Stacia Hoover

From: Alison Guth
Sent: Thursday, October 05, 2006 5:32 PM
To: Ray Ammarell; Alan Stuart; Bill Argentieri; Bob Olsen; Bret Hoffman; Bud Badr; Feleke Arega (aregaf@dnr.sc.gov); Larry Turner (turnerle@dhec.sc.gov); Mike Waddell; Patrick Moore; Mike Schimpff; Jon Quebbeman
Cc: Tony Bebber; Alison Guth; Amanda Hill; Bill Hulslander; Bill Marshall; Charlene Coleman; Dave Landis; Dick Christie; George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Hank McKellar; Jeff Duncan; Jennifer O'Rourke; Joy Downs; Kristina Massey; Mark Leao; Mike Summer (msummer@scana.com); Parkin Hunter; Randal Shealy; Randy Mahan; Russell Jernigan; Steve Bell; Suzanne Rhodes; Theresa Thom; Tom Ruple; Tom Stonecypher; Bret Hoffman
Subject: Saluda Technical Memo

Hello Operations Group

On behalf of Jon Quebbeman, attached is the Saluda technical memo discussing the calibration of the HEC-ResSim model as well as a brief summary paragraph. This is for review before the October 12th meeting. Please forward any comments or questions that you may have about this document to Jon. Thanks and take care, Alison

Summary:

We recently completed assembling and testing two separate methods of determining the inflow hydrographs for Lake Murray over a 16 year period. Within these two methods, the data was organized and tested to provide the best correlation between calculated results, and observed (recorded from USGS gages) results. The two methods were:

1)Mass Balance Method
2)Gage Rating Method

The Mass Balance method uses historical stage data, and discharge data, to compute the required inflow to satisfy the 'mass balance'. Conversely, the Gage Rating method uses three upstream gages, and multiplies the flow rates to account for the ungaged drainage areas for a total inflow into the reservoir. These two methods were compared to determine which produces an inflow hydrograph that results in better correlation of data using HEC-ResSim to observed data.

In summary, more consistent results to observed data were calculated in ResSim using the Mass Balance methodology. At this point, with an acceptable inflow hydrograph determined, we are ready to assemble operational constraints to model various scenarios.

-JAQ

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001-Saluda Model Development M...

Stacia Hoover

From: Bret Hoffman
Sent: Monday, July 24, 2006 12:43 PM
To: 'Tommy Boozer'; 'Aaron Small'; 'Alan Axson'; Alan Stuart; Alison Guth; 'Amanda Hill'; 'Bill Argentieri'; 'Bill Marshall'; 'Bill Mathias'; Bret Hoffman; 'Charlene Coleman'; Dave Anderson; 'David Price'; 'Dick Christie'; 'Edward Schnepel'; 'George Duke'; 'Gerrit Jobsis (American Rivers)'; 'Jennifer O'Rourke'; 'Jerry Wise'; 'Jim Devereaux'; 'John and Rob Altenberg'; 'Joy Downs'; 'Karen Kustafik'; 'Ken Uschelbec'; 'Kenneth Fox'; 'Larry Turner (turnerle@dhec.sc.gov)'; 'Lee Barber'; 'Malcolm Leaphart'; 'Mark Leao'; 'Mike Waddell'; 'Miriam Atria'; 'Norm Nicholson'; 'Norman Ferris'; 'Patrick Moore'; 'Randy Mahan'; 'Roger Hovis '; 'Skeet Mills '; 'Steve Bell'; 'Suzanne Rhodes'; 'Tom Eppink'
Subject: Saluda cross-sections

Good afternoon,

At the request of Mike Waddell during last Thursday's Safety RCG meeting, I am forwarding the map of cross-sections on the lower Saluda River that will be evaluated by the HEC Res-Sim model.

Thanks,

_____

Bret Hoffman, P.E.
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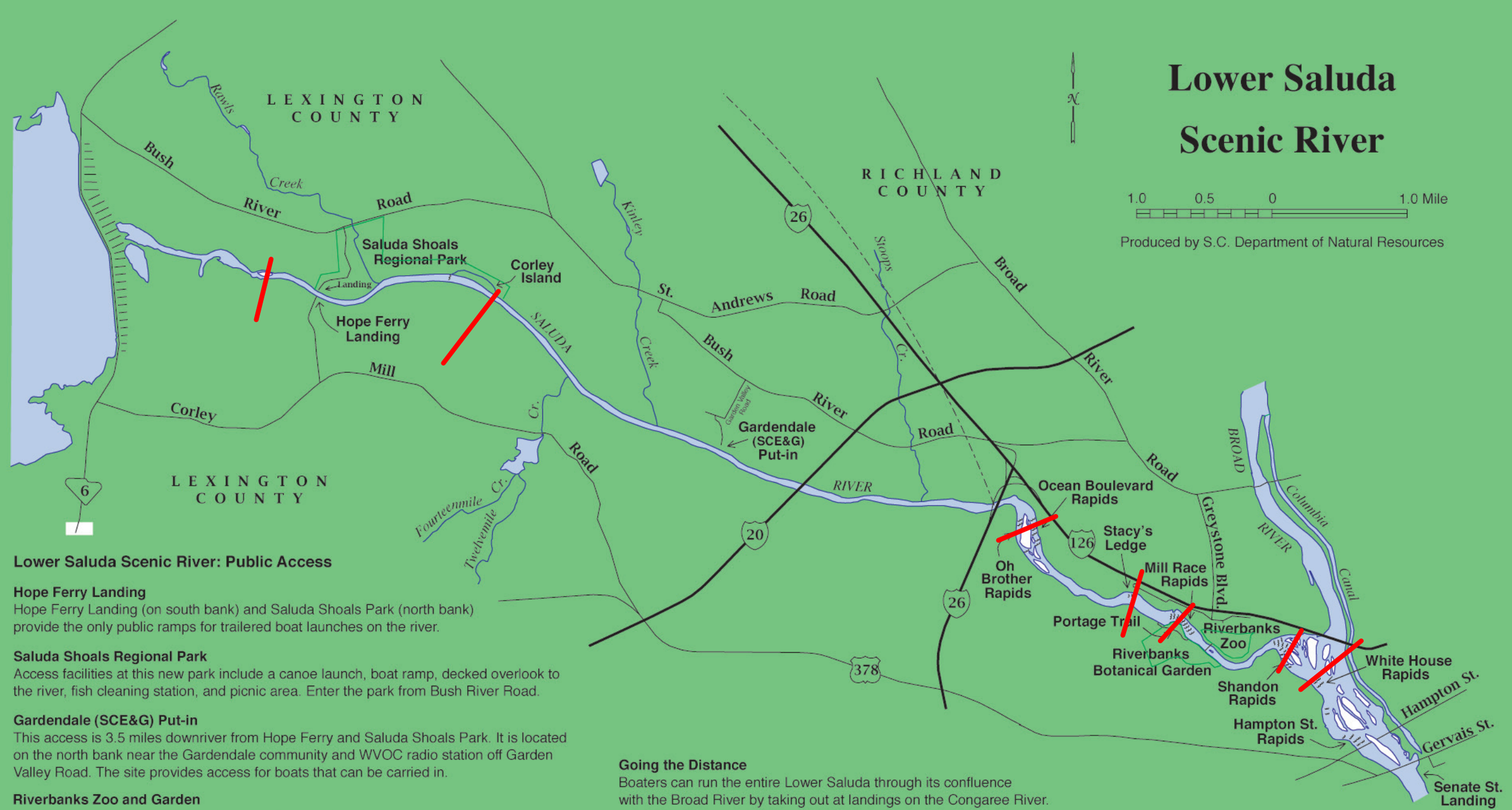
cross-sections.pdf
(1 MB)



Lower Saluda Scenic River: Public Access

Hope Ferry Landing
Hope Ferry Landing (on south bank) and Saluda Shoals Park (north bank) provide the only public ramps for trailered boat launches on the river.

Saluda Shoals Regional Park
Access facilities at this new park include a canoe launch, boat ramp, decked overlook to the river, fish cleaning station, and picnic area. Enter the park from Bush River Road.

Gardendale (SCE&G) Put-in
This access is 3.5 miles downriver from Hope Ferry and Saluda Shoals Park. It is located on the north bank near the Gardendale community and WVOC radio station off Garden Valley Road. The site provides access for boats that can be carried in.

Riverbanks Zoo and Garden
In addition to a zoo and botanical garden, Riverbanks offers nature trails and a pedestrian bridge with views of Mill Race Rapids, historic structures, and native wildlife. Carry-in boat access is available at the west end of the parking lot by walking a short trail to the river. Riverbanks is located off Greystone Blvd. Open daily from 9-5 pm, admission is charged.

Going the Distance
Boaters can run the entire Lower Saluda through its confluence with the Broad River by taking out at landings on the Congaree River. Senate Street landing below Gervais Street bridge provides access only for boats that can be carried in (and parking is limited). Senate Street landing is 10 miles downstream from Hope Ferry and Saluda Shoals Park. Public landings with ramps are located 2 and 3 miles downstream on the east and west banks of the Congaree.

Stacia Hoover

From: Alan Stuart
Sent: Tuesday, June 06, 2006 9:10 PM
To: Alan Stuart; 'Amanda Hill (Amanda_Hill@fws.gov)'; 'Dick Christie (dchristie@infoave.net)'; 'Hal Beard'; 'Prescott Brownell (Prescott.Brownell@noaa.gov)'; 'gjobsis@americanrivers.org'; 'Patrick Moore'; 'Gina Kirkland - DHEC'; 'cdwood@usgs.gov'; 'Sarah W Ellisor'; 'Richard Roos-Collins'; 'Julie Gantenbein'
Cc: BARGENTIERI@scana.com; 'Jim Ruane'; RMAHAN@scana.com; 'Ray Ammarell (RAmmarell@scana.com)'; 'Steve Summer'; 'Tom Eppink'; 'Brian J. McManus'; 'BOWLES, THOMAS M'; Alison Guth; 'EPPINK, THOMAS G'
Subject: 2006 Draft Operations Guidelines

Good evening all,

Attached for your review is the draft report on the 2006 Operations Guidelines during the low dissolved oxygen season for Saluda Hydro. Please review the report and provide any comments you may have by June 26, 2006. The Operating guidelines incorporate updated Look-up Tables based on the findings of the turbine testing work conducted on Units 1 and 5 last October.

A friendly reminder, to date I have not received any comments on the turbine testing report. Comments on that report are due by June 17, 2006.

Don't forget that SCE&G must file the 2006 Operating Guidelines with the FERC by June 30, 2006. This date is established per the Settlement Agreement.

Thank you for your efforts and patience. If you have questions please give me a call.

Regards,
Alan

2006 Draft Aeration Operations...

GUIDELINES FOR OPERATION OF THE SALUDA PROJECT FOR DISSOLVED OXYGEN MANAGEMENT IN 2006

June 30, 2006

PURPOSE

These Guidelines for Operation of the Saluda Project for Dissolved Oxygen Compliance are prepared pursuant to the *Offer of Settlement On Complaint Regarding Water Quality In Lower Saluda River* (May 19, 2004) (Settlement Agreement). Paragraph 9.3 of the Settlement Agreement provides the following:

> To the extent within SCE&G's reasonable control, each Operating Plan will seek to enhance existing water quality in the lower Saluda River and, more specifically, seek to achieve DO concentrations of 4 mg/1 minimum, 5 mg/l daily average, and 5.5 mg/1 monthly average in the lower Saluda River. In seeking to achieve this goal, each Operating Plan will preserve SCE&G's right or duty to modify operations as necessary to: (A) protect life and property, (B) respond to changed hydrologic or other circumstances not addressed in the Operating Plan, (C) maintain the use of the Project to meet system reserve obligations of 200 MW, and (D) comply with a lawful orders of the Commission or other authorities. SCE&G will provide notice of such modification to the Conservation Groups, [South Carolina Department of Health and Environmental Control], and Other Agencies in advance of such modification if practicable, and otherwise, as soon as practicable thereafter. The Parties will then use their best efforts to modify the Operating Plan in response thereto.

SCE&G will implement these Guidelines consistent with paragraph 9.3.

LIMITATIONS

Paragraph 9.3 of the Settlement Agreement includes limitations and these limitations are more fully explained here. Operation of the Saluda Project affects dissolved oxygen (DO) levels in the Saluda River downstream of the Saluda Project. Factors affecting achievement and maintenance of the DO standard include: (1) the limited capability for aeration of water discharged through the turbine units, (2) the requirement that SCE&G manage water levels in Lake Murray for safety and other reasons, (3) the need to use Saluda Hydro for the special operating needs specified under paragraph 9.3 of the Settlement Agreement, and (4) the need to meet SCE&G's

reserve obligations as a member of the Virginia-Carolinas Southeastern Electric Reliability Council sub-region (VACAR).

Generating units occasionally fail, and these generation failures are not generally capable of prediction. These often sudden failures upset the load-generation balance. Because electricity cannot be stored, any such sudden reduction in generation cannot be made up by an inventory, as would be the case in most other kinds of business. Instead, generation losses must be met by reserve generation that can be dispatched instantly, before voltage sags or frequency excursions lead to local or widespread blackouts. VACAR members are bound in a reserve-sharing agreement by which each has agreed to assist any other member in generation emergencies. SCE&G must employ its reserves to meet its own generation emergencies before calling on assistance from other VACAR members, and it must be constantly ready to provide reserve generation to other VACAR members. Generally, the reserves required to be maintained by SCE&G are in the range of 190-200 MW, which matches the capacity of the Saluda Project and its ability to respond quickly to any generation outage on its system.

As done in 2004 and 2005, , SCE&G will provide via email, during 2006, a weekly report to the South Carolina Department of Health and Environmental Control, South Carolina Coastal Conservation League (SCCCL) and other stakeholders documenting the previous week's operation of the Saluda Project.

Unless otherwise specified, these guidelines will be implemented by SCE&G.

TURBINE VENTING OPERATIONS

Use Lookup Tables (LUTs) As Guides To Aerate The Turbine Discharges From the Saluda Project. SCE&G will use the LUTs included in the document, "Lookup Tables for Operating the Saluda Project to Enhance Dissolved Oxygen in the Tailrace to the Extent Practicable for 2006," (Appendix A). These LUTs reflect the best estimate based on field testing and predictive models of how the units at Saluda Hydro can be operated to enhance downstream dissolved oxygen levels and still obtain target MW outputs, given the inflow DO and temperature conditions. (Note: These LUTs may change due to the installation of hub baffles on all the units. Updates to the current LUTs will be generated for 2007 if warranted based on testing of units 2, 3, and 4 in September or October 2006.)

Estimate Inflow DO and Temperature for Units 1-4 and Unit 5. Turbine DO and temperature from inflows change during the course of the low DO period. To track DO and temperature conditions in the turbine inflows, SCE&G will obtain DO and temperature profiles in the Saluda Project forebay every other week and use these profiles to predict conditions in the turbine inflows. SCE&G also will use data collected by the United States Geological Survey (USGS) continuous water quality monitor located near the intake of Unit 5 (U5).[1] These data will also be used to evaluate the presence of conditions that call into operation, constraints to using U5 due to the potential for fish entrainment. If needed, a withdrawal zone model may be used to predict inflow temperature and DO.

Use DO Readings in the Tailrace from the USGS Monitor. During 2006, the USGS monitor (USGS Gage No 02168504) will be used to track DO conditions in the tailrace on a daily basis, supplemented by periodic spot measurements by SCE&G, especially if DO, as measured at the monitor, appears erratic or is lower than expected (*e.g.*, suspected fouling, meter malfunction, *etc.*). It is anticipated that the USGS monitor will be relocated to improve the reliability of the DO readings.

[1] As with any *in-situ* continuous monitor, anomalous readings occur from time to time, due to equipment fouling or malfunction. If the USGS determines the data are suspect through their Quality Control/Quality Assurance Program, that data may be ignored, appropriately adjusted, or otherwise dealt with according to their final determination. It is acknowledged that the USGS data is reported initially as "provisional." SCE&G will use it subject to the data error issues discussed here and agreed to during the March 23, 2006 meeting.

Review effectiveness of the turbine venting operations and other data being collected to see if additional data or adjustments in the LUTs are needed before "near-zero" DO inflow conditions occur. Technical peer review between KA/REMI and National Heritage Institute/SCCCL of the tailrace DO data and operational records collected by USGS and SCE&G will be conducted, as needed, to achieve this objective and determine if changes to the LUTs are warranted.

Conduct monthly training of operators in System Control. The System Control Manager will conduct monthly training sessions with operations personnel to ensure proper application of the LUTs. Training of staff will include review of current practices and procedures in the proper application of the LUTs. The training sessions will be adjusted as appropriate each month for changes in monitored DO and temperature inflow conditions, and will include adjustments in the LUTs should any be needed. Any necessary revisions of the LUTs will be shared with the Conservation Groups.

If during the low DO season, conditions are identified that require immediate changes (agreeable to all parties to the settlement) to the 2006 operating guideline, the System Control manager will convene a special training session to ensure changes in the Operating Guidelines are implemented as soon as reasonably possible.

APPENDIX A

LOOKUP TABLES

LOOKUP TABLES FOR OPERATING THE SALUDA PROJECT TO ENHANCE DISSOLVED OXYGEN IN THE TAILRACE TO THE EXTENT PRACTICABLE FOR 2006

June 30, 2006

Lookup Tables (LUTs) will be used as a tool for operating the Saluda Project during the low DO period of 2006 so that the DO standard in the Lower Saluda River may be met continuously, subject to the limitations contained in paragraph 9.3 of the Settlement Agreement,, and to provide optimal aeration when the standard otherwise cannot be met. The LUTs will be used by SCE&G to select the turbine units that will be operated at various total project flow rates and power production levels, under varying inflow DO concentrations and temperatures. These LUTs provide a guide for operations in 2006, but actual practice is likely to deviate somewhat from this guide as tailwater data are collected and evaluated and the LUTs are adjusted as appropriate. Also, during 2006, the aeration system will be manually operated. It is expected that when a final turbine venting system is installed at some point in the future, a computer-controlled automated system may be needed to adjust these operations for more optimal aeration.

The overall process used to develop the LUTs involved the following steps:

1. The aeration characteristics of units 1 and 5 were modeled using the discrete bubble model as described in "Saluda DO Standard Project—Lower Saluda River DO Technical Study Report, Appendix C, Prediction of Dissolved Oxygen Concentrations for Turbine Discharges from Saluda Hydro" 2003.
2. The model for unit 1 was used to represent units 2-4. The two models for units 1-4 and unit 5 were then used to predict DO in the tailrace over the range of turbine gate settings (*i.e.*, turbine flow conditions) for various DO and temperature levels in the inflows.

3. The predicted DO in the tailrace for each set of inflow DO and temperature conditions was then plotted over the range of hydro operations.
4. The LUTs were then developed using these graphs. One set of LUTs was developed assuming that the units were operated several hours per day and the other set of LUTs was developed assuming the units were operated at a constant level over the course of the entire day.
5. LUTs were developed for a range of DO conditions at the intake, but for only one temperature condition that was similar to that expected during the low DO period of 2006. Model predictions were made for other temperature conditions, but the effort was not expended to develop LUTs for all the temperature conditions modeled due to the time required to develop LUTs. Additional LUTs could be prepared on an "as needed basis" depending on the intake actual temperature conditions that develop during the low DO period of 2006.
6. The LUTs were developed using a model that integrates the effects of all the units and predicts DO in the tailrace, assuming full mixing of the discharges from all the units.
7. For project operations, SCE&G System Control normally dispatches Saluda Hydro by power production levels rather than water flow rates; therefore, the flow rates initially determined using the turbine aeration model were supplemented by conversion to MW levels using the results of unit tests conducted in 1997 and 1998.

The assumed conditions for the turbine aeration systems are as follows:

1. Units 1-5 have hub baffles, and aeration characteristics were assumed to be as modeled in 2006 based on data collected on units 1 and 5 in 2005.
2. Unit 2 cannot be operated unless 2500 cfs is being discharged by the other units.

Assumptions used in developing the LUTs:

1. SCE&G plans to operate the Saluda Project at minimal discharge of approximately 400 cfs during the summer of 2006. Under this condition, DO in the discharge from the Saluda Project should be well over the State DO standard. Also, inflow water quality (*i.e.*, DO and temperature) will change slowly over the course of the summer and early autumn. The need for LUTs under this condition is minimal, so LUTs for only one temperature scenario were prepared.
2. Two sets of LUTs were prepared: one set for hourly operations where the DO target is 4 mg/L (see discussion below), and the other set for daily operations where the DO target is 5 mg/L, *i.e.*, the daily operations tables will be applied when Saluda is being operated around the clock under steady state conditions, the hourly operations tables will be applied when special circumstances, as described in paragraph 9.3 of the Settlement Agreement, necessitate operating for brief periods of greater generation. An analysis of historical conditions (see the report supporting the new site-specific standard for DO for the Lower Saluda River) showed that if 4 mg/L was achieved over a period of several hours during a typical day of operations at the Saluda Project, the other requirements of the DO standard (*i.e.*, the daily average of 5 mg/L and the 30-day moving average of 5.5 mg/L) are achieved under almost all conditions. Considering the current aeration systems, the lack of computerized powerhouse controls, and the DO monitoring system, the use of these two sets of LUTs is considered to be what is practicable.
3. Additional sets of LUTs will be prepared for other temperature conditions if temperatures in the intakes are different than assumed for preparation of these LUTs.
4. It was assumed that the target minimum DO would be 4 mg/L during the period of maximum discharge each day. This is because an analysis of historical conditions showed that if 4 mg/L was achieved during the

maximum discharge period, the other requirements of the DO standard (*i.e.*, the daily average of 5 mg/L and the 30-day moving average of 5.5 mg/L) are achieved under almost all conditions.

5. For days when the Saluda Project would be operated through out the day, it was assumed that the target minimum DO would be 5 mg/L. This approach is consistent with the assumption that SCE&G plans to operate the Saluda Project at around 400 cfs during the low DO period of 2006.

Inflow water quality for Unit 5 was assumed to have the same conditions as the inflows for Units 1- 4. This is a conservative assumption in that DO in the inflow to Unit 5 is rarely less than the DO in the inflows to Units 1- 4. This is based upon an extensive review of historical reservoir profile data.

The following LUTs are proposed for the operating guides for achieving aeration objectives during the low DO period of 2006. Figures 1 through 6 show the predicted DO concentrations in the tailrace versus total project discharges for various operating conditions (i.e., number and selection of units operating and inflow water quality conditions) at the Saluda Project. These graphs were used in developing the LUTs.

LOOKUP TABLES FOR HOURLY OPERATIONS

(DO TARGET IS GREATER THAN OR EQUAL TO 4 MG/L)

Turbine Inflow Conditions: DO 3 – 3.9 mg/L; Temperature = 15°C (approximately mid-July to August 1)	
MWs desired	**For Hourly operations, the following is recommended:**
Any MWs	Normal operations with U2 restricted for thermal load and U5 operated in the "last on, first off mode"

* See discussion on Page 1, Paragraph 1, and Items 2 and 4 on Pages 9 and 10.

Turbine Inflow Conditions: DO 2 – 2.9 mg/L; Temperature = 16°C (approximately August 1 to mid-August); DO objective in tailrace is 4 mg/L		
MWs desired	**Approximate flow (cfs)**	**For <u>Hourly</u> operations, the following is recommended:**
≤ 126	≤ 10,000, limit for 4 mg/L	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
126-148	10,000-12,500	All units except Unit 5—expect DO to be 3.5 to 4 mg/L, or more
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 3 to 4 mg/L, or more

Turbine Inflow Conditions: DO 1 – 1.9 mg/L; Temperature = 16°C (approximately mid-August to September 1); DO objective in tailrace is 4 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Hourly operations, the following is recommended:**
≤ 37	≤ 3150	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
37-69	3150-5500	Any 2 units except U5 operated in the "last on, first off mode";
68-84	5500-6700	Any 3 units except U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 3.8 to 4 mg/L or more
81-97	6700-7800, limit for 4 mg/L	Any 4 units except U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 3.6 to 4 mg/L or more;
97-120	7800-9500	Preferably 4 units except U5 (expect DO to be 3.3 to 4 mg/L, or more); if 3 units are used, expect DO to be 3.3 to 3.6 mg/L, or more)
120-148	9500-12,500	Preferably 4 units except U5 (expect DO to be 2.9 to 3.3 mg/L, or more);
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 2.2 to 2.9 mg/L, or more

Turbine Inflow Conditions: DO 0 – 0.9 mg/L; Temperature = 16°C (approximately September 1 to mid-September and stays at 0 until lake mixing); DO objective in tailrace is 4 mg/L		
MWs desired	**Approximate flow (cfs)**	**For <u>Hourly</u> operations, the following is recommended:**
≤ 31	≤ 2500	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
28-51	2500-4100	Any 2 units except U5 operated in the "last on, first off mode"; if 1 unit is used, expect DO to be 3.5 to 4 mg/L or more
47-65	4100-5300	Any 3 units except U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 3.3 to 4 mg/L or more
60-76	5300-6400, limit for 4 mg/L	Any 4 units except U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 3 to 3.3 mg/L or more;
76-120	6400-9500	Preferably 4 units except U5 (expect DO to be 2.5 to 4 mg/L, or more); if 3 units are used, expect DO to be 2.5 to 3.3 mg/L, or more)
120-148	9500-12,500	Preferably 4 units except U5 (expect DO to be 2 to 2.5 mg/L, or more);
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 1.5 to 2 mg/L, or more

Turbine Inflow Conditions: DO 0 – 0.9 mg/L; Temperature = 20°C (approximately September 1 to mid-September and stays at 0 until lake mixing); DO objective in tailrace is 4 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Hourly operations, the following is recommended:**
≤ 25	≤ 2000	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
21- 44	2000-3600	Any 2 units except U5 operated in the "last on, first off mode"; if 1 unit is used, expect DO to be 3.3 to 4 mg/L or more
43-57	3600-4800	Any 3 units except U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 3.3 to 4 mg/L or more;
52-70	4800-6000, limit for 4 mg/L	Any 4 units except U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 3.3 to 4 mg/L or more; if 2 units are used, expect DO to be 3.0 to 3.2 mg/L or more
70-120	6000-9500	Preferably 4 units except U5 (expect DO to be 2.3 to 4 mg/L, or more); if 3 units are used, expect DO to be 2.3 to 3.2 mg/L, or more)
120-148	9500-12,500	Preferably 4 units except U5 (expect DO to be 2 to 2.3 mg/L, or more);
> 148	>12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 1.4 to 2 mg/L, or more

Lookup Tables for Daily Operations

(DO Target Is Greater Than or Equal to 5 mg/L)

Turbine Inflow Conditions: DO 4 – 4.9 mg/L; Temperature = 14°C (approximately July 1 to mid-July); DO objective in tailrace is 5 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Daily operating conditions (i.e., operating ~ 24 hours per day), the following is recommended:**
Any MWs	Any flow level	Normal operations with U2 restricted for thermal load and U5 operated in the "last on, first off mode"

*See discussion on Page 1 Paragraph 1, and Items 2 and 4 on Pages 9 and 10.

Turbine Inflow Conditions: DO 3 – 3.9 mg/L; Temperature = 15°C (approximately mid-July to August 1); DO objective in tailrace is 5 mg/L		
MWs desired	**Approximate flow (cfs)**	**For <u>Daily</u> operating conditions (i.e., operating ~ 24 hours per day), the following is recommended:**
≤ 120	≤ 9500, limit for 5 mg/L	Normal operations with U2 restricted for thermal load and U5 operated in the "last on, first off mode"
120-148	9500-12,500	Any 4 units except U5 operated in the "last on, first off mode" (expect DO to be > 4.5 mg/L)
>148	>12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 1.4 to 2 mg/L, or more (expect DO to be > 4 mg/L)

Turbine Inflow Conditions: DO 2 – 2.9 mg/L; Temperature = 16°C (approximately August 1 to mid-August); DO objective in tailrace is 5 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Daily operating conditions (i.e., operating ~ 24 hours per day), the following is recommended:**
≤ 59	≤ 4700	Normal operations with U2 restricted for thermal load and U5 operated in the "last on, first off mode"
56-73	4700-5900	Any 3 units except U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 4.7 to 5 mg/L
69-89	5900-7200, limit for 5 mg/L	Any 4 units except U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 4.6 to 5 mg/L
89-120	7200-9500	Preferably 4 units except U5 (expect DO to be 4.1 to 5 mg/L, or more); if 3 units are used, expect DO to be 4.1 to 4.6 mg/L, or more)
120-148	9500-12,500	Preferably 4 units except U5 (expect DO to be 3.8 to 4.1 mg/L, or more);
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 3.2 to 3.8 mg/L, or more

Turbine Inflow Conditions: DO 1 – 1.9 mg/L; Temperature = 16°C (approximately mid-August to September 1); DO objective in tailrace is 5 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Daily operating conditions (i.e., operating ~ 24 hours per day), the following is recommended:**
≤ 25	≤ 2000	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
21- 44	2000-3600	Any 2 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 1 unit is used, expect DO to be 4.3 to 5 mg/L or more
39-60	3600-5000	Any 3 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 4.1 to 5 mg/L or more
56-69	5000-5900, limit for 5 mg/L	Any 4 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 4.2 to 5 mg/L or more; if 2 units are used, expect DO to be 4 to 4.1 mg/L or more
69-77	5900-6500	Preferably 4 units except Unit 2 for thermal load restrictions and U5 (expect DO to be 4.7 to 5 mg/L, or more); if 3 units are used, expect DO to be 4.1 to 4.3 mg/L, or more; if 2 units are used, expect DO to be 3.8 to 4 mg/L, or more
77-120	6500-9500	Preferably 4 units except U5 (expect DO to be 3.3 to 4.7 mg/L, or more); if 3 units are used, expect DO to be 3.3 to 4.1 mg/L, or more;
120-148	9500-12,500	4 units except U5 (expect DO to be 3 to 3.3 mg/L, or more)
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 2.2 to 2.9 mg/L, or more

Turbine Inflow Conditions: DO 0 – 0.9 mg/L; Temperature = 16°C (approximately September 1 to mid-September and stays at 0 until lake mixing); DO objective in tailrace is 5 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Daily operating conditions (i.e., operating ~ 24 hours per day), the following is recommended:**
≤ 18	≤ 1500	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
14-32	1500-2800	Any 2 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 1 unit is used, expect DO to be 3.5 to 5 mg/L or more
29-42	2800-3800	Any 3 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 4.2 to 5 mg/L or more
39-51	3800-4700, limit for 5 mg/L	Any 4 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 4.4 to 5 mg/L or more; if 2 units are used, expect DO to be 3.7 to 4.2 mg/L or more
51-76	4700-6400	Preferably 4 units except Unit 2 for thermal load restrictions and U5 (expect DO to be 4 to 5 mg/L, or more); if 3 units are used, expect DO to be 3.4 to 4.4 mg/L, or more; if 2 units are used, expect DO to be 3 to 3.7 mg/L, or more
76-120	6400-9500	Preferably 4 units except Unit 2 for thermal load restrictions and U5 (expect DO to be 2.5 to 4 mg/L, or more); if 3 units are used, expect DO to be 2.5 to 3.3 mg/L, or more;
120-148	9500-12,500	4 units except U5 (expect DO to be 2 to 2.5 mg/L, or more)
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 1.5 to 2 mg/L, or more

Turbine Inflow Conditions: DO 0 – 0.9 mg/L; Temperature = 20°C (approximately September 1 to mid-September and stays at 0 until lake mixing); DO objective in tailrace is 5 mg/L		
MWs desired	**Approximate flow (cfs)**	**For Daily operating conditions (i.e., operating ~ 24 hours per day), the following is recommended:**
≤ 15	≤ 1300	Any unit, except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"
11-25	1300-2300	Any 2 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 1 unit is used, expect DO to be 3.8 to 5 mg/L or more
22-35	2300-3300	Any 3 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 2 units are used, expect DO to be 4.2 to 5 mg/L or more; if 1 unit is used, expect DO to be 3.4 to 3.8 mg/L or more
32-40	3300-3900, limit for 5 mg/L	Any 4 units except Unit 2 for thermal load restrictions and U5 operated in the "last on, first off mode"; if 3 units are used, expect DO to be 4.7 to 5 mg/L or more; if 2 units are used, expect DO to be 3.7 to 4.2 mg/L or more
40-70	3900-6000	Preferably 4 units except Unit 2 for thermal load restrictions and U5 (expect DO to be 4 to 5 mg/L, or more); if 3 units are used, expect DO to be 3.2 to 4.5 mg/L, or more; if 2 units are used, expect DO to be 3 to 3.8 mg/L, or more
70-120	6000-9500	Preferably 4 units except Unit 2 for thermal load restrictions and U5 (expect DO to be 2.3 to 4 mg/L, or more); if 3 units are used, expect DO to be 2.3 to 3.2 mg/L, or more;
120-148	9500-12,500	4 units except U5 (expect DO to be 2 mg/L, or more)
> 148	> 12,500	Operate Units 1-4 at full gate and add Unit 5 as needed for desired operations—expect DO to be 1.5 to 2 mg/L, or more

FIGURES

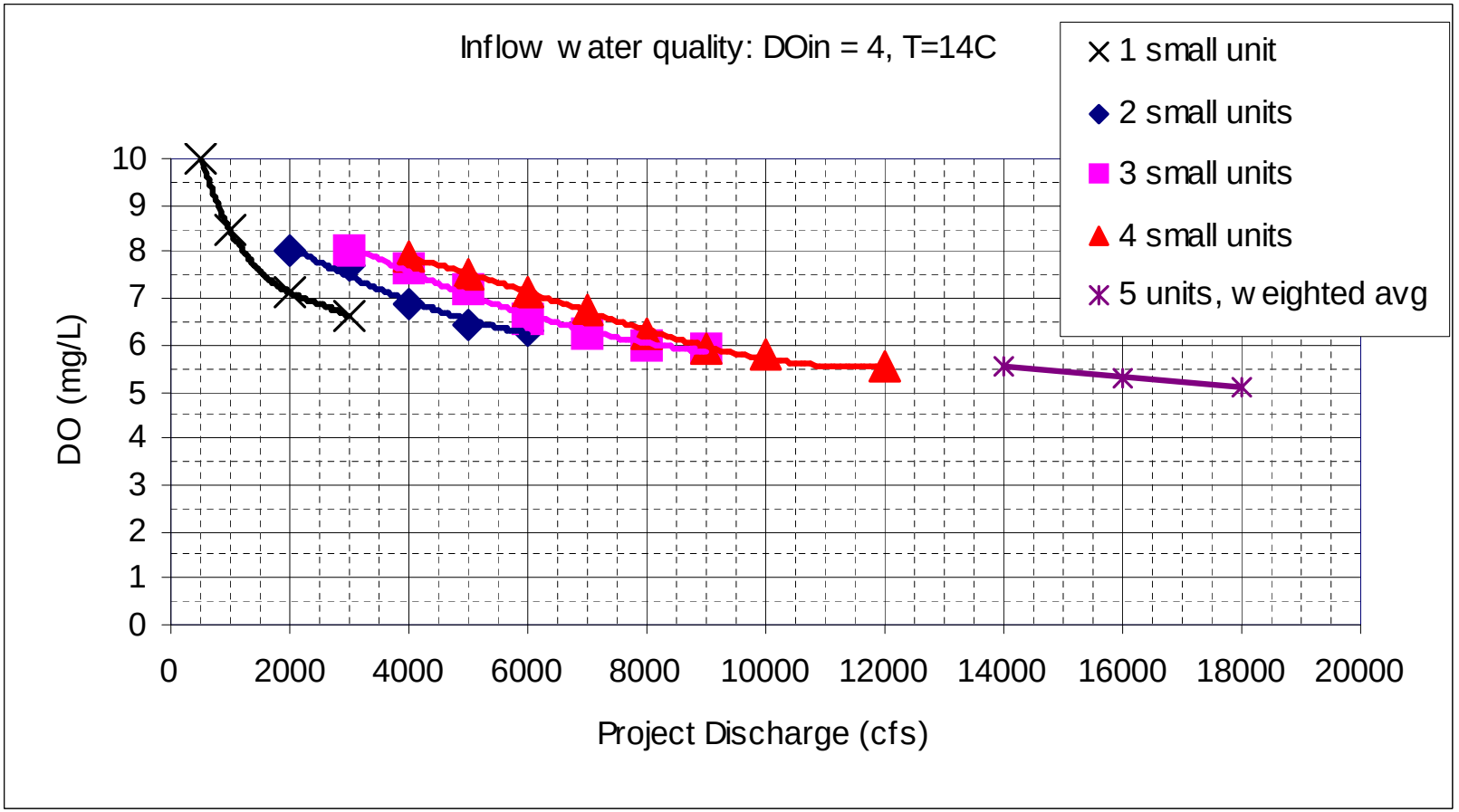


Figure 1: Model predicted DO versus total project discharge for the indicated water quality and operating conditions. This plot was used to develop the LUTs.

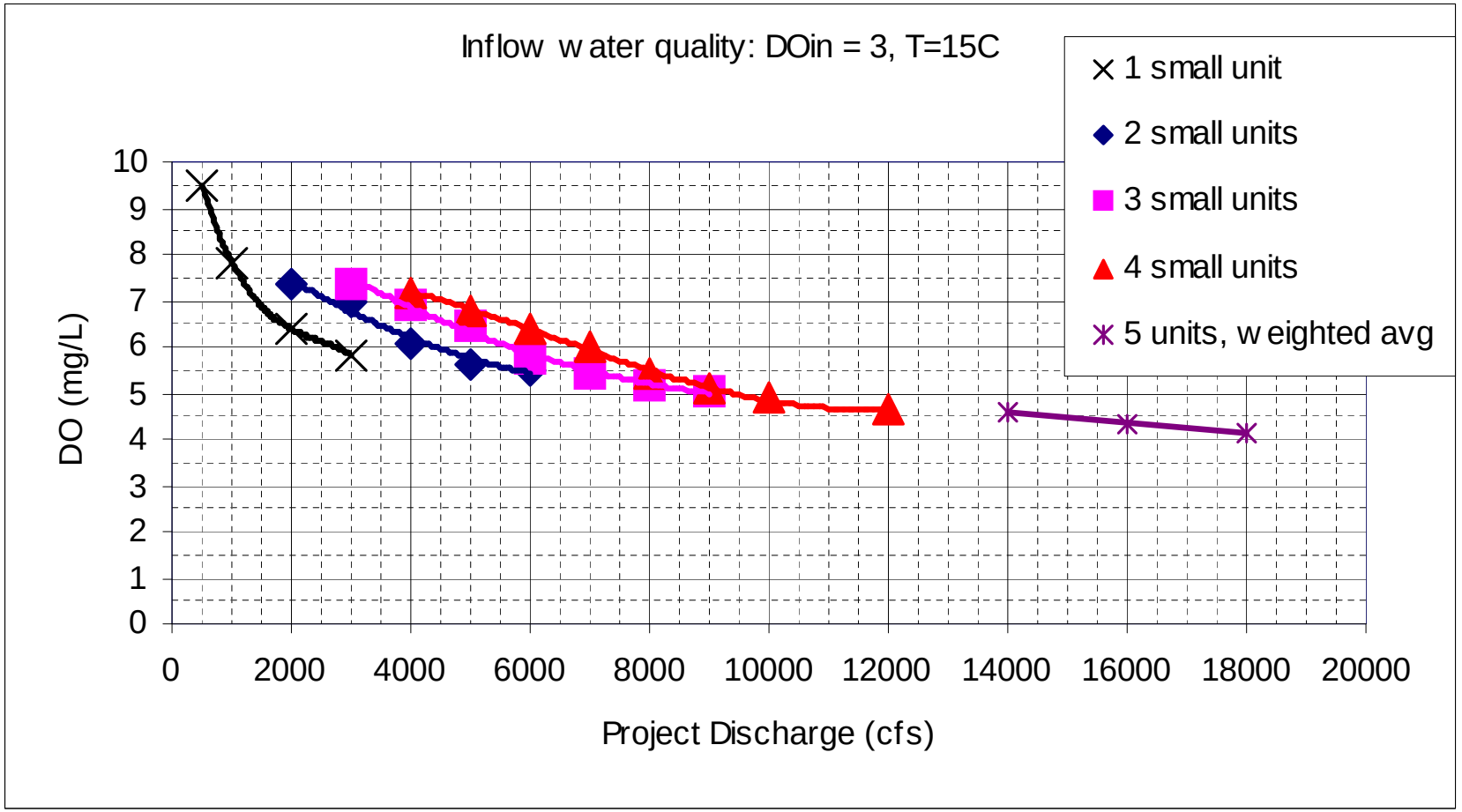


Figure 2: Model predicted DO versus total project discharge for the indicated water quality and operating conditions. This plot was used to develop the LUTs.

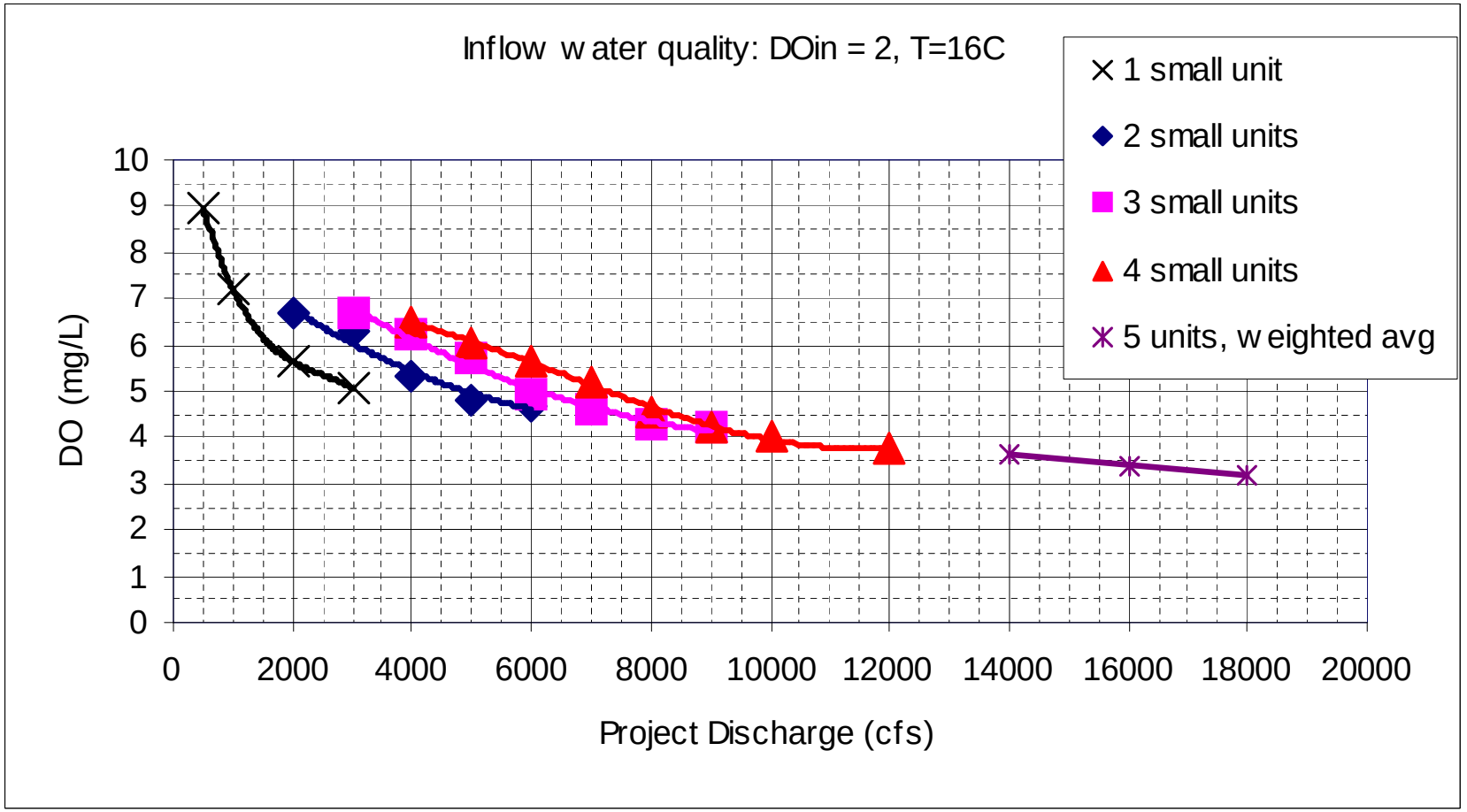


Figure 3: Model predicted DO versus total project discharge for the indicated water quality and operating conditions. This plot was used to develop the LUTs.

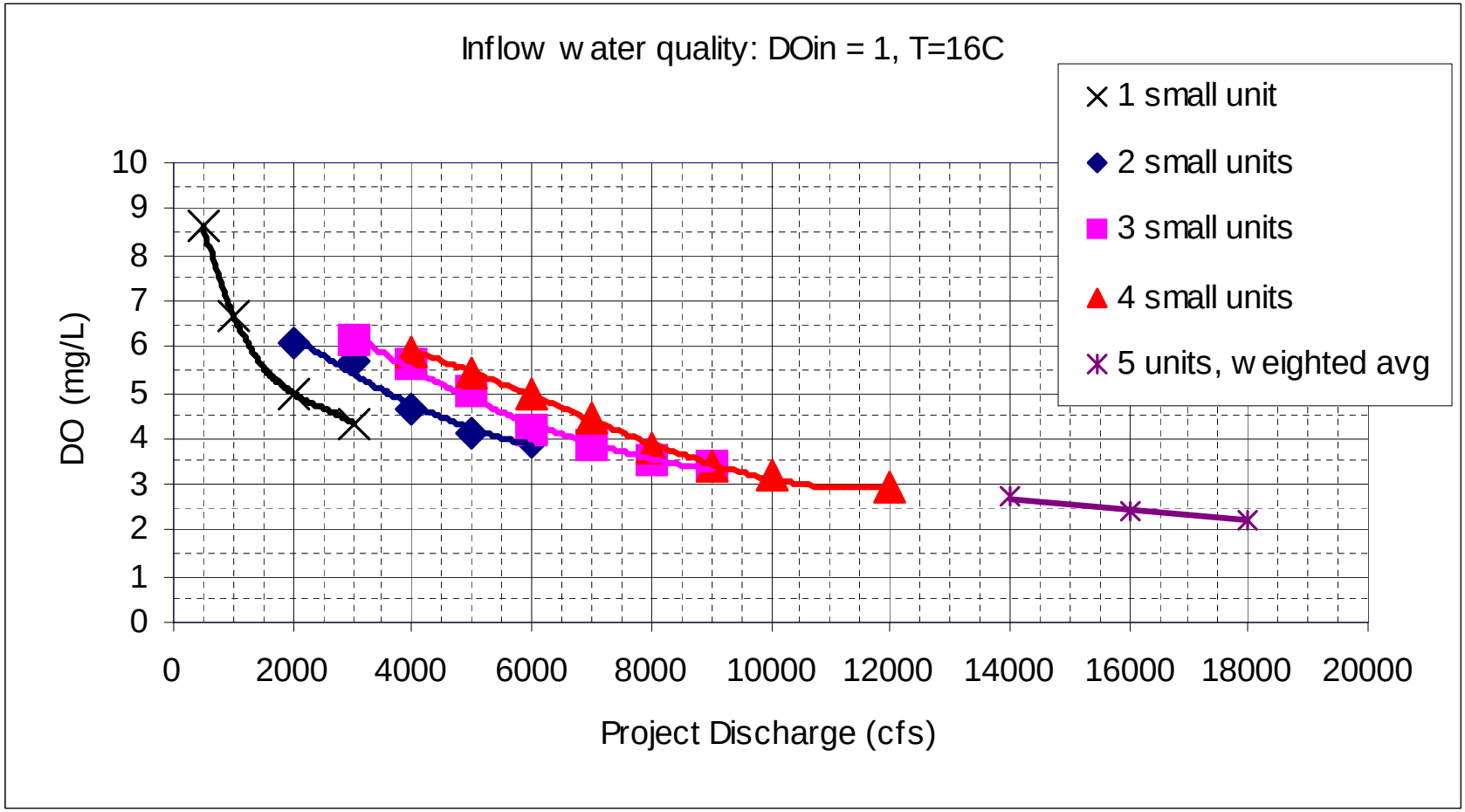


Figure 4: Model predicted DO versus total project discharge for the indicated water quality and operating conditions. This plot was used to develop the LUTs.

