MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
IFIM/Aquatic Habitat TWC

SCE&G Training Center
July 8, 2008

Final acg 8-11-08

ATTENDEES:

Alison Guth, Kleinschmidt Associates	Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates	Ray Ammarell, SCE&G
Scott Harder, SCDNR	Vivianne Vejdani, SCDNR
Dick Christie, SCDNR	John Martin, SCDHEC
Shane Boring, Kleinschmidt Associates	Amanda Hill, USFWS
Mike Waddell, TU	Gerrit Jobsis, American Rivers
Tanjenique Paulin, SCDNR	Milton Quattlebaum, SCE&G

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting and noted that the purpose of this IFIM TWC meeting would be to discuss the Low Inflow Protocol (LIP) proposed by SCE&G. Alan Stuart informed the group that the Recreational Flows TWC has already met regarding this issue and has tailored their flow reductions with regards to the LIP. Ray Ammarell of SCE&G began to present on the LIP and noted that discussions began in association with representatives from DNR. He explained that they received input from DNR based on their current dealings with the drought. It was noted that Hope Mizzell, the state climatologist, had recommended the use of the US Drought Monitor for the LIP index. As Ray reviewed through his presentation, the group viewed the proposed guide curve for Saluda Hydro. Ray explained that they would strive to operated under the normal operating range under normal conditions. However, depending on the inflows and outflows they may be above or below the target level at any point in time.

As a side note, during discussions on the presentation, Gerrit Jobsis noted that he would like to discuss what would happen if SCE&G was below the guide curve. He noted that his main concern was that if in the future there was an advantage for the company to operate down below 358, then there is nothing in the license to prevent them from doing so. Furthermore, Gerrit explained that he believes there should be some sort of operating rule that prevents the reservoir from being drawn down two or three feet under normal conditions. Gerrit continued to note that there would need to be something included that if SCE&G was below the guide curve then there would be no

discretionary generation. Bill noted that they would work to draft up wording to address Gerrit's concerns.

Ray continued the presentation on the LIP and explained the trigger bands set up for each level of the LIP. He pointed out that due to the topography of the Lake, the stage 1 trigger band was two feet wide, while the other bands were one foot. Ray explained, however, that he would be analyzing this further. He pointed out that there were some concerns expressed by lake owner groups on this issue. Ray also presented the group with a variety of graphs that included the recreation flows in the calculations as well as graphs depicting lake levels using the LIP reductions.

After Ray completed the overview presentation, he noted that the group needed to discuss the pulsing of flows proposed for the instream flows. Alan presented information provided by Bret Hoffman of Kleinschmidt which found that a 1.5 hour pulse of 3000 cfs provided the equivalent of 5 hours total passage time of 1300 cfs. This equates to 2 hours of sustained 1300 cfs flow and 3 hours of recedence time. The group discussed the time of day that these flows should be implemented, and Dick Christie noted that initially he believed that these flows should peak at dawn and dusk due to shad and herring movements. In the mean time, Dick noted that he would discuss this internally with DNR as to the best time of day for pulse flows. It was pointed out that if pulses were provided at both dawn and dusk it would provide a total of 10 hours of passage time during the day with 3 hours of generation.

The group then discussed Stage III pulse flows, and that there would only be one 3000 cfs pulse a day versus two pulses. Dick noted he would also find out the most critical daily passage time during which to provide the pulse flow during Stage III.

After discussions on the pulse flows were complete, the group discussed the width of the LIP trigger bands. Several group members suggested increasing all of the trigger bands to two feet in order to protect the river. Dick noted that he would not be in favor of reducing the stage 1 band from two to one foot. There was also the suggestion of increasing all of the trigger bands to two feet. Ray suggested that increasing all of the trigger bands to two feet would uncomfortably deplete the reservoir. Dick explained that they are truly trying to look at the balance of considerations, however, if there was a need to prioritize between the lake levels and the flows, they indicated early on that they would lean towards the flows. Amanda Hill added that she believed it would be better to retain the two foot stage 1 trigger level as well.

The group continued to discuss the trigger bands and Gerrit noted that it would be informative to see how frequently one would be in the different LIP trigger bands and proposed alternatives during the past 30 years of record. During lunch, the agencies and stakeholders caucused separately to discuss the proposed LIP trigger bands. After lunch, several alternative scenarios were proposed to the group for discussion. Gerrit noted that, in the past, the LIP has been implemented under extraordinary circumstances. He continued to add that it does not seem like one foot below full

pool is an extraordinary circumstance. Bill Argentieri pointed out that the LIP does not kick in until the gaged streamflows were below the 25th percentile. It was added that recovery and dropping from normal stages is based on meeting all three indices.

The stakeholder and agency group presented the following four alternatives to be considered during modeling:

	LIP	alt 1	alt 2	alt 3	alt4
N	1 (ft.)	2	2	1	1
I	2 (ft.)	2	2	2	1
II	1 (ft.)	2	1	2	1
III	1 (ft.)	2	1	2	1
IV					

Alan posed the question to the group regarding how much value additional modeling adds to the proposal, as they had already met their 80% WUA goal. Gerrit replied that regardless of the percent WUA, they would like to see how often each band would be triggered under the LIP and above alternatives and how it relates to the natural hydrograph. The group briefly discussed the modeling scenarios with Jon Quebbeman of Kleinschmidt. Jon noted that their proposal could be done but it would have to be tied to stage and time of year and it would not exactly follow the LIP guidelines. Gerrit then asked what it would take to tie in the 28 day rolling streamflow data and USGS drought monitor data. Jon replied that it would require a modeling of the period where the data was available. Jon pointed out that the drought monitor data was only available from the 80's on, and the 28 day streamflow data was only available from the 90's on. He continued to note that it would require a new model run and a new model setup and would not carry through the whole period of record. Gerrit expressed that he believed this would answer his, and the other group members', questions. Bill noted that he would like Jon to first draft up a 1 to 2 page scope of work on what would need to be done so that they could ensure that everyone's needs were being met with what was being done the first time.

The group developed the following proposal for Jon:

- Using table listed above:
    - For LIP and four alternatives, based on flow record only, provide the number of days in each stage and percentage of year in each stage for the period of record
    - Provide the number of days in each stage and percentage of year in each stage for LIP and four alternatives from the 90's on to the present where three drought indices are also available

After the proposal was developed, the group completed discussions and scheduled the next TWC meeting for August 5th. The group adjourned.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
Lower Saluda River Flow Demonstration
May 1 & 2, 2008

Final CSB 06/16/2008

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

MAY 1, 2008

Attendees

Ron Ahle, SCDNR
Gerrit Jobsis, American Rivers
Shane Boring, Kleinschmidt Associates
Jeni Hand, Kleinschmidt Associates
Gerrit Jobsis, American Rivers
Mark Giffin, SCDHEC
Scott Harder, SCDNR
Mark Cantrell, USFWS
Dick Christie, SCDNR
Alan Stuart, Kleinschmidt Associates
Brandon Kulik, Kleinschmidt Associates
Mike Waddell, Trout Unlimited
Amanda Hill, USFWS
Bill Argentieri, SCE&G
Milton Quattlebaum, SCANA Services

The group met at Saluda Shoals Park. Shane Boring opened the session at 9:00 AM, noting that the purpose of the two-day flow demonstration was to allow Technical Working Committee (TWC) members to observe the recommended flows developed by the TWC as a result of the Instream Flow Incremental Methodology (IFIM) Study. Brandon Kulik noted that the flow demonstration would also give the TWC an opportunity to field verify the Physical Habitat Simulation (PHABSIM) modeling results upon which the flow recommendations were based. Brandon provided attendees with copies of the hydraulic modeling results for 700 and 1,000 cfs (depth and velocity), and applicable habitat suitability criteria for selected transects to allow for comparison to actual field conditions.

It was noted that today's session would focus on the 700 cfs flow and tomorrow on the 1,000 cfs flow. Bill Argentieri noted that a demonstration flow release of 733 cfs from the powerhouse had been initiated at approximately 2:00 AM and should be stable throughout the day. The group then visited the Corley Island, Oh Brother/Ocean Blvd. complex, Millrace Rapids, and Shandon Rapids study sites; observations from each are summarized below.

Corley Island

Brandon Kulik, Mark Cantrell, and Gerrit Jobsis collected depth and velocity measurements at multiple locations along Corley Island in both the Saluda main channel and in the side channel (vicinity of transects 10 -14). Depth measurements were found to be highly consistent with depth predicted by the hydraulic model. Velocity estimates from the model were also found to be close (generally within 0.2 – 0.3 feet/second of those observed in the field). Attendees indicated that the 700 cfs flow appeared to be an adequate base flow for the Corley Island study site.

Oh Brother/Ocean Blvd.

The group observed the test flow and collected depth and velocity data at approximate transect locations on both the Oh Brother and Ocean Blvd sides of the river (vicinity of transects 4 – 9). Similar to the Corley Island sites, depths were found to be close to the model results. Modeled velocities were also similar to field measurements (generally within 0.3 to 0.4 feet/second of modeled velocities). Attendees generally agreed that 700 cfs looked very favorable as a base flow; the group observed anglers catching trout and successfully wading the area.

Shandon Rapids/Riverbanks Zoo

To close out the day's session, the group observed the 700 cfs flow in the vicinity of Riverbanks Zoo and Shandon Rapids (Transects 1 and 2). Attendees indicated that the flow looked very favorable as a base flow for achieving the habitat goals for this section of the river.

Before adjourning for the day, the group quickly convened to recap their opinions regarding the 700 cfs flow. Attendees noted that the hydraulic modeling results appeared to match field conditions quite well and that the 700 cfs flow appeared to provide a considerable improvement in terms of habitat quality over the 500 cfs typically provided and observed in the past. Amanda Hill noted specifically that the flow appeared very promising in terms of providing additional wetted width. Ron Ahle added that the flow in general looked good as a base flow, and was of the opinion that a bit more water in the Oh Brother/Ocean Blvd area would further improve wetted width and depth over the gravel at the lower reaches of the site and in the braided channels that bisect the island. Brandon noted that, while increased flow could potentially increase coverage over the gravel bar, it would likely also result in increased velocities, adding that some of the velocities in the area were near 5.0 ft/sec in mid-channel areas were above or nearing suitability limits of most target species. Therefore increased wetted area may be offset by declining velocity suitability at higher flows. Mike Waddell thought that 700 cfs was a good flow and wadable at all locations. In closing, the group agreed that, pending results from the operations model regarding water availability, 700 cfs appeared to be an acceptable minimum flow.

Noting the group's satisfaction with the 700 cfs flow, Bill A. then enquired as to whether the 1,000 cfs flow demonstration (scheduled for the following day) was needed. Ron Ahle, and others indicated that they would like to see the 1,000 cfs flow, particularly at Oh Brother/Ocean Blvd. After additional discussion, the group decided that it was only necessary to observe the 1,000 cfs flow at Oh Brother/Ocean Blvd. Attendees agreed to meet at 9:00 AM the following morning; the day's session adjourned at approximately 4:30 PM.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
Lower Saluda River Flow Demonstration
May 1 & 2, 2008

Final CSB 06/16/2008

MAY 2, 2008

Attendees

Ron Ahle, SCDNR
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Mike Waddell, Trout Unlimited
Mark Giffin, SCDHEC
Scott Harder, SCDNR
David Martin, SCDHEC
Dick Christie, SCDNR
Mark Cantrell, USFWS
Brandon Kulik, Kleinschmidt Associates
Amanda Hill, USFWS
Bill Argentieri, SCE&G
Milton Quattlebaum, SCANA Services

The session convened at the Trout Unlimited access at Oh Brother/Ocean Blvd at approximately 9:00 AM to observe the 1,000 cfs flow release. Similarly to the 700 cfs flow, spot checks of depth and velocity at approximate transect locations were found to be consistent with the hydraulic modeling results. Depth had increased by about 0.2-0.3 ft and velocities were generally a little higher than the previous day. Wading conditions in the lower reach of Oh Brother Rapids had become more challenging, and required use of a wading staff, but were considered to be manageable at least by experienced anglers. Mike Waddell added that 1000 cfs may be nearing the wadable limit for some older and/or less experienced fishermen. Several attendees pointed out a slight increase in mid-channel gravel bar inundation at the lower end of Oh Brother (Transect 4), but added that it added only negligible additional habitat since depth over the newly wetted gravel was only 2 – 3 in.

Following the field inspection, the group convened briefly to re-cap impressions of both days of demonstration flows. Agency and NGO staff in attendance expressed their satisfaction with the flows and recommended moving forward with 700 cfs as the recommended base flow. Alan Stuart noted that the feasibility of recommending 700 cfs as the minimum flow would depend on result of the operations model (i.e. water availability), but added that preliminary results suggest that 700 cfs will likely not be a problem during normal water years. Alan added that there is considerable interest in the operations model results by a wide range of stakeholder groups, and as such, a meeting of all of the Resource Conservation Groups (RCGs) has been scheduled for May 22 at Saluda Shoals Park.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO/COLUMBIA PROJECT RELICENSING
INTREAM FLOW/AQUATIC HABITAT TWC
IFIM Workshop

SCE&G's Lake Murray Training Center
January 23-25 2008

Final CSB 03-25-08

ATTENDEES:

Ron Ahle, SCDNR
Gerrit Jobsis, American Rivers
Shane Boring, Kleinschmidt Associates
Steve Summer, SCANA Services
Jeni Hand, Kleinschmidt Associates
Mike Waddell, Trout Unlimited
Gerrit Jobsis, American Rivers
Mark Giffin, SCDHEC
Bill Argentieri, SCE&G
Prescott Brownell, NMFS
Dick Christie, SCDNR
Alan Stuart, Kleinschmidt Associates
Kevin Nebiolo, Kleinschmidt Associates
Brandon Kulik, Kleinschmidt Associates
Hal Beard, SCDNR
Matt Rice, American Rivers
Amanda Hill, USFWS
Randy Mahan, SCANA Services
Scott Harder, SCDNR
Milton Quattlebaum, SCANA Services

NEXT MEETING

Tentatively set for March 20, 2008

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

January 23, 2008

Shane Boring of Kleinschmidt Associates opened the meeting at approximately 9:30 am, and meeting attendees introduced themselves. Shane briefly reviewed action items that were listed in the previous IFIM meeting. Specifically, Shane asked Hal Beard of SCDNR if he had obtained information from Jason Bettinger regarding striped bass using the lower Saluda River (LSR) as a thermal refuge. Hal noted that he had obtained the information from Jason regarding the status of striper using the LSR as a thermal refuge during summer months (see Attachment A). Hal explained that this information focused on the receiver located at the Riverbanks Zoo. Hal explained that stripers were tagged at Gervais Street Bridge during spawning; both small and large fish were tagged. Temporal and diurnal data is not available at this time due to large data volume.

Kevin N. provided a brief explanation of the methodology used to develop the habitat duration analysis. He explained that WUA was weighted across each reach. Scott Harder noted that

weighting factors for Toenail Rapids and Sandy Beach seemed to be out of proportion. Scott explained that Sandy Beach is a larger area than Toenail, but Toenail received a weighting factor approximately twice that used for Sandy Beach. Shane noted that he would check the reach lengths in GIS and adjust reach weighting accordingly.

Brandon K. then led a review of Leonard and Orth (1988[1]), which provides a framework for applying habitat guilds to instream flow analyses, and shows that the patterns in flow vs. habitat sutiability within guild types observed in this study match classic guild curve types. In the Saluda study, most of the lifestages used within a particular guild showed similar curve shapes, with inflections and peaks occurring at roughly similar flows. Brandon explained that as far as guilds are concerned, Leonard and Orth describe that for large rivers, focus should be on riffle, run and also stream margin, such as shallow slow, shallow fast and deep fast guild representatives. Brandon also pointed out that pool ("deep slow") guild members offer least decision information. Brandon further explained that the Leonard and Orth paper also point out that there are basically four WUA curve patterns or classifications, classes I, II and III are the most informative; conversely WUA curves corresponding to type IV are the least informative. Brandon proposed that the group consider these principals in guiding guild choices. He added that the group should possibly consider eliminating various type IV and deep-slow curves, there may even be an opportunity to blend or eliminate a few species and lifestages with redundant curve shapes. Brandon noted that if committee members are comfortable with developing blended curves for each guild, then we would be able to reduce the volume and complexity of WUA curves for purposes of decision-making. Ron Ahle noted that he was concerned that if we blend species together then, we may lose sensitivity of each life stage. For example, he noted that when a brown trout fry becomes a juvenile, the requirements may change. After additional discussion, the group determined that the methodology was acceptable, because as flow targets driven by blended guilds are considered, effects on individual lifestages can still be viewed and adjustments made as necessary.

The group decided that the best way to use the data was in an interactive table depicting flow and percent WUA for each month. Agency staff noted that a similar tool had been developed during the Catawba-Wateree relicensing to develop minimum flows. The group determined the following blended guilds and key species with lifestages were to be used in the interactive table developed for the following day's meeting.

[1] Leonard, Paul M. And Donald J. Orth. 1988. Use of Habitat Guilds of Fishes to Determine Instream Flow Requirements. *North American Journal of Fisheries Management* 8:399-409.

Species/Guild	Lifestage/Curve	Priority
Brown Trout	Adult	K
	Juvenile	K
	Fry	S
	Spawning	S
Rainbow Trout	Adult	K
	Juvenile	K
	Fry	S
	Spawn	S
Smallmouth Bass	Adult	K
	Juvenile	K
	Fry	S
	Spawning	S
Shortnose Sturgeon	Spawning	S
	YOY	S
Striped Bass	Adult	K_1
Deep-slow Guild	Blended	S
Deep-fast	Blended	K
Shallow-slow	Blended	K
Shallow-fast	Blended	K

K=Key Species; S=Secondary
K_1=Striped bass identified as key species primarily for zone-of-passage and thermal refuge

January 24, 2008

Shane Boring opened the meeting at approximately 9:30 am with a number of housekeeping items. First, an updated version of the dual flow analysis was distributed to attendees; it was noted that the figures 4.2, 5.2, and 5.5 needed to be updated to reflect the ½ unit flow increments previously requested. Kevin Nebiolo noted that these were not updated due to inconsistencies between the graphed and modeled results. Kevin added that he would rerun the regressions for these sites and update the tables ASAP. An updated version of the dual flow analysis was also distributed to attendees.

Scott Harder enquired as to whether the inconstancies pointed out during the previous day regarding reach weighting used in the habitat duration analyses had been addressed. Specifically, Scott reminded the group that, based in his interpretation of proportions of various habitats from the mesohabitat assessment, it appeared that the weighting scheme used in the current analysis resulted in the Toenail Rapids areas being over-represented and the Sandy Beach areas under-represented. Shane noted that he had re-calculated the reach lengths for these sites using ArcGIS and that Scott

was correct; he added that the reach weighting and habitat duration analyses had been updated accordingly.

Brandon Kulik recapped the previous day's accomplishments, noting that the group had agreed on "key" and "secondary" species/lifestages. He added that this was done in an effort to further streamline WUA output produced thus far in the IFIM process and to begin honing in on those species/lifestages that will ultimately be "drivers" in the flow negotiations. He added that the focus of today's discussion would be to use the interactive spreadsheet developed by Kevin N. to examine various flow scenarios, adding that the most expeditious method would be to focus on the "key" species/lifestages and use the "secondary" species as a "sanity check."

The group then engaged in an interaction session using the spreadsheet developed by Kevin N. (example included in Attachment B). The group began discussions with a year-round flow of 700 cfs. Dick Christie requested that a flow of approximately 1200 cfs be evaluated for the spring months to allow passage of striped bass that utilize the LSR for thermal refuge. Alan S. enquired as to whether an earlier recommendation of using pulsing rather than continuous flows would be feasible for providing the passage flows needed for striped bass. Hal B. noted that there is typically a very short, temperature dependant window during which the majority of striped bass migrate into the LSR, and as such, having very short, pulsed flows has a greater potential for missing the window for inmigrating fish. Gerrit noted that a low flow protocol is likely needed and that a pulsed flow could be a possibility during these low flow years.

Brandon Kulik recommended going month-by-month through the interactive spreadsheet to examine the proportion of optimal WUA provided at various flow for the key species/lifestages. Dick C. added that looking at seasonality of the key and secondary species, as well as those identified as SCDNR management priority species, would be beneficial for this exercise. As a result the group developed the following seasonality:

Key Species/Month	J	F	M	A	M	J	J	A	S	O	N	D
Adult trout	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile trout	■	■	■	■	■	■						■
Brown trout spawn/fry										■	■	
Rainbow trout spawn/fry	■	■										
Striped bass passage				■	■							
Striped bass thermal refuge					■	■	■	■	■	■		
Smallmouth bass spawning					■	■						
Smallmouth bass juveniles							■	■				
Shallow-slow guild			■	■	■							
Shallow-fast guild	■	■	■	■	■	■	■	■	■	■	■	■
Deep-fast guild	■	■	■	■	■	■	■	■	■	■	■	■

After considering a number of scenarios, the group agreed on the following proposed flow regime:

Month	**Minimum Flow Recommendation (cfs)**
January 1 – March 31	700
April 1 – April 14	1000
April 15 – May 14	1300
May 15 – May 31	1000
June 1 – December 31	700

Brandon K. noted that, according to the model, the flows being proposed should provide close to 100% of maximum WUA for most target species/lifestages (See spreadsheet result in Attachment B). He reminded the group that, in previous TWC discussions, flows providing 80% of optimal WUA had been deemed acceptable. After consulting the flow duration curves to ensure that sufficient water would likely be available, the group agreed to leave the recommended flows at the near 100% of optimum WUA levels. It was agreed that this would allow room for adjustment should the operations modeling indicate potential conflicts with other water uses.

In closing, the group agreed that the final day of workshop would focus on development of low and high inflow protocols to augment the flows recommended above for normal water years. The session adjourned at approximately 3:45 pm.

January 25, 2008

Shane Boring opened the session at approximately 9:30 am, noting that a set of preliminary flow recommendations had been developed the previous day. He added that today's session would focus on development of high and low inflow protocols.

The group first discussed a low inflow protocol. Noting that the group had previously agreed that 80% of maximum WUA was acceptable for most species, Shane enquired as to whether attendees had species target numbers in mind. Alan S. noted that had consulted the SC State Water Plan, as promised during the previous day's session, and confirmed his assertion of 475 cfs as the minimum navigation flow for the LSR. Alan added that a flow of 400 – 500 cfs during low inflow years would provide at least 80% of maximum WUA for most species/guilds and recommended 400 cfs as a starting point for negotiations. Dick C. recommended that a staged approach linked to the severity of the drought would be appropriate, adding that this was the approach taken for Catawba-Wateree. Dick added that linking to the state's official classification would allow the burden of usage restrictions to be shared with other water users in the state (i.e. municipalities, etc.).

The group then discussed potential impacts of reduced flow during low flow years on water temperature. Gerrit pointed that temperatures below 20° C are generally preferred for optimal trout growth. Hal Beard added that maintenance of suitable conditions for trout is among SCNDR's management goals for the LSR and reiterated the need for temperatures less than 20° C. The group then examined temperature data from the USGS data at Riverbanks Zoo and from SCE&G's relicensing study. Shane pointed out that during the period of May 1 – September 30, 2007, the maximum temperature observed during SCE&G's study was 22° C, adding that this is below the thermal lethal limits for trout. Kevin noted that, based on the Riverbanks Zoo USGS data from 2006 and 2007, the highest temperature was 23.9° C on August 23, 2006 with a flow of 483 cfs. Attendees acknowledged that it may be necessary under low flow conditions to pulse the project periodically to push temperatures back below 20° C.

Kevin then led an interactive session examining the % of maximum WUA provided for target species at the recommended 400 cfs low inflow protocol. Alan noted that at 400 cfs 80% WUA was met or nearly met for all species, with adult smallmouth bass taking the biggest hit. The Group agreed that 400 cfs appeared reasonable during most months. Bill enquired as to whether higher flows would be needed for fish passage during low inflow years. Gerrit and Ron recommended ratcheting down the passage flows depending on the severity of the drought. It was noted that, during more severe droughts, some passage could be provided through pulses. The group agreed that the SCDNR striped bass movement data and the rate-of-change study would likely need to be examined to estimate the magnitude, timing, and during needed for pulses to be effective. After additional discussion, the group agreed on the following recommended low inflow protocol:

SC Drought Stage	Normal	I	II	III	IV
Jan 1 – March 31	700	700	700	400	400
April 1- 14	1000	700	700	400	400
April 15-May 14	1300	1300 pulse	700	400 pulse	400
May 15 – May 31	1000	700	700	400	400
June 1 – Dec 31	700	700	700	400	400

Shane then distributed and the group briefly discussed the updated dual flow analysis (Attachment C). It was noted that all analyses had been reformatted to ½ unit flow increments, as requested, and that macroinvertebrates had been added to the analyses. Several group member asked to be reminded of the purpose of having the dual flow analysis considering the assumption that dual flow analyses are typically only applicable to peaking projects. Shane noted that group members had

voiced concern about the length of the proposed FERC license for the Project and had requested the dual flow in the event that the operating scenario is changed sometime during the license term. The group agreed that the analysis seemed adequate. Shane noted that the analysis would be attached to the meeting notes in order to make it part of the record.

The group then worked towards developing a proposed high flow protocol. Gerrit noted that he would like to see excess water during high flow periods used to enhance the habitat in the Oh Brother/Ocean Blvd area, adding that releases during high flows years could help offset lower flow years. Gerrit added that releasing excess water during high flow years would also be more consistent with a natural hydrograph. Brandon enquired as to what the flow limitations were for wade fishing in this area. Alan and Mike Waddell noted that was generally agreed among fishermen to be around 1000 cfs. After additional discussion, the group reached consensus on the following proposed high flow protocol:

- If reservoir is at full summer pool elevation on March 1, begin releasing the 1000 cfs on March 1 rather than April 1. This early release would last as long as the water level was above the target elevation during a normal inflow year. Once the water level dropped below the target elevation the increased flows would be suspended.

It was noted that proposed low and high inflow protocols would be forwarded to the operations modeling group to evaluate potential conflicts with other water needs (i.e. lake level maintenance, downstream recreation flows, etc.). The meeting closed at approximately 3:30 pm.

ATTACHMENT A
LSR Striped Bass Movement Information from SCDNR

Hal Beard

From: Jason Bettinger
Sent: Tuesday, January 15, 2008 3:01 PM
To: Hal Beard
Cc: 'Alan Stuart (E-mail)'; Dick Christie; Ron Ahle; Jim Bulak
Subject: RE: LSR STB info

Hal, below are answers to some of your questions. As you noted we have not completed the study, and cannot address a few of your questions at this time.

- Fifty-eight percent of fish that were tagged in the Congaree River during spring 2006 entered the lower Saluda River, where they spent the majority of the summer. During spring 2007 21 of 39 (54%) instrumented fish entered the lower Saluda River. Eighteen of those 21 fish used the Saluda River during 2006 and 2007.
- Striped bass that used the Saluda River (Mean TL = 758 mm, range 675 - 930 mm) were significantly larger than striped bass that did not use the lower Saluda River (Mean TL = 685 mm, range = 610 - 775 mm).
- During 2006 striped bass (N=14) entered the Saluda River between 21 April and 30 May (median entry date = 9 May) those fish departed the Saluda River between 13 July and 7 November (median departure date = 25 September). During 2007 striped bass (N=21) entered the Saluda River between 22 April and 31 May (median entry date = 4 May), transmitters expired before departure date could be determined. We have not yet evaluated movements based on flows, but the potential to evaluate that relationship may exist.
- The bulk of striped bass leave the Saluda River during the late summer, but at this point I couldn't say whether or not there is a significant relationship between draw down releases and striped bass departures.

If you have other questions let me know.
Jason

From: Hal Beard
Sent: Thursday, January 03, 2008 10:04 AM
To: Jason Bettinger
Cc: Alan Stuart (E-mail); Dick Christie; Ron Ahle; Jim Bulak
Subject: LSR STB info

Jason,
I spoke with you several weeks ago regarding several aspects of the STB telemetry study as it relates to their movement into and out of the LSR. As part of the Saluda Dam relicensing process, the Instream Flow Committee has been working at establishing flow recommendations for this tail water, with a focus on the fishery resource. One of the stand alone species being considered is STB. A number of questions were posed during our discussions of those habitat (flow) requirements needed for spring passage into the system, as well as that needed to maintain favorable summer habitat. We thought it may be helpful if you could share any of your study results that may help answer some of these questions.

- What percentage of the "tagged" fish entered the lower Saluda in each of the past two years of the study?
- Is there any indication that a particular size fish was more prone to enter the system or in general did both larger and smaller fish do so? What size ranges were involved?
- Based on the data, can the apparent temporal component associated with their movement in or out of the river be defined and how accurately? Specifically, when was the onset of spring migration into the lower portion (zoo receiver) and can any peak periods of movement be correlated to instantaneous flows or diurnal response?

- Is there any indication their movement out of the system is in response to "draw down" releases that begin in the late summer?

It is acknowledged that the study is not complete and the data thus far may not be adequate to definitively answer some of these questions but any input you could provide would be much appreciated.

Alan you can forward this to anyone else on the committee you deem appropriate, I just didn't have the e-mail address of all of the individuals and didn't want to exclude anyone.

ATTACHMENT B
LSR Interactive Flow/Weighted Usable Area Spreadsheet

Saluda Instream Flow Optimization Interactive Table

			Adult Brown Trout		Juvenile Brown Trout		Adult Rainbow Trout		Juvenile Rainbow Trout		Adult Smallmouth Bass		Juvenile Smallmouth Bass		Sturgeon	
			WUA	%	WUA	%	WUA	%	WUA	%	WUA	%	WUA	%	WUA	%
▶	700	January	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	February	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	March	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	1000	April 1-14	2294953.76	85%	2611724.96	90%	6518521.63	99%	2993725.12	95%	3937174.42	88%	2278588.84	95%	2348958.64	57%
	1300	April 15 - May	2071130.20352	77%	2212491.66062	76%	6586126.89091	100%	2747752.69468	87%	4278359.00554	96%	2025338.19148	84%	2781983.40838	67%
	1000	May 15 -30	2294953.76	85%	2611724.96	90%	6518521.63	99%	2993725.12	95%	3937174.42	88%	2278588.84	95%	2348958.64	57%
	700	June	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	July	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	August	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	September	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	October	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	November	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	700	December	2684951.58715	100%	2898849.75994	100%	6228705.6496	94%	3136454.96344	100%	3396836.0802	76%	2368171.31854	99%	1946514.0476	47%
	400	Min Flow	2225202.4168	83%	2826330.79504	97%	5364432.1168	81%	3038911.76464	97%	2568267.2256	58%	1823679.00928	76%	1160859.8648	28%
*	0															

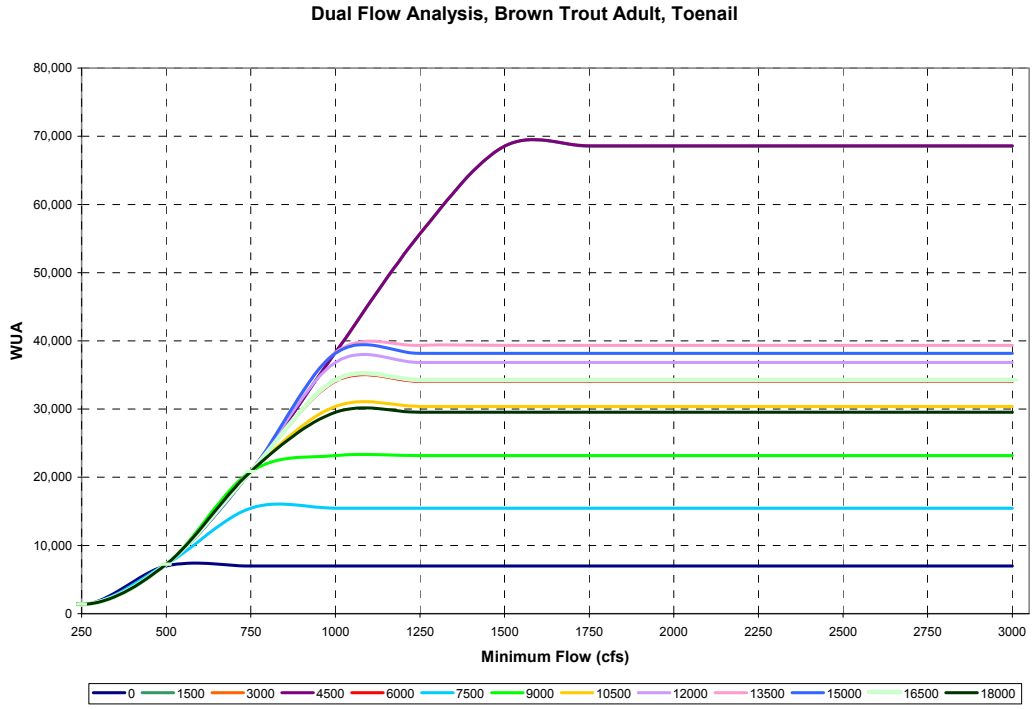
ATTACHMENT C
Final LSR Dual Flow Analysis

Attachment 1
Dual Flow Analysis List of Figures

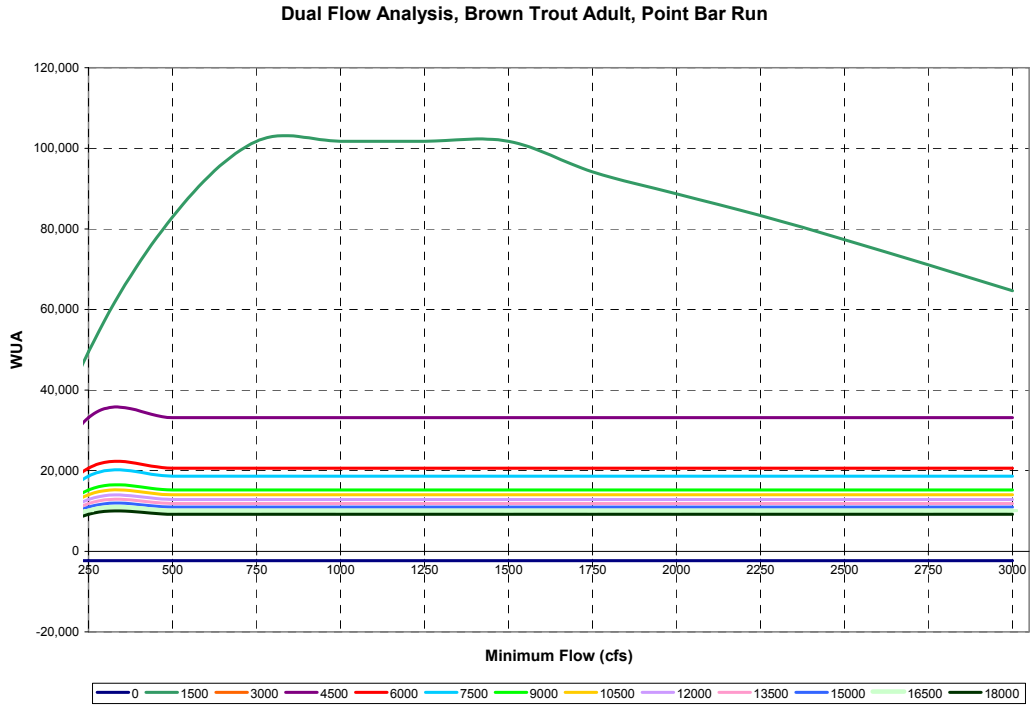
Attachment 1 Dual Flow Analysis

The graphs are contained within the attachment, if you wish to view each graph's corresponding Dual Flow Matrix table please refer Attachment 1A, Dual Flow Tabular Results.

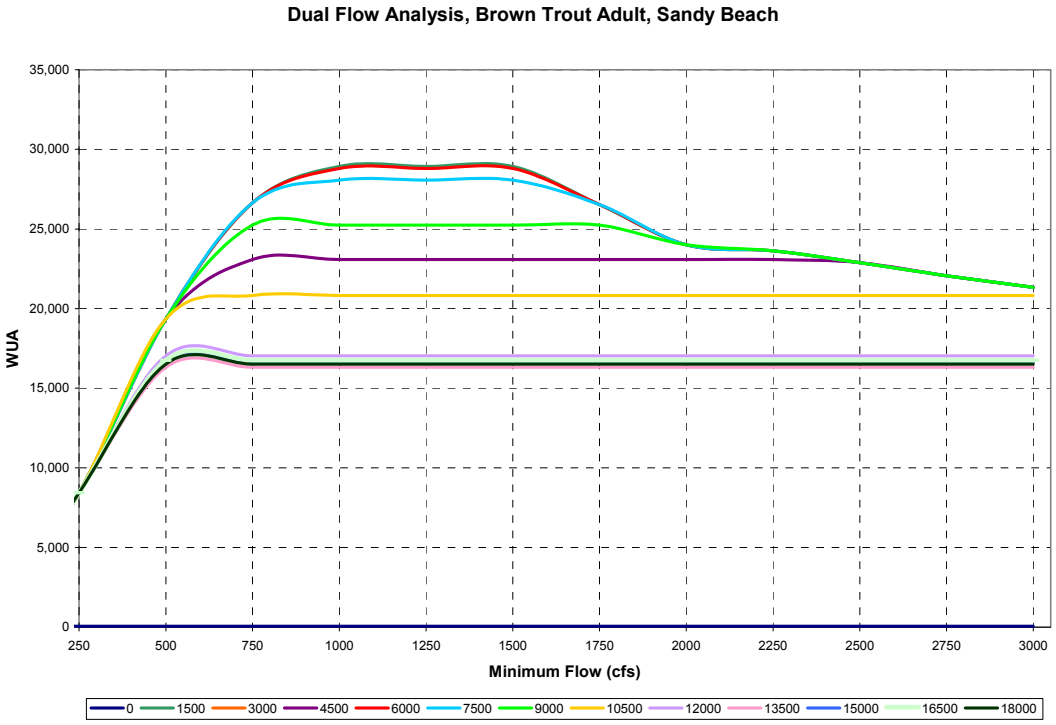
1. Brown Trout Adult



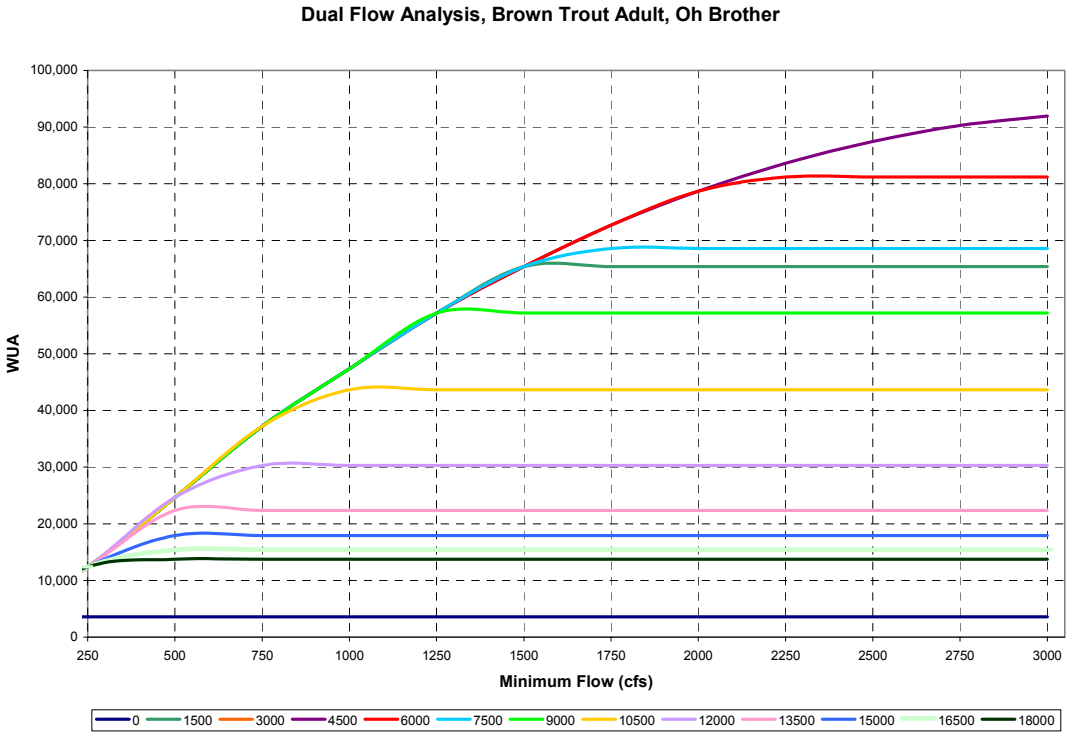
1.1. Dual Flow Analysis Brown Trout Adult at Toenail Riffle



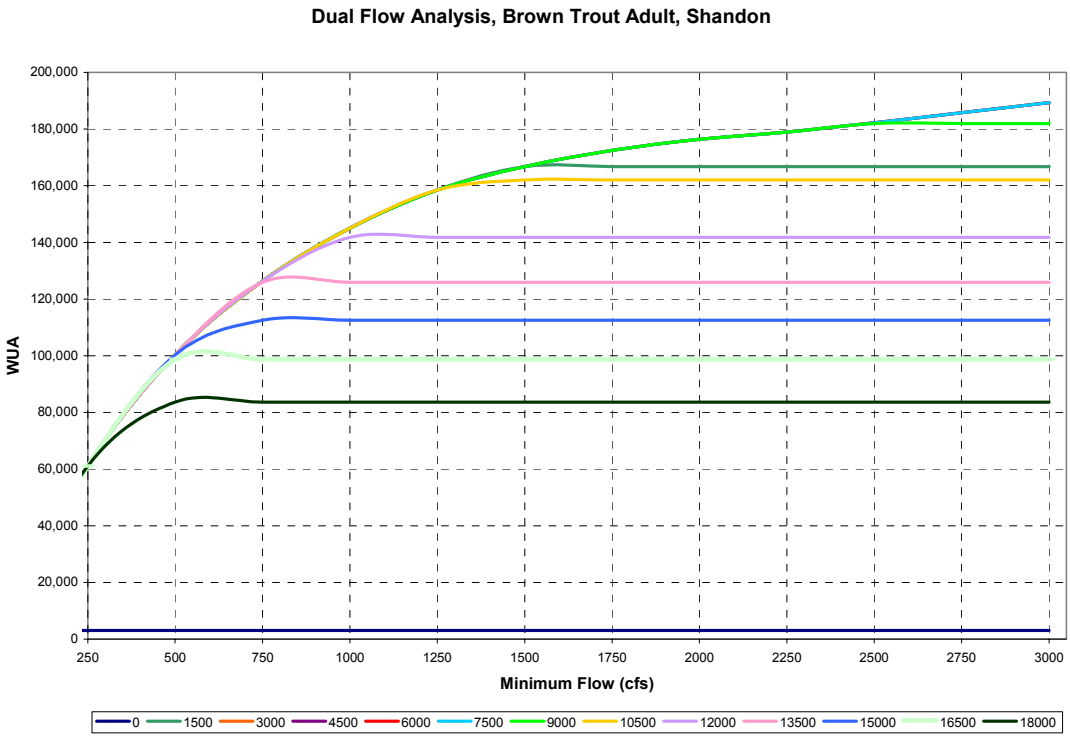
1.2. Dual Flow Analysis Brown Trout Adult at Point Bar Run



1.3. Dual Flow Analysis Brown Trout Adult at Sandy Beach

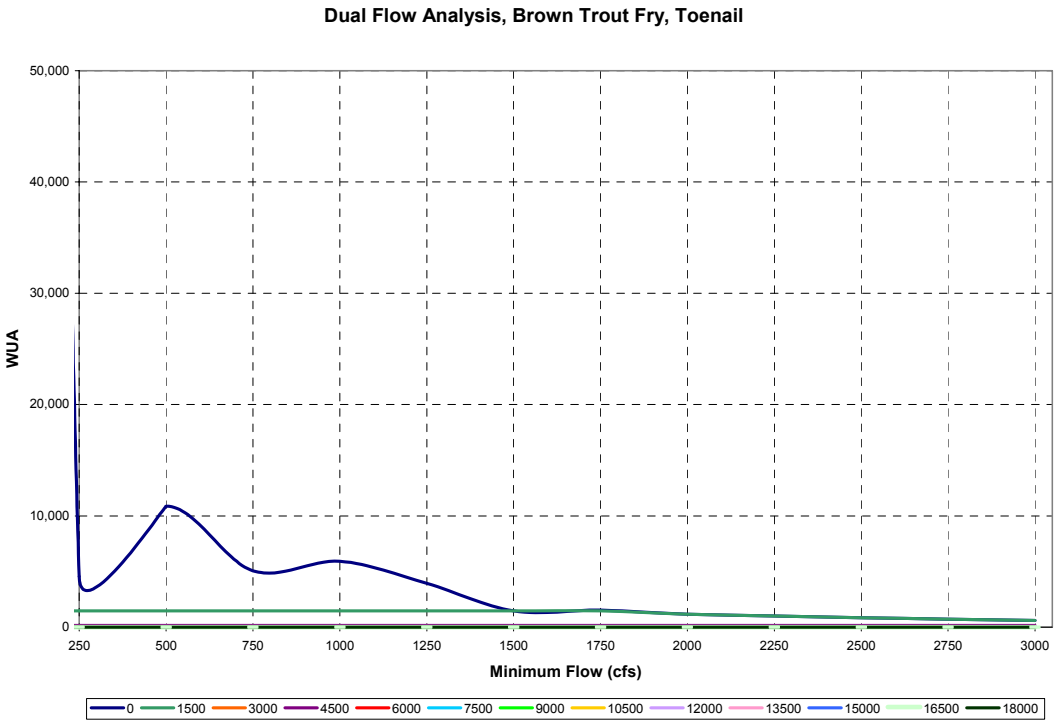


1.4. Dual Flow Analysis Brown Trout Adult at Ocean Blvd/Oh Brothers Rapids

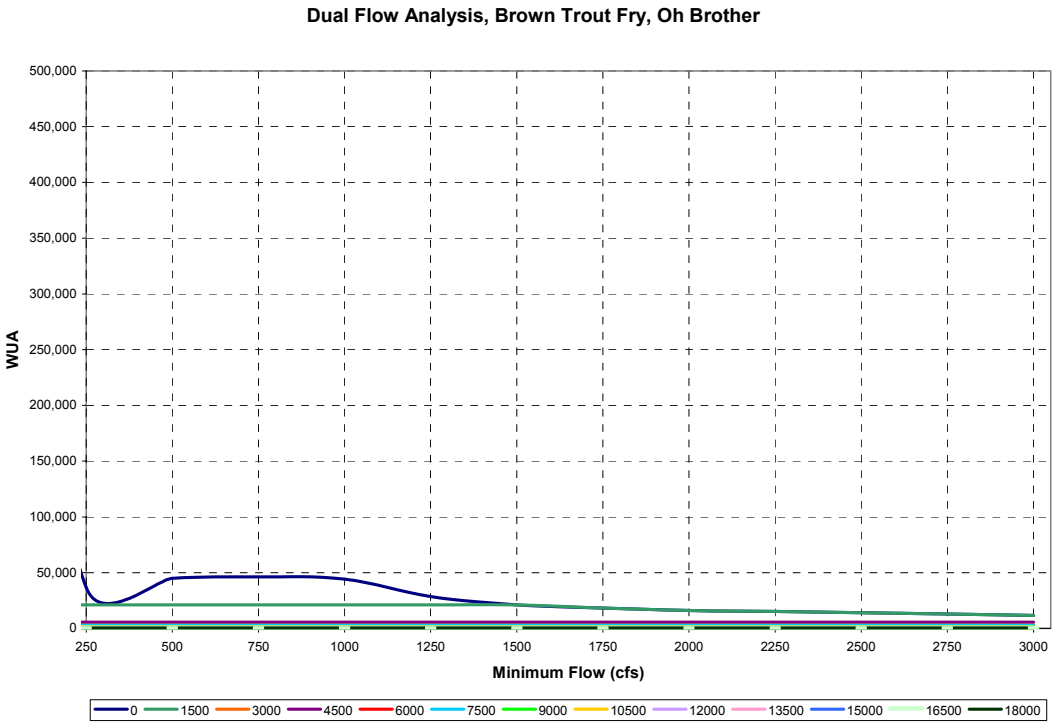


1.5. Dual Flow Analysis Brown Trout Adult at Shandon

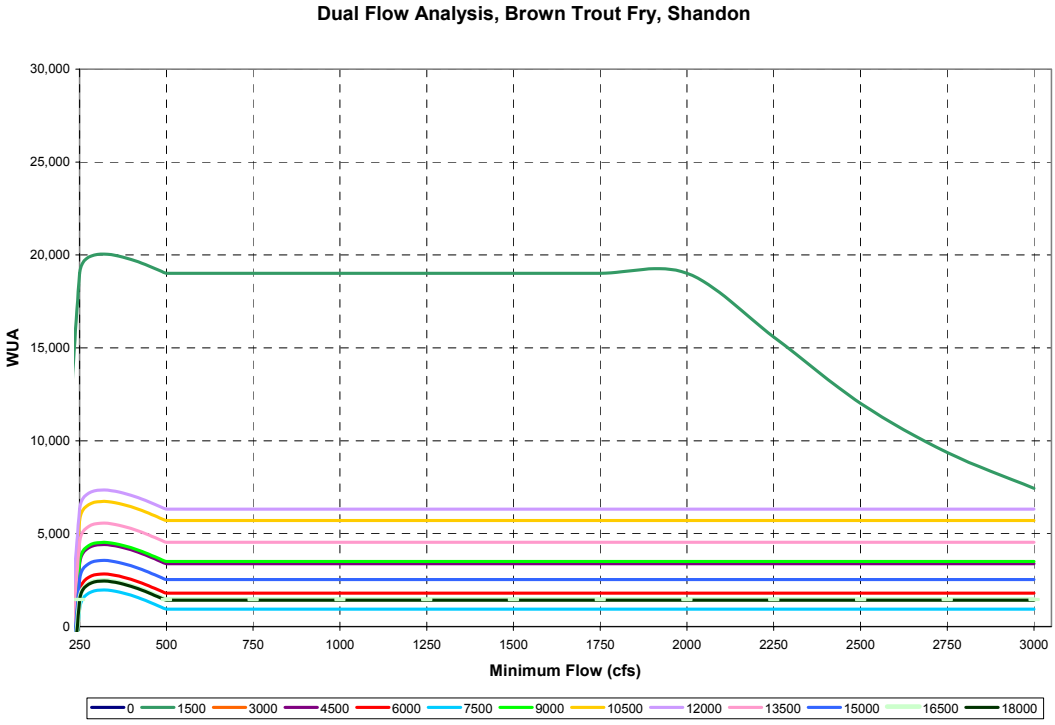
2. Brown Trout Fry



2.1. Dual Flow Analysis Brown Trout Fry at Toenail Riffle

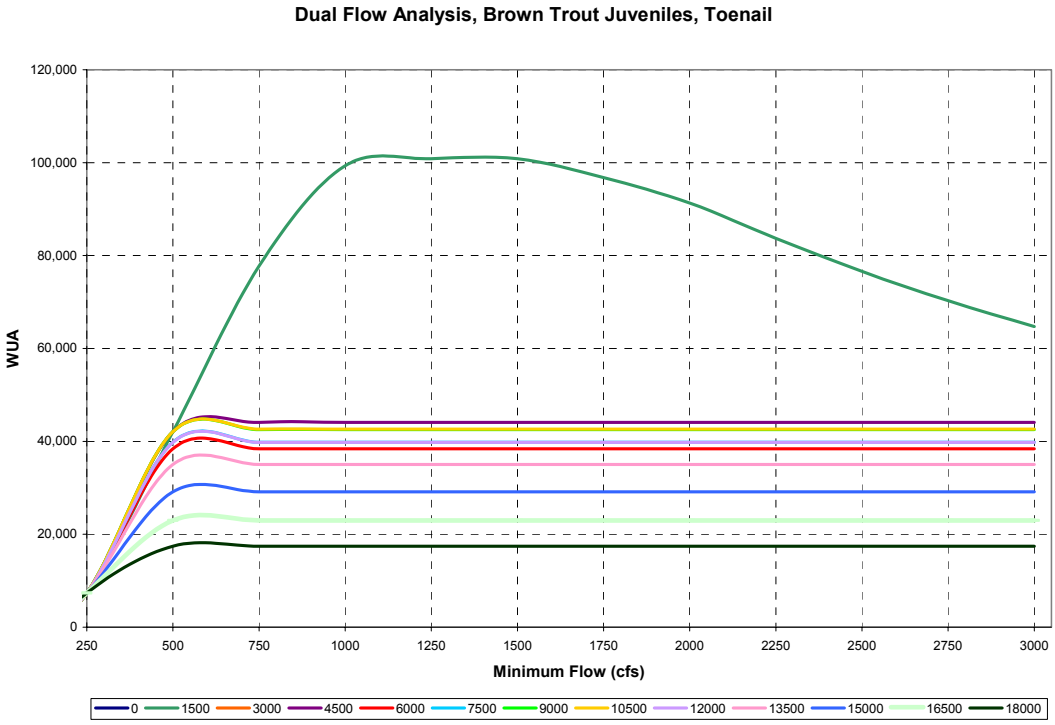


2.2. Dual Flow Analysis Brown Trout Fry at Ocean Blvd/Oh Brother Rapids

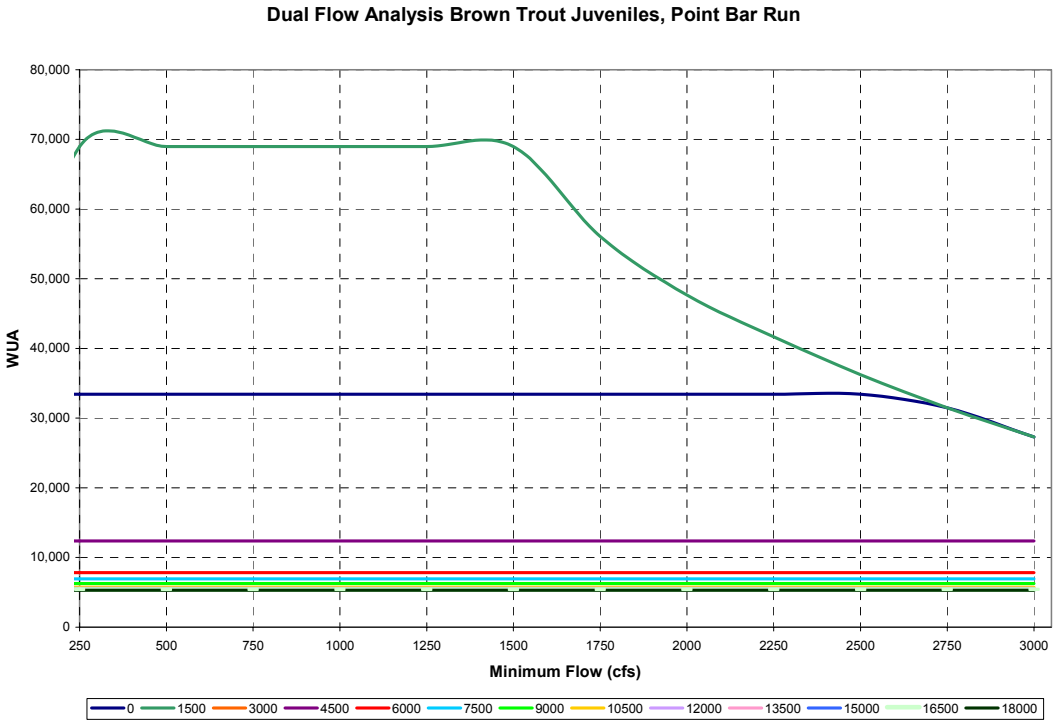


2.3. Dual Flow Analysis Brown Trout Fry at Shandon

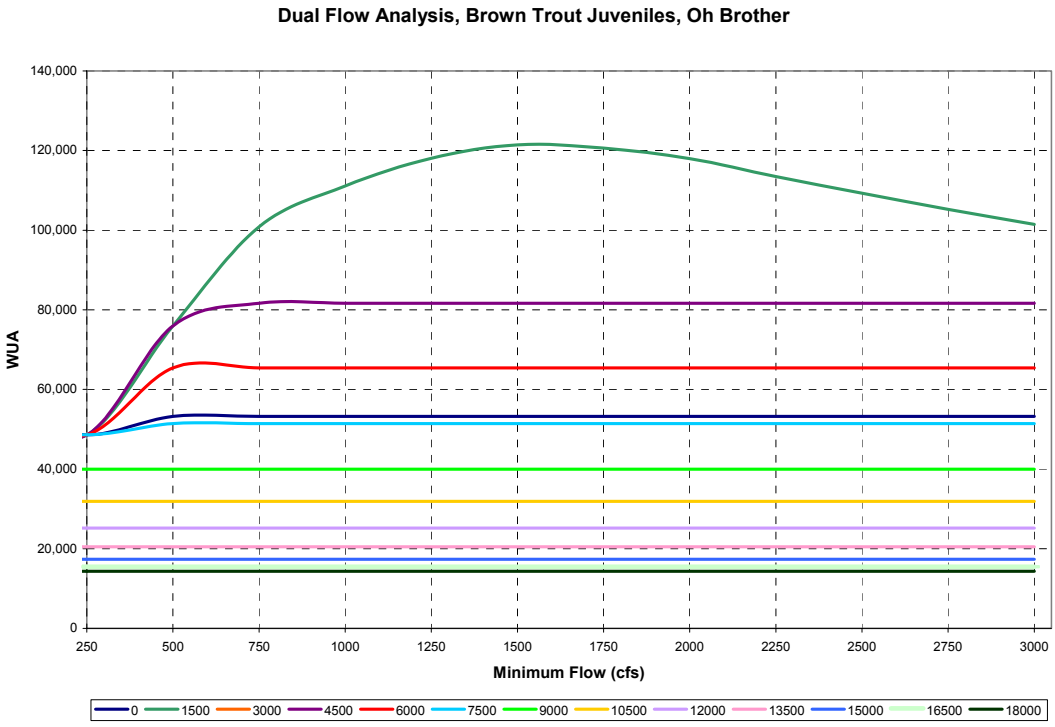
3. Brown Trout Juvenile



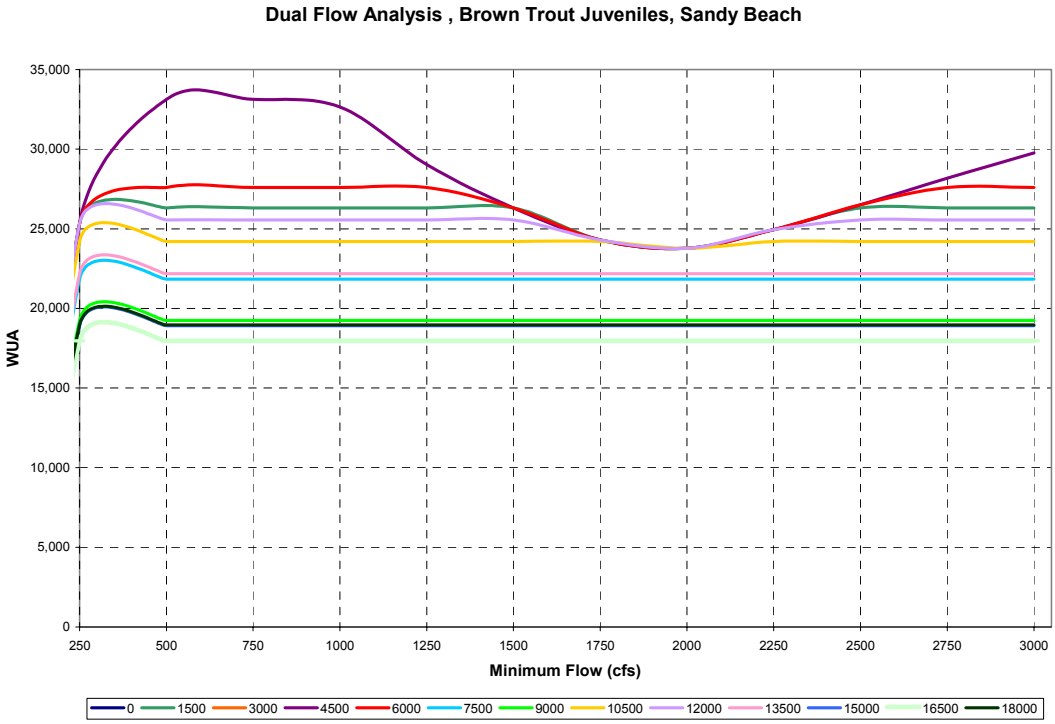
3.1. Dual Flow Analysis Brown Trout Juvenile at Toenail Riffle



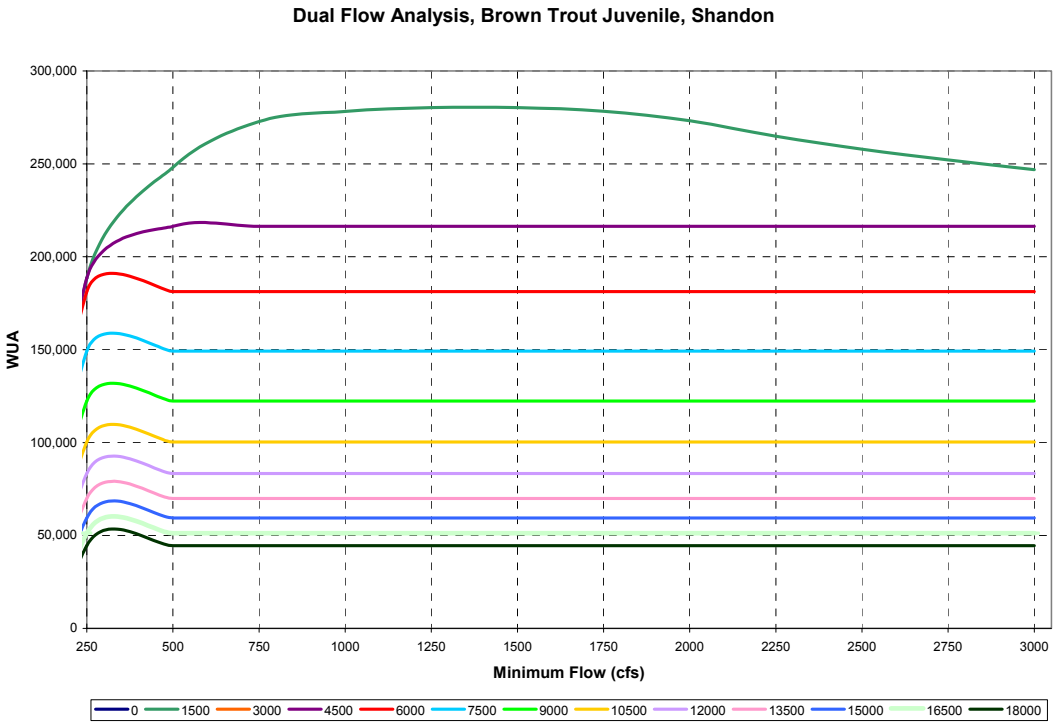
3.2. Dual Flow Analysis Brown Trout Juvenile at Point Bar Run



3.3. Dual Flow Analysis Brown Trout Juvenile at Ocean Blvd/Oh Brother Rapids

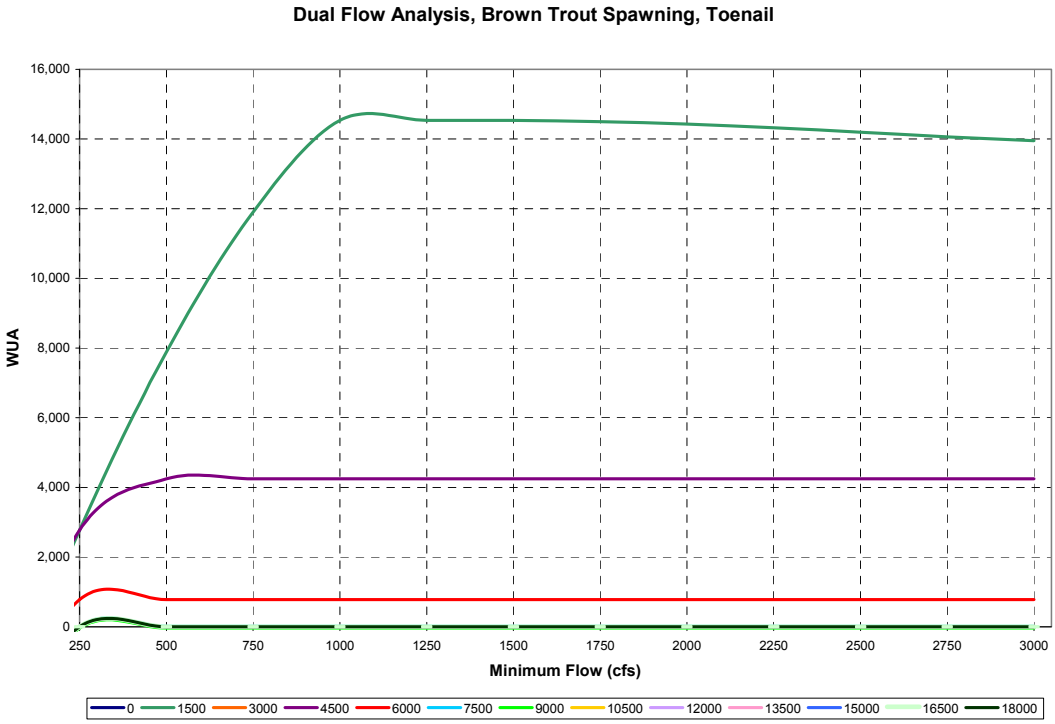


3.4. Dual Flow Analysis Brown Trout Juvenile at Sandy Beach



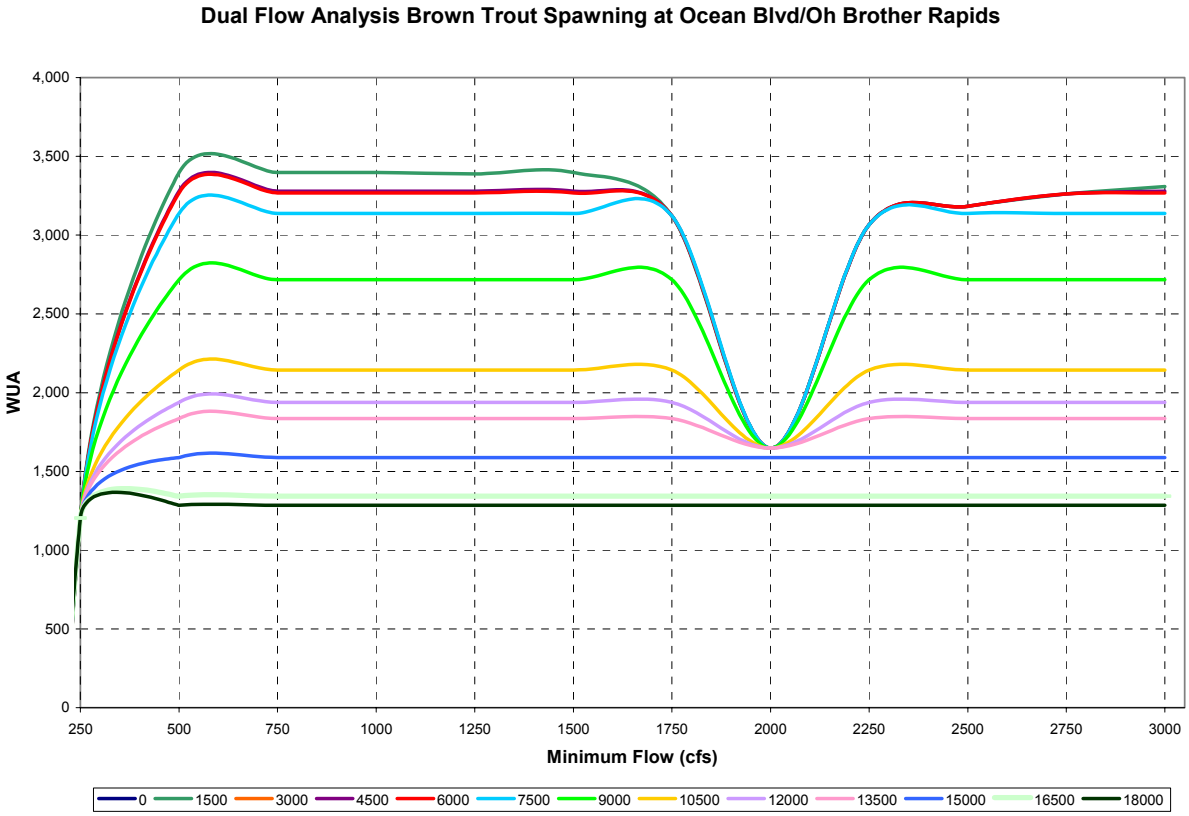
3.5. Dual Flow Analysis Brown Trout Juvenile at Shandon

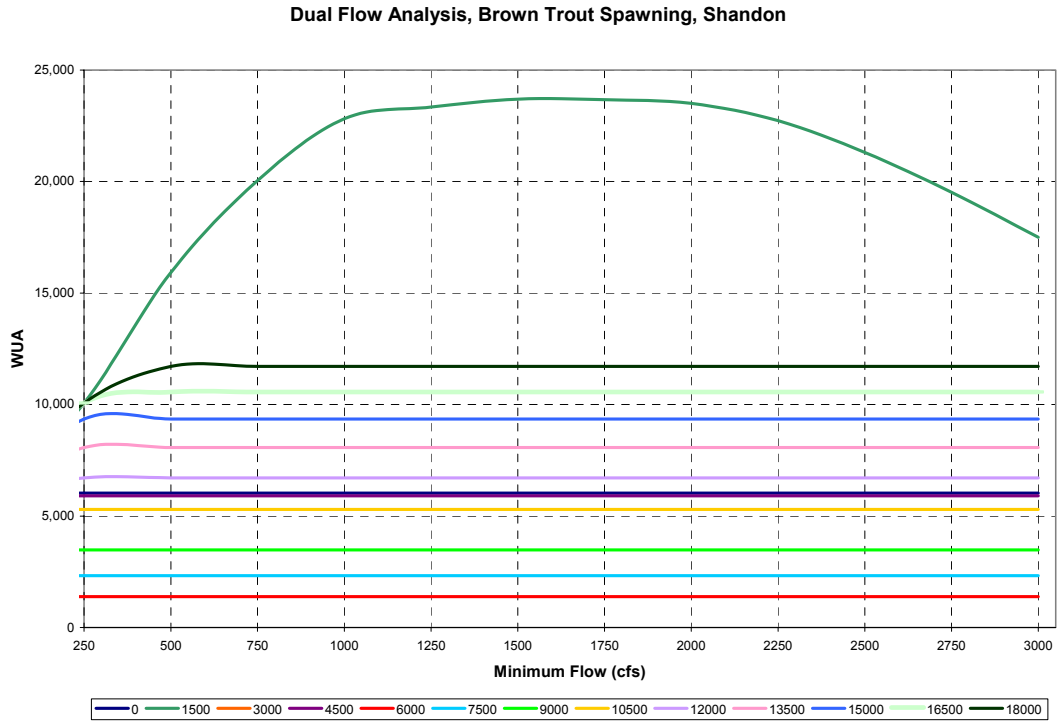
4. Brown Trout Spawning



4.1. Dual Flow Analysis Brown Trout Spawning at Toenail Riffle

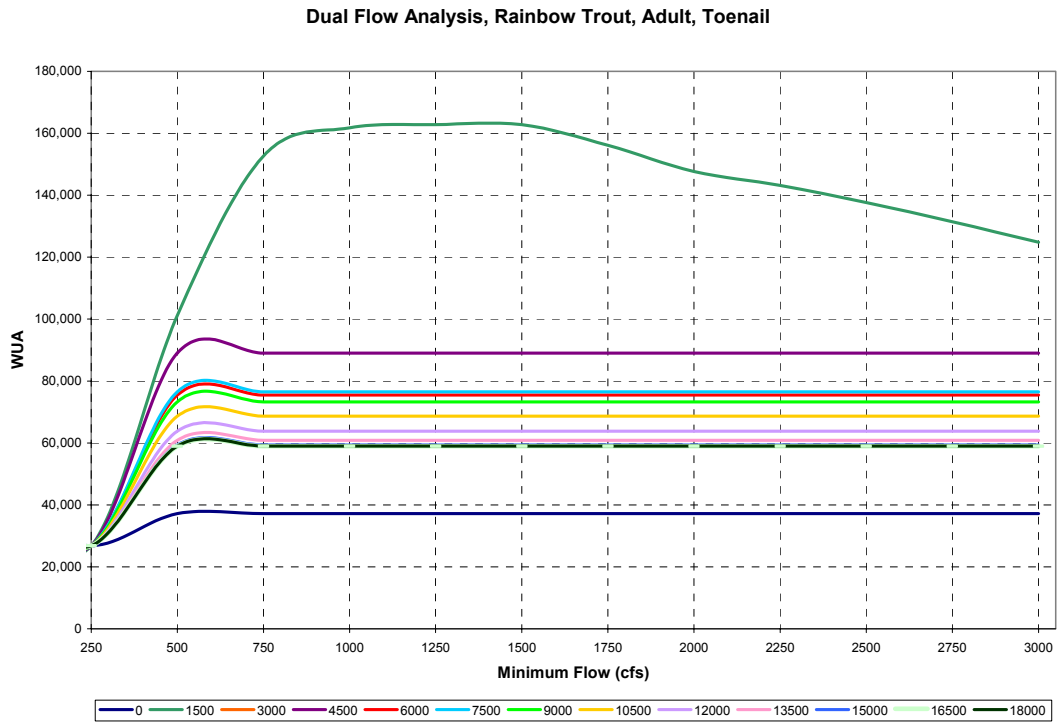
4.2. Dual Flow Analysis Brown Trout Spawning at Oceans Blvd/Oh Brother Rapids



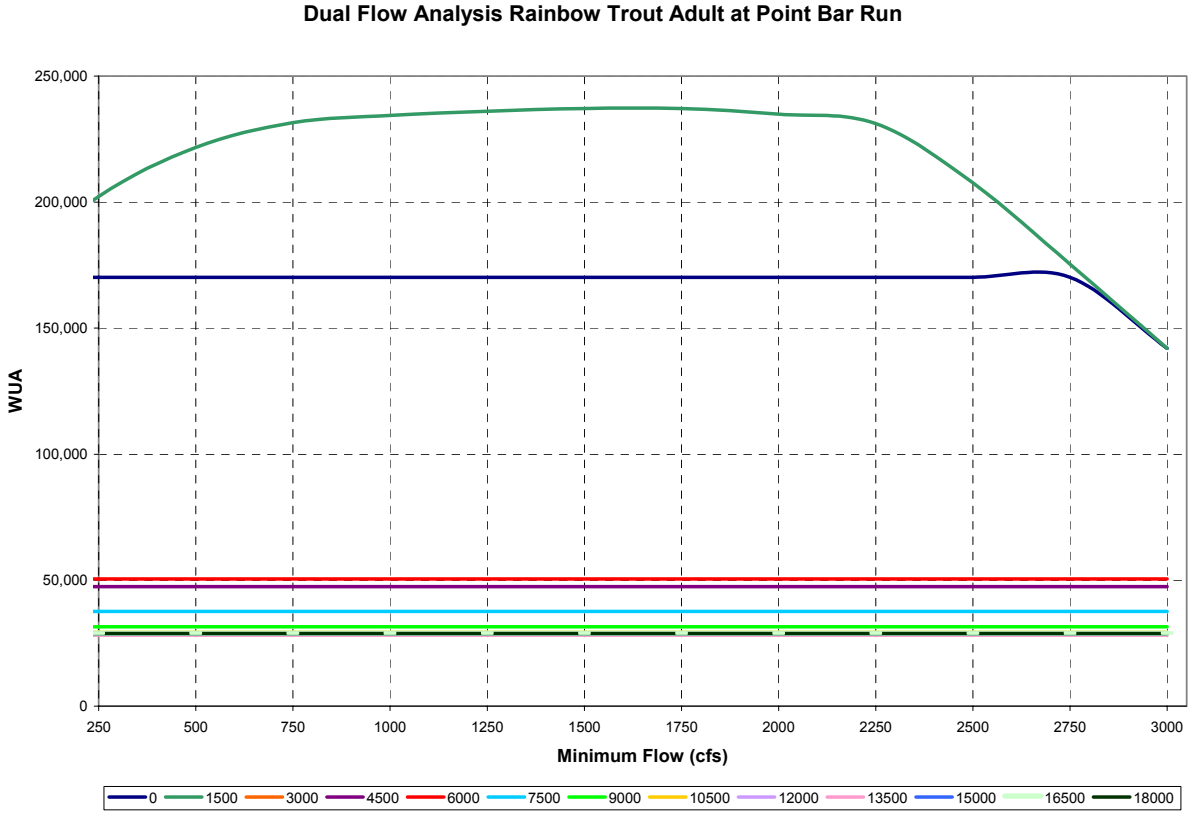


4.3. Dual Flow Analysis Brown Trout Spawning at Shandon

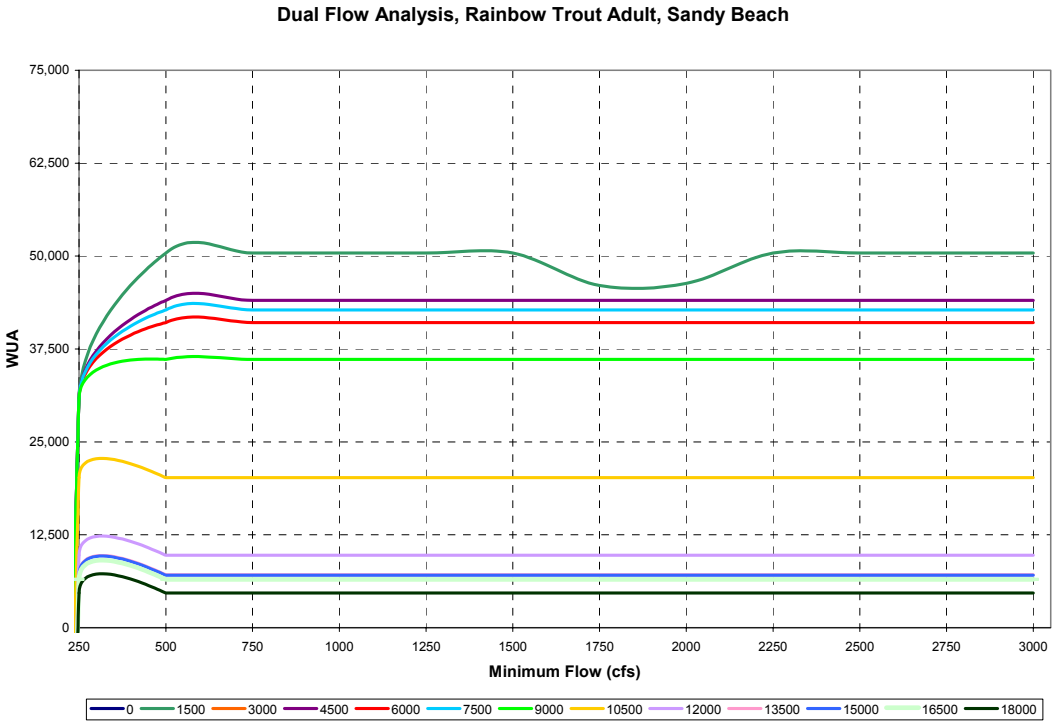
5. Rainbow Trout Adult



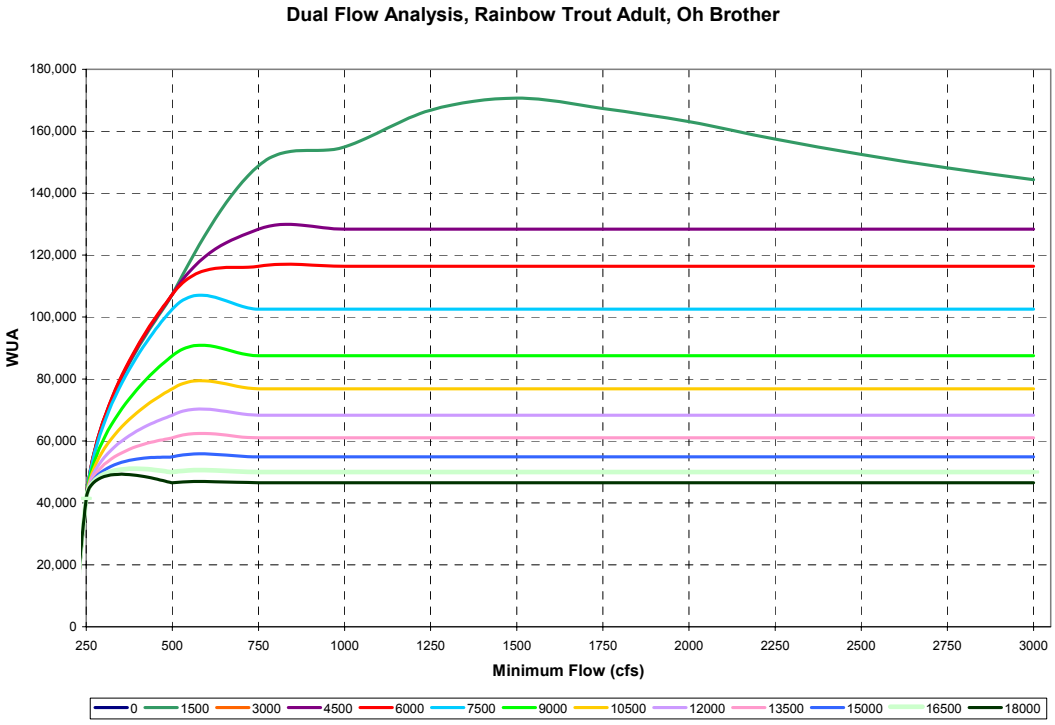
5.1. Dual Flow Analysis Rainbow Trout Adult at Toenail Riffle



