use occurred during the seven months from April through October, with only 13 percent occurring during the remaining five months of the year when a 10-foot drawdown could occur. Based on the recreation facility assessment, of the 7 public boat ramps on High Rock reservoir, 5 provide access at elevations up to a 10-foot drawdown, with an additional one providing access up to a 9-foot drawdown. In addition, the total boatable surface acreage under the Proposed Action would be slightly greater at about 10,132 surface acres[44] during the recreation season (at a 4-foot drawdown), as compared to existing conditions of 9,693 surface acres (at 5-foot drawdown). Therefore, because the reservoir water elevations would be higher during the peak recreation season, the proposed operations at High Rock, overall, would provide enhanced opportunities for recreational use of the reservoir compared to existing conditions. Hazard marking is the responsibility of the state rather than the applicant.

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[44]The boatable surface acreage is estimated by taking the full surface acreage at that elevation and factoring that about 78 percent of it would be boatable as determined by Progress Energy in the boating capacity assessment conducted in recreation study (ERM, 2005c).

Under the Proposed Action, the maximum allowable drawdown at the Tillery development would be 15 feet once every 5 years during a limited period (September 15 through December 15), as compared to the maximum drawdown of 22 feet allowed under the current license. Also, Progress Energy would, for the majority of the year and during the primary recreation season, limit the drawdowns to 2.5 feet during the weekdays and 1.5 feet on the weekends, compared to the current operations of not more than 4 feet. At the Blewett Falls development, Progress Energy proposes to limit the maximum drawdown to 6 to 8 feet during periods when flows are below 7,400 cfs and operate run-of-river when flows are above 7,400 cfs, compared to the maximum allowable drawdown of 17 feet under current conditions. Therefore, overall there would be fewer maintenance drawdowns and reduced fluctuations in the reservoir elevations, resulting in enhanced recreation opportunities and access at the Yadkin-Pee Dee River Project.

Minimum Flows, Boating Flows, and Streamflow Monitoring

Under existing conditions, Alcoa Generating releases a flow from the Falls dam of not less than 1,500 cfs during the 10-week period preceding May 15; 1,610 cfs from May 15 through July 1; and 1,400 cfs from July 1 through September 15. Progress Energy is dependent upon the inflows from the Falls development. Alcoa Generating proposes to provide increased minimum flows from the Falls development and Progress Energy proposes to provide increased minimum flows from the Tillery and Blewett Falls developments. Alcoa Generating also proposes to develop a flow and reservoir elevation monitoring plan in consultation with state agencies.

Under the existing license, Progress Energy is required to release a continuous minimum flow of at least 40 cfs from Tillery dam[45] and 150 cfs from Blewett Falls dam. Progress Energy proposes to provide a minimum flow release downstream of Tillery dam of 330 cfs continuously throughout the year, except for 8 weeks in March when the minimum flow must be at 725 cfs for American shad spawning season, starting in 2010, or at the first passage of American shad above Blewett Falls dam, whichever is later. Progress Energy proposes to release an additional 1,750 acre-feet of water per year (884 cfs over one 24-hour period[46]), above and beyond the required minimum releases, for the purposes of enhancing recreational boating flows below the Tillery development. This recreational release volume could be increased to 1,950 acre-feet per year (985 cfs over one 24-hour period) if releases for recreational purposes are made for at least four days within the period May 16 to May 31 or September 1 to September 15.

Progress Energy proposes within 1 year of license issuance to prepare a recreation release plan in consultation with the North Carolina DENR and WRC. Following the

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[45]As discussed in section 3.3.2.1, *Water Quantity*, minimum flows downstream of Tillery dam are typically between 70 and 80 cfs.

[46]1.98 acre-feet equals 1 cfs over a 24-hour period.

first 3 years of the plan implementation, Progress Energy would evaluate and modify the plan if appropriate. However, Progress Energy does not propose any modification that would increase the volume of additional water for recreational flows above the 1,950 acre-feet agreed to in the Yadkin-Pee Dee Settlement Agreement. After the first evaluation, re-evaluation and modification of a recreation release plan at 5-year intervals may occur, if determined necessary, and if agreed upon by North Carolina DENR, North Carolina WRC, and Progress Energy Any decision arrived at by this group would either have the unanimous support of all or no opposition from any member.

Progress Energy proposes to supply information on its website related to recreational boating flows to be released at Tillery dam and to provide an electronic link to the flow gage at Rockingham and to a flow gage to be installed by Progress Energy downstream of Tillery dam.

American Rivers supports Progress Energy's proposed flow schedule for Blewett Falls as a way to meet recreational flow requirements for the Pee Dee River downstream of this lowermost dam. American Rivers does not support Progress Energy's proposed 330 cfs base flow for the Tillery reach. American Rivers states that the Tillery reach has great potential for recreational uses, including boating, fishing, and swimming, if higher flows are released from Tillery dam.

The city of Rockingham states that the recreational potential of the Tillery riverine reach is unrealized due to project peaking operations, low minimum flows, and lack of public access. Rockingham comments that the Commission and the state have an obligation to require a higher instream flow for recreation to maximize recreational opportunities for the public. Accordingly, the city requests that Progress Energy, within 60 days of license issuance, maintain minimum streamflows of 1,200 cfs (flow amount to be finalized following completion of the city of Rockingham's recommended recreation instream flow study) during daylight hours on weekends and holidays (Memorial Day, Independence Day, and Labor Day) each year from May 16 to September 15.

American Rivers and the city of Rockingham state that the methodology applied in the navigation study conducted by Progress Energy is inadequate and departs from standard practice in Commission relicensing proceedings. Both entities cite the fact that the navigation model results were not field verified to test the accuracy of the model. American Rivers contends that the navigation study conducted by Progress Energy is flawed because the results of the study indicate that 375 cfs would meet the South Carolina DNR navigation standard (DeKozlowski, 1988) for jon boat navigation. American Rivers states that the 375 cfs flow was not field tested and, therefore, does not follow South Carolina DNR guidance for establishing instream flows for navigation.[47]

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[47] American Rivers indicates that the South Carolina DNR guidance and field evaluation uses flows at 100 cfs increments ranging from 500 to 1,000 cfs, to determine the flow at which jon boat navigation would be achieved.

Interior in comments on the draft EIS notes that paddle sports are currently one of the fastest growing recreational activities in the United States and support the communities adjacent to the Tillery reach who seek a reevaluation of minimum flows necessary to support public uses of the river, including boating, paddling, ecotourism, bird watching, and fishing.

The city of Rockingham also states that the study does not associate navigation with a specific recreational use; the navigation method applied in the Pee Dee Navigation Report did not measure recreation quality; the study overlooks other river recreation uses in the Tillery reach; there are numerous disadvantages associated with the methodology (South Carolina navigation method), including its failure to accurately correlate with recreation quality; and the methodology used in the study is rarely used in Commission proceedings (i.e., does not integrate social science methods [interviews and survey tools] with hydrologic analysis).

Accordingly, both American Rivers and the city of Rockingham recommend that Progress Energy develop and conduct an instream flow study prior to license issuance. The city of Rockingham recommends that the study be consistent with the following framework:

- Level 1 – desk-top analysis using existing information, limited interviews with users familiar with the reach and recreation opportunities under investigation.
- Level 2 – limited reconnaissance studies to verify information from Level 1, on-site interviews of users, and single flow evaluations for direct observations of instream flow conditions. (The results of the Level 2 reconnaissance would determine the need for a Level 3 study effort.)
- Level 3 – intensive studies that may include multiple flow comparison surveys and controlled flow studies.

American Rivers recommends that such a study include an evaluation of all recreational uses including nonmotorized boating, fishing, and swimming. The city of Rockingham recommends that Progress Energy undertake measures to improve navigability of project reaches. The city also recommends that Progress Energy, in cooperation with North Carolina WRC, inventory debris (e.g., tree stumps in Blewett Falls reservoir) and other man-made structures or features within the project boundaries that are risks to public health and safety.

The city of Rockingham recommends that compliance be measured at a continuous instream flow gage to be installed about 0.5-mile below Tillery dam at North Carolina Highway 731 Bridge. The city of Rockingham specifically recommends that Progress Energy, in consultation with USGS, install a new flow gage downstream of Tillery dam within 6 months of license issuance. The city of Rockingham also recommends that the licensee provide real-time Pee Dee River streamflow data from this USGS gage and from the existing USGS gage no. 02129000 to the public via a toll-free number and Progress Energy's website. Ron and Nancy Bryant recommend that Progress

Energy provide audible warnings for its flow releases from the Blewett Falls development.

Our Analysis

Alcoa Generating's proposed flow release at Falls dam would have minimal effects on recreational use at the project because the flow releases empty into Lake Tillery. Overall, the proposed releases at Falls dam would result in smaller ranges of flow releases. The range of flows during the recreation season of 2,000 cfs in the spring would be reduced to 1,000 cfs under the Proposed Action, compared to a fluctuation from 1,500 to 610 cfs in the spring period and then back up to 1,400 cfs during the summer period. Therefore, there would be less overall fluctuation in the releases in the tailrace area where recreational use can occur, resulting in minor beneficial effects on recreational use in this area.

Progress Energy's proposed minimum flows and additional recreational boating flows downstream of Tillery dam would enhance recreational boating opportunities as compared to existing conditions. We reviewed Progress Energy's instream flow study for the reach downstream of Tillery dam and found it to be consistent with the study plan developed in consultation with the state agencies and designed to determine at what minimum flows jon boats could navigate safely downstream. However, as discussed below, Progress Energy does not provide information as part of its proposal in terms of the timing and duration of these flows and or the amount of flow to be provided during any period.

In terms of the assessment of flow levels, based on our review of the instream flow study at the transects at RMs 216.5 and 211 between Tillery dam and Highway 109 access area, study results indicate that 671 cfs would be needed at RM 211 and 367 cfs at RM 216.5 to allow safe downstream passage (one-way navigation[48]) of jon boats. The study report found that, at RM 196.2 in the vicinity of the upstream end of Grassy Islands, a flow of 205 cfs would be needed for one-way navigation and of 5,395 cfs for two-way navigation.

Progress Energy's additional releases for recreational boating flows of up to 1,750 acre-feet, or up to 1,950 acre-feet (884 cfs or 985 cfs over one 24-hour period) downstream of Tillery dam, would provide only a small incremental change, depending on the number days/hours that additional flow would be provided. The Yadkin-Pee Dee Settlement does not specify the number of days/hours or duration for each flow event, except to say that the total additional recreation flow would increase to 1,950 acre-feet if

[48]Based on the IFIM/navigation study, the state of North Carolina's recommended navigation assessment level for the reach from Tillery dam to Highway 109 access area was for one-way navigation and the reach from the Highway 109 access area to Blewett Falls reservoir was for one-way and two-way navigation.

at least 4 days of flows are provided in late May or early September. Our analysis of recreational flows in section 3.3.2.2, *Water Quantity*, shows that the amount of additional flow necessary to allow passage downstream at RM 211 would range from as low as 4 cfs in May to as much as 190 cfs in September and average of about 231 cfs during June, July, and August. Assuming a base flow of 330 cfs, plus 231 cfs accretion from Rocky River, an additional 110 cfs would be needed on average to provide downstream boating flows. Therefore, Progress Energy's proposed recreational flows could provide about 20 days of flows sufficient to allow downstream navigation in the reach downstream of Tillery dam.

To provide the city of Rockingham's recommended flow release of 1,200 cfs during daylight hours on weekends and holidays May 15 through September 15 (35 days at 10 hours per day), about 34,650 acre-feet would be necessary, as compared to 9,500 acre-feet from the proposed 330 cfs release. This level of additional flow is considerably higher than what would be required to navigate downstream based on the instream flow study result and also higher than the 900 cfs we calculate would be necessary to provide for upstream navigation between the Highway 109 access area and Tillery dam. Navigating upstream from Grassy Islands to the Highway 109 access area would require flows of more than 5,000 cfs.

To provide boating flows of 671 cfs during daylight hours during weekends and holidays during the primary recreation season of May 15 through September 15 (35 days at 10 hours per day), about 19,400 acre-feet would be necessary. Given the use data for the riverine reach downstream of the Tillery dam, we question the need to provide boatable flows every weekend and holidays during the summer (May 16 – September 15). Flows to allow downstream navigation for about 20 days during the recreation season would allow boating every other weekend plus extra days on the three major holidays in May, July, and September.

Because the instream flow study only evaluated two locations characterized as the most restrictive, and the results were preliminary, it would be important to provide the rationale for the proposed additional flow amount and conduct an additional boating flow study during the first year of implementation. At a minimum, the additional study should assess boatability at flows of 671 and 1,200 cfs. This study could be performed as part of the recreation flow release plan, and would ensure that the additional recreation boating flows produce the intended results and actually provide sufficient flow for a reasonable number of days during the recreation season. Monitoring the level of recreational boating during the first year of implementation of the proposed flows, also as part of the recreation release plan, would provide the means to assess the level of activity and recreation demand associated with these flows.