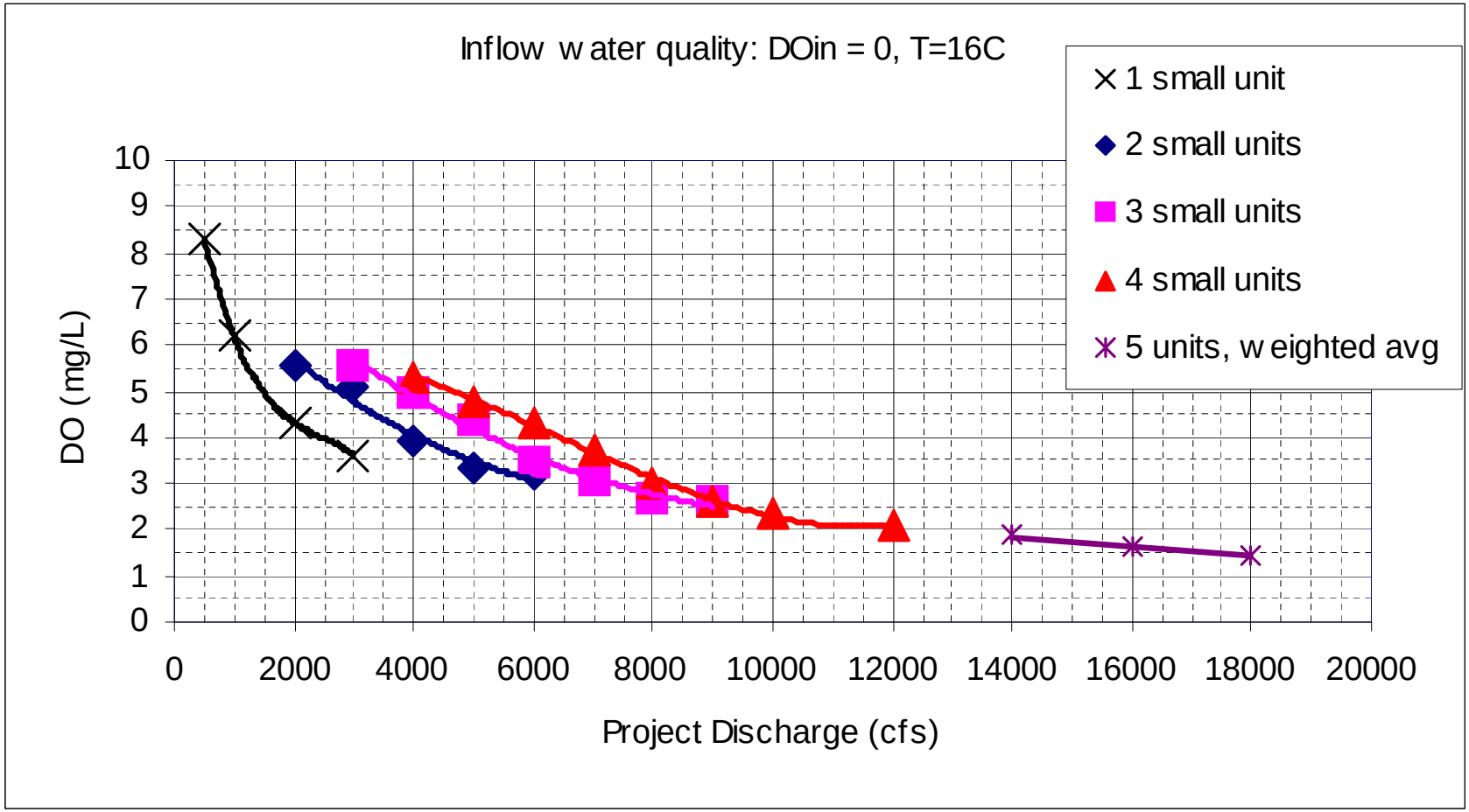


Figure 5: Model predicted DO versus total project discharge for the indicated water quality and operating conditions. This plot was used to develop the LUTs.

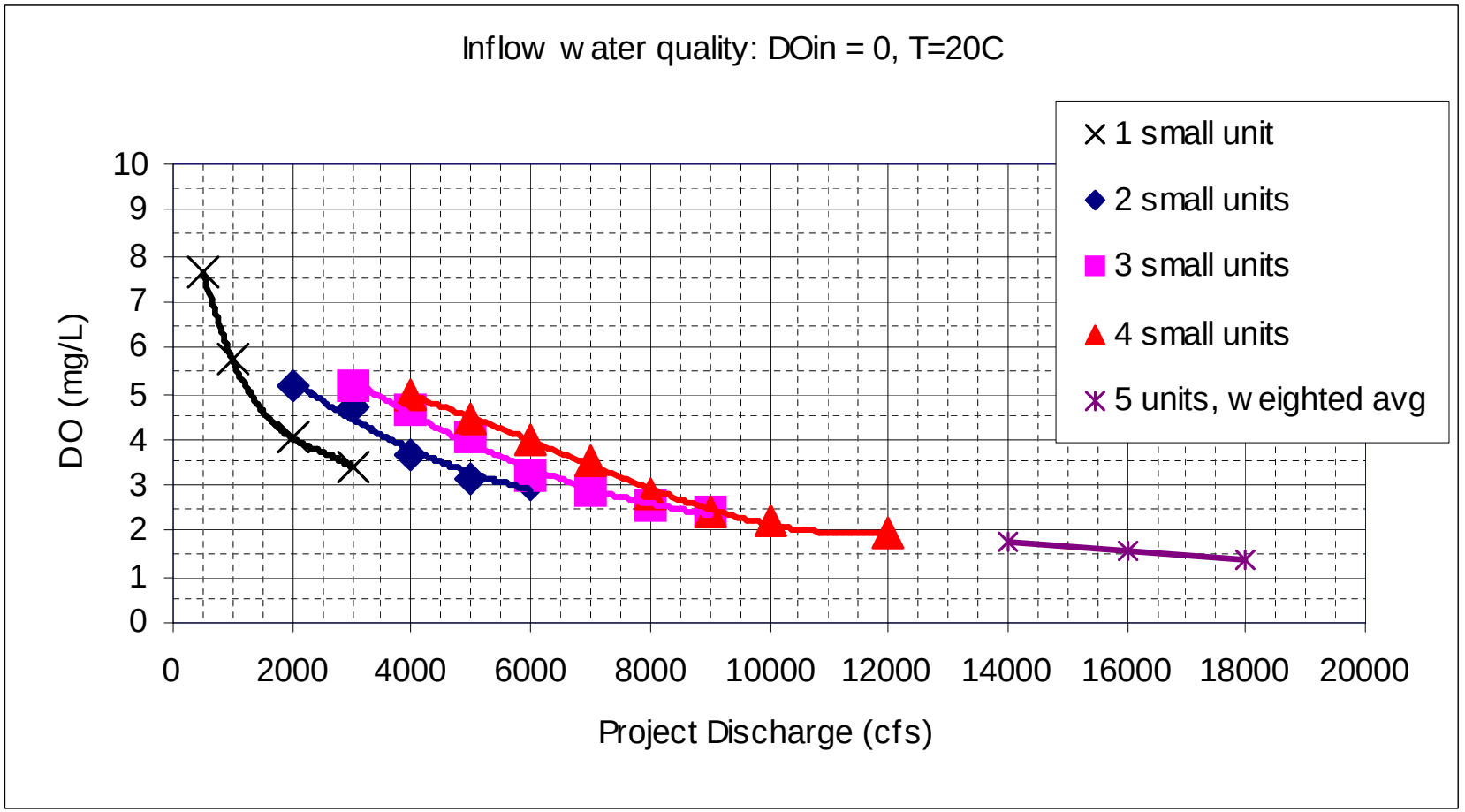


Figure 6: Model predicted DO versus total project discharge for the indicated water quality and operating conditions. This plot was used to develop the LUTs.

Stacia Hoover

From: Alan Stuart
Sent: Tuesday, May 23, 2006 4:21 PM
To: Alan Stuart; 'Amanda Hill (Amanda_Hill@fws.gov)'; 'Dick Christie (dchristie@infoave.net)'; 'Hal Beard'; 'Prescott Brownell (Prescott.Brownell@noaa.gov)'; 'gjobsis@americanrivers.org'; 'Patrick Moore'; 'Gina Kirkland - DHEC'; 'cdwood@usgs.gov'; 'Sarah W Ellisor'; 'Richard Roos-Collins'; 'Julie Gantenbein'
Cc: BARGENTIERI@scana.com; 'Jim Ruane'; RMAHAN@scana.com; 'Ray Ammarell (RAmmarell@scana.com)'; 'Steve Summer'; 'Tom Eppink'; 'Brian J. McManus'; 'BOWLES, THOMAS M'; Alison Guth; 'EPPINK, THOMAS G'
Subject: 2005 Final Operations Plan

Good afternoon,

Attached for your records is the Final 2005 Operations Report for Saluda Hydro. The report reflects the recommendations made during the March 23, 2006 meeting convened at Carolina Research Park.

Thank you for all of your efforts and if you have questions please give me a call.

Thank you,
Alan

2005 Aeration Operations Repor...

SOUTH CAROLINA ELECTRIC AND GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

2005 ANNUAL FINAL REPORT ON WATER QUALITY AND AERATION OPERATIONS AT THE SALUDA PROJECT

MAY 2006

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC AND GAS COMPANY
COLUMBIA, SOUTH CAROLINA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

2005 ANNUAL REPORT ON WATER QUALITY AND AERATION OPERATIONS AT THE SALUDA PROJECT

INTRODUCTION

Section 8.5 of the Settlement requires that SCE&G prepare an annual summary of the following:

1. DO and other water quality monitoring results for Lake Murray and the lower Saluda River;
2. A preliminary evaluation of the implementation of the prior year's Operating Plan; and
3. Preliminary recommendations for the coming year's Operating Plan.

This report will present the results of water quality monitoring[1] for the period July 25 through the time of lake turnover that occurred in late November 2005. Then, an evaluation of maintaining the goal (Sections 9.2 and 9.3 of the Settlement) of the water quality standard will be presented, subject to the conditions identified in Section 9.3.

The following background considerations are restated from the 2004 Operating Plan:

- South Carolina Electric & Gas Company (SCE&G) is committed to complying with the Dissolved Oxygen (DO) standard for the Saluda River downstream from Saluda Project to the extent practicable. Factors affecting the ability to insure continuous compliance include:
  - the limited capability for aeration of water discharged through the turbine units;
  - the requirement that SCE&G manage water levels in Lake Murray for safety and other reasons;

[1] As with any *in-situ* continuous monitor, anomalous readings occur from time to time, due to equipment fouling or malfunction. If the USGS determines the data are suspect through their Quality Control/Quality Assurance Program, that data may be ignored, appropriately adjusted, or otherwise dealt with according to their final determination. It is acknowledged that the USGS data is reported initially as "provisional." SCE&G will use it subject to the data error issues discussed here.

- the need to use Saluda Hydro for the special operating needs specified under Item 9.3 of the settlement agreement dated May 19, 2004; and
- the need to meet SCE&G's reserve obligation to maintain electric load-generation balancing and management of local voltages and system frequency in real time.

- Generators sometimes fail, and generation failures generally are unpredicted and sudden, upsetting the load-generation balance. Because electricity cannot be stored, any sudden reduction in generation cannot be handled by an inventory, as might happen in most other kinds of business. Instead, generation losses must be met by reserve generation that can be dispatched instantly, before voltage sags or frequency excursions lead to local or widespread blackouts. SCE&G is a member of the Virginia-Carolinas Southeastern Electric Reliability Council sub-region (VACAR), whose members are bound in a reserve-sharing agreement by which each has agreed to assist any other member in generation emergencies. SCE&G must employ its reserves to meet its own generation emergencies before calling on assistance from other VACAR members, and it must be constantly ready to provide reserve generation to other VACAR members. Generally, the reserves required to be maintained by SCE&G are in the range of 190-200 MW, which matches the capacity of the Saluda Project and its ability to respond quickly to any generation outage on its system.

During the low DO period of 2005, SCE&G implemented the plan in Appendix A:

- The plan addressed the limited objectives identified in the settlement agreement, i.e., doing what reasonably could be done to improve the likelihood that stream-specific DO standards would be met in the Lower Saluda River, while, at the same time, not constraining in any manner SCE&G's ability to use the Saluda Project to meet its reserve obligations.
- The plan also included evaluations of hub baffles and existing water quality monitoring equipment

Overview of 2005 Aeration Operations:

The SC site-specific DO standard was maintained during most of the period July 25 through late November.

Special challenges during 2005 were:

1) Implementation of aeration systems using hub baffles without the benefit of look-up tables to provide the amount of DO enhancement that can be expected at various levels of generation;
2) Special operations at high flows that were greater than that required for generation (i.e., for aeration and monitor location studies and for special requests for rescue training by the City of Columbia);
3) Extended outages for Units 3 and 4, and a short term outage for Unit 2; and
4) Significant apparent fouling of the DO monitor.

A positive development was the implementation of the aeration systems with hub baffles installed and the availability of relatively higher DO levels at the intake of unit 5 starting about October 20. However, when unit 5 was operated in conjunction with any other unit, the DO monitor did not measure the benefit of the higher DO levels in the releases from unit 5.

The DO measured by the USGS monitor was less than the standard on six occasions when the flow through the Saluda Project was greater than flow levels at which current turbine aeration can attain the DO standard:

1. August 25-27, a special pool level draw down for Hurricane Katrina
2. August 31-Sept 8, pool level management
3. October 2-8, aeration studies
4. October 31, a peak flow lasting less than an hour, probably for system reserve
5. October 23-November 2, rescue training
6. November 1-3, monitor location studies

All the excursions are summarized in a summary section following the detailed presentations of each period of excursions.

SUMMARY OF 2005 OPERATIONS AND WATER QUALITY MONITORING RESULTS

Water Management and Spinning Reserve:

The gauged inflows and pool level elevations of Lake Murray over the period of assessment are presented in Figures 1 and 2.

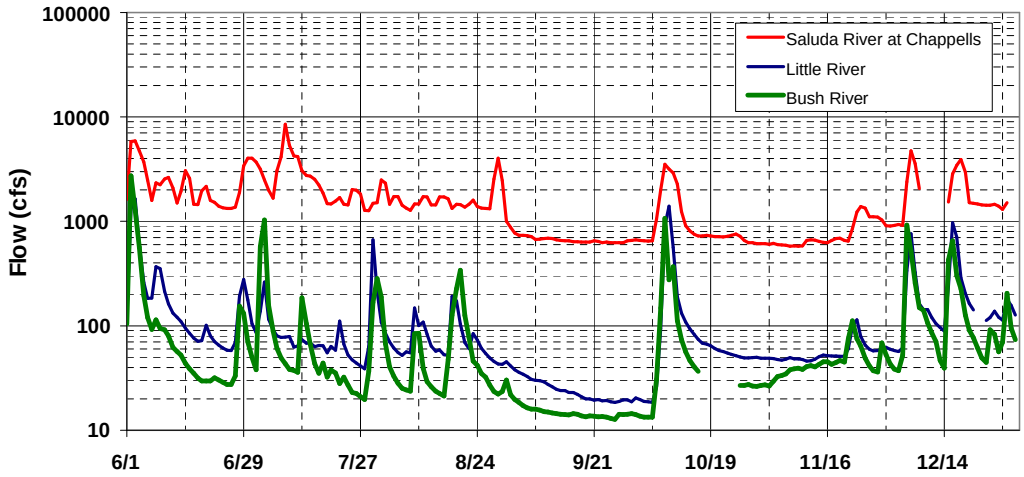

Figure 1: 2005 Lake Murray Gauged Inflows

Figure 2: 2005 Pool Elevation of Lake Murray

Generally, the flows in the discharge from the Saluda Project were low except for the following periods when hourly flows equaled or exceeded 8,000 cfs:

1. Generation was increased for about two hours the evening of July 26, due to one of SCE&G's larger coal fired stations tripping off line about 8:38 PM. Peak flow was 12,300 cfs, but indicated USGS DO dropped to a minimum of only 4.5 mg/L due to the relatively high inflow DO to the units.
2. On October 4 and 8 generation flows were increased due to aeration studies. These studies were conducted to develop revised look-up tables considering the addition of hub baffles to all the units.
3. On October 23, October 26, and November 2 generation flows were increased due to high river flows requested by the City of Columbia for swift water rescue training.
4. On November 3 generation flows were increased due to studies for evaluating the location for a new water quality monitoring system.

Over the period August 25-27, median flow was increased to 5400 cfs in anticipation of Hurricane Katrina.

Over the following periods, the respective median flows occurred to maintain the reservoir drawdown plan:

1. August 31 through September 9, 5300 cfs, and
2. October 10-18, 3900 cfs.

On August 31, SCE&G began the process of drawing down the lake for fall. The lake level began the period at about el. 357.73. SCE&G planned to maintain a target elevation of about 356 ft. during September, subject to weather and system requirements. The SCE&G water management plan called for the pool level to be lowered to elevation 354 msl by the end of November. They were attempting to manage the pool level by dropping it about one foot per month during September through November. SCE&G worked with SCDOT and their contractor to coordinate their work on widening S.C. Route 6 with SCE&G's proposed repairs to the upstream face armor (riprap) on the dam. SCE&G tentatively planned to lower the lake to below elevation 350 msl beginning in early January 2006.

Unit Operations and Aeration Systems:

Hub baffles were installed on all the units prior to the low DO period of 2005, and all air valves were 100% open during the entire low DO period.

Unit 5 was operated on the basis of "last unit on, and first unit off" during most of the low DO period, until October 9 when it was used with Unit 1 to manage lake levels. Unit 3 had problems with headcover leakage and was out of service for the period from the week of August 8 through the week of September 19; and, after it was returned to service, the unit did not draw air into the draft tube. Unit 4 was out of service due to generator problems for the period from the week of August 22 through the week of November 14. Unit 2 experienced an outage due to penstock leakage for the starting October 9 through about October 18.

Water Quality Data:

Figures 3 and 4 present the profiles of temperature and DO for the forebay of Lake Murray during the period March 9 through December 1. These profiles show that DO in front of the intakes for Units 1-4 was near zero from the end of August to the end of November, but the USGS tailrace monitor indicated that DO increased on November 21 probably due to withdrawal zone expansion for water from higher in the water column in the lake.

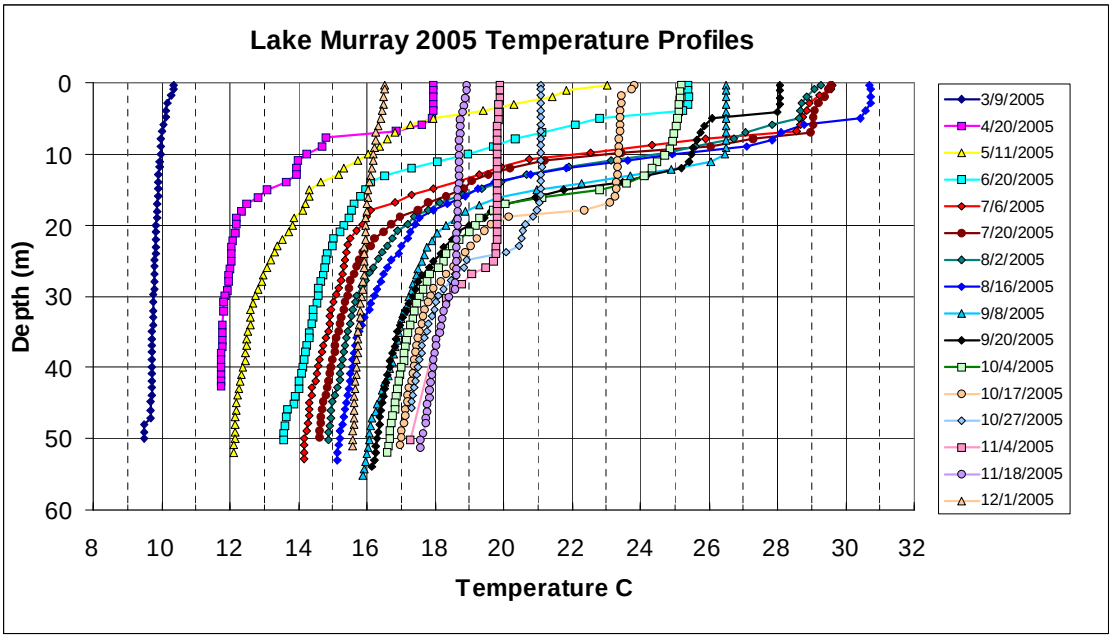

Figure 3: 2005 Temperature Profiles in Lake Murray

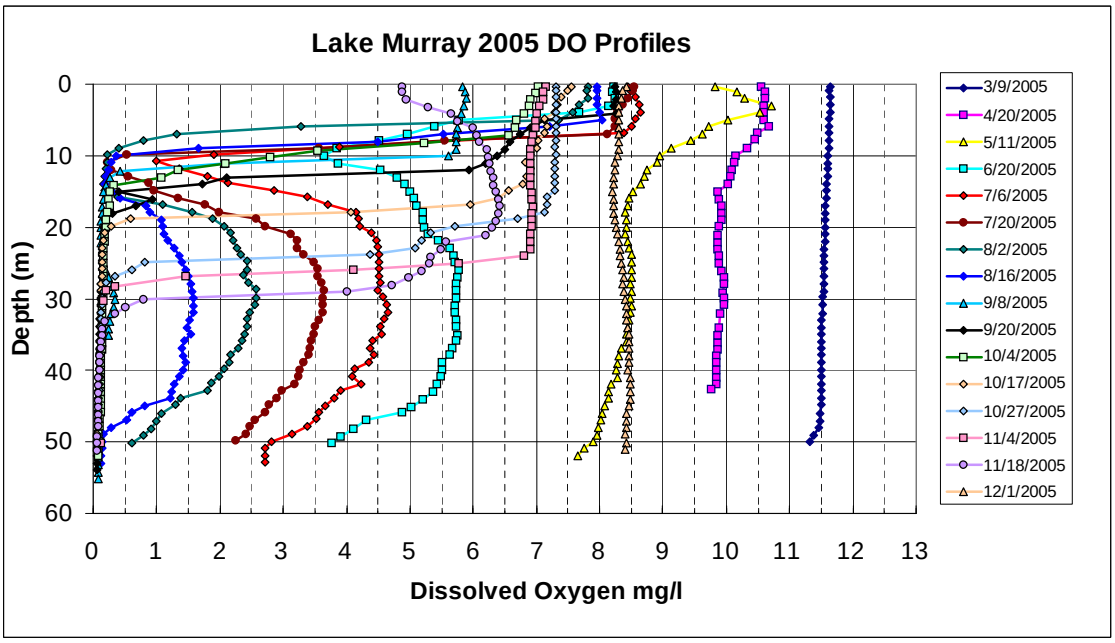

Figure 4: 2005 DO Profiles in Lake Murray

Figure 5 presents the temperature and DO results from the USGS monitors in the forebay of Lake Murray. Figure 5 shows that the temperature and DO at the intake for Unit 5 increased to about the same level as the surface water in the lake on October 25. While the temperature conditions at these two elevations appeared to be about the same, a review of deviations in DO shows that minor differences in temperature resulted in noticeable differences in DO (i.e., DO at the level of Unit 5 was usually lower than a the surface of the lake when the temperature of the lower monitor was ~ 1 C^o lower than the surface temperature). These observations are consistent with observations from previous years. Notice that indicated DO at the surface dropped to 1-2 mg/L starting on November 11 and continued to be low until November 20—it is highly unlikely that DO actually dropped to these levels at the surface (i.e., see the DO profile collected on November 18 in Figure 4.)

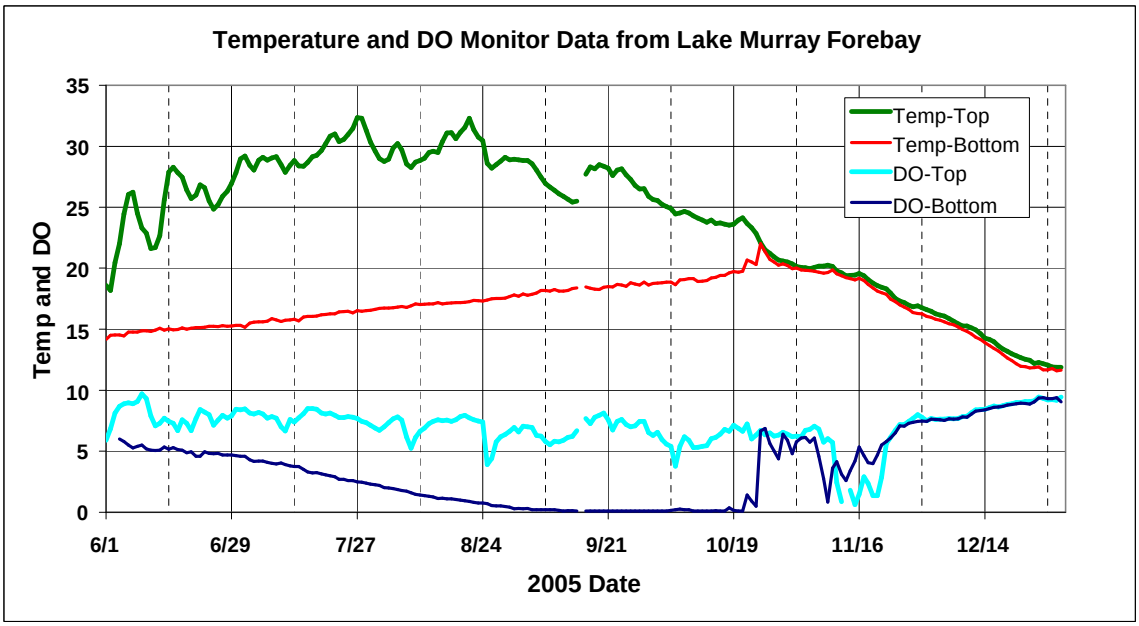

Figure 5: Temperature and DO Monitor Data from Lake Murray Forebay

Figure 6 presents the temperature and DO results of measurements at the USGS monitor (02168504) immediately downstream from the Saluda Powerhouse. The graph includes the data recorded by the monitor as adjusted by USGS and the pre-calibration measurements of the monitor and a separate field monitor by USGS when they maintained the monitor. It also includes the flow measurements by the USGS gauge as well as the daily average and the 30-day average DO values.

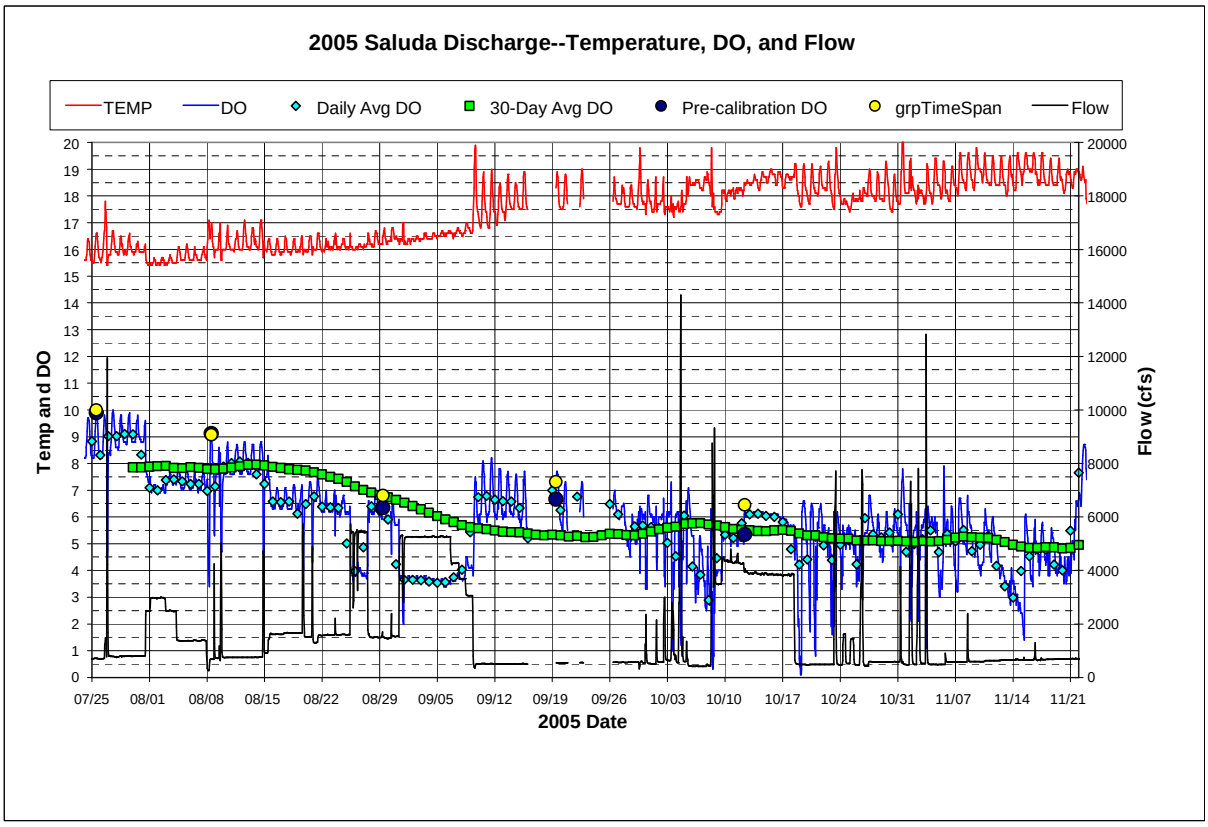

Figure 6: 2005 Saluda Discharge – Temperature, DO, and Flow

Figure 7 presents the temperature and DO results measurements at the USGS monitor (02169000) about eight miles downstream from the Saluda Powerhouse. The graph includes the data recorded by the monitor as adjusted by. It also includes the flow measurements by the USGS gauge as well as the daily average DO values.

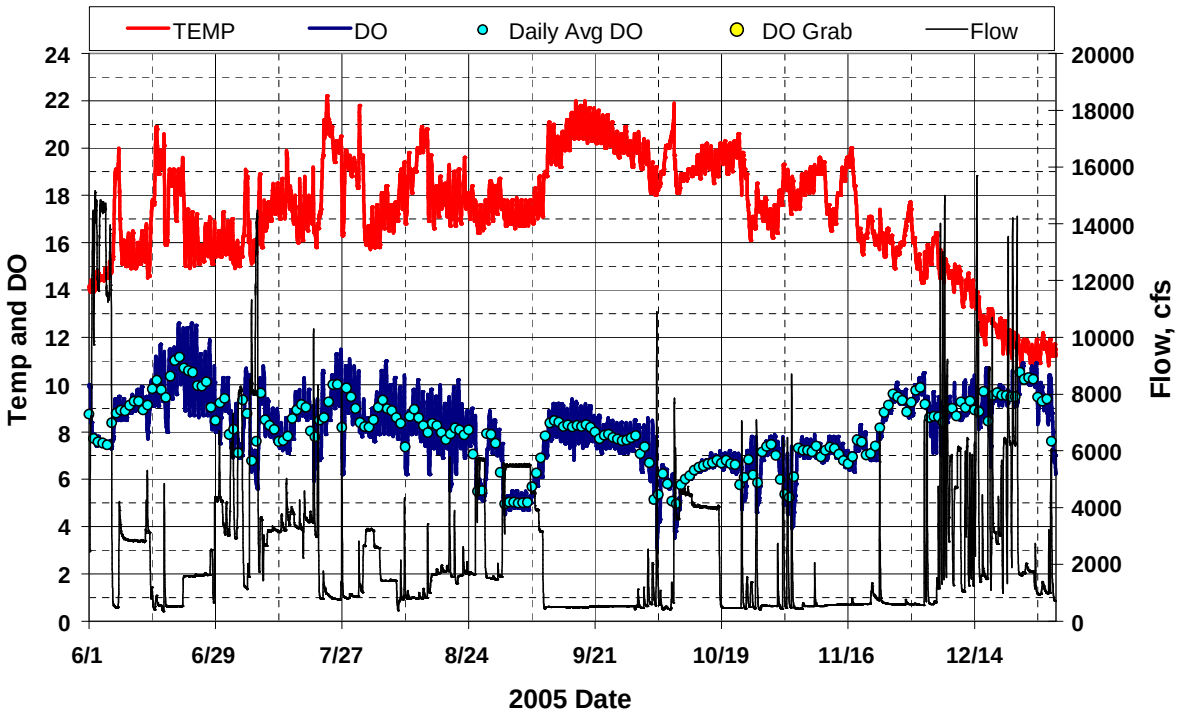

Figure 7: Lower Saluda River – USGS Columbia Gauge

EVALUATION OF 2005 OPERATIONS

In general, DO was better in the tailrace during 2005 considering the benefits of the hub baffles being added to Units 1 through 5. Excursions of DO less than the SCDHEC site-specific DO standard attributed to operations occurred four times, and all these occasions occurred when the flow through the Saluda Project was greater than flow levels at which available turbine aeration could attain the DO standard—two of these times were for pool level management. Excursions of DO less than the DO standard occurred three times during studies requiring less aeration or requested special flows and seven times when the DO monitor was suspected to be fouled or not fully accounting for the benefit of higher DO levels in the discharge from Unit 5.

Figure 6 shows that these excursions occurred over the following time periods:

1. August 8 (Figure 8)
2. August 25-August 27 (Figure 9)
3. August 31-September 9 (Figure 10)
4. September 22-September 24 (Figure 11)
5. September 30 (Figure 12)
6. October 2-October 8 (Figure 13)
7. October 18-October 26 (Figure 14)
8. October 30-November 6 (Figure 15)
9. November 12-November 20 (Figure 16)

Figures 8-16 provide zoomed-in views of the DO and flow conditions on these dates so that the low DO occurrences can be examined in more detail. Following is a more detailed explanation of what happened on these dates.

Turbine vents on Units 1, 2, 4, and 5 were opened to 100 percent during the entire period covered by this assessment. Hub baffles had been installed on Units 1-5 before this same period. The vents on Unit 3 were closed during most of the period (starting the week of August 8-14 due to problems with head cover leakage, and Unit 3 was used only in emergency situations or as requested during studies. Unit 4 went out of service during the week of August 22-28 and remained out of service until the period November 14-27.

August 8 (Figure 8):

The excursion below 4.0 mg/l on the morning of August 8 (minimum DO was 3.4 mg/L and DO was less than 4.0 mg/L about 3 hours) was possibly caused by respiration associated with aquatic plants and related to the discharge from Saluda Hydro dropping below 300 cfs, due to operational issues at the plant. System Control coordinated with Saluda Hydro personnel to avoid minimum flows at 300 cfs.

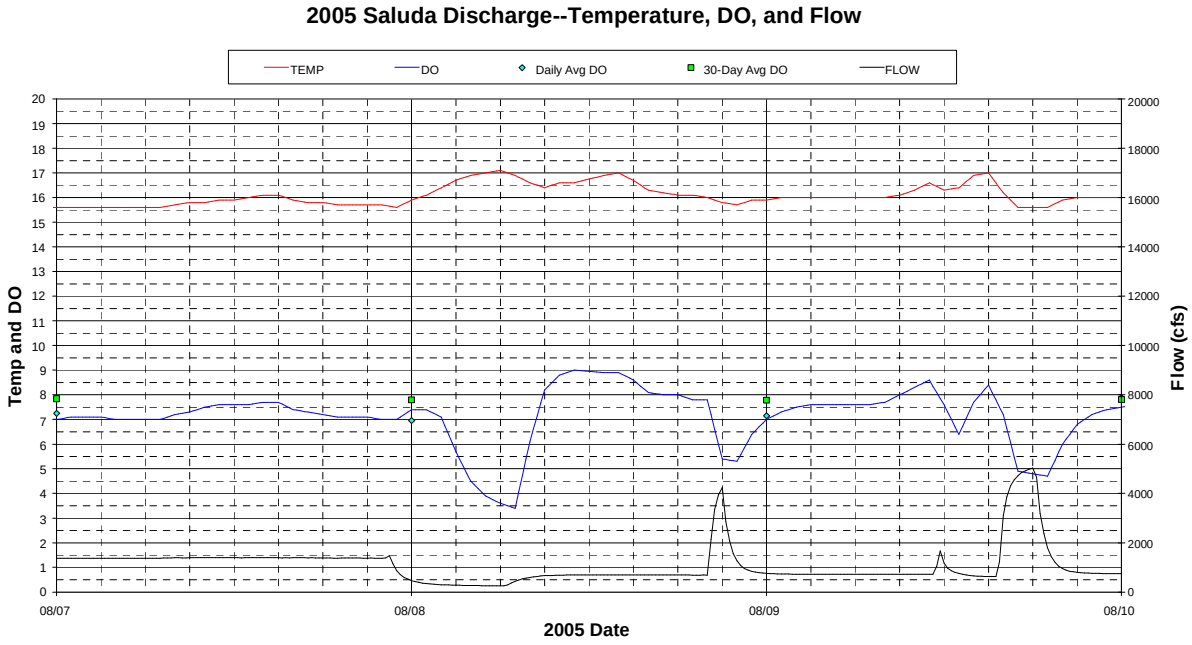

Figure 8: 2005 Saluda Discharge – Temperature, DO, and Flow

August 25-August 27 (Figure 9):

The excursions below 4.0 mg/L were relatively minor (in terms of frequency and duration as well as magnitude—minimum DO was 3.6 mg/L) considering the amount of water that was passed through the plant during this period. Flows were about 5500 cfs over a period of about 2 days because SCE&G was drawing down the pool in anticipation of Hurricane Katrina passing through the area. Units 1 and 2 were used during this period. Prior to the addition of the hub baffles, the DO would have been 1-2 mg/L at this flow level. The DO during this entire generation period was near 4 mg/L.

Generation at Saluda Hydro was increased on August 25, based on forecasts regarding Hurricane Katrina. Generation was reduced when the projected storm track changed. Indicated dissolved oxygen levels in the Saluda Hydro tailrace generally remained between about 6.0 mg/l and 7.0 mg/l during the report period, except during the period of increased generation, when indicated DO dropped around 4.0 mg/L. Unit 4 was unavailable due to electrical problems with the generator. Unit 3 was restricted to emergency use only due to vibrations caused by head cover leakage. Unit 5 was scheduled to be the "last on, first off" unit for normal dispatch to meet reserve generation needs during the low DO period.

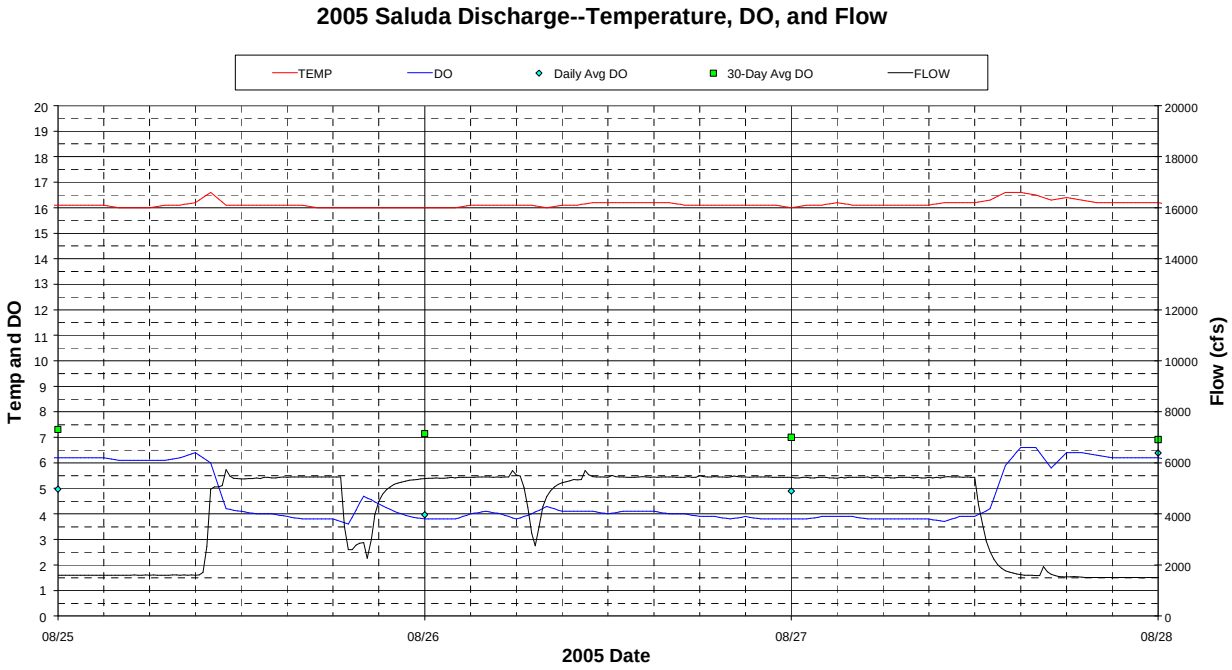

Figure 9: 2005 Saluda Discharge – Temperature, DO, and Flow

August 31-September 9 (Figure 10):

On August 31, SCE&G began the process of drawing down the lake for fall, planning to reduce the lake elevation by about 1 foot each month through December. This plan was subject to adjustment based on weather, system requirements, and other issues as they arose. In the course of implementing the first stage of lake drawdown, SCE&G generated through Units 1 and 2 over a period of 10 days. This resulted in DO levels near 4 mg/L but between 3.5 and 4 mg/L for about 8 days. During a 3-hour event preceding this period, the DO dropped to 2 mg/L while Unit 2 apparently was used. Studies conducted the following month in October revealed that Unit 2 does not draw as much air into the unit and therefore has less aeration capability than Unit 1. As stated for the previous excursion period, the benefits of the hub baffles were significant during the 8-day period since the DO would have been 1-2 mg/L instead of near 4 mg/L.

Indicated dissolved oxygen levels in the Saluda Hydro tailrace remained around 4 mg/l until September 9, when indicated DO increased to between about 6.0 mg/l and 8.0 mg/l. This increase coincided with the target lake level el. 356.0 being achieved and generation being reduced to match inflow.

During this period, USGS checked the monitor and it was reported to be calibrated within an acceptable level.

Unit 4 was unavailable due to electrical problems with the generator. Unit 3 was restricted to emergency use only, due to vibrations caused by head cover leakage. Operations personnel evaluated Unit 3 to see if it could be run at partial load with acceptable vibration levels on a non-emergency basis. Unit 5 continued to be “the last on, first off” unit for normal dispatch to meet reserve generation needs during the low DO period.

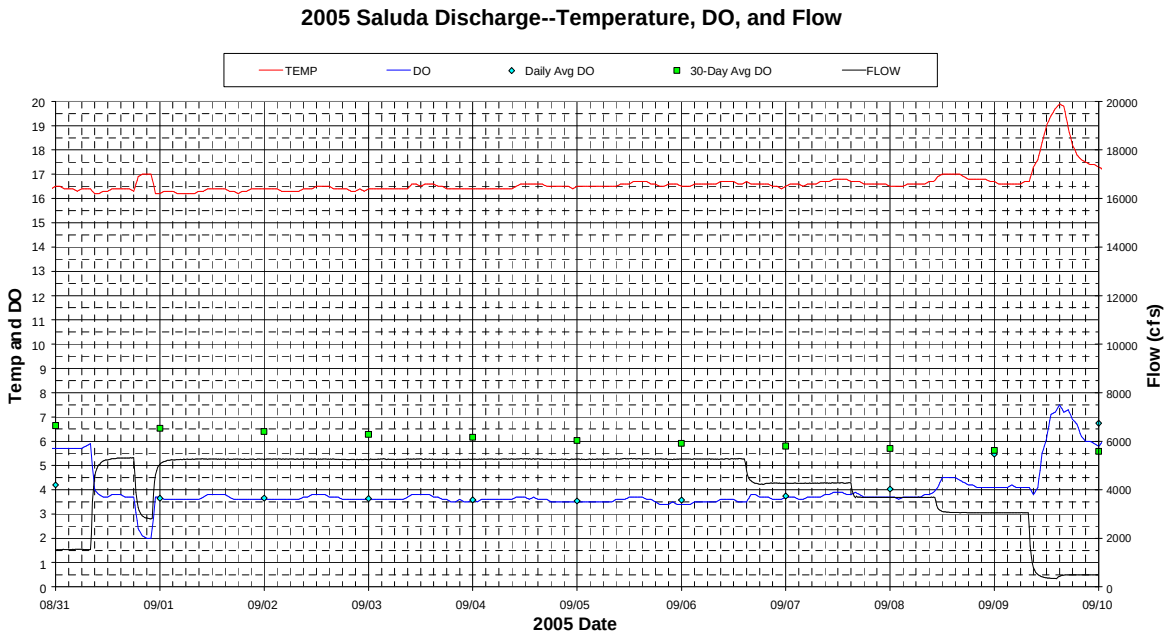

Figure 10: 2005 Saluda Discharge – Temperature, DO, and Flow

September 22-September 24 (Figure 11):

The indicated DO conditions based on provisional USGS data dropped to less than 4 mg/L in the early morning hours of September 23 and 24, indicating that aquatic plant respiration had caused the DO to decrease; however, there also was fouling of the USGS DO monitor during this period. On September 23, the USGS monitor indicated a dissolved oxygen level of 3.0 mg/l at 0900 hours. A SCE&G field reading taken at 0708 hours was 6.4 mg/L using a Hydrolab MS5 with a luminescent dissolved oxygen sensor. A few days earlier (September 19), SCE&G personnel inspected the USGS monitor and reported to the USGS that it appeared to be fouled.

Flows during this whole period were steady at about 550 cfs.

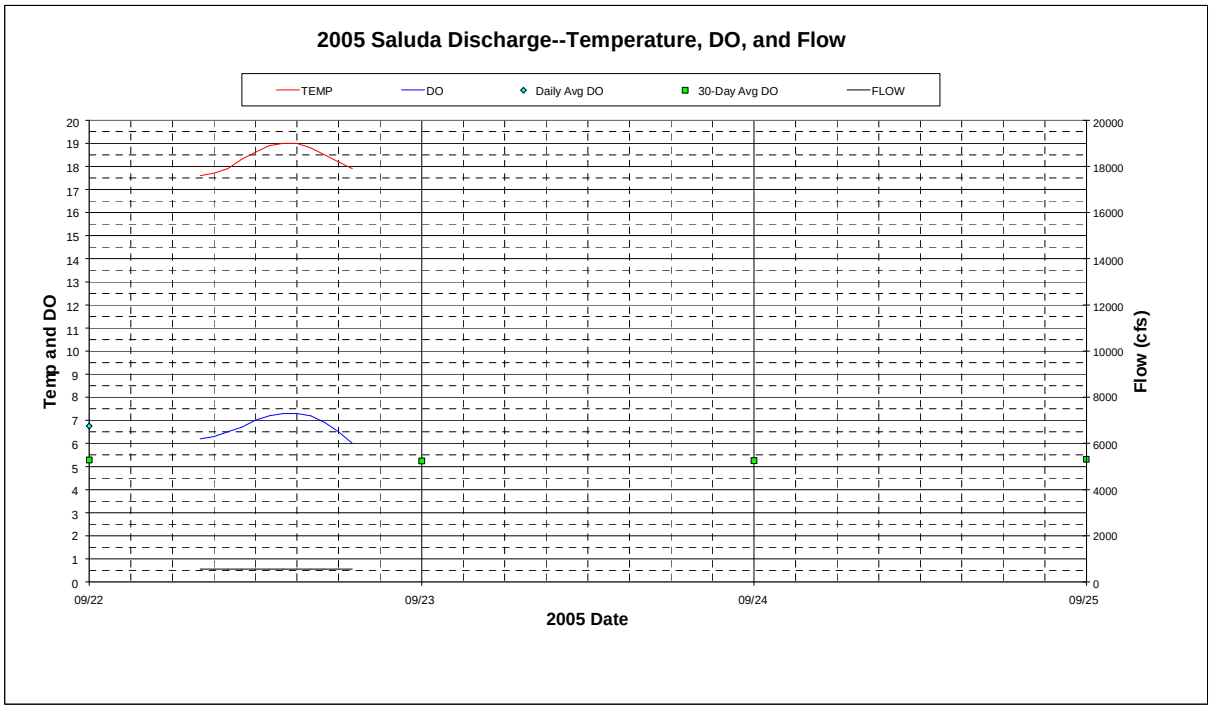

Figure 11: 2005 Saluda Discharge – Temperature, DO, and Flow (excursions were originally indicated by provisional data in the morning hours of September 23 and 24 during a period of continuous flow at ~ 550 cfs)

September 30 (Figure 12):

Indicated DO dropped below 4 mg/L for about two hours on September 30. The indicated minimum DO was about 3.4 mg/L. However, actual DO values were probably 4 mg/L or more considering that Unit 1 was used for generation, and turbine venting studies showed that this unit aerates to > 4 mg/L at the flow levels measured during this time. The values reported at less than 4 mg/L were likely due to aquatic plants and the location of the DO monitor. SCE&G reported "that continued problems with apparent fouling of the USGS dissolved oxygen monitor downstream of Saluda Hydro were encountered again this period."

