

**Affordable Desalination Collaboration
Monthly Technical Progress Report
Covering the Month of June-2010**

TWDB Contract No. 0804830845

CONTRACTOR – Affordable Desalination Collaboration
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Addressed To: Texas Water Development Board
Attention: Contract Administrator
P.O. Box 13231
Austin, TX 78711-3231

RESEARCH PROJECT – Optimizing Brackish Water Reverse Osmosis for Affordable Desalination

BOARD APPROVAL DATE – April 21, 2008

CONTRACT INITIATION DATE – September 15, 2008

STUDY COMPLETION DATE – June 13, 2011

FINAL REPORT DEADLINE – June 13, 2011


TOTAL STUDY COSTS – \$ 1,356,683

BOARD SHARE OF THE TOTAL STUDY COSTS- the lesser of \$496,783 or the total combined amount corresponding to the percentages of TWDB funding for each of the tasks shown in exhibit C.

LOCAL SHARE OF THE TOTAL STUDY COSTS - \$859,900 in cash and \$0.00 in-kind services or the amount remaining after the total combined amount corresponding to the percentages of TWDB funding for each of the tasks shown in Exhibit C.

PAYMENT SUBMISSION SCHEDULE - Monthly

Date Submitted: 7-12-10



Signed, Reviewed by designated representative

- 1. Project Objective:** The objectives of the Affordable Desalination Collaboration (ADC) are to demonstrate affordable, reliable and environmentally responsible reverse osmosis desalination technologies and to provide a platform by which cutting edge technologies can be tested and measured for their ability to reduce the overall cost of the reverse osmosis (RO) treatment process
- 2. Project Description / Background:** A key challenge facing inland desalination today is to develop a new generation of reverse osmosis plants that deliver high-quality, fresh water at reduced economic and environmental cost. Two key areas of focus that will help achieve these goals are the energy consumption and the achievable RO recoveries of inland brackish water systems.

The ADC was formed in 2004 to fund and execute the first part (ADC I), which became a multiple phase project funded under the California Department of Water Resources Proposition 50 program. Under the program the ADC built and operated a demonstration plant at the United States Navy's Seawater Desalination Test Facility in Pt. Hueneme, California. The ADC achieved remarkable results by desalinating seawater at energy levels between 6.0-6.9 kWh/kgal (1960-2250 kWh/acre-ft).

This project funded by the Texas Water Development Board (TWDB) and titled "Optimizing Brackish Water Reverse Osmosis for Affordable Desalination" will pursue the following demonstration, and development tasks.

1. Test and demonstrate state of the art isobaric energy recovery technology in an optimized brackish water design. The ADC expects to achieve 15-30% energy savings over traditional brackish water systems even where energy recovery turbines are applied.
2. Develop and demonstrate new process designs that are possible as a result of the isobaric energy recovery technologies. As a natural result of the pressure exchanger (PX) technology in particular, there are new kinds of flow schemes that can improve the performance of higher recovery brackish water systems. We will use the ADC pilot system to test and demonstrate these new flow schemes in order to push the recoveries beyond what has been traditionally achievable.

The ADC represents a unique collaboration leading government agencies, municipalities, RO manufacturers, consultants and professionals that are working together to improve the designs and technology applied in state of the art desalination systems. Our demonstration plant, processes and personnel have been pre-qualified and proven to meet project goals and produce valid data on the operation of desalination systems. Our outreach and information sharing efforts have been extensive and reached a wide range of audiences. In short, the ADC is an established leader in the field of reverse osmosis technology and we are uniquely qualified to conduct the proposed project and disseminate the results to the appropriate audiences.

3. June Progress and Status:

By the end of June we had completed 6 of the 9 variable flux and recovery points. In addition we demonstrated continuous operation for approximately 3 weeks at the base line demonstration point of 15 gfd and 80% recovery. We are working with Professional Water Technologies to determine the optimum anti-scalent formula to reach the higher 85% recovery points of our matrix. We have sent PWT water samples and they are currently completing their analysis. In July we expect to complete the higher 85% recovery points of the matrix with the assistance of PWT's technical support.

4. Percent Complete of Total Project: ~ 57 %

5. Deliverables:

Trade Show/Conference/Publication	Date(s)	Author(s)	Presenter	TWDB Submittal
Joint ADC-AMTA workshop, Annual Conference, Austin, Texas	July 2009	n/a	Various	Q2-09
Innovative Designs to Be Tested in ADC	Sept/Nov 2007	John P. MacHarg	n/a	Q2-09
Q2 and Q3 2009 Progress Report	Nov 2009	John MacHarg	n/a	Nov-2009
October 2009 Progress Report	Oct-2009	John MacHarg	n/a	April-2010
November 2009 Progress Report	Nov-2009	John MacHarg	n/a	April-2010
December 2009 Progress Report	Dec-2009	John MacHarg	n/a	April-2010
January 2010 Progress Report	Jan-2010	John MacHarg	n/a	April-2010
February 2010 Progress Report	Feb-2010	John MacHarg	n/a	April-2010
March 2010 Progress Report	Mar-2010	John MacHarg	n/a	April-2010
April 2010 Progress Report	May-2010	John MacHarg	n/a	May-2010
May 2010 Progress Report	June-2010	John MacHarg	n/a	June-2010
June 2010 Progress Report	July-2010	John MacHarg	n/a	July-2010

6. Schedule Status: Assuming we can use the 15 GFD-80% recovery data as the most affordable demonstration point we should be able to maintain schedule and complete all phases of the Optimized Isobaric Energy Recovery Demonstration by August 4th. We will then move onto the High Recovery Design Process testing phase of the protocol.

7. Plans for Next Month: In July we expect to complete the higher 85% recovery points of the matrix with the assistance of PWT's technical support and add to the cumulative demonstration hours and should very nearly complete the Optimized Isobaric Energy Recovery Demonstration phase of the study.

