

Kacie Jensen

From: Dick Christie [dchristie@InfoAve.Net]
Sent: Wednesday, December 28, 2005 2:18 PM
To: Alison Guth
Subject: FW: American Eel Report

Hi Alison - these comments also include Steves thoughts. Thanks.

From: Alison Guth [mailto:Alison.Guth@KleinschmidtUSA.com]
Sent: Monday, December 19, 2005 11:34 AM
To: Steve Leach; 'Prescott.Brownell@NOAA.gov'
Subject: FW: American Eel Report

Pres and Steve,

I was going back through comments and such and came to a shocking realization, somehow you guys were left off of the distribution list. I apologize for the oversight, take a few weeks and let me know if you have any comments. Could you have comments back to me by the first week in January? Thanks so much and I hope you have a wonderful holiday season. Alison

-----Original Message-----

From: Alison Guth
Sent: Thursday, November 03, 2005 11:27 AM
To: Shane Boring; 'Amanda Hill'; 'ARGENTIERI, WILLIAM R'; 'Hal Beard'; Alan Stuart; 'mark_a_cantrell@fws.gov'; 'SUMMER, STEPHEN E'; 'rmahan@scana.com'; 'dchristie@infoave.net'
Subject: American Eel Report

Good Morning,

Attached to this email is a draft copy of the 2005 American Eel Survey Report. Please take a look at it and let me know if you have any comments by November 18th. If at all possible, please put any edits to content in track changes. It is quite a large file, so let me know if you have any problems opening it and I will get it to you another way. Thanks so much for all of your involvement, and as always, give me a call if you have any questions.

Thanks,
Alison

<<Diad Fish Eel Survey (11-3-2005 acgdraft).doc>>

Alison Guth

Licensing Coordinator

Kleinschmidt Associates

101 Trade Zone Drive

Suite 21A

West Columbia, SC 29170

P: (803) 822-3177

F: (803) 822-3183

Kacie Jensen

From: Shane Boring
Sent: Tuesday, December 06, 2005 11:44 AM
To: Tom Murphy (murphyt@dnr.sc.gov); Amanda Hill (amanda_hill@fws.gov); BARGENTIERI@scana.com; Boozer Tommy (tbooz@scana.com); Dick Christie (dchristie@infoave.com); Ed_Eudaly@fws.gov; Hal Beard (BeardH@scdnr.state.sc.us); HOFFMAN, VAN B; Laura Blake (E-mail); RMAHAN@scana.com; Ron Ahle (ahler@dnr.sc.gov); Steve Summer (ssummer@scana.com); Alison Guth; Alan Stuart
Subject: November lake Murray Wood Stork Survey

All:

A memo summarizing the final Lake Murray wood stork survey for 2005 is attached and will be posted to the Saluda relicensing website. Although there was a lot of wading bird activity, no wood storks were observed. The draft summary report for the 2005 surveys will be issued within the week. Thank you for your continued interest in the wood stork study.

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



November 05 wood
stork update....

MEMORANDUM

TO: Saluda Hydro Project Relicensing Stakeholders

FROM: Shane Boring

DATE: December 6, 2005

RE: November 2005 Wood Stork Aerial Survey Observations

Dear Relicensing Stakeholder:

The final Lake Murray Wood Stork Survey for 2005 was performed on Wednesday, November, 23rd. Although wading birds were extremely abundant and active on the lake at the time of the survey (particularly great egrets), no wood storks were observed. A draft report summarizing this year's wood stork surveys will be issued by mid-December. Thank you for your continued interest in this issue, and as always, please feel free to contact me should you have any questions.

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

Kacie Jensen

From: Shane Boring
Sent: Tuesday, November 22, 2005 5:06 PM
To: 'Amanda Hill (amanda_hill@fws.gov)'; 'Hal Beard (BeardH@scdnr.state.sc.us)'; 'Prescott Brownell (prescott.brownell@NOAA.gov)'; 'Steve Summer (ssummer@scana.com)'; 'dchristie@infoave.net'; 'Mark A. Cantrell (mark_a_cantrell@fws.gov)'; 'Steve Leach' BARGENTIERI@scana.com; 'Steve Summer (ssummer@scana.com)'; Alison Guth; Alan Stuart
Cc:
Subject: 2005 Lower Saluda/Upper Congaree River Diadromous Fish Study Summary Report -- Draft for Agency Review

Hello folks:

Attached for your review is the Draft Summary Report of SCE&G's diadromous fish sampling efforts in the Lower Saluda and Upper Congaree Rivers during 2005. Please have your comments back to me by December 14, 2005. This will allow sufficient time to incorporate any changes to the 2006 study plan that are deemed necessary based on the 2005 results. Thanks for your continued input and interest in the Saluda Diadromous Studies.

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



2005 Saluda
diadromous Summary

Cheryl Balitz

From: RMAHAN@scana.com
Sent: Tuesday, November 08, 2005 4:58 PM
To: BARGENTIERI@scana.com; Alison Guth
Cc: Shane Boring; Amanda Hill; Hal Beard; Alan Stuart; mark_a_cantrell@fws.gov; SUMMER, STEPHEN E; dchristie@infoave.net
Subject: RE: American Eel Report

I saw only a couple of small items. One is the expiration date for the current Saluda license, which is not August 31, 2005, but 2010. And I'm not sure it is correct to say that the Saluda project lies **along** the banks of the Saluda River so much as **astride** the Saluda River – or words to that effect.

From: ARGENTIERI, WILLIAM R
Sent: Tuesday, November 08, 2005 4:08 PM
To: 'Alison Guth'
Cc: Shane Boring; 'Amanda Hill'; 'Hal Beard'; Alan Stuart; 'mark_a_cantrell@fws.gov'; SUMMER, STEPHEN E; MAHAN, RANDOLPH R; 'dchristie@infoave.net'
Subject: RE: American Eel Report

Alison,

Good job on this report. I have added wording and one comment on page 15, just above Table 1 (see attached document).

Bill

From: Alison Guth [mailto:Alison.Guth@KleinschmidtUSA.com]
Sent: Thursday, November 03, 2005 11:27 AM
To: Shane Boring; 'Amanda Hill'; ARGENTIERI, WILLIAM R; 'Hal Beard'; Alan Stuart; 'mark_a_cantrell@fws.gov'; SUMMER, STEPHEN E; MAHAN, RANDOLPH R; 'dchristie@infoave.net'
Subject: American Eel Report

Good Morning,

Attached to this email is a draft copy of the 2005 American Eel Survey Report. Please take a look at it and let me know if you have any comments by November 18th. If at all possible, please put any edits to content in track changes. It is quite a large file, so let me know if you have any problems opening it and I will get it to you another way. Thanks so much for all of your involvement, and as always, give me a call if you have any questions.

Thanks,
Alison

<<Diad Fish Eel Survey (11-3-2005 acgdraft).doc>>

Alison Guth

Licensing Coordinator

Kleinschmidt Associates

101 Trade Zone Drive

Suite 21A

West Columbia, SC 29170
P: (803) 822-3177
F: (803) 822-3183

Kacie Jensen

From: Prescott Brownell [Prescott.Brownell@noaa.gov]
Sent: Thursday, March 17, 2005 10:52 AM
To: Shane Boring
Cc: Mark A. Cantrell (mark_a_cantrell@fws.gov); Amanda Hill (amanda_hill@fws.gov); 'Steve Summer'; Alan Stuart; BARGENTIERI@scana.com; RMAHAN@scana.com; Alison Guth
Subject: Shortnose sturgeon HSI Curves



Revised SNS
Model.xls (26 KB)

Shane Boring wrote:

>Hello All:

>

>Attached for your review are the draft meeting notes from our 3/2/05
>conference call with NOAA Fisheries regarding shortnose sturgeon
>sampling/permitted. If possible, please provide me with your comments
>by Thursday, March 31st, 2005. Thanks for your continued interest and
>participation in the diadromous fish sampling issue.

>

>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

>

>

>

>

>

Hello Team,

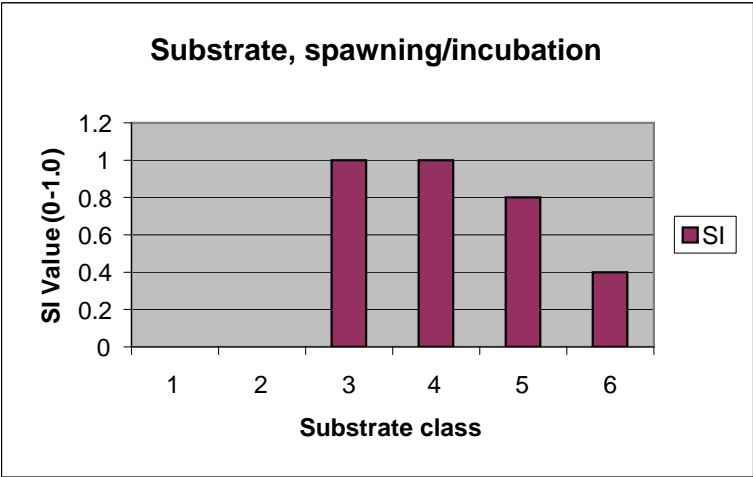
Attached is an excel file with draft HSI curves for shortnose sturgeon spawning and larval development habitat that are part of a draft model we are developing for application in SC. We have used the curves already in several IFIM/PHABSIM studies, based on fairly extensive expert review.

fyi

PB

Revised Shortnose Sturgeon Spawning Habitat Model
V3: Substrate, spawning and incubation.

Code	SI	Substrate [Description
1	0	Mud, soft clay/fines
2	0	Silt, sand < 2.0mm
3	1	Sand/gravel ≥ 2.0mm
4	1	Cobble/gravel > 64mm to 250mm
5	0.8	Boulder, 250-4000mm
6	0.4	Bedrock



Kacie Jensen

From: Amanda_Hill@fws.gov
Sent: Wednesday, January 26, 2005 10:16 AM
To: Shane Boring
Cc: Alan Stuart; Alison Guth; BARGENTIERI@scana.com; Hal Beard (BeardH@scdnr.state.sc.us); 'dchristie@infoave.net'; Jeff Isely (jsiely@clermson.edu); KMASSEY@scana.com; 'leachs@dnr.sc.gov'; 'mark_a_cantrell@fws.gov'; Prescott Brownell (prescott.brownell@NOAA.gov); RMAHAN@scana.com; Steve Summer (ssummer@scana.com); EPPINK, THOMAS G
Subject: Re: Final Saluda Diadromous Fish Study Plan 2005-01-11.pdf

Shane,

Just a few comments on the final plan.

Page 3, 5th paragraph: The species list to be compiled during the study should record all species encountered, not just diadromous species.

Page 3, last paragraph: Ichthyoplankton samples should be preserved in Buffered Neutral Formalin (BNF), not in alcohol. The alcohol may effect the eggs making identification difficult

Page 4, paragraph (b): We recommend the draft and final reports be provided to the resource agencies prior to December 31, 2005. If additional field work is warranted in 2006, then an appropriate amount of time should be provided for preparation. We recommend the Final report be provided no later than Nov. 1, 2005

Thanks,

Amanda Hill
Fisheries Biologist
U.S. Fish and Wildlife Service
176 Croghan Spur Rd., Suite 200
Charleston, SC 29407
843-727-4707 ext. 24
843-727-4218 fax
amanda_hill@fws.gov

"Our mission is working with others to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people."

Kacie Jensen

From: Shane Boring
Sent: Monday, December 18, 2006 10:38 AM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle
Cc: 'Tom Murphy'; 'Ed_Eudaly@fws.gov'
Subject: Saluda Hydro Relicense: November 06 wood stork update



November 06 wood
stork update.... 11:

The final Lake Murray Wood Stork Survey for 2006 was performed by Tom Murphy with SCDNR on Monday, November, 27th. No wood storks were observed. Tom did note that a number of the wetlands along the Saluda above Lake Murray, which were dry during previous surveys, have refilled due to recent rains. He added that storks were still present in low numbers along the SC coast at the time of survey, but suggested that the impending cooler weather would likely drive these birds south in the near future. A draft report summarizing this year's wood stork surveys will be issued by January 1. Thank you for your continued interest in the Lake Murray wood stork surveys.

Thanks
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

MEMORANDUM

TO: Saluda Hydro Project Relicensing Stakeholders

FROM: Shane Boring

DATE: December 18, 2006

RE: November 2006 Wood Stork Aerial Survey Observations

Dear Relicensing Stakeholder:

The final Lake Murray Wood Stork Survey for 2006 was performed by Tom Murphy with SCDNR on Monday, November, 27th. No wood storks were observed. Tom did note that a number of the wetlands along the Saluda above Lake Murray, which were dry during previous surveys, have refilled due to recent rains. He added that storks were still present in low numbers along the SC coast at the time of survey, but suggested that the impending cooler weather would likely drive these birds south in the near future. A draft report summarizing this year's wood stork surveys will be issued by January 1. Thank you for your continued interest in the Lake Murray wood stork surveys.

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

Kacie Jensen

From: Jennifer Summerlin
Sent: Tuesday, December 12, 2006 9:25 AM
To: 'Wade Bales (balesw@dnr.sc.gov)'; 'Amanda Hill'; 'Bill Argentieri'; 'Dick Christie'; 'Gerrit Jobsis (American Rivers)'; 'Hal Beard'; 'Jim Glover'; 'Prescott Brownell'; 'Randy Mahan'; 'Ron Ahle'; Shane Boring; 'Steve Summer'; Brandon Kulik; Alan Stuart
Subject: Saluda Relicensing: November 28th LSR Site Recon

All:

Attached below is a summary of the November 28th lower Saluda River site reconnaissance. If you have any comments, please have them back to me by December 27, 2006.



2006-11-28 Saluda
Instream Flo...

Thanks,

Jennifer Summerlin
Scientist Technician
Kleinschmidt Associates
101 Trade Zone Drive, Suite 21A
West Columbia, SC 29170
P:803.822.3177
F:803.822.3183

Kacie Jensen

From: Gerrit Jobsis [gjobsis@americanrivers.org]
Sent: Tuesday, November 28, 2006 8:49 AM
To: Alison Guth; mpqandrhq@bellsouth.net; balesw@dnr.sc.gov; Amanda Hill; BARGENTIERI@scana.com; Dick Christie; Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; mquattlebaum@scana.com; Prescott Brownell; RMAHAN@scana.com; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart
Subject: RE: IFIM/Aquatic Habitat TWC Meeting

Here are my comments to the draft study plan as discussed in the November 27 meeting. <<Instream Flow Study of Lower Saluda River DRAFT 2006-11-08- jobsis comments.doc>>

Gerrit Jöbsis

Director of Southeast Conservation

American Rivers

2231 Devine Street, Suite 100 • Columbia, S.C. 29205

803/771-7114

803/771-7580 Fax

gjobsis@americanrivers.org

www.AmericanRivers.org

American Rivers protects and restores healthy natural rivers for the benefit of communities, fish and wildlife.

-----Original Appointment-----

From: Alison Guth [<mailto:Alison.Guth@KleinschmidtUSA.com>]

Sent: Monday, November 20, 2006 5:05 PM

To: mpqandrhq@bellsouth.net; balesw@dnr.sc.gov; Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis; Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; mquattlebaum@scana.com; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart

Subject: IFIM/Aquatic Habitat TWC Meeting

When: Monday, November 27, 2006 9:30 AM-3:00 PM (GMT-05:00) Eastern Time (US & Canada).

Where: Lake Murray Training Center

Hello All,

Just a reminder that we have a IFIM/Aquatic Habitat TWC Meeting Scheduled for Monday, November 27 at 9:30

10/26/2007

at the **Lake Murray Training Center**. There is also a tentative field visit scheduled for Tuesday, November 28. I will be sending out a separate reminder for the 28th shortly. **Please RSVP by 12:00 pm Wednesday for lunch.** The agenda for Monday is attached below. Thanks, Alison

<<LSR IFIM agenda 11-27-2006.doc>>

<< File: LSR IFIM agenda 11-27-2006.doc >>

Kacie Jensen

From: Shane Boring
Sent: Wednesday, November 08, 2006 3:03 PM
To: Wade Bales (balesw@dnr.sc.gov); Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart
Cc: Jennifer Summerlin; Alison Guth
Subject: Saluda Hydro Relicense: Draft Instream Flow Study Plan

All:

Attached for your review is the draft Instream Flow Study Plan for Saluda Hydro. Please review the plan prior to our next Instream Flow TWC meeting, scheduled for Nov 27-28, and be prepared to discuss any concerns regarding the study design. Thanks to all who contributed to development of the draft plan.

Please note that, due to file format issues, Appendix A of the plan is included as a separate file.

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



Instream Flow
Study of Lower S...



Saluda IFIM study
plan - appen...

Cheryl Balitz

From: Gerrit Jobsis [gjobsis@americanrivers.org]
Sent: Tuesday, November 28, 2006 8:49 AM
To: Alison Guth; mpqandrhq@bellsouth.net; balesw@dnr.sc.gov; Amanda Hill; BARGENTIERI@scana.com; Dick Christie; Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; mquattlebaum@scana.com; Prescott Brownell; RMAHAN@scana.com; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart
Subject: RE: IFIM/Aquatic Habitat TWC Meeting

Here are my comments to the draft study plan as discussed in the November 27 meeting. <<Instream Flow Study of Lower Saluda River DRAFT 2006-11-08- jobsis comments.doc>>

Gerrit Jöbsis

Director of Southeast Conservation

American Rivers

2231 Devine Street, Suite 100 • Columbia, S.C. 29205

803/771-7114

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gjobsis@americanrivers.org

www.AmericanRivers.org

American Rivers protects and restores healthy natural rivers for the benefit of communities, fish and wildlife.

-----Original Appointment-----

From: Alison Guth [<mailto:Alison.Guth@KleinschmidtUSA.com>]

Sent: Monday, November 20, 2006 5:05 PM

To: mpqandrhq@bellsouth.net; balesw@dnr.sc.gov; Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis; Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; mquattlebaum@scana.com; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart

Subject: IFIM/Aquatic Habitat TWC Meeting

When: Monday, November 27, 2006 9:30 AM-3:00 PM (GMT-05:00) Eastern Time (US & Canada).

Where: Lake Murray Training Center

Hello All,

Just a reminder that we have a IFIM/Aquatic Habitat TWC Meeting Scheduled for Monday, November 27 at 9:30

8/15/2007

at the **Lake Murray Training Center**. There is also a tentative field visit scheduled for Tuesday, November 28. I will be sending out a separate reminder for the 28th shortly. **Please RSVP by 12:00 pm Wednesday for lunch.** The agenda for Monday is attached below. Thanks, Alison

<<LSR IFIM agenda 11-27-2006.doc>>

<< File: LSR IFIM agenda 11-27-2006.doc >>

Kacie Jensen

From: Shane Boring
Sent: Monday, November 06, 2006 2:52 PM
To: Wade Bales (balesw@dnr.sc.gov); Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart
Subject: Saluda Hydro Relicense: Draft Trout Reproduction Paper

Dear Instream Flow/Aquatic Habitat TWC Members:

Attached for your review is the first draft of the white paper examining the potential for natural trout reproduction in the Lower Saluda River. Please submit your comments, preferably in MS Word track changes, by Tuesday November 21, 2006.

Regards,
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



Saluda Trout Paper
DRAFT 2006-...

Kacie Jensen

From: Brandon Kulik
Sent: Tuesday, November 14, 2006 4:59 PM
To: Alison Guth; 'Amanda Hill'; 'Bill Argentieri'; 'Dick Christie'; 'Gerrit Jobsis (American Rivers)'; 'Hal Beard'; 'Prescott Brownell'; 'Ron Ahle'; 'Scott Harder'; Shane Boring; Alan Stuart
Subject: Draft IFIM HSI guilding straw man

Hello all,

One of my homework assignments from the October meeting was to assemble a conceptual framework for slotting species and lifestages into habitat use guilds. Attached is a first pass at doing that. Please consider it to be a work in progress, at this point I am primarily seeking input as to whether you think that the way I have slotted species and lifestages according to guild categories seems reasonable. I am sending this out ahead of the meeting so that those of you who have a bit of time can digest this so that we can make the most of our upcoming meeting time.

Fortunately we have prior recent regional studies to draw on that appear to have well-thought-out criteria. As suggested by the TWC, for the most part I followed conventions established in the Catawba and Pee Dee studies. I know that a number of you worked on those studies and therefore probably have an intuitive sense of the applicability of those criteria to this study and thus your input will be very helpful. At this juncture the main thing to look at is columns A-H in the attached spreadsheet, where I have populated the guilds with the species and lifestages discussed in the meeting.

Columns I and J are my initial impressions of specific study sources and criteria that could be plugged in, and are of secondary concern for the moment, though your thoughts are welcome.

A few life stage categories of interest in this study cropped up that were not directly addressed in the Pee Dee and Catawba studies. In such cases, I have suggested what seems reasonable to me a reasonable candidate guild, but of course these are always open to discussion and refinement. In a few cases I left the criteria blank (marked as "TBD") pending further technical discussion from the team.

As Shane has already noted, I did a quick straw poll by phone with as many of you as I could reach earlier today to get some feedback on various aspects of the study design. There seems to be some interest in viewing and chatting informally about this homework assignment prior to the meeting. The goal is just to gather our thoughts as a study team on the subject, do a sanity-check brainstorm on the matrix structure, but not necessarily reach any formal consensus, since not everyone will likely be able to join in. Probably a short 15-30 minute call. Based on availability, it appears (surprisingly) that Wednesday PM will be relatively convenient for most folks. Shane will handle call coordination.

In the mean time feel free to contact me with any technical questions, and please have a safe and enjoyable Thanksgiving.

Brandon

Brandon H Kulik
Senior Fisheries Biologist
Kleinschmidt Energy & Water Resources
75 Main Street
Pittsfield, ME 04967
(207) 487-3328
Fax: 487-3124



guild table.xls (25
KB)

GUILD CATEGORY

species	life stage	GUILD CATEGORY				habitat generalist	limiting rapid	SI curve source	species
		shallow-slow	shallow fast	deep slow	deep fast				
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	
Highfin carpsucker	spawning		X		X		Catawba-Wateree	guild surrogate	
Highfin carpsucker	fry/YOY				X		Catawba-Wateree	guild surrogate	
Highfin carpsucker	juvenile				X		Catawba-Wateree	guild surrogate	
Highfin carpsucker	adult			X			Catawba-Wateree	guild surrogate (redbreast sunfish adult?)	
Northern carpsucker	spawning				X		Catawba-Wateree	guild surrogate	
Northern carpsucker	fry/YOY				X		Catawba-Wateree	guild surrogate	
Northern carpsucker	juvenile				X		Catawba-Wateree	guild surrogate	
Northern carpsucker	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)	brown trout	
brown trout	fry/YOY	X					Catawba-Wateree (if transferable)	brown trout	
brown trout	juvenile	X					Catawba-Wateree (if transferable)	brown trout	
brown trout	adult			X	X		Catawba-Wateree (if transferable)	brown trout	
rainbow trout	spawning		X				Catawba-Wateree (if transferable)	rainbow trout	
rainbow trout	fry/YOY	X					Catawba-Wateree (if transferable)	rainbow trout	
rainbow trout	juvenile		X		X		Catawba-Wateree (if transferable)	rainbow trout	
rainbow trout	adult				X		Catawba-Wateree (if transferable)	rainbow trout	
redbreast sunfish	spawning	X					Catawba-Wateree		
marginated madtom	adult		X				Catawba-Wateree		
saluda darter	adult		X				Catawba-Wateree or Pee Dee		
redbreast sunfish	adult			X			Catawba-Wateree		
shorthead redhorse	adult				X		Catawba-Wateree	golden redhorse	
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		
shortnose sturgeon	passage					X	Conte Lab-American Rivers		
American eel	juvenile					X	none recommended at this time		

benthic macroinver. juvenile

X

Kacie Jensen

From: Shane Boring
Sent: Tuesday, October 31, 2006 11:52 AM
To: Steve Summer; Alan Stuart; Amanda Hill; Bill Argentieri; Gerrit Jobsis (American Rivers); Jennifer Price ; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Cc: Jennifer Summerlin; Cheryl Balitz; Wade Bales (balesw@dnr.sc.gov); Alison Guth; Bill East; Bill Hulslander; Bill Marshall; Bob Perry ; Bob Seibels (bseibels@yahoo.com); Charlene Coleman; Daniel Tufford; Dick Christie; Ed Diebold; George Duke; Gina Kirkland; Hal Beard; Jeff Duncan; Jennifer O'Rourke; Jim Goller; Joe Logan; Joy Downs; Larry Turner (turnerle@dhec.sc.gov); Laura Boos (laura.mccary@gmail.com); Malcolm Leaphart; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Prescott Brownell; Ralph Crafton; Reed Bull (rbull@davisfloyd.com); Robert Lavisky; 'Sam Drake'; Scott Harder; Steve Bell; Steve Leach; Suzanne Rhodes; Tom Bowles (tbowles@scana.com)
Subject: Saluda Hydro Relicense: Mussel Report - Final



Saluda Hydro
Mussel Report (fi...

ear Freshwater Mussels and Benthic Macroinvertebrate TWC Members:

Attached for your records is the final report from John Alderman summarizing results of the mussel surveys conducted this past summer on Lake Murray and the Lower Saluda and Congaree rivers. As always, the report will be posted to the Saluda Relicensing Website. Thanks for your continued participation in the relicensing process.

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

Cheryl: Could you please post under documents section of the Saluda website. Thanks.

Kacie Jensen

From: Shane Boring
Sent: Tuesday, October 31, 2006 11:33 AM
To: Steve Summer; Alan Stuart; Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American Rivers); Jennifer Summerlin; Jim Glover; Prescott Brownell; Randy Mahan; Shane Boring; Steve Leach
Cc: Cheryl Balitz; Jennifer Summerlin; Wade Bales (balesw@dnr.sc.gov); Alison Guth; Bill East; Bill Hulslander; Bill Marshall; Bob Perry ; Bob Seibels (bseibels@yahoo.com); Charlene Coleman; Daniel Tufford; Ed Diebold; George Duke; Gina Kirkland; Hal Beard; Jeff Duncan; Jennifer O'Rourke; Jim Goller; Joe Logan; Joy Downs; Larry Turner (turnerle@dhec.sc.gov); Laura Boos (laura.mccary@gmail.com); Malcolm Leaphart; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Ralph Crafton; Reed Bull (rbull@davisfloyd.com); Robert Lavisky; Ron Ahle; 'Sam Drake'; Scott Harder; Steve Bell; Suzanne Rhodes; Tom Bowles (tbowles@scana.com)
Subject: Saluda Hydro Relicense: Final 2006 Diadromous Fish Report

Dear Diadromous Fish TWC and Fish and Wildlife RCG Members:

Attached for your records is the final report summarizing the diadromous fish sampling conducted in the Lower Saluda and Congaree Rivers during 2006. Please note that this report summarizes the shad and herring sampling results only; efforts to sample American eels are being summarized under a separate cover. Thanks for your continued dedication to the Saluda relicensing process and please do not hesitate to call should you have any questions regarding the report.

C. Shane Boring
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101 Trade Zone Dr., Suite-21A
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Phone: (803)822-3177
Fax: (803)822-3183



2006 Saluda
iadromous Report ..

Cheryl: Please post to the Saluda relicensing website with the other diadromous reports. Thanks.

Kacie Jensen

From: Gerrit Jobsis [gjobsis@americanrivers.org]

Sent: Monday, October 16, 2006 5:48 PM

To: Shane Boring; Amanda Hill; BARGENTIERI@scana.com; Dick Christie; Hal Beard; Malcolm Leaphart; Prescott Brownell; RMAHAN@scana.com; Ron Ahle; Scott Harder; Theresa Thom; Brandon Kulik; Alan Stuart; Jeff_Duncan@nps.gov

Subject: RE: Saluda Hydro: Lower Saluda IFIM Study

Here is the Progress Energy flow study plan and species curves for Brandon's consideration when developing a draft study plan

Gerrit Jöbsis

Director of Southeast Conservation

American Rivers

2231 Devine Street, Suite 100 • Columbia, S.C. 29205

803/771-7114

803/771-7580 Fax

gjobsis@americanrivers.org

www.AmericanRivers.org

American Rivers protects and restores healthy natural rivers for the benefit of communities, fish and wildlife.

Kacie Jensen

From: theresa_thom@nps.gov
Sent: Wednesday, October 11, 2006 4:51 PM
To: Shane Boring
Cc: Ron Ahle; Alan Stuart; Amanda Hill; balesw@dnr.sc.gov; BARGENTIERI@scana.com; Hal Beard; Brandon Kulik; Dick Christie; Gerrit Jobsis (American Rivers); Jim Glover; Scott Harder; Jennifer Summerlin; Malcolm Leaphart; Prescott Brownell; RMAHAN@scana.com; Shane Boring; Steve Summer
Subject: Re: Congaree Flow Studies

Shane and the Instream Flow/Aquatic Habitat TWC:

Please find the attached document (PDF). This literature review was compiled by Dr. Will Graf and Laura Stroup at USC and includes documents relevant to the resources of the Saluda, Broad and Congaree Rivers. Information was compiled from September 2005 to May 2006, so any finalized studies past May 2006 have not been included. This report contains citations and accompanying annotations of sources related to the physical, chemical, biological, and socio-economic aspects of the three river basins. NOTE: This is still a draft document. -- Theresa Thom

Theresa A. Thom, Ph.D.
Congaree National Park
100 National Park Road
Hopkins, SC 29061
803-695-0214 (phone)
803-776-1555 (fax)
theresa_thom@nps.gov

"Shane Boring"

<Shane.Boring@KleinschmidtUSA.com>

09/12/2006 05:17 PM AST

To: <theresa_thom@nps.gov>
cc: <balesw@dnr.sc.gov>, "Amanda Hill" <amanda_hill@fws.gov>, "Bill Argentieri" <bargentieri@scana.com>, "Dick Christie" <dchristie@infoave.net>, "Gerrit Jobsis (American Rivers)" <gjobsis@americanrivers.org>, "Hal Beard" <beardh@dnr.sc.gov>, "Jennifer Summerlin" <Jennifer.Summerlin@KleinschmidtUSA.com>, "Jim Glover" <GloverJB@dhec.sc.gov>, "Malcolm Leaphart" <malcolml@mailbox.sc.edu>, "Prescott Brownell" <prescott.brownell@noaa.gov>, "Randy Mahan" <rmahan@scana.com>, "Ron Ahle" <ahler@dnr.sc.gov>, "Scott Harder" <HarderS@dnr.sc.gov>, "Shane Boring" <shane.boring@kleinschmidtusa.com>, "Steve Summer" <ssummer@scana.com>, "Brandon Kulik" <Brandon.Kulik@KleinschmidtUSA.com>, "Alan Stuart" <Alan.Stuart@KleinschmidtUSA.com>
Subject: Congaree Flow Studies

Theresa:

As discussed in the Instream Flow TWC meeting last week, I have compiled the available studies that I could find on potential influences of the Lower Saluda (an in turn Saluda Hydro) on Congaree flows at the National Park (see attached). I'm interested to see what additional studies/data are available from NPS; I'm certain you guys have many more sources than I was able to locate. Thanks.

10/29/2007

Shane

C. Shane Boring
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<<Congaree Floodplain Bibliography.doc>>

Kacie Jensen

From: Shane Boring
Sent: Thursday, October 05, 2006 3:08 PM
To: Steve Summer; Alan Stuart; Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American Rivers); Jennifer Summerlin; Jim Glover; Prescott Brownell; Randy Mahan; Shane Boring; Steve Leach
Cc: Wade Bales (balesw@dnr.sc.gov); Alison Guth; Bill East; Bill Hulslander; Bill Marshall; Bob Perry ; Bob Seibels (bseibels@yahoo.com); Charlene Coleman; Daniel Tufford; Ed Diebold; George Duke; Gina Kirkland; Hal Beard; Jeff Duncan; Jennifer O'Rourke; Jim Goller; Joe Logan; Joy Downs; Larry Turner (turnerle@dhec.sc.gov); Laura Boos (laura.mccary@gmail.com); Malcolm Leaphart; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Ralph Crafton; Reed Bull (rbull@davisfloyd.com); Robert Lavisky; Ron Ahle; 'Sam Drake'; Scott Harder; Steve Bell; Suzanne Rhodes; Tom Bowles (tbowles@scana.com)
Subject: Saluda Hydro Relicense: 2006 Draft Diadromous Fish Report

Dear Diadromous Fish Technical Working Committee Members:

Attached for your review is the draft report for the 2006 diadromous fish sampling in the Lower Saluda and Congaree Rivers. Please have comments on the draft report to me by October 26th. Thanks for your continued interest in the Saluda Hydro relicensing process.

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



2006 Saluda
iadromous Report ..

Kacie Jensen

From: Jennifer Summerlin
Sent: Thursday, September 21, 2006 9:10 AM
To: 'Steve Summer'; Alan Stuart; 'Amanda Hill'; 'Bill Argentieri'; 'Dick Christie'; 'Gerrit Jobsis (American Rivers)'; 'Jim Glover'; 'Prescott Brownell'; 'Randy Mahan'; Shane Boring; 'Steve Leach'
Subject: Saluda Relicensing: 2006 American eel report

Hello Folks,

Attached for your review is the 2006 American eel report for the Lower Saluda River. Please have comments on the draft report by Thursday, October 5th.



2006 Diadromous
Fish Eel Surve...

Thanks,

Jennifer Summerlin
Research Technician
Kleinschmidt Associates
101 Trade Zone Drive
Suite 21 A
West Columbia, SC 29170
P: (803) 822.3177
F: (803) 822.3183

Kacie Jensen

From: Shane Boring
Sent: Wednesday, September 13, 2006 1:19 PM
To: Steve Summer; Alan Stuart; Amanda Hill; Bill Argentieri; Gerrit Jobsis (American Rivers); Jennifer Price ; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Cc: Wade Bales (balesw@dnr.sc.gov); Alison Guth; Bill East; Bill Hulslander; Bill Marshall; Bob Perry ; Bob Seibels (bseibels@yahoo.com); Charlene Coleman; Daniel Tufford; Dick Christie; Ed Diebold; George Duke; Gina Kirkland; Hal Beard; Jeff Duncan; Jennifer O'Rourke; Jim Goller; Joe Logan; Joy Downs; Larry Turner (turnerle@dhec.sc.gov); Laura Boos (laura.mccary@gmail.com); Malcolm Leaphart; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Prescott Brownell; Ralph Crafton; Reed Bull (rbull@davisfloyd.com); Robert Lavisky; 'Sam Drake'; Scott Harder; Steve Bell; Steve Leach; Suzanne Rhodes; Tom Bowles (tbowles@scana.com)
Subject: Saluda Hydro Relicense: Mussel Report Draft



kleinschmidt2006dr
aft060808.pd...

Dear Freshwater Mussel/Macroinvertebrate TWC Members:

Attached for your review is the "agency draft" of the report summarizing findings of the freshwater mussel survey performed on the Lake Murray and the Lower Saluda and Congaree rivers by John Alderman. Please have comments on the draft report by Monday, October 2nd. Please accept our apologies for only providing the report in PDF format; the maps will not display properly in MS Word. Thanks and please don't hesitate to call should you have any questions regarding the study.

C. Shane Boring
Environmental Scientist
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West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

Kacie Jensen

From: Reed Bull [rbull@davisfloyd.com]
Sent: Thursday, September 07, 2006 8:10 AM
To: Alison Guth; Shane Boring; Jim Ruane
Subject: Lake Murray Fish Kills

Below is the information on fish kills obtained from SCDNR records. I will either mail or scan and E-mail the backup data referenced to you. Please advise if you should have any questions. REED BULL

STRIPED BASS DIE-OFF EVENTS
FROM SCDNR RECORDS
LAKE MURRAY
PERIOD 1971 THROUGH 2005

<u>PERIOD</u>	<u>DATES</u>	<u>FISH KILL COUNTS</u>	<u>SIZE</u>	<u>REPORTED CAUSE</u>	<u>COMMENTS</u>
1971* – 1977	N/A	N/A	N/A	N/A	See SCDNR Annual Report Sec. – Fish Kill Investigations See Item 1
Summer 1990	8/17/1990	1157	12" – 37"	DO Depletion Thermal Stress	Lake Down During Period, See Item 2
Summer 1991	7/19/91 -8/16/91	3139	12" – 41"	DO Depletion Thermal Stress	Lake Down During Period, See Item 3
Summer 1993	9/9/93 – 9/16/93	592	15" – 23"	DO Depletion Thermal Stress	See Item 4
Summer 1994	8/15/94 – 9/14/94	64	N/A	DO Depletion Thermal Stress	See Item 5
Summer 1998	7/30/98 – 8/10/98	456	N/A	DO Depletion Thermal Stress	See Item 6
Summer 2005	Several Weeks Aug. 2005	742	17" – 38"	DO Depletion Thermal Stress	See Item 7 Lake Drawn Down 3 Year Prior to Kill

* STRIPED BASS STOCKING BEGAN IN 1971

Kacie Jensen

From: Shane Boring
Sent: Wednesday, September 06, 2006 9:07 AM
To: 'Malcolm Leaphart'
Subject: RE: Saluda Hydro Relicense: Sept 7th Instream Flow and Aquatic Habitat TWC



2006-06-30 Memo -
Review of LS...

Malcolm:

Brandon's memo regarding the initial IFIM study on the Saluda is attached. Please accept my apologies on taking so long to get it to you. I was on vacation last week. Thanks.