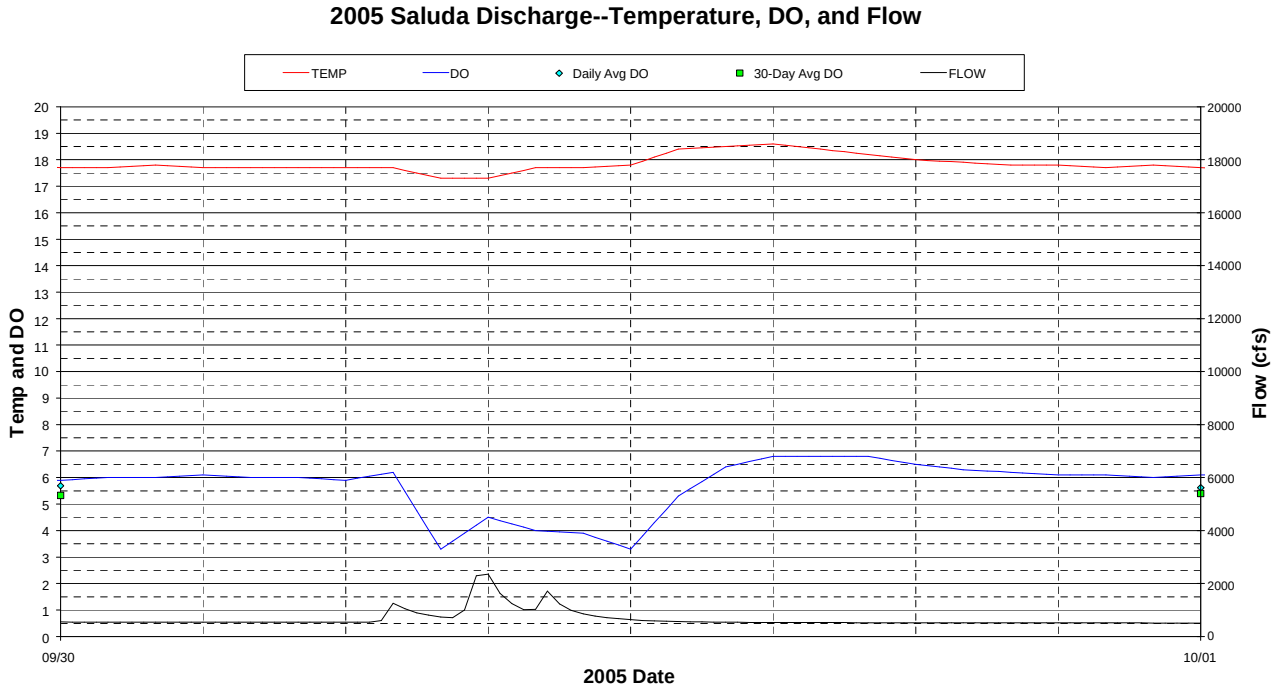

Figure 12: 2005 Saluda Discharge – Temperature, DO, and Flow

October 2-October 8 (Figure 13):

The indicated DO was less than 4 mg/L several times during this period, primarily caused by testing the effectiveness of the new hub baffles and obtaining data for developing the new look-up tables for operating the plant to provide the best DO levels attainable under current plant capabilities. Testing was conducted on October 3, 4, 5, and 8, and the lowest recorded DO levels (i.e., near 1 mg/L) occurred on these dates.

On October 2, the DO dropped to about 3.5 mg/L, and this is the aeration capability of Unit 1 at about 90% gate which appeared to be level of flow measured by the USGS gauge.

The indicated DO dropped to between 2.5 and 3 mg/L on October 6, 7, and 8 (prior to testing on October 8) for no apparent reason since Unit 1 was being operated at about 30% gate and DO should have been about 6 mg/L. During aeration tests on October 8, the indicated USGS DO of less than 0.5 mg/L was lower than the minimum recorded DO levels of 1.6 mg/L during unit tests. During aeration tests on October 4, the indicated USGS minimum DO of 1.2 mg/L was about 0.5 mg/L lower than that recorded during tests. Considering the apparent fouling of the USGS DO monitor on October 6-8 when Unit 1 was operated at 30% gate, it appears reasonable that it was fouled during tests on October 4 and 8.

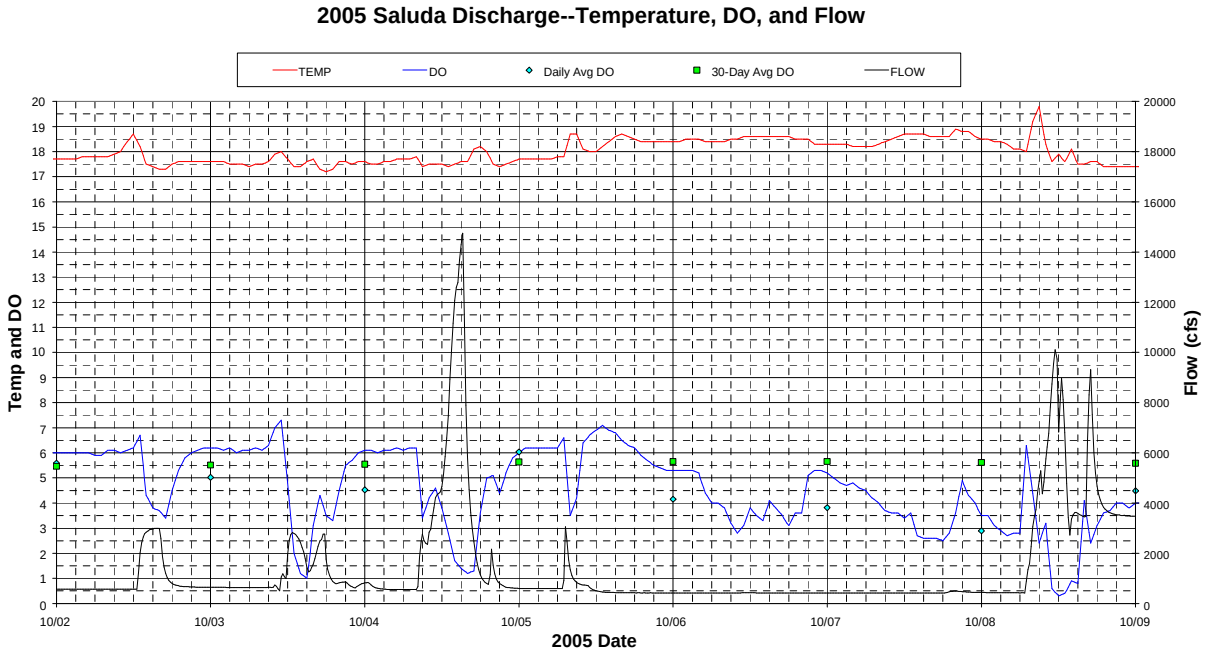

Figure 13: 2005 Saluda Discharge – Temperature, DO, and Flow

October 18-October 26 (Figure 14):

Indicated USGS DO levels were less than 4 mg/L for several hours each day during this nine-day period due to erratic variations unexplained by turbine operations, but higher flow turbine operations caused DO to drop to marginally less than 4 mg/L on two of these days.

Turbine operations at flows up to 8000 cfs occurred on October 23 and 26 (at the request of the City of Columbia for swift water rescue training, and DO dropped to about 3.5 and 3.0 mg/L, respectively. These relatively high DO levels at 8000 cfs are partly attributed to higher DO levels that probably occurred at the intake of Unit 5. Lake temperature and DO profiles indicated that DO at the Unit 5 intake had increased from near zero on October 17 to about 4 mg/L on October 27. Turbine operations at levels of 1500, 3500, and 3900 cfs occurred at various times during this period without the DO dropping below 4 mg/L.

Low flow turbine operations at about 500 cfs were used at all other times during the period, and these operations should have resulted in DO levels of greater than 4 mg/L. However, indicated minimum DO levels dropped to 2 mg/L or less on five days during these operations and less than 4 mg/L on the other days. At other times, the DO was closer to the expected level near 6 mg/L.

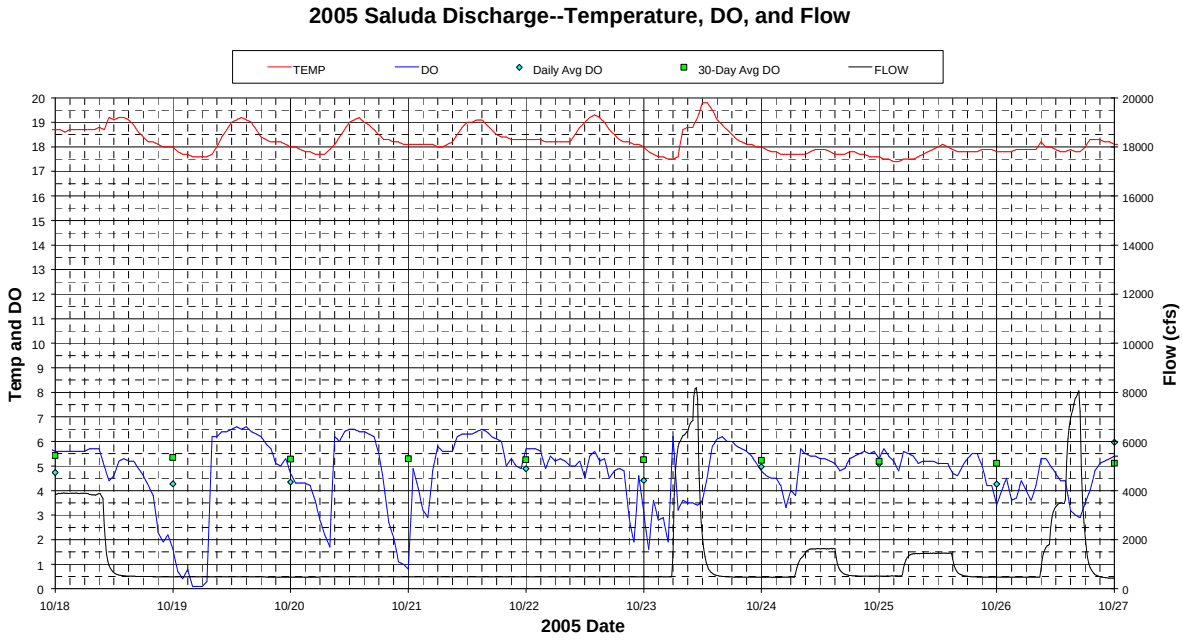

Figure 14: 2005 Saluda Discharge – Temperature, DO, and Flow

October 31-November 7 (Figure 15):

Indicated DO levels dropped below 4 mg/L on six days during this eight-day period. Special operations occurred on three of these days, normal operations occurred on one day, and minimum flow operations occurred on two days. Units 1, 2, 3, and 5 were operational, but U3 air supply valves had to be closed.

The special operations on November 1, 2, and 3 called for higher flow operations than what SCE&G would have used otherwise. Also, the special operations for the monitor location study on November 1 and 3 called for lower DO levels in selected units to allow an assessment of monitoring locations in the tailwater.

On November 1, indicated DO levels dropped to a minimum of 2.2 mg/L. The minimum DO measured by any of the four other monitors located at this transect when the USGS monitor measured 2.2 mg/L was 2.7 mg/L, while the highest minimum DO measured at this transect during this time was 3.7 mg/L.

On November 3, indicated USGS DO levels dropped to a minimum of 1.1 mg/L. The minimum DO measured by any of the three other monitors located at this transect during the time when the USGS monitor measured 1.1 mg/L was 1.5 mg/L, while the highest DO measured at this transect by any of the monitors during the time when the USGS monitor measured 1.1 mg/L was 3.4 mg/L.

The special operations on November 2 were provided to support the City of Columbia Fire Department's swift water rescue training. The flow peaked at 8000 cfs, and the indicated DO dropped to 2.1 mg/L. Based on the turbine aeration studies conducted on October 4, this DO level is close to what would be expected if Units 1, 2, and 3 were used to provide this flow for the City of Columbia. If Units 1 and 5 had been used to provide the flow, the average DO at this transect would have been higher, i.e., about 3.6 mg/L, since the DO at the Unit 5 intake was elevated during this time.

On October 31, SCE&G generated a brief period of time that resulted in a peak flow of 7400 cfs that caused indicated DO to drop to a minimum of 3.1 mg/L and DO was less than 4 mg/L for less than an hour.

On November 5 and 7, indicated DO dropped to less than 4 mg/L for several hours each day (but not less than 3 mg/L); however, these excursions occurred during minimum flow operations when expected DO levels in the discharges from a turbine unit would be much higher. Therefore these excursions are unexplained by turbine operations.

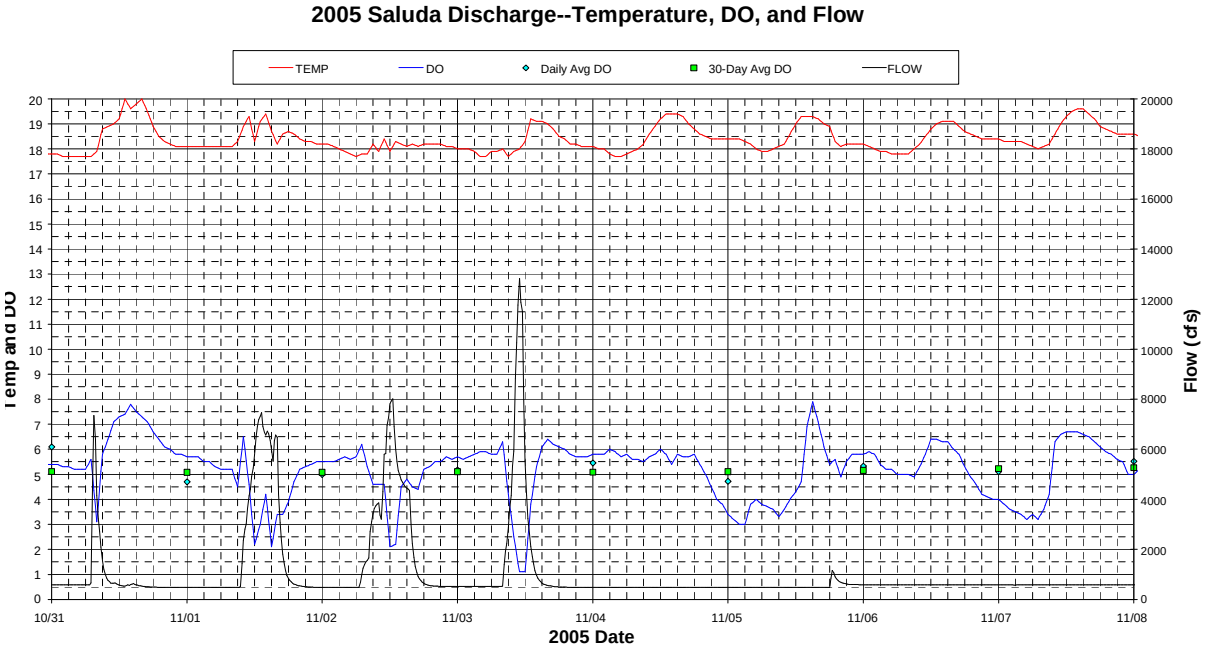

Figure 15: 2005 Saluda Discharge – Temperature, DO, and Flow

November 12-November 20 (Figure 16):

Indicated DO dropped to less than 4 mg/L every day during this nine-day period, especially November 13, 14, and 15 when the DO dropped down to 1.5 mg/L. During the last five days, the daily minimum DO values were between 3.5 and 4 mg/L. During essentially this entire period, the project flow varied from 650 to 700 cfs which is about 20% gate for one of the original units at Saluda. At 20% gate the available units would aerate to 5-6 mg/L. SCE&G personnel obtained a field DO reading of 6.1 mg/l in the Saluda River on Friday, November 11, at 0940 EST, when the USGS monitor read between 5.0 and 5.35 mg/L, at 0930 and 0945, respectively. The gradual decline in the indicated DO readings over the period November 12 to 0900 on November 15 is indicative of probe fouling on a DO monitor. USGS serviced the monitor on November 15. During the last five days of the period, respiration associated with aquatic plants probably caused the DO to drop below 4 mg/L, especially in the early morning hours. The low indicated DO levels through out the days of November 19 and 20 might have been caused by cloudy conditions, senescing conditions, or fouling of the probe on the DO monitor.

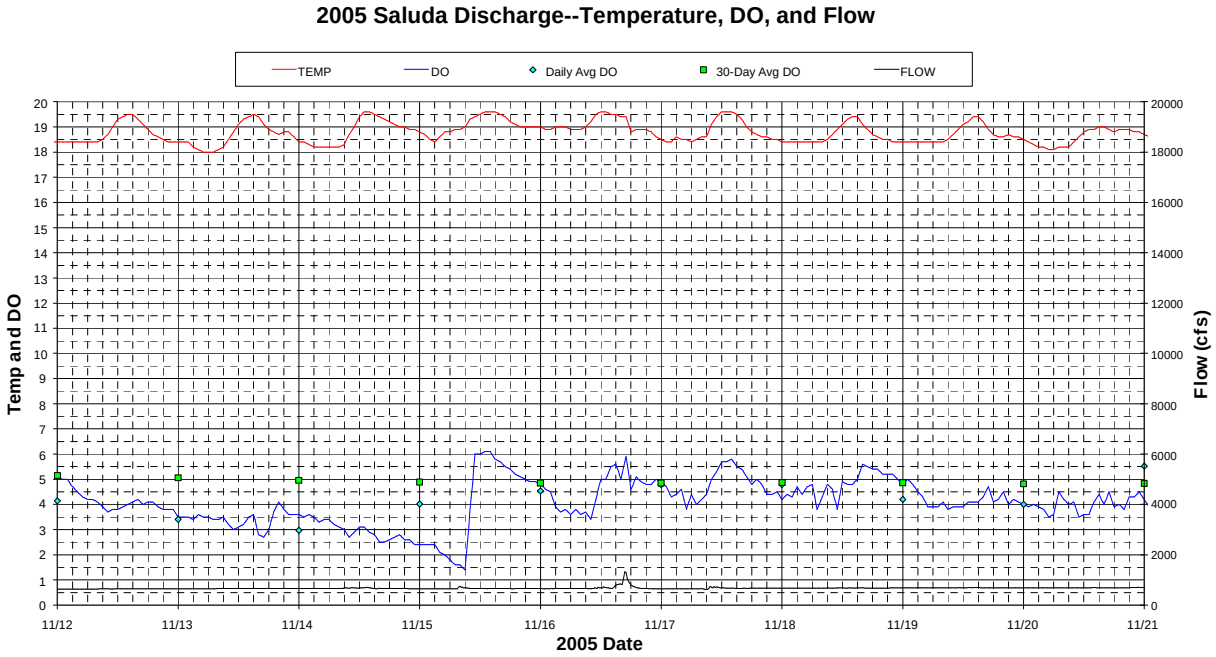

Figure 16: 2005 Saluda Discharge – Temperature, DO, and Flow

Summary of all Excursions during the Period of Study:

The summary is presented in Table 1. All excursions of the DO standard were caused by operations, special studies and flow requests, and monitor fouling as described above. Eighteen of the excursions of the 5 mg/L daily average DO were caused by monitor fouling or undetermined reasons while 11 were caused by operations and 5 were caused by special studies and flow requests. One hundred and eighty-seven of the excursions of the 4 mg/L hourly minimum DO were caused by monitor fouling or uncertain reasons while 224.5 were caused by operations and 54 were caused by special studies and flow requests.

Table 1: Summary of Excursions of DO Less Than the SC Site-Specific DO Standard (Hourly and Daily Standards)

Summary of Excursions--Causes and Metrics, based on USGS indicated DO monitor readings

Causes	Dates		Number of Hours < 4 mg/L	% of Time < 4 mg/L	Average DO during Excursions	Minimum DO during Excursions	Number of Days Avg DO < 5 mg/L	% of Time < 5 mg/L daily Avg	Comments
Operations	Aug 25-27		30.50	0.35	3.84	3.60	2	0.5	Katrina drawdown
	Aug 31-Sept 8		193.25	2.21	3.61	2.00	9	2.5	Lowered pool level
	Oct 31		0.75	0.01	3.53	3.10	0	0.0	
Totals & Averages			**224.50**	**2.6**	**3.7**	**2.0**	**11**	**3.0**	
Studies or Special Flow Requests	Oct 2-8		30.25	0.35	2.50	0.3	2	0.5	Aeration studies; minimum DO measured by study monitors was 1.6 mg/L
	Oct 23-Nov 2		13.00	0.15	3.28	2.1	2	0.5	Rescue training
	Nov 1-3		10.75	0.12	2.77	1.1	1	0.3	Monitor location studies; minimum DO measured by study monitors was 1.5 mg/L
	Totals & Averages		**54.00**	**0.6**	**2.8**	**1.5**	**5**	**1.4**	Minimum DO measured by other monitors was 1.5 mg/L
Monitor Fouling or Uncertain Reasons	Aug 8		2.25	0.03	na	na	0	0.0	Low flow and aquatic plants
	Sept 30		3.00	0.03	na	na	0	0.0	
	Oct 6-8		32.50	0.37	na	na	2	0.5	
	Oct 18-26		41.25	0.47	na	na	6	1.6	
	Nov 5-7		19.50	0.22	na	na	1	0.3	
	Nov 12-20		88.50	1.01	na	na	9	2.5	
	Totals		**187.00**	**2.1**	**NA**	**NA**	**18**	**4.9**	

Most all of the 55 excursions of the 5.5 mg/L 30-day average DO level were attributed to monitor fouling. Seventeen days were attributed to operations: September 14-30 when the minimum 30-day average was 5.3 mg/L. The period attributed to operations could have been only 12 days if special operations had not been required for Hurricane Katrina. The other 38 days were attributed to monitor fouling and special studies or flow requests: October 19 through November 25 when the minimum 30-day average was 4.8 mg/L.

Performance of the LUTs:

The LUTs need to be revised and implemented to account of the effects of the hub baffles that have been added to all the units.

This report focused on excursions, not an hour-by-hour comparison of aeration performance versus the observed DO results. Such a comparison could be developed using the turbine aeration model to check the results against the DO measurements. However, considering the limitations of the current tailwater DO monitoring system, the benefits of such an analysis would be greatly diminished. SCE&G has the inputs for the model, i.e., flows, the units that were operated, and inflow DO and temperature; but, the current monitoring system does not provide data of sufficient quality to allow a reliable comparison between the model results and the actual DO in the tailwater.

Comments on the current monitoring system:

1. Rated excellent, good, fair, and poor for various periods of the water year 2005;
2. The location is not considered to be representative for all conditions in the tailwater, i.e., it's biased towards the DO in the discharge from the unit that's operating that is on the LDB;
3. The objectives for the current USGS monitor do not include the purpose of providing compliance monitoring;
4. Photosynthesis and respiration by aquatic plants in the tailwater can affect in some years the DO level at the location of the monitor;
5. It occasionally malfunctions for several days;
6. Fouling is a significant issue that affects the reliability of the data; and
7. SCE&G spot measurements during the 2005 study period were usually higher than the USGS monitor.

PRELIMINARY RECOMMENDATIONS FOR 2006

1. Consider the recommendations from the monitor location study conducted in 2005. Improve DO monitoring for 2006 by maintaining the DO monitor more frequently, especially when minimum DO is low (e.g., < 3 mg/L).
2. Implement revised look-up tables accounting for the benefits of the hub baffles and provide options for the System Dispatchers when one or more units are out of service or not available for an environmental issue or agreement with an agency.
3. Conduct additional training within SCE&G so that operators are better prepared to minimize DO excursions—in 2005, training was provided for the System Controllers not only on how to use the LUT's, but also to help them understand the impact of Saluda Operations on the environment. They also had the DO and temps to go through one individual so that only the two applicable tables were given to the controller so that there was no confusion on which table to use. This person also labeled the sheets with "Normal dispatch" and "For Emergency Dispatch" again so that it would be clear which table to use in a particular situation. This training really accomplished a lot to help the System Controllers dispatch the units appropriately. Another training session is proposed for June to go over the tables and review their purpose.
4. SCE&G will develop a water management procedure to allow sufficient aeration to exceed the DO objectives in the tailrace when the pool level is being lowered for normal seasonal operations.
5. Conduct aeration tests on Units 2, 3, 4, and 5; develop LUT's for 2007. The testing plan should minimize the number of runs that are conducted without aeration. DHEC should be notified of the testing plan and schedule at least two weeks in advance. The headcover seals on Units 2 and 3 should be repaired no later than September 15.
6. SCE&G will notify organizations desiring special Saluda operations that might impact DO in the tailwater to schedule their plans during periods of the year when low DO is not normally a concern.

GUIDELINES FOR OPERATION OF THE SALUDA PROJECT FOR DISSOLVED OXYGEN MANAGEMENT IN 2005

June 30, 2005

PURPOSE

These Guidelines for Operation of the Saluda Project for Dissolved Oxygen Compliance are prepared pursuant to the *Offer of Settlement On Complaint Regarding Water Quality In Lower Saluda River* (May 19, 2004) (Settlement Agreement). Paragraph 9.3 of the Settlement Agreement provides the following:

> To the extent within SCE&G's reasonable control, each Operating Plan will seek to enhance existing water quality in the lower Saluda River and, more specifically, seek to achieve DO concentrations of 4 mg/1 minimum, 5 mg/l daily average, and 5.5 mg/1 monthly average in the lower Saluda River. In seeking to achieve this goal, each Operating Plan will preserve SCE&G's right or duty to modify operations as necessary to: (A) protect life and property, (B) respond to changed hydrologic or other circumstances not addressed in the Operating Plan, (C) maintain the use of the Project to meet system reserve obligations of 200 MW, and (D) comply with a lawful orders of the Commission or other authorities. SCE&G will provide notice of such modification to the Conservation Groups, [South Carolina Department of Health and Environmental Control], and Other Agencies in advance of such modification if practicable, and otherwise, as soon as practicable thereafter. The Parties will then use their best efforts to modify the Operating Plan in response thereto.

SCE&G will implement these Guidelines consistent with paragraph 9.3.

LIMITATIONS

Paragraph 9.3 of the Settlement Agreement includes limitations and these limitations are more fully explained here. Operation of the Saluda Project affects dissolved oxygen (DO) levels in the Saluda River downstream of the Saluda Project. Factors affecting achievement and maintenance of the DO standard include: (1) the limited capability for aeration of water discharged through the turbine units, (2) the requirement that SCE&G manage water levels in Lake Murray for safety and other reasons, (3) the need to use Saluda Hydro for the special operating needs specified under paragraph 9.3 of the Settlement Agreement, and (4) the need to meet SCE&G's

reserve obligations as a member of the Virginia-Carolinas Southeastern Electric Reliability Council sub-region (VACAR).

Generating units occasionally fail, and these generation failures are not generally capable of prediction. These often sudden failures upset the load-generation balance. Because electricity cannot be stored, any such sudden reduction in generation cannot be made up by an inventory, as would be the case in most other kinds of business. Instead, generation losses must be met by reserve generation that can be dispatched instantly, before voltage sags or frequency excursions lead to local or widespread blackouts. VACAR members are bound in a reserve-sharing agreement by which each has agreed to assist any other member in generation emergencies. SCE&G must employ its reserves to meet its own generation emergencies before calling on assistance from other VACAR members, and it must be constantly ready to provide reserve generation to other VACAR members. Generally, the reserves required to be maintained by SCE&G are in the range of 190-200 MW, which matches the capacity of the Saluda Project and its ability to respond quickly to any generation outage on its system.

As done in 2004, during 2005, SCE&G will provide via email a weekly report to the South Carolina Department of Health and Environmental Control, South Carolina Coastal Conservation League (SCCCL) and other stakeholders documenting the previous week's operation of the Saluda Project.

Unless otherwise specified, these guidelines will be implemented by SCE&G.

TURBINE VENTING OPERATIONS

Use Lookup Tables (LUTs) As Guides To Aerate The Turbine Discharges From the Saluda Project. SCE&G will use the LUTs included in the document, "Final Lookup Tables for Operating Saluda Hydro to Achieve Standards for Dissolved Oxygen in the Tailrace to the Extent Practicable for 2004," dated ~ March 21, 2005 (Appendix A). These LUTs reflect the best estimate based on field testing and predictive models of how the units at Saluda Hydro can be operated to enhance downstream dissolved oxygen levels and still obtain target MW outputs, given the inflow DO and temperature conditions. (Note: These LUTs may change based on installation of hub baffles presently scheduled for early autumn 2005. Updates to the current LUTs will be generated based on any testing following the installation of the hub baffles.)

Estimate Inflow DO and Temperature for Units 1-4 and Unit 5. Turbine DO and temperature from inflows change during the course of the low DO period. To track DO and temperature conditions in the turbine inflows, SCE&G will obtain DO and temperature profiles in the Saluda Project forebay every other week and use these profiles to predict conditions in the turbine inflows. SCE&G also will use data collected by the USGS continuous water quality monitor located near the intake of Unit 5 (U5).[2] These data will also be used to evaluate the presence of conditions that call into operation, constraints to using U5 due to the potential for fish entrainment. If needed, a withdrawal zone model may be used to predict inflow temperature and DO.

Use DO Readings in the Tailrace from the USGS Monitor. During 2005, the USGS monitor (USGS Gage No 02168504) will be used to track DO conditions in the tailrace on a daily basis, supplemented by periodic spot measurements by SCE&G, especially if DO, as measured at the monitor, appears erratic or is lower than expected (*e.g.*, suspected fouling, meter malfunction, *etc.*). As discussed in a following section, additional monitoring will be conducted by USGS and SCE&G during the low DO period of 2005 so that improvements can eventually be made to obtain more representative DO conditions in the tailrace.

[2] As with any *in-situ* continuous monitor, anomalous readings occur from time to time, due to equipment fouling or malfunction. If the USGS determines the data are suspect through their Quality Control/Quality Assurance Program, that data may be ignored, appropriately adjusted, or otherwise dealt with according to their final determination. It is acknowledged that the USGS data is reported initially as "provisional." SCE&G will use it subject to the data error issues discussed here and agreed to during the March 21, 2005 meeting.

Review effectiveness of the turbine venting operations and other data being collected to see if additional data or adjustments in the LUTs are needed before "near-zero" DO inflow conditions occur. Technical peer review between KA/REMI and National Heritage Institute/SCCCL of the tailrace DO data and operational records collected by USGS and SCE&G will be conducted, as needed, to achieve this objective and determine if changes to the LUTs are warranted.

Conduct monthly training of operators in System Control. The System Control Manager will conduct monthly training sessions with operations personnel to ensure proper application of the LUTs. Training of staff will include review of current practices and procedures in the proper application of the LUTs. The training sessions will be adjusted as appropriate each month for changes in monitored DO and temperature inflow conditions, and will include adjustments in the LUTs should any be needed. Any necessary revisions of the LUTs will be shared with the Conservation Groups.

If during the low DO season, conditions are identified that require immediate changes (agreeable to all parties to the settlement) to the 2005 operating guideline, the System Control manager will convene a special training session to ensure changes in the Operating Guidelines are implemented as soon as reasonably possible.

TAILRACE DO MONITORING

The current USGS water quality monitor in the tailrace has served its purpose well with respect to providing information on temperature and DO conditions. Also, the USGS is now correcting provisional data following calibration checks that are made at about two-week intervals, although the corrections may not be made on the web site for about one month following data collection. USGS has also developed and implemented a procedure to rate the accuracy of their monitors. The monitor below Saluda Hydro is rated as "good" and has an accuracy of ±0.3-0.5 mg/L.

However, additional measures which include equipment testing and additional *in situ* measurements are planned for 2005 to look for ways to improve water quality monitoring in the Saluda tailrace: SCE&G plans to coordinate with the SCCCL and the USGS in developing site

specific study plan(s) prior to conducting these additional analyses. Once final, study plans will be distributed to all interested parties.

Hub Baffle Installation Schedule

SCE&G has secured a contractor to oversee the installation of hub baffles on Units 1-4. As of date of these proposed guidelines, the installation of the hub baffle has been completed for Units 1, 3, and 4. The installation of the hub baffle for Unit 2 is scheduled for completion by July 31, 2005.

APPENDIX A

LOOKUP TABLES

LOOKUP TABLES FOR OPERATING THE SALUDA PROJECT TO ENHANCE DISSOLVED OXYGEN IN THE TAILRACE TO THE EXTENT PRACTICABLE FOR 2005

June 30, 2005

Lookup Tables (LUTs) will be used as a tool for operating the Saluda Project during the low DO period of 2004 so that the DO standard in the Lower Saluda River may be met continuously, subject to the limitations contained in paragraph 9.3 of the Settlement Agreement,, and to provide optimal aeration when the standard otherwise cannot be met. The LUTs will be used by SCE&G to select the turbine units that will be operated at various total project flow rates and power production levels, under varying inflow DO concentrations and temperatures. These LUTs provide a guide for operations in 2005, but actual practice is likely to deviate somewhat from this guide as tailwater data are collected and evaluated and the LUTs are adjusted as appropriate. Also, during 2005, the aeration system will be manually operated. It is expected that when a final turbine venting system is installed at some point in the future, a computer-controlled automated system may be needed to adjust these operations for more optimal aeration.

The overall process used to develop the LUTs involved the following steps:

1. The aeration characteristics of each unit were modeled using the discrete bubble model as described in "Saluda DO Standard Project—Lower Saluda River DO Technical Study Report, Appendix C, Prediction of Dissolved Oxygen Concentrations for Turbine Discharges from Saluda Hydro" 2003.
2. The individual models for each unit were used to predict DO in the tailrace over the range of turbine gate settings (*i.e.*, turbine flow conditions) for various DO and temperature levels in the inflows.
3. The predicted DO in the tailrace for each unit was then plotted for each inflow condition.

4. The LUTs were then developed using these graphs. One set of LUTs was developed assuming that the units were operated briefly for special purposes and the other set of LUTs was developed assuming the units were operated at a constant level over the course of the entire day.
5. LUTs were developed for a range of DO conditions at the intake, but for only one temperature condition that was similar to that expected during the low DO period of 2005. Model predictions were made for other temperature conditions, but the effort was not expended to develop LUTs for all the temperature conditions modeled due to the time required to develop LUTs. Additional LUTs will be prepared on an "as needed basis" depending on the intake actual temperature conditions that develop during the low DO period of 2005.
6. The LUTs were checked using a model that integrates the effects of all the units and predicts DO in the tailrace, assuming full mixing of the discharges from all the units.
7. For project operations, SCE&G System Control normally dispatches Saluda Hydro by power production levels rather than water flow rates; therefore, the flow rates initially determined using the turbine aeration model were supplemented by conversion to MW levels using the results of unit tests conducted in 1997 and 1998.

The assumed conditions for the turbine aeration systems are as follows:

1. Unit 5 has hub baffles, and aeration characteristics were assumed to be as modeled in 2003.
2. Units 1- 4 have no hub baffles, so the aeration characteristics are the same as were measured during field tests in 1997 and 1998. There are indications that Unit 2 may not aerate as much as was measured in 1998 and that aeration at 400 cfs may not be as much as predicted by the model; but, DO uptake data were not collected under these conditions. Therefore,

the results of the tests in 1997 and 1998 were used for calibrating the turbine aeration models for each unit.

3. Unit 2 cannot be operated unless 2500 cfs is being discharged by the other units.

Assumptions used in developing the LUTs:

1. SCE&G plans to operate the Saluda Project at minimal discharge of approximately 400 cfs during the summer of 2005, while attempting to refill Lake Murray. Under this condition, DO in the discharge from the Saluda Project should be well over the State DO standard. Also, inflow water quality (*i.e.*, DO and temperature) will change slowly over the course of the summer and early autumn. The need for LUTs under this condition is minimal, so LUTs for only one temperature scenario were prepared.
2. Two sets of LUTs were prepared: one set for brief periods of higher flow hourly operations where the DO target is 4 mg/L (see discussion below), and the other set for daily operations where the DO target is 5 mg/L, *i.e*., the daily operations tables will be applied when Saluda is being operated around the clock under steady state conditions, the hourly operations tables will be applied when special circumstances, as described in paragraph 9.3 of the Settlement Agreement, necessitate operating for brief periods of greater generation. An analysis of historical conditions (see the report supporting the new site-specific standard for DO for the Lower Saluda River) showed that if 4 mg/L was achieved over a period of several hours during a typical day of operations at the Saluda Project, the other requirements of the DO standard (*i.e.,* the daily average of 5 mg/L and the 30-day moving average of 5.5 mg/L) are achieved under almost all conditions. Considering the current aeration systems, the lack of computerized powerhouse controls, and the DO monitoring system, the use of these two sets of LUTs is considered to be what is practicable.

3. Additional sets of LUTs will be prepared for other temperature conditions if temperatures in the intakes are different than assumed for preparation of these LUTs.
4. For special operating conditions, which typically last only a few hours on days when they occur, it was assumed that the target minimum DO would be 4 mg/L during the period of maximum discharge. This is because an analysis of historical conditions showed that if 4 mg/L was achieved during the maximum discharge period, the other requirements of the DO standard (*i.e.*, the daily average of 5 mg/L and the 30-day moving average of 5.5 mg/L) are achieved under almost all conditions.
5. For days when special operation is not required, it was assumed that the target minimum DO would be 5 mg/L. This approach is consistent with the assumption that SCE&G plans to operate the Saluda Project at around 400 cfs during the low DO period of 2005.

Inflow water quality for Unit 5 was assumed to have the same conditions as the inflows for Units 1- 4. This is a conservative assumption in that DO in the inflow to Unit 5 is rarely less than the DO in the inflows to Units 1- 4. This is based upon an extensive review of historical reservoir profile data.

The following LUTs are proposed for the initial operating guides for achieving aeration objectives during the low DO period of 2005. Figures 1 and 2 show the predicted DO concentrations in the tailrace based on operating the Saluda Project according to the LUTs. The technical processes used in developing the LUTs are provided on the Appendix.

LOOKUP TABLES FOR HOURLY PEAKING OPERATIONS

(DO TARGET IS GREATER THAN OR EQUAL TO 4 MG/L)

Turbine Inflow Conditions: DO 3 - 4 mg/L; Temperature = 14°C	
If peak MWs are anticipated to be:	**Then operate Unit(s) hourly:**
Any MW	Normal operations

* See discussion on Page 1, Paragraph 1, and Items 2 and 4 on Pages 9 and 10.

Turbine Inflow Conditions: DO 2 - 3 mg/L; Temperature = 15°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) hourly:**
≤ 21	≤ 1750	Any unit, except Unit 2; if unit 5 is used, 22 MW could be generated
≤ 30	≤ 2350	Any unit; except Units 2 and 3
≤ 34	≤ 2700	Units 1 or 5
≤ 50	≤ 4000	Unit 5; or flow split between any combination of two of Units 1, 3, or 4;
≤ 60	≤ 4700	Unit 5; or flow split between Units 1 and 3 or 4;
≤ 63	≤ 5000	Flow split between Units 5 and 1, 3, or 4; flow split between Units 1 and 4; flow split between 2 and any other 2 units
≤ 93	≤ 7400	Flow split between Units 1 and 5, but flow in Unit 1 limited to 2700 and flow in Unit 5 limited to 4700; flow split between Units 1 and 5 with Units 2, 3, or 4; flow split between Units 1, 2, and 4
≤ 126	≤ 10,000	Flow split between any four Units
≤ 151	≤ 12,000, limit for 4 mg/L	Flow split between any four Units, with Unit 5 operating up to 4500 cfs and the other 3 units operating at 2500 cfs; flow split between 5 units
≥ 151	≥ 12,000	Flow split between all five units, with Unit 5 operating at peak flow

Turbine Inflow Conditions: DO 1 - 2 mg/L; Temperature = 16°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) hourly:**
≤ 15	≤ 1350	Any unit, except Unit 2; if unit 5 is used, 17 MW could be generated
≤ 21	≤ 1850	Units 1 or 4; or flow split between Units 3 and 5
≤ 27	≤ 2300	Unit 1; or flow split between Unit 5 and unit 3 or 4;
≤ 31	≤ 2750	Flow split between any combination of two of Units 1, 3, 4, or 5;
≤ 43	≤ 3700	Flow split between Units 1 and 4; flow split between Unit 5 and units 1 and 3 or units 4 and 3
≤ 48	≤ 4100	Unit 1 maximum flow of 2500 and Unit 2 or 4 at maximum flow of 1600; or flow split between Unit 5 any other two Units;
≤ 70	≤ 6000	Flow split between Units 1, 2, and 4; flow split between any four units
≤ 91	≤ 7400	Flow split between Units 1, 4, 2, and 3 or 5.
≤ 109	≤ 8800, limit for 4 mg/L	7400 cfs split between Units 1- 4 with 1400 cfs through Unit 5
≤ 146	≤ 12,000	Flow split between all five units, with Unit 5 operating at peak flow
≤ 175	≤ 15,000	Flow split between Units 1, 2, 4, and 5, using equal gate settings (*i.e.*, U5 would have ~ twice as much flow)
≥ 175	≥ 15,000, min. DO ~ 2.5 mg/L	See previous policy, except when flow > 15,000 all additional flow goes through Unit 3 (*i.e.*, Unit 3 is the last unit turned on)

Turbine Inflow Conditions: DO 0 - 1 mg/L; Temperature = 16°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) hourly:**
≤ 11	≤ 1050	Any unit, except Unit 2; if unit 5 is used, 13 MW could be generated
≤ 18	≤ 1600	Units 1 or 4; or flow split between Units 3 and 5
≤ 23	≤ 2000	Unit 1; or flow split between any combination of two of Units 3, 4, or 5;
≤ 36	≤ 3200	Flow split between Units 1 and 4; flow split between Unit 5 and units 1 and 3 or units 4 and 3
≤ 60	≤ 5200	Flow split between Units 1, 2, and 4; flow split between Unit 5 and any three Units;
≤ 64	≤ 5600	Flow split between Unit 1 and any other three units
≤ 76	≤ 6400	Flow split between Units 1, 4, 2, and 3 or 5.
≤ 89	≤ 7500, limit for 4 mg/L	6400 cfs split between Units 1- 4 with 1100 cfs through Unit 5
≤ 151	≤ 12,000, min. DO ~ 2.5 mg/L	Flow split between Units 1, 2, 4, and 5, using equal gate settings (*i.e.*, U5 would have ~ twice as much flow as any other unit)
≤ 184	≤ 15,000, min. DO ~ 1.6 mg/L	Flow split between Units 1, 2, 4, and 5, using equal gate settings (*i.e.*, U5 would have ~ twice as much flow)
≥ 184	≥ 15,000, min. DO ~ 1.5 mg/L	See previous policy, except when flow > 15,000 all additional flow goes through Unit 3 (*i.e.*, Unit 3 is the last unit turned on)

Turbine Inflow Conditions: DO 0 - 1 mg/L; Temperature = 20°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) hourly:**
≤ 6	≤ 700	Any unit, except Unit 2; if unit 5 is used, 8 MW could be generated
≤ 12	≤ 1200	Units 1 or 4; or flow split between Units 3 and 5
≤ 17	≤ 1600	Unit 1; or flow split between Unit 5 and unit 3 or unit 4
≤ 25	≤ 2400	Flow split between Units 1 and 4; flow split between Unit 5 and units 1 and 3 or units 4 and 3
≤ 43	≤ 4000	Flow split between Units 1, 2, and 4; flow split between Unit 5 and any three units, preferably with Unit 1 if both Units 3 and 5 are operated.
≤ 49	≤ 4600	Flow split between Units 1, 2, 4, and Unit 3 or 5.
≤ 57	≤ 5300, limit for 4 mg/L	Flow split between five units
≤ 89	≤ 7500, limit for ~ 3 mg/L	6400 cfs split between Units 1- 4 with 1100 cfs through Unit 5
≤ 126	≤ 10,000, min. DO ~ 2	6000 cfs split between Units 1, 2, and 4, and all additional flow goes through Unit 5
≤ 151	≤ 12,000, min. DO ~ 1.5	6000 cfs split between Units 1, 2, and 4, and all additional flow goes through Unit 5 until it peaks at maximum flow
≤ 175	≤ 15,000	Same as previous, except increase flow through Units 1, 2, and 4 until they reach peak flow
≥ 175	≥ 15,000, min. DO ~ 0.5	See previous policy, except when flow > 15,000 all additional flow goes through Unit 3 (*i.e.*, Unit 3 is the last unit turned on)

Lookup Tables for Daily Operations

(DO Target Is Greater Than or Equal to 5 mg/L)

Turbine Inflow Conditions: DO = 4 mg/L; Temperature = 14°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) daily:**
≤ 20	≤ 1700	Any unit except Unit 2.
≤ 28	≤ 2250	Units 1, 4, or 5;
≤ 33	≤ 2650	Units 1 or 5; flow split between units 3 and 4, but MWs need to be limited to 30
≤ 43	≤ 3400	Unit 5; flow split between any two units, except Unit 2, but MWs need to be limited to 41
≤ 57	≤ 4550	Unit 5; flow split between units 1 and 4; flow split between any three units, but MWs need to be limited to 53
≤ 90	≤ 7200	Unit 5 up to 4550 and Unit 1 up to 2650; flow split between any three units except Unit 3
≤ 148	≤ 11,700	Unit 5 up to 4550 and flow split between Units 1, 2, and 4
≤ 168	≤ 13,400, limit for 5 mg/L	Unit 5 up to 4550, flow split between Units 1, 2, and 4 (as in previous level for 11,700 cfs), and add flow through Unit 3 as needed up to 1700 cfs
≥ 168	≥ 13, 400, min. DO ~ 4.4 mg/L	Flow split between five units

*See discussion on Page 1 Paragraph 1, and Items 2 and 4 on Pages 9 and 10.

