Appendix A

2013 Annual Infiltration/Inflow Report: Yelm Water Reclamation Facility

City of Yelm

Sewer Department
931 N.P. Road
Mail:
105 Yelm Ave. W
Yelm, WA 98597

April 17, 2014

Washington State Dept. of Ecology
P.O. Box 47775
Olympia, WA 98504-7775

Re: Annual I&I Report
NPDES Permit #WA0040762

Attached is the Annual I&I Report for the Calendar Year 2013. This should satisfy Condition S4-d of our NPDES Permit. If you have any questions regarding this document, Please contact me at (360) 458-8411.

Sincerely,

James R. Doty
Facility Manager
Yelm Water Reclamation Facility

Cc: Ryan Johnstone P.E., PW Director
File

Annual Infiltration/Inflow Report

Yelm Water Reclamation Facility

January 1, 2013 to December 31, 2013

	Average Monthly Flow (MGD)			Total Monthly Rainfall (Inches)			Population Served		
	Year			Year			Year		
Month	1995		2013	1995		2013	1995		2013
Jan.	0.139		0.364	4.5		2.75	1131		6848
Feb.	0.144		0.360	4.58		2.24	1263		6848
Mar.	0.146		0.368	3.95		3.01	1355		6848
Apr.	0.140		0.365	2.81		4.90	1355		6848
May	0.139		0.373	1.42		4.35	1358		6848
Jun.	0.138		0.367	1.57		1.98	1358		6848
Jul.	0.132		0.360	1.84		0.00	1358		7500
Aug.	0.146		0.350	1.41		1.77	1383		7500
Sept.	0.147		0.366	1.76		8.90	1442		7500
Oct.	0.146		0.377	3.57		2.34	1501		7500
Nov.	0.146		0.381	8.51		3.55	1540		7500
Dec.	0.150		0.399	7.24		1.59	1560		7500
Low Month	0.132		0.350						
High Month	0.150		0.399						
Yearly Average	0.143		0.369						

I/I = High month - Low month

	Additional Sewer Lines Added (Ft.)		
	Year		
			2012
Jan			135
Feb			
Mar			
Apr			
May			
Jun			670
Jul			
Aug			
Sep			
Oct			
Nov			1230
Dec			
Total (Feet)			2,035
Total (Miles)			0.39

Comments: This report shows a 171% increase in I/I over base levels. This is explaned by the fact that at the time that the Sewer System was created and installed in 1995, there were only two schools connected to the sewer system. Currently we have 6 schools connected to the system, one of which is the High School which draws from throughout the district which is rural in nature. Many of the kids attending live outside the boundary of the sewer service area. During the summer the schools shut down and there is a noticeable difference in the influent flow while school is out. We are a STEP System with pressure mains. If the mains were compromised, sewage would leak out rather than have infiltration. The graphs also show that influent flow is unaffected by precipitation.

Plant Design Capacity

Peak Design Flow:	2.5 MGD
Average Design Flow:	1 MGD
Population Equivalents:	1999

Infiltration Inflow Summary

Year	I/I	% over Base I/I	% of Aver. Design
1995	0.018	Base Year	6.00%
2012	0.049	171.15%	4.88%

