

## MEMORANDUM FOR RECORD

SUBJECT: Jim Woodruff Dam Existing Water Management Operations, Section 7 Consultation, Hydrological Modeling Technical Workshop, 24-25 May 2006

1. A technical workshop was held on 24-25 May 2006 at the Lake Seminole Resource Management Office to exchange technical input on the appropriate modeling approach and assumptions to be used by the U.S. Army Corps of Engineers (USACE), Mobile District, and the U.S. Fish and Wildlife Service (USFWS) during the ongoing consultation on existing water management operations at Jim Woodruff Dam and the potential impacts to federally-listed species and critical habitat that occur on the Apalachicola River (the threatened Gulf sturgeon, critical habitat for the Gulf sturgeon, the threatened Purple bankclimber mussel, and the endangered Fat threeridge mussel). Technical representatives from the States of Alabama, Florida and Georgia were also invited to participate in the workshop. A copy of the agenda for the workshop and presentations by participants are attached. The focus of the workshop was on technical matters related to hydrological modeling and ways to capture the impacts of the proposed Interim Operations Plan, as submitted in the Mobile District request dated 7 May 2006 to initiate formal consultation pursuant to Section 7 of the Endangered Species Act of 1973 (ESA). The following representatives from USACE, the USFWS, Alabama Office of Water Resources (AL-OWR), Georgia Department of Natural Resources (GA-DNR), Florida Department of Environmental Protection (FDEP), Northwest Florida Water Management District (NFWFMD), and Florida Fish and Wildlife Conservation Commission (FWCC) participated in the workshop.

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\* Attended 23 May only

\*\* Attended 24 May only

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2. The workshop began with field trips to view the physical limitations of the spillgates at Jim Woodruff Dam (presented by Mr. Richard Johns of Mobile District), and the rock ledge fronting the Chattahoochee River Park on the left descending bank a few thousand feet downstream from the dam which has been documented to serve as suitable spawning habitat for Gulf sturgeon. Mr. Johns demonstrated how the spillgates are opened and closed and discussed the limitations (mechanical and safety) that control the rate of release at various flows. Mr. Johns also explained that all releases at or below approximately 16,000 cfs are made through the powerhouse turbines. Mr. Jerry Ziewitz of USFWS led the discussion at the rock ledge site. Mr. Ziewitz explained the significance of this type of habitat for sturgeon spawning and described recent USACE/USFWS efforts to map suitable spawning habitat, track sturgeon movements, and document areas where spawning is occurring. Following the fieldtrips, the group returned to the Lake Seminole Resource Management Office for the modeling discussion.

3. Mr. Roger Burke (Mobile District) led a brief introduction and then yielded to the meeting facilitator, Mr. Bruce Stedman. Mr. Stedman reviewed the meeting goals, agenda, and ground rules. Highlights and agreements from the meeting sessions are provided below. A copy of each presentation is attached.

4. Session I of the meeting focused on background information regarding relative laws and responsibilities as well as coordination/consultation efforts to date.

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a. Ms. Gail Carmody (USFWS) provided an overview of the Endangered Species Act and the Section 7 consultation process. By law, the formal Section 7 consultation must be completed within a prescribed 90-day consultation period, followed by a 45-day period within which the USFWS must issue a final biological opinion. The end of the 90-day consultation period is 6 June 2006, and the biological opinion must be completed by 21 July 2006, unless an extension is mutually agreed to be the Corps and USFWS. Therefore, it was requested that any comments on the modeling approach and assumptions be provided by 6 June so that they can be considered in the assessment of the IOP.

b. Ms. Joanne Brandt (Mobile District) followed with a chronological discussion of the activities that have occurred during informal and formal consultation with USFWS regarding USACE operations and impacts to listed species in the Apalachicola River. Mrs. Brandt's presentation described the elements of the interim operations plan (IOP). The intent of the IOP is to provide year-round operations to support flow needs for sturgeon spawning, young sturgeon, mussels, and host fish for mussels; minimize or avoid impacts of low flow operations on listed species or critical habitat; provide for storage when water is more plentiful to allow for future augmentation during low flows in support of mussels; and to minimize conflicts with management for other fish and wildlife species (e.g., reservoir fish management).