Turbine Inflow Conditions: DO = 3 mg/L; Temperature = 15°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) daily:**
≤ 15	≤ 1300	Any unit; except Unit 2; if unit 5 is used, 16 MW could be generated
≤ 22	≤ 1800	Units 1 or 4; flow split between units 3 and 5 but MWs need to be limited to 20
≤ 27	≤ 2200	Unit 1; flow split between any two units, except Unit 2, but MWs need to be limited to 23 unless Unit 5 is one of the units and then the MW limit would be 25
≤ 50	≤ 4000	Flow split between Units 1 and 4; flow split between units 2, 3, and 5 but MWs need to be limited to 47
≤ 70	≤ 5700	Flow split between Units 1, 2, and 4; flow split between any four units but MWs need to be limited to 65
≤ 88	≤ 7200	Flow split between Units 1, 2, 4, and Unit 3 or 5; flow split between Unit 1 and any three of the other units
≤ 103	≤ 8500, limit for 5 mg/L	Flow split between all five Units
≥ 103	≥ 8500, min. DO ~ 3.4 mg/L	Flow split between all five Units

Turbine Inflow Conditions: DO = 2 mg/L; Temperature = 16°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) daily:**
≤ 9	≤ 900	Any unit; except Unit 2; if unit 5 is used, 11 MW could be generated
≤ 17	≤ 1500	Units 1 or 4; flow split between units 3 and 5 but MWs need to be limited to 16
≤ 22	≤ 1850	Unit 1; flow split between unit 5 and unit 3 or 4 but MWs need to be limited to 20; flow split between units 3 and 4 but MWs need to be limited to 18
≤ 40	≤ 3300	Flow split between Units 1 and 4; flow split between any three units, except Unit 2, but MWs need to be limited to 37
≤ 57	≤ 4800	Flow split between Units 1, 2, and 4; flow split between any four units but MWs need to be limited to 52 unless unit 5 is one of the units and then MWs need to be limited to 54
≤ 64	≤ 5600	Flow split between Units 1, 2, 4, and Unit 3 or 5; flow split between Unit 1 and any three of the other units
≤ 78	≤ 6750, limit for 5 mg/L	Flow split between all five Units
≥ 78	≥ 6750, min. DO ~ 2.4 mg/L	Flow split between all five Units

Turbine Inflow Conditions: DO = 1 mg/L; Temperature = 16°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) daily:**
≤ 6	≤ 700	Any unit, except Unit 2; if unit 5 is used, 8 MW could be generated
≤ 9	≤ 900	Any unit, except Units 2 and 3
≤ 13	≤ 1200	Units 1 or 4; flow split between units 3 and 5
≤ 19	≤ 1600	Unit 1; flow split between unit 5 and 4 or 3, but MWs need to be limited to 17; flow split between units 3 and 4 but MWs need to be limited to 15
≤ 32	≤ 2800	Flow split between Units 1 and 4; flow split between any three units, except Unit 2, but MWs need to be limited to 30
≤ 43	≤ 3900	Flow split between Units 1, 2, and 4; flow split between any four units but MWs need to be limited to 42
≤ 50	≤ 4600	Flow split between Units 1, 2, 4, and Unit 3 or 5; flow split between any five units but MWs need to be limited to 48
≤ 53	≤ 5000, limit for 5 mg/L	Flow split between all five Units
≤ 89	≤ 7500, min. DO ~ 4 mg/L	6400 cfs split between Units 1- 4 with 1100 cfs through Unit 5
≤ 151	≤ 12,000, min. DO ~ 2.5 mg/L	Flow split between Units 1, 2, 4, and 5, using equal gate settings (*i.e.*, U5 would have ~ twice as much flow)
≤ 184	≤ 15,000, min. DO ~ 1.6 mg/L	Flow split between Units 1, 2, 4, and 5, using equal gate settings (*i.e.*, U5 would have ~ twice as much flow)
≥ 184	≥ 15,000, min. DO ~ 1.5 mg/L	See previous policy, except when flow > 15,000 all additional flow goes through Unit 3 (*i.e.*, Unit 3 is the last unit turned on)

Turbine Inflow Conditions: DO = 0 mg/L; Temperature = 20°C		
If peak MWs are anticipated to be:	**Approximate peak flow associated with MW (cfs):**	**Then operate Unit(s) daily:**
≤ 7	≤ 800	Any unit; except Units 2 and 3; if unit 5 is used, 10 MW could be generated
≤ 11	≤ 1100	Unit 1; or flow split between any two units, except Unit 2, but MWs need to be limited to 9
≤ 19	≤ 1600	Unit 1; or flow split between unit 5 and 4 or 3, but MWs need to be limited to 17; flow split between units 3 and 4 but MWs need to be limited to 15
≤ 19	≤ 1900	Flow split between Units 1 and 4; flow split between any three units, except Unit 2
≤ 30	≤ 3000	Flow split between Units 1, 3, 4, and 5 (Unit 2 cannot be used)
≤ 40	≤ 4000, limit for 5 mg/L	Flow split between five units
≤ 57	≤ 5300, limit for 4 mg/L	Flow split between five units
≤ 89	≤ 7500, limit for ~ 3 mg/L	6400 cfs split between Units 1- 4 with 1100 cfs through Unit 5
≤ 125	≤ 10,000, min. DO ~ 2	6000 cfs split between Units 1, 2, and 4, and all additional flow goes through Unit 5
≤ 151	≤ 12,000, min. DO ~ 1.5	6000 cfs split between Units 1, 2, and 4, and all additional flow goes through Unit 5 until it peaks at maximum flow
≤ 184	≤ 15,000	Same as previous, except increase flow through Units 1, 2, and 4 until they reach peak flow
≥ 184	≥ 15,000, min. DO ~ 0.5	See previous policy, except when flow > 15,000 all additional flow goes through Unit 3 (*i.e.*, Unit 3 is the last unit turned on)

APPENDIX B

FIGURES

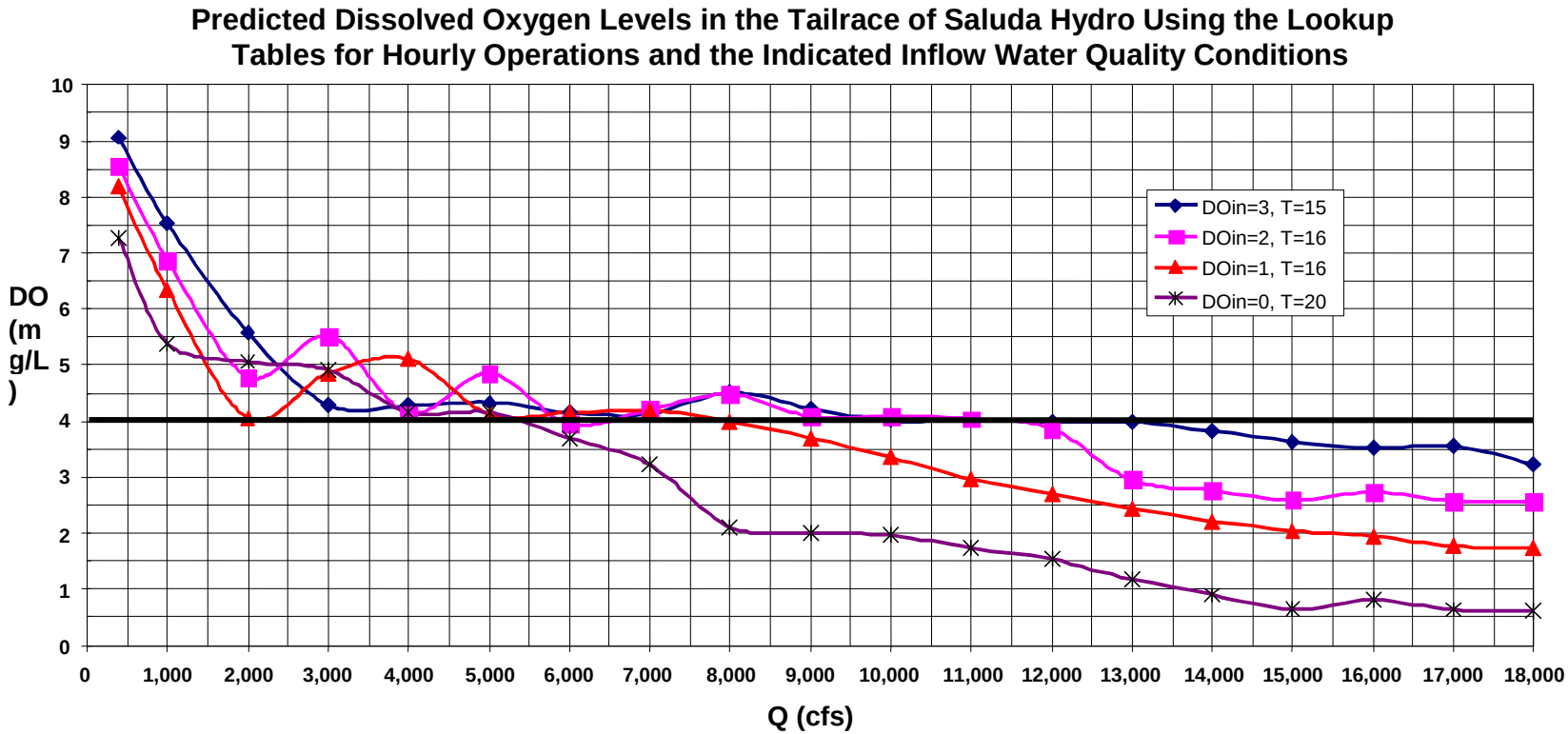

Figure 1: Predicted DO in the tailrace based on the LUTs for hourly operations, *i.e.*, for peaking operations

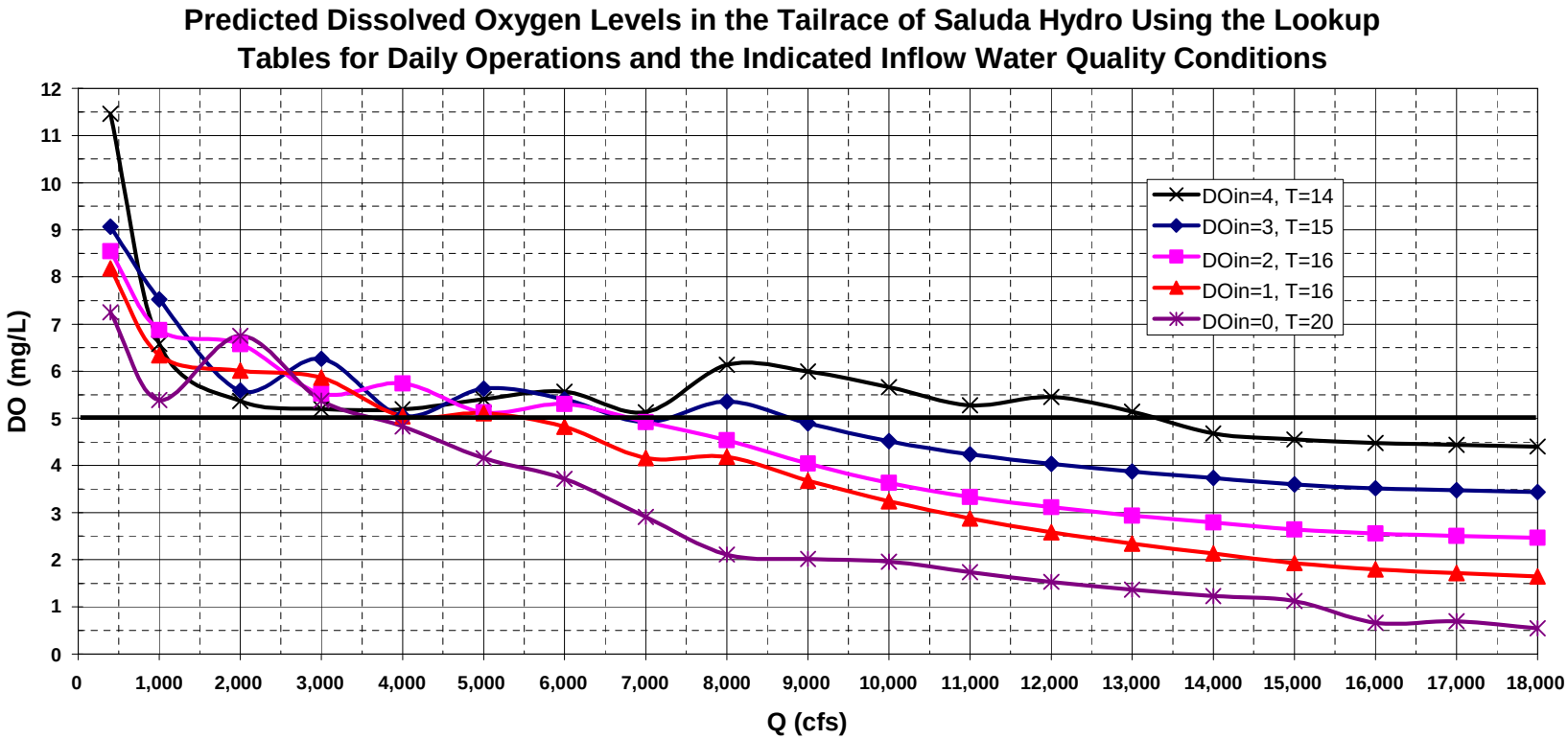

Figure 2: Predicted DO in the tailrace based on the LUTs for daily operations, *i.e.*, for low flow and high flow operations for water management.

APPENDIX C

ADDITIONAL BACKGROUND

ADDITIONAL BACKGROUND ON DERIVATION OF THE LOOKUP TABLES FOR OPERATING THE SALUDA PROJECT TO ACHIEVE DO STANDARDS

This appendix provides the technical procedure used to develop the LUTs.

The overall process used to develop the LUTs involved the following steps:

1. The individual models for each unit were used to predict DO in the tailrace over the range of turbine gate settings (*i.e.*, turbine flow conditions) for various DO and temperature levels in the inflows
2. The predicted DO in the tailrace for each unit was then plotted for all the inflow conditions on one graph—see Figures A1-A5.
3. Then the predicted DO in the tailrace for each inflow DO and temperature condition was plotted for all the turbines on one graph—see Figures A6-A10.
4. The LUTs were then developed using these graphs. One set of LUTs was developed assuming that the units were operated for peaking purposes and the other set of LUTs was developed assuming the units were operated in a similar pattern over the course of the entire day.
5. LUTs were developed for a range of DO conditions in the inflow, but for only one temperature condition that was similar to that expected during the summer of 2004. Model predictions were made for other temperature conditions, but the effort was not expended to develop LUTs for all the temperature conditions modeled due to the time required to develop LUTs (about 17 additional LUTs would be needed to cover the full range of temperature conditions, and each LUT takes two-three hours to develop and check.) Also, it appears from the model runs at other temperature conditions that adjustments in LUTs would be minor and even if the LUTs were not adjusted the impact to DO would be immeasurable (*i.e.*, 0.1-0.2 mg/L). Additional LUTs could be prepared on an "as needed basis" depending on the actual temperature conditions that develop during the summer of 2004. The results of the model runs at other temperature conditions are shown in Figures A11-27 for temperatures of up to 3 C^o different from the expected temperatures used for the LUTs.

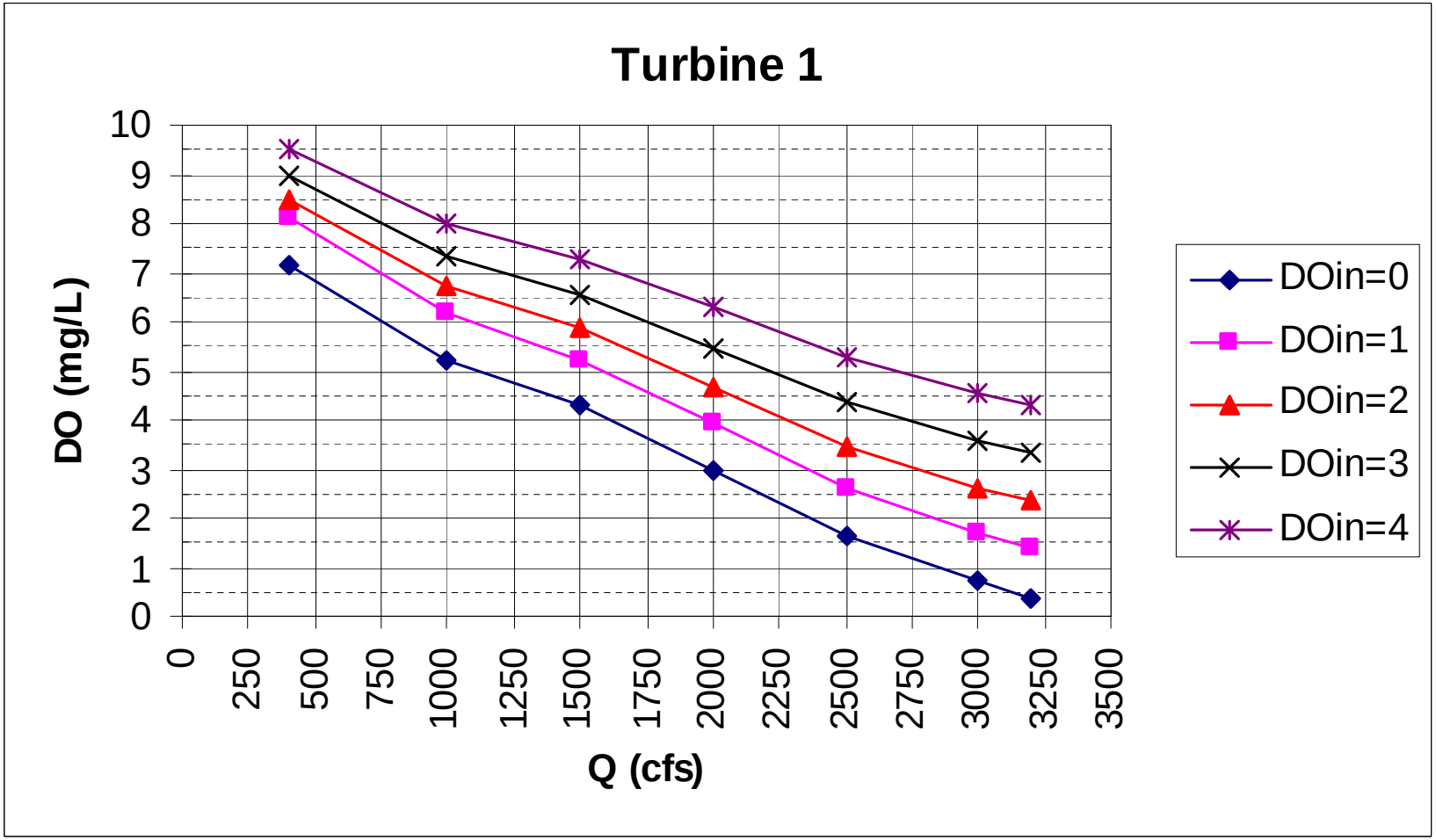

Figure A1: DO in the tailrace of Unit 1 for various DO levels in the inflow. The respective temperature conditions for these DO levels are the following: DO_{in} = 0, T=20 °; DO_{in} = 1, T=16 °; DO_{in} = 2, T=16 °; DO_{in} = 3, T=15 °; DO_{in} = 4, T=14 °.

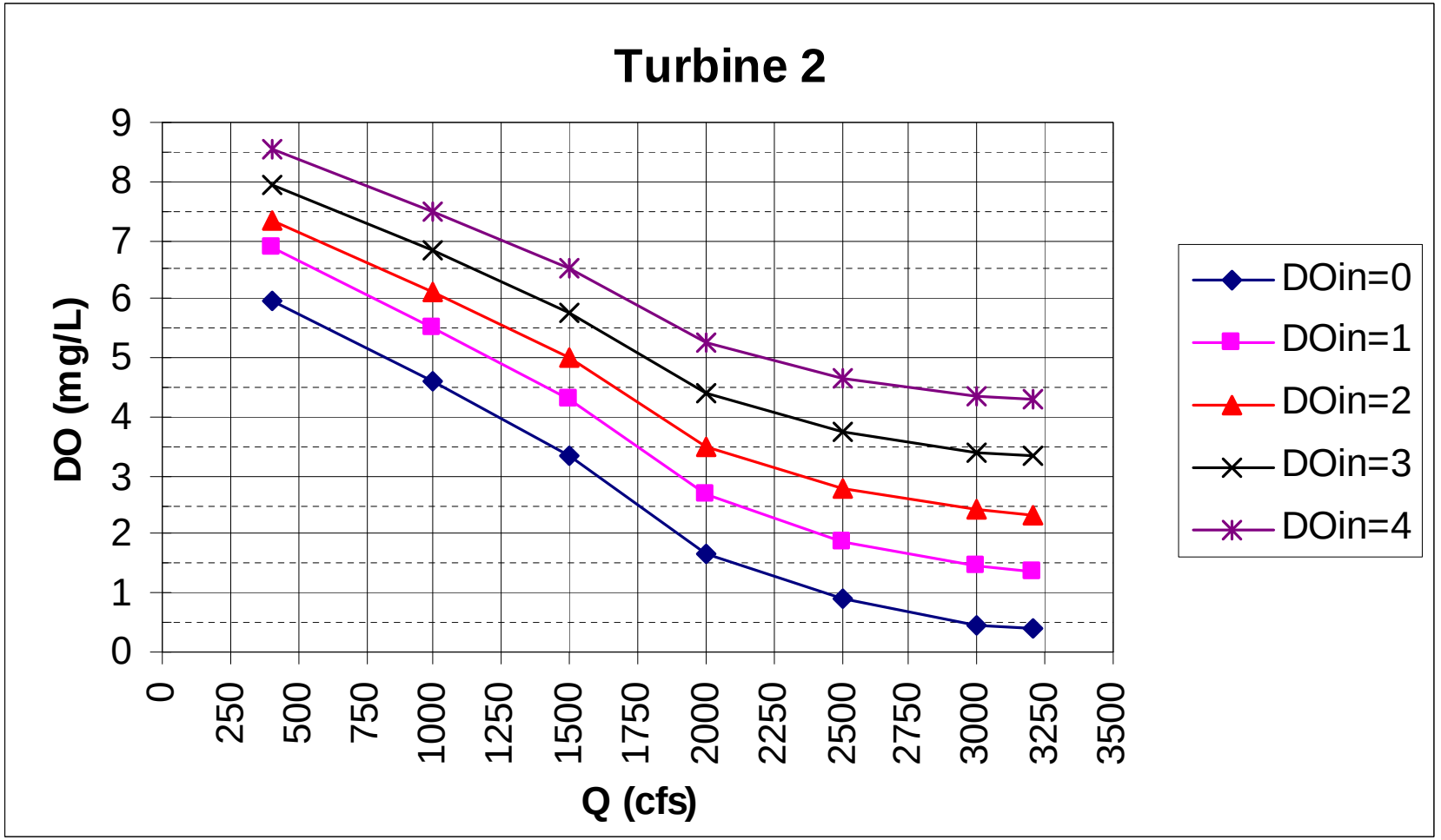

Figure A2: DO in the tailrace of Unit 2 for various DO levels in the inflow. The respective temperature conditions for these DO levels are the following: DO_{in} = 0, T=20 °; DO_{in} = 1, T=16 °; DO_{in} = 2, T=16 °; DO_{in} = 3, T=15 °; DO_{in} = 4, T=14 °.

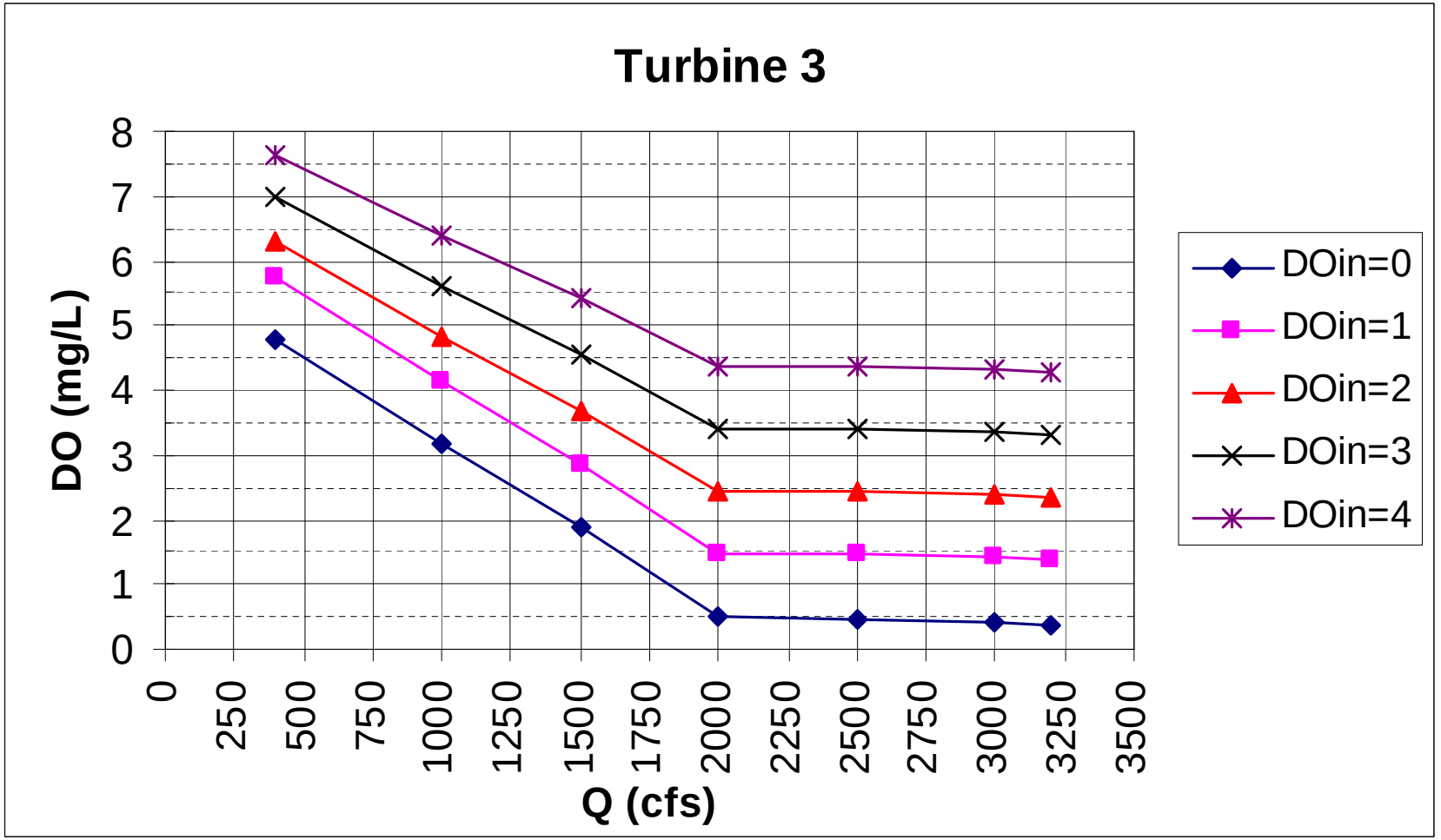

Figure A3: DO in the tailrace of Unit 3 for various DO levels in the inflow. The respective temperature conditions for these DO levels are the following: DO_{in} = 0, T=20 °; DO_{in} = 1, T=16 °; DO_{in} = 2, T=16 °; DO_{in} = 3, T=15 °; DO_{in} = 4, T=14 °.

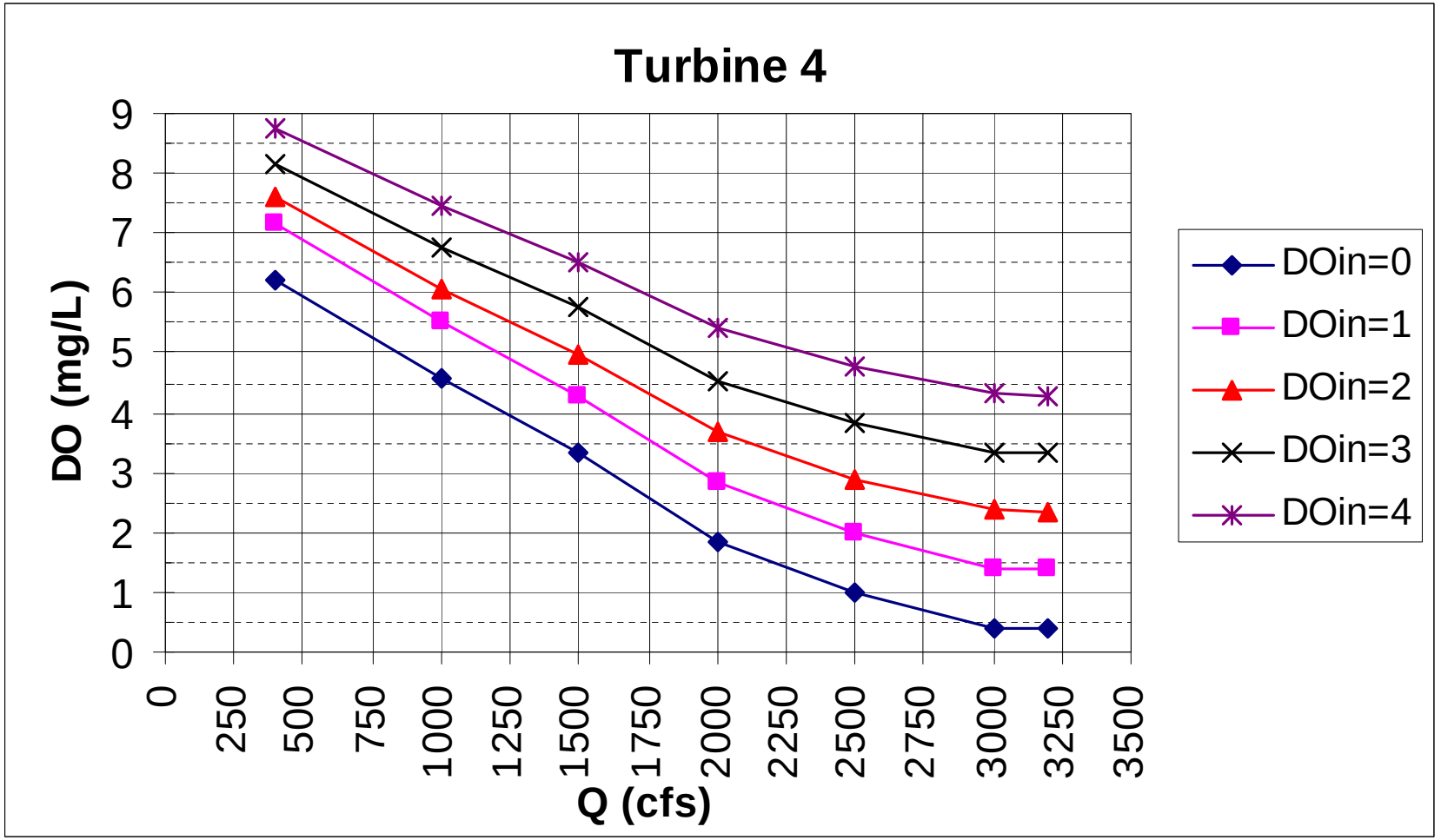

Figure A4: DO in the tailrace of Unit 4 for various DO levels in the inflow. The respective temperature conditions for these DO levels are the following: DO_{in} = 0, T=20 °; DO_{in} = 1, T=16 °; DO_{in} = 2, T=16 °; DO_{in} = 3, T=15 °; DO_{in} = 4, T=14 °.

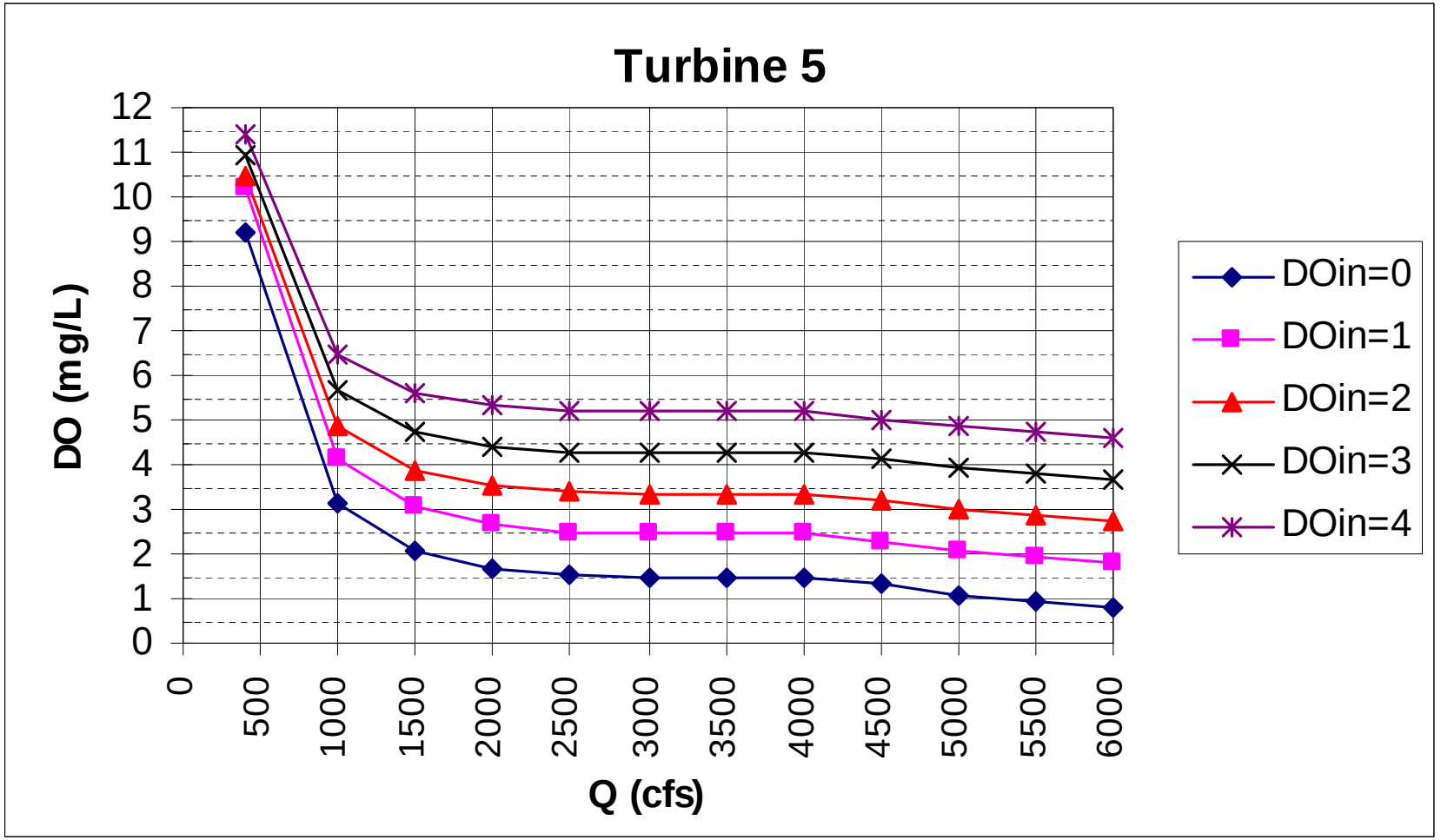

Figure A5: DO in the tailrace of Unit 5 for various DO levels in the inflow. The respective temperature conditions for these DO levels are the following: DO_{in} = 0, T=20 °; DO_{in} = 1, T=16 °; DO_{in} = 2, T=16 °; DO_{in} = 3, T=15 °; DO_{in} = 4, T=14 °.

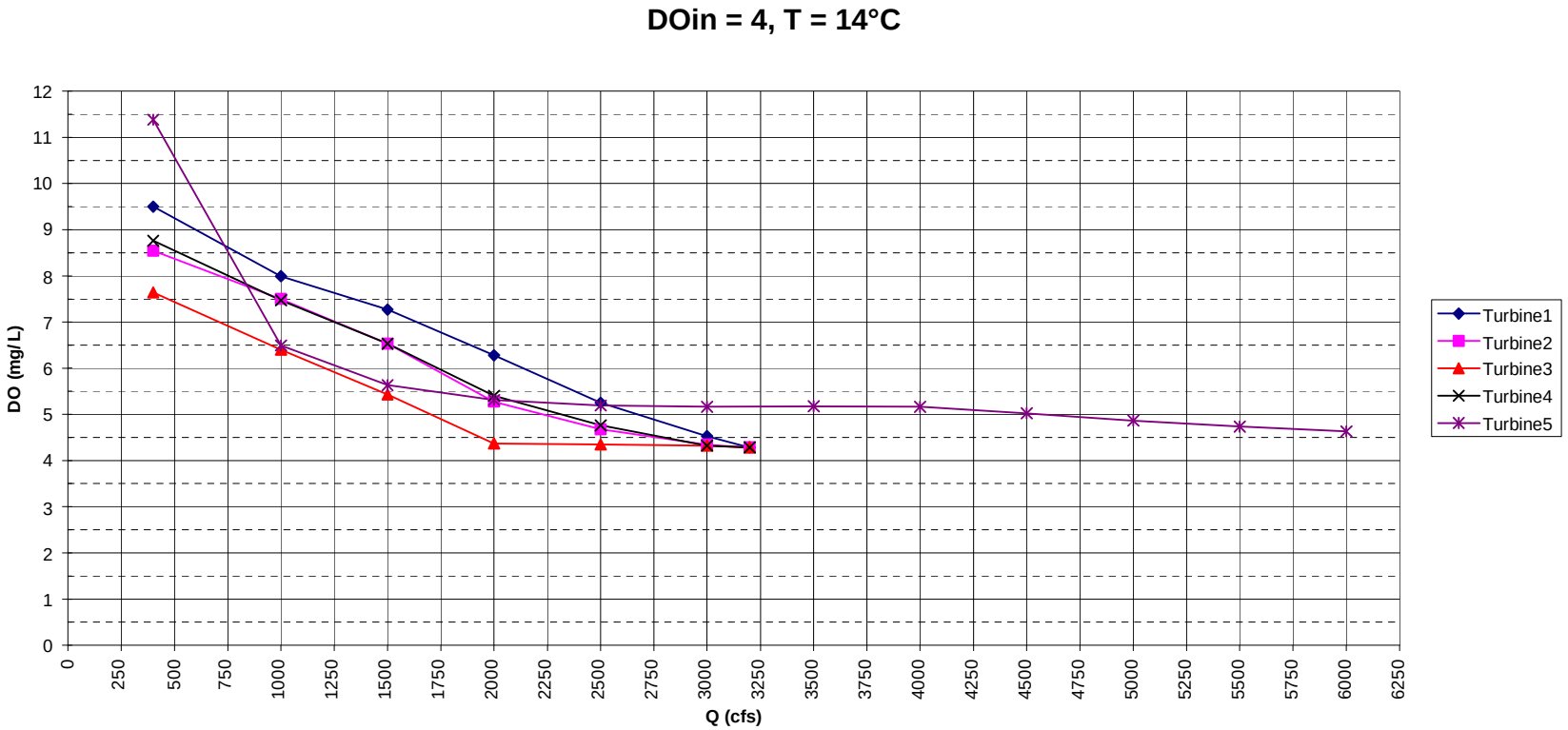

Figure A6: Predicted DO in the tailrace for the range of flow levels for each unit, for the indicated inflow conditions.

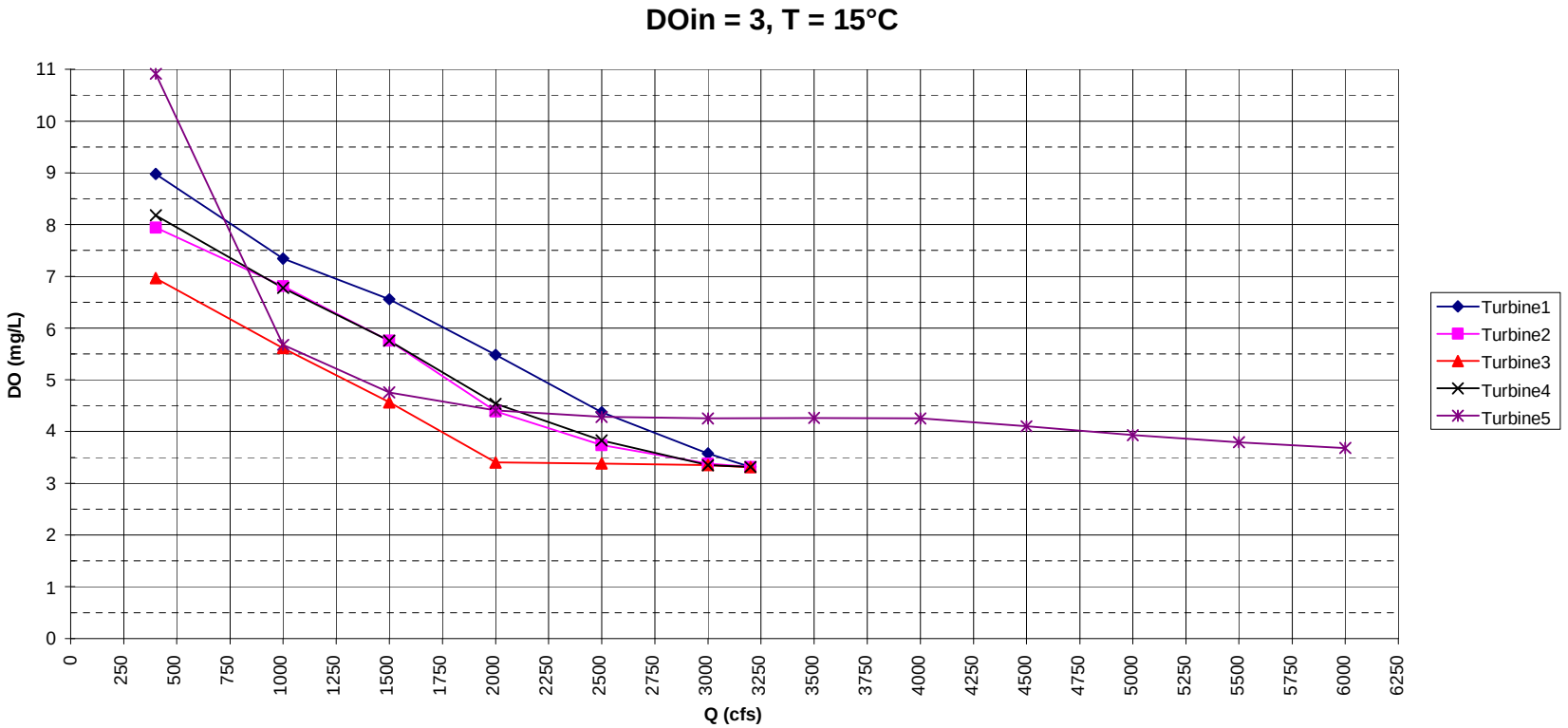

Figure A7: Predicted DO in the tailrace for the range of flow levels for each unit, for the indicated inflow conditions.

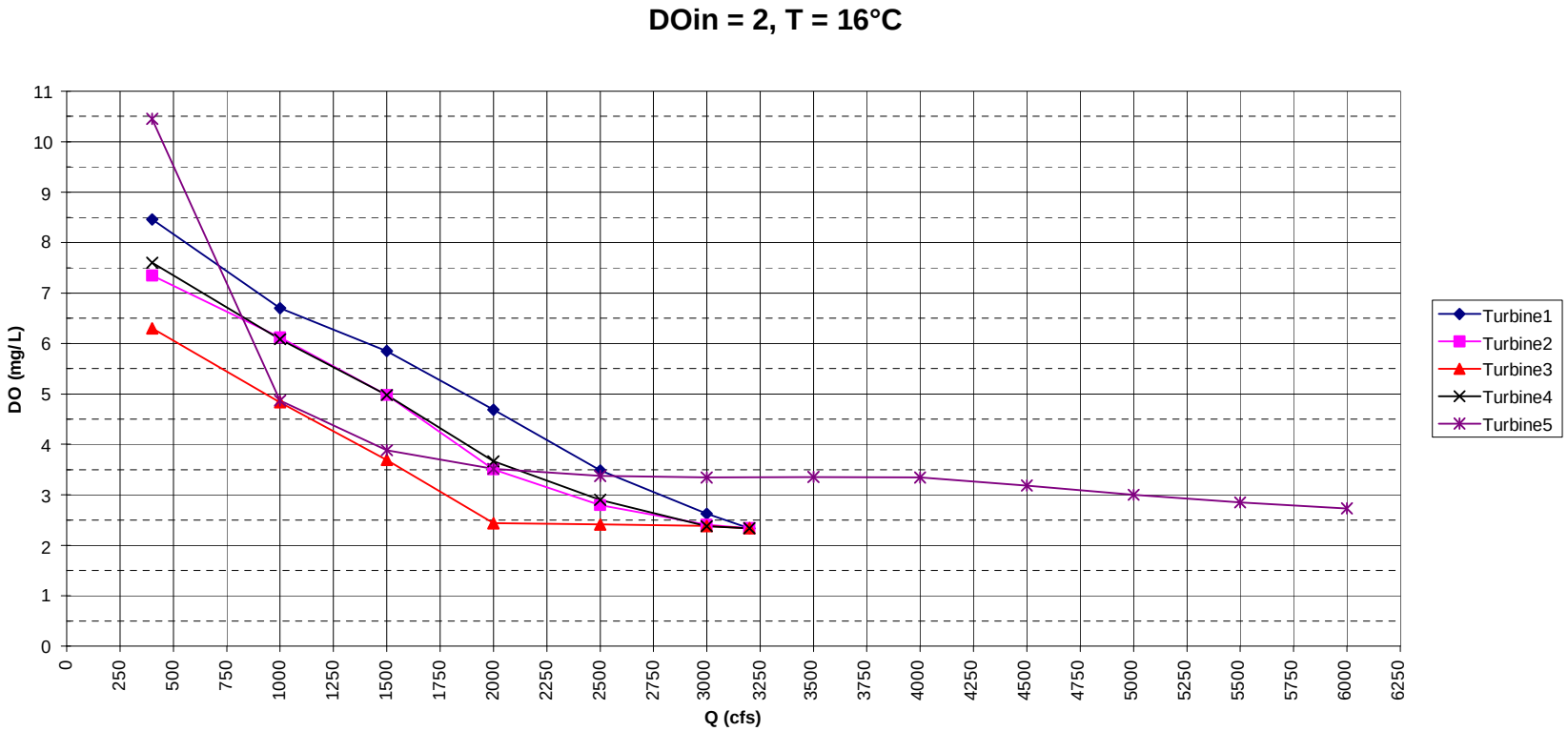

Figure A8: Predicted DO in the tailrace for the range of flow levels for each unit, for the indicated inflow conditions.

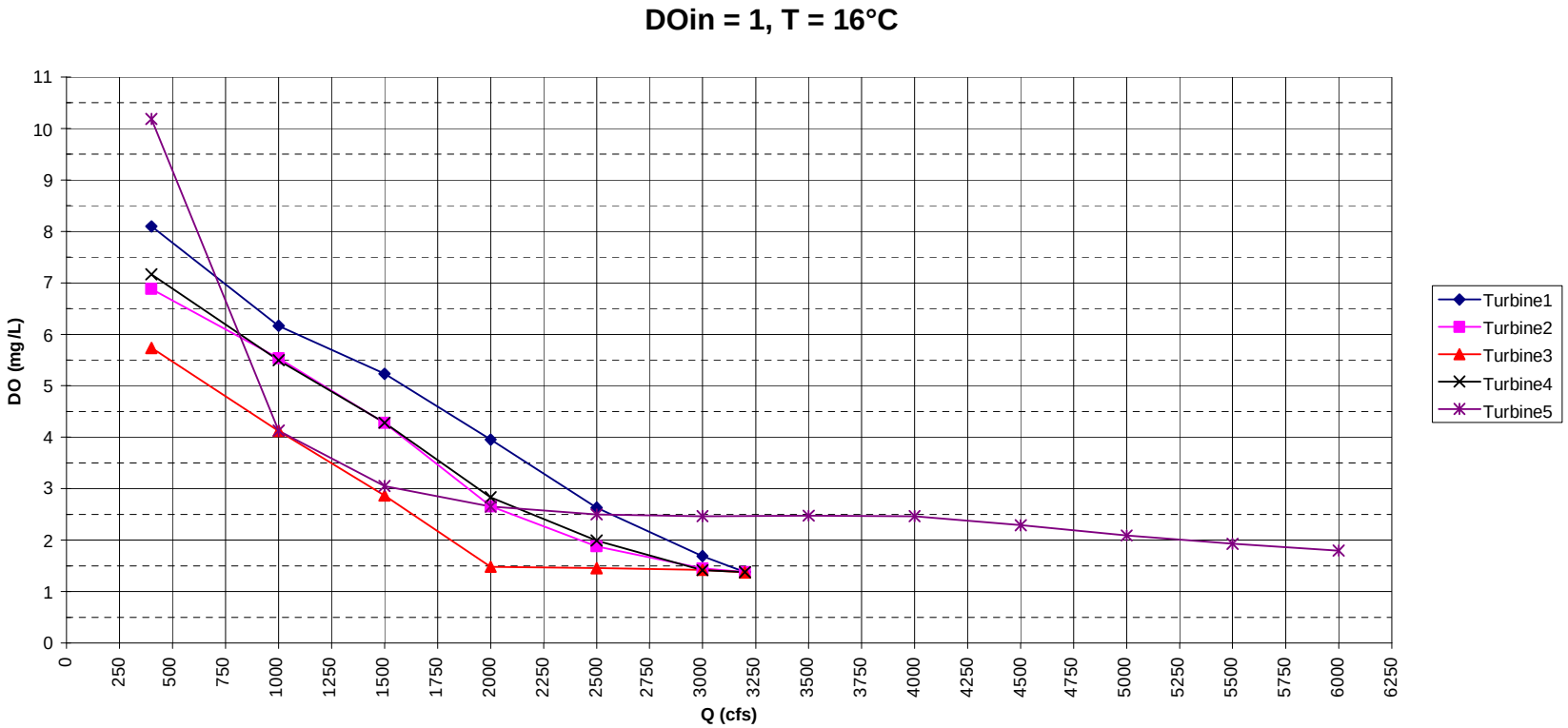

Figure A9: Predicted DO in the tailrace for the range of flow levels for each unit, for the indicated inflow conditions.

