MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Water Quality TWC Conference Call

March 18, 2015

Final KDM 5-1-15

ATTENDEES:

Bill Marshall (SCDNR)
Brandon Stutts (SCANA)
Steve Summer (SCANA)
Henry Mealing (Kleinschmidt)
Kelly Miller (Kleinschmidt)
Ron Ahle (SCDNR)
Bret Hoffman (Kleinschmidt)
Bill Argentieri (SCE&G)
Randy Mahan (SCANA)
Shane Boring (Kleinschmidt)
Byron Hamstead (USFWS)
Bill Stangler (Congaree Riverkeeper)
Gerrit Jobsis (American Rivers)
Amy Bresnahan (SCE&G)

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

Henry opened the meeting by giving a recap of the data collection that occurred in the tailrace and forebay at Parr Shoals Dam during the summer and fall of 2014. Details of the data collection are included in the attached memo, which was distributed to the group prior to the conference call.

Byron asked for clarification regarding the data collection site listed as "NPDES 001 sign" on the data collection sheets. Kelly explained that the NPDES sign was the point of reference used by her and Milton Quattlebaum during data collection, and is located next to the window at the seventh bay in the powerhouse.

Bret then gave the group an overview of the turbine venting/aeration investigation performed at Parr. Details of this investigation are also included in the attached memo. Henry explained that SCE&G and Kleinschmidt met with SCDHEC to discuss the data collected in 2014 and ask if they would require any additional information in support of the 401 water quality certification. SCDHEC reviewed the information and concluded that no additional data needed to be collected, however they would like for SCE&G to develop a plan to implement turbine venting during times of low dissolved oxygen (DO).

Byron said he would like to see the study be repeated in the summer of 2015, with the addition of DO and temperature collection below Hampton Island and Alston. Henry said that the aeration that would occur from the turbine venting wouldn't be significant enough to make a difference on DO that far downstream. Byron asked that future venting demonstrations include a scenario where all turbines are vented. Bill A. said that all six turbines should be operational later this year, so this shouldn't be a problem. When periods of low DO are observed via the USGS gage, operators will vent the turbines and DO will be collected in the tailrace to determine if the venting causes a significant impact.

Bill M. said that he is in support of the turbine venting plan and would like to be kept informed about future venting investigations. Henry said that the WQTWC will be updated on the plan for this work. Bret said he will check with operators to confirm that various combinations of turbine venting are possible.

Action items from this meeting are listed below.

ACTION ITEMS:

- SCE&G and Kleinschmidt will conduct additional turbine venting investigations and develop a turbine venting plan for future use during periods of low DO.
- Bret will check with operators to confirm that various combinations of turbine venting are possible.

Parr Hydroelectric Project – FERC No. 1894
Water Quality Baseline – Memorandum

TO: Parr/Fairfield Relicensing Water Quality Technical Working Committee (TWC)

FROM: Kelly Miller and Henry Mealing – Kleinschmidt Associates

DATE: March 2, 2015

RE: Water Quality Report – Supplemental Dissolved Oxygen Data

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The Parr Hydroelectric Project Baseline Water Quality Report includes analysis of both upstream and downstream water quality associated with the Parr Shoals Development and concluded that project operations could affect water quality downstream of Parr Shoals Dam. At the Water Quality TWC meeting on February 4, 2014, the TWC noted that the Baseline Water Quality Report identified periodic excursions of dissolved oxygen (DO) levels below 4.0 mg/l in the Parr Shoals Dam tailrace, as reported by the USGS station 02160991. In an effort to understand these excursions better, SCE&G contacted USGS and asked if they had any further information on this station. In June of 2011, the USGS installed a new sensor at the station 02160991. From January 2011 through December 2014, there have been approximately 13 hourly excursions in DO below the 4.0 mg/l SCDHEC standard which is approximately 0.04 percent of that period of time. At the request of the Water Quality TWC, SCE&G collected additional water quality data in the tailrace and forebay of Parr Shoals Dam to attempt to determine whether project operations are causing these excursions, and if so, how SCE&G might prevent them from occurring.

Tailrace Data – July – September 2014

Methods

From July through September of 2014, SCE&G collected temperature and DO data at seven sites along the downstream face of the Parr Shoals Dam, adjacent to the USGS station 02160991, and at a location approximately 400 feet downstream of Parr Shoals Dam. Data was collected on a weekly basis, three times per day including one hour before sunrise, at sunrise, and one hour after sunrise. To see if unit location had an effect on DO, the turbine(s) running during collections and the number of any lowered flashboard was also recorded.

Results

SCE&G collected data in the tailrace for two main reasons: (1) to verify the accuracy of the USGS gage station 02160991 and (2) to determine if DO could be correlated to an early morning DO sag or related to which turbine units were running at the time of data collection. During the sampling period, DO levels consistently stayed above 4.0 mg/l. No excursions were recorded by SCE&G or on the USGS gage (Table 1). Data collected by SCE&G at the site of the USGS station 02160991 was consistent with the USGS gage.

TABLE 1 DISSOLVED OXYGEN DATA AT USGS STATION 02160991 AND PARR SHOALS TAILRACE JULY – SEPTEMBER 2014.

	USGS Data		SCE&G Data	
Date	**Time**	**DO mg/l**	**Time**	**DO mg/l**
7/2/14	5:00 AM	6.2	5:35 AM	6.12
	6:00 AM	6.0	6:37 AM	5.95
	7:00 AM	6.0	7:42 AM	5.86
	8:00 AM	6.0		
7/10/14	5:00 AM	6.0	5:32 AM	6.24
	6:00 AM	5.9	6:27 AM	6.16
	7:00 AM	5.7	7:33 AM	6.08
	8:00 AM	5.5		
7/15/14	5:00 AM	5.5	5:34 AM	5.62
	6:00 AM	5.4	6:32 AM	5.32
	7:00 AM	4.9	7:42 AM	4.91
	8:00 AM	5.0		
7/24/14	5:00 AM	5.2	5:41 AM	5.15
	6:00 AM	5.2	6:51 AM	5.03
	7:00 AM	5.1	7:50 AM	5.49
	8:00 AM	5.3		
7/31/14	5:00 AM	5.8	5:43 AM	5.66
	6:00 AM	5.7	6:42 AM	5.55
	7:00 AM	5.7	7:54 AM	5.53
	8:00 AM	5.7		
8/7/14	5:00 AM	6.0	5:39 AM	5.90
	6:00 AM	6.0	6:48 AM	5.84
	7:00 AM	5.9	7:49 AM	5.74
	8:00 AM	5.9		
8/13/14	5:00 AM	5.9	5:30 AM	5.83
	6:00 AM	5.9	6:33 AM	5.86
	7:00 AM	5.9	7:33 AM	5.83
	8:00 AM	5.9		
8/20/14	5:00 AM	5.8	5:48 AM	5.90
	6:00 AM	5.8	6:46 AM	5.97
	7:00 AM	5.7	7:56 AM	5.86
	8:00 AM	5.7		
8/26/14	5:00 AM	6.3	5:41 AM	6.26
	6:00 AM	6.4	6:51 AM	6.51
	7:00 AM	6.4	7:48 AM	6.35
	8:00 AM	6.3		
9/3/14	5:00 AM	5.7	5:29 AM	6.02
	6:00 AM	5.8	6:40 AM	5.73
	7:00 AM	5.4	7:53 AM	5.46
	8:00 AM	5.4		
9/10/14	6:00 AM	5.6	6:30 AM	5.62
	7:00 AM	5.7	7:46 AM	5.78
	8:00 AM	5.7	8:46 AM	5.71
	9:00 AM	5.7		
9/16/14	6:00 AM	5.0	6:22 AM	4.94

	7:00 AM	5.0	7:24 AM	4.98
	8:00 AM	5.0	8:24 AM	4.92
	9:00 AM	5.0		
9/25/14	6:00 AM	7.3	6:33 AM	7.10
	7:00 AM	7.3	7:34 AM	7.65
	8:00 AM	7.3	8:29 AM	7.62
	9:00 AM	7.3		

Results did not detect a clear correlation between DO readings and the units running at the time of data collection. See Appendix A for a complete list of the data collected during this effort.