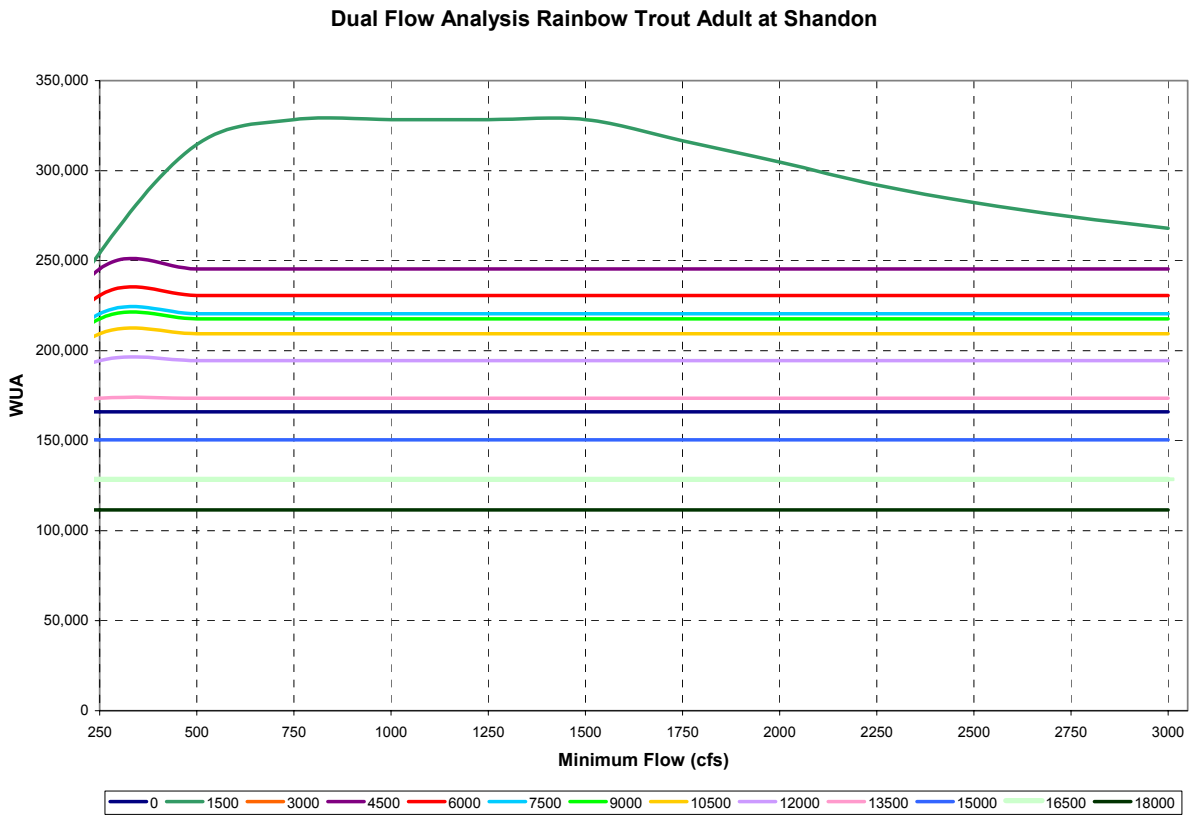
5.2. Dual Flow Analysis Rainbow Trout Adult at Point Bar Run



5.3. Dual Flow Analysis Rainbow Trout Adult at Sandy Beach

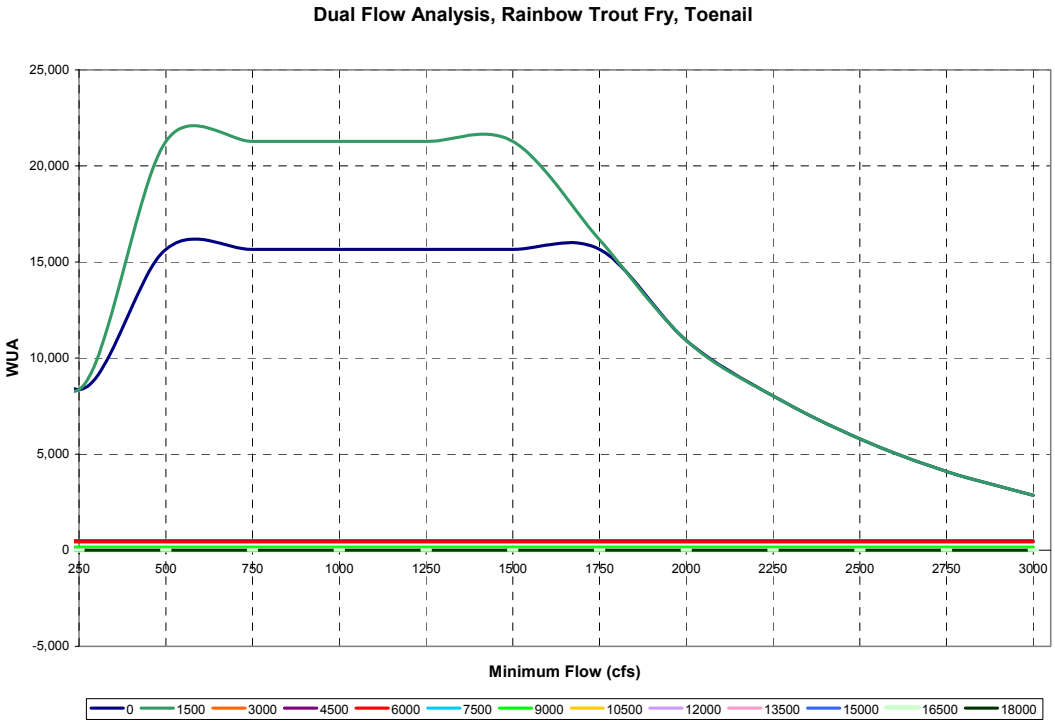


5.4. Dual Flow Analysis Rainbow Trout Adult at Ocean Blvd/Oh Brother Rapids

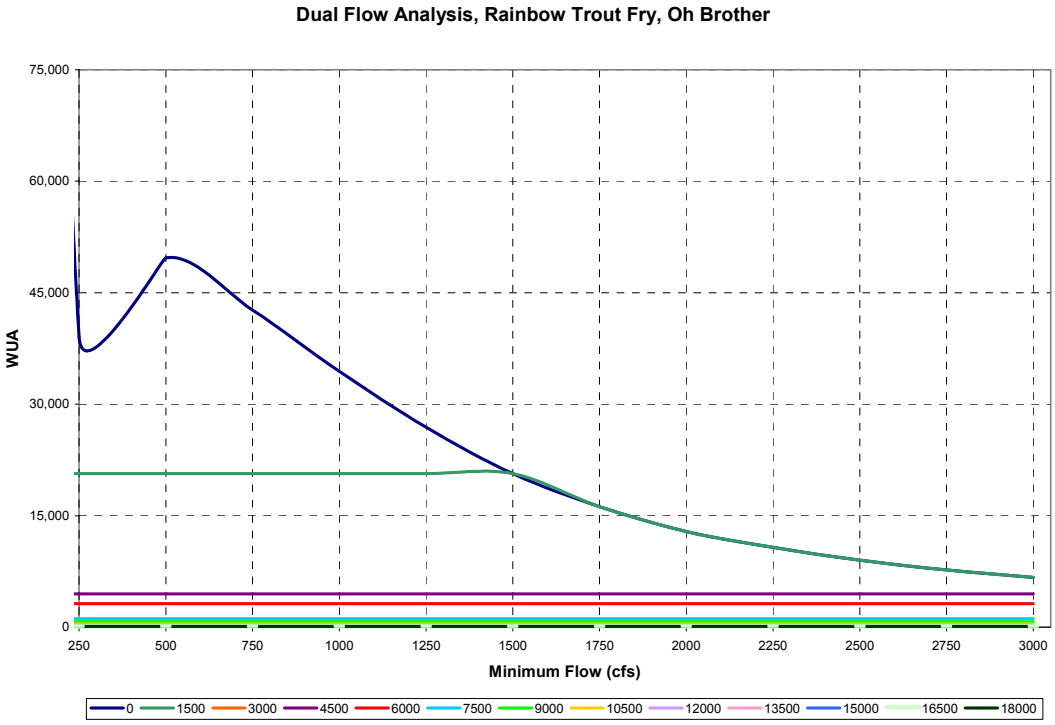


5.5. Dual Flow Analysis Rainbow Trout Adult at Shandon

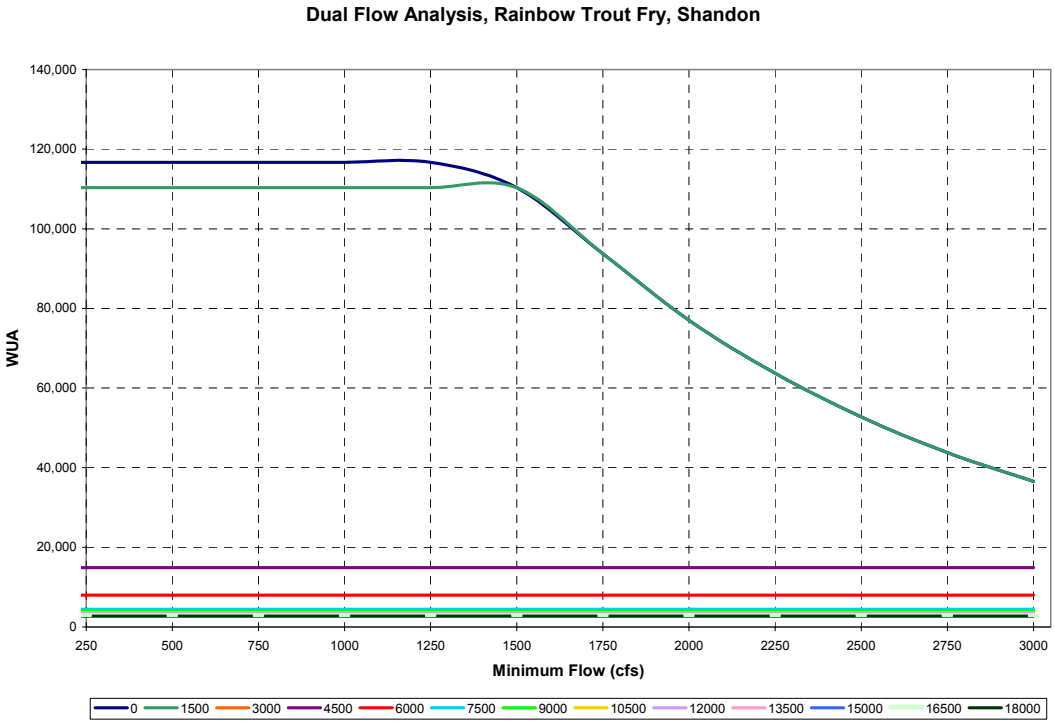
6. Rainbow Trout Fry



6.1. Dual Flow Analysis Rainbow Trout Fry at toenail Riffle

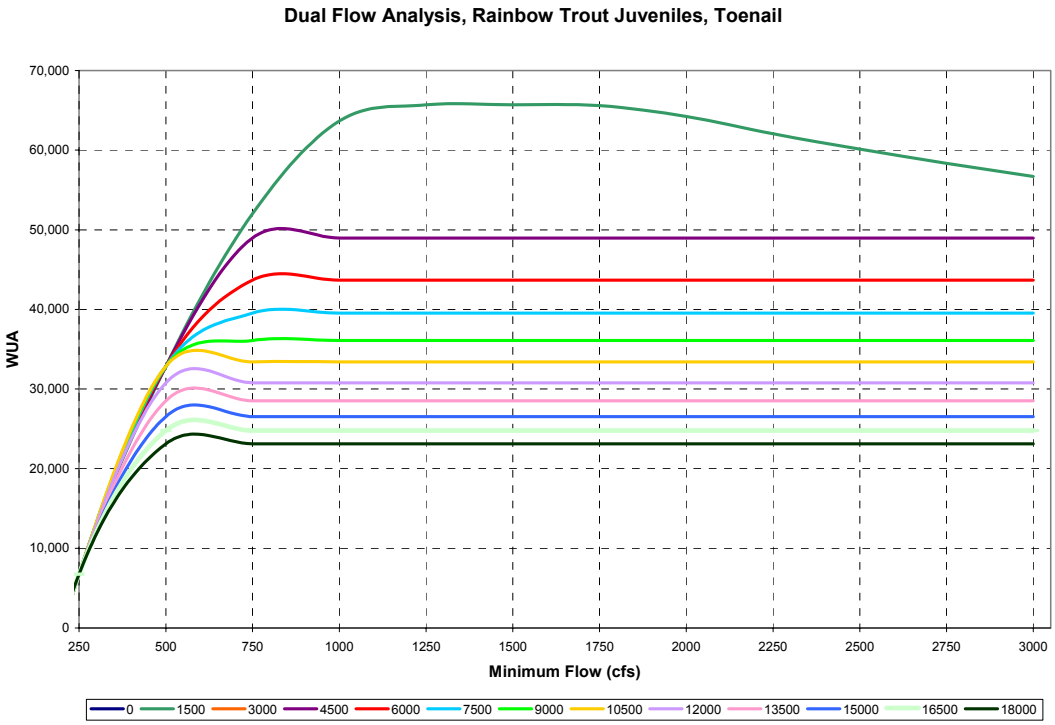


6.2. Dual Flow Analysis Rainbow Trout Fry at Ocean Blvd/Oh Brother Rapids

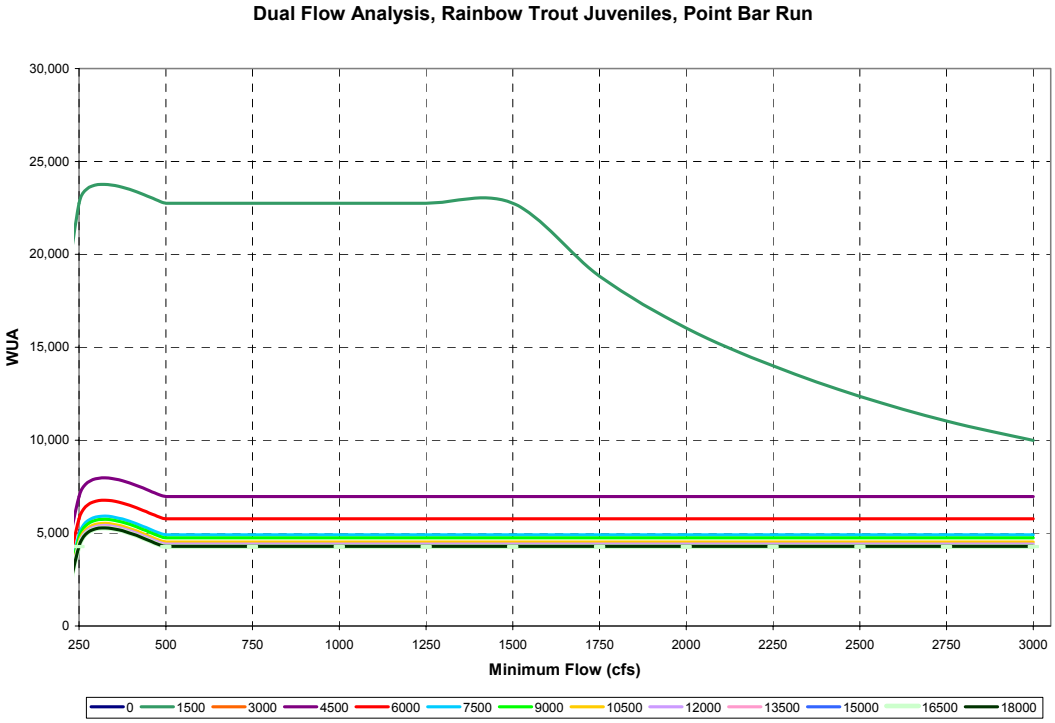


6.3. Dual Flow Analysis Rainbow Trout Fry at Shandon

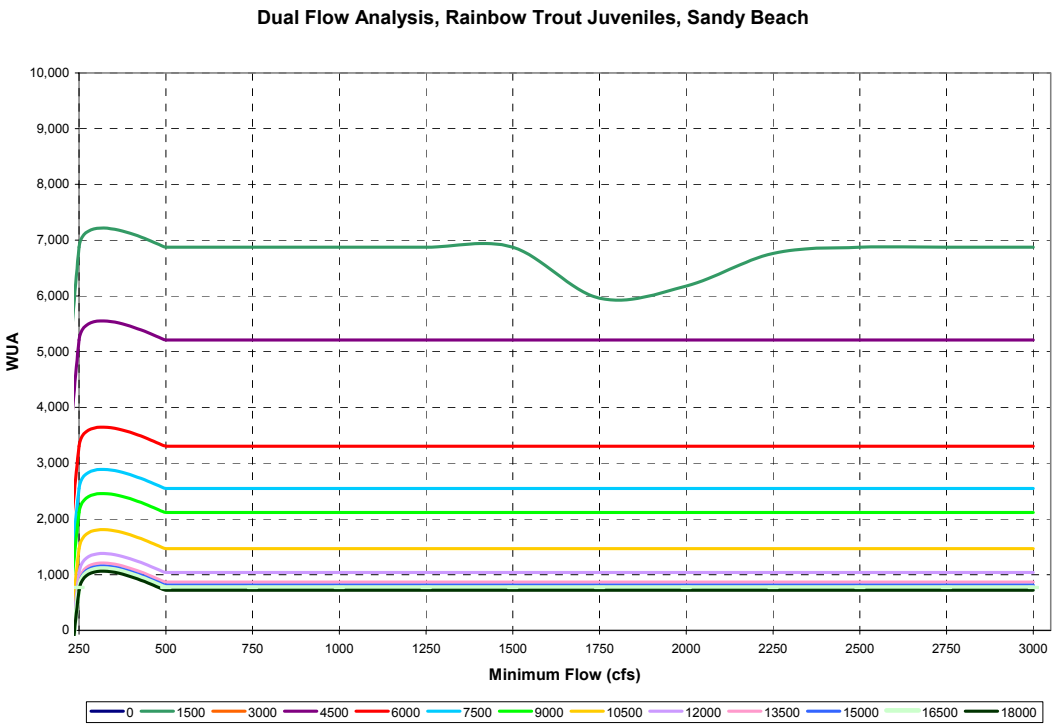
7. Rainbow Trout Juvenile



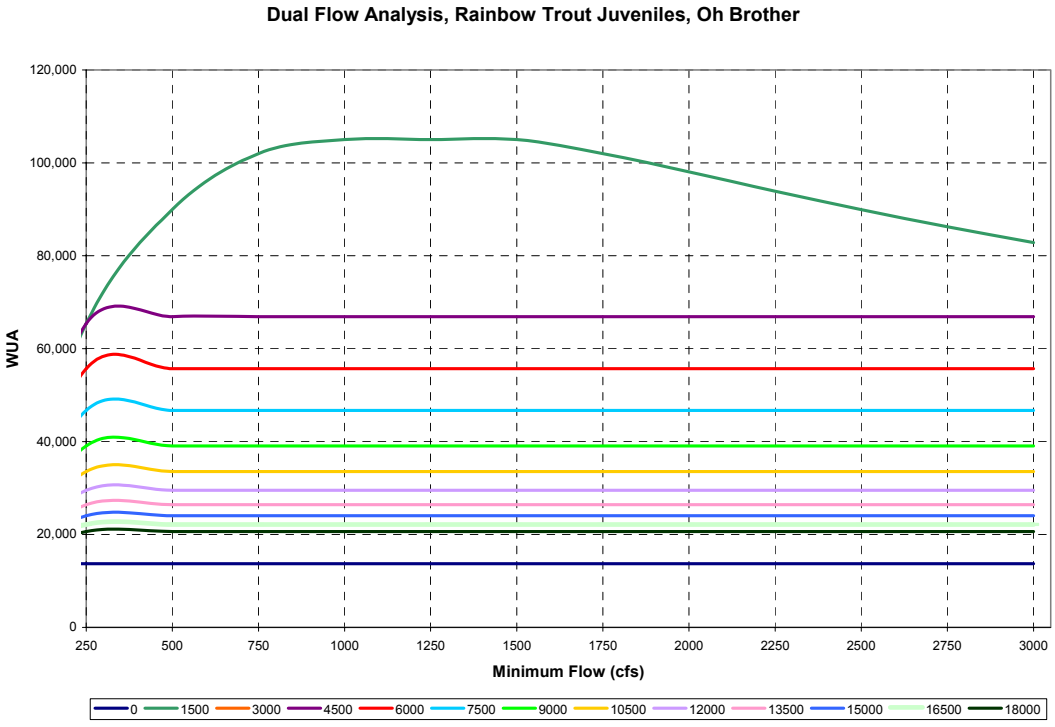
7.1. Dual Flow Analysis Rainbow Trout Juvenile at Toenail Riffle



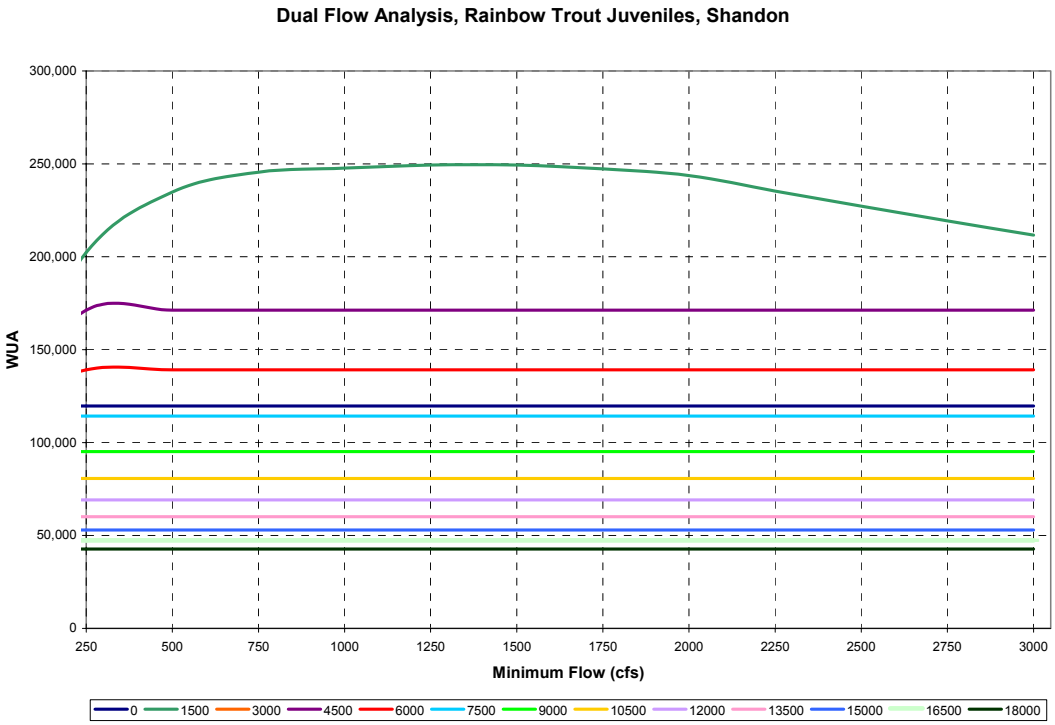
7.2. Dual Flow Analysis Rainbow Trout Juvenile at Point Bar Run



7.3. Dual Flow Analysis Rainbow Trout Juvenile at Sandy Beach

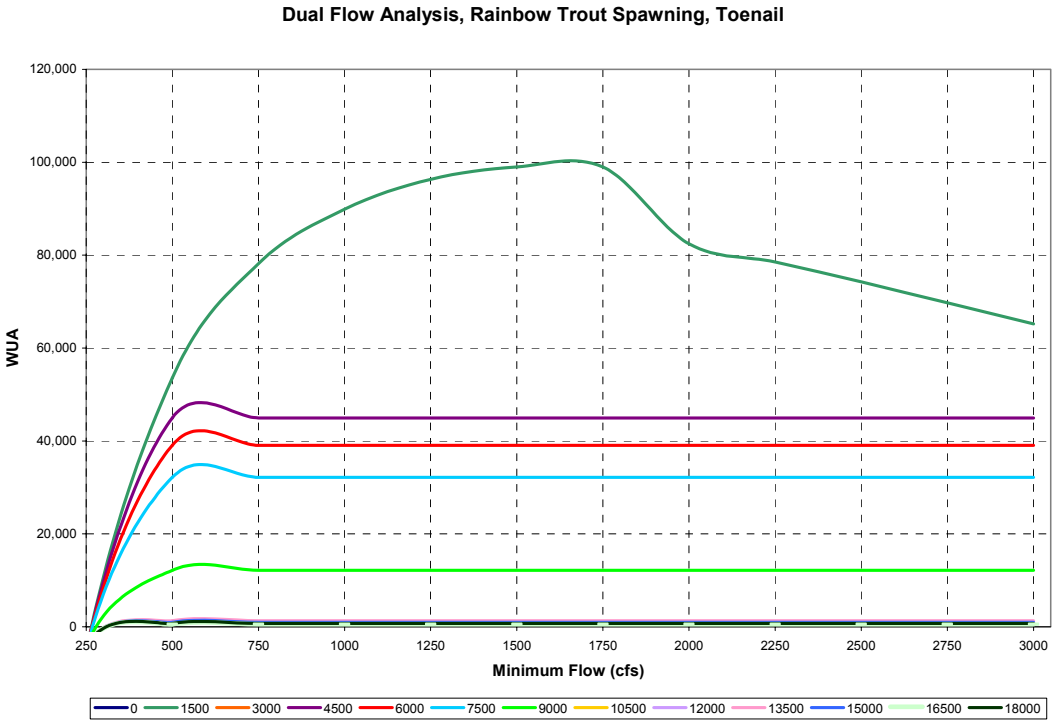


7.4. Dual Flow Analysis Rainbow Trout Juvenile at Ocean Blvd/Oh Brother Rapids

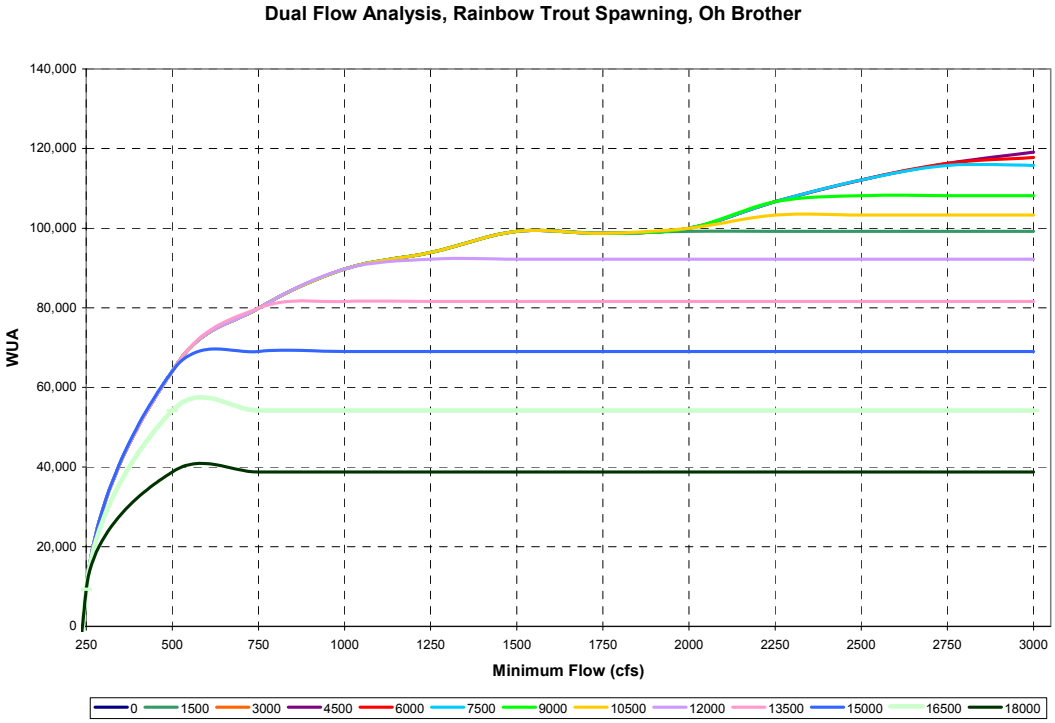


7.5. Dual Flow Analysis Rainbow Trout Juvenile at Shandon

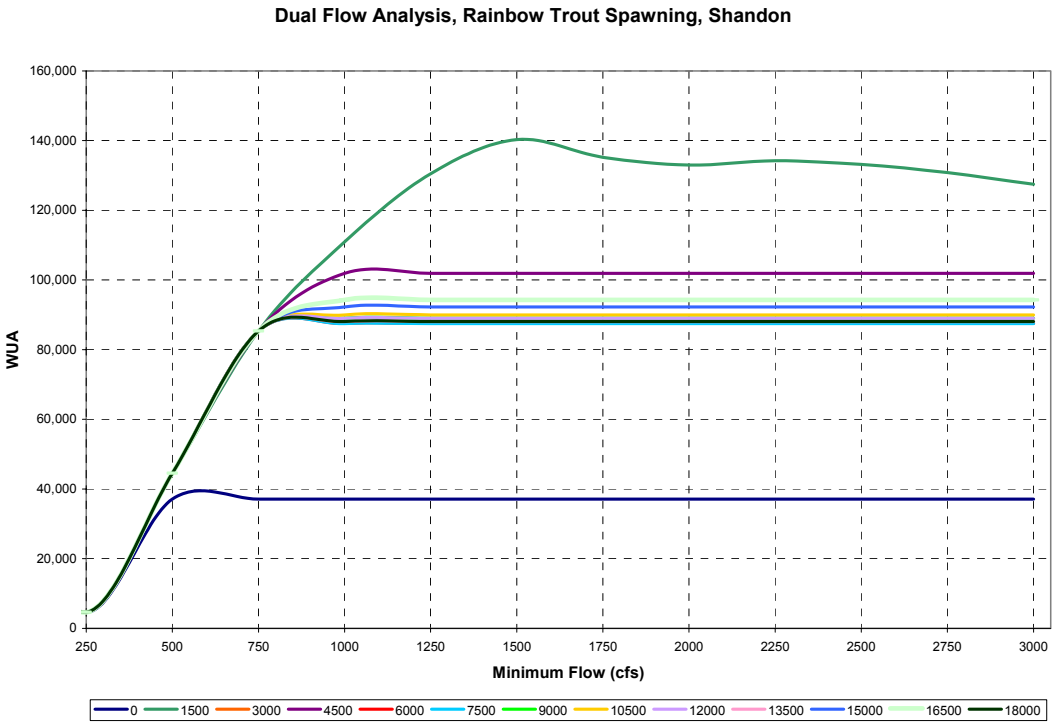
8. Rainbow Trout Spawning



8.1. Dual Flow Analysis Rainbow Trout Spawning at Toenail Riffle

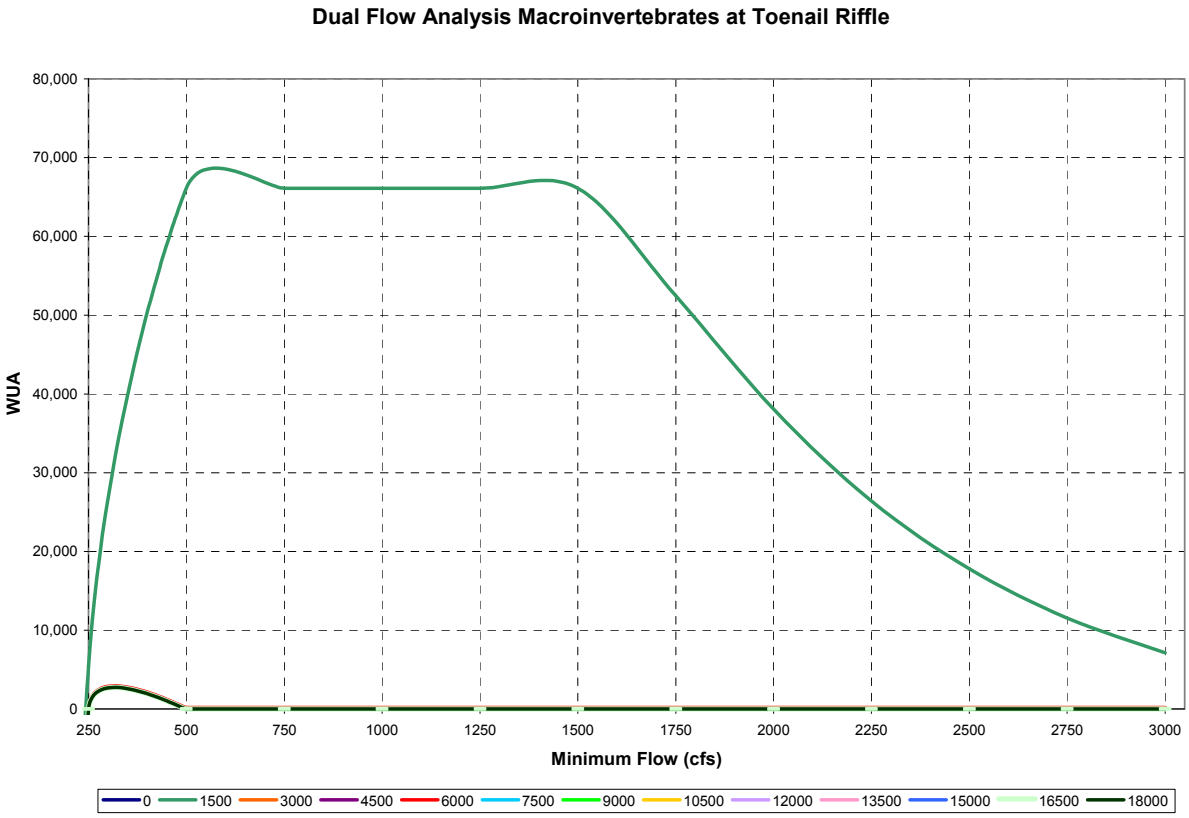


8.2. Dual Flow Analysis Rainbow Trout Spawning at Ocean Blvd/Oh Brother Rapids

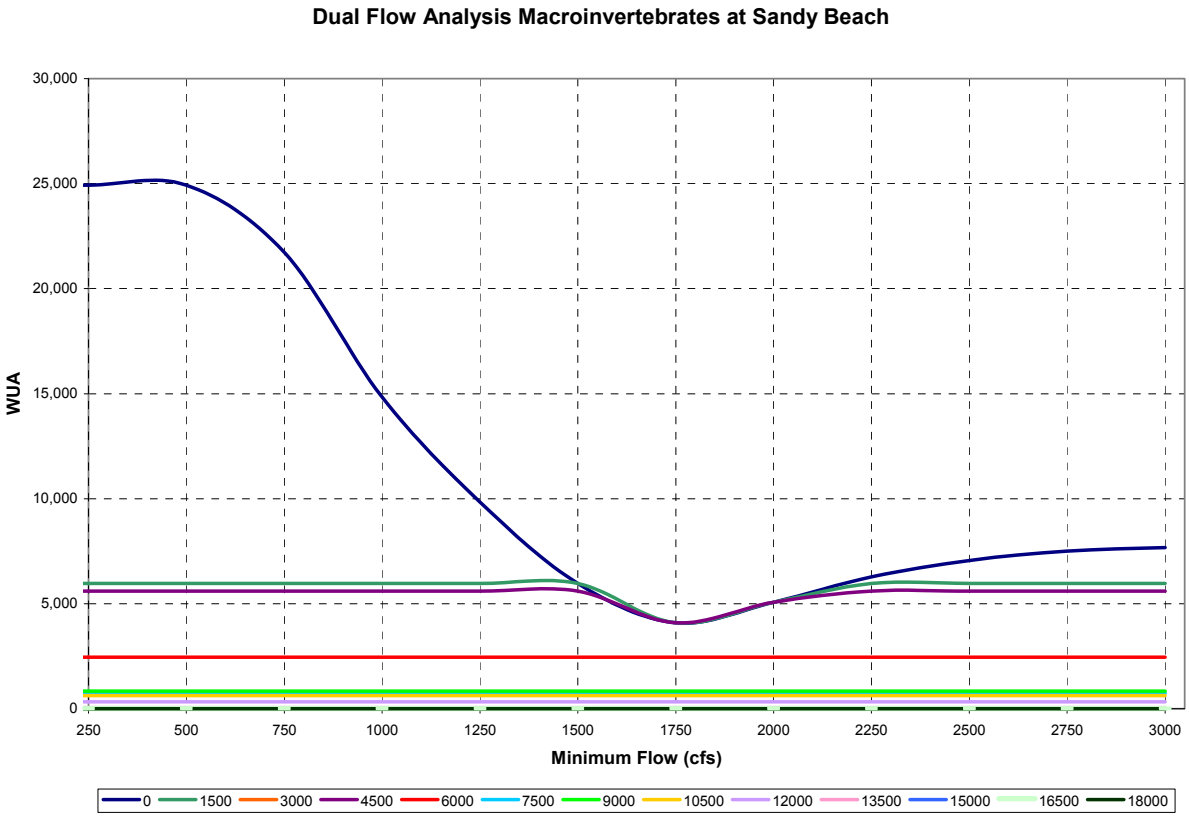


8.3. Dual Flow Analysis Rainbow Trout Spawning at Shandon

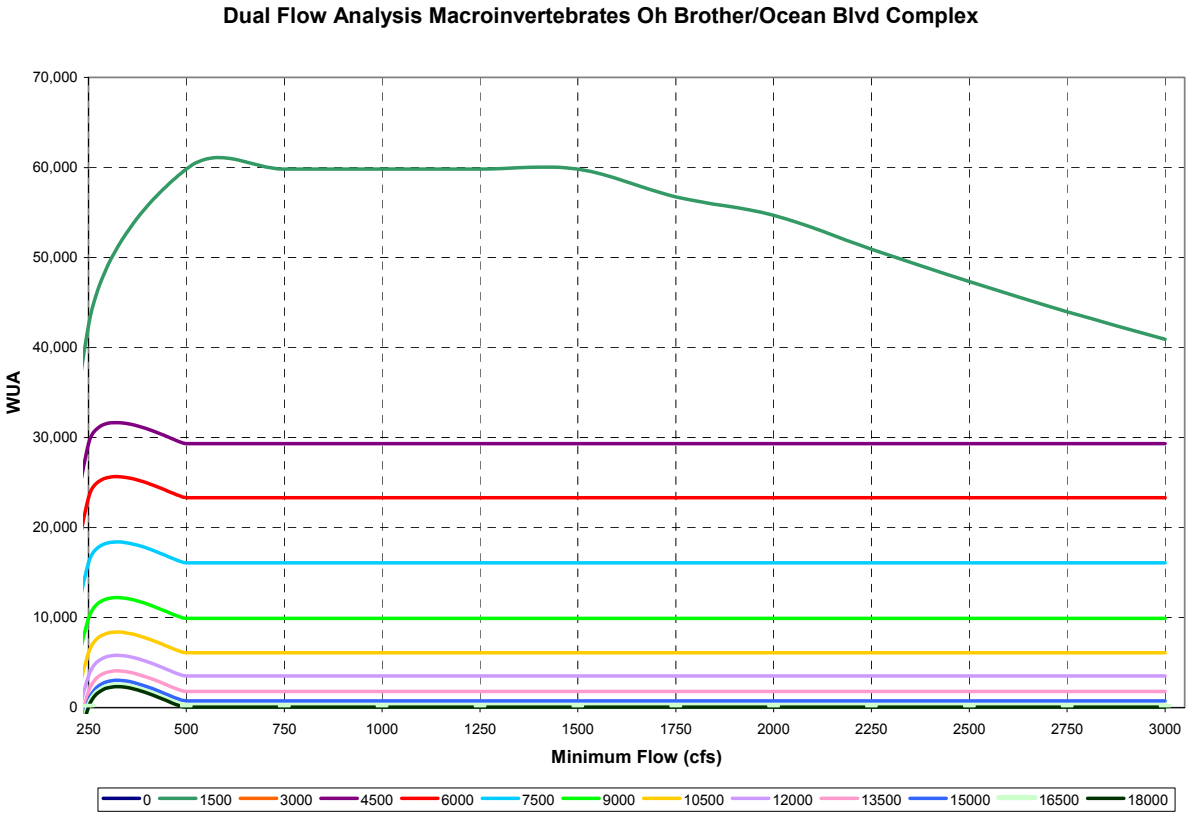
9. Macroinvertebrates



9.1. Macroinvertebrates at Toenail Riffle



9.2. Macroinvertebrates at Sandy Beach



9.3. Macroinvertebrates at Oh Brother/Ocean Blvd Complex

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
Instream Flow Workshop
SCE&G's Lake Murray Training Center
December 11-13, 2007

Final CSB 2-20-08

ATTENDEES:

Ron Ahle, SCDNR
Gerrit Jobsis, American Rivers
Shane Boring, Kleinschmidt Associates
Steve Summer, SCANA Services
Jeni Hand, Kleinschmidt Associates
Mike Waddell, Trout Unlimited
Gerrit Jobsis, American Rivers
Mark Giffin, SCDHEC
Bill Argentieri, SCE&G
Prescott Brownell, NMFS
Dick Christie, SCDNR
Alan Stuart, Kleinschmidt Associates
Kevin Nebiolo, Kleinschmidt Associates
Brandon Kulik, Kleinschmidt Associates
Hal Beard, SCDNR
Matt Rice, American Rivers
Amanda Hill, USFWS
Randy Mahan, SCANA Services
Scott Harder, SCDNR

ACTION ITEMS

- Develop habitat duration analysis utilizing inflow data.
  Kevin Nebiolo, Shane Boring, Brandon Kulik
- Perform a dual flow analysis for selected species/lifestages.
  Kevin Nebiolo, Shane Boring, Brandon Kulik
- Develop 80% WUA summaries for the guilds and stand-alone species/lifestages.
  Kevin Nebiolo, Shane Boring, Brandon Kulik
- Incorporate the following edits to the IFIM data report:
  Brandon Kulik, Shane Boring
  - Add explanation of channel index.
  - Paragraph summarizing WUA for full flow range (for each study site and for whole river).
  - Add explanation regarding how flows were split around side channels.
  - Add discussion of rationale for why various guilds were run at study sites.
  - Incorporate additional guild runs from workshop into report.
  - Add text/figures summarizing pool ADCP profiles.

NEXT MEETING

Instream Flow Workshop
January 23, 24 & 25, 2008
Lake Murray Training Center

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

December 11, 2007

Shane Boring opened the workshop at approximately 9:30 AM. Shane noted that the first day of the workshop would focus on (1) review of the scoping and field execution phases of the Saluda IFIM study; (2) review of the draft Saluda PHABSIM report; and (3) providing TWC members with an opportunity to provide comments on the draft. It was also noted that, if time permitted, it would be worthwhile to begin prioritizing species/life stages in effort to reduce data to a point that a flow recommendation can begin to materialize.

Following introductions, the group reviewed the Saluda IFIM study goals, which were developed by the TWC during the scoping phase of the study and include:

- Identify a minimum flow for the Lower Saluda River (LSR);
- Determine flows needed for target species and lifestages, as well as the downstream floodplain;
- Determine the range of flows acceptable to meet these criteria;
- Determine how project operations affect these flows;
- Mimic the natural hydrograph of the LSR; and
- Consider impact of providing these flows on Lake Murray.

TWC members provided no additional comment or concerns regarding the study goals.

Brandon Kulik then presented an overview of the Saluda IFIM process which included review of the scoping phase of the study, site reconnaissance and transect selection, PHABSIM modeling, and resulting data report. Brandon noted that the draft report, distributed to the TWC prior to the meeting, is a data report only and is merely intended to document the data collection, PHABSIM modeling, and resulting Weighted Usable Area (WUA) calculations for target species at the various study sites. He added that the data report makes no effort to prioritize certain species and/or lifestages, nor is it intended to make flow recommendations. Brandon noted that development of management priorities and resulting flow recommendation would be the function of the TWC. Brandon's presentation is available online at http://www.saludahydrorelicense.com/documents/PHABSIMTWCreview.ppt.

Following Brandon's presentation, Alan Stuart noted that it was his desire to come away from the workshop with at least a preliminary flow recommendation that could then be forwarded to the Operations TWC. He added that the Operations TWC would utilize the Operations Model to evaluate the feasibility of the recommended instream flows relative to other operational targets (i.e., lake levels, recreational flows, maintenance of summer striped bass refuge habitat in Lake Murray). Gerrit inquired as to whether the flow recommendations developed by the Instream Flow TWC would go directly to the RCG or vice versa. Alan explained that the recommended flows would be sent to the RCG only after they have been further refined through the operations model and the Instream Flow TWC.

Brandon then enquired as to whether the group had comments/question on the draft IFIM data report. Scott Harder noted that an explanation is needed in the text regarding how water levels were monitored to ensure stable conditions during data collection (i.e., staff gages). Scott also asked that language be added further explaining rationale of the calibration flows and associated Velocity Adjustment Factors (VAFs). Amanda noted that she would like to see WUA data expressed as percentages, possibly broken down by study site and/or species. Prescott Brownell asked for an explanation of the "channel index" and requested that it be more clearly defined in the report.

Dick asked Brandon how comfortable he was with the data collected. Brandon noted that overall he was very confident, adding that he and Scott Harder had consulted on specific hydraulic nuances at certain sites and had conducted sensitivity tests where necessary. There were a couple of isolated trouble sites in the model; Brandon specifically noted that 3 transects had originally been delineated at the Toenail Rapids area; however, the lowermost of these (transect 19) proved problematic. He added that the water surface elevations at transect 19 consistently uncoupled from transects 20 and 21 in the model, likely due to a downstream hydraulic control backwater effect. After unsuccessful attempts to resolve the hydraulic issues, he modeled this site with the two remaining transects, which had very strong hydraulics. He also noted that data collection was not possible at the proposed high gradient shoal transect just downstream of Millrace Rapids, noting the velocities and water depth made this area too dangerous for field crews to wade and that modeling data would ,likely not have been reliable.

Hal Beard expressed concern that no model results were included for striped bass, with the exception of the zone-of-passage assessment for Millrace Rapids. He reminded the group that striped bass are one of the most important fishery resources in the LSR. Specifically, Hal noted that recent telemetry studies by SCDNR suggest that the LSR is a major thermal refuge for Santee Basin striped bass during the hot summer months, with as many as half of fish tagged utilizing the LSR. Gerrit explained that the only criteria identified during the scoping phase of the study for riverine striped bass was for passage (i.e., no criteria for velocity, substrate); therefore the group had decided to examine striped bass only for zone-of-passage. Gerrit added that the current study zone-of-passage results are fairly consistent with the previous LSR IFIM study (Isely et al., 1995) (1200 – 1300 cfs). Gerrit noted that flows for striped bass passage should be directed to periods when they

would occupy the LSR, adding that they are not present year-round. Steve Summer proposed that it might be possible to meet fish passage flow needs using pulsing rather than a sustained flow. Hal noted that the striped bass likely move into the LSR during a very short period in the spring; therefore the flow would need to targeted to this period. Alan noted that SCDNR telemetry study would be important for defining when striped bass enter the LSR. Amanda noted that temperature would also be an important determinant of when they enter the system. Hal indicated that he would contact Jason Bettinger to obtain study results during the lunch break. It was also agreed that Brandon would obtain striped bass SI criteria (Crance 1985) and model runs and pools.

Following the break, Hal indicated that he had spoken with Jason Bettinger regarding the striped bass telemetry studies in the basin and had learned the following:

- A total of 34 striped bass have been tagged in the Congaree, with a little over 50% of these utilizing the LSR during summer;
- Peak movement into the LSR appears to be during month of April (April 21 and 22nd during 2007 and 2006); and
- Fish appear to move out of the LSR during a short time period (September).

Hal indicated that he would get more detailed information from Jason (i.e., diurnal patterns, size classes tagged) and forward to the TWC at a later date.

Ron Ahle noted that not all guilds were run at each study site and asked for an explanation of the rationale for deciding which should be run at a given site. Brandon noted that guilds represent overall use of a habitat type rather than a species group. Therefore, certain guilds intuitively are not going to be applicable at certain sites and thus are not going to drive the model. For example, deep slow species would not inhabit a riffle or shoal site. Dick, Ron and others noted that most IFIM processes they have been involved in have run all guilds at all sites. Dick added that SCDNR would likely want to see some additional runs at specific sites for certain guilds. Ron asked that the explanation provided by Brandon be included in the report.

Shane noted that, once everyone is comfortable with the data report, the next step would be to begin reducing the data. Brandon noted that this would likely involve prioritizing certain guilds and/or lifestages. It was suggested that this process begin with the trout data. The TWC subsequently engaged in an interactive session during which the study sites and associated flows that provide ≥80% of maximum WUA for various trout lifestages were summarized (Table 1). This was facilitated through an interactive database operated by Kevin Nebiolo.

Meeting attendees suggested that, for further progress to be made on further reducing/prioritizing the study data, management goals for the LSR need to be clearly defined. Alan proposed that the group break to allow agency staff and NGO representatives to caucus regarding what they feel are the highest priority management goals. Agency and NGO staff caucused for the remainder of the

meeting. After which, it was agreed that goals would be summarized at the beginning of the 2nd day of the workshop (December 12). The session adjourned at approximately 3:00 PM.

December 12, 2007

The session opened at approximately 9:00 AM. The group began by reviewing the LSR management goals developed by the agencies and NGO's during their caucus at the previous day's session, which included:

- Maintenance of a balanced indigenous aquatic community for the LSR, specifically to provide flows that represent 80% of maximum WUA for all species.
- Since the LSR is ecologically important to the Santee Basin striped bass fishery (as summer thermal refuge); should pay special attention to summer flows in the LSR.
- Provide flows that maintain and enhance the LSR trout fishery, particularly as it pertains to improving holdover from year to year and maintaining and enhancing trout growth in the LSR.
- Maintain option of implementing flows for shortnose sturgeon, if they are found to inhabit the LSR during the life of the license (See discussion below by P. Brownell, NMFS for additional detail).

Regarding shortnose sturgeon, Prescott Brownell noted they historically occurred in the Saluda River. He acknowledged that, while the species has not been documented in recent history in the LSR, the LSR remains open from a passage standpoint and thus can't be excluded as potential habitat. As such, Prescott noted that the NMFS would like to "keep the door open" to making flows for sturgeon a management goal if in the future they are found in the LSR. He added that considerable research is being conducted on the movements and habitat requirements of sturgeon, and that as new information emerges, we may be able to target flows that would make the LSR more favorable for sturgeon.

Prescott suggested that an analysis of project operations relative to the historic hydrograph might be useful for providing a perspective from which to build our management objectives for target guilds and species. Bill Argentieri noted that it was his understanding that examining pre-dam conditions was not part of relicensing. Prescott noted that NMFS would like to examine historical flows (hydrograph) on a seasonal basis and explained that they do not want to mimic pre-dam conditions, but would like to use historical flows as a baseline to compare to current flows. Gerrit Jobsis noted that it is important to evaluate historical flows to figure out if habitat is currently enhancing with the flows that are being provided and to also figure out how to enhance fish communities by seasonally mimicking historical flows. Gerrit suggested that a habitat duration analysis would likely be suitable for this purpose. Alan noted that the hydrographic period of record for the LSR is likely too short to allow for a thorough habitat duration analysis. He added that a longer period of record was extrapolated as part of the Operations Model and enquired as to whether this dataset would be

suitable for the analysis. The group agreed that dataset was adequate and Kevin Nebiolo of Kleinschmidt was charged with developing the habitat duration analysis prior to the next meeting.

The group then turned its attention back to the rationale used for choosing guilds that were run at each study site. Ron Ahle noted that the paragraph summarizing the full range of flows was missing and asked that it be added. He added that the flows should be summarizing for the entire river, as well as a comparison of the upper river and lower river. The agencies caucused to discuss additional guilds that should be run for various study sites. The agencies agreed that the following additional guild categories should be run:

- For every shallow-fast habitat site, a deep-fast guild should be run using northern hogsucker criteria (spawn, juvenile, fry).
- For Shandon, a shallow-fast guild should be run using the generic guild criteria.
- Run the generic shallow-fast guild curve for all study sites.

The group then discussed modeling results for striped bass, which were requested the previous day. Brandon noted that he ran the PHABSIM model using the Crance criteria for the two deep run study sites (Reach 2 run and Reach 4 run). Brandon noted that, just as the SI criteria would suggest, PHABSIM results suggested that WUA is optimized at depths greater than or equal to 6 ft (i.e. stripers limited by depth in shallow sites). Shane then reviewed the two pool transects (below Saluda Dam and below Millrace Rapids) for which data were collected in coordination with the SCDNR using ADCP technology at each of the three calibration flows. Shane reminded the group that only bed profile and water surface elevation data were included, and as such, the pools were not part of the PHABSIM model. Both pools provide suitable depths for striped bass at the full flow range of interest. Shane noted that they would incorporate this information in the IFIM report.

Shane noted that, on the previous day the group had summarized flow for each trout lifestage that provide 80% or more of optimal WUA, and suggested that the group attempt to further refine potential use of this data. Alan Stuart suggested that, if flows are targeted seasonally for specific trout lifestages, the group needed to agree on when these lifestages would potentially occur (i.e. seasonality). After some discussion the group agreed that the following seasonal periods were reasonable for the considering known conditions in the LSR:

Lifestage	**Brown Trout**	**Rainbow Trout**
Spawning	October – February	January - March
Fry	February – May	March - June
Juvenile	March - October	January - July
Adult	Year-round	Year-round

The session adjourned at approximately 3:00 PM. Attendees agreed that the following day's sessions would begin with a summary of the results of the additional PHABSIM runs for guilds.

December 13, 2007

The session opened at approximately 9:30 AM.

The meeting opened with a brief review of results from the additional PHABSIM guilds runs that were requested the previous day. Specifically, Brandon showed that the shallow-slow runs performed at most selected sites provided additional information, however, at the Reach 2 run, the shallow-slow results were less useful as the only significant habitat occurred at s narrow strip along the stream margin, regardless of the flow increment, and at high flows, in the forested riparian areas that became flooded.

The group briefly discussed the habitat duration analysis requested during the previous day's session. Gerrit noted that he had looked at the inflow data used by Jon Quebbeman (Kleinschmidt) to estimate historic flows for the LSR and agreed that the data, in his opinion, would be suitable for application to the habitat duration analysis. Group attendees agreed. It was agreed that Kleinschmidt would develop the habitat duration analysis and distribute results to the TWC prior to the next meeting.

The group then briefly discussed the need for a dual flow analysis. Brandon noted that the dual flow analyses typically assume that the high flows occur on a relatively frequent basis (i.e. daily, as is the case with peaking operations). Bill A. noted that this analysis likely is not applicable to Saluda, which is currently operated sporadically for reserve capacity and thus does not pulse the river frequently. Several attendees noted that a 50 year license is being pursued for the project and that operations have the potential to change during life of the license. After additional discussion, the group agreed that a dual flow analysis would be useful to provide a protective recommendation in the event that Saluda operations should some day be changed to peaking.

Noting that certain species are more susceptible to high flows (macroinvertebrates and fry and juvenile fish), Amanda Hill recommended that the group clearly define the species/lifestages to be included in the dual flow analysis. The group subsequently agreed that the following species/lifestages should be included in the dual flow analysis: rainbow trout, brown trout, macroinvertebrates, and the shallow-fast guild. Both Amanda and Brandon noted that areas closer to the dam would also be more susceptible and suggested that the group refine the area for which the analysis is to be performed. The group agreed that all of Reach 1 study sites, as well as the Oh Brother, and Ocean Blvd. sites should be assessed.

The group then discussed the need to identify the flow range that provides 80% of optimal WUA for the guilds (similar to what was done during the meeting for trout lifestages). The group reviewed the lifestages/guilds and agreed that "80% WUA" tables were needed for the following:

Study Site	**Guilds/Lifestages Requested**
Shandon	Shallow fast, shallow slow
Reach 4 Run	Shallow slow, deep fast, deep slow
Ocean Blvd.	Shallow fast
Oh Brother	Shallow fast
Corley Island Main Channel	Shallow fast
Corley Island Side Channel	Shallow slow
Reach 2 Run	Shallow slow, deep fast
Sandy Beach	Shallow slow, shallow fast
Point Bar Run	Shallow slow, deep slow
Toenail Riffle	Shallow slow, shallow fast

In closing, the group reviewed the major data deliverables needed for the next meeting. The group agreed that the following additional analyses should be performed:

- A habitat duration analysis utilizing the historic hydrograph (developed from inflow data) and project operations data.
- A dual flow analysis for species/lifestages and study sites discussed above.
- 80% WUA summaries for the guilds and stand-alone species/lifestages, with WUA for stand-alone species weighted according to mesohabitat ratios.

The workshop closed at approximately 2:30 PM. The TWC agreed that a follow-up workshop would be held January 23-25th, 2008, at the Lake Murray Training Center.

Table 1: Summary of Flow Providing 80% or More of Maximum WUA for Trout Lifestages

Brown Trout - Fry	
Location	**Flow (cfs)**
Shandon Rapids	400-700
Oh Brother Rapids	500-1000

Brown Trout - Spawning	
Location	**Flow (cfs)**
Shandon Rapids	700-2000
Toenail Rapids	800-3000

Brown Trout - Adult	
Location	**Flow (cfs)**
Shandon Rapids	1400-10000
Oh Brother Rapids	2000-6000
Toenail Rapids	1600-4000
Point Bar	600-1800
Reach Two	300-900

Brown Trout - Juvenile	
Location	**Flow (cfs)**
Shandon Rapids	400-4000
Oh Brother Rapids	800-3000
Toenail Rapids	800-2000
Point Bar	300-1000
Reach Two	300-900

Rainbow Trout - Fry	
Location	**Flow (cfs)**
Shandon Rapids	300-800
Oh Brother Rapids	400-800
Toenail Rapids	500-1000

Rainbow Trout - Spawning	
Location	**Flow (cfs)**
Shandon Rapids	1200-3000
Oh Brother Rapids	1400-10000
Toenail Rapids	800-2000

Table 2: Transect Guild Assignments by Study Site

Study Site	Final ID	Mesohabitat	Guild Representative	REACH
Toenail	**21**	glide-run	shallow-fast	**1**
Toenail	**20**	riffle/run	shallow-fast	**1**
point bar	**18**	run	deep slow	**1**
Sandy Beach	**17**	glide	shallow-fast	**1**
Sandy Beach	**16**	shoal	shallow-fast	**1**
Sandy Beach	**15**	riffle	shallow-fast	**1**
Corley	**14**	glide	shallow-slow	**2**
Corley	**13**	glide	shallow-slow	**2**
Corley	**12**	run	deep fast	**2**
Corley	**11**	glide	shallow-fast	**2**
Corley	**10**	riffle	shallow-fast	**2**
Ocean Boulevard	**9**	glide/shoal	shallow-fast	**3**
Ocean Boulevard	**8**	run	shallow-fast	**3**
Ocean Boulevard	**7**	shoal	shallow-fast	**3**
Oh Brother	**6**	riffle	shallow-fast	**3**
Oh Brother	**5**	riffle	shallow-fast	**3**
Oh Brother	**4**	riffle	shallow-fast	**3**
Riverbanks Zoo	**2**	run	deep fast	**4**
Shandon	**1**	glide	shallow-slow	**4**

Figure 1: Bed Profile and WSEL's at Pool transect Adjacent to Riverbanks Zoo

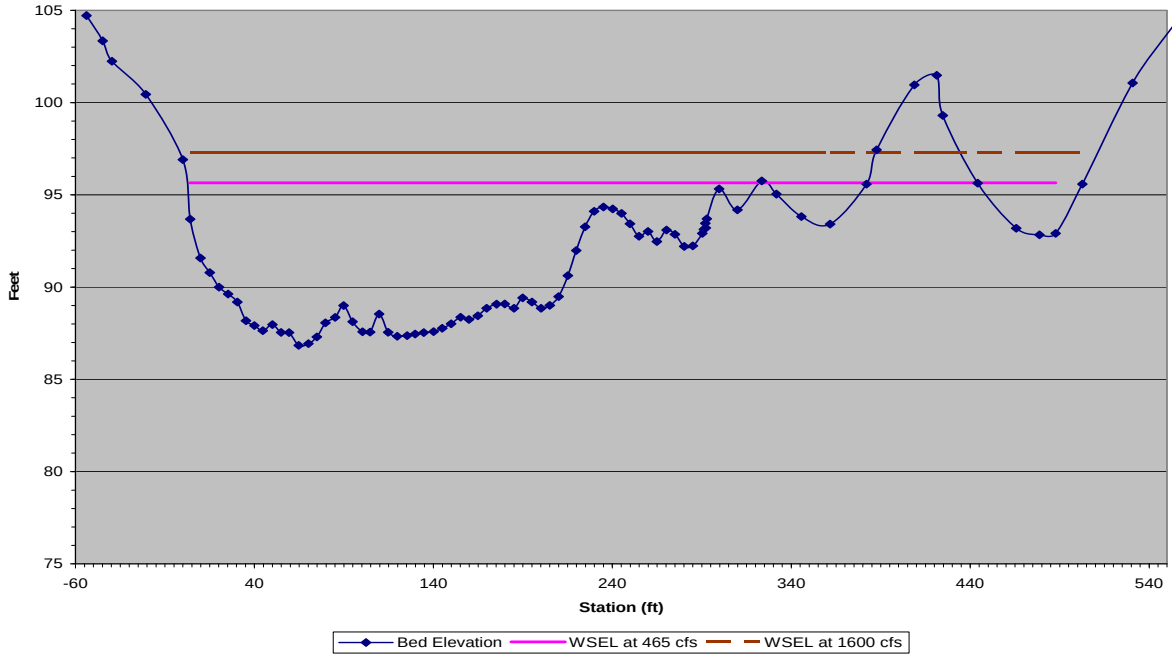
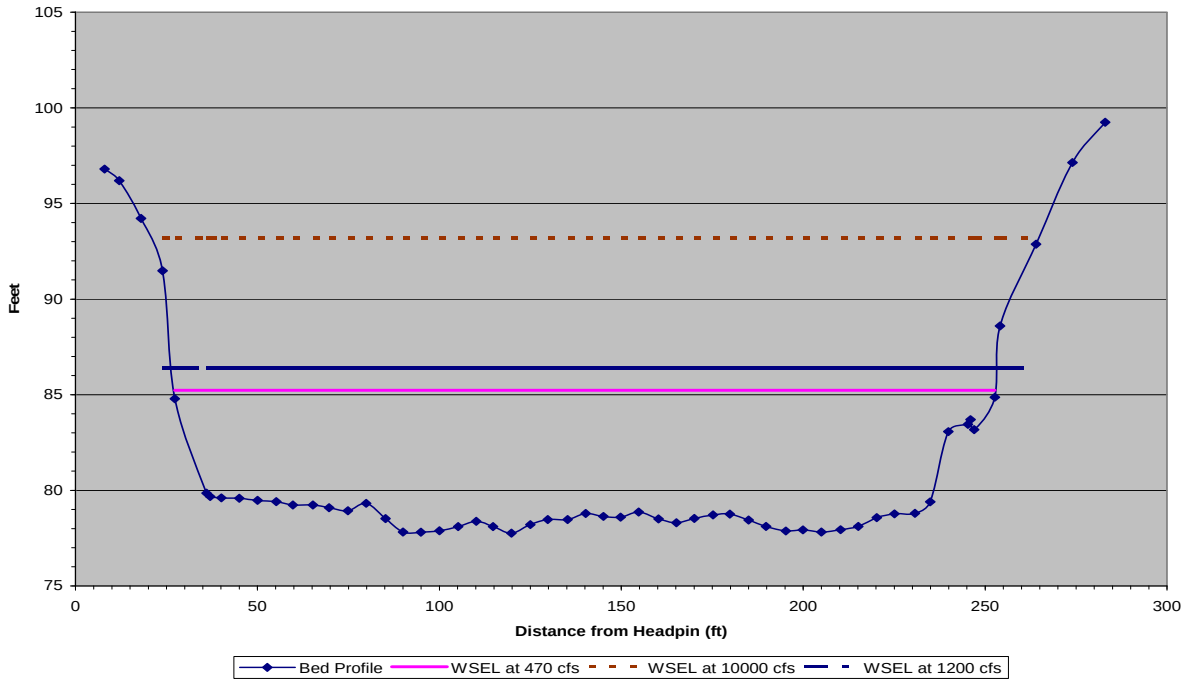


Figure 2: Bed Profile and WSEL's at Pool Transect Downstream of Saluda Hydro Dam



MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FISH AND WILDLIFE TECHNICAL WORKING COMMITTEE

SCE&G Environmental Offices
October 30, 2007

Final CSB 01-07-2008

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Brandon Stutts, SCANA Services
Tom Bowles, SCE&G
Milton Quattlebaum, SCANA Services
Scott Harder, SCDNR
Bob Perry, SCDNR
Brandon Kulik, Kleinschmidt Associates
Dick Christie, SCDNR
Jeni Hand, Kleinschmidt Associates
Malcolm Leaphart, Trout Unlimited
Steve Summer, SCANA Services
Hal Beard, SCDNR
Ron Ahle, SCDNR
Prescott Brownell, NMFS
Gerrit Jobsis, CCL/Amer. Rivers

DATE: October 30, 2007

DATE OF NEXT MEETING:

Date: December 13, 2007
Time: After IFIM Workshop
Location: Lake Murray Training Center

ACTION ITEMS:

- Send Scott Harder the raw and calibrated data files used in the Saluda IFIM study.

Brandon Kulik

- Contact Straud Armstrong about sending Kleinschmidt the pool ADCP data.

Dick Christie / Scott Harder/Bud Bader

- Develop potential framework for adaptive management plan for the LSR trout fishery.

Shane Boring

- Include info on other SE tailwater trout fisheries in Self-Sustaining Trout White Paper.

Shane Boring

- Provide comments on the Self-Sustaining Trout White Paper.

Gerrit Jobsis

- Add state listed species to the Rare, Threatened and Endangered Species (RT&E) Report.

Shane Boring

- Add column to Table 1 indicating species that occur in the project boundary/vicinity.

Shane Boring

- Include table of SCDNR "highest conservation concern" species for counties located within the project boundary.

Shane Boring

- Contact Fritz Rhode and Joe Quattro regarding the status of Saluda darter.

Shane Boring

- Refine the wording of the Rocky Shoals Spider Lilly summary in the RT&E report, stating that project operations may have an effect on populations located in the confluence area.

Dick Christie

- Confirm known locations of Carolina heelsplitter in L. Murray tribs with J. Alderman.

Shane Boring

- Provide Kleinschmidt with link to USDA-NRCS web-based soil data.

Brandon Stutts

- Incorporate Prescott Brownell's comments on shortnose sturgeon in the RT&E report.

Shane Boring

- Send Scott Harder the mesohabitat shapefiles for the Saluda IFIM.

Shane Boring

- Acquired Lake Murray contour from MaryAnn Taylor for calculating littoral habitat areas at varying lake levels.

Shane Boring

- Provide Amanda Hill and Prescott Brownell with Saluda mesohabitat coverages to determine if they satisfy GIS habitat mapping study request.

Shane Boring

- Provide additional clarification on what is needed to satisfy sediment transport study request.

Gerrit Jobsis

DISCUSSION

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring of Kleinschmidt Associates welcomed everyone and noted that the purpose of this meeting was to review and discuss: (1) the Saluda IFIM study status; (2) the Self-Sustaining Trout White paper; (3) the Rare, Threatened and Endangered Species Assessment; (4) the study requests for GIS-based habitat coverages for Lake Murray and the Lower Saluda River (LSR); (5) the Lake Murray waterfowl surveys; and (6) review the Fish and Wildlife Issue Matrix.

Review of the Lower Saluda River IFIM Study Status

Alan Stuart noted that there will be a three day IFIM workshop held on December 11th, 12th, and 13th to discuss the draft report. Specifically, he noted the first day of the workshop, the group will discuss the PHABSIM model; the following two days will be devoted to discussing goals for

minimum flows for the LSR. He informed the group that the draft IFIM study report is anticipated to be sent out to committee members on November 9th, and a conference call will be scheduled for the group to discuss the draft report before the three day workshop. Dick Christie requested that the IFIM data sets to be sent to Scott Harder so he can see how the data was analyzed. Brandon Kulik noted the data files were ready, and that he would send them to Scott today. Brandon informed Scott that he would also send him the raw data files, which will allow him to perform calibrations. Further, Brandon explained that when examining the data, Scott will have to decide which velocity calibrations he wants to use (low, medium, high velocities) for calibration. Brandon noted that the HSI curves will be provided digitally in the program. Dick asked if Kleinschmidt received the ADCP data for the pool transects from Straud Armstrong of SCDNR. Alan noted that they have not received the ADCP data yet, and he explained that it would be better if SCDNR organized the data set since they collect the information with their ADCP. Shane noted that Kleinschmidt will need the X and Y coordinates that were taken from that ADCP site in order to construct a bed profile. Dick noted that Bud Bader will talk to Straud about organizing the data files and to send them to Kleinschmidt as soon as possible.

Brandon informed the group that in the IFIM draft report, the data will be presented in both tabular and graphic form. The tabular data is broken down into flow increments (50-100 cfs). To visually gain a better understanding for gain and loss of habitat that may occur, the graphs are broken down into logical groups, such as wadeable usable area trends for the various guilds as well as stand alone species. Ron Ahle asked if a dual flow analysis was used with the PHABSIM model. Brandon explained that a dual flow analysis will be performed after the Technical Working Committee (TWC) has had a chance to review and discuss the draft report.

Review of the Self-Sustaining Trout White Paper

Shane noted that he would like to finalize the Self-Sustaining Trout White Paper (Attachment A) and opened the floor to any comments on the report. Alan Stuart noted that, in their comments on the Initial Consultation Document, Trout Unlimited (TU) had requested an analysis of the potential for a self-sustaining trout population for the LSR. He added that he felt the draft report accomplishes this and queried the group as to what else is needed to satisfy the study request. Malcolm reiterated the concerns expressed in his email of October 26, 2007 (Attachment B). Specifically, he noted that TU's original request of a "self-sustaining" trout population was likely a misunderstanding of what their group would like to see with respect to trout management in the LSR. Malcolm continued by saying that TU would like to potentially expand the current "put, grow and take" trout fishery to implementing changes in operations (i.e. in- stream flows, improved water quality etc) which may provide some level of trout reproduction. He noted that many factors can effect trout reproduction, such as temperature, dissolved oxygen, predators, and sedimentation which likely prohibited significant trout reproduction. He noted that the draft report focused

primarily on temperature and flow regimes for the LSR, but did not discuss potential physical habitat improvements. Alan noted that he did not see how enhancing potential trout spawning habitat would be priority mitigative measure for a non Project-related impact considering the fishery is a "put, grow and take".

Shane noted that, even if spawning were to take place, it is unlikely that natural reproduction would make a significant contribution to the fishery, as pool/riffle ratio in the LSR does not provide sufficient rearing habitat (< 5% riffle habitat). Hal pointed out that trout have been stocked on the LSR for the past 40 years and there is no sign of reproduction, so they probably have not been reproducing in these riffle/run habitats. He added that temperature and flow are obviously the influencing factors on trout reproduction for the LSR. Gerrit noted that back in the 1980's he caught one trout fingerling, so reproduction could be occurring. Alan noted that during the trout growth study on the LSR, they did not find any fingerlings and pointed out that SCDNR and SCANA have not found any fingerlings during their yearly sampling on the LSR.

Dick Christie inquired as to what could be done to move forward on the issue. Malcolm agreed that the white paper was generally sufficient for its intended purpose (to asses the potential for self-sustaining fishery), but added that he would like to have consideration given to the potential for some level of reproduction to supplement stocking. Several attendees noted that the effort currently underway to further improve DO conditions in the LSR (i.e. turbine venting, and alternate operating scenarios), as well the flow recommendations resulting from the upcoming IFIM process, will likely improve habitat for trout in the LSR. The group agreed that the effectiveness of the DO and flow enhancements likely need to be evaluated for some period of time before a decision can be made regarding the feasibility of a reproducing trout population as a management goal for the LSR. Shane suggested, and the group agreed, that this could be accomplished through an Adaptive Management approach. It was agreed that dissolved oxygen and flow regime effects on trout should be evaluated first; Hal noted that several years of data should be included to evaluate different situations, such as drought and wet years etc.. Alan noted that a plan will be drafted that will address these issues and will include a time schedule.

Ron Ahle and Gerrit noted that comparison of the LSR to other southeastern tailwater trout fisheries was also needed in the white paper. Gerrit agreed to provide reports regarding the reproducing trout population in the Bridgewater tailwater on the Catawba System. The group agreed that once these edits are incorporated, the report should be finalized. Gerrit noted that he would provide specific comments on the white paper in track changes.

Review of Draft Rare, Threatened and Endangered Species Assessment

Shane noted that the Rare, Threatened and Endangered Species Report (Attachment C) was distributed to the group in early October. He informed the group that he had received comments from Amanda Hill from USFWS indicating that she felt the report was adequate for federally listed species. Shane noted that Amanda had also requested that state-level threatened and endangered species be included. Shane added that most state listed species are also federally listed. He noted that he would add a column to the species table indicated that state status of each species and double check to make sure that no state listed species have been excluded. Shane opened the floor to comments on the report. Gerrit requested that the list be expanded to included rare species in the SCDNR Comprehensive Wildlife Conservation Strategy (CWCS) document. Dick Christie noted that this may prove difficult, as there are more than 1200 species in the CWCS. Shane proposes, and the group agreed, that including only those species that are considered in CWCS to be of "highest conservation concern" should be included. Because of the large number of species in the CWCW, it was agreed that this list could be added as an appendix. Alan noted that the goal of this report was to analyze potential impacts to the species and inquired why these species should be included if they're not analyzed for impacts. Ron replied that it would be good to know which CWCS species are likely to occur in surrounding counties for information purposes. Shane noted that he would construct a new table for highest conservation concern species. Gerrit inquired as to why freshwater mussels were not included in the report for the LSR. Shane replied that none of the species documented during the freshwater mussel surveys were state or federally listed.

Dick noted that the report should recognize that conservation management plans may be necessary for species that are found within the Project area or are found to be under Project influence during the life of the license. For example, Dick recommended a statement explaining that if a federally listed species, such as Carolina heelsplitter, is found within the project boundary, then SCE&G will develop a management plan for that species. Dick added that these management plans are usually attached in a shoreline management plan and in the Protection, Mitigation and Enhancement section of the license.

There was a brief discussion of the status of shortnose sturgeon downstream of the Project. Gerrit mentioned that telemetry work by SCDNR during 2002/2003 had documented shortnose sturgeon as far upstream as the confluence of the Broad and Saluda in the vicinity of Gervais Street Bridge. Prescott Brownell noted that there should be a management plan in place should sturgeon turn up in the LSR during the license period; Prescott added that he would assist with development of any such plan. Prescott mentioned that a draft recovery plan for the Santee basin has been prepared which includes documented sturgeon movement, as well as a genetics summary for shortnose sturgeon. He added that NMFS is in the process of identifying critical habitat for shortnose sturgeon in the Santee Basin and will likely designate critical habitat for this species at some point.

Prescott mentioned that the shortnose sturgeon comprehensive management plan should be available by May 2008. Shane noted that SCE&G is assisting SCDNR by putting out more receivers in the lower Saluda and Broad Rivers, as well as the confluence.