#### 5. Session II of the meeting focused on the IOP.

a. Mrs. Brandt described the purpose of the IOP and provided a detailed description of the various elements of the IOP (see IOP Table handout attached). Discussions generated by these presentations focused on clarifying the conditions of the IOP and describing how the various thresholds were determined.

b. Mr. Memphis Vaughan (Mobile District) followed Mrs. Brandt with a presentation outlining the lessons operators have learned from implementation of the IOP during the spring sturgeon spawning season. As a result of the lessons learned, the Corps has identified several adjustments to the IOP that can minimize the potential for over-releases due to the ramping requirements and travel time to move water downstream. These include changing from a 3-day computed average to a 7-day computed average, and using volumetric computations to track BI and releases, with flows used to meet ramping rates included in the volumetric computations. Mr. Vaughan also described that there is a consistent discrepancy between the Woodruff discharge ratings through the spillgates or turbines and the Chattahoochee gage. Generally the difference is 1,000 to 2,000 cfs, but occasionally it can be as high as 4,000 cfs. Representatives from the State of Georgia stated that the discrepancy was consistently around 6% over-release compared to the Woodruff ratings, based on discussions with the United States Geological Society (USGS) and suggested that the Chattahoochee gage should be used as the reference for controlling releases in order to avoid over-releases that could result in a significant amount of storage being lost from Lake Lanier. Mobile District personnel noted that springs, boils and seepage could explain a portion of the discrepancy, but is probably not that significant. They also noted that we would need to confirm that the accuracy of the Chattahoochee gage has been

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recently updated (generally USGS will visit the gage six times a year). Mr. Doug Otto (Mobile District) explained that the Apalachicola, Chattahoochee, Flint Rivers (ACF) total basin inflow is a computed value, derived directly in part from the Corps Jim Woodruff outflow. If that computed ACF total basin inflow is then compared to the outflow measured at another gage, in this case the USGS Chattahoochee Gage, then large differences between total basin inflow and outflow could be inferred, that may in-fact be partially or wholly due to the difference in flow reporting between the Corps published Jim Woodruff outflows and the USGS mean daily flow values reported at the Chattahoochee gage.

6. Session III of the meeting consisted of presentations summarizing the recent modeling efforts conducted by the USACE and USFWS.

a. Mr. Vaughan began the modeling discussion with a description of the Excel Spreadsheet Model he developed to analyze the impacts of the IOP on system wide operations. He noted that this model was not as robust as STELLA or HEC-5, but that it was created as a quick “first cut” tool to determine if various plan alternatives were feasible from an operations standpoint. The model compared 2000-2001 historical data (period of recent drought) with and without the conditions of the IOP in place. Mr. Vaughan also noted that models are better at depicting the results of average conditions rather than extreme conditions.

b. Mr. Steve Leitman (Phipps Foundation) and Mr. Ziewitz summarized the assumptions and results of the STELLA model run with the IOP conditions. Mr. Leitman described that he worked for a non-profit organization and was asked by USFWS to assist with the IOP modeling based on his knowledge of STELLA. They utilized the Florida version of the STELLA model with modifications made in coordination with USFWS and the Corps. Mr. Leitman agreed to share the EXCEL Spreadsheet and copies of the STELLA model used with those interested. The following assumptions were integrated into the STELLA model:

- 2001 unimpaired flow data set
- 1989 Draft WCP Hydropower demands based on zone levels
- 1989 Draft WCP rule curves for reservoirs
- No releases for navigation
- Model utilized 2000 forecasted demands for withdrawals, except for the Atlanta metropolitan area the actual demands for 1998 – 2001 (monthly averages) were used.
- Agricultural demands in Flint River Basin were based on 621,000 acres for agricultural withdrawals and a dry year multiplier of 1.2. This measurement was checked against actual gaged flows and was comparable. (NOTE: Steve stated a few days after the workshop that the multiplier is 1.4.)
- Standard minimum flow requirements at Columbus, Peachtree Creek, and Woodruff Dam

State of Georgia representatives stated that they have new data for computing agricultural demands in the Flint River basin and they will provide that information to the various modelers.