2013 Daily Influent Flows

DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*
1/1/2013	0.382	2/1/2013	0.319	3/1/2013	0.319	4/1/2013	0.378	5/1/2013	0.372	6/1/2013	0.365	7/1/2013	0.361	8/1/2013	0.353	9/1/2013	0.338	10/1/2013	0.384	11/1/2013	0.344	12/1/2013	0.452
1/2/2013	0.348	2/2/2013	0.358	3/2/2013	0.358	4/2/2013	0.375	5/2/2013	0.377	6/2/2013	0.424	7/2/2013	0.37	8/2/2013	0.344	9/2/2012	0.44	10/2/2013	0.37	11/2/2013	0.384	12/2/2013	0.384
1/3/2013	0.341	2/3/2013	0.399	3/3/2013	0.415	4/3/2013	0.354	5/3/2013	0.334	6/3/2013	0.385	7/3/2013	0.344	8/3/2013	0.37	9/3/2012	0.367	10/3/2013	0.381	11/3/2013	0.45	12/3/2013	0.371
1/4/2013	0.329	2/4/2013	0.372	3/4/2013	0.362	4/4/2013	0.368	5/4/2013	0.358	6/4/2013	0.372	7/4/2013	0.343	8/4/2013	0.392	9/4/2012	0.367	10/4/2013	0.34	11/4/2013	0.371	12/4/2013	0.379
1/5/2013	0.366	2/5/2013	0.354	3/5/2013	0.361	4/5/2013	0.341	5/5/2013	0.42	6/5/2013	0.38	7/5/2013	0.349	8/5/2013	0.353	9/5/2012	0.412	10/5/2013	0.347	11/5/2013	0.37	12/5/2013	0.392
1/6/2013	0.419	2/6/2013	0.352	3/6/2013	0.36	4/6/2013	0.376	5/6/2013	0.378	6/6/2013	0.372	7/6/2013	0.362	8/6/2013	0.348	9/6/2012	0.324	10/6/2013	0.439	11/6/2013	0.369	12/6/2013	0.365
1/7/2013	0.359	2/7/2013	0.359	3/7/2013	0.366	4/7/2013	0.384	5/7/2013	0.36	6/7/2013	0.339	7/7/2013	0.399	8/7/2013	0.346	9/7/2012	0.359	10/7/2013	0.378	11/7/2013	0.368	12/7/2013	0.408
1/8/2013	0.361	2/8/2013	0.324	3/8/2013	0.329	4/8/2013	0.346	5/8/2013	0.364	6/8/2013	0.373	7/8/2013	0.366	8/8/2013	0.361	9/8/2012	0.433	10/8/2013	0.363	11/8/2013	0.342	12/8/2013	0.473
1/9/2013	0.364	2/9/2013	0.35	3/9/2013	0.357	4/9/2013	0.331	5/9/2013	0.381	6/9/2013	0.424	7/9/2013	0.358	8/9/2013	0.346	9/9/2012	0.36	10/9/2013	0.361	11/9/2013	0.369	12/9/2013	0.399
1/10/2013	0.358	2/10/2013	0.411	3/10/2013	0.421	4/10/2013	0.333	5/10/2013	0.338	6/10/2013	0.387	7/10/2013	0.361	8/10/2013	0.348	9/10/2012	0.339	10/10/2013	0.362	11/10/2013	0.392	12/10/2013	0.405
1/11/2013	0.34	2/11/2013	0.359	3/11/2013	0.368	4/11/2013	0.331	5/11/2013	0.375	6/11/2013	0.374	7/11/2013	0.351	8/11/2013	0.403	9/11/2012	0.351	10/11/2013	0.34	11/11/2013	0.421	12/11/2013	0.393
1/12/2013	0.364	2/12/2013	0.348	3/12/2013	0.362	4/12/2013	0.321	5/12/2013	0.43	6/12/2013	0.361	7/12/2013	0.347	8/12/2013	0.37	9/12/2012	0.344	10/12/2013	0.366	11/12/2013	0.374	12/12/2013	0.392
1/13/2013	0.415	2/13/2013	0.356	3/13/2013	0.358	4/13/2013	0.366	5/13/2013	0.385	6/13/2013	0.345	7/13/2013	0.362	8/13/2013	0.339	9/13/2012	0.303	10/13/2013	0.433	11/13/2013	0.363	12/13/2013	0.352
1/14/2013	0.359	2/14/2013	0.349	3/14/2013	0.359	4/14/2013	0.426	5/14/2013	0.374	6/14/2013	0.351	7/14/2013	0.385	8/14/2013	0.348	9/14/2012	0.345	10/14/2013	0.409	11/14/2013	0.364	12/14/2013	0.4
1/15/2013	0.357	2/15/2013	0.336	3/15/2013	0.331	4/15/2013	0.353	5/15/2013	0.367	6/15/2013	0.36	7/15/2013	0.367	8/15/2013	0.359	9/15/2012	0.43	10/15/2013	0.369	11/15/2013	0.337	12/15/2013	0.455
1/16/2013	0.366	2/16/2013	0.364	3/16/2013	0.379	4/16/2013	0.362	5/16/2013	0.374	6/16/2013	0.388	7/16/2013	0.359	8/16/2013	0.324	9/16/2012	0.355	10/16/2013	0.383	11/16/2013	0.381	12/16/2013	0.397