Ron noted that the wording of the Rocky Shoal Spider Lilly (RSSL) should be refined stating that the project could have an influence on the species, since it's located in the confluence of the lower Saluda and Broad Rivers. Dick noted that he would assist in rewording the summary of the RSSL in the RT&E report.

The group briefly discussed whether or not the Saluda darter and Carolina darter were the same species, and Shane noted that research has shown they are genetically the same species. Shane explained that he would contact Fritz Rohde to confirm that the Saluda and Carolina darter are the same species. The group agreed that if they are the same species then one name should been used in the report to describe this species.

In regards to the Saluda crayfish, Gerrit noted that the species has been documented in close proximity to Lake Murray and that further effort may be warranted to determine its presence in the Project area. Ron noted that this species utilizes certain soil types and recommended examining the USDA-National Resource Conservation Service (NRCS) soil database for the occurrence of suitable soil in the area. Brandon Stutts noted that he had access to the online database and would pass the link on to Shane.

Shane noted that he would incorporate the requested edits to the RT&E Report and distribute an updated draft to the group prior to the next meeting.

Request for GIS-Based Habitat Coverage for Lake Murray and the Lower Saluda River

Shane reviewed the GIS-based maps showing proportions of riffle/run/pool/glide habitat that were developed as part of the mesohabitat assessment for the IFIM study and inquired as to whether this data would satisfy the study request for the LSR. Dick Christie noted that the LSR had not been included in the SCDNR study request and recommended that we consult with USFWS (A. Hill) to determine whether the mesohabitat coverages were sufficient for the LSR. Shane noted he would send Amanda and Prescott the maps for their approval.

Dick noted that the SCDNR's original study request pertained to shallow-water habitats in Lake Murray. Specifically, he added that they would like to see calculations of the amount of littoral habitat (< 3ft) available at various reservoir levels. Dick further noted that this would be useful for establishing depth/stage relationships and for determining the impact of various reservoir drawdown scenarios on availability of littoral habitat in Lake Murray. Shane noted that the group had

previously discussed using LIDAR data collected by Orbis for this purpose. Dick recommended examining the contour maps from the 340-360 contours to determine how much shoreline is exposed in 10ft increments. Shane noted that he would work with MaryAnn Taylor from SCANA to obtain the needed data.

Lake Murray Waterfowl Surveys

Shane briefly discussed the results of the 2006-2007 waterfowl surveys conducted on Lake Murray; he noted that a total of seven species were found during the study period. Shane mentioned that the report was posted on the Saluda website. Shane handed out the 2007-2008 aerial survey schedule and noted that Cub Stephens from the Savannah River Ecology Lab will be conducting the aerial surveys again for the 2007-2008 surveys.

Review of Fish and Wildlife Issue Matrix

Shane handed out the fish and wildlife issue matrix and noted that most of the study requests listed have been satisfied or something is being done to satisfy the request (Attachment D). Shane briefly discussed the issues/request, description, and the status of the request. Specifically, Gerrit noted that he had requested a study to examine sediment regime and sediment transport for the Saluda Hydro Project. Gerrit noted that he would provide the group more detail on exactly what he would like to see.

Next Meeting

The group agreed that they would discuss follow-up items from this meeting on December 13th after the IFIM workshop at the Lake Murray Training Center.

ATTACHMENT A

DRAFT SELF-SUSTAINING TROUT PAPER

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

EVALUATION OF THE POTENTIAL FOR A SELF-SUSTAINING BROWN AND RAINBOW TROUT POPULATION IN THE LOWER SALUDA RIVER

DRAFT

Rev. 1

OCTOBER 2007

Prepared by:

Saluda Hydroelectric Project
Instream Flow/Aquatic Habitat Technical Working Committee

SOUTH CAROLINA
ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

EVALUATION OF THE POTENTIAL FOR A SELF-SUSTAINING BROWN AND RAINBOW TROUT POPULATION IN THE LOWER SALUDA RIVER

DRAFT
Rev. 1

AUGUST 2007

Prepared by:

Saluda Hydroelectric Project
Instream Flow/Aquatic Habitat Technical Working Committee

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

EVALUATION OF THE POTENTIAL FOR A SELF-SUSTAINING BROWN AND RAINBOW TROUT POPULATION IN THE LOWER SALUDA RIVER

INSTREAM FLOW/AQUATIC HABITAT TECHNICAL WORKING COMMITTEE

DRAFT

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

EVALUATION OF THE POTENTIAL FOR A SELF-SUSTAINING BROWN AND RAINBOW TROUT POPULATION IN THE LOWER SALUDA RIVER

INSTREAM FLOW/AQUATIC HABITAT TECHNICAL WORKING COMMITTEE

DRAFT

1.0 INTRODUCTION

During the Saluda Hydroelectric Project relicensing consultation, interest was expressed by stakeholder groups in the potential for a "self-sustaining" trout fishery in the Lower Saluda River (LSR). According to the stakeholders, the primary benefits of establishing a self-sustaining trout fishery would be the reduction or elimination of annual stockings that are currently required to maintain a sport fishery and the establishment of a balanced trout population with cohorts of various age classes represented. The Relicensing Technical Working Committee agreed to discuss the potential to establish self-sustaining trout populations.

The purpose of this document is to:

1. discuss how overarching inherent macrohabitat characteristics of the LSR affect the biological requirements needed to support self-sustaining trout populations[1],
2. summarize the management expectations for trout in the LSR, and
3. identify any management goals that can be reasonably addressed in the relicensing of the Saluda Project.

The LSR is a Fall-Line river with a relatively cool annual water temperature regime, bedrock-dominated riffles with limited gravel and cobble, and a high percentage of pool habitat. The LSR currently supports a tailrace fishery for brown trout (*Salmo trutta*) and rainbow trout

[1] Macrohabitat considerations are watershed-scale factors such as water quality, water temperature, geology and ecology that may influence the biological resource independently of any management actions taken by man, such as flow modification, stocking, etc.

(*Oncorhynchus mykiss*) that is managed by the South Carolina Department of Natural Resources (SCDNR) as a Put, Grow and Take fishery.[2] This management approach, which has been employed since the mid-1960's, is considered by SCDNR to be appropriate where trout habitat is marginal but can at least provide sufficient growth and survival of enough sub-adult trout to support a recreational fishery (D. Christie, SCDNR, Pers. Comm.). Trout are not native to the LSR, and the fishery is maintained through annual stocking of sub-adult rainbow and brown trout. Presently, the SCDNR stocking program runs from early December until mid-April, with the total number of trout stocked annually averaging around 35,000. Approximately two-thirds of the trout stocked annually are rainbow trout (typically 9-10 inches in length), with the remainder being 7-8 inch brown trout (H. Beard, SCDNR, unpublished data). Angler creel surveys conducted in 1995-97 indicated a pronounced seasonal fishery that coincides with the stocking season (H. Beard, SCDNR, pers. Comm.).

[2] Trout Put, Grow and Take Waters, are defined by the South Carolina Department of Health and Environmental Control (SCDHEC) – Bureau of Water as freshwaters suitable for supporting the growth of stocked trout and a balanced, indigenous aquatic community of fauna and flora (SCDHEC 2004).

2.0 REQUIREMENTS FOR A SELF-SUSTAINING TROUT POPULATION

A self-sustaining population requires that recruitment from natural reproduction must exceed mortality from both natural and manmade sources (Everhart and Youngs, 1981; Moyle and Cech, 2004). Therefore, establishment of any self-sustaining population requires several basic components including spawning adults; spawning habitat (including macrohabitat considerations such as water temperature, water depth and flow, dissolved oxygen); fry/nursery habitat; and acceptable levels of intra- and inter- species-specific competition.

2.1 Spawning Adults

A self-sustaining population requires spawning adults. To obtain spawning age, trout must survive in the Lower Saluda for more than one year. Both rainbow and brown trout will spawn at age II, but fecundity is low (Raleigh et al, 1984; 1886); Age III and IV fish may be required to sustain a population because they produce much higher numbers of eggs.

The habitat requirements needed to provide recruitment into older age classes are well understood for brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*). The preferred temperature range of brown trout is 12.4 – 17.6 C. Upper lethal limits are 25-29 C and above (Jenkins and Burkhead, 1993). At water temperatures greater than 10^{o}C, brown trout generally avoid water with dissolved oxygen levels of less than 5 mg/L. Rainbow trout prefer water temperatures of 12-19 C, and 15 C is considered most favorable for growth. The upper lethal temperature threshold is 25 C (Jenkins and Burkhead, 1993). Optimal dissolved oxygen conditions for adult rainbow trout (and embryos) are > 7.0 mg/L at water temperatures < 15^{o}C and > 9.0 mg/L at water temperatures > 15^{o}C. Rainbow trout can tolerate dissolved oxygen below those thresholds; however, growth and metabolic function may be inhibited. A level of 3.0 mg/L is considered to be the incipient lethal level for dissolved oxygen and can prevent spawning (Raleigh et al., 1984).

2.2 Spawning and Spawning Habitat

Brown trout spawning typically occurs in the fall, although spawning has been reported as late as February (Raleigh et al., 1986). Spawning behavior is triggered by decreasing day length, increased late fall flows, and by decreases in water temperature to between 6°C and 12°C (depending on latitude). Actual spawning typically takes place at water temperatures around 7°C to 9°C, with females digging an egg pit (*redd*) in clean, well-washed gravel deposits (Scott and Crossman, 1973). Optimal gravel size for brown trout redds is approximately 0.50 inches (1 cm) to 2.75 inches (7 cm), but they will spawn in gravel that ranges in size from 0.12 inches (0.30 cm) to 4 inches (10 cm). Gravels with high embeddedness restrict oxygen exchange, and cause entombment, resulting in mortality (Raleigh et al, 1986).

Brown trout spawning sites typically consist of areas influenced by upwelling of cold water and/or fast flow through spawning sized gravels, or by water currents that flow down into the gravel to allow for proper aeration of embryos (Raleigh et al, 1986). Following fertilization, the female covers the redd with unimbedded gravels that allow flow to freely aerate and cleanse the egg during incubation.

Optimal water velocity for spawning brown trout is reported as 1.3 to 2.3 feet per second (fps), with a full range of velocities ranging from 0.5 to 3 fps (Raleigh et al, 1986). Optimal water depth during spawning and for redd construction is reported as 0.8 to 1.5 feet, with a range of 0.4 to 3 feet (Raleigh et al, 1986). Optimal incubation temperatures for brown trout embryos are reported as ranging from 7°C to 13°C, although water temperatures as low as 0°C and as high as 15°C are reported as tolerable (Raleigh et al., 1986), though temperatures exceeding 13.3°C may result in hatching failure (Raleigh et al, 1986). Egg incubation may last from 34 to 148 days, depending on ambient temperature, and climatic conditions (Raleigh et al, 1986).

Rainbow trout typically spawn in the spring as water temperatures approach or exceed 6°C to 7°C (Behnke, 2002). However, spawning is theoretically possible with temperatures ranging up to 16°C (Raleigh et al., 1984). Spawning can begin as early as January in temperate western United States watersheds or as late as July in colder

climates. Hatchery strains may spawn at other times of the year (Behnke, 2002). Eggs are deposited by females in redds as with other salmonids. Redds are located in fast flowing, well-washed gravel-cobble bars that promote good aeration of the eggs during development; suitable substrate for redd construction and embryo development consists of clean gravels and cobbles ranging in size from 0.6 inches (1.5 cm) to 4 inches (10 cm), depending on the size of the adult fish. Substrates of larger sizes will be used if optimal gravel is not present (Raleigh et al. 1984). After fertilization, the female buries the redd with additional gravels that protect the redd from predation or dislocation during the incubation period (Scott and Crossman, 1973).

Optimum temperature for rainbow trout embryo incubation ranges from 7°C to 12°C. Highest egg survivability rates are reported at temperatures ranging from 7.5°C to 10°C. Suitable temperature for the growth of fry during the spring and early summer months (during the four month period after hatching) ranges from 10°C to 21°C (Raleigh et al., 1984). Egg incubation may last from four to seven weeks, depending on ambient temperature, and climatic conditions (Scott and Crossman, 1973).

Rainbow trout spawning can occur in depths of from 0.6 to 8.2 feet; suitable water depth for incubating eggs is generally assumed to be identical to that reported for spawning fish (Raleigh et al., 1984). Optimum water velocity for rainbow trout spawning and egg incubation is between 1.5 and 3.0 fps (Raleigh et al., 1984). Water velocity less than 1.0 or greater than 3.0 fps is considered unsuitable for spawning and incubating rainbow trout (Raleigh et al., 1984).

Due to the protracted egg incubation time, flow regime or water quality changes occurring between egg deposition and fry emergence may affect the productivity of a redd. For example if water temperature increases precipitously after egg deposition, eggs may be subject to mortality (Raleigh et al., 1986). Typically, a 1:1 ratio of pool and riffle habitat is considered optimal to support for both spawning and rearing life stages of rainbow trout (Raleigh et al., 1984).

2.3 Fry/Juvenile Nursery Habitat Requirements

Upon hatching, each brown and rainbow trout fry remains buried in the substrate until the yolk sac is absorbed. Transition to the swim-up fry (alevin) stage requires approximately three to seven days, depending on ambient water temperature (Scott and Crossman, 1973). Alevin emerge from the substrate and can swim weakly.

Brown trout fry are most often found in object cover at the edge of riffles or in river margins where water depth is 0.6 to 1.0 feet, where velocity, competition, and predation from larger fish is minimized and summer water temperature is moderate (Raleigh et al, 1986). Fry are rarely found in backwater or in areas with a small gravel substrate. Fry morph into young-of-year (YOY) juveniles during late spring to early summer in northern climates (Scott and Crossman, 1973).

During the winter months, brown trout juveniles seek refuge in the gravelly stream substrate, often at depths of 0.3 to 1.3 feet (Raleigh et al., 1986). Riverine habitat composition in productive brown trout streams is typically characterized by a 50% to 70% pool to 50% to 30% riffle-run combination of habitat types (Raleigh et al., 1986).

Rainbow trout fry generally inhabit run or stream margin habitat with slower water velocity. Competition with 1+ and older fish for pool habitat often limits young-of-year distribution to other habitats. As fry shift to the YOY juvenile phase they gravitate to somewhat deeper water with more complex cover (Raleigh et al, 1984). Over-wintering habitat for juveniles is comprised of gravels in runs; during the growing season juveniles typically inhabit runs, pools and riffles with gravel/cobble/boulder substrates. The accumulation of fines in riffle habitat can limit invertebrate production, as well as spawning, if gravels are too embedded with silts and sands (Raleigh et al, 1984).

2.4 Intra and Inter – Species Specific Competition

Self-sustaining trout populations typically occur in relatively oligotrophic cold-water ecosystems where population and ecosystem dynamics differ from those found in mesotrophic/eutrophic warmwater streams. Interactions between co-occurring warmwater competitors and predators often result in reduced abundance and viability of coldwater populations. For example, juvenile and adult trout are primarily insectivorous; a smallmouth bass introduction to a coldwater salmonid river ecosystem in Maine has impaired the abundance, growth and catch per unit effort of the natural trout population, because the more fecund adult bass are both insectivores and piscivores and therefore compete with, and prey on juvenile trout. Juvenile bass also compete for both microhabitat niches and food sources with adults and juvenile trout (Boucher and Bonney, 2004).

3.0 FEASIBILITY OF SUCCESSFUL SELF-SUSTAINING TROUT POPULATIONS IN THE LOWER SALUDA RIVER

3.1 Spawning Adults

A self-sustaining population of either rainbow or brown trout will require the presence of adequate numbers of spawning adults. The specific number of adult spawners required to sustain an exploitable population would depend on specific management objectives that would need to be established by SCDNR. The potential number of redds would be limited by the area of available spawning habitat, When spawning habitat is scarce, there may be insufficient space for enough redds to produce adequate catchable sized trout to measurably contribute to a fishery (Everhart and Youngs, 1981).

Available information suggests that adult spawning escapement may be variable or limited. Evidence from electrofishing and angling records indicate some trout do survive for longer than one-year in the river (Kleinschmidt et al., 2003; H. Beard, SCDNR, Pers. Comm.), and thus would be theoretically available as spawning stock. A 2003 growth study found a minimum of two distinct age classes of trout present during the study period (Kleinschmidt et al., 2003). Further, the study found that, of 441 brown and rainbow trout collected, 74 were greater than 16 inches in length. Data from an ongoing study begun by SCDNR to evaluate annual mortality of stocked trout in the LSR suggests that carryover of trout through the spring and summer may vary annually (H. Beard, SCDNR, Pers. Comm.).

Creel data and annual electrofishing by SCDNR generally indicates a significant decline in LSR adult trout abundance beginning in early summer (H. Beard, SCDNR, unpublished data). The reasons for the observed decline in trout abundance during late summer and the variability in yearly adult survival are not fully understood, but it is probable that the cumulative effects of heavy fishing effort and liberal creel limits, as well as predation and physical habitat degradation may limit the number of fish available to recruit to age II and older. As previously noted, creel surveys conducted in 1995-97 indicated a pronounced seasonal fishery that coincides with the stocking season (H. Beard, SCDNR, unpublished data). Although environmental conditions in the late

summer and early fall (particularly water temperature and dissolved oxygen (DO)) are factors with potential to limit survival, water temperatures in the LSR near the most downstream and presumably warmest extent of trout habitat in the river do not exceed the lethal limit for trout of 25°C (maximum of 23.9°C during the 2002 – 2006 period; USGS Gage # 02169000). Recent modifications made to the Saluda Project turbines have also resulted in improved DO levels (Table 1); the DO in the LSR provides suitable growing conditions during the growing season for sub-adult and adult trout, (average growth of 0.67 inches per month (Kleinschmidt et al, 2003)). In the past, low DO, combined with high water temperature, has been attributed to minimal survival of trout (D. Christie, SCDNR, Pers. Comm.).

Table 1: Average Maximum, Minimum, and Average Mean Dissolved Oxygen Levels in the Lower Saluda River from 2000 to 2006, as measured at USGS Gage # 02168504

MONTH	AVERAGE MAX	AVERAGE MIN	AVERAGE MEAN
September	8.0	4.3	6.2
October	8.0	5.6	6.5
November	9.3	7.2	8.3
December	10.8	9.8	10.2
January	11.5	10.4	10.8
February	11.7	10.5	11.0
March	10.6	9.4	10.0
April	9.7	7.9	8.7
May	9.5	6.8	8.1
June	8.9	6.0	7.6
July	8.6	5.6	7.3
August	8.0	5.0	6.7
Absolute Min Value	0.2	(9/25/2000)	-
Absolute Max Value	14.4	(2/25/2005)	-
Lowest Daily Mean	1.2	(9/29/2004)	-
Highest Daily Mean	13	(3/13/2005)	-

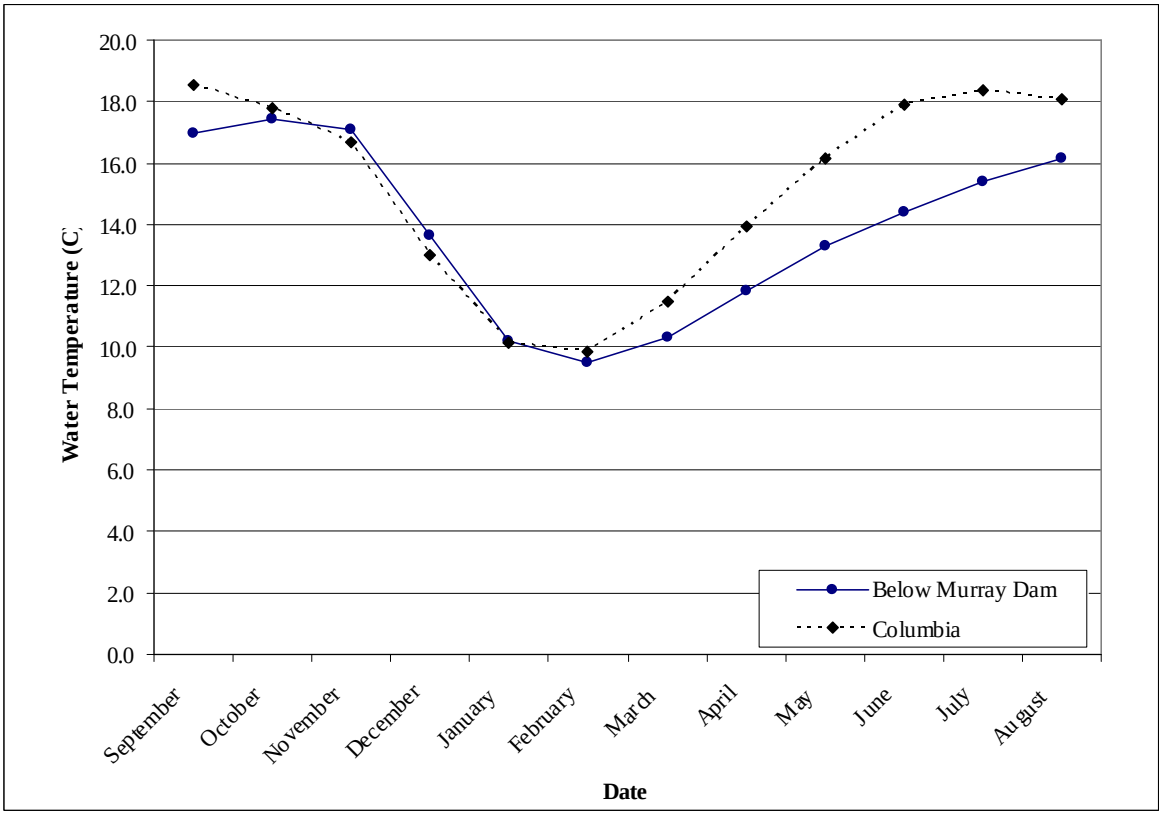


Figure 1: Average Water Temperature in the Lower Saluda River from the Period 08.01.2000 through 08.01.2006 as Measured at USGS Gages 2168504 (below Murray Lake) and 2169000 (Columbia)

3.2 Spawning Habitat

3.2.1 Macrohabitat Considerations

Average water temperature in the lower Saluda River ranges from approximately 17 to 10°C during the brown trout spawning and incubations season (Figure 1). Thus, the ambient temperatures are marginal for supporting brown trout spawning, and would most likely not provide suitable incubation conditions for eggs.

Average water temperature throughout the late winter, spring, and early summer months (February – July) in the lower Saluda River ranges from 9.5°C to 15.4°C and is within the tolerances for adult rainbow trout (Figure 1). Assuming that rainbow trout spawning occurred February or March, ambient water temperature in the lower Saluda River would likely support egg development.

Similarly, suitable water temperatures in the spring and early summer months (March – June) would likely exist for embryo development and rearing of post-emerged larval rainbow trout, as average water temperature typically remains between 10°C and 14°C. Suitable temperature conditions would likely be present for developing rainbow trout fry in the spring and early summer months (Figure 1).

3.2.2 Mesohabitat Considerations

Trout species are habitat specialists that require a series of spatially-linked mesohabitat types (*i.e.* riffles, runs, pools) that have specific parameters unique to each lifestage (Scott and Crossman, 1973, Raleigh, et al., 1986) including a pool/riffle ratio for optimal production. Barthelow et al. (2003) demonstrated that contiguous and sequential downstream linkage of spawning/rearing/nursery habitat was highly correlated to production of an abundance of sub-adult salmonids; conversely, discontinuous or isolated spawning habitats resulted in bioenergetic and predation mortality penalties to cohorts of fry emerging from isolated spawning sites and reduced recruitment success. Similarly, Shirvell and Dungey (1983) concluded that brown trout population size might be limited by the amount of the least abundant activity-specific habitat.

The LSR lacks the pool/riffle ratio and sequencing characteristic of most productive trout streams. Although some mesohabitat components can be found, Instream Flow Incremental Methodology studies performed on the LSR in the early 1990's (Isley et al.1995) and in 2007 (Kleinschmidt Associates, 2007), as well as aerial videography (DTA, 2005) all consistently document that most of the LSR below Lake Murray Dam consists of low-gradient, slow-moving, runs and pools intermittently separated by bedrock dominated shoal. Substrates are dominated by fines interspersed with boulder and gravel. Bedrock is the dominant substrate in the shallow shoal areas that separate pool and run/glide habitat.

According to Isley et al. (1995), there is approximately 0.8 river miles (8.5 percent) of riffle habitat in the lower Saluda River. Both rainbow and brown trout require riffle habitat featuring unimbedded clean gravel substrate (Photo 1) that ranges in size from 1/8 of an inch to 4 inches. The majority of riffle habitat in the LSR consists of bedrock-controlled shoals that have little value as spawning habitat. Ocean Boulevard/Oh Brother Rapids potentially provides the greatest concentration of suitable spawning substrate in an extensive gravel-cobble dominated riffle area. However, these substrates are marginal for spawning due to embedded fines and the lack of uniform gravels (Photo 2).

In addition to embeddedness, suitable LSR spawning substrates are scattered and occupy a relatively small area compared to the length of the LSR. For example in the nine miles of this river reach the spawning gravels in the Oh Brother Rapids area only occupy an area of approximately 100 ft long by 300 feet wide. As noted above, the gravels in this area are not optimal due to particle size and embeddedness. Thus only a relatively small portion of this area would likely provide suitable redd production potential. For the reasons discussed above, these redds would not necessarily generate viable juveniles. This one isolated area would not likely promote juvenile recruitment extensive enough to provide a fishery along a nine-mile segment of river. This would not likely support redd formation on a scale sufficient to support a self-sustaining trout population. Studies conducted in other Southeastern tailwaters have identified that the lack of suitable sized substrate was one of the limiting factors to trout reproduction (Banks and Bettoli, 2000). Furthermore, there is no contiguous connection between this spawning site and downstream fry-rearing habitat. Any fry produced in this area would drift downstream into deep slow moving pools and runs which are unsuitable for fry nursery habitat, and thus survivorship to older lifestages would be limited.

In some large river systems, significant trout spawning may occur in smaller tributaries. There are several tributaries that enter the LSR (*e.g.*, Rawls Creek and 12-mile Creek); however, these tributaries differ significantly from the

lower Saluda River in that they are low-gradient, warmwater reaches unsuitable for coldwater trout.

Isley et al. (1995), Kleinschmidt Associates (present IFIM study) and aerial videography all consistently document that the pool to riffle ratio in the lower Saluda River far exceeds that which is required for optimum productivity of fry and juveniles. Isley et al. (1995) classified the reach as containing approximately 58 percent pool habitat with 8.5 percent riffle habitat, a ratio of 6.8 to 1.

3.3 Intra and Inter – Species Specific Competition

Self-sustaining trout populations generally occur in cold-water habitats. In South Carolina, these cold-water habitats would be classified as trout natural streams. Here, fish species diversity is generally low and the highest level predator is typically the trout, or at least other top predators are unlikely to prey on trout. Such self-sustaining (or "wild") trout streams are limited to the extreme northwest portion of South Carolina and include the Chattooga River and other headwater streams of the Blue Ridge Escarpment (EBTJV, 2007). The fifty-seven or so species of fish documented in the LSR are warmwater species with the exception of the two trout species (SCE&G and SCDNR, unpublished data, as summarized in Kleinschmidt Associates, 2005). It is well documented that striped bass prey on the stocked trout, and that anglers fishing for striped bass often use trout as bait (H. Beard, SCDNR, Pers. Comm.). This is consistent with observations from other river systems in which brown trout have been stocked in waters containing striped bass populations that would normally not occupy the same ecosystem. For example, in the lower Kennebec River, adult striped bass have been documented consuming introduced adult brown trout (Photo 3).

Other species such as largemouth bass and chain pickerel prey on trout as well. Largemouth bass, smallmouth bass and chain pickerel are reported as predators on salmonids in other ecosystems (Keith and Barkley, 1971; Warner and Havey, 1985; Boucher and Bonney, 2004). Besides predation on the stocked trout, it is suspected that if

trout successfully reproduce, these other fish species would prey on the eggs, fry and juveniles as well.

Photo 1: Example of Unimbedded Gravel Spawning Bar Substrates Used by Salmonids, Kennebec River, Maine

Photo 2: Example of Embedded Substrate in Oh Brother Rapids Area, Saluda River, SC

Photo 3: Remains of a 14-Inch Adult Brown Trout Expelled from Stomach of Adult Striped Bass, Lower Kennebec River, Maine, August 2002 (from Yoder and Kulik, 2003)

4.0 CONCLUSIONS AND RECOMMENDATIONS

The existing habitat and water quality in the Saluda River generally provides suitable growing conditions for much of the year for adult brown and rainbow trout. However, self sustaining populations require specific spawning and nursery habitat conditions to allow for sufficient amounts of recruitment to compensate for mortality. These conditions are non-existent or marginal in the LSR.

Spawning Recruitment. Adult survivorship is likely limited during some years, potentially due to a variety of biotic and abiotic factors including predation, competition, angling exploitation and environmental conditions. As a result, few fish survive to reach age II and older.

Limited Spawning and nursery potential. Spawning potential is insufficient to support self-sustaining populations of either species. Factors identified that support this conclusion include marginal spawning and incubation water temperature (brown trout), limited amount and quality of gravel spawning beds for both species, and discontinuous and limited fry and juvenile nursery habitat. It should be noted that conditions for trout will improve with adherence to the new DO standard and with modified hydro-units operation that will lower temperatures during the late summer/early fall season. Not withstanding these improvements, it will still be unlikely that spawning will be sufficient to support self-sustaining populations of trout for other reasons stated.

Mortality in the present fishery is compensated for by annually stocking 35,000 sub-adult trout. Although it is theoretically possible that incidental natural reproduction may presently occur, at least for rainbow trout, the magnitude and frequency of production would not likely support the present level of the recreational fishery given the natural vagaries of reproduction in trout populations, and suboptimal conditions discussed above. The proximity to an urban area and the popularity of angling (where it is reasonable to expect pressure on this fishery to remain the same if not increase) was not assessed in this report but is also a mortality factor. Few if any urban trout fisheries located in native or at least more favorable cold water ecosystems are maintained by natural reproduction. Given the public expectations for this fishery, and the

marginal potential for self-sustaining coldwater salmonid populations, it is not clear what material benefit would be derived by altering LSR trout fishery management to rely on natural reproduction rather than the existing stocking strategy.

Focus should be placed on maximizing the potential for this river to maintain a Put-Grow and Take trout fishery in a manner that will ensure increased survival and growth of the river's trout population. If successful, this should lead to additional year to year survivorship and result in additional years classes contributing to the fishery. This can be accomplished, in part, by determining ways to modify project operations to provide more favorable water temperatures in July through September; to ensure that dissolved oxygen standards are being met and to implement instream flows that enhance habitat for adult trout. However, pursuing a goal of establishing a self-sustaining trout population in the LSR is not considered an appropriate management strategy. because of the limited potential for its success due to poor recruitment potential

5.0 REFERENCES

Banks, S. M., and P. W. Bettoli. 2000. Reproductive potential of brown trout in Tennessee tailwaters. Fisheries Report No. 00-19. Tennessee Wildlife Resources Agency, Nashville, Tennessee.

Bartholow, J.; J.G.Trial, K Beland, and B. Kulik. 2003. Modeling Atlantic Salmon Production on the Narraguagus River, Maine. Am. Fish. Soc. 133rd Annual Meeting, Quebec City, PQ. August 10-14, 2003

Behnke, R.J. 2002. *Trout and Salmon of North America.* Chanticleer Press, Inc. NY. pp. 359.

Devine, Tarbell and Associates, Inc (DTA). 2005. Aerial Video of Lower Saluda River. Prepared for South Carolina Electric & Gas Co.

Eastern Brook Trout Joint Venture (EBTJV). 2007. South Carolina Brook Trout Conservation Strategy. *In* Conserving the Eastern Brook Trout: Strategies for Action. Draft – updated August 2007. Available online at http://easternbrooktrout.org/constrategy.html. Accessed October 3, 2007.

Everhart W. H and W.D. Youngs. 1981. Principles of fishery science. Second edition. Cornell Univ. Press. 349 pp.

Isley, J. J., Jobsis, G., and S. Gilbert. 1995. *Instream Flow Requirements for the Fishes of the Lower Saluda River* (Conducted as part of relicensing studies for the Saluda Project - FERC No. 516).

Jenkins, R.E. and N.M. Burkhead. 1993. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

Keith, W. B., and S. K. Barkley. 1971. *Predation of Stocked Rainbow Trout by Chain Pickerel and Largemouth Bass in Lake Ouachita, Arkansas*. Proceedings of the Annual Conference of Southeastern Fish and Wildlife Agencies 24:401–407.

Kleinschmidt Associates, Loginetics, Inc., Paladin Water Quality Consulting, and Reservoir Environmental Management, Inc. 2003. *Lower Saluda River DO Technical Study Report.* Prepared for South Carolina Electric and Gas Company.

Kleinschmidt Associates. 2005. Initial Consultation Document (ICD) for the Saluda Hydro Project.

Kleinschmidt Associates. 2007. Present Instream Flow Incremental Study. Unpublished data.

Michaelson, D. P. 1996. The impacts of stocking stress.

Moyle, P.B. and J.J. Cech. 2004. Fishes. An introduction to ichthyology. Fifth Edition. Prenntiss-Hall, Inc. 726 pp.

Raleigh, R. F., L. D., Zuckerman, and P. C. Nelson. 1986. *Habitat Suitability Index Models and Instream Flow Suitability Curves: Brown Trout, Revised.* U.S. Fish and Wildlife Services Biol. Rep. 82(10.124). 65 pp. [First printed as: FWS/OBS-82/10.71, September 1984-J.

Raleigh, R. F., T. Hickman, R. C. Solomon, and P. C. Nelson. 1984. *Habitat Suitability Information: Rainbow Trout.* U.S. Fish and Wildlife Services FWS/OBS-82/10.60. 64 pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Bulletin 184, Fish. Res. Board. Ottawa, Canada. 966 pp.

Shirvell, C.S. and R.G. Dungey. 1983. Microhabitat chosen by brown trout for feeding and spawning in rivers. Trans Am. Fish Soc. 112(3):355-366.

South Carolina Department of Health and Environmental Control (SCDHEC). 2004. Water Classification & Standards (R.61-68) and Classified Waters (R.61-69). Bureau of Water, June 25, 2004.

Warner, K and K.A. and Havey. 1985. Life history, ecology and management of Maine landlocked salmon (*Salmo salar*). Maine Dept. of Inland Fisheries and Wildlife. Augusta, ME. 127 pp.

ATTACHMENT B

E-MAIL FROM M LEAPHART

Cheryl Balitz

From: Shane Boring
Sent: Monday, January 14, 2008 4:58 PM
To: Cheryl Balitz
Subject: Should be PDFed and included as Attachment B

-----Original Message-----
From: LEAPHART,JR., MALCOLML [mailto:MALCOLML@mailbox.sc.edu]
Sent: Friday, October 26, 2007 6:30 PM
To: Shane Boring; Theresa Thom; Alison Guth; Amanda Hill; BARGENTIERI@scana.com; Bud Badr; dchristie@comporium.net; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Hand; Jim Glover; Mike Waddell; mquattlebaum@scana.com; Prescott Brownell; RMAHAN@scana.com; Ron Ahle; Scott Harder; Steve Summer; Brandon Kulik; Alan Stuart; ahler@dnr.sc.gov; selfr@dnr.sc.gov; marshallb@dnr.sc.gov; tbebber@scprt.com; Amanda_Hill@fws.gov
Cc: rankind@dnr.sc.gov
Subject: RE: Saluda Hydro Relicense: Trout White Paper

Shane and others:

Thanks to SC DNR for suggesting, and to Kleinschmidt for preparing the white paper. The time and effort to scientifically measure, describe, and assess the lower Saluda River (LSR) is appreciative as such a study is the proper starting point for decision making, as long as the focus is accurate...

The first comment from Trout Unlimited (TU) however concerns the focus and scope of the white paper... I agreed at a past IFIM meeting and documented in writing that TU's main concern was for conditions needed for trout reproduction, not a 'self sustaining' trout fishery which is determined by too many factors outside of the utility company's operations. As I documented in my email to you for filing with the TWC minutes, I used the term 'self sustaining' synonomously with 'reproducing' in the TU ICD letter as is often done in the 'literature' and by fishery biologists all over the country. Clarifying that usage is important as it changes the scope of the white paper completely, certainly making the conclusions meaningless. If the 'self sustaining' response was necessary because of the TU ICD letter,,, fine; but, a further evaluation of reproduction potential as agreed on needs to be done too.

Even with the unwanted 'self sustaining' focus, much of the report however has value in that it establishes the needs of rainbow and brown trout and attempts to evaluate how the LSR fares in meeting those needs (ie, recruitment potential). Specific comments regarding the white paper follow.

-- We are not surprised that the temperature regime is satisfactory for trout reproduction and survival as that is consistent with the conclusions from the 1985 USGS study that TU funded for $5,250 for SC DNR. The note that the temperature range during brown trout spawning is marginal is somewhat surprising, but does provide a target for an important habitat improvement that should be closely evaluated for remedies.

-- According to Monte Seehorn, retired USFS Southeast Fisheries Biologist, experience has shown that pool to riffle ratios are not absolutes and that many trout streams with much less than ideal ratios have significant reproduction, often from relatively small areas suitable for spawning. The point is that many other factors come to bear besides the ratio, or the size of the spawning area, and trout are quite resilient. Much of the documented brown trout spawn in the White River in Arkansas for example has been found to occur in stretches relatively short for the length of the river. And their resiliency has been shown there too as they adapted to huge fluctuations in release levels, including for spawning site selection.

-- The implication that the LSR only has a 100' x 300' suitable for trout spawning is misleading. Most of the entire stretch of river on both sides of the islands below I26 where the 'Oh Brother Rapids' and 'Ocean Boulevard Rapids' are has the potential for trout spawning. Since the islands extend for nearly half a mile, that would mean

over a mile of potential spawning sites alone exists there, counting both sides. Plus, the riffles at the spillway channel juncture, the rapids above Hopes Ferry Landing, the rapids at Corley Islands, and those below the islands below I26 extending all the way to the to the confluence would all have some potential. The .8 mile of riffle habitat is certainly a conservative estimate, and to infer that trout spawning would not occur anywhere else is questionable. That's not even consistent with the cited Raleigh conclusions that trout can spawn in up to 8.2 feet of water with suitable velocity and substrate which could certainly fall out of the observed riffle areas. Again, an empirical study apparently beyond the scope of the white paper is needed to be more definite here.

-- There appears to be a lack of comparison with many southern trout rivers that have more in common with the LSR than many in Maine. Tailrace trout fisheries in Arkansas for example were previously pointed out as examples that were very analagous and whose management could be looked at for guidance giving the hundreds of miles of those rivers and their longer history of research and management by both that state and the Corps of Engineers that built most of the dams. What other state has an 'Aquatic Habitats Manager' as Arkansas has in Larry Rider? But, apparently Mr. Ryder was not consulted after I shared his expertise and contact information with you as to trout habitat for this white paper. The success of their revetments to deepen channels (while providing handicap and other angler access), of gravel beds developed from anchored tree tops, and from root wads installed to provide holding areas (as we have done on the Eastatoe and other upstate streams) are all examples of tailrace habitat improvements for trout that should be considered as the LSR potential is evaluated for trout.

In "The Future of Trout in South Carolina" (A Plan for the Management of South Carolina's Trout Resources" (Geddings, 1998), "Put, grow, and take" trout fisheries are described as having "various habitat deficiencies" that "do not permit successful reproduction" by trout. The LSR is essentially described as 'deficient habitat' in the white paper, though without any empirical studies or peer reviewed research to support that categorization, only observations and assumptions. However, it's difficult to question that description as the Lake Murray dam transformed a warm water piedmont river into a cold water fishery in the late 1920's. That the aquatic habitat that once was a 'self sustaining' warm water fishery is out of sync with the coldwater fishery created is not a surprise to no on. Indeed, that transformation is the crux of the 'habitat deficiency' problem for trout in the LSR and should be acknowledged, with remedies to get the two better in sync as part of the new license.

In summary: TU does not expect the utility company to develop a 'self sustaining' trout fishery as the white paper describes. TU does expect the utility to document steps in their plan to foster trout reproduction through habitat improvements, such as through annual projects developed in concert with TU, US Fish & Wildlife, and SC DNR. Those undertaken in upstate South Carolina in the SC DNR "Partners for Trout" program with the NRCS, and those in Arkansas as mentioned above would both be good starting points. While not totally replacing the need for trout stockings as the white paper indicates, the goal would be to improve the now coldwater habitat to the point where reproduction could at least occur, even if not in significant numbers to reduce stocking needs given the current fishing regs. To not do that while the dissolved oxygen and flow problems are being remedied would be short-sighted to say the least for a state 'wild and scenic' river that is the heart of the extensive rivere greenways of the Columbia area.

From: Shane Boring [mailto:Shane.Boring@KleinschmidtUSA.com]
Sent: Mon 10/15/2007 9:05 AM
To: Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; dchristie@comporium.net; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; LEAPHART,JR., MALCOLML; Mike Waddell; mquattlebaum@scana.com; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
Subject: Saluda Hydro Relicense: Trout White Paper

Dear Instream Flow/Aquatic Habitat TWC Members:

Attached for your review is the updated draft of the white paper examining the potential for a self-sustaining trout

fishery on the Lower Saluda River. Many thanks to those who provided comments on the previous draft. Please provide us with your comments on the updated draft by Tuesday, October 31, 2007. Also, the paper will be an agenda item at our October 30th meeting of the Fish and Wildlife Technical Working Committees. Thanks again for your continued participation in the Saluda relicensing process.

Shane

C. Shane Boring
Environmental Scientist
Kleinschmidt Associates
204 Caughman Farm Lane; Suite 301
Lexington, SC 29072
Phone: (803)951-2077
Fax: (803)951-2124

ATTACHMENT C

DRAFT RTE REPORT

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

RARE, THREATENED AND ENDANGERED SPECIES ASSESSMENT

SEPTEMBER 2007

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RARE, THREATENED AND ENDANGERED SPECIES ASSESSMENT

SEPTEMBER 2007

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RARE, THREATENED AND ENDANGERED SPECIES ASSESSMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

RARE, THREATENED AND ENDANGERED SPECIES ASSESSMENT

1.0 INTRODUCTION

The Saluda Hydro project is a 202.6 megawatt (MW) licensed hydroelectric facility located on the Saluda River in Lexington, Newberry, Richland, and Saluda counties of South Carolina and is owned and operated by South Carolina Electric & Gas (Figure 1). The project consists of Lake Murray, the Saluda Dam, the new back-up Saluda Berm, spillway, powerhouse, intakes, and penstocks. The project is currently licensed by the Federal Energy Regulatory Commission (FERC No. 516) and the present license is due to expire in the year 2010.

To initiate the Project relicensing process, SCE&G prepared and issued the Initial Consultation Document (ICD) on April 29, 2005. The Licensee submitted the document to a number of state and federal resource agencies for their review and comment. In response to the ICD, the United States Fish and Wildlife Service (USFWS), South Carolina Department of Natural Resources (SCDNR), National Marine Fisheries Service (NMFS), and several Non-governmental Organizations (NGO's) requested a number of studies to assess the potential impacts of Project operations on natural resources, including an assessment of potential impacts to rare, threatened and endangered species.

1.1 Consultation History

In comments issued in response to the ICD, the USFWS provided a list of all known rare, threatened and endangered (RT&E) species occurring in the four county region surrounding the Project (See letter dated August 1, 2005; Appendix A). This list included all known species that are currently listed as federally endangered or threatened, species that are candidates for federal listing, as well as federal species of concern. The USFWS suggested that the Licensee conduct a literature-based review to determine

habitat requirements for these species and compare these with available habitat types in the Project area. The USFWS indicated that field surveys for these species should be performed if suitable habitat is found to exist in the Project area.

As part of relicensing, SCE&G formed a Rare, Threatened and Endangered Species Technical Working Committee (RT&E TWC) to determine any impacts to rare, threatened and endangered species with respect to continued operation of the Project. The RT&E TWC is comprised of representatives from state and federal resource agencies (i.e., SCDNR, NMFS and USFWS), representatives from several NGO's, and other stakeholders. The TWC has met three times thus far during relicensing to discuss the status of RT&E species occurring in the Project vicinity and potential strategies for addressing issues related to RT&E species. A comprehensive listing of RT&E TWC meetings held to date is provided in Table 2.

1.2 Species Included in Assessment

This assessment includes the 12 species provided by the USFWS for the four counties surrounding the Saluda Hydro Project that are federally listed as threatened or endangered or are candidates for federal listing (Letter dated August 1, 2005). In addition, the assessment includes three federal species of concern for which state and federal agencies indicated have potential to occur in the Project area or are otherwise of conservation concern during the consultation process. Bald eagle, which was recently de-listed under the Endangered Species Act of 1973, is included in this assessment due to its protection under the Bald and Golden Eagle Protection Act of 1938. Species covered by this assessment are summarized in Table 1.

Table 1: Federally Listed Species, Candidate Species, and Selected Federal Species of Concern Occurring or Potentially Occurring in the Four County Region Surrounding the Saluda Hydroelectric Project (FERC No. 516) (Source: USFWS letter dated August 1, 2005, Charleston Field Office, Charleston, South Carolina, as modified by Kleinschmidt based on consultation with USFWS)

COMMON NAME	*SCIENTIFIC NAME*	FEDERAL STATUS[1]	COUNTIES
	Birds		
Bald eagle	*Haliaeetus leucocephalus*	P[2]	Lexington, Newberry, Richland, Saluda
Red-cockaded woodpecker	*Picoides borealis*	E	Lexington, Richland, Saluda
Wood stork	*Mycteria americana*	E	Newberry
	Fish		
Robust Redhorse Sucker	*Moxostoma robustum*	SC	Lexington (possible)
Saluda darter	*Etheostoma saludae*	SC	Lexington, Richland, Saluda, Newberry
Shortnose sturgeon	*Acipenser brevirostrum*	E	Lexington (possible), Richland
	Invertebrates		
Carolina heelsplitter	*Lasmigona decorata*	E	Lexington (possible), Newberry (possible), Richland (possible), Saluda (possible)
Saluda crayfish	*Distocambarus youngineri*	SC	Newberry
	Plants		
Canby's dropwort	*Oxypolis canbyi*	E	Richland
Georgia aster	*Aster georgianus*	C	Richland
Little amphianthus	*Amphianthus pusillus*	T	Saluda
Piedmont bishop-weed	*Ptilimnium nodosum*	E	Saluda
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E	Richland
Schweinitz's sunflower	*Helianthus schweinitzii*	E	Lexington
Rocky Shoal's spider-lily	*Hymenocallis coronaria*	SC	Lexington, Richland
Smooth coneflower	*Echinacea laevigata*	E	Lexington (possible), Richland

1 Federal Status – E (listed as Endangered under ESA); T (listed as Threatened under ESA); C (Candidate for Federal listing); SC (Federal Species of Concern); P (Federally protected).

2 Bald eagle was removed from the list of federally threatened and endangered species on June 28, 2007; however, the species remains federally protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Table 2: Summary of Saluda Hydro Relicensing Rare, Threatened and Endangered Species Technical Working Committee Meetings

MEETING DATE	LOCATION	TOPICS DISCUSSED
July 26, 2006	SCE&G Offices at Carolina Research Park, Columbia, SC	Rocky Shoals Spider Lily, Species tracking
May 3, 2006	SCE&G Offices at Carolina Research Park, Columbia, SC	Wood Stork, Species tracking
March 8, 2006	SCE&G Lake Murray Training Center, Columbia, SC	Status of key species, strategies for addressing species in relicensing

Figure 1: Location Map for the Saluda Hydroelectric Project (FERC No. 516)

2.0 SPECIES DESCRIPTIONS AND ANALYSES

2.1 Bald Eagle

Bald eagles may be found throughout North America, typically around water where they feed primarily on fish and scavenge carrion. The species thrives around bodies of water where adequate food exists and human disturbance is limited. Eagles nest in large trees near water and typically use the same nest for several years, making repairs to it annually (Degraaf and Rudis, 1986).

Status in the Project Area

Foraging habitat for bald eagle is abundant in the Project area, and bald eagle sightings are common around both Lake Murray and the lower Saluda River. In addition, there are seven active documented bald eagle nests on Lake Murray as well as one active nest on the lower Saluda River (SCDNR, unpublished data).

Determination of Effect

Bald eagles inhabiting the Lake Murray and lower Saluda River are well habituated to and are tolerant of the presence of human activity; thus continued use of the reservoir and river for recreation are not expected to result in any negative effects to this species.

2.2 Red-Cockaded Woodpecker

The red-cockaded woodpecker (RCW) is endemic to open, mature, and old growth pine ecosystems in the southeastern United States (USFWS, 2003). Over 97% of the pre-colonial era RCW population has been eradicated, leaving only 14,000 RCWs living in 5,600 colonies scattered across eleven states, including South Carolina. RCW decline is generally attributed to a loss of suitable nesting and foraging habitats, including longleaf pine systems, due to logging, agriculture, fire suppression, and other factors (USFWS, 2003). Suitable nesting habitat generally consists of open pine forests and

savannahs with large, older pines and minimal hardwood midstory or overstory. Living trees, especially older trees that are susceptible to red-heart disease making them more easily excavated, provide the RCWs preferred nesting cavities. Suitable foraging habitat consists of open-canopy mature pine forests with low densities of small pines, little midstory vegetation, limited hardwood overstory, and abundant bunchgrass and forb groundcover (USFWS, 2003).

Status in the Project Area

There are no known reports of red-cockaded woodpeckers from areas surrounding Lake Murray or the lower Saluda River. Further, there is no known longleaf pine savannah habitat in the Project vicinity.

Determination of Effect

Based on this lack of suitable habitat, it is very unlikely that this species occurs in the Saluda Project vicinity and thus would not be affected by continued operation of the Project.

2.3 Wood Stork

Wood storks are colonial waterbirds that typically nest in large rookeries and feed in flocks (USFWS, 1997). Typical foraging habitats include narrow tidal creeks, flooded tidal pools, and freshwater marshes and wetlands. Like most other wading birds, storks feed primarily on small fish. However, because wood storks feed by tactilocation, depressions where fish become concentrated during periods of falling water levels are particularly attractive sites (USFWS, 1997). Storks typically use tall cypresses or other trees near water for colonial nest sites. Nests are usually located in the upper branches of large trees and several nests are typically located in each tree. Trees utilized for nesting and roosting typically provide easy access from the air and an abundance of lateral limbs (USFWS, 1997). Currently, nesting of the species in the U.S. is thought to be limited to the coastal plain of South Carolina, Georgia, and Florida (USFWS 1997).

Status in the Project Area

Although they are primarily birds of freshwater and brackish wetlands along the coastal plain, wood storks were reported from several locations in the Lake Murray area in recent years. Specifically, a local resident reported observing wood storks feeding at several locations in the Bush River and Big Creek embayments of upper Lake Murray during the period from approximately 2000 through 2004. In addition, approximately 60 storks were observed feeding at various locations in the middle Saluda River and the upper portion of Lake Murray during an aerial survey for bald eagles performed by the SCDNR in early August 2004. In response to these sightings, SCE&G, in coordination with the USFWS and SCDNR, conducted an aerial reconnaissance survey in the upper portions of Lake Murray on August 27, 2004. During this survey, biologists from SCDNR and Kleinschmidt documented approximately 60 wood storks foraging within the Saluda Project Boundary, as well as two potential nesting sites along the floodplain of the middle Saluda River (Tosity Creek and Silverstreet).

Under the current FERC operating license, SCE&G is required to submit 5 year updates to the Lake Murray Shoreline Management Plan (FERC Order ¶ 61,332, June 1, 1984). In an order approving and amending SCE&G's most recent update, which was submitted on February 1, 2000, the FERC requested that SCE&G designate the two identified wood stork "roosting and foraging habitats" near Bush River as "conservation areas" (FERC Order No. 20040623-3015). Further, the order required that these areas, as well as all other wood stork roosting and foraging habitat identified within the project boundary, remain protected and undeveloped until new evidence is submitted to indicate that protection of these areas is not warranted. In response to the wood stork sightings on Lake Murray and the subsequent FERC order, SCE&G initiated consultation efforts with the SCDNR and USFWS and developed a study plan aimed at documenting where and under what conditions wood storks were utilizing habitats within the Saluda Hydro Project Boundary and in the project vicinity (Kleinschmidt, 2004).

In accordance with the Lake Murray Wood Stork Study Plan (Kleinschmidt 2004), aerial surveys were performed monthly during February through November of 2005 and 2006. No wood storks were observed during more than 13 hours of aerial

surveys during 2005 (Kleinschmidt, 2005). A limited number of storks were observed in the Project area during August and September of the 2006 survey season (Kleinschmidt, 2007). Specifically, a single juvenile wood stork was observed soaring above the Saluda River upstream of Lake Murray during the August survey, and an additional 10 – 12 were observed in the same general area during the September 15, 2006 survey - 6 foraging in a farm pond off of the Saluda mainstem just downstream of the Highway 121 bridge and 4 to 6 (4 confirmed, 2 suspected) soaring and feeding in wetlands adjacent to the wood chipping plant near Silverstreet.

The surveys likewise failed to document nesting of wood storks in the study area. Study results found the Tosity Creek or Silverstreet sites, which were identified as being potential wood stork nesting areas during reconnaissance surveys and associated agency consultation, to be great blue heron nests, with both nesting adults and pre-flight juveniles observed during both 2005 and 2006 (Kleinschmidt, 2005; 2007). The lack of nesting in the study area is consistent with the known life-history of wood storks as a coastal nesting species (USFWS, 1997). In South Carolina, all nesting colony sites currently known are located in the coastal plain, and primarily in the coastal counties (Murphy, 2005).

Timing of wood stork observations during 2006 (August and September), suggested that these were likely post-dispersal migrants from coastal nesting sites. During the late-summer/early-fall period, when chicks have fledged and adults are no longer tied to the nest site by chick rearing, adult and juvenile wood stork dispersing from nesting colonies often undertake extensive migrations to exploit ephemeral food resources prior to returning to coastal areas for the winter months. In South Carolina and Georgia, young-of-year storks typically fledge during July and August, but return to the nest for an additional 3 to 4 weeks to be fed before finally dispersing from the colony site in August and September (USFWS, 1996). Storks dispersing post-breeding from southern US colonies (Florida, Georgia, and South Carolina) have been documented as far north as North Carolina and as far west as Mississippi and Alabama (USFWS, 1996).

SCE&G met with representatives from the USFWS and SCDNR via conference call on February 8, 2007, to discuss the status of wood stork monitoring on Lake Murray.

Both SCDNR and USFWS concurred with the findings of the 2006 Wood Stork Monitoring Report (Kleinschmidt, 2007), agreeing that no nesting of wood stork in the Project area was evident based on study results. Due to the limited nature of stork activities observed in the Project vicinity, the agencies concurred with recommendations to discontinue further wood stork surveys on Lake Murray and that continued protection of the areas identified in the FERC order as wood stork "conservation areas" was no longer warranted or necessary.

Determination of Effect

Wood stork usage of the Saluda Project area appears sporadic and extremely limited in nature and thus is unlikely to be affected by operation of the Project.

2.4 Shortnose Sturgeon

Much of the Santee Basin, including the portion of the Saluda Basin encompassed by the Saluda Project, is thought to be within the historic range of the shortnose sturgeon (Welch, 2000; Newcomb and Fuller; 2001). In the Santee Basin, the shortnose sturgeon is believed to be estuarine anadromous, migrating to inland rivers on annual spawning runs (NMFS, 1998). Migratory spawning runs of this species usually occur in early February to mid-March when water temperatures approach 9 – 14° C. Shortnose sturgeon spawning habitat in the southeastern rivers is characterized as "curves with gravel/sand/log substrate" (Hall et al., 1991; Smith et al., 1993). Shortly after spawning, shortnose sturgeon leave spawning grounds and migrate downstream, with most leaving freshwater by May (Hall et al. 1991).

Status in the Project Area

Populations of shortnose sturgeon are known from downstream of the Santee-Cooper dams (lakes Marion and Moultrie) in the lower reaches of the Santee basin (Collins et al., 2003). An additional dam-locked population of shortnose sturgeon has been documented within and upstream of the Santee-Cooper Lakes, with Lake Marion and its tributaries harboring the most significant population. Radio-telemetry studies

conducted by the SCDNR have documented migration of Lake Marion shortnose sturgeon as far upstream as the old Granby Lock and Dam on the Congaree (J. Gibbons, SCDNR, Pers. Comm.). Presence of shortnose sturgeon in the vicinity of Granby Lock and Dam was also confirmed by collection of a single specimen during sampling related to relicensing of Duke Power's Catawba-Wateree Project in March 2004 (Duke Power, 2004). The old Granby Lock and Dam is located adjacent to downtown Columbia, approximately 11 miles downstream of the Saluda powerhouse.

In response to anadromous fish studies requested by the NMFS and SCDNR during the initial stages of the Saluda Project relicensing, SCE&G developed and implemented a Shortnose Sturgeon Study Plan (Kleinschmidt, 2006). The primary objective of this study is to document whether or not shortnose sturgeon are utilizing areas of the lower Saluda and upper Congaree rivers immediately downstream of the Project. Implemented during the 2007 migratory season, the study includes gillnet sampling for adult and juvenile sturgeon, as well as D-net sample for eggs and larvae, at four downstream locations: two in the lower Saluda and two in the upper Congaree (immediately upstream and downstream of the Granby Lock and Dam). Approximately 400 hours of gillnetting during the 2007 season resulted in no captures of adult or juvenile sturgeon; likewise, no eggs or larval sturgeon were captured during the sampling period (Kleinschmidt, 2007). Although additional sampling may be warranted, these data suggest that shortnose sturgeon are absent from areas immediately downstream of the Saluda Hydro Project or are present in extremely low numbers. These findings are consistent with preliminary results of telemetry studies being conducted by the SCDNR, which found that none of the Lake Marion sturgeon implanted with sonic transmitter were detected in the LSR despite the presence of a receiver array (J. Gibbons, SCDNR, Pers. Comm.).

Determination of Effect

Due to the lack of occurrence of shortnose sturgeon in the lower Saluda River Downstream of Saluda Hydro, continued operation of the Project is likely to result in No Effect on this species.

2.5 Robust Redhorse Sucker

The robust redhorse is a large, heavy-bodied sucker which was presumed extinct until being "rediscovered" during the initial stages of relicensing at Georgia Power's Sinclair Hydroelectric Project (FERC No. 1951), fisheries scientists knew little about its life history and habitat requirements. As a result, Georgia Power Company, along with state and federal resource agencies, other hydropower interests and the Georgia Wildlife Federation, formed the Robust Redhorse Conservation Committee (RRCC) in 1995 to guide recovery efforts for the species in lieu of listing under the Endangered Species Act (ESA). Subsequent research has produced valuable information about robust redhorse and its habitat requirements. However, much research is still needed as little is known about the habitat preferences of juvenile robust redhorse.

Based on recent studies, it appears that adult robust redhorse typically inhabit areas of the river where the current is moderately swift. Preferred habitat is riffle areas or in/near outside bends where depths are greater and accumulations of logs and other woody debris are present (Evans, 1997). Spawning typically occurs at water temperatures from 18 – 24° C, usually over gravel substrate in deep and shallow water (Hendricks, 1998).

Status in the Project Area

There are no known collections of robust redhorse from the lower Saluda River. Juvenile robust redhorse have been stocked by the SCDNR in the adjacent Broad River Basin below the Neal Shoals dam and below the Parr Shoals dam. In addition to stocking in the Broad River, juvenile robust redhorse have also been stocked by SCDNR in the Wateree River in the Santee Basin (SCDNR, 2005).

Determination of Effect

Due to lack of occurrence of this species in the Project area, continued operation of the Saluda Hydro Project is likely to result in No Effect on this species.

2.6 Saluda Crayfish

The Saluda crayfish is a terrestrial burrowing crayfish of the genus *Distocambarus* and is endemic to South Carolina (Eversole, 2007). Although knowledge of its habitat requirements is limited, the Saluda crayfish typically has been found in poorly drained areas where the ground is saturated during the rainy season (November – March) (Eversole, 2007, Hobbs and Carlson, 1985). Saluda crayfish have been documented from a range of site types including low, moist woodlands; a machine-maintained powerline; and a manicured lawn. Sites are generally isolated from floodplains and streams, although some have been found in low moist areas near the headwaters of streams (colluvial valleys). Analyses performed by Eversole (Welch and Eversole, 2002) found a close association between occurrence of Saluda Crayfish and the presence of a perched water-table. Soils found in association with Saluda crayfish burrows include Chewacla, Worsham, Toccoa-Cartecay, Enon, and Sedgefield (Eversole, 2007).

Status in the Project Area

Currently, the Saluda crayfish is known from only 14 sites, all of which are located in Newberry County (Eversole, 2007). The known range of the species encompasses portions of the Tyger, Enoree, Lower Broad and Saluda River Basins. The closest confirmed Saluda crayfish site to the Project area (Georges Loop) is approximately 1.2 miles from the Project boundary in a wooded site at the headwaters of a small tributary to Beaverdam Creek (approximately 0.3 miles south of the State Secondary Road 83 crossing at Beaverdam Creek) (Eversole, 2007). Recent surveys aimed at expanding the range further into the Saluda Basin were not successful (Eversole, 2007).

Determination of Effect

As previously noted, Saluda crayfish are generally found on moist, isolated sites and are not typically associated with floodplains or streams. This suggests that the

species is unlikely to occur in areas directly adjacent to Lake Murray and thus would not be affected by continued Project operations.

2.7 Carolina Heelsplitter

The Carolina heelsplitter is the only South Carolina freshwater mussel currently listed as federally endangered (Price, 2005). Although it was once found in large rivers and streams, the Carolina heelsplitter is now restricted to cool, clean, shallow, heavily shaded streams of moderate gradient. Stable streambanks and channels, with pool, riffle and run sequences, little or no fine sediment, and periodic natural flooding, appear to be required for the Carolina heelsplitter (USFWS, 2002).

Status in the Project Area

A freshwater mussel survey of Lake Murray, its tributaries, and the lower Saluda and upper Congaree rivers was conducted during summer 2006 in support the Saluda Hydro Project relicensing (Alderman, 2006). The survey found 15 species of native freshwater mussels within the study area; however, Carolina heelsplitter was not among the species found. A separate survey conducted in fall 2006 in support of a South Carolina Department of Transportation project found Carolina heelsplitter in Clouds Creek, approximately five miles upstream of Lake Murray (J. Alderman, Pers. Comm.).

Determination of Effect

Since Carolina heelsplitter has not been documented in the Project area, continued operation of the Project is expected to result in No Effect on the species.

2.8 Saluda Darter

Saluda darter was first described as a separate species in 1935 (Hubbs and Cannon, as cited in Rankin and Bettinger, 2005). However, after considerable debate through the years regarding its taxonomic status, Saluda darter is currently considered conspecific with the Carolina darter (*Etheostoma collis*) (Jenkins and Burkhead, 1994;

Robins et al, 1991; Rohde et al., 1994; Nelson et al., 2004, as cited in Rankin and Bettinger 2005). The Carolina (Saluda) darter is generally thought to inhabit sluggish to calm areas in clear to slightly turbid small streams with a substrate of mud, sand, gravel and/or bedrock; however, in Wateree Creek, a large South Carolina stream, the Carolina (Saluda) darter has also been found in moderate gradient among coble and leaf packs (Rankin and Bettinger 2005).

Status in the Project Area

The Carolina (Saluda) darter has been collected from several Saluda River Basin tributaries upstream of Lake Murray, including Richland, Red Bank, Indian, Rocky and Mills creeks (H. Beard, SCDNR, unpublished data). However, due to this species' intolerance of impounded conditions, it would not be expected to occur within the influence of the Lake Murray pool. Sampling efforts by SCDNR in Kinley, Rawls, and Twelvemile Creek, tributaries to the lower Saluda River downstream of the Project, have failed to document this species (H. Beard, SCDNR, Pers. Comm.). Likewise, the species has not been collected from the lower Saluda River mainstem, although SCDNR staff have expressed that the gear used for period fish community sampling (boat electrofishing) may not be suitable for detecting darter species (H. Beard, SCDNR, Pers. Comm.).

Determination of Effect

Best available data suggest that the Saluda (Carolina) darter may not occur in the Saluda Project vicinity; therefore continued operation of the Project is expected to have No Effect on the species.

2.9 Canby's Dropwort

Canby's dropwort is a perennial plant that grows in coastal plain habitats including wet meadows, wet pineland savannas, ditches, sloughs, and around the edges of Cypress-pine ponds (USFWS, 1990a). The healthiest populations seem to occur in open bays or ponds which are wet most of the year and have little or no canopy cover. Ideal

soils for Canby's dropwort have a medium to high organic content and a high water table. They are also acidic, deep, and poorly drained.

Status in the Project Area

Canby's dropwort is a coastal plain species and thus would not be expected to occur in the Project area.

Determination of Effect

Because Canby's dropwort is not expected to occur in the Project area, continued operation of the Project would likely result in No Effect on the species.

2.10 Georgia Aster

Georgia aster is a relict species of post oak savanna/prairie communities that existed in the southeast prior to widespread fire suppression and extirpation of large native grazing animals (USFWS, 2001). Typical habitat consists of dry oak-pine flatwoods and uplands in the piedmont of North Carolina, South Carolina, Georgia, and Alabama. Georgia aster occupies a variety of dry, upland habitats. The primary controlling factor appears to be the availability of light. The species is a good competitor with other early successional species, but tends to decline when shaded by woody species. Populations can persist for some undetermined length of time in the shade, but these rarely flower, and reproduce only by rhizomatous expansion. Soils vary from sand to heavy clay, with pH ranging from 4.4 to 6.8 (USFWS, 2001).

Status in the Project Area

There are no populations of Georgia aster known from the Saluda Project area. However, consultation with SCDNR Heritage Staff revealed that some potential exists for this species to occur in frequently disturbed sites, such as transmission line rights-of-way and frequently mowed road shoulders (B. Pittman, SCDNR, Pers.Comm.).

Determination of Effect

Populations of Georgia aster potentially inhabiting the Saluda Project area could be affected by use of herbicides during roadside and transmission line right-of-way maintenance. Routine mowing of these areas would not be expected to result in negative effects, as mowing is generally thought to benefit this species by removing woody competitors (USFWS, 2001).

2.11 Little Amphianthus

Little amphianthus is a rooted aquatic plant restricted to eroded depressions on flat-to-doming granitic (either granite or granite-gneiss) outcrops (USFWS, 1993). These outcrops are similar in appearance, but may differ geologically as igneous, quartzitic, gneissic, or porphyritic granite. These endemics typically occur in shallow flat-bottomed pools found on the crest and flattened slopes of unquarried outcrops. These pools range in size from 0.3 square meters to 10 square meters; the vast majority of these pools range from 0.5 to 1 square meter. These pools retain water for several weeks following heavy rains and completely dry out with summer droughts. They are usually several meters in diameter and are circular or irregularly-shaped due to the coalescence of adjacent pools. This species is typically found in association with two other granite outcrop species: black-spored quillwort (*Isoetes melanospora*) and mat-forming quillwort (*Isoetes tegetiformans*), all of which are restricted to the Piedmont physiographic province of the southeastern U.S. (USFWS, 1993).

Status in the Project Area

There are no populations of this species known from the Saluda Project area. Further, consultation with SCDNR Heritage Program staff confirmed that occurrence of this species in the Piedmont of South Carolina is restricted to eroded pools on flat or domed granitic outcrops, and that suitable habitat for the species likely does not occur in the Project vicinity (B. Pittman, SCDNR, Pers. Comm.).

Determination of Effect

Continued operation of the Saluda Project is expected to result in No Effect on this species due to lack of occurrence in the Project area.

2.12 Piedmont Bishop-Weed

Piedmont bishop-weed (also know as harperella) is a slender, erect annual herb (to 47 in. in height) with hollow quill-shaped leaves and clusters of small white flowers that bloom in July and August (USFWS, 1990b). It typically occurs in two habitat types: (1) rocky or gravel shoals and margins of clear, swift-flowing stream sections; and (2) edges of intermittent pineland ponds in the coastal plain. In both habitats, occurrence is limited to a narrow range of water depths, as the species is intolerant of both dry conditions and deeper water. In addition, harperella appears to be particularly dependant on moderately intensive spring floods for germination, seed dispersal, and control of competing species. It is readily eliminated from its habitat by alterations of the water regime, which result from impoundments, water withdrawal, and drainage, or deepening of ponds. Other factors such as siltation, pollution, and shoreline development have also been cited as threats to harperella populations (USFWS, 1990b).

Status in the Project Area

Potential habitat for Piedmont bishop-weed is restricted to gravel shoal areas of the lower Saluda River; however, numerous aquatic vegetation surveys conducted on the lower Saluda in recent decades have failed to document the species. Although aimed at documenting the extent of invasive aquatic species in the river, these surveys would have documented Piedmont bishop-weed, if it were present (C. Aulbach, South Carolina Botanical Services, Pers. Comm.).

Determination of Effect

Continued operation of the Saluda Project is expected to result in No Effect on this species due to lack of occurrence in the Project area.

2.13 Rough-Leaved Loosestrife

This species generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil) on moist to seasonally saturated sands and on shallow organic soils overlaying sand (USFWS, 1995). Rough-leaf loosestrife has also been found on deep peat in the low shrub community of large Carolina bays (shallow, elliptical, poorly drained depressions of unknown origin). The grass-shrub ecotone, where rough-leaf loosestrife is found, is fire-maintained, as are the adjacent plant communities (longleaf pine - scrub oak, savanna, flatwoods, and pocosin). Suppression of naturally-occurring fire in these ecotones results in shrubs increasing in density and height and expanding to eliminate the open edges required by this plant.

Status in the Project Area

The pine pocosin and Carolina bay environments required by this species do not occur in the Piedmont; therefore, rough-leaved loosestrife is extremely unlikely to occur in the Saluda Project vicinity.

Determination of Effect

Continued operation of the Saluda Project is expected to result in No Effect on this species due to lack of occurrence in the Project area.

2.14 Schweinitz's Sunflower

It is believed that this species formerly occupied prairie like habitats or Post Oak - Blackjack Oak savannas that were maintained by fire (USFWS, 1994). Current habitats include roadsides, power line clearings, old pastures, woodland openings and other sunny or semi-sunny situations. Schweinitz's sunflower is known from a variety of soil types but is generally found growing on shallow, poor, clayey and/or rocky soils, especially those derived from mafic rocks. In the few sites where Schweinitz's sunflower occurs in

relatively natural vegetation, the natural community is considered a Xeric Hardpan Forest.

Status in the Project Area

There are no populations of Schweinitz's sunflower known from the Saluda Project area. Further, consultation with SCDNR Heritage Program staff revealed that suitable habitat for the species likely does not occur in the Project vicinity (B. Pittman, SCDNR, Pers. Comm.).

Determination of Effect

Continued operation of the Saluda Project is expected to result in No Effect on this species due to lack of occurrence in the Project area.

2.15 Rocky Shoals Spider Lily

Rocky shoals spider lily (RSSL), also referred to as Cahaba lily, is a perennial that typically inhabits large streams and rivers at or above the fall line. These areas usually consist of rocky shoals and bedrock outcrops, substrates which provide anchor points for the RSSL's roots and bulbs (Patrick et al., 1995). RSSL grows best in constantly flowing water with relatively low sediment loads and water depths (to bulb) of 4 – 12 inches (Aulbach-Smith, 1998).

Status in the Project Area

Personnel for the USFWS, SCDNR, and other member of the RT&E TWC surveyed the lower Saluda River downstream of the Project for presence of rocky shoals spider lily (RSSL) on May 30th, 2006 (Kleinschmidt, 2006). Two suspected RSSL plants were observed in the Ocean Boulevard Rapid area of the lower Saluda, but were not in bloom and appeared stunted compared to RSSL plants observed farther downstream in the confluence of the Saluda and Broad rivers.

Determination of Effect

No viable populations of RSSL were documented during the May 2006 survey; therefore continued operation of the Project is expected to have No Effect on the species.

2.16 Smooth Coneflower

Smooth coneflower is typically found in open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium and calcium rich soils associated with amphibolite, dolomite or limestone (in Virginia), gabbro (in North Carolina and Virginia), diabase (in North Carolina and South Carolina), and marble (in South Carolina and Georgia) (USFWS, 1995). Smooth coneflower occurs in plant communities that have been described as xeric hardpan forests, diabase glades or dolomite woodlands. Optimal sites are characterized by abundant sunlight and little competition in the herbaceous layer. Natural fires, as well as large herbivores, historically influenced the vegetation in this species' range. Many of the herbs associated with smooth coneflower are also sun-loving species that depend on periodic disturbances to reduce the shade and competition of woody plants.

Status in the Project Area

There are no populations of smooth coneflower known from the Saluda Project area. Further, the diabase glade habitat required by this species is not known to occur in areas around Lake Murray or in the lower Saluda River. Consultation with SCDNR Heritage Program staff confirmed that suitable habitat for smooth coneflower is unlikely to occur in the areas around Lake Murray or the lower Saluda River (B. Pittman, SCDNR, Pers. Comm.).

Determination of Effect

Continued operation of the Saluda Project is expected to result in No Effect on this species due to lack of occurrence in the Project area.

3.0 LITERATURE CITED

Alderman, J.M. 2006. Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, And Selected Tributaries. Prepared for Kleinschmidt Associates. October 31, 2006. 166 pp.

Aulbach-Smith, Cynthia. 1998. *Hymenocallis coronaria*, The rocky shoals spider lily Broad River at Lockhart, SC. Botanical Services of South Carolina, Lexington, South Carolina. 99 pp.

Collins, M. R., D. Cooke, B. Post, J. Crane, J. Bulak, T. I. J. Smith, T. W. Greig, J. M. Quattro. 2003. *Shortnose Sturgeon in the Santee-Cooper Reservoir System, South Carolina*. Transactions of the American Fisheries Society 132:1244-1250.

DeGraff, R.M., and D.D. Rudis. 1986. New England Wildlife: habitat, natural history, and distribution. Gen. Tech. Report NE-108. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

Duke Power. 2004. *Catawba – Wateree Hydro Project Study Plan: Diadromous Fish Studies.* Available at http://www.dukepower.com/community/lakes/cw/library/plans/aquatics3.pdf Last accessed August 31, 2005.

Evans, J.W. 1997. Developing stakeholder partnerships for the management of imperiled species: a case study. Waterpower '97, Proceeding of the International Conference on Hydropower. pp. 490-499.

Eversole, A.G., and Welch S.M. *Distocambarus youngineri*: White Paper. Prepared for Kleinschmidt Associates, West Columbia, SC. December 1, 2006. 17 pp.

Hall, J. Wayne, T. I. J. Smith, and S. D. Lamprecht. 1991. Movements and habitats of shortnose sturgeon (*Acipenser brevirostrum*) in the Savannah River. Copeia 1991(3): 695 – 702.

Hendricks, A.S. 1998. The conservation and restoration of the robust redhorse (*Moxostoma robustum*) Volume 1. Georgia Power Company, Environmental Laboratory, Smyrna, Georgia. 44 pp.

Hobbs, H. H., Jr. and P. H. Carlson. 1985. A new member of the genus *Distocambarus* (Decapoda: Cambaridae) from the Saluda basin, South Carolina. Proceedings of the Biological Society of Washington 98: 81 – 89.

Jackson, J. A. 1994. Red-cockaded woodpecker (*Picoides borealis*). *In* A. Poole and F. Gill, eds. The birds of North America, No. 85. Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington D.C.

Kleinschmidt Associates. 2004. Wood Stork Aerial Survey Trip Report – Lake Murray and Saluda River. Prepared for South Carolina Electric & Gas Co. August 27, 2004. 5 pp.

Kleinschmidt Associates. 2005. Lake Murray Wood Stork Surveys: 2005 Summary Report. Prepared for South Carolina Electric & Gas Co. December 2004. 24 pp.

Kleinschmidt Associates. 2006a. Saluda Project Relicense: Shortnose Sturgeon Study Plan. Prepared for South Carolina Electric & Gas Co. January 2006. 9 pp.

Kleinschmidt Associates. 2006b. Saluda Project Relicense: Lower Saluda River Rocky Shoals Spider Lily Memorandum. Prepared for South Carolina Electric & Gas Co. July 20, 2006. 1 pp.

Kleinschmidt Associates. 2007a. Lake Murray Wood Stork Surveys: 2006 Summary Report. Prepared for South Carolina Electric & Gas Co. March 2007. 32 pp.

Kleinschmidt Associates. 2007b. Lower Saluda River and Upper Congaree River Shortnose Sturgeon Sampling: 2006 Final Report. Lake Murray Wood Stork Surveys: 2006 Summary Report. Prepared for South Carolina Electric & Gas Co.

National Marine Fisheries Service (NMFS). 1998. Recovery plan for the shortnose sturgeon (*Acipenser brevisrostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the NMFS, Silver Spring, Maryland. 104 pp.

Newcomb, T.J. and J.S. Fuller. 2001. Anadromous and Catadromous Fish Survey of Santee/Cooper Basin in North Carolina and South Carolina. Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA. Final Report, Prepared for Duke Power, June 25, 2001. 25 pp.

Patrick, Thomas S., J. R. Allison, and G. A. Krakow. 1995. Protected plants of Georgia. Georgia Department of Natural Resources, Social Circle, GA. 246 pp.

Price, J. 2005. South Carolina Comprehensive Wildlife Conservation Strategy Species Accounts: Carolina Heelsplitter. Available online at www.dnr.sc.gov/cwcs. Accessed September 20, 2007.

Rankin, D. and J. Bettinger. 2005. South Carolina Comprehensive Wildlife Conservation Strategy Species Accounts: Saluda Darter, Christmas Darter, Redeye Bass. Available online at www.dnr.sc.gov/cwcs. Accessed September 20, 2007.

Smith, Theodore I. J., M. R. Collins, and E. Kennedy. 1993. Identification of critical habitat requirements of shortnose sturgeon in South Carolina. South Carolina Department of Natural Resources, Charleston, South Carolina. 102 pp.

South Carolina Department of Natural Resources (SCDNR). 2005. State DNR Stocks Robust Redhorse, 'Fish Lost To Science,' In S.C. Waters. SCDNR Press Release #05-237, November 7, 2005.

United States Fish and Wildlife Service (USFWS). 1990b. Harperella (*Ptilimnium nodosum*) Recovery Plan. Newton Corner, Massachusetts. 60 pp.

United States Fish and Wildlife Service (USFWS). 1997. Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork. U.S. Fish and Wildlife Service, Atlanta, Georgia. 41 pp.

