

# ICR TREATMENT STUDY ANALYSIS

## Base Analysis and Data Review Comments

<b>Treatment Study ID</b>	1032
<b>Study Protocol</b>	Membrane RBSMT treatment study
<b>Plant ICR Number</b>	296
<b>PWS Name</b>	City of Fort Lauderdale
<b>City, State, Zip</b>	Fort Lauderdale, FL 33309

### General Comments:

1. During this bench-scale study, two membranes were evaluated: the Koch-Fluid Systems TFC-SR and the Hydranautics NTR7450. Each membrane was evaluated over four quarters (Winter, Spring, Summer and Autumn) as summarized in Table 5 of the Summary Report.
2. The influent to the study was collected directly from a well-field in the Biscayne Aquifer. The only pretreatment used during this study was bench-scale cartridge filtration. No pretreatment to control inorganic scale formation was used. The lack of a scale inhibitor prior to nanofiltration may have resulted in the short runtimes observed in this study. The addition of acid or antiscalant to control inorganic scale formation may have resulted in longer cleaning intervals than those observed during this study.
3. During data analysis, temperatures of 23°C, 25°C, 26°C, and 24°C for Winter, Spring, Summer, and Autumn, were used, respectively. This was necessary to estimate the range of pressures required to maintain a constant production rate over the course of a calendar year. The temperatures were estimated using the range of full-scale influent water temperatures reported in the Summary Report. The temperatures in the Data Collection Spreadsheets are indicative of lab conditions.
4. No cost information was provided in the Summary Report.

### Water Quality Comments:

1. Four water quality outliers were identified and removed prior to base analysis.
2. SDS conditions are summarized in Table 10 of the Summary Report. Constant target SDS conditions were used over the four quarters: temperature 24°C, pH 8.0, incubation time 24 hours and free residual ~1 mg/L. Although these are Uniform Formation Conditions (UFC),

the Summary Report indicates that they are representative of actual distribution system conditions at the plant.

**Productivity Comments:**

1. Fourteen productivity outliers were identified and removed prior to base analysis. All outliers were removed from the specific flux (MTCw) data; the majority of the outliers occurred with the SR40 membrane.
2. Membrane cleaning was performed using a sodium hydroxide solution at pH = 12 followed by a low pH cleaning with sulfuric acid at pH = 2.5.
3. During this study, membrane cleaning of the NTR7450 resulted in a flux reduction, as indicated by a negative cleaning efficiency. This would indicate that the cleaning procedure used during this study was not compatible with this membrane.

## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 3/9/98 - 3/15/98 (6 days)

## Membrane Information

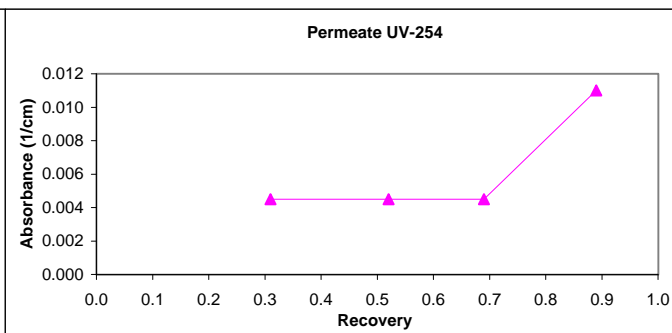
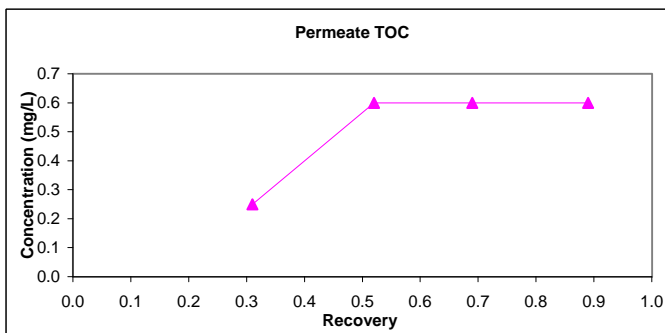
**Manufacturer:** Fluid Systems  
**Trade Name:** TFC-SR  
**MWCO:** 300 Daltons  
**Mfr. Flux:** 24.0 gfd  
**Mfr. NDP:** 100.0 psi  
**Mfr. MTCw:** 0.240 gfd/psi

**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 330.0 ft<sup>2</sup>  
**840 Purchase Price:** N.A.  
**840 Maximum Flow:** 80.0 gpm  
**840 Minimum Flow:** 20.0 gpm  
**840 Total Width:** 58.2 ft  
**840 Feed Spacer Thickness:** 0.0026 ft

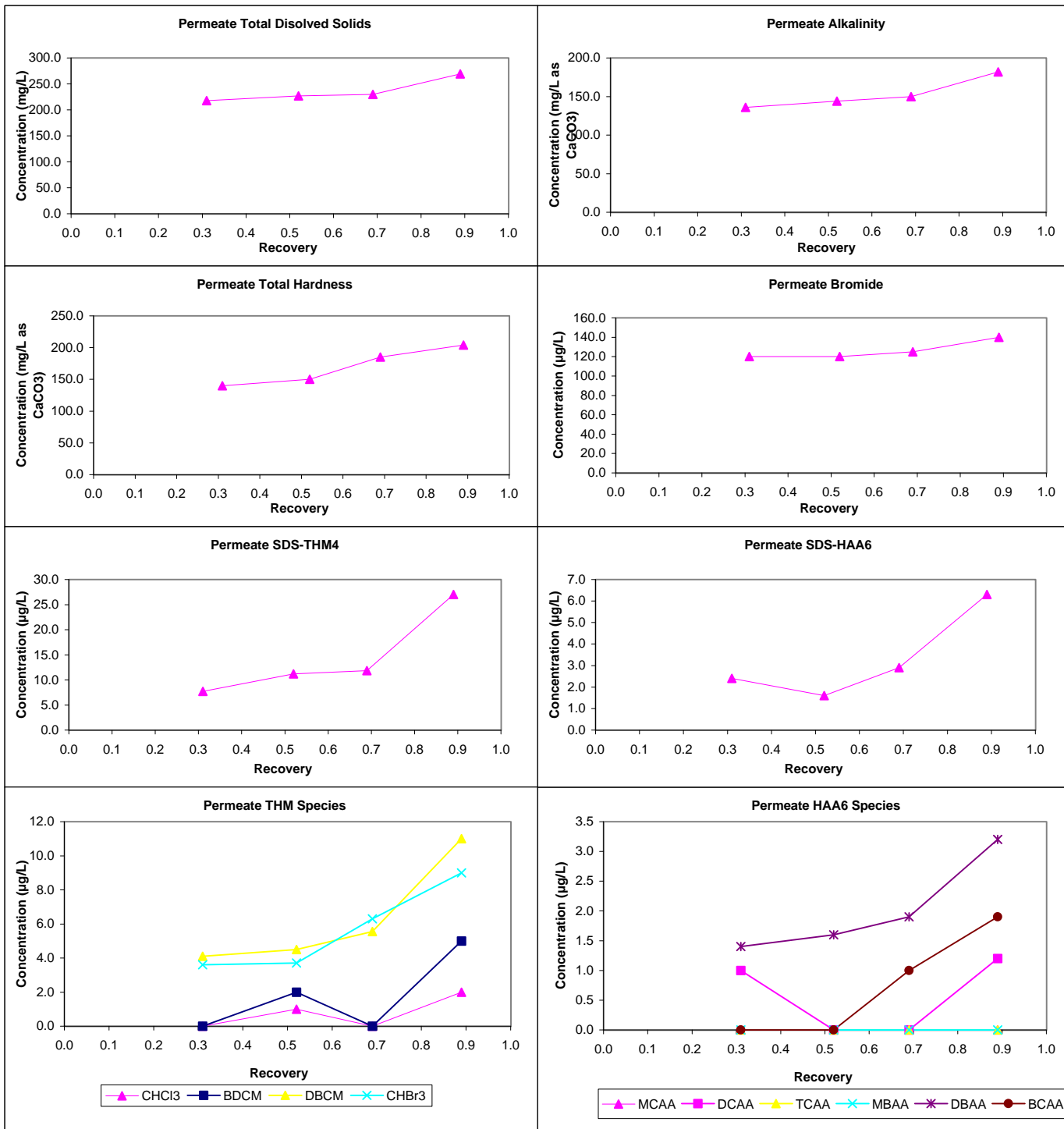
## Water Quality Summary

Water Quality Summary							Mass Balance Closure Err (%)							
Source ->	Feed		Permeate				Concentrate							
Recovery ->	Avg	Diff	0.31	0.52	0.69	0.89	0.31	0.52	0.69	0.89	WQP	Count	Avg	SD
pH	8.3	0.2	8.3	8.2	8.2	8.1	8.4	8.4	8.5	8.5	TDS	18	-5	12
Temp	23.0	1.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	Alk	4	7	8
Alk	192	4	136	144	150	182	228	250	289	334	TDS	4	-3	5
TDS	296	3	218	227	230	269	342	365	415	484	TotHard	4	15	6
TotHard	231	1	140	150	185	204	306	346	421	554	CaHard	4	4	5
CaHard	207	1	126	138	145	172	262	304	366	476	Turb	4	-60	70
Turb	0.31	0.07	0.05	0.05	0.05	0.05	0.47	0.52	0.42	1.02	Amm	0	n/a	n/a
Amm	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	3	-1	9
TOC	11.8	0.0	0.3	0.6	0.6	0.6	16.7	21.4	38.1	106.5	UV254	1	1	n/a
UV254	0.387	0.002	0.005	0.005	0.005	0.011	0.647	0.819	1.268	3.450				
SUVA	3.28	0.01	1.80	0.75	0.75	1.83	3.87	3.83	3.33	3.24				
Bromide	140	10	120	120	125	140								
TOX	980	130	13	13	13	35								
CHCl3	230.0	10.0	0.0	1.0	0.0	2.0								
BDCM	46.5	1.5	1.8	2.0	2.0	5.0								
DBCM	8.1	0.6	4.1	4.5	5.6	11.0								
CHBr3	0.0	0.0	3.6	3.7	6.3	9.0								
THM4	284.6	12.2	9.5	11.2	13.8	27.0								
MCAA	6.9	0.0	0.0	0.0	0.0	0.0								
DCAA	67.0	2.0	1.0	0.0	0.0	1.2								
TCAA	105.0	5.0	1.2	1.2	1.2	1.5								
MBAA	2.4	0.2	0.0	0.0	0.0	0.0								
DBAA	1.9	0.0	1.4	1.6	1.9	3.2								
BCAA	14.5	0.5	0.0	0.0	1.0	1.9								
TBAA	0.0	0.0	0.0	0.0	0.0	4.8								
CDBAA	4.0	0.1	0.0	0.0	0.0	3.1								
DCBAA	33.0	0.0	1.1	1.2	1.0	2.1								
HAA5	183.2	3.3	3.6	2.8	3.1	5.9								
HAA6	197.7	2.8	3.6	2.8	4.1	7.8								
HAA9	234.7	2.8	4.7	4.0	5.1	17.8								
SDS Conditions														
WQP	Avg	SD	Count	Min - Max										
Res (mg/L) (0)	1.01	0.20	6	0.71 - 1.20										
Temp (°C)	24.0	0.0	6	24.0 - 24.0										
pH (unit)	7.9	0.1	6	7.8 - 8.0										
Time (hr)	24.0	0.0	6	24.0 - 24.0										