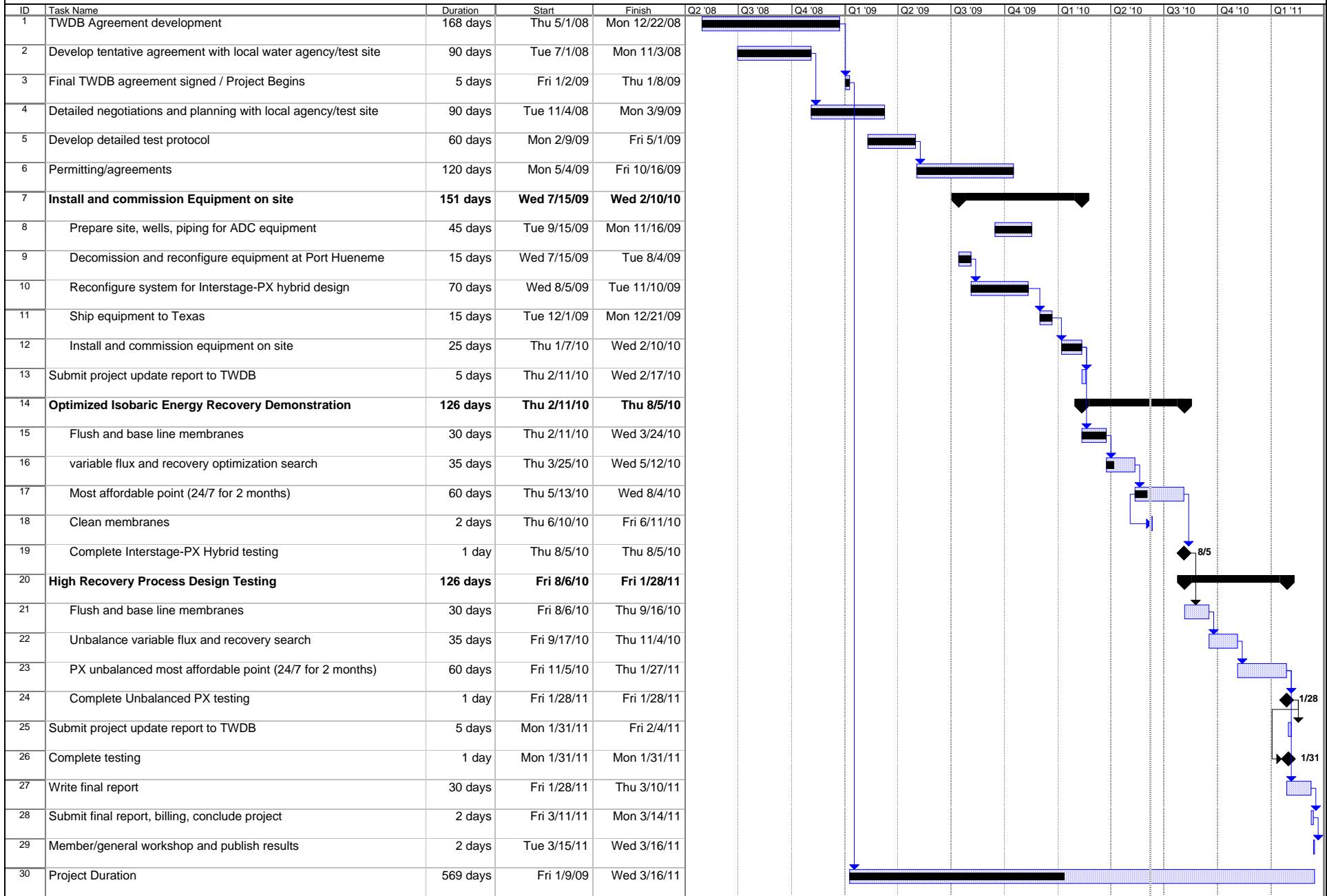
8. Attachments: n/a

Task and % Complete Progress Table

Agreement Number 0804830845	Starting Date: 7-09	1- Completion Date: 13-11	6- Month-Year June-10	Report Number 10	PERCENT OF								
Grantee Agency Name: Affordable Desalination Collaboration		% Time Elapsed 48%	Total Grant Funds used \$ 121,931	Billing this report \$ -	Project	Task Complete Last Report	Task Complete This Report	Project Complete					
Name of Project: Optimizing Brackish Water Reverse Osmosis for Affordable Desalination													
TASKS	YEAR	2009				2010				Project	Task Complete Last Report	Task Complete This Report	Project Complete
	MONTH	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4						
Task 1: Finalize Agreements with local test site/agency									7%	100%	0%	7%	
Task 2: Attain permits									7%	100%	0%	7%	
Task 3: Reconfigure system for interstage optimized design									13%	100%	0%	13%	
Task 4: Decommission equipment at Port Hueneme									8%	100%	0%	8%	
Task 5: Install and commission equipment on site.									8%	100%	0%	8%	
Task 6: Execute multiple point optimization search									10%	35%	35%	7%	
Task 7: Run 2 month demo at most affordable point									17%	15%	25%	7%	
Task 8: Execute unbalanced multiple point optimization search									10%	0%	0%	0%	
Task 9: Run 2 month demo at unbalanced most affordable point									17%	0%	0%	0%	
Task 10: Member/general workshop									3%	0%	0%	0%	
Show Progress by Use of Bar Chart	Scheduled =								100%			57%	
	Completed =												

Schedule

Project Schedule Gant Chart.



Project: ADC TWDB Brackish Demons Date: Mon 6/7/10	Task		Summary		Rolled Up Progress		Project Summary	
	Progress		Rolled Up Task		Split		Group By Summary	
	Milestone		Rolled Up Milestone		External Tasks		Deadline	

