Yadkin Hydroelectric Project (FERC No. 2197)
Water Quality Issue Advisory Group
Final Meeting Summary

May 20, 2003
Alcoa Conference Center
Badin, North Carolina

Meeting Agenda

See Attachment 1.

Meeting Attendees

See Attachment 2.

Welcome and Introductions

Gene Ellis, Yadkin, opened the meeting with introductions and a review of the agenda. Jane Peeples, Meeting Director, distributed laminated copies of the "Issue Advisory Group Meeting Guidelines" agreed to at the February 28, 2003 IAG Organizational Meeting.

Review of March 13, 2003 IAG Meeting

Wendy Bley, Long View Associates, distributed copies of the meeting agenda and the Water Quality Monitoring Draft Study Plan, which were distributed via email on May 9, 2003 and May 14, 2003 respectively (see Attachments 2 and 3).

Wendy said that the IAG had spent a majority of the time at the March 13, 2003 meeting discussing the reservoir and tailwater water quality monitoring program that has been ongoing at the Yadkin Project since 1999. She said that Yadkin was asked to expand the continuous dissolved oxygen and temperature monitoring in the Project tailwaters from the Narrows and Falls tailwaters to all four Project tailwaters for the period May through November, while continuing to sample the four reservoirs monthly.

Wendy noted that Yadkin had also received requests to study sediment transport into the Project and specifically, the distribution of sediments in High Rock Reservoir and the impact of sedimentation on aquatic habitats and recreation. She said that based on a brief discussion at the last meeting and Yadkin's understanding of the issue, NAI developed a preliminary draft study plan (see Attachment 4).

Yadkin Project Water Quality Monitoring Draft Study Plan

Wendy introduced Don Kretchmer, NAI, who reviewed the draft study plan. The objectives of the plan are to 1) continue the collection of reservoir and tailwater water quality data to characterize the baseline water quality at the Project, 2) evaluate the effects of current Project

operations on reservoir water quality, and 3) conduct continuous monitoring of dissolved oxygen and temperature in all four Project tailwaters to evaluate existing water quality conditions and how water quality may be affected by Project operations.

Don reviewed the location of the sampling stations at each of the reservoirs (Figures 1 and 2 in the draft study plan). He noted that High Rock Reservoir has the most sampling stations because of its size and number of embayments. He said that NAI typically monitors water quality at the Project during the third week of every month.

Don asked the group to review of the list of monitoring parameters included in the study plan, which was developed in consultation with resource agencies, to see if anything was missing. Randy Benn, Yadkin counsel, asked what secchi depth measured. Don explained that secchi depth is a measure of water clarity. Don noted that all water quality samples, with the exception of chlorophyll a samples, are sent to and processed by Aqua Tech Environmental Laboratories, a North Carolina State certified laboratory. The chlorophyll a samples are sent to the University of New Hampshire for analysis.

Wendy Bley explained that FERC required Yadkin to submit a water quality monitoring plan as a condition of the license amendment approving the Narrows Development unit upgrades. Yadkin developed a monitoring plan in consultation with the resource agencies (for monitoring of the reservoirs and the Narrows and Falls tailwaters), which was ultimately approved by FERC. The purpose of the historical monitoring was to collect baseline water quality information and track water quality improvements resulting from the unit upgrades at Narrows. She said that the monitoring plan was submitted to and approved by FERC in 2000.

Gerrit Jobsis, South Carolina Coastal Conservation League (SCCCL) and American Rivers, stated that one of the study's objectives is to "evaluate effects of current Project operations, including reservoir water level fluctuations on reservoir water quality". He said that the study plan does not address how NAI will determine if reservoir level fluctuations are affecting water quality. Don Kretchmer said that because samples are collected monthly, NAI would have water quality data at varying water levels. Gerrit commented that there are other variables that may be affecting water quality and suggested that NAI document water quality in the headwater streams to assess the quality of the water feeding the reservoirs. Gerrit said that the affect of the Yadkin Project is impounding the water and creating more stagnant conditions. This assessment will allow for a comparison of the water quality in the headwater streams to water quality in the reservoirs and a determination of the effects of the impoundment on water quality. Don said that it would be very labor intensive to monitor the many tributary streams. Gerrit suggested that NAI target monitoring in tributaries where there are perceived and/or documented water quality problems.

Wendy said that she is aware of eutrophication and related dissolved oxygen issues at the Project, but noted that the problems are generally Project-wide rather than isolated in a particular arm of the reservoir. Wendy asked Gerrit if he could suggest any specific monitoring locations. Gerrit said that there should be sampling where the Yadkin River flows into High Rock Reservoir. Wendy noted that Station H1 (see Figure 1 in the attached study plan) is fairly indicative of the water quality in the headwaters. Wendy said that NAI could compare water

quality data collected at Station H1 to mainstem reservoir stations to see if there are any notable differences. Gerrit said that he is not sure if Station H1 is located far enough upstream. Wendy noted that any stations further upstream than Station H1 would be totally outside of the influence of the impoundment. Gerrit said that such an assessment may show that the upstream water quality is the concern and not the Yadkin Project developments and may help Yadkin.

Darlene Kucken, North Carolina Division of Water Quality (NCDWQ), stated that the area just below High Rock Dam is impaired. She suggested looking at the inputs from Lick Creek (also impaired). She suggested moving sampling stations around or adding new sampling stations. Wendy said that it would be helpful to know of any other known water quality problems in the tributary streams.

Roy Rowe, Piedmont Boat Club, commented that Abbotts Creek is the most impaired tributary to High Rock Reservoir. He suggested moving the current Station H5 further up the creek to around Highway 47. Roy also suggested that Yadkin help the local residents apply pressure to the City of Lexington to clear up the problem in Abbotts Creek. Wendy agreed that NAI would work with the NCDWQ to review the existing sampling stations and determine if any additional stations are needed.