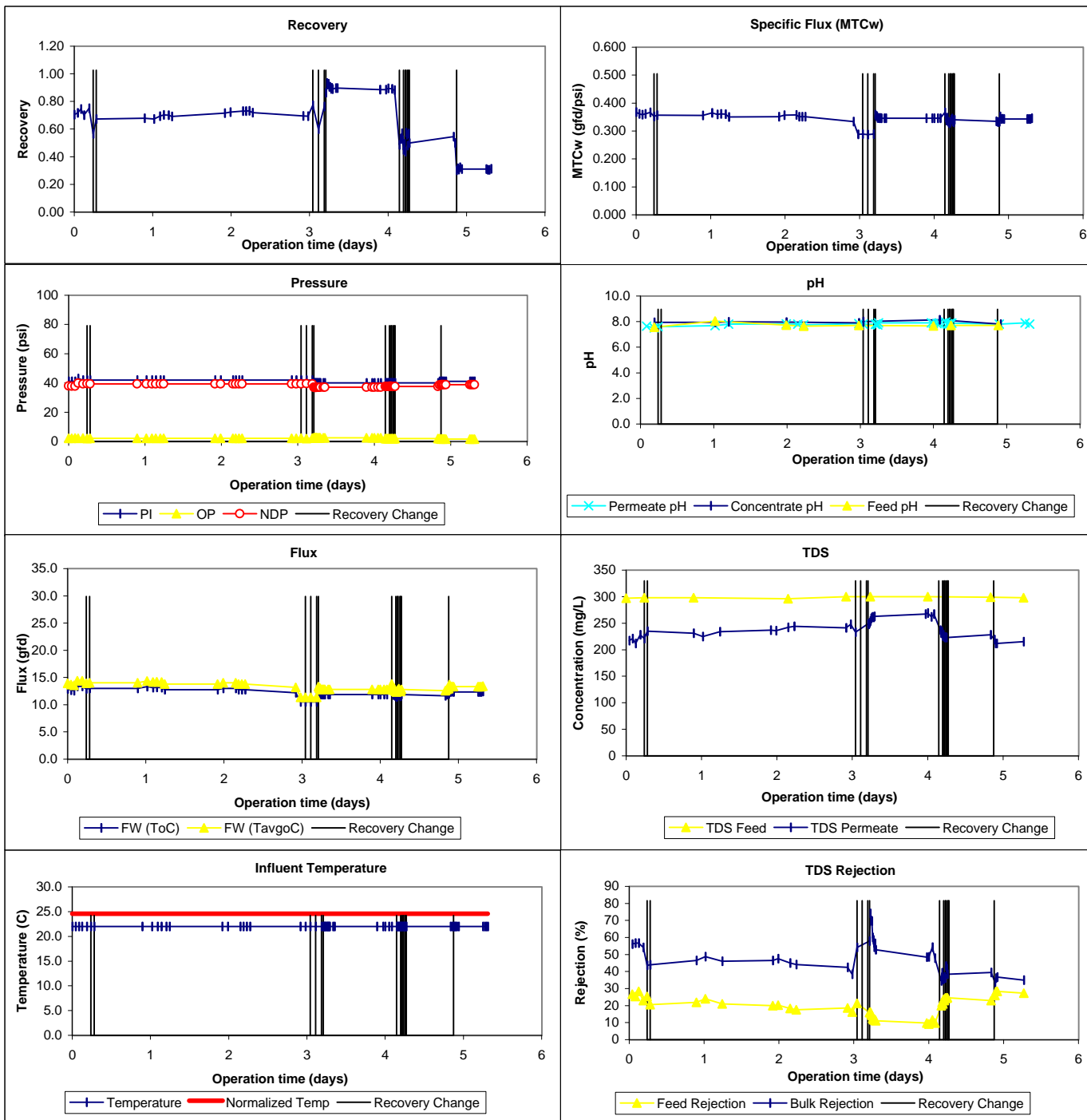
## Water Quality Parameter Graphs



## Water Quality Parameter Graphs (Continued)



## Productivity Graphs



## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 6/13/98 - 6/20/98 (7 days)

## Membrane Information

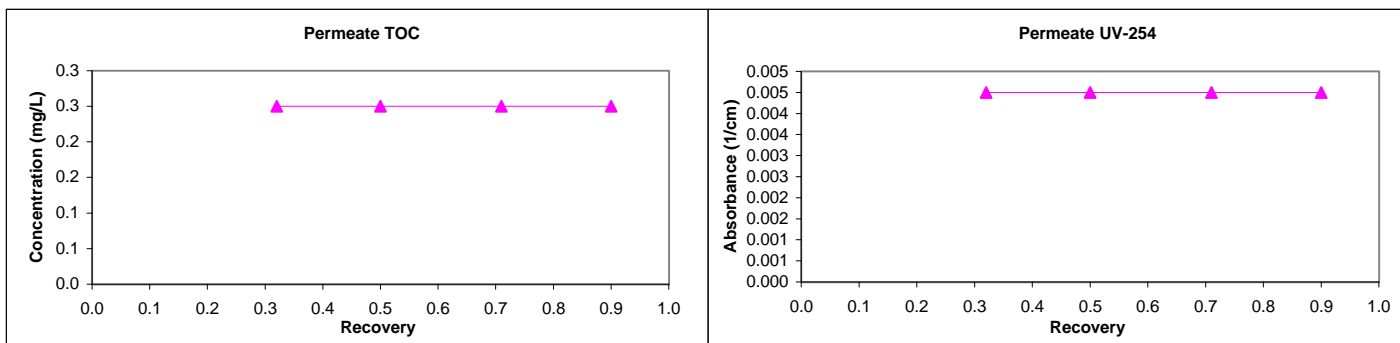
**Manufacturer:** Fluid Systems  
**Trade Name:** TFC-SR  
**MWCO:** 300 Daltons  
**Mfr. Flux:** 24.0 gfd  
**Mfr. NDP:** 100.0 psi  
**Mfr. MTCw:** 0.240 gfd/psi

**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 330.0 ft<sup>2</sup>  
**840 Purchase Price:** N.A.  
**840 Maximum Flow:** 80.0 gpm  
**840 Minimum Flow:** 20.0 gpm  
**840 Total Width:** 58.2 ft  
**840 Feed Spacer Thickness:** 0.0026 ft

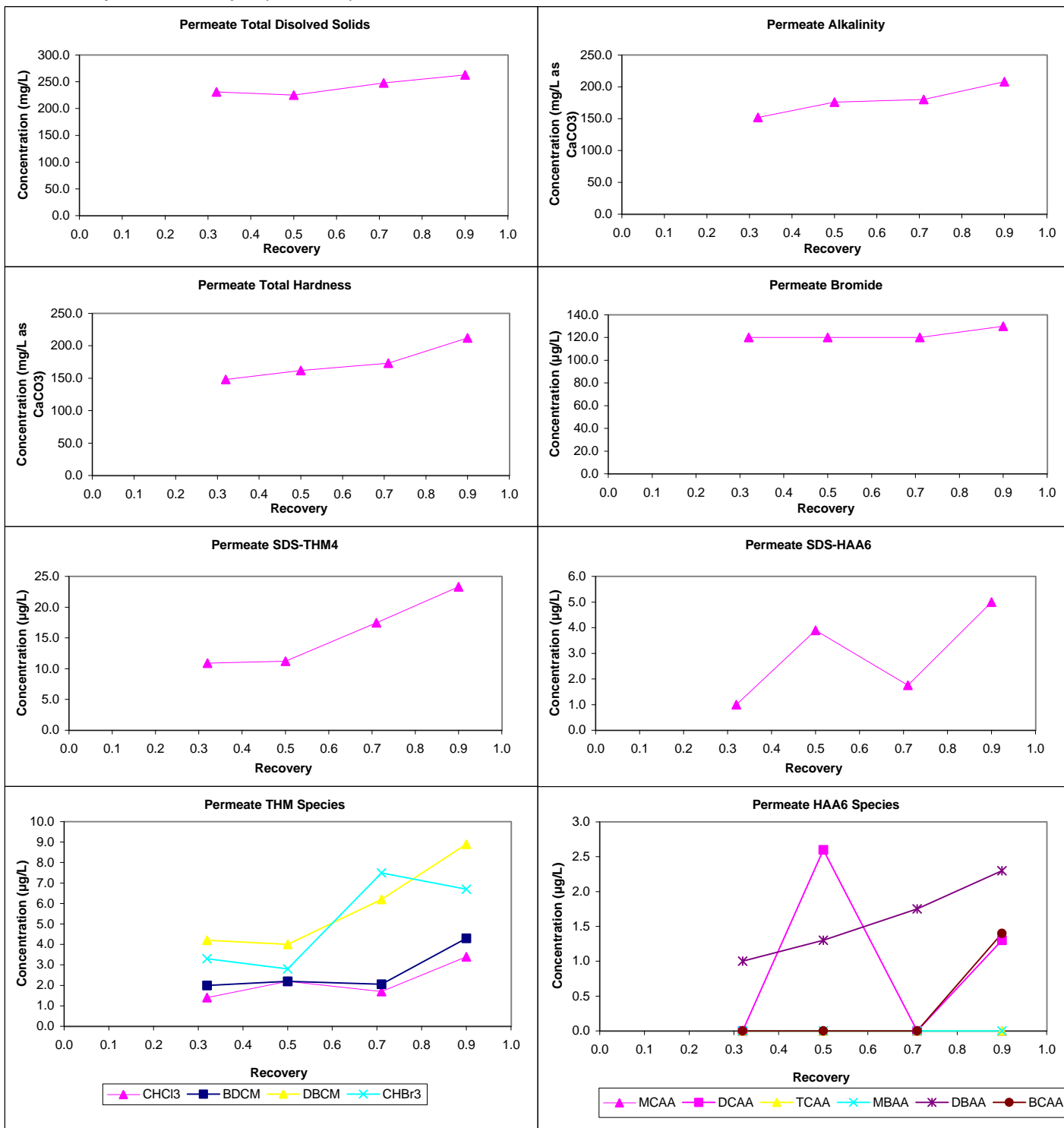
## Water Quality Summary

Water Quality Summary															Mass Balance Closure Err (%)			
Source ->	Feed		Permeate				Concentrate											
Recovery ->	Avg	Diff	0.32	0.50	0.71	0.90	0.32	0.50	0.71	0.90	WQP	Count	Avg	SD				
pH	8.0	0.2	8.3	8.2	8.1	8.2	8.3	8.3	8.3	8.3	TDS	50	-15	57				
Temp	23.0	0.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	Alk	4	-2	5				
Alk	230	0	152	176	180	208	264	294	352	392	TDS	4	-4	12				
TDS	303	1	231	225	248	263	343	366	471	550	TotHard	4	-31	21				
TotHard	291	35	148	162	173	212	306	360	452	624	CaHard	4	-42	32				
CaHard	270	34	132	148	158	186	274	324	405	544	Turb	4	-93	78				
Turb	0.24	0.05	0.04	0.05	0.06	0.04	0.25	0.31	0.36	0.67	Amm	0	n/a	n/a				
Amm	0.06	0.06	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	1	0	n/a				
TOC	12.4	0.3	0.3	0.3	0.3	0.3	17.9	24.8	41.0	110.8	UV254	0	n/a	n/a				
UV254	0.410	0.008	0.005	0.005	0.005	0.005	0.583	0.820	1.377	3.700								
SUVA	3.31	0.14	1.80	1.80	1.80	1.80	3.26	3.31	3.36	3.34								
Bromide	130	0	120	120	120	130	Pretreatment Information											
TOX	1030	170	13	13	13	39												
Process Description Scale																		
CHCl3	265.0	95.0	1.4	2.2	1.7	3.4	Cartridge filtration		5 micron filter		bench							
BDCM	55.5	8.5	2.0	2.2	2.1	4.3												
DBCM	8.0	0.4	4.2	4.0	6.2	8.9												
CHBr3	0.0	0.0	3.3	2.8	7.5	6.7												
THM4	328.5	103.9	10.9	11.2	17.5	23.3												
MCAA	11.0	NA	0.0	0.0	0.0	0.0												
DCAA	69.0	NA	0.0	2.6	0.0	1.3												
TCAA	110.0	NA	0.0	0.0	0.0	0.0												
MBAA	1.2	NA	0.0	0.0	0.0	0.0												
DBAA	1.7	NA	1.0	1.3	1.8	2.3												
BCAA	15.0	NA	0.0	0.0	0.0	1.4												
TBAA	NA	NA	NR	NR	NA	NR												
CDBAA	2.7	NA	0.0	0.0	0.0	0.0												
DCBAA	29.0	NA	0.0	0.0	0.0	1.1	Design Parameters											
HAA5	192.9	NA	1.0	3.9	1.8	3.6												
HAA6	207.9	NA	1.0	3.9	1.8	5.0	Active memb area:		0.167 ft <sup>2</sup>		ID#	Recov (dec.)	F <sub>W-des</sub> (gfd)					
HAA9	NA	NA	NR	NR	NA	NR	Active width:		0.330 ft		1	0.70	15.0					
SDS Conditions							Norm Temp:		24.6 °C		2	0.90	15.0					
							Feed TDS:		300.0 mg/L		3	0.50	15.0					
							Manuf rep TDS rej:		50%		4	0.30	15.0					
							Temp Norm MTC-w:		0.237 gfd/psi									
WQP	Avg	SD	Count	Min - Max		Comments:												
Res (mg/L) (0)	1.32	0.48	6	0.54 - 1.73														
Temp (°C)	24.0	0.0	6	24.0 - 24.0														
pH (unit)	7.9	0.1	6	7.9 - 8.0														
Time (hr)	24.0	0.0	6	24.0 - 24.0														