Data

Water Quality Data

TIME			pH			CONDUCTIVITY							TDS							TURBIDITY		SDI	OTHER					Notes																												
Date	Time	Operation	pH _{F-95}	pH _{P-95}	pH _{C-95}	C _{CF-out}	C _{CF-PK-out}	C _{F-95}	C _{P-total-95}	C _{P-1st stage}	C _{P-2nd stage}	C _{Interstage}	C _{C-95}	C _{CF-out}	TDS _{CF-out}	TDS _{CF-PK-out}	% Inc @ memb in	TDS _{F-95}	TDS _{P-95}	TDS _{C-95}	TDS _{P-1st stage}	TDS _{P-2nd stage}	TDS _{Interstage}	TDS _{C-95}	TDS _{CF-out}	Turbidity (NTU)	Density Index		V _{TANK} (gallons)	Inhibitor Pump Speed (gph)	HP VFD Speed (Hertz)	PX VFD Speed (Hertz)	FEED VFD Speed (Hertz)																							
MM/DD/YY	hh:mm	Time hh:hh	SC5	SC11	SC7	SC3	SC6	SC5	SC11	SC14	SC10	SC13	SC12	SC7	SC3	SC6	SC5	SC11	SC14	SC10	SC13	SC12	SC7	SC3	SC6	NTU _{MF-in}	NTU _{CF-out}							SDI _{CF-out}	39	40	41-02	42-02	43-02																	
25	26	27	28	29	30	31	32	33	34	35	36	37	28	29	30	31	32	33	34	35	36	37	30	38																																
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																	Membrane Ripening Period																							
02/11/10	16:15	12338.00	7.90	6.50	7.99	4490	nd	4529	237.2	139.6	135.4	473.5	9470	18.26	13.45	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.037	nd			20	20/30	53.35	42.51	51.32																				
02/11/10	17:16	12339.00	7.98	6.50	8.12	4514	nd	4626	294	166.3	160.8	659.7	10.11	18.52	15.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.032	nd			20	20/30	45.79	35.86	45.07																					
02/12/10	9:11	12355.30	7.86	6.88	6.86	4477	nd	4505	274.1	158.1	155	559.2	9539	18.62	15.04	3461.00	nd	0.8%	3487.00	177.90	101.00	98.84	376.50	7958.00	17.11	13.33	nd	0.029	nd			20	20/30	53.50	41.54	52.58																				
02/18/10	15:52	12357.60	7.77	6.60	7.99	4464	nd	4617	293.7	170.6	167.8	597.7	9633	18.53	16.27	3446.00	nd	3.9%	3581.00	191.80	109.20	107.10	404.20	802.00	17.09	14.53	nd	0.035	nd			20	20/30	53.58	41.72	47.18																				
02/25/10	13:22	12375.40	7.88	6.50	8.14	4490	nd	4651	304.6	178.5	175.1	625.4	9679	18.62	16.22	3477.00	nd	4.4%	3629.00	201.30	114.70	112.40	423.80	8085.00	17.05	14.51	nd	0.037	nd			20	20/30	53.67	41.46	40.60																				
02/26/10	15:54	12400.20	7.84	6.51	7.99	4499	nd	4622	300	176.7	174.1	613.1	9680	18.65	16.3	3463.00	nd	3.2%	3573.00	196.20	113.30	111.70	414.80	8046.00	17.09	14.59	nd	0.055	nd			19.5	20/30	53.70	41.54	42.60																				
02/27/10	12:35	12420.90	7.85	6.52	7.95	4492	nd	4649	299.9	176.8	174.1	612.7	9727	18.67	16.32	3482.00	nd	3.9%	3619.00	196.00	113.50	111.60	415.70	8090.00	17.16	14.59	nd	0.029	nd			19.5	20/30	53.64	41.42	41.10																				
02/28/10	12:04	12444.30	7.87	6.53	7.97	4495	nd	4650	296.1	175.9	173.1	598.2	9707	18.55	16.22	3478.00	nd	4.2%	3624.00	193.70	113.30	111.00	405.30	8095.00	17.04	14.52	nd	0.029	nd			19	20/30	53.70	41.57	42.51																				
03/01/10	14:20	12470.60	7.85	6.54	8.09	4488	nd	4655	297.5	177.5	173.9	604.1	9714	18.19	16.21	3464.00	nd	4.1%	3605.00	194.70	113.90	111.50	409.10	8089.00	16.61	14.51	nd	0.028	nd			19	20/30	53.64	41.46	40.61																				
03/02/10	12:18	12492.60	7.87	6.56	8.05	4478	nd	4603	301.5	178.1	175.2	622.2	9813	18.71	16.21	3452.00	nd	3.2%	3563.00	197.20	114.30	112.40	421.40	8176.00	17.18	14.49	nd	0.026	nd			19	20/30	53.64	41.04	44.27																				
03/03/10	15:14	12519.50	7.78	6.47	7.88	4479	nd	4615	299.8	179.1	176	614.5	9759	18.48	16.19	3449.00	nd	4.0%	3588.00	197.30	114.90	112.80	415.70	8124.00	16.89	14.48	nd	0.026	nd			18.5	20/30	53.58	41.25	43.07																				
03/04/10	12:40	12540.90	7.76	6.46	7.99	4472	nd	4597	298.6	179.2	176	612.7	9768	18.44	16.18	3443.00	nd	3.0%	3548.00	195.00	115.00	112.90	414.10	8116.00	16.82	14.42	nd	0.027	nd			18.5	20/30	53.58	41.34	43.00																				
03/05/10	14:39	12564.10	7.75	6.46	7.82	4472	nd	4605	299.6	179.9	176.3	611.2	9737	18.36	16.09	3444.00	nd	3.1%	3551.00	195.60	115.60	113.00	413.90	8120.00	16.74	14.35	nd	0.027	nd			18.5	20/30	53.67	41.46	40.86																				