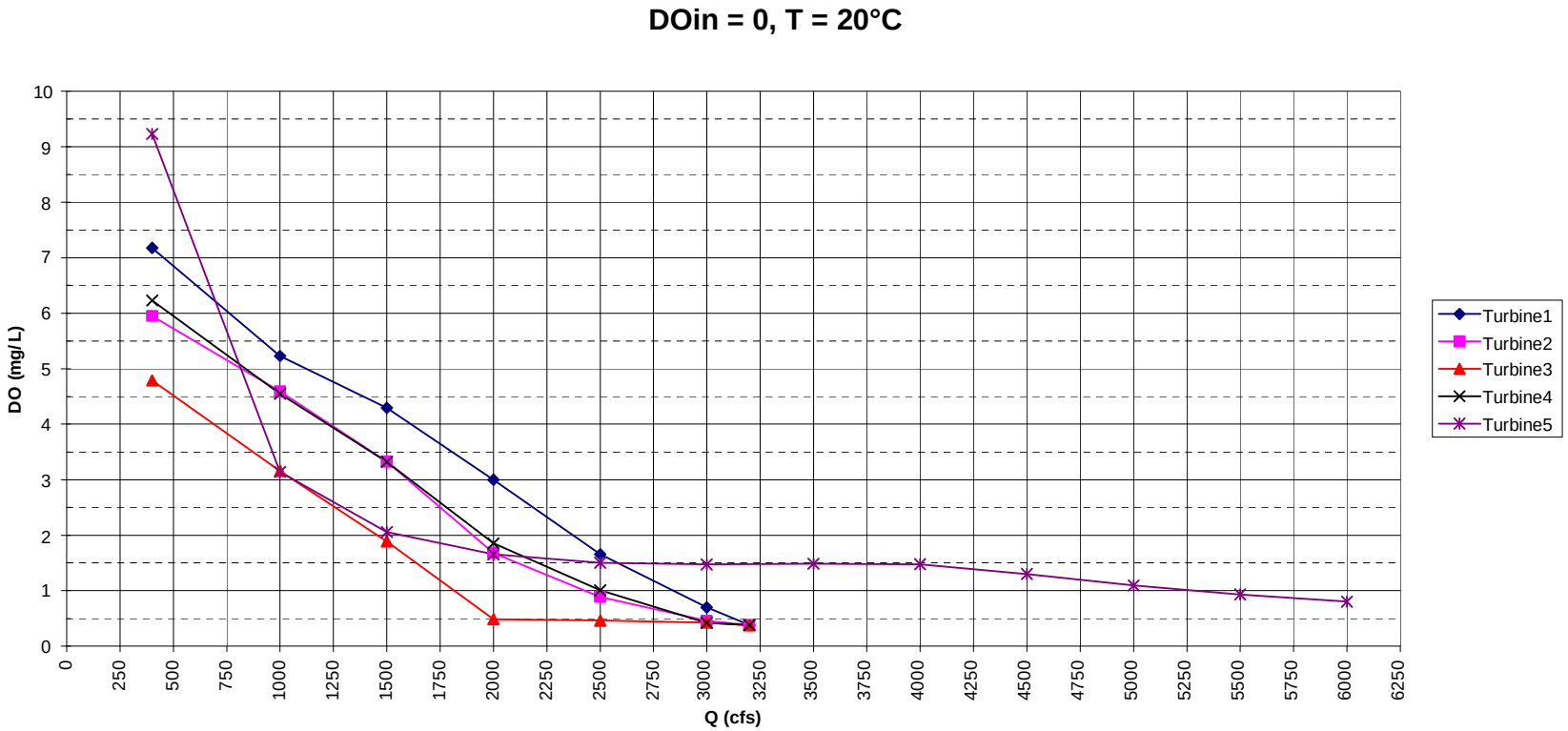

Figure A10: Predicted DO in the tailrace for the range of flow levels for each unit, for the indicated inflow conditions.