United States Fish and Wildlife Service. 1990a. Canby's Dropwort Recovery Plan. Atlanta, Georgia. 25 pp.

United States Fish and Wildlife Service. 1993. Recovery Plan for Three Granite Outcrop Plant Species. Jackson, Mississippi. 41 pp.

United States Fish and Wildlife Service. 1994. Schweinitz's Sunflower Recovery Plan. Atlanta, GA. 28 pp.

United States Fish and Wildlife Service. 1995. Rough-leaved Loosestrife Recovery Plan. Atlanta, GA. 32 pp.

United States Fish and Wildlife Service. 1995. Smooth Coneflower Recovery Plan. Atlanta, GA. 31 pp.

United States Fish and Wildlife Service. 1996. Carolina Heelsplitter Recovery Plan. U.S. Fish and Wildlife Service, Atlanta

United States Fish and Wildlife Service. 2001. Candidate listing and priority assignment form: Georgia aster (*Aster georgianus*). Asheville, NC. 7 pp.

United States Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp.

Welch, S. M. and A. G. Eversole. 2002. A GIS based model of *Distocambarus crockeri* and *D. youngineri.* Completion Report, South Carolina Department of Natural Resources, Columbia, South Carolina.

Welch, S.M. 2000. *A Report on the Historical Inland Migrations of Several Diadromous Fishes in South Carolina Rivers.* Department of Aquaculture, Fisheries and Wildlife, Clemson University, Clemson, SC. Report prepared for Mr. Douglas W. Cook, South Carolina Department of Natural Resources. December 4, 2000. 19 pp.

APPENDIX A

CORRESPONDENCE

United States Fish & Wildlife Service Letter Commenting on Initial Consultation Document and Requesting Rare, Threatened and Endangered Species Assessment

ATTACHMENT D

FISH AND WILDLIFE ISSUES MATRIX

Fish and Wildlife RCG
Issues Matrix

Issue/Request	*Requested by:*	*TWC Assignment/ Category Assignment**	*Description*	*Status*
Mussel Surveys	CCL/American Rivers, SCDNR, LSSRAC, USFWS	Mussels/Benthic Macroinverts TWC	The present status of mussels in the project area should be evaluated, their habitat needs assessed, and any project impacts on habitat be identified. CCL requests an evaluation of the cumulative impact analysis that the Project has on mussel stocks in the Santee Basin	**Mussel field work conducted summer 2006; final report issued 10/31/2006.**
Instream Flow Studies	CCL/American Rivers, City of Columbia Parks and Recreatioin, SCDNR, LSSRAC, NMFS, TU, USFWS	Instream Flows/Aquatic Habitat TWC	Requested for the Saluda River and the Confluence area. An assessment on how Project operations affect stream flows, and which flow regimens would best meeting biota needs. IFIM requested by SCDNR in lieu of implementing an instantaneous flow of at least 470 cfs for navigation, 590 July - Nov, 1170 Jan-April, and 880 May, June and Dec.	**Field work conducted summer 2007; draft report expected Nov 2007. Workshop scheduled Dec 2007.**
Diadromous Fish Studies	CCL/American Rivers, SCDNR, LSSRAC, National Marine Fisheries Service, USFWS	Diadromous Fish TWC	Study requests from the CCL/American Rivers focused on a more in depth analysis of habitat conditions, feasibility of hatchery operations for diadromous fish, impacts analysis of the Project on diad. fish stocks of the Santee-Cooper Basin, the feasibility and costs of fish passage at the Project. SCDNR requests that spawning and nursery habitat for diadromous fish species in the river and lake should be identified and quantified	**Shad and herring studies completed for 2005 and 2006 - final reports issued. Eel trapping conducted during 2005 and 2006. Eel ramps in place through Oct 2007. Shortnose sturgeon - final report issued Sept of 2007.**
Benthic Macroinvertebrate Study	SCDNR, LSSRAC, NMFS, TU, USFWS	Mussels/Benthic Macroinverts TWC	To determine if invertebrate fauna have increased in either number or species diversity as a result of turbine venting. As well as how far downstream they are impacted.	**Field work conducted fall 2006; final report 3/7/07.**
Fish Community Surveys	USFWS		It was requested that these surveys be performed and include small non-game species in the Saluda River above and below the reservoir as well as in Lake Murray, to supplement existing fish community data and/or replace dated information. Specific sampling focused on determining presence or absence of the rare robust redhorse sucker, Carolina sucker, and the highfin carpsucker should be conducted in the lower Saluda River	**Determined that sufficient information exists - see February 22, 2006 meeting notes.**
Migratory Bird Survey	USFWS	Terrestrial Resources TWC	This Survey would evaluate the effects of the Project on migratory bird use at Lake Murray and the Saluda River and riparian ecosystems. Surveys of migratory birds and their habitats to provide baseline information on populations. Aerial surveys for potential roosting, nesting, and foraging sites for the federally endangered woodsotrk should also continue	**Species list was compiled from existing data and distributed to TWC.**
Comprehensive Habitat Assessment	NMFS, USFWS, SCDNR	Instream Flows/Aquatic Habitat TWC	To provide quantitative and qualitative data in GIS format of available and potential spawning, rearing, and foraging habitats (i.e., riffles, shoals, open water, shallow coves, littoral zones) for diadromous and resident fishes in Lake Murray, the Saluda River and its major tributaries, and the Lower Saluda River below the Project. SCDNR requests a summary of water level fluctuations for the months of March, April and May to assess the possible enhancement of spawning habitat	**Draft maps being compiled based on existing mesohabitat (LSR) and ESA data (L. Murray).**
Fish Entrainment Desktop Study	SCDNR, NMFS, USFWS	Fish Entrainment TWC	This study would include conducting a desktop study of potential entrainment using previous studies conducted at other similar facilities. The objectives of the study should be to (1) quantify the numbers and sizes of fish entrained, by species, (2) estimate mortality rates associated by species, and (3) provide recommendations for project design and operation that can reasonably be made to prevent or minimize fish entrainment and associated injury/mortality	**Final report issued in March 2007.**

Fish and Wildlife RCG
Issues Matrix

Self Sustaining Trout Fishery Study	TU	Instream Flows/Aquatic Habitat TWC	The purpose of this study should be to determine the factors needed for a self sustaining trout fishery that can reproduce and thrive year round, and how the operation can be modified to meet the habitat needs. Dissolved oxygen, flows, spawning and rearing habitat, the aquatic food base, especially in the shallow, rocky foraging areas, and actual water chemistry should be key items in such an assessment	**Draft white paper issued and is currently being revised.**
Rare Threatened and Endangered Species Habitat Studies	CCL/American Rivers, SCDNR, LSSRAC, NMFS, USFWS	RT&E Species/Habitat Studies TWC	A study was requested to assess the condition of rare threatened and endangered species in the Project area, as well as how Project operations are affecting these species and how Project operations can be used to protect, restore, or enhance populations. Management plans be developed for species existing in the project area or under the influence of the project. Suggestions include Wood Stork and RSSL Surveys as well as SNS and American eel sampling	**Draft report issued, with final comments due Oct 31, 2007.**
Striped Bass Evaluations	USFWS	Water Quality TWC	This study would involve an evaluation of project operations on the reservoir striped bass population, particularly regarding: (1) the effectiveness of current turbine operations, (2) potential additional enhancements in association with the summer thermocline near the powerhouse; and (3) determine if striped bass migrate upstream of the project within the Saluda River during the spring spawning season, and if and where spawning activities occur.	**Being addressed in Water Quality TWC.**
Sediment Regimen and Sediment Transport Studies	CCL/American Rivers, USFWS	Moved to Instream Flow/Aquatic Habitat group in Fish and Wildlife Group	A request has been made that a study be performed on the sediment regimen in the Project area as well as the Project effects on the sediment regimen of the lower Saluda River. Should include such things as sediment composition, bedload movement, gravel deposition, sediment storage behind dams, and bedload changes below the dam; and project effects on downstream geomorphometry, sediment availability and streambank erosion, and the possible addition of gravel to mitigate for project impacts. Also, the effects of the Project operations on habitat requirements for spawning fishes.	**Major aspects being addressed in IFIM process**
Floodplain Flow Evaluations	CCL/Am Rivers, LSSRAC, NPS	Instream Flow/Aquatic Habitat	A study was requested in order to evaluate the flows necessary for incremental levels of floodplain inundation for the Lower Saluda, Congaree River, and Congaree National Park. It is requested that it include an inventory of floodplain vegetation as well, in order to classify and characterize the vegetative species composition and structure of the floodplain areas within the zone of operational influence of the river reaches.	**NPS is currently developing their own model outside of relicensing. Update is expected in Spring 2008.**
Ecoiogicaily Sustainable Water Management (ESWM)	CCL/Am Rivers, LSSRAC, NPS	Instream Flow/Aquatic Habitat	Described by the National Park Service as a "inclusive, collaborative, and consensus-based process to determine a scientifically based set of river flow prescriptions in order to protect downstream resources while balancing upstream benefits." The NPS notes that they believe this process can be readily adapted to the Saluda Project and have already began gathering information and developing an interactive GIS tool to provide information regarding the effect of various Saluda operational scenarios on the degree of inundation at the Congaree National Park. NPS seeks "partnership" with SCE&G as well as stakeholders in implementing this ESWM process.	**NPS is managing process.**

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
Via Conference Call
April 10, 2007

Final CSB 05-22-07

ATTENDEES:

Dick Christie, SCDNR
Alan Stuart, Kleinschmidt Associates
Milton Quattlebaum, SCANA Services
Jeni Summerlin, Kleinschmidt Associates
Mike Waddell, Trout Unlimited
Gerrit Jobsis, AR/CCL
Shane Boring, Kleinschmidt Associates
Brandon Kulik, Kleinschmidt Associates
Hal Beard, SCDNR

ACTION ITEMS

- Gather and distribute substrate HSC plots and legends from Catawba-Wateree study for brown trout fry/spawning/juveniles to TWC

Dick Christie / Shane Boring

- Finalize HSC curves based on TWC input and incorporate as an appendix to the Saluda IFIM Study Plan

Shane Boring/Brandon Kulik

NEXT MEETING

TBD

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 9:00 AM. Shane noted that, at the January 22nd meeting of the Instream Flow/Aquatic Habitat Technical Working Committee (TWC), the TWC had agreed upon Habitat Suitability Criteria (HSC) for depth and velocity for several target species (smallmouth bass, brown trout, and rainbow trout adults). Shane added that the purpose of today's meeting would be to finalize the HSC selection process by selecting substrate criteria for these species.

Shane enquired as to whether there was any follow-up discussion regarding the depth/velocity criteria selection process or other TWC housekeeping items in need of attention. Hal Beard noted that, at the previous meeting, there was an action item assigned to determine whether HSC curves were available for gizzard shad in riverine systems. Hal added that, after discussing this issue with colleagues at SCDNR, he did not think this species was as much of a priority as he had once thought.

Dick Christie reminded the group that DNR manages the lower Saluda as a put-grow-take trout fishery, and as such, he and other DNR staffers had requested at previous TWC meetings that the habitat modeling for trout focus on adult lifestages (i.e. not include spawning, juvenile, fry). He added that, while DNR certainly welcomes any improvements to water quality or habitat that might benefit these early-lifestages, flow recommendations resulting from the IFIM process should not come at the detriment of providing quality growing conditions for stocked adult and sub-adult trout. Dick added that, while looking at early lifestages in the modeling might be good to have for informational purposes, these lifestages were not within the DNR's management strategy for the lower Saluda. Mike Waddell noted that Trout Unlimited does not agree with DNR's strategy of managing only for adult lifestages.

The group then turned their attention to the memo prepared by Shane Boring and Brandon Kulik (Attachment A), which summarized potential source HSC for substrate from a number of regional studies. After reviewing the source HSC plots for applicability to the lower Saluda, TWC members agreed on substrate HSC for the following species and lifestages:

Species	Life Stage	Curve Source	Modifications
brown trout	adult	Deerfield	Change 'Ledge' to 'Irregular Bedrock' and change SI of this category to 1.0
	juvenile	Deerfield	Change 'Ledge' to 'Irregular Bedrock' and change SI of this category to 1.0
	Fry	Deerfield	Change 'Ledge' to 'Irregular Bedrock'
	Spawning	Deerfield	
rainbow trout	Adult	Deerfield	Change 'Ledge' to 'Irregular Bedrock' and change SI of this category to 1.0; Lower SI for 'Roots, Snags, Undercut banks, Overhead Cover' to 0.2
smallmouth bass	Adult	Deerfield	Change 'Ledge' to 'Irregular Bedrock'
	Juvenile	Deerfield	Change 'Ledge' to 'Irregular Bedrock'
	YOY	Deerfield	Change 'Ledge' to 'Irregular Bedrock'
	spawning	Deerfield	Change 'Ledge' to 'Irregular Bedrock'

The group was not able to reach consensus on an acceptable substrate HSC for rainbow trout juveniles, fry or spawning due to limited source information (i.e., only the Raleigh et al. "Blue Book" value were presented). Mike Waddell, expressed interest in evaluating the curves used in the Catawba-Wateree IFIM Study before making a final selection for these lifestages. Dick Christie noted that these curves were presented in the Catawba-Wateree Final IFIM Report, but added that the legends needed to interpret the plots were not included. Dick agreed to contact the authors regarding the legends. Shane agreed to distribute the curves to the TWC once all of the information is gathered.

The meeting adjourned at approximately 11:00 AM.

Attachment A

Memo Summarizing Potential Source Habitat Suitability Curves for Substrate for Smallmouth Bass and Rainbow and Brown Trout Lifestages

MEMORANDUM

TO: Saluda Hydro: Instream Flow/Aquatic Habitat TWC

FROM: Shane Boring, Brandon Kulik

DATE: March 30, 2007

RE: **INSTREAM FLOW STUDY: HABITAT SUITABILITY CRITERIA**

On January 22nd, 2007, the Instream Flow/Aquatic Habitat Technical Working Committee (TWC) agreed upon Habitat Suitability Criteria (HSC) depth and velocity criteria for target species and lifestages (smallmouth bass, brown trout, and rainbow trout adults, juveniles, young-of-year, and spawning). Criteria from various source studies were evaluated based on transferability to the lower Saluda River (Table 1);

Although depth and velocity HSC were adapted for adult, juvenile, fry/young-of-year, and spawning smallmouth bass, as well as brown and rainbow trout (Table 2), the TWC did not time to completely evaluate substrate suitability. The purpose of this memo is to build upon the decisions made at the January 22nd 2007 TWC meeting by summarizing HSC for substrate and embeddedness for rainbow and brown trout, and smallmouth bass.

Table 1: Summary of Source Studies Evaluated for Depth and Velocity Habitat Suitability Criteria

SPECIES	SOURCE	RIVER	ECO-REGION	PHYSIOGRAPHIC REGION
Smallmouth bass	Leonard *et al*. (1986)	Upper James (VA)	Mid-Atlantic	Appalachian Ridge and Valley
Smallmouth bass	NEP (1990)	Deerfield (MA)	New England	New England Upland
Smallmouth bass	Lockhart IFIM study	Broad (SC)	Southeastern	Piedmont
Smallmouth bass	Groshens and Orth (1994)	N. Anna and Craig Creek	Southeastern Plains	Appalachian Ridge and Valley and Piedmont
Smallmouth bass	Edwards, *et al* (1983)	Generic		
Rainbow trout	KA (2001)	Lackawaxen, (PA)	Mid-Atlantic	Appalachian Plateau
Rainbow trout	NEP (1990)	Deerfield (MA)	New England	New England Upland
Rainbow trout	Raleigh, *et al* (1986)	Generic "Blue Book" data		
Brown trout	KA (2001)	Lackawaxen, (PA)	Mid-Atlantic	Appalachian Plateau

Brown trout	NEP (1990)	Deerfield (MA)	New England	New England Upland
Brown trout	Strakosh, *et al.* 2003	Farmington (CT)	New England	New England Upland
Brown trout	CT DEP	Housatonic (CT)	New England	New England Upland
Brown trout	Raleigh, *et al* (1984)	Generic "Blue Book" data		

Table 2. Summary of Acceptable HSC Curves as Identified By The TWC

Species	Life Stage	Parameter	SI Curve Source
brown trout	adult	Depth	Combination: Housatonic (poor cover), Deerfield
	adult	Velocity	Lackawaxen, w/modifications
brown trout	fry/YOY	Depth	Deerfield
	fry/YOY	Velocity	Deerfield
brown trout	juvenile	Depth	Combination: Deerfield, Raleigh
	juvenile	Velocity	Combination: Lackawaxen, Deerfield
brown trout	spawning	Depth	Raleigh
	spawning	Velocity	Raleigh w/modifications
rainbow trout	adult	Depth	Deerfield
		Velocity	Deerfield (abundant)
rainbow trout	fry/YOY	Depth	Raleigh
		Velocity	Raleigh
rainbow trout	juvenile	Depth	Lackawaxen
		Velocity	Lackawaxen
rainbow trout	spawning	Depth	Raleigh
		Velocity	Raleigh
smallmouth bass	adult	Depth	Combination: Groshens & Orth, Bain
		Velocity	Combination: Groshens & Orth, Deerfield (abundant velocity refuge)
smallmouth bass	juvenile	Depth	Combination: Bain, Deerfield w/modifications
		Velocity	Deerfield (abundant velocity refuge)
smallmouth bass	spawning	Depth	Lockhart
		Velocity	Lockhart
smallmouth bass	YOY	Depth	Combination: Groshens & Orth, Bain
		Velocity	Combination: Deerfield, Bain

SUBSTRATE CRITERIA OPTIONS

Brown Trout

We obtained HSC successfully applied in IFIM studies from the Farmington (CT) (Strakosh, et al. 2003), Deerfield (MA) (NEP, 1990), and Housatonic (CT) (CT DEP) rivers, as well as the generalized "Bluebook" criteria (Raleigh, *et al*., 1986) that have been employed in several regional PHABSIM studies. Appendix A contains graphical representations of substrate criteria for juvenile and adult lifestages. For brown trout juveniles and adults, substrates ranging from gravel/pebble to cobble/small boulder were generally found to be the most suitable, along with undercut banks and vegetation for some studies. The degree of substrate embeddedness is also a sub-criterion.

Rainbow Trout

HSC criteria developed for the Deerfield River (MA) and generalized "Bluebook" criteria (Raleigh, *et al*., 1984) are presented in Appendix B. Although the studies varied in how some substrate sizes were classified, habitat suitability was generally similar between studies, with gravel, cobble and boulder substrates being more suitable than silt, sand and mud. This was particularly true of the early lifestages, i.e. spawning, fry, juvenile. The degree of substrate embeddedness is also a sub-criterion.

Smallmouth Bass

Substrate HSC criteria developed for the Deerfield River (MA), James (VA) (Leonard, et al., 1986) and generalized "Bluebook" criteria (Edwards, *et al*., 1993) are presented in Appendix C. There is relatively good general agreement among all curves relative to substrate and cover suitability, with large cobble/boulder tending to be optimal, and silt/sand/organics being less suitable.

LITERATURE CITED

Edwards, E.A., G. Gebhart, and O.E. Maughan. 1983. Habitat suitability information: smallmouth bass. U.S. Dept. Int., Fish Wildl. Serv. FWS/oES-32/10.36 47 pp.

Connecticut Dept. of Environmental Protection. (unpublished data). Housatonic River IFIM SI criteria. Peter Aarestad, CTDEP, personal communication.

Groshens, T.P. and D.J. and Orth. 1994. Transferability of habitat suitability criteria for smallmouth bass, *Micropterus dolomieu*. Rivers (4)3:194-212

Leonard, P.M., D.J. Orth, and C.J. Goodreau.1986. Development of a method for recommending instream flows for fishes in the upper James River, Virginia. VA poly Inst. and State Univ., Blacksburg, VA. Bull. 152, 109 pp.

New England Power Company. 1990. New England Power Company, Deerfield River Project IFIM Study. Stetson-Harza, Weare, NH.

Newcomb, T.J., S.A. Perry and W.B. Perry. 1995. Comparison of habitat suitability criteria for smallmouth bass (*Micropterus dolomieu*) from three West Virginia rivers. Rivers 5(3):170-183.

Perry, S.A., W.B. Perry, D.L. Graham and N.H. Sagalkin. 1993. Verification and transferability studies for smallmouth bass in West Virginia streams. West Virginia Coop. Fish and Wildl. Res. unit, West Virginia Univ., Morgantown, WV.WVCFRUWRU Cooperative Agreement 14-16-0009-1563. 25 pp. plus appendices.

Raleigh, R.F., L.D. Zuckerman, and P.C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Brown trout, revised. U.S. Fish and Wildl. Serv. FWS/OBS-82(10.124). 65 pp..

Raleigh, R.F., T Hickman, R.C. Solomon and P.C. Nelson. 1984. Habitat suitability information: Rainbow trout. U.S. Fish and Wildl. Serv. FWS/OBS-82/10.60 64 pp.

Strakosh, T.R., R.M. Neumann, and R.A. Jacobsen. 2003. Development and assessment of habitat suitability criteria for adult brown trout in southern New England rivers. Ecology of Freshwater Fish 12:265-274. Blackwell Munksgaards, 2003.

Appendix A
Brown Trout Substrate Habitat Suitability Criteria

Appendix A, Table 1: Substrate Classification Codes - Raleigh

Substrate Codes from Bovee (1982)			
Code	**Description**	**Size (mm)**	**Size (in)**
1	plant/detritus/organic material		
2	mud/soft clay		
3	silt	<0.062	
4	sand	0.062 – 2.0	
5	gravel	2.0 - 64	
6	cobble	64 - 250	
7	boulder	250 – 4000	
8	bedrock	solid	

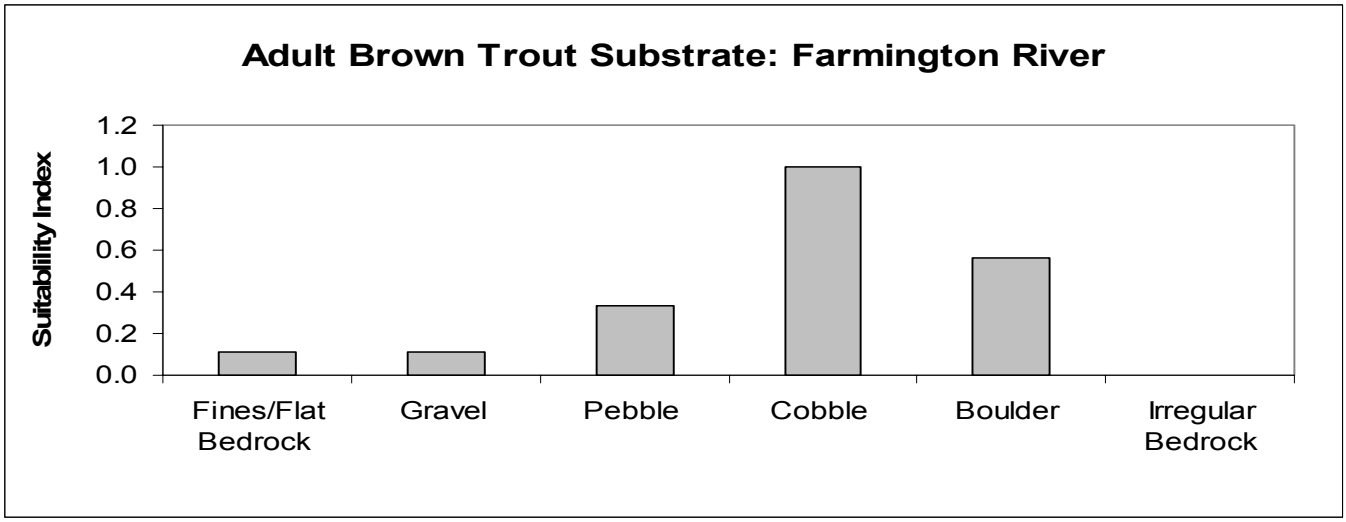
Appendix A, Table 2: Substrate Classification Codes - Deerfield & Housatonic

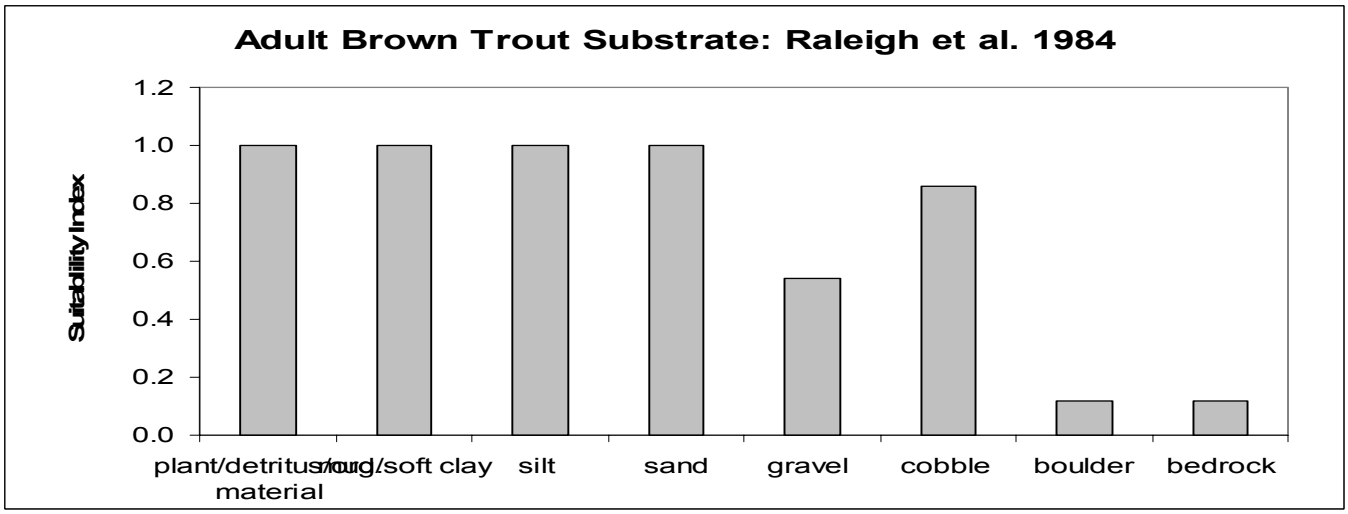
Code	Description	Size (mm)	Size (in)
1	Roots, Snags, Undercut Banks, Overhead Cover		
2	Clay		
3	Silt		
4	Sand		
5	Small Gravel	< 5.1	< 2
6	Gravel	5.1 - 10.2	2-4
7	Cobel	10.2 - 25.4	4 - 10
8	Boulder	25.4 - 61	10 in - 2 ft
9	Boulder	>61	> 2 ft
10	Ledge		
11	Detritus, Vegetation		

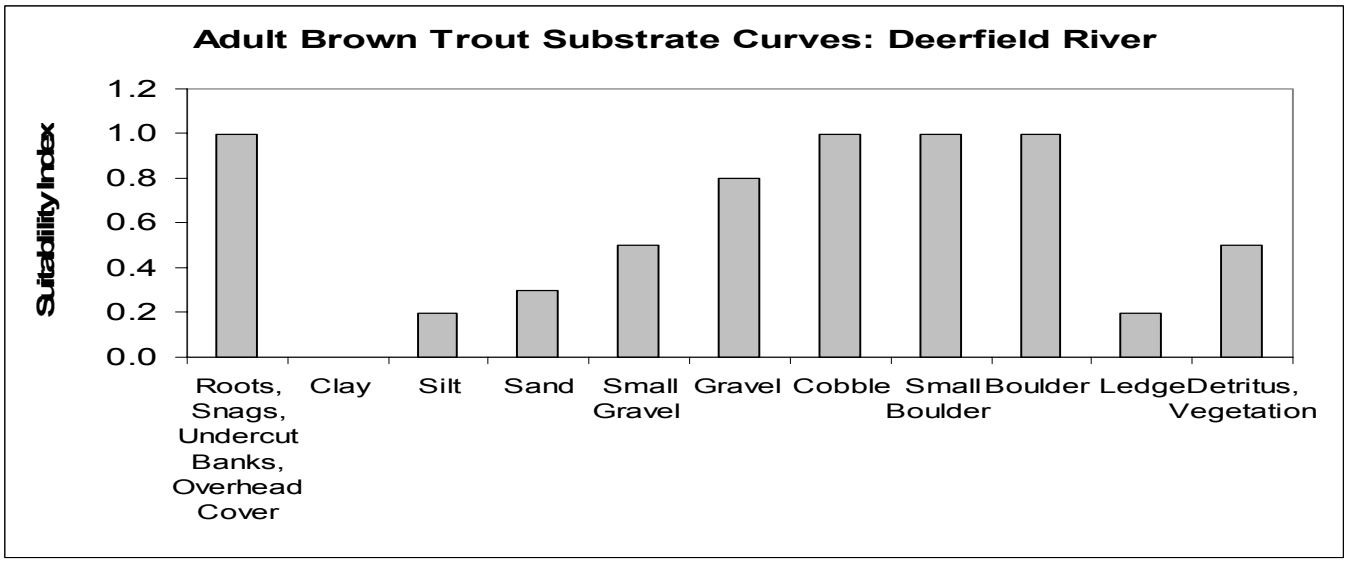
Appendix A, Table 3: Substrate Classification Codes - Farmington

Code	Description	Size (mm)	Size (in)
1	Fines/Flat Bedrock	< 2	< .08
2	Gravel	2 - 16	0.08 - 0.63
3	Pebble	16 - 64	0.63 - 2.52
4	Cobble	64 - 256	2.52 - 10.08
5	Boulder	> 256	> 10.08
6	Irregular Bedrock		

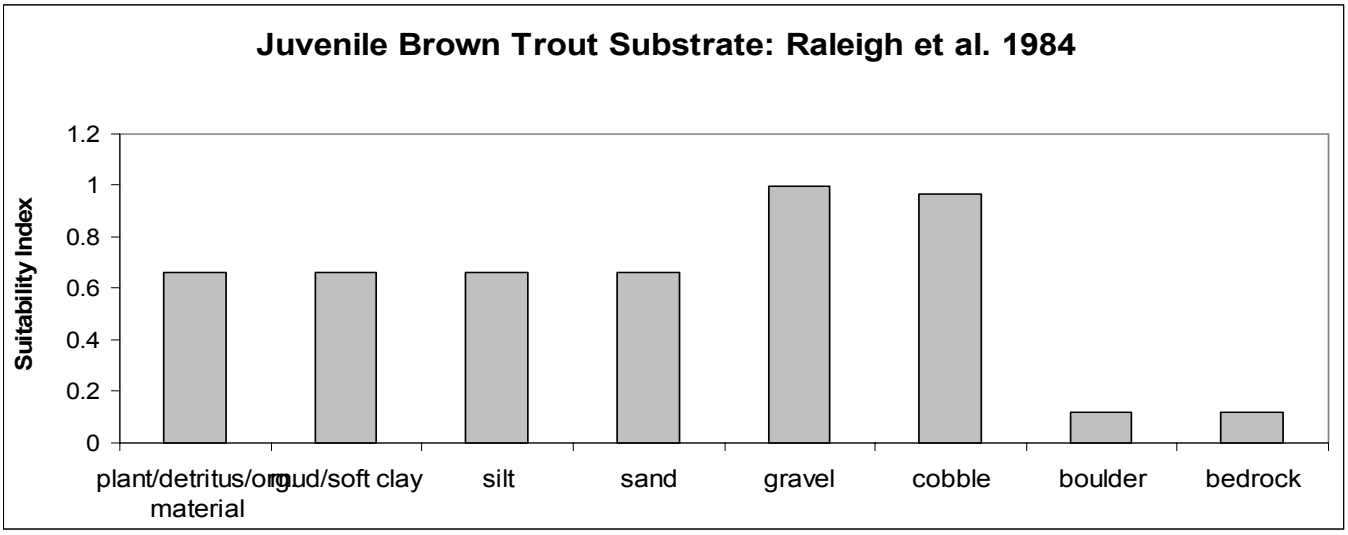
Adult Brown Trout

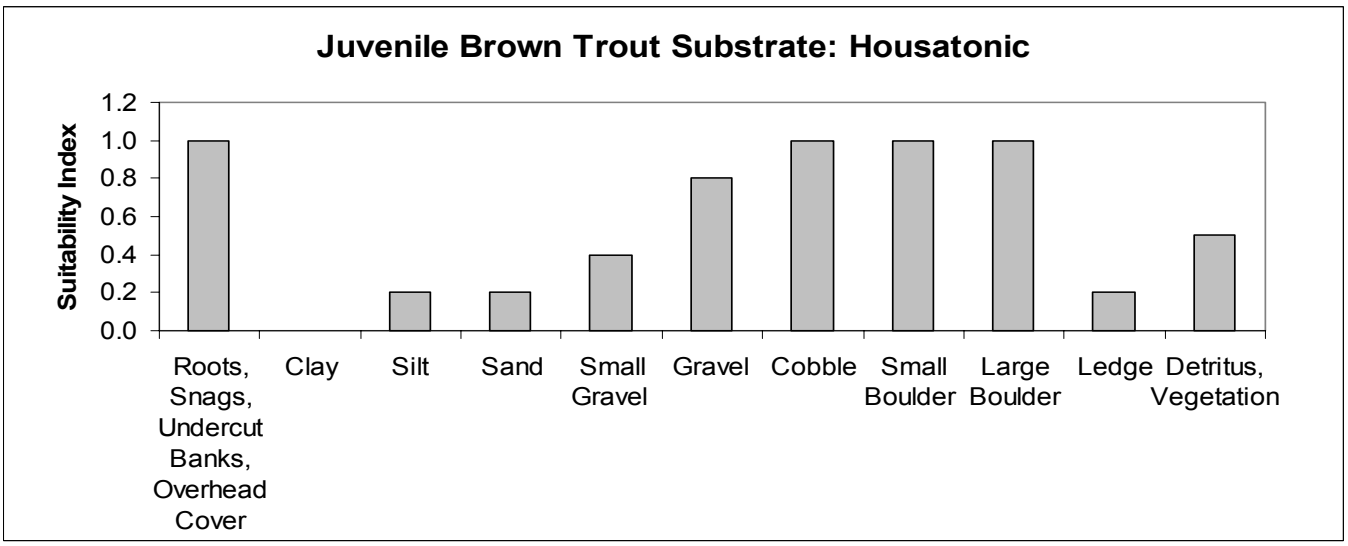


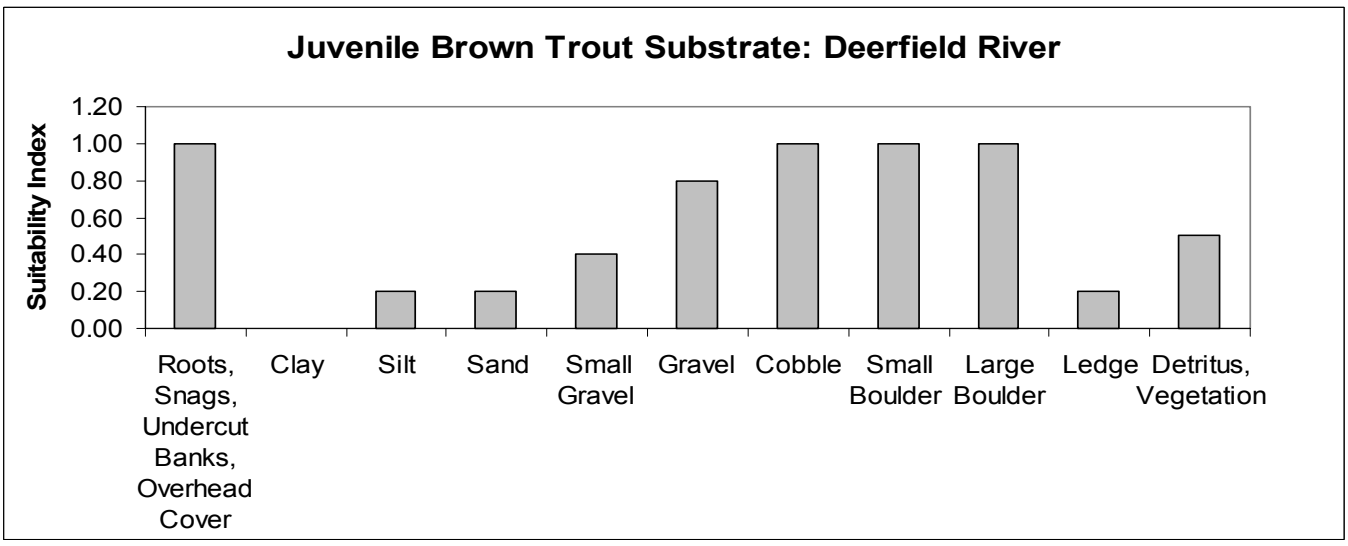




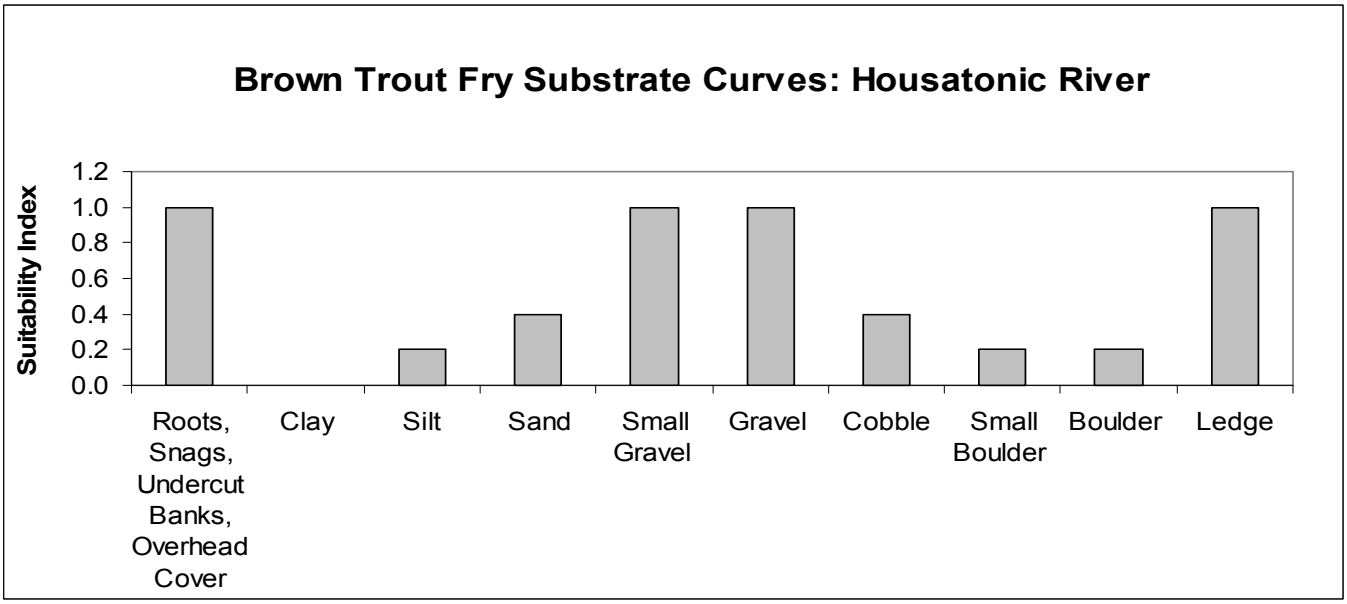
Juvenile Brown Trout

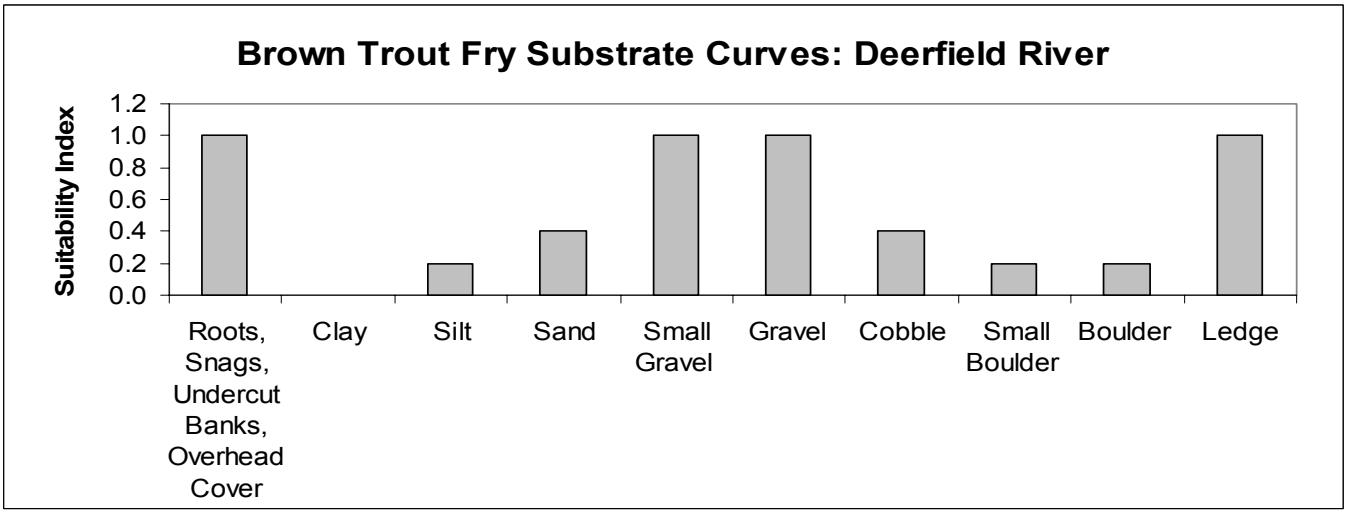


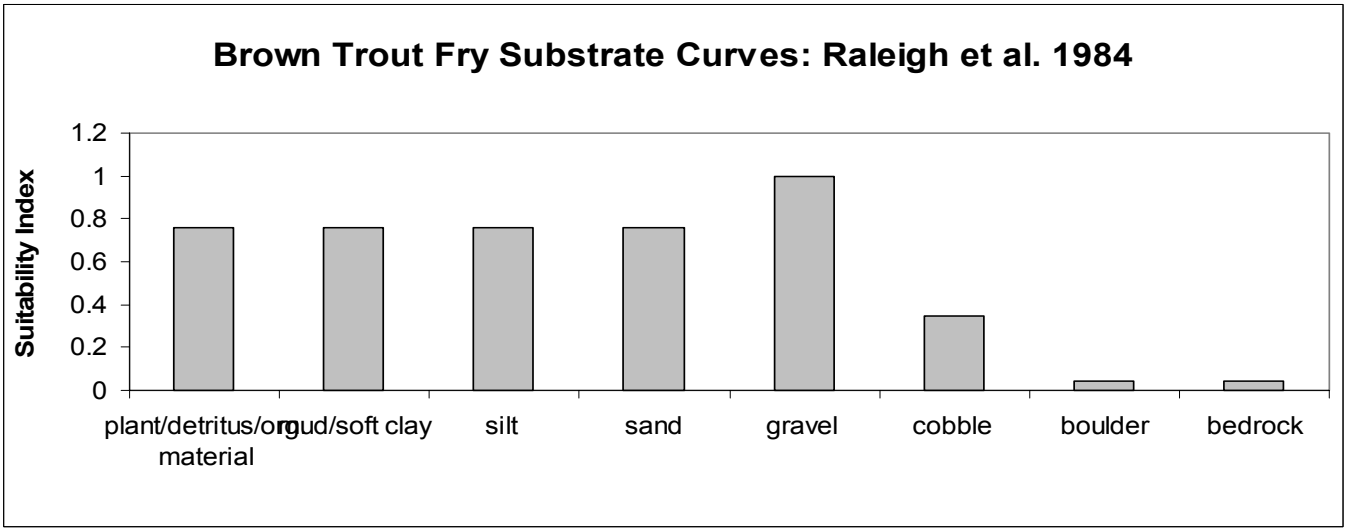




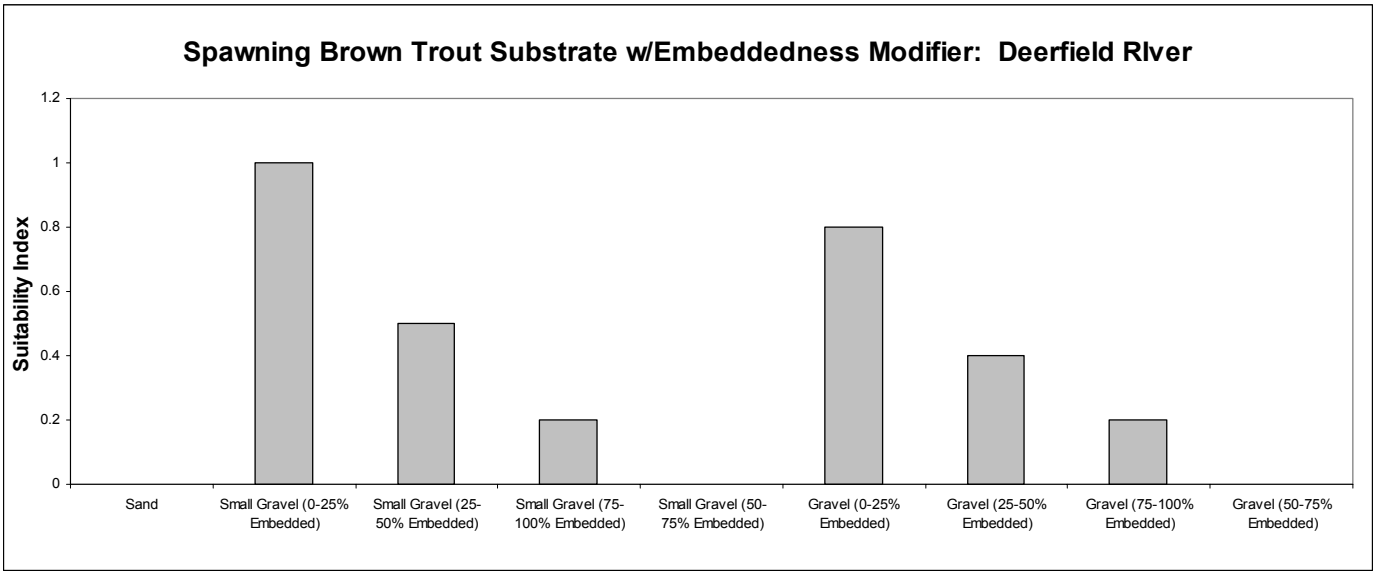
Brown Trout Fry

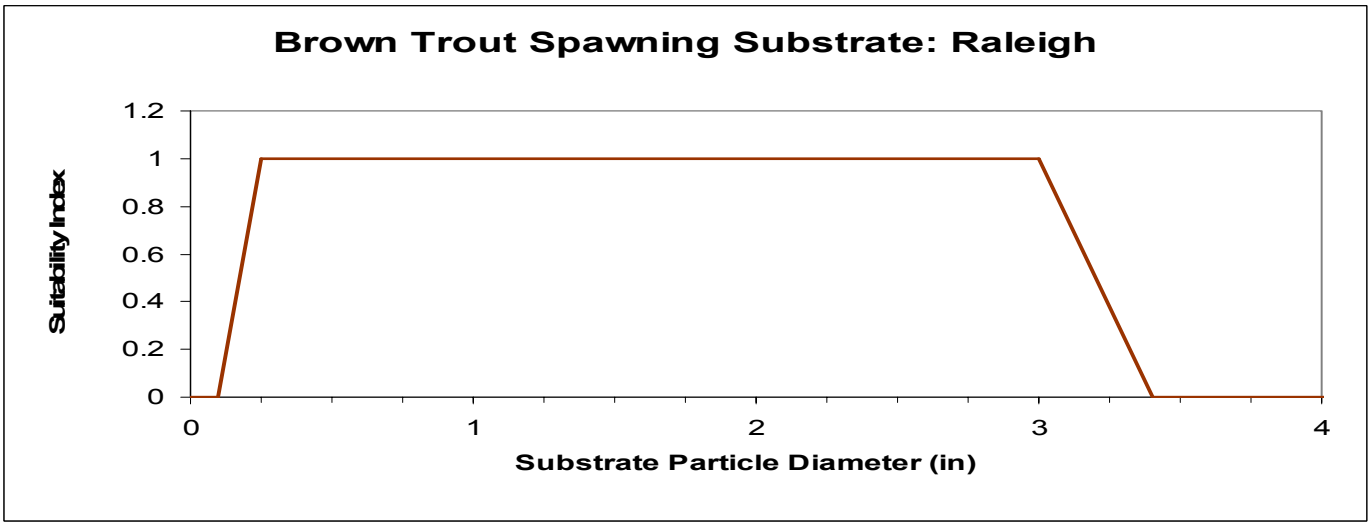






Spawning Brown Trout

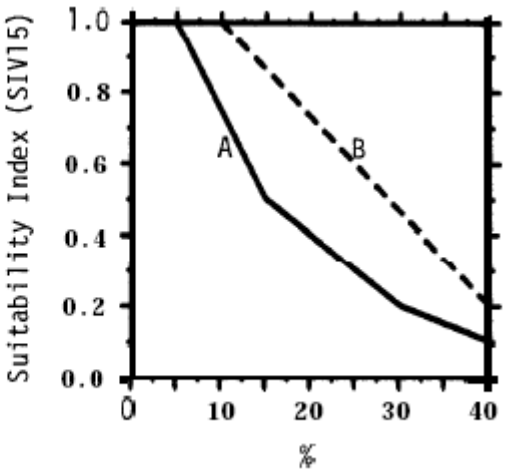




Brown Trout Spawning: Substrate Embeddedness (Raleigh)

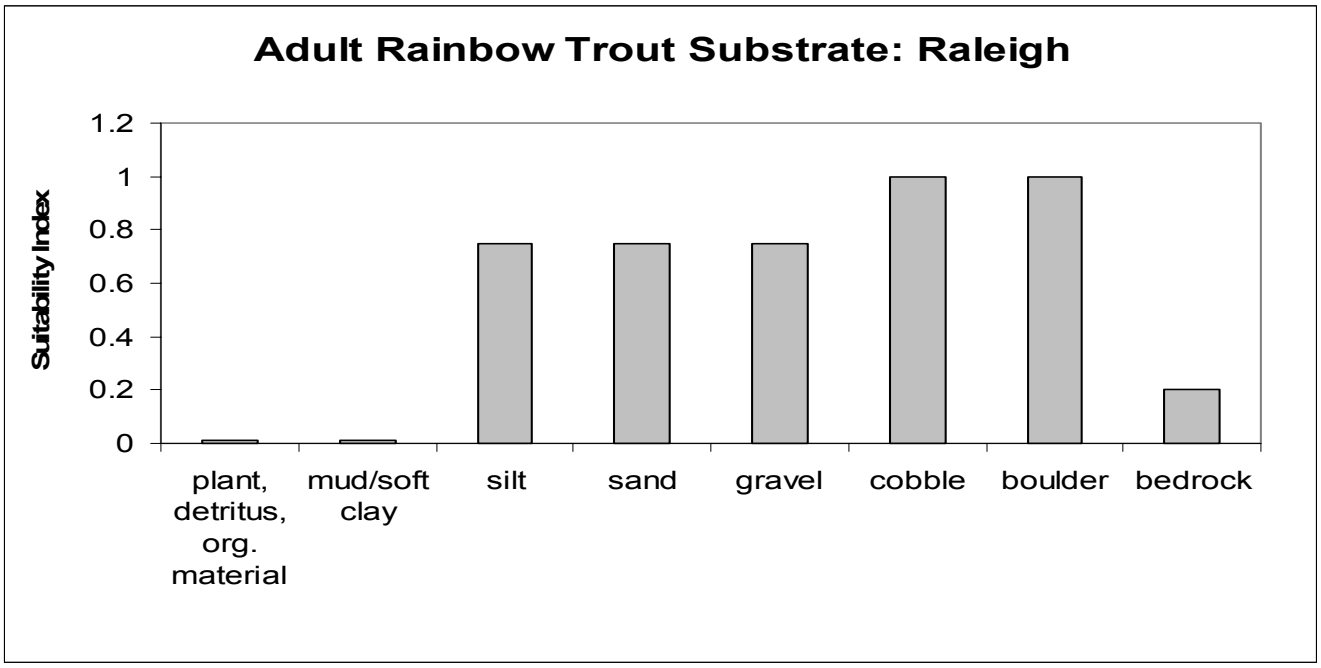
Percent fines (<3 mm) in riffle-run and spawning areas during average summer flows.

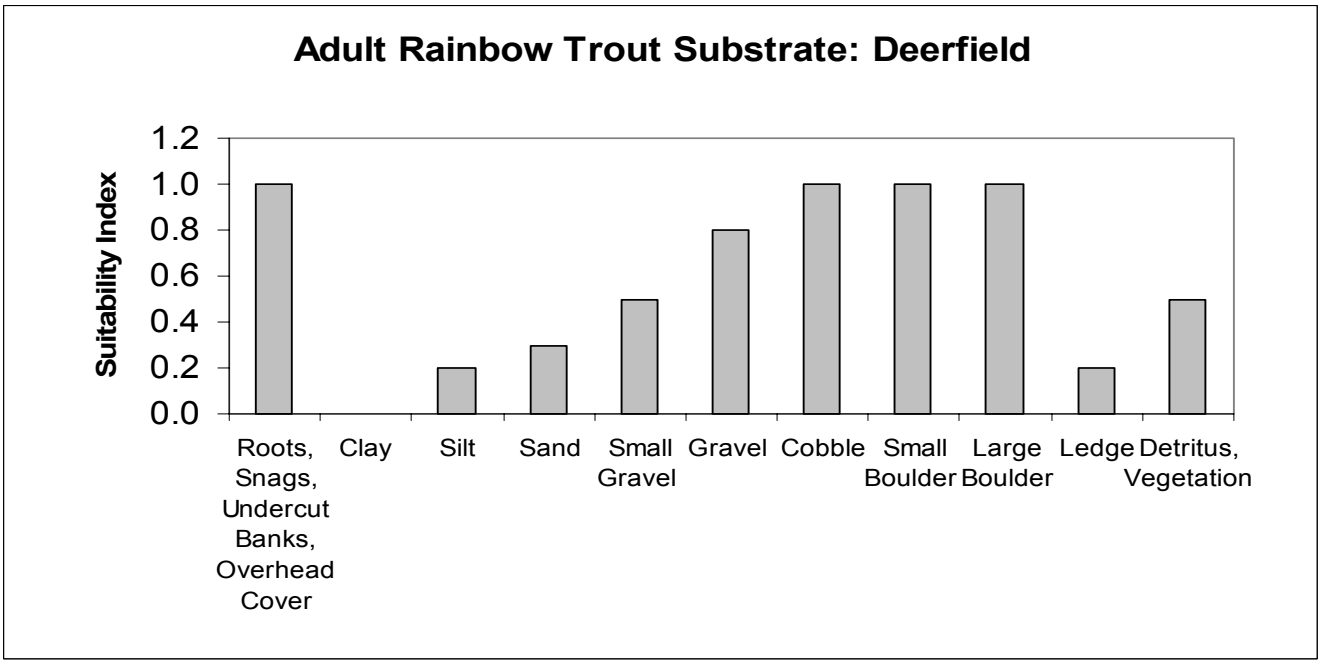
A = spawning
B = riffle-run



Appendix B
Rainbow Trout Substrate Habitat Suitability Criteria

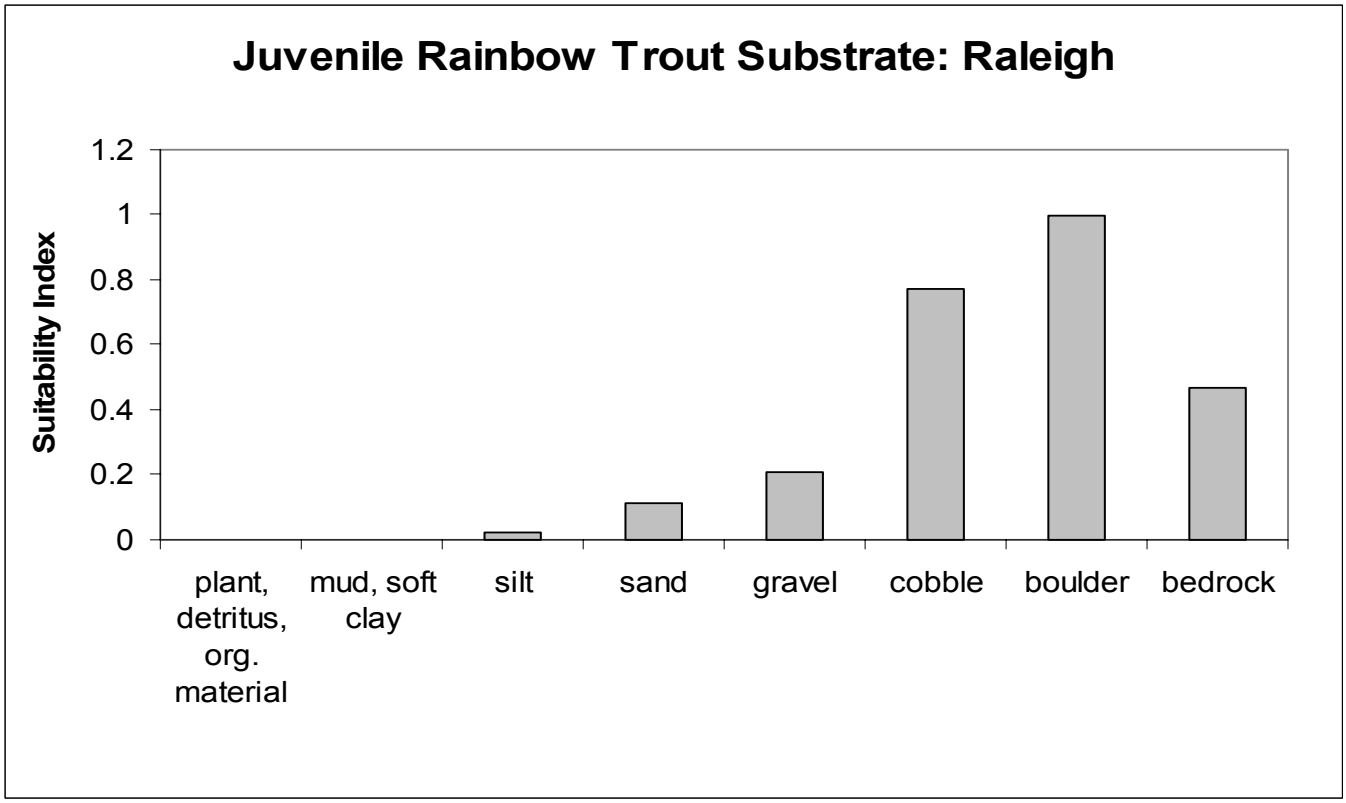
Adult Rainbow Trout[1]



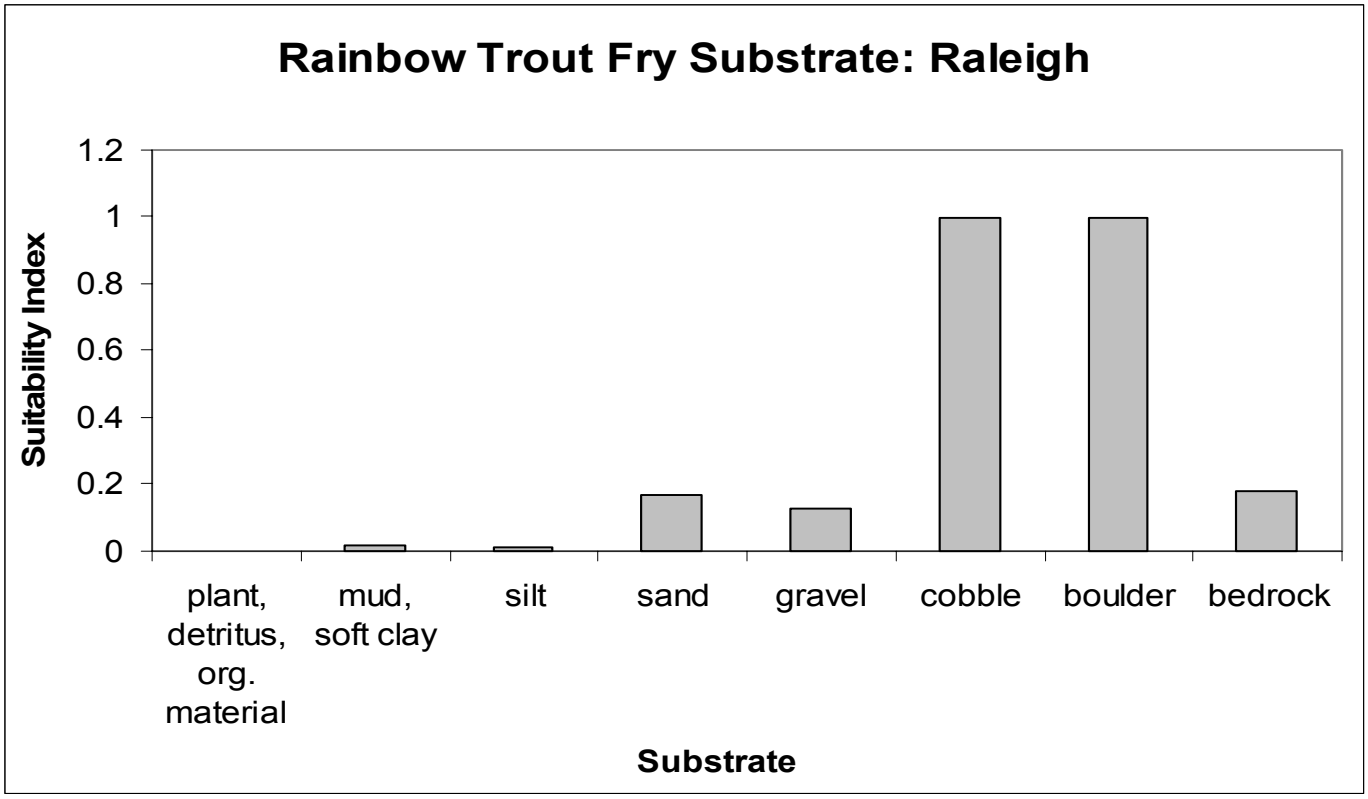


[1] See Appendix A for substrate codes and descriptions.

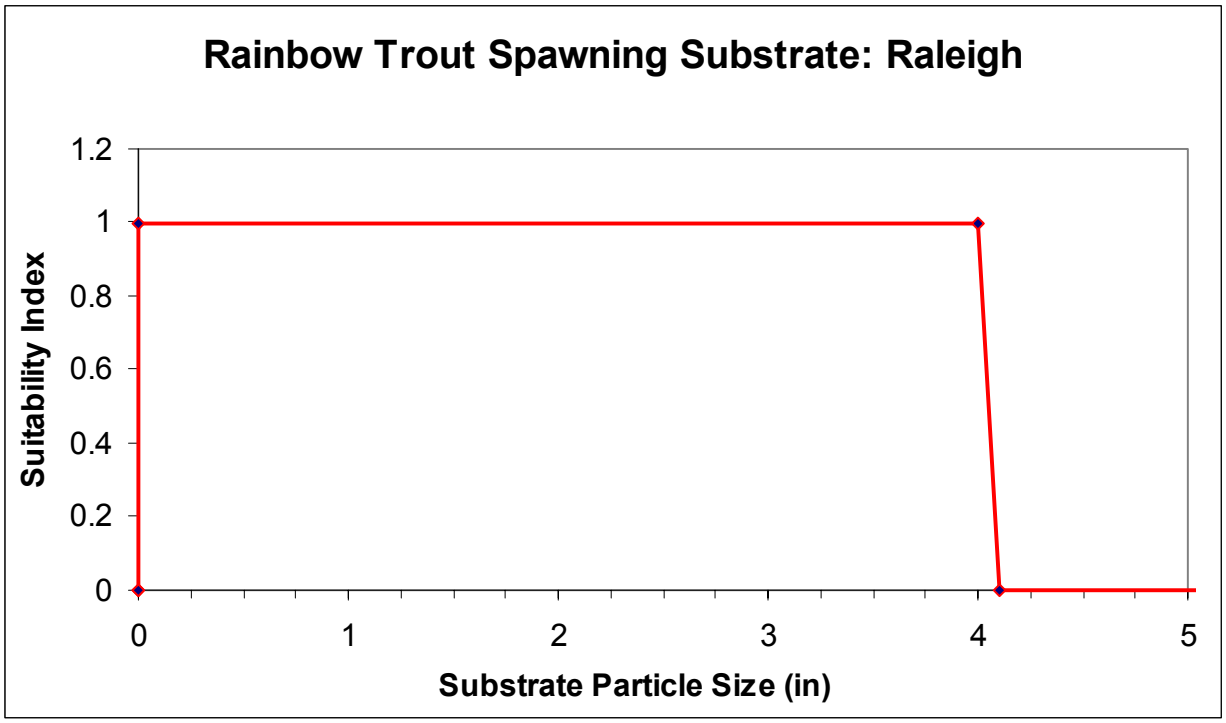
Juvenile Rainbow Trout

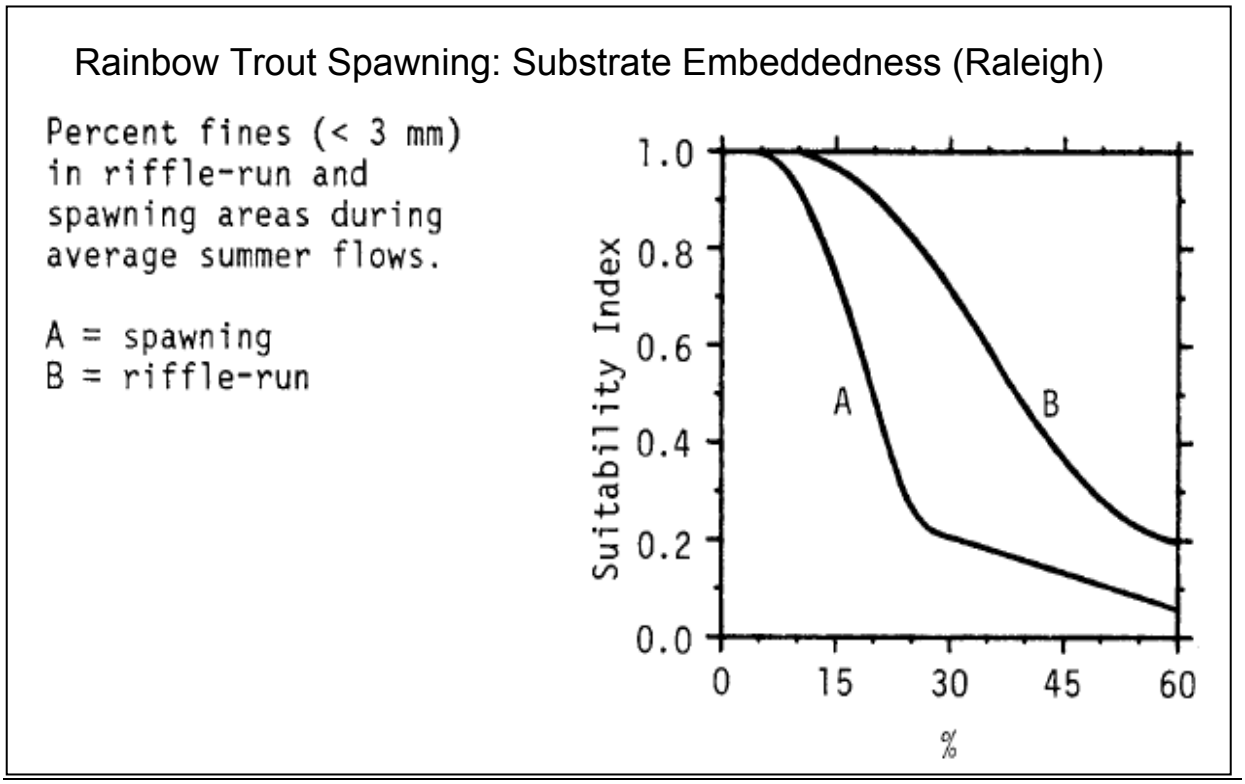


Rainbow Trout Fry



Rainbow Trout Spawning





Appendix C
Smallmouth Bass Substrate Habitat Suitability Criteria

Appendix C, Table 1: Substrate Classification Codes - Bain

Code	Description	Size (mm)	Size (in)
	Silt		
	Sand		
	Gravel	4-75	< 3 in. diam,
	Rubble	75-300	3-12 in. diam.
	Boulder	300-600	1-3 ft. diam.
	Bedrock		

Appendix C, Table 2: Substrate Classification Codes - Deerfield

Code	Description	Size (mm)	Size (in)
1	Roots, Snags, Undercut Banks, Overhead Cover		
2	Clay		
3	Silt		
4	Sand		
5	Small Gravel	< 5.1	< 2
6	Gravel	5.1 - 10.2	2-4
7	Cobel	10.2 - 25.4	4 - 10
8	Boulder	25.4 - 61	10 in - 2 ft
9	Boulder	>61	> 2 ft
10	Ledge		
11	Detritus, Vegetation		

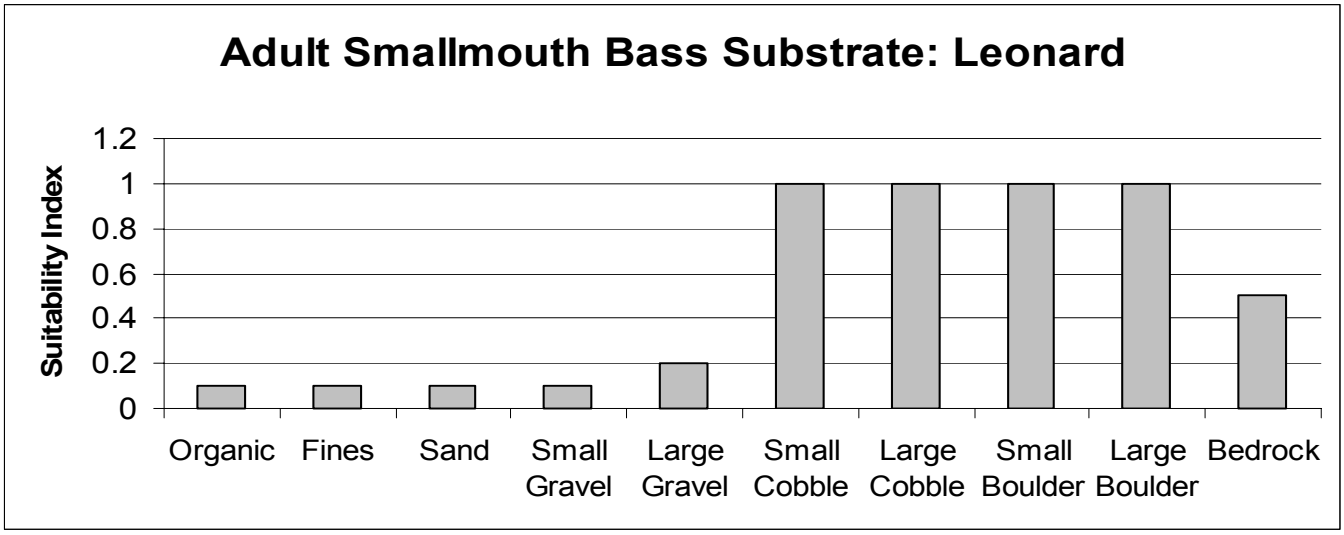
Appendix C, Table 3: Substrate Classification Codes - Leonard

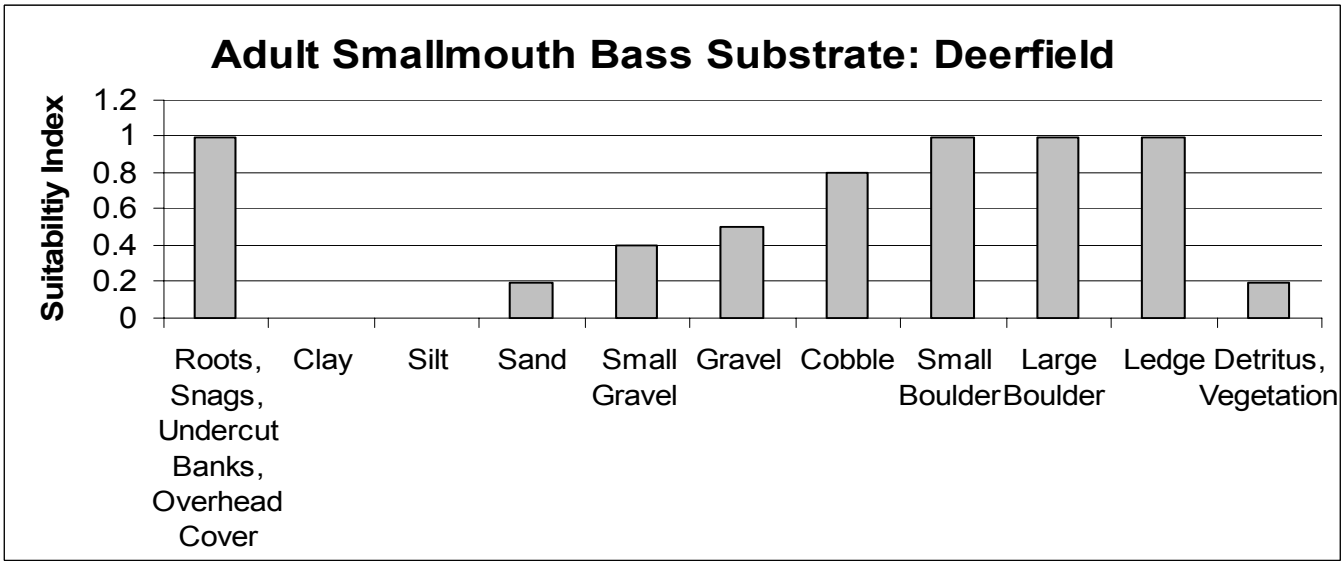
Code	Description	Size (mm)	Size (in)
1	Organic		
2	Fines		
3	Sand		
4	Small Gravel		<2 inches diam.
5	Large Gravel		2-4 inches diam.
6	Small Cobble		4-7 inches diam.
7	Large Cobble		8-10 inches diam.
8	Small Boulder		10-24inches diam.
9	Large Boulder		> 2 ft diameter
10	Bedrock		

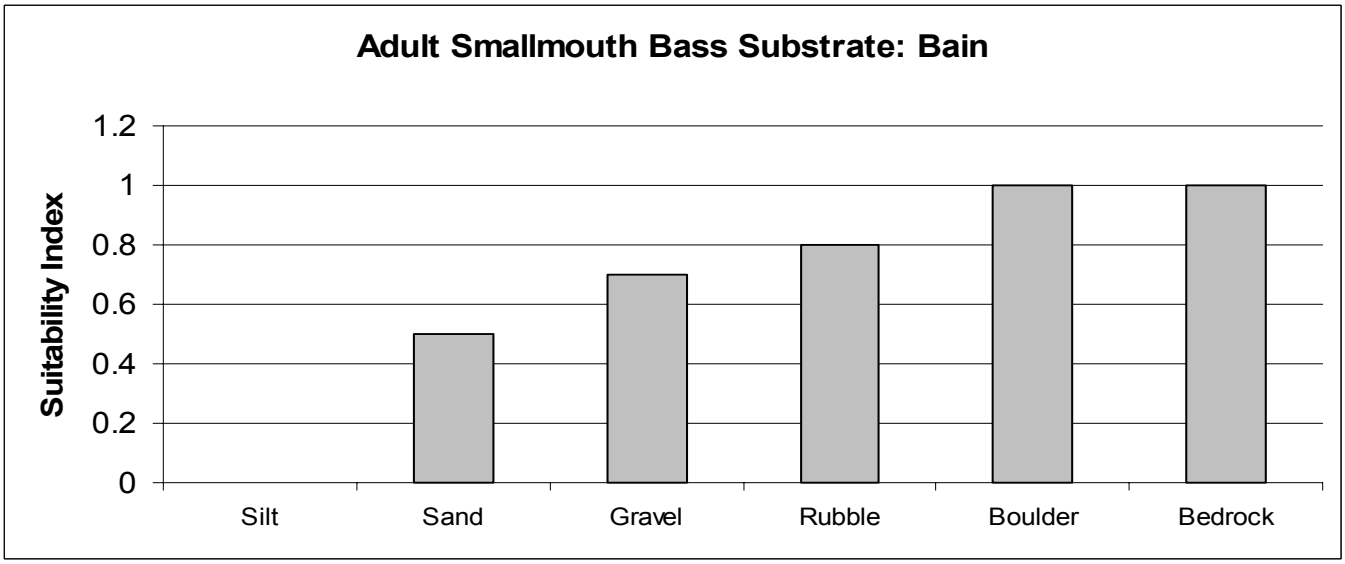
Appendix C, Table 4: Substrate Classification Codes - Lockhart

Code	Description	Size (mm)	Size (in)
1	mud	<1	< 0.4
2	sand	1 - 2	0.4 - 0.8
3	small gravel	2 - 16	0.8 - 6.3
4	large gravel	16 - 64	6.3 - 25.2
5	small cobble	64 - 128	25.2 - 50.4
6	large cobble	128 - 256	50.4 - 100.8
7	small boulder	256 - 512	100.8 - 201.6
8	large boudler	> 512	> 201.6
9	bedrock	-	