Forebay Data – October & November 2014

Methods

Water quality data, including DO and temperature, were collected in the forebay of the Parr Shoals Dam to determine if low DO water is being released through the turbines, causing the DO in the tailrace to drop. The data was collected using two HOBO data loggers, with one logger located approximately one foot above the bottom of the reservoir and the other located approximately one foot below the surface of the reservoir. Data was logged on an hourly basis from October 16, 2014 through December 3, 2014. We had planned to begin collections earlier but did not receive the data loggers until mid-September.

Results

Results showed the expected correlations between DO and temperature and natural diel fluctuations (Figure 1 through Figure 4). DO levels at the bottom of the forebay are consistently slightly lower than those at the top of the forebay, and there was no evidence of stratification in the forebay area of the reservoir. There were no low DO events observed in the tailrace during the monitoring effort.

FIGURE 1 DO AND TEMPERATURE AT BOTTOM OF PARR SHOALS DAM FOREBAY

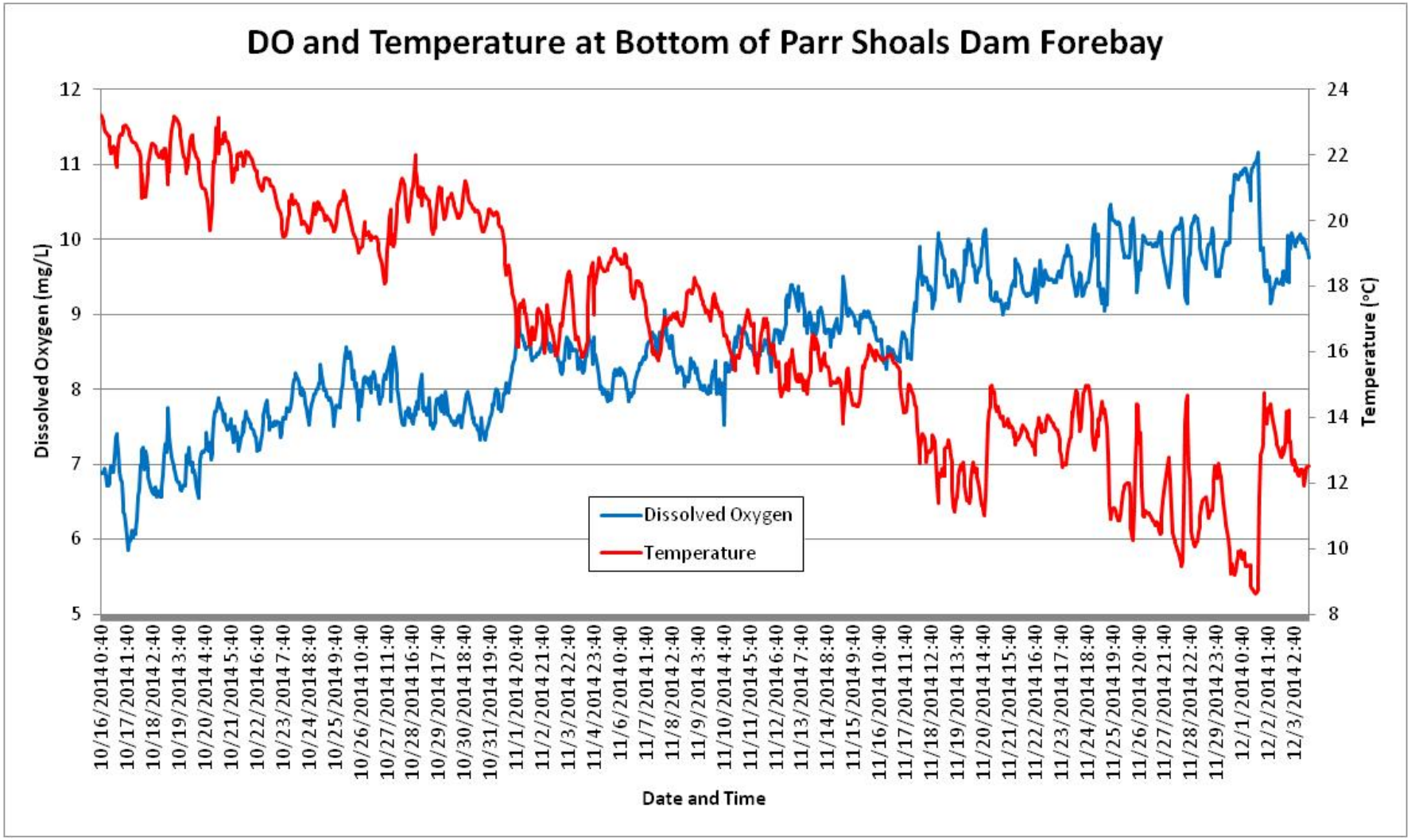


FIGURE 2 DO AND TEMPERATURE AT THE TOP OF PARR SHOALS DAM FOREBAY

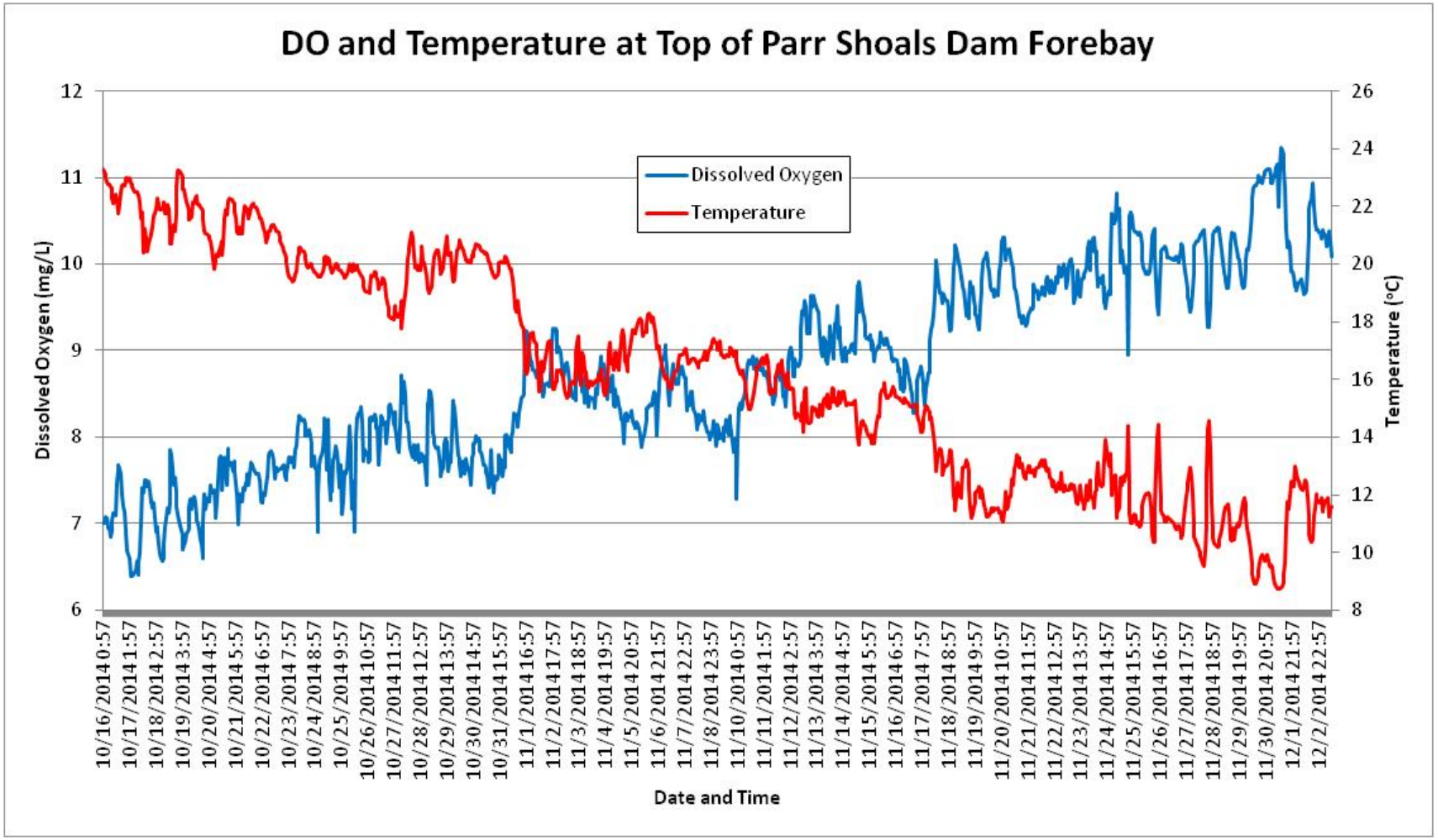


FIGURE 3 PARR SHOALS DAM FOREBAY DISSOLVED OXYGEN

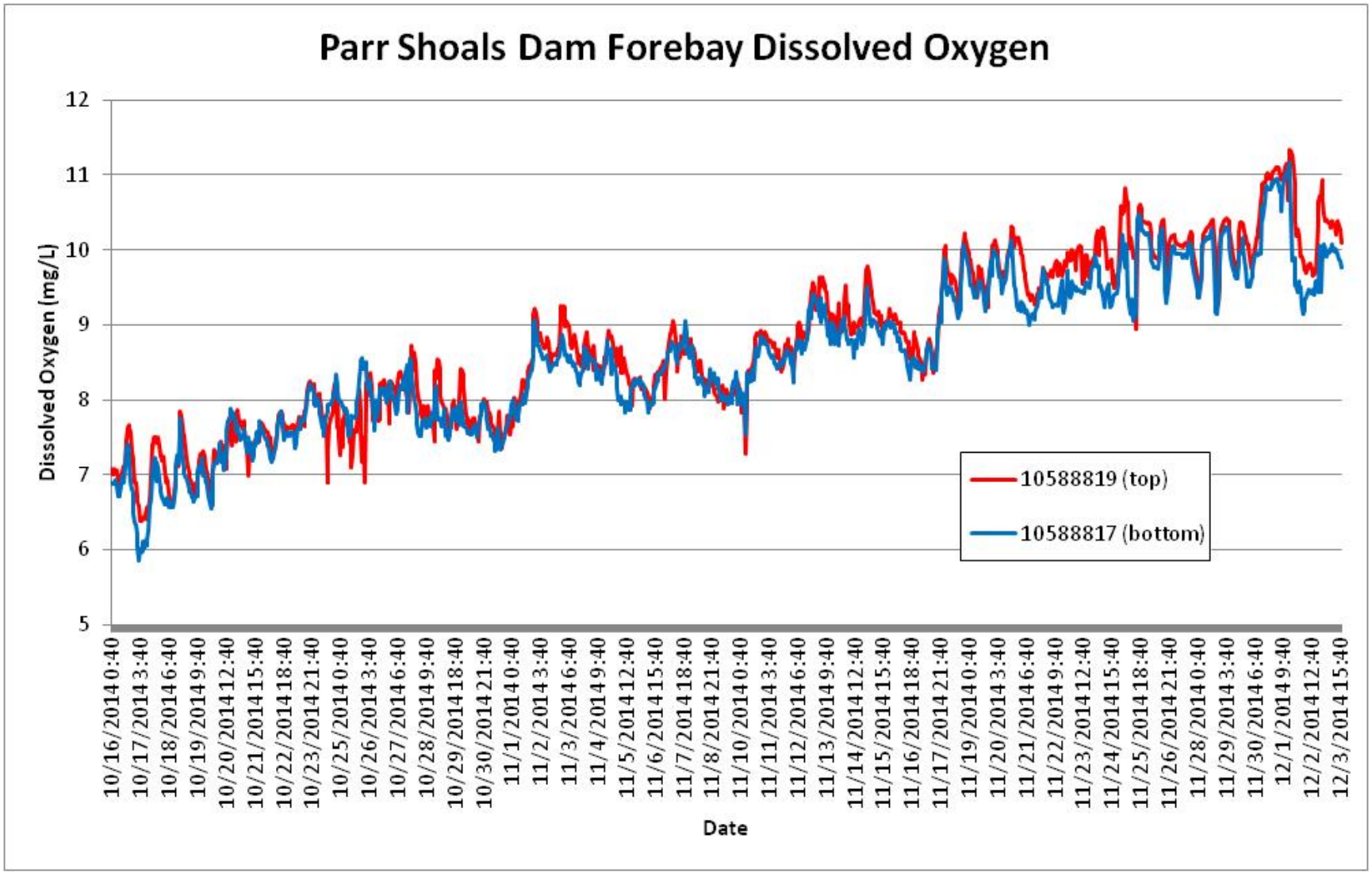
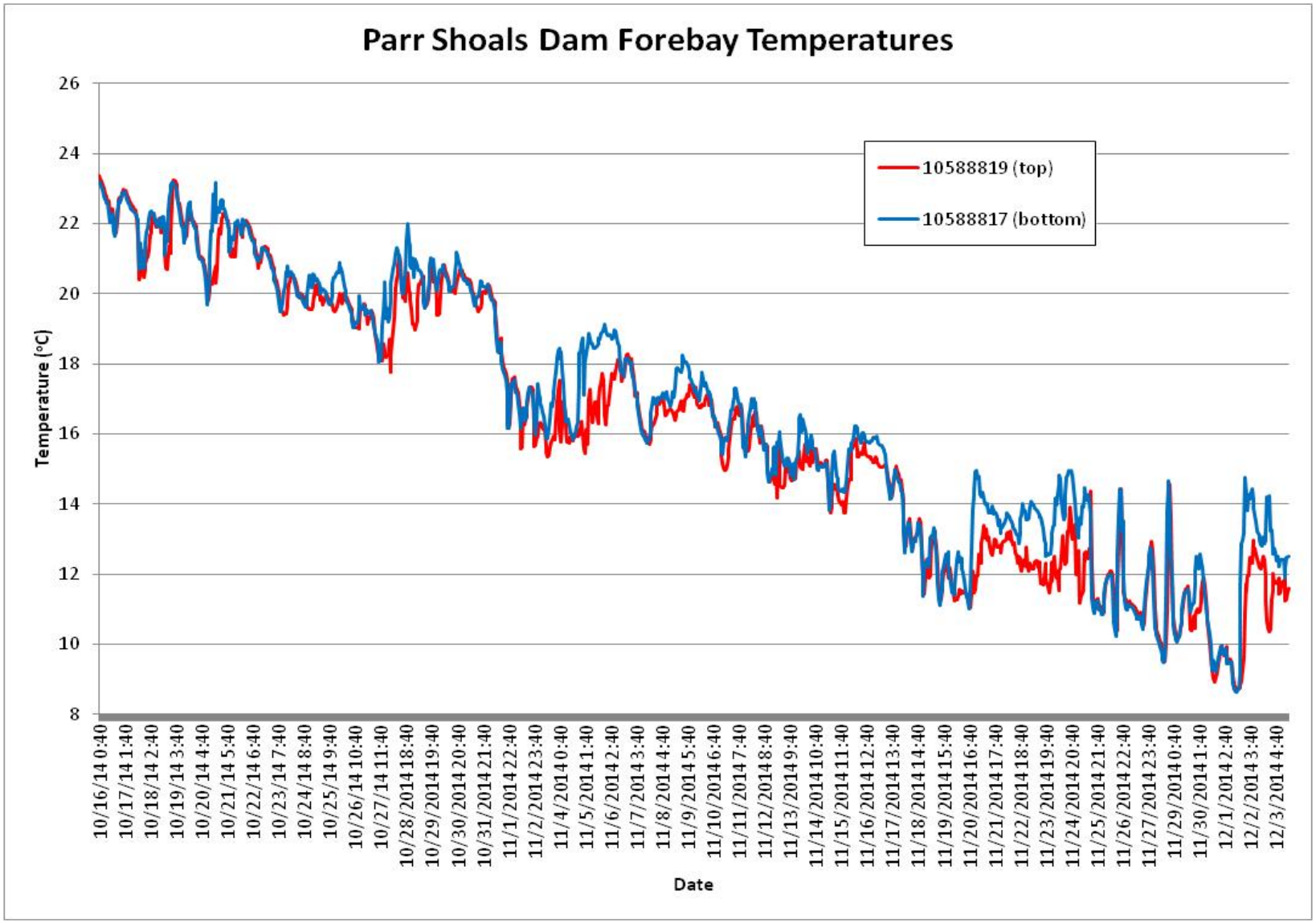