Echoing Gerrit's earlier question, Larry Jones asked how NAI would evaluate the effects of current Project operations on water quality. Don replied that NAI would compare water quality data, collected monthly during a variety of conditions, to reservoir operations to determine if water quality changes with varying water levels. Randy Benn read from Page 8 of the study plan (under Water Quality Database and Report), "The report will evaluate the effects of reservoir operations on reservoir water quality."

Larry Jones said that the need to assess vegetation in the reservoirs and the reason why vegetation is absent in the reservoir (High Rock) and the associated effect on water quality was discussed at a prior IAG meeting. He said that the study plan fails to address the fact that alternative Project operations could affect vegetation growth (positively) and enhance water quality. Wendy Bley noted that the Wetlands, Wildlife, and Botanical IAG would evaluate existing wetlands and the potential changes in those wetlands with potential changes in reservoir operations (to include the addition of new wetlands under more stable reservoir levels).

Continuing, Don Kretchmer said that NAI has monitored dissolved oxygen and temperature continuously below Narrows and Falls dams for the last two years (2001 and 2002). He said that NAI recently installed continuous monitors below High Rock and Tuckertown dams, at the request of the IAG, to monitor dissolved oxygen and temperature. Don said that NAI will confirm that the placement of the monitors below High Rock and Tuckertown dams is representative of the water quality downstream of the dams by measuring dissolved oxygen and temperature at 50-ft intervals along selected transects. When asked, Don reported that the dissolved oxygen concentrations along the transects below Narrows and Falls dams (at 50-ft intervals) varied by less than 10 percent (within 0.5 mg/l). Gerrit asked that the study plan identify criteria for determining whether the location of the monitor is representative of water quality in the tailwater. He said that he is comfortable with any variances within 0.5 mg/l.

Gerrit asked if the placement of the monitors below Narrows and Falls dams was confirmed during generation or no generation. Don said that he was not sure, but that samples were probably taken under both conditions. Don asked Gerrit if he had a preference (generation or no generation). Gerrit said that he had no preference, but acknowledged that there are differences in water quality during generation and no generation. During generation, water quality generally differs between the main channel and the sides. During no generation, water quality is generally uniform across the width of the tailwater.

Don outlined the proposed lateral and longitudinal investigation of dissolved oxygen in the vicinity of the Project dams. He explained that NAI will measure dissolved oxygen and temperature along transects in the reservoir (above the dam) to determine the extent and degree of stratification behind the dams and in the tailwater (below the dam) to understand the dynamics of dissolved oxygen and temperature downstream of the dams. The measurements will be taken under two different scenarios: 1) after a prolonged (> 6 hours) period with no generation or spill at the dam and 2) after a prolonged (> 6 hours) period of generation at the dam. Gerrit asked that NAI also sample during generation. Don said that samples collected under the second scenario would be collected during generation.

Ben West, U.S. Environmental Protection Agency, asked that NAI sample under a normal operating scenario (something in between a prolonged period of generation and no generation). Don stated that samples collected during the two scenarios, as proposed, would represent the extreme cases (all units operating and no units operating) and should bracket most "normal" operating conditions. Don commented that the period of generation will depend largely on how much water is available. Wendy Bley said that it would be difficult to characterize typical generation for each of the developments. She said that if the results of NAI's investigation indicated that they should examine another timing interval, NAI would consider it.

Darlene Kucken asked that water quality data be shared with the IAG as it is collected so that the IAG can reassess the location of the sampling stations. Wendy recommended a meeting in the fall to review and discuss the data collected over the summer (the critical portion of the sampling season). She said that if the continuous dissolved oxygen and temperature monitoring data raise concerns during the summer, the data would be shared with the IAG before a fall meeting. She also said that if the High Rock and Tuckertown continuous monitors were found to be unrepresentative of water quality downstream of the dams, then NAI would go ahead and relocate the monitors.

Donna Davis, Stanly County Utilities, asked if NAI would sample for total organic carbon (TOC). Don answered that NAI would sample for TOC. Scott Jackson, North Carolina Watershed Coalition, noted that TOC is not listed as a parameter in the draft study plan. Don explained that it was inadvertently excluded and that he would add it to the list. Donna commented that the high concentrations of TOC in the summer of 2002 (because of the drought) had a significant impact on Stanly County and the City of Albemarle.

Scott Jackson asked why NAI does not plan to test for fecal coliform. Don explained that as discussed at the March 13, 2003 meeting, the operation of the Yadkin Project does not have much, if any, influence on fecal coliform levels and therefore fecal coliform is not included as a

parameter in the relicensing study (i.e. alterative Project operations will not solve a fecal coliform problem). He noted that fecal problems are typically localized in swimming areas. Larry Jones disagreed. He said that the volume of water at the Project can effectively dilute concentrations of fecal coliforms. Randy Benn noted that the study plan does address fecal coliform (see Page 8 of the draft study plan), "In particular, fecal coliform data collected by the state will be summarized. The potential influence of Project operations on the observed fecal coliform counts will be discussed". Randy said that fecal coliforms are best addressed through the permitting process. Larry Jones asked if the City of Salisbury's discharge permit is based on a full or empty reservoir. Darlene Kucken explained that NPDES (National Pollution Discharge Elimination System) permits are based on the 7Q10 flow (the lowest stream flow for seven consecutive days that would be expected to occur once in 10 years).

Larry Jones said that it only made sense, if Yadkin is studying water quality and recreation at the Project, to also evaluate fecal concentrations in the reservoir. Darlene said that fecal concentrations are not affected by Project operations. Rather, fecal concentrations are affected by land use activities, the amount of inflow, and permit levels. She explained that water levels would not matter with a reservoir the size of High Rock. Don Kretchmer said again that elevated fecal coliforms could be localized along the shoreline, for example in areas where ducks swim. Ben West suggested that Yadkin monitor the swimming areas. Darlene stated that the Division of Environmental Health (also within the North Carolina Department of Environment and Natural Resources) and/or the county health departments would typically monitor local beaches and swim areas. She said, unfortunately, due to resource constraints beaches and swim areas are not monitored consistently. Larry noted that there are no public swimming areas on the Rowan County side of High Rock Reservoir. He said that on this part of the reservoir, swimmers swim around private piers or from boats (areas not sampled for fecal coliforms). He asked that fecal coliform be included as a parameter in the water quality monitoring plan.