Shane

-----Original Message-----

From: Malcolm Leaphart [mailto:malcolml@mailbox.sc.edu]
Sent: Monday, August 21, 2006 10:51 AM
To: Shane Boring
Cc: Alison Guth; theresa_thom@nps.gov; balesw@dnr.sc.gov; Amanda Hill; BARGENTIERI@scana.com; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Prescott Brownell; RMAHAN@scana.com; Ron Ahle; Scott Harder; Steve Summer; Brandon Kulik; Alan Stuart
Subject: Re: Saluda Hydro Relicense: Sept 7th Instream Flow and Aquatic Habitat TWC

Shane,

I plan to attend the next Instream Flow TWC. Thanks for the notice.

Also, I need a copy of Brandon Kulik's memo on the previous IFIM by SC DNR as I catch up from missing the last meeting.

And, I have embedded below in this reply the July article by Pat Robertson regarding the Corps solution to dissolved oxygen in Lake Russell to make sure that all on this TWC learns of this effort. You may also want to share, or have Alison share it with those on other appropriate groups, such as the Operations RCG.

Quoting Shane Boring <Shane.Boring@KleinschmidtUSA.com>:

> Hello all:

>

> This is to confirm that our next of the Instream Flow/Aquatic Habitat
> TWC will be on Thursday, September 7th, from 9:30 am to 3:30 pm. This
> may turn out be one of our most well-attended Instream Flow TWC's. So
> far the following folks have indicated they will be attending:

>

> Amanda Hill
> Dick Christie
> Brandon Kulik
> Alan Stuart
> Shane Boring
> Randy Mahan
> Prescott Brownell
> Hal Beard
> Bill Argentieri
> Gerrit Jobsis

>

> Details regarding the meeting location will be forthcoming.

>

> Thanks,

>
> 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

> > -----Original Message-----

> > From: Shane Boring
> > Sent: Wednesday, August 09, 2006 2:19 PM
> > To: Shane Boring; 'theresa_thom@nps.gov'; Wade Bales
> > (balesw@dnr.sc.gov); Amanda Hill; Bill Argentieri; Dick Christie;
> > Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim
> > Glover; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder;
> > Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
> > Cc: Brandon Kulik
> > Subject: RE: Saluda Hydro Relicense: Review of 1990 Saluda IFIM
> > Study

> > Hello folks:

> > After speaking with several of you, it now looks as if Wednesday,
> > September 7th may be a better date for the proposed Instream Flow
> > TWC meeting. This will allow folks that are traveling from out of
> > state not to have to travel over the holiday weekend. Also, Brandon
> > Kulik from Kleinschmidt's Maine office would like at least a day to
> > see the river before the meeting. Please let me know if your
> > availability. Please feel free to propose alternate dates during
> > this week if the 7th won't work for you. Thanks.

> > Shane

> > 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

> > -----Original Message-----

> > From: Shane Boring
> > Sent: Tuesday, August 01, 2006 5:04 PM
> > To: 'theresa_thom@nps.gov'; Wade Bales (balesw@dnr.sc.gov);
> > Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American
> > Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Prescott
> > Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve
> > Summer; Brandon Kulik; Alan Stuart
> > Cc: Brandon Kulik
> > Subject: Saluda Hydro Relicense: Review of 1990 Saluda
> > IFIM Study

> > Dear Saluda Relicensing Instream Flow/Aquatic Habitat Technical
> > Working Committee Member:

> > Per our discussions at the June 14th meeting, Brandon Kulik
> > (instream flow specialist at Kleinschmidt) has prepared a memo
> > summarizing the 1990 IFIM study and its applicability to the current
> > relicensing effort (see attached). This memo is intended to serve
> > as a starting point for technical discussion regarding the need for
> > and/or scope of additional relicensing-related flow studies. Once

> > everyone has had a couple of weeks to review the memo, we would like
> > to schedule a meeting in early September for Brandon to come and
> > meet with the group. How about Tuesday, September 5th? This will
> > likely be an all-day meeting. 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
> >

> > << File: 2006-06-30 Memo - Review of LSR Instream Flow Study.pdf
> > >>
> >

> Posted on Sun, Jul. 16, 2006email thisprint this

Outdoors

Club wants fish to breath a little easier

By PAT ROBERTSON

Columnist

STRIPED BASS AND other fish species in Lake Thurmond will breathe easier in the hot summer when oxygen levels are depleted, thanks to the efforts of the Clark Hill Striper Club.

Heeding appeals of the striper club and others, the U.S. Senate has restored funding in the fiscal 2007 Energy and Water Appropriations Bill for a system designed to provide oxygen-enriched habitat for fish in the lower end of Lake Thurmond during hot weather.

Funding had been cut in the House version of the bill. When word reached the striper club and other area fishermen of the House action, the striper fishermen mobilized an effort to get the funds restored.

They began a letter-writing and e-mail campaign to senators and U.S. House members in both Georgia and South Carolina, took the issue to the Augusta-area press, and organized a petition drive that garnered 13 pages of signatures in a one-day radio broadcast from West Marine in Augusta.

The Senate version provides \$4.6 million for the project, lower than the \$5.5 million the U.S. Army Corps of Engineers sought, but adequate to complete the system, which is 90 percent design complete. The budget now goes to a Senate- House Conference Committee to work out details, and Washington sources said the House is not expected to object to the reinstated funding.

The oxygen-infusion system, called a "bubble line," is expected to be completed and operational by late 2008, said Ed Lepley a striper club member from Martinez, Ga.

The project will consist of several miles of submerged pipes, perforated with tiny holes, located about five miles up the lake from Thurmond Dam in the Hamilton Branch-Modoc area. During times of low oxygen levels in the lake, pure oxygen will be released along this bubble line.

The cold, oxygenated water will offer opportunities for striped bass and baitfish to congregate in the Modoc area. Currently, big stripers, and the herring and shad they eat, often stay upriver toward the Russell Dam tailrace during hot weather.

"As water quality begins to deteriorate on the lower end of the lake during the hot summer months, they will be able to turn the oxygen on and provide oxygenated habitat for striped bass, hybrids, largemouths and other species," Lepley said.

"The bigger stripers now move up to the Lake Russell Dam tailrace this time of year because Russell Dam had a system to inject oxygen into the tail race when it is generating. That was done because, when the water is pumped back up into

Russell, it loses oxygen."

The corps agreed to build the bubble line to offset the loss of baitfish that are killed when Russell Dam's reversible turbines are operated. Currently, a court order allows the corps to use only two of Russell's four reversible units until the oxygen system is in place.

If the corps could use all four turbines, they could make more electricity and further slow the decline of lake levels, which is one reason the corps wants the oxygen system as badly as the fishermen do.

Augusta Chronicle outdoor columnist Rob Pavey noted that the recent declaration of drought across most of Georgia, and predictions that water levels at Thurmond Lake will soon plummet, makes the oxygen system even more important.

There is precedent for the oxygen infusion system, Lepley noted. A similar system was placed in Tennessee's Lake Cherokee which gets really hot and oxygen deficient in the summer months.

"It worked so well there they had to put in an off-limit fishing zone around it for that time of year because the fish would bunch up around it and fishermen were catching too many," Lepley said.

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 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 rationale 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 (50th 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

(Note: For illustrative purposes only; seasonality and flow information will be refined in coordination with the TWC.)

Species-Based Prioritization Matrix		LSR										
Month	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	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 r 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										
Month	LSR median flow (cfs)	<i>shallow slow guild</i>			<i>shallow fast guild</i>		<i>deep slow guild</i>			<i>deep fast guild</i>
		redbreast sunfish spawning	redbreast sunfish	marginated madtom	Saluda darter	redbreast adults	redbreast sunfish	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
June	843	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

Kacie Jensen

From: Shane Boring
Sent: Friday, August 25, 2006 2:24 PM
To: Shane Boring; Shane Boring; Alan Stuart; 'Amanda Hill'; 'Bill Argentieri'; 'Bob Perry'; 'Brandon Stutts'; 'Buddy Baker'; 'Dick Christie'; Jennifer Summerlin; 'Jim Glover'; 'Randy Mahan'; 'Ron Ahle'
Cc: Cheryl Balitz
Subject: RE: Saluda Relicense: Waterfowl Study Plan

All:

Attached is an updated version of the final Saluda Hydro Wintering Waterfowl Study Plan. I added several conditions related to monthly and annual reporting of study results that were discussed in the meeting on July 26th. The website will also be updated with the revised document. Thanks.

Shane



Lake Murray
Waterfowl Study Pl..

-----Original Message-----

From: Shane Boring
Sent: Thursday, August 24, 2006 1:47 PM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle
Cc: Cheryl Balitz
Subject: Saluda Relicense: Waterfowl Study Plan

Dear Terrestrial Resources TWC Members:

At our last Terrestrial Resources TWC meeting, the group reviewed and approved the Wintering Waterfowl Study Plan, pending some minor "clean-up" of the language in the plan. As such, I have incorporated the requested changes and the final study plan is attached. If somehow your comments were missed or are otherwise not reflected, please let me know as soon as possible. Otherwise, the attached will be posted to the website as final.

Thanks,

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

<< File: Lake Murray Waterfowl Study Plan-Final.pdf >>

Cheryl:

Could you please post the attached to the Saluda Relicensing website under the Fish and Wildlife RCG. Thanks.

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Lake Murray Wintering Waterfowl Surveys

Terrestrial Resources Technical Working Committee
August 24, 2006

I. Study Objective

The objective of this research will be to develop an aerial survey database describing the abundance and distribution of wintering waterfowl (ducks, geese, swans, and coots) using Lake Murray, South Carolina.

II. Geographic and Temporal Scope

This study will focus on all areas of Lake Murray reservoir and will include six (6) aerial surveys over a period of four (4) months to be executed as follows: 1 in late November, 2 in December, 2 in January, and 1 in early February. If inclement weather or aircraft unavailability precludes the completion of flights during the study period, flights may be added to the end of the survey period, at the discretion of the Terrestrial Resource Technical Working Committee (TWC).

III. Methodology

Aerial surveys will be conducted from fixed-wing aircraft by trained observers from the University of Georgia's Savannah River Ecology Laboratory (SREL) and/or Kleinschmidt Associates. Observers will reference the species and numbers of all waterfowl (ducks, geese, swans, and coots) observed during aerial surveys, as well as any occurrences of the federally-endangered wood stork (*Mycteria americana*). Sightings will be map-referenced at the time of occurrence. Other data to be included with each aerial survey are: date, beginning and ending times of the survey, local weather conditions (including temperature, wind speed, extent of wetland icing in winter, etc.), and disturbance-related activities taking place during the aerial survey. Actual duration of these aerial surveys will be approximately 2.5 hours. Aerial surveys will be conducted from a height of approximately 250–300 ft and at a safe airspeed given the prevailing weather conditions. The entire lake pool will be surveyed for waterfowl use.

Data summaries will be performed using the Statistical Analysis System (SAS Institute, Inc.). Summaries will include location graphics of waterfowl numbers, as well as descriptions of temporal changes in waterfowl distributions (species- and/or subfamily-specific).

IV. Schedule and Required Conditions

Waterfowl surveys will be conducted during the winter months (generally late November through early February) of 2006-2007, 2007-2008, and 2008-2009 (3 total overwintering seasons). As previously noted, six (6) aerial surveys will likely be conducted over a period of four (4) months to be executed as follows: 1 in late November, 2 in December, 2 in January, and 1 in early February. If inclement weather or aircraft unavailability precludes the completion of flights during the study period, flights may be added to the end of the survey period, at the discretion of the TWC.

A brief e-mail summarizing survey observations will be distributed to the Terrestrial Resources TWC following each survey. In addition, an annual report summarizing the field season will be issued no later than April 1 following each study season. A more detailed report summarizing all aspects of the study to date will be prepared following the second season (2007-2008) for inclusion in SCE&G's Application for New License, which is slated for submission to the FERC in 2008.

Study methodology, timing, and duration may be adjusted based on consultation with the resource agencies and interested stakeholders. 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, Terrestrial Resources TWC, and other relicensing stakeholders.

VI. Study Participants

NAME	ORGANIZATION	PHONE	E-MAIL
<i>Terrestrial Resources Technical Working Committee</i>			
Buddy Baker	SCDNR	(803)734-3940	bakerb@dnr.sc.gov
Bob Perry	SCDNR	(803)734-3766	perryb@dnr.sc.gov
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
Brandon Stutts	SCANA Services		bstutts@scana.com
Dick Christie	SCDNR	(803)289-7022	christied@dnr.sc.gov
Bob Seibels	Riverbanks Zoo (retired)		bseibels@yahoo.com
<i>Applicant Contacts</i>			
Bill Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

Kacie Jensen

From: Shane Boring
Sent: Thursday, August 24, 2006 10:31 AM
To: Steve Summer; Alan Stuart; Amanda Hill; Bill Argentieri; Gerrit Jobsis (American Rivers); Jennifer Price ; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Cc: Cheryl Balitz
Subject: Saluda Hydro Relicense: Macroinvertebrate Study Plan

All:

Attached is the final study plan for the macroinvertebrate studies that will be performed on the Lower Saluda this fall. Thanks to all who provided comments. As always, the final study plan will be posted to the Saluda Relicense Website.

Thanks,
Shane

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



LSR Macroinvert
Study Plan _fi...

Cheryl:

Please post to the website under the Freshwater Mussels/Benthic Macroinvertebrates TWC, which is part of the Fish and Wildlife RCG. Thanks.

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Macroinvertebrate Assessment of the Lower Saluda River

Freshwater Mussels/Benthic Macroinvertebrate Technical Working Committee
August 24, 2006

I. Study Objective

To assess the status of the macroinvertebrate community in the lower Saluda River (LSR) downstream of the Saluda Hydroelectric Project dam.

II. Geographic and Temporal Scope

This study will evaluate macroinvertebrate fauna in the LSR from downstream of Saluda Hydroelectric Project dam to its confluence with the Broad River. Specific sampling locations are shown in Figure 1.

Macroinvertebrate sampling will occur during late-Summer and early-Fall 2006 and 2007 when dissolved oxygen conditions downstream of the dam are at their most critical.

III. Methodology

Field Methods

If field conditions allow, macroinvertebrate fauna will be sampled at five locations consistent with previous investigation in the LSR¹: the project tailrace (TR); the mouth of the project spillway (SPW); the “middle river” between Corley Island and the mouth of Twelvemile Creek (MR); the “lower river” between Interstates 20 & 26 (LR); and in the vicinity of Riverbanks Zoo (ZO)² (Figure 1). One site not previously investigated, the Ocean Boulevard shoal area (OB), will also be sampled (Figure 1).

Three replicate Hester-Dendy multi-plate samplers will be deployed at each location and allowed to colonize for approximately eight weeks. A multi-habitat assessment, following the USEPA *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (Barbour et al. 1999), will also be performed at the closest wadeable habitat to each of the Hester-Dendy deployment locations (within 200 meters, if possible) at the beginning and end of the colonization period. Multihabitat sampling will involve timed, quantitative sampling of the various habitat types available with the identified reaches (i.e. cobble, sand, snags, woody debris, etc.), using kicknets and/or D-shaped dipnets, with each habitat type sampled in approximate proportion to its availability.

Laboratory Methods

Intact Hester Dendy samplers, as well as raw samples from the multihabitat assessment, will be preserved in the field with 95% ethanol and transported to a South Carolina Department of Health and Environmental Control (SCDHEC) – approved laboratory for processing. In the laboratory, macroinvertebrates will be separated from debris with the aid of a stereo microscope,

¹ Habitat is described in previous investigations at these sites (Shealy 2001; 2003; 2004; 2005).

² Site is in close proximity to the “old police club” (OPC) sampled in previous investigations (see Shealy 2005); sites may be used interchangeably depending on field conditions and access.

identified to the lowest possible taxonomic level, and enumerated using appropriate techniques and taxonomic keys. Specimens will be maintained in a voucher collection for five years or placed permanently in a reference collection.

Data Analysis

Differences in taxonomic composition between sampling sites will be examined using appropriate bioassessment metrics, as described in Barbour et al. (1999). These metrics will likely include taxa richness (diversity); EPT (Ephemeroptera, Plecoptera, Trichoptera) Index; Chironomidae taxa and abundance; ratio of EPT and Chironomid abundance; ratio of scraper/scraper and filtering collectors; shredder/total number of specimens collected; percent contribution of dominant taxa; and North Carolina Biotic Index (NCBI)³. Regression analyses may also be used to detect trends in community composition as a function of distance from the dam. Water Quality data (dissolved oxygen and temperature) will also be reported for the sampling period.

IV. Schedule and Required Conditions

Artificial substrate (Hester-Dendy) samplers will be deployed in late summer 2006 and 2007 (late August / Early September) and will be allowed to colonize for approximately eight weeks; multihabitat sampling will be conducted at the beginning and end of the colonization period during each sample year.

A final report summarizing the study findings will be issued within 90 days of completion of field work during each sampling year. Study methodology, timing, and duration may be adjusted based on consultation with the resource agencies and interested stakeholders. 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
<i>Freshwater Mussels/Benthic Macroinvertebrate Technical Working Committee</i>			
Jim Glover	SCDHEC	(803) 898-4081	gloverjb@dhec.sc.gov
Gerrit Jobsis	Am. Rivers/CCL	(803)771-7114	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	ssummer@scana.com
Jennifer Price	SCDNR	(803)353-8232	pricej@dnr.sc.gov
<i>Applicant Contacts</i>			
William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

³. Bioassessment metrics are described in greater detail in Barbour et al. (1999) and in reports summarizing previous macroinvertebrate investigations at the LSR sites (Shealy 2001; 2003; 2004; 2005).

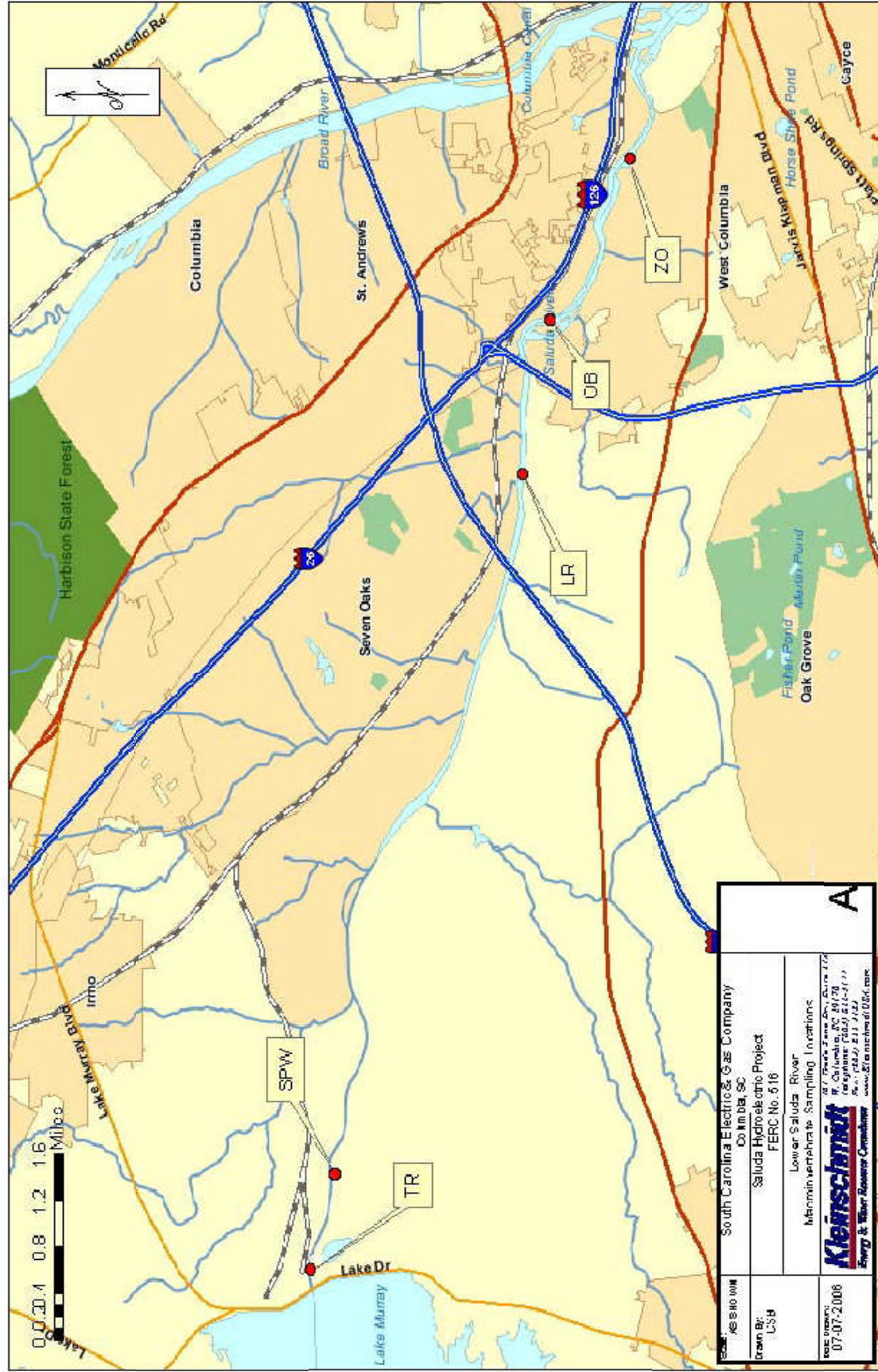
VII. List of Attachments

Figure 1: Map of Benthic Macroinvertebrate Sampling Locations in the Lower Saluda River Downstream of the Saluda Hydroelectric Project Dam

VIII. List of References

- Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.
- Shealy Environmental Services, Inc. (Shealy) 2001. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, South Carolina. Report prepared for South Carolina Electric & Gas Company.
- Shealy Environmental Services, Inc. 2003. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, South Carolina. Report prepared for South Carolina Electric & Gas Company.
- Shealy Environmental Services, Inc. 2004. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, South Carolina. Report prepared for South Carolina Electric & Gas Company.
- Shealy Environmental Services, Inc. 2005. Macroinvertebrate Assessment of the Saluda River, Downstream of the Lake Murray Hydroelectric Dam Operated by South Carolina Electric and Gas Company, Lexington County, South Carolina. Report prepared for South Carolina Electric & Gas Company.

Figure 1. Proposed Macroinvertebrate Sampling Locations in the Lower Saluda River Downstream of the Saluda Hydroelectric Project Dam



Kacie Jensen

From: Shane Boring
Sent: Thursday, August 24, 2006 1:47 PM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle
Cc: Cheryl Balitz
Subject: Saluda Relicense: Waterfowl Study Plan

Dear Terrestrial Resources TWC Members:

At our last Terrestrial Resources TWC meeting, the group reviewed and approved the Wintering Waterfowl Study Plan, pending some minor "clean-up" of the language in the plan. As such, I have incorporated the requested changes and the final study plan is attached. If somehow your comments were missed or are otherwise not reflected, please let me know as soon as possible. Otherwise, the attached will be posted to the website as final.

Thanks,

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



Lake Murray
Waterfowl Study Pl..

Cheryl:

Could you please post the attached to the Saluda Relicensing website under the Fish and Wildlife RCG. Thanks.

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Lake Murray Wintering Waterfowl Surveys

Terrestrial Resources Technical Working Committee
August 24, 2006

I. Study Objective

The objective of this research will be to develop an aerial survey database describing the abundance and distribution of wintering waterfowl (ducks, geese, swans, and coots) using Lake Murray, South Carolina.

II. Geographic and Temporal Scope

This study will focus on all areas of Lake Murray reservoir and will include six (6) aerial surveys over a period of four (4) months to be executed as follows: 1 in late November, 2 in December, 2 in January, and 1 in early February. If inclement weather or aircraft unavailability precludes the completion of flights during the study period, flights may be added to the end of the survey period, at the discretion of the Terrestrial Resource Technical Working Committee (TWC).

III. Methodology

Aerial surveys will be conducted from fixed-wing aircraft by trained observers from the University of Georgia's Savannah River Ecology Laboratory (SREL) and/or Kleinschmidt Associates. Observers will reference the species and numbers of all waterfowl (ducks, geese, swans, and coots) observed during aerial surveys, as well as any occurrences of the federally-endangered wood stork (*Mycteria americana*). Sightings will be map-referenced at the time of occurrence. Other data to be included with each aerial survey are: date, beginning and ending times of the survey, local weather conditions (including temperature, wind speed, extent of wetland icing in winter, etc.), and disturbance-related activities taking place during the aerial survey. Actual duration of these aerial surveys will be approximately 2.5 hours. Aerial surveys will be conducted from a height of approximately 250–300 ft and at a safe airspeed given the prevailing weather conditions. The entire lake pool will be surveyed for waterfowl use.

Data summaries will be performed using the Statistical Analysis System (SAS Institute, Inc.). Summaries will include location graphics of waterfowl numbers, as well as descriptions of temporal changes in waterfowl distributions (species- and/or subfamily-specific).

IV. Schedule and Required Conditions

Waterfowl surveys will begin in late November 2006 and continue through early February 2006 (4 months of study annually). Savannah River Ecology Lab will submit two (2) copies of a final report to Kleinschmidt Associates by March 1, in the year of the investigation's completion, covering all aspects of the investigation.

Study methodology, timing, and duration may be adjusted based on consultation with the resource agencies and interested stakeholders. 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, Terrestrial Resources TWC, and other relicensing stakeholders.

VI. Study Participants

NAME	ORGANIZATION	PHONE	E-MAIL
<i>Terrestrial Resources Technical Working Committee</i>			
Buddy Baker	SCDNR	(803)734-3940	bakerb@dnr.sc.gov
Bob Perry	SCDNR	(803)734-3766	perryb@dnr.sc.gov
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
Brandon Stutts	SCANA Services		bstutts@scana.com
Dick Christie	SCDNR	(803)289-7022	christied@dnr.sc.gov
Bob Seibels	Riverbanks Zoo (retired)		bseibels@yahoo.com
<i>Applicant Contacts</i>			
Bill Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

Kacie Jensen

From: Shane Boring
Sent: Wednesday, August 09, 2006 2:19 PM
To: Shane Boring; 'theresa_thom@nps.gov'; 'Wade Bales (balesw@dnr.sc.gov)'; 'Amanda Hill'; 'Bill Argentieri'; 'Dick Christie'; 'Gerrit Jobsis (American Rivers)'; 'Hal Beard'; Jennifer Summerlin; 'Jim Glover'; 'Prescott Brownell'; 'Randy Mahan'; 'Ron Ahle'; 'Scott Harder'; Shane Boring; 'Steve Summer'; Brandon Kulik; Alan Stuart
Cc: Brandon Kulik
Subject: RE: Saluda Hydro Relicense: Review of 1990 Saluda IFIM Study

Hello folks:

After speaking with several of you, it now looks as if Wednesday, September 7th may be a better date for the proposed Instream Flow TWC meeting. This will allow folks that are traveling from out of state not to have to travel over the holiday weekend. Also, Brandon Kulik from Kleinschmidt's Maine office would like at least a day to see the river before the meeting. Please let me know if your availability. Please feel free to propose alternate dates during this week if the 7th won't work for you. Thanks.

Shane

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

-----Original Message-----

From: Shane Boring
Sent: Tuesday, August 01, 2006 5:04 PM
To: 'theresa_thom@nps.gov'; Wade Bales (balesw@dnr.sc.gov); Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
Cc: Brandon Kulik
Subject: Saluda Hydro Relicense: Review of 1990 Saluda IFIM Study

Dear Saluda Relicensing Instream Flow/Aquatic Habitat Technical Working Committee Member:

Per our discussions at the June 14th meeting, Brandon Kulik (instream flow specialist at Kleinschmidt) has prepared a memo summarizing the 1990 IFIM study and its applicability to the current relicensing effort (see attached). This memo is intended to serve as a starting point for technical discussion regarding the need for and/or scope of additional relicensing-related flow studies. Once everyone has had a couple of weeks to review the memo, we would like to schedule a meeting in early September for Brandon to come and meet with the group. How about **Tuesday, September 5th**? This will likely be an all-day meeting. 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
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<< File: 2006-06-30 Memo - Review of LSR Instream Flow Study.pdf >>

Kacie Jensen

From: Shane Boring
Sent: Tuesday, August 01, 2006 5:04 PM
To: 'theresa_thom@nps.gov'; Wade Bales (balesw@dnr.sc.gov); Amanda Hill; Bill Argentieri; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
Cc: Brandon Kulik
Subject: Saluda Hydro Relicense: Review of 1990 Saluda IFIM Study

Dear Saluda Relicensing Instream Flow/Aquatic Habitat Technical Working Committee Member:

Per our discussions at the June 14th meeting, Brandon Kulik (instream flow specialist at Kleinschmidt) has prepared a memo summarizing the 1990 IFIM study and its applicability to the current relicensing effort (see attached). This memo is intended to serve as a starting point for technical discussion regarding the need for and/or scope of additional relicensing-related flow studies. Once everyone has had a couple of weeks to review the memo, we would like to schedule a meeting in early September for Brandon to come and meet with the group. How about **Tuesday, September 5th**? This will likely be an all-day meeting. 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



2006-06-30 Memo -
Review of LS...

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 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 rationale 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 (50th 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

(Note: For illustrative purposes only; seasonality and flow information will be refined in coordination with the TWC.)

Species-Based Prioritization Matrix												
LSR												
median												
flow												
(cfs)												
Month	American shad	American blueback herring	striped bass	shortnose sturgeon	American eel	robust redhorse	highfin carpsucker	northern hog sucker	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	
March	2,250	X	X	X	X	X	X	X	X	X	X	
April	1,100	X	X	X	X	X	X	X	X	X	X	
May	745	X	X		X	X	X	X	X	X	X	
June	843		X	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 r 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										
Month	LSR median flow (cfs)	<i>shallow slow guild</i>			<i>shallow fast guild</i>		<i>deep slow guild</i>			<i>deep fast guild</i>
		redbreast sunfish spawning	redbreast sunfish	marginated madtom	Saluda darter	redbreast adults	redbreast sunfish	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
June	843	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

Kacie Jensen

From: Alison Guth
Sent: Tuesday, July 25, 2006 10:26 AM
To: Wade Bales (balesw@dnr.sc.gov); Alan Stuart; Alison Guth; Amanda Hill; BARGENTIERI@scana.com; Bill East; Bill Hulslander; Bill Marshall; Bob Perry ; Bob Seibels (bseibels@yahoo.com); Charlene Coleman; Daniel Tufford; Dick Christie; Ed Diebold; George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Hal Beard; Jeff Duncan; Jennifer O'Rourke; Jennifer Summerlin; Jim Glover; Jim Goller; Joe Logan; Joy Downs; Larry Turner (turnerle@dhec.sc.gov); Laura Boos (laura.mccary@gmail.com); Malcolm Leaphart; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Prescott Brownell; Ralph Crafton; RMAHAN@scana.com; Reed Bull (rbull@davisfloyd.com); Robert Lavisky; Ron Ahle; Sam Drake; Scott Harder; Shane Boring; Steve Bell; Steve Leach; Steve Summer; Suzanne Rhodes; Tom Bowles (tbowles@scana.com)
Subject: 2005 Crayfish Assessment

Hello RCG Members,

I have attached, for your perusal, the report on the 2005 Crayfish Assessment. Feel free to contact me with any questions.
Thanks, Alison



Final 2005 LSR
Crayfish Assess...

Alison Guth
Licensing Coordinator
Kleinschmidt Associates
101 Trade Zone Drive
Suite 21A
West Columbia, SC 29170
P: (803) 822-3177
F: (803) 822-3183

July 17, 2006

Fish and Wildlife Resource Conservation Group Members
Saluda Hydro Relicensing Team

South Carolina Electric & Gas Company – FERC Project No. 516
2005 Lower Saluda River Crayfish Assessment

Dear RCG Members:

In response to a request by the U.S. Fish and Wildlife Service (USFWS) and in preparation for the relicensing of the Saluda Hydroelectric Project (FERC No. 516), South Carolina Electric & Gas Company (SCE&G) contracted with Kleinschmidt Associates to perform a crayfish assessment in the lower Saluda River in the fall of 2005. The first of these assessments was conducted on October 11, 2005, and assessments continued on a weekly basis through November 15, 2005. The following is a report presenting our findings of the study.

BACKGROUND

On April 29th of 2005, SCE&G filed the Notice of Intent (NOI) to relicense the Project with the Federal Energy Regulatory Commission (FERC), as well as issuing the Initial Consultation Document (ICD) to the FERC and stakeholders. The current license is due to expire August 31, 2010. Comments on the ICD submitted by the USFWS include a study request for an evaluation of benthic macroinvertebrate assemblages that include crayfish as well as EPT's (*Ephemeroptera*, *Plecoptera*, *Trichoptera*). This was requested with the justification that such studies will provide information for the assessment of Project effects on benthic resources.

Concurrent with the release of the ICD, in spring 2005, SCE&G carried out a series of diadromous fish studies on the lower Saluda river in response to early study requests from the South Carolina Department of Natural Resources (SCDNR), the USFWS, and NOAA Fisheries. Target species included the American shad, hickory shad, blueback herring, shortnose sturgeon, Atlantic sturgeon, striped bass, and the American eel. It was found, during the American eel surveys, that the traps were efficient in the collection of crayfish. After formal discussions with the USFWS, the eel traps were re-deployed in October 2005 in order to gather data on crayfish species.

MATERIALS METHODS

The traps used during the entirety of the sampling period consisted of double-entry, galvanized wire mesh minnow traps, measuring about 2 ½ feet long (see Figure A). These traps

were successful in sampling crayfish during Spring 2005 diadromous fish studies. Each trap was initially baited with herring and was re-baited on two-week intervals or as needed. A one lb weight was also placed in the traps to insure that they remained submerged. The traps were deployed mid-channel and secured to the bank with a length of cord so that they were readily accessible. Moreover, in an attempt to decrease vandalism and disturbance, they were positioned such that they were not readily noticeable. In the event of vandalism or theft, the trap was replaced as soon as feasible.

Each trap was deployed at its respective sampling location on October 3, 2005 and was allowed to fish continuously until early November, with the exception of when a trap was stolen or vandalized. The traps were inspected once a week under most circumstances. However, rain events and high flows occasionally prevented access to the traps, and they would subsequently be checked when the water levels decreased. Any by-catch was field identified and released. Data recorded for each sample included trap deployment and retrieval time, total number of crayfish collected, and the number of males and females, however only the males were kept for identification in the laboratory. After initial genus identification by Kleinschmidt personnel, species were verified by crayfish specialist Dr. Arnold Eversole, with Clemson University.

Traps were deployed at four points along the Saluda River below the Saluda Dam. These locations were chosen according to resource agency recommendations for diadromous species trapping, and included: (1) the Saluda Dam Spillway; (2) the mouth of Twelvemile Creek; (3) the LSR downstream of Interstate 26 near the USGS gage station; (4) and the Saluda Dam Tailrace (see Figure B).

FINDINGS

During the sampling period a total of 41 crayfish were collected from the LSR. Of those individuals, there were 19 males and 22 females field identified. All of the specimens captured were of two genus', *Procambarus* and *Cambarus*; it is believed that only two species were found within those genus', *Cambarus (Depressicambarus) latimanus* and *Procambarus (Scapulicambarus) troglodytes*.

Cambarus (Depressicambarus) latimanus is found in several river basins in North Carolina, South Carolina, Georgia, Florida and Alabama. Considered a secondary burrower, this species spends its time in small to moderately large streams and burrows¹. *Procambarus (Scapulicambarus) troglodytes* is considered a tertiary burrower, meaning that it spends much of its time in open water, retreating to its burrow for winter frost, egg laying and to avoid desiccation. This species is widely distributed throughout the state and populations are considered stable². Neither of these species is listed on the *Federal List of Endangered and Threatened Wildlife and Plants* for Richland, Lexington, Newberry, or Saluda Counties.

¹ Crandall, Keith A., Fetzner, Jr., James W., and Hobbs, Jr., Horton H. 2001. *Cambarus (Depressicambarus) latimanus* Le Conte 1856. Version 01 January 2001 (under construction).

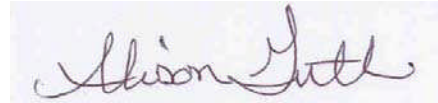
[http://tolweb.org/Cambarus_\(Depressicambarus\)_latimanus/6858/2001.01.01](http://tolweb.org/Cambarus_(Depressicambarus)_latimanus/6858/2001.01.01) in *The Tree of Life Web Project*, <http://tolweb.org>. Viewed 7 July 2006.

² Crandall, Keith A., Fetzner, Jr., James W., and Hobbs, Jr., Horton H. 2001. *Procambarus (Scapulicambarus) troglodytes* Le Conti 1856. Version 01 January 2001 (underconstruction).

I have included Tables 1-4, which depict the findings recorded during the sampling events. If you have any questions or need additional information, please do not hesitate to contact me at (803) 822-3177.

Sincerely,

KLEINSCHMIDT ASSOCIATES

A handwritten signature in cursive script that reads "Alison Guth". The signature is written in black ink on a light-colored background.