FIGURE 4 PARR SHOALS DAM FOREBAY TEMPERATURES



Parr Aeration Investigation – August 2014

Because of the success with turbine self-venting (or self-aerating) at the Saluda Hydro Project, SCE&G performed some initial investigations to determine if turbine aerating at the Parr Shoals Development was feasible for periodically increasing the tailrace DO levels. Bret Hoffman (Kleinschmidt), Amy Bresnahan (SC&EG), Milton Quattlebaum (SCE&G), and Mike Hall (USGS) performed some initial onsite turbine venting tests at the Parr Shoals Development on the morning of August 20, 2014. The results of their investigation are included below.

During each test run, water quality measurements (DO, temperature, and % DO saturation) were recorded with handheld meters (independent of the permanently installed USGS gage station equipment) in the tailrace at the bay 7 location (which is between the six turbine bays and the shore) and along the shoreline adjacent to the USGS gage. These measurements provided a cursory examination of the ability of the Units to aerate by opening the existing vacuum breaker valves located on the turbine head cover. Only Units 1, 3, and 4 were available for operation testing as the other units were out of service for repair, and Unit 4 could not be shut down because of equipment issues. During testing all river flow was passed through the turbine units and the spillway gates were in the closed (raised) position. Test runs for the water quality measurements were conducted in combinations of turbine operations as described below and were partially dictated by the requirement that Unit 4 could not be shut down. The headpond and tailwater elevations were also recorded, as were individual generator kW and kVar outputs.

Unit 4 - Test

Initially, tailrace readings were collected with only Unit 4 operating, and the vacuum breaker valve closed. Then, the vacuum breaker valve was fully opened to allow aeration, and audibly drew in air. The effects of the introduced air were clearly visible in the tailrace. The initial tailrace reading collected with the valve closed was 5.66 mg/l, the reading at bay 7 with the valve open was 5.82 mg/l. Upon closing the valve, the DO at bay 7 dropped to 5.78 mg/l, although the aerated water may not have had time to flush out from the tailrace area. The USGS measurements on the shore were 5.58 mg/l prior to opening any turbine vents, and 5.75mg/l with the vent open for 25 minutes. The USGS reading did not drop after the valve was closed, and matched the bay 7 reading of 5.78 mg/l, supporting the theory that residual aerated water remained in the immediate tailrace area. Initial saturation was 71% (valve closed), and with the valve open the saturation increased to 74.9%. Saturation levels reported near the USGS gage were within a tenth of a percent of those recorded at bay 7.

Units 1 and 4

Unit 1 was started (valve closed) and allowed to stabilize for 15 minutes. DO readings were collected with Unit 1 valve closed and Unit 4 valve open. The USGS reading increased to 5.84 mg/l, while the bay 7 reading increased from 5.82 mg/l to 5.86 mg/l. The Unit 1 valve was opened and readings were collected after 15 minutes of stabilization. The measurement near the USGS gage was 5.80 mg/l, while the bay 7 reading was 5.88 mg/l. Saturation with Unit 1 (valve

closed) and Unit 4 (valve open) was 73%, which increased to 75.4% with both units' valves open.

Units 1, 3, and 4

Unit 3 was started and operated for 15 minutes with no valve open, while the valves for Units 1 and 4 were left open. The measurements from the USGS site and at bay 7 were both 5.80 mg/l, and the saturation at bay 7 was 74.8%. When the valve was opened on Unit 3, the bay 7 reading was 5.76 mg/l and the USGS reading was 5.75 mg/l with a saturation level of 74.3% - with all three units aerating. USGS took an additional measurement at bay 2 (between units 1 and 3) with all units aerating, which ranged from 6.08 mg/l to 6.15 mg/l; at 6.08 mg/l, saturation was 79%.

One final measurement was taken with all units 1, 3 and 4 operating but all three valves closed. The reading near the USGS gage was 5.71 mg/l while the bay 7 reading was 5.73 mg/l, indicating very minimal reduction from aerating. It is likely that the aerated water in the tailrace area did not flush out and resulted in higher readings. The USGS handheld meter was used to re-sample water quality at bay 2 and the DO dropped to 5.89 mg/l and 75% saturation.