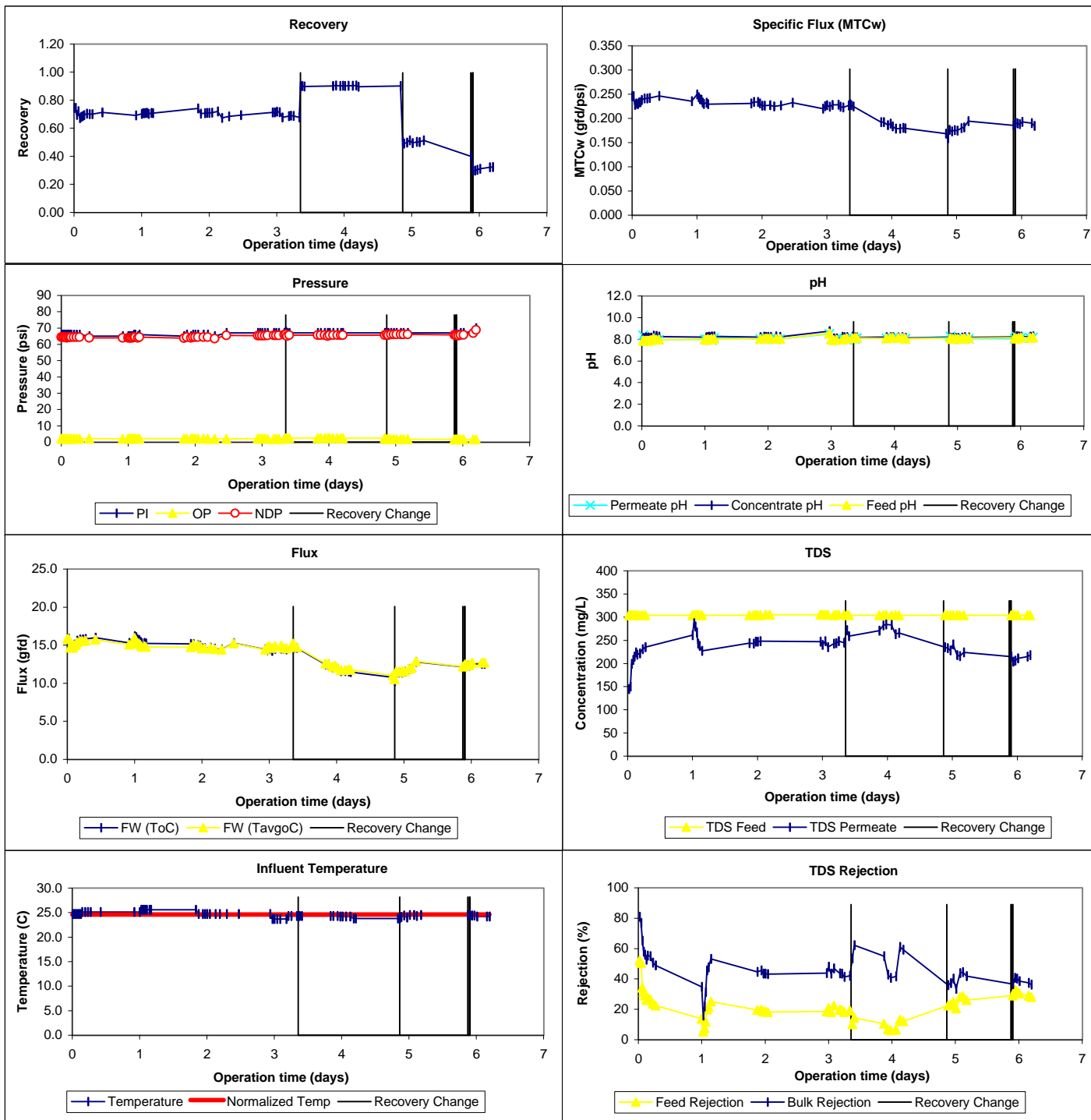
## Water Quality Parameter Graphs



## Water Quality Parameter Graphs (Continued)



## Productivity Graphs





## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 8/1/98 - 8/7/98 (6 days)

## Membrane Information

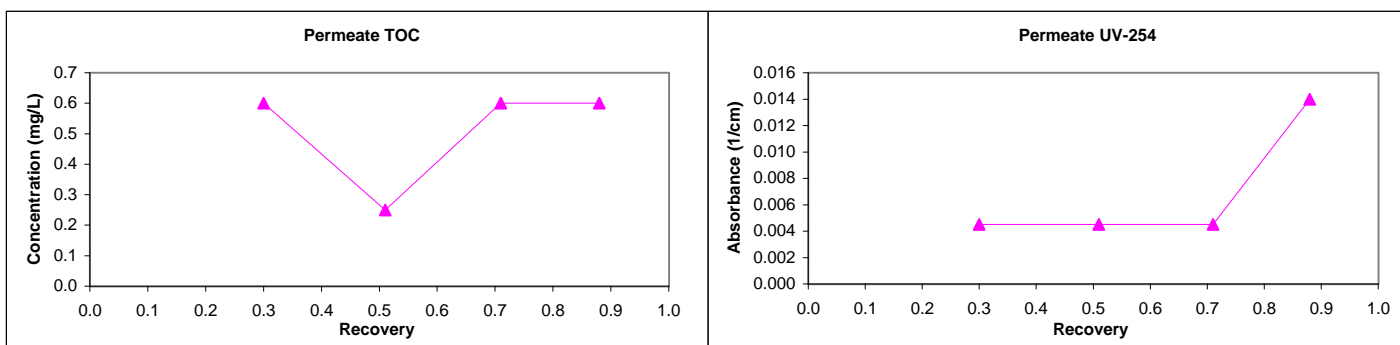
**Manufacturer:** Fluid Systems  
**Trade Name:** TFC-SR  
**MWCO:** 300 Daltons  
**Mfr. Flux:** 24.0 gfd  
**Mfr. NDP:** 100.0 psi  
**Mfr. MTCw:** 0.240 gfd/psi

**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 330.0 ft<sup>2</sup>  
**840 Purchase Price:** N.A.  
**840 Maximum Flow:** 80.0 gpm  
**840 Minimum Flow:** 20.0 gpm  
**840 Total Width:** 58.2 ft  
**840 Feed Spacer Thickness:** 0.0026 ft

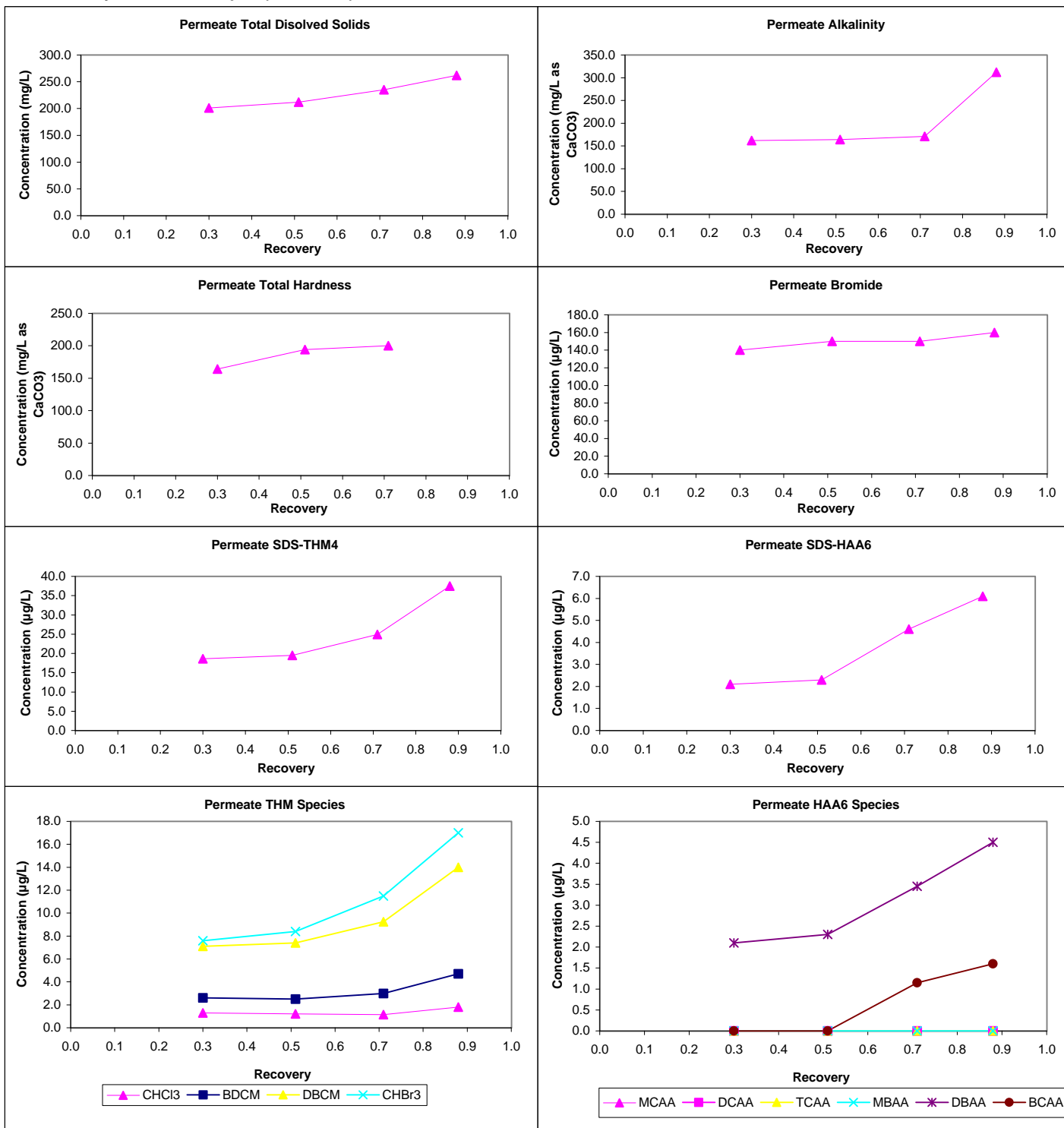
## Water Quality Summary

Water Quality Summary															Mass Balance Closure Err (%)			
Source ->	Feed		Permeate				Concentrate											
Recovery ->	Avg	Diff	0.30	0.51	0.71	0.88	0.30	0.51	0.71	0.88	WQP	Count	Avg	SD				
pH	7.8	0.0	8.1	8.0	8.1	8.0	8.0	8.0	8.1	8.0	TDS	54	-16	34				
Temp	24.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-1	43				
Alk	300	64	162	164	171	312	354	378	427	510	TDS	4	-26	17				
TDS	318	4	201	212	235	262	309	380	426	481	TotHard	3	3	10				
TotHard	316	36	164	194	200	NR	396	514	560	772	CaHard	4	17	13				
CaHard	262	18	154	168	167	234	350	464	506	682	Turb	4	-73	57				
Turb	0.32	0.01	0.06	0.07	0.08	0.11	0.38	0.40	0.48	0.74	Amm	0	n/a	n/a				
Amm	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	3	2	2				
TOC	11.1	0.4	0.6	0.3	0.6	0.6	16.2	21.5	36.8	91.5	UV254	2	-14	14				
UV254	0.409	0.014	0.005	0.005	0.005	0.014	0.599	0.599	1.387	2.578								
SUVA	3.69	0.26	0.75	1.80	0.75	2.33	3.70	2.79	3.77	2.82								
Bromide	165	5	140	150	150	160												
TOX	1100	0	25	13	37	39												
CHCl3	335.0	5.0	1.3	1.2	1.2	1.8												
BDCM	66.0	5.0	2.6	2.5	3.0	4.7												
DBCM	8.3	0.5	7.1	7.4	9.3	14.0												
CHBr3	0.0	0.0	7.6	8.4	11.5	17.0												
THM4	409.3	10.5	18.6	19.5	24.9	37.5												
MCAA	9.1	1.9	0.0	0.0	0.0	0.0												
DCAA	115.0	15.0	0.0	0.0	0.0	0.0												
TCAA	165.0	15.0	0.0	0.0	0.0	0.0												
MBAA	1.2	0.1	0.0	0.0	0.0	1.0												
DBAA	1.7	0.1	2.1	2.3	3.5	4.5												
BCAA	15.5	0.5	0.0	0.0	1.2	1.6												
TBAA	0.0	0.0	0.0	0.0	4.2	4.4												
CDBAA	2.5	0.1	0.0	0.0	0.0	2.3												
DCBAA	24.0	1.0	0.0	0.0	0.0	0.0												
HAA5	291.9	28.1	2.1	2.3	3.5	5.5												
HAA6	307.4	28.6	2.1	2.3	4.6	7.1												
HAA9	333.9	27.8	2.1	2.3	8.8	13.8												
SDS Conditions																		
WQP	Avg	SD	Count	Min - Max														
Res (mg/L) (0)	1.00	0.21	6	0.77 - 1.32														
Temp (°C)	24.0	0.0	6	24.0 - 24.0														
pH (unit)	7.9	0.1	6	7.9 - 8.0														
Time (hr)	24.0	0.0	6	24.0 - 24.0														
Pretreatment Information																		
Process					Description					Scale								
Cartridge filtration					5 micron filter					bench								
Design Parameters																		
Active memb area:										0.167 ft <sup>2</sup>								
Active width:										0.330 ft		ID#		Recov (dec.)	F <sub>W-des</sub> (gfd)			
Norm Temp:										24.6 °C		1		0.70	15.0			
Feed TDS:										300.0 mg/L		2		0.90	15.0			
Manuf rep TDS rej:										50%		3		0.50	15.0			
Temp Norm MTC-w:										0.237 gfd/psi		4		0.30	15.0			
Comments:																		