Alison Guth
Licensing Coordinator

AG:mas
Attachments

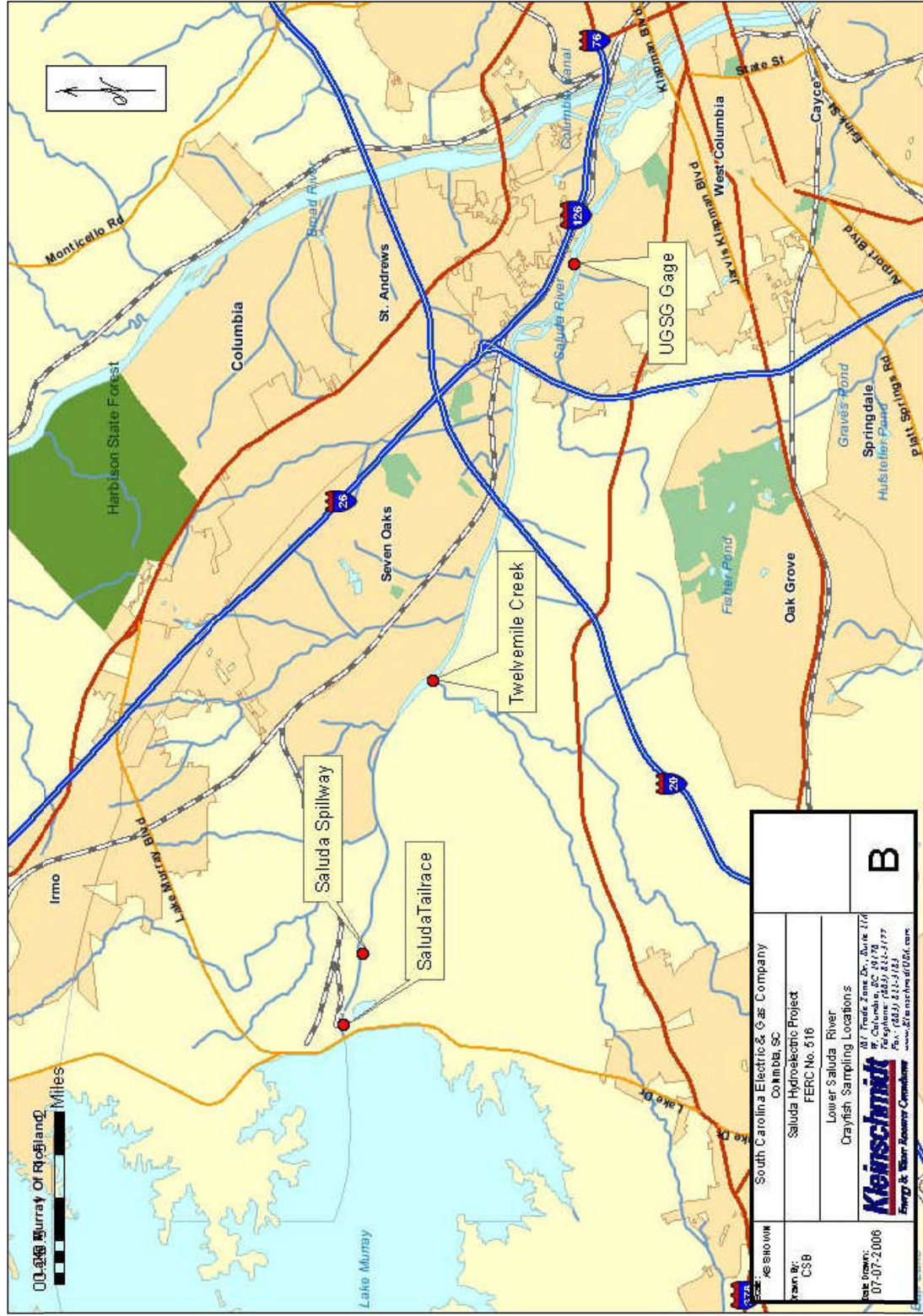
J:\455\029\Docs\001-2005 LSR Crayfish Assessment.doc

ATTACHMENT A
TABLES AND FIGURES

Figure A: Standard Trap that was Used Throughout Sampling



Figure B: Lower Saluda River Crayfish Sampling Locations



Project: AC 510/010 Name: CSB Date Issued: 07-07-2006	South Carolina Electric & Gas Company Columbia, SC Saluda Hydroelectric Project FERC No. 518 Lower Saluda River Crayfish Sampling Locations	811 Fowle, Zone Dr., Suite 116 W. Columbia, SC 29178 Telephone: (803) 211-3177 Fax: (803) 211-3183 www.sce&g.com	Kleinschmidt Energy & Water Resources Consultants	B
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Table 1: Crayfish Surveys – USGS Gage Station

**Saluda Hydro Project Relicensing
2005 Crayfish Surveys**

USGS Gaging Station

Date	Time Retrieved for Inspection	Time Redeployed	Total Number	Genus of Males	Comments
10/3/2005		10:50			Deployed Trap Much vegetation covering trap, removed vegetation
10/11/2005	12:59	1:18			and rebaited, no catch
10/19/2005	11:35	11:39			Rebaited, no catch
10/25/2005	2:46	2:52			Rebaited, no catch
11/3/2005	2:16	2:30			Rebaited, no catch
11/15/2005	2:51				Retrieved trap, no catch
Total			0		

Table 2: Crayfish Surveys – Tailrace

**Saluda Hydro Project Relicensing
2005 Crayfish Surveys**

Tailrace

Date	Time Retrieved for Inspection	Time Redeployed	Total Number	Genus of Males	Comments
10/3/2005		12:23			Deployed Trap
10/11/2005	1:55	2:10	5 (4M, 1F)	Cambarus	Rebaited trap
10/19/2005	12:00				Trap out of water, rebaited
10/25/2005	3:15	3:22			No catch
11/3/2005	2:51				Trap stuck, could not retrieve
Total			5 (4M, 1F)		

Table 3: Crayfish Surveys – Spillway

**Saluda Hydro Project Relicensing
2005 Crayfish Surveys**

Spillway

Date	Time Retrieved for Inspection	Time Redeployed	Total Number	Genus of Males	Comments
10/3/2005		1:06			Deployed Trap
10/11/2005	2:35	2:51	11 (7 F, 4 M)	Procambarus (2), Cambarus (2)	Rebaited
10/19/2005	12:30	12:39	2 (M)	Procambarus (1), Cambarus (1)	
10/25/2005	3:45				Could not access trap, high water
11/3/2005	3:26				Trap gone
Total			13 (7 F, 6 M)		

Table 4: Crayfish Surveys – Twelvemile Creek Location

**Saluda Hydro Project Relicensing
2005 Crayfish Surveys**

Twelvemile Creek Location

Date	Time Retrieved for Inspection	Time Redeployed	Total Number	Genus of Males	Comments
10/3/2005		1:33			Trap Deployed
10/11/2005	3:15	3:27	6 (4 F, 2 M)	Cambarus	Rebaited, caught 1 <i>Anguilla rostrata</i>
10/19/2005	1:52	2:03	4 (3 F, 1 M)	Cambarus	Rebaited
10/25/2005	4:15	4:32	11 (7 F, 4 M)	Cambarus	Rebaited
11/3/2005	3:57	4:03	1 (M)	Cambarus	Rebaited
11/15/2005	3:47		1 (M)	Cambarus	Collected Trap
Total			23 (14 F, 9 M)		

ATTACHMENT B

REFERENCES

REFERENCES:

- Crandall, Keith A., Fetzner, Jr., James W., and Hobbs, Jr., Horton H. 2001. *Cambarus (Depressicambarus) latimanus* Le Conte 1856. Version 01 January 2001 (under construction).
[http://tolweb.org/Cambarus_\(Depressicambarus\)_latimanus/6858/2001.01.01](http://tolweb.org/Cambarus_(Depressicambarus)_latimanus/6858/2001.01.01) in The Tree of Life Web Project, <http://tolweb.org> . Viewed 7 July 2006.
- Crandall, Keith A., Fetzner, Jr., James W., and Hobbs, Jr., Horton H. 2001. *Procambarus (Scapulicambarus) troglodytes* Le Conti 1856. Version 01 January 2001 (under construction).
[http://tolweb.org/Procambarus_\(Scapulicambarus\)_troglodytes/7660/2001.01.01](http://tolweb.org/Procambarus_(Scapulicambarus)_troglodytes/7660/2001.01.01) in The Tree of Life Web Project, <http://tolweb.org> . Viewed 7 July 2006.
- Eversole, Arnold G., Jones, Danny R. Key to the Crayfish of South Carolina. Clemson University, 2004.
- South Carolina Department of Natural Resources. South Carolina Rare, Threatened, & Endangered Species Inventory-County Selection From List. 2005. 7 July 2006.
http://www.dnr.sc.gov/pls/heritage/county_species.select_county_map

Kacie Jensen

From: SUMMER, STEPHEN E [SSUMMER@scana.com]
Sent: Friday, July 21, 2006 12:55 PM
To: BARGENTIERI@scana.com; Shane Boring; Amanda Hill; Jennifer Price; Jennifer Summerlin; Jim Glover; RMAHAN@scana.com; Ron Ahle; Gerrit Jobsis
Subject: FW: Saluda Hydro Relicense: Draft Macroinvertebrate Study Plan for the Lower Saluda River

Once more with the attachment.
Steve

From: Gerrit Jobsis [mailto:gjobsis@americanrivers.org]
Sent: Thursday, July 20, 2006 2:15 PM
To: Shane Boring; SUMMER, STEPHEN E; Amanda Hill; ARGENTIERI, WILLIAM R; Jennifer Price; Jennifer Summerlin; Jim Glover; MAHAN, RANDOLPH R; Ron Ahle
Subject: RE: Saluda Hydro Relicense: Draft Macroinvertebrate Study Plan for the Lower Saluda River

Here are my comments Shane.

Gerrit Jöbsis
Director of Southeast Conservation
American Rivers
2231 Devine Street, Suite 100 • Columbia, S.C. 29205
803/771-7114
803/771-7580 Fax
gjobsis@americanrivers.org

www.AmericanRivers.org

American Rivers protects and restores healthy natural rivers for the benefit of communities, fish and wildlife.

From: Shane Boring [mailto:Shane.Boring@KleinschmidtUSA.com]
Sent: Wednesday, July 19, 2006 5:06 PM
To: Steve Summer; Amanda Hill; Bill Argentieri; Gerrit Jobsis; Jennifer Price; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Subject: Saluda Hydro Relicense: Draft Macroinvertebrate Study Plan for the Lower Saluda River

Hello Folks:

Attached for your review is the first cut at the Lower Saluda Macroinvertebrate Study Plan. As discussed in our May 3rd meeting, the study plan incorporates the existing methods from the studies performed by Shealy Env., as well as the recommended multi-habitat component. Please have your comments/suggestions on the plan back to me by Wednesday, August 2nd. I'm particularly interested in any suggestions regarding sampling locations; the 2005 sampling by Shealy sampled 4 locations, which are primarily in the upper and lower reaches of the LSR. Thanks.

Shane

C. Shane Boring

10/29/2007

Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

<<LSR Macroinvert Study Plan (draft;07-19-2006).doc>>

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Macroinvertebrate Assessment of the Lower Saluda River

Freshwater Mussels/Benthic Macroinvertebrate Technical Working Committee
Draft -- July 19, 2006

I. Study Objective

To assess the status of the macroinvertebrate community in the lower Saluda River (LSR) downstream of the Saluda Hydroelectric Project dam.

II. Geographic and Temporal Scope

This study samples the macroinvertebrate fauna in the LSR from downstream of Saluda Hydroelectric Project dam to its confluence with the Broad River. Specific sampling locations are shown in Figure 1.

Macroinvertebrate sampling will occur during late-Summer and early-Fall 2006 and 2007 when dissolved oxygen conditions downstream of the dam are at their most critical.

III. Methodology

Field Methods

Macroinvertebrate fauna will be sampled at four locations consistent with previous investigation in the LSR (Shealy 2005): the project tailrace (TR); the project spillway (SPW); the “lower river” between Interstates 20 & 26 (LR); and the vicinity of the USGS gage (#01269000) near the “old police club” (OPC) (Figure 1)¹. Three replicate Hester-Dendy multi-plate samplers will be deployed at each location and allowed to colonize for approximately eight weeks. In addition, a multi-habitat assessment following the USEPA Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers (Barbour et al. 1999), will be performed at the closest wadeable habitat to each of the Hester-Dendy deployment locations (within 200 meters, if possible).

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Intact Hester Dendy samplers, as well as raw samples from the multihabitat assessment, will be preserved in the field with 95% ethanol and transported to a South Carolina Department of Health and Environmental Control (SCDHEC) – approved laboratory (Shealy Environmental Services, Inc., West Columbia, SC) for processing. In the laboratory, macroinvertebrates will be separated from debris with the aid of a stereo microscope, identified to the lowest possible taxonomic level, and enumerated using appropriate techniques and taxonomic keys. Specimens will be maintained in a voucher collection for five years or placed permanently in a reference collection.

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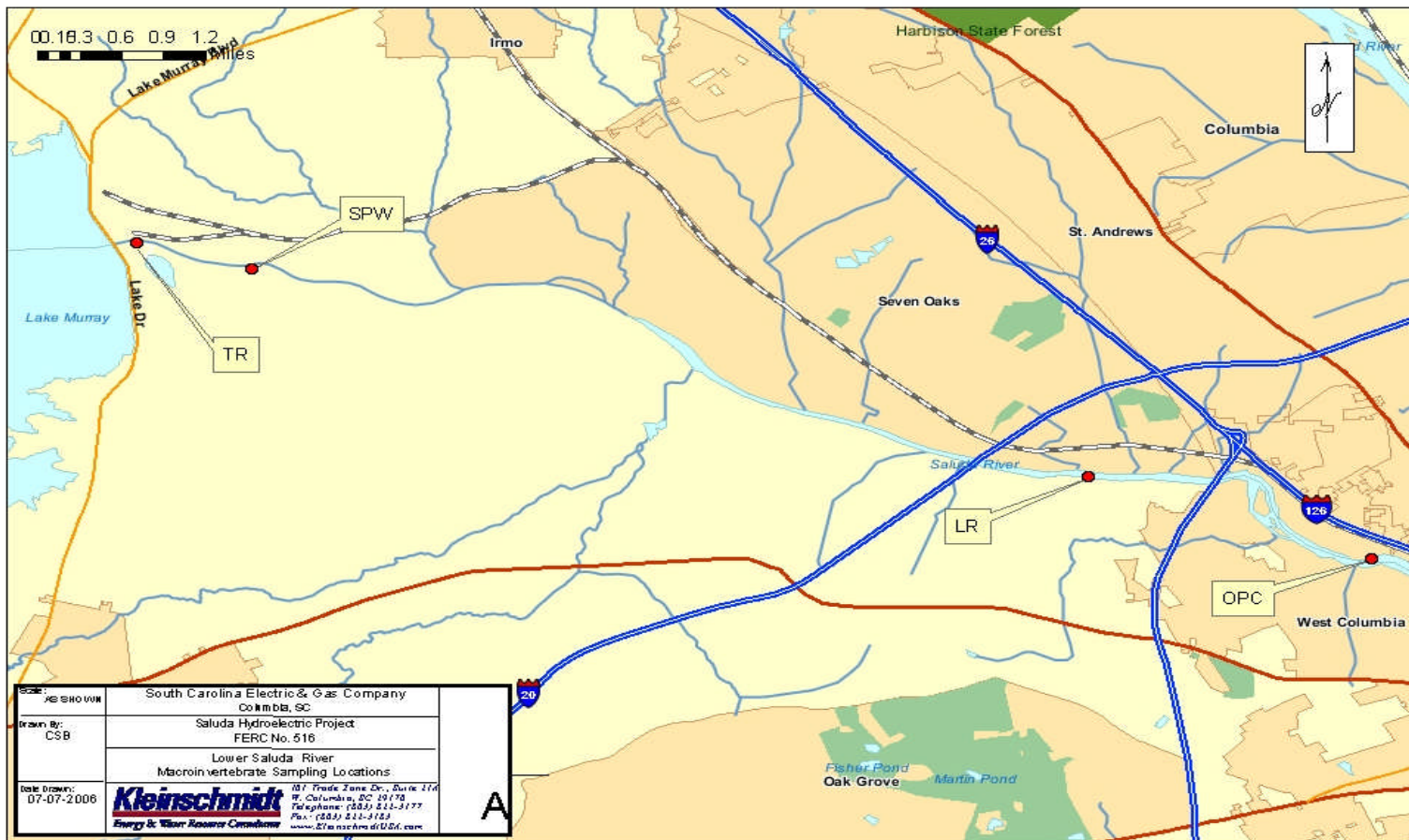
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Figure 1: Map of Benthic Macroinvertebrate Sampling Locations in the Lower Saluda River Downstream of the Saluda Hydroelectric Project Dam

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Please be aware that for any given year, it is normal for one set of samplers placed in the LR and MR areas to be lost/unretrievable. I've also played samplers in the backwater downstream of the spillway channel, but after a couple of years of disappearing samplers (I have to assume vandalism) I gave up on that location.

I also suggest consideration of placing samplers near the zoo in addition to or in lieu of the USGS gage (OPC) if a suitable site can be located (the OPC location is about one mile upriver of the zoo. This area may also be easier to access for multi-habitat sampling (the area at the old police club is privately owned and access to a wadeable site is problematic).

It appears on the map that LR and OPC sites are near tributary streams. I recommend not sampling immediately downstream of any tributary to avoid tributary influence. If a site MUST be near a trib due to access limitations, it should be located upstream by at least 200 m.

Wadeable sections are at a premium. They are difficult to locate at flow high enough for a motorized boat. You are essentially limited to the few near bank sandbars and adjacent aquatic vegetation. To get good samples, you must sample at low water (need to get to areas not exposed to air). This is one of the main reasons that I did not continue the rapid bioassessment methodology and switched to the Hester Dendys. Canoe travel may be the only way to access multi-habitat sampling areas.

Kacie Jensen

From: Shane Boring
Sent: Thursday, July 20, 2006 3:41 PM
To: 'Amanda Hill '; 'Gerrit Jobsis'; 'Bob Seibels'; 'Tom Eppink'; 'Randy Mahan '; Kelly Miller; 'Ron Ahle (ahler@dnr.sc.gov)'
Cc: 'Bill Argentieri'; 'Steve Summer (ssummer@scana.com)'; Alan Stuart; Alison Guth
Subject: Saluda Hydro Rocky Shoals Spider Lily Float Trip

All:

Attached is a draft memo summarizing the May 31 Lower Saluda River float trip to look for rocky shoals spider lilies. Please take a moment to review it and be prepared to provide comments at next weeks meeting (July 26th) of the RT&E TWC. For those not able to attend the meeting, e-mail comments are fine. Thanks.

Shane

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



May 2006 RSSL
Survey Memo (Dra...

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.



Kacie Jensen

From: Gerrit Jobsis [gjobsis@americanrivers.org]
Sent: Thursday, July 20, 2006 2:15 PM
To: Shane Boring; Steve Summer; Amanda Hill; BARGENTIERI@scana.com; Jennifer Price; Jennifer Summerlin; Jim Glover; RMAHAN@scana.com; Ron Ahle
Subject: RE: Saluda Hydro Relicense: Draft Macroinvertebrate Study Plan for the Lower Saluda River

Here are my comments Shane.

Gerrit Jöbsis
Director of Southeast Conservation
American Rivers
2231 Devine Street, Suite 100 • Columbia, S.C. 29205
803/771-7114
803/771-7580 Fax
gjobsis@americanrivers.org

www.AmericanRivers.org

American Rivers protects and restores healthy natural rivers for the benefit of communities, fish and wildlife.

From: Shane Boring [mailto:Shane.Boring@KleinschmidtUSA.com]
Sent: Wednesday, July 19, 2006 5:06 PM
To: Steve Summer; Amanda Hill; Bill Argentieri; Gerrit Jobsis; Jennifer Price; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Subject: Saluda Hydro Relicense: Draft Macroinvertebrate Study Plan for the Lower Saluda River

Hello Folks:

Attached for your review is the first cut at the Lower Saluda Macroinvertebrate Study Plan. As discussed in our May 3rd meeting, the study plan incorporates the existing methods from the studies performed by Shealy Env., as well as the recommended multi-habitat component. Please have your comments/suggestions on the plan back to me by Wednesday, August 2nd. I'm particularly interested in any suggestions regarding sampling locations; the 2005 sampling by Shealy sampled 4 locations, which are primarily in the upper and lower reaches of the LSR. Thanks.

Shane

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

<<LSR Macroinvert Study Plan (draft;07-19-2006).doc>>

Saluda Hydroelectric Project (FERC No. 516)

Study Plan: Macroinvertebrate Assessment of the Lower Saluda River

Freshwater Mussels/Benthic Macroinvertebrate Technical Working Committee
Draft -- July 19, 2006

I. Study Objective

To assess the status of the macroinvertebrate community in the lower Saluda River (LSR) downstream of the Saluda Hydroelectric Project dam.

II. Geographic and Temporal Scope

This study ~~samples~~ the macroinvertebrate fauna in the LSR from downstream of Saluda Hydroelectric Project dam to its confluence with the Broad River. Specific sampling locations are shown in Figure 1.

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Macroinvertebrate sampling will occur during late-Summer ~~and~~ early-Fall 2006 and 2007 ~~when dissolved oxygen conditions downstream of the dam are at their most critical.~~

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¹ Habitat is described in previous investigations at these sites (Shealy Environmental Services, Inc. 2001; 2003; 2004; 2005).

Data Analysis

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Figure 1: Map of Benthic Macroinvertebrate Sampling Locations in the Lower Saluda River Downstream of the Saluda Hydroelectric Project Dam

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Saluda Hydroelectric Project (FERC No. 516)

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Freshwater Mussels/Benthic Macroinvertebrate Technical Working Committee
Draft -- July 19, 2006

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- 1) Develop an entrainment database that can be applied to the Saluda Hydro Project
- 2) Calculate and estimate fish entrainment rate(s) (seasonal if possible)
- 3) Characterize the species composition and length frequency of fish entrainment
- 4) Apply any physical or biological filters that may affect entrainment
- 5) Estimate total annual entrainment for the Saluda Hydro Project

These inputs will be developed as described in the following sections.

Development of Entrainment Database

Over seventy site-specific studies of resident fish entrainment at hydroelectric sites in the United States have been reported to date which provide order-of-magnitude estimates of annual fish entrainment (FERC, 1995). Descriptive information will be gathered from each entrainment study and will include:

- 1) Location: geographical proximity (preference given to same river basin)
- 2) Project size: discharge capacity and power production
- 3) Mode of operation - e.g., peaking, run-of-river etc.
- 4) Biological factors: fish species composition
- 5) Impoundment characteristics: general water quality, impoundment size, flow regime
- 6) Physical project characteristics: trash rack spacing, intake velocity, etc.

This information will be assembled into a “matrix” of data to be used as a database for the Saluda Hydro Project entrainment desktop study. After review and discussion, the Technical Working Committee (TWC) will select specific studies from this “matrix” that are most applicable to the Saluda Hydro Project. Several key criteria to be used in acceptance of candidate studies will be:

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- 2) Similar station hydraulic capacity
- 3) Similar station operation (peaking, pulsing, run-of-river, etc.)
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- 5) Availability of entrainment netting data

Fish Entrainment Rate

The entrainment rate information from the accepted studies will be consolidated to show fish entrainment rates on a monthly basis (when available). Preference will be given to netting entrainment rates over hydroacoustic entrainment rates. The entrainment rates will be presented in fish entrained per hour of operation and fish per volume of water passed through project turbines (fish/million cubic feet). The data will be grouped by season, where appropriate, to determine an entrainment density for each season of the

year. The seasonal data from each entrainment study will be averaged to develop a seasonal mean entrainment estimate at the Saluda Hydro Project.

Species Composition and Length Frequency Analysis

Species composition data from the accepted entertainment studies will be analyzed and compiled to determine the general species and sizes of fish typically entrained at other hydroelectric projects. This information will be grouped to yield predicted seasonal estimates of species-specific length frequency data for entrained fish to determine:

1. A list of potentially entrained fish species
2. Expected relative abundance and size distribution of each species identified as potentially entrained
3. Prediction of seasonality of potentially entrained fish species.

Estimation of Annual Fish Entrainment

Total fish entrainment for the Saluda Hydro Project will be estimated on an annual basis to provide an order-of-magnitude entrainment estimate. The total fish entrainment estimate will be produced for a typical water and operating year.

Turbine Mortality

As fish move through hydroelectric turbines, a percentage are killed due to turbine mortality (i.e. blade strikes, shear forces, and pressure changes, etc.). Turbine passage survival studies have been performed at numerous hydroelectric projects throughout the country. Characteristics of these projects will be compared to the characteristics of the Saluda Hydro Project and suitable studies will be selected for the transfer of turbine mortality data for each development. Selected turbine survival rate data will be obtained from the literature and used to estimate the number of fish killed due to turbine mortality. The following turbine characteristics are recommended as general criteria in accepting turbine mortality studies for use in this analysis:

- 1) design type
- 2) operating head
- 3) runner speed
- 4) diameter, and peripheral runner velocity

These characteristics are commonly attributed to turbine passage mortality (Cramer and Oligher, 1963; Bell, 1991; Eicher, 1987; EPRI, 1992).

To the extent possible, turbine mortality rate data available from source studies will be related to the species-family group and size class of fish estimated to be entrained at the Lake Murray Project. Where multiple tests are available for a given species-family group/size class, a mean survival rate will be computed. For species-family groups/size

classes where no applicable data can be found or accepted, the survival rate reported for a similar group/size class will be substituted.

Once turbine mortality rates are developed from the study database, the rates will be applied to the entrainment estimates for each development. This will be accomplished by multiplying fish entrainment estimates by the composite mortality rates for each family/genus group and size class (where applicable).

Entrainment Filters

Due to certain site-specific characteristics of Lake Murray, it may be necessary to adjust entrainment estimates. Factors affecting entrainment rates that may warrant investigation for adjustment of estimates include:

- 1) stratification at the intakes (dissolved oxygen);
- 2) intake velocities;
- 3) fish habitat available at the intakes, and/or
- 4) other site specific factors.

IV. Schedule and Required Conditions

In an attempt to reach consensus during the entrainment desktop study, each step of the process will be discussed with TWC members. Comments from the TWC will be addressed during each phase of the analysis. Upon completion of the study, a draft report will be prepared and distributed to state and federal resource agencies for review and comment. The Draft report will summarize the results obtained in the study; will contain appropriate tables and figures depicting estimated fish entrainment; and will contain all supporting correspondence among the TWC members. After receipt of all comments, the draft report will be revised to address final comments by all TWC members and will be resubmitted as the Final Report.

V. Use of Study Results

Study results will be used as an information resource during discussion of relicensing issues with the SCDNR, USFWS, Fish Entrainment TWC, and other relicensing stakeholders.

VI. Study Participants

NAME	ORGANIZATION	PHONE	E-MAIL
<i>Fish Entrainment Technical Working Committee</i>			
Tom Bowles	SCE&G	(803)217-9615	tbowles@scana.com
Alan Stuart	Kleinschmidt	(803)822-3177	Alan.stuart@kleinschmidtusa.com
Hal Beard	SCDNR	(803)955-0462	BeardH@dnr.sc.gov
Wade Bales	SCDNR	(803)734-3932	balesw@dnr.sc.gov
Amanda Hill	USFWS	(843)727-4707, x303	Amanda_hill@fws.gov
Shane Boring	Kleinschmidt	(803)822-3177	shane.boring@kleinschmidtusa.com
<i>Applicant Contacts</i>			
Stephen E. Summer	SCANA Services	(803)217-7357	ssummer@scana.com
William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

Kacie Jensen

From: Shane Boring
Sent: Wednesday, July 19, 2006 5:06 PM
To: Steve Summer; Amanda Hill; Bill Argentieri; Gerrit Jobsis (American Rivers); Jennifer Price ; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Subject: Saluda Hydro Relicense: Draft Macroinvertebrate Study Plan for the Lower Saluda River

Hello Folks:

Attached for your review is the first cut at the Lower Saluda Macroinvertebrate Study Plan. As discussed in our May 3rd meeting, the study plan incorporates the existing methods from the studies performed by Shealy Env., as well as the recommended multi-habitat component. Please have your comments/suggestions on the plan back to me by Wednesday, August 2nd. I'm particularly interested in any suggestions regarding sampling locations; the 2005 sampling by Shealy sampled 4 locations, which are primarily in the upper and lower reaches of the LSR. Thanks.

Shane

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



LSR Macroinvert
Study Plan (dr...

Kacie Jensen

From: Shane Boring
Sent: Friday, May 26, 2006 5:13 PM
To: Wade Bales (balesw@dnr.sc.gov); Alan Stuart; Alison Guth; Amanda Hill; BARGENTIERI@scana.com; Bill East; Bill Hulslander; Bill Marshall; Bob Perry ; Bob Seibels (bseibels@yahoo.com); Charlene Coleman; Daniel Tufford; Dick Christie; Ed Diebold; George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Hal Beard; Jeff Duncan; Jennifer O'Rourke; Jennifer Summerlin; Jim Glover; Jim Goller; Joe Logan; Joy Downs; Larry Turner (turnerle@dhec.sc.gov); Laura Boos (laura.mccary@gmail.com); Malcolm Leaphart; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Prescott Brownell; Ralph Crafton; RMAHAN@scana.com; Reed Bull (rbull@davisfloyd.com); Robert Lavisky; Ron Ahle; Sam Drake; Scott Harder; Shane Boring; Steve Bell; Steve Leach; Steve Summer; Suzanne Rhodes; Tom Bowles (tbowles@scana.com)
Cc: Cheryl Balitz
Subject: Saluda Hydro: Mussel Recon Survey Study Plan



Mussel Recon
Survey Study Plan...

Hello All:

Attached for your records is the final study plan for the mussel surveys that will be conducted by John Alderman in Lake Murray and the Lower Saluda and Congaree River. As requested, John has provided clarification regarding several aspects of the survey. Thanks and please let me know if there are additional comments or if you have questions. Have a great weekend!

Shane

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

Cheryl: Please post to the website under the Fish and Wildlife RCG. Thanks.

Mussel Recon Survey Study Plan _final;05-25-2006_.pdf

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
May 25, 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 (late May through early June).

III. Methodology

Qualitative surveys to determine the presence of freshwater mussels will be conducted at suitable habitat sites downstream of Saluda Hydro Dam in the Lower Saluda and Congaree rivers (see Section II above for geographic scope), as well as above Saluda Dam in Lake Murray and selected tributaries. Surveys in Lake Murray will focus on tributary mouths and associated coves that have been identified through prior surveys as providing potential habitat for Savannah lilliput (*Toxolasma pullus*), a high priority federal species of concern with few remaining extant populations in GA, SC, and NC (J. Alderman, pers. comm.). These tributaries include: Beaver Dam Creek, Bush River, Big Creek, Buffalo Creek, Camping Creek, Bear Creek, Little Hollow Creek, Hollow Creek, Clouds Creek, Little Saluda River, Indian Creek, and Saluda River (Figure 1). Surveys at reservoir tributary sites will range in duration from 10 minutes to 2 hours, depending on available habitat, and will extend into lotic (free-flowing) tributary reaches where suitable habitat exists (estimated 4 total survey days). Additional reservoir habitat may be surveyed opportunistically as survey crews move between the tributary sites. The survey area for the Lower Saluda and Congaree rivers will encompass all river reaches within the study area indicated in Section II (estimated 6 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 be 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 late May/early June 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.

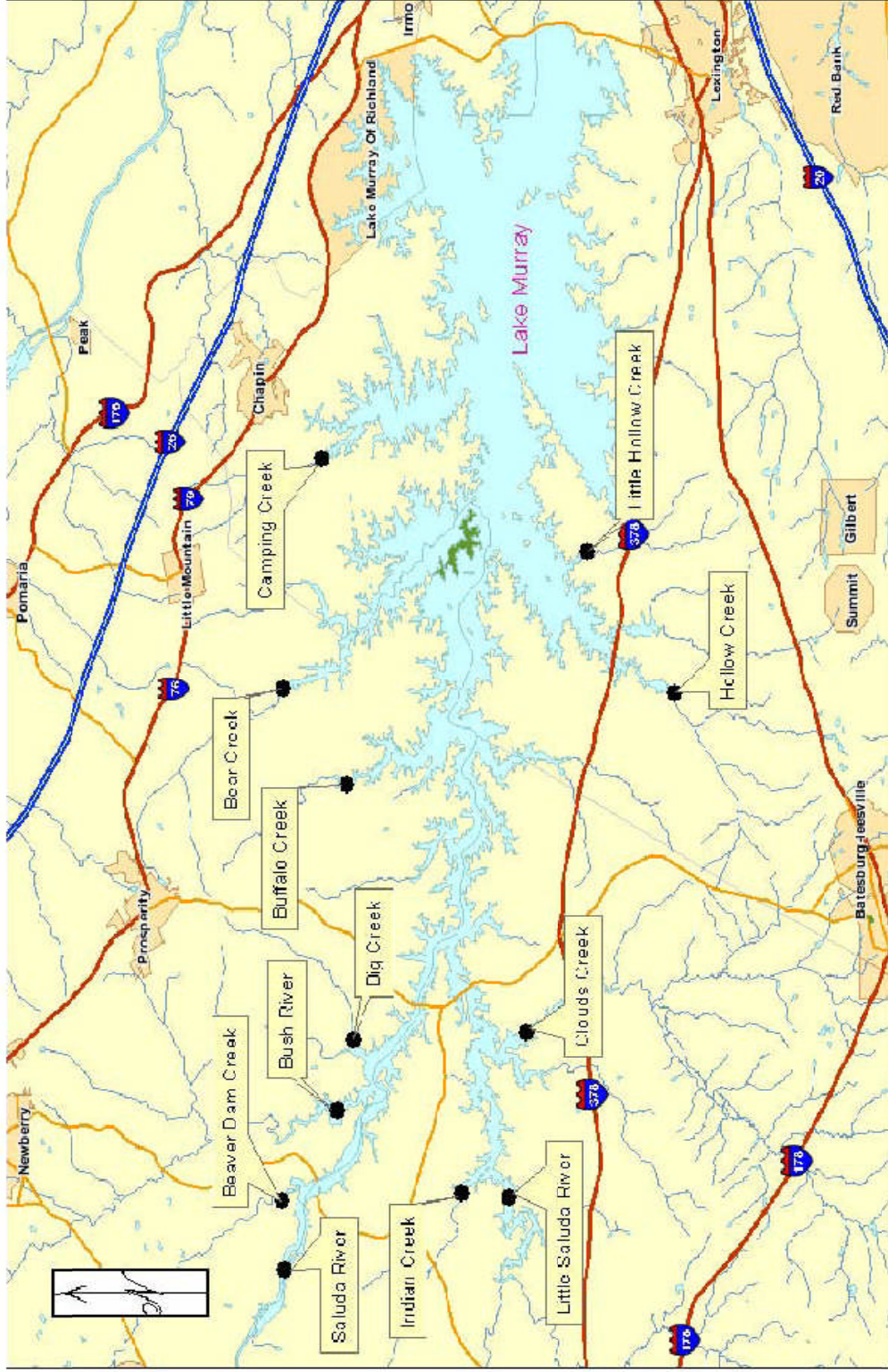
VI. Study Participants

NAME	ORGANIZATION	PHONE	E-MAIL
<i>Water Quality Technical Working Committee</i>			
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	ssummer@scana.com
Jennifer Price	SCDNR	(803)353-8232	pricej@dnr.sc.gov
<i>Applicant Contacts</i>			
William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

VII. List of Attachments

Figure 1: Map of Lake Murray Mussel Sampling Sites

Figure 1. Lake Murray Mussel Sampling Locations



- 1) Develop an entrainment database that can be applied to the Saluda Hydro Project
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NAME	ORGANIZATION	PHONE	E-MAIL
<i>Fish Entrainment Technical Working Committee</i>			
Tom Bowles	SCE&G	(803)217-9615	tbowles@scana.com
Alan Stuart	Kleinschmidt	(803)822-3177	Alan.stuart@kleinschmidtusa.com
Hal Beard	SCDNR	(803)955-0462	BeardH@dnr.sc.gov
Wade Bales	SCDNR	(803)734-3932	balesw@dnr.sc.gov
Amanda Hill	USFWS	(843)727-4707, x303	Amanda_hill@fws.gov
Shane Boring	Kleinschmidt	(803)822-3177	shane.boring@kleinschmidtusa.com
<i>Applicant Contacts</i>			
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William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

Kacie Jensen

From: Shane Boring
Sent: Wednesday, April 26, 2006 3:16 PM
To: 'Gerrit Jobsis'
Subject: RE: (Saluda Hydro) Mussel Recon Survey Study Plan (draft;04192006) alderman comments.doc



Alderman proposal
060411.doc (...)

Gerrit:

I forgot to attach Alderman's proposal to my previous e-mail.

Shane

-----Original Message-----

From: Gerrit Jobsis [mailto:gjobsis@americanrivers.org]
Sent: Wednesday, April 26, 2006 1:13 PM
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

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

gjjobsis@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>>



Alderman Environmental Services, Inc.

April 11, 2006

Mr. C. Shane Boring
Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite 21A
West Columbia, SC 29170

Dear Mr. Boring:

Alderman Environmental Services, Inc. proposes to complete a reconnaissance level mussel survey of the following waterbodies:

Lake Murray – 2 survey days with boat(s) and technician(s) provided by Kleinschmidt Associates

Select Lake Murray tributaries and Saluda River (downriver from L. Murray) – 5 days of surveys completed on the following streams: Saluda River (upriver and downriver from L. Murray), Beaver Dam Cr., Bush R., Big Cr., Buffalo Cr., Camping Cr., Bear Cr., Little Hollow Cr., Hollow Cr., Clouds Cr., L. Saluda R., Big Cr., and Indian Creek. Some streams may provide very poor quality mussel habitat; therefore, survey time will be limited on such streams.

My hourly rate is \$130 per hour. My assistant's rate is \$50 per hour. Mileage charge is \$0.445 per mile. Meals will be charged at \$35 per day. Motel charge will be a maximum of \$75 plus tax per day. Two days will be required to prepare the report at my hourly rate.