1/17/2013	0.355	2/17/2013	0.365	3/17/2013	0.427	4/17/2013	0.358	5/17/2013	0.35	6/17/2013	0.356	7/17/2013	0.356	8/17/2013	0.33	9/17/2012	0.351	10/17/2013	0.38	11/17/2013	0.444	12/17/2013	0.394
1/18/2013	0.332	2/18/2013	0.396	3/18/2013	0.37	4/18/2013	0.353	5/18/2013	0.374	6/18/2013	0.354	7/18/2013	0.35	8/18/2013	0.376	9/18/2012	0.356	10/18/2013	0.342	11/18/2013	0.382	12/18/2013	0.401
1/19/2013	0.356	2/19/2013	0.359	3/19/2013	0.336	4/19/2013	0.352	5/19/2013	0.433	6/19/2013	0.359	7/19/2013	0.349	8/19/2013	0.35	9/19/2012	0.348	10/19/2013	0.381	11/19/2013	0.37	12/19/2013	0.379
1/20/2013	0.362	2/20/2013	0.357	3/20/2013	0.368	4/20/2013	0.378	5/20/2013	0.383	6/20/2013	0.364	7/20/2013	0.353	8/20/2013	0.338	9/20/2012	0.32	10/20/2013	0.457	11/20/2013	0.371	12/20/2013	0.361
1/21/2013	0.403	2/21/2013	0.356	3/21/2013	0.367	4/21/2013	0.442	5/21/2013	0.377	6/21/2013	0.346	7/21/2013	0.391	8/21/2013	0.325	9/21/2012	0.358	10/21/2013	0.384	11/21/2013	0.357	12/21/2013	0.402
1/22/2013	0.36	2/22/2013	0.341	3/22/2013	0.332	4/22/2013	0.359	5/22/2013	0.382	6/22/2013	0.347	7/22/2013	0.361	8/22/2013	0.33	9/22/2012	0.442	10/22/2013	0.373	11/22/2013	0.345	12/22/2013	0.415
1/23/2013	0.369	2/23/2013	0.356	3/23/2013	0.367	4/23/2013	0.352	5/23/2013	0.347	6/23/2013	0.41	7/23/2013	0.36	8/23/2013	0.318	9/23/2012	0.38	10/23/2013	0.371	11/23/2013	0.393	12/23/2013	0.399
1/24/2013	0.364	2/24/2013	0.414	3/24/2013	0.439	4/24/2013	0.362	5/24/2013	0.344	6/24/2013	0.372	7/24/2013	0.348	8/24/2013	0.336	9/24/2012	0.359	10/24/2013	0.369	11/24/2013	0.458	12/24/2013	0.412
1/25/2013	0.323	2/25/2013	0.359	3/25/2013	0.37	4/25/2013	0.358	5/25/2013	0.357	6/25/2013	0.351	7/25/2013	0.355	8/25/2013	0.392	9/25/2012	0.351	10/25/2013	0.335	11/25/2013	0.389	12/25/2013	0.378
1/26/2013	0.36	2/26/2013	0.347	3/26/2013	0.357	4/26/2013	0.33	5/26/2013	0.349	6/26/2013	0.314	7/26/2013	0.337	8/26/2013	0.35	9/26/2012	0.359	10/26/2013	0.367	11/26/2013	0.39	12/26/2013	0.404
1/27/2013	0.417	2/27/2013	0.358	3/27/2013	0.362	4/27/2013	0.364	5/27/2013	0.445	6/27/2013	0.313	7/27/2013	0.363	8/27/2013	0.347	9/27/2012	0.341	10/27/2013	0.444	11/27/2013	0.386	12/27/2013	0.387
1/28/2013	0.386	2/28/2013	0.358	3/28/2013	0.374	4/28/2013	0.44	5/28/2013	0.373	6/28/2013	0.348	7/28/2013	0.395	8/28/2013	0.347	9/28/2012	0.389	10/28/2013	0.373	11/28/2013	0.396	12/28/2013	0.411
1/29/2013	0.361			3/29/2013	0.339	4/29/2013	0.372	5/29/2013	0.373	6/29/2013	0.37	7/29/2013	0.366	8/29/2013	0.352	9/29/2012	0.456	10/29/2013	0.368	11/29/2013	0.357	12/29/2013	0.422
1/30/2013	0.356			3/30/2013	0.383	4/30/2013	0.377	5/30/2013	0.367	6/30/2013	0.395	7/30/2013	0.356	8/30/2013	0.318	9/30/2012	0.377	10/30/2013	0.362	11/30/2013	0.391	12/30/2013	0.392
1/31/2013	0.351			3/31/2013	0.404			5/31/2013	0.334			7/31/2013	0.342	8/31/2013	0.339			10/31/2013	0.349			12/31/2013	0.391
Month Avg.	0.364	Month Avg.	0.360	Month Avg.	0.368	Month Avg.	0.365	Month Avg.	0.373	Month Avg.	0.367	Month Avg.	0.360	Month Avg.	0.350	Month Avg.	0.368	Month Avg.	0.377	Month Avg.	0.381	Month Avg.	0.399