Discussion

The three units tested will aerate with their current valve configurations. The inability to shut down unit 4 likely prevented the aerated flows from units 1 and 3 from reaching the shore, as they are located further toward the middle of the river. While the DO readings with various combinations of valves open for all three units was fairly stable, the initial increase from Unit 4 indicates there is an ability to increase dissolved oxygen by aerating. Saturation was between 71% initial reading (prior to any aeration), and 75% after the valve was opened, indicating an increase in saturation. Saturation levels were near 75% for all readings following the initial valve opening.

Saturation was calculated for all the DO excursions (below 4.0 mg/L) during the past three years as recorded by the USGS gage. While the saturation levels during the aeration testing ranged from 71% (without aerating) up to 76%, the levels calculated for the excursions varied between 44.8% and 51.18%. Water temperatures during the testing ranged between 27.5 and 28.1 ^{o}C, while temperature during the excursions was measured at 29.3 to 30.1 ^{o}C.

The initial increase in DO measured during testing was approximately 0.17 mg/l. This indicates the turbines have some ability to increase DO by aerating, although the saturation percentage and water temperatures were significantly different during the historic DO excursions. A better determination of effectiveness could be made under lower DO and saturation conditions during the summer. Also, testing during a period when all of the turbine units can be manipulated (turned on/off and aerating on/off) would give more precise information on the performance of each unit.

APPENDIX A

TAILRACE DATA

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 7/2/14

Samplers: Milton Quattlebaum and Kelly Miller

Time	Location	DO (mg/L)	Temp (^{o}C)	Units Running
5:11 AM	Unit 1	5.79	27.30	on
5:16 AM	Unit 2	5.92	27.45	off
5:20 AM	Unit 3	5.90	27.44	on
5:23 AM	Unit 4	6.01	27.69	on
5:26 AM	Unit 5	6.18	27.94	off
5:29 AM	Unit 6	6.14	27.94	off
5:35 AM	**At USGS gage**	**6.12**	**27.92**	
5:41 AM	DWNSTRM Plant	6.09	27.89	
6:16 AM	Unit 1	5.97	27.30	on
6:19 AM	Unit 2	5.89	27.40	off
6:21 AM	Unit 3	5.90	27.48	on
6:23 AM	Unit 4	6.06	27.74	on
6:26 AM	Unit 5	5.99	27.76	off
6:28 AM	Unit 6	5.98	27.79	off
6:33 AM	NPDES 001 sign	6.00	27.62	
6:37 AM	**At USGS gage**	**5.95**	**27.74**	
6:42 AM	DWNSTRM Plant	5.94	27.71	
7:17 AM	Unit 1	5.74	27.25	on
7:22 AM	Unit 2	5.82	27.36	off
7:25 AM	Unit 3	5.84	27.40	on
7:27 AM	Unit 4	6.03	27.64	on
7:30 AM	Unit 5	5.93	27.61	off
7:33 AM	Unit 6	5.89	27.63	off
7:36 AM	NPDES 001 sign	5.93	27.62	
7:42 AM	**At USGS gage**	**5.86**	**27.56**	
7:49 AM	DWNSTRM Plant	5.89	27.57	

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	221.37	261.52	258.50	**6.2**	27.8
6:00 AM	221.35	260.89	262.50	**6.0**	27.6
7:00 AM	221.65	260.44	258.50	**6.0**	27.5
8:00 AM				**6.0**	27.4

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 7/10/14

Samplers: Milton Quattlebaum and Kelly Miller

Time	Location	DO (mg/L)	Temp (°C)	Units Running
5:04 AM	Unit 1	5.73	27.40	on
5:08 AM	Unit 2	5.75	27.45	off
5:11 AM	Unit 3	5.86	27.48	on
5:15 AM	Unit 4	6.09	27.53	on
5:18 AM	Unit 5	6.28	27.69	off
5:21 AM	Unit 6	6.24	27.66	off
5:24 AM	NPDES 001 sign	6.26	27.67	
5:32 AM	**At USGS gage**	**6.24**	**27.61**	
5:35 AM	DWNSTRM Plant	6.24	27.65	
6:07 AM	Unit 1	5.75	27.44	on
6:10 AM	Unit 2	5.82	27.47	off
6:13 AM	Unit 3	5.89	27.51	on
6:15 AM	Unit 4	6.27	27.64	on
6:18 AM	Unit 5	6.24	27.65	off
6:20 AM	Unit 6	6.20	27.64	off
6:22 AM	NPDES 001 sign	6.19	27.65	
6:27 AM	**At USGS gage**	**6.16**	**27.63**	
6:32 AM	DWNSTRM Plant	6.16	27.59	
7:14 AM	Unit 1	5.87	27.50	on
7:16 AM	Unit 2	5.84	27.51	off
7:19 AM	Unit 3	5.91	27.51	on
7:21 AM	Unit 4	6.19	27.59	on
7:23 AM	Unit 5	6.15	27.60	off
7:25 AM	Unit 6	6.16	27.62	off
7:27 AM	NPDES 001 sign	6.13	27.61	
7:33 AM	**At USGS gage**	**6.08**	**27.61**	
7:40 AM	DWNSTRM Plant	6.15	27.50	
				*lowered crest gates 5 and 6 at 7:20 am

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	221.36	260.89	266.00	**6.0**	27.6
6:00 AM	221.35	260.57	266.00	**5.9**	27.5
7:00 AM	221.93	260.59	258.00	**5.7**	27.5
8:00 AM				**5.5**	27.4

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 7/15/14

Samplers: Milton Quattlebaum and Kelly Miller

Time	Location	DO (mg/L)	Temp (^{o}C)		Units Running
5:10 AM	Unit 1	5.30		28.19	on
5:14 AM	Unit 2	5.29		28.25	off
5:17 AM	Unit 3	5.30		28.29	on
5:19 AM	Unit 4	5.70		28.42	on
5:22 AM	Unit 5	5.63		28.45	off
5:25 AM	Unit 6	5.54		28.48	off
5:28 AM	NPDES 001 sign	5.64		28.41	
5:34 AM	**At USGS gage**	**5.62**		**28.34**	
5:39 AM	DWNSTRM Plant	5.57		28.41	
6:13 AM	Unit 1	4.77		28.18	on
6:15 AM	Unit 2	4.81		28.21	off
6:18 AM	Unit 3	4.92		28.22	on
6:20 AM	Unit 4	5.19		28.25	on
6:22 AM	Unit 5	5.40		28.16	off
6:25 AM	Unit 6	5.35		28.24	off
6:27 AM	NPDES 001 sign	5.31		28.34	
6:32 AM	**At USGS gage**	**5.32**		**28.30**	
6:36 AM	DWNSTRM Plant	5.33		28.29	
7:22 AM	Unit 1	4.98		28.18	on
7:25 AM	Unit 2	4.94		28.15	off
7:27 AM	Unit 3	4.94		28.11	on
7:30 AM	Unit 4	5.00		28.12	on
7:32 AM	Unit 5	5.18		28.18	off
7:35 AM	Unit 6	5.02		28.19	off
7:37 AM	NPDES 001 sign	5.03		28.16	
7:42 AM	**At USGS gage**	**4.91**		**28.08**	
7:47 AM	DWNSTRM Plant	5.00		28.18	
7:55 AM	Unit 1	4.86		28.12	on