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Mr. Ziewitz described the conditions for the “Environmental Baseline”:

- Does not include effects of action under review
- Does include the effects of past operations at ongoing projects
- Historic flow is calculated using Chattahoochee gage record

Mr. Ziewitz further explained that the STELLA model does not account for routing times, but utilizes a daily time step calculation for Woodruff releases. The STELLA model also utilizes the existing upstream project rule curves to prorate support for the downstream reservoirs. Their STELLA model used a sliding ramping rate for flows below 20,000 cfs of between 0.5 to 2.0 ft/day (this rate may need further clarification). Mr. Ziewitz noted that several questions remain regarding the STELLA model, such as, how to make the model more realistic or more closely approximate the actual operations by the Corps to meet the IOP. USFWS stated that they would use the STELLA model and/or another model such as HEC-5, as determined appropriate.

c. Mr. James Hathorn (Mobile District) followed the STELLA model presentation with a presentation on modeling the IOP using the HEC-5 model. Mr. Hathorn used the Comprehensive Study “Black and White” model as the basis for building the IOP model (this is basically the same operations included in the 1989 draft WCP, with some adjustments to depict current operations). The following assumptions were integrated into the Mobile District IOP HEC-5 model:

- 2001 Unimpaired flow data set (same as STELLA)
- Hydropower based on current use patterns
- Agricultural demands in Flint River Basin were based on 2000 projected Agricultural demands with a wet year multiplier of 1.7
- Ramping rates were captured by utilizing minimum flow requirements at the Chattahoochee gage and a specific flow was computed for a 1 ft change and divided by 0.25 or 0.5 (based on requirements of IOP) to determine the corresponding rate
- No releases for navigation
- Minimum flow requirements at Atlanta = 750 cfs, Columbus=1,850 CFS (WP > 621.6), 1,200 CFS (WP < 621.6);
- Continuous release of 675 cfs from West Point (house unit), 450 cfs from Buford (house unit), 100 cfs from Jim Woodruff (lockages)

Mr. Hathorn noted that one of the significant differences between the USACE model results and the GA-DNR model results was due to differing agricultural demands entered into the models. The GA-DNR had higher agricultural demands. He stated that we should ensure these are actual current demands and not projected future demands. Representatives for the State of Georgia explained that the agricultural demands they utilized were based on the most up-to-date agricultural studies. Another difference was in the hydropower generation rates – the Corps model used current hydropower generation schedules which decrease when moving to lower

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zones, which reflects drought contingency cutbacks in generation as lake levels decline. Before finalizing the models, Mr. Hathorn noted that we should model the critical period in the 1980s and also perform a “reality check” to assure the model reflects “real life” operations.

d. Mr. Wei Zeng (GA-DNR) presented the results of their modeling of the IOP using HEC-5. Mr. Zeng used the Comprehensive Study Existing Condition model as the basis for building the IOP model. The following assumptions were integrated into the Georgia IOP Hec-5 model:

- Standard minimum flow requirements at Columbus, Peachtree Creek, and Woodruff Dam
- Withdrawal demands based on actual 2000 M&I for Atlanta area
- Additional demands for firm hydropower
- Georgia used the Jim Hook 1999-2003 UGA Study and the Lynn Torak USGS Study to derive updated Flint River agriculture withdrawal demands; separated ground and surface water demands at 3 levels (wet, moderate, and dry years) –they used the worst case actual dry year demands without current program in place to cap withdrawals
- Included releases for navigation
- No ramping rate, but included 10% additional release above 100% basin inflow

Discussion of the Georgia model led to a more in depth discussion of the agricultural demands calculations. Reports on the GA-DNR(EPD) website outline the plan for buying up irrigation water and the previously noted studies. The worse case scenario is based on actual use, but future demands could be less due to GA-DNR(EPD) management efforts to reduce irrigation. The USACE needs to determine what data to use for the Flint River Basin agricultural demands. It was suggested that the unimpaired flow data set may need to be updated to reflect the new agricultural demands. Additional questions include: can HEC-5 provide for variable storage rates between 70% and 100% of the basin inflow (BI)? Mr. Zeng also suggested:

- Reduce requirement for BI ramping rate or don't capture the peak BI/release
- Don't provide for firm hydropower during abnormally dry or drought conditions
- Use updated information on sturgeon spawning data. The current thresholds of 20,400 cfs and 37,400 cfs are based on spring spawning data when rainfall was above average - 3 of the 4 data points for egg collections occur on days where flows were above 75% exceedance (these flow levels would not occur in 3 out of 4 years) and the other data point occurs on a day with flows at 50% exceedance (this flow level would not occur half of the time).
- Use the Chattahoochee gage data which is more accurate than the USACE Jim Woodruff release ratings

7. Ms. Carmody concluded the first day with a discussion of the next steps in the Section 7 consultation process. She noted that any additional biological or modeling info needed to be shared with USFWS as soon as possible since the deadline for consultation was approaching (90-

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day consultation period ends June 6, at which time the 45-day period to write biological opinion begins). Ms. Carmody also noted that the proposal for listing critical habitat for the listed mussel species was scheduled to be released on 31 May. USFWS will consider the IOP impacts to mussel critical habitat primary constituent elements (including flow) and whether or not the proposed action appreciably diminishes the value of the primary constituent elements. Ms. Carmody re-emphasized the point that USFWS must err on the side of threatened and endangered species when definitive data is not available (although safety is also a consideration). However, USFWS does not anticipate a jeopardy determination for the proposed action. Her take away message noted:

- USACE must determine the definition of the proposed action
- Re-initiation clause allows for modifications to the BO if new information warrants a change
- Once Section 7 consultation is initiated it must be concluded within the specified time frames with opinion based on best available information
- Monitoring and adaptive management are important especially for complex situations like this

Gail re-emphasized that the 90-day consultation period ends 6 June and then the 45-day period to prepare the biological opinion begins.

8. The second day of the workshop consisted of a round table discussion of the models, the assumptions utilized, and clarification of topics addressed the previous day. The recap of this discussion is presented by general topic.

a. Section 7 Consultation: Ms. Carol Couch (GA-DNR) requested a definition for or the boundaries of “new action” in regards to modifying the proposed action and triggering re-initiation of consultation. The numbers in the IOP are a starting point for consideration in the consultation process. USACE and USFWS agreed that minor changes to the IOP such as refinement of analysis tools would not be considered a new action. However, more significant changes such as modifying the framework, threshold flow values or decision rules in the IOP would likely require re-initiation based on the re-analysis of new information. The current timeline for the consultation may prevent consideration of the 2006 sturgeon spawning data if not available soon. If the new data suggested that the thresholds needed modification, an extension of the consultation period or re-initiation of consultation could occur. Requests for re-initiation of consultation must come from the action agency or USFWS, and would be triggered by either new information or a significant change in the description of the Federal action. Due to a number of reasons, the Corps is reluctant to request an extension of the consultation process.

b. Computing Basin Inflow: Drought contingency is built into the IOP by the requirement to release at least BI during low flow periods (below 20,400 cfs during Mar-May; and below 8,000 cfs during the remainder of the year.). The intent is that when releasing 100 percent BI, reservoir levels would remain steady while river stages gradually decline as BI

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declines. Basin Inflow is calculated by summing the net local inflow for all projects in the system. Net inflow at each project is calculated by subtracting the measured outflow from the measured change in storage. All agreed that the Chattahoochee gage will be utilized for calculating BI and measuring releases. The Chattahoochee gage data is already present in the models. It should be noted that due to the way that BI is computed, all consumptive water losses such as agricultural, municipal, and industrial water withdrawals/returns, as well as lake evaporation, are already subtracted and are not reflected in the BI quantity. Also, the IOP specifies minimum releases and there will at times be releases greater than the computed BI, due to “real life” delays in moving water downstream, the need to ramp down slowly; to augment flows at or above 5,000 cfs; and at times in order to provide additional mitigation flows when additional water is available.