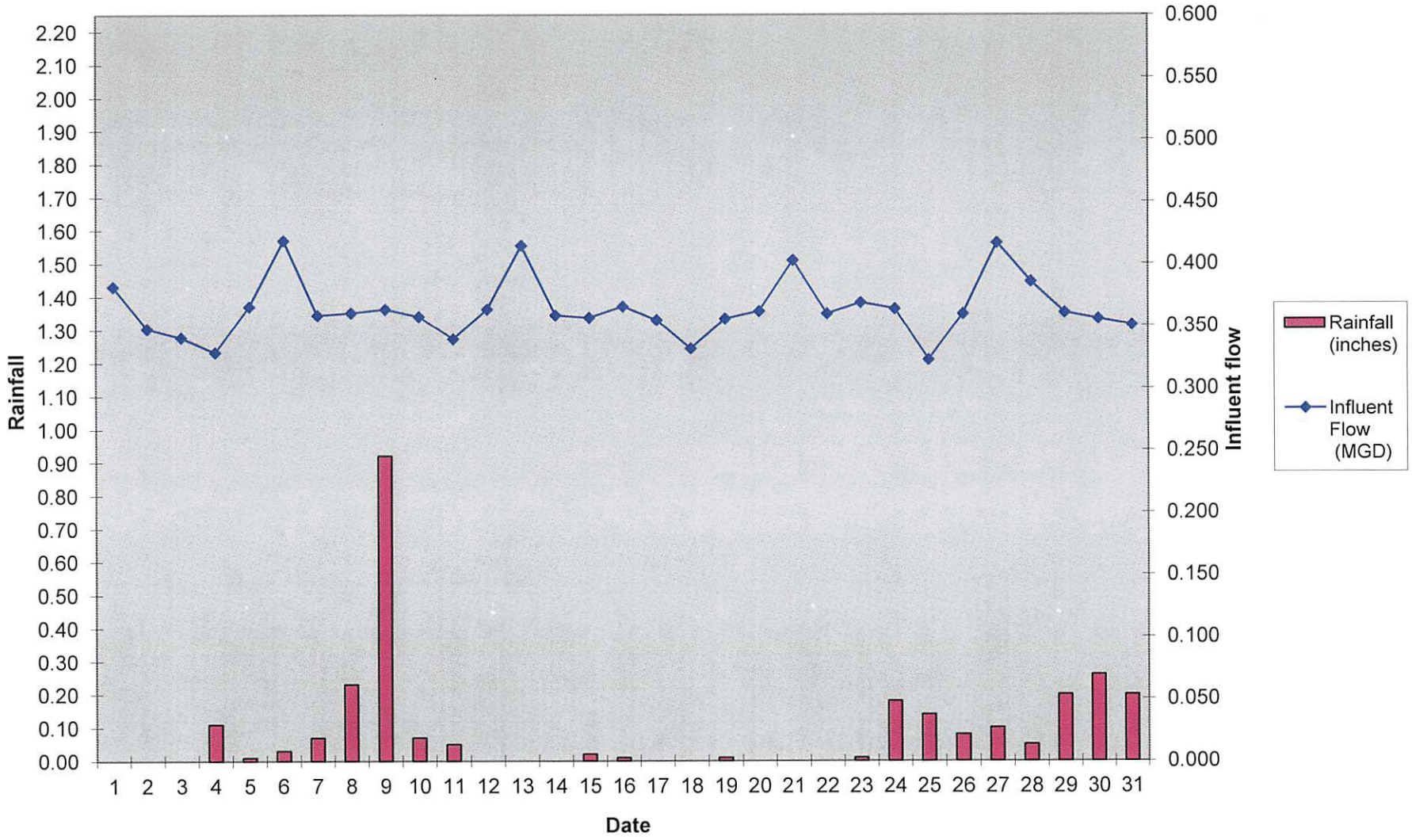
City of Yelm Wastewater Treatment Plant

2013 Precipitation Data **TOTAL RAINFALL FOR 2013 = 37.38**

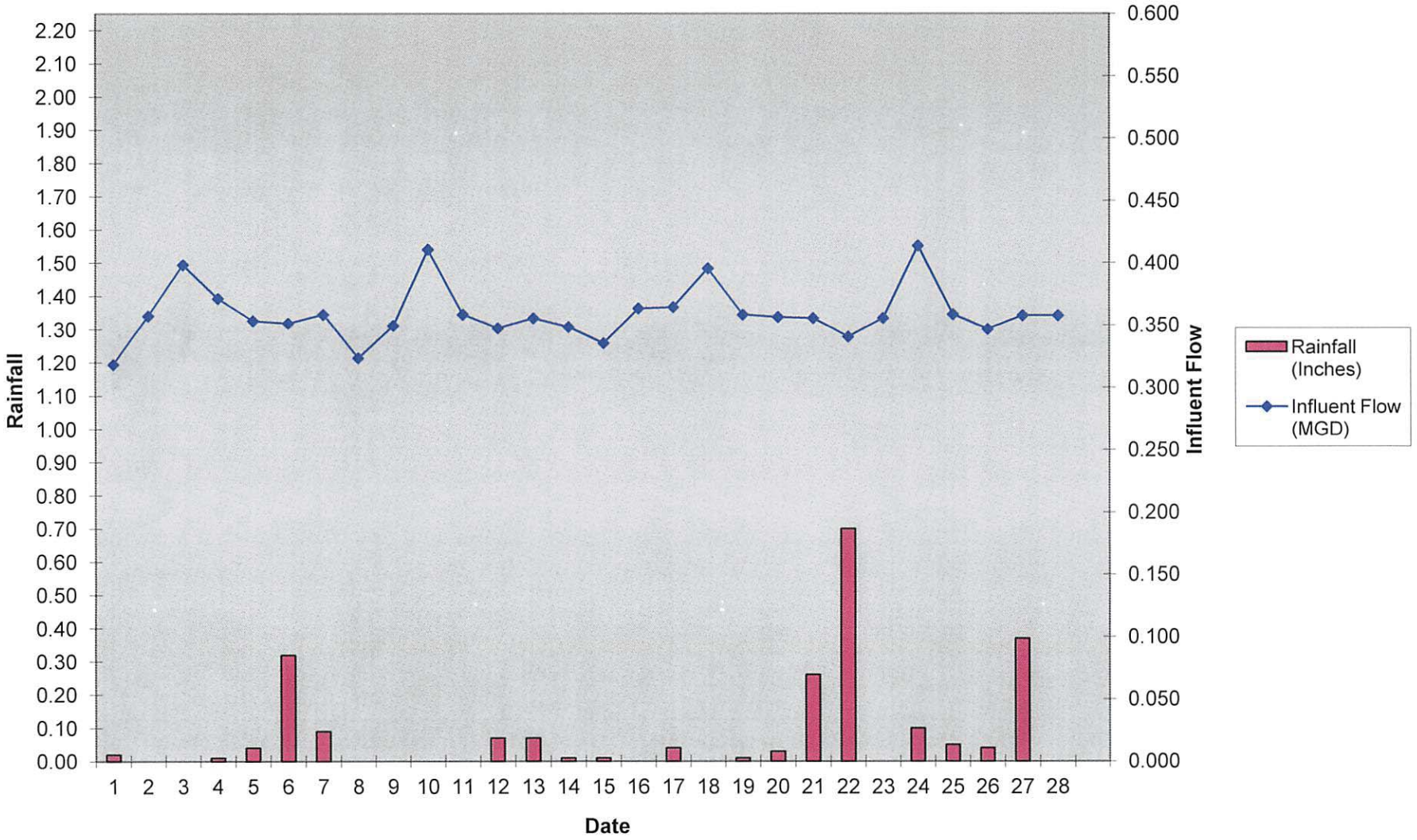
* 24 hour total read at 8:00 AM daily

DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*	DATE	24 total*
1/1/2013	0.00	2/1/2013	0.02	3/1/2013	0.19	4/1/2013	0.00	5/1/2013	0.00	6/1/2013	0.01	7/1/2013	0.00	8/1/2013	0.00	9/1/2013	0.00	10/1/2013	0.71	11/1/2013	0.01	12/1/2013	0.40
1/2/2013	0.00	2/2/2013	0.00	3/2/2013	0.00	4/2/2013	0.00	5/2/2013	0.00	6/2/2013	0.00	7/2/2013	0.00	8/2/2013	0.00	9/2/2013	0.00	10/2/2013	0.36	11/2/2013	0.58	12/2/2013	0.50
1/3/2013	0.00	2/3/2013	0.00	3/3/2013	0.11	4/3/2013	0.00	5/3/2013	0.00	6/3/2013	0.00	7/3/2013	0.00	8/3/2013	0.05	9/3/2013	0.80	10/3/2013	0.39	11/3/2013	0.04	12/3/2013	0.01
1/4/2013	0.11	2/4/2013	0.01	3/4/2013	0.00	4/4/2013	0.01	5/4/2013	0.00	6/4/2013	0.00	7/4/2013	0.00	8/4/2013	0.00	9/4/2013	0.18	10/4/2013	0.00	11/4/2013	0.00	12/4/2013	0.00
1/5/2013	0.01	2/5/2013	0.04	3/5/2013	0.01	4/5/2013	0.91	5/5/2013	0.00	6/5/2013	0.00	7/5/2013	0.00	8/5/2013	0.00	9/5/2013	0.14	10/5/2013	0.00	11/5/2013	0.10	12/5/2013	0.00
1/6/2013	0.03	2/6/2013	0.32	3/6/2013	0.16	4/6/2013	0.95	5/6/2013	0.00	6/6/2013	0.00	7/6/2013	0.00	8/6/2013	0.00	9/6/2013	2.51	10/6/2013	0.00	11/6/2013	0.02	12/6/2013	0.00
1/7/2013	0.07	2/7/2013	0.09	3/7/2013	0.44	4/7/2013	1.20	5/7/2013	0.00	6/7/2013	0.00	7/7/2013	0.00	8/7/2013	0.00	9/7/2013	0.05	10/7/2013	0.12	11/7/2013	0.51	12/7/2013	0.00
1/8/2013	0.23	2/8/2013	0.00	3/8/2013	0.00	4/8/2013	0.10	5/8/2013	0.00	6/8/2013	0.00	7/8/2013	0.00	8/8/2013	0.00	9/8/2013	0.01	10/8/2013	0.12	11/8/2013	0.44	12/8/2013	0.00
1/9/2013	0.92	2/9/2013	0.00	3/9/2013	0.00	4/9/2013	0.00	5/9/2013	0.00	6/9/2013	0.00	7/9/2013	0.00	8/9/2013	0.00	9/9/2013	0.00	10/9/2013	0.18	11/9/2013	0.01	12/9/2013	0.00
1/10/2013	0.07	2/10/2013	0.00	3/10/2013	0.03	4/10/2013	0.00	5/10/2013	0.00	6/10/2013	0.00	7/10/2013	0.00	8/10/2013	0.07	9/10/2013	0.01	10/10/2013	0.01	11/10/2013	0.05	12/10/2013	0.01