Progress Energy's proposed recreation release plan would establish protocols for implementing the recreational boating flow releases, as well as establish measures to monitor and modify the plan. However, Progress Energy's proposal does not provide the specifics of what would be included in the recreation release plan. Additionally, Progress

Energy does not provide sufficient justification for the proposed amount of recommended flow or detail regarding the proposed timing and duration of the flow. In addition, Progress Energy proposes to consult only with North Carolina DENR and WRC. Other entities that have expressed interest in the release of boating flows in this reach, such as American Rivers and the city of Rockingham, may not be consulted.

Development of a comprehensive recreation release plan would ensure that recreational boating flows coincide with periods of key recreational opportunities and use (such as one weekend day and holidays during May 15 through September 15) and the means to monitor the level of use. The plan would ensure that the public is sufficiently notified of the flow releases to afford boating opportunities. Specifically, the recreation release plan would provide the means to establish the specific rationale necessary for the establishment of suitable recreation boating flow in the reach between Tillery dam to the Highway 109 access area if it included the following components:

- protocols and rationale for defining the boating flows, such as type of boating use (e.g., jon boat, flatwater canoe), rate (cfs), timing (e.g., time of year, number of days, day of week, and time of day) and duration (hours);
- measures to monitor flows via the proposed stream gage;
- measures for notifying the public of the timing of the releases;
- measures to monitor recreation use and to adjust the timing and duration of flows based on the results of this use;
- measures for review and update of the recreation release plan;
- provisions for consultation with North Carolina DENR, North Carolina WRC, and the city of Rockingham; and
- measures for submittal of the recreation release plan for review and approval by the Commission prior to implementation.

In addition, providing flows, as proposed by Progress Energy, during the interim period until the recreation release plan is developed (such as the period between license issuance and within 1 year of license issuance at the filing of the plan) would provide the means for a limited level of enhanced boating recreation opportunities in this reach.

Progress Energy's proposed installation of a new USGS stream gage downstream of Tillery dam and the provision for placing information related to recreational boating flows to be released at Tillery dam on its website would facilitate the public's access to flow information.

Recreation Plan and Management

Alcoa Generating proposes, within 2 years of license issuance, to develop and file a recreation plan for the Yadkin Project. The final recreation plan would address, at a minimum, the specific recreation facility improvements proposed in the Yadkin

Settlement, as well as (1) maps that clearly identify all existing and proposed recreation and public access sites, in relation to the existing Yadkin Project boundary; (2) a schedule for implementation of the facility improvements; (3) the length and width of any project-related trail, canoe portage, etc.; (4) a discussion of how the needs of the disabled were considered in the planning and design of the recreation facilities and public access; and (5) identification of appropriate signage.

Progress Energy proposes to submit a plan and schedule for the installation of its proposed recreation facilities at the Yadkin-Pee Dee River Project within 180 days of license issuance. Progress Energy also proposes to meet, every 4 years, with representatives from Stanly and Montgomery counties to discuss and review recreation issues on Lake Tillery. These discussions would include review of public recreation needs and trends, public use, and lake access.

Progress Energy proposes to enter into an agreement with North Carolina WRC whereby, for a period of 10 years commencing from the date of license issuance, North Carolina WRC would be responsible for the operation and maintenance of the public recreation facilities made part of the license. Progress Energy would fund North Carolina WRC's operation and maintenance activities through a one-time payment of $240,000, within 12 months of the license becoming final and non-appealable. Prior to the end of the 10-year period, Progress Energy and North Carolina WRC would renegotiate the recreation facilities operation and maintenance agreement.

Progress Energy proposes to lease to the state of North Carolina for the term of the new license, and at the present lease rate, lands it currently owns between Morrow Mountain State Park and the Pee Dee River in the vicinity of, and including, the existing boat launch area at Morrow Mountain State Park. The lease would be negotiated and executed within 12 months of the issuance of the license that is final and non-appealable. Progress Energy proposes to provide a restrictive covenant for conservation purposes on its land along the current canoe portage route (about 0.3 mile) at the Blewett Falls dam. This would prohibit development on the lands needed for canoe portage, except as required for operation, maintenance, repair, or improvement of the project or Progress Energy's transmission or distribution system.

The city of Rockingham states that Progress Energy does not describe the contents of the proposed recreation plan, protocols for coordination with relevant agencies and stakeholders, or address mitigation and enhancement measures necessary to meet future recreational demand. It requests that Progress Energy, within 1 year of license issuance, develop and implement a recreation management plan in consultation with a Recreation Management Committee. The city of Rockingham comments that the recreation plan should include drawings and specifications for facility construction, standards for facility maintenance, and that facilities should be designed to resist vandalism and otherwise protect public health and safety. The plan should also include estimates of the expected level of use of each site; performance standards for the conditions of facilities appropriate to protect public health and safety; triggers for improvements in facilities if use exceeds

expectation or as appropriate for public health and safety; measures to inspect and maintain facilities on a weekly schedule or more frequently as determined by such inspection; and include comments of Recreation Management Committee and Progress Energy's responses.

The city of Rockingham also requests that Progress Energy, within 2 months of license issuance, establish and implement a Recreation Management Committee that includes North Carolina WRC, North Carolina DWR, the North Carolina Department of Parks and Recreation (DPR), Richmond County, and the city of Rockingham. The city of Rockingham asks that Progress Energy consult with the committee to develop and implement the recreation management plan and coordinate with counterpart collaborative efforts for upstream projects on the Yadkin and Pee Dee rivers. In addition, the city of Rockingham asks that Progress Energy, by consensus with the committee, adopt written protocols for schedule and conduct of meetings and dispute resolution and consult through this committee and as otherwise required by applicable law, with these stakeholders, regarding measures within their respective jurisdictions.

The city of Rockingham suggests that Progress Energy, in cooperation with the city of Rockingham, Richmond County, and North Carolina WRC, establish and undertake a cooperative program for management of recreational use, law enforcement, and emergency communication at project sites. The city asks that the program be subject to modification on basis of performance standards included in the plan.

The city of Rockingham also suggests that Progress Energy, following license issuance by March 1 of each year, provide $50,000 (2007) per year to fund a trained peace officer to provide law enforcement services, including patrol, criminal investigations, and search and rescue. The city states that the position could be housed in Richmond County, North Carolina WRC, or North Carolina DENR, under a memorandum of understanding; and it may consist of a new employee or an appropriate combination of existing employees. The city also asks Progress Energy, in cooperation with the Richmond County's sheriff's office, to investigate, purchase, and install radio repeaters at an appropriate location to assist law enforcement and public safety personnel operating within the Yadkin-Pee Dee River corridor.

Our Analysis

Alcoa Generating's proposed recreation plan would provide the measures to define the specific design and implementation schedule for Alcoa Generating's proposed recreation facilities. Measures to implement appropriate signage would be developed in consultation with federal and state resource agencies. Thus, Alcoa Generating would develop its proposed recreation facilities in a coordinated manner, which would help ensure public safety and that the proposed facilities are consistent with intended purposes, as agreed to under the Yadkin Settlement. However, the proposed plan does not include provisions for reviewing and updating the plan over the license term. As indicated in the recreation use projections provided by Alcoa Generating, recreational use

of the project area is anticipated to increase by more than 40 percent by 2030. As such, during the term of the license the recreational needs and demands may change resulting in the need to modify or enhance recreational facilities during this period. Incorporating provisions to provide for periodic monitoring, review, and consultation, (e.g., consultation with resource agencies in conjunction with FERC Form 80 filings), would provide the means to help ensure future recreational demand and adequate public access to project waters is maintained over the term of a new license.

Progress Energy's proposed recreation plan and implementation schedule does not provide specifics regarding the contents of the plan other than to provide a schedule for the implementation of the proposed recreational enhancements. Progress Energy's proposal to meet with representatives from Montgomery and Stanly counties to review recreation issues at Lake Tillery in the future provides some capacity for coordination and review of the recreation issues. However, the proposal does not provide for consultation with other stakeholders or review of recreation needs and issues within the project, such as the Blewett Falls development.

A recreation management plan for the Yadkin-Pee Dee River Project would ensure that appropriate measures used for the development and implementation of the proposed recreational facilities. It would also provide the means for establishing a review process for future assessment of recreational needs and demands over the term of a new license. Developing such a plan, in consultation with recreation resource management agencies and other interested stakeholders, would help coordinate input for the review of the recreation needs and issues at the project. In addition, submitting the plan for Commission approval would ensure that future recreational needs are met at the project over the term of a new license.

Specifically, to accomplish these measures, in addition to an implementation schedule, the recreation management plan should include construction drawings and specifications for the proposed and staff-recommended recreation facilities; a description of the entity(s) responsible for the maintenance and management of the facilities; a description of safety measures and signs for the facilities; measures for periodic monitoring, review and consultation, such as consultation with resource agencies in conjunction with FERC Form 80 filings. A plan encompassing these measures would help ensure future recreational demand is met and adequate public access to project waters is maintained over the term of a new license. Finally, the plan should include provisions to consult with state resource agencies, counties, and other interested stakeholders in the project area, such as North Carolina WRC, North Carolina DWR, the North Carolina DPR, Stanly, Montgomery, and Richmond counties, and the city of Rockingham.

A Recreation Management Committee would be one option for establishing a process for future review of recreation issues at the project. Other measures such as periodic review, monitoring, and consultation of FERC Form 80 filings, also could be effectively employed. Developing a review process, in consultation with the

stakeholders, as a component of the recreation management plan, would help ensure that a suitable process is established for all parties involved.

The city of Rockingham recommends the development of a cooperative program for management of recreational use, funding for law enforcement, and emergency communication at the project. Law enforcement is typically the responsibility of state or local government. While such measures would be beneficial, such responsibilities are not the licensee's under the project license. In addition, as discussed below, Progress Energy proposes to co-fund, with North Carolina WRC, a joint-use boathouse and boat ramp facility to be used by North Carolina WRC for enforcement purposes on Lake Tillery, and by Progress Energy for lake management purposes. While not specifically a licensee responsibility, this measure would provide enhanced access for lake management.

Recreational Facility Enhancements

Alcoa Generating proposes to upgrade and improve existing recreational facilities and construct new recreational facilities within 10 years of license issuance, with the exception of the planned improvements to the High Rock, Tuckertown, and Narrows portage trails, which would be completed within 20 years of license issuance. The proposed recreation enhancements include:

- providing ADA improvements at up to 10 public recreation sites;
- providing and maintaining new portable toilet facilities at several existing recreation sites, where such facilities are not currently available;
- installing two ADA-compliant fishing piers at existing recreation sites, one on High Rock reservoir and the other on Tuckertown reservoir;
- modifying existing tailwater fishing areas at the High Rock and Tuckertown tailwaters;
- improving the four project portage trails to North Carolina standards;
- constructing a new public recreation site with a swimming area and beach on High Rock reservoir in Rowan County;
- constructing up to 10 campsites dispersed throughout the project area; and
- replacing the Highway 49 Boat access area when necessary.

Alcoa Generating proposes to operate and maintain its existing recreation sites, the new recreation site proposed for High Rock reservoir in Rowan County, and the proposed dispersed campsites. It also proposes to remove its Part 8 and safety signs from the Rowan County pump station access area within 1 year of license issuance to effectively close the site due to safety and security concerns.

For the proposed ADA improvements, Alcoa Generating developed a preliminary list of sites that could most readily be made to comply with ADA standards, and that would benefit recreation users. It proposes to determine the final list of sites and the

improvements necessary to make the sites ADA compatible in consultation with resource agencies and the surrounding counties, as part of developing the proposed recreation plan for the project.

Alcoa Generating proposes to modify the existing tailwater fishing areas at the High Rock and Tuckertown tailwaters to allow improved access to the tailwater areas for fishing, with special consideration given to public safety and facility security issues. Alcoa Generating also proposes to improve the existing portage trails at Falls dam within 10 years of license issuance and at the High Rock, Tuckertown, and Narrows dams portage trails within 20 years of license issuance, unless the North Carolina DENR agrees that recreational use data demonstrates insufficient demand by non-motorized boaters.

Alcoa Generating proposes to develop a new public recreation site with a swimming area and beach on the Rowan County side of High Rock reservoir. The final location of the new recreation site would be determined by Alcoa Generating, and would be on non-project land currently owned by Alcoa Generating. Finally, Alcoa Generating proposes to install up to 10 (platform) campsites dispersed throughout the project area to help promote paddling through the project by non-motorized boaters using the Yadkin-Pee Dee River Trail. Alcoa Generating would consult with North Carolina DENR, North Carolina Division of Parks and Recreation, and others as appropriate, to determine the location of the campsites during the development of the recreation plan.