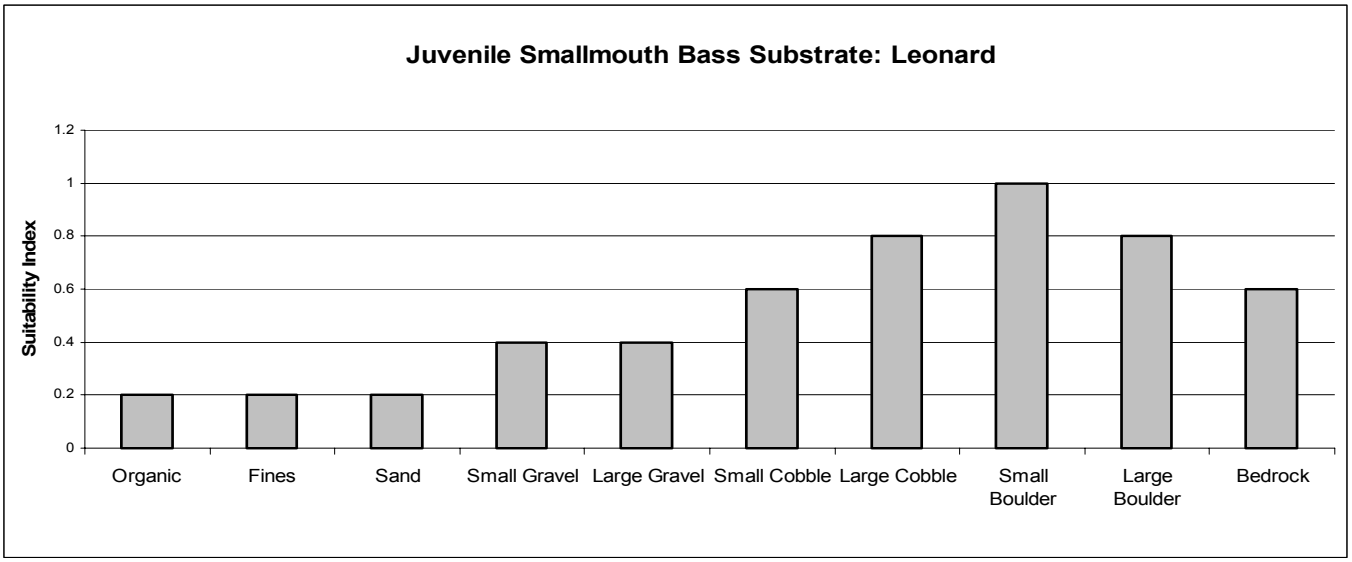
Adult Smallmouth Bass

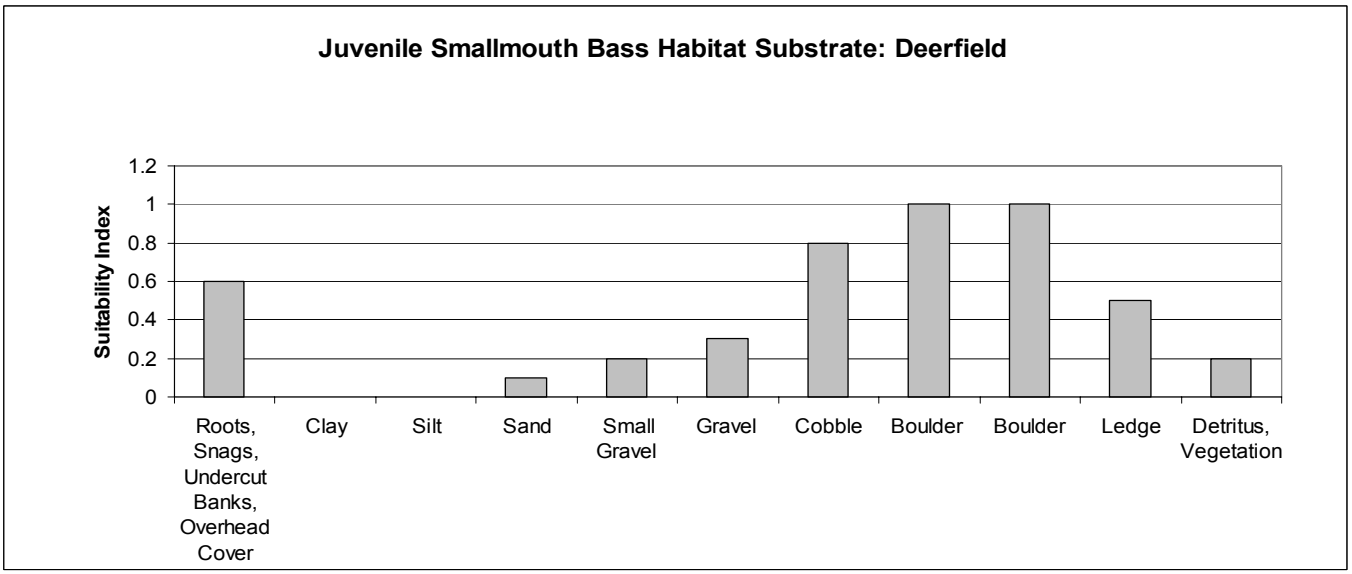


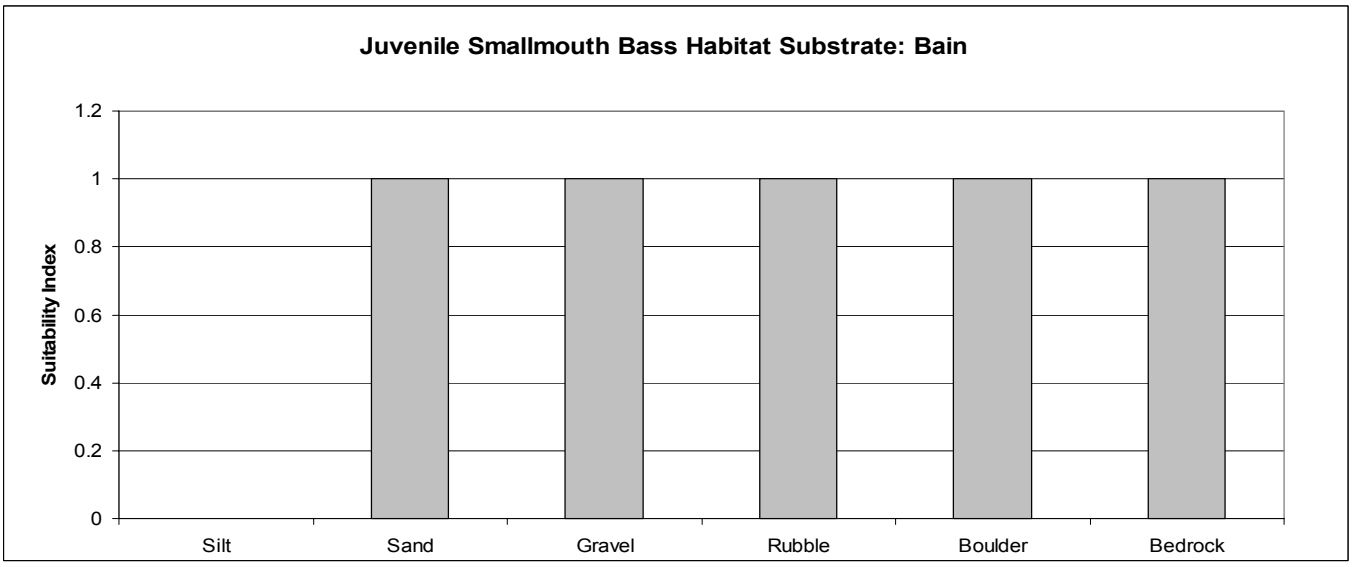




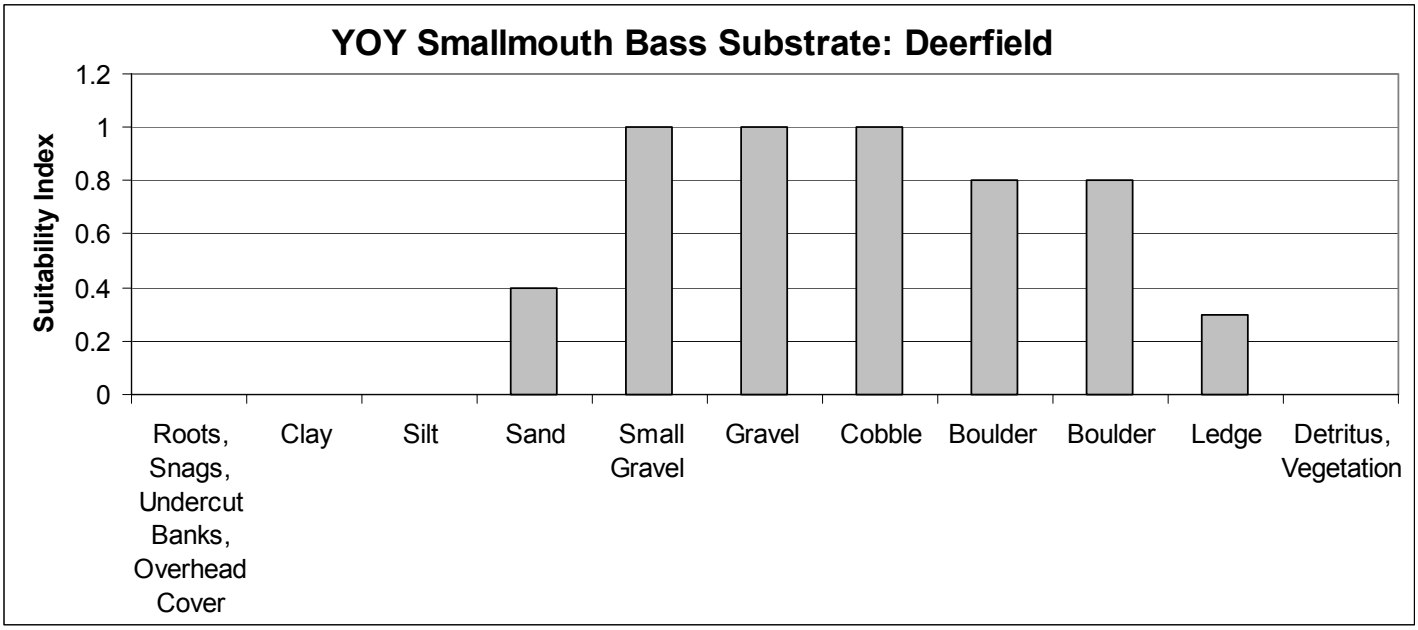
Juvenile Smallmouth Bass

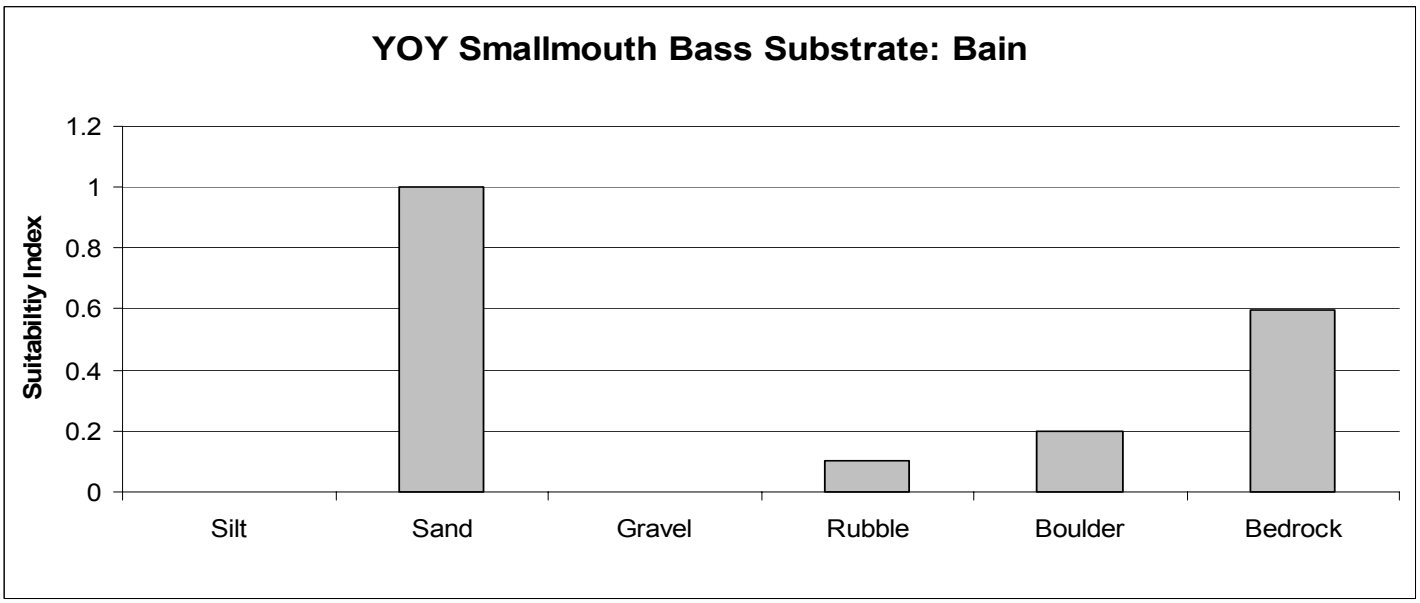




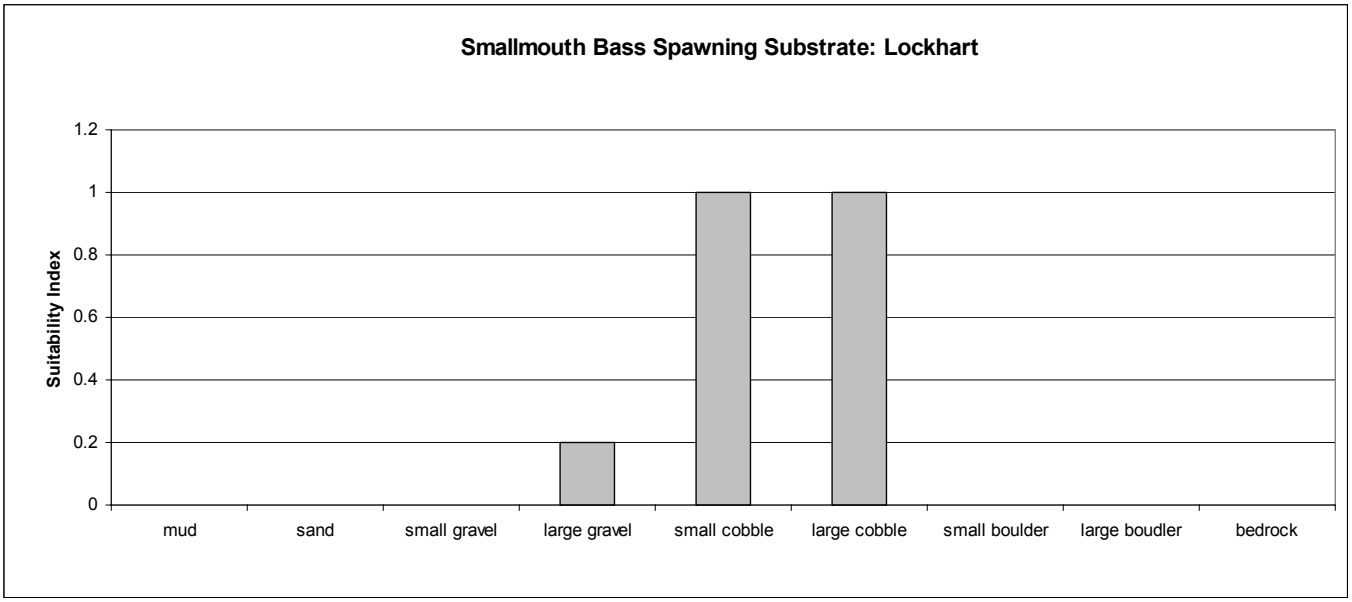


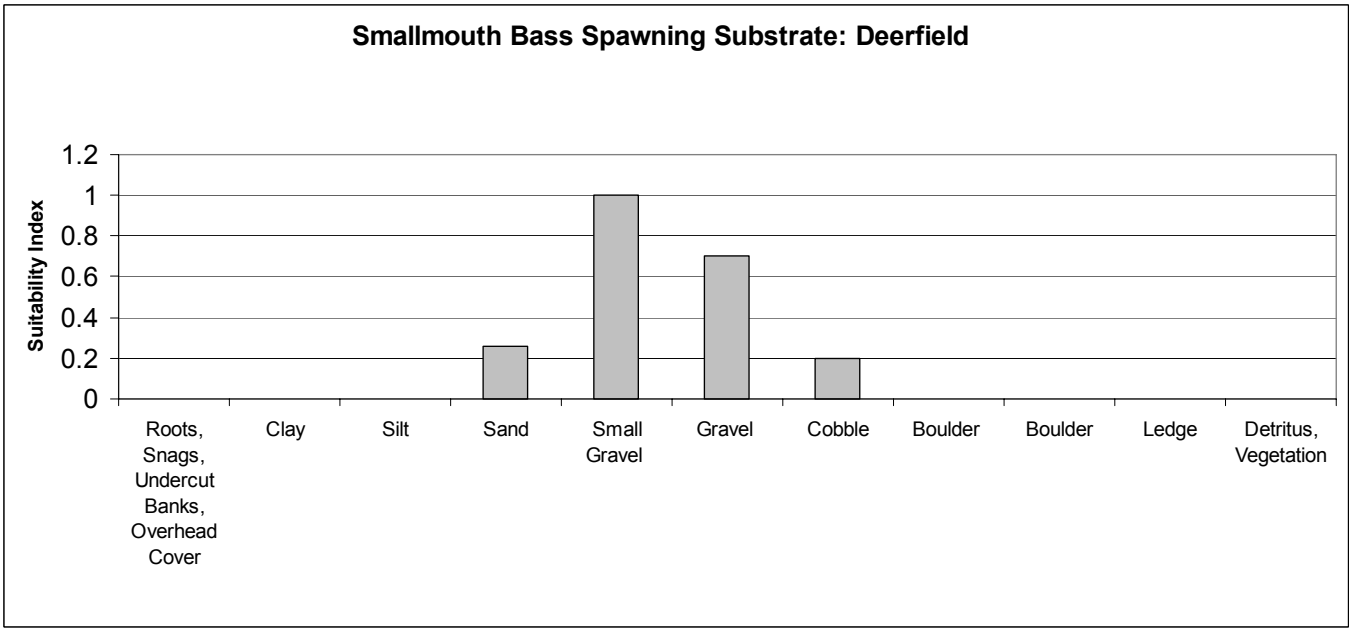
Smallmouth Bass YOY





Smallmouth Bass Spawning





MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Fish Entrainment Technical Working Committee
Conference Call
March 1, 2007

Final jms 04-16-07

ATTENDEES:

Bill Argentieri, SCE&G
Jeni Summerlin, Kleinschmidt Associates
Hal Beard, SCDNR
Tom Bowles, SCE&G
Alan Stuart, Kleinschmidt Associates
Alison Guth, Kleinschmidt Associates
Amanda Hill, USFWS

ACTION ITEMS

- Incorporate comments into the Saluda Fish Entrainment and Turbine Mortality Report and send out to all Technical Working Committee (TWC) members for review

Jeni Summerlin

NEXT MEETING

TBA

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Fish Entrainment Technical Working Committee
Conference Call
March 1, 2007

Final jms 04-16-07

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting at approximately 2:00 PM and noted that the purpose of today's meeting will be to discuss comments on the Saluda Fish Entrainment and Turbine Mortality Report and potential mitigation for subsequent fish mortality.

Questions/Comments on Saluda Fish Entrainment and Turbine Mortality Report

Amanda Hill suggested developing an additional table to determine the percent of fish entrained/killed between Units 1-4 and Unit 5. Jeni Summerlin noted that Table 3-6 describes the monthly estimated total number of fish entrained. The entrainment numbers with the stratification filter applied for the months of July through November, represent the number of fish entrained by Unit 5. Jeni mentioned that fish mortality rates for Units 1-4 and Unit 5 were combined because turbine characteristics for each of these units, such as station head, runner diameter and runner speed are similar in range.

Amanda inquired as to how this desk-top study considers the unique circumstance at Lake Murray of the dissolved oxygen stratification in the summer/fall near the dam in front of Unit 5. Jeni explained that a stratification filter was applied to entrainment rates for Units 1 through 4. This means that the flows for Units 1 through 4 were set to zero for the months of July through November. These months were chosen because Units 1 through 4 are located approximately 190 ft deep and that Lake Murray is typically stratified during these months with very little dissolved oxygen at these depths. Amanda asked why August and October flows were considered in relation to the filters. Jeni noted that during the months of August and October, Lake Murray is typically still stratified.

Mitigation

Amanda asked if any other fish species besides striped bass would likely be entrained in the vicinity of Unit 5 intake. Hal Beard noted that blueback herring would likely be entrained in the Unit 5 intake because of the depth. Bill Argentieri noted that SCE&G will continue to operate Unit 5 as a "last on, first off" operation. Alan noted that Jim Ruane will use the W2 to figure out the striped bass habitat in the area of Unit 5. Hal asked SCE&G if they were continuing to monitor fish entrainment with hydroacoustics during the critical time of year for striped bass. Bill noted that they are currently monitoring entrainment with hydroacoustics and will continue with this method in the future. Hal inquired as to if it was too early to discuss mitigation for the entrained fish at Lake Murray. Alan noted that he conversed with Dick Christie about potential mitigation and Dick thought it may be too early to discuss mitigation at this point.

Moving Forward

Alan asked committee members if they had any other questions or additional problems that were not identified in the report regarding entrainment. The group noted that the edits and comments should be incorporated into the report and then sent back out to the TWC with Dick Christie copied on the email. It was also noted by the group that once the report was finalized by the TWC, then it should be sent to the Resource Conservation Group (RCG) as final. Alan noted that the RCG members may address questions at the next RCG meeting.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
SCE&G's Lake Murray Training Center
January 22, 2007

Final CSB 04-02-07

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates
Milton Quattlebaum, SCANA Services
Jeni Summerlin, Kleinschmidt Associates
Amanda Hill, USFWS
Ron Ahle, SCDNR
Gerrit Jobsis, AR/CCL
Shane Boring, Kleinschmidt Associates
Brandon Kulik, Kleinschmidt Associates
Hal Beard, SCDNR
Scott Harder, SCDNR

ACTION ITEMS

- Incorporate comments into the Instream Flow Study Plan and send out to all committee members for review.

Shane Boring

- Determine whether HSI curves are available for gizzard shad in riverine systems, and if so, distribute to TWC.

Shane Boring/Brandon Kulik

- Email Prescott Brownell about whether it would be applicable to use the Catawba-Wateree shortnose sturgeon HSI curves for the Saluda IFIM study.

Amanda Hill

- Compile potential source HSI substrate curves and distribute to TWC prior to Feb. 21 meeting.

Shane Boring/Brandon Kulik

- Construct plots of finalized HSI curves (Depth/Velocity for smallmouth bass, rainbow trout, brown trout).

Shane Boring/Brandon Kulik

NEXT MEETING

February 21, 2007 at 9:30am
Location: Lake Murray Training Center[1]

[1] This meeting date was later cancelled.

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 10:00 AM and noted that the purpose of today's meeting will be to discuss: (1) HSI criteria for guilds, (2) HSI criteria for stand-alone species, and (3) the next steps that need to be taken for the IFIM study. He briefly reviewed the action items from the previous meeting. Shane noted that he was currently incorporating comments made on the IFIM study plan and would send it back out to committee members within the next week for comments.

Review of HSI Criteria for Guilds

Shane noted that the species guild matrix had been revised based on comments from the previous IFIM meeting and distributed a revised matrix. The group then reviewed the updated matrix, and after several additional revisions, agreed that the following guild approach was acceptable:

DEEP SLOW GUILD		
species	**life stage**	**SI curve source**
American shad	YOY	Catawba-Wateree
blueback herring	spawning	
blueback herring	YOY	
Northern hogsucker	adult	
redbreast sunfish	adult	
robust redhorse	juvenile	
robust redhorse	adult	
spotted sucker	juvenile	
spotted sucker	adult	
DEEP FAST GUILD		
species	**life stage**	**SI curve source**
American shad	YOY	Catawba-Wateree
American shad	spawning	
Northern hogsucker	spawning	
Northern hogsucker	fry/YOY	
Northern hogsucker	juvenile	
shorthead redhorse	adult	
spottail shiner	adult	

DEEP FAST GUILD		
species	**life stage**	**SI curve source**
benthic macroinver.	juvenile	Catawba-Wateree
robust redhorse	spawning	
saluda darter	adult	
spottail shiner	spawning	
spotted sucker	spawning	
DEEP FAST GUILD		
species	**life stage**	**SI curve source**
redbreast sunfish	spawning	Catawba-Wateree
robust redhorse	fry/YOY	
spotted sucker	juvenile	
spotted sucker	fry/YOY	

There was a brief discussion about whether to add threadfin shad to the list of target species. It was noted that HSI curves were not available for threadfin shad, but that gizzard shad could potentially serve as a surrogate. Alan Stuart and others noted that the existing gizzard shad HSI curves were developed for reservoir habitats, not riverine systems. After some discussion, it was determined that availability of appropriate riverine HSI curves for gizzard shad should be evaluated prior to determining whether this species can serve as an appropriate surrogate for threadfin shad. The group agreed to withhold a determination on whether or not threadfin shad should be included until after this information is evaluated.

Review of Habitat Suitability Criteria (HSC) for Stand-Alone Species

Brandon Kulik noted that a memorandum regarding HSC for stand-alone species was sent out on January 16, 2007 to all committee members (Attachment A). He noted that this memorandum summarized HSC curves for smallmouth bass, rainbow trout, and brown trout from a number of potential source studies for purposes of evaluating transferability to the lower Saluda study. He noted that TWC members should consider their field experience/observations regarding the target species and the lower Saluda River in evaluating applicability of the potential source curves. The group examined the HSC curves for each species and lifestage for both depth and velocity. The group agreed to use the following HSC curves for the following species:

SPECIES	LIFE STAGE	PARAMETER	SI CURVE SOURCE
brown trout	adult	Depth	Combination: Housatonic (poor), Deerfield
	adult	Velocity	Lackawaxen, w/modifications
brown trout	fry/YOY	Depth	Deerfield
	fry/YOY	Velocity	Deerfield
brown trout	juvenile	Depth	Combination: Deerfield, Raleigh
	juvenile	Velocity	Combination: Lackawaxen, Deerfield
brown trout	spawning	Depth	Raleigh
	spawning	Velocity	Raleigh w/modifications
rainbow trout	adult	Depth	Deerfield
		Velocity	Deerfield (abundant)
rainbow trout	fry/YOY	Depth	Raleigh
		Velocity	Raleigh
rainbow trout	juvenile	Depth	Lackawaxen
		Velocity	Lackawaxen
rainbow trout	spawning	Depth	Raleigh
		Velocity	Raleigh
smallmouth bass	adult	Depth	Combination: Groshens & Orth, Bain
		Velocity	Combination: Groshens & Orth, Deerfield (abundant)
smallmouth bass	juvenile	Depth	Combination: Bain, Deerfield w/modifications
		Velocity	Deerfield (abundant)
smallmouth bass	spawning	Depth	Lockhart
		Velocity	Lockhart
smallmouth bass	YOY	Depth	Combination: Groshens & Orth, Bain
		Velocity	Combination: Deerfield, Bain

Zone of Passage for Striped Bass

Brandon suggested that the minimal flow limiting passage requirement for a fish would be an adequate amount of water so that the body of the fish is submerged. A maximum flow limiting factor for passage would be a high velocity that exceeds the fish's sustained swimming strength. Gerrit noted that there are striped bass passage standards for South Carolina. He explained that according to the standard, river must be 18 inches in depth for a 20 pound striped bass, with a 10 ft width, covering 10 % of the channel. Hal Beard noted that he thinks there may only be one year in which striped bass were not able to make it up the lower Saluda River past Millrace Rapids. Hal noted that it may have occurred in the months of May/April of 1991. This was because Saluda

Hydro was not releasing. Brandon presented a spreadsheet model from the USGS Conte Lab paper (Attachment B) that described limiting velocities for striped bass passage based on fish size and ambient water temperature.

Next Steps

Brandon noted that the group would need to also agree upon appropriate substrate HSC curves. The group agreed that discussion of potential source curves for substrate would be appropriate for the February 21st TWC meeting. Brandon and Shane agreed to draft and similar memo summarizing potential source curves and distribute to the group prior to the meeting.

Brandon noted that Shane will be going out in the field to characterize mesohabitats on the lower Saluda River. Shane added that they hope to have the mesohabitat characterization completed and available for review by the TWC by late March.

Brandon mentioned that they have not yet obtained the final HSC curves for shortnose sturgeon from Prescott Brownell. After some discussion, the group agreed that the Catawba-Wateree IFIM study would be the most likely source for shortnose sturgeon curves. Amanda Hill noted that she would e-mail Prescott regarding transferability of the Catawba-Wateree curves; she recommended contacting Pace Wilbur at NOAA-Fisheries if we were not able to contact Prescott.

Next Meeting

The group noted that the next TWC meeting had been scheduled for February 21st, 2007 at Lake Murray Training Center. The meeting adjourned at approximately 3:10 PM.

ATTACHMENT A

MEMO SUMMARIZING POTENTIAL SOURCE HABITAT SUITABILITY CURVES FOR DEPTH AND VELOCITY FOR SMALLMOUTH BASS AND RAINBOW AND BROWN TROUT LIFESTAGES

ATTACHMENT B

SPREADSHEET SUMMARIZING LIMITING VELOCITIES FOR STRIPED BASS PASSAGE
(SOURCE: CONTE ANADROMOUS FISH LAB)

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
SCE&G's Lake Murray Training Center
December 19, 2006

Final jms 1-17-07

ATTENDEES:

Bill Argentieri, SCE&G	Gerrit Jobsis, AR/CCL
Alan Stuart, Kleinschmidt Associates	Shane Boring, Kleinschmidt Associates
Randy Mahan, SCANA Services	Jeni Summerlin, Kleinschmidt Associates
Amanda Hill, USFWS	Theresa Thom, NPS
Milton Quattlebaum, SCANA Services	Dick Christie, SCDNR
Ron Ahle, SCDNR	Jennifer O'Rourke, SCWF
Bill Hulslander, NPS	Hal Beard, SCDNR

ACTION ITEMS

- Review the National Park Service literature review for studies of interest (studies were sent out by Theresa Thom on October 11, 2006)

All Committee Members

- Contact Jim Bulak about presenting his dissertation work on striped bass

SCDNR – Ron Ahle

- Contact Will Graf regarding presentation on CNP inundation model

Theresa Thom/Bill Hulslander

- Develop work plan/framework for addressing floodplain flows request based on interests/objects outlined at 12/19/06 TWC meeting

Shane Boring

NEXT MEETING

February 21, 2007 at 9:30am
Located at the Lake Murray Training Center

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
Instream Flow/Aquatic Habitat Technical Working Committee
SCE&G's Lake Murray Training Center
December 19, 2006

Final jms 1-17-07

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring of Kleinschmidt Associates opened the meeting at approximately 9:30 PM and noted that the focus of the meeting would be to discuss impacts of project operations on the downstream floodplain and Congaree National Park (CNP), including aquatic resources. Shane explained that the group should first discuss existing information pertaining to inundation in the CNP and then define study request for this committee.

Review of Study Request

Shane noted that the request for floodplain flow evaluations and sediment regime/transport were among the study requests assigned to the Instream Flow/Aquatic Habitat Technical Working committee (TWC) at the May 3, 2006 meeting. Shane noted that in regards to the floodplain flow evaluations, there are a number of recent and ongoing studies that have potential to assist in addressing this issue. It was noted that a literature review of the known studies on the CNP was distributed to the group via e-mail by Theresa Thom on October 11, 2006.

The group then briefly discussed the study entitled *Hydrologic Variation Study of the Congaree River (2005)*, prepared by Tara Plewa and William Graf from the University of South Carolina. The group reviewed figures from the study describing potential influence of flow variations on the Congaree River from the lower Saluda (LSR) and Broad Rivers. Shane pointed out that from a flow standpoint the LSR appears to have a very limited influence on stage in the CNP. Bill Hulslander explained that the effect is during low flows, when little water is coming from the Broad River. He added that during these low flow periods, there may be potential for the LSR (and subsequently the Saluda Project) to help provide inundation at the CNP.

Randy Mahan inquired as to the extent the CNP is influenced by the Wateree River. Several attendees noted that the Wateree does provide a significant amount of flow to the CNP floodplain, but only in the lower portion of the park (i.e. the confluence area) and that a much greater proportion of the floodplain is controlled by the Congaree. As an example, Gerrit provided figures from the Catawba-Wateree inundation model that illustrated how flows from the Wateree River affect floodplain inundation on the CNP (i.e. percent inundation at various flows). Gerrit and others noted that a similar inundation model could assist in addressing the floodplain flows request for Saluda Hydro.

Alan Stuart noted that John Quebman from Kleinschmidt Associates may be able to develop an inundation model, similar to the Catawba-Wateree model, as an extension of the HEC-RAS model being developed for the operations TWC. NPS staff noted that a HEC-RAS-based inundation model has already been developed for the CNP by Dr. Graf at USC. The group agreed that building

on the CNP's existing model would likely be the best approach. Several group members inquired as to whether Dr. Graf would be willing to present the model at a future TWC meeting. CNP staff agreed to contact Dr. Graf regarding this request.

The group decided to dedicate the remainder of the meeting to further refinement of the study objectives. Through an interactive session the group outlined the following interests, information needs, objectives and potential tools that may be used in determining the impacts of project operations on the downstream floodplain and CNP.

Interests

Floodplain Inundation for the Congaree River/CNP

- Duration, timing, magnitude, frequency, rate of change
- Aquatic biota re-nourishment
- Fish/macro spawning, forest ecology, nursery areas, nutrient cycling etc
- Floodplain sediment transport, flushing and geomorphology
- Groundwater effects on the wetland flooding capacity

Objectives

- Determine what percentage of inundation is provided at various flows in the Congaree River
- Evaluate the effects of Saluda Hydro operations on Congaree floodplain (considering lake levels, flow regimes and temperature)
- Develop recommended seasonal alternatives for flow releases from the Saluda Hydro to enhance floodplain function

Information Needs

- Effects of Wateree on CNP inundation
- Relationship of lower Saluda and Broad rivers on the Congaree River
- Lake Marion pool levels
- Effects of Lake Murray elevations and water availability
- Effects of river stage on inundation
- Forest Ecology Study (SREL Study)
- Temperature study of LSR release
- Effects on RT&E species in the CNP
- Effects on the LSR
- Groundwater within the basin
- Basin hydrology (tributaries)

- Historical floodplain levels

Potential Tools to Use

- USC Inundation Model (May 2007)
- DNR fisheries/macro park studies
- Saluda Hydro Operations Model (February 2007)
- Water quality/vegetation studies (CNP)
- Temperature study results of the lower Saluda and Congaree rivers (October 2007)
- Wateree inundation studies
- LIDAR information
- USGS flow data (CNP)
- USGS groundwater study (June 2007)
- SCE&G flyover video of the Lower Saluda and Congaree River
- Savannah River Ecology Laboratory forest ecology study (January 2007)
- Granby Lock removal study
- Jim Bulak's striped bass thesis

Moving Forward

1. Presentation on the USC Inundation Model
    - Capabilities of model
    - Inputs
    - Constraints
    - Assumptions
    - Limitations
    - Capability with other models, such as the HEC-RAS Model
    - Outputs (GIS, etc.)
2. Presentation on striped bass reproduction/floodplain work in the Congaree River
3. Develop draft work plan for group consideration

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
INSTREAM FLOW/AQUATIC HABITAT TECHNICAL WORKING COMMITTEE

SCE&G Training Center
November 27, 2006

Final jms/bhk/csb 01-03-07

ATTENDEES:

Alan Stuart, Kleinschmidt Associates
Bill Argentieri, SCE&G
Brandon Kulik, Kleinschmidt Associates
Dick Christie, SCDNR
Gerrit Jobsis, American Rivers/CCL
Hal Beard, SCDNR
Jeni Summerlin, Kleinschmidt Associates
Milton Quattlebaum, SCANA Services
Randy Mahan, SCANA Services
Ron Ahle, SCDNR
Scott Harder, SCDNR
Shane Boring, Kleinschmidt Associates
Theresa Thom, National Park Service

ACTION ITEMS:

- Find out if Prescott has HSI curves for Atlantic/shortnose sturgeon

Amanda Hill

- Ask Steve Summer if he has any flow data for the LSR

Milton Quattlebaum

- Provide HSI curves for brown/rainbow trout from Savannah River/Catawba Wateree IFIM studies

Dick Christie

- Contact Jim Ruane about obtaining HSI curves for trout in the Chattahoochee River basin and research other potentially applicable trout curves

Brandon Kulik

- Research applicable smallmouth bass HSI curves

Brandon Kulik

- Edit the guild matrix and send out to committee members

Brandon Kulik

- Plan a meeting to discuss the guild matrix and *HSI* curves in more detail

Shane Boring

- Edit the draft IFIM study plan and send out to committee members

Brandon Kulik / Shane Boring

- Edit mesohabitat descriptions and send out to committee members

Brandon Kulik

DATE OF NEXT MEETING[1]: **December 19, 2006 at 9:30 a.m.**
Located at the Lake Murray Training Center

[1] this meeting will be to discuss issues pertaining to the Congaree River

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Review of Action Items from Previous Meeting:

Shane Boring opened the meeting and noted that the first discussion topic was to review action items from the previous meeting. Shane noted that Brandon Kulik sent the draft IFIM study plan to committee members for review; Gerrit Jobsis provided a link to the Pee Dee HSI curves; and Dick Christie sent the Catawba Wateree HSI curves to Brandon. Shane noted that the purpose of today's meeting is to: (1) review the draft IFIM study plan, (2) review the lower Saluda River (LSR) aerial video, (3) discuss the guild matrix and HSI curves, (4) discuss the classification, types, and definition of mesohabitats, and (5) discuss field site locations that study participants wish to visit on November 28th.

Review of Draft IFIM Study Plan:

Comments on the draft IFIM study plan can be viewed in track changes in Attachment A. A copy of the draft IFIM study plan was distributed and Shane asked committee members if they had any comments. There were several editorial and organizational recommendations made by SCDNR and American Rivers to better describe the context of river fishery resources, and clarify the scope and role of this study. Dick and Hal noted that recent DNR studies reveal that striped bass use the LSR as a thermal refuge (as much as 50% of the population), and that there may be potential for the river to be managed for smallmouth bass in the future, as smallmouth bass are colonizing the Broad River near the confluence with the Saluda and DNR anticipates that they will begin to inhabit the Saluda in the near future. Gerrit recommended that the project description include a reference to other historic operating regimes that the Saluda project has employed during the life of its current license besides the current operating mode (reserve).

Regarding the technical approach, Scott Harder asked about the number of velocity sets that will be taken at each transect. Brandon noted that velocity measurements will be taken on a transect basis. Brandon went on to explain that at least one velocity set will be taken at each transect. There will be three calibration flows (low, medium and high), and velocity data are collected at the middle calibration flow. In the case of transects with complex hydraulics (usually riffles and shoals) additional velocity sets will likely be collected at the low flow since hydraulic parameters such as friction coefficients and turbulence will likely be different due to the substrates and supercritical flows inherent in such sites. This is decided on a case-specific basis with input from a hydraulic engineer, In order to provide a suitable stage-discharge curve for the hydraulic model to project

Weighted Usable Area (WUA) for a flow range from 40 to over 20,000 cfs, the three calibration flows to be used are expected to be approximately:(350-500 cfs, 1200-1500 cfs, and 10,000 cfs. Scott inquired how error will be treated in the model. Brandon indicated that for each flow increment at each transect, the Velocity Adjustment Factor (VAF) obtained during each transect's calibration is used as an indicator of accuracy. If VAF's for some flow range is out of range, additional modeling or supplemental .flow data may be required. Brandon agreed to supplement the modeling discussion in the draft plan methodology with additional details.

In regards to the fish passage evaluation, Gerrit explained that the 1990 IFIM study that he participated in came up with a 1300 cfs fish passage flow based on SCDNR criteria for Millrace Rapids. This was based on data obtained at a location in Millrace Rapids chosen by Steve De Kozlowski. Gerrit questioned the need to redo this part of the study, because the criteria will not change much, and he believes that the river channel characteristics have not changed much. Brandon noted that the study plan was written so as not to foreclose on the need to conduct a new analysis, but that the full study team would make the final decision. Another option might be to obtain and review the original data sets and Steve De Kozlowski input if practical. Dick Christie felt that the study should take advantage of new fish passage hydraulic criteria that may be specifically applicable to anadromous fish species. Brandon added that he had obtained these criteria from Alex Haro of the Conte Anadromous Fish Laboratory in Turners Falls, MA, and that they rate, temperature, fish swimming strength, slope and water velocity in ascending rapids.

Hal Beard asked how braided sections in the LSR will be evaluated. Brandon indicated to the extent the team desires that these be modeled, that each channel braid selected will be treated as a separate stream channel, with separate transects. Manual flow gauging will be required during calibration to provide an estimate of how water flows through each braid. Scott inquired as to how the Acoustic-Doppler Current Profiler (ADCP) will be used with the large amounts of vegetation in the LSR. Brandon explained that if these mats of vegetation are extensive, they may effect the model simulation, in that they act as ephemeral objective cover and may change the velocity relative to unvegetated periods. Brandon specifically noted that vegetation will certainly be considered when evaluating the mesohabitats. Hal noted that vegetation in the LSR has increased over the years; about 70% of the river has vegetation, specifically from Twelvemile Creek to the I-20 Bridge. Vegetation is most pronounced in areas of lower velocity and comparatively less pronounced in rapids and riffles. Hal mentioned that the group may want to consider talking to Cindy Aulbach. She conducts fly-over's for SCE&G to evaluate vegetation in the LSR.

Review of Lower Saluda River Aerial Video:

To gain a better understanding of the different types of habitats, the group viewed flows of the LSR at 540 and 840 cfs video graphed from a helicopter flying from downstream to upstream during spring 2005. Gerrit noted that transects at Corley Island, Oh Brother Rapids and Shandon Rapids should be evaluated. Through discussion, the group separated the LSR into four segments: (1) Lake Murray Dam to Rawls Creek; (2) Rawls Creek to I-26 Bridge; (3) I-26 Bridge to Millrace Rapids; and (4) Millrace Rapids to the confluence of the lower Saluda and Broad river's. The group noted that segment (2) was extremely uniform in width, depth, and channel shape.

Classification, Types and Definition of Mesohabitats:

Comments on the guild matrix can be viewed in track changes in Attachment B. Brandon explained that in order to simplify the WUA analysis, the TWC had agreed to sort species and life stages into habitat-use guilds. Brandon noted that for purposes of this straw man, the guild groups (shallow-slow, shallow-fast, *etc*) categories were the commonly-used categories developed by Mark Bain. Brandon explained that life stages of each species were assigned to habitat use guilds based on life history and habitat preference using Dilts et al. (2003) *Application of New Approaches to Instream Flow: Use of Two Dimensional Modeling and Habitat-Use Guilds in a Southeastern Stream* as a generalized model. He asked that the TWC review this approach for reasonableness and welcomed any river- or species-specific refinements that the group cared to recommend.

Gerrit pointed out that spawning and adult life stages of shortnose sturgeon should be added to the guild matrix. He mentioned that the Catawba Wateree, Pee Dee, and Santee Cooper may have developed HSI curves for shortnose/Atlantic sturgeon. Amanda Hill noted that Prescott Brownell may have developed these curves. Amanda recommended adding spawning life stage for striped bass. Dick indicated that there has been no indication of spawning striped bass in the LSR. He clarified that striped bass use the LSR as a thermal refuge area rather than for spawning. Dick noted that if striped bass spawning is included, we may be able to use HSI curves from the Savannah River or Catawba Wateree. There was a brief discussion about the type of HSI curves that could be used for brown trout and Shane noted Dick had observed that it may not be feasible to use Catawba Wateree curves because it would not be reflective of the LSR. In response to a question, Brandon noted that USFWS "bluebook" adult and juvenile HSI trout curves have been criticized as non-transferable curves, at least in most eastern rivers. He was aware of some recent trout curve development in Pennsylvania and New England that may have potential transferability. Hal noted that SCDNR is more concerned with adult trout from a resource perspective; they would like to include some southeastern trout HSI curves. Alan Stuart noted that TVA may have developed HIS curves for trout in the Chattahoochee basin. Gerrit mentioned that the USFWS HSI curves for trout are from 1984/1985. He mentioned that Jim Ruane may be able to provide some information on

these curves. It was generally agreed that if Brandon could find and circulate these HSI curves for committee members to review that satisfactory adult curves could be identified by the group. Brandon will also research and summarize smallmouth bass HSI criteria.

Shane inquired if committee members were satisfied with the guild approach. The group noted that they were comfortable with this guild approach, but certain species should be stand alone. Specifically, Dick noted that smallmouth bass, spottail shiner, gizzard and threadfin shad species are not easily categorized into specific guilds. Gerrit noted that the group should reexamine each species and how they are categorized into each guild, specifically the northern hogsucker. Brandon noted that he would update the guild matrix and send out to committee members for review. Shane noted, and the group agreed, that a meeting devoted entirely to finalizing the guilds is needed.

Classification, Types and Definition of Mesohabitats:

Brandon displayed various mesohabitats definitions for the group and noted that it is important to reach a common understanding of these definitions. These definitions are in part a way to link life stages to habitat-use guilds, but is primarily a tool to facilitate habitat mapping. The distribution and abundance of mesohabitats in each reach will in turn be used as a mechanism to select study sites and transects at a later stage. He pointed out that the definition of each mesohabitat was adopted from the Catawba Wateree, and Santee Cooper studies and Dunn and Leopold, 1998. Brandon read through each habitat type and a few comments were made.

The group agreed to meet at the guard shack located at the Saluda Hydro Dam at 9:30AM to visit specific sites of interest, gain a common understanding of the river from a habitat perspective, and test and refine the definitions of mesohabitats on the LSR.

ATTACHMENT A

COMMENTS ON THE DRAFT IFIM STUDY PLAN

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT
(FERC NO. 516)

INSTREAM FLOW STUDY OF THE LOWER SALUDA RIVER

DRAFT – November 8, 2006

1.0 INTRODUCTION

The Saluda Hydro project is a 202.6 megawatt (MW) licensed hydroelectric facility located on the Saluda River in Lexington, Newberry, Richland, and Saluda counties of South Carolina and is owned and operated by South Carolina Electric & Gas (Figure 1). The project consists of Lake Murray, the Saluda Dam, the new back-up Saluda Berm, spillway, powerhouse, intakes, and penstocks. The project is currently licensed by the Federal Energy Regulatory Commission (FERC No. 516) and the present license is due to expire in the year 2010.

To initiate the Project relicensing process, SCE&G prepared and issued the Initial Consultation Document (ICD) on May 20, 2005. The Licensee submitted the document to a number of state and federal resource agencies for their review and comment. As a result, the United States Fish and Wildlife Service (USFWS), South Carolina Department of Natural Resources (SCDNR), National Marine Fisheries Service (NMFS), and several Non-governmental Organizations (NGO's) requested studies to determine the potential impact of Project operation on downstream fishery resources and aquatic habitat, including a Instream Flow Incremental Methodology Study for the lower Saluda River downstream of the Project. A separate study will be conducted to evaluate effects of project operation on the Congaree River.

1.1 Existing Operations

Saluda Hydro occupies a specific, very important niche in SCE&G's generating portfolio in that it is a facility in the SCE&G system that provides *reserve capacity*. Reserve capacity means the Project generators can increase output immediately in response to a major generator or transmission *outage* and can reach full output within 15 minutes to comply with the North American Electric Reliability Council's Control Performance Standard.

SCE&G is a member of the Virginia-Carolinas Southeastern Electric Reliability Council sub-region (VACAR), whose members are bound in a reserve-sharing agreement by which each has agreed to assist any other member in generation emergencies. SCE&G must employ its reserves (Saluda Hydro) to meet its own generation emergencies before calling on assistance from other VACAR members, but it also must be constantly ready to provide reserve generation to other VACAR members to meet SCE&G's contractual reserve obligations.

Comment: This section should focus on the hydrologic affects of operations not VACAR or reserves. Delete below and insert summary of project op effects on downstream hydrology. Document that project operations have varied under the existing license term from Peaking to Load-Following to Reserve Capacity - document years under each operation mode.-Gerrit Jobsis

Under SCE&G's obligations as a member of VACAR, it must be able to supply approximately 200 MW within 15 minutes in the event of an out-of-system emergency. The Saluda Project's greatest single value in support of SCE&G's system obligations is its ability to provide up to 202 MW of generation almost instantly. In the case of any system emergency, Saluda may be dispatched for up to full capacity generation for minutes or even hours.
Add intro section on Saluda River - state's first scenic river, trophy striped bass fishery, significant refuge habitat for Santee-Cooper striped bass spawning stock, unique trout fishery; this river segment is of high statewide priority

1.2 Use of Study Results

In general, the TWC is interested in exploring the protection of instream habitat in the lower Saluda River (LSR) below the Saluda Project (see Appendix A for a detailed summary of discussions).

- Identify a minimum flow for the LSR
- Determine flows needed for target species and lifestages, as well as the downstream floodplain
    - Determine the range of flows acceptable to meet these criteria
    - Determine how project operations affect these flows
    - Mimic the natural hydrograph of the LSR
    - Consider impact of providing these flows on Lake Murray

The TWC has identified the following issues that this study will provide data for:

Comment: New Section - Information provided by this study-Gerrit Jobsis

- evaluate alternative flow regimens for the LSR;
- identifying flow regimens that are protective of aquatic habitat;
- provide data that can be used to weigh the effects of managing Lake Murray water levels on downstream habitat; and
- provide data that can be used to weigh the effects of project operations on downstream habitat.

1.3 Purpose of This Study

The scope of this study is to provide data quantifying the effects of flows on aquatic habitat suitability in the LSR for the aquatic community and its managed fish resources, including diadromous and resident fish species, and aquatic invertebrates and to assist the TWC in identifying flow regimens that support habitat requirements for a balanced aquatic community. These data will then be used in conjunction the Congaree River flow study, and hydrologic, operational and other models to evaluate the costs and benefits of providing alternate flows to the lower Saluda River.

Comment: Move this sentence to top paragraph

2.0 DESCRIPTION OF STUDY AREA

The Saluda River rises on the east slope of the Appalachian Mountains, and flows southwest across the Piedmont geomorphic province to its confluence at the fall line (Hunt 1974) with the Broad River in Columbia, South Carolina, where the combined flows form the Congaree River. Between the Lake Murray dam and the confluence, LSR flows for approximately ten miles through generally low gradient[2] riverine geomorphology (Figure 2). The drainage area at Lake Murray dam is 2,420 square miles. Real time stream flow gages exist at USGS 02168504 (*Saluda River below Lake Murray Dam*), and USGS 02169000 (*Saluda River near Columbia, SC*).

2.1 Upstream and Downstream Boundaries

The LSR segment between Lake Murray and the confluence with the Broad River, (Figure 2) was identified by the TWC as the study area for purposes of this study. Flow in this reach is primarily influenced by releases from the Saluda Project powerhouse, although there are some additional contributions from small tributaries such as Rawls, Twelvemile , Kinley , and Stoop creeks and Senn Branch, which collectively contribute approximately 100 square miles of additional drainage area.

2.2 Habitat and Geomorphology

The LSR flows southeasterly through a river corridor that gradually shifts from rural to suburban to urban land uses, and in general the river banks and riparian zones are forested. Overall the river is relative straight, with gentle bends and little sinuosity. The upper segment of the LSR is dominated by well-defined banks, relatively low-gradient pools and glides periodically segmented by short shoals and alluvial riffles. The lowermost segment also contains pools, glides and runs, but exhibits higher gradient, more pronounced riffles, and features ledge and boulder substrates which reflect down cutting through the piedmont terrace at the fall line. There is some evidence of localized bank erosion and ephemeral alluvial shoaling. Beginning downstream of Riverbanks Zoo, the LSR becomes highly braided, with the lowermost mile becoming backwatered by the Broad River (Isely, et. al, 1995). There are a few scattered islands with pronounced side channels and/or braids in both the upper and lower reaches of the LSR.

An important macrohabitat consideration on the LSR is that the ambient water temperature and dissolved oxygen (DO) is influenced by cold water releases from below the thermocline of Lake Murray via the project powerhouse. Average water temperatures below the Project dam range from approximately 9.5^{o}C in February to 17.5^{o}C in early-October, and from approximately 10 to 18.5^{o}C in the vicinity of Riverbanks Zoo[3]. A site-specific study aimed at gaining greater understanding of the downstream extent and mixing characteristics of temperature impacts is underway. Average DO levels below the

[2] Reach is punctuated by short, higher gradient reaches (3-4%), such as Millrace Rapids, but generally gradient is 1% or less.

[3] Based on monthly averaged 2000 to 2006 data as measured at USGS Gage # 02168504 (below Murray Dam) and at USGS Gage # 2169000 (Columbia).

dam range from 6.2 mg/L during September to 11.0 mg/L during February, with periodic excursions below 1.0 mg/L for short periods of time[4].

Comment: May want to mention trout fishery is enabled by project operations

2.3 Fishery, Fish Management Objectives, and Seasonal Habitat Uses

The LSR supports a diverse community of coldwater and warm water fish species and provides a variety of fishing opportunities (Beard, 1997). This two-story fishery has been established through SCDNR stocking to enhance LSR recreational fishing opportunities. In 1995, the SCDNR investigated the potential to establish a smallmouth bass fishery in the LSR. SCDNR's findings suggested that while many criteria to support a smallmouth bass fishery were present, it was not feasible to implement this strategy as a fishery management goal in the LSR because suitable habitat was found to be inadequate.

Comment: Add that water quality (DO and temperature) of Saluda is recognized as affecting fish community.-Gerrit Jobsis

Comment: Add paragraph on LSR being a state scenic rive and a valuable fishery

Comment: Add that DNR stocked smallmouth bass in mid-1980s but this was generally recognized as unsuccessful.-Hal Beard

Resident Fishery Resources

The LSR resident fishery is typical of many southern tailwater systems, and includes an assortment of resident game and non-game species (Table 1). Studies conducted as early as 1991 found approximately 50 species of fish, 48 of which are considered endemic to the region (Jobsis, 1991). Cite Crane 1987 study

Comment: Include table of resident fish species.-Theresa Thom

Redbreast sunfish were the most abundant game species found in the 1991 study. Bluegill were also typically found in relatively high abundance but abundance was highly variable based on specific habitat types (Jobsis, 1991). Redbreast sunfish were dominant in the upper sections as compared to the lower and middle sections. LSR redbreast sunfish growth studies indicated that this species grows slowly compared to those of other rivers in the southeast (Jobsis, 1991). However, this is not surprising since coldwater temperatures have been shown to limit growth of warmwater fish in similar watersheds (Ruane et al., 1986).

SCE&G data show that gizzard shad comprised approximately 25% of the catch prior to 1997. After 1997, a marked decline was observed in LSR gizzard shad abundance, while sport fish species abundance increased. Recent SCDNR sampling indicates similar trends. SCDNR theorized a significant increase in chain pickerel populations is due to recent increases in the aquatic macrophyte community (personal communication, H. Beard, SCDNR, 2003).

Comment: Turbine venting??

Comment: Suggest clarification or delete. Has not necessarily increased.-Hal Beard

Cold water releases from the Saluda Hydro Project have supported a unique put, grow, and take rainbow and brown trout recreational fishery in the LSR since the early 1950's. According to stocking records, SCDNR typically stocks the LSR with approximately 28,000 to 30,000 trout annually, at a 3:1 ratio of brown trout to rainbow trout. The fish length at time of stocking is typically 7-8" for brown trout and 9-10" for rainbow trout. Trout are typically stocked from November – March throughout the LSR. These trout do not represent a native population, and are presently restocked annually to offset angling exploitation and predation. However, angler reports of trophy fish of 4 to 8 pounds indicate that some rainbow trout may survive up to several years (Kleinschmidt, 2003).

Comment: Add recent striped bass information

[4] Based on monthly averaged 2000 to 2006 data as measured at USGS Gage # 02168504 (below Murray Dam).

A fishery management plan for the LSR is currently being revised by the SCDNR. However, a recent SCDNR creel census suggested that the fishery generates approximately 1.8 million dollars annually, with the trout fishery being responsible for the majority of the revenues (Beard, 2000).

Diadromous Fishery Resources

American shad, striped bass, and Atlantic and shortnose sturgeon have historically used Project waters. Mills reported as early as 1826 that American shad and sturgeon ascended rivers above the fall-line, more specifically the Saluda River (USFWS, 2001). Striped bass, the only known anadromous fish to consistently use the LSR, migrate upstream from the Santee Cooper lakes in early spring and use areas of the LSR in late summer as thermal refuge. LSR anglers have reported catching individuals exceeding 50 pounds (personal Communication, Hal Beard, SCDNR, 2002). SCE&G's 1995–2003 spring electrofishing sampling revealed only sporadic catches of striped bass. The SCDNR has reported no presence of diadromous species such as blueback herring or American shad in the LSR (Beard, 2002); however, sampling conducted by SCE&G in the spring of 2003 detected the presence of three American shad in the LSR. The American eel is the only know catadromous fish reported to inhabit Project waters (Beard, 2002). Recent sampling during 2005 and 2006 resulted in the capture of only one eel, and electrofishing by SCE&G and SCDNR has yielded only sporadic eel captures (Kleinschmidt, 2005; Kleinschmidt, 2006; personal communication, H. Beard, SCDNR, 2006; S. Summer, SCANA Services, Inc., 2006), suggesting that eel densities in the LSR are likely limited in abundance.

Comment: Make sure this statement is correct

Anadromous fish restoration efforts for the Santee Basin appear to focus on restoring runs of anadromous fish primarily up the Congaree and Broad Rivers. The Santee Cooper Basin Diadromous Fish Passage Restoration Plan reports that the Broad River and its tributaries are the highest priority for diadromous fish restoration (USFWS, 2001). The Saluda along with Catawba and Wateree sub-basins are listed as next in priority. The Plan states that the cold hypolimnetic water significantly reduces the ambient LSR water temperature, and thus migrating fish may choose to use the warmer waters of the Broad rather than the Saluda (USFWS, 2001). Furthermore, alteration of the existing thermal regime of the LSR would be an engineering challenge and likely adversely affect the coldwater trout fishery in the tailwater.

Comment: May want to mention fish use LSR during active seasons

Comment: Sentence may need to be revised-based on engineering enhancement

3.0 PROPOSED METHODS

3.1 Field Reconnaissance and Habitat Mapping

The TWC concluded that the an Incremental Instream Flow Methodology (IFIM) study would be appropriate to develop an understanding of key habitat-flow relationships in the LSR, and elected to use a Physical Habitat Simulation (PHABSIM) model to quantify these relationships. The model will be used to quantify flows that meet habitat requirements to support a balanced aquatic community based on model results representing selected diadromous and resident fish, and aquatic biota (*i.e.* macroinvertebrates). In addition, empirical data and/or a flow demonstration approach may be required to document flows that provide adequate fish passage at falls such as Millrace Rapids.

Consistent with IFIM protocol, a study team comprised of agency and licensee biologists will be formed for the purpose of making technical decisions regarding input parameters and review of study output. Specifically, that team will designate the 1) boundaries of the study area, 2) locations of specific representative or critical study sites, 3) locations of study site transects, 4) Habitat Suitability Index (HSI) criteria, and 5) calibration flows and range of flows to be assessed. The study team may participate in field and analytical activities as deemed feasible.

Mesohabitat Classification

A field reconnaissance survey will be conducted with the study team to determine:

1) the classification and distribution of mesohabitats in the LSR study area; and
2) the location(s) of potentially limiting zone of passage for migratory fish movement.

Mesohabitat mapping will include a review of a Isely, et al.(1995), aerial photographs, fly-over video, followed by ground verification. Mesohabitat will be field-mapped to delineate the relative quantity and spatial distribution of each habitat type in the study area. The team will define each mesohabitat type of interest, and assign specific attributes to each that can be used for field delineation. Delineation will occur during a period of relatively low-to-moderate flow so that breaks in mesohabitat, substrate, object cover and hydraulics representative of approximate base flow conditions can be readily observed. Study team members are encouraged to participate in delineation to the extent feasible. The upstream and downstream boundary of each mesohabitat within the study area will be classified and geo-referenced in the field, and the information transferred to a Geographic Information System (GIS) format. GIS will then be used to provide both a visual map and quantitative tabular information on the abundance of mesohabitat types in the study area. Additional features relevant to differentiation of mesohabitats, such as geomorphic and physiographic characteristics, will also be collected where appropriate.

Selection of Reaches, Study Sites And Transects

The study team will consult to define study reaches and select applicable mesohabitat study sites within each reach, as well as transects within each study reach. Study reach boundaries are typically placed at significant breaks in geomorphic, hydrologic or habitat use in the study area (Bovee, et al., 1998)[5]. Within each study reach, the study team will identify candidate study sites that represent typical and/or unique but critical mesohabitats, and select upstream and downstream cell boundaries within each study site based on localized observable shifts in stream width, cover, substrate, and hydraulics. The field crew will subsequently locate a transect within each longitudinal cell.

3.2 Field Data Collection

3.2.1 PHABSIM Study Sites

General Approach

The second phase will entail the determination of habitat-discharge relationships for selected species, lifestages, and guilds in the LSR. Standard PHABSIM data collection and flow modeling procedures of the Instream Flow Incremental Methodology (IFIM) (Bovee, 1982, Bovee et al. 1998) will be used to evaluate habitat suitability, and empirical flow measurements will be obtained to evaluate zone-of-passage hydraulics at a limiting river channel site.

Modeling will be based on hydraulic data developed from cross-sectional depth, velocity, and substrate measurements following Milhouse, *et al.* (1989), using PHABSIM for Windows (V 1.2), developed by the United States Fish and Wildlife Service and distributed by the USGS Fort Collins (CO) Science Center.

Flow Range to Be Modeled

Based on TWC consultation (See Appendix A), SCE&G anticipates that habitat-discharge relations would be developed for flows ranging up to approximately 20,000 cfs, and that the modeling effort would focus on both representative mesohabitat types and the limiting fish passage channel site selected by the study team.

Suitability Index Criteria

The TWC is presently gathering and considering specific habitat Suitability Index (SI) rating curves for use in this study. Based on TWC

[5] As noted above, the upper and lower ends of the study area have distinct differences in slope and substrate, suggesting that at least two geomorphic reaches may be justifiable. Hydrologic reach breaks are conventionally set at points where a tributary adds 10% of more additional drainage area to the study area.

consultation, SCE&G proposes the use of HSI curves adopted primarily from those previously used in instream flow studies in the Catawba-Wateree and Pee Dee River studies. These curves, which are contained in Appendix B, were developed in support of recent IFIM studies and PHABSIM models conducted for similar fish assemblages with similar geomorphic and ecoregion characteristics. To the extent possible, species and lifestages of interest will be classified into habitat guild classes (*i.e*. deep slow, shallow slow, shallow fast, deep fast), and representative HSI curves for each guild selected by the team in consultation.

In some cases, stand-alone species and lifestages may be modeled, such as rainbow and brown trout. Additional HSI curves for brown trout, rainbow trout, and a surrogate for fish passage will be obtained from other studies and reviewed for applicability, discussed, modified as necessary and approved by the study team.

Transect Data Collection

The location of each transect will be field blazed with flagging or other appropriate means. Each study site and cell will be mapped sufficiently to quantify the area represented by each transect. The transect headpin and tailpin ends will be located at or above the top-of-bank elevation, and secured by steel rebar or other similar means. A measuring tape accurate to 0.1 ft will be secured at each transect to enable repeat field measurements to occur at specific stream loci[6]. Stream bed and water elevations tied to a local datum will be surveyed to the nearest 0.1 ft using standard optical surveying instrumentation and methods.

Depth, velocity, and substrate data will be gathered at intervals (verticals) along each transect. Each vertical will be located to the nearest 0.1 ft wherever an observed shift in depth or substrate occurs. Between 20 and 99 verticals per transect will be established as necessary to define cross-sectional habitat. Verticals will be arranged so that no more than 10% of the river discharge passes between any pair, thus enhancing hydraulic model calibration. At least one staff gage will be located per study site, and will be monitored at the beginning and end of each set of hydraulic measurements to confirm stable flow during measurements. If flow is found to be insufficiently stable, the related data will be discarded and re-measured once stable flow is established.

Mean column velocity will be measured to the nearest 0.1 ft/second with either a calibrated electronic velocity meter mounted on a top-setting wading rod, or alternatively an Acoustic-Doppler Current Profiler (ADCP) transducer. In water less than 2.5 ft depth, measurements will be made at 0.6 of total depth (measured from the water surface); at greater depths, paired measurements will be made at 0.2 and 0.8 of total depth and averaged.

Each calibration flow will be provided by scheduled releases from the Project via unit operation. Turbine rating curves, USGS gaging, and study-site

[6] Supplemental transects may be located as needed to record water surface and bed elevation data at hydraulic controls to establish backwatering parameters necessary for hydraulic modeling.

field gaging will be collectively used to estimate each calibration flow release. The hydraulic model will be built from measurements gathered at a *minimum* of three calibration flows to facilitate extrapolation of hydraulic data across the range of interest. To accomplish calibration, a full set of depth, velocity and water surface elevation (WSEL) data will be gathered at the intermediate flow, and WSEL will be measured at each transect for the low and high flow calibrate. At transects with complex hydraulics such as braided channels or riffles, and/or sites with unusual backwatering or eddy effects, supplemental velocity data may be gathered at the low and/or high calibration flows. This will be determined in the field on a case-by-case basis.

Each calibration flow should ideally be separated by about an order of magnitude to provide a suitable stage-discharge curve for the hydraulic model. At a minimum, SCE&G anticipates utilizing calibration flows of approximately: 350-500; 1200-1500; and 10,000 cfs. Depending on calibration quality, this should allow the PHABSIM model to theoretically project Weighted Usable Area (WUA) for a flow range from 40 to over 20,000 cfs. The need for additional calibration flow data may vary by transect and will be evaluated on a case-by-case basis.

Hydraulic Modeling

Hydraulic modeling will be accomplished by correlating each surveyed water stage with discharge to develop a stage-discharge relationship for each transect. PHABSIM uses a family of hydraulic models such as IFG4, MANSQ and WSP. Once this relationship is established, the model then adjusts velocities obtained at calibration flows to other flow increments of interest for which defined water stages have been calculated. The model is then calibrated by comparing simulated hydraulics to empirical measurements taken at the calibration flows. Coefficients such as relative stream channel roughness are then iteratively adjusted as needed to optimize model accuracy across the full flow range.

Comment: Add details on calibration measurements and accuracy

Habitat Suitability

Once the hydraulic model is calibrated, estimates of habitat suitability at each flow increment of interest will be generated by combining the HSI and hydraulic model data using the HABTAE and supporting programs within PHABSIM. These ultimately produce output known as Weighted Usable Area (WUA) for each transect at each flow increment. WUA is an index of habitat suitability based on units of square ft of optimal habitat available per 1,000 ft of represented stream length. WUA output for all transects in a given mesohabitat type are then weighted according to actual linear distance each transect represents within the mesohabitat, as mapped in the field, to provide a mesohabitat habitat-flow curve. All mesohabitat WUA within a given study reach is then weighted and summed for each flow increment to provide a net WUA estimate for the entire study reach.

3.2.2 Fish Passage Study Site(s)

The TWC identified fish passage through shoals as a critical habitat concern, specifically at Millrace Rapids, a location where the LSR descends through a demolished mill dam at the Piedmont fall line boundary. This location is characterized by large rubble, boulder, and other object cover that produces complex hydraulics and interstitial flow that is difficult to model. The TWC concluded that an alternate approach will be required at this site. The objective at this site is to establish sufficient water depth to facilitate volitional upstream fish passage through the most limiting portion of the channel. SCE&G proposes to conduct a site visit with the study team during a period of low wadable flow when channel geometry and probable zone of passage routes can be readily be observed. The study team will then select a representative transect location at a critical passage site to allow characterization of hydraulics (wetted depth, width, and velocity) at a range of flows bracketing what the team feels will produce suitable fish passage conditions according to the established HSI criteria. The field crew will then proceed to obtain water elevation and velocity measurements at the transect at each flow of interest, with gaging data obtained from the USGS 02169000 gage, which is located in close proximity to Millrace Rapids. These data will then be displayed graphically and in tabular format to identify flows that promote hydraulics that can provide suitable fish passage.

Comment: Is another study needed? Little channel morphometry changes are anticipated since 1980's study.-Gerrit Jobsis

Comment: Include reference to passage releases (1500 cfs?) by SCE&G requested by Bulak in 1991(?) that resulted in fish passing Millrace Shoals. –Gerrit Jobsis

4.0 REPORTING

A draft report will be prepared for study team review and comment, documenting methods and results as encountered in the field and during modeling. WUA and supporting hydraulic data will be presented in graphic and tabular form, along with an analysis of trends in the data, and documentation of study team consultation. Appendices will also include cross-sectional survey data and reference photographs of study sites. The report will be finalized and provided to the TWC following receipt of input from the study team.

5.0 CONSULTATION

Upon receipt of the final report, the TWC may elect to apply these data to further analyses such as assessing project operation issues, lake level management, and overall flow regime evaluation (see section 1.3).

6.0 SCHEDULE

TASK	COMPLETION DATE
Finalize target species/guilds	February 1, 2007
Finalize HSI curves to be used	February 15, 2007
Mesohabitat characterization; select transect locations	April 15, 2007
Collect transect data	May 15, 2007
Complete modeling	July 15, 2007
Issue draft report	August 15, 2007
Issue final report	October 1, 2007

7.0 LITERATURE CITED

Beard, H. 1997. Fisheries investigations in lakes and streams – District VIII. South Carolina Department of Natural Resources Study Progress Report.

Beard, H. 2000. Fisheries Investigations in Lakes and Streams, District VIII. South Carolina Department of Natural Resources Study Progress Report F-49.

Beard, H. 2002. Fisheries investigations in lakes and streams – District VIII. South Carolina Department of Natural Resources Study Progress Report F-63-1-10: 43 pp.

Bovee, K.D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Office of Biol. Serv., USFWS, U.S. Dept. Of Interior, Wash., DC. FWS/OBS-82-26. 248 pp.

Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.B. Stalnaker, J. Taylor and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD-1998-0004/ viii + 131 pp.

Hunt, C.B. 1974, Natural regions of the United States and Canada. W.H. Freeman and Company. San Francisco, CA. 725 pp.

Isely, J.J., G. Jobsis, and D. Gilbert. 1995. Instream flow requirements for the fishes of the lower Saluda River. March 28, 1995. 15 pp. plus appendices

Jobsis, G. J. 1991. Assessment of Tailwater Fisheries, South Carolina. Wildlife and Marine Resources Department, Columbia, SC. F-30.

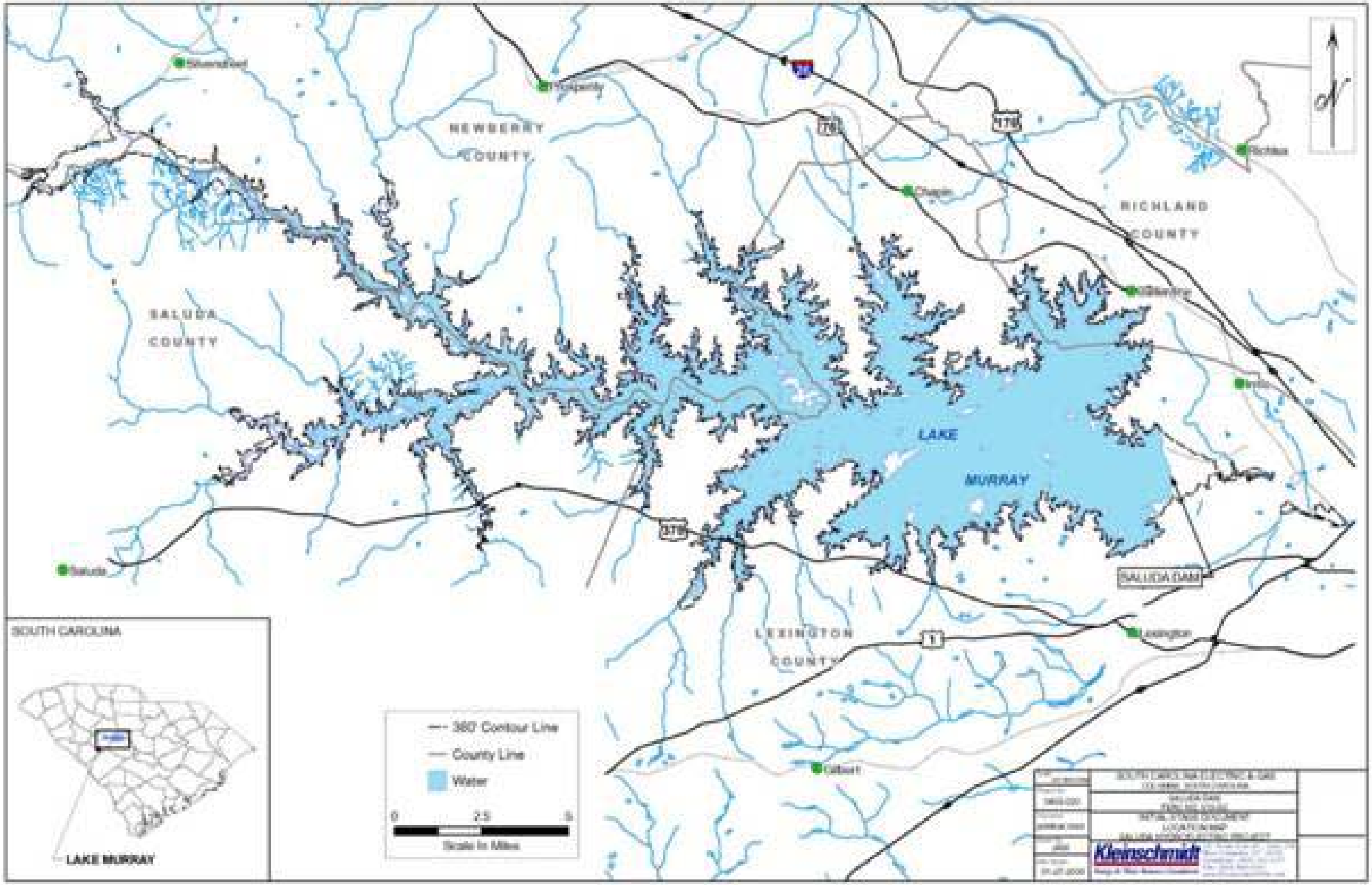
Kleinschmidt. 2005. Lower Saluda River diadromous fish studies 2005: American eel (*Anguilla rostrata*) survey report. Prepared for South Carolina Electric & Gas. 41pp.

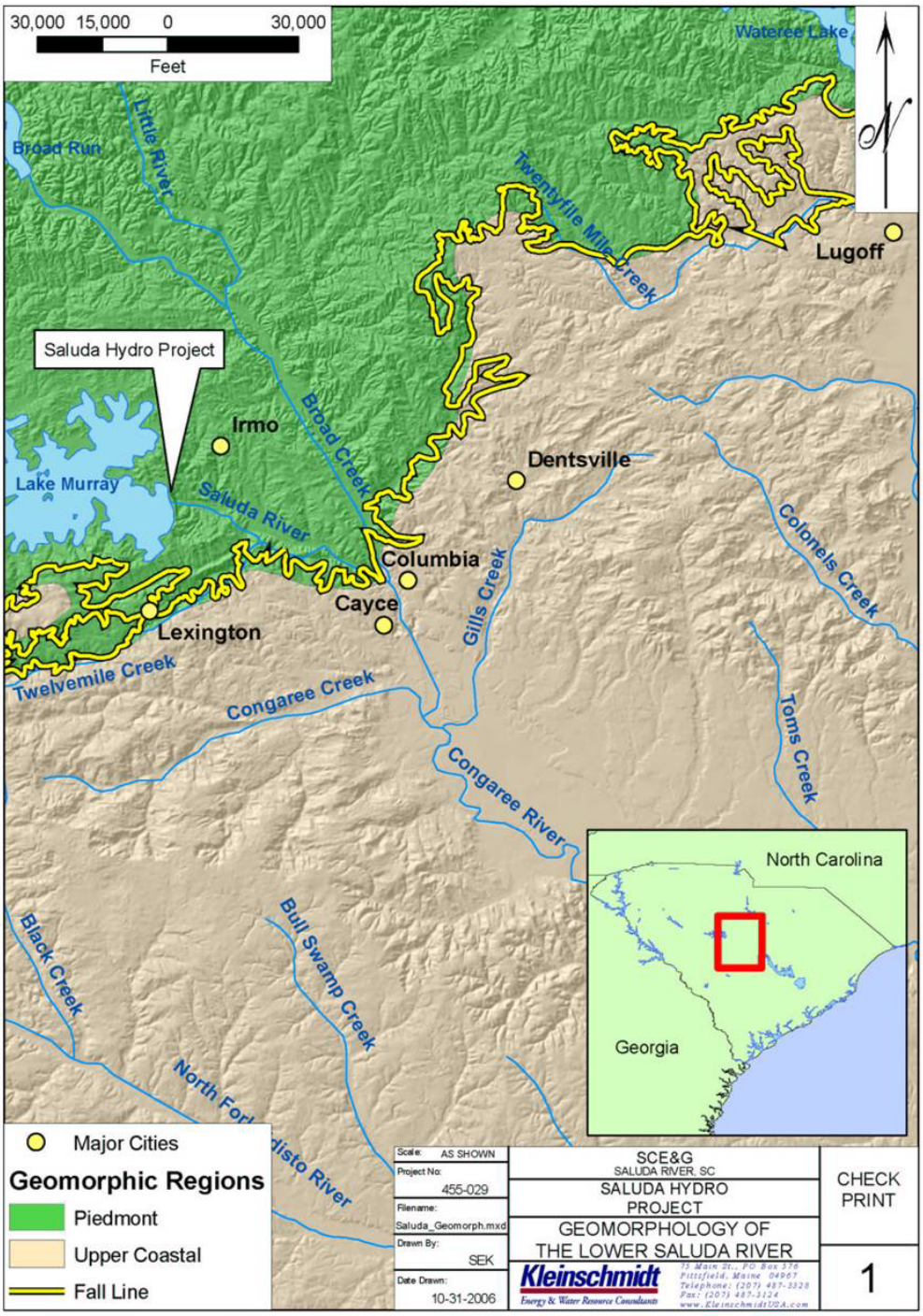
Kleinschmidt. 2006. Lower Saluda River diadromous fish studies 2006: American eel (*Anguilla rostrata*) survey report. Prepared for South Carolina Electric & Gas. 59pp.

Milhouse, R.T., M.A. Updike, and D.M. Schneider. 1989. Physical habitat simulation system reference manual - Version II. U.S. Dept. of Interior, Fish and Wildlife Serv. Wash., DC. Biol. Report. 89(16). v.p.

Ruane, RJ., C.E. Bohac, W.M. Seawell, and R. M. Shane. 1986. Improving the downstream environment by reservoir release modifications. Reservoir fisheries management and strategies. American Fisheries Society, Southern Division, Bethesda Md. 273 p.

U.S. Fish and Wildlife Service, National Marine Fisheries Service and South Carolina Department of Natural Resources. 2001. Santee Cooper Diadromous Fish Passage Restoration Plan.


NEWBERRY COUNTY
Prosperity
Chapin
RICHLAND COUNTY
Irmo
SALUDA COUNTY
LAKE MURRAY
SALUDA DAM
Saluda
Lexington
LEXINGTON COUNTY
Gilbert
SOUTH CAROLINA
LAKE MURRAY
360' Contour Line
County Line
Water
0
2.5
5
Scale In Miles
Kleinschmidt



South Carolina Department of Natural Resources. South Carolina Geological Survey. 2005. Fall Line, Geological Provinces and DEM. Available online at: www.dnr.sc.gov/GIS.