Roy Rowe asked if the impoundment of water increases the concentration of fecal coliforms. Wendy Bley said that it was possible, but would be difficult to measure. She noted that concentrations of fecal coliforms may be more affected by localized inputs, flow through the system and the residence time of water in the reservoir. Wendy said that high flows into the reservoir will typically bring in higher concentrations of fecal coliforms and that coliform levels would likely be lowest in the summer when there is low inflow into the reservoirs.

Gerrit Jobsis asked if NAI still planned to review and summarize fecal coliform data collected by North Carolina as a component of the study. Don replied yes.

Summarizing, Don said that Gerrit requested that there be some sort of test or criteria to determine if the continuous monitors are in representative locations (continuous dissolved oxygen monitoring) and clarification that the lateral and longitudinal investigations of dissolved oxygen in the vicinity of the dams be during generation and no generation. Gerrit commented that the amount of generation may also impact how far downstream an effect may occur (i.e. the downstream extent of the effects will be different depending on the number of units that are operating). He said that there is nothing in the study plan that addresses how many units are operating at the development. Gerrit said that the study needs to address the worst-case scenario – generation at full capacity. Don indicated that NAI was proposing to do the surveys in August

when water temperatures would be the warmest. He indicated that they would make every attempt to sample under conditions of "generation at full capacity", but noted that water availability in August may be limited and that there might not be enough water for generation at full capacity.

Ben West asked why NAI proposed surveys only in August and September if the objective of the study is to understand the temporal and spatial extent of dissolved oxygen problems immediately upstream and downstream of the dam – why not June and July also. Don said that August is the extreme event (low flows, warm water temperatures), which will cover any condition expected in June and July. Ben commented that air injection at the Narrows development only occurs at certain times (a temporal aspect). Don explained that the continuous dissolved oxygen and temperature monitors in the tailwater would capture this.

Recognizing that the group was struggling with how to collect enough data to understand the nature and extent of the dissolved oxygen problem, Wendy said that the continuous monitors will offer the best information – dissolved oxygen and temperature conditions day in and day out over the entire warm season. She said that the important thing would be to make sure that the monitors are representative of water quality downstream of the dams. Rather than spending time, too much effort, and resources on documenting the problem, Wendy suggested that the intent should be to collect enough data to demonstrate the need for water quality improvements and then the focus should be on how to successfully mitigate the problem.

Gerrit said that it is important to document the downstream extent of the water quality condition. Don said that at some point, the tailwater will end and the reservoir will begin. Gerrit thought it necessary to know if poor water quality was being pushed through the tailwater and into the impoundment. He suggested monitoring water quality downstream of the dam until there are no measurable impacts (even into the reservoir). Don said that this would be a hard breakpoint to identify, given the stratification of the reservoir. Gerrit said that it had been documented at other projects that during periods of generation, water from the dam displaces stratified water until a point when the water dives below the stratified water.

Wendy Bley questioned the need for documenting the downstream extent of the water quality impact. Gerrit said that Yadkin has made no commitment to improve water quality at the Project to meet state standards by the time a new license is issued by FERC and that, in the interim (until Yadkin upgrades the units at all the developments), he wants some mitigation/compensation. Randy Benn noted that FERC cannot issue Yadkin a new license, unless North Carolina certifies that the Project is meeting all state water quality standards and issues a Clean Water Act Section 401 water quality certificate.

Gerrit said that water quality impacts have been documented as far as six and seven miles downstream of a U.S. Army Corps of Engineers development. He stated that water quality impacts can extend well beyond the tailwater. Wendy said that she did not disagree. However, she said, Yadkin is not prepared to quantify the impacts for the purposes of interim mitigation. She acknowledged that there are dissolved oxygen problems in the tailwaters and that Yadkin expects to have to mitigate for those impacts to receive a Section 401 water quality certificate from North Carolina. She noted that the Yadkin developments are not similar to USACE projects

in that they do not have deep intakes and therefore do not release large amounts of cold, low dissolved oxygen water. She said that eutrophication caused by nutrient inputs from primarily upstream sources is the real water quality issue at the Yadkin Project and noted that some level of eutrophication would occur in rivers irrespective of the impoundments.

Darlene Kucken suggested a couple of additional monthly sampling stations located downstream of the dams in the tailwaters might be appropriate. Wendy agreed to consult with the NCDWQ on the need for additional tailwater sampling stations.

Gerrit Jobsis said that the study plan does not describe how NAI will collect Project operation data and evaluate how discharges from the Project affect dissolved oxygen. NAI agreed to describe this task more explicitly in the study plan.

Ben West questioned whether the use of quarter points for the lateral investigation of dissolved oxygen would be adequate. He suggested using closer intervals in wider sections. Ben asked if the longitudinal measurements would be taken at the surface, middle, and bottom. Don explained that depending on depth and current, NAI would measure dissolved oxygen and temperature in half-meter increments.

During a meeting break, Wendy distributed copies of the Sediment Fate and Transport Preliminary Draft Study Plan (see Attachment 4). Darlene Kucken distributed copies of a Yadkin-Pee Dee River Basin Fact Sheet. She said that additional copies are available from the NCDWQ.

Sediment Fate and Transport Preliminary Draft Study Plan

Recognizing that the IAG had little opportunity to discuss sediment transport at the last IAG meeting, Wendy noted that the draft study plan was “preliminary”. She said that that NAI proposes to address sediment fate and transport through a review of existing U.S. Geological Survey (USGS), University of North Carolina, and Duke University data, rather than collecting new data. Don Kretchmer added that NAI will prepare a report, which documents the source of sediments to the Project, the sediment load and the distribution of sediment among the four Project reservoirs and within each reservoir. The probable impact of sediment deposits on aquatic habitat, aquatic plant growth, recreation, water quality, and other resources will also be discussed.