The Yadkin Settlement stipulates that the preferred locations of the campsites would meet the following minimum criteria:

- be located on Alcoa Generating-owned project or non-project land;
- be located in areas not prone to flooding;
- be located away from existing public recreation sites;
- be accessible by water or by trail;
- be sites conducive for use primarily by non-motorized watercraft;
- be sites distributed throughout the project so as to support use of the project reservoirs as part of the Yadkin- Pee Dee River Trail; and
- be conducive to the safety and security of the project and project facilities.

Alcoa Generating proposes to replace the existing boat launch access area immediately off Highway 49, in the vicinity of the Highway 49 Bridge. While the facility is located primarily on property owned by Alcoa Generating, parking for the site is located in the Highway 49 right-of-way. The North Carolina Department of Transportation has plans to widen Highway 49 in this area, and it is likely that when that widening occurs the existing site would need to be closed due to lack of parking. Alcoa Generating would make the final determination on the location of the new facility. The facility would be designed in consultation with North Carolina WRC and other resource agencies, and the plans for the new facility would be filed for Commission approval.

FWS expresses concerns that the tailwater areas are becoming unnecessarily restricted to public access and that these areas have traditionally provided access to prime recreational fishing, particularly during the spring when striped bass and white bass congregate below the dams. Accordingly, FWS recommends that Alcoa Generating maintain and enhance the public tailwater access areas and provide facilities that comply with ADA.

The city of Salisbury recommends that Alcoa Generating immediately take all measures needed to close the Rowan County pump station access area, or in the alternative, that the access area closure be among the terms and conditions of the license. Rowan County also wants immediate closure of the site to stop damage and ongoing pump station security problems.

At the Tillery development, Progress Energy proposes, within 4 years of license issuance, to make improvements to the Stony Mountain, Norwood, Swift Island, and Lilly's Bridge access areas, and to submit a plan and schedule for the installation of the recreation facilities within 180 days of license issuance. Progress Energy would consult with resource agencies prior to the construction of any new facilities. The proposed enhancements include the following measures:

- Stony Mountain – vault-type sanitary facilities, trash receptacles, updated signage, new information kiosk, and improved parking management.
- Norwood – a shelter and picnic tables, separate men's and women's vault-type restroom facilities, trash receptacles, updated signage, new information kiosk, and improved parking management (i.e., identification of parking locations for vehicles and trailers). Also at Norwood, an enhancement to the existing dock and boat launch if needed to provide boat access over the range of future lake levels.
- Lilly's Bridge – a shelter with picnic tables, separate men's and women's vault-type restroom facilities, trash receptacles, updated signage, new information kiosk, and improved parking management (i.e., identification of parking locations for vehicles and trailers).
- Swift Island – vault-type sanitary facilities, trash receptacles, updated signage, a new information kiosk, and improved parking management (i.e., identification of parking locations for vehicles and trailers).

Also, Progress Energy proposes to relocate, to Clarks Creek, the unimproved boat access site that is currently located in the area just south of the tailrace. This new access site would include a formal parking area, signage, information kiosk, as well as boat access to the Pee Dee River. Finally, Progress Energy proposes to provide North Carolina WRC access across project lands and matching funds, up to $25,000, for a shoreline public fishing area in Stanly County. The fishing area would consist of an ADA-accessible fishing pier and a gravel parking area. This facility would be completed within 4 years of license issuance.

At the Blewett Falls development, Progress Energy proposes to make improvements to the Anson County (Pee Dee) and Mountain Creek (Grassy Islands) public access areas within 4 years of license issuance. Progress Energy would submit a plan and schedule for the construction of the recreation facilities within 180 days of license issuance. Progress Energy would also consult with resource agencies prior to the construction of any new facilities. The proposed enhancements include:

- Anson County (Pee Dee) – a vault-type restroom facility, improvements to boat ramps to allow for ease of put-in over the range of proposed lake fluctuations, updated signage, a new information kiosk, and improved parking management (i.e., identification of parking locations for vehicles and trailers).
- Mountain Creek (Grassy Islands) – boat ramp modifications as necessary, updated signage, and improved parking management. Consultation with resource agencies would occur prior to the construction of any new facilities.

Progress Energy proposes to upgrade the existing canoe portage at the Blewett Falls dam to applicable North Carolina state standards. Progress Energy also proposes, within 24 months of issuance of a license that is final and non-appealable, to provide North Carolina DENR a one-time contribution of matching funds up to a maximum of $25,000 for the enhancement and/or expansion of the Yadkin-Pee Dee River Trail. The funds would be used for developmental, promotional and/or implementation purposes for any portion of the trail extending from Tillery dam in North Carolina to the I-95 Bridge in South Carolina. Finally, Progress Energy proposes to co-fund, with North Carolina WRC, a joint-use boathouse and boat ramp facility to be used by North Carolina WRC for enforcement purposes on Lake Tillery, and by Progress Energy for lake management purposes. This facility would be located in the vicinity of the proposed new public fishing access site in Stanly County and would be completed within 4 years of license issuance.

Anson County recommends that Progress Energy provide additional recreation access to the western shoreline of Blewett Falls reservoir. The city of Rockingham recommends that Progress Energy construct and maintain recreational facilities in the vicinity of the Highway 109 landing, including: (a) in cooperation with North Carolina WRC, repair the existing, and construct an additional, boat ramp to assure reliable boating access across the range of permitted lake fluctuations; (b) level, expand, and pave or provide gravel at the existing access road and parking area; (c) install and maintain appropriate, vandal-resistant lighting at parking area; (d) install and maintain vault toilets, trash receptacles, and picnic tables in appropriate locations commensurate with use and consistent with North Carolina WRC guidance; (e) maintain these facilities weekly during the season of use or more frequently commensurate with use; and (f) with North Carolina Department of Transportation's approval, install and maintain appropriate signage on Highway 109 to indicate recreation facilities and maintain safe traffic control.

The city of Rockingham also recommends that Progress Energy undertake measures to enhance recreational use of the Grassy Islands access area, including: (a) in

cooperation with North Carolina WRC and Richmond County implement certain enhancement measures (e.g., dredging channel,[49] floating boat ramps, or extending boat ramps) within 1 year of license issuance to assure reliable access across the range of permitted lake fluctuations; (b) install a minimum of two vault toilets and trash receptacles at appropriate locations, commensurate with use and pursuant to North Carolina WRC guidance; (c) maintain these facilities weekly during the season of use or more frequently commensurate with use; (d) install appropriate, vandal-resistant lighting at parking area; and (e) in cooperation with North Carolina WRC, study feasibility of installing overnight campsites.

At the Pee Dee access area, the city of Rockingham recommends that Progress Energy: (a) enlarge the existing parking lot and designate spaces to accommodate users during the high use season; (b) with Anson County and/or North Carolina Department of Transportation's approval, install and maintain appropriate signage to indicate the location of recreation facilities and to help maintain safe traffic control; (c) in cooperation with North Carolina WRC and Anson County implement certain enhancement measures (e.g., extending existing ramps, installing floating ramps) within 1 year of license issuance to ensure reliable boating access across the range of permitted lake fluctuation; (d) install a minimum of two vault toilets and trash receptacles at appropriate locations commensurate with use and pursuant to North Carolina WRC guidance; (e) install picnic tables; (f) maintain these facilities weekly during the season of use or more frequently, commensurate with use; (g) install appropriate, vandal-resistant lighting; (h) in cooperation with North Carolina WRC, study feasibility of installing overnight campsites; and (i) designate a jet ski area on the lake.

Finally, the city of Rockingham recommends that Progress Energy conduct a feasibility study to identify and recommend, for subsequent approval, cost-effective facilities and locations for public boating access on the east side of the Tillery riverine reach, between the Highway 109 access site and the Grassy Islands access area, to provide access across the range of project flow releases. The city recommends that the study be developed in consultation with North Carolina WRC, North Carolina DENR, land conservation nongovernmental organizations (e.g., Trust for Public Land and The Nature Conservancy), boating nongovernmental organizations (e.g., American Whitewater and American Canoe Association), the Yadkin-Pee Dee Trail Association, Richmond County, and the city of Rockingham. The city requests that Progress Energy submit the feasibility study, and a plan to construct, operate, and maintain such access facilities, as part of the city's recommended recreation management plan.

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[49]North Carolina WRC (letter dated December 3, 2007) reports that it has recently completed dredging a channel from the Grassy Islands access area to remove stumps and sand that inhibited access to the Blewett Falls reservoir at low water levels, and that at water surface elevation 174 feet, there is a channel 3 feet deep from the ramp to the reservoir.

Our Analysis

Alcoa Generating's proposed ADA enhancements to existing recreation facilities would provide significantly increased ADA accessibility to the project's recreational resources. The ADA-compliant fishing piers would provide enhanced public access for recreational fishing opportunities. In addition Alcoa Generating's proposed tailwater access enhancements would provide the opportunity for public access in these areas, while also considering public safety and facility security. As FWS states, the tailwater areas provide access to prime recreational fishing, particularly during the spring when striped and white bass congregate below the dams. Alcoa Generating's proposed development of up to 10 campsites would provide the opportunity for enhanced recreational camping opportunities throughout the project area. In addition, the proposed measures would help ensure that proper design and location criteria are implemented for the siting of the campsite facilities. Accordingly, all proposed enhancement measures would enhance recreational use and access at the Yadkin Project.

Replacing the Highway 49 access area at the same time parking would be eliminated would help ensure that comparable public access is provided to the project. In addition, the proposed consultation process for the final determination on the site location and design of the new facility would help ensure that any new facility is located and designed appropriately to meet recreational needs at the project.

Both the city of Salisbury and Stanly County raise the need for the immediate closure of the Rowan County pump station access area on High Rock reservoir due to safety and security concerns. Alcoa Generating proposes, within 1 year of license issuance, to close the site and remove the Part 8 and safety signs. No concerns were raised regarding restriction of public access to the project as a result of this closure. Due to the safety concerns and security issues, removal of the signs and closure of the site within 60 days rather than the proposed 1 year of license issuance, would help to resolve the issues associated with this area more expeditiously.

Progress Energy's proposed recreation enhancements to the Stony Mountain, Norwood, Swift Island, and Lilly's Bridge access areas would provide additional sanitary facilities and trash receptacles at public access sites at the Tillery development. As part of Progress Energy's recreation study, about 20 percent of survey respondents indicated trash and litter as a concern. Norwood, Stony Mountain, and Swift Island access areas were indicated as areas where this was a concern. In terms of toilet facilities at the project, currently they are only provided at the state recreation area, Morrow Mountain State Park. Also according to Progress Energy's recreation study, 25 percent of the survey respondents indicated that the toilet facilities were inadequate, with the Stony Mountain, Norwood, Swift Island, and Lilly's Bridge sites indicated as the sites with the greatest need for sanitary facilities. The proposed relocation of the unimproved boat access site south of the tailrace to Clarks Creek would help establish a more formal public access area with enhanced amenities. Therefore, the proposed enhancements at these facilities and the proposed new public boat access facility would help meet

recreational use needs and demands at the Tillery development. Also, Progress Energy's proposed provision of access and funding (up to $25,000) to North Carolina WRC for a public shoreline fishing access area in Stanly County would provide enhanced access at the project for recreational fishing opportunities.

For Blewett Falls, Progress Energy's proposed enhancements at the Anson County (Pee Dee) and Mountain Creek (Grassy Islands) access locations would provide enhanced information and signage, restroom facilities, improved parking and enhanced boating access to the reservoir. Progress Energy's proposed upgrade to the existing canoe portage at Blewett Falls dam, to applicable North Carolina state standards, would provide beneficial enhancements for the canoe portage access. These enhancements would improve the overall recreation experience of the project.

In the license application, Progress Energy proposes to install, at the Pee Dee access area, a picnic shelter with tables and additional signage at the facility, and to design the picnic shelter, sanitary facilities, and parking associated to provide ADA accessibility. The Proposed Action under the Yadkin-Pee Dee Settlement does not include the picnic tables, shelter, or ADA accessibility enhancements at this area. The city of Rockingham requests additional facilities at the Pee Dee access area beyond those provided under the settlement, specifically picnic tables and lighting, and recommends that Progress Energy conduct a feasibility study of providing campsites and designate a jet ski area. For the Mountain Creek (Grassy Islands) access area, the city asks for measures beyond those proposed in the Yadkin-Pee Dee Settlement, including vault toilets, trash receptacles, lighting, and study feasibility of installing overnight campsites.

Survey respondents, during Progress Energy's recreation study, indicate there is a need for toilet facilities (more than 50 percent). The respondents also recommend enhanced lighting, trash cans, disabled accessibility, and improved boating access at the Blewett Falls reservoir. In terms of campground facilities, respondents indicate the desire for campground facilities overall at Blewett Falls reservoir (36 percent) and at Grassy Islands (50 percent). No estimates were provided for the Pee Dee access area. In terms of capacity at the parking areas, there were six occasions during the 2004 to 2005 study period where the Pee Dee facility, and three occasions at the Grassy Islands access area, exceeded the estimated maximum capacity.