APPENDIX A

SALUDA HYDROELECTRIC PROJECT

INSTREAM FLOW/AQUATIC HABITAT

TECHNICAL WORKING COMMITTEE MEETING NOTES

Included as a separate file.

APPENDIX B

SALUDA HYDROELECTRIC PROJECT

HABITAT SUITABILITY CURVES FOR TARGET SPECIES/GUILDS

This information is currently being developed by the Instream Flow TWC.

ATTACHMENT B

COMMENTS ON THE GUILD MATRIX

Legend: guild selection change recommended 11/27/06
SI curve research and review desired
habitat generalist no specific guild or SI curve required at this time

		GUILD CATEGORY							
SPECIES	**LIFE STAGE**	**Shallow Slow**	**Shallow Fast**	**Deep Slow**	**Deep Fast**	**Habitat Generalist**	**Limiting Rapid**	**SI CURVE SOURCE**	**SPECIES**
robust redhorse	spawning		X					Catawba-Wateree	Generic or robust redhorse
robust redhorse	fry/YOY	X						Catawba-Wateree	*guild surrogate*
robust redhorse	juvenile			X				Catawba-Wateree	golden redhorse
robust redhorse	adult			X				Catawba-Wateree	golden redhorse
Norrthern hogsucker	spawning				X			Catawba-Wateree	*guild surrogate*
Norrthern hogsucker	fry/YOY				X			Catawba-Wateree	*guild surrogate*
Norrthern hogsucker	juvenile				X			Catawba-Wateree	*guild surrogate*
Norrthern hogsucker	adult			X				Catawba-Wateree	*guild surrogate* (redbreast sunfish adult?)
spotted sucker	spawning		X					Catawba-Wateree	*guild surrogate*
spotted sucker	fry/YOY	X						*TBD*	*guild surrogate* (redbreast sunfish spawning?)
spotted sucker	juvenile	X		X				*TBD*	*guild surrogate* (redbreast sunfish spawning?)
spotted sucker	adult			X				*TBD*	*guild surrogate* (redbreast sunfish adult?)
brown trout	spawning		X					Catawba-Wateree *(if transferable)*	TVA, other source studies
brown trout	fry/YOY	X						Catawba-Wateree *(if transferable)*	TVA, other source studies
brown trout	juvenile	X						Catawba-Wateree *(if transferable)*	TVA, other source studies
brown trout	adult			X	X			Catawba-Wateree *(if transferable)*	TVA, other source studies
rainbow trout	spawning		X					Catawba-Wateree *(if transferable)*	TVA, other source studies
rainbow trout	fry/YOY	X						Catawba-Wateree *(if transferable)*	TVA, other source studies
rainbow trout	juvenile		X		X			Catawba-Wateree *(if transferable)*	TVA, other source studies
rainbow trout	adult				X			Catawba-Wateree *(if transferable)*	TVA, other source studies
redbreast sunfish	spawning	X						Catawba-Wateree	
saluda darter	adult		X					Catawba-Wateree or Pee Dee	fantail darter surrogate
spottail shiner			X						
redbreast sunfish	adult			X				Catawba-Wateree	
shorthead redhorse	adult				X			Catawba-Wateree	golden redhore
threadfin shad								*get SCDNR staff input*	
American shad	spawning				X			Catawba-Wateree	
American shad	YOY			X	X			Catawba-Wateree	American shad spawning *or deep slow guild*
American shad	passage						X	Conte Lab-American Rivers	
blueback herring	spawning	X						*TBD*	shallow-slow guild surrogate
blueback herring	YOY	X						*TBD*	shallow-slow guild surrogate
blueback herring	passage						X	Conte Lab-American Rivers	
striped bass	passage						X	Conte Lab-American Rivers	
striped bass	adult							Catawba-Wateree & Savannah	*thermal refuge in summer*
shortnose sturgeon	passage						X	Conte Lab-American Rivers	
shortnose sturgeon	spawning							NMFS	
shortnose sturgeon	adult							NMFS	
shortnose sturgeon	juvenile							NMFS	
American eel	juvenile					X		none recommended at this time	
benthic macroinver.	juvenile		X					Catawba-Wateree	
smallmouth bass	spawning								
smallmouth bass	YOY								
smallmouth bass	juvenile								
smallmouth bass	adult								

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
IFIM/Aquatic Habitat TWC

SCE&G Training Center
October 16, 2006

Final acg 11-22-06

ATTENDEES:

Alison Guth, Kleinschmidt Associates	Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates	Randy Mahan, SCANA Services, Inc.
Ron Ahle, SCDNR	Scott Harder, SCDNR
Dick Christie, SCDNR	Hal Beard, SCDNR
Shane Boring, Kleinschmidt Associates	Brandon Kulik, Kleinschmidt Associates
Malcolm Leaphart, TU	Gerrit Jobsis, American Rivers

HOMEWORK:

- Perform literature review for existing studies on widths and depths necessary for fish passage – *Brandon Kulik*
- Distribute draft IFIM study plan to group by email prior to 27th meeting – *Brandon Kulik*
- Send Catawba Wateree HSI curves to Brandon K - *SCDNR*
- Forward Brandon K. an example list of species to be considered under each guild - *SCDNR*
- Send Pee Dee HSI curves to Brandon K. – *Gerrit Jobsis*

UPCOMING AGENDA ITEMS:

- *Addressing the influences of Saluda Operations on the Congaree*

DATE OF NEXT MEETING: **November 27, 2006 at 9:30 a.m.**
Lake Murray Training Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Review of Homework Items from Previous Meeting:

Shane Boring opened the meeting and noted that the first discussion topic was to review action items from the previous meeting. Shane noted that Gerrit Jobsis was charged with finding the HSI curves used in 1989-90 LSR IFIM Study. Gerrit replied that they could be found in the study

report. Shane also noted that he had talked to Theresa Thom regarding her homework assignment to check with USC Geography Dept. for GIS habitat coverages for the LSR. Shane explained that she was not able to find any GIS habitat layers. Shane also noted that he has contacted MaryAnn Taylor to discuss potential for using existing LIDAR photography to develop GIS-based habitat layers, as was his homework assignment. He noted that Clarence at Orbis was investigating this issue.

Discussion About the Meeting Topic:

The group then discussed the recommendations for instream flows that DNR presented in their ICD comments (1170 cfs during the month of January through April, 879 cfs during May and June, 586 during July through November, and 879 cfs during December). Bill Argentieri noted that SCE&G has reviewed the flow options presented. Bill noted that the flows that were proposed were apparently reflective of the USGS gage at the lower end of the confluence, adding about a hundred sq. miles to the drainage area. Bill explained that based on the 20/30/40 proposal, SCE&G came up with 493 740 and 986 cfs based on the gage directly below the dam. Bill also reiterated that at the last meeting Gerrit provided numbers from the study of the Saluda River by the Water Resources Commission/Wildlife and Marine Resource Department (Bulak, J.S. and G.J. Jöbsis. 1989) which are 575 950 and 1326 cfs. Gerrit noted that the numbers provided in the report are based on physical measurements from the Saluda river to meet the criteria for passage.

As the group began to discuss the existing DNR IFIM report in a little more detail, Dick Christie gave the group a little more background to the report. Dick noted that when the study was done in the 80's, there was only one gage on the lower Saluda River, the gage down by the zoo. He noted that mean daily flow was calculated from that gage. Dick noted that when DNR made the flow recommendations they were actually recommendations for that site in particular, so by default there is a little bit of inflow between the dam and that gage. Dick continued to explain that there may be room for calculating and that they would support the updating of the numbers if the group can come to terms of doing that. Dick asked Bill if SCE&G had developed their flow estimates by subtracting what was calculated to be the drainage area. Bill replied that they had. Gerrit noted that they have dealt with this in the past by using the monthly calculated inflow rather than annual averages, because the drainage areas would have less contribution in the summer.

The group then began to discuss what would be involved in performing a new site specific test. Gerrit suggested a real time analysis to look at the habitat available, looking at flows not based on annual average but on daily or hourly flows. Bill pointed out that the new study would probably not be performed before next year due to the low lake levels. Dick noted that the transects could probably be laid out and the low flow data could be obtained, while the high flow data could be reserved for times when the lake level is higher. Gerrit noted that he believed that the fish passage transects provided in the Bulak, J.S. and G.J. Jöbsis 1989 study were important to consider. He explained that a panel of experts was assembled to weigh in on what they felt was necessary for

unimpeded fish passage. At that time the panel felt that a 10 ft wide, by 18 inch deep slot was necessary for this, or 10% of the channel width. Alan Stuart asked the group if there have been any studies preformed that further address passage. Brandon Kulik noted that he does know of a few studies that they could look into. Brandon also noted that a mesh model could be developed at the rapids that would allow the rapids to be modeled probably better than transects.

Dick noted that he was curious as to whether consideration was given to the time or timing on the flows for fish passage in the existing IFIM report. Hal Beard was asked to give an account of his experience fish sampling on the lower Saluda. Hal noted that based on the years that he has worked, both drought and normal, he has not seen an absence of striped bass in the river. However he noted that he could not comment as to the relative abundance of striped bass. He mentioned that he could compare the data he collected to flows.

Malcolm Leaphart asked for an reiteration as to why the flows had been requested for those particular times during the year. Dick noted that the 20/30/40 recommendation is based on a typical hydrograph and is also something that the utilities are able to implement.. Dick continued to explain that if you look at a typical hydrograph you will see the highest flows are in the spring, and that it is commonly understood that the fish have probably adapted to the hydrograph. Thus, the policy should be adapted to the hydrograph, to which the fish have adapted to.

Presentation and Review of Scoping Elements:

After a short break, Brandon gave a brief presentation on PHABSIM. (Can be viewed on the website). Alan suggested reviewing the video flyovers to help decide what areas to use in the study and what reach breaks to use. Brandon explained that during a study they would have to come up with commonly understood definitions of runs and riffles along the lower Saluda.

After lunch the group discussed the 7 basic instream flow study scoping elements, listed below.

BASIC INSTREAM FLOW STUDY SCOPING ELEMENTS

1. Specify habitat and resource management objectives
2. Define geographic boundary of study area
3. Define type of problem (*i.e*. diversion, maintenance of minimum flow, alteration of existing flow regime, *etc*)
4. Define macrohabitat influences (*e.g*. water quality, temperature, etc.)
5. Select and justify evaluation criteria
6. Define temporal periods and units
7. Define flow ranges and increments of interest

During discussions on item number 2, defining geographic boundary of study area, Gerrit noted that he believed the Congaree river was important to consider as well. Gerrit further asked that the group have an agenda item at an upcoming meeting to specifically address Saluda's potential influence on the Congaree.

Brandon moved to item number three, Define the type of problem. Dick explained that it could be defined as the alteration of an existing regulated flow. He also asked if there would be an evaluation of peaking included in the study. It was explained that peaking over a 12 hour period would have quite a different impact than peaking over a 1 hour period (Reserve usage). The group noted that the duration of high flows would be taken into account in a dual flow analysis.

The group progressed through the scoping elements, pausing for brief discussion on number 6. Ron noted that he preferred the idea of initially taking smaller temporal units and lumping them together if need be. Gerrit suggested using the same temporal periods for setting up life stages as used in the Pee Dee. Brandon noted that there were advantages to using monthly units, and asked the group if they would like the units to be smaller than that.

The group discussed how to look at the reserve component during this study. Brandon noted that if reserve is used for only a few hours there is probably some sort of measurable effect just below the powerhouse, however these effects will probably attenuate throughout the stretch of river. The group agreed that in order to best look at the reserve use is to have a few transects close to the dam.

On item 7, Alan noted that the flow range would be up to 20,000 cfs, or what the top-end of the potential upgrade is going to be.

Discussion of Proposed Target Species List:

The group then began to discuss the Proposed Target Species list and the group interactively changed a few items (attached below). Brandon noted that it would be helpful to begin mapping out the different life stages for diadromous fish at different months of the year, as well as what type of meso-habitat is necessary.

As the group discussed the proposed target species, the guild approach as well as potential stand alone species, it was noted that an HSI curve did not exist for the Saluda Darter, so a surrogate curve would have to be used for that species. The group noted that general HSI curves would be used, unless specific curves were needed for a species. A list of the individual species contained in each HSI curve will be made as well. The group emphasized keeping the amount of species considered at a manageable level that the group could comfortably handle. Alan asked the group if there were any species that are not on the target species list that should be. The group indicated that the list was satisfactory. Kleinschmidt Associates will look at combining some of the species, where applicable. Concurrently, the agencies will also look at obtaining HSI curves from Catawba

Wateree data. SCDNR will also send an example to Brandon of a list of species considered under each guild. Gerrit will forward the Pee Dee HSI curves to Brandon.

Brandon noted that he felt comfortable drafting a study plan with the information gleaned from the meeting and the group closed. Brandon noted that he would send out the study plan for review prior to the next meeting. The group scheduled the next meeting date for November 27th at the Training Center.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
IFIM/Aquatic Habitat TWC

SCE&G Training Center
October 16, 2006

Final acg 11-22-06

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife and Freshwater Fisheries
Environmental Programs Office

MEMORANDUM

To: L & LM TWC (Saluda Hydro Project)
From: Ron Ahle
Date: 5-05-06
Subject: Proposed Species List for IFIM Study

Guild Approach - use Catawba-Wateree and possibly Pee Dee curves

1) Shallow Slow Guild (<2 ft, <1 ft/sec); redbreast sunfish spawning
2) Shallow Fast Guild (<2 ft, >1 ft/sec); spottail shiner, ~~margined madtom~~,
3) Deep Slow Guild (>2 ft, <1 ft/sec); redbreast sunfish adult
4) Deep Fast Guild (>2 ft, >1 ft/sec); shorthead redhorse

Potential Stand Alone Species

1) Diadromous Fish
    a. American shad
    b. Blueback herring
    c. Striped bass
    d. Shortnose sturgeon
2) Resident Fish
    a. Robust redhorse (golden redhorse)
    ~~b. Highfin carpsucker~~
    c. Northern hogsucker
    d. Spotted sucker
    e. Brown trout
    f. Rainbow trout
    g. Threadfin/Gizzard shad
    h. Smallmouth bass
    i. Saluda darter (fantail darter)

3) Others
    a. Native mussels (wetted perimeter study)
    b. Benthic macro-invertebrates (EPT)

Deleted: Saluda darter

Deleted: <#>American eel¶

Formatted: Bullets and Numbering

Formatted: Bullets and Numbering

Deleted: <#>Spider lily¶

REMBERT C. DENNIS BUILDING * P.O. BOX 167 * COLUMBIA, SC 29202
TELEPHONE: (803) 734-2728 * FACSIMILE: (803) 734-6020

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
INSTREAM FLOW/AQUATIC HABITAT
TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
September 7, 2006

ATTENDEES:

Bill Argentieri, SCE&G
Randy Mahan, SCANA Services
Alan Stuart, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Dick Christie, SCDNR
Amanda Hill, USFWS
Scott Harder, SCDNR
Shane Boring, Kleinschmidt Associates
Malcolm Leaphart, Trout Unlimited
Theresa Thom, National Park Service
Brandon Kulik, Kleinschmidt Associates
Ron Ahle, SCDNR
Gerrit Jobsis, Am. Rivers
Hal Beard, SCDNR

ACTION ITEMS:

- Provide Brandon Kulik with HSI curves used in 1989-90 LSR IFIM Study

Gerrit Jobsis

- Check with USC Geography Dept. for GIS habitat coverages for the LSR

Theresa Thom

- Provide Theresa Thom with bibliography of Congaree floodplain flow studies found thus far

Shane Boring

- Discuss acceptability of SCDNR flow proposal with SCE&G management

Bill Argentieri

- Contact MaryAnn Taylor to discuss potential for using existing LIDAR photography to develop GIS-based habitat layers

Shane Boring

DATE OF NEXT MEETING: **October 16th, 2006, at Lake Murray Training Center, beginning at 9:30 am.**

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 9:30 AM with a review of action items from the last meeting (June 14). Specifically, Shane noted that he had completed the literature review for studies with potential to help address the National Park Service (NPS) request for floodplain flow studies to assess the impact of project operations on Congaree National Park. Shane indicated he would compile the studies he found into a bibliography, which he would forward to Theresa Thom. Theresa Thom indicated that she would compare the bibliography to NPS studies/data that she is aware of and report back to the group. Scott Harder noted that he had spoken with Bud Badr and that Bud was not aware of any additional studies.

In reference to the request for a comprehensive habitat assessment of shallow aquatic areas of Lake Murray, Shane noted that he had received contact info for MaryAnn Taylor (GIS Analyst, SCANA) from Bill Argentieri and that he would be contacting her in the coming week to discuss the potential for using the existing LIDAR photography to develop GIS-based habitat layers. Shane noted that he would report back to the group at the next meeting regarding this issue.

Shane then noted that, since Brandon Kulik was in attendance, the remainder of the meeting would focus on utilizing his knowledge of IFIM studies to review the existing Saluda study, assess its applicability to the current relicensing, and to define goals of any future IFIM study, if deemed necessary.

IFIM Goals for the Saluda River

Brandon encouraged the group to make IFIM goals as specific as possible. After some discussion, the group outlined the following as potential goals of an IFIM study:

- Identify a minimum flow for the Lower Saluda River (LSR)
- Determine flows needed for target species and lifestages, as well as the downstream floodplain
    - Determine the range of flows acceptable to meet these criteria
    - Determine how project operations affect these flows
    - Mimic the natural hydrograph of the LSR
    - Consider impact of providing these flows on Lake Murray

Malcolm Leaphart requested that reproduction of trout be included in any new IFIM analysis. Alan Stuart noted that a white paper outlining the habitat requirements for trout spawning is being drafted by Kleinschmidt and will be distributed to the TWC for review within the next couple of weeks. Dick Christie noted that, in additional to summarizing the needed habitat, the paper will summarize the agency management objectives for the LSR as they relate to trout reproduction.

Dick Christie noted the need to clearly define the "impact area" for any IFIM studies, noting that it likely extends beyond the Project Boundary. Gerrit Jobsis agreed and emphasized the need to consider the downstream floodplain when developing the IFIM goals.

Discussions of Target Species

Shane noted that, at the June 14th meeting, Ron Ahle had distributed a draft list of IFIM targets, which included both species and guilds (Attachment A). He added, and Brandon agreed, that typically either a species-specific or guild approach is used for such studies. Ron clarified, noting that the list was intended to be a starting point and that his preference was to take a guild approach, but also include certain priority species (i.e. smallmouth bass and threadfin shad). Amanda Hill noted the importance of keeping diadromous species on the list USFWS, adding that it may be acceptable to remove American eel. Gerrit recommended going back and looking at the HSI curves for compatibility with the guild approach. Gerrit agreed to provide Brandon with the HSI curves used in the previous study.

In reference to the species list category "other", Shane enquired as to whether generalized (multi-species) HSI curves exist for categories such as benthic macroinvertebrates and mussels. Dick noted that there are HIS curves for EPT's. Gerrit added that there were generalized curves for freshwater mussels that were used for the Duke Power relicensing.

After considerable discussion, it was determined that defining the specific target species/guild may not be possible at today's meeting. It was determined that the existing IFIM study should be reviewed more thoroughly and a determination made as to whether an additional study is needed. The group agreed to revisit the issue of target species/guild after such a determination is made.

Discussion of Existing IFIM Study and Need for Additional Study

The group then discussed the memo prepared by Brandon Kulik providing a critical review of the existing IFIM study (Attachment B). Brandon pointed out several aspects of the study that he feels need further clarification, including:

- Choice of HIS curves and how they were weighted;
- Number of curves (too many curves resulted in difficult interpretation of result); and

- Applicability of transects to current conditions (i.e. potential changes in stream geomorphology).

The group then briefly discussed the accuracy of the existing transect information relative to current conditions. Gerrit noted potential changes in the areas of the transects due to sedimentation, and added that he felt instream aquatic vegetation has also increased. Ron Ahle noted that there has been considerable channel widening in the upper LSR due to streambank erosion. Several group members enquired as to whether there are GIS layers and/or aerial photography that could be used to determine the degree of change in the transect areas. Shane indicated that he had recently conducted a search and was unable to find any GIS data. Theresa Thom noted that she would check with the Geography Department at USC for potentially applicable GIS layers. Gerrit and Ron A. subsequently suggested a possible field visit to determine the degree to which transects have changed.

Brandon Kulik noted that the model in the previous study was calibrated at low flows, thus the accuracy of the model likely starts to decrease at flows greater than 1000 cfs. Gerrit noted that, during execution of the study, Jeff Isely did have problems with calibrations and thus limited the flow range to lower flows. Scott Harder added that SCDNR has concerns about model accuracy in riffle and pool areas at higher flows.

Dick Christie reiterated the flow proposal provided by SCDNR in their comments on the ICD. Specifically, he noted that SCE&G could forego an additional IFIM study if they implement the proposed flow of 1170 cfs during the month of January through April, 879 cfs during May and June, 586 during July through November, and 879 cfs during December. Dick added that these flows are based on the SC State Water Plan and were developed using the 20%, 30%, 40% method (of mean annual flow). Several group members noted that, despite the many shortcoming that have been pointed out, the flows recommended in the existing IFIM study report (1326 cfs January – April; 950 cfs May – June; 575 cfs July – November; 950 cfs in December) are very similar those being proposed by SCDNR.

Gerrit Jobsis noted that he would have to give some consideration as to whether his group would be satisfied with the flows being proposed by SCDNR, adding that he would prefer the flows recommended through study of the Saluda River by the Water Resources Commission/Wildlife and Marine Resource Department (Bulak, J.S. and G.J. Jöbsis. 1989[1]) as this study provides site-specific information (i.e. on channel morphology, fish passage, hydrography). Bill Argentieri noted that the project is being operated much differently than when these site-specific recommendations were

[1] Bulak, J.S. and G.J. Jöbsis. 1989. *South Carolina instream flow studies: a status report*. South Carolina Wildlife and Marine Resources Department. 51 pages.

developed. Alan Stuart pointed out that the primary difference between the two proposals is the magnitude of the high flow period (1170 vs. 1326 cfs). Gerrit added that the higher flow in the report was based on providing passage for adult striped bass at Millrace Rapid, the most limiting area. He clarified that the recommendation was based on development of a stage – discharge relationship, which took into consideration a number of site-specific factors (i.e., wetted perimeter, depth needed for adult passage, natural hydrography). The existing IFIM study took measurements at Corley's Island and Millrace Rapids and verified that Millrace was the most limiting.

Gerrit added that the existing study does not take into the account potential negative impacts associated with infrequent higher flow (> 10,000 cfs), adding that this should be taken into account in any future studies. Attendees added that the frequency, duration, and magnitude of such flow should also be taken into consideration. Amanda Hill and Gerrit cited the potential for using a dual flow analysis to address this issue. Gerrit and others also raised interests in how project operations affect the Congaree River, e.g. striped bass and diadromous fish spawning, flows for floodplains and the Congaree National Park, that would not be addressed under the DNR proposal.

After some discussion, it was determined that there are too many uncertainties with the existing study. The group then began to discuss what the next steps should be considering this decision. It was determined that it is up to SCE&G to determine whether proposed flow regime is acceptable. Agency staff noted that if the proposed flows are deemed not acceptable, SCE&G will need to conduct an additional IFIM study. Bill Argentieri agreed to discuss the proposed flows with SCE&G management and report their decision back to the group. Bill requested, and the group agreed, to give SCE&C until mid to late-October to evaluate the proposal.

Date/Location of Next Meeting

The group agreed that the next Instream Flow TWC meeting will occur on October 16th, 2006 at the Lake Murray Training Center, starting at 9:30 AM. Shane B. will send out an electronic meeting announcement confirming date, time and location. The meeting adjourned at approximately 3:00pm.

Attachment A

Proposed List of IFIM Target Species/Guilds
(Source: SCDNR)

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife and Freshwater Fisheries
Environmental Programs Office

Guild Approach

1) Shallow Slow Guild (<2 ft, <1 ft/sec); redbreast sunfish spawning
2) Shallow Fast Guild (<2 ft, >1 ft/sec); margined madtom, Saluda darter
3) Deep Slow Guild (>2 ft, <1 ft/sec); redbreast sunfish adult
4) Deep Fast Guild (>2 ft, >1 ft/sec); shorthead redhorse

Potential Stand Alone Species

1) Diadromous Fish
    a. American shad
    b. Blueback herring
    c. Striped bass
    d. Shortnose sturgeon
    e. American eel
2) Resident Fish
    a. Robust redhorse
    b. Highfin carpsucker
    c. Northern hogsucker
    d. Spotted sucker
    e. Brown trout
    f. Rainbow trout

3) Others
    a. Native mussels
    b. Benthic macro-invertebrates
    c. Spider lily

REMBERT C. DENNIS BUILDING * P.O. BOX 167 * COLUMBIA, SC 29202
TELEPHONE: (803) 734-2728 * FACSIMILE: (803) 734-6020

Attachment B

Memo: Technical Review of Existing Lower Saluda River Instream Flow Study
(Source: Brandon Kulik, Kleinschmidt Associates)

Kleinschmidt
Energy & Water Resource Consultants
40 YEARS 1966 - 2006

MEMORANDUM

TO: Instream Flow/Aquatic Habitat Technical Working Committee (TWC)

FROM: Brandon Kulik, Kleinschmidt Associates

DATE: July 31, 2006

RE: Review of Lower Saluda River Instream Flow Study

It is my understanding that TWC is interested in evaluating how much of the study entitled "*Instream Flow Requirements for the fishes of the lower Saluda River*" dated March 28, 1995 can be applied to contemporary relicensing decisions about the Saluda Hydroelectric Project. The stated purpose of this study was "*to evaluate the effects of rate from the Lake Murray Dam on the amount of suitable habitat for fishery resources of the LSR*".

At your request I have reviewed the report, and am providing some observations.

General Comments

The field study and methods of computer modeling as described appear to generally adhere to methods described by Bovee (1982), and thus the raw Weighted Usable Area (WUA) vs. flow relationships are probably reasonable at least for the lower flow range. A few aspects of this report, that at face value may not be entirely consistent with study design elements recommended by Bovee, *et al.* (1998), may or may not affect how the extrapolated and weighted WUA data in the existing report can be used, but to start the discussion, I have flagged a few of these items as they may be worth group discussion.

Specific Comments

The following comments are arranged by report topic heading.

1. *Study Area:* The overall study area boundaries appear logical, as it extends from the point of flow control (Lake Murray Dam) to the influence from another large and independent source of flow (Broad River).

    a. The report does not clearly articulate a rationale for establishing the boundaries for the three reaches. It appears that the reaches were divided into thirds. Reach boundaries are typically placed where there is a shift in conditions that may influence hydraulics (*e.g.* river channel morphology, slope), habitat (geomorphology, dominant cover, substrate, or mesohabitat composition), or hydrology (contribution of tributary inflow, such as a 10% increase in flow or drainage area) (Bovee, *et al*., 1998).

b. It is not clear from the description (pp 6-7) if model output was weighted according to the relative linear abundance of each habitat type (see Table 2) within each reach or globally for the entire study area (*i.e.* all three reaches combined). Reach weighting can influence the shape of the wetted area and WUA curves.

c. Model results obtained in rapids and riffles usually will show a different sensitivity to flow changes from pools and runs. However, frequently, certain species and lifestages may only use a subset of the overall habitat types. The report as written leads to a conclusion that all habitats were blended together for each lifestage to develop a WUA curve. Thus it may be worth some group discussion to clarify how this was handled.

2. *Target Species and Criteria*

a. Fish Passage: An adult striped bass habitat Suitability Index (SI) was used as a criterion for shoal zone-of-passage passage requirements. This SI curve is driven by the resting and foraging requirements of a large pelagic predator. For the purpose of fish migration passage, it may be worthwhile to consider other criteria such as zone-of-passage criteria in natural channels set forth by Bovee (1982), and/or principals of ichthyomechanics and hydraulics (Clay 1995, Bell 1991).

b. Brown trout and rainbow trout: I note that the spawning lifestage for trout is employed, which I take to mean that there is a management objective to establish or maintain a wild population of these species. If so, both fry and juvenile lifestages for these species should also be included but were not. Because spawning/incubation, and fry lifestages of these species occur only for a limited portion of the year; these WUA curve should probably not be employed as part of a blended year-round flow recommendation, but assigned to a time series that targets applicable weeks or months when the lifestage is specifically expected to be present (see suggested matrix below). Because salmonids are not habitat generalists, this analysis would also benefit by documenting the following:

i. Does fishery management rely on natural reproduction?
ii. Does suitable macrohabitat and mesohabitat exist to support each lifestage?
iii. Is suitable fry and YOY habitat available in contiguous reaches?
iv. Can fry and YOY lifestage flows be evaluated and applied during appropriate months?

c. Suitability Index Criteria (*general comment*). SI criteria appear to generally be taken from the literature with no transferability evaluation. For example, Raleigh (1984 and 1986) criteria for brown and rainbow trout were primarily developed from general literature and habitat studies on large western rivers. Use of these criteria on dissimilar ecosystems and

regions without some documented transferability assessment, while expedient, has been criticized in many recent IFIM studies (Bovee, *et al.* 1998, K. Bovee, personal communication). The TWC may wish to discuss overall comfort using such curves.

3. *Discharge Measurements:* Three calibration flows were employed to construct this model, with a single set of calibration velocities taken at the lowest of the three flows. For purposes of a low-flow IFIM model this is probably adequate; however. The accuracy of model hydraulics as flow approaches the middle-to-higher flow range is potentially questionable without further documentation that Velocity Adjustment Factors fell within an acceptable range. The report should explicitly state the range of modeled flows that meet hydraulic accuracy standards. If greater accuracy is deemed important at higher flows, there may be cost effective ways to obtain such data.

4. *Presentation of WUA Data*

These are just some observations about how the WUA results are presented and how that could be enhanced to support decision-making.

a. Although the general statement is made that "*WUA increased rapidly to maximum levels for flows between 300-1000 cfs for most species and life stages…*", this is still a wide range, perhaps due mostly to the blending of species/lifestages, habitat types, and timeframes together. Optimizing habitat for one species at 300 cfs may impair habitat suitability for others that are optimized at higher flows, and visa versa. Also, not all species/lifestages coexist at the same time and in all habitats. Thus the analysis should provide a biological rational for:

   i. Prioritizing species/life stages or at least balancing trade-offs when conflicting WUA curves occur (Bovee 1982, Bovee et al. 1998).
   ii. Correlating species/lifestages to applicable seasonal or monthly periods so seasonally varying flows can be assessed (see example matrix attached below).

b. WUA data are only presented in a "normalized" (*i.e*. percent-of-optimal format) in the main body of the report. (I realize that they are presented in Appendix I as individual graphs, but in that format the relative WUA comparisons among lifestages are difficult to make). Easily viewing the relative magnitude of WUA potentially available at a given flow among species and lifestages would facilitate prioritization of species and lifestages so that inter-lifestage trade-offs can be better evaluated. Along those same lines, WUA data are presented only in graphs; tabular WUA data would enhance the assessment of trade-offs at the finer increments of flow ranging in the zone of interest, and enhance flow recommendations and negotiation.

c. A flow recommendation using a percentage of "optimal" WUA as the sole metric, can potentially be difficult to defend, because optimal WUA is merely an artifact of stream geometry hydraulics and SI information that doesn't factor in site-specific, seasonally varying flow availability. For example, if a flow supporting "optimal" WUA is an infrequent event, then an alternate habitat metric might be the amount of WUA that results from the naturally occurring median for the time increment of interest (*i.e.* seasonal, annual, monthly).

5. *Suggestions*

Model Accuracy

Two primary areas that PHABSIM models are most sensitive to error or bias are in SI criteria, (especially depth and velocity curves), and in how results obtained from study reaches and mesohabitat types are weighted (J. Henrikson, USGS/MESC, personal communication). Related to this is study site stability. If, (as noted by Ron Ahle on June 14, 2006), the river channel geometry has changed, then it would be worth re-surveying at least a subset of the transects to confirm if that has happened, and if it has, the extent to which the potential for past data to be transferable may be lost. If the channel profile details have shifted, but the overall geometry, slopes and widths remain similar, the differences may not be significant.

Assuming the transects remain representative of current and anticipated future conditions, secondary area for potential error in this instance could be in extrapolation of hydraulic data from calibration data.

SI Criteria

The TWC may wish to evaluate if the SI criteria applied to the original model is sufficiently accurate for this application, and update and/or refine criteria if needed. In some cases, new SI criteria may need to be developed to account for new species or lifestages identified at the June 14, 2006 TWC meeting.

Reach Weighting

The TWC may wish to seek clarification as to how individual reach WUA/flow curves were weighted together, and make revisions if deemed necessary. Also consider looking at transect data representing individual mesohabitats that best correlate to use by guild groups and/or lifestages identified at the June 14, 2006 TWC meeting. To the extent supporting data exists, the TWC may wish to re-analyze and re-calculate WUA's. For some species objectives, such as the wild trout fishery some additional habitat mapping and transect data collection may be required, at least to account for early lifestages.

Hydraulic Model Calibration

Of the three calibration data sets, only the low flow contains velocity as well as stage data. The other flows have stage data only. Assuming that the historic transects are found to still be representative of existing channel conditions, the TWC may wish to assess if additional velocity data at a higher flow are necessary to satisfactorily calibrate the model throughout the entire flow range of interest. If the historic transects are adequately geo-referenced, then additional velocity data may be readily collected.

Flow Analysis

Contemporary instream flow recommendations typically recommend flows or flow targets that vary seasonally, rather than provide a single flat minimum flow (Annear et al., 2000). The conventional problem-solving steps would be to:

1. Time series: prioritize species /lifestages according to management objectives, season of occurrence within and throughout the study reaches so that trade-offs among species, lifestages and other water uses can be assessed.
2. Establish a benchmark flow for each month (or season) that represents "typical" inflow for that period, such as a median (50^{th} percentile) flow.
3. Develop a matrix, by month or season (if applicable), of flow and species and lifestages present (see attached example).
4. Based on that flow matrix, select the discharge corresponding to the lowest-flow period during which each species and lifestage is present.
5. Calculate the ambient WUA occurring during that flow period. The month featuring the lowest WUA value is the naturally-occurring maximum WUA and should be used in comparisons. For some species and lifestages, this may require breaking out WUA results from separate habitat types contained in the model.

These next two steps are iterative:

6. Compare WUA produced under alternative flow releases to determine which alternatives provide an acceptable amount of WUA relative to what would exist compared to the naturally-limiting monthly or seasonal WUA.
7. Based on the prioritizations established under steps 1 and 2, determine what species/lifestage(s) drive the flow recommendation for each month, and what the trade-offs if any are to other lifestages and human water uses. If further balancing is required, return to step 6 and assess a different scenario.

Hypothetical Times Series Prioritization Matrices
(N*ote: For illustrative purposes only; seasonality and flow information will be refined in coordination with the TWC.)*

Species- Based Prioritization Matrix

Month	LSR median flow (cfs)	American shad	blueback herring	striped bass	shortnose sturgeon	American eel	robust redhorse	highfin carpsucker	northern hogsucker	spotted sucker	brown trout	rainbow trout
January	1,930			x		x	x	x	x	x	x	x
February	2,090	x	x	x	x	x	x	x	x	x	x	x
March	2,250	x	x	x	x	x	x	x	x	x	x	x
April	1,100	x	x	x	x	x	x	x	x	x	x	x
May	745	x	x	x		x	x	x	x	x	x	x
June	843			x		x	x	x	x	x	x	x
July	1,250			x		x	x	x	x	x	x	x
August	1,330			x		x	x	x	x	x	x	x
September	1,380			x	x	x	x	x	x	x	x	x
October	1,570			x	x	x	x	x	x	x	x	x
November	1,526			x	x	x	x	x	x	x	x	x
December	1,760			x		x	x	x	x	x	x	x

Early Lifestage (ELS)- Based Prioritization Matrix									
Month	**LSR median flow (cfs)**	**Robust Redhorse ELS**	**highfin carpsucker ELS**	**northern hogsucker ELS**	**spotted sucker ELS**	**brown trout spwn & incub.**	**brown trout ELS**	**rainbow trout spwn & incub.**	**rainbow trout ELS**
January	1,930						x		
February	2,090						x	x	
March	2,250						x	x	
April	1,100							x	
May	745	x	x	x	x				x
June	843	x	x	x	x				x
July	1,250	x	x	x	x				x
August	1,330								
September	1,380								
October	1,570					x			
November	1,526					x			
December	1,760					x			

Guild - Based Prioritization Matrix

		shallow slow guild	*shallow fast guild*		*deep slow guild*	*deep fast guild*
Month	**LSR median flow (cfs)**	**redbreast sunfish spawning**	**margined madtom**	**Saluda darter**	**redbreast sunfish adults**	**shorthead redhorse**
January	1,930		x	x	x	x
February	2,090		x	x	x	x
March	2,250		x	x	x	x
April	1,100		x	x	x	x
May	745	x	x	x	x	x
June	843	x	x	x	x	x
July	1,250		x	x	x	x
August	1,330		x	x	x	x
September	1,380		x	x	x	x
October	1,570		x	x	x	x
November	1,526		x	x	x	x
December	1,760		x	x	x	x

Attachment A

Proposed List of IFIM Target Species/Guilds
(Source: SCDNR)

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife and Freshwater Fisheries
Environmental Programs Office

Guild Approach

1) Shallow Slow Guild (<2 ft, <1 ft/sec); redbreast sunfish spawning
2) Shallow Fast Guild (<2 ft, >1 ft/sec); margined madtom, Saluda darter
3) Deep Slow Guild (>2 ft, <1 ft/sec); redbreast sunfish adult
4) Deep Fast Guild (>2 ft, >1 ft/sec); shorthead redhorse

Potential Stand Alone Species

1) Diadromous Fish
    a. American shad
    b. Blueback herring
    c. Striped bass
    d. Shortnose sturgeon
    e. American eel
2) Resident Fish
    a. Robust redhorse
    b. Highfin carpsucker
    c. Northern hogsucker
    d. Spotted sucker
    e. Brown trout
    f. Rainbow trout

3) Others
    a. Native mussels
    b. Benthic macro-invertebrates
    c. Spider lily

REMBERT C. DENNIS BUILDING * P.O. BOX 167 * COLUMBIA, SC 29202
TELEPHONE: (803) 734-2728 * FACSIMILE: (803) 734-6020

Attachment B

Memo: Technical Review of Existing Lower Saluda River Instream Flow Study
(Source: Brandon Kulik, Kleinschmidt Associates)

Kleinschmidt
Energy & Water Resource Consultants
40 YEARS 1966 - 2006

MEMORANDUM

TO: Instream Flow/Aquatic Habitat Technical Working Committee (TWC)

FROM: Brandon Kulik, Kleinschmidt Associates

DATE: July 31, 2006

RE: Review of Lower Saluda River Instream Flow Study

It is my understanding that TWC is interested in evaluating how much of the study entitled "*Instream Flow Requirements for the fishes of the lower Saluda River*" dated March 28, 1995 can be applied to contemporary relicensing decisions about the Saluda Hydroelectric Project. The stated purpose of this study was "*to evaluate the effects of rate from the Lake Murray Dam on the amount of suitable habitat for fishery resources of the LSR*".

At your request I have reviewed the report, and am providing some observations.

General Comments

The field study and methods of computer modeling as described appear to generally adhere to methods described by Bovee (1982), and thus the raw Weighted Usable Area (WUA) vs. flow relationships are probably reasonable at least for the lower flow range. A few aspects of this report, that at face value may not be entirely consistent with study design elements recommended by Bovee, *et al.* (1998), may or may not affect how the extrapolated and weighted WUA data in the existing report can be used, but to start the discussion, I have flagged a few of these items as they may be worth group discussion.

Specific Comments

The following comments are arranged by report topic heading.

1. *Study Area:* The overall study area boundaries appear logical, as it extends from the point of flow control (Lake Murray Dam) to the influence from another large and independent source of flow (Broad River).

    a. The report does not clearly articulate a rationale for establishing the boundaries for the three reaches. It appears that the reaches were divided into thirds. Reach boundaries are typically placed where there is a shift in conditions that may influence hydraulics (*e.g.* river channel morphology, slope), habitat (geomorphology, dominant cover, substrate, or mesohabitat composition), or hydrology (contribution of tributary inflow, such as a 10% increase in flow or drainage area) (Bovee, *et al*., 1998).

b. It is not clear from the description (pp 6-7) if model output was weighted according to the relative linear abundance of each habitat type (see Table 2) within each reach or globally for the entire study area (*i.e.* all three reaches combined). Reach weighting can influence the shape of the wetted area and WUA curves.

c. Model results obtained in rapids and riffles usually will show a different sensitivity to flow changes from pools and runs. However, frequently, certain species and lifestages may only use a subset of the overall habitat types. The report as written leads to a conclusion that all habitats were blended together for each lifestage to develop a WUA curve. Thus it may be worth some group discussion to clarify how this was handled.

2. *Target Species and Criteria*

a. Fish Passage: An adult striped bass habitat Suitability Index (SI) was used as a criterion for shoal zone-of-passage passage requirements. This SI curve is driven by the resting and foraging requirements of a large pelagic predator. For the purpose of fish migration passage, it may be worthwhile to consider other criteria such as zone-of-passage criteria in natural channels set forth by Bovee (1982), and/or principals of ichthyomechanics and hydraulics (Clay 1995, Bell 1991).

b. Brown trout and rainbow trout: I note that the spawning lifestage for trout is employed, which I take to mean that there is a management objective to establish or maintain a wild population of these species. If so, both fry and juvenile lifestages for these species should also be included but were not. Because spawning/incubation, and fry lifestages of these species occur only for a limited portion of the year; these WUA curve should probably not be employed as part of a blended year-round flow recommendation, but assigned to a time series that targets applicable weeks or months when the lifestage is specifically expected to be present (see suggested matrix below). Because salmonids are not habitat generalists, this analysis would also benefit by documenting the following:

i. Does fishery management rely on natural reproduction?
ii. Does suitable macrohabitat and mesohabitat exist to support each lifestage?
iii. Is suitable fry and YOY habitat available in contiguous reaches?
iv. Can fry and YOY lifestage flows be evaluated and applied during appropriate months?

c. Suitability Index Criteria (*general comment*). SI criteria appear to generally be taken from the literature with no transferability evaluation. For example, Raleigh (1984 and 1986) criteria for brown and rainbow trout were primarily developed from general literature and habitat studies on large western rivers. Use of these criteria on dissimilar ecosystems and

regions without some documented transferability assessment, while expedient, has been criticized in many recent IFIM studies (Bovee, *et al.* 1998, K. Bovee, personal communication). The TWC may wish to discuss overall comfort using such curves.

3. *Discharge Measurements:* Three calibration flows were employed to construct this model, with a single set of calibration velocities taken at the lowest of the three flows. For purposes of a low-flow IFIM model this is probably adequate; however. The accuracy of model hydraulics as flow approaches the middle-to-higher flow range is potentially questionable without further documentation that Velocity Adjustment Factors fell within an acceptable range. The report should explicitly state the range of modeled flows that meet hydraulic accuracy standards. If greater accuracy is deemed important at higher flows, there may be cost effective ways to obtain such data.

4. *Presentation of WUA Data*

These are just some observations about how the WUA results are presented and how that could be enhanced to support decision-making.

a. Although the general statement is made that "*WUA increased rapidly to maximum levels for flows between 300-1000 cfs for most species and life stages…*", this is still a wide range, perhaps due mostly to the blending of species/lifestages, habitat types, and timeframes together. Optimizing habitat for one species at 300 cfs may impair habitat suitability for others that are optimized at higher flows, and visa versa. Also, not all species/lifestages coexist at the same time and in all habitats. Thus the analysis should provide a biological rational for:

   i. Prioritizing species/life stages or at least balancing trade-offs when conflicting WUA curves occur (Bovee 1982, Bovee et al. 1998).
   ii. Correlating species/lifestages to applicable seasonal or monthly periods so seasonally varying flows can be assessed (see example matrix attached below).

b. WUA data are only presented in a "normalized" (*i.e*. percent-of-optimal format) in the main body of the report. (I realize that they are presented in Appendix I as individual graphs, but in that format the relative WUA comparisons among lifestages are difficult to make). Easily viewing the relative magnitude of WUA potentially available at a given flow among species and lifestages would facilitate prioritization of species and lifestages so that inter-lifestage trade-offs can be better evaluated. Along those same lines, WUA data are presented only in graphs; tabular WUA data would enhance the assessment of trade-offs at the finer increments of flow ranging in the zone of interest, and enhance flow recommendations and negotiation.

c. A flow recommendation using a percentage of "optimal" WUA as the sole metric, can potentially be difficult to defend, because optimal WUA is merely an artifact of stream geometry hydraulics and SI information that doesn't factor in site-specific, seasonally varying flow availability. For example, if a flow supporting "optimal" WUA is an infrequent event, then an alternate habitat metric might be the amount of WUA that results from the naturally occurring median for the time increment of interest (*i.e.* seasonal, annual, monthly).

5. *Suggestions*

Model Accuracy

Two primary areas that PHABSIM models are most sensitive to error or bias are in SI criteria, (especially depth and velocity curves), and in how results obtained from study reaches and mesohabitat types are weighted (J. Henrikson, USGS/MESC, personal communication). Related to this is study site stability. If, (as noted by Ron Ahle on June 14, 2006), the river channel geometry has changed, then it would be worth re-surveying at least a subset of the transects to confirm if that has happened, and if it has, the extent to which the potential for past data to be transferable may be lost. If the channel profile details have shifted, but the overall geometry, slopes and widths remain similar, the differences may not be significant.

Assuming the transects remain representative of current and anticipated future conditions, secondary area for potential error in this instance could be in extrapolation of hydraulic data from calibration data.

SI Criteria

The TWC may wish to evaluate if the SI criteria applied to the original model is sufficiently accurate for this application, and update and/or refine criteria if needed. In some cases, new SI criteria may need to be developed to account for new species or lifestages identified at the June 14, 2006 TWC meeting.

Reach Weighting

The TWC may wish to seek clarification as to how individual reach WUA/flow curves were weighted together, and make revisions if deemed necessary. Also consider looking at transect data representing individual mesohabitats that best correlate to use by guild groups and/or lifestages identified at the June 14, 2006 TWC meeting. To the extent supporting data exists, the TWC may wish to re-analyze and re-calculate WUA's. For some species objectives, such as the wild trout fishery some additional habitat mapping and transect data collection may be required, at least to account for early lifestages.

Hydraulic Model Calibration

Of the three calibration data sets, only the low flow contains velocity as well as stage data. The other flows have stage data only. Assuming that the historic transects are found to still be representative of existing channel conditions, the TWC may wish to assess if additional velocity data at a higher flow are necessary to satisfactorily calibrate the model throughout the entire flow range of interest. If the historic transects are adequately geo-referenced, then additional velocity data may be readily collected.

Flow Analysis

Contemporary instream flow recommendations typically recommend flows or flow targets that vary seasonally, rather than provide a single flat minimum flow (Annear et al., 2000). The conventional problem-solving steps would be to:

1. Time series: prioritize species /lifestages according to management objectives, season of occurrence within and throughout the study reaches so that trade-offs among species, lifestages and other water uses can be assessed.
2. Establish a benchmark flow for each month (or season) that represents "typical" inflow for that period, such as a median (50^{th} percentile) flow.
3. Develop a matrix, by month or season (if applicable), of flow and species and lifestages present (see attached example).
4. Based on that flow matrix, select the discharge corresponding to the lowest-flow period during which each species and lifestage is present.
5. Calculate the ambient WUA occurring during that flow period. The month featuring the lowest WUA value is the naturally-occurring maximum WUA and should be used in comparisons. For some species and lifestages, this may require breaking out WUA results from separate habitat types contained in the model.

These next two steps are iterative:

6. Compare WUA produced under alternative flow releases to determine which alternatives provide an acceptable amount of WUA relative to what would exist compared to the naturally-limiting monthly or seasonal WUA.
7. Based on the prioritizations established under steps 1 and 2, determine what species/lifestage(s) drive the flow recommendation for each month, and what the trade-offs if any are to other lifestages and human water uses. If further balancing is required, return to step 6 and assess a different scenario.

Hypothetical Times Series Prioritization Matrices
(N*ote: For illustrative purposes only; seasonality and flow information will be refined in coordination with the TWC.)*

Species- Based Prioritization Matrix

Month	LSR median flow (cfs)	American shad	blueback herring	striped bass	shortnose sturgeon	American eel	robust redhorse	highfin carpsucker	northern hogsucker	spotted sucker	brown trout	rainbow trout
January	1,930			x		x	x	x	x	x	x	x
February	2,090	x	x	x	x	x	x	x	x	x	x	x
March	2,250	x	x	x	x	x	x	x	x	x	x	x
April	1,100	x	x	x	x	x	x	x	x	x	x	x
May	745	x	x	x		x	x	x	x	x	x	x
June	843			x		x	x	x	x	x	x	x
July	1,250			x		x	x	x	x	x	x	x
August	1,330			x		x	x	x	x	x	x	x
September	1,380			x	x	x	x	x	x	x	x	x
October	1,570			x	x	x	x	x	x	x	x	x
November	1,526			x	x	x	x	x	x	x	x	x
December	1,760			x		x	x	x	x	x	x	x

Early Lifestage (ELS)- Based Prioritization Matrix									
Month	**LSR median flow (cfs)**	**Robust Redhorse ELS**	**highfin carpsucker ELS**	**northern hogsucker ELS**	**spotted sucker ELS**	**brown trout spwn & incub.**	**brown trout ELS**	**rainbow trout spwn & incub.**	**rainbow trout ELS**
January	1,930						x		
February	2,090						x	x	
March	2,250						x	x	
April	1,100							x	
May	745	x	x	x	x				x
June	843	x	x	x	x				x
July	1,250	x	x	x	x				x
August	1,330								
September	1,380								
October	1,570					x			
November	1,526					x			
December	1,760					x			

Guild - Based Prioritization Matrix

		shallow slow guild	*shallow fast guild*		*deep slow guild*	*deep fast guild*
Month	**LSR median flow (cfs)**	**redbreast sunfish spawning**	**margined madtom**	**Saluda darter**	**redbreast sunfish adults**	**shorthead redhorse**
January	1,930		x	x	x	x
February	2,090		x	x	x	x
March	2,250		x	x	x	x
April	1,100		x	x	x	x
May	745	x	x	x	x	x
June	843	x	x	x	x	x
July	1,250		x	x	x	x
August	1,330		x	x	x	x
September	1,380		x	x	x	x
October	1,570		x	x	x	x
November	1,526		x	x	x	x
December	1,760		x	x	x	x

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
TERRESTRIAL RESOURCE
TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
Final jms 7/26/06 ***July 26, 2006***

ATTENDEES:

Bill Argentieri, SCE&G
Tom Eppink, SCANA Services
Ron Ahle, SCDNR
Amanda Hill, USFWS
Bob Seibels, Riverbanks Zoo
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Alison Guth, Kleinschmidt Associates
Bob Perry, SCDNR

ACTION ITEMS:

- Sort the bird data by family

Shane Boring

- Add brown pelican to the bird data

Shane Boring

- Contact Dick Christie about the use of high resolution photography by using GIS for the shallow water fish habitat assessment

Ron Ahle

- **Develop a winter waterfowl study plan**

Shane Boring

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring welcomed committee members and noted that the focus of the meeting would be to discuss: (1) the species list developed from existing data, (2) development of framework for winter waterfowl survey study plan, and (3) the next meeting date (including need for an RCG meeting).

Review of Species List Developed From Existing Data

Shane distributed the species list that was developed from the 2005 and 2006 bird data and noted that all sources were cited. He explained that the list from Dreher Island State Park was recently updated. It was suggested that the list should be sorted out by family. Shane reminded the group that committee members agreed in the previous meeting that this comprehensive species list would satisfy the migratory bird data study request. He noted that this list will be part of exhibit E in the final report for the license application. Ron Ahle asked if the wadding bird rookeries would be included as well. Shane explained that the two known rookeries are currently being examined in the wood stork survey and will be described in the license application. It was noted that the brown pelican should be added to the list.

Development of Framework for Winter Waterfowl Survey Study Plan

Shane directed attention to the Waterfowl Survey Study Plan and Alan Stuart noted that this is a standard aerial survey protocol. There was some discussion as to whether the study would be conducted over a three year period. Alan asked how a three year survey would fit in the relicensing timeframe. Bob Perry noted that it would continue to build the waterfowl historical database and it would also give us information on habitat use. Ron Ahle noted that waterfowl hunting and observation are two recreational attributes of the project that would provide a nexus for this survey. He added that by conducting these surveys over a longer period, it may answer the question of whether or not the recreational needs of the project are being met in these areas. Through further discussion, the group agreed that the study would be conducted over a three year period, with an interim report being issued after the two year timeframe. It was also agreed that the survey would be conducted up to the project boundary, which should include wood stork habitat. Shane noted that this study may explain the rapid decrease in waterfowl population in recent years.

Date/Location of Next Meeting

Before the meeting closed, there was a brief discussion about the request for a comprehensive assessment of Lake Murray, and a proposed framework for a study plan, developed by SCDNR and USFWS, was distributed (Attachment A). To gain a better understanding of the available habitat around the project boundary, Ron mentioned the use of high resolution photography, by using GIS. He added that this method would allow for shallow water habitats to be examined. Amanda noted that this would satisfy her interest in regards to this topic, however Ron should check with Dick Christie. Ron noted that he would check with Dick before sending Shane criteria for GIS mapping.

The group agreed to have the next meeting in early 2007. Shane noted that he would issue an electronic meeting invitation to confirm a date with individual members.

Attachment A

Proposed Framework for Addressing the Request for GIS-Based
Comprehensive Habitat Assessment on Lake Murray
(Developed by SCDNR and USFWS)

Study Plan Name: Shallow Water Fish Habitat Assessment

1) **Study Objectives**

a. Identify and map substrate (sand, gravel, cobble…), cover (woody debris, rip-rap and piers) and aquatic vegetation in the shallow water (<5 feet) areas of the reservoir.
b. Identify and map substrate (sand, gravel, cobble…), cover (woody debris, rip-rap and piers) and aquatic vegetation in the major tributaries under project influence.
c. Determine the stage/area relationship of these habitat types between the 354-358 pool elevations in one-foot increments.

2. **Basis**

The FERC licensing process requires an assessment of any potential impacts to fish and wildlife resources by the project and its operation (18CFR4.51).

3. **Geographic and Temporal Scope**

The availability and abundance of aquatic habitat is often correlated with stage. The availability emergent shoreline vegetation, woody debris, and man-made structures associated with the shoreline usually peaks at full pool and declines as water levels are lowered. The establishment of a stage-habitat relationship is important in evaluating the effects of operations and guide curves on habitat.

This would essentially be a mapping exercise, coupled with some field verifications, to determine the relationships between habitat and depth.

Elevation and slope associated with the shallow water habitats listed above will be determined in each project reservoir. Sampling transects (minimum of five where available) will be established in each habitat type based on the percentage of shoreline that a particular habitat type contributes to the total shoreline mileage. An Abney level and stadia rod will be used to measure the range in elevation and slope of the habitats during significant drawdown periods. Data from each transect will be summarized and mean ranges in elevation and slope will be calculated for the habitat types in each reservoir.

Data collected will be used in conjunction with aerial photography data (and/or other appropriate supporting information) to expand the areal estimates of habitat at various one-foot changes in reservoir water levels.

- **Use of Study Results**

Shoreline aquatic habitat maps will be used to evaluate current project operations and changes proposed as result of hydro relicensing on the aquatic community of each impoundment. In addition, this information may be useful for identifying ways to enhance reservoir fish habitat.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RARE THREATENED AND ENDAMGERED SPECIES TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
July 26, 2006

Final jms 7-26-06

ATTENDEES:

Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates
Tom Eppink, SCANA Services
Amanda Hill, USFWS
Bob Perry, SCDNR
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Ron Ahle, SCDNR
Bob Seibels, Riverbanks Zoo

ACTION ITEMS:

- Contact Arnie Eversol about crafting a white paper for the Saluda crayfish

Alison Guth

- Email committee members Saluda crayfish information

Amanda Hill

DATE OF NEXT MEETING: **TBA**

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RARE THREATENED AND ENDAMGERED SPECIES TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
July 26, 2006

Final jms 7-26-06

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring welcomed committee members and noted that the focus of the meeting would be to discuss: (1) Rocky Shoals Spider Lilly (RSSL) survey results, (2) species tracking table, and (3) the next meeting date (including need for an RCG meeting).

Rocky Shoals Spider Lilly Survey Results

The group briefly reviewed notes from the RSSL float trip. Amanda Hill noted that the most of the RSSL observed along the LSR were single plants. Amanda specifically pointed out that plants found in the Ocean Blvd location on the LSR seemed to be smaller in size than those found at the confluence of the rivers and had no blooms.

Species Tracking Table

Shane projected the updated tracking table of all federally listed species that may occur in the project area. He reminded the group that this list was prepared by the USFWS in the initial consultation document. He mentioned that in light of the mussel survey conducted on Lake Murray, Lower Saluda and Congaree Rivers, several species such as the Carolina heelsplitter were not found. Shane inquired as to how to deal with species that are federally listed, but not found within the project boundary during the course of their studies. Amanda noted that it should be documented that they were not found during the studies and that project operations was not likely to adversely affect these species. Ron Ahle suggested adding state RT&E species along with the federally listed species. He also recommended listing the species according to priority according to SCDNR's conservation priority list.

In discussion with the RT&E species, Shane informed the group that he has received the sampling permit from NOAA for shortnose sturgeon and sampling will begin in February 2007. Alison Guth noted that in regards to the Saluda Crayfish, she will contact Arnie Eversol about crafting a white paper. Amanda noted that she found some information on the Saluda Crayfish and would send it out through email to all committee members. There was a brief discussion about habitat preferences of the red cockaded woodpecker. Shane noted that there have not been any sittings of these species within the project boundaries, which may be due to the lack of longleaf pine habitat around the Lake. Shane then directed attention to the ivory billed woodpecker and noted that potential habitat for this species exists around the Congaree National Park. Amanda noted that

because this species has not been documented, it does not raise much concern. However, she noted that it may be beneficial to mention the surveys currently being performed in the Congaree National Park. Shane explained to the group that he is in the progress of compiling information for other species listed in the tracking table.

Date/Location of Next Meeting

The group agreed to have the next meeting in early 2007. Shane noted that he would issue an electronic meeting invitation to confirm a date with individual members.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FRESHWATER MUSSEL/BENTHIC MACROINVERTEBRATES TECHNICAL WORKING COMMITTEE

SCE&G Training Center
July 26, 2006

Final jms 7-31-06

ATTENDEES:

Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates
Ron Ahle, SCDNR
Tom Eppink, SCANA Services
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Amanda Hill, USFWS

ACTION ITEMS:

- Contact John Alderman about:
    1. discussing how water chemistry may effect freshwater mussels in his report.
    2. Anadromous hosts for freshwater mussels
    3. Find out if he sampled tributaries and the Ocean Boulevard reach on the LSR.

Shane Boring

- Finalize the study plan for Lower Saluda River (LSR) macroinvertebrate sampling

Shane Boring

- Research benefits and provide justification for macroinvertebrate study in Lake Murray

Ron Ahle

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 9:30 PM and noted that the focus of the meeting would be to discuss: (1) the LSR/Lake Murray mussel survey results, (2) comments on the draft study plan for continued LSR macroinvertebrate sampling, and (3) the next meeting date (including need for an RCG meeting).

Review of the LSR/Lake Murray Mussel Survey Results

Shane briefly reviewed results of the mussel survey conducted by John Alderman on Lake Murray, lower Saluda and Congaree Rivers. Shane presented a map that described the 61 locations that were sampled throughout the survey. He noted that timed surveys were conducted at each site and method type depended upon depth of the water. Methods throughout the survey included wading, batiscope, snorkeling, and/ or scuba. Shane noted that particular attention was placed on the Savannah lilliput in the backwater areas of the Saluda River. This species inhabits areas with gentle sloping banks. There were a total of 15 mussel species documented within the areas surveyed. He noted that most of the specimens collected were live, except for the Savannah lilliput. He noted that there were no mussel species found in the Lower Saluda River. Shane noted that mussel species collected in the upper portion of the Congaree River were for the most part distributed along the Broad River side. Ron Ahle noted that the cold water temperatures of the LSR should not have any effect on the freshwater mussel population and diversity. Ron noted that in order to find out if project operations has an affect on the freshwater mussel population, tributaries of the LSR should be included in this survey. Ron questioned whether the middle portion (Ocean Boulevard) of the LSR was sampled. He noted that the Ocean Boulevard stretch provides potential habitat for freshwater mussels and should be included in the survey. There was a brief discussion on water quality conditions in the LSR and Ron noted that dissolved oxygen may be the reason for low population of mussels in the LSR. Amanda Hill noted that methods for each sampling station need to be clearly stated in the report. Shane noted that he would contact John Alderman to address these questions and provide an explanation in the report. Shane mentioned that he would also find out if he's available to sample the tributaries and middle portion of the LSR.

Shane briefly discussed how freshwater mussels' use anadromous fish species as a host. Alan Stuart noted that there have not been any anadromous fish species documented in the LSR during 2005 or 2006 diadromous fish sampling. Shane noted that the report should detail the host species of those mussels that were found.

Comments on the Draft Study Plan for LSR Macroinvertebrate Sampling

Shane noted that Dan Carnegie holds Shealy's certification and will examine possible areas to sample macroinvertebrates along the LSR. Shane briefly explained methods that would be used throughout the survey and Ron suggested that Ocean Blvd. be a possible sampling location. Alan noted that this study should be top priority because he was concerned that the lake may turn over early this year. Shane noted that the deadline for comments on the study plan is August 2nd and any comments should be emailed to him as soon as possible.

There was a brief discussion as to whether a macroinvertebrate study on Lake Murray was needed. Ron noted that this is a standard limnological study that is conducted on reservoirs. He suggested using the Lake Murray water quality stations as index points to set up shallow water stations. Ron explained that by examining the substrate of Lake Murray, we may be able to determine whether project operations has an effect on the macroinvertebrate community. Alan S questioned the need for this study and whether the results would provide useful information. Ron noted that he would research benefits to justify the need for this study.

Date/Location of Next Meeting

The group agreed to have the next meeting in early 2007. Shane noted that he would issue an electronic meeting invitation to confirm a date with individual members.

MEMORANDUM

TO: Saluda Hydro Project Relicensing Stakeholders

FROM: Saluda Hydro Rare, Threatened, and Endangered Species Technical Working Committee

DATE: July 20, 2006

RE: May 2006 Lower Saluda River Rocky Shoals Spider Lily Survey Observations

---

On May 31, 2006, members of the Rare, Threatened, and Endangered Species Technical Working Committee conducted a survey of the Lower Saluda River (LSR) for presence of the Rocky Shoals Spider Lily (RSSL), a federal species of concern. Survey attendees, methods, and observations are summarized below.

Survey Attendees: Ron Ahle, SCDNR
Amanda Hill USFWS
Gerrit Jobsis, American Rivers
Bob Seibels, Riverbanks Zoo (retired)
Shane Boring, Kleinschmidt Associates
Kelly Miller, Kleinschmidt Associates
Bill Argentieri, SCE&G
Randy Mahan, SCANA Services
Tom Eppink, SCANA

Survey Duration: approximately 1030 – 1730 hrs

Survey Methods and Observations:
The LSR was surveyed by canoe along its entire length, from the SCE&G boat landing near the base of Saluda Hydro to the Senate Street Landing on the Congaree River. Shoal areas not accessible by canoe were examined on foot for presence of RSSL.

Two RSSL plants were documented in the Ocean Boulevard Rapid area of the LSR by Gerrit Jobsis, Amanda Hill, and Shane Boring. These plants were not in bloom and appeared stunted compared to RSSL plants observed farther downstream (see observations below).

The group also observed a large stand of RSSL (> 100 plants) in the confluence of the Saluda and Broad rivers, just upstream of the Highway 12 bridge. This population displayed a vigorous growth pattern and abundant blooms at the time of the survey. This population has been documented previously during investigations related to relicensing of the Columbia Hydroelectric Project (FERC# 1895) and is described in greater detail in *Columbia Hydroelectric Project: Rocky Shoals Spider Lily Plant Survey* (Kleinschmidt Associates, 1998).

Please direct any questions related to the RSSL survey to Shane Boring, Kleinschmidt Associates, at (803) 822-3177.

Saluda HYDRO RELICENSING

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
INSTREAM FLOW/AQUATIC HABITAT
TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
Final 6/23/2006 ***June 14, 2006***

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Dick Christie, SCDNR
Amanda Hill, USFWS
Scott Harder, SCDNR
Anthony Green, SCDNR
Randy Mahan, SCANA Services
Tom Eppink, SCANA Services
Kelly Miller, Kleinschmidt Associates
Ron Ahle, SCDNR
Gerrit Jobsis, Am. Rivers
Wade Bales, SCDNR

ACTION ITEMS:

- Contact Bud Bader with SCDNR to obtain possible inundation studies for the Congaree and/or LSR

Scott Harder

- Continue the search for Congaree River floodplain/inundation studies from NPS and other sources

Shane Boring

- Quantify habitat types in Lake Murray

Dick Christie/Amanda Hill

- Contact Brandon Kulik to determine his availability and set potential instream flow workshop dates

Alan Stuart

DATE OF NEXT MEETING: **TBA**

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting at approximately 9:30 AM and new attendees introduced themselves. Alan noted that the focus of the meeting would be to discuss: (1) the 1989-1990 IFIM study and it's relevance in the current relicensing project, (2) available inundation studies, (3) possibilities for a comprehensive habitat assessment for Lake Murray, and (4) establishment of an initial framework for addressing the potential self-sustaining trout fishery in the lower Saluda River (LSR).

Alan S. noted that the purpose of the Instream Flow Technical Working Committee (TWC) is to assess how project operations affect stream flows, and to evaluate which flow regimes would best meet the needs of the biota. Alan briefly reviewed action items from the May 11th Instream Flow TWC meeting and noted that Jeff Duncan from the National Park Service (NPS) is in the process of developing a strawman for the Ecologically Sustainable Water Management (ESWM) process on Congaree River.

Presentation on the 1989-1990 IFIM Study

Gerrit Jobsis presented Instream Flow Requirements for the Fishes of the Lower Saluda River that he, Jeff Isely, and Steve Gilbert conducted in 1989-1990[1]. Gerrit J. opened by discussing locations sampled on the lower Saluda River. He noted that the river was divided into three segments for the study: (1) dam to the base of Corley Island, (2) Corley Island to I-20 bridge, and (3) I-20 bridge to Mill Race Rapids. Gerrit then briefly discussed the habitat classifications used in the study and summarized the percentages of each present in each of the above segments under various flow conditions. Gerrit continued by explaining the target species (striped bass, rainbow trout, redbreast sunfish, margined madtom, Northern hogsucker, brown trout) and life stages (adult, spawning and fish passage) that were chosen for the study.

In summarizing the study results, Gerrit noted that flows in the Saluda ranged between 100 and 18,000 cfs during the study period. He explained that the flow range was modeled from 50 cfs to 10,000 cfs and added that analyzing WUA at flows above 6,000 cfs were less reliable. He added that, from the results, the recommended flow range of 300-1,000 cfs was developed for the Lower Saluda River. Gerrit pointed out that fish passage through Mill Race Rapids was limited but found that a flow of 1,326 cfs provided adequate passage for fish species. In closing, Gerrit added that he

[1]Copies of the study were distributed to attendees by Jeni Summerlin before the meeting began.

felt this was a sound study and that it provided the best information that technology would allow for the time.

The group began discussing possibilities of using the 1989-1990 IFIM Study for the Saluda Relicensing Project. Gerrit noted that he believes the sampling methods in this study are sound. He mentioned that there may be a problem with the velocity data, as it was collected at low flows. It was noted that most of the data files for this study are not available.

Ron Ahle noted that replicating this study may be difficult because the Saluda River may have changed overtime, such as the aquatic life present and sediment input. He also pointed out that it would be difficult to find the original transects that were used in the study. Gerrit noted that rebar was used to mark each transects throughout the course of the study.

Ron A. then presented a list of fish species that should be considered in the IFIM Study (attachment A). Ron A. explained that he used a guild approach to determine fish species of importance. He then listed potential stand alone species, which were broken down into three categories: diadromous fish, resident fish and other aquatic species.

Alan S. suggested, and the group agreed, to craft a strawman to evaluate specific factors using the 1989-1990 IFIM Study and Water Resource Report (attachment B). Alan S. noted that he would send the strawman and outline to Brandon Kulik, Kleinschmidt's instream flow expert, to determine if these factors can be analyzed with the data available. Alan also suggested and the group agreed to schedule a two or three day workshop with Brandon K. to explain the analysis of the IFIM data.

Distribution of Congaree Flood Plain Studies/Data

Copies of a study entitled *Hydrologic Variation of the Congaree River Near Congaree National Park, South Carolina* (Plewa and Grag 2005) was distributed to the group. Alan noted that Shane Boring is in the process of compiling existing inundation/floodplain studies from the National Park Service (NPS) and other sources that my help to determine any effects of project operations on the flood plains. Scott Harder noted that he would contact Bud Bader from SCDNR about available inundation studies. It was specifically noted that the studies should include frequency, duration, magnitude and timing of project operations.

Comprehensive Habitat Assessment Discussion

Dick Christie noted that he and Amanda Hill are in the process of identifying the habitat types their agencies would like to see mapped around Lake Murray. He noted that he would like to quantify these habitats using a GIS map or table. He explained that GIS maps and/or tables will show the

percentages of habitats at different elevations. Dick C. noted that the list should be complete within four weeks, upon which time he will distribute the information for everyone to review before the next meeting.

Discussions on Initial Framework of White Paper Assessing Potential for Self-Sustaining Trout Fishery in LSR

Dick C. suggested that the group approach the trout fishery issues by first examining how to improve the habitat in the LSR, rather than trying to develop a self-sustaining trout population. Dick C. mentioned that, even if the habitat improves, the reproduction success of trout would be limited primarily by the warmwater predators found within the system. The group developed a strawman outlining issues that should to be considered for the LSR trout fishery (attachment C)

Date/Location of Next Meeting

Alan S. noted that he would contact Brandon K. about his availability and would schedule a potential IFIM workshop in August sometime. The meeting adjourned at approximately 2:00pm.

Attachment A

Recommended Target Species for Lower Saluda River IFIM Studies
(Source: SCDNR)

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife and Freshwater Fisheries
Environmental Programs Office

Guild Approach

1) Shallow Slow Guild (<2 ft, <1 ft/sec); redbreast sunfish spawning
2) Shallow Fast Guild (<2 ft, >1 ft/sec); margined madtom, Saluda darter
3) Deep Slow Guild (>2 ft, <1 ft/sec); redbreast sunfish adult
4) Deep Fast Guild (>2 ft, >1 ft/sec); shorthead redhorse

Potential Stand Alone Species

1) Diadromous Fish
    a. American shad
    b. Blueback herring
    c. Striped bass
    d. Shortnose sturgeon
    e. American eel
2) Resident Fish
    a. Robust redhorse
    b. Highfin carpsucker
    c. Northern hogsucker
    d. Spotted sucker
    e. Brown trout
    f. Rainbow trout

3) Others
    a. Native mussels
    b. Benthic macro-invertebrates
    c. Spider lily

REMBERT C. DENNIS BUILDING * P.O. BOX 167 * COLUMBIA, SC 29202
TELEPHONE: (803) 734-2728 * FACSIMILE: (803) 734-6020

Attachment B

Framework for Evaluating Existing Lower Saluda River IFIM Study

Framework for Evaluating Existing Lower Saluda River IFIM Study

If possible, the group would like to evaluate each of the following using the 1995 IFIM Report and Water Resources Report (velocity data collected at 200 cfs).

- Effects of high discharges / Mitigation
- Base flow regime
- Thermal influences / longitudinal variation
- Seasonal variations
- Cover analyses
- Effects of Broad River on the confluence (confluence is defined as Shandon Rapids downstream to Senate Street).
- Scope of project influences (Saluda vs. confluence)
- Types of species to model
- Use the 1989 IFIM report using a wetted perimeter analysis to normalize the USGS gage records. Then run it through an IHA / RVA analysis
- Dissolved oxygen component of the IFIM

Attachment C

Draft Framework for Evaluating the Potential for a Reproducing Trout Fishery in the Lower Saluda River Trout Fishery

Draft Framework for Evaluating the Potential for a Reproducing Trout Fishery in the Lower Saluda River Trout Fishery

1. Species / Requirements / Needs

2. Current Habitat / Management Strategy

    a. Water Quality
    b. Substrate
    c. Food Preferences
    d. Flow Regime

3. Feasibility

    a. Trout predators (striped bass / other warm water species)
    b. Water quality limitations (metals dissolved oxygen)
    c. Flow regimes
    d. Harvesting of adult trout
    e. Available spawning habitat

4. Potential for success self-sustaining trout population with no augmentation

5. Potential for success self-reproducing trout population

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RT&E SPECIES TECHNICAL WORKING COMMITTEE

Carolina Research Park
May 3, 2006

Final csb 6-2-06

ATTENDEES:

Bill Argentieri, SCE&G
Bob Seibels, River Banks Zoo
Tom Eppink, SCANA Services
Ron Ahle, SCDNR
Dick Christie, SCDNR
Shane Boring, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Amanda Hill, USFWS
Sam Drake, L. Murray Association

ACTION ITEMS:

- Compare DNR's CWCS species list to species tracking table

Ron Ahle

- Add Saluda crayfish, wood stork, ivory-billed woodpecker to tracking sheet

Shane Boring

- Provide Arnie Eversol's study on the Saluda crayfish

Amanda Hill

DATE OF NEXT MEETING:

July 26, 2006 at 9:30 AM

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 12:30 PM and noted that the focus of the meeting would be to discuss: (1) action items from previous meeting minutes, (2) the 2006 wood stork survey, (3) species tracking table, and (4) set a date for the next meeting.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RT&E SPECIES TECHNICAL WORKING COMMITTEE

Carolina Research Park
May 3, 2006

Final csb 6-2-06

Review of Action Items

Shane briefly discussed action items listed in previous meeting notes. He noted that an email was sent out to inform all committee members that the 1999 Rocky Shoal Spider Lily Report for the Columbia Hydro Project was available for download from the Kleinschmidt ftp site. Shane then distributed copies of the species account for Saluda darter from SCDNR's Comprehensive Wildlife Conservation Strategy (CWCS), noting that it provides the most up-to-date information on the species (Attachment A).

Species Tracking Table

Shane distributed the Rare, Threatened, and Endangered (RT&E) Species Tracking Sheet (Attachment B). He noted that the list of species included in the tracking sheet are those listed in the USFWS's comments on the Initial Consultation Document (ICD) and that the sheet will be used to track the status of various species through the relicensing process. Shane added that the next step will be to begin looking at habitat and known species occurrences to determine which of these have potential to occur in the project area. Amanda Hill added that if there's a chance that project operations have an effect on one of these species, then additional efforts may be needed. The group briefly examined the tracking sheet and Ron Ahle noted that wood stork and Saluda darter should be added to the list. It was noted that the ivory-billed woodpecker should also be included on the list. The group suggested that the table should be grouped by birds, plants, fish, etc. Amanda H. also suggested, and the group agreed, that the scientific names should be sorted alphabetically. Ron A. mentioned that he would look through DNR's list of species addressed in the CWCS for any species that may not have been included in the USFWS species list.

2006 Wood Stork Survey Observations

Shane informed the group that the wood stork aerial surveys are continuing on a monthly basis and will be carried out through November of this year. He noted that in discussion with Tom Murphy, there have been no sightings of wood storks in the project boundaries this year. He added that Tom noted numerous drying pools in the Saluda River upstream of Lake Murray during the April survey, providing good wood stork habitat, but none were being used. He added that Tom M. documented 40 great blue heron nests at the Tossity Creek and Silverstreet colony sites during the April fly-over.

Date/Location of Next Meeting

The group agreed to meet again on July 26, 2006, at Carolina Research Park, with August 14th, 15th, or 16th as alternate dates if committee members are not able to attend.

Attachment A

Species Account for Saluda Darter
(Source: SCDNR Comprehensive Wildlife Conservation Strategy)

Highest Conservation Priority – Other Species

Christmas Darter *Etheostoma hopkinsi*
Saluda Darter *Etheostoma saludae (*form of *E. collis)*
Redeye Bass *Micropterus coosae*

Contributors: Dan Rankin and Jason Bettinger

DESCRIPTION

Taxonomy and Basic Description

The Christmas darter (Rohde et al. 1994) is a member of the family Percidae; this diverse family contains approximately 150 species of darters, all of which are found in rivers, lakes, swamps and springs of eastern North America. The Christmas darter belongs to the genus *Etheostoma,* the largest genus of North American fishes (Jenkins and Burkhead 1994). The Christmas darter is the only South Carolina representative of the subgenus *Oligocephalus,* one of the largest subgenera of *Etheostoma.* Two subspecies have been identified: *E. binotatum* from the Savannah River drainage in both Georgia and South Carolina and *E. hopkinsi* from the Altamaha and Ogeechee river drainages in Georgia. Kuehne and Barbour (1983) have hypothesized possible species level differentiation of *E. binotatum* and *E. hopkinsi* due to marked differences in appearance of breeding males. The colorful Christmas darter ranges in length from 41 to 71 mm (1.6 to 2.8 inches). As is typical of other members of the subgenus *Oligocephalus*, the Christmas darter has a small conical head, broad frenum and two anal spines. Breeding males have a blue marginal and a red sub-marginal band on the spiny dorsal fin (Kuehne and Barbour 1983). This darter has 10 to 12 dark green bars on its side, separated by a red bar in a mature male and a yellow bar in the female. Its greenish back has eight dark saddles and its belly is light green.