Darlene Kucken asked if the Duke University study evaluated long-term data at the Yadkin College gage. Don replied yes. Gerrit Jobsis asked if any of the studies address sediment transport. Don replied yes. He explained that one of studies measured sediment above and below the Project and the difference between the two is what was left in the Project impoundments.

Darlene asked if Yadkin is interested in any additional studies and reports. Don and Wendy answered yes. Randy Tinsley, counsel for the City of Salisbury, asked if Yadkin was aware of any other relevant studies. Wendy said that all of the publicly available studies that Yadkin is aware of are listed in the study plan’s references list.

Wendy said that Yadkin was asked to examine the distribution of sediment within High Rock Reservoir. She noted that PB Power has aerial photos that NAI will use to determine the patterns of sediment deposition. Larry Jones asked if Yadkin or PB Power has a good idea of what the reservoir bottom looks like today, as compared to 1930 (the data included in the Yadkin Initial Consultation Document). Wendy said that NAI would be able to estimate the total sediment load being delivered to High Rock, using the USGS data. She said that the issue of the reservoir bottom and reservoir capacity had not been raised. Larry commented that sedimentation reduces the volume of the reservoir. Wendy said that the study, as proposed, is not an engineering study to determine reservoir capacity, but rather a study to characterize sediment fate and transport and probable impacts of sediment deposits on environmental resources.

Paul Shiers, PB Power, said that based on 1997 aerial photographs, when the reservoir (High Rock) was down 12-ft, the volume of the reservoir had changed, over time, by about five percent. Larry asked if there were aerial photos when the reservoir was down 20-ft. Paul said no. Larry asked if there is a way to estimate the current volume of the reservoir. Paul said he could use technical data to estimate the current volume of the reservoir.

Randy Tinsley asked if Yadkin planned to study sedimentation at the City of Salisbury's intakes. Wendy Bley answered no. She stated that it is likely that the City's intakes are more affected by sedimentation in the river than sedimentation in the reservoir (i.e. sedimentation at the intakes is not caused or exacerbated by the operation of the Project reservoirs). She said that while the operation of the Yadkin Project is only a minor contributor to the sediment problem, Yadkin is willing to characterize the transport of sediment through the system.

Larry Jones said that when the reservoir (High Rock) is operated in store-and-release mode, it captures a larger amount of sediment than when it is operated in a run-of-river mode. Larry stated that if High Rock Reservoir was operated as run-of-river, sediments would have a less detrimental effect on the reservoir. Larry asked that the study address the operation of High Rock Reservoir and associated impacts on sediment deposition and/or transport. Wendy said that the study will document the current status of sedimentation and sediment load entering and leaving the Yadkin Project. She agreed to add a study objective to the plan, which will address Larry's issue. Larry reiterated his concern about the effect of the mode of operation of High Rock Reservoir on sediment transport and the amount of sediment accumulation in the reservoir under the current mode of operation.

Randy Tinsley said that it is the slow flow of water and sediment load that is impacting the City of Salisbury's intakes. Wendy agreed that the slow flow of water in the area of the City's intakes is causing sediments to settle out. Randy asked that Yadkin model the hydraulic characteristics of the reservoir at this location. He said that he is concerned that accelerated deposition will impact the City's intakes. Wendy said that the sediment deposition near the City's intakes is not necessarily caused by High Rock reservoir – this deposition could have occurred naturally. Randy asked that the second study objective (as outlined on Page 4 of the study plan) be revised to read, ". . . Evaluate how sediment deposition patterns in High Rock may be impacting (negatively or positively) aquatic habitats **and municipal water supplies**."

Gerrit Jobsis asked how NAI would evaluate the effects of sedimentation on environmental resources (e.g. aquatic habitat). He said that he is concerned about the transport and availability of gravels (important for redhorse spawning) below the Yadkin and Progress Energy projects. He asked if NAI would compare the particle sizes of sediments going into and coming out of the Project, giving consideration to certain species' habitat preferences. Don Kretchmer said that NAI will characterize the physical characteristics of the sediments within the reservoirs and sediments being transported downstream, to the extent that the data is available.

For clarification, Ben West said that there is a separate study, being discussed in the Fish and Aquatics IAG, to identify shoreline erosion and describe impacts to resources (environmental, recreation, and cultural). Wendy agreed that the two studies may overlap.

Wrap-up

In conclusion, Wendy said that NAI would revise the study plans based on all comments received. Yadkin will then distribute the revised study plans to the IAG for a second round of review and comment. Wendy said that if there are substantive comments requiring discussion, Yadkin will schedule a conference call. She suggested that the IAG meet again in the fall, when there are data to review. Wendy tentatively scheduled the next meeting of the Water Quality IAG for October 8, 2003.

Gene Ellis reminded the group of upcoming IAG meetings – the Fish and Aquatics IAG will meet on June 3, 2003 (and possibly in the morning on June 4, 2003) and the Recreation, Aesthetics, and Shoreline Management IAG will meet on June 4, 2003.

The meeting adjourned at about 12:00 noon.

Attachment 1 – Meeting Agenda

Yadkin Project
(FERC No. 2197)
Communications Enhanced Three-Stage Relicensing Process

Water Quality Issue Advisory Group Meeting

Tuesday, May 20, 2003
Alcoa Conference Center
Badin, North Carolina

9:00 a.m. – 12:00 noon
(Note: Due to the short agenda, lunch will not be provided at the meeting.)