*not spilling while monitoring

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	221.34	258.63	266, except 5&6 at 264	**5.5**	28.3
6:00 AM	221.31	258.40	266, except 5&6 at 264	**5.4**	28.2
7:00 AM	221.34	258.68	266, except 5&6 at 264	**4.9**	28
8:00 AM				**5.0**	28

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 7/24/14

Samplers: Milton Quattlebaum and Kelly Miller

Time	Location	DO (mg/L)	Temp (^{o}C)	Units Running
5:10 AM	Unit 1	5.23	27.34	off
5:15 AM	Unit 2	5.26	27.32	off
5:17 AM	Unit 3	5.21	27.30	off
5:21 AM	Unit 4	5.43	27.35	on
5:24 AM	Unit 5	5.15	27.32	off
5:29 AM	Unit 6	4.81	27.21	off
5:35 AM	NPDES 001 sign	5.11	27.29	
5:41 AM	**At USGS gage**	**5.15**	**27.28**	
5:46 AM	DWNSTRM Plant	4.70	27.19	
6:27 AM	Unit 1	5.27	27.29	off
6:33 AM	Unit 2	5.26	27.23	off
6:35 AM	Unit 3	5.28	27.28	off
6:38 AM	Unit 4	5.19	27.30	on
6:41 AM	Unit 5	5.09	27.29	off
6:43 AM	Unit 6	4.97	27.27	off
6:46 AM	NPDES 001 sign	5.05	27.21	
6:51 AM	**At USGS gage**	**5.03**	**27.27**	
6:56 AM	DWNSTRM Plant	4.72	27.09	
7:22 AM	Unit 1	5.18	27.24	off
7:32 AM	Unit 2	5.68	27.24	off
7:33 AM	Unit 3	5.68	27.27	off
7:37 AM	Unit 4	5.83	27.26	on
7:40 AM	Unit 5	5.49	27.25	off
7:42 AM	Unit 6	5.43	27.11	off
7:45 AM	NPDES 001 sign	5.50	27.21	
7:50 AM	**At USGS gage**	**5.49**	**26.68**	
7:55 AM	DWNSTRM Plant	5.47	27.06	
8:00 AM	Unit 1	5.63	27.25	off

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	220.47	260.11	Gates 1, 2, 3, 4: 264	**5.2**	27.2
6:00 AM	220.47	259.41	Gates 5, 6, 7, 8: 266	**5.2**	27.2
7:00 AM	220.46	258.97		**5.1**	27.1
8:00 AM				**5.3**	27.1

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 7/31/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (°C)		Units Running
5:18 AM	Unit 1	5.72		27.49	on
5:21 AM	Unit 2	5.73		27.52	off
5:24 AM	Unit 3	5.73		27.50	off
5:27 AM	Unit 4	5.78		27.51	on
5:30 AM	Unit 5	5.65		27.49	off
5:33 AM	Unit 6	5.60		27.48	off
5:37 AM	NPDES 001 sign	5.67		27.46	
5:43 AM	**At USGS gage**	**5.66**		**27.32**	
5:50 AM	DWNSTRM Plant	5.54		27.39	
6:22 AM	Unit 1	5.71		27.42	on
6:25 AM	Unit 2	5.71		27.47	off
6:28 AM	Unit 3	5.73		27.48	off
6:31 AM	Unit 4	5.81		27.46	on
6:33 AM	Unit 5	5.61		27.42	off
6:36 AM	Unit 6	5.59		27.41	off
6:38 AM	NPDES 001 sign	5.64		27.43	
6:42 AM	**At USGS gage**	**5.55**		**27.32**	
6:47 AM	DWNSTRM Plant	5.61		27.22	
7:32 AM	Unit 1	5.64		27.41	on
7:36 AM	Unit 2	5.69		27.37	off
7:39 AM	Unit 3	5.69		27.42	off
7:41 AM	Unit 4	5.73		27.41	on
7:44 AM	Unit 5	5.63		27.39	off
7:46 AM	Unit 6	5.66		27.38	off
7:49 AM	NPDES 001 sign	5.68		27.38	
7:54 AM	**At USGS gage**	**5.53**		**27.36**	
7:59 AM	DWNSTRM Plant	5.61		27.32	
8:07 AM	Unit 1	5.60		27.49	on *no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	220.97	260.44	Gates 1, 2, 5, 6, 9, 10: 266	**5.8**	27.4
6:00 AM	220.99	259.66	Gates 3, 4:264	**5.7**	27.3
7:00 AM	220.95	259.00	Gates 7, 8: 263	**5.7**	27.3
8:00 AM				**5.7**	27.3

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 8/7/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (°C)		Units Running
5:14 AM	Unit 1	5.90		27.37	off
5:14 AM	Unit 2	5.92		27.30	off
5:20 AM	Unit 3	6.02		27.32	on
5:23 AM	Unit 4	5.99		27.29	on
5:26 AM	Unit 5	5.92		27.34	off
5:29 AM	Unit 6	5.92		27.33	off
5:33 AM	NPDES 001 sign	5.88		27.30	
5:39 AM	**At USGS gage**	**5.90**		**27.30**	
5:48 AM	DWNSTRM Plant	5.80		27.18	
6:25 AM	Unit 1	5.94		27.33	off
6:29 AM	Unit 2	5.94		27.33	off
6:31 AM	Unit 3	6.02		27.34	on
6:34 AM	Unit 4	5.95		27.32	on
6:36 AM	Unit 5	5.90		27.32	off
6:39 AM	Unit 6	5.86		27.28	off
6:42 AM	NPDES 001 sign	5.90		27.30	
6:48 AM	**At USGS gage**	**5.84**		**27.27**	
6:58 AM	DWNSTRM Plant	5.68		27.13	
7:27 AM	Unit 1	5.82		27.34	off
7:30 AM	Unit 2	5.92		27.29	off
7:33 AM	Unit 3	5.97		27.36	on
7:36 AM	Unit 4	5.95		27.32	on
7:39 AM	Unit 5	5.90		27.27	off
7:42 AM	Unit 6	5.85		27.26	off
7:45 AM	NPDES 001 sign	5.90		27.28	
7:49 AM	**At USGS gage**	**5.74**		**27.21**	
7:56 AM	DWNSTRM Plant	5.73		27.15	
8:03 AM	Unit 1	5.83		27.27	off
					*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	220.76	258.89	Gates 1, 2, 9, 10:266	**6.0**	27.2
6:00 AM	220.75	258.17	Gates 3, 4, 5, 6, 7, 8: 264	**6.0**	27.2
7:00 AM	220.72	258.02		**5.9**	27.2
8:00 AM				**5.9**	27.2