03/06/10	11:33	12585.00	7.83	6.50	7.92	4510	nd	4631	298.4	180	176.4	606.8	9728	17.96	16.02	3481.00	nd	3.0%	3586.00	195.10	115.60	113.40	410.90	8084.00	15.64	14.28	nd	0.027	nd			18	20/30	53.64	41.48	39.36																				
03/07/10	13:55	12611.30	7.77	6.47	7.86	4470	nd	4622	297.8	180.4	177.5	608.6	9747	18.21	15.98	3441.00	nd	3.6%	3566.00	194.80	115.80	113.90	411.50	8105.00	16.57	14.26	nd	0.028	nd			17.8	20/30	53.58	41.46	37.80																				
03/08/10	15:33	12637.00	7.86	6.36	7.85	4476	nd	4613	299.1	180.1	176	615.4	9828	18.37	16.07	3454.00	nd	3.2%	3566.00	196.50	115.80	112.90	417.80	8181.00	16.76	14.10	nd	0.028	nd			17.8	20/30	53.67	41.13	40.79																				
03/09/10	14:14	12659.70	7.76	6.15	7.97	4612	nd	4789	311.1	-	-	-	-	-	-	3579.00	nd	4.0%	3721.00	204.30	-	-	-	-	-	-	nd	nd									Plant shut down during data collection due to																			
03/10/10	13:07	12681.90	7.77	6.33	7.96	4481	nd	4649	298.6	180.8	177.2	611.3	9849	18.27	16.1	3440.00	nd	5.1%	3614.00	195.40	116.00	113.70	414.20	8254.00	16.68	14.37	nd	0.028	nd			17.8	20/30	53.70	41.37	41.23																				
03/16/10	16:04	12706.10	7.79	6.53	7.91	4487	5038	4510	332.8	195.7	192.3	768.4	10.64	18.84	16.33	3470.00	3920.00	13.0%	3477.00	219.20	126.30	124.20	524.50	8954.00	17.27	14.61	nd	nd					17.8	20/30	55.34	40.08	35.04																			
03/26/10	16:29	12718.20	7.80	6.60	7.85	5250	6456	5419	388.2	235.7	232	870.7	12.19	20.28	18.22	4103.00	5166.00	25.9%	4245.00	257.20	152.90	150.50	598.80	10.43	18.84	nd	0.034	nd					17.8	20/30	54.80	41.95	30.00																			
03/27/10	16:28	12720.58	7.80	6.69	7.75	5274	5705	5286	407.1	242.9	237.9	978.4	12.19	20.56	16.71	4140.00	4510.00	8.9%	4133.00	270.50	157.60	154.50	677.30	10.62	19.20	nd	0.030	nd					17.8	20/30	52.62	38.79	30.00																			
04/02/10	15:35	12726.22	7.79	6.78	7.80	4134	4787	4197	255.9	182.4	178.7	444.6	8147	12.96	11.48	3168.00	3709.00	17.1%	3206.00	165.90	117.30	114.60	297.50	6647.00	11.16	9740.00	nd	0.033	nd					17.6	50/90	46.28	45.73	35.73																		
04/02/10	17:57	12728.58	7.65	6.69	7.77	4072	4247	4098	232.6	161.1	163.3	396.4	7633	12.2	9857	3118.00	3282.00	5.3%	3125.00	151.10	106.20	104.40	263.00	6183.00	10.43	8204.00	nd	0.033	nd					17.5	50/90	46.26	46.20	33.38																		
04/08/10	14:50	12731.97	7.60	6.60	7.66	4060	4242	4092	240.3	169.6	167	409.9	7705	12.4	10.01	3071.00	3215.00	4.7%	3075.00	154.40	107.40	105.70	269.80	6205.00	10.51	8265.00	nd	0.029	nd					17	50/90	46.29	46.11	33.26																		
04/09/10	15:10	12740.34	7.70	6.38	7.73	4003	4175	4035	235	167.6	164.1	401.3	7545	12.22	9887	3017.00	3171.00	5.1%	3029.00	151.00	105.40	103.70	263.70	6054.00	10.33	8143.00	nd	0.033	nd					16.1	50/90	46.26	46.14	48.02																		
04/10/10	12:11	12761.37	7.66	6.41	7.64	4011	4187	4040	230.8	164.9	162.5	388.6	7499	12.12	9845	3021.00	3165.00	4.8%	3044.00	148.40	104.30	102.70	255.00	5997.00	10.25	8115.00	nd	0.027	nd					14.2	50/90	46.25	46.55	46.67																		
04/11/10	13:17	12786.47	7.65	6.43	7.65	4009	4169	4054	231	165.2	162.4	386.9	7510	12.11	9836	3026.00	3149.00	4.1%	3051.00	148.50	104.50	102.60	253.80	6007.00	10.22	8097.00	nd	0.032	nd					12.5	90/00	46.20	46.88	50.79																		
04/12/10	17:15	12814.43	7.73	6.46	7.75	4053	4222	4088	232.8	167.1	164.4	389.6	7562	12.13	9951	3053.00	3193.00	4.6%	3079.00	149.70	105.70	103.90	255.60	6047.00	10.24	8200.00	nd	0.028	nd					23	50/90	46.23	46.96	43.79	Filled up anti-scalant tank with 10:1 dilution																	
04/21/10	15:44	12833.22	7.49	6.21	7.65	4065	4249	4121	241.2	172.1	169.6	406.8	7598	12.26	10.01	3063.00	3216.00	5.0%	3107.00	155.00	109.10	107.40	267.40	6079.00	10.37	8253.00	nd	0.032	nd					21.3	50/90	46.26	46.73	46.90																		
04/23/10	16:00	12853.47	7.62	6.31	7.72	4035	4148	4051	234.2	168.1	165.5	391.8	7522	12.09	10.04	3033.00	3141.00	3.6%	3062.00	150.70	106.40	104.80	257.60	6039.00	10.22	8266.00	nd	0.035	nd					19.3	50/90	46.41	47.29	46.65																		
04/24/10	11:46	12873.25	7.54	6.33	7.65	4059	4274	4131	238.7	171.2	168.2	400.6	7607	12.15	9979	3068.00	3248.00	5.9%	3120.00	153.50	108.50	106.50	263.30	6091.00	10.27	8231.00	nd	0.033	nd																											