Hubbs and Cannon (1935) first described the Saluda darter (*Etheostoma saludae)* from the Saluda River system of the Santee drainage. They described the fish as a separate species from Carolina darter (*Etheostoma collis*). Collette (1962) was uncertain if *E. saludae* was specifically or subspecifically different from *E. collis collis*, the Carolina darter of the Pee Dee and Catawba (Santee drainage) drainages and *E. collis lepidinion* of the Roanoke, Neuse and Cape Fear drainages. Collette (1962) and Page (1983) noted *E. saludae* differed from the two Carolina darter subspecies principally in having interorbital pores (2 versus 0) and in number of anal spines (2 versus 1). Kuehne and Barbour (1983) listed the Saluda darter as a separate species but stipulated, "…the two forms (*saludae* and *collis*) may not actually be specifically distinct." Jenkins and Burkhead (1994) stated they found no "sufficiently

distinctive" character for taxonomic recognition of *E. saludae* or subspecific recognition within the *E. collis* group. Robins et al. (1991), Rohde et al. (1994) and Nelson et al. (2004) followed that the Saluda darter was conspecific with the Carolina darter; all adopted the scientific name *E. collis* for the broadened species with no subspecific distinctions. However, Rohde (pers. comm.) now feels *E. saludae* may be specifically or subspecifically different. Currently, it is still not clear if *E. saludae* is a separate species from *E. collis*; however, there is sufficient genetic and morphologic difference between the two that they should be managed separately as evolutionary significant units (J. Quattro, pers. comm.). The Saluda darter is plain in color with brown on the back and sides and a yellow to white belly. The sides have a dozen or so brown blotches and are speckled with brown dots. This small darter only reaches about 60 mm (2.4 inches).

The redeye bass is a member of the family Centrarchidae. Redeye bass represent one of only two native black basses in South Carolina; both smallmouth and spotted bass (*Micropterus dolomieu* and *M. punctulatus*, respectively) are introduced in this state. The closest relative of the redeye bass is the shoal bass (*M. cataractae*), which is endemic to the Apalachicola River system (Lee et al. 1980). Redeye bass are similar in structural features and more closely related to spotted bass than to smallmouth bass. However, redeye bass are known to hybridize with both species (Turner and Bulow 1989; Pierce and Van Den Avyle 1997; Philipp et al. 2002). In native stream habitat, redeye bass range in length from 144 to 381 mm (5.6 to 15 inches) (Rohde et al. 1994); however, in the Savannah River impoundments, redeye bass often exceed this size range. Redeye bass are typically olivaceous to bronze dorsally with black blotching or mottling. The jaw extends even with the back of the eye. Laterally, redeye bass have black vertical bars or blotches, which are not connected unlike the lateral stripe of spotted bass. Redeye bass typically have ten or fewer lateral bars or blotches, whereas spotted bass generally have more than ten. Redeye bass have ventro-lateral streaks that are typically darker and more irregular than those in spotted bass. A white margin on the upper and lower tips of the caudal fin and often along the margin of the anal fin is a key character. This margin may be less obvious in older specimens. The anal fin typically has dark pigmentation. About sixty percent of redeye bass from the upper Savannah River basin possess a tooth patch on the tongue (SCDNR unpublished data).

Status

The Christmas darter is currently considered stable within its range (Warren et al. 2000). NatureServe (2004) listed the status as apparently secure both globally (G4) and locally in South Carolina and Georgia (S4). The South Carolina Department of Natural Resources Heritage Program lists the Christmas darter as a species of special concern.

Warren et al. (2000) listed the global status of the broader Carolina darter as vulnerable within its range and it is considered a species of special concern in both North Carolina and South

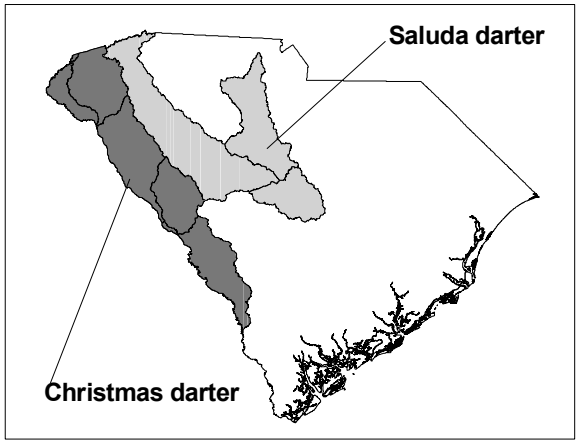
Carolina. NatureServe (2004) considered the global status as undetermined due to inadequate surveys. NatureServe (2004) also listed the local status as undetermined for South Carolina (S?). The local status for North Carolina and Virginia was vulnerable (S3) and imperiled (S2), respectively (NatureServe 2004). Currently, Saluda darter is recognized as a synonym of the Carolina darter; however, our taxa team considered it an evolutionarily significant unit (ESU) of Carolina darter and suggested that it be managed separately. Saluda darter is an imperiled, narrow-range endemic of South Carolina.

The redeye bass is currently stable (Warren et al. 2000) and secure (G5) (NatureServe 2004). NatureServe (2004) did not list a state rank for the redeye bass in South Carolina and stream populations appear to be fairly secure. Reservoir populations, on the other hand, are likely imperiled due to potential displacement by spotted bass and hybridization with nonnative black bass species (smallmouth bass and spotted bass). In Tennessee, redeye bass are considered vulnerable (S3) and in North Carolina they are considered imperiled (S1), largely due to their limited range (NatureServe 2004).

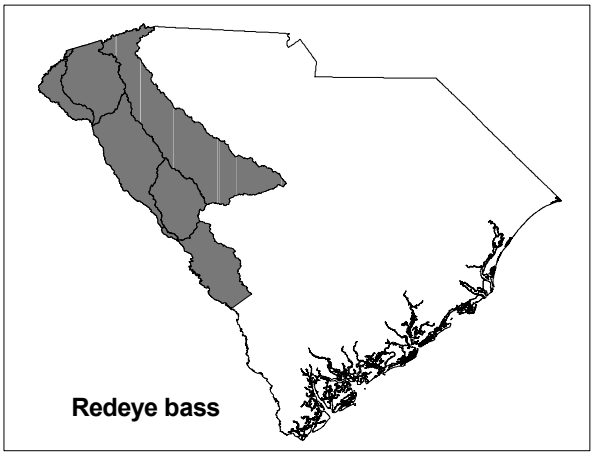
POPULATION DISTRIBUTION AND SIZE

Distribution

The Christmas darter is found in the upper Savannah River drainage, primarily above the fall line. Populations identified below the fall line may be Savannah darters. Outside of South Carolina, Christmas darters are found in the Altamaha and Ogeechee drainages in Georgia, both above and below the fall line (NatureServe 2004).



The Saluda darter only occurs in South Carolina, where it is restricted to the Saluda, Broad and Congaree River basins (Kuehne and Barbour 1983).



The native range of the redeye bass includes the Mobile Basin above the fall line and the upper Chattahoochee, Altamaha and Savannah Drainages (Etnier 1993; Rohde 1994; Lee 1980). Ramsey (1973) considered all populations outside this range to be a result of stocking. Redeye bass have also been introduced in Tennessee, Kentucky, California and Puerto Rico (Etnier 1993; Lee 1980). The redeye bass occurs in the Saluda River (Santee drainage), South Carolina, primarily in the river's mainstem and tributaries below the Saluda Dam. One report of redeye from a tributary stream upstream of Saluda Dam is documented in the

Clemson University museum collection. However, redeye bass are conspicuously absent in cool headwater rivers of the North, Middle and South Saluda Rivers and their tributaries, in what appears prime redeye habitat. This would tend to support taxonomists opinion that redeye bass are not native to the Saluda River system. The Chattooga River, once being a tributary to the Chattahoochee system (Ross 1970), likely explains the presence of redeye bass in the Savannah drainage. In South Carolina, redeye bass are also found below the fall line in the mainstem of the Savannah River (SCDNR unpublished data).

Population Size and Trend

The Christmas darter was considered by Kuehne and Barbour (1983) to be currently stable. They note that *E. binotatum* is common in creeks along the fall line containing gravel and rubble substrate and in headwater creeks in the Savannah River drainage. Page and Burr (1991) also refer to the Christmas darter as fairly common. However, areas of abundance are often disjunct. Major land disturbances within critical habitat could cause severe loss within their range. Our taxa team was of the impression that Christmas darter may be in decline within South Carolina.

The Saluda darter is thought to be doing well within its narrow range, with the exception of populations in close proximity to Columbia, South Carolina. There, populations may be in decline due to habitat loss and contamination (F. Rohde, pers. comm.).

Redeye bass appear abundant in upper Savannah River tributaries (SCDNR unpublished data) and in Lakes Jocassee and Hartwell (Duke Power unpublished data; SCDNR unpublished data). Redeye bass appear somewhat resilient to habitat alterations. Coneross Creek, a tributary to the Seneca River arm of Lake Hartwell, harbors good numbers of redeye bass despite being severely impacted both by increased sediment loading from agriculture and development and by greatly increased nutrient loads from a large municipal sewage discharge. Abundance of redeye bass has decreased in Lake Keowee as a result of non-native spotted bass introductions (Duke Power, unpublished data). The same trend is expected in Lakes Jocassee and Hartwell as spotted bass abundance increases. Redeye bass appear to be fairly common in streams of the upper Savannah. Although redeye bass reportedly perform poorly in impoundments within their native range, this species has thrived in the large oligotrophic and mesotrophic reservoirs of the upper Savannah River system, such as Jocassee, Keowee and Hartwell (Barwick and Moore 1983; SCDNR unpublished data). Redeye bass also occur in lakes Russell and Thurmond, although apparently in lower abundance (SCDNR unpublished data). Recent introduction of spotted bass into Lake Keowee has resulted in hybridization with redeye bass and a major decline in redeye bass abundance (Duke Power unpublished data). It is not known what effects spotted bass will have on redeye bass in tributary streams. Many of the tributaries to the lakes have barriers to upstream fish movement, which may protect stream populations of redeye bass from invasion of spotted bass.

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

The Christmas darter inhabits gravel or rubble riffles in cool water springs, creeks and small to medium-sized rivers where stronger currents exist. It sometimes occurs in slower moving waters with submerged vegetation (Rohde et al. 1994).

The Saluda darter inhabits sluggish to calm areas in clear to slightly turbid small streams with a substrate of mud, sand, gravel and/or bedrock (Collette 1962; Rohde et al. 1994). However, in Wateree Creek, a large South Carolina stream, the Saluda darter was found in moderate gradient among coble and leaf packs (pers. obs.).

Redeye bass occur in a variety of habitats in South Carolina from fast flowing, high gradient streams of the Blue Ridge and upper piedmont ecoregions to low gradient streams and the Savannah River below the fall line. It is found in small streams to large rivers and reservoirs.

CHALLENGES

The Christmas darter is currently stable throughout its range; however, the wide separations between critical habitats and healthy populations are a concern. Because of the limited distribution of the Christmas darter within South Carolina, this fish is vulnerable to development, deforestation, loss of riparian cover, siltation and the effects of impoundments within areas of abundance.

The Saluda darter is challenged due to its limited distribution solely within South Carolina. It is especially vulnerable to development because many Saluda darter populations occur in streams within the greater Columbia metropolitan area and are, therefore, increasingly subject to chemical contamination and siltation from urban runoff. Other threats include agricultural runoff and habitat destruction resulting from inundation by dams.

The redeye bass is primarily threatened by the introduction of the non-native spotted bass. Other threats may include deforestation and associated stream warming and siltation, impoundment, acid deposition, and displacement by non-native fishes (D. Rankin, SCDNR, pers. comm.).

CONSERVATION ACCOMPLISHMENTS

Redeye bass habitat is primarily protected by land ownership patterns in some key habitats streams such as Chattooga River, Chauga River, Eastatoee River and Stevens Creek. However, the amount of unprotected habitat for this species far exceeds protected habitat.

CONSERVATION RECOMMENDATIONS

- Determine statewide distribution and population status of Christmas darters, Saluda darter and redeye bass with statewide stream surveys.
- Describe life history and habitat requirements of Christmas darters, Saluda darter and redeye bass.
- Determine the status of known populations of both Christmas and Saluda darters. Saluda darter surveys in the Broad River Drainage are critical to understanding the genetic relationship of *E. saludae* and *E. collis*. Resurvey historically identified locations of Christmas darters below the fall line to determine its current status.
- Conduct a genetic survey to determine the relationship between Christmas and Savannah darters.

- Inventory and monitor water quality and habitat in redeye bass streams to identify water quality threats as well as habitat needs and deficiencies
- Protect critical habitats from future development and further habitat degradation by following best management practices and protecting and purchasing riparian areas.
- Promote land stewardship practices through educational programs both within critical habitats with healthy populations and other areas that contain available habitat.
- Encourage responsible landuse planning.
- Consider species needs when participating in the environmental permit review process.
- Develop a Non-Game Fishes of South Carolina poster and other educational materials in order to raise public awareness of nongame species and their ecological importance to the natural history of South Carolina's aquatic habitats.
- Educate motor vehicle operators of the negative affects of crossing streams at multiple locations and using stream bottoms as trails.
- Monitor the success of redeye bass habitat protection and advocate for additional protection through the environmental permit review process.
- Promote redeye bass as a sport fishery in larger streams.
- Conduct an education and outreach campaign to raise awareness of the impacts of illegal introductions of non-native species.

MEASURES OF SUCCESS

Determining the distribution, life history, habitat needs and southeastern population structure and trends would represent a measure of success for these species. Methods that protect water quality are also likely to protect most of these species. Genetic resolution of the status of the Saluda darter will allow for more specific management protocols for that species.

Attachment B

Saluda Hydroelectric Project Relicensing
Rare, Threatened, and Endangered Species Tracking Sheet

Section 7 Species Tracking Tool: Saluda Relicensing Project

Common Name	*Scientific Name*	Federal Status[1]	Population Status[2]	Critical Habitat Identified	Existing Restoration Plan (FWS or Other)	Counties	Determination of effect	Data Needs/Comments
Bald eagle	*Haliaeetus leucocephalus*	T		No	FWS (Southeastern States)	Lexington, Newberry, Richland, Saluda		
Carolina heelsplitter	*Lasmigona decorata*	E		Yes, but not listed in project boundaries	FWS	Lexington (possible), Newberry (possible), Richland (possible), Saluda (possible)		
Red-cockaded woodpecker	*Picoides borealis*	E		No	FWS	Lexington, Richland, Saluda		
Shortnose sturgeon	*Acipenser brevirostrum**	E		No		Lexington (possible), Richland		
Smooth coneflower	*Echinacea laevigata*	E		No	FWS	Lexington (possible), Richland		
Schweinitz's sunflower	*Helianthus schweinitzii*	E		No	FWS	Lexington		
Southern Dusky Salamander	*Desmognathus auriculatus*	SC		N/A	N/A	Lexington (possible), Richland (possible)		
Dwarf aster	*Aster mirabilis*	SC		N/A	N/A	Lexington (possible)		
Shoal's spider-lily	*Hymenocallis coronaria*	SC		N/A	N/A	Lexington, Richland		
Prairie birdsfoot-trefoil	*Lotus purshianus var. helleri*	SC		N/A	N/A	Lexington (possible), Newberry (possible), Richland (Possible), Saluda (possible)		
Piedmont cowbane	*Oxypolis ternata*	SC		N/A	N/A	Lexington		
Wire-leaved dropseed	*Sporobolus teretifolius*	SC		N/A	N/A	Lexington		
Pickering's morning-glory	*Stylisma pickeringii var. pickeringii*	SC		N/A	N/A	Lexington		
Rayner's blueberry	*Vaccinium crassifolium ssp sempervirens*	SC		N/A	N/A	Lexington, Richland		
American kestrel	Falco sparverius	SC		N/A	N/A	Lexington (possible), Newberry (possible), Richland, Saluda (possible)		
Loggerhead shrike	Lanius ludovicianus	SC		N/A	N/A	Lexington (possible), Newberry (possible), Richland, Saluda (possible)		
Painted bunting	Passerina ciris ciris	SC		N/A	N/A	Lexington (possible), Richland (possible)		
Southern hognose snake	Heterodon simus	SC		N/A	N/A	Lexington (possible), Richland, Saluda		
Robust Redhorse Sucker	Moxostoma robustum	SC		N/A	N/A	Lexington (possible)		

Butternut	Juglans cinerea	SC	N/A	N/A	Newberry (possible)
Biltmore green briar	Smilax biltmoreana	SC	N/A	N/A	Newberry
Sweet pinesap	Monotropsis odorata	SC	N/A	N/A	Newberry
Bachman's sparrow	Aimophia aestivalis	SC	N/A	N/A	Newberry, Saluda, Richland, Lexington
Henslow's sparrow	Ammodramus henslowii	SC	N/A	N/A	Newberry, Saluda, Richland, Lexington
Saluda crayfish	Distocambarus youngineri	SC	N/A	N/A	Newberry
Rough-leaved loosestrife	Lysimachia asperulaefolia	E	No	FWS	Richland
Canby's dropwort	Oxypolis canbyi	E	No	FWS	Richland
Georgia aster	Aster georgianus	C	N/A	FWS	Richland
Sandhills milk-vetch	Astragalus michauxii	SC	N/A	N/A	Richland
Purple balduina	Balduina atropurpurea	SC	N/A	N/A	Richland
Creeping St. John's wort	Hypericum adpressum	SC	N/A	N/A	Richland
Bog spicebush	Lindera subcoriacea	SC	N/A	N/A	Richland
Carolina bogmint	Macbridea caroliniana	SC	N/A	N/A	Richland
Algae-like pondweed	Potamogeton confervoides	SC	N/A	N/A	Richland
False coco	Pteroglossaspis ecristata	SC	N/A	N/A	Richland
Awned meadowbeauty	Rhexia aristosa	SC	N/A	N/A	Richland
Reclined meadow-rue	Thalictrum subrotundum	SC	N/A	N/A	Richland
White false-asphodel	Tofieldia glabra	SC	N/A	N/A	Richland
Carolina darter	Etheostoma collis	SC	N/A	N/A	Richland
Rafinesque's big-eared bat	Corynorhinus rafinesquii	SC	N/A	N/A	Richland
Piedmont bishop-weed	Ptilimnium nodosum	E	No	N/A	Saluda
Little amphianthus	Amphianthus pusillus	T	No	FWS	Saluda
Dwarf burhead	Echinodorus parvulus	SC	N/A	N/A	Saluda
Creeping St. John's wort	Hypericum adpressum	SC	N/A	N/A	Saluda
Savannah lilliput	Toxolasma pullus	SC	N/A	N/A	Saluda

[1] E – Federally Listed as Endangered
T - Federally Listed as Threatened
SC - species is a Candidate for Federal Listing as Threatened or Endangered (species of concern)
EDCH - Federally Listed as Endangered and has Designated Critical Habitat in the counties surrounding the project.
TPDH - Federally Listed as Threatened and has Designated Critical Habitat in the counties surrounding the project.
PE - Presumed extinct/no current status

[2] N - No recent records
E - Extant; occurs within project boundaries

EO - Extant; occurs outside project boundaries
RD - Recently discovered

[3] NE - No Effect
NL - Not likely to adversely affect
LA - Likely to adversely affect

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
TERRESTRIAL RESOURCE TWC

Carolina Research Park
May 3, 2006

Final csb 6-2-06

ATTENDEES:

Bill Argentieri, SCE&G
Shane Boring, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Ron Ahle, SCDNR
Sam Drake, LMA
Tom Eppink, SCANA Services
Bob Seibels, River Banks Zoo
Amanda Hill, USFWS
Buddy Baker, SCDNR
Dick Christie, SCDNR

ACTION ITEMS:

- Prepare study plan for waterfowl surveys on L. Murray during period of late-October through January

Shane Boring

- Contact Columbia Audubon for additional bird data

Ron Ahle

- Contact Saluda Shoals for additional bird data

Shane Boring

DATE OF NEXT MEETING: **July 26, 2006 at 9:30 AM**

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 2:30 PM and noted that the focus of the meeting would be to discuss: (1) action items from previous meeting minutes, (2) SCDNR's Lake Murray waterfowl survey data, (3) River Banks Zoo/Columbia Audubon/other migratory and resident songbird data, and (4) the need for any additional surveys for songbirds.

Review of Action Items

Shane briefly discussed action items listed in previous meeting minutes. Shane noted that he obtained the River Banks Zoo bird observation data from Bob Seibels, which was distributed to all committee members by email. Shane also mentioned that he received the Lake Murray waterfowl data from Buddy Baker, which was also emailed to all TWC members.

SCDNR's Lake Murray Waterfowl Survey Data

A copy of the waterfowl data (Attachment A) was distributed to everyone and the group immediately began discussing the decline in species over the years. Shane asked Buddy B. to briefly describe the data to the group. Buddy B. explained that Lake Murray waterfowl peaked in the mid 70's and has considerably declined in recent years. He indicated that the survey was conducted on the lower 2/3 of Lake Murray. He explained that the decreasing waterfowl populations may be correlated with decreasing aquatic vegetation. For an example, he noted that as submerged aquatic vegetation declined, diving duck populations also declined. The group briefly discussed grass carp populations and their effect on aquatic vegetation in Lake Murray. Amanda Hill noted that Santee-Cooper had a problem balancing grass carp populations.

Buddy B. mentioned that the group should not draw any drastic conclusions from this data. Amanda H. suggested that additional survey likely are in order and suggested a survey schedule similar to what was done at Santee-Cooper. Buddy B. noted that an adequate survey would consist of a series of aerial surveys. He specifically noted that five to six flights that correspond to winter migration (late Oct., Nov., Dec., Jan.) would provide a sufficient amount of data. He also indicated that these species need heavily vegetated shorelines for habitat, food, and shelter, which have ultimately declined over time. Bill A. agreed that Kleinschmidt should begin drafting a study plan to conduct five to six waterfowl surveys during winter months on Lake Murray.

River Banks Zoo/Columbia Audubon/Other Migratory and Resident Bird Data

The group examined and discussed the River Banks Zoo bird observation data[1], as well as the data posted on the Columbia Audubon website for Dreher Island State Park on Lake Murray[1]. Bill A. enquired how the bird data being requested will be used in the relicensing process. Amanda H. explained that this information will be used to describe the avifauna occurring in the project area in exhibit E of the license application. She added that this information will ultimately be used to make recommendations to the shoreline management plan. Shane noted that if the objective of the group is to compile a comprehensive species list to include in the exhibit E, this can probably be accomplished using existing data. The group agreed that an attempt should be made to acquire any additional existing data, after which a final species list can be constructed for the exhibit E. Ron Ahle was tasked with contacting Columbia Audubon to determine if data are available that are more up-to-date than what is posted on the website. Shane noted that there may also be a dataset available for Saluda Shoals Park.

Date/Location of Next Meeting

The group decided to meet again on July 26, 2006, at Carolina Research Park, with August 14th, 15th, or 16th as alternates if committee members are not able to attend. Shane Boring agreed to send out an electronic meeting announcement and directions to the meeting location.

[1] Data not attached due to file size; please contact Saluda Relicensing staff for access to data.

Attachment A

SCDNR Lake Murray Waterfowl Survey Data

Winter Waterfowl Surveys – SC Midlands Piedmont

	Lake Murray 2003	Lake Murray 2004	Lake Murray 2005	Lake Murray 2006	Total
Mallard	26	19	2	44	**91**
Black Duck	4				**4**
Mot. Duck					**0**
Gadwall					**0**
Am. Wigeon					**0**
G.W.Teal					**0**
B.W.Teal					**0**
N.Shoveler	3				**3**
N.Pintail					**0**
Wood Duck					**0**
Total Dabblers	**33**	**19**	**2**	**44**	**98**
					0
Redhead			1		**1**
Canvasback					**0**
Scaup	2610	1718	2	4	**4334**
Ringneck	200	1353	34		**1587**
Goldeneye	3				**3**
Bufflehead	80	40		139	**259**
Ruddy Duck	7				**7**
Total Divers	**2900**	**3111**	**37**	**143**	**6191**
					0
Mergansers			5	4	**9**
Unidentified		4		4	**8**
					0
TOTAL DUCKS	**2933**	**3134**	**44**	**195**	**6306**
					0
Snow Goose					**0**
Can. Goose	394	86	12	56	**548**
White-Fronted Goose					**0**
TOTAL GEESE	**394**	**86**	**12**	**56**	**548**
					0
Tundra Swan					**0**
Am. Coot	19500	9000	753	125	**29378**
TOTAL WATERFOWL	**22827**	**12220**	**809**	**376**	**36232**

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
INSTREAM FLOW/AQUATIC HABITAT
TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
May 3, 2006

Final csb 6-2-06

ATTENDEES:

Bill Argentieri, SCE&G
Shane Boring, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Dick Christie, SCDNR
Amanda Hill, USFWS
Scott Harder, SCDNR
Steve Summer, SCANA Services
Tom Eppink, SCANA Services
Jim Glover, SCDHEC
Ron Ahle, SCDNR
Sam Drake, L. Murray Assoc.

ACTION ITEMS:

- Distribute 1989-90 Lower Saluda IFIM Study Report to TWC

Shane Boring/Jeni Summerlin

- Draft list of target species for IFIM studies on Lower Saluda

Amanda Hill/Ron Ahle

- Compile and distribute Congaree floodplain studies to TWC

Shane Boring

- Contact NPS to determine status of ESWM process on Congaree River

Shane Boring/Bill Argentieri

- Provide clarification regarding GIS coverages needed to satisfy Comprehensive Habitat Assessment

Dick Christie/Amanda Hill

- Coordinate with Tommy Boozer regarding available GIS-based habitat maps for L. Murray

Bill Argentieri

- Draft framework for white paper assessing potential for self-sustaining trout fishery in LSR

Shane Boring/Jeni Summerlin

- Contact Gerrit Jobsis and Jeff Isely to make presentation on existing IFIM Study

Shane Boring

DATE OF NEXT MEETING: **June 14, 2006 at 9:30 am**

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 10:20 AM. Shane reminded the group that, at the February 22nd Fish and Wildlife RCG meeting, the Technical Working Committees (TWCs) were formed and study requests were assigned to the TWCs[1]. It was noted that the purpose of today's meeting would be to review the study requests assigned to the Flow/Aquatic Habitat TWC (See Meeting Handout - Attachment A) and to begin assigning tasks toward addressing each request. Discussions regarding each of the study requests are summarized below.

Request for Instream Flow Studies[2]

Shane noted that Ron Ahle from SCDNR had provided the field datasheets, study plan, and final report for the 1989-90 Lower Saluda River (LSR) Instream Flow Study. A copy of the study plan was distributed to attendees (Attachment B) and the original data was returned to Ron. Shane noted that he would scan the final report and distribute it to the TWC via e-mail. He added that photocopies had been made of the field data should the TWC decide to use the existing data in the evaluating instream flow as part of the current relicensing. Ron Ahle proposed, and the group agreed, that having the authors of the 1989-90 IFIM study provide a presentation detailing the project methods and findings would be a reasonable first step in evaluating it's relevance in the current relicensing. Shane agreed to contact Gerrit Jobsis and Jeff Isely in hopes of scheduling a presentation for the next TWC meeting. Ron Ahle, Dick Christie, and Amanda Hill noted the importance of establishing target species in evaluating the existing IFIM data. Ron and Amanda agreed to collaborate on development of a list of target species.

Bill Argentieri noted that specific flows were recommended by SCDNR in their comments to the Initial Consultation Document [470 cfs for one-way downstream navigation; 590 cfs (July-November), 1170 cfs (January-April), and 880 cfs (May, June, & December) for seasonal aquatic habitat] and enquired as to how these flows were derived. Bill enquired specifically as to whether these flows were based on the 1989-90 LSR IFIM study. Dick Christie noted that the recommended flows were based on the SC Water Plan and were not related to the 1989-90 study. He added that the flow recommendations were offered in lieu of a site-specific IFIM study for LSR, adding that the agency certainly encourages a site-specific study.

[1] See February 22nd, 2006, Fish and Wildlife RCG meeting notes for study request summaries and assignments.
[2] Subheading correspond to Study Requests in attached meeting handout.

Scott Harder recommended that Acoustic Doppler (AD) technology be considered for any site-specific studies, adding that it could provide fine-scale data and is considerably less labor-intensive. Steve Summer agreed, noting that AD technology is being considered for evaluating impacts of operating unit 5 on stripped bass habitat during the DO "crunch" period in late summer.

Request for Floodplain Flow Evaluations

Shane noted that there are a number of recent and ongoing studies that have potential to assist in addressing this issue. Specifically, Shane noted that there is a USC graduate student currently researching the impacts of hydro dam operations in the Santee Basin on Congaree River flows and subsequently the vegetative communities of Congaree National Park (NP). Bill Argentieri noted an existing study that examined the influence of the Saluda on overall flows in the Congaree, adding that he believed the study concluded that the Saluda contributes approximately 1/3 of the Congaree's flow. Shane agreed to gather as many of these studies as possible and distribute to the TWC. The group agreed that the best course of action is to coordinate with the National Park Service to determine what data/studies exist. Following review of existing data and studies, the TWC will convene to determine a course of action for this issue.

Ecologically Sustainable Water Management (ESWM) Request

Dick Christie noted that SCDNR was involved with the development of an ESWM framework for the Savannah River, adding that the process involved numerous experts working together through a series of workshops to develop recommendations for the basin. Ron Ahle noted that result of any instream and/or floodplain flow studies conducted as part of this relicensing (see above, as well as items 1&2 of attached handout) would undoubtedly provide important information for development of an ESWM framework and suggested that it may be beneficial to complete these studies prior to beginning ESWM discussions. Amanda Hill noted that the ESWM process provides a framework to develop a flow regime that balances the various water uses in the basin. Dick noted that The Nature Conservancy (TNC) has managed development of ESWM in other basin and suggested contacting them to provide additional information regarding the process. After further discussion, the group agreed that the NPS should be contacted to determine exactly how they would like SCE&G to contribute to the ESWM process and how far along they are in the development process.

Request for Sediment Regime and Transport Studies

Shane enquired as to whether the group was aware of any existing sedimentation data for the LSR. Steve Summer noted that he was not aware of any specific studies, but noted that substrate was one of the factors considered in the 1989-90 LSR IFIM study. Ron Ahle suggested a good starting point

for addressing this issue might be to revisit the transect locations from the previous study to determine whether there have been changes in substrate at these sites. Several group members noted that, while this is undoubtedly a good first step, the scope of the study request appears to go beyond just substrate. It was noted by some attendees that this is a very broad study request and it is unclear exactly what is being requested (i.e. the proposed study objectives(s)).

Request for Comprehensive Habitat Assessment

Shane noted that SCE&G's aerial photography for Lake Murray and video flyover for the LSR have potential for providing a fairly thorough assessment of the aquatic habitat in the project area. Amanda Hill acknowledged this, but added that they are looking for a GIS-based approach. Bill Argentieri noted that the shoreline GIS maps developed by Tommy Boozer's group includes Environmentally Sensitive Areas and thus may include the level of detail being requested. Dick Christie and Amanda Hill both noted that they needed to give further consideration to what is needed and would report back to the group at the next meeting. Bill agreed to coordinate with Tommy Boozer to determine the suitability of the shoreline maps in helping to address this issue.

Request for Study to Determine Feasibility of Self-Sustaining LSR Trout Population

Dick Christie noted that, while SCDNR certainly encourages improvement in water quality and/or habitat that might result in improvements to the existing put, grow and take trout fishery (i.e., improved growth and/or survival), establishment of a reproducing trout population is not one of the agency's management goals for the LSR. Amanda Hill noted that USFWS would certainly support any enhancements to the existing fishery, but added that USFWS is "not in the business of promoting reproducing populations of non-native species." After some additional discussion, it was determined that, despite the fact that a reproducing population is not within agency management objectives, stakeholders requesting this study (Trout Unlimited) are due a fair evaluation of the proposal. As such, the group agreed to author a white paper summarizing the biotic and abiotic factors necessary for establishment of a self-sustaining population; summarizing potential benefits of existing and proposed water quality and/or habitat enhancements on the existing put, grow, and take fishery (including incidental reproduction); and outlining agency management objectives relative to trout for the LSR. Kleinschmidt staff will compile an initial framework for the white paper and distribute to the TWC for input.

Date/Location of Next Meeting

The group agreed to have the next Instream Flow/Aquatic Habitat TWC meeting on June 14, 2006 at the Research Park at 9:30 am. Shane noted that he would issue an electronic meeting invitation to confirm the date with individual members and provide directions to the meeting site. The meeting adjourned at approximately 1:00 PM.

Attachment A

May 3, 2006, Instream Flow/Aquatic Habitat TWC
Meeting Handout

Saluda Hydro Relicensing
Instream Flow/Aquatic Habitat Technical Working Committee Meeting
May 3, 2006 – Carolina Research Park

Members:

Shane Boring	Alan Stuart	Brandon Kulik
Ron Ahle	Amanda Hill	Dick Christie
Steve Summer	Gerrit Jobsis	Prescott Brownell
Hal Beard	Wade Bales	

Study Requests to be Addressed:

1) **Instream Flow Studies**: Requested for the Saluda River and the Confluence area. An assessment on how Project operations affect stream flows, and which flow regimens would best meet the needs of the biota.

   Requested by: CCL/American Rivers, City of Columbia Parks and Recreation, SCDNR*,* LSSRAC, National Marine Fisheries Service, SC Council Trout Unlimited, USFWS

   **[IFIM requested by SCDNR in lieu of implementing an instantaneous flow of at least 470 cfs needed to support one-way downstream navigation, and flows of 590 cfs (July – November), 1170 cfs (Jan-April), and 880 cfs (May, June and December) to provide seasonal aquatic habitat]*

2) **Floodplain Flow Evaluations**:[1] A study was requested in order to evaluate the flows necessary for incremental levels of floodplain inundation for the Lower Saluda, Congaree River, and Congaree National Park. It is requested that it include an inventory of floodplain vegetation as well, in order to classify and characterize the vegetative species composition and structure of the floodplain areas within the zone of operational influence of the river reaches.

   Requested by: CCL/American Rivers *(requested floodplain inundation study as well as floodplain vegetation component)*, LSSRAC *(requested floodplain vegetation component only)* National Park Service

   **In relation to this study, SCDNR requests that the hydrologic record associated with the operation of the project be compared to the unregulated hydrology that would have occurred under a natural flow regime over the life of the project. Including an estimate of the timing, duration and magnitude of flood events that occurred and that would have occurred in absence of the project*.

   Requested by: SCDNR

3) **Ecologically Sustainable Water Management (ESWM)**: Described by the National Park Service as a "inclusive, collaborative, and consensus-based process to determine a scientifically based set of river flow prescriptions in order to protect downstream resources while balancing upstream benefits." The NPS notes that they believe this process can be readily adapted to the Saluda Project and have already began gathering information and developing an interactive GIS tool to provide information regarding the effect of various Saluda operational scenarios on the degree of inundation at the Congaree National Park. NPS seeks "partnership" with SCE&G as well as stakeholders in implementing this ESWM process.

   Requested by: National Park Service

4) **Sediment Regime and Sediment Transport Studies:** A request has been made that a study be performed on the sediment regimen in the Project area as well as the Project effects on the sediment regimen of the lower Saluda River. Should include such things as sediment composition, bedload movement, gravel deposition, sediment storage behind dams, and bedload changes below the dam; and project effects on downstream geomorphometry, sediment availability and streambank erosion, and the possible addition of gravel to mitigate for project impacts. Also, the effects of the Project operations on habitat requirements for spawning fishes.

   Requested by: CCL/American Rivers, USFWS

5) **Comprehensive Habitat Assessment**: To provide quantitative and qualitative data in GIS format of available and potential spawning, rearing, and foraging habitats (i.e., riffles, shoals, open water, shallow coves, littoral zones) for diadromous and resident fishes in Lake Murray, the Saluda River and its major tributaries, and the Lower Saluda River below the Project.

   Requested by: National Marine Fisheries Service, USFWS

6) **A Study to Determine the Factors Needed for a Self Sustaining Trout Fishery**: The purpose of this study should be to determine the factors needed for a self sustaining trout fishery that can reproduce and thrive year round, and how the operation can be modified to meet the habitat needs. Dissolved oxygen, flows, spawning and rearing habitat, the aquatic food base, especially in the shallow, rocky foraging areas, and actual water chemistry should be key items in such an assessment.

   Requested by: SC Council Trout Unlimited

Attachment B

1989-90 Lower Saluda River IFIM Study Plan

Lower Saluda River Study Plan

July 9, 1990

I. Introduction

The lower Saluda River (LSR) is an important recreational resource offering approximately 10 river miles of fishing, picnicking, sunbathing, and whitewater canoeing within the Columbia, South Carolina metropolitan area. The fishery resources of the river include an assortment of resident and migratory populations of game and non-game species. The river supports put-grow-and-take brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) fisheries. Adult striped bass (Morone saxatilis) migrate upstream from the Congaree River after spawning and use the LSR as a cool-water refuge during the spring and summer months. The flow of the LSR is almost entirely controlled by releases from generation of electricity at the Lake Murray Dam (also known as Saluda Dam), owned and operated as a peaking hydroelectric facility by South Carolina Electric and Gas Company (SCE&G). This dam is licensed (Number 516) by the Federal Energy Regulatory Commission (FERC).

The following study has been initiated as a cooperative effort among the Charleston, South Carolina Field Office of the U.S. Fish and Wildlife Service (USFWS-SC); the USFWS Aquatic Systems Branch, Fort Collins, Colorado (USFWS-CO); and the South Carolina Wildlife and Marine Resources Department (SCWMRD). SCE&G has been informed of the study plans and has agreed to provide reasonably available information and has conditionally agreed to water releases necessary for its completion. SCE&G

will have the opportunity to review and comment on the study plan prior to field work and is welcome to participate in all study phases.

This study will have two phases. Phase I will be an evaluation of the magnitude, duration, and water quality of releases from the Lake Murray Dam and their effects on the fishery resources of the LSR. To establish how these variables affect fishery habitat, fish passage through shoals, and water quality, we will use the Instream Flow Incremental Methodology (IFIM) developed by the USFWS-CO.

Phase II will evaluate alternatives that can reduce the impacts, if Phase I indicates current conditions are negatively affecting LSR fishery habitat, fish passage through shoals, or water quality. Should reasonable alternatives that reduce these impacts be identified during Phase II, then agencies participating in the study will petition the FERC to append these alternatives to the project's operating license.

II. Fishery Resource Issues

Based on past studies (Younginer 1986; Borders 1987; Crane 1987; McKellar and Stecker 1988), the SCWMRD and the USFWS are concerned that the magnitude, duration, and water quality of releases from the dam may be negatively affecting the fishery resources of the river.

III. Phase I

Objective: Assess if current conditions limit the fishery habitat of the LSR.

Phase I will assess the effects of current conditions on the LSR fishery resources. Dissolved oxygen, water temperature, base-flow, and generation-flow effects on habitat will be evaluated. Instream flows required to allow passage of migratory fishes through shoals will also be assessed.

Resident fish species need flows for adult fish populations, spawning and rearing of fry and juveniles. Selected non-game and game species of pool/stream-margin and riffle habitat guilds will be used to represent resident fish community habitat requirements. Passage requirements of fish populations migrating through shoals will also be evaluated.

IV. Phase II

Objective: Identify reasonable alternatives to reduce impact if Phase I results indicate current conditions are significantly limiting fishery habitat.

Trade-off analysis is required to determine how various modifications affect fishery habitat. If study results indicate alternative flow regimens are needed for fishery resources, then the effects of those regimens on hydroelectric power generation and other water uses will be evaluated. The SC Water Resources

Commission's Saluda River Water Budget and Reservoir Operation Model, which relates water release requirements to lake-level maintenance and power production, will be used as part of this evaluation.

V. Study Boundaries

The study area comprises of the entire LSR, from the Lake Murray Dam to the confluence with the Broad River. This area encompasses approximately 10 river miles (RM). Major tributaries of the LSR are Rawls Creek (RM2.1), Twelvemile Creek (RM3.7), and Kinley Creek (RM4.5). Under natural flow conditions these creeks do not contribute significantly ($\geq$ 10%) to the Saluda's stream flow. However, because the dam can reduce or eliminate all but leakage flow from the river, these tributaries can contribute significantly to the LSR flows especially during periods of non-generation and high runoff.

Habitat analysis is needed from the dam downstream to include Millrace Rapids, approximately 9 miles downstream of the dam. Downstream of Millrace Rapids to its confluence with the Broad River, the lower Saluda becomes highly braided. This 1-mile section will not be included in the IFIM analysis because of backwater effects from the Broad River.

VI. Target Species

Several target species and lifestages will be used to represent the habitat requirements of the LSR fish community and

important game species. Riffle and pool/stream-margin habitat guilds will be used to represent the resident populations as prescribed by Leonard and Orth (1988). The adult northern hogsucker (Hypentelium nigricans) and margined madtom (Noturus insignis), both obligate riffle dwellers, will represent the riffle guild. The pool/stream-margin guild will be represented by redbreast sunfish (Lepomis auritus) spawning and young-of-the-year northern hogsucker lifestages. Requirements of important game species to be modeled include striped bass - adult habitat; redbreast sunfish - adult habitat; brown trout - adult, spawning, and incubation habitat; and rainbow trout - adult, spawning, and incubation habitat.

Shoal passage requirements of migrating fish populations, which include American shad (Alosa sapidissima), gizzard shad (Dorosoma cepedianum), threadfin shad (Dorosoma petenense), blueback herring (Alosa aestivalis), and striped bass, will be represented by adult striped bass (> 24").

The flow requirements of each target species and lifestage will be evaluated only during their respective periods of occurrence (Table 1).

VII. Habitat Suitability Criteria

A. IFIM Target Species

Habitat suitability criteria available from published literature and recently completed, unpublished studies will be evaluated for all target species. Specific curves will then be

developed for this study. The habitat suitability criteria to be evaluated are given in Appendix I.

B. Fish Passage

Criteria for passage at shoals will be based on requirements that allow unimpeded passage of adult striped bass (> 24") and will be developed from published literature. The passage flow will be the discharge that meets striped bass passage criteria for 10% of the stream width during the period of occurrence.

VIII. Hydrologic Baseline and Time-Step Analyses

Hydrologic conditions of the LSR are controlled by releases from the Lake Murray Dam, completed in 1930. Lake Greenwood, located approximately 50 river miles upstream of Lake Murray Dam, has limited control over water availability of the LSR. Filling of Lake Greenwood was completed during 1941. Therefore, the appropriate period of hydrologic record for this study should be from 1942 to present. During this period, flows of the LSR have been monitored by US Geological Survey (USGS) gage number 02169000, the Saluda River at Columbia. This gage is located 8.4 river miles downstream of the Lake Murray Dam. A second USGS gage, Saluda River below Lake Murray Dam (number 02168504), is located 1/2 mile downstream of the Lake Murray Dam and has been in operation for 2 years.

The LSR hydrology will be analyzed incorporating historical streamflow (with project) and natural streamflow (without

project) information. The time-step to be used for this study will be determined after the hydrologic analysis has been completed.

IX. Data Collection and Required Measurements

A. Habitat Mapping

Transect location selection will be based on habitat-type rather than representative-reach methods. To determine the proportions of different habitats occurring, the LSR was canoed by SCWMRD personnel in August 1988 at Q = 600 cfs (USGS gage 02169000). The frequency of major habitat types was determined by classifying habitats at 48, equally spaced transects. Six major habitat types were found. All riffle habitats were associated with transverse ridges of rock outcroppings. Run and pool habitats were separated into those with and without rock outcroppings. The last habitat type was split channel. Two major split channel habitats occur; Corley's Island at RM2.7 and Saluda Hills at RM7.5. Rapids are known to occur in the river, but no habitat transects were located at this habitat type.

The proportion of habitat types determined in August 1988 (Table 2) will be used for weighting transects selected to represent each habitat type.

The proportion of the habitats was a function of the discharge at the time of evaluation (600 cfs). The classification of habitat type is expected to change as

discharges vary. For example, pools may become runs at higher flows and visa-versa at lower flows.

B. Stream Segments

The 9-mile study section will be divided into 3 segments of 3 miles each to enable evaluation of hydroelectric peaking effects. The upper section begins at the dam and terminates at the lower end of Corley's Island (RM1-RM3). The middle segment (RM4-RM6) will span from Corley's Island to the I-20 bridge. The lower segment extends from the I-20 bridge to Millrace Rapids (RM7-RM9).

C. Microhabitat Study Sites

Each habitat type will be represented by at least 2 transects in each the upper and lower study segments. No microhabitat measurements will be made in the middle segment because 1) tributaries entering this segment cause discharge to vary longitudinally within this segment, 2) hydroelectric peaking effects on habitat availability will be transitional with respect to the upstream and downstream segments (Gore et al. 1989), and 3) base-flow requirements will be adequately addressed by the upper and lower segments.

Representative areas of the upper and lower segments with good access in which transects can be located are given in Table 3. The exact location of each transect will be determined in the field.

D. Microhabitat Study Site Measurements

Modelling the base-flow requirements for the LSR's fishery resources and the effects of the current hydroelectric operation on fishery habitat will be approached using different methods. To address base-flow requirements, habitat data from the upper and lower segments will be combined and used to represent the base-flow needs of the entire LSR. To evaluate the hydroelectric operation effects on fishery habitat, the upper and lower segments will be evaluated separately because the stage, discharge, and rate at which they change differ longitudinally.

A complete set of microhabitat measurements will be made at the lowest flow used for modelling. This set will include depth, velocity, substrate, and cover. The stage of zero flow will also be determined at this time. Candidate substrate and cover codes (Table 4) will be modified to match habitat suitability curves of target species after the selection of those curves has been finalized.

Water surface elevation measurements will be made at least one mid-range and one high discharge. An additional set of velocity measurements will also be made at a mid-range flow.

E. Discharge Measurements

River flow can range from < 100 cfs at leakage flow to 18,000 cfs when all five hydroelectric units are generating at full capacity. The full range of flows need to be modeled to

evaluate base flow requirements and peaking flow impacts. Microhabitat measurements will be made at a low flow of approximately 200 cfs. Water surface elevation measurements will be made at approximately 200 cfs, 1200 cfs, and 7200 cfs.

Discharges will be determined from depth and velocity data collected during the microhabitat measurements.

Measurements are scheduled for summer 1990. Work requiring low flows will be scheduled for weekends, if necessary. This should enable SCE&G to provide low flows needed for microhabitat measurements with minimal effect on generation requirements. Adequate water for higher, model-calibration flows should be available at this time. Tributary input can be relatively high at this time of year and will have to be accounted for.

F. Macrohabitat Parameters

1. Dissolved Oxygen

Dissolved oxygen, an important water quality variable of the LSR, is controlled to a large extent by releases from the dam. Water quality at temperatures >15 C becomes unsuitable for brown trout at DO concentrations of 6 mg/L (Raleigh et al. 1986) and for rainbow trout at 5 mg/L (Raleigh et al. 1984).

Water discharged from the dam for December through June generally has DO concentrations adequate for fishery resources. Flows of 100 cfs or greater maintain DO concentrations above 5 mg/L throughout the entire river (Borders 1987).

From late July through November DO concentrations from water released through the dam can be below those required for fishery resources. At moderate flows (approximately 225 cfs) the water is reaerated at the first rapids, Hope Ferry Rapids, approximately 1 mile downstream of the dam (McKellar and Stecker 1988). At high discharges the water is not reaerated to 5 mg/L within the study area. Dissolved oxygen concentrations at a flow of 7,350 cfs were approximately 1 mg/L at the dam, 2 mg/L at RM2, 3 mg/L at RM4, 4 mg/L at RM7, and < 5 mg/L at RM9 during this period (Borders 1987). Flows >7350 cfs can be expected to result in lower DO concentrations downstream of the dam.

Because of these temporal differences, DO will be modeled in a monthly time step for July through November. SCDHEC has modelled the LSR's oxygen dynamics using the QUAL2E model (Borders 1987). McKellar and Stecker (1988) collected empirical DO data at different flows. This information will be used to define the relationship between discharge and DO dynamics for the purpose of this study.

2. Water Temperature

Water temperature dynamics need to be evaluated. Trout habitat quality may be limited by high water temperatures in the lower end of the study segment during summer months. Temperature data from the upstream gage (USGS 02168504), downstream gage (USGS 02169000), and McKellar and Stecker (1988) will be analyzed to determine how temperature differs longitudinally at different flows and at different times of the year. The analysis will

determine the discharge versus maximum temperature relationship by river mile using mean daily ambient temperatures for each month from May through October.

G. Channel Morphometry

The channel is considered to be an equilibrium for the purposes of this study. Substrates are mainly stable as a result of years of high discharges from hydroelectric peaking and the dam preventing gravel and sediment from entering the study area.

Due to the hydropeaking operation, a more scoured channel is expected in the upper segment of the river than in the lower segment. Segmenting the river as discussed above will allow evaluation of potential differences in channel morphometry and substrate types between the upper and lower segments.

H. Fish Passage Transects

Flows to allow passage of immigrating striped bass stocks will be evaluated at Millrace Rapids, the shoal most limiting to passage. A bed profile and water surface elevation data at 3 discharges will be collected. Velocity measurements will not be made because water velocities will not exceed adult striped bass burst-swimming speeds (6 to 14 feet per second).

X. Schedule

A schedule for completion of the lower Saluda River study is given in Table 5.

Hydraulic measurements have been scheduled to begin in the summer of 1990. All reports are to be completed by February 1991. If this study determines current conditions are negatively affecting the fishery habitat of the LSR and reasonable alternatives can reduce this impact, then the agencies participating in this study will petition the FERC for an amendment to the project operating license during spring 1991.

XI. Personnel, Equipment, and Expenses

Field measurements will require 2 crews and a minimum of 6 workers. Three of the personnel will be provided by each SCWMRD and USFWS. All costs associated with personnel will be met by their respective agency.

Most equipment has already been purchased. SCWMRD will provide 1 set of surveying equipment, flow meter, and miscellaneous items such as cable, flagging, etc. USFWS-CO will supply 1 set of surveying equipment, a flow meter, plus equipment necessary for high discharge measurements.

XII. Required Documents

A. Reports

1. Plan of study - SCWMRD

2. Phase I: Effects of current conditions on fishery habitat - SCWMRD and USFWS (December 15, 1990)

3. Phase II: Reasonable alternatives for reducing negative impacts -SCWMRD and USFWS (February 28, 1991) *

4. Recommendation to FERC for amending Saluda Hydro license - SCWMRD and USFWS (May 1, 1991) *

B. Memoranda

Agencies to SCE&G: Summary of status, transmittal of plan of study, request for meeting.

C. Agreement to Cooperate

A written agreement to cooperate throughout the study, provide required flows as available, and supply reasonably available information will be signed by all participants (SCWMRD, USFWS-SC, USFWS-CO, SCE&G). Copy attached.

* Required only if current conditions determined to be negatively affecting the fishery habitat of the lower Saluda River and reasonable alternatives exist.

XIII. References

Borders, T.L. 1987. Water quality of the lower Saluda River, Lexington County. Technical Report 010-87, South Carolina Department of Health and Environmental Control, Columbia.

Crane, J.S. 1987. Lower Saluda River fishery study, preliminary report. South Carolina Wildlife and Marine Resources Department, Columbia.

Gore, J.A., J.M. Nestler, and J.B. Layzer. 1989. Instream flow predictions and management options for biota affected by peaking-power hydroelectric operations. Regulated Rivers: Research & Management 3:35-48.

Leonard, P.M. and D.J. Orth. 1988. Use of habitat guilds of fishes to determine instream flow requirements. North American Journal of Fisheries Management 8:399-409.

McKellar, H.N., Jr. and M.K. Stecker. 1988. Oxygen dynamics in the lower Saluda River. University of South Carolina.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. US Fish and Wildlife Service. FWS/OBS-82/10.60.

Raleigh, R.F., L.D. Zuckerman, and P.C. Nelson. 1986. Habitat suitability models and instream flow suitability curves: brown trout, revised. US Fish and Wildlife Service. Biological Report 82(10.124).

Younginer, E.M. 1986. A water quality survey of the lower Saluda River, Lexington County, South Carolina. Technical Report 010-87, South Carolina Department of Health and Environmental Control, Columbia.

Table 1. Periods of occurrence for target species and lifestages.

Species	Lifestage	J	F	M	A	M	J	J	A	S	O	N	D
striped bass	adult				———	———	———	———	———				
striped bass	passage				———	———							
no. hogsucker	adult	———	———	———	———	———	———	———	———	———	———	———	———
mar. madtom	adult	———	———	———	———	———	———	———	———	———	———	———	———
rainbow trout	adult	———	———	———	———	———	———	———	———	———	———	———	———
rainbow trout	spawning	———	———										—
rainbow trout	incubation	———	———	———									—
brown trout	adult	———	———	———	———	———	———	———	———	———	———	———	———
brown trout	spawning										———	———	
brown trout	incubation	———	———	———							———	———	
red. sunfish	adult	———	———	———	———	———	———	———	———	———	———	———	———
red. sunfish	spawning				———	———							
		J	F	M	A	M	J	J	A	S	O	N	D

NHS YOY

Table 2. Occurrence of habitat types of the lower Saluda River, August 1988, at a discharge of approximately 600 cfs at the USGS gage 02169000 (river mile 8.4). RO = rock outcropping

Habitat	Percent	Miles of river
Riffle/RO	8 1/2	0.8
Run/RO	13	1.2
Run	7	0.6
Pool/RO	23	2.1
Pool	36	3.2
Split Channel	12 1/2	1.1

Table 3. Representative areas with good access in which transects can be located.

Habitat	River Mile	Description
		Upper segment
Riffle/RO	1.3	Shoal upstream of Hope Ferry
Run/RO	1.4	Shoal upstream of Hope Ferry
Pool/RO	1.4	Shoal upstream of Hope Ferry
Pool	1.5	Hope Ferry ramp
Split Channel	2.7	Corley's Island
		Lower segment
Riffle/RO	8.4	Shoal at USGS gage
Run/RO	7.0	Quail Hollow
Pool/RO	8.1	Police Club
Pool	7.2	Below I-26 Bridge
Split Channel	7.8	Saluda Hills Island

Table 4. Description, classification, and coding of habitat.

Code	Classification	Description
Substrate		
0	Organic	Organic debris/detritus
1	Fines	<0.08 inches
2	Small Gravel	0.1-0.6 inches
3	Large Gravel	0.6-2.5 inches
4	Small Cobble	2.5-5.0 inches
5	Large Cobble	5.0-10.0 inches
6	Small Boulder	10.1-39.4 inches
7	Large Boulder	>39.4 inches
8	Plain Bedrock	surface irregularities <6 inches
9	Irregular Bedrock	surface irregularities >6 inches
Cover		
0	No Cover	Open Water
1	Boulders	Rocks >10 inches
2	Ledges	Bedrock irregularities >10 inches
3	Undercut	Streambank undercut >10 inches
4	Overhang	Objects suspended within 3 feet
5	Log	Log (on bottom) >6 inches
6	Log Complex/ Root wad	Aggregates of logs/ Root system
7	Attached vegetation	Aquatic veg. attached to rocks
8	Rooted vegetation	Aquatic veg. rooted in substrate
Embeddedness		
1	≤25% embedded	Gravel, cobble, and boulder particles have less than 25% of their surface embedded by fines.
2	50% embedded	Gravel, cobble, and boulder particles have between 25 and 50% of their surface embedded by fines.
3	75% embedded	Gravel, cobble, and boulder particles have between 50 and 90% of their surface embedded by fines.
4	90-100% embedded	Gravel, cobble, and boulder particles have more than 90% of their surface embedded by fines.

Table 4. Continued.

Code	Classification	Description
Vegetation type		
0	No vegetation	
7	Attached vegetation	
8	Rooted vegetation	
Vegetation Density		
0	No vegetation	No vegetation present
1	Sparse	≤25% coverage
2	Moderate	25-75% coverage
3	Heavy	75-100% coverage

Table 5. Schedule for completion of lower Saluda River study.

	1989 A M J J A S O N D	1990 J F M A M J J A S O N D	1991 J F M A M
Phase I			
Scoping	———		
Habitat Mapping	complete		
Plan of Study		———	
Meeting		–	
Habitat Suit. Criteria		———	
Hydraulic/Habitat Measurements		—	
Water Quality/ Hydrologic Analyses		—	
PHABSIM Modelling		———	
Output Evaluation		—	
Meeting (Agencies & SCE&G)		–	
Phase I Final Report		—	
Phase II *			
PHABSIM Modeling		———	
Output Evaluation		—	
Meeting (Agencies & SCE&G)		–	
Phase II Final Report		—	
Develop and Submit Recommendations to FERC		—	

	J F M A M J J A S O N D 1990	J F M A M 1991

* Required only if Phase I determines current conditions negatively affecting the fishery habitat of the lower Saluda River.

Appendix I. Habitat suitability criteria to be used for this study.

Currently being compiled.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FRESHWATER MUSSEL/BENTHIC MACROINVERTEBRATE
TECHNICAL WORKING COMMITTEE

SCE&G Offices at Carolina Research Park
May 3, 2006

Final csb 6-2-06

ATTENDEES:

Bill Argentieri, SCE&G
Shane Boring, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Dick Christie, SCDNR
Amanda Hill, USFWS
Steve Summer, SCANA Services
Tom Eppink, SCANA Services
Jim Glover, SCDHEC
Ron Ahle, SCDNR
Sam Drake, L. Murray Assoc.

ACTION ITEMS:

- Incorporate additional detail from J. Alderman into mussel survey study plan

Shane Boring

- Distribute 1987 DHEC LSR Study Report (Younginer 1987) to TWC

Shane Boring

- Provide LSR macroinvertebrate data for years not covered by Shealy Env. reports

Steve Summer

- Draft study plan for LSR macroinvertebrate sampling

Shane Boring/Jeni Summerlin

- Conduct literature review for appropriate method for reservoir macroinvertebrate sampling

Shane Boring/Jeni Summerlin

- Contact Dave Caughlin regarding macroinvert methods used on Catawba-Wateree reservoirs

Shane Boring/Jeni Summerlin

- Draft strawman for macroinvertebrate sampling plan for Lake Murray

Shane Boring

- Coordinate with Shealy Environmental to determine suitable upstream/downstream locations for multi-habitat macroinvert sampling in the LSR

Steve Summer

DATE OF NEXT MEETING:

July 26, 2006 at 9:30 am
(Freshwater Mussels, RT&E Species, Terrestrial Resources TWC's)

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at 9:15 AM. Jim Glover provided a copy of the 1987 SCDHEC study discussed at the last Freshwater Mussels/Benthic macroinvertebrate TWC meeting (Younginer 1987; See March 8, 2006, meeting notes and action items). Shane noted that he would scan the report and distribute it electronically to the TWC members.

Reconnaissance Mussel Survey

Shane noted that since the last meeting he had contacted John Alderman, who subsequently provided a proposal for performing a reconnaissance mussel survey for Lake Murray, the Lower Saluda River (LSR), and the Congaree River. The draft mussel survey study plan was then distributed to the group for review (Attachment A). Shane noted that the draft had been reviewed and approved by John Alderman and subsequently distributed to the TWC for review via e-mail on April 24th. He added that to date, the only comments received on the study plan were from American Rivers (Gerrit Jobsis).

The group then briefly reviewed comments received from American Rivers on the draft study plan (Attachment B). Amanda Hill added that, in addition to the information requested by Gerrit, she would like for the plan to include an explanation of how survey sites will be chosen in Lake Murray. Specifically, she enquired as to which habitat types will be surveyed in the lake and how many representative sites will be surveyed for each of these habitat types. Amanda also noted the need for a map showing the sampling locations and that the final report should include not only the species encountered, but also the numbers of live and dead specimens, the depth found, and the location. Shane noted that he would get further clarification from John Alderman regarding these items. He added that he would work directly with the TWC through e-mail to finalize the study plan as soon as possible, noting John Alderman's desire to get surveys underway prior to significant rises in lake level due to spring rains.

Benthic Macroinvertebrate Studies in the LSR

Shane noted that TWC members were notified via e-mail on April 3rd, that the 2001, 2003, 2004 and 2005 LSR macroinvertebrate survey reports (prepared by Shealy Environmental) were available for download from the Kleinschmidt FTP site. Steve Summer noted that, while reports were only prepared for the above - referenced years, SCE&G has contracted with Shealy since 1999 to conduct macroinvertebrate sampling in the LSR. He added that initially a rapid bioassessment (multi-habitat) method was used prior to implementation of the current Hester Dendy methods. Steve noted that he would try to find the data from the surveys not summarized in the reports and distribute it to the group.

The group then briefly discussed the adequacy of these studies for characterizing the macroinvertebrate fauna of the LSR and potential impacts from project operations. Dick Christie noted that the current program, which uses Hester Dendy samplers, be continued in order to examine pre- vs. post-venting impacts to the macroinvert community. After some discussion, the group agreed that a study plan should be prepared to formalize the current sampling regime. In addition, Dick Christie and Steve Summer suggested adding an additional sampling location in the vicinity of Riverbanks Zoo. Steve S. noted that this could easily be coordinated with the field work associated with the temperature studies. Jim Glover noted that the addition of a multi-habitat component might be beneficial for providing a more complete picture of the macroinvert fauna and suggested an upstream and downstream site would be appropriate for the LSR. Steve Summer agreed to coordinate with Shealy to identify a suitable upstream and downstream site. Shane agreed to draft a study plan and distribute to the TWC.

Benthic Macroinvertebrate Studies in Lake Murray

Sam Drake noted that, in addition to the LSR, some attention should be given to the lake fauna. Jim Glover noted that, because it is not a natural system, the usefulness of such a study was unclear considering most of the invert sampling methods for assessing the health of aquatic systems were developed for natural streams and rivers. Ron Ahle noted that the Florida Dept. of Environmental Protection has developed methods for their natural lakes that may prove applicable to reservoirs. Several group members cited use of an Echman Dredge as potentially more suitable for the reservoir than the artificial substrate method (i.e. Hester Dendy) being used for the LSR. Sam Drake noted that it may be beneficial to coordinate invert sampling sites in the lake with the Lake Murray Association, SCE&G, SCDHEC, and other water quality sampling locations. After additional discussion, Shane Boring was tasked with conducting a brief literature search for appropriate methods and to coordinate with Dave Caughlin at Duke Power to determine what methods, if any, were used for the Catawba-Wateree reservoirs. Following completion of the literature review, Shane agreed to prepare a strawman for the next TWC meeting detailing potential methods and number and locations of potential sampling locations.

Date/Location of Next Meeting

The group agreed that the next meeting of the Freshwater Mussels/Benthic Macroinverts, RT&E Species, and Terrestrial Resources TWC's will occur on July 26, 2006 at the Research Park at 9:30 AM. Shane noted that an electronic meeting invitation will be issued to confirm the date with individual members and provide directions to the meeting site. The meeting adjourned at approximately 10:20 am.

ATTACHMENT A

MUSSEL SURVEY DRAFT STUDY PLAN

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree River, Lake Murray, and Selected Tributaries

Freshwater Mussels/Benthic Macroinvertebrate Technical Working Committee
Draft – April 19, 2006

I. Study Objective

The study objective will be to determine whether freshwater mussels occur in the Saluda Hydroelectric Project vicinity, and if so, provide a qualitative measure of species diversity, spatial distribution, and abundance.

II. Geographic and Temporal Scope

Qualitative mussel surveys will focus on Lake Murray and selected major and minor tributaries (including the Saluda and Little Saluda rivers at the reservoir headwaters); the LSR from downstream of Saluda Hydro Dam to its confluence with the Broad River; and the Congaree River from its origin at the confluence of the Saluda and Broad rivers to approximately the I-77 bridge.

The study will be conducted during Spring 2006 (May through early June).

III. Methodology

Qualitative surveys to determine the presence of freshwater mussels will be conducted at suitable habitat sites in the Lower Saluda and Congaree rivers (see Section II above for geographic scope), as well as above Saluda Dam in Lake Murray and in the following Lake Murray tributaries: Beaver Dam Creek, Bush River, Big Creek, Buffalo Creek, Camping Creek, Bear Creek, Little Hollow Creek, Hollow Creek, Clouds Creek, Big Creek, Little Saluda River, Indian Creek, and Saluda River (7-8 total survey days).

All surveys will be led by John Alderman of Alderman Environmental Services, Inc. (Pittsboro, NC), with assistance from Kleinschmidt and/or SCE&G staff. Surveys will conducted from a canoe, boat, or by wading, and will utilize mask and snorkel, tactile, visual, and/or SCUBA methods to search for mussels. At each survey site, potential mussel habitat will be identified, photographed, and Geographic Information System (GPS) coordinates recorded. When found, mussels will be identified to species, length measured (sample measured when high abundances present), and a catch-per-unit-effort determined. All live mussels will be returned to the collection site.

IV. Schedule and Required Conditions

Surveys will begin in May 2006 and will take a maximum of two weeks to complete. Study methodology, timing, and duration may be adjusted based on consultation with the resource agencies and interested stakeholders. A final report summarizing the study findings will be issued within 90 days of completion. All data collected will be provided in electronic format to agencies and interested stakeholders.

V. Use of Study Results

Study results will be used as an information resource during discussion of relicensing issues with the SCDNR, USFWS, Wildlife and Fisheries RCG, Freshwater Mussels/Benthic Macroinvertebrate TWC, and other relicensing stakeholders.

VI. Study Participants

NAME	ORGANIZATION	PHONE	E-MAIL
Water Quality Technical Working Committee			
Jim Glover	SCDHEC	(803) 898-4081	gloverjb@dhec.sc.gov
Gerrit Jobsis	Am. Rivers/CCL	(803)771-7114 x 22	gjobsis@americanrivers.org
Ron Ahle	SCDNR	(803)734-2728	ahler@dnr.sc.gov
Amanda Hill	USFWS	(843)727-4707, x303	Amanda_Hill@fws.gov
Shane Boring	Kleinschmidt	(803)822-3177	Shane.Boring@KleinschmidtUSA.com
Stephen E. Summer	SCANA Services	(803)217-7357	summer@scana.com
Jennifer Price	SCDNR	(803)353-8232	pricej@dnr.sc.gov
Applicant Contacts			
William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

ATTACHMENT B

AMERICAN RIVERS' COMMENTS ON DRAFT MUSSEL SURVEY STUDY PLAN

Close

From: Gerrit Jobsis [SMTP:gjobsis@americanrivers.org]

To: Shane Boring; Steve Summer; Amanda Hill; Bill Argentieri; Jennifer Price; Jim Glover; Randy Mahan; Ron Ahle

Cc: Jennifer Summerlin

Subject: RE: (Saluda Hydro) Mussel Recon Survey Study Plan (draft;04192006) alderman comments.doc

Sent: 4/26/06 1:13 PM **Importance:** Normal

Shane,

This is a very general study plan without much detail.

I agree with the geographic area. I count 13 Lake Murray tributaries plus the lower Saluda and the Congaree rivers.

I agree with the temporal scope (late May - early June) for an initial effort. Based on the results, additional survey work may be needed in fall 2005 or perhaps a repeat of the survey in 2007.

I am concerned there may be future disagreement as to the adequacy of effort if more detail is not provided. How much time will be expended at each site? How far upstream will the surveys extend at the headwater tribs? To include unimpounded reaches? How will the Lake Murray shoreline be surveyed with the current 6 to 7 foot drawdown?

Also we have about 10 miles of the lower Saluda and 10 miles of the Congaree below the dam. How much effort will be expended at each of these rivers? What habitats will be surveyed? These things need detail before the study begins. A map of proposed study sites is also needed.

You asked for a quick turnaround, so I have provided one. Due to our move and other workload I have not been able to discuss this with other stakeholder and agencies. I am especially interested in the opinion of the DNR and USFWS re the plan.

Gerrit

We have moved! Please see our new address below.

<;>>><

Gerrit Jöbsis

American Rivers * Southeast Office

2231 Devine Street, Suite 100 * Columbia, S.C. 29205

Telephone (803) 771-7114 * Fax (803) 771-7580

gjobsis@americanrivers.org

-----Original Message-----
From: Shane Boring [mailto:Shane.Boring@KleinschmidtUSA.com]
Sent: Monday, April 24, 2006 9:49 AM
To: Steve Summer; Amanda Hill; Bill Argentieri; Gerrit Jobsis; Jennifer Price; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring

Cc: Jennifer Summerlin
Subject: (Saluda Hydro) Mussel Recon Survey Study Plan (draft;04192006) alderman comments.doc

Dear Freshwater Mussels/Benthic Macroinvertebrate TWC Member:

Attached for your review is the draft study plan for the freshwater mussel reconnaissance survey on Lake Murray and the Lower Saluda and Congaree Rivers. The draft has been reviewed by John Alderman, and his comments have been incorporated. We have tried to keep the study plan as brief as possible to facilitate a quick review, as John would like to get this study started ASAP while the rivers and Lake are still low and clear. We will discuss the study plan and hopefully get final approval from the TWC at next week's meeting (May 3 at Research Park). Thanks in advance for your input.

C. Shane Boring
Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

Mussel Recon Survey Study Plan (draft;04192006) alderman comments.doc
<<Mussel Recon Survey Study Plan (draft;04192006) alderman comments.doc>>

ATTACHMENT C

SCDHEC MACROINVERTEBRATE DATA FOR LOWER SALUDA RIVER TRIBUTARIES
PROVIDED BY JIM GLOVER, SCDHEC

PHYLUM	CLASS	ORDER	FAMILY	TAXA	S-052 7/1/1997	S-260 7/27/2001	S-260 7/3/1997	S-287 8/15/2003	S-287 7/3/1997	S-848 7/27/2001	S-848 7/1/1997
Annelida	Hirudinea	NA	NA	Hirudinea		7		9		1	
Annelida	Hirudinea	Rhynchobdellida	Glossiphoniidae	Placobdella sp.			1				
Annelida	Hirudinea	Rhynchobdellida	Glossiphoniidae	Placobdella papillata					2		
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	Lumbriculidae	1						
Annelida	Oligochaeta	NA	NA	Oligochaeta	2	7	5	21	2		10
Arthropoda	Crustacea	Amphipoda	Gammaridae	Crangonyx serratus	6						
Arthropoda	Crustacea	Decapoda	Cambaridae	Cambaridae		2	3			1	
Arthropoda	Crustacea	Decapoda	Cambaridae	Procambarus sp.		1					
Arthropoda	Hexapoda	Coleoptera	Dytiscidae	Coptotomus sp.						1	
Arthropoda	Hexapoda	Coleoptera	Elmidae	Ancyronyx variegatus	7			1		25	11
Arthropoda	Hexapoda	Coleoptera	Elmidae	Dubiraphia sp.						4	
Arthropoda	Hexapoda	Coleoptera	Elmidae	Dubiraphia vittatata	1		2		1		1
Arthropoda	Hexapoda	Coleoptera	Elmidae	Macronychus glabratus	36			1	1	19	2
Arthropoda	Hexapoda	Coleoptera	Elmidae	Microcylloepus pusillus	24					1	
Arthropoda	Hexapoda	Coleoptera	Elmidae	Stenelmis sp.	3	14	35	2	1	45	4
Arthropoda	Hexapoda	Coleoptera	Gyrinidae	Dineutus sp.	1						
Arthropoda	Hexapoda	Coleoptera	Haliplidae	Peltodytes sp.		1					
Arthropoda	Hexapoda	Coleoptera	Hydrophilidae	Berosus sp.			1				
Arthropoda	Hexapoda	Diptera	Chironomidae	Ablabesmyia mallochi		3	7	3	7	3	5
Arthropoda	Hexapoda	Diptera	Chironomidae	Brillia sp.							2
Arthropoda	Hexapoda	Diptera	Chironomidae	Chironomus sp.							2
Arthropoda	Hexapoda	Diptera	Chironomidae	Conchapelopia Group			6		6		11
Arthropoda	Hexapoda	Diptera	Chironomidae	Corynoneura sp.					1		
Arthropoda	Hexapoda	Diptera	Chironomidae	Cricotopus/Orthocladius			2	2		1	7
Arthropoda	Hexapoda	Diptera	Chironomidae	Cryptochironomus sp.		3				2	2
Arthropoda	Hexapoda	Diptera	Chironomidae	Cryptotendipes sp.		3					
Arthropoda	Hexapoda	Diptera	Chironomidae	Dicrotendipes sp.		3			1	1	
Arthropoda	Hexapoda	Diptera	Chironomidae	Labrundinia sp.				1			
Arthropoda	Hexapoda	Diptera	Chironomidae	Micropsectra sp.							1
Arthropoda	Hexapoda	Diptera	Chironomidae	Nanocladius sp.					1		

PHYLUM	CLASS	ORDER	FAMILY	TAXA	S-052 7/1/1997	S-260 7/27/2001	S-260 7/3/1997	S-287 8/15/2003	S-287 7/3/1997	S-848 7/27/2001	S-848 7/1/1997
Arthropoda	Hexapoda	Diptera	Chironomidae	Natarsia sp.			3				
Arthropoda	Hexapoda	Diptera	Chironomidae	Omisus pica					1		
Arthropoda	Hexapoda	Diptera	Chironomidae	Parachironomus sp.					1		
Arthropoda	Hexapoda	Diptera	Chironomidae	Paratanytarsus sp.		4		1	3	3	
Arthropoda	Hexapoda	Diptera	Chironomidae	Paratendipes sp.				1			
Arthropoda	Hexapoda	Diptera	Chironomidae	Pentaneura sp.	1						
Arthropoda	Hexapoda	Diptera	Chironomidae	Phaenopsectra sp.							1
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum aviceps			1				1
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum convictum	1	29	2	10	14	25	7
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum fallax							2
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum halterale				2			
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum illinoense		13	9	1	9	1	2
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum scalaenum		1	3	1	1	1	1
Arthropoda	Hexapoda	Diptera	Chironomidae	Procladius sp.		2				1	
Arthropoda	Hexapoda	Diptera	Chironomidae	Rheocricotopus robacki		1	5		1		4
Arthropoda	Hexapoda	Diptera	Chironomidae	Rheotanytarsus sp.		24		11	59	4	10
Arthropoda	Hexapoda	Diptera	Chironomidae	Stenochironomus sp.				1			
Arthropoda	Hexapoda	Diptera	Chironomidae	Synorthocladius sp.					1		9
Arthropoda	Hexapoda	Diptera	Chironomidae	Tanytarsus sp.		3		3		5	4
Arthropoda	Hexapoda	Diptera	Chironomidae	Thienemaniella sp.							3
Arthropoda	Hexapoda	Diptera	Chironomidae	Thienemannimyia GR	1	10		1		13	
Arthropoda	Hexapoda	Diptera	Chironomidae	Tribelos jucundus		3			2		13
Arthropoda	Hexapoda	Diptera	Chironomidae	Tribelos sp.				3			
Arthropoda	Hexapoda	Diptera	Chironomidae	Xenochironomus sp.		1					
Arthropoda	Hexapoda	Diptera	Simuliidae	Simulium sp.	2	4	1	7	5	22	10
Arthropoda	Hexapoda	Diptera	Tipulidae	Hexatoma sp.		1					
Arthropoda	Hexapoda	Diptera	Tipulidae	Tipula sp.		3	4		1	11	2
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Baetis flavistriga		9				2	
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Baetis intercalaris	10				2		2
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Baetis pluto		2		2		6	

PHYLUM	CLASS	ORDER	FAMILY	TAXA	S-052 7/1/1997	S-260 7/27/2001	S-260 7/3/1997	S-287 8/15/2003	S-287 7/3/1997	S-848 7/27/2001	S-848 7/1/1997
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Labiobaetis propinquus	17					2	2
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis diminuta					1		
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis sp.				19			
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis hilaris							1
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis diminuta/punctata			1			1	
Arthropoda	Hexapoda	Ephemeroptera	Heptagenidae	Stenonema modestum	6					10	2
Arthropoda	Hexapoda	Ephemeroptera	Isonychiadea	Isonychia sp.	2						
Arthropoda	Hexapoda	Ephemeroptera	Tricorythidae	Tricorythodes sp.	14						
Arthropoda	Hexapoda	Megaloptera	Corydalidae	Corydalus cornutus	2					2	
Arthropoda	Hexapoda	Megaloptera	Corydalidae	Nigronia serricornis	1						
Arthropoda	Hexapoda	Neuroptera	Sisyridae	Climacia areolaris					2		
Arthropoda	Hexapoda	Odonata	Aeshnidae	Basiaeschna janata		3	3				
Arthropoda	Hexapoda	Odonata	Aeshnidae	Boyeria vinosa	18	1	3		2		14
Arthropoda	Hexapoda	Odonata	Calopterygidae	Calopterygidae	2						
Arthropoda	Hexapoda	Odonata	Calopterygidae	Calopteryx sp.		3				17	1
Arthropoda	Hexapoda	Odonata	Calopterygidae	Hetaerina tittia	1						
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Argia sp.	5	24	15	2	1	7	4
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Coenagrionidae				2		17	
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Enallagma sp.	2	22	6	6	2		3
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Ischnura sp.						1	
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Ischnura/Anomalagrion		2	10		4		1
Arthropoda	Hexapoda	Odonata	Corduliidae	Neurocordulia sp.	4		2		3		
Arthropoda	Hexapoda	Odonata	Corduliidae	Tetragoneuria sp.		2					
Arthropoda	Hexapoda	Odonata	Gomphidae	Gomphus sp.	3						2
Arthropoda	Hexapoda	Odonata	Gomphidae	Hagenius brevistylus							1
Arthropoda	Hexapoda	Odonata	Gomphidae	Progomphus sp.						3	
Arthropoda	Hexapoda	Odonata	Libellulidae	Libellulidae		1					
Arthropoda	Hexapoda	Odonata	Macromiidae	Macromia sp.	2				1		10
Arthropoda	Hexapoda	Trichoptera	Hydropsychidae	Cheumatopsyche sp.	29	95	2	49	60	55	5
Arthropoda	Hexapoda	Trichoptera	Hydropsychidae	Hydropsyche betteni	1	1	9			4	

PHYLUM	CLASS	ORDER	FAMILY	TAXA	S-052 7/1/1997	S-260 7/27/2001	S-260 7/3/1997	S-287 8/15/2003	S-287 7/3/1997	S-848 7/27/2001	S-848 7/1/1997
Arthropoda	Hexapoda	Trichoptera	Hydropsychidae	Hydropsyche venularis	31						
Arthropoda	Hexapoda	Trichoptera	Leptoceridae	Nectopsyche exquisita	7						
Arthropoda	Hexapoda	Trichoptera	Leptoceridae	Oecetis persimillis	9						
Arthropoda	Hexapoda	Trichoptera	Leptoceridae	Triaenodes ignitus	20						
Mollusca	Gastropoda	Basommatophora	Physidae	Physella sp.		5	4		2		
Mollusca	Gastropoda	Basommatophora	Planorbidae	Helisoma anceps		4					
Mollusca	Pelecypoda	Heterodonta	Corbiculidae	Corbicula fluminea		17	1	6	3	7	9
Mollusca	Pelecypoda	Heterodonta	Sphaeriidae	Sphaeriidae					6		
				Count-	272	334	146	168	210	324	191
				Taxa Richness-	33	38	28	26	35	35	41
				EPT-	11	4	3	5	3	7	5
				Biotic Index-	5.18	6.96	7.34	6.41	6.47	6.34	6.42
				EPT Score-	2.0	1.0	1.0	1.0	1.0	1.4	1.0
				Biotic Index Score-	5.0	2.0	2.0	3.0	2.6	3.0	3.0
				Combined Score-	3.3	1.5	1.5	2.0	1.8	2.2	2.0
				Bioclassification-	Good-Fair	Poor	Poor	Fair	Fair	Fair	Fair
				Aquatic Life Use Designation*-	PS	NS	NS	PS	PS	PS	PS

*PS=Partially Supporting

*NS=Not Supporting

STATION	COUNTY	LOCATION	LONG-DD	LAT-DD	REFERENCE/TEST
S-260	Lexington	Kinley Creek @ St. Andrews Rd	81.1491727	34.0470041	Test
S-287	Lexington	Rawls Creek @ SR 107	81.1863002	34.0538641	Test
S-848	Lexington	Fourteen Mile Creek @ SR 28	81.2026243	34.0094024	Test
S-052	Lexington	Twelve Mile Creek @ SR 106	81.1933733	34.0009869	Test

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
RARE, THREATENED, AND ENDANGERED SPECIES TECHNICAL WORKING COMMITTEE

SCE&G Training Center
March 8, 2006

final 04/21/2006

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt
Jennifer Summerlin, Kleinschmidt**
Ed Diebold, Riverbanks Zoo
Bob Seibels, Riverbanks Zoo
Tom Eppink, SCANA**
Amanda Hill, USF&WS**
Shane Boring, Kleinschmidt*,**
Brandon Stutts, SCANA Services
Gerrit Jobsis, Am. Rivers/Coastal Cons. League**

*Facilitator
** R,T&E Species TWC member

ACTION ITEMS:

- Provide a tracking sheet for RT&E species occurring in the project vicinity

Shane Boring

- Send historical information on the Saluda Darter to S. Boring to distribute to committee members

Gerrit Jobsis

- Distribute SCE&G's Rocky Shoals Spider Lilly report for the Columbia Hydro project

Shane Boring

DATE OF NEXT MEETING: **May 3, 2006 at 9:00 AM**

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at 12:40 PM. Shane reminded the group that, at the February 22nd Fish and Wildlife RCG meeting, the Technical Working Committees (TWCs) were formed and study requests were assigned to the TWCs[1]. He added that the purpose of today's meeting would be to further discuss the study requests assigned to the Rare, Threatened, and Endangered Species TWC and to begin evaluating the need for studies, reviewing available data and data needs (gaps), defining study objectives and scope, and to assign tasks toward addressing each study request.