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 8/13/14

Samplers: Milton Quattlebaum and Kelly Miller

Time	Location	DO (mg/L)	Temp (°C)	Units Running
5:09 AM	Unit 1	5.87	26.18	on
5:13 AM	Unit 2	5.85	26.24	off
5:15 AM	Unit 3	5.89	26.26	on
5:18 AM	Unit 4	5.93	26.26	on
5:20 AM	Unit 5	5.80	26.28	off
5:23 AM	Unit 6	5.81	26.27	off
5:25 AM	NPDES 001 sign	5.82	26.27	
5:30 AM	**At USGS gage**	**5.83**	**26.24**	
5:35 AM	DWNSTRM Plant	5.85	26.23	
6:13 AM	Unit 1	5.85	26.20	on
6:16 AM	Unit 2	5.87	26.19	off
6:18 AM	Unit 3	5.85	26.21	on
6:20 AM	Unit 4	5.93	26.19	on
6:23 AM	Unit 5	5.83	26.18	off
6:25 AM	Unit 6	5.81	26.18	off
6:28 AM	NPDES 001 sign	5.83	26.18	
6:33 AM	**At USGS gage**	**5.86**	**26.15**	
6:38 AM	DWNSTRM Plant	5.87	26.14	
7:17 AM	Unit 1	5.86	26.14	on
7:19 AM	Unit 2	5.86	26.15	off
7:21 AM	Unit 3	5.88	26.15	on
7:23 AM	Unit 4	5.94	26.12	on
7:25 AM	Unit 5	5.86	26.10	off
7:27 AM	Unit 6	5.88	26.09	off
7:29 AM	NPDES 001 sign	5.89	26.08	
7:33 AM	**At USGS gage**	**5.83**	**26.07**	
7:37 AM	DWNSTRM Plant	5.90	26.06	
7:41 AM	Unit 1	5.90	26.12	on
				*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	221.33	259.89	1, 2, 9, 10: 266	**5.9**	26.1
6:00 AM	221.33	259.5	3, 4, 5, 6, 7, 8: 261	**5.9**	26.0
7:00 AM	221.07	259.57		**5.9**	26.0
8:00 AM				**5.9**	26.0

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 8/20/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (°C)	Units Running
5:24 AM	Unit 1	5.53	27.54	on
5:27 AM	Unit 2	5.88	27.68	off
5:30 AM	Unit 3	5.91	27.65	off
5:33 AM	Unit 4	5.99	27.67	on
5:36 AM	Unit 5	5.92	27.68	off
5:39 AM	Unit 6	5.91	27.64	off
5:42 AM	NPDES 001 sign	5.91	27.64	
5:48 AM	**At USGS gage**	**5.90**	**27.47**	
5:53 AM	DWNSTRM Plant	5.90	27.55	
6:26 AM	Unit 1	5.63	27.70	on
6:29 AM	Unit 2	5.87	27.68	off
6:31 AM	Unit 3	5.86	27.67	off
6:33 AM	Unit 4	5.91	27.66	on
6:35 AM	Unit 5	5.87	27.63	off
6:38 AM	Unit 6	5.86	27.60	off
6:41 AM	NPDES 001 sign	5.93	27.65	
6:46 AM	**At USGS gage**	**5.97**	**27.21**	
6:50 AM	DWNSTRM Plant	5.86	27.48	
7:32 AM	Unit 1	5.67	27.64	on
7:34 AM	Unit 2	5.96	27.57	off
7:38 AM	Unit 3	5.92	27.66	off
7:41 AM	Unit 4	6.02	27.65	on
7:43 AM	Unit 5	5.97	27.64	off
7:45 AM	Unit 6	5.87	27.53	off
7:48 AM	NPDES 001 sign	5.93	27.61	
7:56 AM	**At USGS gage**	**5.86**	**27.47**	
8:00 AM	DWNSTRM Plant	5.83	27.50	
8:09 AM	Unit 1	5.73	27.61	on

*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	220.97	258.50	1, 2, 9, 10: 265	**5.8**	27.6
6:00 AM	220.96	258.37	3, 4, 5, 6, 7, 8: 266	**5.8**	27.6
7:00 AM	220.94	258.42		**5.7**	27.5
8:00 AM				**5.7**	27.5

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 8/26/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (°C)	Units Running
5:17 AM	Unit 1	7.05	28.08	off
5:20 AM	Unit 2	7.02	28.08	off
5:23 AM	Unit 3	7.09	28.07	on
5:26 AM	Unit 4	6.41	28.08	on
5:28 AM	Unit 5	6.29	28.06	off
5:31 AM	Unit 6	6.25	28.03	off
5:34 AM	NPDES 001 sign	6.30	28.04	
5:41 AM	**At USGS gage**	**6.29**	**27.90**	
5:46 AM	DWNSTRM Plant	6.20	27.95	
6:26 AM	Unit 1	7.00	28.02	off
6:29 AM	Unit 2	7.06	28.00	off
6:32 AM	Unit 3	7.03	27.98	on
6:35 AM	Unit 4	6.64	27.90	on
6:38 AM	Unit 5	6.43	27.86	off
6:41 AM	Unit 6	6.41	27.82	off
6:45 AM	NPDES 001 sign	6.50	27.87	
6:51 AM	**At USGS gage**	**6.51**	**27.82**	
6:56 AM	DWNSTRM Plant	6.36	27.61	
7:30 AM	Unit 1	6.74	27.81	off
7:32 AM	Unit 2	6.81	27.79	off
7:34 AM	Unit 3	6.80	27.84	on
7:36 AM	Unit 4	6.68	27.71	on
7:38 AM	Unit 5	6.45	27.74	off
7:42 AM	Unit 6	6.47	27.66	off
7:44 AM	NPDES 001 sign	6.50	27.74	
7:48 AM	**At USGS gage**	**6.35**	**27.71**	
7:53 AM	DWNSTRM Plant	6.29	27.60	
8:01 AM	Unit 1	6.67	27.79	off
				*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	221.10	261.50	1, 2, 9, 10: 266	**6.3**	27.9
6:00 AM	221.10	261.33	3, 4, 5, 6, 7, 8: 265	**6.4**	27.8
7:00 AM	221.08	261.01		**6.4**	27.6
8:00 AM				**6.3**	27.5

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 9/03/14

Samplers: Milton Quattlebaum and Kelly Miller

Time	Location	DO (mg/L)	Temp (^{o}C)	Units Running
5:01 AM	Unit 1	5.88	28.45	on
5:04 AM	Unit 2	5.74	28.41	off
5:10 AM	Unit 3	5.61	28.40	on
5:14 AM	Unit 4	5.75	28.42	on
5:17 AM	Unit 5	5.67	28.49	off
5:19 AM	Unit 6	5.63	28.48	off
5:24 AM	NPDES 001 sign	5.82	28.35	
5:29 AM	**At USGS gage**	**6.02**	**28.86**	
5:35 AM	DWNSTRM Plant	6.11	28.43	
6:19 AM	Unit 1	5.56	28.41	on
6:21 AM	Unit 2	5.58	28.41	off
6:25 AM	Unit 3	5.53	28.42	on
6:27 AM	Unit 4	5.62	28.44	on
6:30 AM	Unit 5	5.73	28.46	off
6:33 AM	Unit 6	5.69	28.47	off
6:35 AM	NPDES 001 sign	5.71	28.46	
6:40 AM	**At USGS gage**	**5.73**	**28.46**	
6:45 AM	DWNSTRM Plant	5.69	28.13	
7:31 AM	Unit 1	5.57	28.61	on
7:36 AM	Unit 2	5.62	28.60	off
7:39 AM	Unit 3	5.63	28.59	on
7:41 AM	Unit 4	5.61	28.57	on
7:44 AM	Unit 5	5.63	28.54	off
7:47 AM	Unit 6	5.56	28.54	off
7:49 AM	NPDES 001 sign	5.53	28.55	
7:53 AM	**At USGS gage**	**5.46**	**28.51**	
7:59 AM	DWNSTRM Plant	5.56	28.30	
8:05 AM	Unit 1	5.55	28.51	on
				*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
5:00 AM	221.43	259.43	all @ 266	**5.7**	28.4
6:00 AM	221.38	259.1		**5.8**	28.4
7:00 AM	221.38	258.74		**5.4**	28.4
8:00 AM				**5.4**	28.4