Based on the analysis above, the enhancements proposed by Progress Energy, with some of the additional measures recommended by the city of Rockingham and the additional new access area of the western shoreline as recommended by Anson County, would help address recreational needs and demand at the Blewett Falls reservoir. Specifically, the additional measures, beyond those proposed by Progress Energy, would include: (1) at Pee Dee access area - picnic tables and lighting; (2) at Grassy Islands - vault toilets, trash receptacles, and lighting; and (3) at a location on the western shoreline, such as at the informal SR 1744 access site or at an alternative site to be determined as part of the recreation plan - a boat ramp (or modifications to the existing boat ramp), parking, a vault toilet, trash receptacles, and a picnic area. Staff also notes that the

addition of a port-a-john at the Blewett Falls tailrace would address survey respondents' demand for this amenity at an increasingly popular location for angling. In addition, due to indicated demand for camping facilities, the assessment of the feasibility of installing overnight campsite facilities at these sites as part of the recreation management plan would provide the means to further determine if such facilities are warranted, and potentially established, in the future.

Progress Energy's proposed measures to co-fund, with North Carolina WRC, a joint-use boathouse and boat ramp facility, would provide enhanced access to both North Carolina WRC and Progress Energy for enforcement and lake management purposes. Also, Progress Energy's proposed funding (up to $25,000) for the enhancement and/or expansion of the Yadkin-Pee Dee River Trail would contribute to the enhancement of recreational opportunities associated with this trail.

The city of Rockingham recommends that Progress Energy upgrade the existing Highway 109 landing access area and conduct a feasibility study to determine the need for public boating access between the Highway 109 and Grassy Islands access areas. While the recommended enhancements and a new facility would provide enhanced recreational access to this reach, no significant demand has been demonstrated sufficient to require Progress Energy to provide such facilities.

3.3.7.3 Unavoidable Adverse Effects

None.

3.3.8 Land Use and Aesthetics

3.3.8.1 Affected Environment

Land use in the Yadkin-Pee Dee River Basin is primarily forested (50 percent) with some agricultural (15.6 percent) and pasture land (14.1 percent). About 13 percent of the area is developed. Most of the population is centered in large urban areas in Charlotte, Greensboro, and Winston-Salem, about a 1-hour drive from the Projects.

Below the Blewett Falls development, the Pee Dee River travels 188 miles through the coastal plain of South Carolina to the Atlantic Ocean. South Carolina counties in the lower Pee Dee watershed include Chesterfield, Darlington, Dillon, Florence, Georgetown, Horry, Marion, Marlboro, and Williamsburg. The area is composed of rural floodplains dominated by forest (about 59 percent) and agriculture (about 25 percent). Developed land comprises about 6 percent of the watershed.

Land Use

The Yadkin Project is located about 60 miles northeast of Charlotte in central North Carolina on the Yadkin River in Davidson, Davie, Montgomery, Rowan, and Stanly counties. Local cities and towns include Albemarle, Badin, Lexington,

Mocksville, Salisbury, and Troy. The Yadkin River Basin was historically used for forestland and agriculture. While forest still covers much of the area and farming and timberland are common, residential development has been increasing in the past two decades, particularly around the project's shorelines. Industrial use is predominantly for Alcoa Generating power generation.

The Yadkin Project encompasses 556 miles of shoreline distributed over four reservoirs. High Rock is the largest reservoir, with 360 miles of shoreline, Narrows covers about 100 miles of shoreline, Tuckertown about 75 miles, and Falls is the smallest reservoir with only 6 miles of shoreline. Table 45 summarizes land uses for each reservoir at the Yadkin Project.

Table 45. Yadkin Project (P-2197) reservoir shoreline miles in each land use category. (Source: Alcoa Generating, 2006a)

	High Rock		Tuckertown		Narrows		Falls		Total	
Land Use	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**	**Miles**	**%**
Forest	219.2	60.9	68.3	91.1	69.8	60.7	5.7	95	363.0	65.3
Developed	114.8	31.9	1.3	1.7	42.2	36.7	0.1	1.7	158.4	28.5
Agriculture	26.0	7.2	5.4	7.2	3.0	2.6	0.2	3.3	34.6	6.2
Total Shoreline	360.0	100.0	75.0	100.0	115.0	100.0	6.0	100.0	556.0	100.0

The middle and lower portions of High Rock reservoir are heavily developed with seasonal and permanent residences, private piers, and boat houses. Residential development dominates the shoreline in the lower reservoir tributary embayments such as Abbotts Creek, Flat Swamp Creek, Panther Creek, Dutch Second Creek, Crane Creek, and Swearing Creek. Duke Energy Carolinas, LLC, operates the Buck Steam Station, a four-unit coal-fired generating station that provides 369 MW of energy to Rowan County and uses water from High Rock reservoir for condenser cooling and other purposes (Duke Energy, 2007).

Tuckertown reservoir is largely undeveloped with habitat areas such as wetland complexes. The majority of land is Alcoa-owned land[50] not associated with project operations and designated as North Carolina game lands. These lands are open for public recreation use as allowed under state game land regulations.

Moderate development along Narrows reservoir is primarily older, high-density residential. Residential land is particularly concentrated in the eastern arm of Badin Lake along Beaver dam and Reynolds Creeks. About 10 percent of the undeveloped forested

[50] In this case, Alcoa-owned lands refer to either land outside the project boundary owned either by Alcoa Generating or its parent company, Alcoa, Inc.

shoreline outside the project boundary on the eastern side of the reservoir is included in the Uwharrie National Forest.

The relatively undeveloped Falls reservoir is deep and narrow with a forested, gorge-like shoreline. The eastern shoreline outside the project boundary includes National Forest System lands, while the western shoreline includes Alcoa-owned lands not associated with project operations.

The Yadkin-Pee Dee River Project is on the Pee Dee River, about 50 miles east of Charlotte in south-central North Carolina in Anson, Montgomery, Richmond, and Stanly counties. Norwood is the closest town to the Tillery development, and Rockingham is the closest town to the Blewett Falls development. Table 46 summarizes land uses within the Yadkin-Pee Dee River Project boundary. Federal lands adjacent to the project include the Uwharrie National Forest and the Pee Dee National Wildlife Refuge.

Table 46. Yadkin-Pee Dee River Project (P-2206) boundary acreages in each land use category. (Source: Progress Energy, 2006a)

	Tillery		Blewett Falls		Total	
Land Use	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Forest	799.7	61.2	2,163.9	89.0	2,963.6	79.3
Range	38.3	2.9	223.1	9.2	261.4	7.0
Developed	432.7	33.1	0	0	432.7	11.6
Agriculture	22.9	1.7	0.3	0	23.2	0.6
Project Works	6.3	0.5	36.2	1.5	42.4	1.1
Barren	7.1	0.5	7.9	0.3	15.0	0.4
Total	1,307.0	100.0	2,431.4	100.0	3,738.4	100.0

The landscape around Lake Tillery is rolling hills, forestland, and farmland. The shoreline includes both year-round and seasonal homes and cottages. According to the Lake Tillery SMP, more than half of the shoreline is classified as residential (54 percent), 28 percent is undeveloped lands, and 10 percent is undeveloped recreation. The remaining 8 percent includes a number of uses such as commercial, agricultural, project operations, public infrastructure, and developed recreation (Progress Energy, 2007c). Water from the Tillery development supplies two municipalities. The town of Norwood has an intake on the western shoreline of Lake Tillery about 2.5 miles upstream of Tillery dam, and Montgomery County has an intake 500 yards upstream of Tillery dam on the eastern shoreline.

Blewett Falls reservoir is dominated by forestland with few homes and seasonal cottages and no urban development. Blewett Falls reservoir is used for municipal water supply in both Anson and Richmond counties. The intake for Anson County is on the

western shoreline about 1.5 miles upstream from Blewett Falls dam, and Richmond County's intake is about 1,000 yards from the dam.

Land Ownership and Management

Land owned by Alcoa Generating and associated with Yadkin Project operations or outside of the project boundary (generally full pond elevation at all four reservoirs) comprises the majority of the Yadkin Project area. There are no federal lands in the Yadkin Project boundary. The Uwharrie National Forest comprises federal lands adjacent to the Yadkin Project. State-owned or managed lands adjacent to the project include North Carolina State Game Lands, and Morrow Mountain State Park and Natural Heritage Areas. The Eagle Point Nature Preserve is owned and managed by Rowan County. Private land consists of privately owned shoreline property.

Uwharrie National Forest—The Forest Service manages the Uwharrie National Forest adjacent to the Projects. The Forest covers 50,368 acres over 61 parcels interspersed with private forestland. The Forest Service manages about 10 percent of the eastern Narrows shoreline and a small portion of shoreline upstream of Falls dam and powerhouse, outside of the Yadkin Project boundary. The Uwharrie National Forest includes diverse forest communities, habitats, and archaeological and heritage resources.

Management of the Uwharrie National Forest is guided by the *Proposed Land Management Plan for the Uwharrie National Forest* (Forest Service, 2007a). The plan contains guidelines to restore natural ecological conditions and manage heritage resources while providing environmentally friendly outdoor recreation opportunities. The Uwharrie National Forest offers opportunities for hiking, camping, mountain biking, and off-road vehicles. The forest also offers commercial timber activities, which require maintenance of vegetated riparian corridors along perennial streams.

Morrow Mountain State Park—Morrow Mountain State Park covers 4,693 acres on the western shoreline of the Yadkin River immediately downstream of Falls dam. The state park was established by the North Carolina DPR to protect and provide public access to representative examples of unique biological, archaeological, geological, scenic, and recreational resources of the Uwharrie Mountains. Land acquisition priorities under the Morrow Mountain State Park Master Plan would increase the park acreage by 863 acres, to a total of 5,586 acres (North Carolina DPR, 2005).

State parks in North Carolina are managed by the North Carolina DPR under the *Systemwide Plan for the North Carolina State Parks System* (North Carolina DPR, 2005). This action plan aims to conserve and protect representative examples of natural beauty and ecological features while providing outdoor recreation and environmental education opportunities. The plan outlines goals for interpretation and education, natural and cultural resource protection, park operations, capital improvements, planning, public awareness, community outreach, and system expansion.

North Carolina State Game Lands—There are three game land areas in the Yadkin Project area. Linwood Game Land, owned by the North Carolina WRC, covers 126 acres of water-access lands in Davidson County upstream of High Rock reservoir. Alcoa Game Land is owned by Alcoa Generating and leased to North Carolina WRC. These lands cover 8,372 acres along the shores of High Rock, Tuckertown, Narrows, and Falls reservoirs. Camping is not allowed at either Linwood or Alcoa game lands. The Uwharrie game land covers 50,189 acres of Forest Service lands in the Uwharrie National Forest east of Narrows and Falls reservoirs. Camping is allowed in designated areas in the Uwharrie game land. All game lands are open to hunting 6 days per week. Primary game species include deer, turkey, fox, raccoon, rabbit, squirrel, quail, waterfowl, and warmwater fishes (North Carolina WRC, 2007).

Natural Heritage Areas—There are 28 significant natural heritage areas, including 5 of national significance, 12 of statewide significance, and 11 of regional significance in the Yadkin Project area (North Carolina NHP, 2005). A significant natural heritage area is an area of land or water identified by the Natural Heritage Program as being important for conservation of the state's biodiversity. It contains one or more natural heritage elements, including rare natural communities, rare species, and special animal habitats. Many of the heritage areas in the project area are in private ownership or managed by the Forest Service as part of the Uwharrie National Forest.

Eagle Point Nature Preserve—The Eagle Point Nature Preserve is a 200-acre preserve managed by Rowan County Parks and Recreation, of which 100 acres are leased by Rowan County from Alcoa Generating. Located on the southern shore of High Rock reservoir near the town of Salisbury, the preserve offers hiking trails, vistas, historic home sites, fishing, and canoe access, as well as wildlife habitat (RCPR, 2007).

Progress Energy-owned land associated with Yadkin-Pee Dee River Project operations or outside of the project boundary (generally full pond elevation) comprises the majority of the Yadkin-Pee Dee River Project area. There are no federal lands in the Yadkin-Pee Dee River Project boundary. The Pee Dee National Wildlife Refuge represents federal lands that lie adjacent to the project. State-owned or managed lands adjacent to the project include North Carolina State Game Lands and natural heritage areas. Private land consists of privately owned shoreline property.

Pee Dee National Wildlife Refuge—The 8,443-acre Pee Dee National Wildlife Refuge is located on the reach of the Pee Dee River between the Tillery and Blewett Falls developments but not within the project boundary. FWS manages the refuge to provide habitat for migratory waterfowl, song birds, and threatened and endangered species, and to provide recreation, environmental education, and interpretation opportunities. FWS is currently developing a Comprehensive Conservation Plan for the Pee Dee National Wildlife Refuge. The plan outlines management objectives and strategies that would be implemented over 15 years to achieve refuge vision and goals, which include protecting

cultural and biological resources and providing outstanding hunting and fishing opportunities (FWS, 2007).