Sincerely,

John M. Alderman, President

MAILING ADDRESS:
244 Red Gate Road
Pittsboro, NC 27312

TELEPHONE: 919-542-5331 (O)
919-444-9576 (M)
EMAIL: aldermjm@mindspring.com

Kacie Jensen

From: James Glover [GLOVERJB@dhec.sc.gov]
Sent: Wednesday, April 26, 2006 2:02 PM
To: Jennifer Summerlin
Subject: Re: Saluda Relicensing:SCDHEC Report/Data



Lower Saluda
Tributaries.xls (...)

Jennifer,

Find attached in the form of an Excel Spreadsheet macroinvertebrate data from Tributaries of the Lower Saluda River collected by the SCDHEC. I will attempt to located the 1986 SCDHEC report from the LSR.

Please let me know if you have any questions.

Jim

James B. Glover, Ph.D.
South Carolina Department of Health and Environmental Control Aquatic Biology Section 2600
Bull Street Columbia SC 29201
Phone- 803-898-4081
Fax- 803-898-4200
E-Mail- GloverJB@DHEC.SC.Gov

>>> Jennifer Summerlin <Jennifer.Summerlin@KleinschmidtUSA.com>

>>> 4/11/2006 2:41 PM >>>

Jim,
Shane Boring asked me to follow up on the action items that were discussed in the March 8th Freshwater Mussel/Benthic Macroinvertebrate TWC meeting notes. You mentioned that you could provide: 1. Raw data on tributaries that were sampled along the LSR by DHEC 2. 1986 SCDHEC macroinvertebrate report for LSR When you get a chance, could you send this information to me? Thanks for your continued interest in the Saluda relicensing process.

Jennifer Summerlin
Scientist Technician
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

PHYLUM	CLASS	ORDER	FAMILY	TAXA	S-052 7/1/1997
Annelida	Hirudinea	NA	NA	Hirudinea	
Annelida	Hirudinea	Rhynchobdellida	Glossiphoniidae	Placobdella sp.	
Annelida	Hirudinea	Rhynchobdellida	Glossiphoniidae	Placobdella papillata	
Annelida	Oligochaeta	Lumbriculida	Lumbriculidae	Lumbriculidae	1
Annelida	Oligochaeta	NA	NA	Oligochaeta	2
Arthropoda	Crustacea	Amphipoda	Gammaridae	Crangonyx serratus	6
Arthropoda	Crustacea	Decapoda	Cambaridae	Cambaridae	
Arthropoda	Crustacea	Decapoda	Cambaridae	Procambarus sp.	
Arthropoda	Hexapoda	Coleoptera	Dytiscidae	Coptotomus sp.	
Arthropoda	Hexapoda	Coleoptera	Elmidae	Ancyronyx variegatus	7
Arthropoda	Hexapoda	Coleoptera	Elmidae	Dubiraphia sp.	
Arthropoda	Hexapoda	Coleoptera	Elmidae	Dubiraphia vittatata	1
Arthropoda	Hexapoda	Coleoptera	Elmidae	Macronychus glabratus	36
Arthropoda	Hexapoda	Coleoptera	Elmidae	Microcylloepus pusillus	24
Arthropoda	Hexapoda	Coleoptera	Elmidae	Stenelmis sp.	3
Arthropoda	Hexapoda	Coleoptera	Gyrinidae	Dineutus sp.	1
Arthropoda	Hexapoda	Coleoptera	Halipilidae	Peltodytes sp.	
Arthropoda	Hexapoda	Coleoptera	Hydrophilidae	Berosus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Ablabesmyia mallochi	
Arthropoda	Hexapoda	Diptera	Chironomidae	Brillia sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Chironomus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Conchapelopia Group	
Arthropoda	Hexapoda	Diptera	Chironomidae	Corynoneura sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Cricotopus/Orthocladius	
Arthropoda	Hexapoda	Diptera	Chironomidae	Cryptochironomus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Cryptotendipes sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Dicrotendipes sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Labrundinia sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Micropsectra sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Nanocladius sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Natarsia sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Omisus pica	
Arthropoda	Hexapoda	Diptera	Chironomidae	Parachironomus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Paratanytarsus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Paratendipes sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Pentaneura sp.	1
Arthropoda	Hexapoda	Diptera	Chironomidae	Phaenopsectra sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum aviceps	
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum convictum	1
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum fallax	
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum halterale	
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum illinoense	
Arthropoda	Hexapoda	Diptera	Chironomidae	Polypedilum scalaenum	
Arthropoda	Hexapoda	Diptera	Chironomidae	Procladius sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Rheocricotopus robacki	
Arthropoda	Hexapoda	Diptera	Chironomidae	Rheotanytarsus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Stenochironomus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Synorthocladius sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Tanytarsus sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Thienemaniella sp.	

Arthropoda	Hexapoda	Diptera	Chironomidae	Thienemannimyia GR	1
Arthropoda	Hexapoda	Diptera	Chironomidae	Tribelos jucundus	
Arthropoda	Hexapoda	Diptera	Chironomidae	Tribelos sp.	
Arthropoda	Hexapoda	Diptera	Chironomidae	Xenochironomus sp.	
Arthropoda	Hexapoda	Diptera	Simuliidae	Simulium sp.	2
Arthropoda	Hexapoda	Diptera	Tipulidae	Hexatoma sp.	
Arthropoda	Hexapoda	Diptera	Tipulidae	Tipula sp.	
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Baetis flavistriga	
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Baetis intercalaris	10
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Baetis pluto	
Arthropoda	Hexapoda	Ephemeroptera	Baetidae	Labiobaetis propinquus	17
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis diminuta	
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis sp.	
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis hilaris	
Arthropoda	Hexapoda	Ephemeroptera	Caenidae	Caenis diminuta/punctata	
Arthropoda	Hexapoda	Ephemeroptera	Heptageniidae	Stenonema modestum	6
Arthropoda	Hexapoda	Ephemeroptera	Isonychiadea	Isonychia sp.	2
Arthropoda	Hexapoda	Ephemeroptera	Tricorythidae	Tricorythodes sp.	14
Arthropoda	Hexapoda	Megaloptera	Corydalidae	Corydalus cornutus	2
Arthropoda	Hexapoda	Megaloptera	Corydalidae	Nigronia serricornis	1
Arthropoda	Hexapoda	Neuroptera	Sisyridae	Climacia areolaris	
Arthropoda	Hexapoda	Odonata	Aeshnidae	Basiaeschna janata	
Arthropoda	Hexapoda	Odonata	Aeshnidae	Boyeria vinosa	18
Arthropoda	Hexapoda	Odonata	Calopterygidae	Calopterygidae	2
Arthropoda	Hexapoda	Odonata	Calopterygidae	Calopteryx sp.	
Arthropoda	Hexapoda	Odonata	Calopterygidae	Hetaerina tittia	1
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Argia sp.	5
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Coenagrionidae	
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Enallagma sp.	2
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Ischnura sp.	
Arthropoda	Hexapoda	Odonata	Coenagrionidae	Ischnura/Anomalagrion	
Arthropoda	Hexapoda	Odonata	Corduliidae	Neurocordulia sp.	4
Arthropoda	Hexapoda	Odonata	Corduliidae	Tetragoneuria sp.	
Arthropoda	Hexapoda	Odonata	Gomphidae	Gomphus sp.	3
Arthropoda	Hexapoda	Odonata	Gomphidae	Hagenius brevistylus	
Arthropoda	Hexapoda	Odonata	Gomphidae	Progomphus sp.	
Arthropoda	Hexapoda	Odonata	Libellulidae	Libellulidae	
Arthropoda	Hexapoda	Odonata	Macromiidae	Macromia sp.	2
Arthropoda	Hexapoda	Trichoptera	Hydropsychidae	Cheumatopsyche sp.	29
Arthropoda	Hexapoda	Trichoptera	Hydropsychidae	Hydropsyche betteni	1
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	Trienodes ignitus	20
Mollusca	Gastropoda	Basommatophora	Physidae	Physella sp.	
Mollusca	Gastropoda	Basommatophora	Planorbidae	Helisoma anceps	
Mollusca	Pelecypoda	Heterodonta	Corbiculidae	Corbicula fluminea	
Mollusca	Pelecypoda	Heterodonta	Sphaeriidae	Sphaeriidae	

Count- 272
Taxa Richness- 33
EPT- 11

Biotic Index-	5.18
EPT Score-	2.0
Biotic Index Score-	5.0
Combined Score-	3.3
Bioclassification-	Good-Fair
Aquatic Life Use Designation*-	PS

*PS=Partially Supporting

*NS=Not Supporting

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
7		9		1	
	1				
			2		
7	5	21	2		10
2	3			1	
1					
		1		1	11
				25	
				4	
	2		1		1
		1	1	19	2
				1	
14	35	2	1	45	4
1					
	1				
3	7	3	7	3	5
					2
					2
	6		6		11
			1		
	2	2		1	7
3				2	2
3					
3			1	1	
		1			1
			1		
	3				
			1		
			1		
4		1	3	3	
		1			
	1				1
29	2	10	14	25	1
					7
					2
		2			
13	9	1	9	1	2
1	3	1	1	1	1
2				1	
1	5		1		4
24		11	59	4	10
		1			
			1		9
3		3		5	4
					3

10		1		13	
3			2		13
		3			
1					
4	1	7	5	22	10
1					
3	4		1	11	2
9				2	
			2		2
2		2		6	
				2	2
			1		
		19			
	1			1	1
				10	2
				2	
			2		
3	3				
1	3		2		14
3				17	1
24	15	2	1	7	4
		2		17	
22	6	6	2		3
				1	
2	10		4		1
	2		3		
2					
					2
					1
				3	
1					
			1		10
95	2	49	60	55	5
1	9			4	
5	4		2		
4					
17	1	6	3	7	9
			6		
334	146	168	210	324	191
38	28	26	35	35	41
4	3	5	3	7	5

	6.96	7.34	6.41	6.47	6.34	6.42
	1.0	1.0	1.0	1.0	1.4	1.0
	2.0	2.0	3.0	2.6	3.0	3.0
	1.5	1.5	2.0	1.8	2.2	2.0
Poor NS	Poor NS	Fair PS	Fair PS	Fair PS	Fair PS	Fair PS

Kacie Jensen

From: Shane Boring
Sent: Monday, April 24, 2006 9:49 AM
To: Steve Summer; Amanda Hill; BARGENTIERI@scana.com; Gerrit Jobsis (American Rivers); Jennifer Price ; Jim Glover; RMAHAN@scana.com; Ron Ahle; Shane Boring
Cc: Jennifer Summerlin
Subject: (Saluda Hydro) Mussel Recon Survey Study Plan (draft;04192006) alderman comments.doc



Mussel Recon
Survey Study Plan...

ear 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

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 be 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
<i>Water Quality Technical Working Committee</i>			
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	ssummer@scana.com
Jennifer Price	SCDNR	(803)353-8232	pricej@dnr.sc.gov
<i>Applicant Contacts</i>			
William Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com
Randy Mahan	SCANA Services	(803)217-9538	rmahan@scana.com

Kacie Jensen

From: Jennifer Summerlin
Sent: Monday, April 17, 2006 5:06 PM
To: 'Wade Bales (balesw@dnr.sc.gov)'; 'Amanda Hill'; 'Bill Argentieri'; 'Hal Beard'; 'Jim Glover'; 'Randy Mahan'; Shane Boring; 'Tom Bowles (tbowles@scana.com)'; Alan Stuart
Subject: Saluda Relicensing: Fish Entrainment Desktop Study Plan

All:
Please disregard the previous fish entrainment desktop study plan email. Attached for your review is the draft study plan for the fish entrainment desktop study. Please provide comments (preferably in track changes) by Tuesday, May 16th or earlier. Thanks your for your continued participation and dedication to the Saluda relicensing process.



Saluda Entrainment
Study Plan ...

Jennifer Summerlin
Scientist Technician
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

Introduction

The Saluda Hydro project is a 202.6 MW licensed hydroelectric facility located in Lexington, Newberry, Richland, and Saluda Counties of South Carolina and is owned and operated by South Carolina Electric & Gas (Licensee). 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.

The Licensee prepared and issued the Initial Stage Consultation Document (ISCD) on May 20, 2005, in order to initiate the relicensing process for the Project. The Licensee submitted the document to a number of state and federal resource agencies for their review and comment.

The Licensee hosted an on-site Technical Working Committee (TWC) meeting on February 22, 2006, which was attended by several members of State and Federal resource agencies. As a result, the United States Fish and Wildlife Service (USFWS) and the South Carolina Department of Natural Resources (SCDNR) requested studies to determine the potential impact of Project operation on the fishery resource. The resource agencies recommended the Licensee assess potential fish entrainment effects on the fishery resource due to project operation.

In response to resource agency requests for studies in support of relicensing, SCE&G proposed to develop entrainment estimates from the extensive entrainment database that currently exists from recent project relicensing. Resource agencies concurred with SCE&G's proposal to determine potential fish entrainment effects through a desktop analysis (meeting minutes dated February 22, 2006).

Methods

Fish entrainment is the passage of fish through the trash rack, penstock, and turbines into the tailrace of the development. Fish entrainment at the Saluda project will be assessed through a desktop study. The goal of this study is to characterize and provide an order-of-magnitude estimate of entrainment using existing literature and site specific information. The primary inputs for this analysis will be:

- 1) Define the entrainment database that can be applied to the Saluda Hydro Project
- 2) Calculate and estimate fish entrainment rate(s) (seasonal if possible)
- 3) Characterize the species composition and length frequency of fish entrainment
- 4) Apply any physical or biological filters that may affect entrainment
- 5) Estimate total annual entrainment for the Saluda Hydro Project

These inputs will be developed as described in the following sections.

Review Existing Entrainment Studies

Over seventy site specific studies of resident fish entrainment at hydroelectric sites in the United States have been reported to date which provide order-of –magnitude estimates of annual fish entrainment (FERC, 1995). Descriptive information will be gathered from each entrainment study and will include:

- 1) Location: geographical proximity (preference given to same river basin)
- 2) Project size: discharge capacity and power production
- 3) Mode of operation - e.g., peaking, run-of-river etc.
- 4) Biological factors: fish species composition
- 5) Impoundment characteristics: general water quality, impoundment size, flow regime
- 6) Physical project characteristics: trash rack spacing, intake velocity, etc.

This information will be assembled into a “matrix” of data to be used as a database for the Saluda Hydro Project entrainment paper study. After review and discussion, the Technical Working Committee (TWC) will select specific studies from this “matrix” that are most applicable to the Saluda Hydro Project. Several key criteria to be used in acceptance of candidate studies will be:

- 1) Similar geographical location, with preference given to projects located on the same river basin
- 2) Similar station hydraulic capacity
- 3) Similar station operation (peaking, pulsing, run-of-river, etc.)
- 4) Biological similarities: fish species, composition and water quality
- 5) Entrainment netting data available

Fish Entrainment Rate

The entrainment rate information from the accepted studies will be consolidated to show fish entrainment rates on a monthly basis (when available). Preference will be given to netting entrainment rates over hydroacoustic entrainment rates. The entrainment rates will be presented in fish entrained per hour of operation and fish per volume of water passed through project turbines (fish/million cubic feet). The data will be grouped by season, where appropriate, to determine an entrainment density for each season of the year. The seasonal data from each entrainment study will be averaged to develop a seasonal mean entrainment estimate at the Saluda Hydro Project.

Species Composition and Length Frequency Analysis

Species composition data from the accepted entertainment studies will be analyzed and compiled to determine the general species and sizes of fish typically entrained at other hydroelectric projects. This information will be grouped to yield predicted seasonal estimates of species-specific length frequency data for entrained fish

to determine:

1. A list of potentially entrained fish species
2. Expected relative abundance and size distribution of each species identified as potentially entrained
3. Prediction of seasonality of potentially entrained fish species.

Estimation Of Annual Fish Entrainment

Total fish entrainment for the Saluda Hydro Project will be estimated on an annual basis to provide an order-of-magnitude entrainment estimate. The total fish entrainment estimate will be produced on a typical water and operating year.

Turbine Mortality

As fish move through hydroelectric turbines, a percentage are killed due to turbine mortality (i.e. blade strikes, shear forces, and pressure changes, etc.). Turbine passage survival studies have been performed at numerous hydroelectric projects throughout the country. Characteristics of these projects will be compared to the characteristics of the Saluda Hydro Project and suitable studies will be selected for the transfer of turbine mortality data for each development. Selected turbine survival rate data will be obtained from the literature and used to estimate the number of fish killed due to turbine mortality. The following turbine characteristics are recommended as general criteria in accepting turbine mortality studies for use in this analysis:

- 1) design type
- 2) operating head
- 3) runner speed
- 4) diameter, and peripheral runner velocity

These characteristics are commonly attributed to turbine passage mortality (Cramer and

Oligher, 1963; Bell, 1991; Eicher, 1987; EPRI, 1992).

To the extent possible, turbine mortality rate data available from source studies will be related to the species-family group and size class of fish estimated to be entrained at the Lake Murray Project. Where multiple tests are available for a given species-family group/size class, a mean survival rate will be computed. For species-family groups/size classes where no applicable data can be found or accepted, the survival rate reported for a similar group/size class will be substituted.

Once turbine mortality rates are developed from the study database, the rates will be applied to the entrainment estimates for each development. This will be accomplished by multiplying fish entrainment estimates by the composite mortality rates for each family/genus group and size class (where applicable).

Entrainment Filters

Due to certain site-specific characteristics of Lake Murray Project, it may be necessary to adjust entrainment estimates. Factors affecting entrainment rates that may warrant investigation for adjustment of estimates include:

- 1) stratification at the intakes (dissolved oxygen),
- 2) intake velocities,
- 3) fish habitat available at the intakes, and/or
- 4) other factors site specific factors.

Reporting

In an attempt to reach consensus during the entrainment paper study, each step of the process will be discussed with TWC members. Comments from the TWC will be addressed during each phase of the analysis. Upon completion of the study, a draft report will be prepared and distributed to State and Federal Resource agencies for review and comment. The Draft report will summarize the results obtained in the study; will contain appropriate tables and figures depicting estimated fish entrainment; and will contain all supporting correspondence among the TWC members. After receipt of all comments, the draft report will be revised to address final comments by all TWC members and will be resubmitted as the Final Report.

LITERATURE CITED

Bell, M. C. 1991. Fisheries Handbook of Engineering Requirements and Biological Criteria. United States Corps of Engineers. Fish Passage Development and Evaluation Program. Portland, OR.

Cramer, F. K., and R. C. Oligher. 1963. Passing fish through hydraulic turbines. Transactions of the American Fisheries Society 93:243-259.

Eicher Associates, Inc. 1987. Turbine-related fish mortality: review and evaluation of studies. Research Project 2694-4. Prepared for Electric Power Research Institute, Palo Alto, CA.

EPRI (Electric Power Research Institute). September 1992. Fish Entrainment and Turbine Mortality Review and Guidelines. TR-101231 Research Project 2694-01. Prepared by Stone & Webster Environmental Services.

Federal Energy Regulatory Commission (FERC). 1995. Preliminary assessment of fish entrainment at hydropower projects – volume 1 (Paper No. DPR-10). Office of Hydropower Licensing, FERC, Washington, DC.

Kacie Jensen

From: Jennifer Summerlin
Sent: Wednesday, April 12, 2006 9:16 AM
To: 'bseibels@riverbanks.org'
Subject: Rocky Shoals Spider Lilly Report

Bob,
I have attached the report below. This document is 11 MB, so it might take up lots of email space!
Thanks, Jennifer



Columbia RSSL
Report.pdf (11 M...

Jennifer Summerlin
Scientist Technician
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

Kacie Jensen

From: Jennifer Price [PriceJ@dnr.sc.gov]
Sent: Tuesday, March 07, 2006 5:23 PM
To: Shane Boring
Subject: RE: Saluda (Lake Murray) Relicensing: Terrestrial; Freshwater Mussel/Benthic Inverts; and Rare, Threatened and Endangered Species Technical Working Committee Meetings

Shane,

[Here is the reference on conservation status a little outdated](#)

Williams, J.D., M.L. Warren Jr., K.S. Cummings, J.L. Harris and R.J. Neves. 1993. Conservation status of the freshwater mussels of the United States and Canada. *Fisheries*. 18(9):6-22.

I am also attaching the most recent data I have from Tim Savidge of the Catena Group, John Alderman of Alderman Env. Services, Gene Keferl (retired) from Coastal Georgia Community college as well as some of the information from the North Carolina Museum of Natural Sciences database given to me by Art Bogan. Some of the data is a little bit tricky to look at. It's hard to find the dates on John's data and some of the abbreviations are confusing (for example is L. Saluda Lower or Little Saluda?) but some of that can be overcome by the GPS coordinates.

I know you are interested in a list of all species in South Carolina. I am providing a list of our conservation priorities from the Comprehensive wildlife conservation plan. The only species from South Carolina not included in the conservation plan are Pyganodon cataracta, Utterbackia imbecillis, and Uniomerus carolinanus because we felt that they were a little bit more tolerant and widespread than the others. However, all mussels are pretty sensitive when compared with most other groups of organisms. For more information on particular species, see the website <http://www.dnr.sc.gov/wcp/soon.htm> I wish that all the mussels were grouped together, but I didn't design the website. there are some rough range maps you could use to get an idea of which species are found in the Saluda/Congaree, though any info. collected after summer of 2004 won't be on there. It's also possible that some locations for these species were missed, since the maps were created by people sitting around a table putting their heads together listing drainages where they'd found them.

Art Bogan and John Alderman's Workbook and key to the Freshwater Bivalves of South Carolina is another good reference, but I can't find a copy on the web.

Let me know if I can be of any more help.

Jennifer

Summary

Based upon the available information, we have put the species in the following categories based upon

their abundance, potential threats and need for conservation efforts. Although some species were difficult to place in a category due to lack of information, we made a decision based upon what is known. It is possible that some species will be more abundant than previously thought after more thorough sampling efforts are conducted.

Highest

All of these species are either rare and have limited geographic ranges, or, if widespread, have exhibited sharp declines throughout their ranges.

Brook Floater *Alasmidonta varicosa*
Barrel Floater *Anodonta couperiana*
Brother Spike *Elliptio fraterna*
Waccamaw Spike *Elliptio waccamawensis*
Atlantic Pigtoe *Fusconaia masoni*
Carolina Heelsplitter *Lasmigona decorata*
Yellow Lampmussel *Lampsilis cariosa*
Triangle Floater *Alasmidonta undulata*
Creeper *Strophitus undulatus*
Savannah Lilliput *Toxolasma pullus*
Notched Rainbow *Villosa constricta*
Carolina Creekshell *Villosa vaughniana*
Southern Rainbow *Villosa vibex*

High (the bold font doesn't mean anything. I don't know why it came up when I pasted this into the e-mail & I can't get rid of it.)

This group of species has shown significant declines or moderately restricted ranges, but may still be abundant at some sites.

Alewife Floater *Anodonta implicata*
Roanoke Slabshell *Elliptio roanokensis*
Elliptio fisheriana/nasutilus
Pod Lance *Elliptio folliculata*
Rayed Pink Fatmucket/Eastern Lampshell *Lampsilis radiata/splendida*
Tidewater Mucket *Leptodea ochracea*
Eastern Pondmussel *Ligumia nasuta*

Moderate

Although healthy populations of these species have been observed in many locations, there are concerns that they may be in decline. The *Elliptio complanata* and *E. icterina* complexes probably contain several species some of which are endangered and some of which are relatively common.

Carolina Lance *Elliptio angustata*
Carolina Slabshell *Elliptio congarea*
Eastern Elliptio Complex *Elliptio complanata* complex
Variable Spike Complex *Elliptio icterina* complex
Atlantic Spike *Elliptio producta*
Eastern Creekshell *Villosa delumbis*

-----Original Message-----

From: Shane Boring [mailto:Shane.Boring@KleinschmidtUSA.com]

Sent: Thursday, March 02, 2006 12:06 PM

To: Amanda Hill (amanda_hill@fws.gov); Jennifer Price; Ron Ahle; EPPINK, THOMAS G; Bob Seibels; Dick Christie; Gerrit Jobsis (American Rivers); Gerrit Jobsis (CCL); Steve Summer; Alan Stuart; Alison Guth; Bill Argentieri; Randy Mahan; Buddy Baker; 'bstutts@scana.com'

Subject: Saluda (Lake Murray) Relicensing: Terrestrial; Freshwater Mussel/Benthic Inverts; and Rare, Threatened and Endangered Species Technical Working Committee Meetings

When: Wednesday, March 08, 2006 9:00 AM-3:00 PM (GMT-05:00) Eastern Time (US & Canada).

Where: Lake Murray Training Center

~~*~*~*~*~*~*~*~*

Hello Folks:

As discussed in the Fish and Wildlife Resource Conservation Group (RCG) meeting last week, the inaugural meetings of the Terrestrial, Freshwater Mussel/Benthic Invert, and Rare, Threatened and Endangered Species Technical Working Committees (TWCs) will be held on Wednesday March 8 at the Lake Murray Training Center. Throughout the relicensing process, similar efforts will be made to combine meeting to a single day to ease the travel burden on involved stakeholders and agency staff. A draft agenda is provided below for those who only want to attend the committees for which they are a member. Finally, please RSVP so that we can make the proper arrangements for lunch.

Thanks for you continued participation in the Saluda Relicensing.

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

<<Fish and Wildlife TWC Agenda 3-08-06.doc>>

Cheryl Balitz

From: Steve Leach [LeachS@dnr.sc.gov]
Sent: Monday, February 27, 2006 12:08 PM
To: Steven R Johnson; SUMMER, STEPHEN E; djcoughl@duke-energy.com; Shane Boring; Alison Guth; Gene E Vaughan
Cc: Dick Christie; Val Nash
Subject: Shad passage report

All,

Please forward this to anyone that I missed who may be interested:

My estimation is that the shad run into the Santee Cooper system began in earnest yesterday, with several thousand passed at St. Stephen, and continuing operations for passage through Pinopolis Lock. Water temperature at St. Stephen reached 12 C during the afternoon yesterday.

Also, three shortnose sturgeon are making a move upstream, upon last location (2/24, they were in the reach between the Hwy 601 crossing of the Congaree River and the Congaree Swamp National Park put-in. We will be looking to locate those fish starting at Rosewood and working downstream tomorrow.

If you have any questions, please feel free to contact me.

Thanks

Steven D. Leach

South Carolina Department of Natural Resources
Dennis Wildlife Center
305 Black Oak Rd.
Bonneau, SC 29431
(843) 825-3388

Kacie Jensen

From: Amanda_Hill@fws.gov
Sent: Monday, January 09, 2006 11:14 AM
To: Alison Guth
Subject: FWS Eel Survey Comments



COMMENTS_Eel_Su
rvey_Report_200...

(See attached file: COMMENTS_Eel_Survey_Report_2005.doc)

Amanda Hill
Fisheries Biologist
U.S. Fish and Wildlife Service
176 Croghan Spur Rd., Suite 200
Charleston, SC 29407
843-727-4707 ext. 303
843-727-4218 fax
amanda_hill@fws.gov

NOTE NEW PHONE EXTENSION

"Our mission is working with others to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people."

December 2, 2005

SCE&G
111 Research Drive
Columbia, South Carolina 29203

Re: COMMENTS, South Carolina Electric & Gas, Saluda Hydroelectric Project (FERC No. 516), Diadromous Fish Studies 2005 – American eel (*Anguilla rostrata*) Survey

Attn: Alan Stuart, Kleinschmidt Associates

Dear Mr. Stuart:

The U.S. Fish and Wildlife Service (Service) has reviewed the *Diadromous Fish Studies 2005- American eel (Anguilla rostrata) Survey* report submitted for agency review in September 2005 as part of South Carolina Electric & Gas' (SCE&G) Saluda Hydropower relicensing process. We submit the following comments and recommendations in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. §§ 661-667e); Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. §§ 1531-1543); the Federal Power Act (16 U.S.C. § 791 et seq.); the National Environmental Policy Act (42 U.S.C. § 4321 et seq.); the Clean Water Act (33 U.S.C. § 1251 et seq.); and the Electric Consumers Protection Act of 1986 (Pub. L. No. 99-495, 100 Stat. 1243).

General Comments

The Service has reviewed the 2005 American eel survey report for the lower Saluda River. We commend SCE&G for agreeing to begin early sampling prior to the initiation of the relicensing process. This early start to the diadromous fish sampling will provide multiple years of sampling allowing for a larger data set. It also allows participants including the resource agencies, applicant, and consultants to improve upon methodologies utilized in previous sampling seasons.

Due to the increased interest in the status of American eel along the Atlantic Coast resulting from a petition to the Service to investigate its potential listing and protection under the Endangered Species Act, new information is being gathered and reported daily. Based on the results of American eel sampling during 2004-2005 at Duke Power's Catawba-Wateree Hydropower Project on the Wateree River, results of 2005 sampling on the lower Saluda River, and 2005 sampling reports from the Roanoke River at the Roanoke Rapids Hydropower Project, we recommend modifying sampling strategies on the lower Saluda River for the 2006 sampling season. It has become apparent that eel pots and traps are ineffective at gathering American eels in freshwaters of the Santee Basin. What do appear to be effective are eel ramps in tailwaters at dams and in spillways. We have also learned that the eels appear to be active around 15° C, which did not occur until May in the lower Saluda River in 2005. We recommend the following methodologies and gear types be utilized in 2006 in lieu of eel pots and traps. Details of 2006 survey efforts should be developed in coordination with the Service.

- 1) Develop and install eel ramps at the Saluda Dam and Saluda Spillway, similar to the structure located at Duke Power's Wateree Dam on the Wateree River.
- 2) Spring and Fall sampling efforts should be concentrated around a range of temperatures, specifically at $\pm 15^{\circ}$ C.
- 3) Visual observations/surveys should be conducted at the spillway during the above referenced temperature range including spring and fall.

Specific Comments on Report

- Page 1, Introduction, 3rd Paragraph. The text should be revised to the following: "Resource agencies goals and objectives for the Santee Basin include the restoration of diadromous species. Target species include the American shad, hickory shad, blueback herring, shortnose sturgeon, Atlantic sturgeon, striped bass, and the American eel."
- Page 14, 2nd Paragraph. It should be noted and included in the text that although no American eels were caught in eel traps at six locations in 2005 at the Catawba-Wateree Hydropower Project on the Wateree River, over 50 American eels were caught at the Wateree Dam utilizing an eel ramp.
- Pages 14-17, Tables 1-4. If the data is available, it would be helpful for the Service, if water temperatures at the sampling sites were included as a column in the four Tables.

We appreciate the opportunity to comment on the 2005 American eel survey and look forward to coordinating with SCE&G and Kleinschmidt to develop 2006 American eel sampling methodologies. We recommend scheduling a meeting in January to discuss

2006 American eel and anadromous fish sampling efforts for the lower Saluda River and Congaree River.

If you have any questions or need additional information, please contact Ms. Amanda Hill of my staff at 843-727-4707 ext. 303.

Sincerely yours,

Timothy N. Hall
Field Supervisor

TNH/AKH

Kacie Jensen

From: Mark_A_Cantrell@fws.gov
Sent: Monday, January 09, 2006 11:27 AM
To: Mark_A_Cantrell@fws.gov
Cc: Alan Stuart; Alison Guth; 'Amanda Hill (amanda_hill@fws.gov)'; BARGENTIERI@scana.com; 'Hal Beard (BeardH@scdnr.state.sc.us)'; 'Steve Leach'; 'Prescott Brownell (prescott.brownell@NOAA.gov)'; RMAHAN@scana.com; Shane Boring; 'Steve Summer (ssummer@scana.com)'
Subject: Re: Conference call with agencies to discuss 2006 Saluda dia dromous fish sampling

Per the conference call, here are some descriptions of ramp-type traps for eels.

I was able to get Dr. Knights to look at some maps and photographs of the Saluda Project and some other sites a few weeks ago - he recommended some better locations based on flows.

To detect eel movements, timing, etc., not to sample adult resident eels, he recommended ramp-type traps he describes in his paper, to be located at dams or other obstructions. Quieter water adjacent to swift!

He favored the pool below Saluda spillway, or something at one of the side channels below the powerhouse.

He did note frequent checks, daily, and security issues are a factor in trap success.

Flow across the ramp and attraction flow should be about 1/4 - 1/2" in depth. This can be by gravity or pumped.

thnaks,
Mark A. Cantrell
U.S. Fish & Wildlife Service
160 Zillicoa Street
Asheville, NC 28801
828/258-3939, ext 227
fax: 828/258-5330
mobile: 828/215-1739
mark_a_cantrell@fws.gov

"Our mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

Kacie Jensen

Subject: Updated: Conference call with agencies to discuss 2006 Saluda diadromous fish sampling
Location: via conference call

Start: Mon 1/9/2006 10:00 AM
End: Mon 1/9/2006 11:00 AM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Required Attendees: 'Amanda Hill (amanda_hill@fws.gov)'; 'Hal Beard (BeardH@scdnr.state.sc.us)'; 'Prescott Brownell (prescott.brownell@NOAA.gov)'; 'Steve Summer (ssummer@scana.com)'; 'dchristie@infoave.net'; 'Mark A. Cantrell (mark_a_cantrell@fws.gov)'; 'Steve Leach'; Alan Stuart; Alison Guth; Argentieri, Bill

Optional Attendees: MAHAN, RANDOLPH R

Hello all:

Attached is the 2005 Saluda Diadromous Fish Study Plan for your review prior to our call on Monday. Please be prepared to discuss any changes that you feel should be made prior to starting the 2006 sampling. Looking forward to talking with you all at 10 AM on Monday.

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



Diadromous_Fish_S
tudy_Plan_011...

Kacie Jensen

From: Shane Boring
Sent: Wednesday, January 04, 2006 12:01 PM
To: Shane Boring; 'Amanda Hill (amanda_hill@fws.gov)'; 'Hal Beard (BeardH@scdnr.state.sc.us)'; 'Prescott Brownell (prescott.brownell@NOAA.gov)'; 'Steve Summer (ssummer@scana.com)'; 'dchristie@infoave.net'; 'Mark A. Cantrell (mark_a_cantrell@fws.gov)'; 'Steve Leach'
Cc: BARGENTIERI@scana.com; 'Steve Summer (ssummer@scana.com)'; Alison Guth; Alan Stuart
Subject: Final 2005 Lower Saluda/Upper Congaree River Diadromous Fish Study Summary Report

Hello All:

Attached is the final report summarizing the result's of SCE&G's diadromous fish sampling effort in the Saluda and Congaree Rivers during 2005. Thanks to all who provided comments on the draft. As always, please feel free to give me a call if you have any comments or questions regarding the report.

Thank you,
Shane Boring



2005 Saluda
adromous Summary

Kacie Jensen

From: Shane Boring
Sent: Tuesday, January 03, 2006 11:18 AM
To: Tom Murphy (murphyt@dnr.sc.gov); Amanda Hill (amanda_hill@fws.gov); BARGENTIERI@scana.com; Boozer Tommy (tboozer@scana.com); Dick Christie (dchristie@infoave.com); Ed_Eudaly@fws.gov; Hal Beard (BeardH@scdnr.state.sc.us); HOFFMAN, VAN B; Laura Blake (E-mail); RMAHAN@scana.com; Ron Ahle (ahler@dnr.sc.gov); Steve Summer (ssummer@scana.com); Alison Guth; Alan Stuart
Subject: 2005 Lake Murray Wood Stork Surveys - Summary Report

Hello All:

Attached is the final report summarizing the 2005 Lake Murray wood stork surveys. As you may remember from the monthly updates, no wood storks were observed on the lake during 2005. The 2006 surveys will begin in February. Thank you all for your continued interest in this study.

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



2005 Wood Stork
Summary Report...

Kacie Jensen

From: Alan Stuart
Sent: Wednesday, August 22, 2007 2:54 PM
To: 'Prescott Brownell (Prescott.Brownell@noaa.gov)'; 'Dick Christie'; 'Amada_Hill@fws.gov'
Cc: Jennifer Summerlin; 'QUATTLEBAUM, MILTON'; 'SUMMER, STEPHEN E'
Subject: 2007 Shortnose Sturgeon draft Report

Good afternoon all,

Attached is the 2007 Draft Shortnose Sturgeon Report prepared by Jenni Summerlin. The report details the efforts of this year's sampling. As most of you know, no sturgeon (of any life stage) were captured during the study. No additional sturgeon sampling is scheduled for next year. However, we are planning to convene a meeting in October/November to discuss the American Shad telemetry study and potential Columbia Fishway monitoring for next season.

Please review the attached report and provide us comments by September 21st so we can begin finalize the report. Also, please circulate the report to anyone in your respective agencies you believe could benefit from the information. As always, should you have questions before then just let us know.



2007 Shortnose
Sturgeon Draft ...

Thank you for all of your efforts !!

Alan

Senior Licensing Coordinator
Kleinschmidt Energy and Water Resources
101 Trade Zone Drive Suite 21A
West Columbia, SC 29170

Phone 803.822.3177
Cell 803.640.8765

Kacie Jensen

From: Shane Boring
Sent: Friday, May 25, 2007 3:30 PM
To: Jennifer Summerlin; Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jim Glover; Malcolm Leaphart; Mike Waddell; Milton Quattlebaum (mquattlebaum@scana.com); Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
Cc: Alan Stuart; 'Bill Argentieri'
Subject: Saluda IFIM Transects

Dear Instream Flow TWC Members:

As many you aware, we finished up selection of transect locations for the upcoming lower Saluda IFIM study during our field visit earlier this week. Many thanks to those who made it out for the field visits. To ensure we're all on the same page, the attached documents includes a table summarizing the selected transects as well as maps showing their spatial distribution. If there are any questions on the transects that have been selected, please contact Brandon Kulik (207-487-3328) or me by close of business next Wednesday, May 30. Field data collection is slated to begin Monday June 4.

Thanks
Shane Boring

Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183



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et_sek.pdf (11...