3-Day Average vs. 7-Day Average and Volumetric Measurement for computing BI and releases: The 3-Day Average was initially proposed in the IOP, but results in frequent fluctuations in releases and tends to result in possible over-releases due to frequent need to ramp down following rain events and delays in routing flows downstream. The Corps and USFWS both recommend that a 7-Day Average more accurately captures “real life” operations than the 3-day average, is easier to manage from the water management perspective, and produces few fluctuations in flows and therefore less disruption to the species. The 7-day average will result in smoother transitions. It is also proposed to track compliance with the 7-day release by making a volumetric computation of the 7-day BI and assuring that the equivalent volume is released to the river. This should assist in more closely meeting the intents of the IOP. For example, when matching the volumes of BI and releases more closely, the intent to meet reservoir fish spawning SOP guidance by releasing 100% of BI as closely as possible should result in reservoir levels remaining relatively steady during the fish spawn. The models will not require operating for the steady reservoir levels, but will measure how successful operations are in meeting this intent. The USACE will likely use 7-Day Average calculations and the volumetric computations to determine day to day operations. It was suggested that the running 7-Day Average should be utilized for the models as well. It was noted that the HEC-5 and STELLA models do not account for routing times downstream, but using a 7-day average will compensate for this to some degree.

c. Flint River Agricultural Demands: GA-DNR utilized two studies to determine the agricultural demands in the Flint River Basin. The two studies modeled irrigation demands for different crops during 1998 – 2003. The studies described irrigation demands for wet, typical, and dry years. GA-DNR utilized the worst case demands for dry year data for the Flint River agricultural demands in their model. GA-DNR agreed to share this data with the other modelers as well as provide copies of the 2 studies and current rules and regulations for managing agricultural withdrawals (which require reduced withdrawals during dry years). However, for modeling purposes, GA-DNR confirmed that their program to cap irrigation demand should result in Agriculture demands similar to those experienced during 2000, so the year 2000 demand already incorporated into the unimpaired flow dataset would be appropriate for these modeling purposes.



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Ted Hoehn of Florida asked how the models address Agriculture demands temporally over various climatic conditions. James Hathorn noted that the HEC-5 model used the spreadsheet projections from the Comprehensive Study when the Corps extended the unimpaired flow dataset. Steve Leitman explained that the STELLA model incorporated an estimate of Ag demands which apparently replicates observed Flint River conditions experience in the year 2000. Jerry Zeiwitz noted that their analysis would probably project future impact over only the short-term, perhaps through the year 2010. Georgia indicated they believed that the Ag demand had “plateaued”, and would be managed by their plan to purchase irrigation rights during dry periods; therefore, there was probably no need to project future increases in Ag demand to determine future cumulative impacts.

d. . Differences in Modeling Results due to Different Assumptions Between Models:  
The group identified where there were discrepancies in the assumptions used for the 2 HEC-5 models (USACE and GA-DNR). The significant differences include:

- Flint River agricultural demands
- Hydropower demands – GA-DNR used the previous hydropower demands which included navigation releases. USACE model has no navigation releases and therefore lower hydropower demands. USACE model also requires no hydropower releases if Lake Lanier is below elevation 1069. However, hydropower generation still occurs as incidental benefit to meeting minimum flow requirements.
- Ramping rates

The following was suggested in order to standardize assumptions:

- Use 2000 actual demands for M&I withdrawals,
- Ag demand to be determined soon. Will probably use 2000 Agricultural demands, with possible adjustments to calibrate to actual observed 2000 demands, as used in the STELLA model
- Use USACE hydropower demands since they are the best approximation of current operations
- No releases for navigation (do not use navigation to support extra hydropower generation demand)
- Use standard minimum flow requirements
- Use USACE value for leakages
- Use zone elevations for system balancing and as triggers for hydropower generation

It was noted that the models are not meant to determine the IOP, rather they are meant to reflect the impacts of implementing the proposed IOP.