North Carolina State Game Lands—Pee Dee River Game Land is owned by Progress Energy and leased to North Carolina WRC. The area covers 6,829 acres of the Pee Dee River in the reach between the Tillery and Blewett Falls developments, but outside the project boundary. Camping is allowed in designated areas, and the game land is open to hunting 6 days per week. Primary game species include deer, turkey, fox, raccoon, squirrel, waterfowl, and warmwater fishes (North Carolina WRC, 2007).

Natural Heritage Areas—There are 21 significant natural heritage areas, including 4 of national significance, 9 of statewide significance, and 8 of regional significance in the Yadkin-Pee Dee River Project area (North Carolina NHP, 2005).

Great Pee Dee River Heritage Preserve—Located on the Pee Dee River downstream of the Blewett Falls development in South Carolina, the Great Pee Dee River Heritage Preserve is a 2,275-acre preserve covering 7 miles of river frontage. The preserve protects wildlife habitat and offers recreational use, such as boating and wildlife viewing. South Carolina DNR manages the preserve (South Carolina DNR, 2007).

Shoreline Management Plans

The Yadkin SMP establishes reservoir management priorities for each of the four project reservoirs. The management priorities were designed to reflect the natural character and historical use while managing the level of shoreline development at each reservoir. These priorities include protection of fish and wildlife habitat, bald eagle habitat, and fishery resources through preservation of wetlands and aquatic vegetation; protection of remaining areas of natural shoreline; encouraging low-impact recreational (e.g., bank fishing) and providing adequate public access facilities; and monitoring recreational use.

The Yadkin SMP also designates natural resource areas along project reservoir shorelines as conservation zones. Development in conservation zones is prohibited if potential impacts on resources cannot be adequately avoided or mitigated. Table 47 presents the percentage of shoreline designated as conservation zone at each reservoir in the Yadkin Project. The largest conservation zones along High Rock reservoir are found in the upper reaches above Swearing Creek.

The Lake Tillery SMP (Progress Energy, 2007c) establishes guidelines for management of the Yadkin-Pee Dee River Project's 118 shoreline miles on Lake Tillery. The goal of these guidelines is to provide a mechanism to assist in the protection and enhancement of the environmental, scenic, and recreational values provided by Lake Tillery and project lands, while ensuring the continued safe and reliable production of hydroelectric power at the project and compliance with regulatory requirements.

Table 47. Percentage of shoreline as conservation zone at the Yadkin Project (P-2197). (Source: Alcoa Generating, 2006a)

	Shoreline	Conservation Zone	
Reservoir	**Miles**	**Miles**	**Percent**
High Rock	360	119	33
Tuckertown	75	49	65
Narrows	115	54	47
Falls	6	5	91
Total	556	227	41

The Lake Tillery SMP guides the types of uses allowed on project lands and defines the permitting procedures required to obtain approval. Residents are allowed to seek approval for construction of facilities that are primarily water-based, such as docks, boathouses, and retaining walls. The Lake Tillery SMP maintains a vegetated buffer of 30 feet around the project impoundment and requires that at least 75 percent of leased areas be maintained in a natural, undisturbed condition.

Under the Lake Tillery SMP, 17.3 shoreline miles are classified as environmental/natural and 14.2 miles are classified as impact minimization zone (IMZ). Environmental/natural designated areas are areas that contain wildlife habitat or other characteristics (e.g. shallow water, cultural resource areas, terrestrial resource areas) where development is undesirable from a lake management standpoint. Development is prohibited in these areas, which include all currently undeveloped lands identified as emergent/submerged aquatic vegetation that are associated with a tributary stream. IMZ designated shoreline areas are characterized as having specifically identified importance on the reservoir from a scenic, environmental, or cultural standpoint. Although IMZ protection does not necessarily preclude private, commercial, business, or industrial access to the reservoir, disturbance, including shoreline clearing and modification, impacts on aquatic vegetation beds including the removal of submerged woody debris, and construction of piers, in areas within IMZs requires the approval of Progress Energy. Any proposed disturbance must include an impact minimization plan that contains measures to avoid, minimize, or mitigate impacts on environmental features within the IMZ. Approval of disturbance activities and the plan to minimize impacts of proposed activities is decided on a case-by-case basis.

Visual Aesthetics

Alcoa Generating evaluated visual aesthetics of the Yadkin Project in its project-wide aesthetic study and Uwharrie National Forest aesthetic study. Visual aesthetics are evaluated using scenic integrity, a measure of the degree to which a landscape is visually perceived to be whole, intact, and complete. Scenic integrity levels are established by the

Forest Service as a frame of reference for measuring achievement of scenic integrity. Scenic integrity is a continuum ranging from very high (unaltered) to very low (heavily altered). Very high scenic integrity, which corresponds to a completely intact, unaltered, natural landscape, is considered the baseline. High Rock reservoir is slightly to moderately altered and received a low-moderate scenic integrity rating. Tuckertown reservoir is relatively undeveloped, but the presence of overhead transmission lines alters the natural landscape, thus it received a moderate scenic integrity rating. The area surrounding Narrows reservoir is slightly to moderately altered, and it received a low-moderate scenic integrity rating. Falls reservoir is the least developed of the four project developments, and the area received a high scenic integrity rating.

The project-wide aesthetic study also included a user analysis, based on the responses from surveys of visitors, waterfront residents, and non-waterfront residents of private communities regarding project aesthetics. Three user groups were asked to rate scenic quality of the reservoirs on a scale of 1 to 5, with 1 being very unattractive and 5 being very attractive. On average, scenic quality was perceived as average to somewhat attractive at all reservoirs; the average score ranged from 3.7 for High Rock reservoir to 4.3 for Narrows reservoir. Table 48 summarizes the percent of responses within each rating category. Over half of the respondents at all reservoirs felt that scenic quality was somewhat attractive to very attractive. Primary detractors to scenic quality were floating debris, muddy water, exposed reservoir bottom (High Rock only), eroding shoreline, and timber harvesting. Project facilities such as dams, powerhouses, and overhead transmission lines were identified as detractors by less than 15 percent of respondents.

Table 48. Summary of user responses on Yadkin Project (P-2197) reservoir aesthetics. (Source: Alcoa Generating, 2006a)

		Percent of Responses				
Reservoir	**Number of. Respondents**	**Very Unattractive**	**Somewhat Unattractive**	**Average**	**Somewhat Attractive**	**Very Attractive**
High Rock	1,559	4	5	36	29	26
Tuckertown	215	1	2	29	18	49
Narrows	915	5	2	15	20	58
Falls	17	0	12	29	29	29

The Uwharrie National Forest aesthetic study evaluated the consistency of existing and proposed project facilities and operations that are visible from the Uwharrie National Forest with the visual quality objectives of the Uwharrie National Forest Management Plan. Visual quality objectives describe five different degrees of acceptable alteration of the natural landscape based upon the importance of aesthetics. The portion of the Uwharrie National Forest adjacent to the project area has a partial retention objective, which means that it provides for management activities that may be evident, but remain visually subordinate to the characteristic landscape.

Results of the Uwharrie National Forest aesthetic study user's survey indicate that, for a majority of visitors (85 percent), scenic quality is a minor consideration or not considered when deciding to visit the Uwharrie National Forest, although 67 percent feel that scenic quality of the Uwharrie National Forest is better than other areas. The scenic quality of the Uwharrie National Forest was rated very attractive by 66 percent of respondents and attractive by 28 percent of respondents. Floating debris, eroding shoreline, muddy water, and timber harvesting were identified as primary detractors from scenic quality of the Uwharrie National Forest. According to respondents, the reservoir, forest, and wildlife are the most attractive features with regard to the scenery of the Uwharrie National Forest. Trails, campsites, and hunting/fishing opportunities also were identified as attractive features. Rough, dusty roads and trash were the predominant least attractive features, followed by erosion and lack of trails by the reservoir.

Users were asked to rate their reaction to specific landscape features as positive, negative, or neutral. The majority of respondents reacted positively towards campgrounds and picnic areas (74 percent) and reservoirs (83 percent). Respondents reacted negatively towards roads and related structures (47 percent) and timber harvests (36 percent). Fifty-nine percent of users indicated that they did not notice the power generation facilities. Of the 36 percent that did notice power generation facilities, 44 percent had a strong positive reaction, 25 percent had a neutral reaction, and 19 percent had a strong negative reaction.

At the Yadkin-Pee Dee River Project, aesthetic features of Lake Tillery include views of Morrow Mountain and Tater Top Mountain. Project facilities are not visible from viewpoints on Lake Tillery, such as the downstream view from Morrow Mountain State Park. Also, there is little effect from the Tillery development on the view looking downstream from the reservoir surface toward Tillery dam. The powerhouse is not visible from the reservoir, and the dam is not prominent in the viewshed. From the NC Highway 731 Bridge crossing, the dam and powerplant make up the primary view.

The area surrounding Blewett Falls reservoir is dominated by rolling hills with less relief than the upper reaches of Lake Tillery. Shoreline development is minimal with only a few houses visible, resulting in views of a primarily undisturbed vegetated shoreline. The powerhouse is not visible from the reservoir. The dam is the primary view looking upstream from the informal public access point below the dam.

3.3.8.2 Environmental Effects

Existing project facilities and operations are generally consistent with the existing land use, management, and visual aesthetics of the area. Some facilities are visible on the landscape and contrast with the forested setting, but have not been shown to detract substantially from the natural character of the area. Alcoa Generating and Progress Energy do not propose any new construction that would affect land use, management, or visual aesthetics. However, proposed environmental measures, such as recreation

enhancements and changes in flows and reservoir elevations may affect land use management, and visual aesthetics over the term of the new license.

Minimum Flows and Reservoir Levels

Under the settlement agreements, Alcoa Generating and Progress Energy propose to increase minimum flows from the Falls, Tillery, and Blewett Falls developments to enhance aquatic habitat downstream of the Blewett Falls development. Proposed operations demand that changes in water levels occur on a daily basis for power production and to maintain minimum flow for downstream users. In addition, seasonal changes in reservoir elevations are proposed to enhance aquatic habitat. Under the new license, maintaining higher flows from the Falls, Tillery, and Blewett Falls developments may cause fluctuations in reservoir levels different from existing conditions.

Our Analysis

Proposed changes in minimum flows at the Falls development and reservoir levels at all four Yadkin reservoirs would have minimal, to no, effect on land use, ownership, or management. Based on the project-wide and Uwharrie National Forest aesthetic studies, existing operations are generally compatible with the scenic integrity ratings at each reservoir.

Proposed changes in minimum flows and reservoir levels would have little effect on visual aesthetics on most days. The proposed minimum elevation at High Rock reservoir is 3 feet higher in winter than currently allowed, which may improve visual aesthetics during winter. Proposed year-round minimum elevations at the other three project developments are within 1 to 2 feet of existing conditions. Maintaining reservoir elevations within 1 to 2 feet of the recorded elevation from April 15 to May 15 to enhance conditions for fish spawning would benefit visual aesthetics by ensuring high reservoir elevations in spring, thereby enhancing the natural character of the reservoirs.

However, because maintaining minimum flows is a priority over reservoir levels, extensive drawdowns beyond maximum levels may be periodically needed to maintain flows from Falls reservoir during drought conditions, under the Low Inflow Protocol, and during maintenance activities. These drawdowns would adversely affect visual aesthetics by exposing a band of muddy substrate between the water surface and shoreline vegetation. In the project-wide aesthetic study, exposed reservoir bottom at High Rock reservoir was identified as a detractor from scenic quality. Alcoa Generating would minimize adverse effects on visual aesthetics for shoreline property owners and reservoir users by returning to normal minimum elevation as quickly as possible following drawdowns below normal minimum elevation. Alcoa Generating's website currently provides real-time reservoir level data. Projecting reservoir levels and providing maximum drawdown advisories and planned maintenance drawdown notices may minimize effects by allowing users to avoid temporary drawdowns in reservoir elevations during trip planning.

Proposed changes in minimum flows and reservoir levels for the Yadkin-Pee Dee River Project would not affect land use, ownership, or management. Overall, the proposed changes in minimum flows and reservoir levels would have minimal impact on visual aesthetics. Proposed maximum drawdown limits at Tillery and Blewett Falls reservoirs are stricter than currently allowed. Further, proposed daily reservoir levels are within 1 to 2 feet of existing conditions, and typical operations would not result in maximum drawdowns. Limiting drawdown to within 1 to 2 feet of April 15 elevations until May 15 to enhance conditions for fish spawning would benefit visual aesthetics by ensuring high reservoir levels in spring and enhancing the natural beauty.