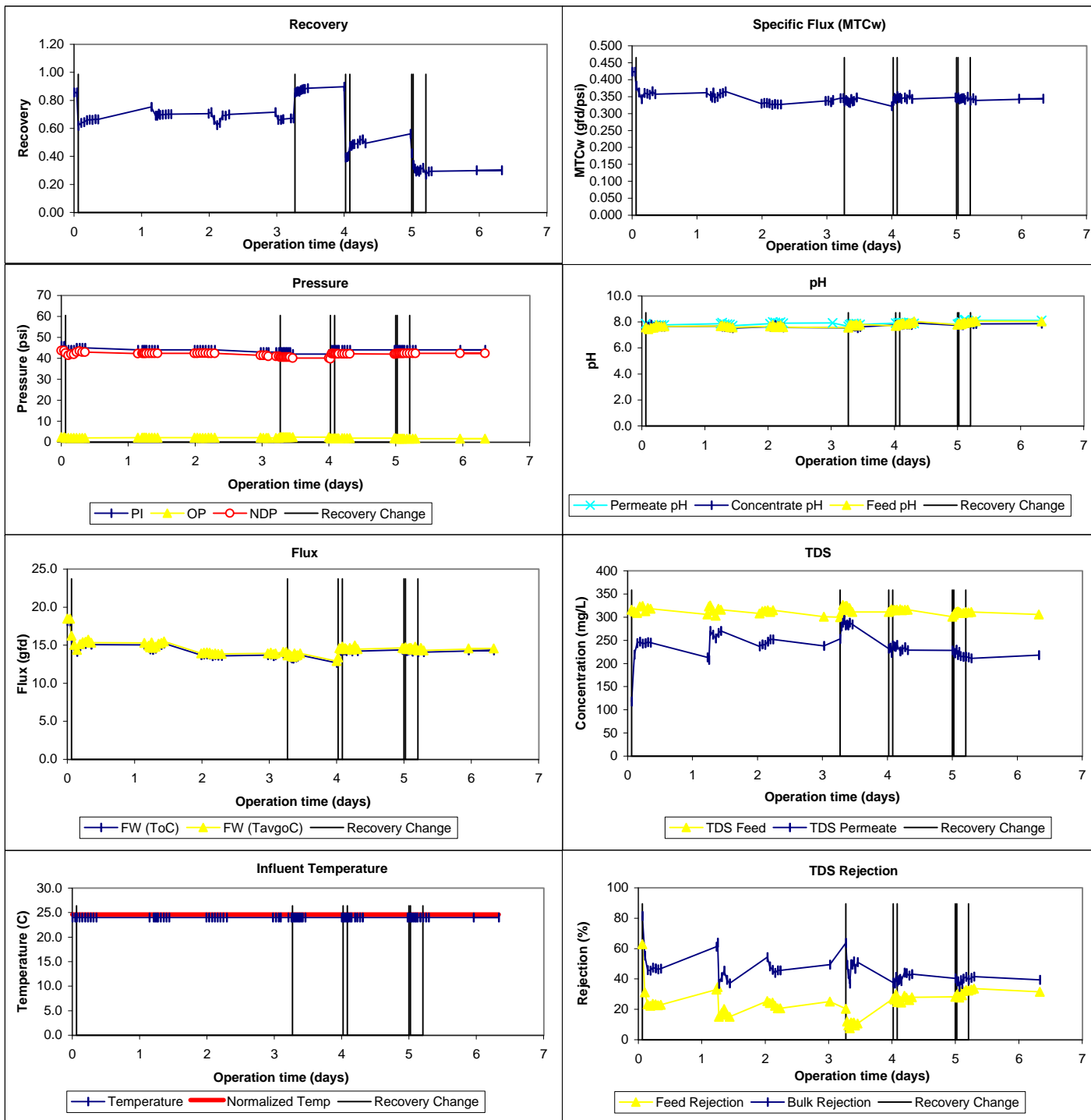
## Water Quality Parameter Graphs



## Water Quality Parameter Graphs (Continued)



## Productivity Graphs



## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 1/5/99 - 1/11/99 (6 days)

## Membrane Information

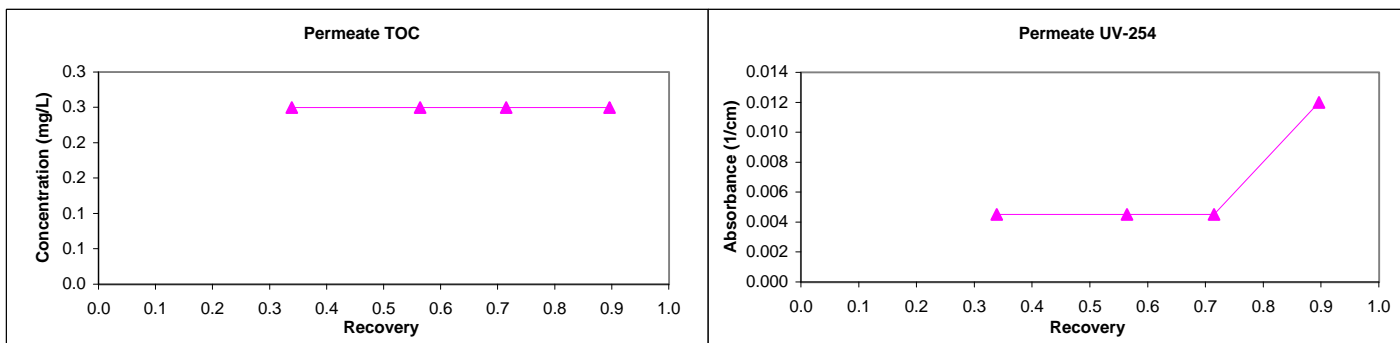
**Manufacturer:** Fluid Systems  
**Trade Name:** TFC-SR  
**MWCO:** 300 Daltons  
**Mfr. Flux:** 24.0 gfd  
**Mfr. NDP:** 100.0 psi  
**Mfr. MTCw:** 0.240 gfd/psi

**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 330.0 ft<sup>2</sup>  
**840 Purchase Price:** N.A.  
**840 Maximum Flow:** 80.0 gpm  
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**840 Total Width:** 58.2 ft  
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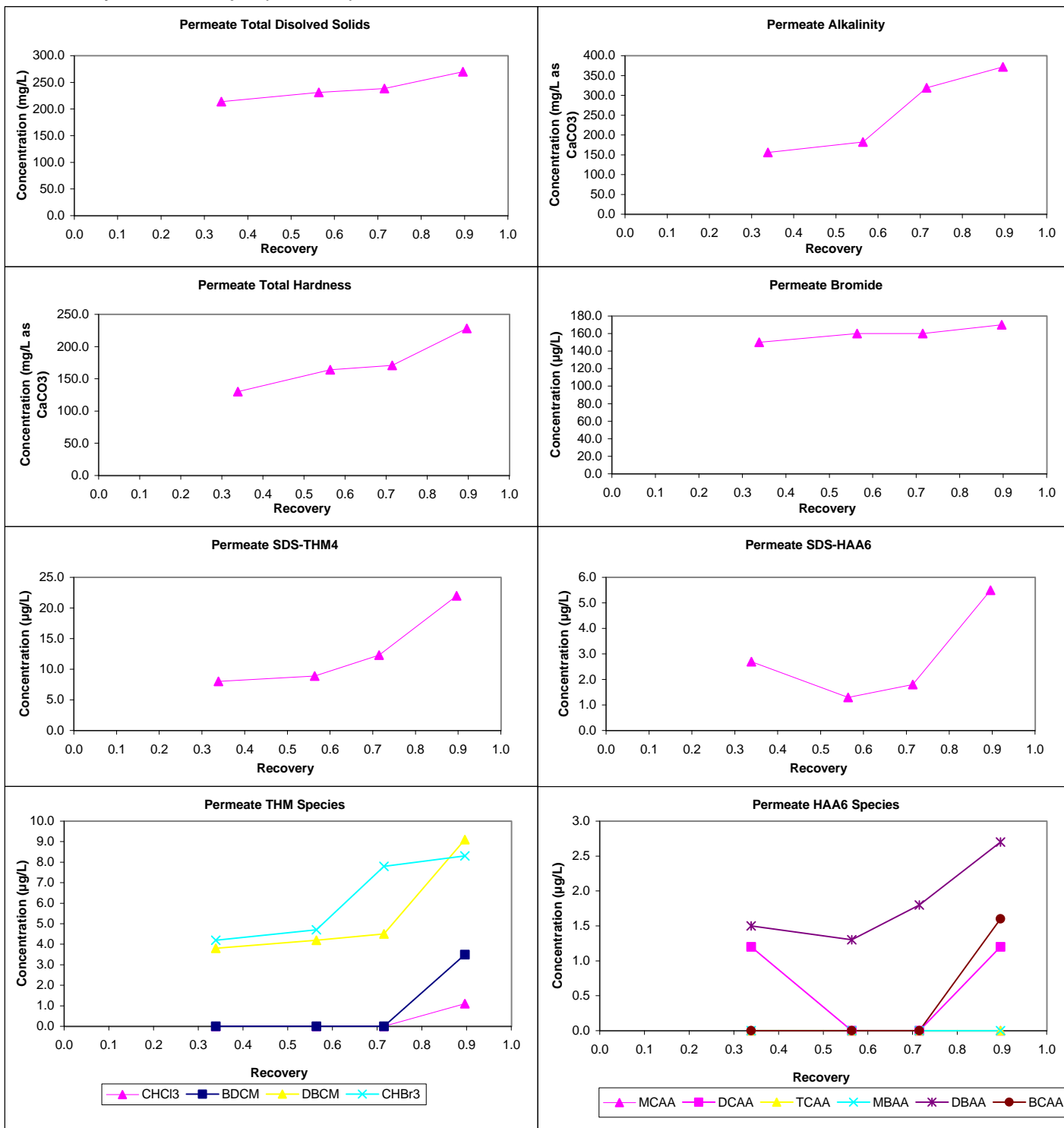
## Water Quality Summary

Source ->		Feed		Permeate				Concentrate				Mass Balance Closure Err (%)			
Recovery ->		Avg	Diff	0.34	0.56	0.72	0.90	0.34	0.56	0.72	0.90	WQP	Count	Avg	SD
pH		8.2	0.1	8.1	8.2	8.0	8.2	8.0	8.0	8.1	8.1	TDS <sub>st</sub>	44	-5	28
Temp		23.0	0.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	Alk	4	-14	13
Alk		430	2	156	182	319	372	556	596	693	748	TDS	4	3	4
TDS		300	2	214	231	239	270	358	418	468	541	TotHard	4	12	8
TotHard		249	3	130	164	171	228	324	400	488	560	CaHard	4	3	11
CaHard		214	6	120	142	162	178	248	328	418	504	Turb	4	-93	58
Turb		0.33	0.03	0.07	0.08	0.12	0.15	0.33	0.38	0.44	0.67	Amm	0	n/a	n/a
Amm		0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	0	n/a	n/a
TOC		13.0	0.9	0.3	0.3	0.3	0.3	20.2	37.4	51.2	103.1	UV254	2	-32	36
UV254		0.462	0.007	0.005	0.005	0.005	0.012	0.742	1.319	1.660	2.582				
SUVA		3.57	0.30	1.80	1.80	1.80	4.80	3.67	3.53	3.24	2.50				
Bromide		180	0	150	160	160	170	Pretreatment Information							
TOX		1180	10	13	13	13	13								
ProcessDescriptionScale															
Cartridge filtration5 micron filterbench															
CHCl3		275.0	15.0	0.0	0.0	0.0	1.1	Design Parameters							
BDCM		62.0	4.0	1.3	1.4	0.0	3.5								
DBCM		9.1	0.0	3.8	4.2	4.5	9.1								
CHBr3		0.0	0.0	4.2	4.7	7.8	8.3								
THM4		346.1	19.0	9.3	10.3	12.3	22.0								
MCAA		0.0	0.0	0.0	0.0	0.0	0.0								
DCAA		104.5	5.5	1.2	0.0	0.0	1.2								
TCAA		140.0	10.0	0.0	0.0	0.0	0.0								
MBAA		0.5	0.5	0.0	0.0	0.0	0.0								
DBAA		2.2	0.4	1.5	1.3	1.8	2.7								
BCAA		17.0	2.0	0.0	0.0	0.0	1.6								
TBAA		0.0	0.0	0.0	0.0	0.0	0.0								
CDBAA		2.6	0.4	0.0	0.0	0.0	0.0								
DCBAA		23.0	0.0	0.0	0.0	0.0	0.0								
HAA5		247.2	16.4	2.7	1.3	1.8	3.9								
HAA6		264.2	18.4	2.7	1.3	1.8	5.5								
HAA9		289.8	18.8	2.7	1.3	1.8	5.5								
SDS Conditions								Active memb area: 0.167 ft² Active width: 0.330 ft Norm Temp: 24.6 °C Feed TDS: 300.0 mg/L Manuf rep TDS rej: 50% Temp Norm MTC-w: 0.237 gfd/psi							
WQP	Avg	SD	Count	Min - Max											
Res (mg/L) (0)	1.31	0.41	6	0.84 - 1.79											
Temp (°C)	24.0	0.0	6	24.0 - 24.0											
pH (unit)	7.9	0.0	6	7.9 - 8.0											
Time (hr)	24.0	0.0	6	24.0 - 24.0											
Comments:															