LSR transects.doc
(55 KB)



Saluda_Lower_She
et_sek.pdf (96...



Saluda_Sheet_sek.
pdf (213 KB)

Kacie Jensen

From: Shane Boring
Sent: Monday, May 07, 2007 9:07 AM
To: Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; Mike Waddell; Milton Quattlebaum (mquattlebaum@scana.com); Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
Subject: Lower Saluda River IFIM Study: Mesohabitat Assessment

All:

Attached is the draft memo and accompanying maps summarizing the recent mesohabitat assessment on the Lower Saluda River. As you may remember, the mesohabitat assessment was prepared in support of the upcoming IFIM study. We wanted to get the information to the group prior to the field visit later this week in order to facilitate selection of appropriate transect locations.

As previously noted, the mesohabitat assessment is still in draft format, so please feel free to provide comments. I do ask, however, that all comments be submitted by May 18, 2007. Thanks for your continued participation in the Lower Saluda IFIM Study.

Shane Boring

Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183



Lower Saluda IFIM
Mesohab Asse...

Kacie Jensen

From: Shane Boring
Sent: Monday, May 07, 2007 9:07 AM
To: Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; Mike Waddell; Milton Quattlebaum (mquattlebaum@scana.com); Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
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All:

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As previously noted, the mesohabitat assessment is still in draft format, so please feel free to provide comments. I do ask, however, that all comments be submitted by May 18, 2007. Thanks for your continued participation in the Lower Saluda IFIM Study.

Shane Boring

Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183



Lower Saluda IFIM
Mesohab Asse...

Kacie Jensen

Subject: Conference Call to Discuss Lower Saluda River Self-sustaining Trout White Paper
Location: Via Conference Line
Start: Wed 5/23/2007 9:30 AM
End: Wed 5/23/2007 10:30 AM
Show Time As: Tentative
Recurrence: (none)
Meeting Status: Not yet responded
Required Attendees: Fish & Wildlife TWC - IFIM/Aquatic Habitat



Saluda Trout Paper
DRAFT 2006-...

Hello All:

We would like to convene a conference call in the near future to discuss and hopefully finalize the draft white paper discussing the potential for a self-sustaining/reproducing trout fishery in the Lower Saluda River (attached). As you may remember, the draft white paper was issued via e-mail on 11/6/2006. No major comments were received, and we want to go ahead and finalize the report as soon as possible. Thanks and please let us know of your availability for the above date and time.

Thanks,
Shane Boring

Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

Kacie Jensen

From: Shane Boring
Sent: Friday, April 20, 2007 11:04 AM
To: Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; Mike Waddell; Milton Quattlebaum (mquattlebaum@scana.com); Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Brandon Kulik; Alan Stuart
Subject: Saluda Instream Flow Study: Brown Trout Habitat Suitability Information

All:

As you may remember, the Instream Flow TWC met via conference call last Tuesday (May 10) and selected substrate Habitat Suitability Criteria for a number of target species and lifestages (smallmouth bass and brown and rainbow trout). At that conference call, the group reached consensus on source substrate for all the lifestages discussed, with the exception of brown trout juveniles, spawning and fry. HSC criteria were not selected for these lifestages due to limited source study information (i.e. only the Raleigh et al. "Blue Book" values were available). At the request of Mike Waddell and others, included below are the substrate HSC criteria used for the Catawba-Wateree Study (originally developed for the Tuckaseegee and Nantahala IFIM Studies), along with a legend that describes the substrate codes. To facilitate closing out the HSC selection process, please provide feedback regarding the acceptability of these curves versus the Raleigh et al. curves by COB next Friday, April 27th. When providing feedback, please use the "reply to all" option so that we can maintain an open forum.

Many thanks to Dick Christie for getting in touch with the original authors to acquire the legends needed to interpret the Catawba-Wateree data. The graphs included below are excerpted from the final Catawba-Wateree IFIM report (Page 250).

Thanks and have a good weekend,
Shane Boring

Environmental Scientist
Kleinschmidt Associates
101 Trade Zone Dr., Suite-21A
West Columbia, SC 29170
Phone: (803)822-3177
Fax: (803)822-3183

Kacie Jensen

From: Shane Boring
Sent: Tuesday, April 10, 2007 4:57 PM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle
Subject: Saluda Hydro Relicense: Lake Murray Waterfowl Surveys -- 2006-07 Draft Report

Dear Terrestrial Resources TWC Members:

Attached for your review is the draft report summarizing the waterfowl survey performed by Savannah River Ecology Lab on Lake Murray during the 2006-2007 waterfowl season. Please provide comment on the draft report, preferably in MS Word track changes, by April 24th, 2007. Thanks for your interest in the Lake Murray waterfowl surveys.

Shane Boring
Kleinschmidt Associates



SREL Waterfowl
Report 2006-07(...

Kacie Jensen

From: Prescott Brownell [Prescott.Brownell@noaa.gov]
Sent: Monday, April 02, 2007 11:08 AM
To: Shane Boring
Cc: Theresa Thom; Alison Guth; Amanda Hill; BARGENTIERI@scana.com; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Hand; Jim Glover; Malcolm Leaphart; Mike Waddell; mquattlebaum@scana.com; RMAHAN@scana.com; Ron Ahle; Scott Harder; Steve Summer; Brandon Kulik; Alan Stuart; Cheryl Balitz; balesw@dnr.sc.gov; Bill East; Bill Hulslander; Bill Marshall; Bob Perry; bseibels@yahoo.com; Charlene Coleman; Daniel Tufford; Ed Diebold; George Duke; Gina Kirkland; Jeff Duncan; Jennifer O'Rourke; Jim Goller; Joe Logan; Joy Downs; turnerle@dhec.sc.gov; laura.mccary@gmail.com; Mark Leao; Mike Sloan; Norman Ferris; Patrick Moore; Ralph Crafton; rbull@davisfloyd.com; Robert Lavisky; Sam Drake; Steve Bell; Steve Leach; Suzanne Rhodes; tbowles@scana.com
Subject: Re: Saluda Hydro Relicense: 1/22/2007 Instream flow/Aquatic Habitat TWC Final Meeting Notes



Sturgeon Model
Draft March 03....



Atlantic Sturgeon
Model.xls (2...



Revised SNS
Model.xls (27 KB)



prescott.brownell.v
cf (401 B)

Hello Shane and team,

The notes state that you had been unable to contact me regarding shortnose sturgeon model curves and their applicability to the Saluda. I sent a copy of the most recent shortnose and Atlantic sturgeon model in February, and a draft earlier version with the same curves in October ???. The curves should be well adapted for use in the Saluda River. Attached is another copy of the sturgeon model just in case.

Call if you have questions..

PB

Shane Boring wrote:

>
> All:
>
> Attached for your records are the final meeting notes from the January
> 22nd, 2007, meeting of the Instream Flow / Aquatic Habitat TWC.
> Thanks to all who provided comments. As always, the notes will be
> posted to the relicensing website.
>
> Have a good weekend,
> Shane Boring
>
>
> <<2007-01-22 Instream Flow TWC meeting notes(final).pdf>>
>
> Cheryl:
>
> Could you please post these to the website under Fish and Wildlife
> RCG, Instream Flow TWC. Thanks.
>

Spawning Habitat Suitability Index Models

And Instream Flow Suitability Curves

Model I: Shortnose Sturgeon

Model II: Atlantic Sturgeon

Southeastern Atlantic Coast River Basins

Draft

March 12, 2003

Edited by:

Prescott H. Brownell

Fishery Biologist

National Marine Fisheries Service

Charleston, South Carolina

Acknowledgements

The draft models have been prepared in coordination with Joe Hightower, North Carolina Cooperative Fish and Wildlife Research Unit, N.C. State University; Mark Collins, South Carolina Division of Marine Resources, Charleston, SC; Boyd Kynard and Micah Kieffer, Silvio Conte Anadromous Fish Laboratory, Turners Falls, Massachusetts; Steve Gilbert, U.S. Fish & Wildlife Service, Charleston, SC Field Office, and Wilson Laney, U.S. Fish & Wildlife Service, Fishery Resources Office, Raleigh, N.C. Their assistance is greatly appreciated. The current draft model has been circulated to a wider audience of biologists, and their recommendations will be included in preparation of final models for publication.

PREFACE

The information and suitability curves presented in this draft model are intended for use in evaluating instream habitat conditions, employing Habitat Evaluation Procedures (HEP) and/or the Instream Flow Incremental Methodology (IFIM). The IFIM curves for Atlantic sturgeon and shortnose sturgeon presented are project team modifications of the original model for shortnose sturgeon that was prepared by Crance (1986)¹. As noted by Crance in the original documentation, the SI curves were intended as starting points for users of HEP or IFIM to develop their own curves and relationships, in response to project-specific conditions and needs. Since publication of the original model in 1986 considerable research has been conducted on shortnose sturgeon, and to a lesser degree Atlantic sturgeon behavior and habitat preferences, as well as historic distribution and habitat use in northeastern and southeastern habitats. The information and curves presented are hypotheses of species-habitat relationships, not statements of proven cause and effect relationships. Further, the model relationships and outputs are intended to aid in the assessment of impacts, and design of potential instream flow mitigation features and recommendations. The fishery biologists using these relationships will need to make project specific recommendations whether or not an IFIM model is available. It is hoped that this model will aid their efforts and promote consensus in management decisionmaking.

SHORTNOSE AND ATLANTIC STURGEON SPAWNING HABITAT MODELS

HABITAT USE INFORMATION, Southeastern Rivers

General

Sturgeon are known to have ascended major southeastern river basins such as the St. Johns, St. Mary 's, Altamaha, Ogeechee, Savannah, Edisto, Santee, Pee Dee, Neuse, and Roanoke to riverine habitats well past the limit of the coastal plain, based on historic accounts (Goode, 1887², and Bowers, 1896³). Because of the fact that sturgeon data in historic accounts did not distinguish between shortnose and Atlantic sturgeon, it is impossible to ascertain if there were differences in distribution (river ascent) between the species. The assumption is made that sturgeon of both species were capable of moving upstream as far as hydraulic conditions would allow, and in all probability did migrate upstream well into the piedmont in larger river systems. Sturgeon stocks have declined drastically since the mid 19th century due to overfishing, habitat degradation, and to blockage of access to primary spawning habitats by dams on many rivers. An additional factor contributing to the decline of sturgeon species may be alteration of natural instream flows due to water diversions, hydropower operations, and related impacts on sturgeon spawning behavior due to non-natural fluctuations in flows during spawning periods. Based on the consensus opinion of the model development team, optimal spawning habitat conditions were generally present in rocky shoal and rock outcrop habitats in major rivers of the east. These shoal habitats are generally present at the moderate to high gradient transition between coastal plain and piedmont physiographic provinces, and at other locations well into the piedmont sections of these rivers. In nearly all cases, such habitats have been blocked by major

hydropower and navigation dams and are no longer accessible to spawning sturgeon. Limited spawning and recruitment may be possible in other riverine habitats, possibly accounting for the presence of small remnant populations of sturgeon in some rivers such as the Altamaha, Savannah, Santee, Pee Dee, and Neuse.

MODEL I: SHORTNOSE STURGEON (*Acipenser brevirostrum*)

Modified IFIM Spawning Habitat Suitability Curves for Shortnose Sturgeon

The following variables and relationships are considered important for assessment of shortnose sturgeon spawning habitat quality, and related evaluation of impacts due to changes in substrate, water velocity, temperature, and depth. The overall habitat suitability value expressed in this model is simply the lowest of the four individual Suitability Index (SI) values. Figures identified below are the attached excel files.

- V1. Water Velocity, spawning and incubation. Measured as mean water column velocity in Meters per second. Figure 1 displays a table of data values and corresponding SI value relationships.
- V2. Depth, spawning, incubation. Figure 2 displays a table of data values and SI relationships. The depth vs. SI values are estimated to represent minimum suitable depths for spawning adults assuming that access to these depths is not obstructed by habitat features further downstream.
- V3. Substrate, spawning and incubation. This habitat variable is intended to capture behavioral preferences of spawning adults and habitat conditions for eggs during the incubation period prior to the first downstream migration of larvae. Factors such as oxygenation, substrate embeddedness, available egg attachment sites, and protection of eggs from other predators are hypothesized to be available in gravel, and cobble gravel substrates. Bedrock typically is interspersed with pockets of cobble and gravel, and may also contain fissures and microhabitat features that provide cover and well oxygenated sites for egg maturation. Figure 3 displays a table of data values and SI relationships
- V4. Temperature, spawning. The SI values and relationships to temperature are based on literature and consensus of the model review team. Figure 4 displays a table of values and SI relationships.

The overall SI value for shortnose sturgeon spawning habitat is represented by the lowest individual variable si value.

SI = the lowest of: V1 si, V2 si, V3 si, V4 si.

MODEL II: ATLANTIC STURGEON (*Acipenser oxyrinchus*)

IFIM Habitat Suitability Curves for Spawning Atlantic Sturgeon

The following variables and relationships are considered important for assessment of Atlantic sturgeon spawning habitat quality, and related evaluation of impacts due to changes in substrate, water velocity, temperature, and depth. Figures referenced below are the attached excel files.

- V1. Water Velocity, spawning and incubation. Measured as mean water column velocity in meters per second. Figure 1 presents a table of data values and SI relationships
- V2. Depth, spawning, incubation. The depth vs. SI values are estimated to represent minimum suitable depths for spawning adults assuming that access to these depths is not obstructed by habitat features further downstream. The depth relationships are based on the hypothesized minimum depths for spawning age Atlantic sturgeon. Figure 2 displays variable relationships.
- V3. Substrate, spawning and early incubation. This habitat variable is intended to capture behavioral preferences of spawning adults and habitat conditions for eggs during the incubation period prior to the first downstream migration of larvae. The curve and data values for Atlantic sturgeon are based on the model for shortnose sturgeon, assuming similar habitat preferences and conditions are required. Factors such as oxygenation, substrate embeddedness, available egg attachment sites, protection of eggs from other predators, light intensity, solar warming...are hypothesized to be available in gravel, boulder, and cobble gravel substrates. Bedrock typically is interspersed with pockets of cobble and gravel, and may also contain fissures and microhabitat features that provide cover and well oxygenated sites for egg maturation. Figure 3 displays a table of data values and SI relationships
- V4. Temperature, spawning. The SI values and relationships to temperature are based on the generally later upstream spawning movement of Atlantic sturgeon, compared with the shortnose sturgeon. Figure 4 displays a table of values and SI relationships.

The overall SI value for Atlantic sturgeon spawning habitat is represented by the lowest individual variable si value.

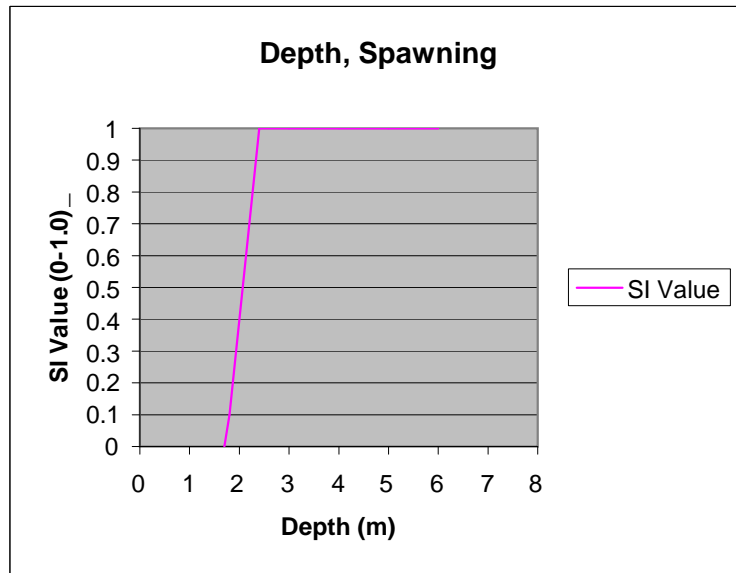
SI = the lowest of: V1si, V2 si, V3 si, V4 si

REFERENCES

- Crance, J.H. 1986. Habitat suitability index models and instream flow suitability curves: shortnose sturgeon. U.S. Fish Wildl. Serv. Biol. Rep. 82(10.129). 31 pp.
- Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum* LeSeur 1818. Food and Agricultural Organization of the United Nations Fishery Synopsis 140 (NMFS/S 140). 45 pp.
- Kynard, B. 1997. Life history, latitudinal patterns, and status of the shortnose sturgeon, *Acipenser brevirostrum*. Env. Biol. Fish: 48:319-334.

Atlantic Sturgeon
V2: Depth, spawning and incubation.

Depth (m)	Depth (ft)	SI Value
1.7	0	0
1.8		0.1
2.4		1
3		1
4		1
5		1
6		1
7		1
8		1

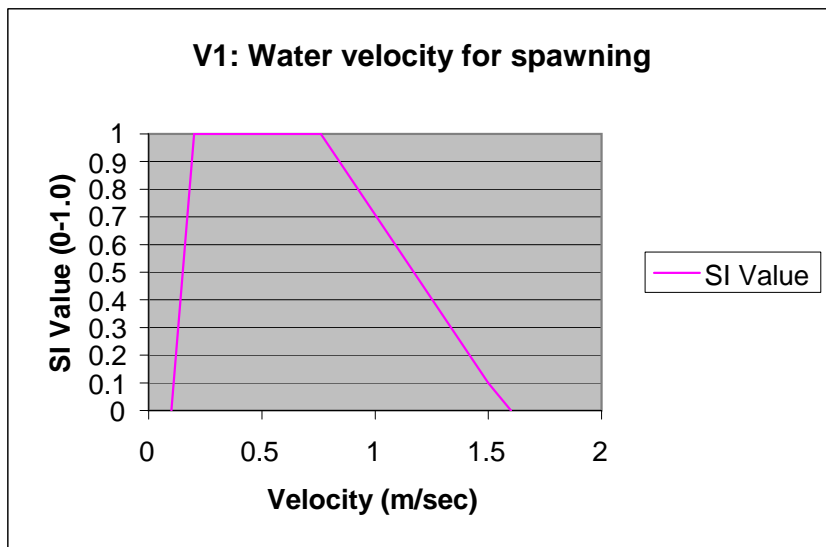


Shortnose Sturgeon IFIM Curves

Revised Shortnose Sturgeon Spawning Habitat Model

V1: Water velocity, spawning and incubation. Measured as mean water column velocity in meters per s

Velocity	SI Value
0.1	0
0.2	1
0.76	1
1.5	0.1
1.6	0



second.

Kacie Jensen

From: Shane Boring
Sent: Wednesday, March 07, 2007 11:52 AM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle
Subject: Lake Murray Waterfowl Surveys



2006-2007 Lake Murray Waterfow... 2006-2007 Lake Murray Waterfow...

Dear Terrestrial Resources TWC Members:

The Lake Murray waterfowl survey for the 2006-2007 season are complete (see attached data summaries). Observations during the mid-February survey were similar to those in January, with scaup being the most abundant species observed. The data suggests that most ducks had cleared out by the February 27th survey. One interesting note was the observation of two mute swans during the February 19th survey. The final report from SREL should be forthcoming sometime around the first of April. Thanks for your continued interest in the Lake Murray waterfowl surveys.

Thanks,
Shane

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

Kacie Jensen

From: Amanda_Hill@fws.gov
Sent: Tuesday, February 13, 2007 3:23 PM
To: Jennifer Summerlin
Cc: Alan Stuart
Subject: Re: FW: Saluda Relicensing: Saluda Hydro Fish Entrainment/Turbine Mortality Report



Saluda Hydro



Saluda Hydro



Mortality

Entrainment-Mortality Report 2007-1-29 (301 KB)

Jenny,

Attached are some comments to the Entrainment/Mortality Study in track changes. In addition I have the following questions.

1. In addition to the "With and Without Filter" can you determine and develop a Table with the percentage of Entrained/Killed between units 1-4 and 5.
2. How does this study consider the unique circumstance at Lake Murray of the dissolved oxygen stratification in the summer/fall near the dam in front of unit #5?
3. Why are August and October flows considered in relation to the filters?
4. What might proposed mitigation include?

(See attached file: Saluda Hydro Entrainment-Mortality Report 2007-1-29 (JMS)draft_FWS_comments.doc)

Amanda Hill
Fisheries Biologist
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NOTE NEW PHONE EXTENSION

"Our mission is working with others to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people."

"Jennifer
Summerlin"

<Jennifer.Summerlin@KleinschmidtUSA.com>

02/12/2007 01:14
PM

To
<balesw@dnr.sc.gov>, "Amanda Hill"
<amanda_hill@fws.gov>, "Bill
Argentieri"
<bargentieri@scana.com>, "Hal
Beard" <beardh@dnr.sc.gov>, "Jim
Glover" <GloverJB@dhec.sc.gov>,
"Randy Mahan" <rmahan@scana.com>,
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<shane.boring@kleinschmidtusa.com>,
<tbowles@scana.com>, "Alan Stuart"
<Alan.Stuart@KleinschmidtUSA.com>

cc

Table C-2: Fish Entrainment at the Ninety-Nine Islands Project Based on Hydroacoustic Sampling During February - December of 1990

MONTH	DAYS SAMPLED	HOURLY ENTRAINMENT RATE	TOTAL HOURS OF TURBINE OPERATION	PROJECTED NUMBER OF FISH ENTRAINED
January	No Data	Used Feb = 0.4	3,140	1,256
February	13	0.4	3,656	1,487
March	13	4.6	3,937	18,150
April	9	4	3,362	13,474
May	7	12.8	2,862	36,701
June	15	11	1,708	18,722
July	15	5.9	1,655	9,838
August	9	14.8	1,489	22,037
September	12	8	1,357	10,788
October	No Data	Ave. of Sept. and Nov. rates = 13.2	2,605	34,386
November	9	18.4	2,064	37,936
December	No Data	Feb. rate = 0.4	2,026	810
TOTAL	101 days	Mean =6.9 fish/hr	29,861 hrs	205,585 fish

2.0 *GASTON SHOALS*

Hydroacoustic and full recovery netting were performed on Unit 6 (a 2.5 MW vertical Francis-type turbine) of the Gaston Shoals Hydroelectric project during January - December of 1990.

2.1 Full Recovery Entrainment Netting

Full recovery entrainment netting was performed on Unit 6 of the Gaston Shoals project during the daylight (0800 - 1600) and the nighttime hours (2000 - 0400). Netting was performed on a monthly basis with a 2 hour sample taken 4 times a day (one 24 hr period) once per month yielding a total of 64 (32 daytime and 32 nighttime) sampling hours for the year (Table 3). "Initial and steady-state", daytime, and nighttime sampling was performed, but no apparent trends were observed; therefore all monthly netting data was combined to yield a total number of fish (by species) entrained per hour of sampling. Monthly netting efficiencies were calculated and each monthly data set was corrected for net losses. The total number of fish entrained by month was determined by totaling the number of generation hours for each of the three operational turbine units at the project and multiplying by the monthly entrainment netting rate. The sum of the estimated monthly entrainment yields a total estimated annual entrainment of 156,619 fish for the project. Investigators indicated that these estimates may be inflated due to suspected net intrusion in the tailrace collections.

2.2 Hydroacoustic Entrainment Sampling

Hydroacoustic sampling was performed on Unit 6 of the Gaston Shoals on a monthly basis during both daytime and nighttime project operation with a total of 112 days of data collected (Table 4). Fish entrainment is reported as the number of fish entrained per hour of sampling. Reported monthly rates are the mean of all hourly sampling rates for the collection month. The total number of fish entrained by month was

determined by totaling the number of generation hours for each of the three turbine units at the project and multiplying by the monthly hydroacoustic entrainment rate for Unit 6. The sum of the monthly fish entrainment estimates yields a total estimated annual entrainment of 91,753 fish for the project. Based on background noise levels, it was calculated that the smallest fish target "acoustically visible" was 100 mm in length. By comparing simultaneous netting and hydroacoustic samples, it was determined that there was no acceptable correlation between the entrainment netting estimates and the hydroacoustic entrainment estimates for the Gaston Shoals project.

Table C-3: Entrainment Netting Recovery Data Collected at the Gaston Shoals Project During February - December of 1990

MONTH	HOURS SAMPLED	HOURLY ENTRAINMENT RATE	TOTAL HOURS OF TURBINE OPERATION	PROJECTED NUMBER OF FISH ENTRAINED
January	No Data	Ave. of Dec. and Feb. rates = 2.9	2,021	5,859
February	8	3.3	2,012	6,639
March	8	1.4	2,224	3,113
April	8	11.5	2,152	24,749
May	8	3.4	2,182	7,418
June	8	20.9	1,568	32,773
July	No Data	June rate = 20.9	1,382	28,882
August	No Data	June rate = 20.9	1,260	26,334
September	8	9.0	1,080	9,720
October	No Data	Ave. of Sep. and Nov. rates = 5.6	1,352	7,569
November	8	1.0	1,253	1,255
December	8	1.3	1,776	2,308
TOTAL	64 hrs	Mean = 7.7 fish/hr	20,262 hrs	156,619 fish

Table C-4: Fish Entrainment at the Gaston Shoals Project Based on Hydroacoustic Sampling During February - December of 1990

MONTH	DAYS SAMPLED	HOURLY ENTRAINMENT RATE	PROJECT TURBINE OPERATION	PROJECTED NUMBER OF FISH ENTRAINED
January	8	8.5	2,021	17,199
February	10	2.3	2,012	4,628
March	5	3.6	2,224	7,984
April	8	2.7	2,152	5,875
May	13	0.3	2,182	715
June	15	10.5	1,568	16,495
July	16	2.5	1,382	3,455
August	6	1.4	1,260	1,701
September	9	1.8	1,080	1,948
October	6	5.2	1,352	7,059
November	16	8.0	1,253	10,042
December	No Data	Ave of Nov.& Jan. rates = 8.25	1,776	14,652
TOTAL	112 days	Mean = 4.5 fish/hr	20,262 hrs	91,753 fish

3.0 *NEAL SHOALS*

Hydroacoustic and full recovery netting were performed on Unit 3 (1.1 MW horizontal Francis-type turbine) of the Neal Shoals Hydroelectric project during February 1991 through January 1990.

3.1 Full Recovery Entrainment Netting

Full recovery entrainment netting was performed on Unit 3 of the Neal Shoals project during the daylight hours (0600 - 1200 or 1600 - 2200 hrs). During each netting-month, a 6 hour sample taken once a day for 2 consecutive days per month (12 hrs/month). There were six successful netting events during March, May, June, August, October, and December yielding a total of 45.75 sampling hours for the year (Table 5). Entrainment netting collection efficiencies were determined for fish < 100 mm (96%) and for fish > 100 mm (71%). Reported entrainment rates were not corrected for these net losses but assumed 100% net efficiency. The total number of fish entrained annually was determined by totaling the number of generation hours for each of the four operational turbine units at the project and multiplying by the mean annual entrainment netting rate of 13.7 fish/hr. Based on the annual project operation time of 19,819.3 hours, the estimated annual entrainment for the project was 271,524.4 fish.

Discussions with Gerrit Jöbsis (South Carolina Department of Natural Resources) determined that the netting rates were adjusted for a 73% netting recovery rate which increased the annual entrainment rate to 345,510 fish for the project.

3.2 Hydroacoustic Entrainment Sampling

Hydroacoustic entrainment sampling was performed on Unit 3 of the Neal Shoals project on a monthly basis during both daytime and nighttime project operation. The hydroacoustic data was analyzed through July of 1991 with poor or no correlation with

the entrainment netting data. Based on these results, the number of fish entrained at the site was based solely on entrainment netting.

Table C-5: Entrainment Netting Recovery Data Collected at the Neal Shoals Project During March - December of 1991

MONTH	HOURS SAMPLED	NUMBER OF FISH COLLECTED	INITIAL HOURLY ENTRAINMENT RATE	ADJUSTED HOURLY ENTRAINMENT RATE	PROJECTED NUMBER OF FISH ENTRAINED
January	NA	-----	NA	NA	
February	NA	-----	NA	NA	
March	10.25	171	16.7	21.2	
April	NA	-----	NA	NA	
May	11	259	23.5	29.9	
June	3	58	19.3	24.5	Project
July	NA	-----	NA	NA	Operation =
August	10	109	10.9	13.8	19819.3 hrs
September	NA	-----	NA	NA	times the annual
October	0.5	5	10.0	12.7	entrainment rate
November	NA	-----	NA	NA	of 17.4 fish/hr =
December	11	25	2.3	2.9	
TOTAL	45.75 hrs	627 fish	Mean = 13.7 fish/hr	Mean = 17.4 fish / hr	345,510 fish/yr

4.0 SALUDA STATION

Hydroacoustic and full recovery netting were performed on Unit 1 (a 0.6 MW horizontal twin-runner Francis-type turbine) of the Saluda Station project during January - December of 1990 and January of 1991.

4.1 Full Recovery Entrainment Netting

Full recovery entrainment netting was performed on Unit 1 of the Saluda Station project during the daylight hours of 0800 - 1700 hrs. Netting was performed on a monthly basis with a 2 hour sample taken 2 times a day for 2 consecutive days per month (8 hrs/month) yielding a total of 48 sampling hours for the year (Table 6). "Initial and steady-state" sampling was performed, but no apparent trends were observed; therefore all the monthly netting data was combined to yield a total number of fish (by species) entrained per hour of sampling. Monthly netting efficiencies were calculated and each monthly data set was corrected for net losses. The total number of fish entrained by month was determined by totaling the number of generation hours for each of the four operational turbine units at the project and multiplying by the monthly entrainment netting rate. The sum of the estimated monthly entrainment for 9 months of operation yields a total estimated entrainment of 87,274 fish for the project. Investigators indicated that these estimates may be inflated due to suspected net intrusion in the tailrace collections.

4.2 Hydroacoustic Entrainment Sampling

Hydroacoustic entrainment sampling was performed on both Unit 1 and Unit 2 of the Saluda Station project a monthly basis during both daytime and nighttime project operation with a total of 1587 hours of data collected over 95 days (Table 7). Unit 1 was sampled during January through October 1990 and Unit 2 was sampled during November of 1990 through January of 1991. Fish entrainment is reported as the number of fish

entrained per hour of sampling. Reported monthly rates are the mean of all hourly sampling rates for the collection month. The total number of fish entrained by month was determined by totaling the number of generation hours for each of the four turbine units at the project and multiplying by the monthly hydroacoustic entrainment rate for either Unit 1 or Unit 2. The sum of the monthly fish entrainment estimates yields a total estimated annual entrainment of 31,811 fish for the project. Based on background noise levels, it was calculated that the smallest fish target "acoustically visible" was 100 mm in length. By comparing simultaneous netting and hydroacoustic samples, it was determined that there was limited agreement between the entrainment netting estimates and the hydroacoustic entrainment estimates for the Saluda Station project.

Table C-6: Entrainment Netting Recovery Data Collected at the Saluda Hydroelectric Project During January - December of 1990

MONTH	HOURS SAMPLED	HOURLY ENTRAINMENT RATE	TOTAL HOURS OF TURBINE OPERATION	PROJECTED NUMBER OF FISH ENTRAINED
January	No Data	Dec. rate = 6.2	1917	11,885
February	No Data	Dec. rate = 6.2	2244	13,913
March	No Data	No estimate	2238	-----
April	No Data	No estimate	1963	-----
May	No Data	No estimates	1624	-----
June	8	11.6	1097	12,725
July	No Data	Ave. of June & Aug. rates = 9.3	855	7,952
August	8	6.7	780	5,226
September	8	6.3	720	4,536
October	8	14.5	1350	19,575
November	8	5.5	932	5,126
December	8	6.2	1022	6,336
TOTAL	48 hrs	Mean = 5.2 fish/hr	16742	87,274 fish
Adjusted for 9 months of sampling		Mean = 8.0 fish/hr	10,917	87,274 fish

Table C-7: Fish Entrainment at the Saluda Hydroelectric Project Based on Hydroacoustic Sampling During January 1990 to January of 1991

MONTH	DAYS SAMPLED	HOURLY ENTRAINMENT RATE	TOTAL HOURS OF TURBINE OPERATION	PROJECTED NUMBER OF FISH ENTRAINED
January	4	1.1	1,917	2,032
February	4	0.0	2,244	0
March	12	0.6	2,238	1,388
April	23	0.8	1,963	1,570
May	1	0.4	1,624	585
June	9	0.8	1,097	823
July	No Data	3.3	855	2,822
August	4	5.8	780	4,547
September	2	2.3	720	1,663
October	9	7.7	1,350	10,449
November	2	5.1	932	4,716
December	11	1.2	1,022	1,216
January	14	3.0	No Data	No Data
TOTAL	95 days	Mean = 2.4 fish/hr	16,742	31,811 fish

5.0 *HOLLIDAYS BRIDGE*

Hydroacoustic and full recovery netting were performed on Unit 3 (a 0.9 MW horizontal triple-runner Francis-type turbine) during January - December of 1990 and on Unit 2 during April - June of 1992 of the Hollidays Bridge Hydroelectric project.

5.1 Full Recovery Entrainment Netting

Full recovery entrainment netting was performed on Unit 3 of the Hollidays Bridge project during the daylight hours of 0800 - 1700 hrs. Netting was performed on a monthly basis with a 2 hour sample taken 2 times a day for 2 consecutive days per month (8 hrs/month) yielding a total of 40 sampling hours for the year (Table 8). "Initial and steady-state" sampling was performed, but no apparent trends were observed; therefore all the monthly netting data was combined to yield a total number of fish (by species) entrained per hour of sampling. Monthly netting efficiencies were calculated and each monthly data set was corrected for net losses. The total number of fish entrained by month was determined by totaling the number of generation hours for each of the four operational turbine units at the project and multiplying by the monthly entrainment netting rate. The sum of the estimated monthly entrainment for 5 months of project operation yields a total estimated entrainment of 28,489 fish for the project.

To satisfy a FERC AIR, additional entrainment net sampling was performed during April - June of 1992 to fill in missing months of project entrainment. Unit 2 was sampled during this period using the same sampling methodology employed during the 1990 studies. The similarities between the configuration of Unit 3 and Unit 2 were deemed appropriate to assume similar entrainment rates. A total of 32 hours of entrainment netting were performed during the 1992 study bringing the total project entrainment netting to 72 hrs. The total estimated annual fish entrainment of 112,345 fish is based on project operation hours during 1992. Investigators indicated that these estimates may be inflated due to suspected net intrusion in the tailrace collections.

5.2 Hydroacoustic Entrainment Sampling

Hydroacoustic entrainment sampling was performed on a monthly basis during January, February, and September - December of 1990 with a total of 720 hours of data collected over 38 days (Table 9). Unit 1 was sampled during January - October 1990 and Unit 2 was sampled during November of 1990 - January of 1991. Fish entrainment is reported as the number of fish entrained per hour of sampling. Reported monthly rates are the mean of all hourly sampling rates for the collection month. The total number of fish entrained by month was determined by totaling the number of generation hours for each of the three turbine units at the project and multiplying by the monthly hydroacoustic entrainment rate for Unit 1 or Unit 2. The sum of the monthly entrainment estimates yields an estimated entrainment of 14,330 fish for 8 months of project operation. Based on background noise, it was calculated that the smallest fish target "acoustically visible" was 100 mm in length. There was no report of additional hydroacoustics sampling performed in 1992. This is probably due to the limited agreement between the entrainment netting estimates and the hydroacoustic entrainment estimates for the Hollidays Bridge project.

Table C-8: Entrainment Netting Recovery Data Collected at the Hollidays Bridge Project During January - December of 1990 and April-June of 1992

MONTH	HOURS SAMPLED	HOURLY ENTRAINMENT RATE	HOURS OF TURBINE OPERATION (1992)	PROJECTED NUMBER OF FISH ENTRAINED
January	NA	Dec. rate = 3.8	1,468	5,578
February	8	1.4	1,419	1,987
March (92)	8	11.1	1,475	16,373
April (92)	8	6.3	1,382	8,707
May (92)	8	19.9	1,290	25,671
June (92)	8	12.1	1,179	14,266
July	NA	June rate = 12.1	1,015	12,282
August	NA	June rate = 12.1	941	11,386
September	8	4.9	751	3,680
October	8	5.3	729	3,864
November	8	2.1	845	1,775
December	8	5.6	1,210	6,776
TOTAL	72 hrs	Mean = 8.2 fish/hr	13,704	112,345 fish

Table C-9: Fish Entrainment at the Hollidays Bridge Project Based on Hydroacoustic Sampling During January 1990 to January of 1991

MONTH	DAYS SAMPLED	HOURLY ENTRAINMENT RATE	TOTAL HOURS OF TURBINE OPERATION	PROJECTED NUMBER OF FISH ENTRAINED
January	9	0.3	1,749	507
February	13	0.3	2,102	631
March	No Data	Feb. rate = 0.3	1,179	354
April	No Data	ND	0	0
May	No Data	ND	0	0
June	No Data	ND	0	0
July	No Data	ND	0	0
August	No Data	1.3	475	618
September	4	1.4	782	1,103
October	2	1.2	1,312	1,561
November	6	4.8	852	4,124
December	4	5.3	1,023	5,432
TOTAL	38 days	Mean = 1.5 fish/hr	9,474 hrs	14,330 fish

6.0 RICHARD B. RUSSELL

Full recovery netting was performed on Unit 5 (an 80MW Francis-type turbine) at the Richard B. Russell Project.

6.1 Full Recovery Entrainment Netting

Full discharge recovery netting was performed during conventional generation on Unit 5 of the Richard B. Russell Project as part of a mid-1980s study to analyze the effects of pumpback turbines on the fisheries of Lakes Russell and Thurmond. Sampling was conducted over a full 12-month cycle. Entrainment was dominated by threadfin shad (87.3%), blueback herring (6.6%), and yellow perch (4.2%). Entrainment rates from the Richard B. Russell entrainment study were presented by month and species. For the purpose of summarizing this study, Table 10 presents the average entrainment rate by month and Table 11 presents the average annual entrainment rate for each entrained fish species.