Preliminary Agenda

1. Introductions, Review Agenda
2. Review of March 13, 2003 IAG Meeting
3. Review Project Water Quality Draft Study Plan
4. Review Sedimentation Study Issue and Draft Study Plan
5. Schedule and Agenda for Next Meeting

Attachment 2 – Meeting Attendees

Name	Organization
Ben West	U.S. Environmental Protection Agency
Bob Barwick	NC Wildlife Resources Commission
Chris Vera	Framatome ANP
Darlene Kucken	NC Division of Water Quality
Dean Vick	Concerned Property Owners of High Rock Lake
Don Kretchmer	Normandeau Associates
Donna Davis	Stanly County Utilities
Gene Ellis	APGI – Yadkin Division
Jane Peeples	Meeting Director
Jim Melton	SaveHighRockLake.org
Jody Cason	Long View Associates
Julian Polk	APGI – Yadkin Division
Larry Jones	High Rock Lake Association
Matt Bernhardt	City of Salisbury and Salisbury/Rowan Utilities
Max Walser	Davidson County
Patricia Masters	Concerned Property Owners of High Rock Lake
Paul Shiers	PB Power
Randy Benn	Yadkin counsel
Randy Tinsley	City of Salisbury (counsel)
Raymond Allen	City of Albemarle
Robert Hyatt	Davidson County
Roy Rowe	Piedmont Boat Club
Ryan Heise	NC Wildlife Resources Commission
Scott Jackson	NC Watershed Coalition
Scott Leonard	Davidson County
Wendy Bley	Long View Associates

Attachment 3 – Water Quality Monitoring Draft Study Plan

Yadkin Project (FERC No. 2197)
Water Quality Monitoring
Draft Study Plan
5/12/03

Background

Alcoa Power Generating Inc. (APGI) is the licensee for the Yadkin Hydroelectric Project. The Yadkin Project is currently licensed by the Federal Energy Regulatory Commission (FERC) as Project No. 2197. This license expires in 2008 and APGI must file a new license application with FERC on or before April 30, 2006 to continue operation of the Project.

The Yadkin Project consists of four reservoirs, dams, and powerhouses (High Rock, Tuckertown, Narrows, and Falls) located on a 38-mile stretch of the Yadkin River in central North Carolina. The Project generates electricity to support the power needs of Alcoa's Badin Works, to support its other aluminum operations, or is sold on the open market.

As part of the relicensing process, APGI prepared and distributed, in September 2002, an Initial Consultation Document (ICD), which provides a general overview of the Project. Agencies, municipalities, non-governmental organizations and members of the public were given an opportunity to review the ICD and identify information and studies that are needed to address relicensing issues. To further assist in the identification of issues and data/study needs, APGI has formed several Issue Advisory Groups (IAGs) to advise APGI on resource issues throughout the relicensing process. IAGs will also have the opportunity to review and comment on Draft Study Plans. This Draft Study Plan has been developed in response to comments on the ICD and through discussions with the Water Quality IAG, to provide additional necessary information for consideration in the relicensing process.

Overview

The Yadkin Division of APGI (Yadkin) has begun the process of preparing for the relicensing of the Yadkin Hydroelectric Project (FERC Project Number 2197-038), located on the Yadkin River in North Carolina. The watershed area above the lowest dam in the Project encompasses 4,200 square miles. This river is a part of the larger Yadkin/Pee Dee River Basin that extends from the eastern slopes of the Blue Ridge Mountains to the Atlantic coast. In preparation for the relicensing effort, Yadkin has been collecting baseline water quality data in the Project reservoirs and tailwaters since 1999. In response to comments on the ICD, this plan addresses the continued collection of baseline water quality data as well as the monitoring of dissolved oxygen and temperature conditions in the Project tailwaters.

As noted above, the Yadkin Project consists of a system of four dams and reservoirs. From upstream to downstream the reservoirs and dams include, High Rock Reservoir, Tuckertown Reservoir, Narrows Reservoir and Falls Reservoir. The High Rock Reservoir covers approximately 15,180 acres and has a shoreline length of 360 miles. It is the largest of the four reservoirs. Tuckertown Reservoir covers 2,560 acres and has a shoreline length of 75 miles. Narrows Reservoir covers 5,355 acres and has a shoreline length of 115 miles. Falls Reservoir, the smallest of the four reservoirs covers 204 acres and has a shoreline length of 6 miles. Both High Rock and Narrows Reservoirs and to a lesser extent Tuckertown are highly dissected with numerous side channels and bays. Forest and residential land uses predominate the shorelines of High Rock and Narrows reservoirs while the shoreline zone

of Tuckertown and Falls reservoirs is mostly undeveloped and forested. There are 31 National Pollutant Discharge Elimination System (NPDES) permitted discharges to High Rock Reservoir or tributaries to High Rock, 5 NPDES discharges to Tuckertown Reservoir or its tributaries, 2 discharges to Narrows Reservoir or its tributaries and 1 discharge to Falls Reservoir or its tributaries. These discharges range from small to medium sized wastewater treatment systems to industrial discharges, and are significant sources of nutrients and other pollutants to the Yadkin Project. In addition, the reservoirs provide source water for several communities.

Historic water quality throughout the Yadkin Project has been evaluated through several studies conducted by the North Carolina Division of Water Quality (NCDWQ). These data are summarized in more detail in the Yadkin Project ICD (September 2002) Water quality collected by NCDWQ and data collected by Normandeau Associates from June 1999 to the present support trophic classifications of eutrophic for High Rock and Tuckertown reservoirs and mesotrophic for Narrows and Falls reservoirs (Normandeau Associates 2000, Normandeau Associates 2002). Water quality in each of the impoundments is influenced by upstream water quality, discharges to the reservoirs and tributaries, hydropower operations, and processes within each reservoir.

Issues

The following issues were raised during initial consultation regarding water quality at the Yadkin Project:

- Current status of Yadkin Project reservoir and tailwater quality
- Effects of Yadkin Project operations/reservoir fluctuations on reservoir and tailwater water quality

Objectives

On March 13, 2003 the Water Quality IAG met and discussed objectives for the reservoir and tailwater water quality monitoring study. Over the course of those discussions the following objectives were identified for the study.