1/11/2013	0.05	2/11/2013	0.00	3/11/2013	0.07	4/11/2013	0.30	5/11/2013	0.00	6/11/2013	0.00	7/11/2013	0.00	8/11/2013	0.00	9/11/2013	0.00	10/11/2013	0.07	11/11/2013	0.00	12/11/2013	0.02
1/12/2013	0.00	2/12/2013	0.07	3/12/2013	0.21	4/12/2013	0.00	5/12/2013	0.05	6/12/2013	0.00	7/12/2013	0.00	8/12/2013	0.00	9/12/2013	0.00	10/12/2013	0.12	11/12/2013	0.06	12/12/2013	0.00
1/13/2013	0.00	2/13/2013	0.07	3/13/2013	0.16	4/13/2013	0.21	5/13/2013	0.53	6/13/2013	0.18	7/13/2013	0.00	8/13/2013	0.00	9/13/2013	0.00	10/13/2013	0.00	11/13/2013	0.04	12/13/2013	0.18
1/14/2013	0.00	2/14/2013	0.01	3/14/2013	0.14	4/14/2013	0.34	5/14/2013	0.25	6/14/2013	0.05	7/14/2013	0.00	8/14/2013	0.00	9/14/2013	0.00	10/14/2013	0.00	11/14/2013	0.01	12/14/2013	0.01
1/15/2013	0.02	2/15/2013	0.01	3/15/2013	0.05	4/15/2013	0.10	5/15/2013	0.01	6/15/2013	0.01	7/15/2013	0.00	8/15/2013	0.09	9/15/2013	0.11	10/15/2013	0.00	11/15/2013	0.00	12/15/2013	0.01
1/16/2013	0.01	2/16/2013	0.00	3/16/2013	0.08	4/16/2013	0.06	5/16/2013	0.08	6/16/2013	0.00	7/16/2013	0.00	8/16/2013	0.09	9/16/2013	0.12	10/16/2013	0.00	11/16/2013	0.38	12/16/2013	0.00
1/17/2013	0.00	2/17/2013	0.04	3/17/2013	0.22	4/17/2013	0.00	5/17/2013	0.14	6/17/2013	0.00	7/17/2013	0.00	8/17/2013	0.00	9/17/2013	0.09	10/17/2013	0.00	11/17/2013	0.08	12/17/2013	0.00
1/18/2013	0.00	2/18/2013	0.00	3/18/2013	0.03	4/18/2013	0.01	5/18/2013	0.19	6/18/2013	0.04	7/18/2013	0.00	8/18/2013	0.00	9/18/2013	0.14	10/18/2013	0.00	11/18/2013	0.67	12/18/2013	0.00
1/19/2013	0.01	2/19/2013	0.00	3/19/2013	0.02	4/19/2013	0.08	5/19/2013	0.05	6/19/2013	0.00	7/19/2013	0.00	8/19/2013	0.00	9/19/2013	0.00	10/19/2013	0.02	11/19/2013	0.50	12/19/2013	0.00
1/20/2013	0.00	2/20/2013	0.01	3/20/2013	0.51	4/20/2013	0.21	5/20/2013	0.00	6/20/2013	0.01	7/20/2013	0.00	8/20/2013	0.00	9/20/2013	0.00	10/20/2013	0.01	11/20/2013	0.00	12/20/2013	0.06
1/21/2013	0.00	2/21/2013	0.03	3/21/2013	0.43	4/21/2013	0.01	5/21/2013	0.48	6/21/2013	0.03	7/21/2013	0.00	8/21/2013	0.00	9/21/2013	0.10	10/21/2013	0.00	11/21/2013	0.00	12/21/2013	0.02