**Table C-10: Monthly Average Entrainment Rates for the Richard B. Russell Project
Conventional Generation Netting Study**

MONTH	ENTRAINMENT RATE (FISH/HR)
January	1,458.22
February	7,251.67
March	224.91
April	251.83
May	108.46
June	71.63
July	101.21
August	269.67
September	127.45
October	91.64
November	556.56
December	228.72
AVERAGE	894.23

Table C-11: Mean Annual Entrainment Rates of Fish Entrained During Conventional Generation Netting at the Richard B. Russell Project

NAME	MEAN ANNUAL
threadfin shad	781.363
blueback herring	58.397
yellow perch	36.635
white catfish	6.354
bluegill	2.939
white perch	2.080
black crappie	2.010
channel catfish	0.613
spottail shiner	0.379
white crappie	0.378
carp	0.265
gizzard shad	0.159
warmouth	0.085
yellow bullhead	0.084
flathead catfish	0.062
hybrid bass	0.060
black bullhead	0.036
spotted bass	0.026
green sunfish	0.016
striped bass	0.015
snail bullhead	0.014
golden shiner	0.013
largemouth bass	0.012
redbreast sunfish	0.012
silver redhorse	0.012
tesselated darter	0.010
blackbanded darter	0.007
whitefin shiner	0.007
longnose gar	0.007
rainbow trout	0.006
walleye	0.006
smallmouth bass	0.005
northern hogsucker	0.004
white bass	0.004
Coosa bass	0.001

Table C-12: Richard B. Russell Fish Entrainment Species Composition (by Percent)

COMMON NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Northern Hogsucker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0726	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Silver Redhorse	0.0000	0.0000	0.0000	0.0047	0.0739	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0200
Black Crappie	0.0244	0.0023	0.1062	0.3718	5.2876	17.4898	1.8707	0.7093	0.0000	0.0000	0.0635	0.0400
Coosa Bass	0.0000	0.0000	0.0000	0.0000	0.0148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Largemouth Bass	0.0023	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0215	0.0970	0.0000	0.0000
Smallmouth Bass	0.0000	0.0000	0.0000	0.0216	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Spotted Bass	0.0000	0.0000	0.0000	0.0000	0.0000	0.0693	0.0000	0.0801	0.0000	0.0000	0.0086	0.0000
White Crappie	0.0000	0.0000	0.0000	1.1535	0.0708	1.6104	0.0564	0.1290	0.0000	0.0000	0.0000	0.0000
Blueback Herring	10.0929	3.5211	21.2217	29.5016	41.1762	30.8363	8.5071	24.1845	5.2183	24.1518	0.7930	1.0700
Gizzard Shad	0.0078	0.0009	0.0583	0.0420	0.0000	0.0665	0.4962	0.0701	0.1628	0.3686	0.0225	0.0400
Threadfin Shad	86.7983	95.5201	17.0483	17.0313	1.6977	15.1388	64.4096	66.4364	78.3285	28.0236	94.9874	83.7000
Carp	0.0000	0.0000	0.0000	0.0619	0.0303	0.2377	0.9427	0.0494	0.0861	1.7073	0.0000	0.0300
Golden Shiner	0.0034	0.0000	0.0000	0.0436	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Spottail Shiner	0.0572	0.0060	0.5785	0.4113	0.3082	0.1868	0.0000	0.0000	0.0000	0.0000	0.0000	0.2300
Whitefin Shiner	0.0000	0.0000	0.0000	0.0080	0.0000	0.0000	0.0606	0.0000	0.0000	0.0000	0.0000	0.0000
Walleye	0.0000	0.0009	0.0000	0.0117	0.0000	0.0000	0.1691	0.0000	0.0000	0.0000	0.0000	0.0000
Black Bullhead	0.0000	0.0000	0.0160	0.0963	0.0000	0.2065	0.0000	0.2615	0.0000	0.0000	0.0000	0.0000
Brown Bullhead	0.0000	0.0000	0.0160	0.0000	0.1289	0.0813	2.3746	0.0000	5.8122	0.9271	0.0319	6.1400
Channel Catfish	0.0138	0.0015	0.0000	0.0262	0.5256	0.0813	0.0751	0.2293	0.2066	0.0970	0.8373	0.1100
Flathead Catfish	0.0000	0.0000	0.0000	0.0114	0.0000	0.0000	0.0000	0.0000	0.0000	0.0970	0.0915	0.0500
Snail Bullhead	0.0000	0.0000	0.0000	0.0000	0.0000	0.0707	0.0000	0.0000	0.0000	0.0000	0.0000	0.0500
White Catfish	0.1101	0.0246	0.4023	0.2249	0.7180	1.0050	1.1070	1.4991	5.0192	39.8065	2.6459	3.8000
Yellow Bullhead	0.0244	0.0000	0.0000	0.0000	0.0000	0.0000	0.6421	0.0000	0.0000	0.0000	0.0000	0.0000
Longnose Gar	0.0023	0.0000	0.0000	0.0000	0.0000	0.0665	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hybrid Bass	0.0033	0.0000	0.1070	0.0808	0.1328	0.0000	0.0000	0.0000	0.0000	0.0000	0.0150	0.0000
Striped Bass	0.0000	0.0000	0.0301	0.0346	0.0271	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
White Bass	0.0000	0.0000	0.0151	0.0058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
White Perch	0.0000	0.0090	0.8298	4.7006	9.1373	0.9421	0.0706	0.0000	0.0441	0.0000	0.0391	0.0000
Blackbanded Darter	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tesselated Darter	0.0000	0.0000	0.0000	0.0000	0.1059	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Yellow Perch	2.7780	0.9028	59.0916	41.4511	38.7012	28.7646	15.6773	3.1601	2.6820	3.1278	0.3424	4.3600
Rainbow Trout	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0706	0.0000	0.0000	0.0000	0.0000	0.0000
Bluegill	0.0739	0.0090	0.4791	4.3537	1.7257	2.9677	3.4140	3.1195	2.3575	1.5961	0.1220	0.3200
Green Sunfish	0.0000	0.0000	0.0000	0.0149	0.0210	0.1062	0.0564	0.0000	0.0000	0.0000	0.0000	0.0000
Redbreast Sunfish	0.0000	0.0000	0.0000	0.0232	0.0000	0.0000	0.0000	0.0322	0.0000	0.0000	0.0000	0.0000
Warmouth	0.0080	0.0000	0.0000	0.1334	0.1171	0.0000	0.0000	0.0395	0.0612	0.0000	0.0000	0.0300

APPENDIX D

SALUDA RIVER MEAN ANNUAL DAILY FLOW DATA COLLECTED FROM
USGS GAUGE NUMBER 02169000 DOWNSTREAM OF SALUDA HYDRO
PROJECT

AVERAGE HISTORICAL OPERATION OF UNIT 5 BASED ON FLOW DURATION
RECORDS 1978 – 2003

SALUDA HYDRO PROJECT FLOW DURATION CURVES

Table D-1: Saluda River Mean Annual Daily Flow Data Collected from USGS Gauge Number 02169000 Downstream of Saluda Hydro Project

	1978-1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
October	613	2386	2809	1131	1612	1791	1340	1458	1320	1385	2415	2408	5751	1732	3049	1442	3500	3626	2201	1863	2039	1176	2049	1776	2674
November	993	4110	2495	1061	621	927	1453	6552	927	743	1175	1844	1828	2262	4709	1962	2710	4574	991	3187	2179	435	1217	1296	1545
December	1700	2226	2124	1129	2916	5413	1267	4736	3582	1522	2286	4217	496	731	5826	2375	4000	3953	686	2871	1919	984	1641	621	3994
January	2673	3165	1825	9255	5521	5802	2160	1928	4854	942	462	2752	1281	1299	9053	2674	7089	3500	1175	6935	1553	3786	737	746	3049
February	5025	3013	955	5100	6348	5129	4654	707	4514	1455	795	7441	2794	1167	7346	1740	8416	4814	4444	8999	1390	1818	641	832	3888
March	5410	7807	787	3469	5451	5389	1305	711	5911	1049	4186	6161	4962	3162	7807	1913	1998	6118	4140	6510	1389	1476	686	717	10530
April	5747	5927	504	1039	5905	3484	880	862	2364	321	3199	3089	4202	2281	4385	1281	691	2424	1976	7260	803	981	609	603	7259
May	3304	2166	482	1137	1405	4510	602	575	541	441	2529	747	4121	1067	2270	774	911	2639	2226	5091	596	629	561	894	5811
June	3817	2101	542	2225	1686	1799	373	550	1460	349	1982	1453	2701	2582	1894	3283	2497	2397	2792	3508	626	663	685	848	3412
July	4108	2953	1153	1968	2229	3385	477	863	1991	380	4252	1754	4132	2273	2382	2996	2046	2234	2639	1151	2342	686	1090	1334	4705
August	2329	1039	656	2693	2884	4178	2620	534	1905	635	3192	2234	3933	2424	1813	5682	4377	2213	2657	1854	748	1468	2036	1545	3555
September	2631	1746	1929	1329	1261	2077	1931	1900	1490	558	2033	6390	2796	3009	1191	3423	3349	7642	1845	2513	726	1651	1040	1748	1496

Table D-2: Average Historical Operation of Unit 5 Based on Flow Duration Records 1978 – 2003

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Cubic Feet/Sec*	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
Cubic Feet / Hr	21600000	21600000	21600000	21600000	21600000	21600000	21600000	21600000	21600000	21600000	21600000	21600000
Days/Month	31	28.25	31	30	31	30	31	31	30	31	30	31
Hours/Month	744	678	744	720	744	720	744	744	720	744	720	744
Estimated % of time Unit 5 was Operated	0.04	0.04	0.05	0.04	0.01	0.005	0	0.01	0	0.01	0	0.005
Total flow through Unit 5 (cubic feet)	642,816,000	585,792,000	803,520,000	622,080,000	160,704,000	77,760,000	0	160,704,000	0	160,704,000	0	80,352,000

*assumed 6000 cfs through unit 5, operated at flows above 12,000 cfs (capacity of U1-4 combined)

Figure 1.0 Sakula Project FERC No. 516, South Carolina Electric & Gas Co., January Flow Duration Curve

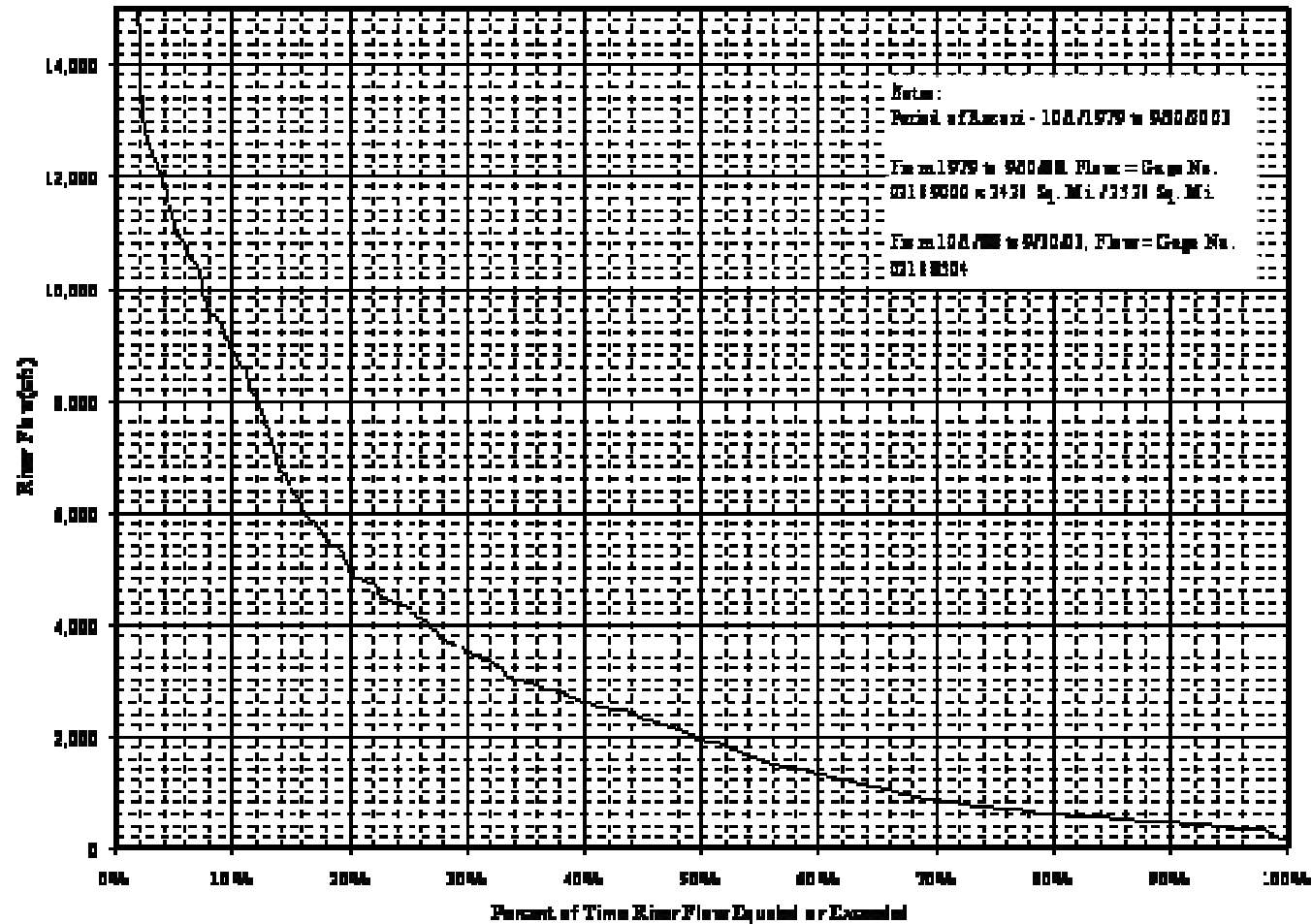


Figure 2.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., February Flow Duration Curve

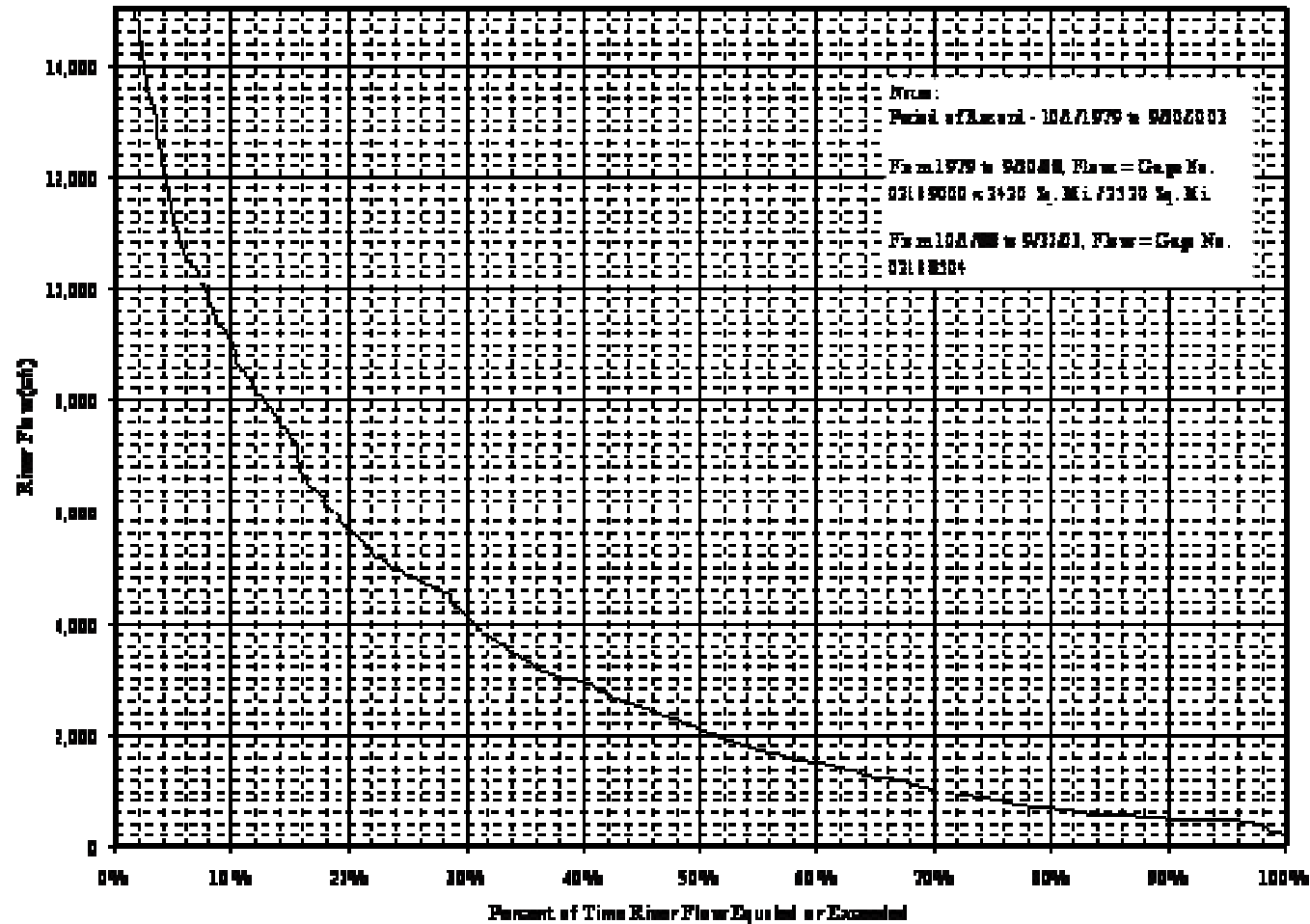


Figure 3.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., March Flow Duration Curve

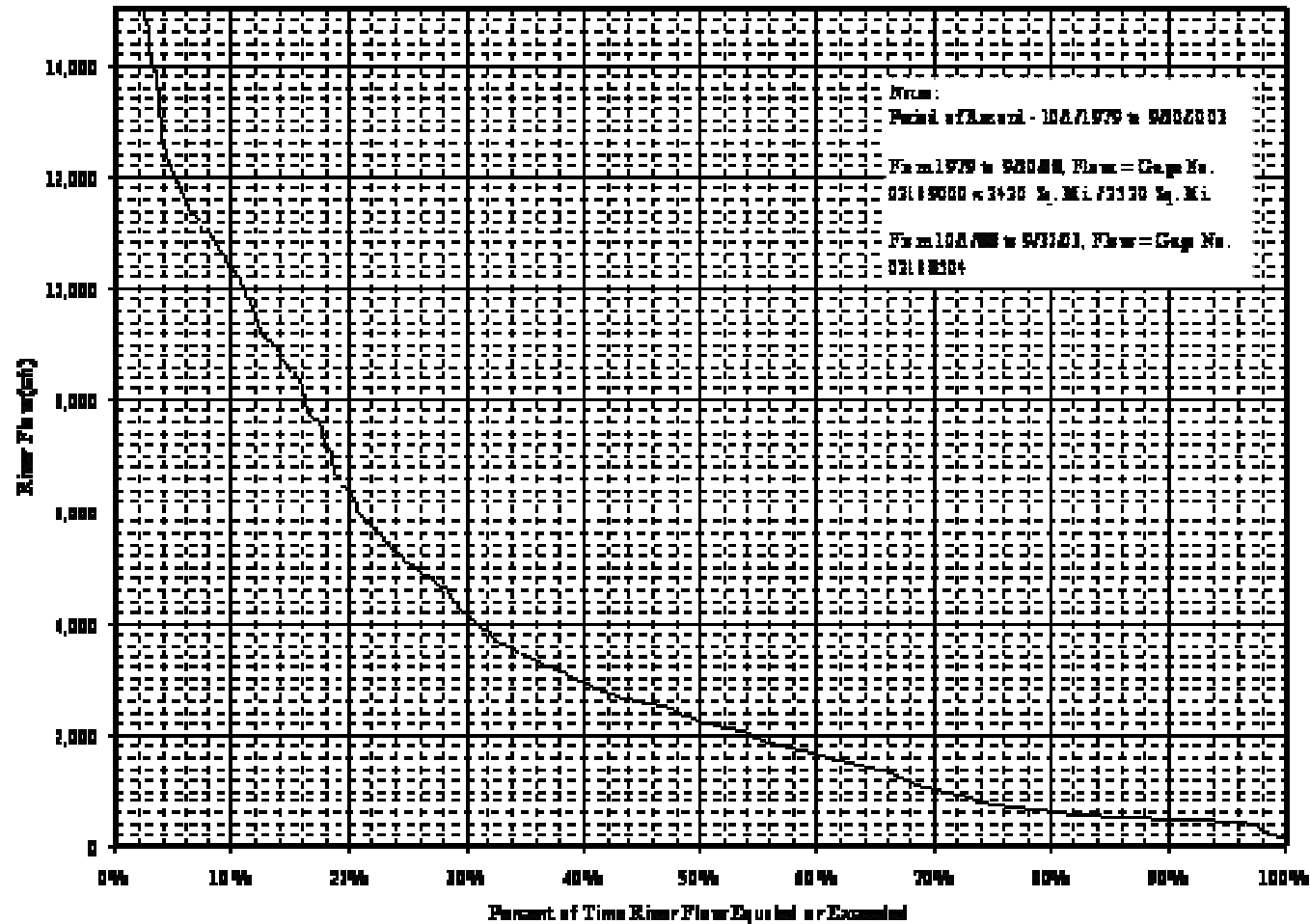


Figure 4.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., April Flow Duration Curve

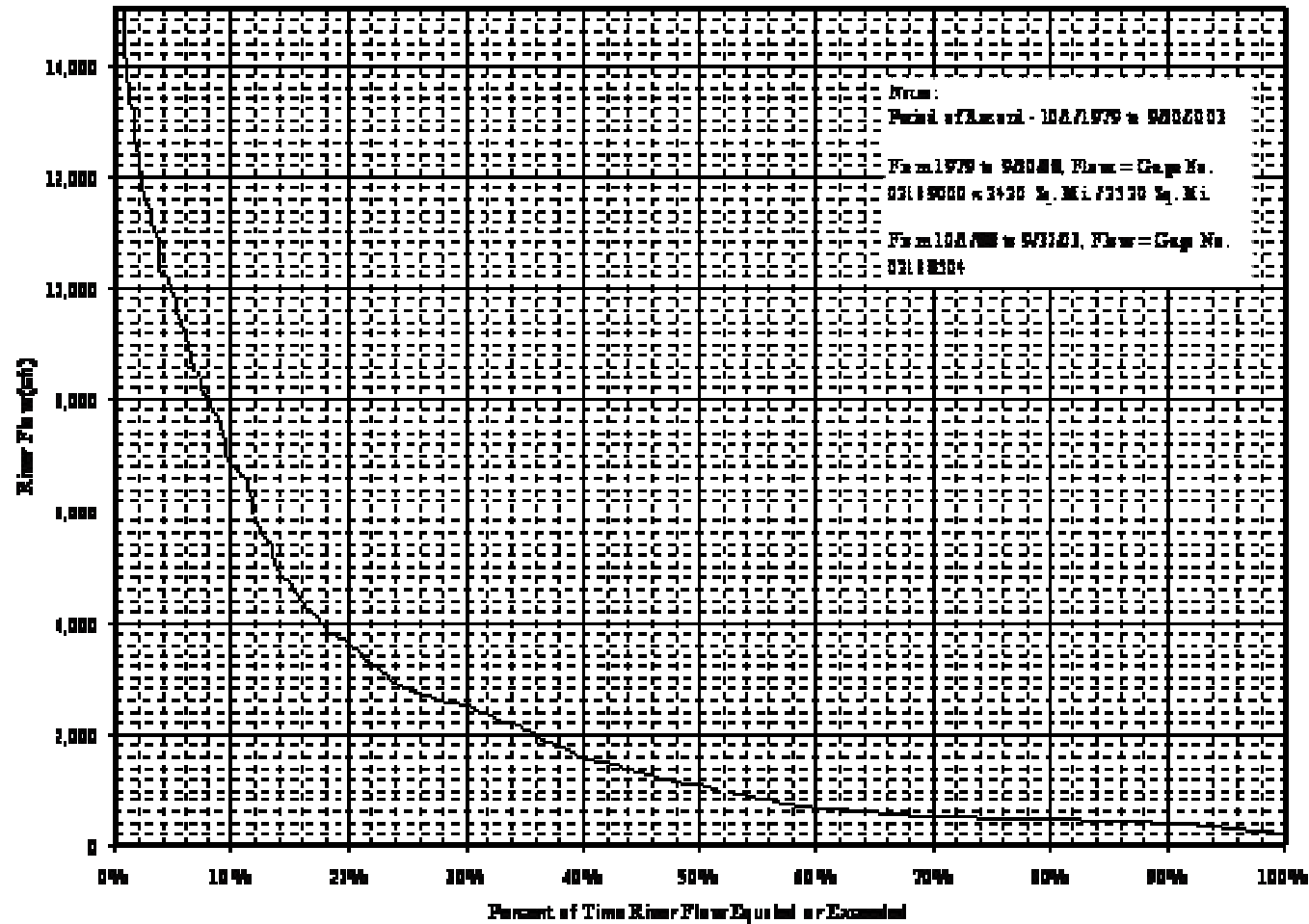


Figure 5.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., May Flow Duration Curve

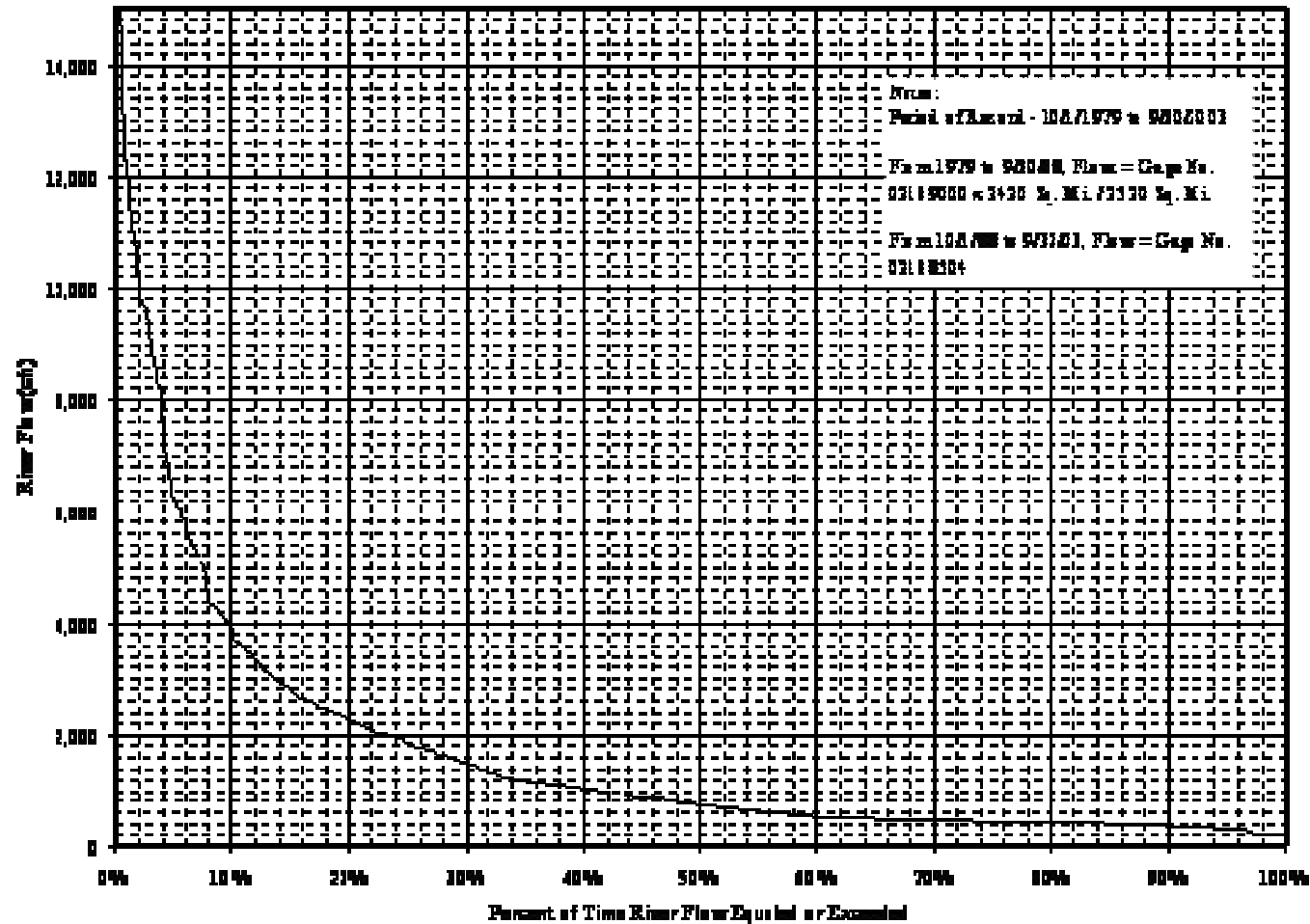


Figure 6.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., June Flow Duration Curve

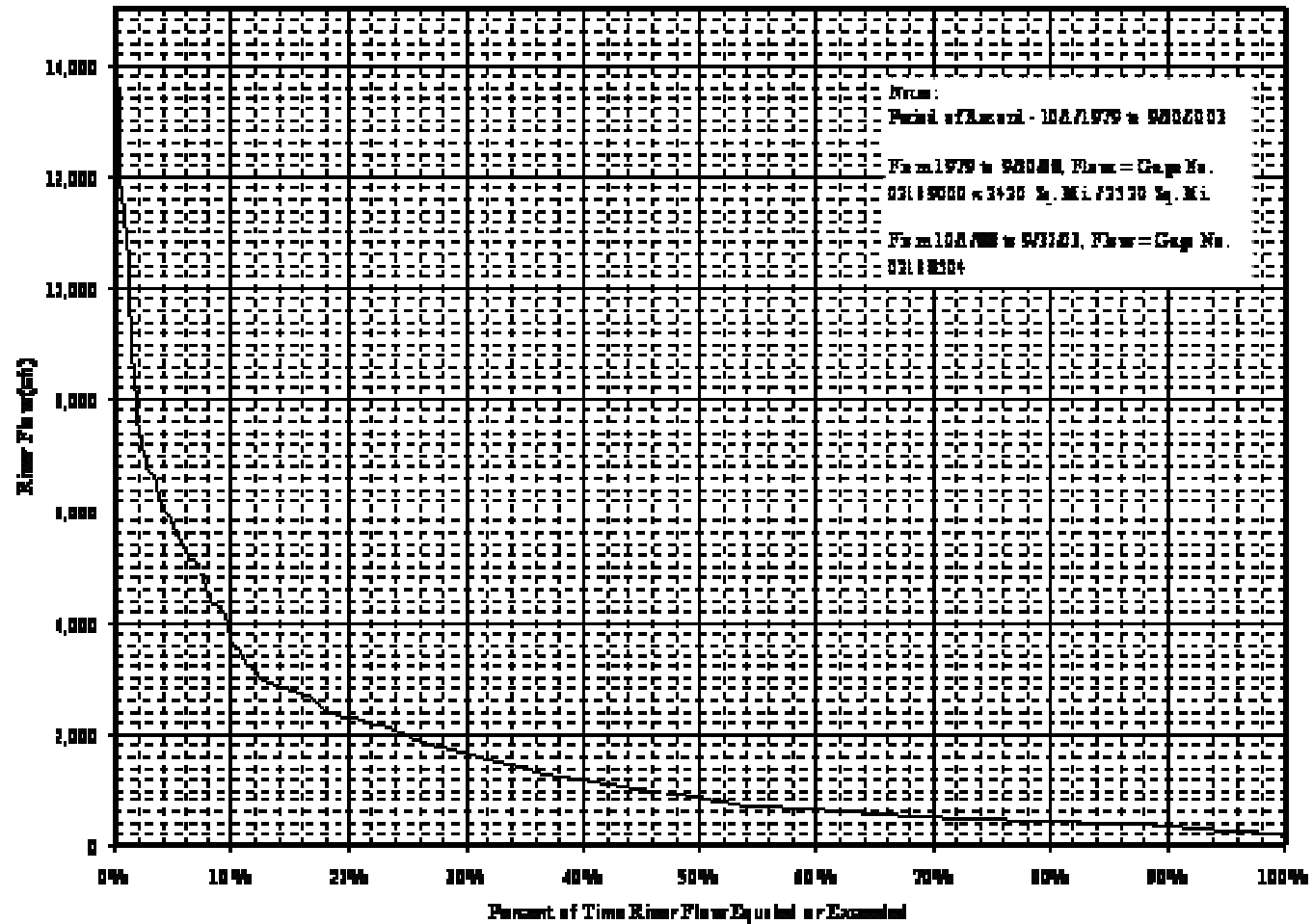


Figure 7.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., July Flow Duration Curve

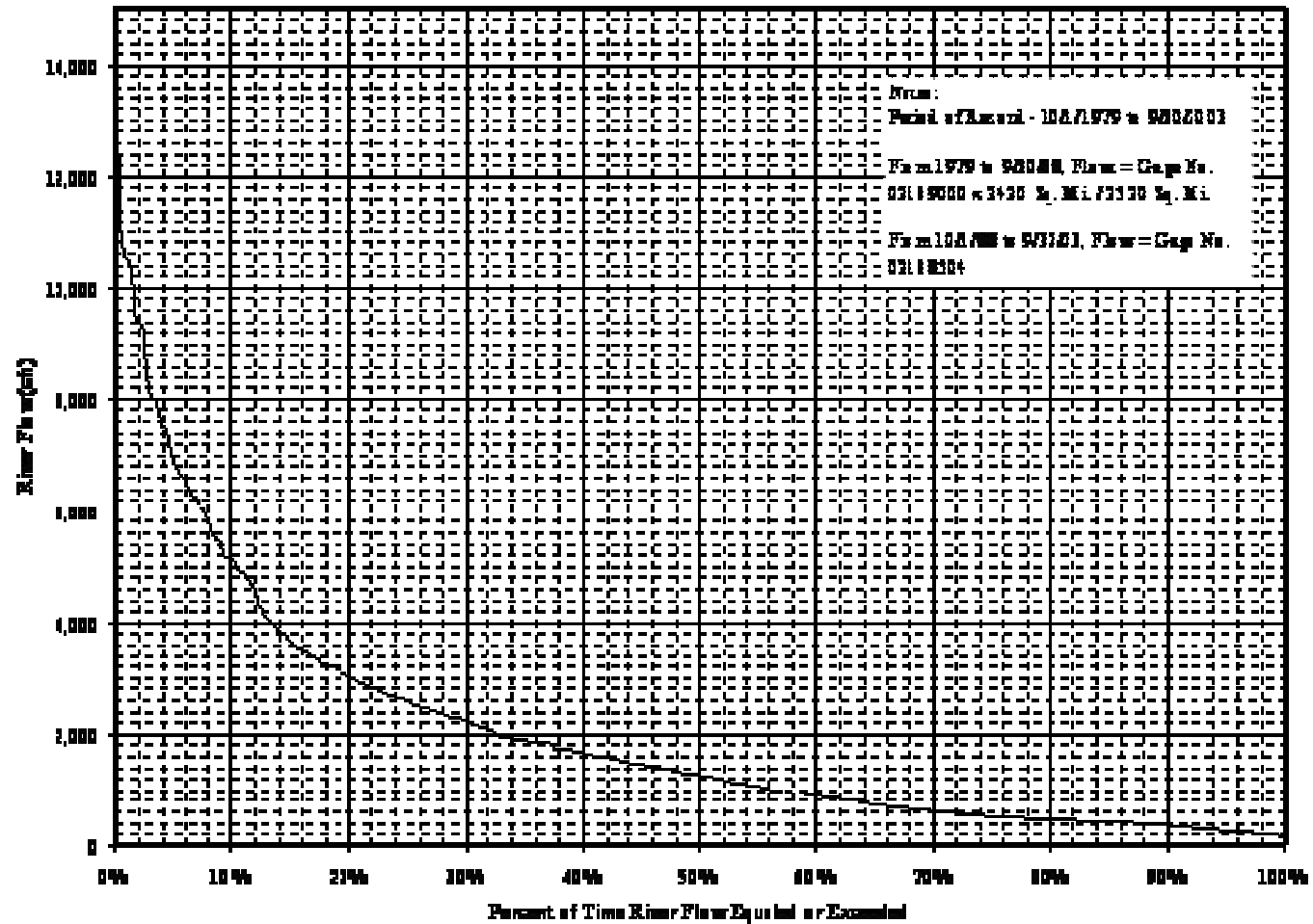
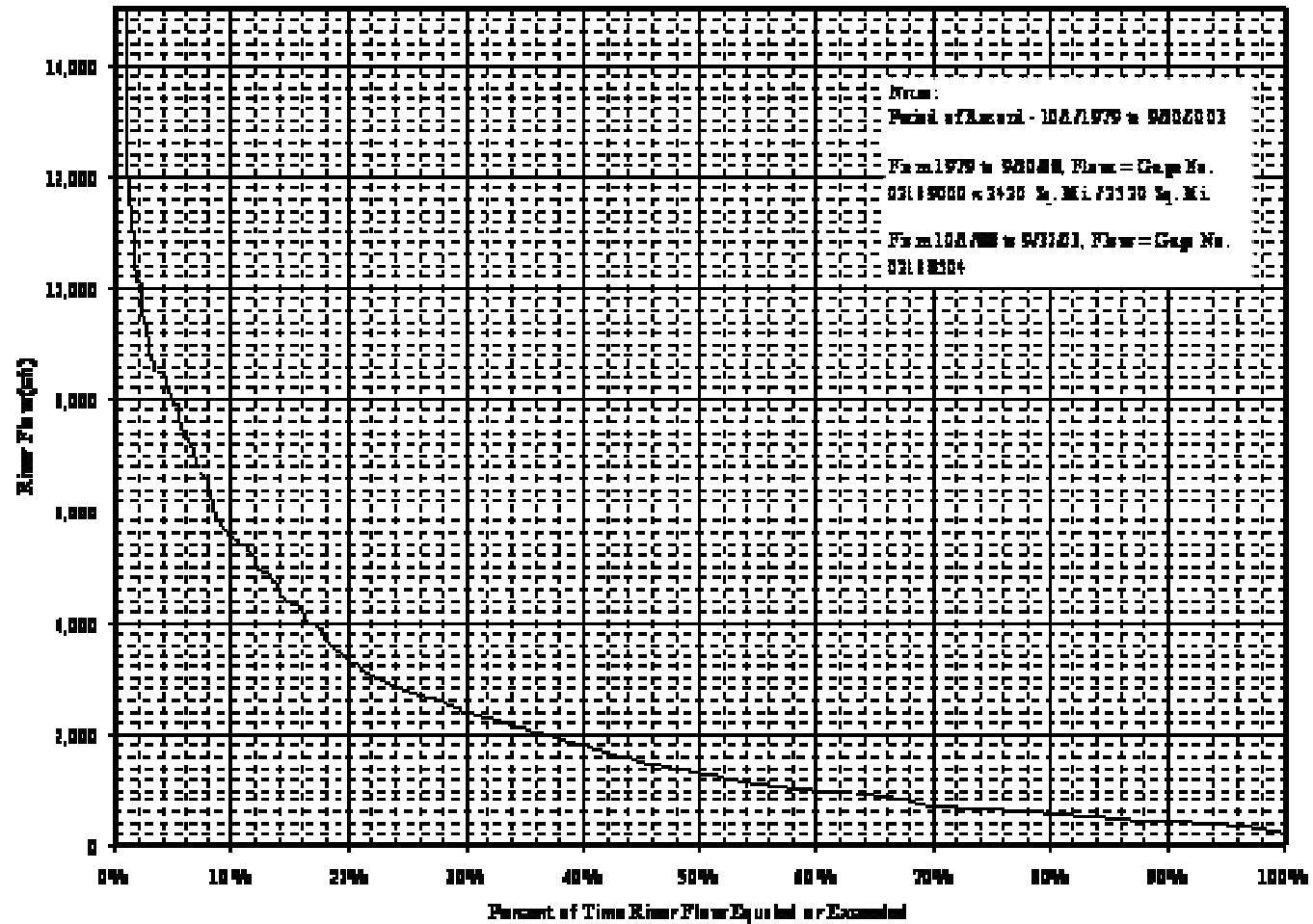