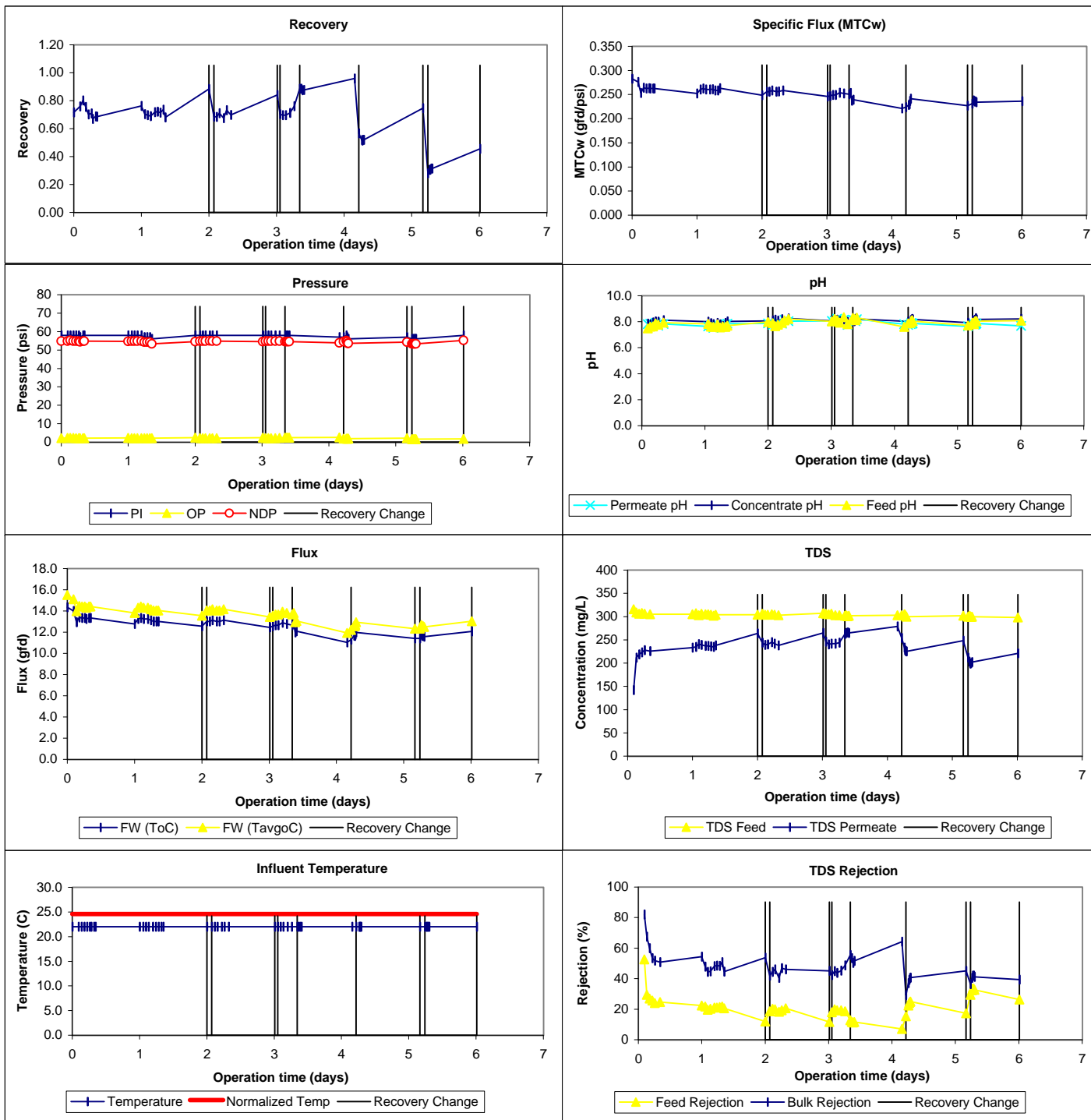
## Water Quality Parameter Graphs



## Water Quality Parameter Graphs (Continued)



## Productivity Graphs



## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 2/27/98 - 3/5/98 (6 days)

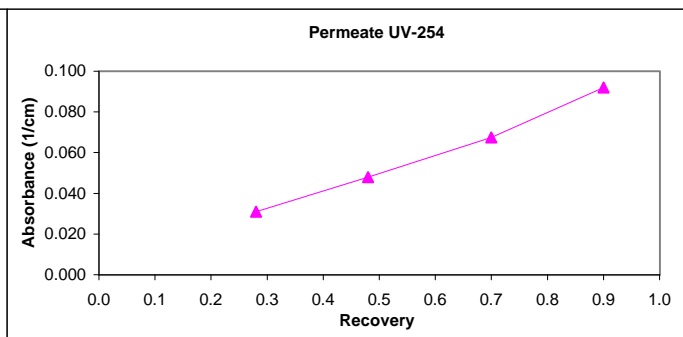
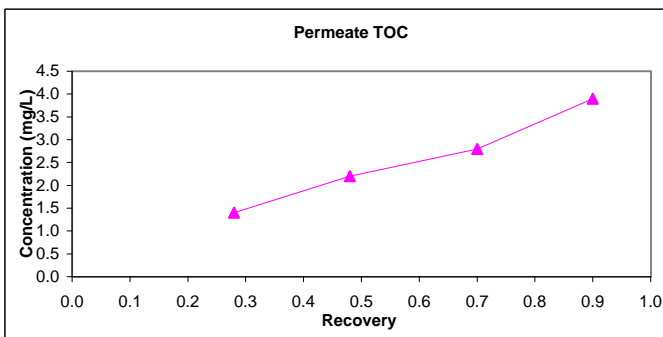
## Membrane Information

**Manufacturer:** Hydranautics Corp., San Diego, CA  
**Trade Name:** NTR7450  
**MWCO:** 1,000 Da Daltons  
**Mfr. Flux:** 45.0 gfd  
**Mfr. NDP:** 140.0 psi  
**Mfr. MTCw:** 0.320 gfd/psi  
**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 365.0 ft<sup>2</sup>  
**840 Purchase Price:** \$800  
**840 Maximum Flow:** 75.0 gpm  
**840 Minimum Flow:** 25.0 gpm  
**840 Total Width:** 64.4 ft  
**840 Feed Spacer Thickness:** 0.0023 ft

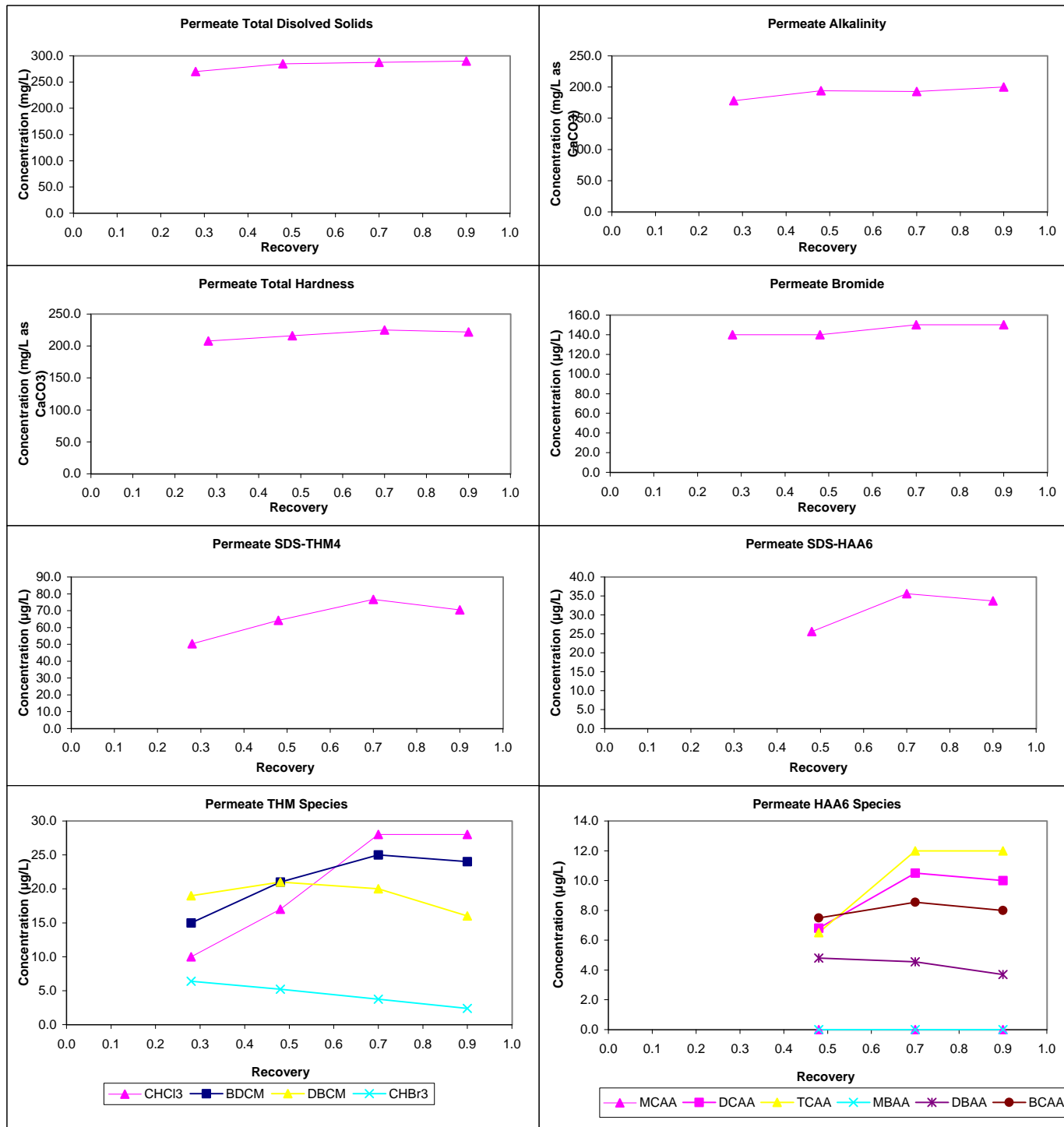
## Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err (%)			
Recovery ->	Avg	Diff	0.28	0.48	0.70	0.90	0.28	0.48	0.70	0.90	WQP	Count	Avg	SD
pH	8.3	0.2	8.5	8.5	8.5	8.4	8.1	8.4	8.5	8.4	TDSt	23	-5	22
Temp	23.5	0.5	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0				
Alk	195	7	178	194	193	200	198	206	216	234	Alk	4	12	17
TDS	296	3	270	285	288	290	310	317	314	338	TDS	4	0	3
TotHard	231	1	208	216	225	222	254	276	268	314	TotHard	4	7	5
CaHard	207	1	182	194	200	206	210	232	234	266	CaHard	4	6	9
Turb	0.31	0.07	0.05	0.06	0.08	0.06	0.41	0.56	0.93	0.94	Turb	4	-37	86
Amm	0.00	0.00	0.00	0.00	0.24	0.00	NA	NA	NA	NA	Amm	0	n/a	n/a
TOC	11.8	0.0	1.4	2.2	2.8	3.9	15.6	25.4	38.3	88.4	TOC	4	9	9
UV254	0.387	0.002	0.031	0.048	0.068	0.092	0.592	1.013	1.430	3.000	UV254	4	16	14
SUVA	3.28	0.01	2.21	2.18	2.41	2.36	3.79	3.99	3.73	3.39				
Bromide	140	10	140	140	150	150	Pretreatment Information							
TOX	980	130	105	140	195	235								
							Process	Description		Scale				
							Cartridge filtration		5 micron filter		bench			
CHCl3	230.0	10.0	10.0	17.0	28.0	28.0	Design Parameters							
BDCM	46.5	1.5	15.0	21.0	25.0	24.0								
DBCM	8.1	0.6	19.0	21.0	20.0	16.0								
CHBr3	0.0	0.0	6.4	5.2	3.8	2.4								
THM4	284.6	12.2	50.4	64.2	76.8	70.4								
MCAA	6.9	0.0	NA	0.0	0.0	0.0								
DCAA	67.0	2.0	NA	6.8	10.5	10.0								
TCAA	105.0	5.0	NA	6.5	12.0	12.0								
MBAA	2.4	0.2	NA	1.0	1.2	0.0								
DBAA	1.9	0.0	NA	4.8	4.6	3.7								
BCAA	14.5	0.5	NA	7.5	8.6	8.0								
TBAA	0.0	0.0	NA	0.0	0.0	0.0								
CDBAA	4.0	0.1	NA	6.6	6.4	4.6								
DCBAA	33.0	0.0	NA	10.0	12.5	11.0								
HAA5	183.2	3.3	NA	19.1	28.2	25.7	Active memb area:		0.167 ft <sup>2</sup>		ID#	Recov	F <sub>W-de</sub>	
HAA6	197.7	2.8	NA	26.6	36.8	33.7	Active width:		0.330 ft			(dec.)	(gfd)	
HAA9	234.7	2.8	NA	43.2	55.6	49.3	Norm Temp:		24.6 °C		1	0.70	15.0	
SDS Conditions							Feed TDS:		300.0 mg/L		2	0.90	15.0	
							Manuf rep TDS rej:		50%		3	0.50	15.0	
							Temp Norm MTC-w:		0.316 gfd/psi		4	0.30	15.0	
							Comments:							
WQP	Avg	SD	Count	Min - Max										
Res (mg/L) (0)	1.22	0.32	6	0.83 - 1.75										
Temp (°C)	24.0	0.0	6	24.0 - 24.0										
pH (unit)	7.8	0.1	6	7.7 - 8.0										
Time (hr)	24.0	0.0	6	24.0 - 24.0										