1/22/2013	0.00	2/22/2013	0.26	3/22/2013	0.06	4/22/2013	0.13	5/22/2013	0.12	6/22/2013	0.01	7/22/2013	0.00	8/22/2013	0.00	9/22/2013	0.06	10/22/2013	0.00	11/22/2013	0.00	12/22/2013	0.12
1/23/2013	0.01	2/23/2013	0.70	3/23/2013	0.00	4/23/2013	0.00	5/23/2013	0.44	6/23/2013	0.03	7/23/2013	0.00	8/23/2013	0.00	9/23/2013	0.70	10/23/2013	0.00	11/23/2013	0.00	12/23/2013	0.14
1/24/2013	0.18	2/24/2013	0.00	3/24/2013	0.00	4/24/2013	0.00	5/24/2013	0.43	6/24/2013	1.15	7/24/2013	0.00	8/24/2013	0.00	9/24/2013	0.13	10/24/2013	0.00	11/24/2013	0.01	12/24/2013	0.01
1/25/2013	0.14	2/25/2013	0.10	3/25/2013	0.00	4/25/2013	0.00	5/25/2013	0.02	6/25/2013	0.14	7/25/2013	0.00	8/25/2013	0.00	9/25/2013	0.19	10/25/2013	0.02	11/25/2013	0.00	12/25/2013	0.01
1/26/2013	0.08	2/26/2013	0.05	3/26/2013	0.00	4/26/2013	0.00	5/26/2013	0.04	6/26/2013	0.06	7/26/2013	0.00	8/26/2013	0.01	9/26/2013	0.09	10/26/2013	0.01	11/26/2013	0.00	12/26/2013	0.00
1/27/2013	0.10	2/27/2013	0.04	3/27/2013	0.00	4/27/2013	0.00	5/27/2013	0.58	6/27/2013	0.24	7/27/2013	0.00	8/27/2013	0.03	9/27/2013	0.00	10/27/2013	0.06	11/27/2013	0.01	12/27/2013	0.00
1/28/2013	0.05	2/28/2013	0.37	3/28/2013	0.08	4/28/2013	0.10	5/28/2013	0.21	6/28/2013	0.02	7/28/2013	0.00	8/28/2013	0.52	9/28/2013	0.71	10/28/2013	0.02	11/28/2013	0.00	12/28/2013	0.01
1/29/2013	0.20			3/29/2013	0.01	4/29/2013	0.18	5/29/2013	0.51	6/29/2013	0.00	7/29/2013	0.00	8/29/2013	0.10	9/29/2013	1.69	10/29/2013	0.00	11/29/2013	0.00	12/29/2013	0.00
1/30/2013	0.26			3/30/2013	0.00	4/30/2013	0.00	5/30/2013	0.09	6/30/2013	0.00	7/30/2013	0.00	8/30/2013	0.81	9/30/2013	1.07	10/30/2013	0.00	11/30/2013	0.03	12/30/2013	0.00
1/31/2013	0.20			3/31/2013	0.00			5/31/2013	0.13			7/31/2013	0.00	8/31/2013	0.00			10/31/2013	0.12			12/31/2013	0.08
Monthly Total	2.75		2.24		3.01		4.90		4.35		1.98		0.00		1.77		8.90		2.34		3.55		1.59
max day	0.92		0.7		0.51		1.2		0.58		1.15		0		0.81		2.51		0.71		0.67		0.5
Max day for Yr.	2.51																						