Water Quality Data

TIME			pH			CONDUCTIVITY										TDS							TURBIDITY		SDI	OTHER					Notes																																		
Date MM/DD/YY	Time hh:mm	Operation Time hh:hh	pH _{F-5ys} SC5	pH _{P-11} SC11	pH _{C-7} SC7	C _{CF-out} SC3	C _{F-PK-out} SC6	C _{F-5ys} SC5	C _{P-total 5ys} SC11	C _{P-1st stage 1} SC14	C _{P-1st stage 2} SC10	C _{P-2nd stage} SC13	C _{Interstage} SC13	C _{C-5ys} SC12	C _{C-PK-out} SC7	TDS _{CF-out} SC3	TDS _{F-PK-out} SC6	% Inc @ memb in	TDS _{F-5ys} SC5	TDS _{P-5ys} SC11	TDS _{P-1st stage} SC14	TDS _{P-1st stage} SC10	TDS _{P-2nd stage} SC13	TDS _{Interstage} SC13	TDS _{C-5ys} SC12	TDS _{C-PK-out} SC7	Turbidity (NTU) NTU _{MF-in} SC1	NTU _{CF-out} meter	Density Index SDI _{CF-out} CART	V _{TANK} (gallons)		Inhibitor Pump Speed (gph)	HP VFD Speed (Hertz)	PX VFD Speed (Hertz)	FEED VFD Speed (Hertz)																														
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																														12 gfd flux 75% Recovery																																			
06/16/10	11:46	13886.18	7.57	6.47	7.63	4235	4343	4261	293.6	187.3	182	676	9697	14.64	11.97	3293.00	3391.00	3.0%	3318.00	194.90	122.60	119.00	466.40	8206.00	13.16	10.41	nd	0.026	74.71	16.3	50/90	45.06	38.47	43.88	SDI was done twice to confirm first value																														
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																														14.9 gfd flux 75% Recovery																																			
06/17/10	12:23	13910.80	7.54	6.44	7.66	4235	4358	4265	237	155.6	151	531.4	9554	15.09	11.9	3290.00	3404.00	3.5%	3321.00	156.40	100.90	97.83	362.70	8069.00	13.60	10.34	nd	0.026	0.935	13.8	50/90	55.55	45.79	53.88																															
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																														16 gfd flux 75% Recovery																																			
06/18/10	8:46	13931.18	7.47	6.37	7.61	4236	4376	4264	214.6	143.1	138.9	457.7	9287	14.75	11.74	3304.00	3422.00	3.6%	3324.00	141.50	92.66	89.93	311.00	7831.00	13.26	10.19	nd	0.025	0.896	11.7	50/90	59.85	50.24	58.27																															
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																														BASELINE																																			
06/22/10	11:42	13972.79	7.55	6.40	7.65	4276	4460	4312	285.4	174.8	169.4	768.9	10.97	17.56	13.64	3323.00	3492.00	5.1%	3363.00	189.10	114.00	110.30	532.20	9402.00	16.17	12.14	nd	0.027	nd	17.9	50/90	55.15	40.17	46.66																															
06/23/10	12:39	13997.74	7.48	6.42	7.59	4914	5074	4937	352.6	215.9	209.3	1012	12.93	19.92	15.14	3874.00	4017.00	3.7%	3899.00	236.60	142.40	137.80	710.70	11.35	18.82	nd	0.026	nd	15.6	50/90	55.14	39.15	39.43																																
06/24/10	22:53	14019.47	7.52	6.47	7.59	5037	5239	5057	365.2	223.6	216.7	1050	13.27	20.4	15.71	3991.00	4170.00	4.5%	4009.00	245.70	147.80	143.00	741.20	11.70	19.35	nd	0.026	nd	12.9	50/90	55.20	39.29	38.70																																
06/26/10	12:22	14042.20	7.48	6.47	7.61	5108	5247	5134	374.3	229.9	223	1080	13.41	20.52	15.94	4050.00	4173.00	3.0%	4077.00	252.10	151.80	147.20	762.10	11.92	19.49	nd	0.026	nd	10.4	50/90	55.20	39.23	40.63																																
06/29/10	11:52	14073.72	7.47	6.48	7.56	5721	5927	5742	458.5	281.3	272.6	1405	15.5	23.22	17.54	4597.00	4771.00	3.8%	4609.00	311.70	186.40	180.20	1004.00	14.03	22.55	nd	0.027	nd	7.5	50/90	55.25	38.20	49.92																																
06/30/10	11:38	14096.30	7.50	6.49	7.57	5703	5893	5733	451.2	277.6	269.5	1369	15.38	23.02	17.44	4577.00	4741.00	3.6%	4600.00	306.50	183.70	178.00	977.10	13.92	22.28	nd	0.026	nd	19.9	50/90	55.25	38.53	45.94																																