## Water Quality Parameter Graphs

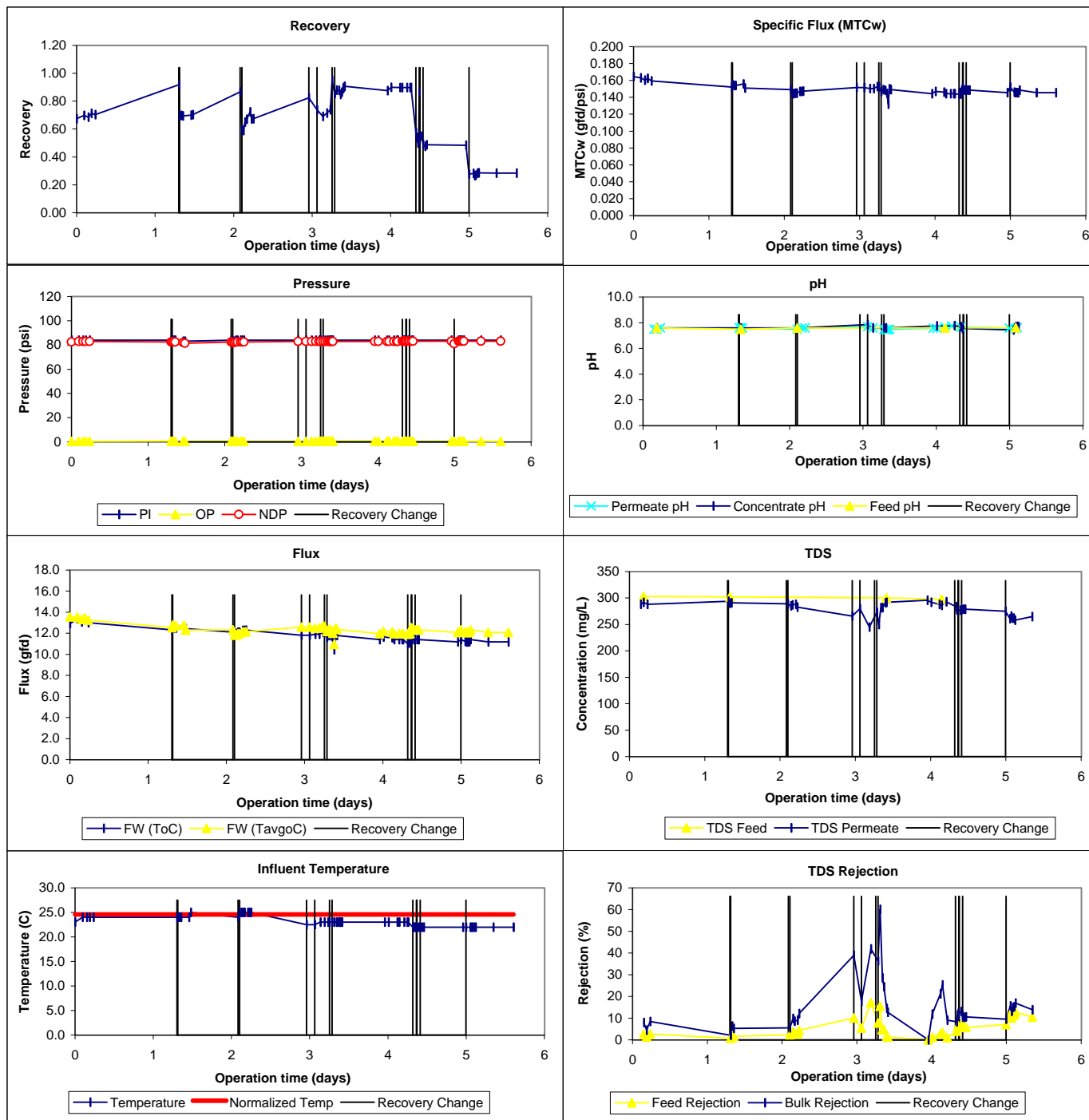


## Water Quality Parameter Graphs (Continued)





## Productivity Graphs



## ICR Information

ID / ICR#: FL-4060486 / 296  
 ICR Contact: Craig Canning  
 Phone No.: (954) 492-7865  
 Period: 6/4/98 - 6/11/98 (7 days)

## Membrane Information

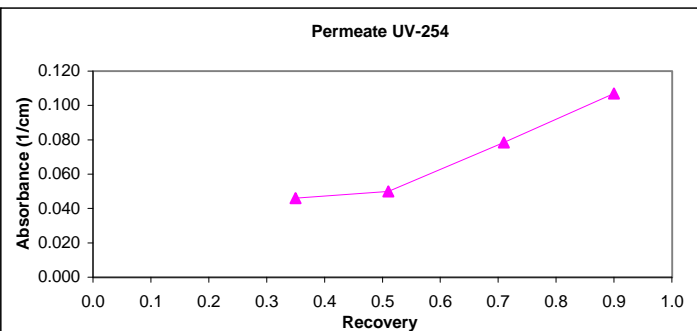
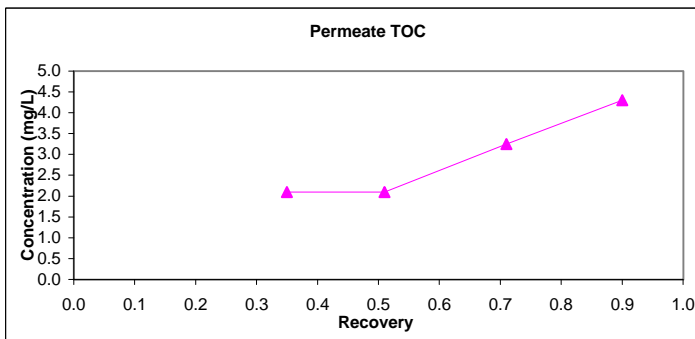
Manufacturer: Hydranautics Corp., San Diego, CA  
 Trade Name: NTR7450  
 MWCO: 1,000 Da Daltons  
 Mfr. Flux: 45.0 gfd  
 Mfr. NDP: 140.0 psi  
 Mfr. MTCw: 0.320 gfd/psi

Mfr. Temp: 25.0 °C  
 840 Element Area: 365.0 ft<sup>2</sup>  
 840 Purchase Price: \$800  
 840 Maximum Flow: 75.0 gpm  
 840 Minimum Flow: 25.0 gpm  
 840 Total Width: 64.4 ft  
 840 Feed Spacer Thickness: 0.0023 ft

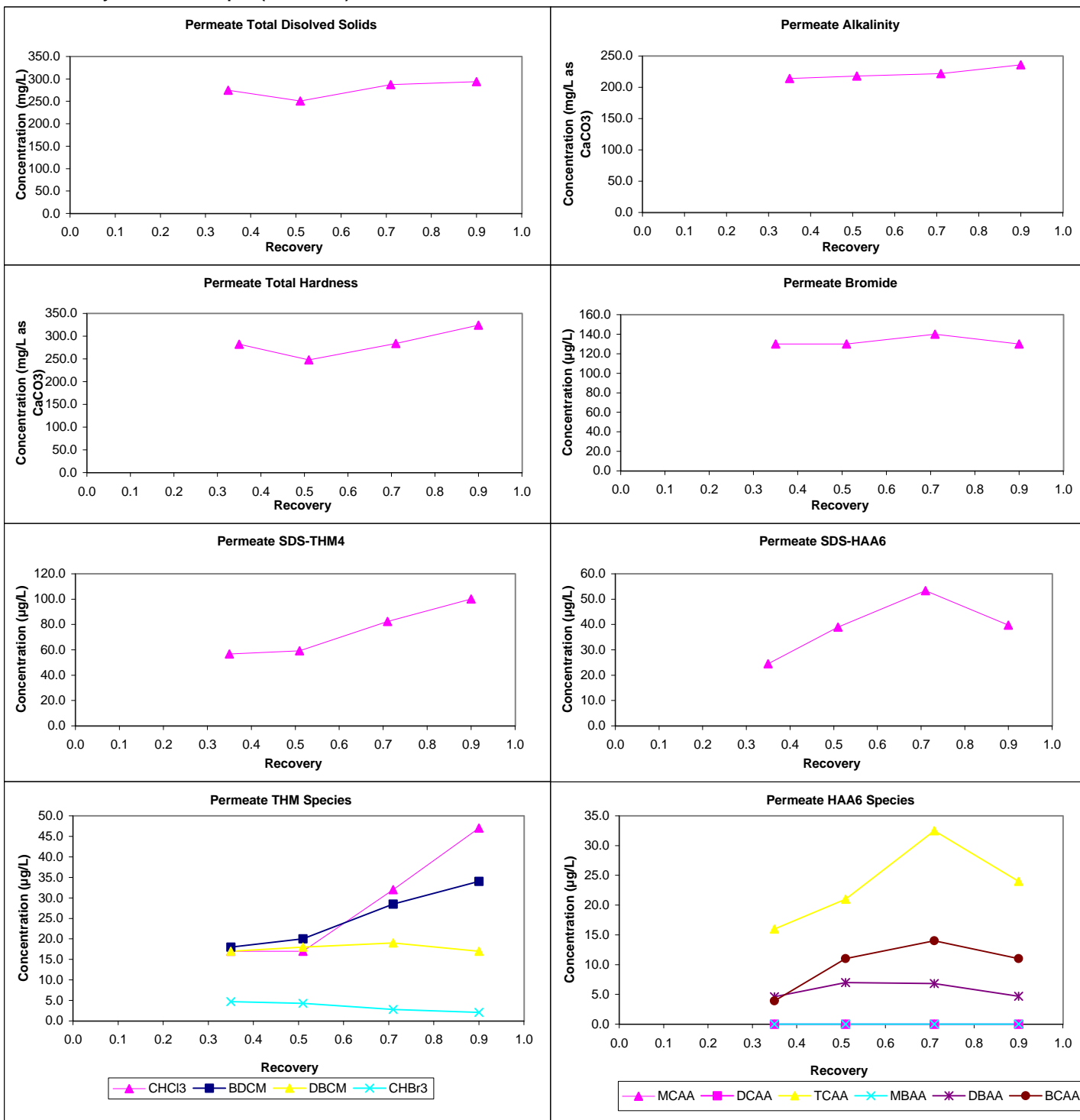
## Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err. (%)											
Recovery ->	Avg	Diff	0.35	0.51	0.71	0.90	0.35	0.51	0.71	0.90	WQP	Count	Avg	SD								
pH	8.0	0.2	8.0	7.8	8.1	7.9	8.1	8.0	8.2	8.4	TDS <sub>t</sub>	48	-10	28								
Temp	23.0	0.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	Alk	4	13	22								
Alk	230	0	214	218	222	236	240	246	260	320	TDS	4	-12	6								
TDS	303	1	275	251	288	294	300	310	312	323	TotHard	4	30	48								
TotHard	291	35	282	248	284	324	328	314	375	476	CaHard	4	15	50								
CaHard	270	34	214	228	253	294	248	272	338	444	Turb	4	-61	60								
Turb	0.24	0.05	0.06	0.07	0.08	0.11	0.33	0.33	0.40	0.61	Amm	0	n/a	n/a								
Amm	0.06	0.06	0.06	0.00	0.05	0.06	NA	NA	NA	NA	TOC	4	-8	5								
TOC	12.4	0.3	2.1	2.1	3.3	4.3	17.6	21.2	32.8	75.5	UV254	4	-1	3								
UV254	0.410	0.008	0.046	0.050	0.079	0.107	0.595	0.812	1.194	3.080	Pretreatment Information											
SUVA	3.31	0.14	2.19	2.38	2.42	2.49	3.38	3.83	3.64	4.08												
Bromide	130	0	130	130	140	130	Process								Description	Scale						
TOX	1030	170	170	160	228	280																
CHCl3	265.0	95.0	17.0	17.0	32.0	47.0	Cartridge filtration				5 micron filter		bench									
BDCM	55.5	8.5	18.0	20.0	28.5	34.0																
DBCM	8.0	0.4	17.0	18.0	19.0	17.0	Design Parameters															
CHBr3	0.0	0.0	4.7	4.3	2.8	2.1																
THM4	328.5	103.9	56.7	59.3	82.3	100.1																
MCAA	11.0	NA	0.0	0.0	0.0	0.0																
DCAA	69.0	NA	0.0	0.0	0.0	0.0																
TCAA	110.0	NA	16.0	21.0	32.5	24.0																
MBAA	1.2	NA	0.0	0.0	0.0	0.0																
DBAA	1.7	NA	4.6	7.0	6.8	4.7																
BCAA	15.0	NA	3.9	11.0	14.0	11.0																
TBAA	NA	NA	NR	NR	NA	NR																
CDBAA	2.7	NA	NR	NR	NA	NR																
DCBAA	29.0	NA	NR	NR	NA	NR																
HAA5	192.9	NA	20.6	28.0	39.3	28.7																
HAA6	207.9	NA	24.5	39.0	53.3	39.7																
HAA9	NA	NA	NR	NR	NA	NR																
SDS Conditions															Active memb area: 0.167 ft <sup>2</sup> Active width: 0.330 ft Norm Temp: 24.6 °C Feed TDS: 300.0 mg/L Manuf rep TDS rej: 50% Temp Norm MTC-w: 0.316 gfd/psi							
WQP	Avg	SD	Count	Min - Max																		
Res (mg/L) (0)	0.99	0.48	6	0.41 - 1.58																		
Temp (°C)	24.0	0.0	6	24.0 - 24.0																		
pH (unit)	8.0	0.1	6	7.9 - 8.1																		
Time (hr)	24.0	0.0	6	24.0 - 24.0																		
Comments:																						