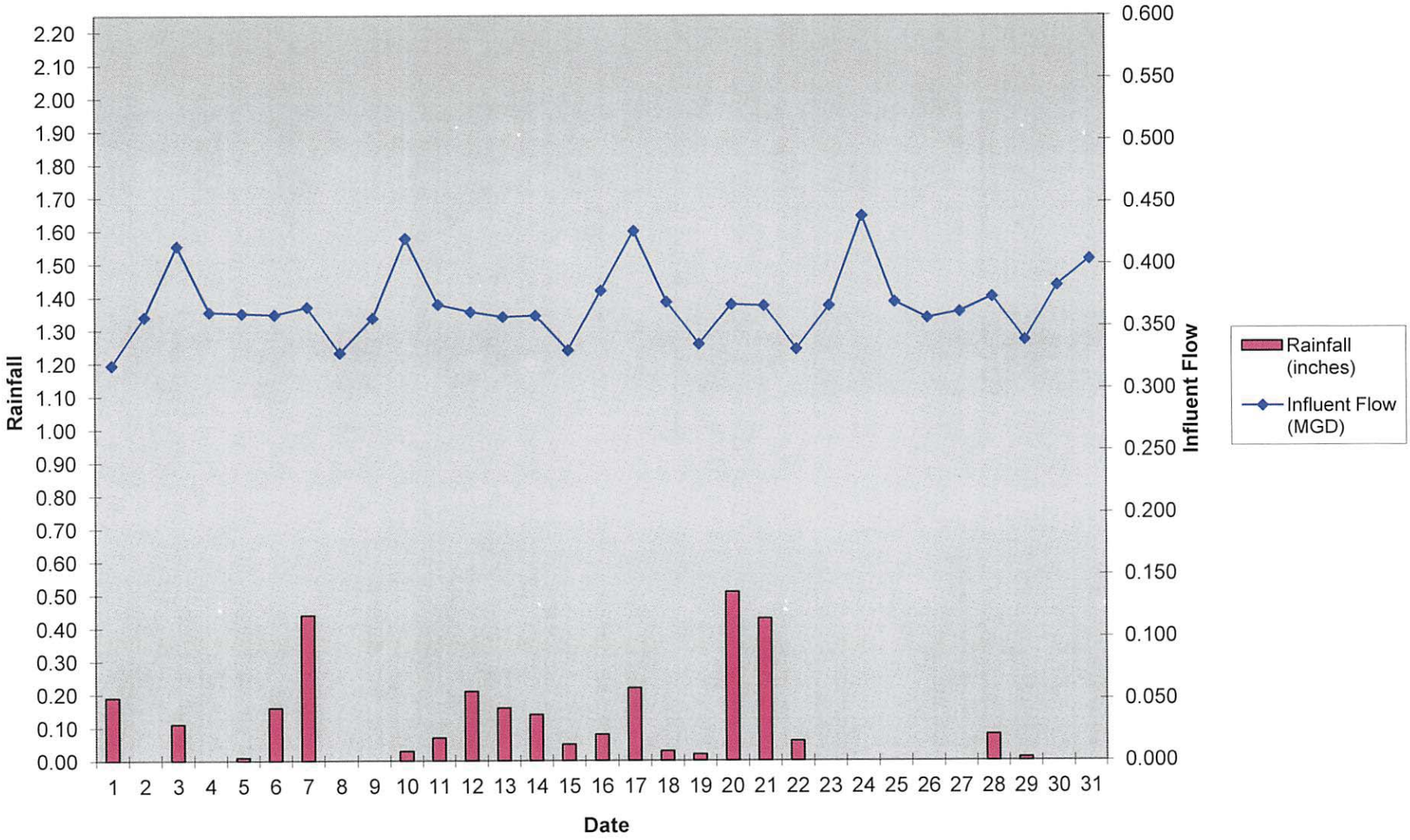
January 2012 Rainfall and Influent Flow



February 2012Rainfall and Influent Totals



Mar. 2012 Rainfall and Influent Flows