However, extensive drawdowns beyond maximum limits may be needed to maintain minimum flows from Blewett Falls reservoir during drought conditions, under the Low Inflow Protocol, and during maintenance activities. These drawdowns would adversely affect visual aesthetics similar to effects described above for the Yadkin Project. Progress Energy would minimize adverse effects by returning to normal minimum elevation as quickly as possible following drawdowns. Progress Energy proposes to add a projection of the expected daily water levels on their existing public messaging service, and provide an annual notice on November 15 of the first 5 years of the license alerting the public to drawdown limits that apply between December 15 and March 1. Informing the public through these routes and additional avenues, such as on Progress Energy's website, may minimize effects by allowing users to plan visits to avoid temporary drawdowns in reservoir elevations.

Shoreline Management Plan

Alcoa Generating proposes to submit a revised Yadkin SMP within 2 years of the effective date of a new license. An initial revision involving minor changes to the original SMP was filed with the Commission in 2002. Modifications to the current SMP would be identified through a collaborative process that includes state and federal agencies, public recreation users, nongovernmental organizations, and shoreline property owners. Alcoa Generating proposes modifications to the existing SMP specifications for private recreation facilities, shoreline stewardship policy, subdivision access approval, multi-use facility permitting, and industrial approval procedures (Alcoa Generating, 2007a, appendix D). Proposed changes to private recreation facility specifications would allow siting areas within forested setbacks,[51] and minimum water depth of piers would decrease from 8 feet to 6 feet. Other major changes include allowing boat lifts inside boat slips to have supports resting on the reservoir bottom, relaxing limitations on vegetation removal in forested setbacks to allow residents to remove limbs to improve

[51]Per the proposed SMP revisions, a sitting area would be permitted within the 100-foot setback. The sitting area must be at ground level, must not exceed 200 square feet, and must have a pervious surface (e.g., pressure-treated wood, gravel, or uncemented brick, rock, stone, or paving blocks).

water views while maintaining significant vegetative cover, and removing voluntary guides for timbering operations as most of the protective measures are already contained in the forested setback requirement.

The proposed changes are designed to continue the current level of protection to the shoreline and reservoirs, while providing adjoining property owners and Alcoa Generating more flexibility in considering and approving specific shoreline development proposals and requests. The Commission would reserve the right to require changes to the modified SMP. The SMP would be modified within 1 year of the effective date of a new license and filed with the Commission for final approval within 2 years of the effective date of a new license.

A Commission-approved SMP for Lake Tillery, part of the Yadkin-Pee Dee River Project, has been in effect since November 2004 and would continue to be enforced in the next license term. Progress Energy does not propose any changes for the Lake Tillery SMP under re-licensing.

Progress Energy proposes to develop a written shoreline management policy for Blewett Falls reservoir where it concerns its proposed management of project lands surrounding the reservoir. The policy would prohibit private access, except normal foot access, to the reservoir across Progress Energy-owned lands except at designated public access areas. The policy would focus on natural resource protection to preserve the undisturbed nature of the Blewett Falls development. Progress Energy does not propose to develop a formal SMP for Blewett Falls reservoir given that private development permitting for shoreline access and structures is not proposed for the next license term.

Our Analysis

Changes to the Yadkin SMP are unlikely to affect land ownership, management, or visual aesthetics because the proposed Yadkin SMP would not allow additional large-scale development without review and permission from the Commission. Proposed changes would allow residents more flexibility in pier construction and enhancement of water views, while maintaining existing measures to ensure the forested nature of the shoreline is protected. Visual aesthetics would not be affected if changes resulting from SMP modifications are consistent with the existing protective measures laid out in the Yadkin SMP.

Because no changes to the Lake Tillery SMP are proposed by Progress Energy, it would not affect land use, management, and visual aesthetics. The implementation of a shoreline management policy for Blewett Falls would have beneficial environmental effects on land use, management, and visual aesthetics by ensuring that the natural resources and undeveloped character of Blewett Falls reservoir are protected in the next license term. The shoreline management policy limiting development along with the restrictions on clearing and burning in the 100-foot buffer in the area of Grassy Island adjacent to the shoreline would help maintain a stable shoreline where vegetation currently exists above the fluctuation zone. Within the fluctuation zone, however, we

would expect project operations to result in some shoreline erosion. Any shoreline management policy developed for Blewett Falls, emphasizing resource protection and shoreline preservation, should define management objectives. In addition, measures for consultation in the development of this policy and provisions for periodic review and update of this policy would help ensure that these shoreline management guidelines would provide long-term protection of the shoreline resources over the term of a new license. Minor, positive environmental effects would result from implementation of the shoreline management policy by discouraging informal access points on Progress Energy-owned lands and through the provision of a protective vegetative buffer.

Visual aesthetics would be preserved under a shoreline management policy through preservation of the area's natural character. Although private development permitting is not currently proposed, if such development is proposed in the future, the policy could be revised to include more strict stewardship regulations or a formal SMP could be developed to ensure that the shoreline is protected from private development in the future.

Recreation Improvements

Alcoa Generating proposes to improve existing facilities, close unsafe facilities, and provide new recreational opportunities in the Yadkin Project area. A recreation plan for the Yadkin Project would be developed within 2 years of the effective date of a new license. Proposed recreation improvements for all project reservoirs are summarized in detail in section 3.3.7, *Recreation Resources*.

Progress Energy proposes several recreational enhancements for Lake Tillery to be completed within 4 years of license issuance. Progress Energy also proposes several recreation improvements to the Anson County and Mountain Creek access areas on Blewett Falls reservoir. Proposed recreation improvements for project reservoirs are summarized in detail in section 3.3.7, *Recreational Resources*.

Our Analysis

A recreation plan for the Yadkin Project would have positive environmental effects by guiding recreation land use and management for the license term, and may help avoid conflicts by coordinating interagency management of recreation and land use. A recreation plan is unlikely to affect visual aesthetics. Improvements to existing facilities would not affect land use, management, or visual aesthetics provided that improvements are consistent with guidelines set by the Yadkin SMP.

Construction of a swimming area and beach on High Rock reservoir, ADA-accessible fishing piers on High Rock and Tuckertown reservoirs, and dispersed campsites would change land use from forested to developed recreational use. Developed recreation facilities, such as campgrounds, were viewed as positive landscape features in the Uwharrie National Forest Aesthetic Study (ERM, 2005b), suggesting that visual aesthetics would benefit from additional recreation facilities. Enhancing low-

density recreational uses, such as swimming and fishing, would not affect management or visual aesthetics, provided construction activities are temporary and are conducted within guidelines set forth by the Yadkin SMP.

Construction of a fishing pier, boathouse, and boat ramp in Lake Tillery would have minor environmental effects on land use. The new boathouse and boat ramp would benefit land management by improving enforcement and management access on the reservoir. Construction activities, particularly associated with the boathouse and ramp, may temporarily detract from the natural character of the lake, but effects on visual aesthetics would be limited to the construction period and would be minimized provided construction is consistent with guidelines set forth in the Lake Tillery SMP.

Constructing a new boating access area in Clarks Creek downstream of Tillery dam would change a previously forested area to developed recreation. However, because existing activities at the informal tailrace site would be discontinued and relocated to the new access site immediately downstream, overall use of the area would not change. The Clarks Creek site would provide controlled access to this reach compared to the informal site, resulting in positive environmental effects on land use. Minor adverse effects on visual aesthetics may occur during construction of the new boating access site, but effects would be temporary (limited to the construction period) and would be minimized provided Lake Tillery SMP guidelines are followed.

Improvements proposed by Progress Energy for Blewett Falls would include minor construction activities (e.g., installation of restrooms). Therefore, environmental effects on land use, management, or visual aesthetics would be negligible.

Cultural Resources

Alcoa Generating proposes to develop a historic properties management plan (HPMP) for the Yadkin Project. Progress Energy proposes to implement and enforce an HPMP for the Yadkin-Pee Dee River Project.

Our Analysis

Management of cultural resources is not currently provided for on Alcoa-owned lands, within or outside the project boundary. An HPMP for the Yadkin reservoirs would change existing land use in some areas. Potential land use changes under an HPMP include closing culturally sensitive areas, implementing cultural resource protection and mitigation measures, and redirecting recreational use in the project areas. HPMP protective measures would benefit visual aesthetics because they would provide additional protection from development of the shoreline.

Management of cultural resources is not currently provided for on Progress Energy-owned lands, within or outside of the project boundary. Environmental effects of an HPMP on land use, management, and visual aesthetics would be the same as for the Yadkin Project.

Land Conveyances

Several resource agencies provided additional comments and recommendations regarding land management. Several areas of Alcoa-owned lands, not associated with project operations, were identified for transfer to federal, state, or local entities through sale or deed. The potential for land transfers is included in the Yadkin Settlement, but is not considered under the Proposed Action for relicensing and would be decided by Alcoa Generating at a later date.

Progress Energy proposes restrictive covenants, leases, and donations of Progress Energy lands in the project area for the purpose of providing additional protection to stream and riparian habitats. A restrictive covenant would be placed on lands along the Uwharrie River confluence, including lands extending downstream of Dutchman's Creek on the south side of the mouth of the Uwharrie River, and lands at the upper end of the bay created by the above peninsula within 24 months of license issuance. Under the restrictive covenant, only non-consumptive land uses such as fishing, hunting, hiking, bird-watching, and other low-density recreational activities would be allowed. Prohibited activities on all restrictive covenant lands would include filling, draining, flooding, dredging, impounding, clearing, burning, cutting or destroying vegetation, cultivating, excavating, erecting, overnight camping, construction, releasing wastes, or otherwise doing any work including introducing exotic species, changing the grade or elevation, impairing the flow or circulation of waters, reducing the reach of waters, and any other discharge or activity requiring a permit under clean water or water pollution control laws and regulations, as amended.

Progress Energy proposes to donate to the state of North Carolina 300 acres of riparian habitat extending 4 miles from the Highway 731 Bridge downstream of Tillery dam on the eastern bank of the Pee Dee River within 5 years of license issuance. Progress Energy also proposes to lease Progress Energy-owned lands between the Morrow Mountain State Park and Pee Dee River, including the existing Morrow Mountain State Park boat launch, to the state of North Carolina for the term of the new license at present lease rates within 12 months of license issuance.

Progress Energy also proposes a restrictive covenant in the Grassy Islands area of the upper reaches of Blewett Falls reservoir containing wetland resources of regional significance within 24 months of license issuance. Activities would be restricted to non-consumptive uses and development would be prohibited. Progress Energy would also enforce a restrictive covenant for conservation purposes on the Diggs Tract of the Pee Dee River. Within 12 months of license issuance, Progress Energy would establish a 100-foot minimum buffer zone along 15,867 feet of shoreline 4 miles south of Highway 74, under which activities would be limited to selective clearing and controlled burning in accordance with a forest management plan approved by the North Carolina DENR, limited unimproved foot trails not more than 4 feet in width, and a single boat access point to the river. Progress Energy proposes to donate to the state of North Carolina, within 5 years of license issuance, approximately 1,600 acres of non-project lands along

the Pee Dee River below Blewett Falls dam. Lands include shoals below Highway 74 Bridge, the Gabbro Slopes area upstream of the Highway 74 Bridge, and valuable riparian and wetland complexes on the eastern and western river banks.

Our Analysis

We reviewed the lands proposed by Alcoa Generating for transfer and find that none of the lands are currently located within the project boundary. In addition, none are needed for project operations or to protect the project's environmental resources because they do not provide access, encompass facilities, or include environmental resources affected by project operations. While transfer or donation of lands for conservation purposes would generally be viewed as beneficial for visual aesthetics, we do not provide any further analyses of these measures.

Some of the lands proposed for donation, lease, and restrictive covenant under the Yadkin-Pee Dee Settlement are considered necessary for project purposes, in that they are consistent with the need to protect vegetated habitat for diadromous fish and preserve the natural aesthetic of the reservoir shorelines. Restrictive covenants on lands at Grassy Islands and near the mouth of the Uwharrie River, which are currently located within the Yadkin-Pee Dee River Project boundary, would prevent future disturbance to these lands and provide protection for wildlife habitat. North Carolina DENR, or North Carolina WRC, would manage these lands in accordance with the Lake Tillery or shoreline management policy for Blewett Falls. Restrictive covenants, leases, and donations would protect shoreline areas and preserve their natural character, resulting in positive environmental effects on visual aesthetics. We do not find the lands proposed for donation or covenants, which are located downstream of the Blewett Falls development project boundary, necessary for project purposes, as they are located outside of the project boundary and downstream of the project's influence on the Pee Dee River. However, protection of these lands along the Pee Dee River would be beneficial for streambank protection.

Transmission Line Corridor Management Plan

Alcoa Generating proposes to develop a transmission line corridor management plan within 2 years of the effective date of a new license, in consultation with the North Carolina WRC, FWS, and other appropriate state and federal wildlife resource agencies. The transmission line corridor plan would establish vegetation and wetland management objectives for the two Project transmission line corridors and would outline actions to manage corridors consistent with those objectives.