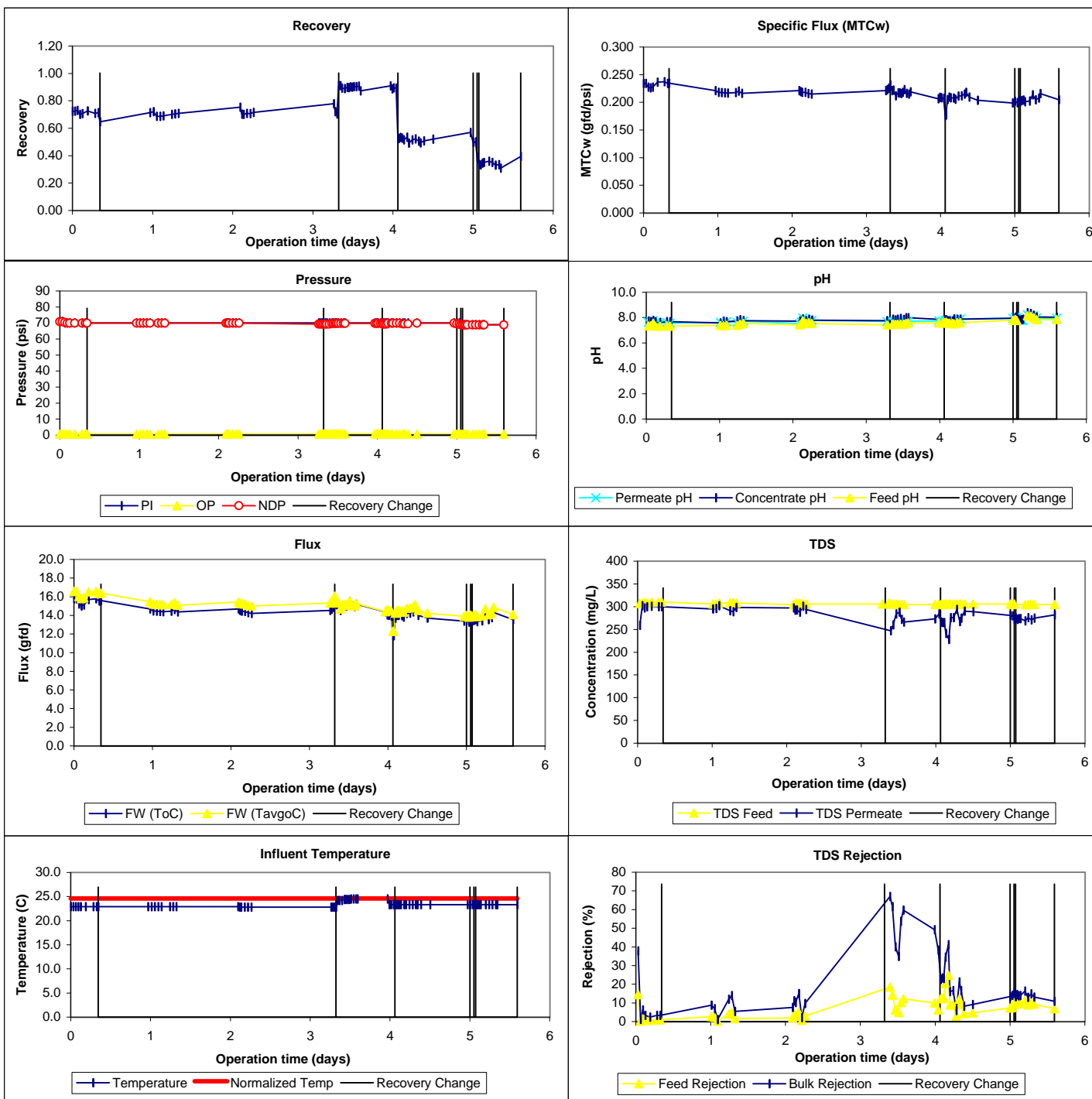
## Water Quality Parameter Graphs



## Water Quality Parameter Graphs (Continued)



## Productivity Graphs



## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 7/28/98 - 8/4/98 (7 days)

## Membrane Information

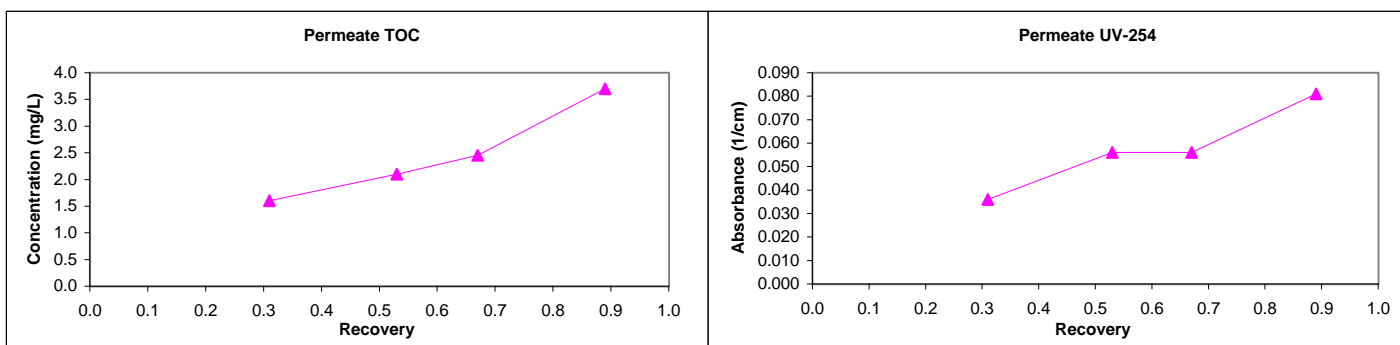
**Manufacturer:** Hydranautics Corp., San Diego, CA  
**Trade Name:** NTR7450  
**MWCO:** 1,000 Da Daltons  
**Mfr. Flux:** 45.0 gfd  
**Mfr. NDP:** 140.0 psi  
**Mfr. MTCw:** 0.320 gfd/psi

**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 365.0 ft<sup>2</sup>  
**840 Purchase Price:** \$800  
**840 Maximum Flow:** 75.0 gpm  
**840 Minimum Flow:** 25.0 gpm  
**840 Total Width:** 64.4 ft  
**840 Feed Spacer Thickness:** 0.0023 ft

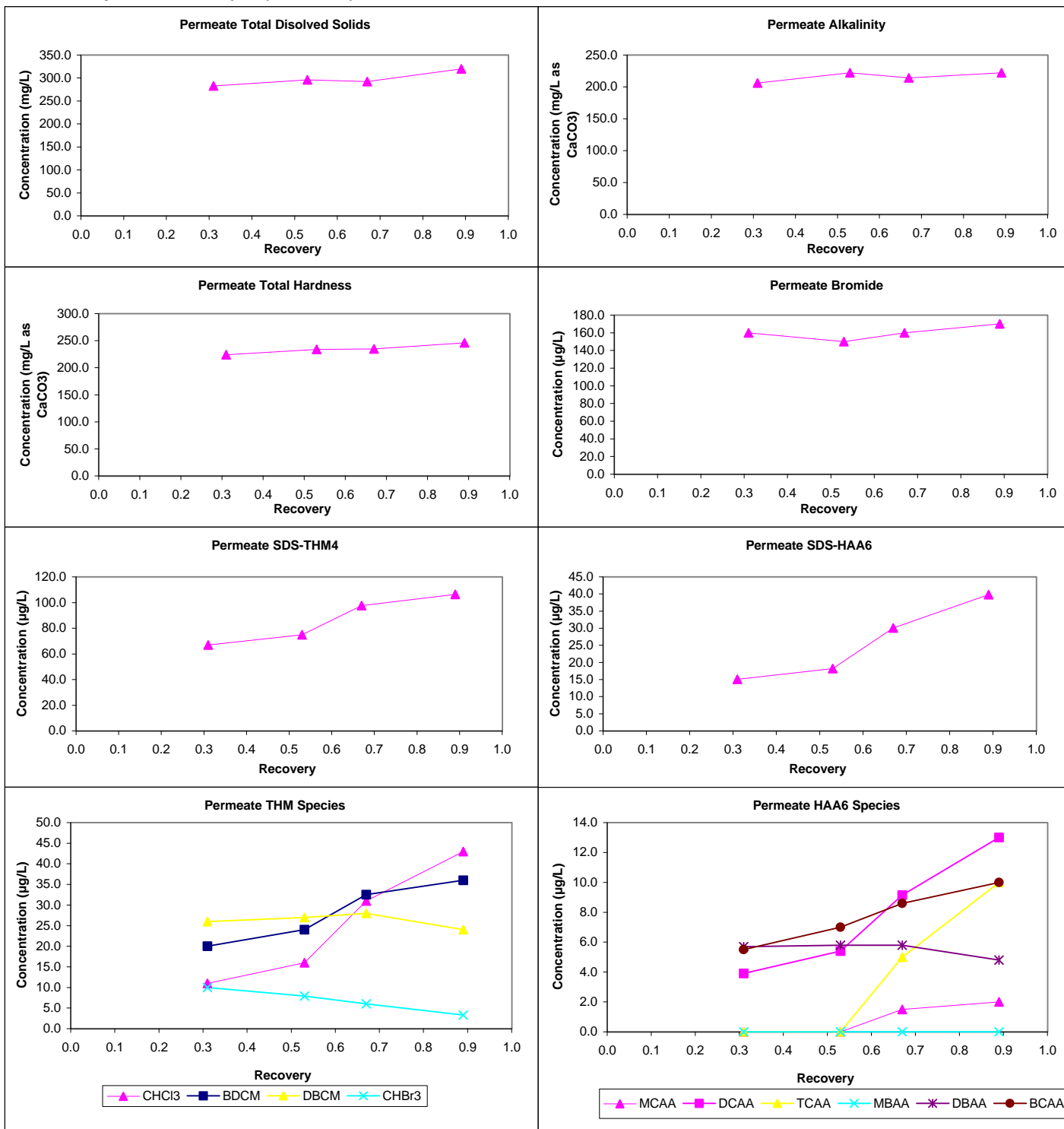
## Water Quality Summary

Water Quality Summary															Mass Balance Closure Err (%)			
Source ->	Feed		Permeate				Concentrate											
Recovery ->	Avg	Diff	0.31	0.53	0.67	0.89	0.31	0.53	0.67	0.89	WQP	Count	Avg	SD				
pH	7.8	0.0	7.9	7.9	7.8	7.9	7.9	8.0	7.8	8.0	TDS	49	-2	19				
Temp	24.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-103	94				
Alk	300	64	206	222	214	222	250	260	257	274	TDS	4	0	11				
TDS	318	4	283	296	293	320	327	333	339	359	TotHard	4	-73	57				
TotHard	316	36	224	234	235	246	272	288	298	344	CaHard	4	-28	16				
CaHard	262	18	196	210	215	234	250	274	282	322	Turb	4	-42	47				
Turb	0.32	0.01	0.07	0.08	0.08	0.07	0.46	0.48	0.51	1.13	Amm	0	n/a	n/a				
Amm	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	4	14	8				
TOC	11.1	0.4	1.6	2.1	2.5	3.7	17.1	22.7	34.3	94.1	UV254	4	1	6				
UV254	0.409	0.014	0.036	0.056	0.056	0.081	0.594	0.848	1.172	2.855								
SUVA	3.69	0.26	2.25	2.67	2.29	2.19	3.47	3.74	3.42	3.03								
Bromide	165	5	160	150	160	170												
TOX	1100	0	120	145	213	280												
CHCl3	335.0	5.0	11.0	16.0	31.0	43.0												
BDCM	66.0	5.0	20.0	24.0	32.5	36.0												
DBCM	8.3	0.5	26.0	27.0	28.0	24.0												
CHBr3	0.0	0.0	10.0	7.9	6.1	3.3												
THM4	409.3	10.5	67.0	74.9	97.6	106.3												
MCAA	9.1	1.9	0.0	0.0	0.0	2.0												
DCAA	115.0	15.0	3.9	5.4	9.2	13.0												
TCAA	165.0	15.0	1.8	3.1	5.0	10.0												
MBAA	1.2	0.1	0.0	0.0	0.0	0.0												
DBAA	1.7	0.1	5.7	5.8	5.8	4.8												
BCAA	15.5	0.5	5.5	7.0	8.6	10.0												
TBAA	0.0	0.0	0.0	0.0	0.0	0.0												
CDBAA	2.5	0.1	4.4	4.7	4.7	4.6												
DCBAA	24.0	1.0	3.8	5.5	6.7	10.0												
HAA5	291.9	28.1	11.4	14.3	20.0	29.8												
HAA6	307.4	28.6	16.9	21.3	28.6	39.8												
HAA9	333.9	27.8	25.1	31.5	39.9	54.4												
SDS Conditions																		
WQP	Avg	SD	Count	Min - Max														
Res (mg/L) (0)	0.97	0.24	6	0.68 - 1.31														
Temp (°C)	24.0	0.0	6	24.0 - 24.0														
pH (unit)	7.9	0.0	6	7.9 - 8.0														
Time (hr)	24.0	0.0	6	24.0 - 24.0														
Design Parameters																		
Active memb area:		0.167 ft <sup>2</sup>																
Active width:		0.330 ft										ID#		Recov (dec.)				
Norm Temp:		24.6 °C										1		0.70				
Feed TDS:		300.0 mg/L										2		0.90				
Manuf rep TDS rej:		50%										3		0.50				
Temp Norm MTC-w:		0.316 gfd/psi										4		0.30				
Comments:																		