Hydraulic and Power Data

TIME	CALCULATED PARAMETERS										TEMP	PRESSRE		FLOWS										MAIN PANEL KW METER				VFD KW METER			Notes			
	Operation	System	RO	Ave. Sys. Flux	1st Stage Flux	2nd Stage Flux	Power	Influent Temp F	P _{CFin}	P _{CFout}		P _{FXFeed In}	P _{FXconc out}	%HP out RO 1 s	P _{RO 2 feed}	P _{CGRO1 FX booster inlet}	P _{CGRO2}	P _{PSYS}	Q _{HP Pump}	Q _{FX HP-out}	Q _{Feed FX in}	Q _{Stage 1}	Q _{Stage 2}	Q _{SSYS}	A _{app}	P HP/PX	P booster	Power	PX power	HP Power		Feed Pump		
Date	Time	Time	Recovery %	Recovery %	Gfd	Gfd	Gfd	kWh/m3	Temp F	(psi)	(psi)	(psi)	(psi)	(psi)	(psi)	(psi)	(psi)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	amp	(kw)	(kw)	(kw)	Factor	(kw)	(kw)	(kw)			
MM/DD/YY	hh:mm	hh:mm																																
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																		
Membrane Ripening Period (BASELINE)																																		
02/11/10	13:00	12335.8	69.0%	79.7%	14.14	14.91	12.60	0.69	70.0	32.5	30.5	29.0	23.8	175	200		150	178	21.3	80.0	21.00	37.02	58.00	24.50	82.50	19.50	12.90	4.1	0.700	1.70	10.1	3.4		
02/11/10	17:06	12339	74.4%	80.0%	12.09	13.37	9.51	0.59	71.0	31.5	29.7	29.0	26.5	155	170	133.7	158	14.5	70.5	17.62	24.26	52.00	18.50	70.50	14.50	9.48	3.3	0.753	1.10	7.5	2.2			
02/12/10	9:01	12355.1	73.2%	79.9%	14.06	14.91	12.34	0.67	70.5	32.5	30.0	29.2	25.5	175	195		150	178	20.5	80.0	20.64	30.01	58.00	24.00	82.00	19.40	12.54	4.3	0.775	1.60	9.9	3.6		
02/18/10	15:41	12357.5	76.1%	80.5%	14.14	14.91	12.60	0.67	71.0	32.5	30.0	29.2	26.5	170	190		148	172	17.2	80.0	20.02	25.97	58.00	24.50	82.50	19.15	12.49	3.86	0.771	1.60	9.8	2.6	Total product data is calculated.	
02/25/10	13:10	12375.3	76.0%	80.2%	14.14	15.04	12.34	0.66	70.0	32.3	30.0	29.3	26.5	171	190		149	172	17.2	81.0	20.40	26.02	58.50	24.00	82.50	18.77	12.40	3.12	0.779	1.60	9.7	2.4		
02/26/10	15:41	124000	76.3%	80.2%	14.23	15.17	12.34	0.66	70.5	32.5	30.0	29.2	26.3	172	190		150	172.5	17.3	80.5	20.50	25.78	59.00	24.00	83.00	18.94	12.52	3.36	0.777	1.60	9.8	1.9	Plant was shut off when arrived due to k	
02/27/10	12:27	12420.7	76.0%	80.0%	14.13	15.04	12.29	0.66	72.0	32.3	30.0	29.3	26.2	172	191		150	175	17.2	81.0	20.66	26.03	58.50	23.90	82.40	19.30	12.29	3.19	0.778	1.60	9.7	1.9		
02/28/10	12:00	12444.2	76.1%	79.9%	14.23	15.17	12.34	0.65	71.5	32.5	30.2	29.3	26.5	172	191		150	175	17.3	80.0	20.93	26.03	59.00	24.00	83.00	19.23	12.27	3.27	0.776	1.50	9.6	2		
03/01/10	14:04	12470.4	76.1%	80.1%	14.13	15.04	12.29	0.65	71.0	32.5	30.0	29.5	26.3	172	191		150	175	17.2	80.0	20.48	25.89	58.50	23.90	82.40	18.86	12.21	3.147	0.787	1.50	9.6	1.8		
03/02/10	12:05	12492.4	76.1%	80.3%	14.23	15.30	12.09	0.65	71.0	32.2	31.0	29.4	26.5	172	191		150	175	17.0	81.0	20.37	26.05	59.50	23.50	83.00	18.76	12.24	3.43	0.784	1.40	9.7	2.2		
03/03/10	15:06	12519.4	75.8%	80.0%	14.09	15.17	11.93	0.65	73.0	32.2	30.1	29.3	26.2	173	191		150	175	17.3	80.0	20.56	26.22	59.00	23.20	82.20	19.44	12.19	3.33	0.780	1.50	9.7	2.1	Vessel 1 is leaking water from end cap.	
03/04/10	12:21	12540.6	76.0%	79.9%	14.19	15.30	11.98	0.65	73.0	32.5	30.2	29.3	26.3	172	191		150	176	17.2	81.0	20.84	26.12	59.50	23.30	82.80	19.28	12.27	3.44	0.784	1.50	9.7	2.3		
03/05/10	14:25	12563.8	75.8%	79.9%	14.23	15.38	11.93	0.66	73.0	32.5	30.0	29.2	26.2	172	191		150	177	17.3	80.0	20.94	26.54	59.80	23.20	83.00	18.88	12.37	3.14	0.790	1.50	9.8	1.6	Plant was shut off when arrived due to k	