- Continue the collection of reservoir water quality data at sampling stations used in previous years in order to characterize the baseline water quality of the four Project reservoirs and four tailwater areas.
- Evaluate effects of current Project operations, including reservoir water level fluctuations on reservoir water quality.
- Conduct continuous monitoring of dissolved oxygen and temperature conditions in all four Project tailwaters during the months of warm water temperatures (May through November) in order to evaluate existing water quality conditions in the tailwaters and how these conditions may be affected by Project operations.

Sampling Stations

High Rock Reservoir

Sampling will be conducted monthly at ten water quality stations (H1-H10) shown in Figure 1. These stations have been sampled monthly by Normandeau since the inception of Yadkin's water quality monitoring program in June 1999. These stations represent locations in each of the major arms of the reservoir as well as three locations along the main stem of the reservoir distributed from the upper end of the reservoir (H1) to a station just above the dam (H10). Tailrace sampling will be conducted at station T1 that also serves as the upstream station of the Tuckertown reservoir. Monthly sampling will continue through the 2003 field season. The inclusion of monitoring data over three growing seasons should ensure that the data collected reflect a range of hydrometeorlogic conditions. In addition, the influence of operational changes over that time span can be evaluated.

Tuckertown Reservoir

Sampling will be conducted at three sampling locations along the main stem of the Tuckertown Reservoir (stations T1-T3) shown in Figure 1. Tailrace sampling will occur at station N1 that also serves as the upstream station in the Narrows Reservoir. These stations have been monitored monthly since June 1999. Monthly sampling will continue through the 2003 field season.

Narrows Reservoir

Sampling will be conducted at four sampling locations in the Narrows Reservoir (stations N1-N4) shown in Figures 1 and 2. These stations include one in the major tributary arm (N3) and three along the mainstem. Tailrace sampling will occur at station F1 that also serves as the upstream station in the Falls Reservoir. Monthly sampling was initiated in June of 1999 and will continue through the 2003 field season.

Falls Reservoir

Sampling will be conducted at two stations in the Falls Reservoir (stations F1 and F2 shown in Figure 2) and one station in the Falls tailrace (F3). Monthly sampling was initiated in June of 1999 and will continue through the 2003 field season.

All sampling stations will be located and identified with Global Positioning System (GPS) coordinates.

Figure 1. Upper Impoundments and Sampling Stations.

Figure 2. Lower Impoundments and Sampling Stations.

Sampling Schedule

Samples will be collected monthly through 2003. Monthly sampling has been ongoing throughout the Project since June of 1999.

Sampling Protocol

Reservoir sampling will follow North Carolina Division of Water Quality sampling protocols for lakes and reservoirs. In-situ profile measurements of temperature, turbidity, dissolved oxygen, pH, and conductivity will be taken at each station using a multi-parameter water quality instrument (Hydrolab Surveyor 4 or similar device). Secchi depth measurements will also be taken at each station. After determination of profiles and Secchi depth, water quality samples will be collected. Surface water samples will be collected from a composite sample of the photic zone, defined as twice the Secchi transparency depth for all samples except metals. The deep sample will be collected using a Van Dorn bottle or a water pump and hose. Chlorophyll a samples will be collected from the photic zone composite only. Alkalinity, solids (TS< TSS and TDS) and BOD samples will be placed on ice immediately after collection. Nutrient (TP, NO3, NH3, TKN and TN), COD and TOC samples will be preserved with sulfuric acid. Nitrite (NO2) samples will be analyzed in the field. Metals samples will be preserved with nitric acid and cyanide samples will be preserved with sodium hydroxide. All samples will be collected in appropriate containers, stored on ice after preservation, and transported to the lab for analysis under chain of custody forms.

Parameters

The following is a list of all parameters to be measured in the field or analyzed in the lab:

Field Measurement

Water Temperature - profile
Dissolved Oxygen - profile
pH - profile
Conductivity - profile
Turbidity - surface and bottom
Secchi Depth
Nitrite

In addition to these parameters field notes will be made which will include date, time of sample, air temperature, weather conditions, and other physical observations of importance. These notes will be recorded on data sheets for each sampling station.

Laboratory Analysis

Chlorophyll *a* - Analyzed from only the epilimnetic core sample
Total Alkalinity
Total Solids (TS)

Total Suspended Solids (TSS)
Total Dissolved Solids (TDS)
Total Phosphorus (TP)
Nitrate, Nitrogen (NO3)
Total Nitrogen (TN)
Ammonia, Nitrogen (NH3)
Total Kjeldahl Nitrogen (TKN)
Biochemical Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)
Lead
Cadmium
Copper
Mercury
Cyanide

Laboratory Analysis

All laboratory analyses will be conducted by North Carolina State certified laboratories. Aqua Tech Environmental Laboratories (NCDEH Certification No. 37742, NCDWQ Certification No. 372) will provide analyses of water quality samples. Chlorophyll a will be sent to the University of New Hampshire for analysis.

Continuous Dissolved Oxygen Monitoring

Dissolved oxygen and temperature will be monitored continuously below the High Rock, Tuckertown, Falls and Narrows developments from May through December. This period will encompass both a high temperature and a low flow period. Data from this effort will be used to evaluate the downstream dissolved oxygen dynamics. Monitors will be placed in the tailwaters of the four dams at the point where bypass, spillage and hydropower flows merge. These monitors will be YSI multiparameter sonde instruments or the equivalent. Monitors will be downloaded, serviced and recalibrated weekly throughout the deployment to prevent battery depletion and fouling. The monitors will log dissolved oxygen concentrations and temperature at 15-minute intervals. Continuous monitors have been in place below the Falls and Narrows dams for the May through November period since 2001. In 2003 the program will be expanded to include monitors below High Rock and Tuckertown. Monitor locations below these two dams will be determined through consultation with the resource agencies.