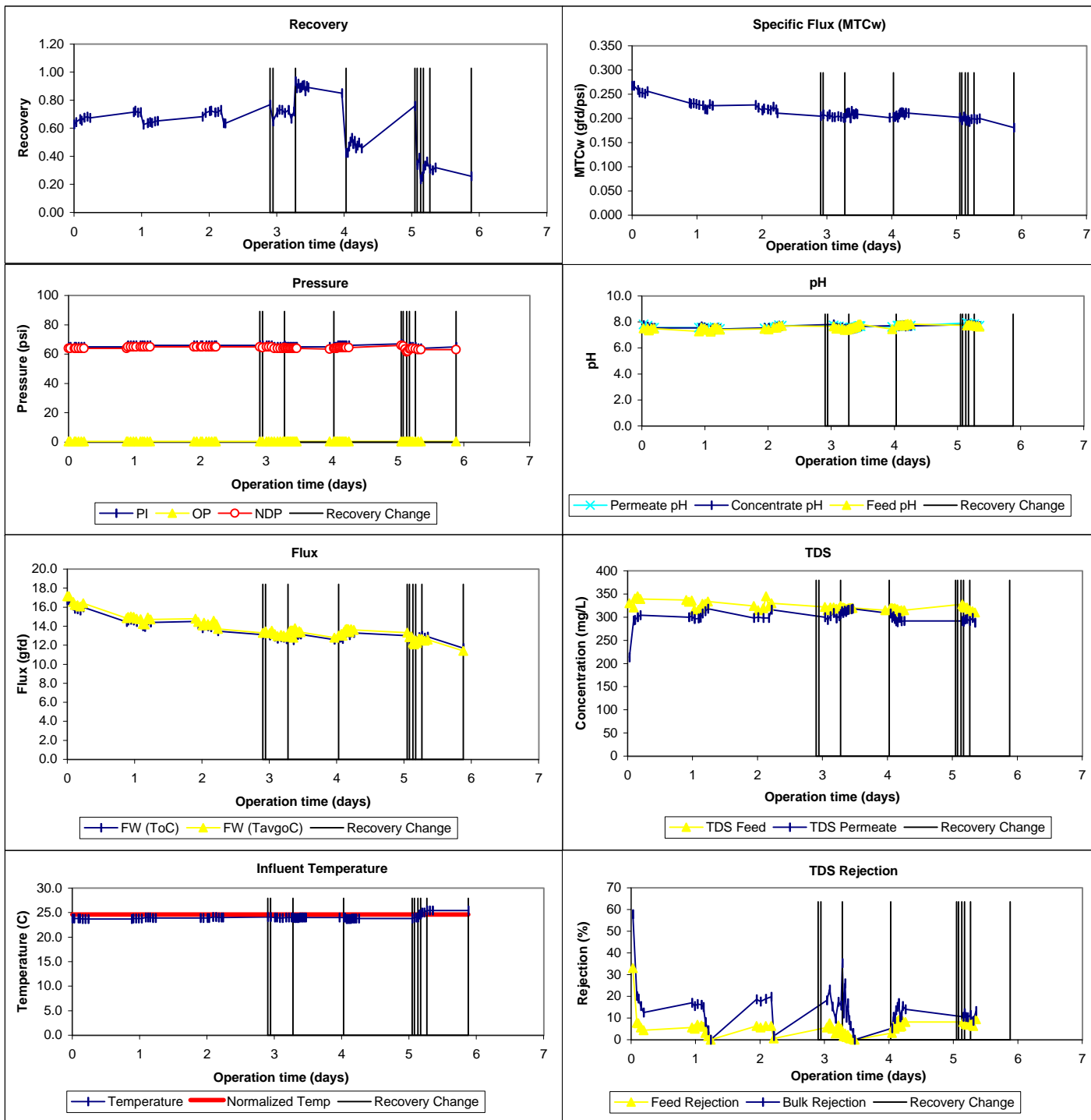
## Water Quality Parameter Graphs



## Water Quality Parameter Graphs (Continued)



## Productivity Graphs



## ICR Information

**ID / ICR#:** FL-4060486 / 296  
**ICR Contact:** Craig Canning  
**Phone No.:** (954) 492-7865  
**Period:** 1/29/99 - 2/4/99 (6 days)

## Membrane Information

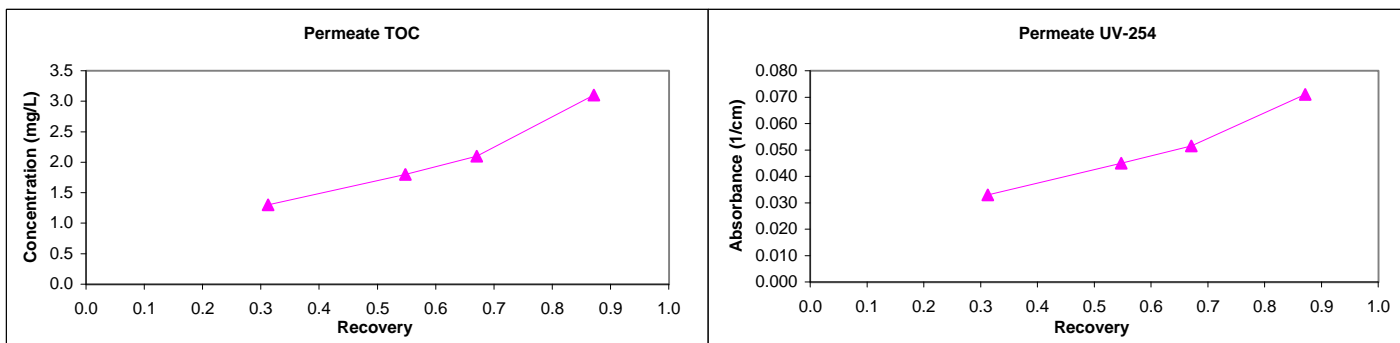
**Manufacturer:** Hydranautics Corp., San Diego, CA  
**Trade Name:** NTR7450  
**MWCO:** 1,000 Da Daltons  
**Mfr. Flux:** 45.0 gfd  
**Mfr. NDP:** 140.0 psi  
**Mfr. MTCw:** 0.320 gfd/psi

**Mfr. Temp:** 25.0 °C  
**840 Element Area:** 365.0 ft<sup>2</sup>  
**840 Purchase Price:** \$800  
**840 Maximum Flow:** 75.0 gpm  
**840 Minimum Flow:** 25.0 gpm  
**840 Total Width:** 64.4 ft  
**840 Feed Spacer Thickness:** 0.0023 ft

## Water Quality Summary

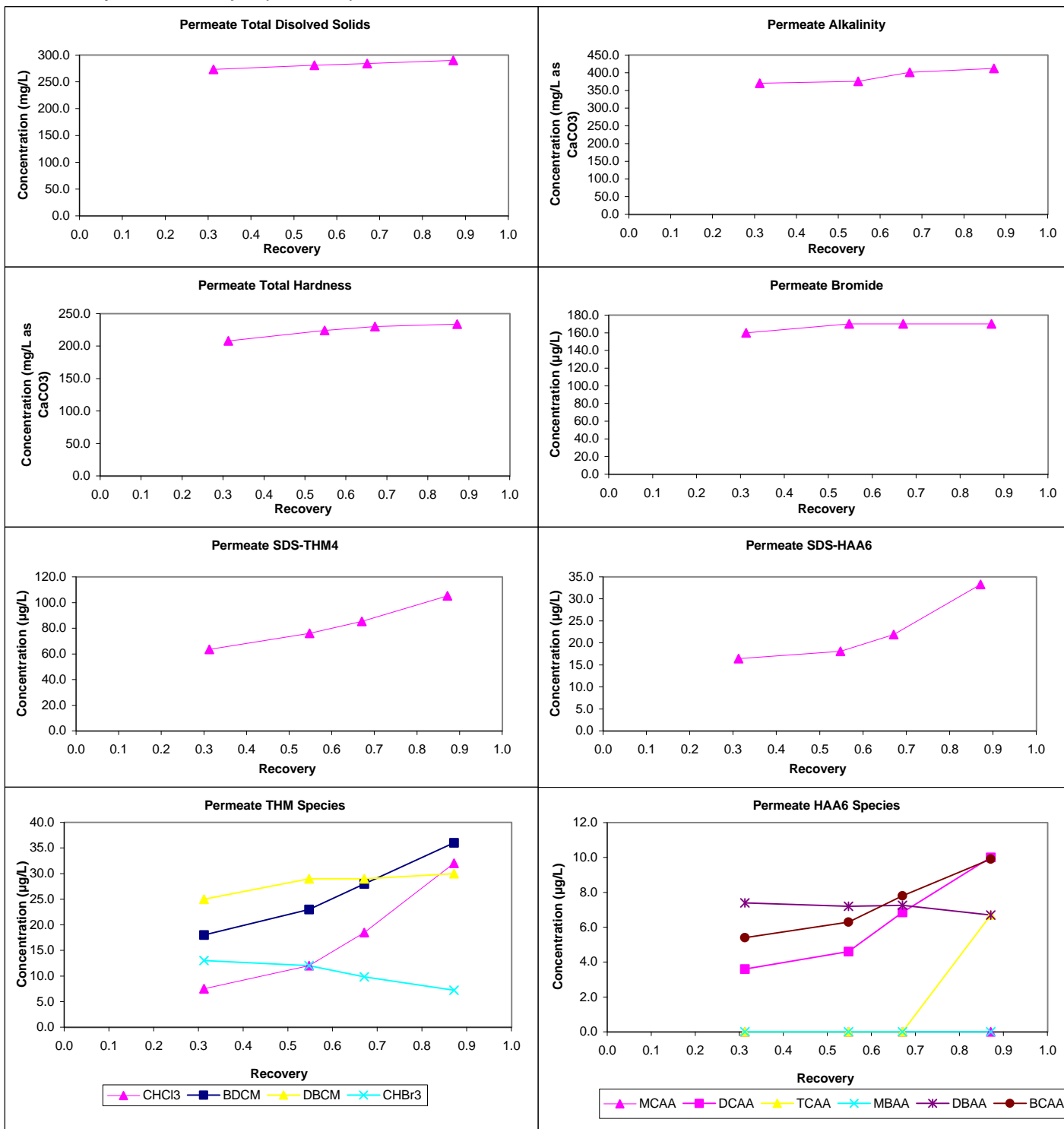
Water Quality Summary															Mass Balance Closure Err (%)			
Source ->	Feed		Permeate				Concentrate											
Recovery ->	Avg	Diff	0.31	0.55	0.67	0.87	0.31	0.55	0.67	0.87	WQP	Count	Avg	SD				
pH	8.2	0.1	8.3	8.4	8.3	8.0	8.2	8.1	8.5	8.0	TDS	45	-3	9				
Temp	23.0	0.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	Alk	4	-7	6				
Alk	430	2	370	376	401	412	456	460	470	484	TDS	4	-2	2				
TDS	300	2	273	281	284	290	308	320	328	348	TotHard	4	-2	6				
TotHard	249	3	208	224	230	234	258	284	299	322	CaHard	4	9	5				
CaHard	214	6	184	194	198	204	236	262	294	304	Turb	4	-78	83				
Turb	0.33	0.03	0.07	0.08	0.09	0.13	0.43	0.52	0.39	0.59	Amm	0	n/a	n/a				
Amm	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	4	7	12				
TOC	13.0	0.9	1.3	1.8	2.1	3.1	17.8	34.5	39.0	79.9	UV254	4	2	5				
UV254	0.462	0.007	0.033	0.045	0.052	0.071	0.632	0.954	1.412	3.256								
SUVA	3.57	0.30	2.54	2.50	2.45	2.29	3.55	2.77	3.62	4.08								
Bromide	180	0	160	170	170	170	Pretreatment Information											
TOX	1180	10	98	140	158	220												
ProcessDescriptionScale																		
Cartridge filtration5 micron filterbench																		
CHCl3	275.0	15.0	7.5	12.0	18.5	32.0	Design Parameters											
BDCM	62.0	4.0	18.0	23.0	28.0	36.0												
DBCM	9.1	0.0	25.0	29.0	29.0	30.0												
CHBr3	0.0	0.0	13.0	12.0	9.9	7.2												
THM4	346.1	19.0	63.5	76.0	85.4	105.2												
MCAA	0.0	0.0	0.0	0.0	0.0	0.0												
DCAA	104.5	5.5	3.6	4.6	6.9	10.0												
TCAA	140.0	10.0	1.8	2.3	3.5	6.7												
MBAA	0.5	0.5	0.0	0.0	0.0	0.0												
DBAA	2.2	0.4	7.4	7.2	7.3	6.7												
BCAA	17.0	2.0	5.4	6.3	7.8	9.9												
TBAA	0.0	0.0	0.0	0.0	0.0	0.0	Active memb area: 0.167 ft² Active width: 0.330 ft Norm Temp: 24.6 °C Feed TDS: 300.0 mg/L Manuf rep TDS rej: 50% Temp Norm MTC-w: 0.316 gfd/psi											
CDBAA	2.6	0.4	4.5	4.0	3.9	5.1												
DCBAA	23.0	0.0	3.5	4.0	4.4	8.5												
HAA5	247.2	16.4	12.8	14.1	17.6	23.4												
HAA6	264.2	18.4	18.2	20.4	25.4	33.3												
HAA9	289.8	18.8	26.2	28.4	33.6	46.9												
SDS Conditions																		
WQP	Avg	SD	Count	Min - Max														
Res (mg/L) (0)	1.15	0.26	6	0.84 - 1.60														
Temp (°C)	24.0	0.0	6	24.0 - 24.0														
pH (unit)	8.0	0.0	6	7.9 - 8.1														
Time (hr)	24.0	0.0	6	24.0 - 24.0														
Comments:																		

## Water Quality Parameter Graphs





## Water Quality Parameter Graphs (Continued)



## Productivity Graphs