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 9/10/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (^{o}C)	Units Running
6:02 AM	Unit 1	5.90	27.12	on
6:04 AM	Unit 2	5.82	27.11	off
6:07 AM	Unit 3	5.71	27.09	off
6:10 AM	Unit 4	5.77	27.09	on
6:13 AM	Unit 5	5.62	27.08	off
6:17 AM	Unit 6	5.61	27.04	off
6:20 AM	NPDES 001 sign	5.65	27.01	
6:30 AM	**At USGS gage**	**5.62**	**27.04**	
6:35 AM	DWNSTRM Plant	5.64	26.98	
7:22 AM	Unit 1	5.82	26.95	on
7:26 AM	Unit 2	5.76	26.94	off
7:29 AM	Unit 3	5.83	26.92	off
7:32 AM	Unit 4	5.81	26.92	on
7:35 AM	Unit 5	5.66	26.93	off
7:38 AM	Unit 6	5.74	26.67	off
7:41 AM	NPDES 001 sign	5.69	26.90	
7:46 AM	**At USGS gage**	**5.78**	**26.64**	
7:50 AM	DWNSTRM Plant	5.72	26.72	
8:27 AM	Unit 1	5.78	26.81	on
8:30 AM	Unit 2	5.80	26.87	off
8:33 AM	Unit 3	5.79	26.85	off
8:36 AM	Unit 4	5.85	26.85	on
8:38 AM	Unit 5	5.80	26.86	off
8:40 AM	Unit 6	5.76	26.83	off
8:42 AM	NPDES 001 sign	5.78	26.84	
8:46 AM	**At USGS gage**	**5.71**	**26.75**	
8:50 AM	DWNSTRM Plant	5.80	26.80	
9:00 AM	Unit 1	5.65	26.82	on
				*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
6:00 AM	221.07	259.38	all @ 266	**5.6**	26.9
7:00 AM	221.05	259.44		**5.7**	26.8
8:00 AM	221.06	259.43		**5.7**	26.8
9:00 AM				**5.7**	26.8

APPENDIX B

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 9/16/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (°C)	Units Running
6:01 AM	Unit 1	5.13	26.99	off
6:04 AM	Unit 2	5.37	26.73	off
6:07 AM	Unit 3	5.36	27.06	off
6:09 AM	Unit 4	5.25	27.06	on
6:12 AM	Unit 5	4.95	27.01	off
6:15 AM	Unit 6	4.97	26.96	off
6:18 AM	NPDES 001 sign	4.95	26.84	
6:22 AM	**At USGS gage**	**4.94**	**26.81**	
6:26 AM	DWNSTRM Plant	4.87	26.77	
7:03 AM	Unit 1	5.16	26.99	off
7:05 AM	Unit 2	5.20	26.96	off
7:08 AM	Unit 3	5.34	26.98	off
7:11 AM	Unit 4	5.10	26.99	on
7:13 AM	Unit 5	5.00	26.92	off
7:16 AM	Unit 6	4.97	26.93	off
7:19 AM	NPDES 001 sign	4.81	26.85	
7:24 AM	**At USGS gage**	**4.98**	**26.80**	
7:30 AM	DWNSTRM Plant	4.95	26.83	
8:02 AM	Unit 1	5.18	26.91	off
8:05 AM	Unit 2	5.15	26.92	off
8:08 AM	Unit 3	5.30	26.88	off
8:11 AM	Unit 4	5.24	26.93	on
8:13 AM	Unit 5	4.99	26.93	off
8:15 AM	Unit 6	4.96	26.91	off
8:18 AM	NPDES 001 sign	5.04	26.80	
8:24 AM	**At USGS gage**	**4.92**	**26.87**	
8:28 AM	DWNSTRM Plant	5.12	26.67	
8:39 AM	Unit 1	5.26	26.89	

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
6:00 AM	220.54	259.57	1, 2, 9, 10 @266	**5.0**	26.9
7:00 AM	220.54	259.73	3, 4, 5, 6, 7, 8@262	**5.0**	26.8
8:00 AM	221.44	259.81		**5.0**	26.9
9:00 AM				**5.0**	26.8

Parr/Fairfield Relicensing Dissolved Oxygen Study 2014

Date: 9/25/14

Samplers: Milton Quattlebaum

Time	Location	DO (mg/L)	Temp (°C)	Units Running
6:09	Unit 1	7.80	21.40	off
6:11	Unit 2	7.76	21.42	off
6:15	Unit 3	7.81	21.44	on
6:17	Unit 4	7.85	20.90	on
6:21	Unit 5	7.70	21.39	off
6:24	Unit 6	7.65	21.42	off
6:27	NPDES 001 sign	7.66	21.43	
6:33	**At USGS gage**	**7.10**	**21.40**	
6:40	DWNSTRM Plant	7.61	21.36	
7:17	Unit 1	7.69	21.68	off
7:19	Unit 2	7.71	21.67	off
7:21	Unit 3	7.80	21.67	on
7:23	Unit 4	7.70	21.61	on
7:25	Unit 5	7.58	21.57	off
7:27	Unit 6	7.62	21.62	off
7:29	NPDES 001 sign	7.60	21.62	
7:34	**At USGS gage**	**7.65**	**21.61**	
7:39	DWNSTRM Plant	7.31	21.59	
8:13	Unit 1	7.67	21.75	off
8:15	Unit 2	7.65	21.72	off
8:17	Unit 3	7.71	21.75	on
8:19	Unit 4	7.66	21.62	on
8:21	Unit 5	7.65	21.51	off
8:23	Unit 6	7.58	21.59	off
8:25	NPDES 001 sign	7.63	21.60	
8:29	**At USGS gage**	**7.62**	**21.42**	
8:34	DWNSTRM Plant	7.59	21.47	
8:39	Unit 1	7.68	21.65	off
				*no gates spilling

Time	Jenkinsville 02160991	Parr Res. Level 02160990	Parr Crest Gate	**USGS DO data at Jenkinsville**	USGS Temp data at Jenkinsville
6:00 AM	221.06	259.18	all @ 266	**7.3**	21.5
7:00 AM	221.05	259.2		**7.3**	21.5
8:00 AM	221.05	259.24		**7.3**	21.5
9:00 AM				**7.3**	21.5