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

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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