03/06/10	11:20	12584.8	76.1%	80.1%	14.14	15.17	12.09	0.65	73.0	32.3	29.9	29.4	26.3	174	192		151	178	17.4	80.0	20.51	25.95	59.00	23.50	82.50	18.60	12.22	3.11	0.783	1.50	9.7	1.8		
03/07/10	13:42	12611.1	75.7%	79.7%	14.09	15.17	11.93	0.65	74.0	32.5	30.1	29.3	26.2	174	192		150	178	17.3	80.0	20.97	26.34	59.00	23.20	82.20	18.89	12.21	3.15	0.782	1.50	9.7	1.7		
03/08/10	15:20	12636.8	76.0%	80.2%	14.40	15.43	12.34	0.64	73.0	32.5	30.0	29.2	26.3	175	193		151	179	17.2	79.0	20.74	26.49	60.00	24.00	84.00	18.44	12.28	3.36	0.784	1.40	9.8	1.9		
03/09/10	14:02	12659.5	76.2%	80.4%	14.38	15.43	12.29	0.64	73.0	33.0	30.1	29.4	26.2	175	193		151	179	17.1	80.0	20.48	26.23	60.00	23.90	83.90	18.66	12.25	3.25	0.784	1.50	9.7	1.8		
03/10/10	12:55	12681.7	76.5%	80.3%	14.57	15.69	12.34	0.64	71.0	32.5	29.9	29.3	26.1	176	194		152	178	17.1	80.0	20.90	26.04	61.00	24.00	85.00	18.95	12.30	3.36	0.773	1.50	9.7	1.9		
03/11/10	12:45	12702.8																															Plant was shut off when arrived due to	
03/12/10	15:45																																	Plant down for new piping. Up and runn
03/13/10	13:00	12705.2																																Plant was shut down when arrived due
03/16/10	15:50	12705.8	76.3%	80.6%	14.71	16.71	10.70	0.67	70.0	32.8	30.1	29.2	26.5	179	196		158	180	18.0	88.0	20.66	26.60	65.00	20.80	85.80	19.89	13.07	2.7	0.775	1.40	10.6	1	Plant start up after replacing old rotor an	
03/26/10	16:18	12718.1	75.8%	79.7%	14.43	16.51	10.29	0.70	74.0	32.2	30.0	29.5	26.5	186	207		162	190	17.6	87.0	21.45	26.88	64.20	20.00	84.20	20.06	13.47	2.722	0.782	1.50	10.8	0.8	plant start up after new filters. cleaned o	
03/27/10	16:20	12720.45	72.2%	79.7%	13.89	16.20	9.26	0.67	72.0	31.0	28.0	29.2	25.8	182	200		165	188	17.5	85.0	20.68	31.13	63.00	18.00	81.00	18.85	12.27	2.566	0.773	1.20	10.1	1	Cartridge Filget Pressure Gauge has a cr	
04/02/10	15:26	12726	67.1%	71.3%	12.17	12.86	10.80	0.62	72.0	32.2	30.0	29.3	25.0	142	171		120	149	15.0	73.0	28.64	34.88	50.00	21.00	71.00	15.41	9.92	2.7	0.765	2.00	6.9	1.1		
04/02/10	17:50	12728.4	61.2%	71.0%	12.17	12.86	10.80	0.61	72.0	33.0	30.2	29.0	22.0	141	170		119	145	15.0	73.0	28.93	45.04	50.00	21.00	71.00	15.32	9.81	2.723	0.765	2.00	6.8	1.2		
04/08/10	14:43	12731.8	62.0%	71.8%	12.17	12.86	10.80	0.60	73.0	32.9	30.2	29.3	22.5	135	165		111	140	10.7	74.0	27.88	43.53	50.00	21.00	71.00	15.14	9.64	2.69	0.768	2.10	6.6	1.1		
04/09/10	15:00	12740.1	62.1%	72.4%	12.26	12.86	11.06	0.60	75.0	32.9	30.1	29.2	22.5	135	165		111	139	11.0	73.0	27.23	43.61	50.00	21.50	71.50	15.50	9.70	3.921	0.752	2.00	6.6	3.2		
04/10/10	12:00	12761.2	62.1%	71.6%	12.26	12.86	11.06	0.60	75.0	32.8	30.2	29.3	22.7	136	165		111	139	10.9	74.0	28.42	43.61	50.00	21.50	71.50	15.32	9.68	3.709	0.754	2.10	6.6	2.9		
04/11/10	13:11	12786.3	62.0%	71.7%	12.27	12.86	11.11	0.60	76.0	32.9	30.3	29.2	23.3	135	165		111	139	11.0	73.0	28.21	43.85	50.00	21.60	71.60	16.19	9.71	3.14	0.753	2.10	6.6	2.8		
04/12/10	17:07	12814.3	62.1%	71.5%	12.26	12.86	11.06	0.60	77.0	32.9	30.3	29.2	22.5	135	165		111	140	11.1	73.0	28.49	43.68	50.00	21.50	71.50	14.90	9.78	3.649	0.751	2.20	6.7	2.9		
04/21/10	15:33	12833	62.2%	71.7%	12.26	12.86	11.06	0.59	76.0	32.9	30.3	29.3	22.6	130	160		108	135	11.2	73.0	28.17	43.37	50.00	21.50	71.50	14.85	9.55	3.344	0.756	2.10	6.4	2.5		
04/23/10	15:50	12853.3	62.6%	70.6%	12.31	12.86	11.21	0.60	70.0	33.0	30.3	29.5	22.8	131	161		109	136	11.3	73.0	29.94	42.98	50.00	21.80	71.80	15.59	9.74	3.915	0.750	2.20	6.6	2.7		
04/24/10	11:38	12873.1	62.5%	71.1%	12.31	12.93	11.06	0.59	73.0	32.9	30.2	29.4	22.6	131																				