Figure 8.0 Sakuda Project FERC No. 516, South Carolina Electric & Gas Co., August Flow Duration Curve



**TURBINE PASSAGE SURVIVAL DATABASE
SURVIVAL DATA**

TEST ID INFO			SURVIVAL ESTIMATES								
Test ID No.	Site Name	Species Tested	Based on number released			Based on number recovered			Based on number recovered		
			Immediate Survival	24-Hour Survival	48-Hour Survival	Immediate Survival	24-Hour Survival	48-Hour Survival	Control Immediate	Control 24 hour Survival	Control 48 hour Survival
SS-20	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.743	0.743	0.758	0.717	0.717	0.731	1.000	1.000	0.929
SS-21	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.292	0.243	0.233	0.273	0.227	0.218	1.000	1.000	0.833
SS-22	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.659	0.659	0.659	0.794	0.794	0.794	1.000	1.000	1.000
SS-23	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.519	0.519	0.534	0.583	0.583	0.601	1.000	1.000	0.971
SS-24	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.579	0.521	0.516	0.545	0.491	0.486	1.000	1.000	0.973
SS-25	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.405	0.381	0.357	0.424	0.399	0.374	0.955	0.955	0.955
SS-26	Sandstone Rapids	fathead minnow, creek chub, white sucker, golden/shorthead redhorse	0.584	0.584	0.611	0.537	0.537	0.562	0.957	0.957	0.913
STC-01	Schaghticoke	brook trout	0.228		0.245	0.170		0.182	0.983		0.914
STC-02	Schaghticoke	brook trout	0.000		0.000	0.000		0.000	0.905		0.703
STC-03	Schaghticoke	largemouth bass	0.418		0.415	0.314		0.311	0.917		0.883
STC-04	Schaghticoke	brook trout	0.506		0.486	0.433		0.416	0.966		0.862
STC-05	Schaghticoke	golden shiner	0.531		0.483	0.617		0.561	0.985		0.923
STC-06	Schaghticoke	white sucker	0.503		0.405	0.516		0.415	0.928		0.594
STC-07	Schaghticoke	white sucker	0.471		0.492	0.615		0.643	1.000		0.897
STC-08	Schaghticoke	bluegill	0.382		0.294	0.414		0.318	0.984		0.852
STC-09	Schaghticoke	largemouth bass	0.268		0.250	0.254		0.238	0.982		0.912
STC-10	Schaghticoke	yellow perch	0.508		0.540	0.501		0.532	0.913		0.725
STC-11	Schaghticoke	brook trout	0.061		0.063	0.045		0.047	0.846		0.821
STC-12	Schaghticoke	white sucker	0.328		0.309	0.349		0.330	0.906		0.859
STC-13	Schaghticoke	white sucker	0.115		0.118	0.137		0.140	0.936		0.915
STC-14	Schaghticoke	largemouth bass	0.154		0.108	0.189		0.133	0.743		0.529
STC-15	Schaghticoke	largemouth bass	0.000		0.000	0.000		0.000	0.824		0.608
STC-16	Schaghticoke	brook trout	0.209		0.197	0.224		0.211	0.882		0.868
STC-17	Schaghticoke	white sucker	0.319		0.175	0.295		0.161	0.945		0.863
STC-18	Schaghticoke	white sucker	0.265		0.223	0.296		0.249	0.756		0.686
STC-19	Schaghticoke	largemouth bass	0.692		0.900	0.666		0.865	0.520		0.400
STC-20	Schaghticoke	walleye	0.436		0.444	0.382		0.389	0.786		0.257

**TURBINE PASSAGE SURVIVAL DATABASE
SURVIVAL DATA**

TEST ID INFO			SURVIVAL ESTIMATES								
Test ID No.	Site Name	Species Tested	Based on number released			Based on number recovered			Based on number recovered		
			Immediate Survival	24-Hour Survival	48-Hour Survival	Immediate Survival	24-Hour Survival	48-Hour Survival	Control Immediate	Control 24 hour	Control 48 hour
STC-21	Schaghticok e	brook trout	0.806		0.770	0.737		0.704	0.969		0.953
STC-22	Schaghticok e	brook trout	0.500		0.397	0.427		0.338	0.969		0.906
STC-23	Schaghticok e	bluegill	0.420		0.233	0.491		0.272	0.908		0.566
STC-24	Schaghticok e	yellow perch	0.758		0.751	0.791		0.784	0.900		0.800
STC-25	Schaghticok e	yellow perch	0.585		0.549	0.764		0.717	0.828		0.797
SC-01	Stevens Creek	blueback herring	1.019	1.010	0.993	0.967	0.959	0.943	1.000	1.000	1.000
SC-02	Stevens Creek	sunfish spp	0.974	1.053	1.057	0.974	1.053	1.057	0.981	0.907	0.778
SC-03	Stevens Creek	sunfish spp	0.938	0.909	0.976	0.938	0.909	0.976	1.000	0.964	0.804
SC-04	Stevens Creek	yellow perch/spotted sucker	0.983	0.966	0.972	0.983	0.966	0.972	0.983	0.975	0.883
TS-01	Townsend	largemouth bass	1.000	1.000	1.000	1.000	1.000	1.000	0.980	0.980	0.980
TS-02	Townsend	largemouth bass	0.860	0.860	0.860	0.860	0.860	0.860	1.000	1.000	1.000
TS-03	Townsend	rainbow trout	0.944			0.944			1.000		
TS-04	Townsend	rainbow trout	0.919	0.919	0.919	1.000	1.000	1.000	1.000	1.000	1.000
TBU1-01	Twin Branch	bluegill	1.231		1.202	0.973		0.950	1.000		0.971
TBU5-01	Twin Branch	chinook/channel catfish	0.986		0.963	1.000		0.976	1.000		1.000
TBU5-02	Twin Branch	chinook/channel catfish	0.970		0.815	0.986		0.829	1.000		0.903
TBU5-03	Twin Branch	steelhead/channel catfish	0.703		0.656	0.862		0.804	1.000		0.950
VNU10-01	Vernon	Atlantic salmon	0.959		0.949	1.000		0.989	1.000		1.000
VNU10-02	Vernon	Atlantic salmon	1.013		1.013	1.000		1.000	1.000		1.000
VNU4-01	Vernon	Atlantic salmon	0.851		0.851	0.840		0.840	1.000		1.000
WNP-01	Wanapum	coho salmon	0.897		0.897	0.897		0.897	0.988		0.981
WNP-02	Wanapum	coho salmon	0.949		0.955	0.949		0.955	0.988		0.981
WNP-03	Wanapum	coho salmon	0.935		0.942	0.924		0.930	0.994		0.987
WNP-04	Wanapum	coho salmon	0.981		0.987	0.968		0.975	0.994		0.987
WNP-05	Wanapum	coho salmon	0.942		0.942	0.948		0.948	0.987		0.987
WNP-06	Wanapum	coho salmon	1.006		1.006	1.000		1.000	0.987		0.987
WNP-07	Wanapum	coho salmon	0.868		0.873	0.885		0.890	1.000		0.994
WNP-08	Wanapum	coho salmon	0.962		0.962	0.968		0.968	1.000		0.994
WR-01	White Rapids	bluegill	0.944		1.022	0.945		1.024	1.000		0.852
WR-02	White Rapids	bluegill	0.957		0.967	1.000		1.011	1.000		0.676
WR-03	White Rapids	white sucker	1.018		1.000	1.009		0.992	0.941		0.882
WR-04	White Rapids	white sucker	0.991		1.023	0.930		0.960	1.000		0.932
WD-01	Wilder	Atlantic salmon	0.960	0.943	0.943	0.960	0.943	0.943	1.000	0.984	0.984

Kacie Jensen

From: Shane Boring
Sent: Friday, February 09, 2007 3:23 PM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle
Cc: 'ARGENTIERI, WILLIAM R'; Alan Stuart
Subject: FW: Lk. Murray Waterfowl Survey Data



2006-2007 Lake Murray Waterfow... 2006-2007 Lake Murray Waterfow...

Dear Terrestrial Resources TWC Members:

The attached datasheets summarize observations of the Lake Murray waterfowl surveys through the January 19th survey. It is interesting to note that results are similar to those from SCDNR's boat surveys, with scaup being the most abundant species observed. Thanks for your continued interest in the Lake Murray waterfowl surveys.

Have a good weekend,
Shane

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



The University of Georgia

Savannah River Ecology Laboratory

2006-07 Lake Murray, South Carolina, Waterfowl Aerial Survey Flight Conditions

Survey Date:	12/14/2006	12/27/2006	1/9/2007	1/19/2007		
Observer	W.L. Stephens	W.L. Stephens	W.L. Stephens	W.L. Stephens		
Start Time	14:45	13:00	12:00	12:30		
Stop Time	16:15	14:45	13:30	14:30		
Noted General Conditions	PC/Hazy/Calm	Clear/Calm	Clear/Windy	Clear/Windy		
Irmo Temp Range (C)*	17-19°C	11°C	13-14°C	13-14°C		
Irmo Wind (mph)*	Calm-SW@2	Calm-W@5	Calm-SW@17;Gust@22	Calm-SW@14;Gust@23		
Irmo Rainfall (mm)*	None	None	None	None		
Irmo Sky Conditions*	OVC	FEW	CLR	BKN		

*Dutch Oaks, Irmo, SC Lat: N 34 °8 ' 49 " (34. 147 °); Lon: W 81 °12 ' 54 " (-81.215 °); Elev ation: 366 ft; Station Hardware: Oregon Scientific WMR968

Abbreviations: PC=Partly Cloudy, OVC=Overcast, FEW=Few Clouds, SCT=Scattered Clouds, CLR=Clear Skies, BKN=Broken Skies



The University of Georgia

Savannah River Ecology Laboratory

2006-07 Lake Murray, South Carolina, Waterfowl Aerial Survey Data

Survey Date:	12/14/2006	12/27/2006	1/9/2007	1/19/2007			All Surveys
Mallard	211	46	16	23			296
American Black Duck							0
Mottled Duck							0
Gadwall							0
American Wigeon							0
G-W Teal							0
B-W Teal							0
Cinnamon Teal							0
Northern Shoveler							0
Northern Pintail							0
Wood Duck							0
Whistling Ducks							0
Total Dabblers:	211	46	16	23	0	0	296
Redhead							0
Canvasback							0
Scaup spp.		920	100	600			1620
Ring-necked Duck		106					106
Common Goldeneye							0
Bufflehead		14	8	11			33
Ruddy Duck							0
Total Divers:	0	1040	108	611	0	0	1759
Eider spp.							0
Scoter spp.							0
Long-tailed Duck							0
Harlequin Duck							0
Total Seaducks:	0	0	0	0	0	0	0
Merganser spp.							0
Unidentified Ducks							0
Total Ducks:	211	1086	124	634	0	0	2055
Brant							0
Snow Goose							0
Blue Goose							0
Ross's Goose							0
White-Fronted Goose							0
Canada Goose		66	144	140			350
Total Geese:	0	66	144	142	0	0	350
Tundra Swan							0
Trumpeter Swan							0
Mute Swan							0
Total Swans:	0	0	0	0	0	0	0
American Coot	50						50
Grand Total:	261	1152	268	776	0	0	2455

Kacie Jensen

From: Shane Boring
Sent: Friday, February 09, 2007 1:18 PM
To: Steve Summer; Alan Stuart; Amanda Hill; Bill Argentieri; Gerrit Jobsis (American Rivers); Jennifer Price ; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Shane Boring
Subject: Saluda Hydro Relicense: 2006 Lower Saluda Macroinvert report



2006 Lower Saluda
Macroinvert ...

ear Freshwater Mussel/Aquatic Macroinvertbrate TWC Members:

Attached for your review is the draft 2006 Lower Saluda River Macroinvertbrate Assessment, prepared by Dan Carnagey of Carnagey Biological (formerly with Shealy). Please review the draft document and provide comments to me (preferably in MS Word track changes) by March 2, 2007. Thanks to all who contributed to development of the study plan and thanks in advance for you comments.



Have a good weekend,
Shane

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

2006 Lower Saluda Macroinvert report (agency review draft.doc;020907).doc

Kacie Jensen

From: Prescott Brownell [Prescott.Brownell@noaa.gov]
Sent: Thursday, February 08, 2007 4:51 PM
To: Shane Boring
Cc: balesw@dnr.sc.gov; Alison Guth; Amanda Hill; BARGENTIERI@scana.com; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; mquattlebaum@scana.com; RMAHAN@scana.com; Ron Ahle; Scott Harder; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart
Subject: Re: Instream Flow Study of Lower Saluda River DRAFT 2007-02-01.doc

 
ATT375015.doc prescott.brownell.v
(459 KB) cf (401 B)

Hello Shane and Team,
Attached is a draft Study Plan with some minor additions and clarifications shown in red text. An excellent Plan. Do you have recommended HSI curves ready for review yet?

PB

Shane Boring wrote:

> All:
>
> Attached for your review is the updated draft of the Lower Saluda
> River IFIM Study Plan. If possible, please have your comments back to
> me by February 15, 2007. Thanks to all who provided comments on the
> previous draft.
>
> Shane
>
> 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
>
>
>
> Instream Flow Study of Lower Saluda River DRAFT 2007-02-01.doc
> <<Instream Flow Study of Lower Saluda River DRAFT 2007-02-01.doc>>

Kacie Jensen

From: Shane Boring
Sent: Friday, February 02, 2007 7:06 AM
To: Wade Bales (balesw@dnr.sc.gov); Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie; Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Summerlin; Jim Glover; Malcolm Leaphart; Milton Quattlebaum (mquattlebaum@scana.com); Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Theresa Thom; Brandon Kulik; Alan Stuart
Subject: Instream Flow Study of Lower Saluda River DRAFT 2007-02-01.doc



Instream Flow
Study of Lower S...

All:

Attached for your review is the updated draft of the Lower Saluda River IFIM Study Plan. If possible, please have your comments back to me by February 15, 2007. Thanks to all who provided comments on the previous draft.



Shane

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

Instream Flow Study of Lower Saluda River DRAFT 2007-02-01.doc

Kacie Jensen

From: Prescott Brownell [Prescott.Brownell@noaa.gov]
Sent: Friday, February 02, 2007 3:39 PM
To: Shane Boring
Subject: Re: Saluda Instream Flow Team address list

 
DRAFT spawning prescott.brownell.v
ms. PDF.pdf (40... cf (401 B)

Hello Shane,

Attached is a draft paper from Boyd Kynard and Kieffer. Look at Page 12 for their methods for using the egg nets. I'd go with their approach. Boyd has used this approach extensively. Call if you'd like to discuss in more detail.

By the way....the TWC addresses did not come through our server for some reason. Could you try again to send the TWC email address/name list?

Thank you for your effort on this
PB

Shane Boring wrote:

> Pres:
>
> Attached is an electronic business card with names and addresses of
> all of the Instream Flow TWC members. On a different note, I left a
> message at your office earlier today. I have a question regarding our
> upcoming sturgeon sampling -- Specifically, we state in the study plan
> that "egg nets will be fished concurrently with gillnets to sample
> for shortnose sturgeon eggs/larvae". We do not state, however,
> exactly how long the egg nets should be fished. Kleinschmidt projects
> in CT have fished a 1 m diameter D-ring net for 1 hour during each
> sampling day. We have acquired 0.5 m diameter nets (flattened to
> D-ring shape) for our project (we were concerned that the larger nets
> would stick out of water in the shallow portions of the Congaree).
> My question is this -- is there a specific length of time or volume of
> water that you guys would like to have sampled? Thanks so much.
>
> Shane

> -----

> --

> Subject:
> Fish & Wildlife TWC - IFIM/Aquatic Habitat
> From:
> "Alison Guth" <Alison.Guth@KleinschmidtUSA.com>
> Date:
> Tue, 14 Mar 2006 13:18:33 -0500
>
>

Kacie Jensen

From: Shane Boring
Sent: Friday, January 19, 2007 5:36 PM
To: Shane Boring; Alan Stuart; Amanda Hill; Bill Argentieri; Bob Perry ; Brandon Stutts ; Buddy Baker ; Dick Christie; Jennifer Summerlin; Jim Glover; Randy Mahan; Ron Ahle; Bob Seibels (bseibels@yahoo.com); Gerrit Jobsis (American Rivers); J. Hamilton Hagood; Tom Murphy (murphyt@dnr.sc.gov); Boozer Tommy (tboozr@scana.com); Dick Christie (dchristie@infoave.com); Ed_Eudaly@fws.gov; Hal Beard (BeardH@scdnr.state.sc.us); HOFFMAN, VAN B; Laura Blake (E-mail); Steve Summer (ssummer@scana.com); Alison Guth; Alan Stuart
Cc: Cheryl Balitz
Subject: 2006 Wood Stork Report Summary Report (DRAFT;011907;CSB).doc



2006 Wood Stork
Report Summary...

All:

Attached for your review is the draft 2006 Lake Murray wood stork survey report. If possible, please provide comments on the report by February 7th. Thanks for your interest in the Lake Murray Wood Stork Study.

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

Cheryl: While these folks are reviewing, could you please update the formatting on the attached, the TOC in particular.

2006 Wood Stork Report Summary Report (DRAFT;011907;CSB).doc

**SOUTH CAROLINA ELECTRIC
& GAS COMPANY**
COLUMBIA, SOUTH CAROLINA

**LAKE MURRAY WOOD STORK SURVEYS
2006 SUMMARY REPORT**

JANUARY 2007

Prepared by:

Kleinschmidt Associates
Energy & Water Resource Consultants
101 Trade Zone Drive Suite 21
West Columbia, SC 29170

SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

LAKE MURRAY WOOD STORK SURVEYS
2006 SUMMARY REPORT

JANUARY 2007

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COLUMBIA, SOUTH CAROLINA**

**LAKE MURRAY WOOD STORK SURVEYS
2006 SUMMARY REPORT**

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Attachment B: Meeting Minutes From September 17, 2004, Conference Call With
SCDNR and USFWS

12/14/05 – CLB
455-030-92-02

Z:\SCO\455\030\2005 Wood Stork Report Summary Report (Final;01032005).doc

**SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA**

**LAKE MURRAY WOOD STORK SURVEYS
2005 SUMMARY REPORT**

1.0 INTRODUCTION

The wood stork was federally-listed as endangered on February 28, 1984 (USFWS 1997). The only stork native to North America, wood storks occurred historically throughout the coastal plain of the southeastern U.S. and Texas. The current U.S. breeding population has declined from an estimated 20,000 pairs in the 1930's to between 5,500 and 9,500 in recent years, with declines attributed primarily to loss of suitable foraging and nesting habitat. 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). No critical habitat has been designated for this species.

Wood storks are highly colonial and 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. Because wood storks feed by tactilocation, depressions where fish become concentrated during periods of falling water levels are particularly attractive for foraging (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).

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 2001 through 2004 (Appendix A, Attachment A, Figure 1). 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 South Carolina Department of Natural Resources (SCDNR) in early August 2004 (Appendix A,

Attachment A, Figure 2). 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 (See detailed study observations in Attachment A of Appendix A).

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 are utilizing habitats within the Saluda Hydro Project Boundary and in the project vicinity. A number of specific study objectives were also identified in consultation with the resource agencies and are outlined in the attached Lake Murray Wood Stork Study Plan (Appendix A).

2.0 METHODS

Suitable habitat in the Saluda Project vicinity was surveyed monthly using fixed-wing aircraft (typically a Cessna 172) from February through November 2006 for the presence of wood storks (Table 1). The February through April surveys were conducted by SCDNR personnel (Tom Murphy) in conjunction with Avian Vacuolar Myelinopathy (AVM) / bald eagle surveys, while the remainder were conducted by biologists from Kleinschmidt Associates. During a typical survey, the Saluda River arm of Lake Murray and the river upstream to approximately Silverstreet were investigated at low altitude (approximately 1000 ft), focusing particularly on the sites where storks have previously been observed and the potential nesting areas at Silverstreet and Tosity Creek (Appendix A, Attachment A, Figures 1 - 5). During flights to and from the sites in the upper lake, the main body of the lake was flown at moderate altitude (1500 – 2000 ft) and scanned for presence of wading birds. Birds suspected of being wood storks (i.e., white birds) were circled at lower altitude and airspeed, and examined with binoculars until a positive identification was made.

Table 1: Summary of 2005 Lake Murray Wood Stork Surveys

DATE	PERSONNEL	OBSERVATIONS
2/18/05	Tom Murphy, SCDNR	No wood storks. Approximately 1/3 of the approximately 22 nests identified during 2004 utilized by nesting blue herons.
3/29/05	Tom Murphy, SCDNR	No wood storks. Remainder of nest identified during 2004 occupied by incubating great blue herons.
5/4/05	Tom Murphy, SCDNR	No wood storks. 13 and 15 great blue heron nests respectively at the Silverstreet and Tosity Creek nesting sites.
6/7/05	Shane Boring, Kleinschmidt	No wood storks. Tosity Creek and Silverstreet nests occupied by pre-flight juvenile great blue herons.
6/30/05	Shane Boring, Kleinschmidt	No wood storks. All juvenile great blue herons at Tosity Creek and Silverstreet sites fledged and nests vacant.
7/27/05	Shane Boring, Kleinschmidt	No wood storks. Scattered great blue herons and great egrets.
8/26/05	Shane Boring, Kleinschmidt	No wood storks. Scattered great blue herons and great egrets.
9/30/05	Shane Boring, Kleinschmidt	No wood storks. Scattered great blue herons and great egrets.
10/28/05	Shane Boring, Kleinschmidt	No wood storks. Waders very active; numerous solitary great blue herons and flocked great egrets.
11/23/05	Shane Boring, Kleinschmidt	No wood storks. Wading birds very abundant; numerous flocks of foraging great egrets.

* Not provided by SCDNR; duration time assumed based on previous and subsequent surveys.

Table 2: Summary of 2006 Lake Murray Wood Stork Surveys

DATE	PERSONNEL	OBSERVATIONS
2/22/06	Tom Murphy - SCDNR	No wood storks. Nests identified during 2004 utilized by nesting blue herons.
3/20/06	Tom Murphy - SCDNR	No wood storks. Nests identified during 2004 occupied by incubating great blue herons.
4/28/06	Tom Murphy - SCDNR	No wood storks. Significant foraging habitat present along Saluda River above Lake Murray. Approx. 40 great blue heron nests at the Silverstreet and Tosity Creek nesting sites.
5/31/06	Shane Boring - Kleinschmidt	Wading birds observed in drying pools off Saluda main channel above Lake Murray; however, no wood storks.
6/30/06	Shane Boring - Kleinschmidt	Scattered foraging great blue herons and great egrets, but no wood storks.
8/04/06	Jennifer Summerlin - Kleinschmidt	No wood storks. Scattered great egrets.
8/26/06	Shane Boring - Kleinschmidt	Moderate wading bird activity. A single wood stork, likely a juvenile, observed soaring over Saluda River upstream of Lake Murray.
9/15/06	Shane Boring - Kleinschmidt	12-14 wood storks foraging in wetlands off of the Saluda mainstem upstream of Lake Murray: 6 foraging in a farm pond off of the Saluda mainstem just downstream of the Highway 121 bridge and 4-6 (4 confirmed, 2 suspected) soaring and feeding in wetlands adjacent to the wood chipping plant near Silverstreet.
10/26/06	Tom Murphy - SCDNR	No wood storks; many wetlands along Saluda above Lake Murray dry.
11/27/06	Tom Murphy - SCDNR	Habitat along Saluda, which were dry during 10/06 survey, refilled by rains, but no wood storks.

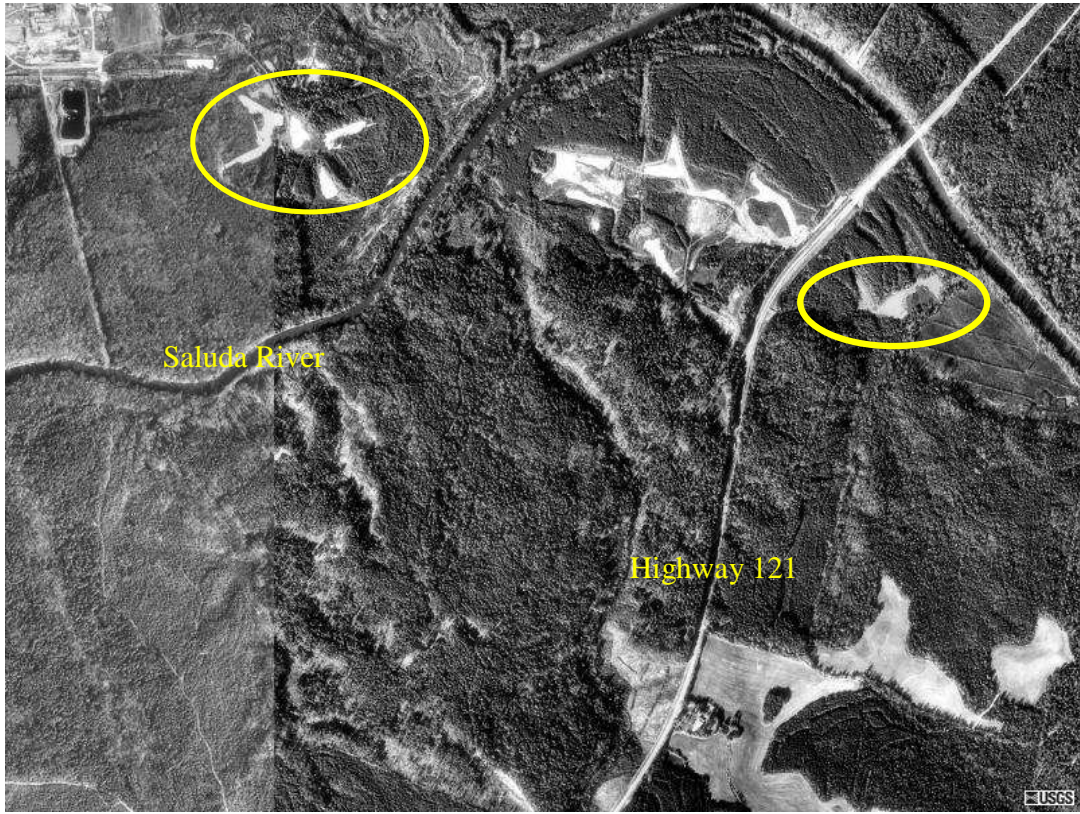
* Not provided by SCDNR; duration time assumed based on previous and subsequent surveys.

3.0 RESULTS

No wood storks were observed during more than 13 hours of aerial surveys performed over the 10 month period from February through November 2005 (Table 1). During the 2006 survey season, wood storks were observed during August and September. A single juvenile wood stork was observed soaring above the Saluda River upstream of Lake Murray during the August survey, and an additional 12 – 14 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 (Figure 1).

No wood stork nesting was observed at the Tosity Creek or Silverstreet sites, which were identified as being potential wood stork nesting areas during the 2004 reconnaissance survey and associated agency consultation (see Meeting Notes, Appendix B). Surveys revealed these to be great blue heron nests, with both nesting adults and pre-flight juveniles observed during both 2005 and 2006 (Tables 1 & 2).

Figure 1. Aerial Photograph of Locations of Wood Stork Sightings During September 2006 Survey (Circles denote locations where wood storks were observed)



4.0 DISCUSSION

The lack of nesting in the study area is consistent with the known life-history of wood storks as a coastal nesting species (USFWS 1996). In South Carolina, all nesting colony sites currently known are located in the coastal plane, and primarily in the coastal counties (Murphy 2005).

Aerial survey observations suggested that wood storks likely did not utilize Lake Murray and the middle Saluda River upstream of the impoundment for nesting, foraging, roosting, or other activities during the 2005 survey period. In 2006, approximately 12 – 14 wood storks were observed in areas of the Saluda Basin upstream of Lake Murray on September 15, 2006. 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 Recovery Plan, 1997).

Limited wood stork occurrences observed during 2005 and 2006 suggest that the relatively large number of storks observed during 2004 may have been attributed to favorable feeding conditions created by the drawdown of the reservoir during construction of the Saluda Backup Dam. Good feeding conditions for wood storks have been characterized as relatively calm water, with water depths between 2 – 10 inches, and where the water column is not cluttered by dense aquatic vegetation (Coulter and Bryan 1993). Reduced overall pool elevation associated with the drawdown likely increased the potential for fish entrapment in shallow embayments during periods of falling water levels, which has been cited as an important factor in wood stork foraging sites (Kahl 1964, Kushlan et al. 1975). This was likely the case during the reconnaissance survey on August 27, 2004, when USFWS and Kleinschmidt biologists observed approximately 60 wood storks foraging in a shallow embayment near the mouth of Beaverdam

Creek in the Saluda River Arm of Lake Murray during falling water (Appendix A, Attachment A, Figure 3).

5.0 *MANAGEMENT IMPLICATIONS*

Wood storks in South Carolina readily change foraging sites in response to prevailing hydrology (Murphy 2005), as was demonstrated by the large number of storks utilizing upper portions of Saluda Project vicinity during the Lake Murray drawdown. Because they have potential to occur anywhere within the Project in response to hydrologic conditions, continued designation of the Bush River and Big Creek areas as wood stork research or conservation areas is not warranted and should be discontinued. Further, usage of the Saluda Project area appears limited to post-dispersal foraging migrations, which are typical of the species during the post-breeding season. As such, continued surveys of the area may not be warranted.

6.0 LITERATURE CITED

- Coulter, M.C. and A.L. Bryan, Jr. 1993. Foraging ecology of Wood Storks (*Mycteria Americana*) in east-central Georgia. I. Characteristics of Foraging Sites. Colonial Waterbirds 16:59-59-70.
- Kahl, M.P., Jr. 1964. Food ecology of the wood stork (*Mycteria Americana*) in Florida. Ecological Monographs 34:97-117.
- Kushlan, J.A. 1979. Prey choice by tactile foraging wading birds. Proceedings of the Colonial Waterbird Group 3:133-142.
- Murphy, T.M. 2005. Memo: South Carolina Wood Stork Survey Results (1981-2005). South Carolina Department of Natural Resources, August 29, 2005. 7 pp.
- U.S. Fish and Wildlife Service (USFWS). 1996. Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork. U.S. Fish and Wildlife Service, Atlanta, Georgia. 41 pp.

APPENDIX A
SALUDA HYDROELECTRIC PROJECT
WOOD STORK STUDY PLAN

SALUDA HYDRO PROJECT (FERC NO. 516) STUDY PLAN

Study Plan Name: Wood Stork Monitoring Plan

Applicable Hydro Projects: Saluda Hydro FERC No. 516

I. Introduction

Contained in the Federal Energy Regulatory Commission's (Commission or FERC) Order issuing a New Operating License for Saluda Hydro (FERC Order ¶ 61,332, June 1, 1984), are conditions that require South Carolina Electric & Gas Company (SCE&G) to submit 5 year updates to the Project shoreline management plan. SCE&G submitted the most recent five-year update to the Commission on February 1, 2000. The Commission issued an order approving and modifying the updated shoreline management plan on June 1, 2004 (FERC Order No. 20040623-3015). Item H of the order requires that SCE&G, in consultation with the South Carolina Department of Natural Resources (SCDNR) and the U.S. Fish and Wildlife Service (USFWS), designate two identified wood stork "roosting and foraging habitats" near Bush River as "conservation areas." Further, the order requires 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, SCE&G initiated consultation efforts with the SCDNR and USFWS. Following an initial reconnaissance survey to confirm wood stork activity within the project area (See Survey Trip Report; Attachment A), a meeting was held on September 17, 2004, among SCE&G and the resource agencies to begin development of a framework for a long-term study plan (See meeting notes; Attachment B).

II. Summary of Existing Data

The wood stork was federally-listed as endangered on February 28, 1984 (USFWS 1996). The only stork native to North America, wood storks occurred historically throughout the coastal plain of the southeastern U.S. and Texas. The current U.S. breeding population has declined from an estimated 20,000 pairs in the 1930's to between 5,500 and 9,500 in recent years, with declines attributed primarily to loss of suitable foraging and nesting habitat. 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 1996). No critical habitat has been designated for this species.

Wood storks are highly colonial and typically nest in large rookeries and feed in flocks (USFWS 1996). 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 1996). 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 1996).

As previously noted, wood storks are primarily birds of freshwater and brackish wetlands along the coastal plain. However, wood stork activity has been reported by local residents at several locations within the Lake Murray area in recent years (See Attachment A, Figure 1). In addition, on August 11, 2004, Tom Murphy of the SCDNR observed approximately 60 storks feeding at various locations in the middle Saluda River area and the upper portion of Lake Murray while conducting an aerial survey for bald eagles (See Attachment A, Figure 2). In response to these sightings, SCE&G, in coordination with the USFWS and SCDNR, conducted an aerial reconnaissance in the upper portions of Lake Murray on August 27, 2004 (See Survey Trip Report; Attachment A). During this reconnaissance 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 (See detailed study observations in Attachment A).

III. Study Objectives

The overall study objective is to document where and under what conditions wood storks are utilizing habitats within the Saluda Hydro Project Boundary and in the project vicinity. In consultation with the SCDNR and the USFWS, a number of specific objectives have been identified (See September 17, 2004, meeting notes; Attachment B), including the following:

- Examination of the potential influence of the Lake Murray drawdown on the presence of storks in the area (i.e. whether and/or to what degree storks will continue to utilize the project once the reservoir is returned to its usual operating range).
- 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).
- Examination of foraging conditions over multiple years and a range of water levels.
- Documentation of seasonal usage by various age classes (i.e., young-of-year, immature, adult).

The following tasks must be undertaken and completed in order to meet the above objectives:

- a) Review and compilation of all credible anecdotal accounts of wood stork occurrences within the Saluda Hydro Project Boundary and in the project vicinity.
- b) Completion of surveys to document current wood stork usage of areas within the Saluda Hydro Project Boundary and in the project vicinity.

IV. Geographic and Temporal Scope

The Saluda Hydro Project Boundary will be the focal point of the wood stork study. The study area will include the main body of Lake Murray and the Middle Saluda River, from the Saluda Dam upstream to the vicinity of Silverstreet and including all tributaries within the project boundary.

Surveys for wood storks will commence in mid-February 2005 and continue through the fall of 2009 (5 years of study). On an annual basis, surveys will begin in mid-February, when storks would be expected to arrive in South Carolina, and continue on a monthly basis through November or until it is determined, in consultation the resource agencies, that storks have left the area.

In consultation with the USFWS and SCDNR, SCE&G proposes to designate the two wood stork foraging and roosting habitats cited in the FERC's order, as well as all other areas within the project boundary where wood stork activity has been documented (See Figures 1 and 2; Appendix B), as temporary Environmental Research Areas. These Environmental Research Areas will remain protected and undeveloped throughout the execution of this study plan. Upon completion of the study, a determination will be made in consultation with the resource agencies, as to whether or not the areas should be granted permanent protected status. If further protection of these areas is deemed necessary, any parameters, conditions, and/or requirements of that protective status will also be determined at this time.