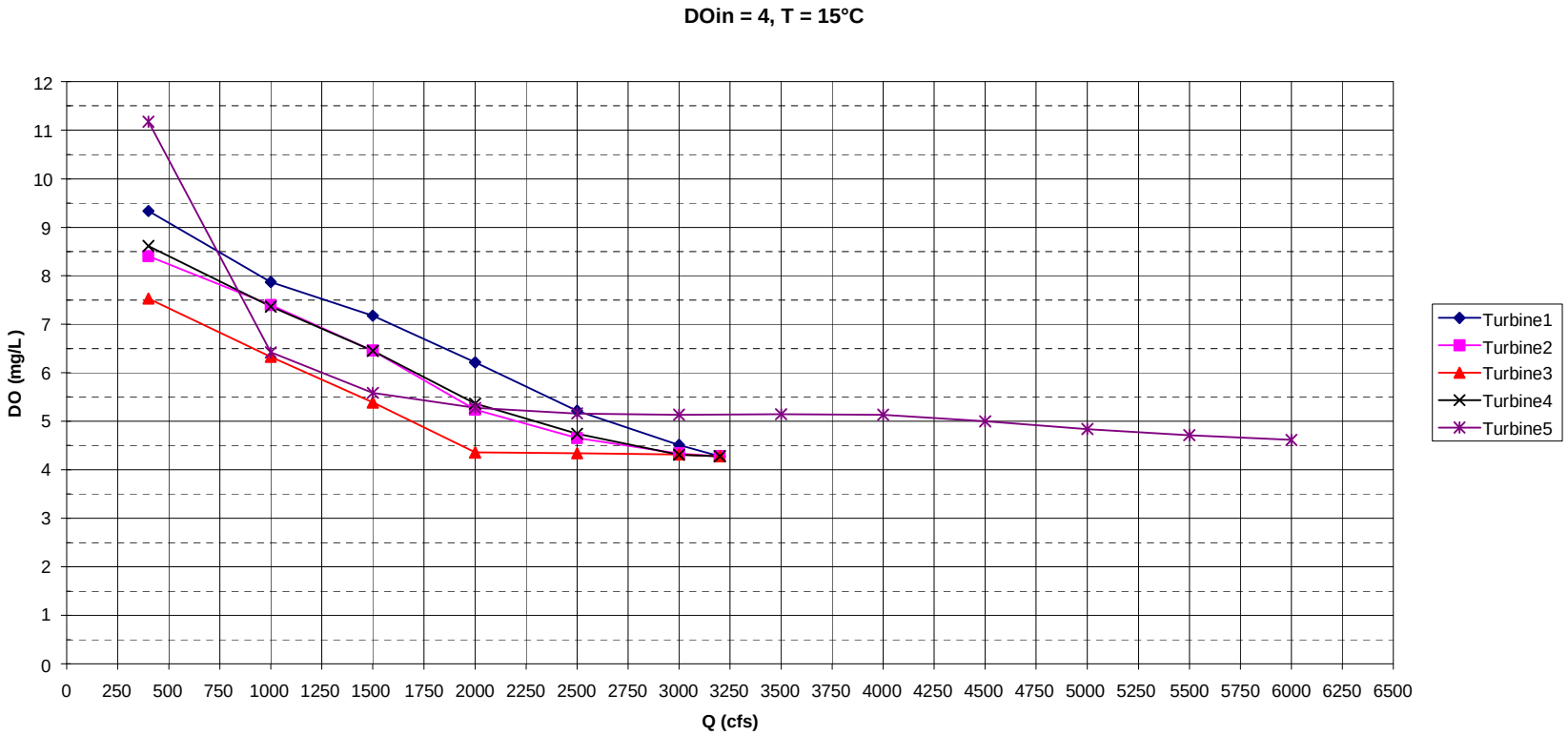

Figure A11: Sensitivity of DO uptake for DO_{in} = 4 and temperature = 15^{o}C

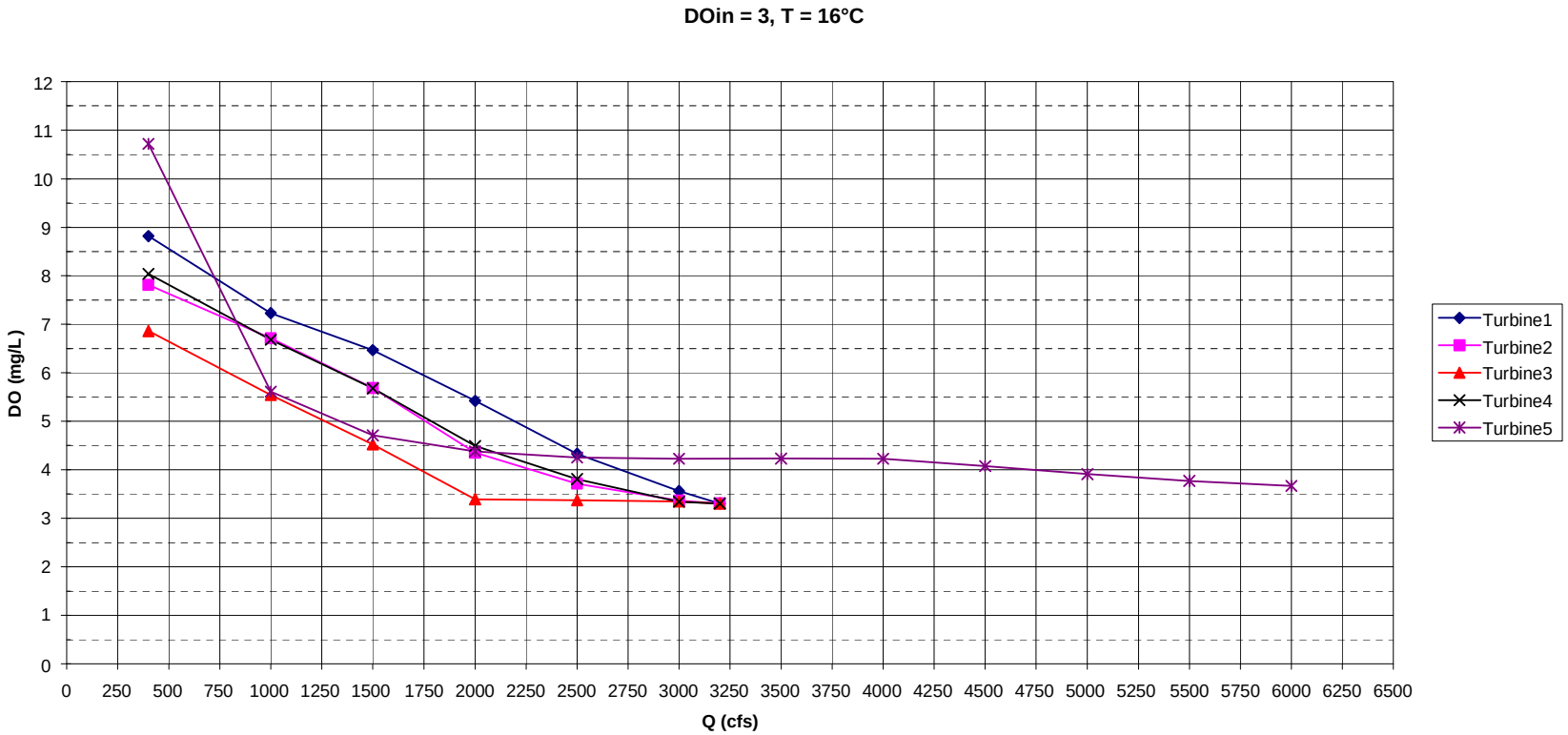

Figure A12: Sensitivity of DO uptake for DO_{in} = 3 and temperature = 16°C

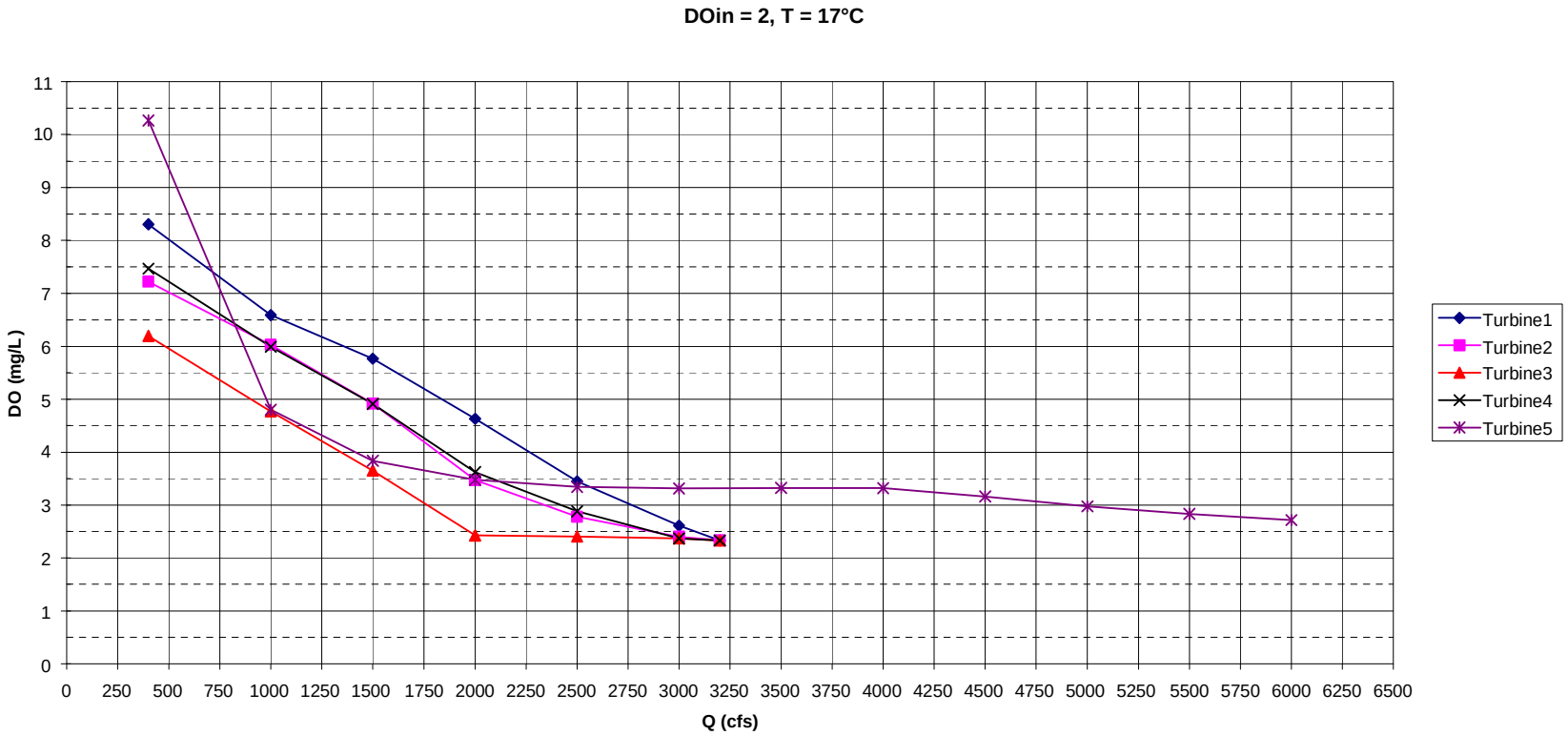

Figure A13: Sensitivity of DO uptake for DO_{in} = 2 and temperature = 17^{o}C

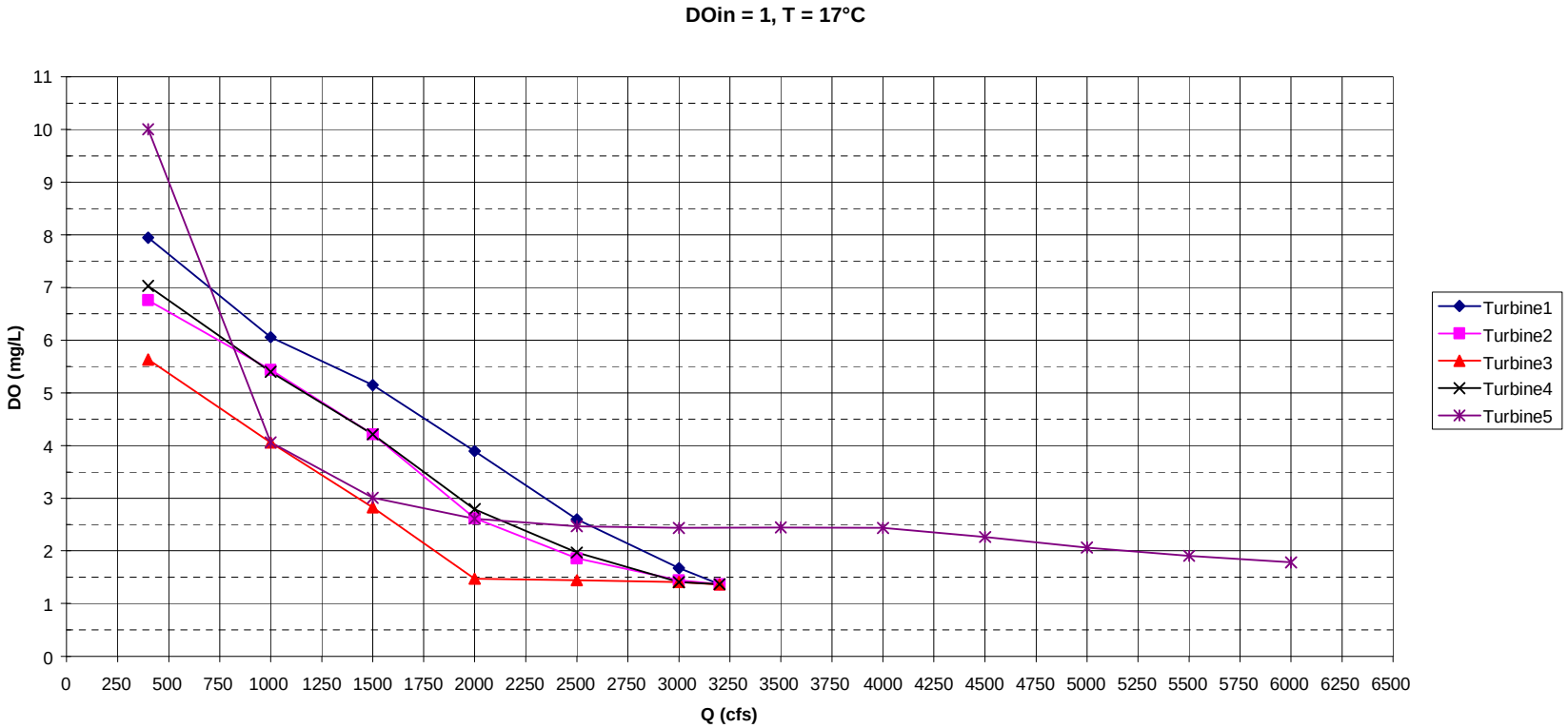

Figure A14: Sensitivity of DO uptake for DO_{in} = 1 and temperature = 17^{o}C

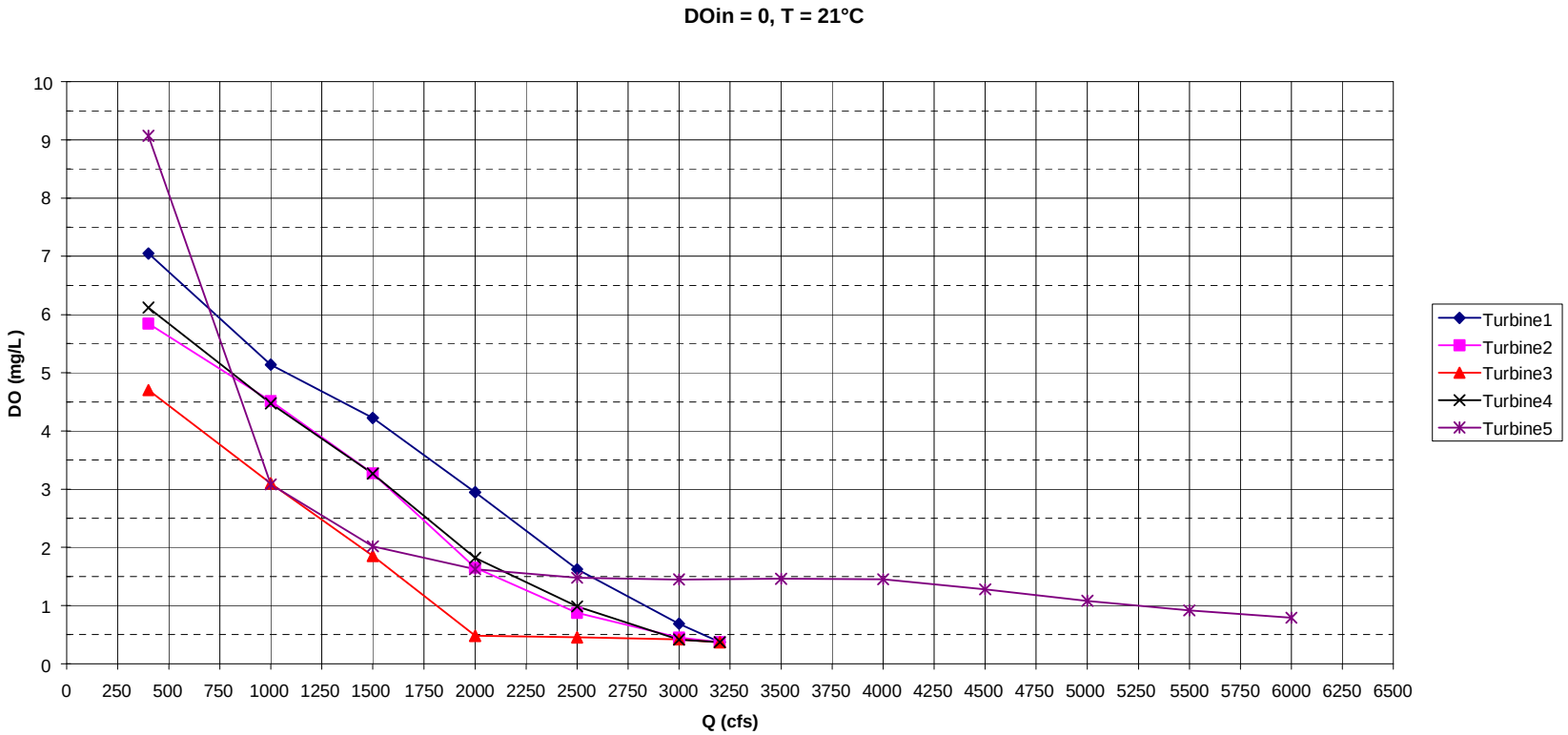

Figure A15: Sensitivity of DO uptake for DO_{in} = 0 and temperature = 21^{o}C

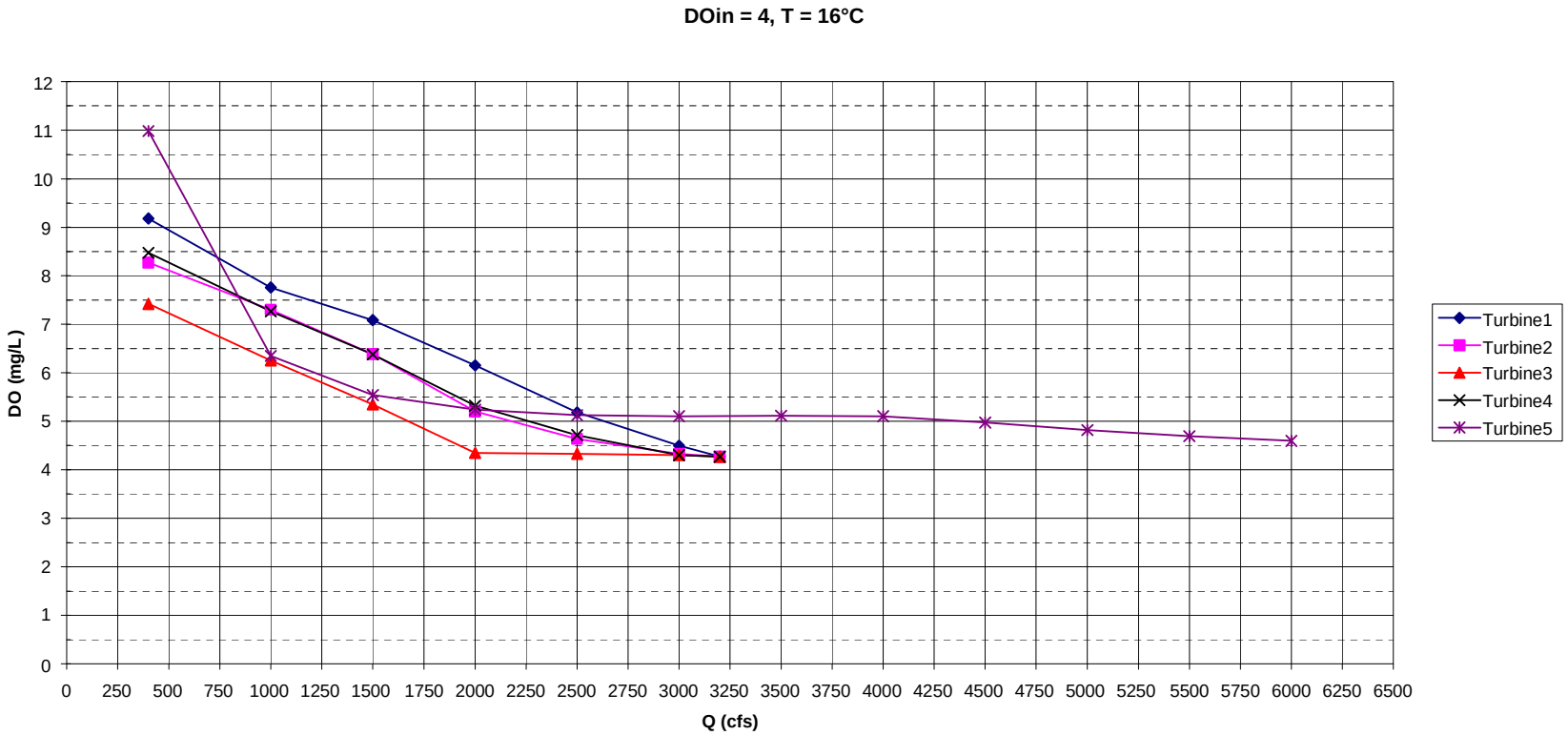

Figure A16: Sensitivity of DO uptake for DO_{in} = 4 and temperature = 16^{o}C

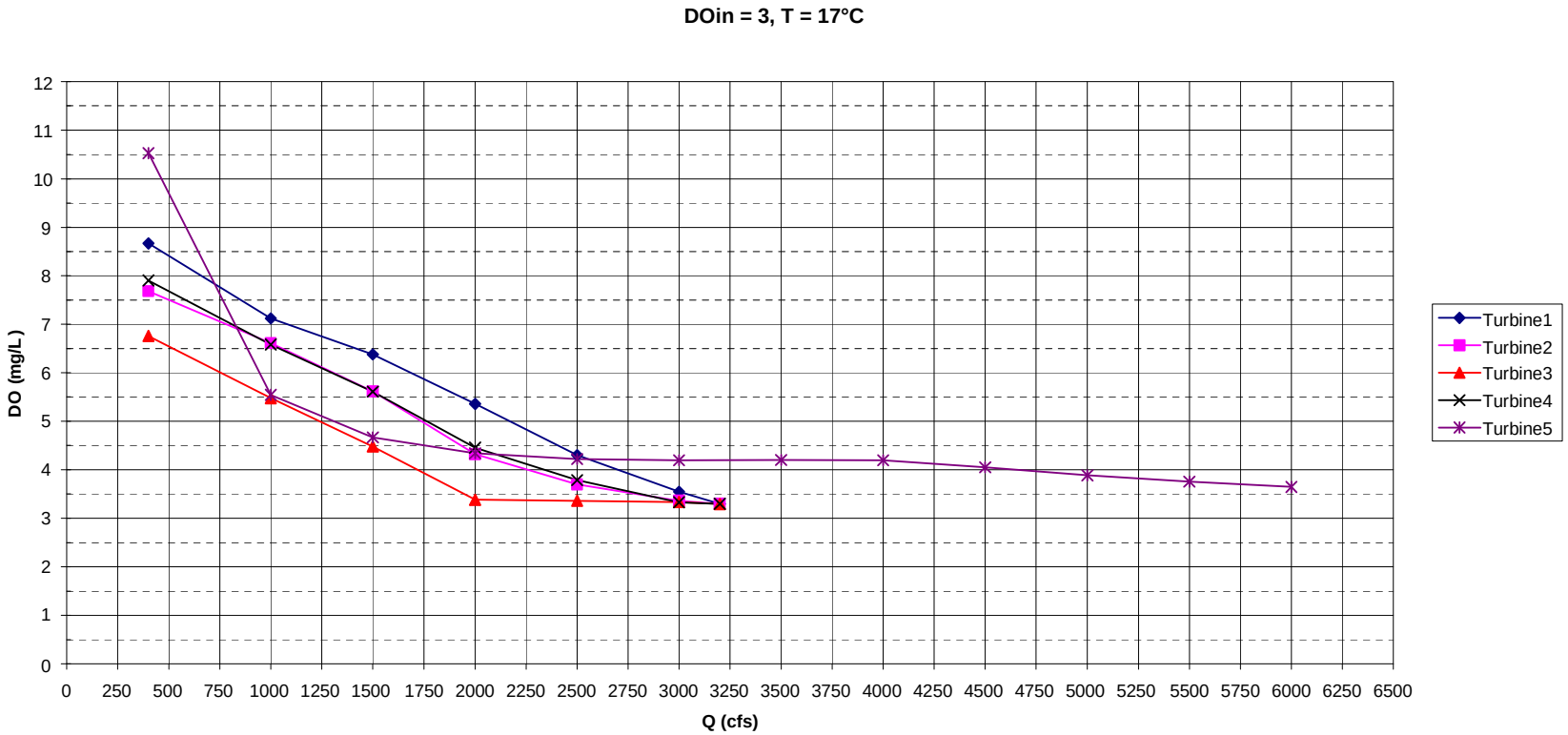

Figure A17: Sensitivity of DO uptake for DO_{in} = 3 and temperature = 17^{o}C

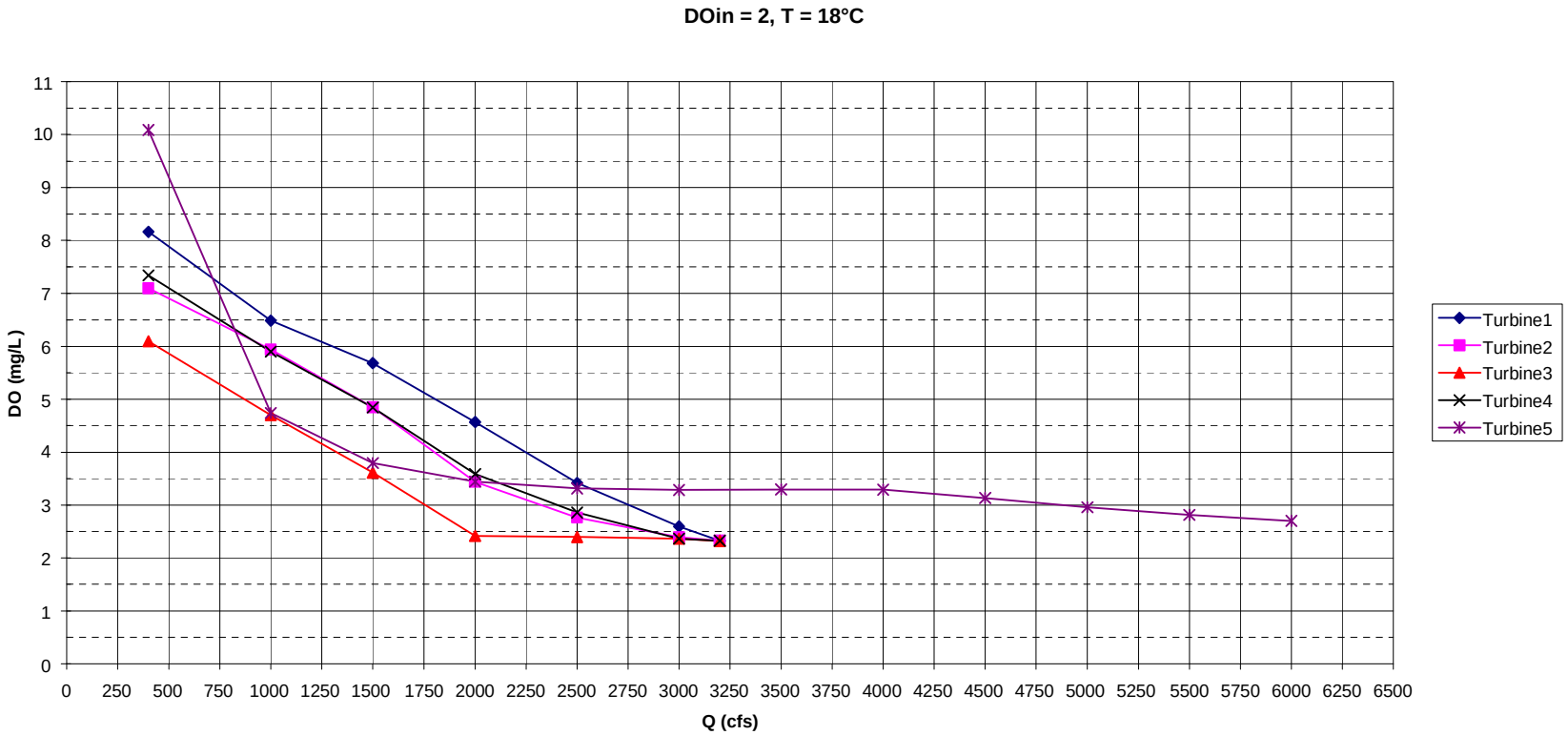

Figure A18: Sensitivity of DO uptake for DO_{in} = 2 and temperature = 18^{o}C

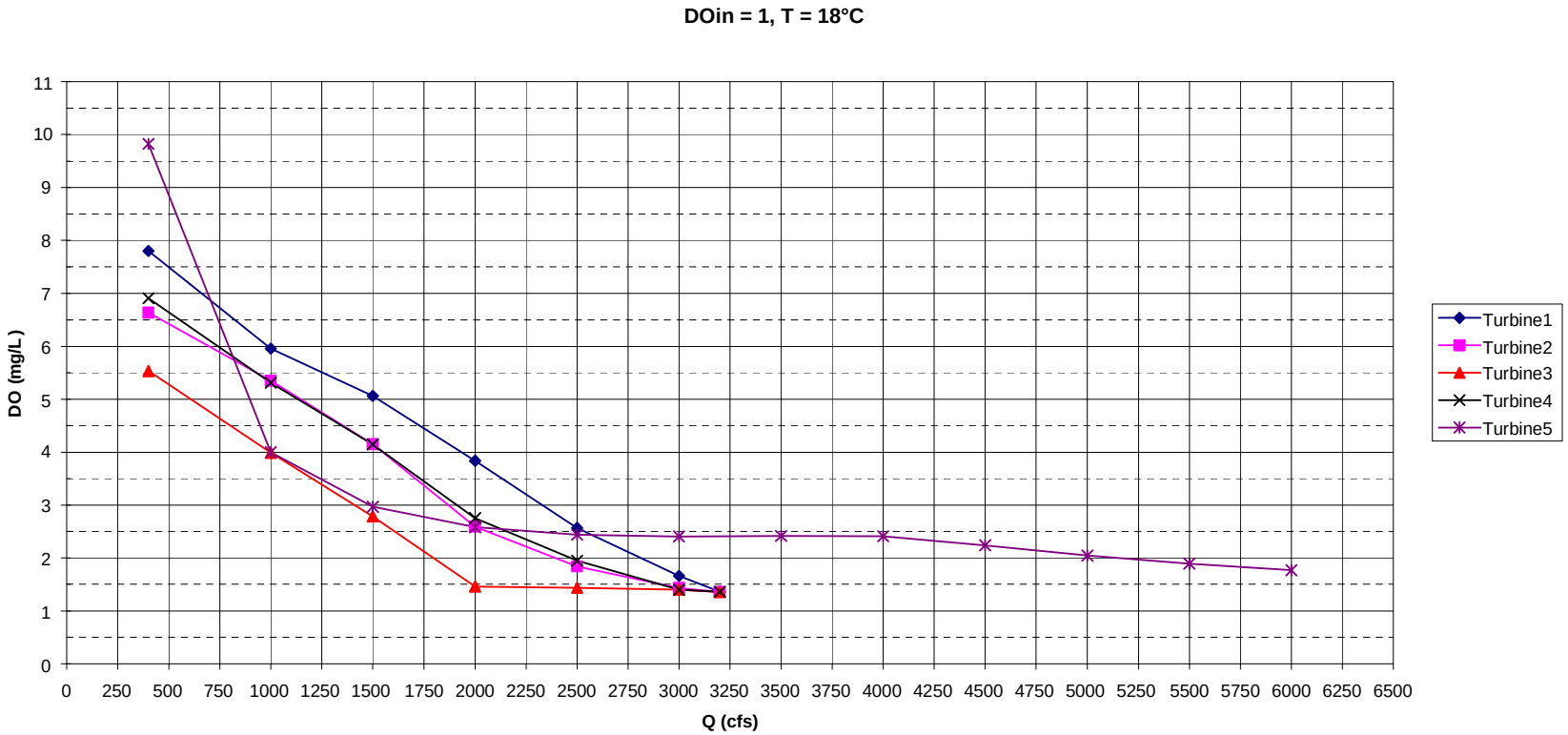

Figure A19: Sensitivity of DO uptake for DO_{in} = 1 and temperature = 18°C

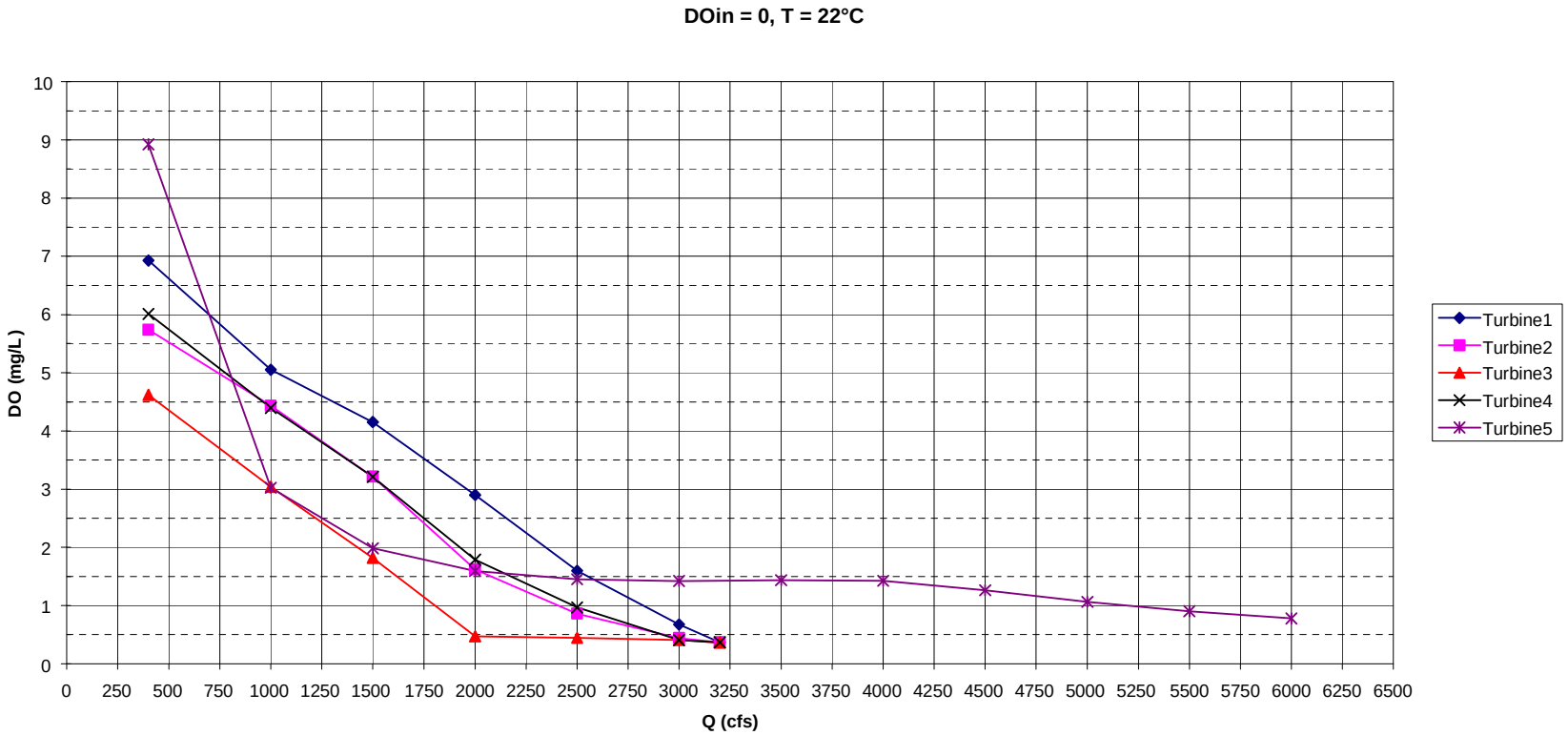

Figure A20: Sensitivity of DO uptake for DO_{in} = 0 and temperature = 22°C

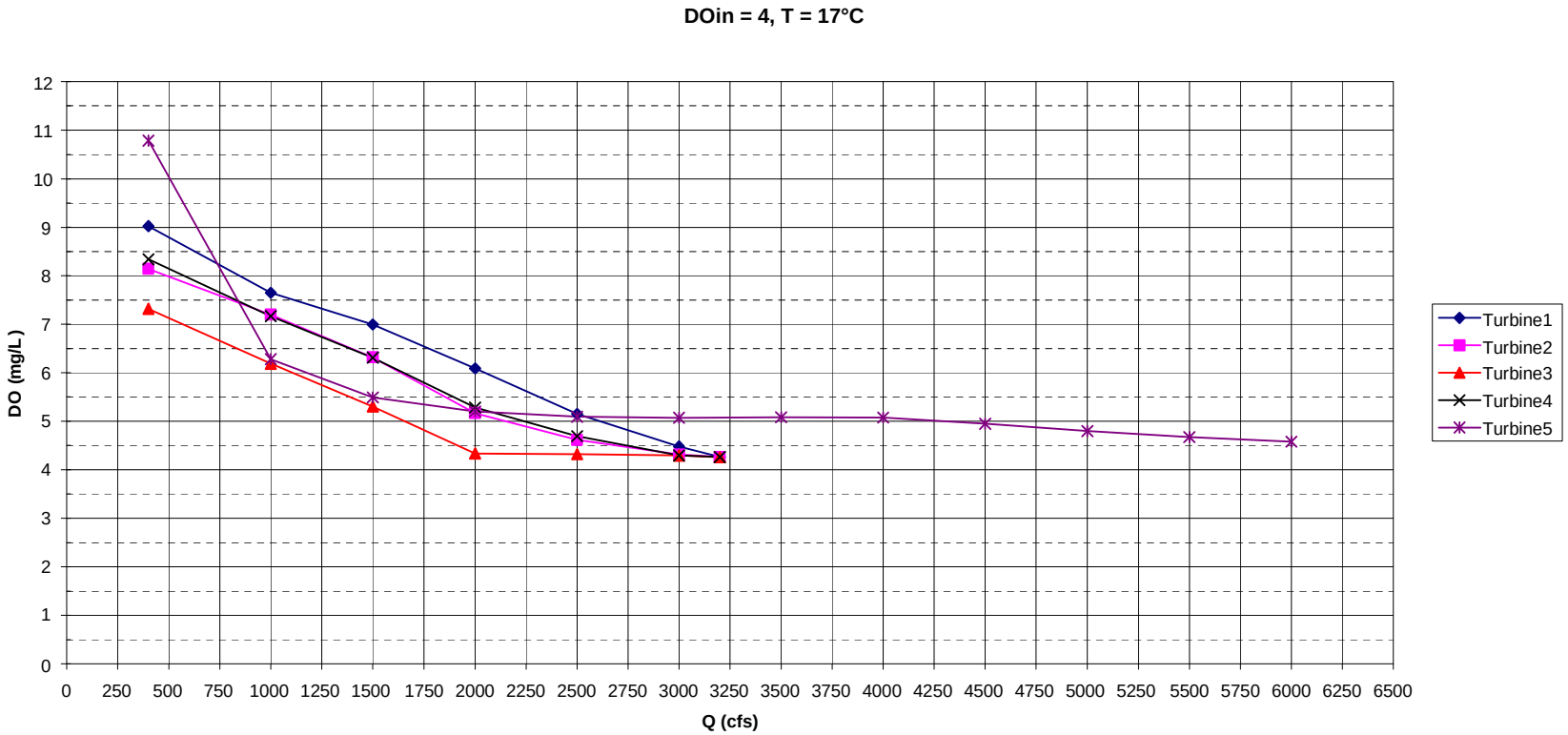

Figure A21: Sensitivity of DO uptake for DO_{in} = 4 and temperature = 17^{o}C

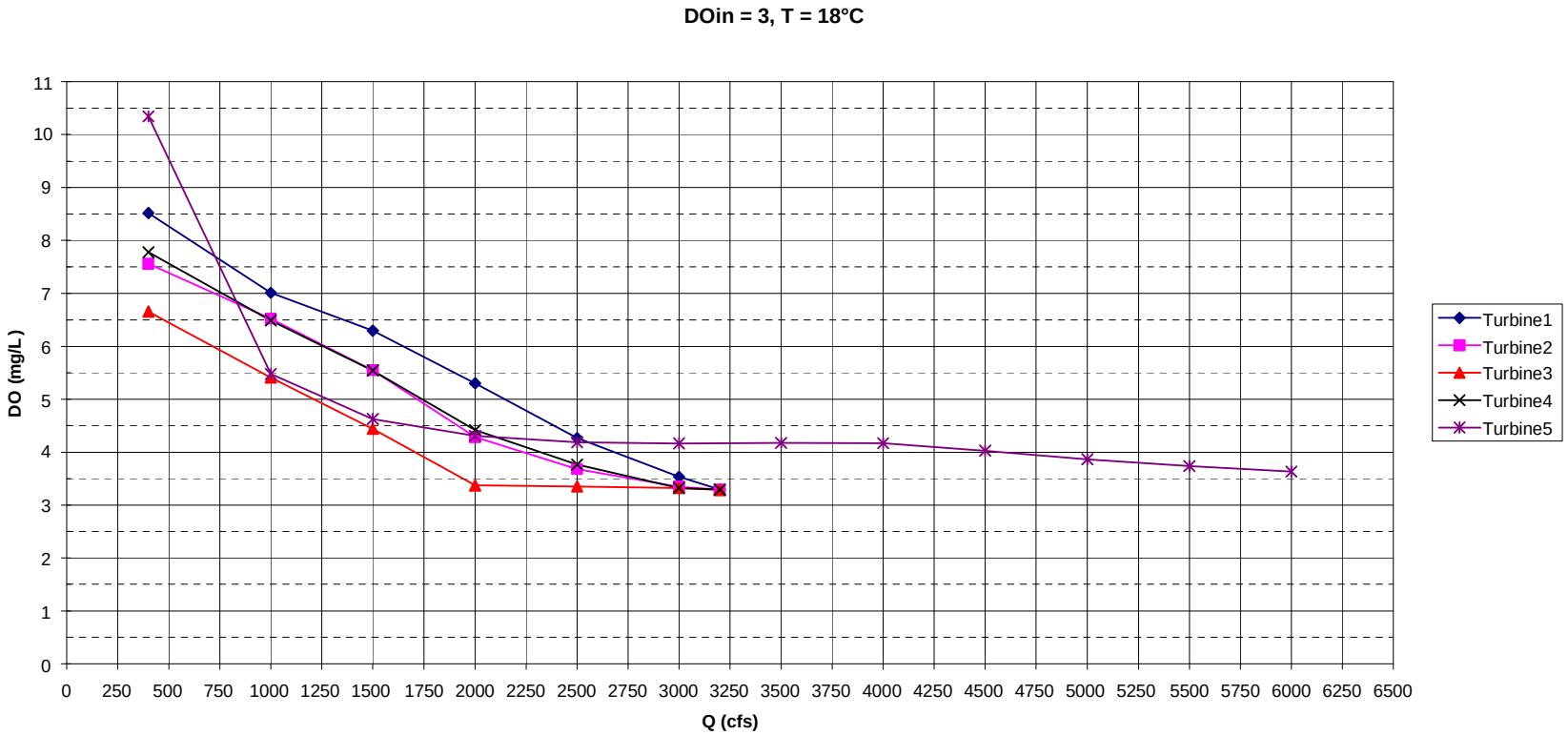

Figure A22: Sensitivity of DO uptake for DO_{in} = 3 and temperature = 18^{o}C

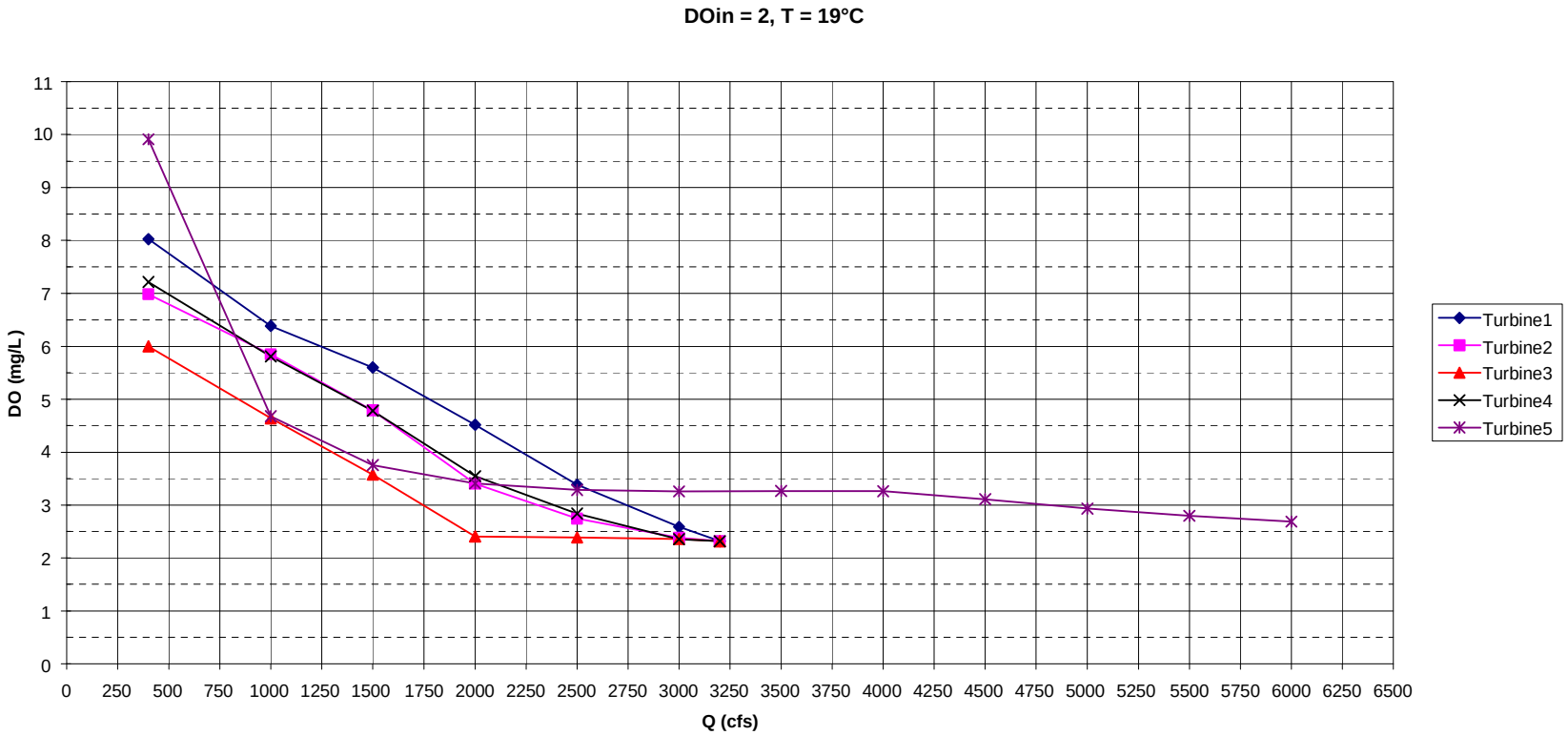

Figure A23: Sensitivity of DO uptake for DO_{in} = 2 and temperature = 19^{o}C

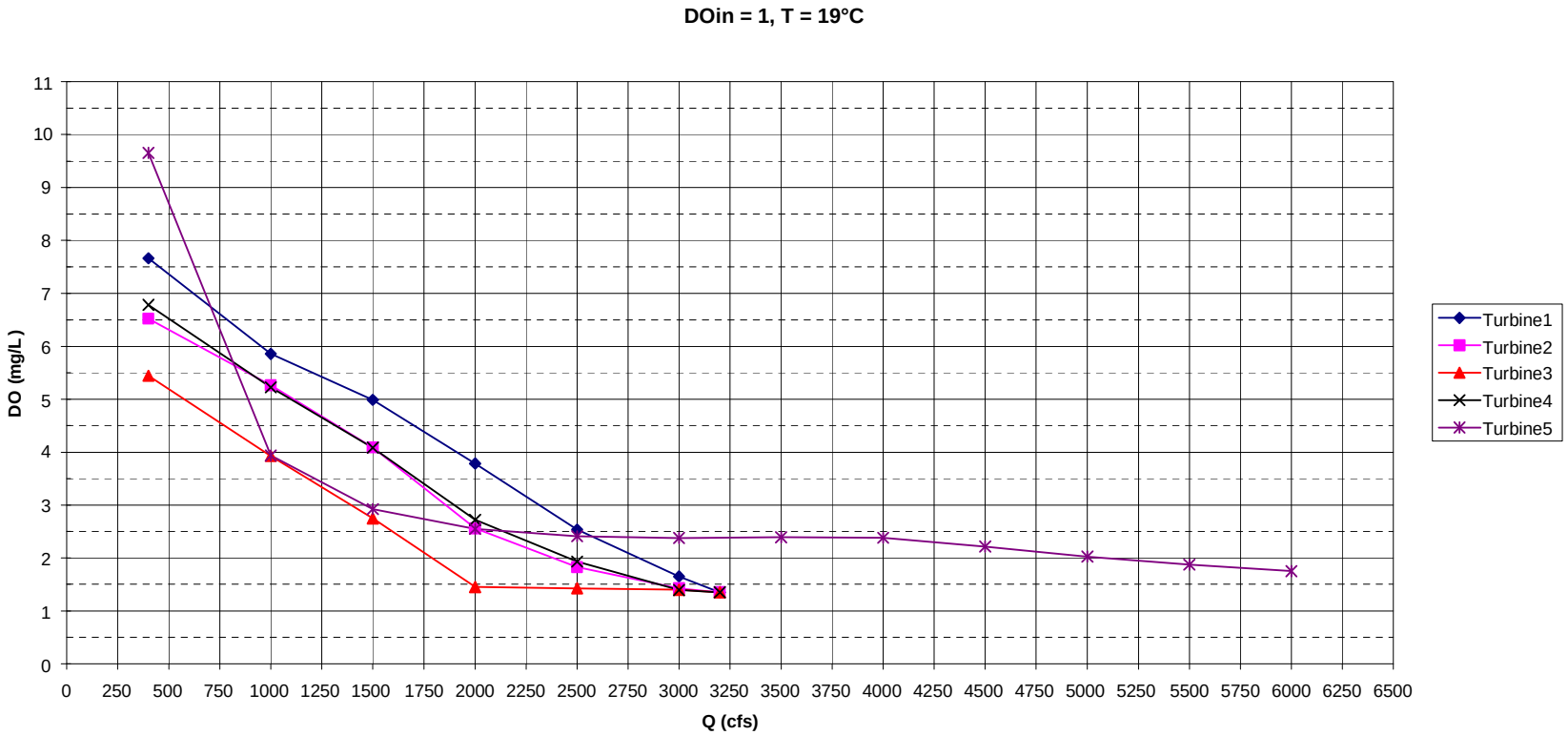

Figure A24: Sensitivity of DO uptake for DO_{in} = 1 and temperature = 19^{o}C

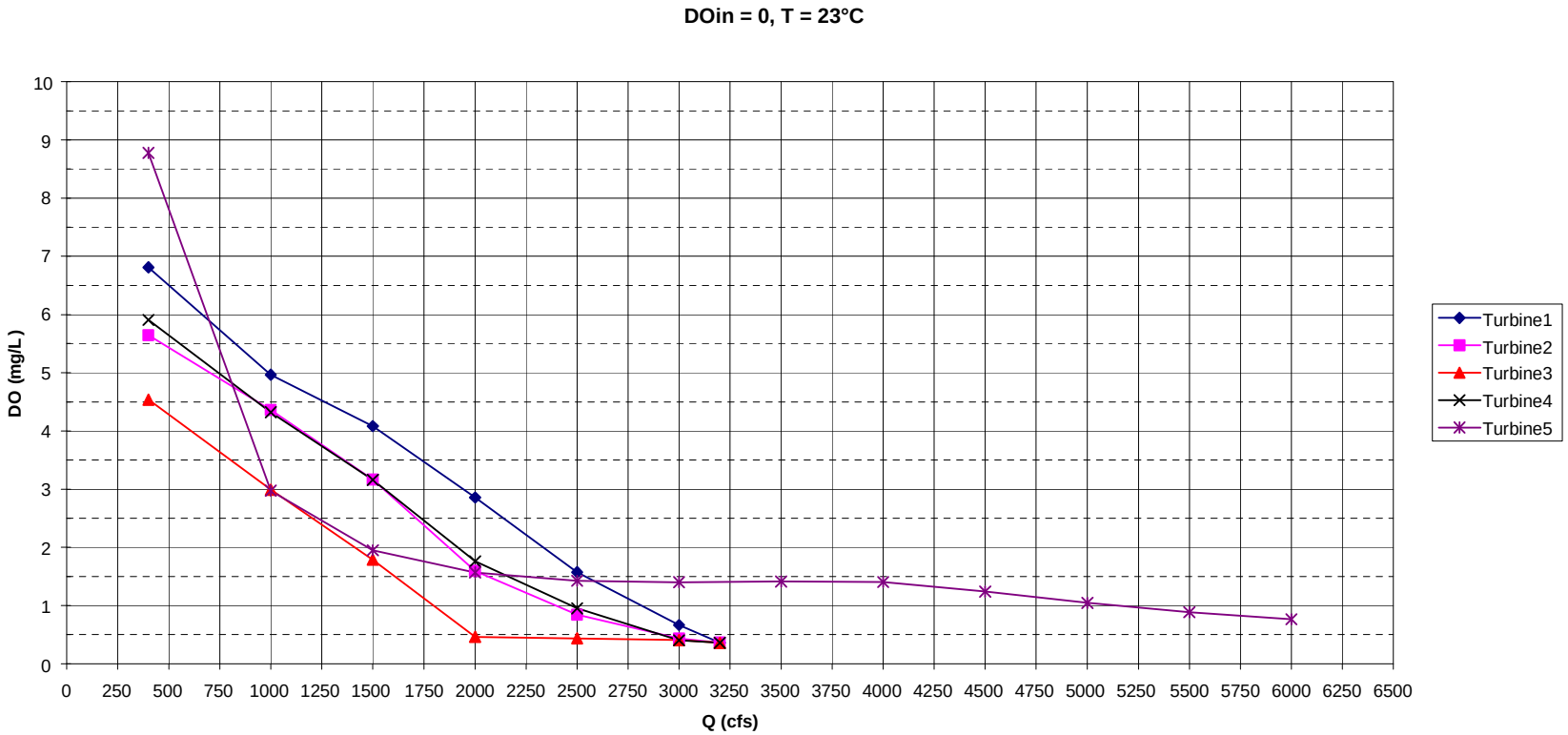

Figure A25: Sensitivity of DO uptake for DO_{in} = 0 and temperature = 23°C

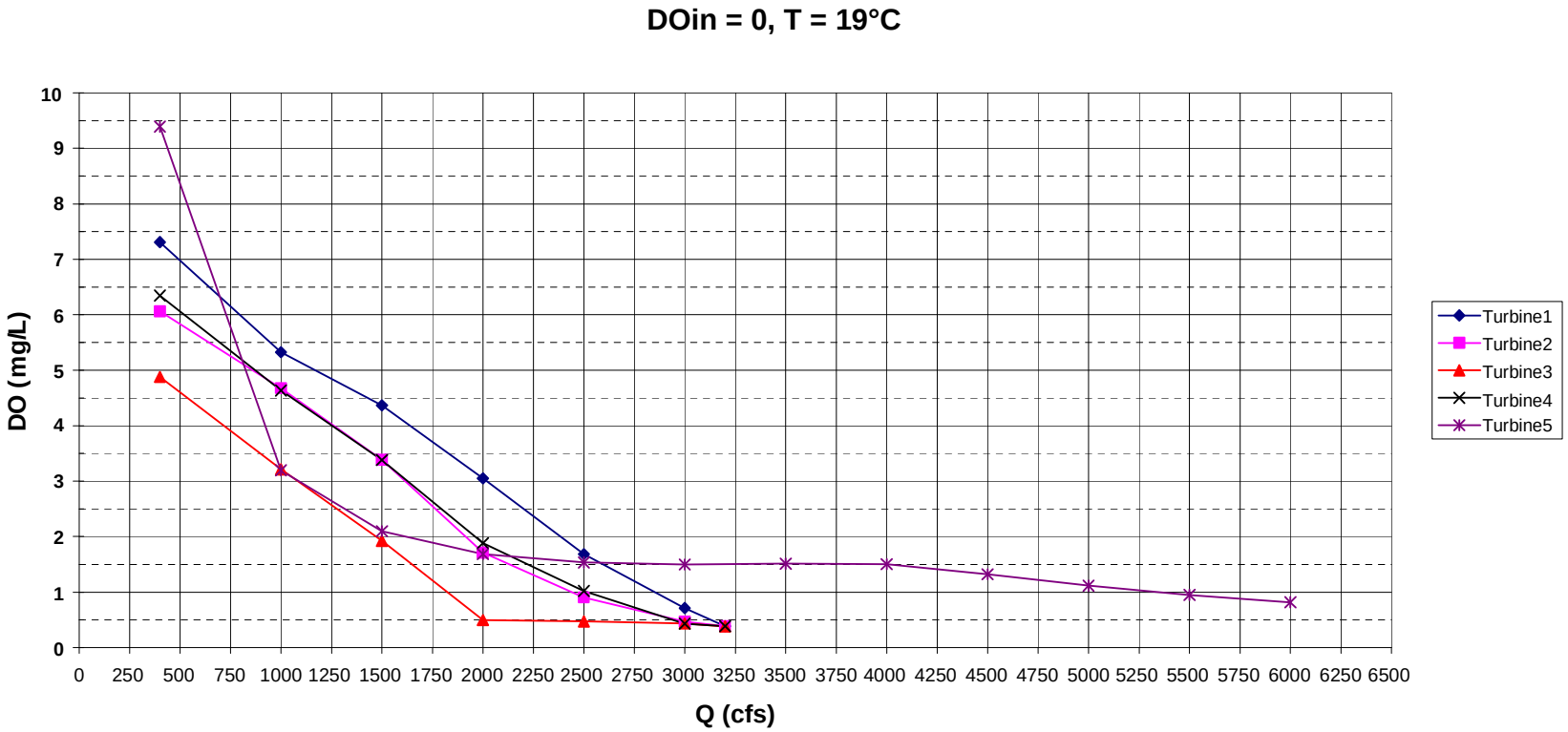

Figure A26: Sensitivity of DO uptake for DO_{in} = 0 and temperature = 19^{o}C

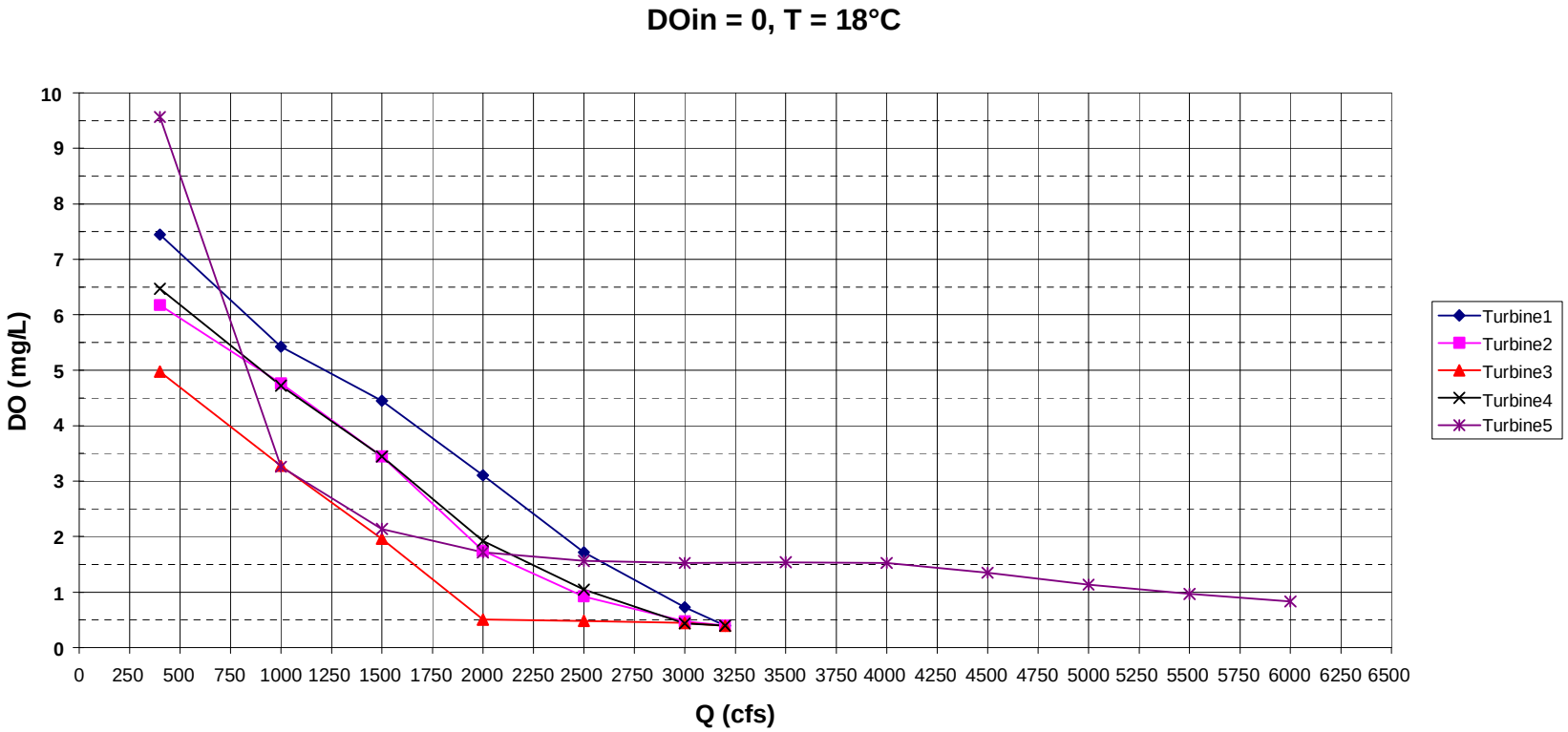

Figure A27: Sensitivity of DO uptake for DO_{in} = 0 and temperature = 18^{o}C

MEMORANDUM

TO: Operations Committee – Technical Working Group

FROM: M. Schimpff, PE, J. Quebbeman, PE – Kleinschmidt Associates

DATE: October 5, 2006

RE: HEC-ResSim Model Calibration

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1. Introduction

The technical working committee, tasked with the development of an operations model, met at Saluda on August 23, 2006 to discuss the progress of the model development and calibration. During that meeting, several ideas were discussed to determine a best-fit approach for determining the Lake Murray inflow hydrograph over a long period of record. This memo is a discussion of these various approaches in addition to results of the best-fit data.

The main focus of this study is to determine the best methodology for hind-casting the inflow hydrograph. From the technical committee discussions, two main methodologies were evaluated:

1. Use the reservoir lake level data (instantaneous daily) data in conjunction with the gaged outflow immediately downstream of the dam.

2. Use the available gaged upstream inflows, (Chappels, Little River and Bush River gages), and prorate the gaged flows to account for the ungaged contributing drainage areas. The common period of record is from 1990 to present.

Releases from Lake Murray, into the Saluda River, are controlled through the operations of the Saluda Dam Hydroelectric Facility. Constraints on operations with respect to seasonal lake level 'guide curves', minimum flow discharges and min/max operating levels can affect the discharges and/or the resulting lake levels throughout the year. The affects of these constraints are especially apparent during extremely wet or dry years, where operating constraints can create situations where these guidelines may be violated. In order to assess various constraints over a historic period of operation, a HEC-ResSim model has been developed to assess various guidelines, in addition to their impacts on allowable operations and lake levels over an extended period of record, approximately sixteen years.

The first step in this process was to develop a model which determines the approximate inflow to Lake Murray over this historic period of record. Calibration of the model is determined by the 'fit' of both the resulting lake stage and outflow data as compared to observed lake stage and outflow data as recorded by the respective USGS gages. Once calibrated, the model will be, used to hind-cast inflow and apply a series of operational and seasonal constraints to determine the effects on the reservoir operation. It is important to note that when calibrating this model, matching specific daily inflows is not as critical as matching the overall reservoir volumes for the period of

record, or matching the observed stage levels which are considered the 'guide curve'. If there is any erroneous data, it will be applied equally amongst all evaluated scenarios.

2. Model Development

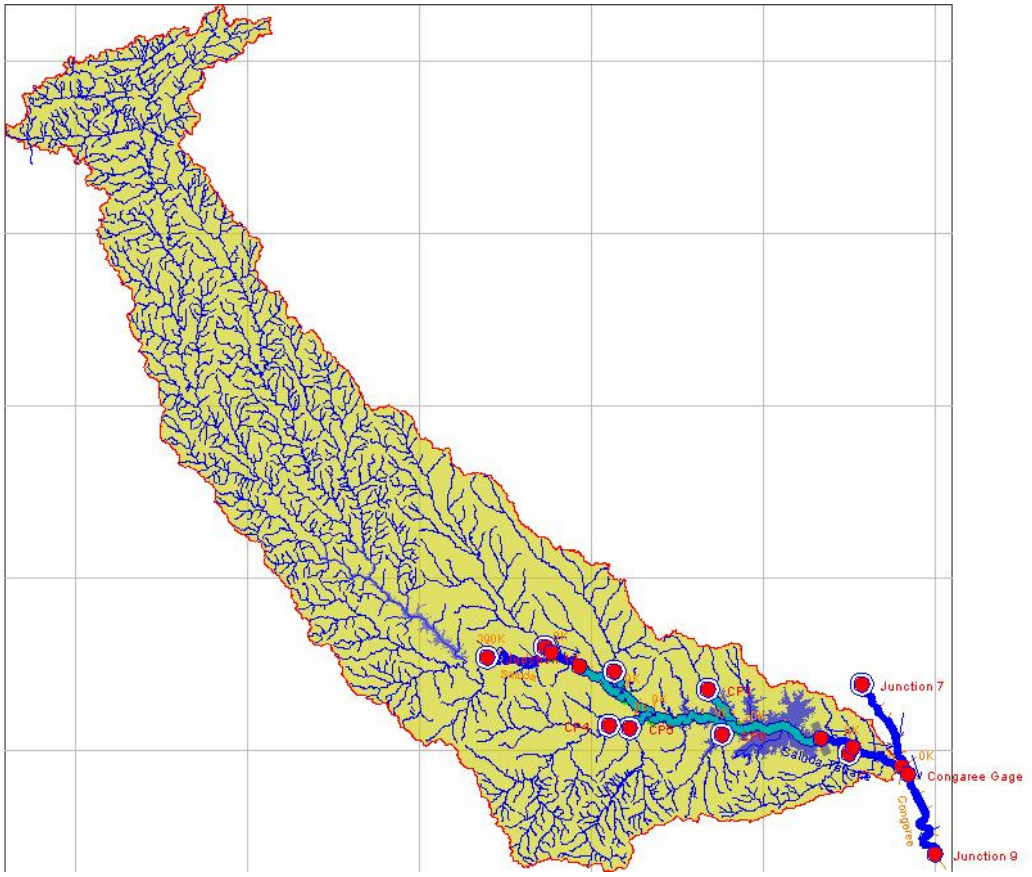
The model was developed to consider the whole of the Saluda River drainage basin. Review of available gage data however, indicated that a long term gage (Chappels gage), located immediately downstream of Lake Greenwood, would represent this major portion of the basin. On this basis, the model framework consisted of the Saluda River basin downstream of the gage, through Lake Murray to the confluence with the Broad River.

The model was developed using publicly available and accepted software created by the Army Corp of Engineers called HEC-ResSim[1]. This software is specifically designed to model reservoir operations with multiple constraints and is considered the latest version of HEC-5.

A Geographic Information System (GIS) was used to assemble and develop basemap information, which was then imported as a background for the ResSIM model. This allows easy navigation of inflow reaches and downstream routing when required.

The figure below displays the watershed used as a basemap in addition to the layout of the model with the locations of several gages used in inflow trials.

Figure 2.1 – HEC-ResSim Basemap Background Layout



[1] More information can be found at http://www.hec.usace.army.mil/software/hec-ressim/hecressim-hecressim.htm

3. Site Specific & Historical Data

Several sources of data were reviewed to develop this model, which include both historical flow and physical mapping data. The following is a list of inputs used in the development of this model:

- USGS Daily Average Stream Gages[2]
  - Chappels River (Gage #2167000)
  - Bush River (Gage #2167582)
  - Little River (Gage #2167450)
  - Saluda River @Lk Murray (Gage #2168504)
  - Saluda River @ Columbia (Gage #2169000)
  - Congaree River (Gage #2169500)
- USGS Lake Level Data[2]
  - Lake Murray (Gage #2168500)
- USGS NHD Flowline[3]
- USGS 1/3 Second Digital Elevation Map (DEM)[4]

This information was used to aid in the development of the basemaps used for the model, in addition to the development of the flow data required by the model.

4. Calculations of Inflow Values

Lake Murray is a large reservoir (approximately 75 square miles) with a total contributing watershed of approximately 2,422 square miles. There are no direct measurements of *all* the flows that enter or exit the reservoir. There are however several gages located upstream of the reservoir which monitor portions of the watershed. For example, the Chappels gage, Bush River and Little River account for 1,705 square miles of the total 2,422 total area.

Two separate methods were evaluated for determining a total historical observed inflow into the reservoir as follows.

4.1. Method 1 – Use of storage data and outflow (Mass Balance Method)

4.1.1. Data Assembly and Calculations

Recorded dam discharge values used in conjunction with observed lake levels and stage-storage data was noted to potentially be the most reliable method in hind-casting inflow hydrographs. This method accounts for inflows without using upstream gages, inflows directly into the reservoir in the form of rainfall, and evaporation from the reservoir (which can be significant during the summer months). Using this approach, a single daily average inflow value for the reservoir was back calculated rather than assigning several points of inflow, some gaged and others not gaged.

[2] http://waterdata.usgs.gov/nwis
[3] http://nhd.usgs.gov/
[4] http://seamless.usgs.gov/

Inflow is calculated using the standard mass balance approach which evaluates the observed outflow and the change in reservoir storage to determine a required inflow. The following equation displays this balance:

$$Q_{in} = \Delta Storage - Q_{out}$$

To determine the change in storage volume, the differences between reservoir stages over two days was converted into a resulting change of volume. Similarly, the daily average flow as measured by the stream gage just downstream of the Saluda Dam was used to determine a daily volume of discharge. The difference between the change in storage and the volume discharged is the volume flowing into the reservoir on a daily timestep. This volume is averaged over a 24-hour period to determine a daily average flow in cubic feet per second (cfs). The following stage-storage data was used for the development of the changes in storage volume:

Saluda Stage-Storage Data

Stage (ft)	Storage (ac-ft)	Area (acre)
190	0	41
200	764.64	160
210	3447.44	436
220	8739.17	637
230	16218.89	1,051
240	29557.17	1,898
250	52319.22	2,869
260	85591.02	4,146
270	132664.21	5,540
280	195100.2	7,387
290	277895.76	9,572
300	385182.61	12,465
310	524587.3	16,123
320	703680.06	20,615
330	930668.09	25,551
335	1064796.29	28,526
340	1214565.74	31,866
345	1381667.03	35,510
350	1567093.68	39,186
355	1771028.97	42,757
360	1992948.86	48,162

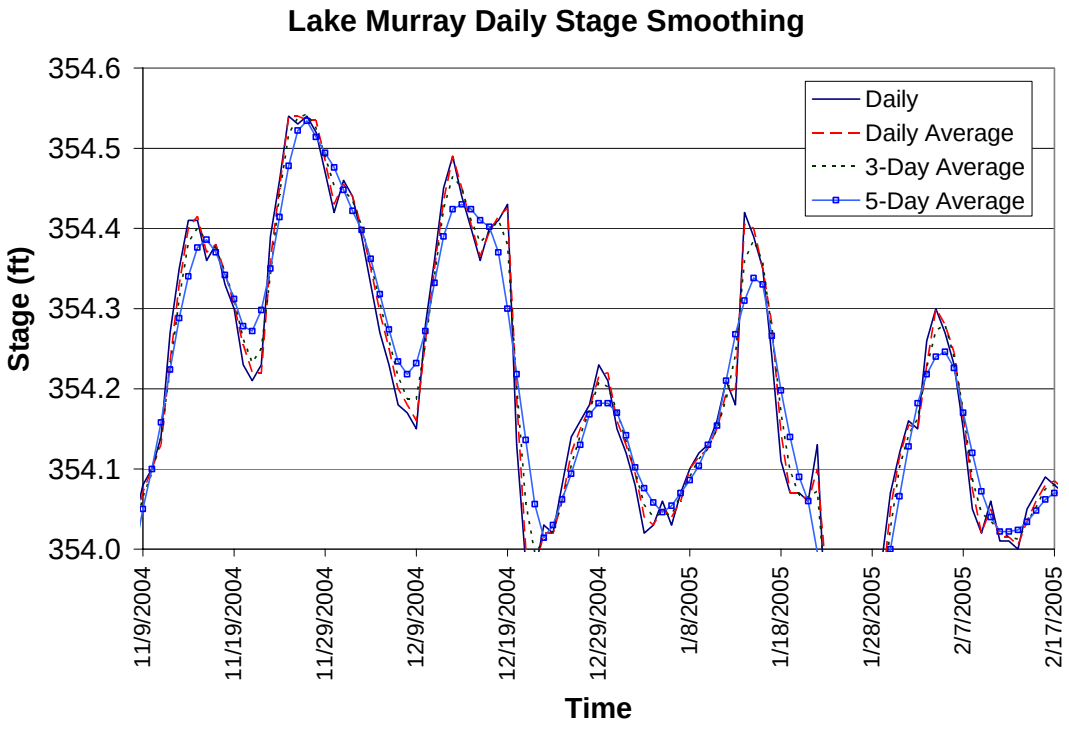
Daily stage readings were acquired from the USGS Lake Murray stage gage (#2168500). Data provided includes daily average data in addition to measurements taken at midnight. A very small change in measured lake elevation can produce an extremely large difference in storage volume change. Assuming typical levels, a 0.1 foot variation in lake level equates to a 2,200 cfs (4,360 ac-ft) flow variation over a 24-hour period. For this reason, the recorded stage data had to be 'smoothed' to account for abnormal readings from wave action or other such disturbances. Four different methods of smoothing were developed and evaluated in the model as described below:

- Daily Measurements (no smoothing)
- Daily Averaged (Daily Reading & Midnight Reading)

- 3-Day Moving Average of Daily Measurements
- 5-Day Moving Average of Daily Measurements

A sample displaying the various smoothing methods of the daily stage values is shown below. The reservoir can fluctuate on a daily basis dependant on demands, inflows and even evaporation, but localized variation in stage readings can create significant rapid changes in storage which may not be realistic. The graph below shows, for a sample period of record, increased levels of smoothing over time, but peak level detail over a period of days becomes lost with increased periods of moving average smoothing.

Figure 4.1 – Sample Daily Stage Smoothing Comparison



With the daily values of reservoir stage smoothed, the resulting daily change in storage was used to calculate the daily average inflow. This data, for each of the four cases above, was then used as input for the hydrologic model to compute the variation between the value of calculated outflow to the value of recorded outflow from Saluda Dam.

4.1.2. Determination of Best Fit

The model was used to calculate lake levels and outflows from the Saluda Dam, following the observed historical lake level stage data as a guide curve. Outflows are determined according to rules set in the operation schemes, which for calibration purposes, was to follow 'observed' pool as a guide curve. Outflows calculated were then compared to recorded values at the USGS stream gage just downstream from the Saluda Dam. This process was repeated for each of methods noted above.

The model will not always match exact daily average outflows measured at the stream gage downstream, although in general, operations appear to follow the general pattern observed by the gage, and volumes of historic data versus calculated are relatively close.

Values for discharge were compared using the computed volume R^2 to determine the best correlation between data pairs. Correlation values closest to 1.0 represent the best fit. The figure below (Figure 4.1) shows data comparisons for each of the four different stage smoothing conditions, in addition to the trend lines with R^2 values. It can be seen from the R^2 values that the 3-day average allows for the best correlation to recorded USGS discharge values.

4.1.3. Discussion of Method-1 Mass Balance Results

Applying this method, several issues surrounding the model calibration were noted. The first was the significant impact variations in the lake level had on the potential inflow. As noted above, a 0.1 foot change in lake level corresponds to approximately 2,200 cfs variation in inflow. It has been reported that up to 0.06 feet of variation in the gage is the normal "noise" in the readings. Another potential issue is the reliance on a single recording station for stage, and a single outflow station for flow values. Errors or anomalies in data recording can significantly effect the accuracy of the results with no 'buffer' from other sources.

This method does however allow for the automatic accounting of evaporation rates. Whether inflows are from direct rainfall on the reservoir, from further up in the watershed, or actually losses from evaporation, the only value that is calculated is an absolute change in storage volume independent of source.

Figure 4.2 shows a result of the model runs using the mass balance method. The upper curve is a measure of stage relationships, plotting both the calculated stage and the observed stage. There is a very close correlation between the data sets under most circumstances, but there is a slight variation of data at lower stages. It can be seen that the calculated values at low reservoir stages tend to be slightly higher than observed. This could potentially be from variations between actual and accepted stage-storage values.

In general, there is a very close correlation between the calculated and recorded stage and discharge values using the mass balance method with smoothing of the recorded gage data using a three-day moving average.

Figure 4.1 – Comparison of Outflow Values with Various Methods of Smoothing

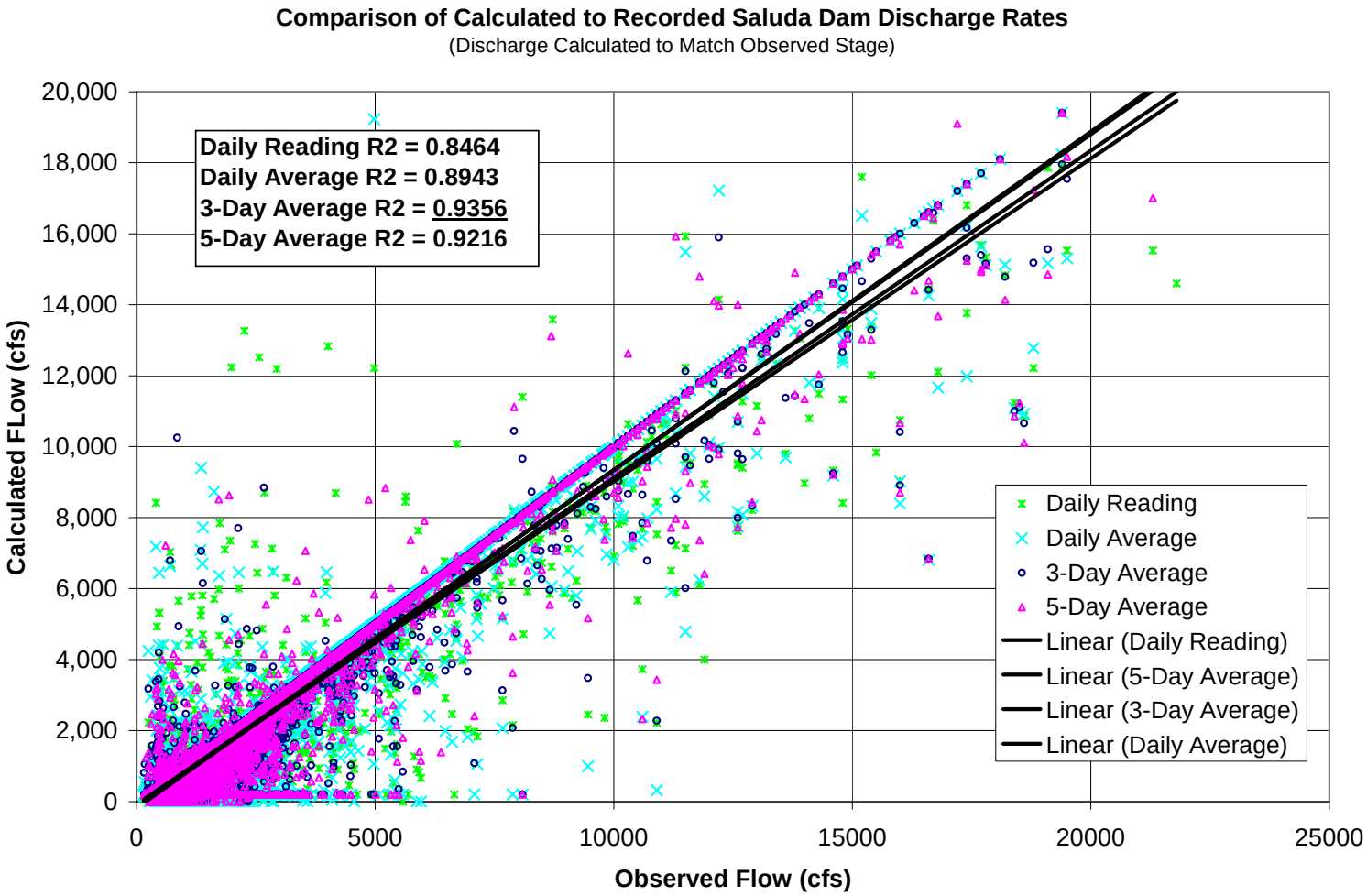


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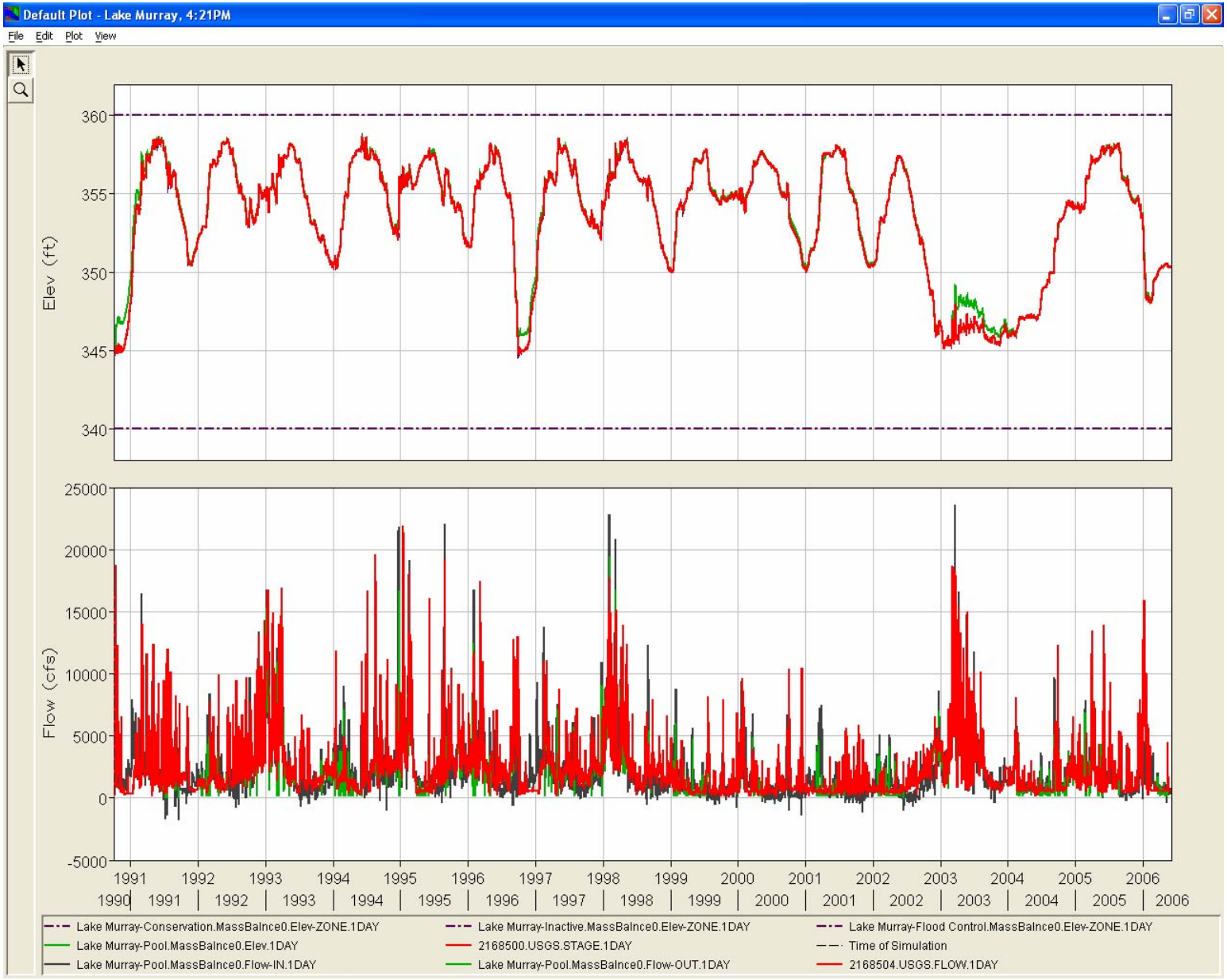
Figure 4.2 - Plot of HEC-ResSim Stage/Discharge Output (Mass Balance)



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4.2. Method 2 – Pro-Ration of Upstream Gaged Inflows

4.2.1. Data Assembly and Calculations

There are several gages located upstream of Lake Murray which include the Chappels gage on the Saluda River just downstream of Lake Greenwood, the Bush River gage, and the Little River Gage. The technical working committee determined that these three gages may provide a good correlation for determining the total inflow into Lake Murray. These three gages monitor 1,705 square miles of the total Lake Murray watershed (approximately 2,422 square miles) and have a common period of record of sixteen years (1990-present).

Various factors have been applied to the three gages located upstream in the reservoir and were used as inflows in the model. Comparison of the historical levels versus the computed levels, along with total inflow volume versus outflow volume, were used as the means of calibration.

4.2.2. Determination of Best Fit

This data is derived entirely through observed and recorded inflow data and accounts for a majority of the area of inflows into the reservoir. This method is accurate at it resembles recorded values and negates the potential for negative inflows into the reservoir (as potentially recorded from the determination of the mass balance). Conversely, the methodology does not directly account for the temporal variation in evaporation from the reservoir, which during summer months can be substantial.

Evaluation of the 'best-fit' was performed using variations of ratios applied to the recorded gages. Daily average flow values for the various gages were multiplied by certain factors to obtain the best correlation of data from the perspective of inflow and outflow correlations. The following is a table of trial results performed using various pro-ration factors to obtain the 'best-fit'.

Table 4.2 – Gage Weighted Value Determination

	Multiplication Factor			
Little River Gage	3.5	3.6	3.7	3.8
Bush River Gage	1.0	1.0	1.0	1.0
Chappels River Gage	1.0	1.0	1.0	1.0
Outflow Volume (cfs-days)	12,153,952	12,255,100	12,358,230	12,457,727
Stage R^2	0.982	0.978	0.976	0.970
Volume R^2	0.837	0.841	0.812	0.843

From Table 4.2, it can be seen that there is an inverse relationship between the stage correlation, and the volume correlation (discharge from the reservoir is approximately 14 million cfs-days). There does not appear to be a direct relationship between observed and calculated values dependent on the variation of the Little River gage.

4.2.3. Discussion of Method-2 Gage Rating Results

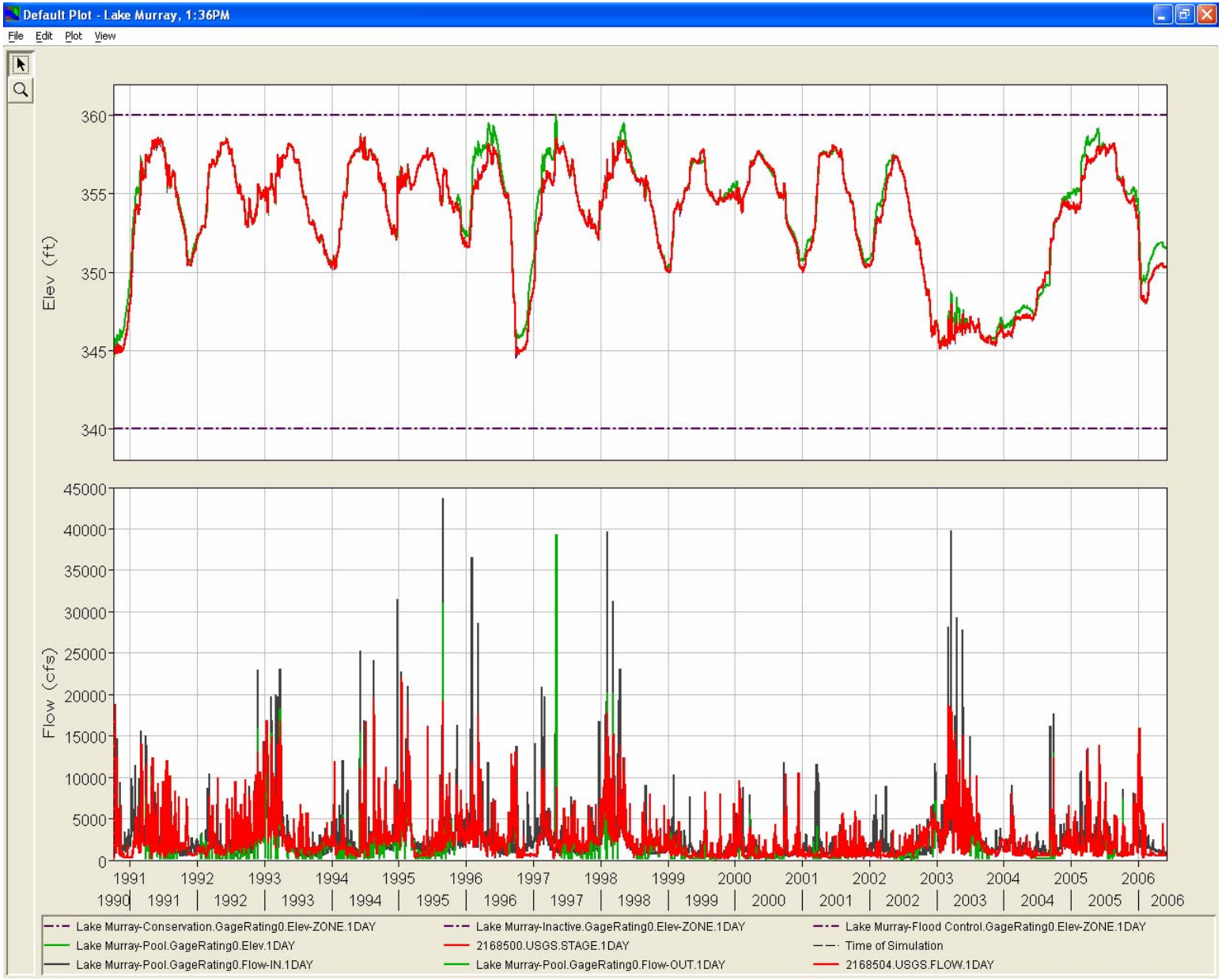
When applying this method, determining the factors to apply to the gages to represent the 715 square miles of additional un-gaged drainage area is critical. It was determined that use of the Chappels gage would not be a good representation because this flow is regulated by the operation of Lake Greenwood, whereas the 'missing' gaged areas are direct runoff from smaller subcatchments. Additionally, the factors must account for the direct precipitation on the 75 square mile reservoir which has effectively no lag time for a response in the reservoir.

In order to derive the applied factors to address the ungaged drainage area, an analysis of the inches runoff versus annual precipitation was completed. Review of the NOAA weather gage at Columbia Airport noted an annual average precipitation value of 48.3 inches. Data for the Bush River for the period 1990-2005 reported an average annual flow of 106 cfs which reduced to 12.51 inches of runoff, per gage records. Similar data for the Little River noted an average annual inflow of 187 cfs with a total runoff of 11.03 inches. The annual values of the gage downstream of Lake Murray reported an average annual flow of 2,495 cfs with a corresponding inches runoff of 14.01.

Using these values, the initial pro-ration factors were developed for the Bush and Little River by evaluating the percentage of ungaged area to the area available from the various gages. The values determined were a factor of 3.5 for the Little River and 1.0 for the Bush River, and for all conditions Chappels remained un-rated with a multiplication value of 1.0.

Figure 4.3 illustrates the comparison for the sixteen year period. Several checks were also made in regards to the statistical correlation between computed and actual values. An R squared value of 0.982 was calculated when comparing calculated stages using this method, which is considered a very close correlation and is shown below.

Figure 4.3 – Plot of HEC-ResSim Stage/Discharge Output (Gage Rating)



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5. Results & Discussion

Both of these methods used 'observed' data for the determination of the inflow hydrographs. One method used observed data in the stages and accounted for losses, whereas the other method looked at recorded values and accounted for actual recorded inflows and adjusted ratings to create a 'best-fit'. In either condition, data is heavily reliant upon the quality of the data.

Recorded stage data may skew the volumes because of wind setup, whereas a localized storm directly of the reservoir may not be accounted for by the USGS gages upstream and missed as an inflow. Both methodologies develop datasets that are estimations of the potential inflow into Lake Murray, but a determination of the best-fit data must be made.

The following is a table of model results using the best available data from the two methodologies.