The mixing characteristics of the tailrace waters below the Narrows and Falls Dams were evaluated monthly from August through November 2001. The purpose of this effort was to confirm that the placement of the continuous dissolved oxygen and temperature monitors was representative of water quality downstream of the dams. Measurement of dissolved oxygen at 50 foot intervals along 6 transects showed little variability in dissolved oxygen concentrations or temperature and supported the conclusion that the locations were representative (Normandeau 2002). A similar demonstration will be conducted below High Rock and Tuckertown Dams in August and September of 2003. This effort will be coordinated with the lateral and longitudinal dissolved oxygen and temperature evaluations described in the section below.

Lateral and Longitudinal Investigation of Dissolved Oxygen in the Vicinity of the Dams

The extent and degree of stratification in behind the dams will be evaluated during two surveys. One survey will be conducted in August and one survey will be conducted in September. During each survey, dissolved oxygen and temperature will be measured by profile at the quarter points in each impoundment along transects spaced at ¼ mile intervals starting at the buoy line and proceeding upstream. Additional transects will be added until two adjacent transects show similar profiles in terms of the depth of the thermocline and the extent of dissolved oxygen depletion at depth. Two scenarios will be evaluated. One scenario will be after a prolonged (> 6 hour) period with no generation or spill at the dam. The second scenario will be after a prolonged (> 6 hour) period of generation at the dam.

The dynamics of dissolved oxygen and temperature downstream of the dams will be evaluated in August and September in a similar fashion as the reservoir surveys. Starting at the continuous monitoring locations, dissolved oxygen and temperature will be measured by profile at the quarter points in the channel along transects spaced at ¼ mile increments downstream. Additional transects will be added until temperature and dissolved oxygen conditions at consecutive transects are similar or the river channel becomes part of the next downstream impoundment.

Water Quality Database and Report

Results of all water quality monitoring described above will be incorporated into an electronic database. The database will contain all information relevant to the monitoring task including sample time, date, air temperature, weather conditions, GPS coordinates, and other field observations. Data will be provided electronically at the conclusion of each sampling season. A summary report will accompany the data. The report will evaluate the effects of reservoir operations on reservoir water quality. The report will include a review of existing water quality data for the Project developments. The discussion of reservoir operations influence on water quality will incorporate additional water quality data collected by State and Federal agencies as well as volunteer monitoring groups where appropriate. In particular, fecal coliform data collected by the state will be summarized. The potential influence of Project operations on the observed fecal coliform counts will be discussed. The influence of aquatic vegetation on water quality will also be discussed as will the impact of observed water quality on the biologic community in the project area. The collection of water quality data in 2002 will allow the evaluation of the impacts of an extreme low water event period on water quality in the impoundments and downstream. The relationship of observed water quality to water level will be discussed along with a summary of relevant literature regarding the influence of fluctuating water levels on water quality. The potential influence of any changes in Project operations on water quality will be discussed.

Outline of Quality Control/Quality Assurance Procedures

In recognition of the requirements for valid and reliable information as the basis for sound environmental management decisions concerning the Yadkin Project, Normandeau Associates intends to implement a Quality Assurance (QA) Plan that provides for the attainment of desired quality levels in field, laboratory and data reporting activities including the QA requirements of ASME NQA-1 and appropriate EPA and state QA requirements. The QA Plan has been designed to meet or exceed the guidance criteria of the U.S. Environmental Protection Agency (1979, 1980), and to be consistent

with the intent of 10 CFR 50 which requires that quality assurance be separated from operational and budgetary concerns.

Project managers are responsible for conducting the project quality control program. These responsibilities include the following:

- monitor instrument maintenance, calibration, and reliability;
- monitor document control and conduct audits of documentation resulting from instrument maintenance and calibration, and data processing; and
- monitor training of technicians.

It is corporate policy to supply quality services, information, data, and products at minimum cost and with timely delivery, suitable for the purpose intended, and to the satisfaction of the client's requirements. It is the responsibility of the quality assurance organization to monitor the activities of all program personnel to demonstrate and verify the achievement of quality through all phases of the project. Once the proposal, program design, and SOP are complete, these responsibilities are accomplished primarily by audits, tests, and surveys which provide objective evidence that the quality control program and technical requirements, methods, and procedures as outlined in the project procedures manuals are being implemented. As a minimum, applicable elements of the projects are subject to quality assurance surveys and audits at least once within the life of the activity. These surveys and audits are conducted by an audit team of technically qualified personnel familiar with, but independent of and not responsible for, the work or activities under evaluation. Surveys, which review the operations, specifications, plans, and objectives of the project, are made at the beginning and end of the project. A field audit, which includes a detailed examination of the acquisition and transfer of data from field to report, will be performed during the 2003 field season.

Audit results are presented orally to the appropriate project or facility management by the audit team after the audit has been completed. At this time, specific findings are presented and recommended courses of corrective action developed. Subsequently, the audit results are documented in a written audit report and reviewed by management having responsibility in the areas audited. These reports include a summary of audit results, observations made with a listing of nonconformances and program deficiencies, recommendations as to possible corrective action, and suggestions for the possible improvement of the quality program or its implementation.

Observations of nonconformities and program deficiencies are classified into four categories:

- Deficiencies that affect the data adversely;
- Deficiencies that might affect the data adversely;
- Deficiencies that cannot affect the data adversely;
- Paperwork deficiencies that cannot affect the data adversely

Class A deficiencies are resolved before that portion of the program can proceed. Class B deficiencies must have a determination as to the severity of the deficiency and whether or not corrective action is necessary. If corrective action is necessary, it is performed within a reasonable time frame agreed to by the program management and the Quality Assurance Department. Operations with either Class A or B deficiencies are subject to reaudit to determine the effectiveness

of corrective action. Class C and D deficiencies must have corrective action accomplished before the next scheduled audit or end of the project whichever comes first.

References

Federal Energy Regulatory Commission (FERC). 2000. Order Amending License on Project Number 2197-038. Yadkin, Inc.