V. Methodology

- a) To the degree practicable, SCE&G and/or their consultant will coordinate with local residents to compile all credible occurrences of wood stork activity within the Saluda Hydro Project Boundary and in the project vicinity. Anecdotal occurrence will be considered credible only if they are from experienced observers (i.e., those who demonstrate the knowledge needed to identify wood storks). For all occurrences, information regarding the number of storks, where they were observed, the time of year when they were first and last observed, and the time of day when the birds arrived and departed on a daily basis will be obtained, if available. An attempt also will be made to acquire photo documentation of occurrences whenever possible.

While anecdotal, such information has the potential to provide significant insight into the daily movements of storks utilizing the area, as well as annual temporal patterns (i.e., when they first arrive and depart from the region).

- b) Aerial surveys to document wood stork activity within the Saluda Hydro Project Boundary will be conducted on a monthly basis during the 2005 through 2009 nesting and post-breeding seasons (mid- February through approximately November; See Section IV – Geographic and Temporal Scope). Aerial surveys will be conducted from fixed-wing aircraft, by qualified SCDNR, SCE&G, and/or Kleinschmidt staff. Aerial surveys initially will focus on those locations where wood stork activity was observed during the 2004 wood stork reconnaissance and bald eagle surveys and where stork activity has been reported by local residents (See Trip Report from 8/27/04). At each location where storks are observed, the following data will be collected:

- An estimate of the total number of storks present.
- An estimate of the numbers of storks of various age classes present (i.e., adult, juvenile, young-of-year).
- Evidence of nesting activity (i.e., evidence of egg-laying, nest construction and/or maintenance, presence of pre-flight juveniles).
- Other activity observed (i.e., foraging, roosting, loafing).
- General description of the habitat being utilized.
- GPS coordinates of the location (Lat/Long).

Supplemental ground surveys will be conducted as deemed necessary based on aerial surveys (i.e., to confirm nesting, confirm the number of individuals of various age classes, determine the presence of a night roost, etc.). Appropriate ground survey methods will vary on a site-by-site basis and thus will be developed on an as-needed basis in consultation with the USFWS and SCDNR.

VI. Schedule and Required Conditions

- a) Compilation of all available anecdotal accounts of wood stork occurrences in the project vicinity will commence in November 2004 with the bulk of the information expected to be compiled by February 1, 2005. As will be discussed in greater detail below, an annual report will be issued upon completion of each field season. Results of the initial data gathering effort will be reviewed in consultation with the resource agencies and subsequently included in the 2005 annual report. As with any such effort, additional information will undoubtedly develop throughout the course of the study and will be duly incorporated into that year's annual report.
- b) For the 2005 nesting season, aerial surveys for wood storks will commence in Mid-February of 2005 and continue through approximately November of 2005 (See Section IV – Geographic and Temporal Scope). Surveys will follow this schedule on an annual basis through October 2009 (5 years of study). A brief e-mail update will

be distributed to the Wood Stork Work Group following each survey. In addition, an annual report will be issued upon completion of each field season and distributed to the Group to provide an update on the study's progress. The Group will subsequently meet in person or via conference call to discuss the study findings and potential modifications to the study scope.

A more detailed report will be prepared following the second year of the study for inclusion in the SCE&G's Application for New License, which is slated for submission to the FERC in 2008.

VII. Use of Study Results

Results of the wood stork study will be used as an information resource during discussion of relicensing issues with the SCNDR, USFWS, relicensing issue working groups and other relicensing stakeholders. Specifically, study results will be used to assess, in coordination with the resource agencies, whether permanent wood stork conservation measures are warranted and to help identify appropriate conservation measures.

VIII. Study Participants

	NAME	ORGANIZATION	PHONE	E-MAIL
Applicant Leads	Stephen E. Summer	SCANA Services, Inc.	(803)217-7357	ssummer@scana.com
	Shane Boring	Kleinschmidt	(803)822-3177	shane.boring@kleinschmidtusa.com
Agency Leads	Tom Murphy	SCDNR	(843)844-2473	murphyt@dnr.sc.gov
	Ed Eudaly	USFWS	(843)727-4707, Ext. 13	Ed_Eudaly@fws.gov
Additional Applicant Contacts	Randy Mahan	SCANA Services, Inc.		rmahan@scana.com
	Alan W. Stuart	Kleinschmidt	(803)822-3177	alan.stuart@kleinschmidtusa.com
	Bill Argentieri	SCE&G	(803)217-9162	bargentieri@scana.com

IX. List of Attachments

ATTACHMENT A: August 27, 2004, Wood Stork Aerial Survey Trip Report

ATTACHMENT B: Meeting Minutes from September 17, 2004, conference call with
SCDNR and USFWS

X. List of References

U.S. Fish and Wildlife Service (USFWS). 1996. Revised Recovery Plan for the U.S.
Breeding Population of the Wood Stork. U.S. Fish and Wildlife Service, Atlanta,
Georgia. 41 pp.

ATTACHMENT A

TRIP REPORT FROM AUGUST 27, 2004, WOOD STORK AERIAL SURVEY

Wood Stork Aerial Survey Trip Report

Lake Murray and Saluda River August 27, 2004

Survey Attendees

Shane Boring	Kleinschmidt
Tom Murphy	SCDNR Endangered Species Biologist
Bucky Harris	SCDNR Pilot

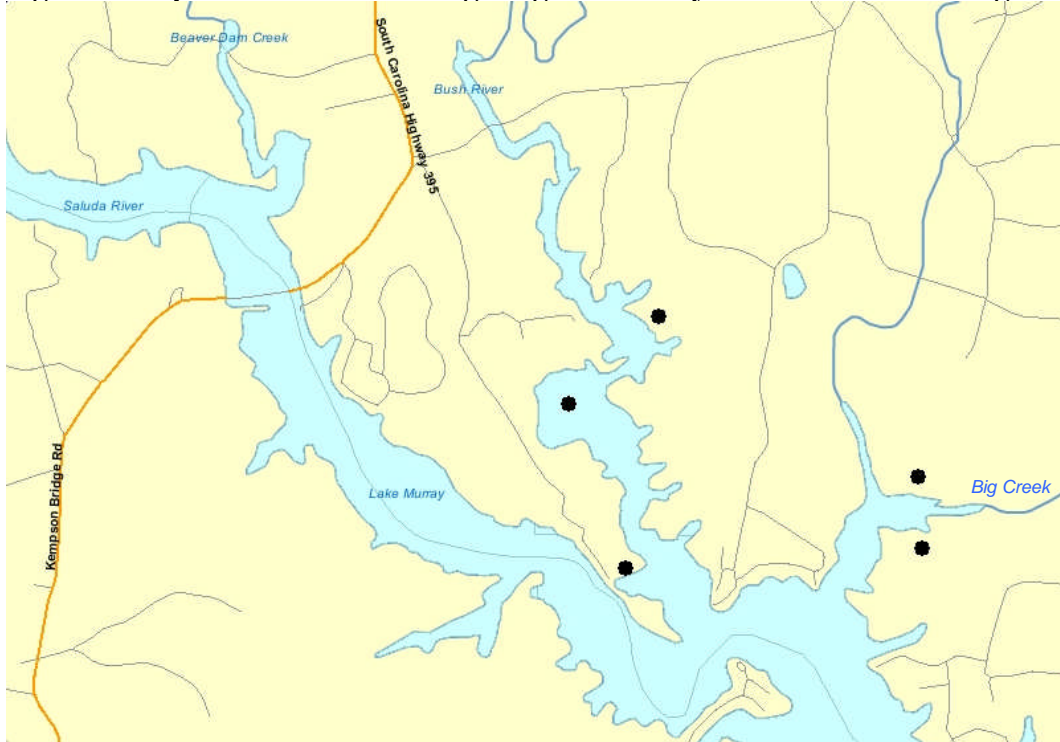
Aircraft: Fixed-Wing Cessna 210 **Survey Duration:** 1300 – 1415 hrs

Survey Observations

The survey crew departed the SC Avionics Facility at Columbia Metropolitan Airport at approximately 1300 hrs. The survey traversed the Lower Saluda River, from the confluence to the Saluda Hydro Dam, and the lower portion of Lake Murray, with the survey crew remarking on the lack of stork habitat in the vicinity. According to the USGS gauge (Lake Murray near Columbia, SC), the reservoir elevation at the time of the survey was 349.9 ft.

The survey crew also examined several sites along Bush River and Big Creek where foraging storks have been reported by a local resident for approximately the past three years (See Figure 1). However, no storks were observed at these sites.

Figure 1: Reported Wood Stork Sightings in Vicinity of Bush River and Big Creek

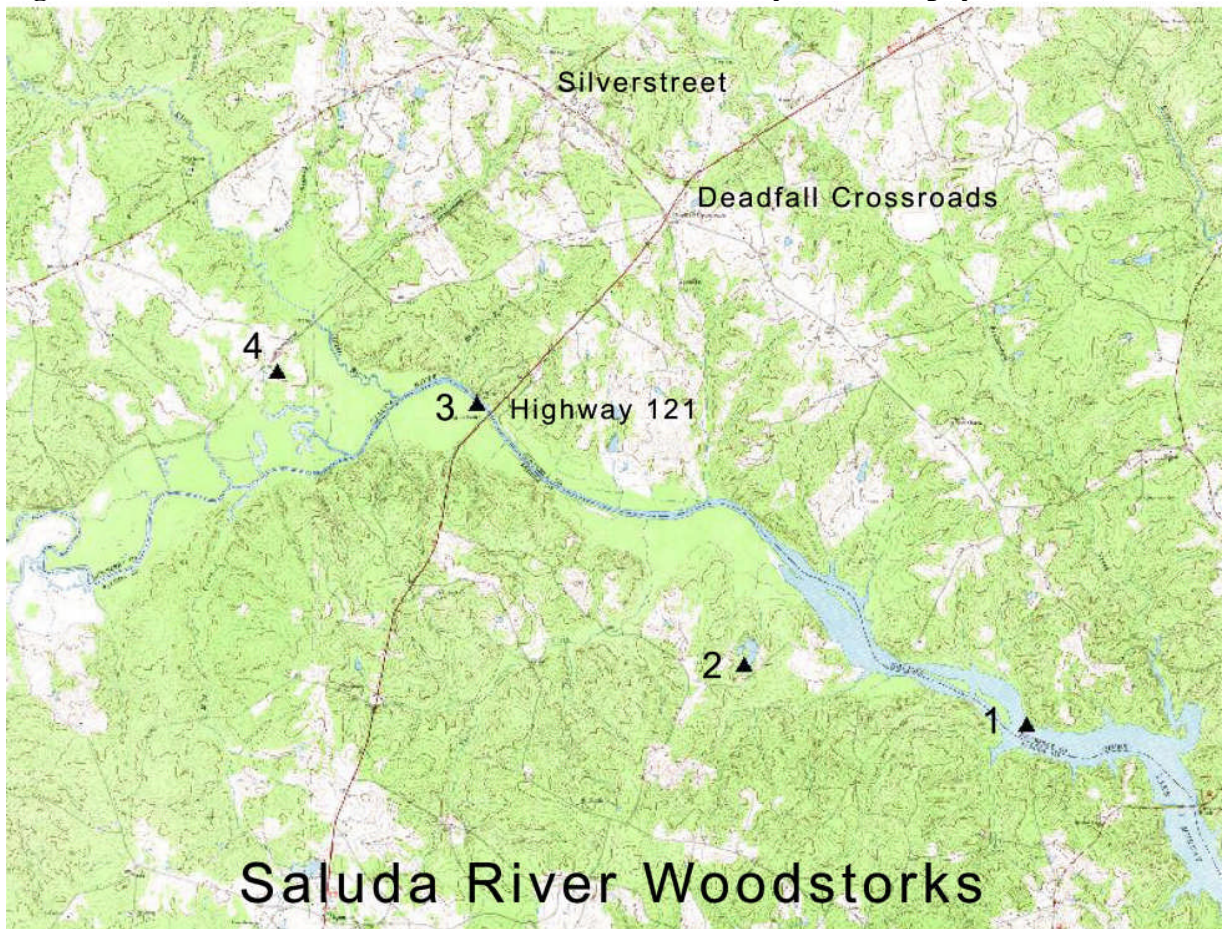


Wood Stork Aerial Survey Trip Report

Lake Murray and Saluda River August 27, 2004

The remainder of the survey focused on the extreme upper end of Lake Murray and upstream in the middle Saluda River. Four sites where foraging wood storks were previously observed by Tom Murphy on 8/4/04 were examined (See Figure 2). Approximately 60 wood storks were observed foraging on exposed mudflats within the project boundary upstream of Beaverdam Creek on the Saluda River (See Point 1 - Figure 2). Several passes were made to confirm that the birds were wood storks, photograph the birds (See Figure 3), and obtain a more accurate count of the number of birds.

Figure 2: Saluda River Wood Stork Locations Provided By Tom Murphy (SCDNR)



Wood Stork Aerial Survey Trip Report

Lake Murray and Saluda River
August 27, 2004

Figure 3: Wood Stork Feeding Assemblage Observed Upstream of Beaverdam Creek



The potential nesting area (See Point 4 – Figure 2; also See Figure 4), originally identified by Tom Murphy on 8/4/04, was also examined as part of the survey. Approximately 12 nests were observed in a small forested wetland (old clay pit) located in the floodplain of the middle Saluda River, south of Silverstreet, and adjacent to International Paper’s wood chipping facility (See Figure 5). The nests appeared to be wood stork nests, but no storks were observed in the vicinity at the time of the survey. It should be noted that approximately 20 storks were observed standing on the nests and roosting in the vicinity of the nests when they were first located on 8/4/04; however, none appeared to be freshly-fledged juveniles.

The survey examined another potential nesting site in the Saluda River floodplain near the mouth of Tosity Creek, which was initially located by Bucky Harris (SCDNR Pilot) during a flight on approximately 8/25/04. Approximately 10 nests were observed in two adjacent forested wetlands (See Figure 4). The nests appeared to be wood stork nests; however, no storks were present at the site, and it was noted by Tom Murphy that they could potentially be great blue heron nests. GPS coordinates for the two potential nesting areas are provided in Table 1.

Table 1: Latitude and Longitude of Potential Wood Stork Nesting Locations

	Latitude (Deg. / Dec. Min.)	Longitude (Deg. / Dec. Min.)
Silverstreet Site	34 11.20	81 45.28
Tosity Creek Site	34 10.19	81 42.19

Wood Stork Aerial Survey Trip Report

Lake Murray and Saluda River
August 27, 2004

Figure 4: Potential Wood Stork Nesting Sites on the Middle Saluda River

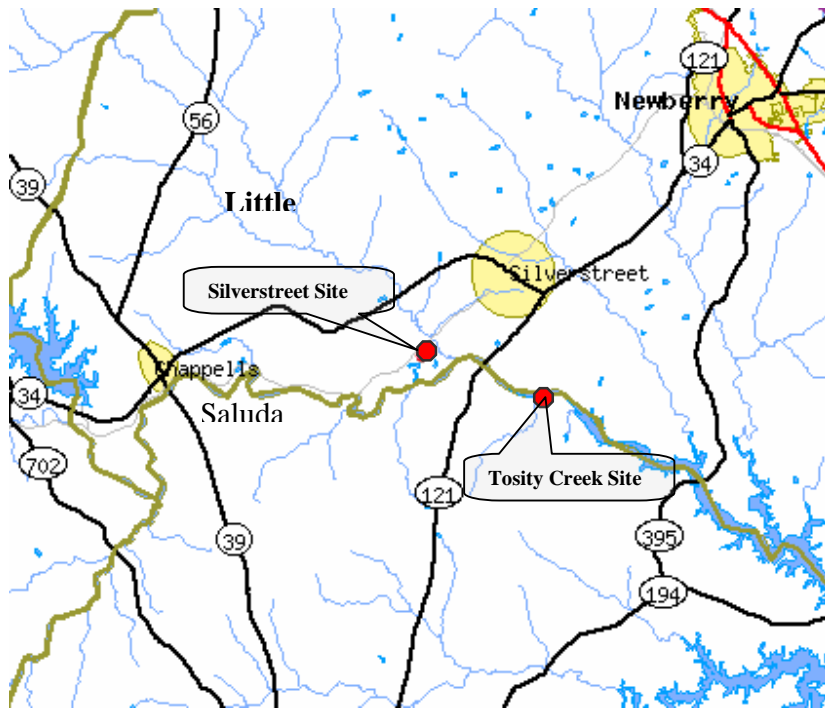


Figure 5: Aerial Photo of Potential Wood Stork Nesting Site Near Silverstreet, SC



Wood Stork Aerial Survey Trip Report

Lake Murray and Saluda River August 27, 2004

Summary

Approximately 60 wood storks were observed foraging on exposed mudflats within the Saluda Project Boundary upstream of Beaverdam Creek (See Point 1 - Figure 2). This observation, combined with other sightings of feeding assemblages throughout the middle Saluda Basin, suggests that wood storks are readily using a wide range of habitats in the basin for foraging. The storks observed feeding within the project boundary were feeding on mudflats exposed by the Lake Murray drawdown. It remains unclear at this time whether storks will utilize the lake as a foraging area once the lake has returned to full pool elevation. Tom suggested follow-up surveys next year to determine if storks are utilizing the lake for foraging after it is returned to full pool.

Two potential nesting sites were examined during the survey, one just south of Silverstreet and the other along the Saluda River near Tosity Creek (See Figure 4). At the Silverstreet site, approximately 12 nests resembling wood stork nests were observed; however, no storks were present at the time of the survey. When the nests were initially located on 8/4/04, several storks were observed standing in the nests and roosting nearby; however, none appeared to be newly-fledged juveniles. The Silverstreet Site is not located within the Saluda Project Boundary.

Approximately 10 nests were located at the Tosity Creek site. The size, structure, and location of the nests were typical of wood storks; however, no wood storks were observed in the vicinity and it was noted that they could potentially be great blue heron nests. Based on initial field observations, the Tosity Creek site appears to be located within the Saluda Project Boundary.

Some uncertainty remains as to whether the observed nests were wood stork nests, and if so, whether nesting was successful at the Silverstreet and Tosity Creek sites. In discussions with Tom Murphy, it was suggested that a similar survey be conducted during next year's nesting season to determine whether reproduction is taking place at these locations.

ATTACHMENT B

MEETING MINUTES FROM SEPTEMBER 17, 2004, CONFERENCE CALL WITH
SCDNR AND USFWS

**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

**Saluda Hydro Project – Meeting RE August 27, 2004 Wood Stork Reconnaissance Survey
Via Conference Call – September 17, 2004**

Revision 09-30-04

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.

**Saluda Hydro Project – Meeting RE August 27, 2004 Wood Stork Reconnaissance Survey
Via Conference Call – September 17, 2004**

Revision 09-30-04

*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.

Cheryl Balitz

From: Jennifer Summerlin
Sent: Monday, January 08, 2007 10:07 AM
To: 'Steve Bell'; Alan Stuart; Alison Guth; 'Amanda Hill'; 'Bill Argentieri'; 'Columbia Individual (jdjaco@columbiasc.net)'; 'Dee Bennett '; 'Dick Christie'; 'Harold Moxley'; Jennifer Summerlin; 'Prescott Brownell'; Shane Boring
Subject: Saluda Relicensing: 2007 American Shad Telemetry Study Plan

All:

Attached for your review is the 2007 American Shad Telemetry Study Plan. Please review and have comments back to me by January 29, 2007.



American Shad
Telemetry Study ...

Thanks,

Jennifer Summerlin
Scientist Technician
Kleinschmidt Associates
101 Trade Zone Drive, Suite 21A
West Columbia, SC 29170
P:803.822.3177
F:803.822.3183

Saluda Hydro Project (FERC No. 516)

Study Plan: 2007 Diadromous Fish Studies American Shad Telemetry Study for the Lower Saluda, Congaree and Broad Rivers

Diadromous Fish Technical Working Committee
Draft – January 8, 2007

I. Study Objective

The objective of this study will be to characterize the movements of migrating American shad (*Alosa sappadissima*) in the Lower Saluda (LSR), Congaree, and Broad Rivers for purposes of determining:

- usage of the lower Saluda River (LSR) downstream of Saluda Hydro dam;
- potential usage of the Columbia Hydro tailrace;
- potential usage of the Columbia fish passage facility on the Broad River; and
- migration upstream of the Columbia Hydro Project to the base of Parr Hydro.

II. Basis

Enhancement and restoration of anadromous Alosids to South Carolina waters has become an important objective of resource agencies. Each spring, efforts to pass migrating American shad and blueback herring are undertaken at the first barriers to migration in the Santee-Cooper system. Once passed, these fish have several migration pathways from which to choose. One potential pathway could result in these fish entering the LSR near Columbia. The relative abundance and potential spawning of this segment of the population is of particular interest to managers.

Another pathway would result in fish entering the Broad River, also located near Columbia. Recently, South Carolina Electric and Gas (SCE&G) installed a fish passage facility at the Columbia Hydro diversion dam. The fish passage facility was constructed to allow target fish species, such as American shad and blueback herring, to migrate upstream over the diversion dam to reach spawning grounds. The success of passing diadromous species through the Columbia fish passage facility is of importance to resource agencies and interested stakeholders.

During the relicensing process of Columbia Hydro, resource agencies expressed interest in the potential for American shad to utilize the tailwaters of the project. Agencies were concerned that during times of high power generation, American shad may be influenced and be attracted to the tailrace as opposed to migrating up the bypass reach towards the fish way. Further, the agencies indicated that if significant numbers of Alosids utilize the Columbia tailrace then reductions in project operations may be necessary to re-direct shad in the tailrace to the bypass reach.

III. Geographic and Temporal Scope

The telemetry study will focus on the Congaree River near the downstream extent of the Congaree National Park, upstream of Highway 601 Bridge; the LSR from downstream of the Saluda Hydro Dam to its confluence with the Broad River; and the Broad River from the Parr Shoals Dam to its confluence with the LSR.

The study will be conducted during Spring 2007, when American shad would be expected to undertake their upstream spawning migrations. Study timing will be based on passage numbers at the St Stephens Fish Ladder located downstream at the Santee Cooper Project (FERC Project No. 299). Duration of the study may be adjusted based on battery life of transmitters, mortality of target species and/or consultation with resource agencies and interested stakeholders. It is anticipated the study will last through August 2007.

IV. Methodology

Tagging

Approximately 40 - 50 American shad will be collected from the Congaree River in the vicinity of the Highway 601 Bridge during the 2007 immigrating spawning season. Both male and female will be captured depending on availability. To facilitate collections, the SCDNR will notify Kleinschmidt Associates and/or SCE&G when significant numbers of Alosids begin to move through St. Stephens Fish Lift at Pineopolis Dam. Collections will be by standard boat electrofishing methods, and captured fish will be dip netted and placed in a live well. Each captured fish will be measured (mm) and a VemcoV-9 coded acoustic transmitter will be inserted through the esophagus into the upper alimentary canal via a slender wooden probe (Olney et al. 2006). Each transmitter will be coated with glycerin to reduce abrasion of the esophagus (Beasley et al. 2000). Dry weight of acoustic transmitters will not exceed 2% of fish wet weight. Tagged American shad will be placed in a holding pen for a short observation period to ensure recovery and then released.

Monitoring

The SCDNR has installed an array of receivers in the lower Saluda and Congaree Rivers. To expand the current SCDNR study and conduct the scope of this study, additional receivers will be installed at locations in the Broad River and below the Columbia Hydro Powerhouse. Acoustic equipment for this study will include Vemco V-9 coded acoustic transmitters (69 kHz) and Vemco VR2 ultrasonic receivers (Vemco, Shad Bay, Nova Scotia). The transmitters will relay an acoustic ping to the Vemco receiver(s), which will be programmed to record the transmitter code, time of passage, depth, and location of each shad. Data will be downloaded from receivers on a bi-monthly basis.

Locational data will be recorded from an array of Vemco receivers deployed (or will be deployed prior to tagging) at the following locations (Attachment A):

- Congaree River near Highway 601 Bridge;
- Congaree River at the upstream extent of the Congaree National Park;
- Congaree River near Carolina Eastman;

- Congaree River in the vicinity of the Rosewood Boat Landing;
- LSR below Lake Murray Dam;
- LSR near Corley Mill Island;
- LSR adjacent to the Radio Towers;
- LSR adjacent to Riverbanks Zoo;
- Broad River in the vicinity of Columbia Hydro tailrace;
- Broad River below the diversion dam;
- Broad River in the vicinity of Harbison State Park; and
- Broad River below Parr Shoals Dam.

Data Retrieval

Data will be retrieved from the receivers on a bi-monthly basis by SCDNR, SCE&G or Kleinschmidt personnel. Data retrieved from the receivers will be given a unique file name which includes receiver location and date.

V. Schedule and Required Conditions

Sampling for American shad in the lower Saluda, Broad, and Congaree Rivers will be conducted during spring 2007 when significant number of American shad reaches the St. Stephens fish lift at Pineopolis Dam. A draft report summarizing the results will be issued in October 2007. The report will contain information on spatial and temporal movements of tagged fish and contain any appropriate maps or GIS information.

VI. Use of Study Results

Results of the telemetry study will be used as an information resource during discussion of relicensing issues with the SCDNR, NMFS, USFWS, relicensing issue working groups, and other relicensing stakeholders.

VI. Study Participants

	NAME	ORGANIZATION	PHONE	E-MAIL
Applicant Leads	Stephen Summer Milton Quattlebaum Alan Stuart Shane Boring Jennifer Summerlin	SCANA Services SCANA Services Kleinschmidt Kleinschmidt Kleinschmidt	803.217.7357 803.608.6296 803.822.3177 803.822.3177 803.822.3177	ssummer@scana.com mquattlebaum@scana.com alan.stuart@kleinschmidtusa.com shane.boring@kleinschmidtusa.com jennifer.summerlin@kleinschmidtusa.com
Agency Leads	Dick Christie Jason Bettinger Amanda Hill Prescott Brownell	SCDNR SCDNR USFWS NOAA Fisheries	803.289.7022 803.353.8232 843.727.4707 843.762.8591	dchristie@infoave.net BettingerJ@dnr.sc.gov Amanda-hill@fws.gov Prescott.brownell@noaa.gov
Other Participants	William Argentieri Randy Mahan	SCE&G SCANA Services	803.217.9162 803.217.9538	bargentieri@scana.com rmahan@scana.com

VII. List of Attachments

ATTACHMENT A: Map of receiver monitoring stations on the lower Saluda, Broad, and Congaree rivers.

VIII. List of References

Beasley, C. A. and J. E. Hightower. 2000. Effects of a low-head dam on the distribution and characteristics of spawning habitat used by striped bass and American shad. Transactions of the American Fisheries Society 129:1316-1330.

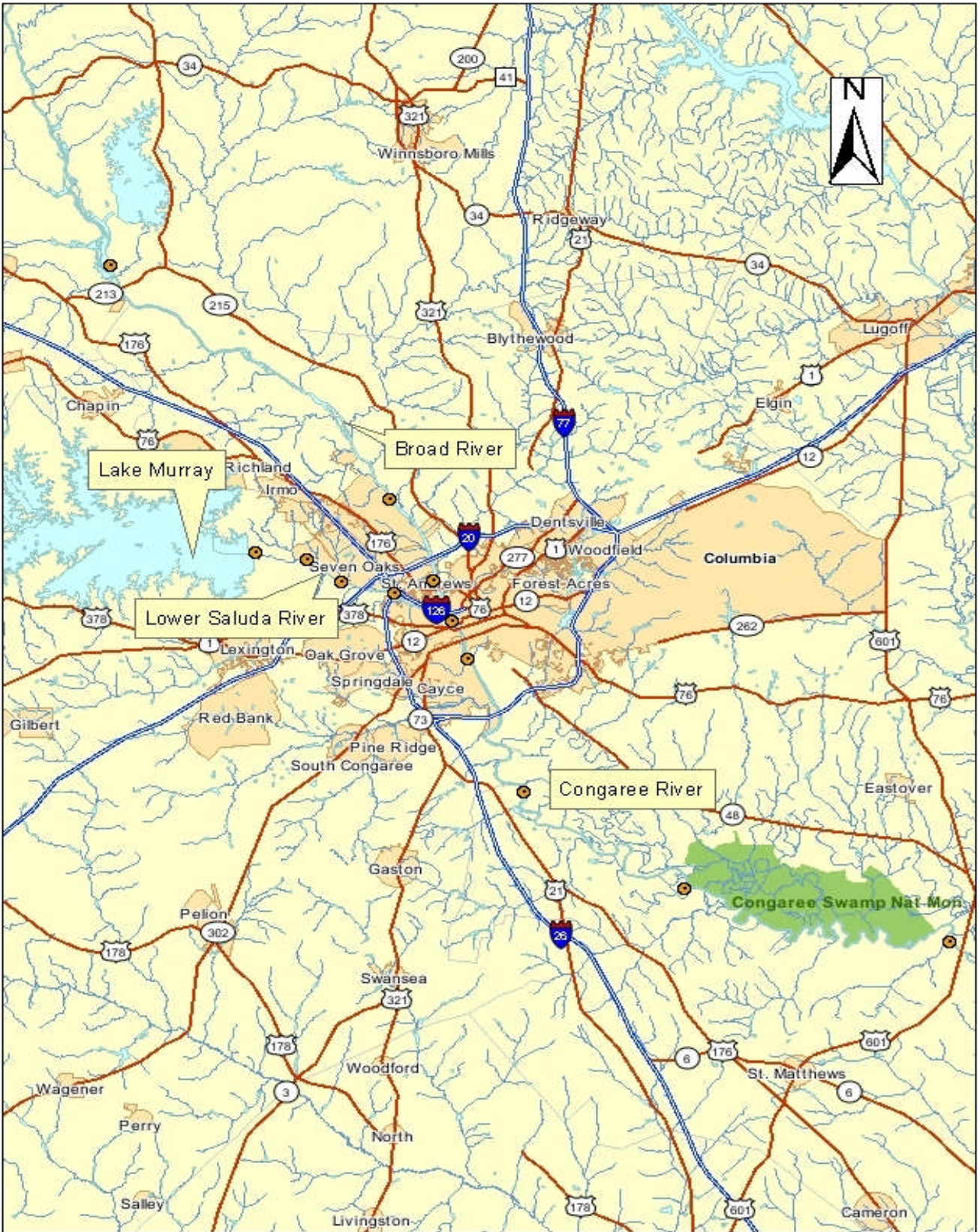
Olney, J.E., R.J. Latour, B.E. Watkins, and D.G. Clarke. 2006. Migratory behavior of American shad (*Alosa sapidissima*) in the York River, Virginia with implications for estimating in-river exploitation from tag-recovery data. Transactions of the American Fisheries Society 135:889-896.

VEMCO. 2004. Coded Acoustic Tag Technical Information Website. Available: <http://www.vemco.com/products/transmitters/index.php>. Accessed: December 21, 2006.

ATTACHMENT A

Map of receiver monitoring stations on the lower Saluda, Broad, and Congaree Rivers

Attachment A: Receiver monitoring stations on the lower Saluda, Broad, and Congaree Rivers



Kacie Jensen

From: Jennifer Summerlin
Sent: Monday, January 08, 2007 10:07 AM
To: 'Steve Bell'; Alan Stuart; Alison Guth; 'Amanda Hill'; 'Bill Argentieri'; 'Columbia Individual (jdjaco@columbiasc.net)'; 'Dee Bennett '; 'Dick Christie'; 'Harold Moxley'; Jennifer Summerlin; 'Prescott Brownell'; Shane Boring
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American Shad
Telemetry Study ...

Thanks,

Jennifer Summerlin
Scientist Technician
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Saluda Hydro Project (FERC No. 516)

Study Plan: 2007 Diadromous Fish Studies American Shad Telemetry Study for the Lower Saluda, Congaree and Broad Rivers

Diadromous Fish Technical Working Committee
Draft – January 8, 2007

I. Study Objective

The objective of this study will be to characterize the movements of migrating American shad (*Alosa sappedissima*) in the Lower Saluda (LSR), Congaree, and Broad Rivers for purposes of determining:

- usage of the lower Saluda River (LSR) downstream of Saluda Hydro dam;
- potential usage of the Columbia Hydro tailrace;
- potential usage of the Columbia fish passage facility on the Broad River; and
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Enhancement and restoration of anadromous Alosids to South Carolina waters has become an important objective of resource agencies. Each spring, efforts to pass migrating American shad and blueback herring are undertaken at the first barriers to migration in the Santee-Cooper system. Once passed, these fish have several migration pathways from which to choose. One potential pathway could result in these fish entering the LSR near Columbia. The relative abundance and potential spawning of this segment of the population is of particular interest to managers.

Another pathway would result in fish entering the Broad River, also located near Columbia. Recently, South Carolina Electric and Gas (SCE&G) installed a fish passage facility at the Columbia Hydro diversion dam. The fish passage facility was constructed to allow target fish species, such as American shad and blueback herring, to migrate upstream over the diversion dam to reach spawning grounds. The success of passing diadromous species through the Columbia fish passage facility is of importance to resource agencies and interested stakeholders.

During the relicensing process of Columbia Hydro, resource agencies expressed interest in the potential for American shad to utilize the tailwaters of the project. Agencies were concerned that during times of high power generation, American shad may be influenced and be attracted to the tailrace as opposed to migrating up the bypass reach towards the fish way. Further, the agencies indicated that if significant

numbers of Alosids utilize the Columbia tailrace then reductions in project operations may be necessary to re-direct shad in the tailrace to the bypass reach.

III. Geographic and Temporal Scope

The telemetry study will focus on the Congaree River near the downstream extent of the Congaree National Park, upstream of Highway 601 Bridge; the LSR from downstream of the Saluda Hydro Dam to its confluence with the Broad River; and the Broad River from the Parr Shoals Dam to its confluence with the LSR.

The study will be conducted during Spring 2007, when American shad would be expected to undertake their upstream spawning migrations. Study timing will be based on passage numbers at the St Stephens Fish Ladder located downstream at the Santee Cooper Project (FERC Project No. 299). Duration of the study may be adjusted based on battery life of transmitters, mortality of target species and/or consultation with resource agencies and interested stakeholders. It is anticipated the study will last through August 2007.

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Tagging

Approximately 40 - 50 American shad will be collected from the Congaree River in the vicinity of the Highway 601 Bridge during the 2007 immigrating spawning season. Both male and female will be captured depending on availability. To facilitate collections, the SCDNR will notify Kleinschmidt Associates and/or SCE&G when significant numbers of Alosids begin to move through St. Stephens Fish Lift at Pineopolis Dam. Collections will be by standard boat electrofishing methods, and captured fish will be dip netted and placed in a live well. Each captured fish will be measured (mm) and a VemcoV-9 coded acoustic transmitter will be inserted through the esophagus into the upper alimentary canal via a slender wooden probe (Olney et al. 2006). Each transmitter will be coated with glycerin to reduce abrasion of the esophagus (Beasley et al. 2000). Dry weight of acoustic transmitters will not exceed 2% of fish wet weight. Tagged American shad will be placed in a holding pen for a short observation period to ensure recovery and then released.

Monitoring

The SCNDR has installed an array of receivers in the lower Saluda and Congaree Rivers. To expand the current SCDNR study and conduct the scope of this study, additional receivers will be installed at locations in the Broad River and below the Columbia Hydro Powerhouse. Acoustic equipment for this study will include Vemco V-9 coded acoustic transmitters (69 kHz) and Vemco VR2 ultrasonic receivers (Vemco, Shad Bay, Nova Scotia). The transmitters will relay an acoustic ping to the Vemco receiver(s), which will be programmed to record the transmitter code, time of

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- LSR below Lake Murray Dam;
- LSR near Corley Mill Island;
- LSR adjacent to the Radio Towers;
- LSR adjacent to Riverbanks Zoo;
- Broad River in the vicinity of Columbia Hydro tailrace;
- Broad River below the diversion dam;
- Broad River in the vicinity of Harbison State Park; and
- Broad River below Parr Shoals Dam.

Data Retrieval

Data will be retrieved from the receivers on a bi-monthly basis by SCDNR, SCE&G or Kleinschmidt personnel. Data retrieved from the receivers will be given a unique file name which includes receiver location and date.

V. Schedule and Required Conditions

Sampling for American shad in the lower Saluda, Broad, and Congaree Rivers will be conducted during spring 2007 when significant number of American shad reaches the St. Stephens fish lift at Pineopolis Dam. A draft report summarizing the results will be issued in October 2007. The report will contain information on spatial and temporal movements of tagged fish and contain any appropriate maps or GIS information.

VI. Use of Study Results

Results of the telemetry study will be used as an information resource during discussion of relicensing issues with the SCDNR, NMFS, USFWS, relicensing issue working groups, and other relicensing stakeholders.

VI. Study Participants

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VII. List of Attachments

ATTACHMENT A: Map of receiver monitoring stations on the lower Saluda, Broad, and Congaree rivers.

VIII. List of References

- Beasley, C. A. and J. E. Hightower. 2000. Effects of a low-head dam on the distribution and characteristics of spawning habitat used by striped bass and American shad. Transactions of the American Fisheries Society 129:1316-1330.
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- VEMCO. 2004. Coded Acoustic Tag Technical Information Website. Available: <http://www.vemco.com/products/transmitters/index.php>. Accessed: December 21, 2006.

ATTACHMENT A

Map of receiver monitoring stations on the lower Saluda, Broad, and Congaree Rivers

Attachment A: Receiver monitoring stations on the lower Saluda, Broad, and Congaree Rivers