Table 5.1 – Summary of Model Results

	Observed Gage Data	**Mass Balance Method**	**Gage Weighting Method**
Total Volume In (cfs-days)	n/a	13,262,703	14,000,921
Total Volume Out (cfs-days)	13,960,366	13,262,703	12,183,398
Stage R^2	n/a	0.993	0.982
Discharge R^2	n/a	0.902	0.810

It can be seen in this table that the best correlation for both the stage data and the discharge data is from using the Mass Balance methodology. This method presents errors with respect to the reliance on the recorded stage values and daily average outflow rates, but provides the best correlation of datasets.

Using this methodology, the data appears to follow a relatively decent correlation using a 3-day moving average smoothing of the daily stages. It also can be seen that there is a greater variability, or scatter, of the data at lower flow conditions, which is consistent with the difficulty of estimating low flows from small changes in lake level. Similarly, the greatest variations of stage data from observed values occur at low reservoir stages (Figure 4.2). Very subtle changes in lake stage can produce very large differences in lake volumes averaged over a 24-hour period and there is a heavy reliance on the accuracy of the stage-storage relationships.

The ultimate goal of utilizing this sixteen years of data is to evaluate various operating conditions and flow/stage constraints; the respective frequencies that these 'guidelines' may be violated according to historic inflows under certain operating constraints will be applied equally for all scenarios. With this in mind, we feel that the calculated inflow as described above, using the Mass Balance Methodology, would sufficiently determine the inflow hydrograph for the modeling period of record.

From: Alison Guth
To: "Amy Bennett";
Subject: RE: Fwd: Saluda Technical Memo
Date: Monday, October 09, 2006 8:21:21 AM

Hi Amy,
I will add you to the mailing list and look forward to meeting you on Thursday! The website address is www.saludahydrorelicense.com . Thanks! Alison
-----Original Message-----
From: Amy Bennett [mailto:BENNETAM@dhec.sc.gov]
Sent: Friday, October 06, 2006 9:10 AM
To: Alison Guth
Subject: Re: Fwd: Saluda Technical Memo

Hi Alison,
I work for Gina and have been assigned the 401 for the Saluda Hydro FERC Relicensing. Please add me to your mailing list. I will be attending the meeting on 10/12. Could you also send me the link to the website that has been set up about this project.
Thanks,

Amy M. Bennett
Water Quality Standards Coordinator
SCDHEC - Bureau of Water
803-898-3256
803-898-4140 (fax)
bennetam@dhec.sc.gov
>>> Gina Kirkland 10/6/2006 7:42 AM >>>
FYI and have Alison add you to the group...thanks.
>>> "Alison Guth" <Alison.Guth@KleinschmidtUSA.com> 10/5/2006 5:31 PM
>>> >>>
Hello Operations Group
On behalf of Jon Quebbeman, attached is the Saluda technical memo discussing the calibration of the HEC-ResSim model as well as a brief summary paragraph. This is for review before the October 12th meeting. Please forward any comments or questions that you may have about this document to Jon.
Thanks and take care, Alison
Summary:
We recently completed assembling and testing two separate methods of determining the inflow hydrographs for Lake Murray over a 16 year period. Within these two methods, the data was organized and tested to provide the best correlation between calculated results, and observed (recorded from USGS gages) results. The two methods were:

1)Mass Balance Method
2)Gage Rating Method

The Mass Balance method uses historical stage data, and discharge data, to compute the required inflow to satisfy the 'mass balance'. Conversely, the Gage Rating method uses three upstream gages, and multiplies the flow rates to account for the ungaged drainage areas for a total inflow into the reservoir. These two methods were compared to determine which produces an inflow hydrograph that results in better correlation of data using HEC-ResSim to observed data. In summary, more consistent results to observed data were calculated in ResSim using the Mass Balance methodology. At this point, with an acceptable inflow hydrograph determined, we are ready to assemble operational constraints to model various scenarios. -JAQ
Jon Quebbeman, P.E.
Kleinschmidt Associates
Energy & Water Resource Consultants
75 Main Street
PO Box 576
Pittsfield, ME 04967

P 207-487-3328
F 207-487-3124
Jon.Quebbeman@KleinschmidtUSA.com
<<001-Saluda Model Development Memo.pdf>>

From:	Bret Hoffman
To:	"Ray Ammarell"; Alan Stuart; "Amy Bennett"; "Bill Argentieri"; "Bob Olsen"; Bret Hoffman; "Bud Badr"; "Feleke Arega (aregaf@dnr.sc.gov)"; "Jim Cumberland "; "Larry Turner (turnerle@dhec.sc.gov)"; "Mike Waddell"; Mike Schimpff; Jon Quebbeman;
cc:	Alison Guth;
Subject:	Saluda Operations Model Update
Date:	Wednesday, September 12, 2007 12:11:42 PM

Good afternoon Operations TWC members,

Several months back we received a request from Dr. Badr to consider a longer period of record for the Saluda operations model. As you may recall, the downstream gage period of record limited our inflow hindcasting to 16 years. At Dr. Badr's request, we contacted USGS to discuss the possibility of extending the record of the gage just downstream of the dam.

Mr. Paul Conrads at the USGS, along with other hydrologists in the SC District office, developed two methodologies to hindcast the flows for the gage just downstream of the dam (station 02168504) by utilizing the data from the gage near Columbia (station 02169000). After selecting the preferred methodology, they provided us with hindcasted daily average flows at the gage just downstream of the dam back to 1940. Along with daily lake stage data, this provides us over 60 years of data to base our operations model on. From a hydrologic aspect, this is important because it expands the base model to include a broader range of inflows. The downside of including data from a longer period of calculated flows is the accuracy declines.

Statistically, the USGS flow model had a tested R-squared value of 0.986. Using the hindcasted data from the USGS model, the modified operations model has a discharge R-squared value of 0.963 (vs. 0.992 for the original model). The modified model has an R-squared value for stage predictions between 1960 and 2006 of 0.914 (vs. 0.993 for the original model). The year 1960 was chosen as a start for this calculation because prior to that, the lake was operated in a much broader range of levels, sometimes going down to elevation 330'. The stage-storage curve loses accuracy at such low elevations, and since the project does not operate in these low ranges, it is appropriate to consider operations since 1960 for calculating stage values from outflow for the purpose of calibration. (The R-squared value for the entire period between 1940 and 2006 is 0.696, again because of low elevation inaccuracy of the stage-storage curve). Runs will be completed for the entire historic period from 1940 to 2006, as modeled operations should remain within expected operating levels.

Since the operations model is based on the USGS flow calculations, the overall R-squared values for discharge and stage are products of the modified operations model R-squared values with those of the USGS model. The original model values were 0.993 and 0.992 for stage and discharge, respectively; the overall modified model values are 0.950 (for discharge over the whole period) and 0.901 (for stage from 1960 to 2006).

This extension of data is an improvement to the model based upon data provided to us from the USGS; the ability to model the broader range of inflows captured by over six decades of data is a great benefit at the cost of reducing the correlation accuracy. Please let me know your opinions on this, as we need to update the Operations RCG (as well as all other RCG's) of this modification to the operations model. If needed, we can schedule a meeting via conference call to discuss this.

Thanks,

_____

Bret R. Hoffman, P.E.
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204 Caughman Farm Lane, Suite 301
Lexington, SC 29072
(803) 951-2077
FAX (803) 951-2124
Bret.Hoffman@KleinschmidtUSA.com

From:	Bill Marshall
To:	Alison Guth; Tony Bebber; BARGENTIERI@scana.com; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Hand; Jim Cumberland ; Karen Kustafik; Kelly Maloney; Malcolm Leaphart; Mike Waddell;
cc:	Alan Stuart;
Subject:	RE: Draft Flow Study Report
Date:	Thursday, October 18, 2007 6:46:45 PM

Hello everyone – Here are my comments on the Draft Downstream Recreation Flow Assessment Report. Only wish I had a bit more time to process this and do a more thorough review but must get it out today.

General comment: I think this report provides much useful information and provides a helpful integration of Saluda River recreational information, which has been produced in various reports of the Saluda Relicensing Process.

Page 10: regarding the paragraph explaining the hydro operational scenarios that are demonstrated by the model. Comment: Demonstrating typical hydro operational scenarios, as was done, is appropriate; however, because we are concerned with safety issues and risks from hydro operations to downstream river users, we should include analyses of maximum flow scenarios that create conditions that pose the greatest risks to downstream river users. Conditions that pose the greatest risks are probably those where the hydro operations produce the maximum rates of change in river stage at each downstream station.
A reserve call of only 1.5-hour duration may have less affect (produce slower rates of rise) at the Zoo area than reserve calls of longer durations (three hours or more) because it takes roughly two hours for the "wave" to arrive at the zoo. While, the 6-hour lake-level management scenarios provide adequate duration of flows to see a maximum effect at the zoo, another question arises (as presented in a following comment re. page-13): how would the incremental flow increase of 1,167 cfs per minute, versus 850 cfs, effect the results for rate of change?

Page 11: The second and third paragraphs refer to matching calculated hydraulic results with the observed hydraulic results. Comment: The report needs to include more information and discussion of accuracy. Is there some measure of error or accuracy that can be reported for matching the calculated results with those observed? It would be helpful to have a graphical presentation of model calibration results comparing model predictions against observed data for important hydraulic features such as depth, time of arrival, and rates of stage

increase along the river reach.

Page 13: The first paragraph explains assumptions related to the analyses and reports that incremental flow increases were set at 850 cfs per minute (a median figure) regardless of operational scenario. Comment: Because we are concerned with safety issues and risks to river users related to downstream flows resulting from hydro operations, shouldn't we model flow scenarios using the maximum incremental flow of 1,167 cfs per minute, as this would give us information about the most rapid rates of change in the river. And if judged that there are only minor differences in results using the various incremental flow increases, then it would be useful to demonstrate and explain the differences.

Page 13-14: regarding the paragraph explaining "wave arrival." Comment: Explanations about "initial rates of rise" and the transition to the "more steep rates of rise" and how much time is involved overall is important to understand. More graphical presentations would help improve the information.

The last sentence of this paragraph mentions the importance of understanding the first 15 minutes following "wave arrival" compared to overall rate of change at each location on the river. Based on our knowledge of the lower Saluda, it would seem that the first 15 and 30-minute periods of time after wave arrival and the first 1 to 4 feet in rise are the most important aspects to understand for dealing with river safety concerns.

Overall, more graphical presentations in the report would be a welcomed addition to the many tables provided.

Page 14, second paragraph, last sentence may need clarification: Sentence seems to say the greatest rate of change is between 75% and 90% of maximum. Should it say "between start of rise to 75% and 90% of maximum"?

Pages 13-14, discussion of assumptions: Comment: Please explain what boundary conditions were used in the downstream side. Does the downstream condition always include 500 cfs flow.

Page 17, second paragraph – Edit: Cornerstone Presbyterian Church, located off of Old Bush River Road, owns waterfront property adjacent to the boat ramp at Saluda Shoals Park (not Rawls Creek).

Page 21, one report bullet says: "A hand-carry access site below the I-20 bridge (City of Columbia is currently working on this access site)." – this should be "site below I-26 bridge" -- as this is where City of Columbia will be developing the

Saluda River Walk with a boater access just below the bridge.

Pages 27-29 – Comment: The discussion of average daily flows (here and on page 81) tends to misrepresent the flows that are realistically available to recreational users. Because flows fluctuate widely in any given day due to hydro operations, the statistical "average daily flow" (3,291 cfs for example) might only be available for 10 minutes in a given day as the river goes from 500 cfs to 18,000 cfs and back down again in one day.
Perhaps a better way to characterize "available flows" for recreationist would be to look at hourly averages and describe when favorable flow ranges are maintained for some period of time (and not just a brief point on a dynamic hydrograph). For example, I'd suggest looking at favorable flow ranges that were maintained four hours during daylight hours, as this sort of timeframe better fits what recreational uses might really consider as a flow opportunity.

Page 73, bullet item – I think the telephone ring-down (call-down) system was tested for a while but is not yet "in place" (or is it?)

Page 80, third paragraph -- I don't think the River Alliance study evaluated flows for flatwater boating, as the report, on pp 22-23, says that the study "focused only on sections of the lower Saluda which had whitewater characteristics." The RA study does address "open tandem canoes" on the whitewater sections and two flows (roughly 2,000 cfs and 4500 cfs) were evaluated. On p. 45 a table RA reports flows as "recommended safety ranges" for "canoe" but does not distinguish between the "open tandem canoe" and "whitewater canoe" categories.

Page 81-82 – Comment: Similar to comments, above, for page 10 and page 13, I think the rate of change analyses and conclusions about rate of change should address a maximum and sustained flow scenario from the hydro plant that produces the most rapid change effects downstream at all sites. I think that would be a 3-hour reserve call requiring 18,000 cfs released at maximum incremental flow rates (1,167 cfs?). Various scenarios are well analyzed and presented in this report but none of them of them seem to push the variables to their potential maximum limits.
Probably the most safety-relevant information to produce and report is the steepest rates of change within the first 15 and 30 minutes (or first 1 to 4 feet of rise) after "wave arrival" at each site.

From:	Bret Hoffman
To:	"Feleke Arega"; "Ray Ammarell"; Alan Stuart; "Amy Bennett"; BARGENTIERI@scana.com; "Bob Olsen"; "Bud Badr"; "Jim Cumberland "; "turnerle@dhec.sc.gov"; "Mike Waddell"; Mike Schimpff; Jon Quebbeman;
cc:	Alison Guth;
Subject:	RE: Saluda Operations Model Update
Date:	Thursday, September 20, 2007 10:35:39 AM
Attachments:	Statistical Analysis Saluda Op Model.pdf

Operations TWC members,

In response to Dr. Arega's email (below), please see the attached write-up regarding additional statistical analyses of the revised Saluda Operations model. The results of these analyses indicate the model does a very good job predicting stage and flow with reservoir elevations in the current (and future) ranges. If you have any additional questions please email them to me.

Thanks,

Bret R. Hoffman, P.E.
Kleinschmidt
Energy & Water Resource Consultants
204 Caughman Farm Lane, Suite 301
Lexington, SC 29072
(803) 951-2077
FAX (803) 951-2124
Bret.Hoffman@KleinschmidtUSA.com

-----Original Message-----
From: Feleke Arega [mailto:AregaF@dnr.sc.gov]
Sent: Thursday, September 13, 2007 10:02 AM
To: Bret Hoffman; Ray Ammarell; Alan Stuart; Amy Bennett; BARGENTIERI@scana.com; Bob Olsen; Bud Badr; Jim Cumberland ; turnerle@dhec.sc.gov; Mike Waddell; Mike Schimpff; Jon Quebbeman
Cc: Alison Guth
Subject: RE: Saluda Operations Model Update

Bret,
Thanks for the update. I have the following suggestion. The statistical tests that used for evaluating model predictions should include more

measures. The R-squared value only does not tell much. If you include more statistical tests like the Mean Error (ME), Mean Absolute Error (MAE), Root Mean Square (RMS) error, Maximum Absolute Error, Relative Mean Error and Relative Absolute Mean Error would give a better picture of model performance. At least, it would be good to see the RMS values for discharge and stage.

Feleke Arega, PhD
Hydrologist
Land, Water, and Conservation Division
SC Department of Natural Resources
PO Box 167
Columbia, South Carolina 29202
Phone: (803) 734-0073
Fax: (803) 734-9200
Email: aregaf@dnr.sc.gov

From: Bret Hoffman [mailto:Bret.Hoffman@KleinschmidtUSA.com]
Sent: Wednesday, September 12, 2007 12:12 PM
To: Ray Ammarell; Alan Stuart; Amy Bennett; Bill Argentieri; Bob Olsen; Bret Hoffman; Bud Badr; Feleke Arega; Jim Cumberland ; turnerle@dhec.sc.gov; Mike Waddell; Mike Schimpff; Jon Quebbeman
Cc: Alison Guth
Subject: Saluda Operations Model Update

Good afternoon Operations TWC members,
Several months back we received a request from Dr. Badr to consider a longer period of record for the Saluda operations model. As you may recall, the downstream gage period of record limited our inflow hindcasting to 16 years. At Dr. Badr's request, we contacted USGS to discuss the possibility of extending the record of the gage just downstream of the dam.

Mr. Paul Conrads at the USGS, along with other hydrologists in the SC District office, developed two methodologies to hindcast the flows for the gage just downstream of the dam (station 02168504) by utilizing the data from the gage near Columbia (station 02169000). After selecting the preferred methodology, they provided us with hindcasted daily average flows at the gage just downstream of the dam back to 1940. Along with daily lake stage data, this provides us over 60 years of data to base our

operations model on. From a hydrologic aspect, this is important because it expands the base model to include a broader range of inflows. The downside of including data from a longer period of calculated flows is the accuracy declines.

Statistically, the USGS flow model had a tested R-squared value of 0.986. Using the hindcasted data from the USGS model, the modified operations model has a discharge R-squared value of 0.963 (vs. 0.992 for the original model). The modified model has an R-squared value for stage predictions between 1960 and 2006 of 0.914 (vs. 0.993 for the original model). The year 1960 was chosen as a start for this calculation because prior to that, the lake was operated in a much broader range of levels, sometimes going down to elevation 330'. The stage-storage curve loses accuracy at such low elevations, and since the project does not operate in these low ranges, it is appropriate to consider operations since 1960 for calculating stage values from outflow for the purpose of calibration. (The R-squared value for the entire period between 1940 and 2006 is 0.696, again because of low elevation inaccuracy of the stage-storage curve). Runs will be completed for the entire historic period from 1940 to 2006, as modeled operations should remain within expected operating levels.

Since the operations model is based on the USGS flow calculations, the overall R-squared values for discharge and stage are products of the modified operations model R-squared values with those of the USGS model. The original model values were 0.993 and 0.992 for stage and discharge, respectively; the overall modified model values are 0.950 (for discharge over the whole period) and 0.901 (for stage from 1960 to 2006).

This extension of data is an improvement to the model based upon data provided to us from the USGS; the ability to model the broader range of inflows captured by over six decades of data is a great benefit at the cost of reducing the correlation accuracy. Please let me know your opinions on this, as we need to update the Operations RCG (as well as all other RCG's) of this modification to the operations model. If needed, we can schedule a meeting via conference call to discuss this.

Thanks,

_____

Bret R. Hoffman, P.E.
Kleinschmidt
Energy & Water Resource Consultants
204 Caughman Farm Lane, Suite 301
Lexington, SC 29072

(803) 951-2077
FAX (803) 951-2124
Bret.Hoffman@KleinschmidtUSA.com

From: Alison Guth
To: "Kustafik, Karen";
Subject: RE: Aquatic Studies Next Week
Date: Friday, June 01, 2007 1:02:51 PM

Thanks Karen, I will forward your email to the survey staff. Have a great weekend! Alison

-----Original Message-----
From: Kustafik, Karen [mailto:kakustafik@columbiasc.net]
Sent: Friday, June 01, 2007 1:00 PM
To: Alison Guth
Subject: RE: Aquatic Studies Next Week

Aaaah, studies. We just concluded the Rocky Shoals Spider Lily survey this week. Yay!

I want to let you know that Andy Grizzell and I will be on the water 1-5 Tuesday -Friday with kids from summer camp. We will certainly stay alert for cables and survey staff. Tuesday and Wednesday will be Millrace 1 & 2 areas, probably downsteam to Gervias Thursday & Friday.

Happy Weekend, Karen

-----Original Message-----
From: Alison Guth [mailto:Alison.Guth@KleinschmidtUSA.com]
Sent: Friday, June 01, 2007 12:44 PM
To: Winward point Yacht Club ; Aaron Small; Axson, William; Alan Stuart; aharmon@lpagroup.com; Alison Guth; Amanda Hill; Amy Bennett; Andy Miller; Bertina Floyd; Bill Argentieri; Bill Brebner ; Bill East; BGreen@smeinc.com; Bill Hulslander; Bill Marshall; Bill Mathias; Bob Olsen; bseibels@yahoo.com; Brandon Stutts ; Bret Hoffman; Brett Bursey; btrump@scana.com; Bud Badr; Buddy Baker ; Charlene Coleman; Charles Floyd; Charlie Compton; Charlie Rentz; Chris Page; ccantley@scdah.state.sc.us; Daniel Tufford; Dave Anderson; Dave Landis; David Allen; David Hancock; David Jones; David Price; Dee Dee Simmons ; Dick Christie; Don Tyler; Donald Eng; Ed Diebold; duncane@mrd.dnr.state.sc.us; Edward Schnepel; aregaf@dnr.sc.gov; George Duke; Gerrit Jobsis (American

Rivers); Gina Kirkland; Guy Jones; Hal Beard; Hank McKellar; ipitts@scprt.com; J. Hamilton Hagood; Jay Schabacher ; Jeff Duncan; Jennifer O'Rourke; Jennifer Price ; Jerry Wise; Jim Devereaux; Jim Glover; Jim Goller; Jim Ruane ; JoAnn Butler; Joe Logan; Joel Huggins ; John and Rob Altenberg; johned44@bellsouth.net; John Frick; Jon Leader; Joy Downs; Kustafik, Karen; Keith Ganz-Sarto; Ken Styer ; Ken Uschelbec; Kenneth Fox; Kim Westbury; Kristina Massey; turnerle@dhec.sc.gov; Lee Barber; Linda Lester ; Linda Schneider ; Malcolm Leaphart; Mary Kelly; Michael Murrell; Mike Duffy; Mike Sloan; msummer@scana.com; Mike Waddell; Miriam Atria; Norm Nicholson; Norman Ferris; Parkin Hunter; Patricia Wendling; Patrick Moore; Phil Hamby ; Prescott Brownell; Randal Shealy; Randy Mahan; Ray Ammarell; Rebekah Dobrasko; rbull@davisfloyd.com; Rhett Bickley; Richard Kidder; Richard Mikell; SKEENER@sc.rr.com; Robert Lavisky; Roger Hovis ; Ron Ahle; Ronald Scott; Roy Parker; Russell Jernigan; ryanity@scana.com; Sandra Reinhardt; Sean Norris; Shane Boring; Sheri Armstrong ; Skeet Mills ; sjones@imichotels.net; Steve Bell; Steve Summer; Suzanne Rhodes; Synithia Williams; Theresa Powers; Theresa Thom; Tim Vinson; tbowles@scana.com; Tom Ruple; Tom Stonecypher; Tommy Boozer; Tony Bebber; tylehowe@nc-cherokee.com; Van Hoffman; balesw@dnr.sc.gov; Wenonah Haire
Subject: Aquatic Studies Next Week

Hello All,

This is just a reminder regarding next week's IFIM (Instream Flow Incremental Methodology) Study on the lower Saluda River. SCE&G, Kleinschmidt and DNR will perform this detailed study of aquatic habitat in the lower Saluda Sunday, June 3, through Friday, June 8 from approximately 7 am to 6 pm each day. As Alan has described in the past RCG/TWC and Quarterly Public Meetings, the study methodology requires scientists and biologists to establish approximately 20 transects across the lower Saluda River and collect information such as habitat types, water depth, water surface elevations and water velocity measurements at various flows released from the dam.

To collect data, field crews will establish Kevlar cables across the river at each transect where data is to be collected. The cables are used to stabilize the boats in which the scientists are collecting the required data. The cables will be marked with orange flagging and will be manned by a field crew at all times. The field crews will move across the cabled transects laterally collecting data which may present an obstacle to boaters and other river users.

The location of the field scientists and transects where they are collecting data will vary from day to day. Locations of the transects range from just below the Saluda Dam to the confluence with the Broad River.

We ask that you use caution during any river activities and watch for field crew members and cables. Also, it is important that you pay attention to signage, sirens and changing water elevations. There will be a press release published in the local papers regarding this, as well. Thanks, Alison

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

From:	Prescott Brownell
To:	Alan Stuart;
cc:	Gerrit Jobsis; PatrickM@scccl.org; Amanda_Hill@fws.gov; dchristie@infoave.net; Hal Beard; Gina Kirkland; rrcollins@n-h-i.org; Julie Gantenbein; BARGENTIERI@scana.com; Mike Summer; Steve Summer; RMAHAN@scana.com; BOWLES, THOMAS M; BJMcManus@jonesday.com; Alison Guth; Jim Ruane;
Subject:	Re: 2006 Report on Turbine Aeration Studies at Saluda Hydro and Draft 2007 Operations Guidlines
Date:	Monday, June 18, 2007 5:44:50 PM
Attachments:	prescott.brownell.vcf

Hello Alan and team,
I have reviewed the attached reports and Operating Plan and find them to be very well done, and adequate for filing with FERC. Please let me know if you or others find the need to change or add anything to the reports and plan.

V/R
Prescott Brownell
National Marine Fisheries Service
South Atlantic Branch Office
Charleston, SC
843-953-7204

Alan Stuart wrote:

> Good morning all,
>
> Attached to this email are the 1) revised (per our meeting) 2006 Operations Report of Saluda Hydro 2) 2006 Turbine Aeration Study Report and 3) 2007 Operating Plan with revised Look up tables based on the 2006 turbine aeration study. Please review these documents and provide us any further comments you may have by June 17, 2007. Per the agreement we must file the 2007 Operating Plan by June 30, 2007.
>
> We would like to get comments back on all of these documents by June 17, 2007. However, realizing everyone is very busy these days we recommend that empahsis be place on review of the 2007 Draft Operations Plan, as this is the only document required to be submitted to the FERC by June 30. One final note, in the 2006 Operations Report all suggested revisions provided at our Marchl meeting were accepted and clarfications added.
>
> Should you have questions on these documents please let us know. We appreciate everyone's efforts on the Saluda Aeration studies and look forward to a successful 2007 season.
>
> Thank you,
> Alan
>
> ***Alan Stuart***

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

Office: 803-822-3177
Cell: 803-640-8765
Fax: 803-822-3183

email: Alan.Stuart@kleinschmidtusa.com

From: Alison Guth
To: "Julie Gantenbein"; "Gerrit Jobsis"; Alan Stuart; "Amanda_Hill@fws.gov"; "Hal Beard"; "Prescott.Brownell@noaa.gov"; "Gina Kirkland"; "Richard Roos-Collins"; "Jim Cumberland"; "Dchristie@coporium.net";
cc: BARGENTIERI@scana.com; "Mike Summer"; "Steve Summer"; RMAHAN@scana.com; "BOWLES, THOMAS M"; "BJMcManus@jonesday.com"; "Jim Ruane";
Subject: RE: 2007 Operations Report For Saluda Hydro
Date: Friday, March 21, 2008 10:52:30 AM

Hello all,

For those of you who are calling into the meeting on Wednesday, the call-in information will be sent out on Monday. The SCE&G contact who has the call-in information is out of the office until that time.

Thanks,
Alison

-----Original Message-----
From: Julie Gantenbein [mailto:JGantenbein@n-h-i.org]
Sent: Friday, March 21, 2008 10:47 AM
To: 'Gerrit Jobsis'; Alan Stuart; Alison Guth; Amanda_Hill@fws.gov; Hal Beard; Prescott.Brownell@noaa.gov; Gina Kirkland; Richard Roos-Collins; Jim Cumberland; Dchristie@coporium.net
Cc: BARGENTIERI@scana.com; Mike Summer; Steve Summer; RMAHAN@scana.com; BOWLES, THOMAS M; BJMcManus@jonesday.com; Jim Ruane
Subject: RE: 2007 Operations Report For Saluda Hydro

Alan and/or Alison:

Will you also please send out call-in information? Thank you. Julie

_____
Julie Gantenbein
Staff Attorney
Natural Heritage Institute
1423 Marshall Street
Houston, Texas 77006
(707) 931-0034
(866) 779-4316 (efax)
jgantenbein@n-h-i.org
www.n-h-i.org

From: Gerrit Jobsis [mailto:gjobsis@americanrivers.org]
Sent: Thursday, March 20, 2008 2:57 PM
To: Alan Stuart; Alison Guth; Amanda_Hill@fws.gov; Hal Beard; Prescott. Brownell@noaa.gov; Gina Kirkland; Richard Roos-Collins; Julie Gantenbein; Jim Cumberland; Dchristie@coporium.net
Cc: Bill Argentieri; Mike Summer; Steve Summer; RMahan@scana.com; BOWLES, THOMAS M; BJMcManus@jonesday.com; Jim Ruane
Subject: RE: 2007 Operations Report For Saluda Hydro

Alan,

We're looking forward to the meeting. Can you send out the time and location. I can't find it.

Thanks

Gerrit

Gerrit Jobsis, American Rivers
Southeast Regional Director
2231 Devine Street, Suite 202, Columbia, S.C. 29205
803.771.7114 (t) 803.771.7580 (f)
gjobsis@americanrivers.org

From: Alan Stuart [mailto:Alan.Stuart@KleinschmidtUSA.com]
Sent: Monday, March 17, 2008 2:24 PM
To: Alison Guth; Gerrit Jobsis; Amanda_Hill@fws.gov; Hal Beard; Prescott. Brownell@noaa.gov; Gina Kirkland; rrcollins@n-h-i.org; Julie Gantenbein; Jim Cumberland; Dchristie@coporium.net
Cc: Bill Argentieri; Mike Summer; Steve Summer; RMahan@scana.com; BOWLES, THOMAS M; BJMcManus@jonesday.com; Jim Ruane
Subject: 2007 Operations Report For Saluda Hydro

Good afternoon all,

Attached to this email is a draft copy of the 2007 Operations report for Saluda Hydro. As was the case in 2006, dissolved oxygen levels were

kept at or above standards for most of the low DO season during 2007. Please review the document and be prepared to ask any questions at our meeting next Wednesday (March 26th). Our goal as always will be to discuss the findings from 2007 and begin developing the operating plan for the 2008 low DO season.

On another note, you will also be receiving on Wednesday or Thursday of this week a report on the turbine venting work conducted last year. If you have questions on that work you will also have a chance to ask them next week.

thanks !
Alan

From:	Alison Guth
To:	"Mark Giffin"; "Vivianne Vejdani";
cc:	Dick Christie (dchristie@comporium.net); Alan Stuart;
Subject:	FW: 2007 Operations Report For Saluda Hydro with 2008 Operations Plan Appended and Turbine testing report
Date:	Monday, June 02, 2008 12:39:15 PM
Attachments:	Final Saluda Annual Report on 2007 Operations 5-29-08.doc
	Updated Saluda Hydro Aeration Studies-5-29-08.doc

-----Original Message-----
From: Alan Stuart
Sent: Thursday, May 29, 2008 11:55 AM
To: Alan Stuart; Alison Guth; 'Gerrit Jobsis'; 'Amanda_Hill@fws.gov'; 'Hal Beard'; 'Prescott.Brownell@noaa.gov'; 'Gina Kirkland'; 'rrcollins@n-h-i.org'; 'Julie Gantenbein'; 'Jim Cumberland'; Dchristie@coporium.net; giffinma@dhec.sc.ogv
Cc: 'Bill Argentieri'; 'Mike Summer'; 'Steve Summer'; 'RMahan@scana.com'; 'BOWLES, THOMAS M'; 'BJMcManus@jonesday.com'; 'Jim Ruane'
Subject: 2007 Operations Report For Saluda Hydro with 2008 Operations Plan Appended and Turbine testing report

Good afternoon all,

Attached to this email is a Final copy of the 2007 Operations report for Saluda Hydro. The report reflects suggestions provided during our annual meeting back on March 26, 2008. Appended to the final report is the draft 2008 Operating Plan (Plan) for Saluda Hydro. The draft Plan incorporates the lastest information on the 2007 turbine testing and the Look-up Tables have been amended to reflect this recent information. Please review the 2008 draft Plan and provide any comments to us by **June 16, 2008** as we must file the Plan with the Commission by June 30th.

Additionally, attached to this email is the report on the Turbine Testing Studies conducted in 2007.

On another note, during the meeting held on March 26, 2008, SCE&G discussed with American Rivers, *et al* , and the various resource agencies the possibility of the Company approaching the South Carolina Department of Health and Environmental Control for the purpose of amending the discharge permit for the McMeekin Steam Station under section 402 of the Clean Water Act to allow for the use of a cone valve that would supplement aeration in the tailwater of the Saluda Project. As explained by SCE&G, such use of the cone valve could be on an "as needed" basis, without the need for prior authorization to the department. Subsequent to that meeting in March, SCE&G has considered this matter further and has concluded that it would not be appropriate to constrain the operation of the McMeekin Station, a facility that is not under FERC jurisdiction, to operations of the Saluda Project. Accordingly, SCE&G has decided not to include in recommendations regarding the operation of the Saluda Project any reference to the McMeekin Station.

However, SCE&G has indicated they will still pursue discussions with SCDHEC with regard to the discharge permit for the McMeekin Station in an effort to provide less stringent requirements for prior notification when the cone valve is to be used, but as a matter independent of the operation of the Saluda Project.

If you have questions on any of the items please let us know. Again, our thanks for everyone's hard work !

thank you,
Alan

Carl Bussells

From: Shane Boring
Sent: Tuesday, September 18, 2007 1:14 PM
To: Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie (dchristie@comporium.net); Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Hand; 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: Oh Brother Geomorph Assessment

Saluda Assessment 09-18-2007.p...

Dear Instream Flow TWC Members:

As you may remember, we had a geologist (Dr Tim Kana) conduct an assessment of the Oh Brother Rapids area of the Lower Saluda prior to placing transects there for the IFIM study. Attached for your records is the memo summarizing Dr Kana's observations. Thanks for your continued interest in the IFIM study.

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

Carl Bussells

From: Shane Boring
Sent: Tuesday, September 18, 2007 1:14 PM
To: Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie (dchristie@comporium.net); Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Hand; 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: Oh Brother Geomorph Assessment

Saluda Assessment 09-18-2007.p...

Dear Instream Flow TWC Members:

As you may remember, we had a geologist (Dr Tim Kana) conduct an assessment of the Oh Brother Rapids area of the Lower Saluda prior to placing transects there for the IFIM study. Attached for your records is the memo summarizing Dr Kana's observations. Thanks for your continued interest in the IFIM study.

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

Kelly: Please clarify that there is a limitation of 850 cfs because of the HEC-RAS code or is this your limitation. Because what concerns me is on page 13 the report states in reality when the reserve is call up to 18,000 cfs the actual rate of rise is 1,167 cfs. This is not significant for most areas on the river except at Metts Landing and Corley Island where we fish. So what has to be done to simulate reality.

Mike

From: Kelly Maloney [mailto:Kelly.Maloney@KleinschmidtUSA.com]
Sent: Monday, October 15, 2007 11:51 AM
To: Mike Waddell
Cc: Alan Stuart; Jon Quebbeman
Subject: RE: Down Stream Recreation Flow Assessment Report {SpamScore: sss}

Mike,

I am having the graphs you requested generated and will send them shortly.

If I understand your second question correctly, the model assumes that the plant starts with a baseline flow of 500 cfs, then increases flows incrementally by 850 cfs per minute regardless of operational scenario. For a flow of 3000 cfs, for example, the model assumes at minute zero the flow is 500 cfs; at minute one the flow is 500 cfs plus 850 cfs (1350 cfs); minute two gains an additional 850 cfs increase, resulting in a flow of 2200 cfs; and minute three reaches the targeted flow of 3000 cfs. This assumption is discussed as a limitation of the model on page 13 of the report.

Just a reminder that, because I am departing for maternity leave on October 26, I would like to have all comments by October 19, if at all possible.

Thank you,
Kelly

-----Original Message-----
From: Mike Waddell [mailto:mwaddell@esri.sc.edu]
Sent: Monday, October 15, 2007 10:04 AM
To: Kelly Maloney
Subject: RE: Down Stream Recreation Flow Assessment Report

What I need to evaluated the report is to know at each cross section across the river where there was a water level recorder the graph showing the modeling results and actual water levels from the data recorders to determine how well the model calibrated with actual measurements. The other question I have are the rates of change in time and elevation base on incremented the flow at 850 cfs not 18000 cfs at one time.

Mike

From: Kelly Maloney [mailto:Kelly.Maloney@KleinschmidtUSA.com]
Sent: Monday, October 15, 2007 9:50 AM
To: Mike Waddell
Subject: RE: Down Stream Recreation Flow Assessment Report

Mike,

They are generated from the model which was created with the level logger data.

Thanks,
Kelly
-----Original Message-----
From: Mike Waddell [mailto:mwaddell@esri.sc.edu]
Sent: Monday, October 15, 2007 9:48 AM
To: Kelly Maloney
Subject: RE: Down Stream Recreation Flow Assessment Report

Kelly I was able to open them. In Appendix F the hydrographs are generated from the model or are they from the water level recorders?

Mike

From: Kelly Maloney [mailto:Kelly.Maloney@KleinschmidtUSA.com]
Sent: Monday, October 15, 2007 9:24 AM
To: Mike Waddell; Alan Stuart
Subject: RE: Down Stream Recreation Flow Assessment Report

Mike,

The files are quite large. Please let me know if you are unable to retrieve or open them.

Thank you,
Kelly

-----Original Message-----
From: Mike Waddell [mailto:mwaddell@esri.sc.edu]
Sent: Monday, October 15, 2007 7:45 AM
To: Kelly Maloney; Alan Stuart
Subject: Down Stream Recreation Flow Assessment Report

Kelly: I am missing Appendix E and F. Therefore I cannot finish reviewing this report. Would please send me the missing appendices and I will need a another week or two to finish reviewing and making comments.

Mike

Michael G. Waddell
Research Associate Professor
Earth Sciences and Resources Institute
University of South Carolina
Office (803) 777-6484

From: Feleke Arega
To: Bret Hoffman; Ray Ammarell; Alan Stuart; Amy Bennett; BARGENTIERI@scana.com; Bob Olsen; Bud Badr; Jim Cumberland ; turnerle@dhec.sc.gov; Mike Waddell; Mike Schimpff; Jon Quebbeman;
cc: Alison Guth;
Subject: RE: Saluda Operations Model Update
Date: Thursday, September 13, 2007 10:02:08 AM

Bret,

Thanks for the update. I have the following suggestion. The statistical tests that used for evaluating model predictions should include more measures. The R-squared value only does not tell much. If you include more statistical tests like the Mean Error (ME), Mean Absolute Error (MAE), Root Mean Square (RMS) error, Maximum Absolute Error, Relative Mean Error and Relative Absolute Mean Error would give a better picture of model performance. At least, it would be good to see the RMS values for discharge and stage.

Feleke Arega, PhD
Hydrologist
Land, Water, and Conservation Division
SC Department of Natural Resources
PO Box 167
Columbia, South Carolina 29202
Phone: (803) 734-0073
Fax: (803) 734-9200
Email: aregaf@dnr.sc.gov

From: Bret Hoffman [mailto:Bret.Hoffman@KleinschmidtUSA.com]
Sent: Wednesday, September 12, 2007 12:12 PM
To: Ray Ammarell; Alan Stuart; Amy Bennett; Bill Argentieri; Bob Olsen; Bret Hoffman; Bud Badr; Feleke Arega; Jim Cumberland ; turnerle@dhec.sc.gov; Mike Waddell; Mike Schimpff; Jon Quebbeman
Cc: Alison Guth
Subject: Saluda Operations Model Update

Good afternoon Operations TWC members,
Several months back we received a request from Dr. Badr to consider a longer period of record for the Saluda operations model. As you may recall, the downstream gage period of record limited our inflow hindcasting to 16 years. At

Dr. Badr's request, we contacted USGS to discuss the possibility of extending the record of the gage just downstream of the dam.

Mr. Paul Conrads at the USGS, along with other hydrologists in the SC District office, developed two methodologies to hindcast the flows for the gage just downstream of the dam (station 02168504) by utilizing the data from the gage near Columbia (station 02169000). After selecting the preferred methodology, they provided us with hindcasted daily average flows at the gage just downstream of the dam back to 1940. Along with daily lake stage data, this provides us over 60 years of data to base our operations model on. From a hydrologic aspect, this is important because it expands the base model to include a broader range of inflows. The downside of including data from a longer period of calculated flows is the accuracy declines.

Statistically, the USGS flow model had a tested R-squared value of 0.986. Using the hindcasted data from the USGS model, the modified operations model has a discharge R-squared value of 0.963 (vs. 0.992 for the original model). The modified model has an R-squared value for stage predictions between 1960 and 2006 of 0.914 (vs. 0.993 for the original model). The year 1960 was chosen as a start for this calculation because prior to that, the lake was operated in a much broader range of levels, sometimes going down to elevation 330'. The stage-storage curve loses accuracy at such low elevations, and since the project does not operate in these low ranges, it is appropriate to consider operations since 1960 for calculating stage values from outflow for the purpose of calibration. (The R-squared value for the entire period between 1940 and 2006 is 0.696, again because of low elevation inaccuracy of the stage-storage curve). Runs will be completed for the entire historic period from 1940 to 2006, as modeled operations should remain within expected operating levels.

Since the operations model is based on the USGS flow calculations, the overall R-squared values for discharge and stage are products of the modified operations model R-squared values with those of the USGS model. The original model values were 0.993 and 0.992 for stage and discharge, respectively; the overall modified model values are 0.950 (for discharge over the whole period) and 0.901 (for stage from 1960 to 2006).

This extension of data is an improvement to the model based upon data provided to us from the USGS; the ability to model the broader range of inflows captured by over six decades of data is a great benefit at the cost of reducing the correlation accuracy. Please let me know your opinions on this, as we need to update the Operations RCG (as well as all other RCG's) of this modification to the operations model. If needed, we can schedule a meeting via conference call to discuss this.

Thanks,

Bret R. Hoffman, P.E.
Kleinschmidt
Energy & Water Resource Consultants
204 Caughman Farm Lane, Suite 301
Lexington, SC 29072
(803) 951-2077
FAX (803) 951-2124
Bret.Hoffman@KleinschmidtUSA.com

From:	Bret Hoffman
To:	"Feleke Arega"; "Ray Ammarell"; Alan Stuart; "Amy Bennett"; BARGENTIERI@scana.com; "Bob Olsen"; "Bud Badr"; "Jim Cumberland "; "turnerle@dhec.sc.gov"; "Mike Waddell"; Mike Schimpff; Jon Quebbeman;
cc:	Alison Guth;
Subject:	RE: Saluda Operations Model Update
Date:	Thursday, September 20, 2007 10:35:39 AM
Attachments:	Statistical Analysis Saluda Op Model.pdf

Operations TWC members,

In response to Dr. Arega's email (below), please see the attached write-up regarding additional statistical analyses of the revised Saluda Operations model. The results of these analyses indicate the model does a very good job predicting stage and flow with reservoir elevations in the current (and future) ranges. If you have any additional questions please email them to me.

Thanks,

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Bret.Hoffman@KleinschmidtUSA.com

-----Original Message-----
From: Feleke Arega [mailto:AregaF@dnr.sc.gov]
Sent: Thursday, September 13, 2007 10:02 AM
To: Bret Hoffman; Ray Ammarell; Alan Stuart; Amy Bennett; BARGENTIERI@scana.com; Bob Olsen; Bud Badr; Jim Cumberland ; turnerle@dhec.sc.gov; Mike Waddell; Mike Schimpff; Jon Quebbeman
Cc: Alison Guth
Subject: RE: Saluda Operations Model Update

Bret,
Thanks for the update. I have the following suggestion. The statistical tests that used for evaluating model predictions should include more

measures. The R-squared value only does not tell much. If you include more statistical tests like the Mean Error (ME), Mean Absolute Error (MAE), Root Mean Square (RMS) error, Maximum Absolute Error, Relative Mean Error and Relative Absolute Mean Error would give a better picture of model performance. At least, it would be good to see the RMS values for discharge and stage.

Feleke Arega, PhD
Hydrologist
Land, Water, and Conservation Division
SC Department of Natural Resources
PO Box 167
Columbia, South Carolina 29202
Phone: (803) 734-0073
Fax: (803) 734-9200
Email: aregaf@dnr.sc.gov

From: Bret Hoffman [mailto:Bret.Hoffman@KleinschmidtUSA.com]
Sent: Wednesday, September 12, 2007 12:12 PM
To: Ray Ammarell; Alan Stuart; Amy Bennett; Bill Argentieri; Bob Olsen; Bret Hoffman; Bud Badr; Feleke Arega; Jim Cumberland ; turnerle@dhec.sc.gov; Mike Waddell; Mike Schimpff; Jon Quebbeman
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Carl Bussells

From: Alison Guth
Sent: Tuesday, September 25, 2007 4:40 PM
To: Tony Bebber; Bill Argentieri; Bill Marshall; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Hand; Jim Cumberland ; Karen Kustafik; Kelly Maloney; Malcolm Leaphart; Mike Waddell
Cc: Alan Stuart
Subject: Draft Flow Study Report

The following message is from Kelly Maloney:

Good Afternoon Everyone,

I hope this email finds you well. First of all, I would like to thank everyone for assisting with this effort - whether it be feedback received during TWC meetings, participation in the focus group, and/or participation in the on-site evaluations, your input into this effort is truly appreciated and invaluable.

Attached is the Draft Downstream Flow Study Report for your review and comment. I have attempted to reduce the file size by zipping the three files (report and two appendices). I was unable to email them, however, because the file sizes are still too large. I am having Alison Guth pass these files along to you but if you are unable to retrieve these due to file size constraints, please let me know and I will get these to you in hardcopy or via CD, if necessary.

I would love to be able to tell everyone to take their time in reviewing this document but alas, my due date is impending. It would be wonderful if everyone could get their comments and edits back to me in the next three weeks (by October 19). That should give me enough time to address any issues or corrections and finalize the report before my departure. I thank everyone, in advance, for their time and assistance.

Please let me know if you have any questions or concerns.

Thank you,

Kelly Maloney
Kleinschmidt Associates
Energy and Water Resource Consultants
141 Main Street, PO Box 650
Pittsfield, Maine 04967-0650
207-487-3328 x 271
207-487-3124 fax
Kelly.Maloney@KleinschmidtUSA.com

Draft Flow
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Draft Flow
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Carl Bussells

From: Bill Marshall [MarshallB@dnr.sc.gov]
Sent: Monday, September 10, 2007 4:24 PM
To: Kelly Maloney; Tony Bebber; BARGENTIERI@scana.com; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Hand; Karen Kustafik; Malcolm Leaphart; Patrick Moore; Alan Stuart; Dick Christie
Subject: RE: Downstream Flows Study Update

Okay, Kelly. Thanks for the quick reply. I hope all goes well for you and baby.

-----Original Message-----
From: Kelly Maloney [mailto:Kelly.Maloney@KleinschmidtUSA.com]
Sent: Mon 9/10/2007 4:12 PM
To: Bill Marshall; Tony Bebber; BARGENTIERI@scana.com; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Summerlin; Karen Kustafik; Malcolm Leaphart; Patrick Moore; Alan Stuart; Dick Christie
Subject: RE: Downstream Flows Study Update

Bill,

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Hope all is well,
Kelly

> -----Original Message-----
> From: Bill Marshall [mailto:MarshallB@dnr.sc.gov]
> Sent: Monday, September 10, 2007 4:04 PM
> To: Kelly Maloney; Tony Bebber; BARGENTIERI@scana.com; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Summerlin; Karen Kustafik; Malcolm Leaphart; Patrick Moore; Alan Stuart; Dick Christie
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> Dave, Kelly, or Alan -- I just looked over the online presentation slides for the "Flow Release Study" (study based on level-logger data) that was provided at the July 19 quarterly meetings. I had to miss those meetings and the presentation but am interested in knowing more about the findings, as the slides are brief and some even seem to get into issues beyond our basic question -- that is, how fast does the water rise under a range of typical hydro release scenarios?
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> Please remind me of the plan for sharing results with the TWC and producing draft reports on this and the other parts of the downstream flows assessment, described below. Thanks.
>
> Bill Marshall
>
> _____

From: Kelly Maloney [mailto:Kelly.Maloney@KleinschmidtUSA.com]
Sent: Friday, April 06, 2007 3:16 PM
To: Tony Bebber; Bill Argentieri; Bill Marshall; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Summerlin; Karen Kustafik; Kelly Maloney; Malcolm Leaphart; Patrick Moore
Cc: Alan Stuart
Subject: Downstream Flows Study Update

Downstream Flows TWC,

Good afternoon. I hope this email finds you well. As several of you have posed questions and inquiries as to the status of the Downstream Recreation Flow Assessment, we thought we would provide a progress report. I have provided an update below on the various phases outlined in the Downstream Recreation Flow Assessment Study Plan:

Phase I - Literature Review and Desktop Analysis

This component of the study is ongoing and will continue through the duration. So far, we have compiled a fair amount of literature pertaining to recreation on the lower Saluda River including the Three Rivers Greenway Plan, South Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP), the Lower Saluda Scenic River Corridor Plan and Update, the Draft 2006 Saluda Recreation Assessment, and lower Saluda River creel surveys. In addition, we have collected hydrologic data from the USGS.