Our Analysis

Development of a transmission line corridor plan would not change land use and would benefit land management by defining objectives for protecting vegetation and wetlands. Overhead transmission lines were identified in the project-wide aesthetic study

(EMS, 2005a) as inconsistent with the scenic integrity rating of project reservoirs. A transmission line corridor plan would have positive environmental effects on visual resources because it would ensure that adverse effects of overhead transmission lines are minimized by integrating the corridors with the surrounding natural vegetation.

3.3.8.3 Cumulative Effects

The North Carolina Wildlife Action Plan (2005), a comprehensive plan listed in section 5.3, identifies the Yadkin-Pee Dee River corridor as an area of ecoregion site priority for preservation. The river corridor downstream of the Tillery and Blewett Falls development offers 30 contiguous miles of riparian and wetland shoreline that support diverse habitat types and wildlife species. The donation of riparian lands along the Tillery and Blewett Falls reaches to conservation organizations and the state of North Carolina and the non-project Alcoa-owned lands proposed for transfer would add positively to efforts of land managing agencies to protect the shorelines from development that could affect the aesthetics, water quality, recreational opportunities, and wildlife along these reaches.

3.3.8.4 Unavoidable Adverse Effects

Maintaining minimum flows from the Falls, Tillery, and Blewett Falls developments could result in fluctuations below existing minimum elevations in project reservoirs. Alcoa Generating and Progress Energy would restore minimum elevations as quickly as possible to minimize any adverse effects associated with exposed shoreline.

3.3.9 Socioeconomic Resources

3.3.9.1 Affected Environment

The areas potentially affected by the proposed changes to Yadkin and Yadkin-Pee Dee River Project operations are the surrounding counties, including Davidson, Davie, Montgomery, Rowan, Stanly, Anson, and Richmond. The primary areas expected to experience any socioeconomic effects from proposed changes to the water levels in project reservoirs are the surrounding counties of Rowan and Davidson and the lower central part of North Carolina.

Population and Demographics

North Carolina's population grew from 6.62 million in 1990 to 8.05 million in 2000 (21.6 percent) and is projected to grow to 9.45 million by 2010 (17.4 percent) (North Carolina State Data Center, 2000). As table 49 shows, the population of Davidson County grew more slowly between 1990 and 2000, increasing by 16.2 percent to 147,246 (North Carolina State Data Center, 2000). However, the population is expected to grow by 39 percent by 2030 to more than 205,000 (table 49). Thomasville, more than 13 miles from High Rock reservoir in eastern Davidson County, was one of the fastest growing towns in North Carolina between 2000 and 2005; growing by 31.8 percent to 26,084.

Table 49. Yadkin and Yadkin-Pee Dee River Project areas population change, 1990-2005. (Source: North Carolina State Data Center, 2000)

County	Population (1990)	Population (2000)	Percent change (1990-2000)	Population Estimate (2005)
Yadkin Project				
Davidson	126,688	147,246	16.2	154,294
Davie	27,859	34,835	25.0	38,930
Montgomery	23,359	26,822	14.8	27,359
Rowan	110,605	130,340	17.8	133,339
Stanly	51,765	58,100	12.2	58,912
Yadkin-Pee Dee River Project				
Anson	23,474	25,275	7.7	25,672
Richmond	44,518	46,564	4.6	46,586

Rowan County also saw modest growth between 1990 and 2000, growing by 17.8 percent to 130,340. Rowan County is expected to grow by 48.2 percent to more than 170,000 by 2030 (table 50). Stanly County was the slowest growing of the Yadkin Project counties from 1990 to 2000, and is predicted to continue to be the slowest growing among the Yadkin Project counties through 2030. The two counties associated with the Yadkin-Pee Dee River Project, Anson and Richmond, have experienced even slower growth, and Anson County is predicted to actually lose population over the next two decades.

In 2005, the population of North Carolina was 68.3 percent White, 21.8 percent Black, 6.4 percent Hispanic, 1.8 percent Asian, and 1.3 percent Native American (U.S. Census Bureau, 2005a). By contrast, the racial makeup of the Yadkin Project counties is generally more than 80 percent White and less than 15 percent Black, while the makeup of the Yadkin-Pee Dee River Project counties is less than 65 percent White and more than 30 percent Black (U.S. Census Bureau, 2005a). Anson County's population in 2006 was 48.8 percent White and 49.1 percent Black.

Table 50. Yadkin and Yadkin-Pee Dee River Project area population projections, 2000-2030. (Source: North Carolina State Data Center, 2000)

Area	Population (2000)	Projected Population (2010)	Projected Population (2020)	Projected Population (2030)	Percent Growth (2000-2010)	Percent Growth (2000-2020)	Percent Growth (2000-2030)
North Carolina	8,046,813	9,450,494	10,850,228	12,274,000	17.4	34.8	52.5
Yadkin Project							
Davidson	147,246	165,751	185,606	205,386	12.6	26.1	39.5
Davie	34,835	42,235	49,564	57,124	21.2	42.3	64.0
Montgomery	26,822	29,797	33,321	37,006	11.1	24.2	38.0
Rowan	130,340	147,800	170,167	193,201	13.4	30.6	48.2
Stanly	58,100	63,454	69,936	76,056	9.2	20.4	30.9
Yadkin-Pee Dee River Project							
Anson	25,275	24,729	24,303	23,748	-2.2	-4	-6.4
Richmond	46,564	47,046	47,019	46,757	1	0.98	0.41

Economic Base

The median household income of Davidson County in 2005 was $39,766; slightly below the state median of $40,863. In Davidson County, 13.2 percent of the residents were below the poverty line, as defined by the U.S. Census Bureau compared with the state average of 13.8 percent (U.S. Census Bureau, 2005b). The median household income for Rowan County was $38,598, with 13.0 percent of the residents living below the poverty line. In Stanly County, the median household income was slightly lower at $37,866, but the number of residents living below the poverty line was also lower (12.8 percent). Anson and Richmond counties had much lower median household incomes ($29,320 and $29,111 respectively), and much higher levels of residents living below the poverty line (both at 19.7 percent).

The largest segments of employment in Davidson County are manufacturing (45.4 percent), retail trade (15.7 percent), health care (12.7 percent), hospitality (10.1 percent), and wholesale trade (4.6 percent) (U.S. Census Bureau, 2005c). Education-related employment figures were unavailable. The largest segments of employment in Rowan County are manufacturing (37.3 percent), healthcare (18.6 percent), retail trade (15 percent), and hospitality (9.4 percent) (U.S. Census Bureau, 2005c). Education-related employment figures were unavailable. In Stanly County, industrial employment has declined in recent years in part due to closure of the Badin Smelting Works. In its comments on the draft EIS, Stanly County indicated that there were more than 900 jobs

associated with the Carolina Aluminum Company's aluminum operations in 1958, and that Alcoa currently employs fewer than 70 people in the county.

In its Regional Economic Impact Study, Environmental Resources Management (ERM) estimates that total recreation spending related to the Yadkin Project totals $11.4 million annually; accounting for economic output totaling $9.6 million and about 175 jobs (ERM and Global Insights, 2005, table 4-1). While important to the local economies, this activity represents only 0.04 percent of the 5-county region's economic output and 0.12 percent of its employment.

No comparable studies have been made of recreational spending related to the Yadkin-Pee Dee River Project. However, if spending per visitor to the Yadkin-Pee Dee River Project were comparable to spending per visitor to the Yadkin Project, recreational spending related to the Yadkin-Pee Dee River Project would equal roughly $319,000 annually and account for fewer than 10 jobs.

3.3.9.2 Environmental Effects

Although the Yadkin Project formerly supported, indirectly, hundreds of jobs associated with the aluminum industry, the scaling back of that industry in Stanly County has eliminated most of those jobs. The primary contribution that the project currently makes to the local economy is related to recreational use and the value of lakeshore and near-lakeshore properties, particularly at High Rock reservoir. The Yadkin Project reservoirs together average 2.5 million recreation days per year (ERM and Global Insights, 2005). By comparison, there are about 72,000 visits to the Yadkin-Pee Dee River Project each year. The Yadkin Pee-Dee Project's primary contribution to the local economy is recreational use, particularly along the river reach downstream of the Tillery development.

Changes to reservoir water surface elevations and instream flows could affect these water uses in varying ways. Project relicensing studies indicate that higher reservoir water levels year round are more desirable to both visitors and residents, with full pond level being most desirable (RTI International, 2005). Thus, higher reservoir levels would generally be associated with more recreational use, visitor spending, income to local recreation-related businesses, recreation-related employment, and higher property values and tax revenues. By the same token, lower reservoir levels would be associated with less recreation use, spending, income, employment, property value, and tax revenue.

Reservoir Levels

Changes in reservoir levels can affect seasonal tourism. The presence of a lake or reservoir and its water level can affect the value of shoreline and near-shoreline properties, which in turn can affect property tax revenue collected by local taxing districts. At the Yadkin Project, Alcoa Generating proposes to raise the typical summer pool level of High Rock reservoir (from 5 feet below full pool to 4 feet below full pool), which would extend the typical summer pool level about 12 weeks: 6 weeks earlier in

the spring (from mid-May to April 1) and 6 weeks later in the fall (from mid-September to October 31). Alcoa Generating's proposal also would raise the typical winter pool level at High Rock reservoir (from 12 to 13 feet below full pool under current operations to 10 feet below full pool).

Other parties have requested maximum drawdown levels, including 6 feet in winter and 4 feet the rest of the year (Savehighrocklake.org), a 2-foot drawdown year-round (Martin), and a winter drawdown of no more than 7 feet (Davidson County).

Progress Energy proposes to operate the Tillery development to keep Lake Tillery from April 15 to May 15 within 1.5 feet of the recorded water surface elevation on April 15. From May 15 to December 15, the lake level would be maintained within 2.5 feet of full pool on weekdays and 1.5 feet of full pool on weekends and holidays. Progress Energy proposes to operate Blewett Falls reservoir as run-of-river when flows are greater than 7,400 cfs. When flows are below 7,400 cfs, Progress Energy proposes to maintain year-round water-level fluctuations up to 6 feet except for system emergencies and to follow the Low Inflow Protocol. An additional 2 feet of drawdown would be allowed to safely replace flashboards. From April 15 to May 15, Progress Energy proposes to limit water level changes in Blewett Falls reservoir to 2 feet to enhance bass spawning, except when additional reservoir storage is necessary to meet minimum flow release obligations or if flashboards fail.

Our Analysis

In a study prepared for Alcoa Generating, RTI International studied the economic effects of three different High Rock reservoir water level scenarios on seasonal/tourism related values, which address the use of the water by residents and visitors for recreational activities (RTI International, 2005). As part of the study, RTI International interviewed businesses to determine their estimates of the potential impact on revenue based on the three scenarios. Scenario 1 would maintain relatively high water levels year-round at approximately 3 feet below normal full pool. Compared to existing conditions, Scenario 2 would result in higher water levels in March, April, October, and November, and would limit the winter drawdown to 10 feet. Scenario 3 would result in lower water levels all year compared to existing conditions, including a winter drawdown to 20 feet below full pool.

As reported by RTI International (2005), surveyed businesses strongly prefer Scenario 1 to all others, prefer Scenario 2 over existing conditions, and strongly oppose Scenario 3; some said that the reservoir levels associated with Scenario 3 would be devastating to their business. Businesses tend to consider a drop in water level as being about 5 feet below full pond level and lasting at least a few weeks. Businesses estimate revenue losses between 8 and 65 percent for such a drop. RTI International reports an overall estimated increase in sales of 10 to 20 percent under Scenario 1; 2 to10 percent increase under Scenario 2; and 20 to 100 percent decrease in sales under Scenario 3. While hypothetical scenarios can be difficult to envision, RTI International reports that

respondents seemed to draw on their experiences with the 2002 drought, which caused the High Rock reservoir water level to drop up to 10 feet for sustained periods. The drought and its effects on businesses featured prominently in the respondents' survey responses. Individual businesses reported drought-associated revenue losses between 19 and 100 percent, with an average revenue loss of 64 percent compared to typical years.

While the scenarios analyzed differ somewhat from Alcoa Generating's proposal for High Rock reservoir and from alternative water level regimes suggested by other entities, they provide some basis for assessing the potential effects of the alternatives considered in this EIS. Estimated increases in retail revenue for Scenarios 1 and 2 range from $579,000 to $2.6 million for the 5-county region (RTI International, 2005).

In another study associated with Yadkin Project relicensing, ERM and Global Insights (2005) used a three-step process to evaluate the economic effects of recreational spending at the Yadkin Project that included (1) evaluating the effects of the three water level scenarios on recreational use, (2) estimating recreational spending per recreation day; and (3) using the IMPLAN model[52] to estimate the effects of project-related recreational spending on the regional economy for each scenario. Compared to project recreation-related sales and employment under current conditions, ERM and Global Insight estimated that Scenario 1 would lead to a 23 percent increase in sales and 17 percent increase in employment (13 jobs), Scenario 2 would lead to a 10 percent increase in sales and 5 percent increase in employment (3 jobs), and Scenario 3 would lead to a 39 percent reduction in sales and 40 percent decline in employment (loss of 33 jobs).