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Mr. Hathorn suggested that the STELLA model be updated with the USFWS/COE agreed upon assumptions and utilized for the Section 7 consultation, due to certain limitations of the HEC-5 model. However, the results of both models should be compared as a check.

e. Unimpaired Flow Data Set: The unimpaired flow data set is being updated to 2004, but has not yet been completed (still awaiting some data from the States).. Also the relationship of Ag pumping to Flint River flow is being evaluated by Georgia and USGS, but is not yet refined. When complete this information could also be incorporated, as appropriate, into the unimpaired flow dataset. However, these changes can not be made prior to the end of the consultation period.

f. Rule Curve Operation vs. IOP Operation: The IOP affects the timing and rate of refill of the lakes to meet the rule curve, but does not change the rule curves. This results in occasions where the lakes do not refill in accordance with the rule curve. During normal years the lakes will refill in accordance with the rule curve. A period of record analysis will be conducted to determine the impact of the IOP on ability to refill the reservoirs.

#### 9. Subsequent adaptations for Modeling Assumptions.

a. Clarification of Flood Control Ramping Rates. The IOP Table contained a footnote noting that the ramping rates may not be applied during flood control operations. The following description of flood control ramping rates have been agreed to by the Corps and USFWS for incorporation into the models.

- For flows greater than 30,000 cfs, no ramping rate will be imposed
- For flows between 20,000 and 30,000 cfs, ramping rates will be between 1.0 to 2.0 foot/day
- For flows between greater than 16,000 cfs and less than 20,000 cfs, ramping rates will be between 0.5 and 1.0 foot/day
- For flows of 16,000 cfs or less the ramping rates will reflect those shown in the IOP table.

b. Another adjustment has been proposed to reflect a lower upper threshold value for the months of June through February, based on previous data provided by the Florida Fish and Wildlife Conservation Commission on flow needed for potential host fish for mussels. This proposed lower threshold value has been coordinated with USFWS during consultation discussions to assure the flows will still be protective of mussels and host-fish for mussels. The upper flow threshold in the IOP table of 37,400 cfs has been lowered to 23,000 cfs. For flows greater than or equal to 23,000 cfs, at least 16,000 cfs would be released (approximate average monthly flow for months of June through August), and excess BI above this threshold can be stored. For flows of 23,000 or less, but greater than or equal to 8,000 cfs, at least 70 percent of BI would be released (but not less than 8,000 cfs) and up to 30 percent BI could be stored. For flows less than 8,000 cfs, at least 100 percent of BI would be released.

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c. The Mobile District will continue to use HEC-5 as the modeling tool to evaluate the impacts of the IOP. Comparisons between HEC-5 and STELLA will continue throughout the consultation and biological opinion formulation.

/s/

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Compliance Manager  
Inland Environment Team

/s/

BRIAN ZETTLE  
Biologist  
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Enclosures  
Workshop Presentations

**Jim Woodruff Dam Water Management Operations  
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Lake Seminole Resource Management Site Office, Chattahoochee, FL  
24-25 May 2006

Bruce J. Stedman, RESOLVE Facilitator

***Workshop Objectives:***

- Review and understand what has been done to date regarding informal and formal Endangered Species Act / Section 7 Consultation
- Review and achieve a common understanding of the Interim Operations Plan
- Review and discuss hydrological models of the Interim Operations Plan (especially modeling approaches and underlying assumptions)
- Describe actions needed to complete Biological Opinion

NOTE: All Times Eastern Daylight Time (EDT)

**WEDNESDAY, MAY 24**

**11:00 – 11:10 Meet at Lake Seminole Resource Management Site Office**

**11:10 – 12:30 Field Trip to Observe Jim Woodruff Dam Physical / Equipment Constraints / Gulf Sturgeon Spawning Site**

Purpose: Understanding operations, especially during low-flow conditions

Clarifying Questions and Answers

**12:30 – 1:00 Working Lunch** (gather lunch and begin working session)

**12:50 – 1:00 Welcome, Introductions, Hopes for the Workshop, Opening Comments**  
Roger A. Burke

**1:00 – 1:10 Review Meeting Goals, Agenda, and Ground Rules**  
Bruce Stedman

**1:10 – 1:40 Session I: Background**

**1:10 – 1:20 Session Ia: Requirements of Endangered Species Act / Section 7 Consultation**  
Gail Carmody

**1:20 – 1:30**      **Session Ib: Informal Consultation**  
**Joanne Brandt**      Purpose: Describe what has been done to date regarding:

- Additional Data Collection / Surveys
- Fish Spawn Coordination / Draft SOP (1130-2-9 (Feb 05)
- Low Flow Operations Matching Basin Inflow
- Physical and Operational Constraints at Jim Woodruff Dam

Clarifying Questions and Answers

**1:30 – 1:40**      **Session Ic: Formal Section 7 Consultation**  
**Joanne Brandt**      Purpose: Describe what has been done to date regarding:

- Interim Operations Plan
- Request to Initiate Formal Consultation, 7 May 2006
- Formal Consultation to be completed by 21 July 2006

Clarifying Questions and Answers

**1:40 – 2:40**      **Session II: Interim Operations Plan**  
**Joanne Brandt**      **Session IIa: Intent of Interim Operations Plan**  
Purpose: Describe Purposes of Interim Operations Plan  
Clarifying Questions and Answers

**Joanne Brandt**      **Session IIb: Elements of Interim Operations Plan**  
Purpose: Describe and Review Interim Operations Plan Table  
Handout: Interim Operations Plan Table  
Clarifying Questions and Answers

**Memphis**      **Session IIc: Lessons Learned**  
**Vaughan**      Purpose: Discuss what operators have learned from recent  
implementation of Operations Plan  
Clarifying Questions and Answers

- 2:40 – 5:00**      **Session III: Status of Modeling Efforts by USFWS/COE**
- 2:40 – 3:00**      **Session IIIa: Spreadsheet Modeling by COE**  
**Memphis**      Purpose: Understand spreadsheet model  
**Vaughan**      Clarifying Questions and Answers
- 3:00 – 3:15**      **Break**
- 3:15 – 3:55**      **Session IIIb: Summary of STELLA Modeling by USFWS**  
**Jerry Ziewitz**      Purpose: Understand STELLA model  
Clarifying Questions and Answers
- 3:55 – 4:15**      **Session IIIc: HEC-5 and. HEC-ResSim**  
**James Hathorn**      Purpose: Understand HEC models  
Clarifying Questions and Answers
- 4:15 – 5:00**      **Session IIId: State Input on Modeling of Interim Operations Plan**  
Purpose: State input into how to represent interim operations in hydrological modeling.
- 5:00 – 6:30**      **Session IV: Facilitated Discussion of Modeling**  
**Bruce Stedman**      Purpose: Review and compare modeling assumptions underlying each model in use  
Expected Outcomes:
- Data sharing for dam operations
  - Understanding operational constraints
  - Adequacy of models for handling assumptions
  - Facilitated comparison of models; attention to differences with models
- 6:30 – 9:00**      **Break and Dinner**

**THURSDAY, MAY 25**

**8:00 – 8:15**    **Review of Previous Day; Reconsideration of Agenda**  
Bruce Stedman

**8:15 – 9:15**    **Session IV continued (if necessary)**  
Bruce Stedman  
Purpose: Complete review and comparison.

**9:15 – 11:45**    **Session V: Review of Modeling Assumptions**  
**9:15 – 10:130**    **Session Va: Modeling Assumptions for use in the Interim Operations**  
Bruce Stedman    **Plan**  
Purpose: Facilitated discussion of topic

**10:30 – 10:45**    **Break**

**10:45 – 11:45**    **Session Vb: Next Steps for Modeling Efforts**  
Bruce Stedman  
Purpose: Facilitated discussion of topic

**11:45 – 12:00**    **Session VI: Process Needed to Complete Biological Opinion**  
Purpose: Understand next steps FWS/COE will take

**12:00**            **Adjourn**