TIME			CALCULATED PARAMETERS										FLOWS										MAIN PANEL KW METER				VFD KW METER				Notes	
Date	Time	Operation	System	RO	Ave. Sys Flux	1st Stage Flux	2nd Stage Flux	Power	Influent Temp F	P _{CF-in} (psi)	P _{CF-out} (psi)	P _{PX-feed in} (psi)	P _{PX-conc out} (psi)	P _{HP out RO 1st} (psi)	P _{RO 2 feed} (psi)	P _{CG-RO1 PX booster inlet} (psi)	P _{CG-RO2} (psi)	P _{P-SYS} (psi)	Q _{HP Pump} (gpm)	Q _{PX HP-out} (gpm)	Q _{Feed PX in} (gpm)	Q _{Stage 1} (gpm)	Q _{Stage 2} (gpm)	Q _{P-SYS} (gpm)	A _{sys} amp	P HP/PX (kw)	P booster (kw)	Power Factor	PX power (kw)	HP Power (kw)		Feed Pump (kw)
MM/DD/YY	hh:mm	hh:hh	Recovery %	Recovery %	Gfd	Gfd	Gfd	kWh/m3	Temp F	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
BASELINE																																
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
16 gfd flux																																
05/27/10	9:19	13476.8	72.9%	81.5%	15.98	20.47	12.34	0.66	78.0	33.5	30.2	29.5	24.9	177	197	150	180	8.5	95.0	21.20	34.56	79.60	24.00	93.2	20.65	13.98	3.374	0.793	1.70	11.2	2.6	
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
BASELINE																																
05/27/10	19:05	13486.6	72.4%	80.8%	14.88	16.46	10.95	0.61	79.0	33.1	30.2	29.5	25.1	163	182	140	168	6.7	88.1	20.57	33.09	64.00	21.30	86.8	15.39	11.98	2.984	0.765	1.40	9.5	2	
05/29/10	11:37	13508.1	72.5%	80.8%	14.90	16.59	10.90	0.61	80.0	33.0	30.2	29.4	25.2	164	183	141	178	7.0	88.3	20.64	32.90	64.50	21.20	86.9	16.89	12.03	2.779	0.776	1.40	9.4	1.7	
05/30/10	11:40	13532.2	72.4%	80.8%	14.86	16.51	10.80	0.61	80.0	33.1	30.2	29.6	25.1	165	184	141	178	6.9	88.2	20.55	33.04	64.20	21.00	86.7	17.38	12.10	2.882	0.776	1.40	9.5	1.9	
05/31/10	11:00	13555.5	72.4%	81.2%	14.86	16.71	10.75	0.61	79.0	33.0	30.1	29.4	25.1	166	185	141	170	7.0	88.0	20.13	33.07	65.00	20.90	86.7	17.97	12.09	2.997	0.777	1.40	9.6	2.1	
06/01/10	12:01	13580.5	72.4%	80.8%	14.85	16.84	10.59	0.62	79.0	33.0	30.2	29.3	25.0	168	185	142	171	6.9	88.0	20.64	33.08	65.50	20.60	86.6	20.90	12.15	2.762	0.770	1.40	9.6	1.7	
06/02/10	13:00	13605.5	72.4%	81.1%	14.86	16.92	10.39	0.62	80.0	33.2	30.1	29.3	25.0	168	187	143	171	7.2	88.2	20.23	33.13	65.80	20.20	86.7	20.07	12.19	3.092	0.776	1.40	9.6	2.2	
06/03/10	12:25	13628.9	72.4%	80.8%	14.90	16.97	10.29	0.62	79.5	33.1	30.2	29.3	25.1	168	187	142	172	7.0	88.0	20.67	33.15	66.00	20.00	86.9	20.49	12.20	2.761	0.777	1.40	9.7	1.7	
06/05/10	13:24	13653.6	72.0%	80.5%	14.86	16.97	10.23	0.62	81.0	33.1	30.2	29.5	25.1	168	186	142	171	6.9	88.1	20.95	33.68	66.00	19.90	86.7	15.89	12.13	3.41	0.777	1.40	9.7	2.6	
06/06/10	13:24	13677.6	72.1%	80.3%	14.81	16.97	10.13	0.62	81.0	33.2	30.1	29.3	25.0	169	187	143	171	7.0	88.0	21.19	33.49	66.00	19.70	86.4	17.18	12.15	2.941	0.786	1.40	9.7	2.1	
06/07/10	12:32	13700.7	72.3%	80.8%	14.85	17.10	9.87	0.62	80.0	33.1	30.1	29.4	25.0	170	188	145	172	7.2	88.0	20.54	33.25	66.50	19.20	86.6	19.95	12.19	3.196	0.784	1.40	9.6	2.6	
06/08/10	12:00	13724.2	72.2%	80.6%	14.81	17.13	9.77	0.62	80.0	33.2	30.1	29.4	25.1	170	189	146	172	7.2	88.0	20.73	33.34	66.60	19.00	86.4	18.97	12.26	3.376	0.788	1.30	9.8	2.7	
06/09/10	11:03	13747.2	72.2%	80.6%	14.85	17.23	9.67	0.62	80.5	33.3	30.2	29.2	25.0	171	189	147	175	7.0	88.1	20.89	33.40	67.00	18.80	86.6	18.77	12.27	3.363	0.784	1.30	9.8	2.7	
06/10/10	11:00	13771.2	72.0%	80.8%	14.88	17.31	9.46	0.62	80.0	33.5	30.3	29.4	25.1	172	190	148	175	7.2	88.1	20.69	33.74	67.30	18.40	86.8	18.91	12.32	3.442	0.780	1.40	9.8	2.6	
06/12/10	12:30	13796.5	72.2%	81.2%	14.88	17.33	9.41	0.62	80.0	33.5	30.3	29.5	25.0	172	190	148	175	7.0	88.0	20.09	33.50	67.40	18.30	86.8	19.48	12.27	3.527	0.783	1.30	9.8	2.8	
06/13/10	16:07	13824.2	72.1%	80.2%	14.81	17.49	9.26	0.63	80.0	33.8	30.1	29.5	25.0	173	191	149	176	7.0	88.0	21.30	33.39	68.00	18.00	86.4	18.66	12.34	3.538	0.781	1.30	9.9	2.7	
06/15/10	12:16	13862.6	71.9%	80.5%	14.79	17.54	8.85	0.62	80.0	34.0	30.1	29.3	25.2	174	191	150	178	7.0	88.0	20.84	33.78	68.20	17.20	86.5	19.78	12.22	3.373	0.782	1.30	9.9	2.8	
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
12 gfd flux 75% Recovery																																
06/16/10	11:40	13886	67.4%	76.2%	12.05	14.27	7.30	0.53	80.0	33.0	30.3	29.4	25.0	141	160	121	145	3.5	71.8	21.90	33.94	55.50	14.20	70.3	12.82	8.38	2.795	0.756	1.10	6.3	2.1	
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
14.9 gfd flux 75% Recovery																																
06/17/10	12:18	13910.7	67.5%	75.9%	14.90	17.23	9.82	0.66	80.0	35.0	30.6	29.4	24.0	171	196	143	176	7.0	88.0	27.53	41.76	67.00	19.10	86.9	19.35	12.95	4.169	0.787	1.90	9.8	3.8	Raw water feed pressure very low about
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
16 gfd flux 75% Recovery																																
06/18/10	8:39	13931	66.7%	75.9%	16.03	18.46	11.26	0.72	79.5	36.0	30.8	29.3	21.0	182	212	150	189	8.1	94.5	29.73	46.66	71.80	21.90	93.5	22.70	15.26	4.615	0.809	2.50	11.7	4.8	Raw water feed pressure very low about
Optimized Isobaric Energy Recovery Demonstration - Hydranautics ESPA 1 Membranes																																
BASELINE																																
06/22/10	11:38	13972.7	72.5%	81.1%	14.88	17.74	8.38	0.63	81.0	35.2	30.1	29.3	25.0	178	195	154	180	7.1	88.2	20.21	32.94	69.00	16.30	86.8	19.41	12.45	3.07	0.782	1.30	10.1	2.5	
06/23/10	12:32	13997.6	71.5%	81.0%	14.86	18.26	7.66	0.64	81.0	35.3	30.2	29.4	25.1	188	203	165	190	7.0	88.3	20.34	34.50	71.00	14.90	86.7	19.23	12.64	2.474	0.787	1.10	10.3	1.6	Main plant switched one well 97 to 512.
06/24/10	22:48	14019.3	71.6%	80.8%	14.81	18.44	7.66	0.65	80.0	35.3	30.1	29.5	25.0	190	208	169	192	7.0	88.1	20.54	34.27	71.70	14.90	86.4	19.25	12.85	2.748	0.785	1.20	10.6	1.9	
06/26/10	12:17	14042.0	71.5%	80.9%	14.85	18.49	7.66	0.65	80.0	35.5	30.2	29.2	24.8	190	208	169	192	6.9	88.3	20.50	34.48	71.90	14.90	86.6	20.25	12.84	2.483	0.783	1.10	10.7	1.7	
06/29/10	11:46	14073.6	71.4%	80.9%	14.85	18.51	7.20	0.67	79.0	35.1	30.1	29.3	24.8	200	215	179	202	7.0	88.4	20.48	34.65	72.00	14.00	86.6	19.94	13.12	3.135	0.778	1.10	10.9	2.6	
06/30/10	11:32	14096.1	71.4%	81.1%	14.86	18.62	7.10	0.67	79.0	35.2	30.1	29.4	24.9	200	217	180	203	7.1	88.2	20.25	34.78	72.40	13.80	86.7	20.39	13.15	2.889	0.778	1.00	11.1	2.6	