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Attachment 4 – Sediment Fate and Transport Preliminary Draft Study Plan

Yadkin Project (FERC No. 2197)
Sediment Fate and Transport
Preliminary Draft Study Plan
5/20/03

Background

Alcoa Power Generating Inc. (APGI) is the licensee for the Yadkin Hydroelectric Project. The Yadkin Project is currently licensed by the Federal Energy Regulatory Commission (FERC) as Project No. 2197. This license expires in 2008 and APGI must file a new license application with FERC on or before April 30, 2006 to continue operation of the Project.

The Yadkin Project consists of four reservoirs, dams, and powerhouses (High Rock, Tuckertown, Narrows, and Falls) located on a 38-mile stretch of the Yadkin River in central North Carolina. The Project generates electricity to support the power needs of Alcoa's Badin Works, to support its other aluminum operations, or is sold on the open market.

As part of the relicensing process, APGI prepared and distributed, in September 2002, an Initial Consultation Document (ICD), which provides a general overview of the Project. Agencies, municipalities, non-governmental organizations and members of the public were given an opportunity to review the ICD and identify information and studies that are needed to address relicensing issues. To further assist in the identification of issues and data/study needs, APGI has formed several Issue Advisory Groups (IAGs) to advise APGI on resource issues throughout the relicensing process. IAGs will also have the opportunity to review and comment on Draft Study Plans. This Draft Study Plan has been developed in response to comments on the ICD and through discussions with the Water Quality IAG, to provide additional necessary information for consideration in the relicensing process.

Overview

The Yadkin Division of APGI (Yadkin) has begun the process of preparing for the relicensing of the Yadkin Project, located on the Yadkin River in North Carolina. The watershed area above the lowest dam in the Project encompasses 4,200 square miles. This river is a part of the larger Yadkin/Pee Dee River Basin that extends from the eastern slopes of the Blue Ridge Mountains to the Atlantic coast. As part of this effort, Yadkin is collecting baseline information on resources at the Yadkin Project. In particular, Yadkin is interested in characterizing the fate and transport of sediment in the Project area.

As noted above, the Yadkin Project consists of a system of four reservoirs, dams and powerhouses. From upstream to downstream the reservoirs are High Rock Reservoir, Tuckertown Reservoir, Narrows Reservoir and Falls Reservoir. The High Rock Reservoir covers approximately 15,180 acres and has a shoreline length of 360 miles. It is the largest of the four reservoirs. Tuckertown Reservoir covers 2,560 acres and has a shoreline length of 75 miles. Narrows Reservoir covers 5,355 acres and has a shoreline length of 115 miles. Falls Reservoir, the smallest of the four reservoirs covers 204 acres and has a shoreline length of 6 miles. Both High Rock and Narrows Reservoirs and to a lesser extent Tuckertown are highly dissected with numerous side channels and bays. Forest and residential land uses predominate the shorelines of High Rock and Narrows reservoirs while the shoreline zone of Tuckertown and Falls reservoirs is mostly undeveloped and forested. There are 31 National Pollutant Discharge Elimination System (NPDES) permitted discharges to High Rock Reservoir or tributaries to High Rock, 5 NPDES discharges to Tuckertown Reservoir or its tributaries, 2 discharges to Narrows Reservoir or its tributaries

and 1 discharge to Falls Reservoir or its tributaries. These discharges range from small to medium sized wastewater treatment systems to industrial discharges, and are significant sources of nutrients and other pollutants to the Yadkin Project.

Historic water quality throughout the Yadkin Project has been evaluated through several studies conducted by the North Carolina Division of Water Quality (NCDWQ) and Yadkin. Data collected during these studies is summarized in the Yadkin Project ICD (September, 2002). Recent water quality data suggest that eutrophication is a problem for both High Rock and Tuckertown reservoirs. Sedimentation, turbidity and a large load of incoming sediment, primarily from upstream sources has also been identified as a water quality problem in the Yadkin reservoir system, particularly at High Rock.

Issues

The following issues were raised during initial consultation regarding sediment transport, sediment load and sedimentation at the Yadkin Project:

- Current status of sedimentation and sediment load entering and leaving the Yadkin Project
- Effects of sediment deposition on reservoir habitats
- Effects of dams and reservoirs on sediment transported to the lower river
- Physical characteristics of sediments

Figure 1. Yadkin Project

Objectives

On March 13, 2003 the Water Quality IAG met and discussed objectives for the sedimentation study. Over the course of those discussions the following objectives were identified for the study.

- To the extent possible, utilize existing data and literature sources to estimate the current sediment load to the Yadkin Project reservoir system and identify the sources of sediment
- Estimate the sediment load being retained within the Yadkin Project reservoir system and identify patterns of sedimentation with High Rock Reservoir. Evaluate how sediment deposition patterns in High Rock may be impacting (negatively or positively) aquatic habitats.
- Characterize the physical characteristics (particle size, etc.) of the sediments within High Rock reservoir and those being transported downstream.

Sediment Fate and Transport

This study will involve a review of available literature and existing data on sedimentation, sediment transport and physical characteristics of sediment of the Yadkin impoundments and a discussion of the findings as well as a discussion of the possible sources of sediment. Of particular interest to this study are reports of recent significant investigations conducted by the University of North Carolina and Duke University (Richter et. al. 1995) and related reports. Related research from the USGS, TVA, USACE and NCDEM will be included where appropriate. A review report will be prepared which documents the source of sediments to the Project, the sediment load and the distribution of sediment among the four Project reservoirs and within each reservoir, particularly High Rock.

Once the sources and distribution of sediment have been established from the literature, the probable impact of those sediment deposits on aquatic habitat, aquatic plant growth, recreation, water quality and other resources will be discussed. The transport of sediments downstream of the four projects will also be evaluated qualitatively. The influence of Project operation and potential future Project operations on sediment fate and transport will be discussed.

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