Alcoa Generating's current proposal for High Rock reservoir levels would extend the higher summer lake level for 6 weeks in the spring and 6 weeks in the fall, and would reduce the winter drawdown to 10 feet. While not identical to either Scenario 1 or Scenario 2 in the studies by RTI International (2005) or ERM and Global Insights (2005), there are enough similarities to draw general conclusions about the effects on recreation use and spending and the effects on local recreation-related businesses. We conclude that the higher lake levels and extended recreation season would result in enhanced recreational opportunities that could result in increased recreational use of the reservoir. An increase in recreational use would result in increased recreational spending and associated increased incomes of recreation-related businesses. Because the recommendations of other parties would yield even higher lake levels during at least

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[52]IMPLAN is an input-output impact assessment modeling system used to estimate the impacts of economic changes in states, counties, or communities. It was originally developed by the Forest Service in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management. Subsequent development and distribution of the model has been managed by the Minnesota IMPLAN Group, Inc. This model is widely accepted by resource agencies for economic impact assessment.

some parts of the year, they would tend to incrementally increase recreational use and recreational spending by more than Alcoa Generating's proposal.

Alcoa Generating's proposal for High Rock reservoir also includes improvements to existing recreational facilities that would, among other things, improve accessibility by disabled persons, add portable toilets, add ADA-compliant fishing piers, improve portage trails, add a new public recreation site, and improve overall fishing by implementing a fish passage program and enhancing DO levels in the water. These enhancements, and similar changes recommended by other parties, would also tend to increase tourism and related spending in the area, although the extent of the change has not been estimated.

The changes proposed by Progress Energy to the Yadkin-Pee Dee River Project reservoirs would result in fewer maintenance drawdowns and reduced fluctuations in the reservoir elevations during the recreation season at the project. In addition, Progress Energy proposes some recreational improvements at the reservoirs, such as improving access areas and boat ramps. These improvements would enhance recreational opportunities and, as such, could potentially increase recreational use of the reservoirs and the associated recreational spending.

In its study of the economic effects of the Yadkin Project, RTI International (2005) made a statistical analysis using the hedonic method, a multiple regression technique that allowed it to isolate the effect of individual characteristics of a home and its environment on its sale value. RTI International collected data on water levels, residential property characteristics, and sales values for homes within 2 miles of the shorelines of two Yadkin Project reservoirs (High Rock and Narrows/Badin) and six other reservoirs in North and South Carolina.

As table 51 shows, RTI estimates that, in Davidson County, Scenario 1 lake level management at High Rock reservoir would increase the price of homes within 0.05 mile (about 250 feet) of the shoreline by about $34,000 compared to existing prices, while the same properties would sell for about $8,000 more than current prices under Scenario 2 and about $30,000 less under Scenario 3. The same relationship was found for similar properties in Rowan County, where sale prices would go up by about $31,000 and $7,000 for scenarios 1 and 2, respectively, and decrease by about $27,000 under Scenario 3. The effect on home prices farther from the reservoir would be smaller, but would follow the same direction (that is, higher under Scenarios 1 and 2 and lower under Scenario 3).

Table 52 presents the effects on property taxes of all homes within an estimated impact area of 2 miles from the water. The table shows, for example, that if all the properties within 2 miles of High Rock reservoir were revalued as predicted by the model and taxed at 2004 tax rates, Scenario 1 would increase Davidson County property tax revenues by $133,00 and Rowan County property tax revenues by almost $220,000. Scenario 2 would have a smaller positive effect, and Scenario 3 would have a negative effect on property tax revenues.

Table 51. Estimated home sale prices at High Rock reservoir by water level scenario and distance. (Source: RTI International, 2005)

County/Home Distance from Shoreline	Number of Homes	Existing Conditions (12-foot range)	Scenario 1 (3-foot range)	Scenario 2 (10-foot range)	Scenario 3 (20-foot range)
Davidson County					
<0.05 mile	485	$150,800	$184,800	$158,400	$120,600
Between 0.05 and 0.5 mile	637	$129,600	$138,600	$131,600	$121,600
.0.5 mile	329	$106,000	$113,400	$107,700	$99,500
Total/Weighted Average	1,451	$131,335	$148,329	$135,139	$116,255
Rowan County					
<0.05 mile	660	$136,700	$167,500	$143,500	$109,300
Between 0.05 and 0.5 mile	740	$137,300	$146,900	$139,400	$128,800
.0.5 mile	1223	$88,200	$94,300	$89,500	$82,711
Total/Weighted Average	2,623	$114,256	$127,558	$117,165	$102,404

Table 52. Estimated change in property tax revenues at High Rock reservoir by water level scenario. (Source: RTI International, 2005)

County/Home Distance from Shoreline	Number of Homes	Scenario 1 (3-foot range)	Scenario 2 (10-foot range)	Scenario 3 (20-foot range)
Davidson County	1,451	$133,200	$29,800	$-118,200
Rowan County	2,623	$219,800	$48,100	-$195,800

As noted previously, Alcoa Generating's current proposal for High Rock reservoir levels is most similar to Scenario 2. We conclude that the higher lake levels and extended recreation season would increase the value of nearby properties, which would in turn increase related property tax revenues. Because other parties' recommendations would yield even higher lake levels during some parts of the year, they would tend to incrementally increase property values and property tax revenues by more than Alcoa Generating's proposal, although the magnitude of the difference has not been estimated.

No similar study has been done related for the Yadkin-Pee Dee River Project reservoirs. However, the changes proposed by Progress Energy to the Yadkin-Pee Dee

River Project are similar enough to existing conditions that they would likely have minimal impact on property values or property tax revenues.

Minimum Flows Downstream of Tillery Dam

In addition to minimum flows provided for other purposes, Progress Energy proposes to provide 1,750 acre-feet of water per year below the Tillery development to enhance recreational boating flows. Additional volumes up to 1,950 acre-feet per year would be allowed if releases are made for at least 4 days between May 16 to May 31 or September 1 to September 15. Progress Energy also proposes to install a new flow gage downstream of Tillery dam and to improve the quality and timeliness of its information concerning the recreational boating flows released at the dam. The city of Rockingham recommends a recreational boating flow of 1,200 cfs during daylight hours on weekends and holidays each year from May 16 to September 15, as well as improved access to the river reach downstream of Tillery dam and improved boating flow information.

Our Analysis

The city of Rockingham cites two studies that provide information concerning the potential for local tourism growth and the economic impact of that growth in the region: North Carolina's Central Park – *Assessing Tourism and Outdoor Recreation in the Uwharrie Lakes Region* (Evans et al., 1999) and *The Economic Impact of an Alternative Economic Development Strategy on the Central Park Region of North Carolina* (Connaughton and McGregor, 1999). As summarized by the city of Rockingham, the studies indicate that the demand for recreation is expected to grow substantially in the seven-county Central Park region[53] in the next decades, and that an economic development approach that focuses on tourism could help close the gap between the faster growing metropolitan areas and these rural counties (see table 49) and provide an economic boost for the city of Rockingham.

While the studies do not specifically address the potential impact of improving flows, access, or flow information associated with the river reach downstream of Tillery dam, they do provide information concerning the potential economic impact of increased tourism to the region, of which increased river recreation could be a part. We conclude that improving flows, access, and flow information associated with the river reach, either as proposed by Progress Energy or as suggested by the city of Rockingham, would likely increase recreational boating use of the river, as well as recreation-related spending, which would benefit local businesses and employment.

[53]This region includes Anson, Davidson, Montgomery, Randolph, Richmond, Rowan, and Stanly counties.

Allocation of Low-Cost Power

As noted previously, the Yadkin Project's provision of inexpensive power to the aluminum industry indirectly supported hundreds of local jobs in the past. However, the scaling back of that industry in Stanly County has eliminated most of those jobs. In Stanly County, industrial employment has declined in recent years in part due to closure of the Badin Smelting Works. In its comments on the draft EIS, Stanly County indicated that there were more than 900 jobs associated with the Carolina Aluminum Company's aluminum operations in 1958, and that Alcoa, Inc. currently employs fewer than 70 people in the county. To help address this loss of employment, Stanly County recommends that the Commission consider in this EIS an alternative that would offer inexpensive, cost-based power from the Yadkin Project to support the local economy and jobs. Stanly County also recommends that the EIS acknowledge the negative effects of Alcoa Generating's proposal to instead sell the power at market prices for the benefit of its shareholders.

Our Analysis

Alcoa Generating's proposal for power allocation would depend on market-based forces, while Stanly County is recommending that power be offered locally at below market prices to support local economic development. The Commission's policy on wholesale electric energy issues is that an open-market mechanism is the most appropriate and efficient means of allocating wholesale electric energy in the United States.[54] Providing cost-based power to local entities would simply shift the power-related benefit to local entities and away from those who would otherwise purchase the power. There would be no net benefit overall.

We recognize Stanly County's desire to improve local economic conditions, and understand that the low-cost power previously provided to the smelting operation supported many jobs in the area. However, we also recognize that the factors affecting the aluminum industry go much beyond the cost of power. Closure of the smelting operation would have been tied to market forces that include the demand for and price of aluminum in global markets, the supply of and cost of raw materials, transportation costs, the number and market power of competing companies, and other factors. We do not view the decisions made by businesses that have used project power, however negatively they have affected the local economy, as a project effect. Thus, it is not incumbent upon the project to remedy that effect.

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[54]For example, Kootenai Electric Cooperative, 82 FERC ¶61,112 (1998) (all applicants for a new license for the Priest Rapids Project were required to present plan showing how power would be allocated to designated regional interest in a fair, equitable, and nondiscriminatory manner pursuant to market-based principles).

Land Conveyance

Several areas of Alcoa, Inc.-owned lands, not associated with project operations, were identified for transfer to federal, state, or local entities through sale or deed. The potential for land transfers is included in the Yadkin Settlement, but is not considered under the Proposed Action for relicensing and would be decided by Alcoa Generating at a later date.

Our Analysis

As we note in draft and final EIS section 3.3.8.2, *Land Use and Aesthetics, Environmental Effects, Land Conveyance,* none of the lands proposed by Alcoa Generating for transfer are located within the project boundary or are needed for project operations or to protect the project's environmental resources. However, insofar as currently taxable properties would be transferred to the state of North Carolina or other government entities, such a transfer would negatively affect the tax revenue of the counties where the transferred property is located. The reduction in property tax revenue could reduce the counties' ability to provide services to its residents. The degree of effect would depend upon the proportion of tax revenue lost and each county's ability to compensate for such a loss. However, as noted above, these lands fall outside of the project boundary, are not necessary for project purposes and therefore also fall outside of the Commission's jurisdiction relative to the relicensing of the Yadkin Project.

3.3.9.3 Unavoidable Adverse Effects

None.

3.4 NO-ACTION ALTERNATIVE

Under the No-action Alternative, the Projects would continue to operate under the terms and conditions of their existing licenses, and there would be no change to the existing environment. Under this scenario, there would be continued energy production and no enhancement of existing natural resources. We use the No-action Alternative to establish baseline environmental conditions for comparison with other alternatives.

Specifically, under the No-action Alternative, sedimentation would continue to occur in High Rock reservoir, and the potential for flooding the Salisbury pump station would persist. Low DO in the tailwaters of both Projects would continue to occur and to affect fish populations in the downstream reaches. Passage of target fish species (American shad, American eel, and shortnose sturgeon) would remain blocked. Rare species populations would continue to be threatened by inadvertent disturbance from recreation use along the shorelines. The additional toilets, trash receptacles, and lighting would not be provided to improve the comfort and safety of recreational users. The river reach downstream of the Tillery dam would have insufficient flows for boating during part of the recreation season, and the elevation of existing public boats ramps to Blewett Falls reservoir would continue to limit access to the reservoir.

3.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Continued operation of the existing Projects would continue to commit lands and waters previously developed for energy production. This commitment would not necessarily be irreversible or irretrievable because removal of the project dams and restoration of disturbed areas could return the projects areas to near pre-project conditions. However, given the substantial costs and loss of energy, recreational, and socioeconomic benefits, removal of the dams is unlikely in the foreseeable future.

3.6 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM USES

Under all alternatives considered, the Projects would continue to generate power for customers of Alcoa Generating and Progress Energy, as well as provide recreation and socioeconomic benefits for the duration of any new licenses. The Proposed Actions with staff-recommended modifications would provide significant long-term protection and enhancement of biological, cultural, and recreational resources in the Yadkin and Yadkin-Pee Dee River Basin, although energy generation at the existing Projects would be somewhat reduced.

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