The group then briefly discussed the status of several of the RT&E species mentioned in study requests and at the February 22nd Fish and Wildlife RCG meeting:

Saluda Crayfish

Amanda Hill noted that the Saluda Crayfish is federally listed as a species of concern. She explained that the only known location of the Saluda Crayfish is in Newberry County, near Silverstreet. It was noted that Saluda Crayfish construct chimneys along the shoreline and that it is thought to be correlated with soil type. She recommended that habitat within the project boundary should be compared to requirements for this species to determine whether it is likely to occur in the project area.

Rocky Shoals Spider Lilly (RSSL)

Gerrit noted that a survey on the RSSL population should be conducted to examine possible impacts from project operations. Tom Eppink provided some additional background on this species, noting that there are approximately 8,000 RSSL plants located in the vicinity of the Broad/Saluda confluence. Alan noted that Kleinschmidt conducted a survey of this population during relicensing of the Columbia Hydro Project. He suggested taking a group boat trip in late May or June, depending on when this species blooms, to look at the RSSL population on the river. The group agreed and scheduled a float trip for May 31, 2006.

[1] See February 22nd, 2006, Fish and Wildlife RCG meeting notes for study request summaries and assignments.

Bald Eagle

Shane noted that bald eagle surveys are ongoing on the lake by Tom Murphy from SCDNR. Amanda noted that no survey is needed, but a Bald Eagle Management Plan of some type would likely be needed. She added that Tom Murphy can identify the locations of this species within the project area.

Shortnose Sturgeon

Shane noted that he talked to Shane Guan (NOAA Fisheries), and that Shane G. had indicated that the scientific research permit would be issued in 9-10 weeks. He added that, due to the permitting delays, sturgeon sampling will likely begin in 2007 since spawning season has almost come to an end for this year. Alan noted that Steve Leach is presently tracking sturgeon, and they are currently moving through the confluence of the Wateree. He added that information that Steve is collecting at this time will be beneficial to us next year.

Saluda Darter

Gerrit noted that the Saluda Darter should be considered. He added that he has life history information on the species, and would send it to Shane to distribute to the committee.

Shane noted that, in addition to the species mentioned specifically in the study requests and previous RCG meetings (i.e., RSSL, shortnose sturgeon, bald eagle, Saluda crayfish, wood stork), the USFWS had provided a much more substantial species list as part of their comments on the Initial Consultation Document (ICD). Shane added that many of these species have not been discussed thus far during relicensing and enquired as to how these species should be dealt with. Amanda noted that this list was based on the USFWS county listings for the counties surround the Saluda Project (Saluda, Richland, Lexington, Newberry). In assessing the status of these species, Amanda recommended comparing habitat available in the project area to the habitat requirements for the species. It was noted that, if there are no known occurrences of a species in the project area and likewise no suitable habitat, it may be possible to begin eliminating some species from further analysis. She added that looking at the Heritage Trust Database to find out if any of these species occur in the project boundaries may be a beneficial first step.

Bill Argentieri noted that Kleinschmidt should begin constructing a list of the RT&E species that occur in the project area. Shane noted he has developed tracking sheets for other projects that may

be beneficial for tracking the consultation status of each of the species. The group agreed that this would be beneficial, and Shane was tasked with developing and distributing the tracking sheet.

Date/Location of Next Meeting

The group agreed to meet again on May 3, 2006, at Carolina Research Park. Shane noted that an effort would be made to hold several TWC meetings on a single day to cut down on travel for agency staff. He added that he will issue an electronic meeting invitation to confirm the date with individual members and provide directions to the meeting site. The meeting was adjourned at approximately 1:47 PM.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FRESHWATER MUSSEL/BENTHIC MACROINVERTEBRATE
TECHNICAL WORKING COMMITTEE

SCE&G Training Center
March 8, 2006

Final csb 04-14--06

ATTENDEES:

Bill Argentieri, SCE&G
Shane Boring, Kleinschmidt Associates
Jeni Summerlin, Kleinschmidt Associates
Randy Mahan, SCANA Services
Gerrit Jobsis, SCCCL & Am. Rivers
Alan Stuart, Kleinschmidt Associates
Tom Eppink, SCANA Services
Jim Glover, SCDHEC
Amanda Hill, USFWS

ACTION ITEMS:

- Contact John Alderman regarding mussel habitat reconnaissance survey

Shane Boring

- Provide info regarding impacts of dissolved oxygen on freshwater mussels

Gerrit Jobsis

- Provide information on temperature impacts on mussels

Shane Boring

- Send out LSR macroinvertebrate survey reports (prepared by Shealy Environmental) to all team members

Shane Boring

- Provide copy of 1986 SCDHEC macroinvertebrate report for LSR

Jim Glover

- Provide raw data on tributaries that were sampled along the LSR by DHEC

Jim Glover

- Distribute mussel survey data provided by SCDNR (J. Price) to group for review

Shane Boring

DATE OF NEXT MEETING: **May 3, 2006 at 9:00 am**

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FRESHWATER MUSSEL/BENTHIC MACROINVERTEBRATE
TECHNICAL WORKING COMMITTEE

SCE&G Training Center
March 8, 2006

Final csb 04-14--06

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at 9:00 AM. Shane reminded the group that, at the February 22nd Fish and Wildlife RCG meeting, the Technical Working Committees (TWCs) were formed and study requests were assigned to the TWCs[1]. He added that the purpose of today's meeting would be to further discuss the study requests assigned to the Freshwater Mussels/Benthic Macroinvertebrates TWC and to begin evaluating the need for studies, available data, data needs (gaps), study objectives and scope, and to assign tasks toward addressing each study request.

Request for Mussel Survey

Amanda Hill noted the USFWS requests a mussel survey in the Lower Saluda River (LSR) and Lake Murray. She explained that, if mussels are found in the area, they would eventually like to have a map that illustrates species locality, richness and abundance.

The group then discussed the status of existing mussel survey data in the Santee Basin and in SC in general. Specifically, Shane noted that he had spoken with Jennifer Price at SCDNR and that she had provided a database of known mussel surveys conducted in SC waters in recent years. He added that, according to Jennifer, this data is fairly comprehensive and consolidates information from a number of sources including John Alderman (Alderman Environmental), Art Bogan (NC Museum of Natural History), Tim Savidge (Catena Group), and Gene Keferl (Coastal Georgia Comm. College). Shane added that, based on discussions with Jennifer and her review of the data, he was not aware of any surveys for Lake Murray or the LSR. Gerrit Jobsis requested that the mussel survey data from SCDNR be shared with the group for review. Shane agreed to distribute the data to group members via e-mail.

Amanda suggested contacting John Alderman to discuss the potential for conducting a reconnaissance mussel survey in Lake Murray and the LSR. The group agreed, and Shane was tasked with contacting John. Shane noted that he would provide John with SCE&G's fly-over data for the LSR to help in determining sampling locations.

The group then briefly discussed habitat types that would likely need to be sampled as part of a mussel survey. Amanda Hill noted the importance of sampling tributaries, around islands, selected

[1] See February 22nd, 2006, Fish and Wildlife RCG meeting notes for study request summaries and assignments.

coves, and in any unique habitats in the lake. For the LSR, Gerrit and Amanda noted the importance of surveying the confluence and in pool, shoal, and bank habitats. It was noted that sampling locations could be further refined through discussions with John Alderman.

Request for Benthic Macroinvertebrate Study

The group discussed the status of existing data on benthic macroinvertebrate fauna in the project area. Specifically, Shane noted that SCE&G contracted Shealy Environmental to conduct macroinvertebrate surveys of the LSR. Bill Argentieri added that Shealy conducted studies in 2001, 2003, 2004 and 2005 and that study reports are available in electronic format. Shane agreed to distribute copies of the reports to group members via e-mail. Jim Glover added that, while the artificial substrate sampling conducted by Shealy undoubtedly provides valuable information, it may be necessary to add a multi-habitat sampling component to provide a complete picture of invertebrate fauna.

Jim Glover noted that SCDHEC conducted a macroinvertebrate study in the LSR in 1986. He agreed to attempt to find a copy of this report and distribute to the group. Jim also mentioned that SCDHEC recently conducted multi-habitat sampling of several fairly large tributaries of the LSR. He explained that they have raw data for this study and would distribute the information. Shane enquired as to whether SCDHEC has conducted any multi-habitat sampling in Lake Murray tributaries. Jim noted that most of their sampling is in tributaries above the influence of the reservoir and thus would be of limited value.

Shane noted that he had spoken with staff from the Columbia USGS office and that they may have macroinvertebrate data for the LSR. Jim Glover noted that he understands this data to be from the headwaters (wadeable) areas of tributaries, and thus it is likely to be of limited value in assessing the LSR mainstem.

The group briefly discussed the need for a benthic macroinvertebrate study in Lake Murray. Jim Glover and others noted that the methods used for their multi-habitat sampling were developed for streams and may not be applicable to the reservoir. Gerrit noted that it would be beneficial to discuss this issue with Ron Ahle, as Ron has some knowledge of methods developed specifically for reservoir environments.

The group agreed that once the existing data has been distributed for review, the TWC should meet again to determine the need for additional studies. Jim noted that, if field studies are needed, they should be conducted in the summer to late winter. He added that collecting within this time frame

will establish a qualitative comparison of species across seasons. The group agreed that the macroinvertebrate community should be evaluated under normal operating conditions.

Date/Location of Next Meeting

The group agreed to have the next TWC meeting on May 3, 2006 at the Research Park at 9:00 am. Shane noted that an effort would be made to hold several TWC meetings on a single day to cut down on travel for agency staff. He added that he will issue an electronic meeting invitation to confirm the date with individual members and provide directions to the meeting site. The meeting adjourned at approximately 10:20 am.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
TERRESTRIAL RESOURCES TECHNICAL WORKING COMMITTEE

SCE&G Training Center
March 8, 2006

Final csb 04052006

ATTENDEES:

Bill Argentieri, SCE&G
Alan Stuart, Kleinschmidt
Jennifer Summerlin, Kleinschmidt
Ed Diebold, Riverbanks Zoo
Bob Seibels, Riverbanks Zoo**
Bob Perry, SCDNR
Tom Eppink, SCANA
Amanda Hill, USF&WS**
Shane Boring, Kleinschmidt*,**
Brandon Stutts, SCANA Services**
Randy Mahan, SCANA Services
Buddy Baker, SCDNR**

*Facilitator
** Terrestrial Resources TWC member

ACTION ITEMS:

- Provide bird observation data from Riverbanks Zoo site (to S. Boring via e-mail)

Bob Seibels

- Compile existing bird observation data (Columbia Audubon, Jerrold Riggs) and distribute to TWC

Shane Boring

- Provide TWC with electronic copies of Catawba-Wateree migratory bird study plan and final report

Shane Boring

- E-mail Lake Murray waterfowl observation data to S. Boring for distribution to and review by TWC

Buddy Baker

- Draft study request detailing SCDNR's concerns regarding historical versus current waterfowl usage on Lake Murray

Buddy Baker and Bob Perry

DATE OF NEXT MEETING: **May 3, 2006 at 9:00 AM**

Location: SCE&G Offices at Carolina Research Park
111 Research Drive
Columbia, SC 29203

MEETING NOTES:

These notes serve as a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at 10:30 AM. Shane reminded the group that, at the February 22nd Fish and Wildlife RCG meeting, the Technical Working Committees (TWCs) were formed and study requests were assigned to the TWCs[1]. He added that the purpose of today's meeting would be to further discuss the study requests assigned to the Terrestrial Resources TWC to begin evaluating the need for a study, available data, data needs (gaps), study objectives and scope, and to assign tasks toward addressing each study request.

Migratory Bird Study Request

Shane asked agency staff in attendance to further clarify their objectives for the study request. Amanda Hill summarized the USFWS's objectives for this study as essentially three-fold: 1) continuation of the Wood Stork survey to provide additional information on usage at the project; 2) identification of all bald eagle sites; and 3) identification of all species that are using the project (i.e., a species list). Shane noted that the first two are being addressed. He added that the woodstork surveys are ongoing and are being jointly conducted by Kleinschmidt and SCNDR staff (Shane Boring and Tom Murphy, respectively). He added that Tom Murphy is also conducting bald eagle nest surveys for SCDNR again this year and that data should be available to the group. Amanda noted that, as long as the data is made available during the relicensing process, these efforts should satisfy the first two objectives.

In regards to the USFWS request to identify all species known to use the project (item 3 above), Shane suggested that, if the primary objective is simply a measure of diversity for the project area, this probably can be accomplished using existing data. He added that a number of data sources have potential to provide a fairly comprehensive species list, including the Columbia Audubon observations from Dreher Island State Park, data compiled by Riverbanks Zoo, and Jerrold Grigg's (professor at USC) observations from Saluda Shoals Park and other areas of the LSR. Bob Seibels noted that the zoo's data is available in an Excel spreadsheet, which could easily be shared with the group. Ed Diebold provided additional background on the Zoo's efforts, noting that they have begun to do faunal inventory of the zoo site, with migratory birds being a primary component of the survey efforts. He added that they are currently seeking funding for this effort and hope to hire a fulltime conservation biologist, as well as potentially expand their survey efforts beyond just the zoo grounds, possibly to a regional level. The group agreed that the available data should be

[1] See February 22nd, 2006, Fish and Wildlife RCG meeting notes for study request summaries and assignments.

gathered and distributed to TWC members for review to determine if further studies are needed. Alan Stuart added that a fairly comprehensive species list was provided in the ICD and urged group members to review that section in evaluating data needs.

Shane noted that a similar request was made for the Catwaba-Wateree relicensing and suggesting a review of the study plan and final report might be beneficial in evaluating the need for a study at Saluda. The group agreed and Shane was tasked with distributing electronic copies of these documents to the TWC members.

Shane noted that information regarding waterfowl usage of Lake Murray (i.e. species present, numbers, seasonality) was requested by both the USFWS and SCDNR. Buddy Baker noted that his group at SCDNR has conducted boat-based surveys on the main lake pool during the winter months for the last 3 years. He added that this data could provide information regarding general species distribution, but likely will be of limited value in assessing seasonal and/or year-to-year trends. Bob Perry and Buddy noted that, should the TWC determine that trend data is needed, additional aerial survey, similar to those done for the Santee-Cooper relicensing, would likely be needed. Buddy agreed to pass the data collected thus far on to Shane for distribution to the group. The group agreed that it should meet again after reviewing the data to determine whether further surveys are warranted.

Bob Perry noted that SCDNR is concerned that abundance and diversity of ducks using Lake Murray have declined from historic levels due to habitat loses associated with shoreline development and increased noise, boat traffic, and other disturbances associated with increased popularity of the lake. He added that it might be useful to compare current and historical data on waterfowl usage to examine these factors. He added that it might also be useful to examine the influence of current versus historical operations (i.e. lake levels) on waterfowl usage. Shane noted that this had not been previously submitted as a study request, and that he had some uncertainly regarding the feasibility of such a study and what its objectives would be. Shane proposed, and the group agreed, that SCNDR prepare a study request to further clarify their objectives and the project nexus. Bob and Buddy Baker agreed to draft a study request for distribution to the TWC.

Bob Perry also enquired as to whether there is benthic macroinvertebrate data for the lake, noting their importance as prey for diving ducks. Shane noted that the status of benthic macroinvertebrate data for the lake is being evaluated by the Freshwater Mussels/Benthic Macroinvertebrates TWC. Finally, Shane noted that the request regarding designation of additional waterfowl hunting areas would be addressed in the Recreation RCG and TWCs.

Date/Location of Next Meeting

The group agreed to meet again on May 3, 2006, at Carolina Research Park. Shane noted that an effort would be made to hold several TWC meetings on a single day to cut down on travel for agency staff. He added that he will issue an electronic meeting invitation to confirm the date with individual members and provide directions to the meeting site. The meeting was adjourned at approximately 11:35 am.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
DIADROMOUS FISH TECHNICAL WORKING COMMITTEE

SCE&G Training Center
February 22, 2006

Final-jms- 4-3-06

ATTENDEES:

Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates
Gerrit Jobsis, SCCCL & Am. Rivers
Dick Christie, SCDNR
Steve Leach, SCDNR
Alan Stuart, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Jennifer Summerlin, Kleinschmidt Associates
Amanda Hill, USFWS
Steve Summers, SCE&G

ACTION ITEMS:

- Provide Jimmy Livingston's (Eel fisherman) contact information to Shane Boring – *Steve Leach*
- Conduct site visit with Bret Hoffman to potential eel ladder locations – *Alan Stuart, Shane Boring*
- Propose a date for the next Diadromous Fish TWC – *Shane Boring*

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Shortly after the fish and wildlife RCG meeting (notes prepared separately), the group agreed to proceed with the Diadromous Fish Technical Working Committee (TWC) meeting. Shane Boring opened the meeting at approximately 2:05 pm, noting that, as agreed in the RCG meeting, the primary focus of the meeting would be discussion of American eel sampling. He noted that USFWS recommended the use of an eel ramp to sample for elvers due to ineffectiveness of the eel pot sampling.

Amanda Hill noted that water temperature should be taken into account in determining when a ramp needs to be in place; she added that eel migration generally occurs from spring to fall when water temperature is above approximately 15˚C. It was mentioned that 15˚C water temperatures in the Lower Saluda River (LSR) usually occurs beginning in June. Due to time constraints, the group agreed to continue sampling with eel pots until potential eel ramp sites/design can be further evaluated.

The group reviewed SCE&G's fly-over video of the LSR and briefly discussed possible locations for an eel ramp. The group identified several potential ramp locations including attaching a ramp directly to the downstream side of the dam (i.e., to the taildeck or the wall adjacent to the powerhouse), the spillway, and the USGS gauge below the dam. It was agreed the spillway was the most likely location. Alan Stuart noted that Bret Hoffman, a Kleinschmidt engineer, had been involved with eel ramp design and proposed that Bret make a site visit to evaluate feasibility and design considerations for each of the locations. The group agreed that this was acceptable, and Alan and Shane were tasked with coordinating a field visit with Bret. Steve Leach noted that, due to the feasibility concerns at various sites, it may be beneficial to use an inexpensive ramp design to allow for relocation if sampling at a particular site proves ineffective. Use of corrugated plastic pipe supported by rebar was noted as a potential design.

Steve Leach noted that it might be beneficial to discuss eel trapping strategies with commercial fishermen. He added that SCDNR has been in contact with a gentleman in the Santee area (Jimmy Livingston), which has proven effective for their eel sampling efforts. Steve L. agreed to obtain Mr. Livingston's contact information and send it to Shane.

There was a brief discussion on the shortnose sturgeon project. Shane noted that the application was submitted around eight months ago and a permit has still not been issued. He added they expect to have the permit issued in about 9 to 10 weeks.

The meeting adjourned at approximately 3:45 pm. Shane agreed to arrange the next meeting of the Diadromous Fish TWC once a site visit has been made to the potential ell ramp locations.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FISH AND WILDLIFE RESOURCE CONSERVATION GROUP

SCE&G Training Center
February 22, 2006

Final jms/csb 3-31-06

ATTENDEES:

Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates*
Tom Eppink, SCANA Services
Randy Mahan, SCANA Services
Gerrit Jobsis, SCCCL & Am. Rivers
Dick Christie, SCDNR
Malcolm Leaphart, Trout Unlimited
Amanda Hill, USFWS
George Duke, LMHOC
Tom Bowles, SCE&G
Gina Kirkland, SCDHEC
** Facilitator*

Alan Stuart, Kleinschmidt Associates
Steve Bell, Lake Watch
Bill East, Lake Murray Assoc.
Jennifer Summerlin, Kleinschmidt Associates
Hal Beard, SCDNR
Wade Bales, SCDNR
Joe Logan, Midland Stripers
Bob Seibels, Riverbanks Zoo
Ron Ahle, SCDNR
Brandon Stutts, SCANA Services
Bill Marshall, SCDNR & LSSRAC
Steve Leach, SCDNR

ACTION ITEMS:

- Prepare a study plan on fish entrainment and submit to the Fish Entrainment TWC for review

Alan Stuart, Shane Boring

- Provide raw data and other information for the 1989 Saluda IFIM study

Ron Ahle

- Compile available studies on resident fish fauna and distribute for review

Shane Boring, Alan Stuart, Steve Summer

- Schedule next Fish & Wildlife RCG meeting

Fish and Wildlife TWCs – Shane Boring will coordinate

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FISH AND WILDLIFE RESOURCE CONSERVATION GROUP

SCE&G Training Center
February 22, 2006

Final jms/csb 3-31-06

MEETING NOTES:

These notes summarize the major items discussed during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane Boring opened the meeting at approximately 9:00 am, and meeting attendees introduced themselves. It was noted that the primary purpose of today's meeting would be to form the Technical Working Committees (TWCs) for the Fish and Wildlife Resource Conservation Group (RCG) and assign study request to the TWCs.

Mission Statement

Shane reviewed the following mission statement for the Fish and Wildlife RCG, noting that it had been finalized and placed on the Saluda Relicensing website:

> *The mission of the Fish and Wildlife RCG is to develop a Protection, Mitigation, and Enhancement Agreement (PM&E Agreement) relative to fisheries and wildlife management for inclusion within the Saluda Hydroelectric Project license application. The objective of the PM&E Agreement shall be to assure the development and implementation of a level of integrated management best adapted to serve the public interests. To achieve this mission, the Fish and Wildlife RCG shall identify the need for, define the scope of, and manage or influence as appropriate, data collection and/or studies relative to potentially impacted fish, wildlife, and plant species and ecological communities, ecosystems and/or habitat within the Saluda Hydroelectric Project.*

Gerrit Jobsis asked that "within the Saluda Hydroelectric Project" be changed to "within the project vicinity" since some impacts can be outside of the project boundary. Alan Stuart and Alison Guth noted that it would require some work to change the mission statement as it had already been distributed to stakeholders and posted to the website as final. The group agreed that it was implicit in the mission statement that the project has potential to impact areas outside of the project boundary.

Formation and Membership of TWCs / Assignment of Study Requests

Shane reminded the group that, at the initial RCG meeting, a document was distributed that summarizes the study requests received in response to issuance of the Initial Consultation Document (ICD). He added that the primary purpose of today's meeting would be to review the fish-and-wildlife-related study requests (see attached handout from the meeting), form appropriate TWCs to handle these requests, and solicit (volunteer) membership for the TWCs. It was noted that, while all RCG members are welcome to attend the technical meetings, the TWC membership should consist of individuals with technical expertise in the resource area.

Following a review of the study requests received to date, 6 TWCs were formed; these TWCs, their membership, and their study request assignments are summarized below:

1) Freshwater Mussels/Benthic Macroinvertebrates TWC

Membership: Shane Boring, Amanda Hill, Gerrit Jobsis, Steve Summer, Ron Ahle, Jennifer Price, SCDHEC Representative

Study Requests[1] *to be Addressed:* Mussel Surveys, Benthic Macroinvertebrate Study

2) Terrestrial Resources TWC

Membership: Shane Boring, Amanda Hill, Ron Ahle, Dick Christie, Buddy Baker, Brandon Stutts

Study Requests to be Addressed: Migratory Bird Study (includes wood storks, waterfowl, and bald eagles)

3) Rare Threatened and Endangered Species/Habitat Studies TWC

Membership: Shane Boring, Ron Ahle, Amanda Hill, Gerrit Jobsis, Bob Seibels, Tom Eppink

Study Requests to be Addressed: Rare, Threatened and Endangered Species/Habitat Studies

4) Diadromous Fish TWC

Membership: Alan Stuart, Gerrit Jobsis, Dick Christie, Steve Leach, Jeni Summerlin, Amanda Hill, Steve Summers, Prescott Brownell, Shane Boring

Study Requests to be Addressed: Diadromous Fish Studies

[1] Study Requests correspond to the study request summaries included in the attached meeting handout.

5) Instream Flow / Aquatic Habitat TWC

*Membershi*p:	Alan Stuart	Shane Boring
	Steve Summers	Gerrit Jobsis
	Ron Ahle	Amanda Hill
	Hal Beard	Dick Christie
	Brandon Kulik	Wade Bales
	Scott Harden	

Study Requests to be Addressed: Instream Flow Studies, Floodplain Flow Elevations, Ecologically Sustainable Water Management, Comprehensive Habitat Assessment, Sediment Regime and Sediment Transport Studies, Evaluation of Potential for Self-Sustaining Trout Population

6) Fish Entrainment TWC

Membership:	Alan Stuart	Wade Bales
	Amanda Hill	Hal Beard
	Tom Bowles	Shane Boring

Study Requests to be Addressed: Fish Entrainment Desktop Study

Discussion/Comments on Study Requests

Diadromous Fish Studies

Shane noted that the sampling of diadromous species is among the early studies that SCE&G decided to begin prior to relicensing. He added that sampling is currently being done by Dr. Jeff Isely from Clemson University and that the study plan is available on the Saluda relicensing website. Amanda Hill explained that state and federal agencies, including NMFS, USFWS, and SCDNR, have an interest in restoring diadromous species in the Santee basin, and as such, have cooperatively developed a restoration plan to guide such efforts. She added that the diadromous study was requested to help understand potential impacts operation of Saluda may have on migration and/or spawning of the diadromous species in the Saluda and Congaree.

Shane then provided the group with a brief summary of SCE&G's effort to obtain a scientific research permit from NOAA Fisheries – National Marine Fisheries Service (NMFS) to sample for

shortnose sturgeon in the Saluda and Congaree. Specifically it was noted that the application had been submitted since June of 2005 (informally since April 2005), and to date, a permit has still not been issued. Shane noted that he had spoken with Shane Guan at NMFS, and they are expecting to have the permit issued in 9 to 10 weeks.

Amanda Hill enquired as to the status of American eel sampling. Shane provided a quick review of the discussions regarding eel sampling from the January 6, 2006 conference call with the agencies (see meeting notes on the Saluda relicensing website). Specifically, it was noted that USFWS recommended use of an eel ramp to sample for elvers due to the ineffectiveness of the eel pot sampling. He added that the group had agreed to evaluate use of an eel ramp; however, due to time constraints (sampling was slated to begin February 1), it was determined that eel pot sampling should continue in the interim until potential eel ramp sites/design can be evaluated. Amanda reiterated that USFWS still strongly recommends a ramp for sampling elvers.

Freshwater Mussel Surveys

Shane noted that he had talked to Jennifer Price with SCDNR and Lora Zimmerman with USFW, and unfortunately, data on historical distributions of mussels in SC is extremely limited. He added that no mussels are known to occur in the LSR; however, no surveys have been conducted. Amanda Hill reiterated that information on mussels in SC is extremely limited and that recent FERC relicensing efforts have provided a lot of what is known. Amanda noted a similar lack of known mussel populations at the beginning of the Santee-Cooper relicensing; however, a survey by John Alderman indicated presence of several species, includes species with conservation status. The group agreed that a potential mussel survey was deserving of further discussion in the technical committee.

Benthic Macroinvertebrate Studies

The group briefly discussed the status of the crayfish pilot survey that was conducted on the LSR in fall 2005. Alan noted that a significant number were captured, have been IDed, and are currently being verified by Arnie Eversol at Clemson. Hal Beard noted the crayfish populations may fluctuate over time due to the amount of vegetation available along the shoreline, which is directly related to flow regime. Gina Kirkland noted that, since she is likely not going to be on the TCW, she would like to ensure that the crayfish population is properly evaluated due to their importance as prey for trout in the LSR.

Gerrit noted that importance of considering sediment dynamics when evaluating potential impacts to the macroinvertebrate community. Shane noted that the sediment regime study request had been shifted to the Instream Flow/Aquatic Habitat TWC under the Fish and Wildlife RCG to ensure that

such factors are taken into account. The group agreed to defer further discussion to the TWC meeting.

Instream Flow Studies

Alan Stuart specifically noted that instream flow evaluations are a standard request for most relicensing efforts. Alan pointed out an important role of the Instream Flow TWC will be to provide input and alternatives to the Operations TWC. Dick Christie clarified, the purpose of this committee would be to use another model to identify flows that will protect and potentially restore habitat on the LSR. Once flows have been identified, the operations group may be able to answer what else happens to the project if these specific flows proceed downstream. Ron Ahle noted that it may be important to examine the habitat needs of specific target species, and from this information, determine which flows are necessary to provide habitat for these particular species. Ron recommended using a Physical Habitat Model (PHABSIM). Ron noted that there was a previous IFIM study done on the LSR, but that it is outdated. Several group members noted the importance of including data from the previous IFIM study into the discussions of the Instream Flow TWC. Ron noted that he has the raw data and summary information on the IFIM study and would share the information with the group. The group decided to propose a date after information has been obtained from Ron.

Fish Community Surveys

Shane noted that numerous studies have been done through the years on the resident fish fauna and that consolidating this information might satisfy the request. Shane referenced specifically Steve Summer's quarterly electrofishing in the LSR, Hal Beard's spring sampling on the LSR, and the Lake Murray Management Reports (SCDNR). Hal noted that, while the management reports provide some valuable information, they are typically species specific and would not cover the full range of potential species. He added that his boat electrofishing in the LSR likely misses some of the smaller species. Dick Christie noted that a compilation of the studies conducted over the last approximately 40 years would likely provide a fairly comprehensive species list. Amanda Hill proposed, and the group agreed, that available studies should be compiled and distributed to the group for review to determine whether any further surveys are needed.

Evaluation of Potential for Self-Sustaining Trout Population in LSR

Malcolm Leaphart noted that USGS did a study of the LSR in 1985 and found that, based on temperature and flow, the LSR has potential to be a coldwater fishery year-round. He noted that, in his opinion, the river has been impaired for decades due to operations at Saluda, and as such, has not been able to function as year-round coldwater habitat. Malcolm requested that the potential for

establishing a year-round coldwater fishery be at least considered and discussed in the relicensing and referenced the Smith River trout studies as an example of potential enhancements. Gina Kirkland noted that the LSR's designated use is as a Put-Grow-and-Take trout stream; thus the stream is not impaired for its current designated use. Dick Christie noted that there is obviously strong interest in this issue and proposed that it be discussed further in the technical committees. After some discussion, it was determined that the limiting factors for reproducing trout are primarily habitat-related; thus the study request was assigned to the Instream Flow/Aquatic Habitat TWC. Dick Christie noted that a special meeting, drawing from several TWCs, may be in order.

Rare, Threatened and Endangered (RT & E) Species

Amanda Hill noted that the Ivorybill Woodpecker had recently been rediscovered in Arkansas and that the experts felt that the most likely place for additional Ivory-bills is Congaree Swamp. She added that, since we will be evaluating impacts of project operations on Congaree Swamp, the Ivorybill should be considered in the evaluation of RT &E species. She also noted that the Saluda Crayfish, a terrestrial species known from a single location near Silversreet, SC in Newberry Co., should also be considered.

Fish Entrainment

Shane noted there was a request to conduct a desktop study of potential entrainment using previous studies conducted at other similar facilities. Alan pointed out that this is a typical request for relicensing. He added that there is a fairly standard study plan that is used. The group agreed that Kleinschmidt should distribute the study plan for review, after which, a conference call can be scheduled to discuss how to proceed on this issue.

Migratory Bird Survey

Shane noted that there is a considerable amount of data available for Dreher Island State Park, as well as the Lower Saluda River, from Columbia Audubon and other sources. Bob Seibels added that the zoo has access to considerable amount of data for their site. The group agrees this request should be deferred to the terrestrial TWC for further discussion of existing data and to determine whether a study is needed. It was also proposed that the study request regarding waterfowl usage, habitat, and hunting areas be deferred to the terrestrial group for discussion along with the other migratory bird request.

Striped Bass Evaluations

The group agreed that many of the issue related to impacts to striped bass are water-quality-related and thus are being handled by the Water Quality TWC. Dick Christie noted, and the group acknowledged, that there will undoubtedly be a need for the Water Quality TWC and Fish and Wildlife RCG to interface regarding this issue.

Hydrologic/Hydraulic Operations Model

After some discussion, it was noted that the scope of this request is being handled in the Operations TWC; however, several group members noted the need to ensure that information is shared between the Operations and Instream Flow/Aquatic habitat TWCs.

Low Inflow Protocol Study

The group likewise agreed that the scope of this request is being handled in the Operations TWC; group members also noted the need to ensure that information is shared between the Operations and Instream Flow/Aquatic habitat TWCs.

Other Relevant Studies in the LSR and Congaree River

Wade Bales briefly discussed two future studies that the SCDNR will be conducting downstream of Saluda Hydro. He explained the first study will be to evaluate trout mortality in the river. He noted there is very little historical information on which to base trout stocking strategies, and they would like to establish baseline data to further enhance management strategies. This study will assess estimated annual mortality based on the number of trout released. He added that, after the trout have been stocked in the river, SCDNR will sample by electrofishing methods quarterly. Hal added that they are also hoping to identify any mortality differences between brown and rainbow trout, including the potential for holdovers. He noted they recently stocked trout in the river on January 10th and would start sampling in about one week. He added sampling would also take place in June, September, and possibly December.

Wade also noted SCDNR is developing a striped bass telemetry project. The goal of this study will be to document striped bass spatial and temporal use on the river via receivers deployed as part of Steve Leach's Shortnose Sturgeon study. He noted 30 striped bass, with a size range over ten pounds, will be tagged with transmitters in the Lower Saluda, Congaree, and Wateree Rivers. He explained that SCDNR is interested in movements of mature spawning striped bass, as well as how stocked and reproducing populations intermingle.

Dates and of Upcoming RCG and TWC Meetings

The RCG meeting was closed at approximately 2:00 pm and the group agreed to use the remainder of the afternoon to convene the Diadromous Fish TWC (notes prepared separately). No date was set for the next Fish and Wildlife RCG meeting as the group determined it best that the TWC meet a few times and then propose a date to the RCG for its next meeting. The group also agreed to have the Terrestrial; Rare, Threatened and Endangered Species; and Freshwater Mussel/Benthic macroinvertebrate TWCs meet on March 8, 2006 at 9:00 am at the Lake Murray Training Center.

Fish and Wildlife

Study Requests:

- **Diadromous Fish Studies**: Study requests from the CCL/American Rivers focused on a more in depth analysis of habitat conditions, feasibility of hatchery operations for diadromous fish, impacts analysis of the Project on diad. fish stocks of the Santee-Cooper Basin, the feasibility and costs of fish passage at the Project. SCDNR requests that spawning and nursery habitat for diadromous fish species in the river and lake should be identified and quantified.

  Requested by: CCL/American Rivers, SCDNR, LSSRAC, National Marine Fisheries Service, USFWS

- **Mussel Surveys**: It was requested that the present status of mussels in the project area should be evaluated, their habitat needs assessed, and any project impacts on habitat be identified. CCL requests an evaluation of the cumulative impact analysis that the Project has on mussel stocks in the Santee Cooper Basin.

  Requested by: CCL/American Rivers, SCDNR, LSSRAC, USFWS

- **Benthic Macroinvertebrate Study**: Requested in order to determine if invertebrate fauna have increased in either number or species diversity as a result of turbine venting. As well as how far downstream they are impacted.

  Requested by: SCDNR, LSSRAC, National Marine Fisheries Service, SC Council Trout Unlimited, USFWS

- **Fish Community Surveys:** It was requested that these surveys be performed and include small non-game species in the Saluda River above and below the reservoir as well as in Lake Murray, to supplement existing fish community data and/or replace dated information. Specific sampling focused on determining presence or absence of the rare robust redhorse sucker, Carolina sucker, and the highfin carpsucker should be conducted in the lower Saluda River.

  Requested by: USFWS

- **Striped Bass Evaluations:** This study would involve an evaluation of project operations on the reservoir striped bass population, particularly regarding: (1) the effectiveness of current turbine operations, (2) potential additional enhancements in association with the summer thermocline near the powerhouse; and (3)

determine if striped bass migrate upstream of the project within the Saluda River during the spring spawning season, and if and where spawning activities occur.

Requested by: USFWS

- **Migratory Bird Surveys**: This survey would evaluate the effects of the project on migratory bird use at Lake Murray and the Saluda River and riparian ecosystems. Surveys of migratory birds and their habitats to provide baseline information on populations. Aerial surveys for potential roosting, nesting, and foraging sites for the federally endangered woodstork should also continue.

  Requested by: USFWS

- **Hydrologic/Hydraulic Operations Model**:[2] Requested development of a computer simulation model that incorporates the operating characteristics of the Saluda Hydro Project. The model would be capable of simulating the Project's operations using specific hydraulic relationships based on inflows from all drainages to Lake Murray ending downstream in the Congaree River floodplain. The model would also include water flows in the Broad River above its confluence with the Saluda to accurately model combined flow conditions at the confluence and in the Congaree River.

  Requested by: LSSRAC

- **Low Inflow Protocol Study**:[1] Requested study to evaluate the effects of periods of low flow on elements such as reservoir levels, water availability, river flora and fauna habitat, etc. Study leading to the development of a low flow operations plan for the Project. According to the City of Columbia Parks and Recreation, this study should include the development of a "Hydrologic/Hydraulic Operations Model."

  Requested by: CCL/American Rivers, City of Columbia Parks and Recreation, LSSRAC

- **Floodplain Flow Evaluations**:[1] A study was requested in order to evaluate the flows necessary for incremental levels of floodplain inundation for the Lower Saluda, Congaree River, and Congaree National Park. It is requested that it include an inventory of floodplain vegetation as well, in order to classify and characterize the vegetative species composition and structure of the floodplain areas within the zone of operational influence of the river reaches.

[2]Not included as part of meeting handout; however, this study request was discussed in the meeting and thus is included in the meeting notes.

Requested by: CCL/American Rivers *(requested floodplain inundation study as well as floodplain vegetation component)*, LSSRAC *(requested floodplain vegetation component only)* National Park Service

**In relation to this study, SCDNR requests that the hydrologic record associated with the operation of the project be compared to the unregulated hydrology that would have occurred under a natural flow regime over the life of the project. Including an estimate of the timing, duration and magnitude of flood events that occurred and that would have occurred in absence of the project*.

Requested by: SCDNR

- **Instream Flow Studies**:[1] Requested for the Saluda River and the Confluence area. An assessment on how Project operations affect stream flows, and which flow regimens would best meet the needs of the biota.

  Requested by: CCL/American Rivers, City of Columbia Parks and Recreation, SCDNR*, LSSRAC, National Marine Fisheries Service, SC Council Trout Unlimited, USFWS

  **[IFIM requested by SCDNR in lieu of implementing an instantaneous flow of at least 470 cfs needed to support one-way downstream navigation, and flows of 590 cfs (July – November), 1170 cfs (Jan-April), and 880 cfs (May, June and December) to provide seasonal aquatic habitat]*

- **Ecologically Sustainable Water Management (ESWM)**:[1] Described by the National Park Service as a "inclusive, collaborative, and consensus-based process to determine a scientifically based set of river flow prescriptions in order to protect downstream resources while balancing upstream benefits." The NPS notes that they believe this process can be readily adapted to the Saluda Project and have already began gathering information and developing an interactive GIS tool to provide information regarding the effect of various Saluda operational scenarios on the degree of inundation at the Congaree National Park. NPS seeks "partnership" with SCE&G as well as stakeholders in implementing this ESWM process.

  Requested by: National Park Service

[1] Not included as part of meeting handout; however, this study request was discussed in the meeting and thus is included in the meeting notes.

- **Sediment Regime and Sediment Transport Studies:**[1] A request has been made that a study be performed on the sediment regimen in the Project area as well as the Project effects on the sediment regimen of the lower Saluda River. Should include such things as sediment composition, bedload movement, gravel deposition, sediment storage behind dams, and bedload changes below the dam; and project effects on downstream geomorphometry, sediment availability and streambank erosion, and the possible addition of gravel to mitigate for project impacts. Also, the effects of the Project operations on habitat requirements for spawning fishes.

  Requested by: CCL/American Rivers, USFWS

Information Needs:

- **Comprehensive Habitat Assessment**: To provide quantitative and qualitative data in GIS format of available and potential spawning, rearing, and foraging habitats (i.e., riffles, shoals, open water, shallow coves, littoral zones) for diadromous and resident fishes in Lake Murray, the Saluda River and its major tributaries, and the Lower Saluda River below the Project.

  Requested by: National Marine Fisheries Service, USFWS

- **Fish Entrainment Desktop Study:** This study would include conducting a desktop study of potential entrainment using previous studies conducted at other similar facilities. The objectives of the study should be to (1) quantify the numbers and sizes of fish entrained, by species, (2) estimate mortality rates associated by species, and (3) provide recommendations for project design and operation that can reasonably be made to prevent or minimize fish entrainment and associated injury/mortality.

  Requested by: SCDNR, National Marine Fisheries Service, USFWS

- **A Study to Determine the Factors Needed for a Self Sustaining Trout Fishery**: The purpose of this study should be to determine the factors needed for a self sustaining trout fishery that can reproduce and thrive year round, and how the operation can be modified to meet the habitat needs. Dissolved oxygen, flows, spawning and rearing habitat, the aquatic food base, especially in the shallow, rocky foraging areas, and actual water chemistry should be key items in such an assessment.

[1] Not included as part of meeting handout; however, this study request was discussed in the meeting and thus is included in the meeting notes.

Requested by: SC Council Trout Unlimited

- **Rare Threatened and Endangered Species/Habitat Studies**: A study was requested to assess the condition of rare threatened and endangered species in the Project area, as well as how Project operations are affecting these species and how Project operations can be used to protect, restore, or enhance populations. Management plans be developed for species existing in the project area or under the influence of the project. Suggestions include Wood Stork and RSSL Surveys as well as SNS and American eel sampling.

  Requested by: CCL/American Rivers, SCDNR, LSSRAC, National Marine Fisheries Service, USFWS

- ***SCDNR*** requests a summary of emergency spill gate testing protocol to include the frequency, time of year, and any adaptive measures that are used to reduce fish mortality as a result of spill gate testing.

- Information on species composition, location, and acreage of aquatic plants in the project is needed to aide in the development of an aquatic plant management plan. ***SCDNR***

- Information be dispersed to lake users by SCE&G on aquatic weed control measures. ***County of Newberry***

- Please provide copies of the existing environmental studies conducted at the Saluda Hydroelectric Project by SCE&G contractors and the South Carolina Department of Natural Resources that are referenced in the literature cited section of the Initial Consultation Document. These may be provided as hard copies or via CD (preferable). **USFWS**

Requests for Potential Mitigation: None

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FISHERIES AND WILDLIFE RESOURCE CONSERVATION GROUP
WATER QUALITY RESOURCE CONSERVATION GROUP
JOINT MEETING

Saluda Shoals Park, Irmo, SC
December 7, 2005

ATTENDEES:

Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Steve Bell, Lake Murray Watch
Gina Kirkland, SCDHEC
Malcolm Leaphart, TU
George Duke, LMHOC
Joe Logan, Midlands Stripers
Jeff Duncan, National Park Service
Bill Marshall, SCDNR & LSSRAC
Glen Siebels
Gerrit Jobsis, American Rivers
Ron Ahle, SCDNR
Amanda Hill, USFWS
Bud Badr, SCDNR
Bob Keener, Lake Murray Assn./LMSCA
Wade Bales, SCDNR
Tony Bebber, SC Parks, Rec. & Tourism
Norm Ferris, TU
Richard Mikell, Adventure Carolina
Jim Ruane, REMI
Ray Parker, Lake Murray Assoc.
Alan Stuart, Kleinschmidt Associates
Steve Summer, SCANA Services
Randy Mahan, SCANA Services
Dick Christie, SCDNR
Bob Seibels, Riverbanks Zoo
Tom Bowles, SCE&G
Steve Leach, SCDNR
Hal Beard, SCDNR
Bill Hulslander, Congaree National Park
Mary Kelly, League of Women Voters (Cola area)
Patrick Moore, Coastal Conservation League
Mike Summer, SCE&G
Joy Downes, Lake Murray Assn.
Bill East, Lake Murray Assn.
Jim Goller, Midlands Striper Club
Reed Bull, Midlands Striper
Dan Tufford, Univ. of SC
J. Charles Floyd, Lake Murray Homeowner's Assoc.
Andy Miller, SCDHEC
Pamela Greenlaw, Sierra Club - John Bachman Group
Andy Sawyer, REMI

ACTION ITEMS:

- Review list of study requests.

DATE OF NEXT MEETING:

February 1 (Water Quality) and 2nd (Wildlife and Fisheries) at 9:00 a.m. at SCE&G's Lake Murray Training Center[1].

[1] Due to conflict with the Catawba-Wateree Relicensing, dates were subsequently changed to February 21st and 22nd for the Water Quality and Fish and Wildlife RCG's, respectively.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FISHERIES AND WILDLIFE RESOURCE CONSERVATION GROUP
WATER QUALITY RESOURCE CONSERVATION GROUP
JOINT MEETING

Saluda Shoals Park, Irmo, SC
December 7, 2005

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting at approximately 9:30 AM, noting that the Water Quality and Fish &Wildlife Resource Conservation Groups (RCG)s had been combined for this meeting due to several common requests for presentations to provide background information relevant to the relicensing of Saluda Hydro. He added that, because the meeting consisted almost exclusively of presentations, the meeting would be mostly educational in nature and would likely not include significant discussion of relicensing issues. Following Alan's introduction, the following presentations were given (click on presentation title to view):

Water Quality Standards and *§**401 Water Quality Certification Process for Federal Energy Regulatory Commission (FERC) Hydro Relicensing***, Gina Kirkland, South Carolina Department of Health and Environmental Control (SCDHEC).

Water Quality Update: Lower Saluda River and Lake Murray, Andy Miller, Watershed Manager - Saluda and Santee Basins, SCDHEC.

Developing a Site-Specific Dissolved Oxygen Standard for the Lower Saluda River, Shane Boring, Kleinschmidt Associates.

(Note: This presentation was a recap of the presentation given by A. Stuart, J. Ruane, Dr. G. Chapman (Paladin Water Quality Consulting), and G. Hauser (Loginetics, Inc.) at the July 30th, 2003, Public Information Meeting for establishment of the Saluda site-specific DO standard.)

Water Quality Data Analysis and the CE-QUAL-W2 Modeling for Lake Murray, Jim Ruane and Andy Sawyer, Reservoir Environmental Management, Inc. (REMI).

(NOTE: Some portions of this presentation are not available through the website due to virtual memory, software and animation requirements.)

Alan Stuart closed the meeting at approximately 4:00 PM, noting that the next Water Quality and Fish and Wildlife RCG Meetings would be held at the SCE&G Training Center on February 1st and 2nd, 2006, respectively[2]. In closing, he urged group members to review the compiled list of study request and to be prepared to discuss them.

[2] Due to conflict with the Catawba-Wateree Relicensing, dates were subsequently changed to February 21st and 22nd for the Water Quality and Fish and Wildlife RCG's, respectively.

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
SALUDA HYDRO PROJECT RELICENSING
FISHERIES AND WILDLIFE RESOURCE GROUP

SCE&G Training Center
November 10, 2005

ATTENDEES:

Bill Argentieri, SCE&G
Alison Guth, Kleinschmidt Associates
Shane Boring, Kleinschmidt Associates
Prescott Brownell, NOAA Fisheries
Gina Kirkland, SCDHEC
Malcolm Leaphart, TU
George Duke, LMHOC
Joe Logan, Midlands Stripers
Jeff Duncan, National Park Service
Bill Marshall, SCDNR & LSSRAC
Alan Stuart, Kleinschmidt Associates
Steve Summer, SCANA Services
Randy Mahan, SCANA Services
Dick Christie, SCDNR
Bob Seibels, Riverbanks Zoo
Tom Bowles, SCE&G
Steve Leach, SCDNR
Hal Beard, SCDNR
Bill Hulslander, Congaree National Park

HOMEWORK ITEMS:

- Review list of study requests.
- Review the ICD and the water quality report at the back of the ICD.

DATE OF NEXT MEETING: **December 7, 2005 at 9:00 a.m. (Combined Meeting with Fish and Wildlife Resource Group)**
Located at the Saluda Shoals Park Rivers Center

MEETING NOTES:

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting at approximately 9:30 AM, noting that the Resource Conservation Groups (RCG)s were formed to allow relicensing stakeholders and their diverse interests to be expressed.

Mission Statement

Several groups/individuals cited issues that they believe need to be considered in the mission statement. Specifically, the National Park Service noted that floodplain inundation at the Congaree National Park is among their primary issues and suggested that floodplain vegetation somehow be considered in the mission statement. Gina Kirkland added that a discussion of state water quality standards as they pertain to fisheries might be beneficial. Prescott Brownell noted the importance of having a high, overarching goal in the statement. George Duke cited the need for a method to measure success under the mission statement and to consider at every meeting 'are we in fact doing this?'.

Through an interactive session, the group developed the following list of essential elements for the mission statement:

- Fish, wildlife, and plant species, ecological communities and the eco-systems and/or habitat
- Seek to achieve the highest level of consensus based, good faith cooperation
- Highest level of integrated management best adapted to serve the public interests
- Develop a PM&E (Protection, Mitigation, and Enhancement) Agreement
- Fisheries and wildlife management

SCE&G agreed to develop a draft mission statement base on the above elements and distributed to group members for review and comment.

Potential of Combining F&W and WQ RCGs

Several group members enquired as to the whether or not the WQ and F&W RCGs should be combined due to the many common issues. Several members agreed that it may be beneficial; however, after some discussion it was agreed that they should remain separate for the time being. Steve Summer suggested that combining the groups at the Technical Working Committee (TWC) level might be more appropriate. The group agreed that this issue should be discussed further once a work plan has been developed for each group. Alan Stuart added that, if group members are

interested in topics being discussed at the other RCGs, they you are welcome to attend as an observer.

Relicensing Operating Procedures

Alan Stuart noted that comments have been received from several NGOs on the Operating procedures. He added that those comments are being evaluated and additional comments are expected from Patrick Moore's group very soon.

Study Requests

Alan Stuart noted that the relicensing study requests had been categorized according to resource groups. He noted that, if stakeholders did not see their request/comment under the Fish and Wildlife (F&W) category, it likely was included with another RCG. Anyone who felt that their comment/request should have been included in F&W, but was not, was asked to let the group know. Dick Christie noted the need to review study requests and discuss the appropriateness of where they had been placed in the RCG's. For example, he suggested that the IFIM study request might be more appropriate in the F&W RCG, rather than WQ.

Alan also noted that discussions regarding the study requests will likely begin soon; therefore, any other concerns/comments regarding studies should be brought to light as soon as possible. Ron Ahle (SDNR) noted his concern about the status of waterfowl populations and habitat on the lake. In regards to the Conagree Swamp floodplain study request, Jeff Duncan added that his agency is interested in the possibility of coupling an inundation model with a hydrologic operations model. He added that this would likely provide much needed information regarding the relationship between operations at the dam and their ecological management efforts at the park. Gina Kirkland added that DHEC met as a board earlier in the day, and they are considering designating waters of the Congaree Swamp as outstand resource waters.

Hal Beard enquired as to who would ultimately decide which studies will be performed. Alan Stuart noted that, although all the study requests may no be carried out, all will be considered in some shape or form by the various RCGs. Randy Mahan clarified that, ultimately, SCE&G has the statutory obligation to prepare and file the license application; therefore, they also have an obligation to study the issues appropriately. He went on to note that, although all parties may not agree as to whether or not a study needs to be performed, an effort will be made to address each and every study request submitted. Jeff Duncan added that FERC typically will look at whether the study request has a nexus to the project, and if so, is the available data adequate to address it. He also noted that those requesting studies are required by FERC to state explicitly how the available data is inadequate.

The group then briefly discussed the potential for use of existing data in addressing study request. Alan Stuart mentioned specifically the request for fish community and habitat surveys, noting that the lake and river fish resources have been studies extensively over the years. USFWS (Amanda Hill) recommended that existing data be compiled to identify any data gaps and proceeding from there with the studies, if needed. Steve Summer noted that SCE&G recently completed a helicopter video of the river from the confluence up to the dam at low flows, and that is data may be helpful in assessing habitat conditions. He added that they also have some footage from the Santee all the way up to the Saluda River, but at higher flows. The group agreed that this has potential as a starting point for assessing the river habitat. Randy Mahan summarized the discussion by noting that there is a tremendous amount of data out there that many people may not be aware of.

Malcolm Leaphart enquired as to whether or not most of SCE&G's studies have been peer reviewed. Randy Mahan and Alan Stuart both noted that, while studies typically have not been reviewed for publication, they typically seek involvement form resources agencies, which serves as the peer review. Jeff Duncan noted that, in this relicensing, both FERC and the RCG will function as the peer review. Prescott Brownell noted that NOAA Fisheries typically has a group of engineers/scientists that they use to provide review for instream flow, fish passage, and other studies. Gina Kirkland added that there is quite a bit of quality data and information available that is not peer reviewed, but that doesn't mean that it is not good or valid data. She added that quality assurance quality control standards in establishing a certain level of confident among stakeholders and that the technical working groups may be a useful platform for establishing the standards.

Several group members enquired as to how the Technical Working Committees (TWC) would be formed. Alan Stuart noted that TWC's would likely be formed from within the RCGs to address specific issues identified by the group. Malcolm Leaphart emphasized the importance of having the TWC's coordinate with the RCGs to promote education regarding relicensing issues.

Baseline For Studies

Dick Christie noted the importance of the RCG having a good understanding of the what constitutes the baseline. Alan noted that FERC views the baseline as the project is today, not pre-project. Jeff Duncan added, "The courts have interpreted what the baseline is, but that doesn't preclude us from doing what is better or looking at historical aspects for resources such as fisheries, etc." Randy Mahan added that SCE&G has no problem with attempting to understand historical conditions and added that "If the current baseline is not good it does not mean we will keep a bad baseline.

Dick Christie noted that he interpreted the ICD as being SCE&G's attempt to describe the baseline. He added that SCDNR has provided comments regarding some of the information presented in the

ICD and would like to discuss those comments as they relate to establishing baseline. Gina Kirkland added that, even if we consider the ICD a starting point, nothing precludes us from building upon that. Alan agreed, noting that, although the ICD itself is final, we will build on its content to develop the application. He added that it should not be confused, that we will not distribute multiple versions of the ICD. Dick Christie added that he felt the ICD, with a few possible exceptions, was a pretty accurate portrayal of the Fish and wildlife resources. Bill Argentieri closed the discussion, noting that SCE&G did send an acknowledgement of receiving SCDNR's comments on the ICD.

Next Meeting Date / Agenda

Alan noted that at the Water Quality (WQ) RCG meeting the previous day (November 9th), the group proposed that their next meeting be combined with the F&W group to discuss common issues (i.e., tie-ins between water quality and fisheries, etc.) He added that several potential presentations had been discussed (see 11-9-05 notes), as well as a proposed meeting date (December 7th). The group agreed that this date was acceptable. The group briefly discussed the proposed agenda for the next meeting, including the following presentations:

- Presentation: Water Quality Standards and Classifications of Lake Murray and the Lower Saluda River
  Gina Kirkland
- Presentation: Status on impaired areas within Lake Murray
  Andy Miller
- Presentation: A Review of 25 years of Water Quality in Lake Murray
  Jim Ruane - Reservoir Environmental Management
- A Review of the QUAL 2 -E Water Quality Model and its Application to Lake Murray
  Jim Ruane
- A Review of the Site-Specific Dissolved Oxygen Standard
  Alan Stuart/Shane Boring

Operations Presentation

The meeting was closed by a presentation by Lee Xanthakos on operations at Saluda Hydro and it's role in providing reserve capacity. This presentation can be viewed through the Saluda Relicense http://www.saludahydrorelicense.com/documents/Presentaion-SaludaHydroWorkshop-LeeX.pdf, as well as through the November 1st Operations meeting notes.

Saluda Hydro Relicensing – Diadromous Fish Study Meeting – November 10, 2004
Meeting Location – SCE&G Training Center – Columbia, SC

Revision 12-10-04

Attendees:

Steve Summer	SCE&G	Dick Christie	SCDNR
Bill Argentieri	SCE&G	Steve Leach	SCDNR
Kristina Massey	SCE&G	Hal Beard	SCDNR
Randy Mahan	SCE&G	Amanda Hill	USFWS
Alan Stuart	Kleinschmidt	Mark Cantrell	USFWS
Shane Boring	Kleinschmidt	Alison Guth	Kleinschmidt

Action Items:

- Prepare a study plan for sampling diadromous fish on the Lower Saluda River and distribute to the resource agencies for review and comment.
- Obtain and distribute D.O. and flow data to the agencies. SCE&G will obtain data from the USGS.
- Organize canoes, transportation, etc. that is needed for a low flow float trip on the lower Saluda on the 29th of November (to be taken care of by Alison).
- Set up meeting with Prescott Brownell of NOAA fisheries about sturgeon issues.
- Check on permitting for studies, who needs to be there?
- Steve Leach and Mark Cantrell said that they could provide an electronic copy of the Santee Cooper Basin Diadromous Fish Passage Restoration Plan to anyone who needs it.

Meeting Notes:

These notes summarize the major items discussed during the meeting and are not intended to be a transcript or analysis of the meeting.

Alan Stuart opened the meeting at 10:00 AM and noted that the focus of the meeting would be to discuss: (1) Target Species and Restoration Plans for the Lower Saluda River (LSR), (2) Historical data needs, (3) NOAA shortnose sturgeon sampling permit, (4) Lower Saluda River Sampling logistics, (5) Sampling in Lake Murray tributaries and, (6) Establish a date for low flow float trip on the Lower Saluda River & above Lake Murray.

Target Species and Restoration Plans:

The agencies began this discussion by briefly stating the target species that they would like to see included in the diadromous fish study. The fish mentioned include: blueback herring, hickory and American shad, American eel, Atlantic and shortnose sturgeon, and striped bass. Dick Christie noted that the Broad River Basin is considered number one (most promising) for fish restoration in the Santee Cooper Diadromous Fish Passage Restoration Plan. He also mentioned that the restoration plan is considered a general, wide-reaching plan.

The group decided that more studies need to be performed in order for the agencies to more fully develop their restoration plan, which is considered a living document.

Historical Data Needs:

Mark Cantrell mentioned that the flows into Lake Murray vs. the flows out of Lake Murray would provide great comparison data from which to figure out a fish's response to flow. Amanda Hill mentioned that she would like to look at temperature distributions as requested by Doug Cooke. Simple temperature data comparing the Broad River and LSR may rule out the presence of sturgeon.

Amanda Hill stated that it would be helpful to know the temperature data above and below the dam. This would allow the agencies to determine how far downstream the project influences. Steve Leach brought up the possibility of using USGS as a source for temperature data, possibly from the last 10-15 years. Dick Christie concurred that January through August would be good months to look at in regards to temperatures, flows, etc.

Amanda Hill asked if there were temperature and D.O. monitors on the Congaree itself. In response, it was stated that there was only stage data on Gervais Street. Also that there is possible data for city at sewer plant, which needs to be checked into. Moreover, around October of '88 through the present there should be data available at the dam. The agencies asked SCE&G to investigate locations for additional monitors, and the agencies will provide what data they already have. It was pointed out that SCDHEC may have some data prior to 1988.

Mark Cantrell of the USFWS asked how the project operations have changed since they first began. In response, Kristina Massey stated that since there is no flood storage pool, the project has always operated to pass large inflows so the dam won't be overtopped. Up to the late 1950s the project was operated as a base-load facility, and the lake fluctuated much more than it does at the present. From the 1960s to 1990s, the project moved into a load-following and peaking mode, generating when power was most needed on the system and reducing the amount of annual lake

fluctuation. The annual flow of water through the system has remained relatively unchanged. Currently the project is used primarily to meet system reserve needs.

Alan inquired as to where the striped bass fit into the study plan. Hal Beard replied that the striped bass use the river for refuge and then they leave and no one is sure when they arrive, what the environmental demands are and where they go. It is possible that over-exploitation could occur. Although inconclusive, work conducted by Gene Hayes suggests that, to some degree, landlocked striped bass may utilize the Upper Saluda River as spawning area. Generally, the LSR is a two-tiered fishery, trout in the winter and striped bass in the summer. Hal continued to mention that there is also concern that the striped bass could become genetically depressed due to the over fishing of the best individuals.

Mark Cantrell would like to know how stripers have been sampled historically. The group stated that the sampling performed by Hal Beard is the first sampling that has been done on a regular basis. Hal indicated he usually samples in May/October. Dick suggested that IFIM study work has been done by Isley and Jobsis.

NOAA Shortnose Sturgeon sampling permit:

- Will be discussed in a meeting with Prescott Brownell

Saluda River Sampling Logistics:
Gill Netting:

When: Start in the beginning of March (1x a week) then increase to 3x's a week from the third week in March through April
4am to 10am or 2pm to 8pm.

Where: One gillnet near the mouth of the Saluda River near the Congaree River and one towards the dam

Supplies: 2 ½" to 7" stretch mesh nets. One net should be constructed of 2.5-inch stretched mesh, the other of 5-inch stretched mesh.

How: Possibly set at an angle to the bank. Fish two nets (one net of each mesh size) at each site, to cover approximately one half of the river's width if possible.

The group began to discuss gillnetting and its caveats. Hal Beard mentioned that he will be interested in how the gill netting is going to be performed; he has not had much luck with it in the past. However, he has achieved the most luck with it when the nets were set at an angle to the bank, rather than perpendicular. When

considering a site for the net, one must consider both access and velocity. (i.e., Is velocity going to increase fish catch?)

According to Dick, in order to target American shad and blueback herring, the smallest mesh size needs to be 2 ½ " for smaller fish and as much as 7" for larger adults. Moreover, net panels need to be made to the right length and height in order to cover the channel. The group mentioned that SCE&G may want to test the feasibility of gillnetting in 2004.

Mark Cantrell clarified that the goals of this early study were as follows: to determine the presence or absence of target species, what their distribution is in the habitat, and where along the river they are located.

Kristina brought up the fact that flows may be a serious setback when gillnetting, all depending on how wet of a winter and spring we have.

The group decided that sampling should occur in 6 hour time periods. The time period for setting and monitoring gill nets should be during either 2:00 pm -8:00 pm, or possibly 4:00 am to 10:00 am. According to Dick Christie there should be a gill net set up at least at one site around the mouth of the Saluda River at the Congaree River and one in the upper reaches, near the dam (Saluda Shoals). Hal Beard suggested that one of the nets should be located about 100m below the zoo bridge.

Alan suggested using the passage rates at St Stephens as a catalyst to increase sampling efforts in the LSR. Coordination with SCDNR, as was done during the relicensing of Columbia Hydro, was proposed. There needs to be coordination with Doug Cooke and Steve Leach to find out when the fish are being passed. Steve Leach responded that the peak at Pinopolis Dam occurs around March 7th and at St. Stevens around the 20th of March.

The discussion turned to possible sampling times and dates. It was mentioned that SCE&G may only need to sample using gill nets once a week until end of March, beginning of April, and then increase up to around 3x's a week. Hal cautioned against sampling too far into April because of the large amount of stripers.

The agencies indicated that it may be acceptable to electrofish while gill nets were soaking.

> **Note**: *The following comments and clarifications were made by the resource agencies following the meeting*: Starting in February, set nets once a week for one run. A run will include setting nets at each site and then returning to the first site to retrieve the nets. The nets should be allowed to fish for at least 4 hours. In addition to sampling for early run fish, this would allow for resolution of

problems associated with access, site selection, and various trip-based logistical problems to be addressed.

After notification of "significant" alosine passage at the Santee Cooper dams, increase sampling dates to twice per week (The agencies suggested shooting for Monday and Thursdays, to allow for some variation due to hazardous weather conditions).

The sites should be run at least twice in a day, so that nets are checked without removing from the water, if possible, on the first run, and then retrieved on the second or third trip. The goal is to fish the nets for as much of the daylight period as possible. The number of trips will be dependent on the amount of time required to make one run of the nets, travel time, etc. and can be adjusted accordingly. Nets should be fished in this mode through April and then reduced to one run (on one day) per week through May if alosine catch has decreased significantly.

The sites should be determined by locating adequate fishing habitat in close proximity to a private, public or improvised launching facility. Ideally, three sampling locations should be sampled. These locations should roughly correspond to upper, middle and lower sections of the river. A potential upper-river site should be near the SCE&G ramp at Saluda Shoals. The middle river should be generally between Fourteen Mile Creek and the Interstate 20 Bridge; the lower-river site suggested is in the vicinity of Riverbanks Zoo. Actual locations may have to be adjusted at the time of sampling due to varying flow conditions.

One additional site in the Congaree River near the confluence of the Broad and Saluda Rivers would provide information on relative abundance of fish in the river and provide indications as to whether they are selecting for the Saluda or Congaree. Sampling with the same techniques and timing as in the Saluda River would also provide insight to the effectiveness of gear and techniques, and was strongly encouraged by the agencies. Fishing near the Rosewood landing on Congaree River may prove suitable for this site.

If the catch of non-target species is high at any of the sampling sites, the length of time nets are fished can be shortened to reduce by-catch.

Eel Traps:

When: February to April

Where: At the mouths of rivers, channels and islands

Supplies: Eel pots can possibly be ordered from Wildco

Amanda Hill of FWS mentioned that they would like eel pots to be set at the mouths of rivers, channels and islands and that they were looking for potential elvers. She also stated that these would not be as laborious as gillnetting, the eel traps only needed to be checked every couple of days. Hal Beard indicated that in the past he has caught about three eels in a 10 day sampling season on average, and also that he had 5 yrs of data. Amanda replied that she would like to get that data from him if at all possible. The group mentioned that the first step was to compile as much historical data as possible.

The discussion turned to time periods in which to sample. Mark Cantrell said that February to April would be the best time to deploy eel pots.

The USFWS will provide info on equipment suppliers such as Wildco.

Note: *The following comments and clarifications were made by the resource agencies following the meeting*: Efforts should be made to determine whether eel traps can be fished on a corresponding schedule with gill nets sets. If locations as previously described (e.g. creek entrances) can be located near gill net sites, they should be utilized. Eel traps should be set there upon first deployment of the day, and checked at the end of the day. They could also be left set until the next trip (once twice a weekly sampling starts), when they should be checked and re-baited.

Plankton Nets:

When: While gill netting

Where: DNR would prefer that plankton nets be set to fish off the bottom

Supplies ½ meter, 220/500 micron single nets, possibly with flow meter attached

Amanda Hill mentioned that they would like SCE&G to put up fixed plankton nets to gather eggs and larvae. In response, Alan mentioned that if gillnetting and electrofishing provide no results, plankton nets may be unnecessary. Amanda said that plankton nets are just another way of determining presence or absence, and they are definitely needed during the spring of 2005, if nothing else.

In regards to the nets themselves, Mark Cantrell mentioned that they would prefer tows but it may be difficult to do in the river, so maybe stationary nets would be better for a given period of time. Moreover, in regards to catching herring, shad and

stripers, Mark pointed out that ½ meter, 220 micron would perform the best. He also stated that a flow meter would provide volume measurements, but you would need a meter attached to each net unless they are paired closely together. The group decided that single nets, not bongo nets, should be used. DNR would prefer that the river was fished off the bottom.

It was concluded that plankton nets can be sampled while electrofishing and gillnetting are taking place.

Note: *The following comments and clarifications were made by the resource agencies following the meeting*: Efforts should be made to fish plankton nets in conjunction with gillnets. Plankton nets may be anchored after the first gill net set at each site and retrieved upon the last gillnet retrieval of the day. This will allow for filtering the maximum volume of water during low flow periods, increasing the likelihood of sampling alosine eggs and larvae. However, if clogging with vegetation, detritus, etc. becomes problematic, plankton nets may be retrieved at the retrieval stage of the first run for gillnets each day. If clogging is still problematic, then shorter sampling times should be investigated.

Telemetry Study:

FWS expressed the desire to have a telemetry study preformed with some sentinel fish for American shad. This study will help the agencies determine if the shad utilize the Broad and LSR or just the Broad River. Also if they have thermal preferences and selection based upon the water temperature. Dick Christie believes it would be a good idea to do this because we do not know where they go. Dick Christie also mentioned that it would benefit SCE&G if the American Shad went up the Broad River.

Kristina made the point that if we were going to do this it needed to be done right, and it may be too late to put it together properly by the springtime.

It was discussed that the fish would probably be tagged in Pinopolis. However, SCE&G does not want to study the whole basin just to determine presence in the LSR. Alan suggested that it could possibly be combined with the Columbia fish passage project effectiveness testing and yield more information and better results. It was suggested that fish needed for the effectiveness tracking effort could be obtained from the Congaree River.

In the end, it was decided that telemetry will be performed as a second phase, along with studies associated with the Columbia Hydro Fish Passage Testing.

Temperature Monitoring:

The influence of the project, water temperature wise, downstream was again brought up. Mark Cantrell mentioned the possible need for temperature monitoring downstream, to the Congaree. Moreover, the most likely time that water temperature is affected is in the summer and fall. Amanda Hill stated that describing the thermal environment of the LSR would help determine if a possible temperature difference influences a fish's choice of sub-basin.

In regards to location, it was stated that there should be temperature sensors 1 mile downstream of dam and 1 mile upstream from zoo. Steve Summer mentioned that SCE&G could put some tidbits (temperature recorders) near the confluence on the left and right banks. Mark Cantrell suggested that they do a transect across the river and decide where equilibrium is reached in mixing of both rivers. However SCE&G mentioned that quite a few transects would be needed to determine this, which may be difficult. Steve Summer suggested that one tidbit should be placed in the Saluda and one in the Broad River near the confluence just to track the differences for now. Mark Cantrell stated that the tidbit needs to be positioned towards the bottom but still in the water column. SCE&G mentioned that there are continuous temperature monitors in the Saluda River about 1,000 feet downstream of the hydro plant, and upstream of the zoo that are operated by USGS. It was also mentioned that there is a continuous temperature monitor in the Broad River immediately downstream of Parr Hydro, also operated by the USGS. Data from all three of these gages is available on the USGS website.

Steve Leach stated that the preferred spawning water temperature range for sturgeon is 7-18 degrees C. He also pointed out that the divergence of water temperatures between the Broad and LSR begins earlier in year then previously thought, begins around April, and is also more of an obvious difference what was once thought.

Hal Beard pointed out that it is possible that fish orient themselves toward flow instead of temperature.

It was decided that this study would be "tabled" as well.

Sampling in Lake Murray tributaries:

The agencies indicated that they would like an evaluation of potential spawning areas in the Lake and in tributaries. Amanda Hill stated that a characterization of the physical habitat below the dam and above the Lake would be helpful. This can possibly be submitted in GIS format, and would be used to determine if there is potential diadromous fish spawning habitat.

Hal Beard pointed out that Gene Hayes did some cursory work to determine if stripers could possibly be reproducing in middle Saluda, and his determination concluded that numbers were insignificant.

"Tabled" Studies

- Telemetry Study
- Temperature Monitoring in LSR and Congaree.
- Will possibly do a future Habitat Evaluation if it is in conjunction with a required flow study.
- Will determine need of habitat study after video fly-over and float trip.

Low Flow Float Trip on the Lower Saluda River:

The meeting concluded with a discussion of the canoe trip that was going to be taking place on the Lower Saluda River during low flows (400-500 cfs). It was determined that the 29th of November was the best date for everyone.

Amanda and Alan will both ask Prescott Brownell to attend.

The meeting adjourned at approximately 3:00 pm.

Saluda Hydro Project – Meeting RE August 27, 2004 Wood Stork Reconnaissance Survey Via Conference Call – September 17, 2004

Revision 09-30-04

Attendees

Ed Eudaly	USFWS	Tom Murphy	SCDNR
Randy Mahan	SCANA Services	Kristina Massey	SCE&G
Tom Eppink	SCANA Services	Tommy Boozer	SCE&G
Van Hoffman	SCE&G	Bill Argentieri	SCE&G
Shane Boring	Kleinschmidt	Alan Stuart	Kleinschmidt

Action Items — Due Date

- Incorporate comments from 9/17/04 conference call into report and distribute to group.
  Shane Boring — October 12, 2004

- Draft study plan based on recommendations from 9/17/04 conference call and distribute to group for review and comment.
  Shane Boring — October 13, 2004

Meeting Notes

These notes summarize the major items discussed during the meeting and are not intended to be a transcript or analysis of the meeting.

Shane opened the meeting at 10:00 AM and noted that the focus of the meeting would be to discuss: (1) the trip report from the 8/27/04 wood stork aerial reconnaissance survey, (2) future wood stork monitoring needs on Lake Murray, and (3) FERC's order to designate two areas in the Brushy Creek and Bush River areas as "conservation areas" for wood storks.

Comments on Reconnaissance Survey Trip Report

The group found the report generally acceptable. Ed Eudaly asked that the reservoir elevation be added to the Survey Observations portion of the report in order to provide as much pertinent background information as possible.

Shane asked Tom Murphy to clarify whether the storks reported feeding along Brushy Creek and Bush River (See Figure 1 of report) had been observed by SCDNR staff or had been reported by private individuals. Tom indicated that Mr. Joe Harris (a local resident) had observed and documented storks feeding at these locations intermittently over an approximately three-year-long period. Randy Mahan noted that SCE&G staff had a meeting scheduled with Mr. Harris on October 4 to discuss these observations.

Van Hoffman noted that the two locations where potential nests were observed (See Figure 4) were located in backwater areas approximately 500 -600 feet off the main river channel and that these areas are more influenced by operations at Lake Greenwood (Buzzard's Roost) than by the Lake Murray pool. He added that the location where storks were observed feeding during the survey (Point 1 on Figure 2) is in the vicinity of where the riverine habitat (influenced

by Buzzard's Roost) begins to give way to more lacustrine habitats influenced by the Lake Murray pool.

Future Monitoring Needs

Tom and Ed both noted the need for a longer-term study (possible 3-7 years) to document where and under what conditions storks are using Lake Murray. The group identified several objectives for the study including the following:

- Documentation of nesting (i.e., whether the nests observed during 2004 were in fact stork nests), and if so, if successful reproduction is taking place.
- Documentation of foraging habitat and roosting areas, in particular, documentation of important night roosts (if they exist in the area).
- Examination of foraging conditions over multiple years and a range of water levels.
- Documentation of usage by various age classes (i.e., young-of-year, immature, adult).
- Examination of the influence of the Lake Murray drawdown on the presence of storks in the area.

The group briefly discussed the possibility of additional surveys during 2004, but decided that it would be better to begin surveys in March 2005 (when the birds begin returning to SC for the nesting season) and focus the remainder of this year on putting together a solid study plan. The group agreed upon the following study plan components:

- Monthly aerial surveys beginning in late-March and continuing through October each year.
- Ground surveys as necessary based on aerial observations (i.e., to confirm nesting, presence of young-of-year or pre-flight juveniles, presence of night roosts, etc.)
- A defined geographic and temporal scale.

Shane Boring agreed to draft a proposed study plan as outlined above and distribute the group for review as soon as is practicable.

Kristina Massey suggested, and the group agreed, that the preliminary result of the first two years of the study should be compiled in a report for inclusion with the Saluda Hydro FERC license application. The group also agreed that a brief annual report should be issued, followed by a conference call with the agencies to discuss the progress of the study and need for potential modifications to the scope. Shane and Tom agreed that a brief e-mail update could be issued following each survey flight.

Potential Designations of Conservation Areas in response to the Shoreline Management Plan FERC Order

Randy Mahan provided a brief explanation of FERC's Shoreline Management Plan order (dated 06/24/04), specifically, Item H dealing with consultation with the agencies regarding wood storks. Randy explained that Item H required SCE&G to consult with the agencies and to develop a plan to provide protection for areas where wood stork foraging and roosting has been documented. Randy indicated that consultation efforts are underway and that SCE&G proposes to temporarily designate these areas as Environmental Research Areas. Randy indicated that, under SCE&G's proposal, consultation efforts and protection of the areas would continue through the duration of the long-term study outlined above. He added that this would allow for evaluation of the influence of the Lake Murray drawdown on usage of the project area by storks (i.e., whether they will be present in significant numbers at normal reservoir elevation) and an appropriate long-term designation. Alan queried Tom Murphy and Ed as to whether this approach seemed logical and whether their agencies would support SCE&G's efforts in this regard. Ed and Tom were both of the opinion that SCE&G's proposal sounded like a reasonable approach and one that their respective agencies could support.