Phase II - Focus Group and Field Reconnaissance

Expert Panel Focus Group - We would like to schedule this fairly soon as input received during the focus group will help us to determine what flows should be evaluated during the on-site reconnaissance. The members of the Downstream Flows TWC, and additional experienced recreational users and resources experts, as needed, will comprise the focus group. Please provide information regarding your availability for a focus group meeting on the afternoon or evening or April 17, the afternoon or evening of April 18 or the morning of April 20. Please also provide any suggestions you may have for additional individuals who should be invited to participate in the focus group panel.

Expert Panel On-site Evaluation - We would also like to schedule this effort soon. We are tentatively looking at the week of May 14 through May 20. We anticipate that this will be a combination of a land and water-based reconnaissance whereby participants will engage in a variety of activities (paddling, angling) or observe recreation sites with specific activities in mind (swimming, rock hopping) to provide input on the appropriateness of each flow level for the specific activity in which that individual is participating or observing. There will be three flows provided which will be discussed and finalized during the expert panel focus group. Tentatively, we anticipate requesting a flow of 1,000 cfs or less (indicated in TWC meeting notes as being most appropriate for boating, swimming, rock hopping and wade angling), a flow of 2,500 cfs (indicated in TWC meeting notes as being most appropriate for boating, tubing and bank angling), and a flow of 5,000 cfs (indicated in TWC meeting notes and American Whitewater as most appropriate for whitewater paddling).

Rate of Change Video Documentation - A high flow rate of change event (18,000 cfs) was video documented on January 31, 2007. The

surveyor was stationed at Mill Race rapids from approximately 7:00 am to about 12:30 pm to capture both the water rise and a duration of maximum stage

Phase III - Field Data Collection

Level Logger Deployment and Data Collection - The level loggers, which record the stage (in feet) and temperature every minute, were deployed at the 8 sites detailed in the study plan. The level loggers were installed during the week of January 15 and removed during the week of February 19. Data was collected from January 22 through February 22 and includes the following flow events:

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Tuesday, January 23 - 10,000 cfs - 5:56 AM
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Level Logger Analysis - Analysis of the level logger data, in conjunction with USGS hydrologic data, as per the study plan is ongoing.

We hope that this helps to clarify the status of the Downstream Recreation Flow Assessment Study Plan. If you have any additional questions or concerns, do not hesitate to contact me or Dave Anderson.

Thank you,
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Subject: Downstream Flows Study Update

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Good afternoon. I hope this email finds you well. As several of you have posed questions and inquiries as to the status of the Downstream Recreation Flow Assessment, we thought we would provide a progress report. I have provided an update below on the various phases outlined in the Downstream Recreation Flow Assessment Study Plan:

Phase I - Literature Review and Desktop Analysis

This component of the study is ongoing and will continue through the duration. So far, we have compiled a fair amount of literature pertaining to recreation on the lower Saluda River including the Three Rivers Greenway Plan, South Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP), the Lower Saluda Scenic River Corridor Plan and Update, the Draft 2006 Saluda Recreation Assessment, and lower Saluda River creel surveys. In addition, we have collected hydrologic data from the USGS.

Phase II - Focus Group and Field Reconnaissance

Expert Panel Focus Group - We would like to schedule this fairly soon as input received during the focus group will help us to determine what flows should be evaluated during the on-site reconnaissance. The members of the Downstream Flows TWC, and additional experienced recreational users and resources experts, as needed, will comprise the focus group. Please provide information regarding your availability for a focus group meeting on the afternoon or evening or April 17, the afternoon or evening of April 18 or the morning of April 20. Please also provide any suggestions you may have for additional individuals who should be invited to participate in the focus group panel.

Expert Panel On-site Evaluation - We would also like to schedule this effort soon. We are tentatively looking at the week of May 14 through May 20. We anticipate that this will be a combination of a land and water-based reconnaissance whereby participants will engage in a variety of activities (paddling, angling) or observe recreation sites with specific activities in mind (swimming, rock hopping) to provide input on the appropriateness of each flow level for the specific activity in which that individual is participating or observing. There will be three flows provided which will be discussed and finalized during the expert panel focus group. Tentatively, we anticipate requesting a flow of 1,000 cfs or less (indicated in TWC meeting notes as being most appropriate for boating, swimming, rock hopping and wade angling), a flow of 2,500 cfs (indicated in TWC meeting notes as being most appropriate for boating, tubing and bank angling), and a flow of 5,000 cfs (indicated in TWC meeting notes and American Whitewater as most appropriate for whitewater paddling).

Rate of Change Video Documentation - A high flow rate of change event (18,000 cfs) was video documented on January 31, 2007. The surveyor was stationed at Mill Race rapids from approximately 7:00 am to about 12:30 pm to capture both the water rise and a duration of maximum stage

Phase III - Field Data Collection

Level Logger Deployment and Data Collection - The level loggers, which record the stage (in feet) and temperature every minute, were deployed at the 8 sites detailed in the study plan. The level loggers were installed during the week of January 15 and removed during the week of February 19. Data was collected from January 22 through February 22 and includes the following flow events:

Monday, January 22 - 12,000 cfs - 5:49 AM
Tuesday, January 23 - 10,000 cfs - 5:56 AM
Wednesday, January 24 - 8,000 cfs - 5:49 AM
Tuesday, January 30 - 14,000 cfs - 6:11 AM
Wednesday, January 31 - 18,000 cfs - 6:10 AM
Thursday, February 1 - 16,000 cfs - 6:10 AM
Tuesday, February 6 - 14,000 cfs - 5:00 AM
Tuesday, February 6 - 1,000 cfs - 6:00 PM
Wednesday, February 7 - 2,000 cfs - 5:55 PM
Thursday, February 8 - 3,000 cfs - 3:55 AM
Tuesday, February 13 - 4,000 cfs - 6:03 AM
Wednesday, February 14 - 5,000 cfs - 5:00 PM
Thursday, February 15 - 6,000 cfs - 4:00 AM

Level Logger Analysis - Analysis of the level logger data, in conjunction with USGS hydrologic data, as per the study plan is ongoing.

We hope that this helps to clarify the status of the Downstream Recreation Flow Assessment Study Plan. If you have any additional questions or concerns, do not hesitate to contact me or Dave Anderson.

Thank you,
Kelly Maloney

Carl Bussells

From: Bill Marshall [MarshallB@dnr.sc.gov]
Sent: Monday, September 10, 2007 4:04 PM
To: Kelly Maloney; Tony Bebber; BARGENTIERI@scana.com; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Hand; Karen Kustafik; Malcolm Leaphart; Patrick Moore; Alan Stuart; Dick Christie
Subject: RE: Downstream Flows Study Update

Dave, Kelly, or Alan -- I just looked over the online presentation slides for the "Flow Release Study" (study based on level-logger data) that was provided at the July 19 quarterly meetings. I had to miss those meetings and the presentation but am interested in knowing more about the findings, as the slides are brief and some even seem to get into issues beyond our basic question -- that is, how fast does the water rise under a range of typical hydro release scenarios?

Please remind me of the plan for sharing results with the TWC and producing draft reports on this and the other parts of the downstream flows assessment, described below. Thanks.

Bill Marshall

From: Kelly Maloney [mailto:Kelly.Maloney@KleinschmidtUSA.com]
Sent: Friday, April 06, 2007 3:16 PM
To: Tony Bebber; Bill Argentieri; Bill Marshall; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Summerlin; Karen Kustafik; Kelly Maloney; Malcolm Leaphart; Patrick Moore
Cc: Alan Stuart
Subject: Downstream Flows Study Update

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We hope that this helps to clarify the status of the Downstream Recreation Flow Assessment Study Plan. If you have any additional questions or concerns, do not hesitate to contact me or Dave Anderson.

Thank you,
Kelly Maloney

From:	Dave Anderson
To:	Van Hoffman; Bill Marshall; Dave Anderson; David Hancock; Dick Christie (dchristie@comporium.net); George Duke; Jennifer Hand; Jim Cumberland ; Joy Downs; Kelly Maloney; Lee Barber; Malcolm Leaphart; Marty Phillips; Steve Bell; Tim Vinson; Tommy Boozer; Tony Bebber; Alison Guth; Alan Stuart;
Subject:	Final Spring Addendum
Date:	Monday, October 08, 2007 5:54:08 PM
Attachments:	Saluda Spring Use Addendum Study Report (2007-10-05;FINAL).pdf

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Recreation Management TWC Members,
Attached is the final version of the "Spring Addendum." Thanks to those of you that provided comments; responses to the comment received can be found in Appendix B. We will posting this to the web with an announcement to the Recreation RCG shortly.
Dave

From:	Alan Stuart
To:	Alan Stuart; Alison Guth; "Gerrit Jobsis"; "Amanda_Hill@fws.gov"; "Hal Beard"; "Prescott.Brownell@noaa.gov"; "Gina Kirkland"; "rrcollins@n-h-i.org"; "Julie Gantenbein"; "Jim Cumberland"; Dchristie@coporium.net; giffinma@dhec.sc.ogv;
cc:	"Bill Argentieri"; "Mike Summer"; "Steve Summer"; "RMahan@scana.com"; "BOWLES, THOMAS M"; "BJMcManus@jonesday.com"; "Jim Ruane";
Subject:	2007 Operations Report For Saluda Hydro with 2008 Operations Plan Appended and Turbine testing report
Date:	Thursday, May 29, 2008 11:55:27 AM
Attachments:	Final Saluda Annual Report on 2007 Operations 5-29-08.doc Updated Saluda Hydro Aeration Studies-5-29-08.doc

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Good afternoon all,

Attached to this email is a Final copy of the 2007 Operations report for Saluda Hydro. The report reflects suggestions provided during our annual meeting back on March 26, 2008. Appended to the final report is the draft 2008 Operating Plan (Plan) for Saluda Hydro. The draft Plan incorporates the lastest information on the 2007 turbine testing and the Look-up Tables have been amended to reflect this recent information. Please review the 2008 draft Plan and provide any comments to us by **June 16, 2008** as we must file the Plan with the Commission by June 30th.

Additionally, attached to this email is the report on the Turbine Testing Studies conducted in 2007.

On another note, during the meeting held on March 26, 2008, SCE&G discussed with American Rivers, *et al* , and the various resource agencies the possibility of the Company approaching the South Carolina Department of Health and Environmental Control for the purpose of amending the discharge permit for the McMeekin Steam Station under section 402 of the Clean Water Act to allow for the use of a cone valve that would supplement aeration in the tailwater of the Saluda Project. As explained by SCE&G, such use of the cone valve could be on an "as needed" basis, without the need for prior authorization to the department. Subsequent to that meeting in March, SCE&G has considered this matter further and has concluded that it would not be appropriate to constrain the operation of the McMeekin Station, a facility that is not under FERC jurisdiction, to operations of the Saluda Project. Accordingly, SCE&G has decided not to include in recommendations regarding the operation of the Saluda Project any reference to the McMeekin Station.

However, SCE&G has indicated they will still pursue discussions with SCDHEC with regard to the discharge permit for the McMeekin Station in an effort to provide less stringent requirements for prior notification when the cone valve is to be used, but as a matter independent of the operation of the Saluda Project.

If you have questions on any of the items please let us know. Again, our thanks for everyone's hard work !

thank you,
Alan

From:	Shane Boring
To:	Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; Dick Christie (dchristie@comporium.net); Gerrit Jobsis (American Rivers); Hal Beard; Jennifer Hand; 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 Hydro Relicense: Trout White Paper
Date:	Monday, October 15, 2007 9:05:34 AM
Attachments:	Saluda Trout Paper DRAFT 2007-10-12.pdf Saluda Trout Paper DRAFT 2007-10-12.doc

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Dear Instream Flow/Aquatic Habitat TWC Members:

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

Shane

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

From: Alison Guth
To: "QUATTLEBAUM, MILTON"; "Carl Sundius"; Alison Guth; Winward point Yacht Club ; Aaron Small; Alan Axson; Alan Stuart; Alex Harmon (aharmon@lpagroup.com); Alison Guth; Amanda Hill; Amy Bennett; Bertina Floyd; Bill Argentieri; Bill Brebner ; Bill East; Bill Hulslander; Bill Marshall; Bill Mathias; Bob Seibels (bseibels@yahoo.com); Brandon Stutts ; Bret Hoffman; Brett Bursey; btrump@scana.com; Bud Badr; Buddy Baker ; Charlene Coleman; Charles Floyd; Charlie Compton; Charlie Rentz; Chris Page; Chuck Cantley (ccantley@scdah.state.sc.us); Chuck Hightower ; Daniel Tufford; Dave Anderson; Dave Landis; David Allen; David Hancock; David Jones; David Price; Dee Dee Simmons ; Dick Christie (dchristie@comporium.net); Don Tyler; Donald Eng; Ed Diebold; Edward Schnepel; Feleke Arega (aregaf@dnr.sc.gov); George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Guy Jones; Hal Beard; Hank McKellar; Irvin Pitts (ipitts@scprt.com); J. Hamilton Hagood; Jay Schabacher ; Jeff Duncan; Jennifer Price ; Jim Cumberland ; Jim Devereaux; Jim Glover; Jim Goller; Jim Ruane ; JoAnn Butler; Joe Logan; Joel Huggins ; John and Rob Altenberg; John Davis (johned44@bellsouth.net); John Frick; Jon Leader; Joy Downs; Karen Kustafik; Keith Ganz-Sarto; Ken Styer ; Ken Uschelbec; Kenneth Fox; Kristina Massey; Larry Turner (turnerle@dhec.sc.gov); Lee Barber; Linda Lester ; Linda Schneider ; Malcolm Leaphart; Mark Giffin (giffinma@dhec.sc.gov); Matthew Rice ; Michael Murrell; Mike Duffy; Mike Sloan; Mike Summer (msummer@scana.com); Mike Waddell; Miriam Atria; Norm Nicholson; Norman Ferris; Parkin Hunter; Phil Hamby ; Prescott Brownell; Randal Shealy; Randy Mahan; Ray Ammarell; Rebekah Dobrasko; Reed Bull (rbull@davisfloyd.com); Rhett Bickley; Richard Kidder; Richard Mikell; Robert Keener (SKEENER@sc.rr.com); Robert Lavisky; Ron Ahle; Ronald Scott; Roy Parker; ryanity@scana.com; S padget; Sandra Reinhardt; Sean Norris; Shane Boring; Sheri Armstrong ; Skeet Mills ; Stan Jones (sjones@imichotels.net); Steve Bell (lakewatchman@yahoo.com); Steve Summer; Suzanne Rhodes; Synithia Williams; Theresa Powers; Theresa Thom; Tim Vinson; Tom Bowles (tbowles@scana.com); Tom Ruple; Tommy Boozer; Tony Bebber; Tyler Howe (tylehowe@nc-cherokee.com); Van Hoffman; Vivianne Vejdani ; Wenonah Haire; "All RCG & TWC Members"; "Gerrit Jobsis"; Dave Anderson; "Kustafik, Karen"; RMAHAN@scana.com; "David Price"; "Feleke Arega"; "SUMMER, STEPHEN E"; "Mark Giffin"; BARGENTIERI@scana.com; "BOWLES, THOMAS M"; "SUMMER, MICHAEL C"; "skeener@sc.rr.com"; "adventurec@mindspring.com"; "HOFFMAN, VAN B"; "rbull@davisfloyd.com"; "Mike Waddell"; Alan Stuart; "James Glover"; "Vivianne Vejdani"; "Dobrasko, Rebekah"; "Jim Cumberland"; Shane Boring; "Larry Turner"; "Gina Kirkland"; Bret Hoffman; "BOOZER, THOMAS C"; "Irvin Pitts"; "AMMARELL, RAYMOND R"; "Ed Diebold"; "Ron Ahle"; "QUATTLEBAUM, MILTON"; "Carl Sundius";

Subject: Updated: All RCG"s Meeting - Operations Model
Start: Thursday, May 22, 2008 9:30:00 AM
End: Thursday, May 22, 2008 3:00:00 PM
Location: Saluda Shoals Park, Rivers Conference Center

Hello Folks,
Just an update, we will be holding this meeting at the Saluda Shoals Park Rivers Conference Center (up at the top of the hill). Email me with any questions. Thanks, Alison
Previous Message:
Hello all,
Well, after much hard work from all of the TWC's, many of the inputs have been identified for the Operations Model. Jon Quebbeman is scheduled to join us in order to review and discuss the model results on Thursday, May 22, at 9:30. the meeting will likely last into the early afternoon. I would like to get a head count ASAP in order to book a room of the appropriate size, as this is an All RCG's Meeting. So please let me know if you can attend, or will likely attend, as soon as possible. Thanks, and I will email out location information soon. Alison

From:	Alan Stuart
To:	Alan Stuart; Alison Guth; "Gerrit Jobsis"; "Amanda_Hill@fws.gov"; "Hal Beard"; "Prescott.Brownell@noaa.gov"; "Gina Kirkland"; "rrcollins@n-h-i.org"; "Julie Gantenbein"; "Jim Cumberland"; Dchristie@coporium.net; giffinma@dhec.sc.ogv;
cc:	"Bill Argentieri"; "Mike Summer"; "Steve Summer"; "RMahan@scana.com"; "BOWLES, THOMAS M"; "BJMcManus@jonesday.com"; "Jim Ruane";
Subject:	2007 Operations Report For Saluda Hydro with 2008 Operations Plan Appended and Turbine testing report
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If you have questions on any of the items please let us know. Again, our thanks for everyone's hard work !

thank you,
Alan

Carl Bussells

From: Alison Guth
Sent: Tuesday, April 29, 2008 2:30 PM
To: 'lee.emery@ferc.gov'
Subject: Project 516 Info...

Hello Mr. Emery,

To answer a few of your questions,

The intake rack spacing is 4 inches in between bars.

The approximate lengths between the crest of the earthen dam and the backup dam will be a little more difficult to determine but the picture itself may answer your questions...This picture is from 2005, there is actually now two lanes running down between the two. If you still need to know average distances, let me know and our engineer can get back to you on that. As you can see from the picture, the toe of the backup dam is only about 20 feet or so from the powerhouse.

dam overview.jpg
(258 KB)

Alison Guth
Licensing Coordinator
Kleinschmidt Associates
204 Caughman Farm Lane, Suite 301
Lexington, SC 29072
Phone 803-951-2077
Fax 803-951-2124

Carl Bussells

From: Alison Guth
Sent: Tuesday, April 29, 2008 3:17 PM
To: 'Lee Emery'
Subject: RE: Project 516 Info...

Yes, the picture definitely helps. There are intake racks on all of the towers, they are a little bit different style on Unit 5 but the spacing is the same. Brett is looking for the information on the distance for you. I did talk to Alan, and he wanted to let you know that he apologizes for not getting back with you. He noted that he had tried to call later but got your voicemail.

For our information, is there any particular reason you need this information? We want to make sure we include anything in the final application that may be lacking in the draft.

Thanks! Alison

-----Original Message-----
From: Lee Emery [mailto:Lee.Emery@ferc.gov]
Sent: Tuesday, April 29, 2008 2:47 PM
To: Alison Guth
Subject: RE: Project 516 Info...

Wow! Thanks that photo really helps me see what is going on. I would like an estimate of the distance between the crest of the old dam to the crest of the new dam at the point near the location of the powerhouse. In other words, a hypothetical string attached to the crest of the new dam above the powerhouse to a site perpendicular to the new dam on the old dam crest. Am I confusing you? I hope not. I can see that the distance varies between the two dam crests as you go in either direction.

So there are trashracks at all five intake towers?

Thanks for your help.

Lee Emery
Fishery Biologist
Office of Energy Projects
Federal Energy Regulatory Commission
Phone (202) 502-8379
FAX (202) 219-0205

From: Alison Guth [mailto:Alison.Guth@KleinschmidtUSA.com]
Sent: Tuesday, April 29, 2008 2:30 PM
To: Lee Emery
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Phone 803-951-2077
Fax 803-951-2124

Carl Bussells

From: Alison Guth
Sent: Wednesday, April 30, 2008 1:02 PM
To: 'Lee Emery'
Cc: BARGENTIERI@scana.com; Alan Stuart
Subject: RE: Project 516 Info...

Hello Mr. Emery,

To answer your question from yesterday, the distance from the crest of the earthen dam to the RCC dam (from directly behind the powerhouse) is 422 feet. If you have any more questions on this issue or similar issues please contact Bill Argentieri at SCE&G (bargentieri@scana.com , 803-217-9162). We are happy to provide you with this information, however as SCE&G is our client, typically requests such as this are directed toward the applicant. Hope this information helps.

Alison

-----Original Message-----
From: Lee Emery [mailto:Lee.Emery@ferc.gov]
Sent: Tuesday, April 29, 2008 3:28 PM
To: Alison Guth
Subject: RE: Project 516 Info...

I am preparing some in-house documents. This gives me an opportunity to look closer at the draft document. I may list some things that I see are missing, so they can be incorporated into the final filing. I have barely scratched the surface in my look at the draft document. I appreciate your help on getting the info to me.

Lee Emery
Fishery Biologist
Office of Energy Projects
Federal Energy Regulatory Commission
Phone (202) 502-8379
FAX (202) 219-0205

From: Alison Guth [mailto:Alison.Guth@KleinschmidtUSA.com]
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Fax 803-951-2124

From: Alison Guth

To: Winward point Yacht Club ; Aaron Small; Alan Axson; Alan Stuart; Alex Harmon (aharmon@lpagroup.com); Alison Guth; Amanda Hill; Amy Bennett; Bertina Floyd; Bill Argentieri; Bill Brebner ; Bill East; Bill Hulslander; Bill Marshall; Bill Mathias; Bob Seibels (bseibels@yahoo.com); Brandon Stutts ; Bret Hoffman; Brett Bursey; btrump@scana.com; Bud Badr; Buddy Baker ; Charlene Coleman; Charles Floyd; Charlie Compton; Charlie Rentz; Chris Page; Chuck Cantley (ccantley@scdah.state.sc.us); Chuck Hightower ; Daniel Tufford; Dave Anderson; Dave Landis; David Allen; David Hancock; David Jones; David Price; Dee Dee Simmons ; Dick Christie (dchristie@comporium.net); Don Tyler; Donald Eng; Ed Diebold; Edward Schnepel; Feleke Arega (aregaf@dnr.sc.gov); George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Guy Jones; Hal Beard; Hank McKellar; Irvin Pitts (ipitts@scprt.com); J. Hamilton Hagood; Jay Schabacher ; Jeff Duncan; Jennifer Price ; Jim Cumberland ; Jim Devereaux; Jim Glover; Jim Goller; Jim Ruane ; JoAnn Butler; Joe Logan; Joel Huggins ; John and Rob Altenberg; John Davis (johned44@bellsouth.net); John Frick; Jon Leader; Joy Downs; Karen Kustafik; Keith Ganz-Sarto; Ken Styer ; Ken Uschelbec; Kenneth Fox; Kristina Massey; Larry Turner (turnerle@dhec.sc.gov); Lee Barber; Linda Lester ; Linda Schneider ; Malcolm Leaphart; Mark Giffin (giffinma@dhec.sc.gov); Matthew Rice ; Michael Murrell; Mike Duffy; Mike Sloan; Mike Summer (msummer@scana.com); Mike Waddell; Miriam Atria; Norm Nicholson; Norman Ferris; Parkin Hunter; Phil Hamby ; Prescott Brownell; Randal Shealy; Randy Mahan; Ray Ammarell; Rebekah Dobrasko; Reed Bull (rbull@davisfloyd.com); Rhett Bickley; Richard Kidder; Richard Mikell; Robert Keener (SKEENER@sc.rr.com); Robert Lavisky; Ron Ahle; Ronald Scott; Roy Parker; ryanity@scana.com; S padget; Sandra Reinhardt; Sean Norris; Shane Boring; Sheri Armstrong ; Skeet Mills ; Stan Jones (sjones@imichotels.net); Steve Bell; Steve Summer; Suzanne Rhodes; Synithia Williams; Theresa Powers; Theresa Thom; Tim Vinson; Tom Bowles (tbowles@scana.com); Tom Ruple; Tommy Boozer; Tony Bebber; Tyler Howe (tylehowe@nc-cherokee.com); Van Hoffman; Vivianne Vejdani ; Wenonah Haire;

Subject: All RCG"s Meeting - Operations Model

Start: Thursday, May 22, 2008 9:30:00 AM

End: Thursday, May 22, 2008 3:00:00 PM

Location: Saluda Shoals Park, Rivers Conference Center

Hello all,
Well, after much hard work from all of the TWC's, many of the inputs have been identified for the Operations Model. Jon Quebbeman is scheduled to join us in order to review and discuss the model results on Thursday, May 22, at 9:30. the meeting will likely last into the early afternoon. I would like to get a head count ASAP in order to book a room of the appropriate size, as this is an All RCG's Meeting. So please let me know if you can attend, or will likely attend, as soon as possible. Thanks, and I will email out location information soon. Alison

Hi Dave,
I made a few updates on the recommendations after receiving some feedback from members of the TWC. Specifically, I included recreational releases for holidays and attempted to clear up any confusion concerning safe recreational flows—flows that do not exceed 1000cfs at any time during hours/days dedicated wade fishing and flows that do not exceed target releases for boating.
Thanks,
Matt

Matthew Rice
Associate Director Southeast Conservation
American Rivers
2231 Devine Street, Suite 202, Columbia, SC 29205
Phone: 803-771-7206
Fax: 803-771-7580
mrice@americanrivers.org

www.americanrivers.org

From: Dave Anderson [mailto:Dave.Anderson@KleinschmidtUSA.com]
Sent: Thursday, February 21, 2008 11:52 AM
To: Dave Anderson; Tony Bebber; Alan Stuart; Bill Argentieri; Bill Marshall; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Hand; Jim Cumberland ; Karen Kustafik; Malcolm Leaphart; Matt Rice; Mike Waddell; Randy Mahan
Cc: Bret Hoffman; Alison Guth
Subject: RE: 02-25-08 Downstream Flows TWC Meeting Agenda

Good morning;

Attached is the flow schedule that Matt Rice will presenting at next week's meeting. See y'all on Monday.

Dave

<<Recommendations for Recreational Flow Releases on the Lower Saluda River.doc>>

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

From: Dave Anderson

Sent: Tuesday, February 19, 2008 12:07 PM

To: Tony Bebber; Alan Stuart; Bill Argentieri; Bill Marshall; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Summerlin; Jim Cumberland ; Karen Kustafik; Malcolm Leaphart; Matthew Rice ; Mike Waddell; Randy Mahan

Cc: Bret Hoffman; Alison Guth

Subject: 02-25-08 Downstream Flows TWC Meeting Agenda

Downstream Flows TWC Members:

Attached is the agenda for our meeting on February 25th at 10 am at the Lake Murray Training Center.

I have also attached the recommendation that I sent around previously--remember the flow schedule in this document was requested by American Whitewater.

SCPRT also requested some additional flows in a letter from Tony B. dated February 8, 2008:

"add some portions of days where flows will be “no more than 1,000 cfs.” State holidays and a couple of weekends per month would be appreciated (something wade anglers could “count on” to be relatively safe). Half days are fine (mornings in warm weather, maybe 11 to mid-afternoon in cold weather). Some of those December-February days can be great for fishing – since DNR usually stocks in early December. Spring months definitely need some “wade fishing time periods.” If I was going to leave out some days for wade fishing, it’d be Sept-Nov., but if the DO levels continue to improve, that may be hard to give up too."

Also, Matt Rice, with American Rivers, has also requested some meeting time to present a proposal that, as I understand it, was crafted by some people in our TWC.

Finally, I have not forgotten about the DVDs. I will bring copies of the DVDs to the meeting on the 25th; if you are unable to attend the meeting and would still like a copy, let me know your mailing address and I will send you some via snail mail.

Please reply back to Alison if you are planning on attending the meeting so we can get a count for lunch.

See y'all next week,

Dave

<< File: 2008-02-25 Downstream Flows TWC Agenda.doc >> << File: Recreational Flow Releases Recommendation (2008-02-05;DRAFT).doc >>

From: Gerrit Jobsis
To: Shane Boring; vejdaniv@dnr.sc.gov; Alison Guth; amanda_hill@fws.gov; BARGENTIERI@scana.com; badrb@dnr.sc.gov; dchristie@comporium.net; kirklagl@dhec.sc.gov; BeardH@dnr.sc.gov; Jennifer Hand; gloverjb@dhec.sc.gov; malcolml@mailbox.sc.edu; giffinma@dhec.sc.gov; mwaddell@esri.sc.edu; mquattlebaum@scana.com; prescott.brownell@noaa.gov; RMAHAN@scana.com; ahler@dnr.sc.gov; harders@dnr.sc.gov; ssummer@scana.com; theresa_thom@nps.gov; Brandon Kulik; Alan Stuart;
Subject: Re: Saluda Hydro Relicense: Reminder of Flow Demo on May 1&2; Cancellation of April 25 IFIM Conference Call
Date: Wednesday, April 30, 2008 9:19:16 AM

<

Dave: I read the recreational flow recommendations and from the IFIM TWC flows exceeding 4000 cfs is detrimental to all the aquatic life in the river, except for sturgeon. So TU position is fish first.
I will be attending this meeting.

Mike

From: Dave Anderson [mailto:Dave.Anderson@KleinschmidtUSA.com]
Sent: Wednesday, February 06, 2008 3:39 PM
To: Tony Bebber; Bill Argentieri; Bill Marshall; Charlene Coleman; Dave Anderson; Guy Jones; J. Hamilton Hagood; Jennifer Summerlin; Jim Cumberland ; Karen Kustafik; Kelly Maloney; Malcolm Leaphart; Mike Waddell
Cc: Randy Mahan
Subject: Recreational Flow Recommendations and Meeting

Downstream Flows TWC Members,

Attached is the initial draft issue recommendation that includes a recreational flow schedule for the lower Saluda River. This schedule is based on flow requests submitted by American Whitewater.

We will be meeting on Monday, February 18th at 10 am at the Lake Murray Training Center to discuss these requests and recommendation.

Let me know if you have any questions.

Dave

<<Recreational Flow Releases Recommendation (2008-02-05;DRAFT).doc>>

From: AMMARELL, RAYMOND R

To: BARGENTIERI@scana.com; BLALOCK, JOHN TROY; LANDRETH, JAMES M; FITTS, MARY R; C Coleman; Skip Foley ; HANCOCK, DAVID E; Jessie Cook; Rick Dye; Woody Ford; Michael Frank ; Jim Gunter; Josh Mecca; Randy Mecca; Richard Mikell; Gary Price ; Jeannette Wells ; Shane Boring; Jennifer Hand; Bret Hoffman; Mike Mayo; Matthew Moskwik ; YANITY, ROBERT; Alison Guth; Winward point Yacht Club ; Aaron Small; Alan Axson; Alan Stuart; Amanda Hill; Andy Miller; Bertina Floyd; Bill Brebner ; Bill East; BGreen@smeinc.com; Bill Hulslander; Bill Marshall; Bill Mathias; Bob Olsen; bseibels@yahoo.com; STUTTS, BRANDON G; Bret Hoffman; Brett Bursey; TRUMP, BETH W; Bud Badr; Buddy Baker ; Charlene Coleman; Charles Floyd; Charlie Compton; Charlie Rentz; Chris Judge; Chris Page; Daniel Tufford; Dave Anderson; Dave Landis; David Allen; HANCOCK, DAVID E; David Jones; David Price; Dick Christie; Don Tyler; Donald Eng; Ed Diebold; duncane@mrd.dnr.state.sc.us; Ed Fetner; Edward Schnepel; aregaf@dnr.sc.gov; George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Guy Jones; Hal Beard; Hank McKellar; ipitts@scprt.com; Jeff Duncan; Jennifer O"Rourke; Jennifer Price ; Jennifer Hand; Jerry Wise; DEVEREAUX, JAMES; Jim Glover; Jim Goller; Jim Ruane ; BUTLER, JO A; Joe Logan; Joel Huggins ; John and Rob Altenberg; johned44@bellsouth.net; jsfrick@mindspring.com; Jon Leader; Joy Downs; Karen Kustafik; Keith Ganz-Sarto; Ken Styer ; Ken Uschelbec; Kenneth Fox; Kim Westbury; Kristina Massey; turnerle@dhec.sc.gov; Lee Barber; Linda Lester ; Malcolm Leaphart; Mary Kelly; Michael Murrell; Mike Duffy; Mike Sloan; SUMMER, MICHAEL C; Mike Waddell; Miriam Atria; Norm Nicholson; Norman Ferris; Parkin Hunter; Patricia Wendling; Patrick Moore; Phil Hamby ; Prescott Brownell; Randal Shealy; RMAHAN@scana.com; Rebekah Dobrasko; rbull@davisfloyd.com; Rhett Bickley; Richard Kidder; Richard Mikell; SKEENER@sc.rr.com; Robert Lavisky; Ron Ahle; Ronald Scott; Roy Parker; Russell Jernigan; YANITY, ROBERT; Sam Drake; Sandra Reinhardt; Shane Boring; Skeet Mills ; Stanley Yalicki; Steve Bell; SUMMER, STEPHEN E; Suzanne Rhodes; tpowers@newberrycounty.net; Theresa Thom; Tim Vinson; BOWLES, THOMAS M; Tom Stonecypher; BOOZER, THOMAS C; Tony Bebber; HOFFMAN, VAN B; balesw@dnr.sc.gov; Wenonah Haire; Mike Schimpff; Tom Rupple ; mzajac@icrc.net; QUATTLEBAUM, MILTON; Chuck Cantley; Vivianne Vejdani; DELK, HENRY E JR; GOEBEL, RONALD J; Steve Curry; Harry Tinsley; Mark Giffin;

cc: RITTER, TIMOTHY W; ANDERSON, BETTY L; BUXTON, ANGELA G; BROWN, OSCIE O; HAMILTON, J. HAGOOD JR; DODD, GREG M; KRUGER, JEFF A; SHEARER, LESLIE J;

Subject: Saluda Hydro Flow Release Notification System Activation

Date: Monday, April 14, 2008 8:06:29 AM

To All,

SCE&G has increased flow on the Saluda River this morning. Our dispatcher attempted to activate the new Saluda Hydro notification system, but the new system did not activate properly. Our telecommunications group is working on the problem at this time, and it will be resolved as soon as possible. Thank you for your patience during the implementation of this new system.

Thanks,

Ray Ammarell
SCE&G - Fossil Hydro Technical Services
111 Research Drive
Columbia, SC 29203
803-217-7322 Phone
803-206-3710 Cell
803-933-7847 Fax
rammarell@scana.com

Downstream Flows TWC Members,

Attached is the initial draft issue recommendation that includes a recreational flow schedule for the lower Saluda River. This schedule is based on flow requests submitted by American Whitewater.

We will be meeting on Monday, February 18th at 10 am at the Lake Murray Training Center to discuss these requests and recommendation.

Let me know if you have any questions.

Dave

<<Recreational Flow Releases Recommendation (2008-02-05;DRAFT).doc>>

From: Gerrit Jobsis
To: Brandon Kulik; Shane Boring; Theresa Thom; Alison Guth; Amanda Hill; BARGENTIERI@scana.com; Bud Badr; dchristie@comporium.net; Gina Kirkland; Hal Beard; Jennifer Hand; Jim Glover; Malcolm Leaphart; giffinma@dhec.sc.gov; Mike Waddell; mquattlebaum@scana.com; Prescott Brownell; RMAHAN@scana.com; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Alan Stuart;
Subject: RE: Monthly median Project inflows, and some light reading and food for thought
Date: Thursday, January 17, 2008 11:08:44 AM

Good information Brandon. Of course we don't have to work in full months. For example I'd be much more comfortable lumping Dec 21-Feb 28, than starting Dec 1.

_____
Gerrit Jobsis, American Rivers
Southeast Regional Director
2231 Devine Street, Suite 202, Columbia, S.C. 29205
803.771.7114 (t) 803.771.7580 (f)
gjobsis@americanrivers.org

From: Brandon Kulik [mailto:Brandon.Kulik@KleinschmidtUSA.com]
Sent: Thursday, January 17, 2008 10:59 AM
To: Shane Boring; Theresa Thom; Alison Guth; Amanda Hill; Bill Argentieri; Bud Badr; dchristie@comporium.net; Gerrit Jobsis; Gina Kirkland; Hal Beard; Jennifer Hand; Jim Glover; Malcolm Leaphart; giffinma@dhec.sc.gov; Mike Waddell; mquattlebaum@scana.com; Prescott Brownell; Randy Mahan; Ron Ahle; Scott Harder; Shane Boring; Steve Summer; Alan Stuart
Subject: Monthly median Project inflows, and some light reading and food for thought

Hello everyone,

Attached as requested, is a table of monthly median project inflows It may suggest some alternative ways of lumping months other than that proposed on our call. Open for discussion at our workshop.

Month	Median Value
Jan	2782
Feb	3188

March 3549
April 2387.5
May 1610
June 1315.5
July 1135
August 1109.5
Sept 1052.5
Oct 946
Nov 1166
Dec 1828

One possible mix based on both rough flow magnitudes and biological seasons could be:

Dec-Feb ("Winter")
March ("early spring")
April-May ("late spring")
June-Sept ("summer")
Oct-Nov ("fall")

Kevin has tallied the permutations and combinations of guilds, study sites, and seasonal month-combo flows for use in the habitat duration analysis and reports that it will be in the neighborhood of 1000+/- individual data sets, even with some months combined. In looking toward continuing to try to find ways to streamline some of the data we are generating without losing critical habitat-flow relationships, I have been giving further thought to how best to employ our guild data. I went back to what many consider to be the seminal paper on use of guilds in warmwater stream flow assessment, a 1988 paper by Paul Leonard and Don Orth (attached in the case you haven't already seen it). I also took the liberty of cutting and pasting the key elements of L&O into a word summary document, in the event you are pressed for time and can't wade through the entire paper.

<<L and O 1988.doc>> <<Leonard and Orth 1988.pdf>>

Insofar as guilds are concerned, some of the take-home points are:

- For large rivers, focus on riffle, run and also stream margin ("shallow slow" in Saluda lingo) guild representatives
- Pool (deep slow) guild members offer the least decision information

Not a guild-specific point but L&O also note that there are basically 4 WUA curve patterns or classifications, classes I, II, and III are the most informative; conversely WUA curves corresponding to type IV are the least informative. I think you will likely recognize these shape categories of the curves in our modeling data from the Saluda study.

If you have a chance to glance through the material, I would propose that as a group we consider these principles in guiding our guild choices during the workshop. Possibly consider eliminating various type IV and deep-slow curves, there may even be an opportunity to blend or eliminate a few species and lifestages with redundant curve shapes. Again, just food for thought for next week

Brandon

Brandon H Kulik
Senior Fisheries Scientist
Kleinschmidt Energy & Water Resource Consultants
141 Main Street
Pittsfield, Maine 04967
(207) 487-3328

Carl Bussells

From: Alison Guth
Sent: Wednesday, April 02, 2008 1:48 PM
To: 'Gerrit Jobsis'
Subject: RE: Presentation tomorrow

Thanks!

-----Original Message-----
From: Gerrit Jobsis [mailto:gjobsis@americanrivers.org]
Sent: Wednesday, April 02, 2008 1:47 PM
To: Alison Guth; Ron Ahle
Cc: vetaylor@roadrunner.com
Subject: RE: Presentation tomorrow

Alison,

Vicki Taylor will start things off with an overview (w no props) and I'll follow w a power point which I'll bring on a thumb drive. Our presentation title is

Integrating Ecologically Sustainable Water Management into the Saluda Relicensing

See you then.

Gerrit

Gerrit Jöbsis, American Rivers
Southeast Regional Director
2231 Devine Street, Suite 202, Columbia, S.C. 29205
803.771.7114 (t) 803.771.7580 (f)
gjobsis@americanrivers.org

From: Alison Guth [mailto:Alison.Guth@KleinschmidtUSA.com]
Sent: Wednesday, April 02, 2008 12:21 PM
To: Gerrit Jobsis; Ron Ahle
Subject: Presentation tomorrow

Hey Guys,

Just making sure everything was on for tomorrow and you didn't need anything. If you have presentations, just bring them on cd or thumb drive (or you could go ahead and email them to Alan and I for a backup as well). I am allotting Gerrit 1 hr and Ron 30-45 min. I am putting together the agenda, so if your presentation has a specific title you would

Carl Bussells

From: Alison Guth
Sent: Wednesday, April 02, 2008 12:21 PM
To: 'Gerrit Jobsis'; Ron Ahle
Subject: Presentation tomorrow

Hey Guys,

Just making sure everything was on for tomorrow and you didn't need anything. If you have presentations, just bring them on cd or thumb drive (or you could go ahead and email them to Alan and I for a backup as well). I am allotting Gerrit 1 hr and Ron 30-45 min. I am putting together the agenda, so if your presentation has a specific title you would like me to include please let me know. Thanks and see you tomorrow! Alison

Alison Guth
Licensing Coordinator
Kleinschmidt Associates
204 Caughman Farm Lane, Suite 301
Lexington, SC 29072
Phone 803-951-2077
Fax 803-951-2124

like me to include please let me know. Thanks and see you tomorrow! Alison

Alison Guth
Licensing Coordinator
Kleinschmidt Associates
204 Caughman Farm Lane, Suite 301
Lexington, SC 29072
Phone 803-951-2077
Fax 803-951-2124

From: Shane Boring

To: Winward point Yacht Club ; Aaron Small; Alan Axson; Alan Stuart; Alex Harmon (aharmon@lpagroup.com); Alison Guth; Amanda Hill; Amy Bennett; Bertina Floyd; Bill Argentieri; Bill Brebner ; Bill East; Bill Hulslander; Bill Marshall; Bill Mathias; Bob Seibels (bseibels@yahoo.com); Brandon Stutts ; Bret Hoffman; Brett Bursey; btrump@scana.com; Bud Badr; Buddy Baker ; Charlene Coleman; Charles Floyd; Charlie Compton; Charlie Rentz; Chris Page; Chuck Cantley (ccantley@scdah.state.sc.us); Chuck Hightower ; Daniel Tufford; Dave Anderson; Dave Landis; David Allen; David Hancock; David Jones; David Price; Dee Dee Simmons ; Dick Christie (dchristie@comporium.net); Don Tyler; Donald Eng; Ed Diebold; Edward Schnepel; Feleke Arega (aregaf@dnr.sc.gov); George Duke; Gerrit Jobsis (American Rivers); Gina Kirkland; Guy Jones; Hal Beard; Hank McKellar; Irvin Pitts (ipitts@scprt.com); J. Hamilton Hagood; Jay Schabacher ; Jeff Duncan; Jennifer Price ; Jim Cumberland ; Jim Devereaux; Jim Glover; Jim Goller; Jim Ruane ; JoAnn Butler; Joe Logan; Joel Huggins ; John and Rob Altenberg; John Davis (johned44@bellsouth.net); John Frick; Jon Leader; Joy Downs; Karen Kustafik; Keith Ganz-Sarto; Ken Styer ; Ken Uschelbec; Kenneth Fox; Kristina Massey; Larry Turner (turnerle@dhec.sc.gov); Lee Barber; Linda Lester ; Linda Schneider ; Malcolm Leaphart; Mark Giffin (giffinma@dhec.sc.gov); Matthew Rice ; Michael Murrell; Mike Duffy; Mike Sloan; Mike Summer (msummer@scana.com); Mike Waddell; Milton Quattlebaum (mquattlebaum@scana.com); Miriam Atria; Norm Nicholson; Norman Ferris; Parkin Hunter; Phil Hamby ; Prescott Brownell; Randal Shealy; Randy Mahan; Ray Ammarell; Rebekah Dobrasko; Reed Bull (rbull@davisfloyd.com); Rhett Bickley; Richard Kidder; Richard Mikell; Robert Keener (SKEENER@sc.rr.com); Robert Lavisky; Ron Ahle; Ronald Scott; Roy Parker; ryanity@scana.com; S padget; Sandra Reinhardt; Sean Norris; Shane Boring; Sheri Armstrong ; Skeet Mills ; Stan Jones (sjones@imichotels.net); Steve Bell (lakewatchman@yahoo.com); Steve Summer; Suzanne Rhodes; Synithia Williams; Theresa Powers; Theresa Thom; Tim Vinson; Tom Bowles (tbowles@scana.com); Tom Ruple; Tommy Boozer; Tony Bebber; Tyler Howe (tylehowe@nc-cherokee.com); Van Hoffman; Vivianne Vejdani ; Wenonah Haire;

Subject: Saluda Hydro Relicensing: Final Submittal of Restraints to the Operations Model

Date: Wednesday, June 18, 2008 4:44:22 PM

Attachments: Ops Form.doc

Dear RCG Members,

As you all may remember, Jon Quebbeman from Kleinschmidt gave a presentation on the workings of the operations model at the all-RCG's meeting held on May 22nd. Following the presentation, several stakeholder expressed an interest in providing additional restraints/parameters for potential inclusion in the model. Now that folks have had several weeks to consider what additional constraints they would like to see run, we ask that you please submit those to us using the attached form. Please submit requests to Alison Guth at HYPERLINK "mailto:Alison.Guth@kleinschmidtusa.com"Alison.Guth@kleinschmidtusa.com. Please have all submittals to Alison by Monday, June 30.

As a side note - You will be receiving the draft Technical Summary Document for the model within the next

few days. As you may remember, Jon was asked at the meeting on the 22nd to prepare a brief technical document summarizing the workings of the model and pertinent results.

Thanks for your continued interest and dedication to the Saluda relicensing process.

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

From: Alan Stuart
To: Alan Stuart; Alison Guth; "Gerrit Jobsis"; "Amanda_Hill@fws.gov"; "Hal Beard"; "Prescott.Brownell@noaa.gov"; "Gina Kirkland"; "rrcollins@n-h-i.org"; "Julie Gantenbein"; "Jim Cumberland"; Dchristie@coporium.net; giffinma@dhec.sc.gov;
cc: "Bill Argentieri"; "Mike Summer"; "Steve Summer"; "RMahan@scana.com"; "BOWLES, THOMAS M"; "BJMcManus@jonesday.com"; "Jim Ruane";
Subject: RE: 2007 Operations Report For Saluda Hydro with 2008 Operations Plan Appended and Turbine testing report
Date: Monday, June 16, 2008 1:27:52 PM

Afternoon all,

Just a reminder, comments on the 2008 Saluda Operating Plan are due by COB today. Please send us any comments you may have so we can make the June 30th filing deadline.

thanks !
Alan

From: Alan Stuart
Sent: Thu 5/29/2008 11:55 AM
To: Alan Stuart; Alison Guth; 'Gerrit Jobsis'; 'Amanda_Hill@fws.gov'; 'Hal Beard'; 'Prescott.Brownell@noaa.gov'; 'Gina Kirkland'; 'rrcollins@n-h-i.org'; 'Julie Gantenbein'; 'Jim Cumberland'; Dchristie@coporium.net; giffinma@dhec.sc.ogv
Cc: 'Bill Argentieri'; 'Mike Summer'; 'Steve Summer'; 'RMahan@scana.com'; 'BOWLES, THOMAS M'; 'BJMcManus@jonesday.com'; 'Jim Ruane'
Subject: 2007 Operations Report For Saluda Hydro with 2008 Operations Plan Appended and Turbine testing report

Good afternoon all,

Attached to this email is a Final copy of the 2007 Operations report for Saluda Hydro. The report reflects suggestions provided during our annual meeting back on March 26, 2008. Appended to the final report is the draft 2008 Operating Plan (Plan) for Saluda Hydro. The draft Plan incorporates the lastest information on the 2007 turbine testing and the Look-up Tables have been amended to reflect this recent information. Please review the 2008 draft Plan and provide any comments to us by **June 16, 2008** as we must file the Plan with the Commission by June 30th.

Additionally, attached to this email is the report on the Turbine Testing Studies conducted in 2007.

On another note, during the meeting held on March 26, 2008, SCE&G discussed with American Rivers, *et al* , and the various resource agencies the possibility of the Company approaching the South Carolina Department of Health and Environmental Control for the purpose of amending the discharge permit for the McMeekin Steam Station under section 402 of the Clean Water Act to allow for the use of a cone valve that would supplement aeration in the tailwater of the Saluda Project. As explained by SCE&G, such use of the cone valve could be on an "as needed" basis, without the need for prior authorization to the department. Subsequent to that meeting in March, SCE&G has considered this matter further and has concluded that it would not be appropriate to constrain the operation of the McMeekin Station, a facility that is not under FERC jurisdiction, to operations of the Saluda Project. Accordingly, SCE&G has decided not to include in recommendations regarding the operation of the Saluda Project any reference to the McMeekin Station.

However, SCE&G has indicated they will still pursue discussions with SCDHEC with regard to the discharge permit for the McMeekin Station in an effort to provide less stringent requirements for prior notification when the cone valve is to be used, but as a matter independent of the operation of

the Saluda Project.

If you have questions on any of the items please let us know. Again, our thanks for everyone's hard work !

thank you,
Alan