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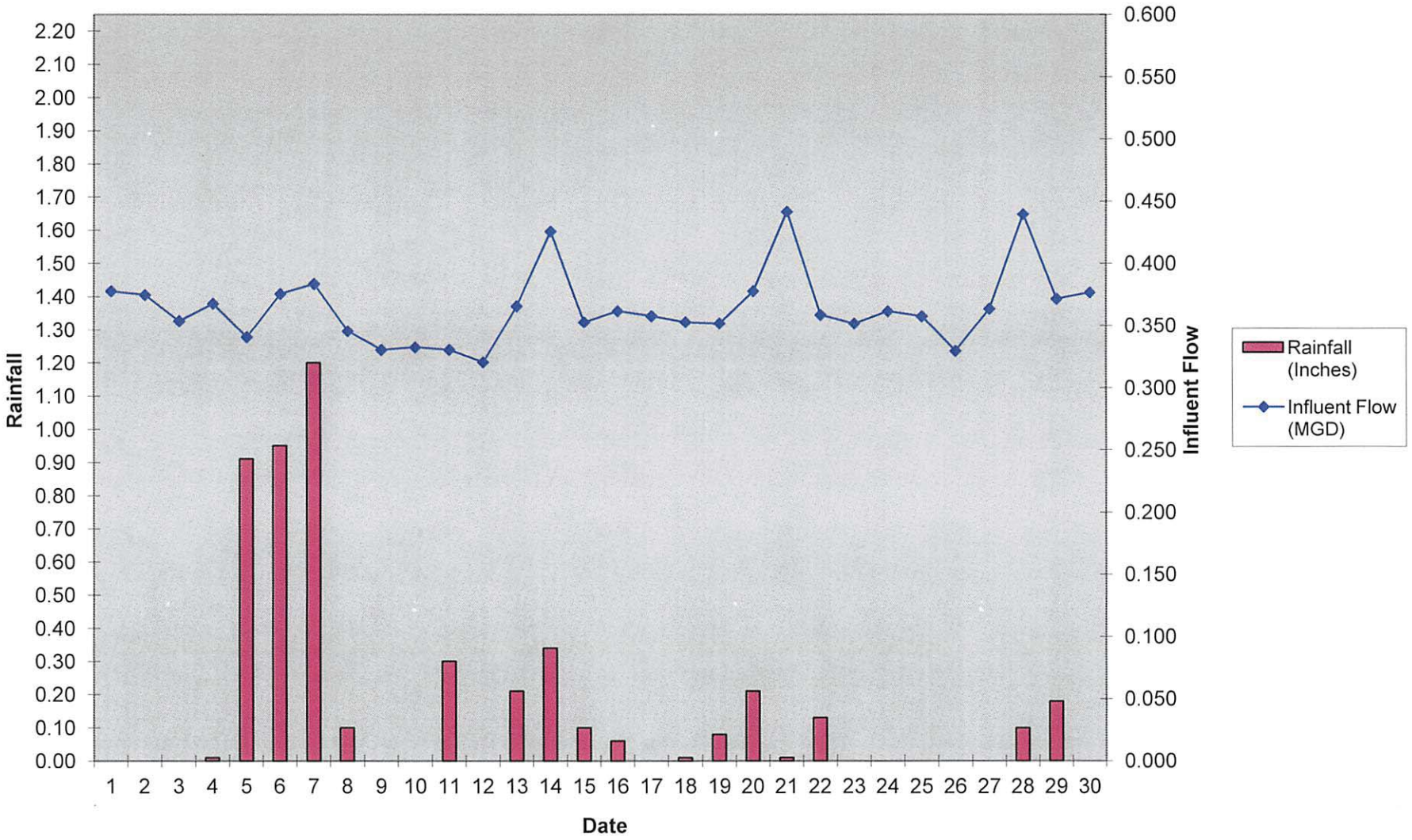
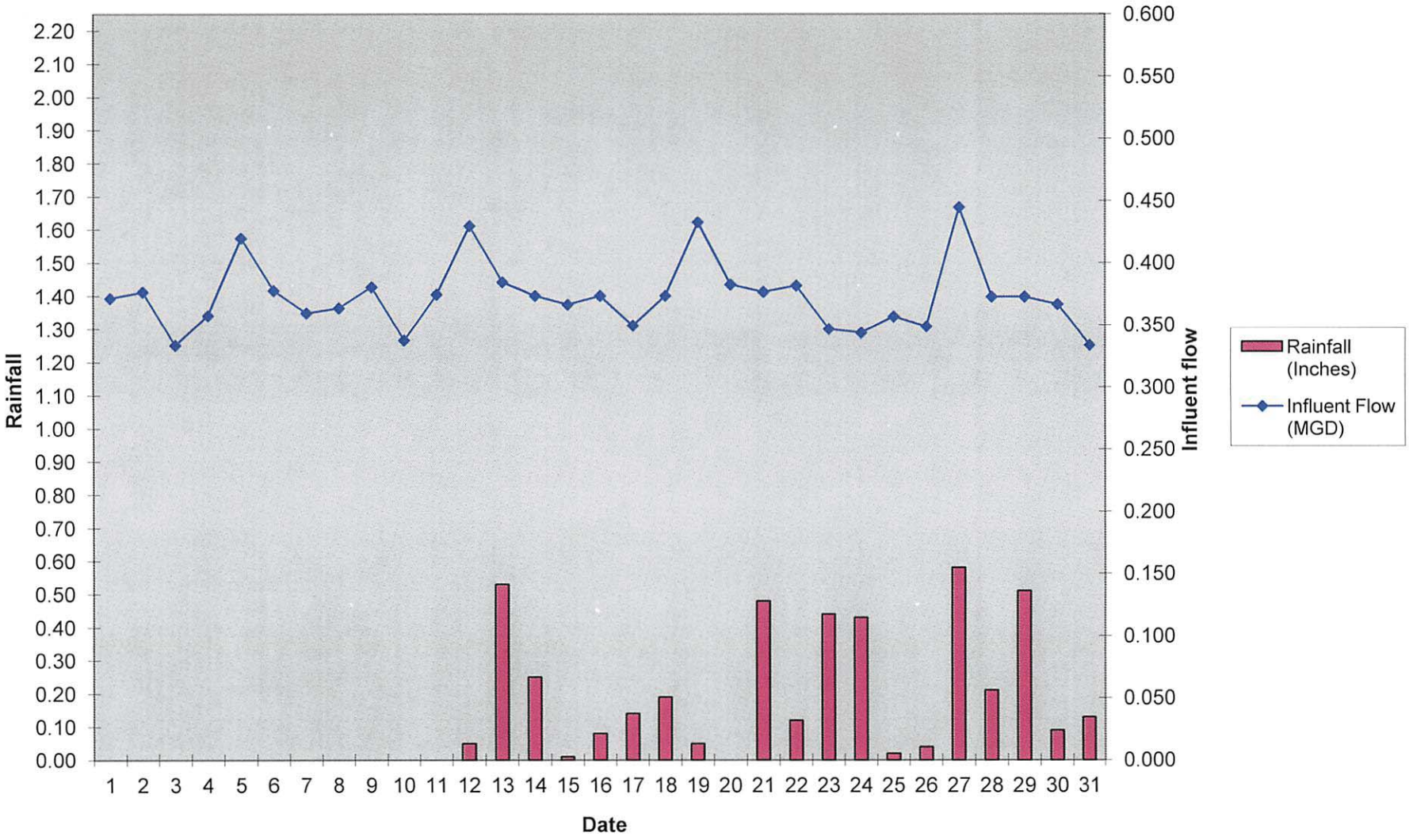
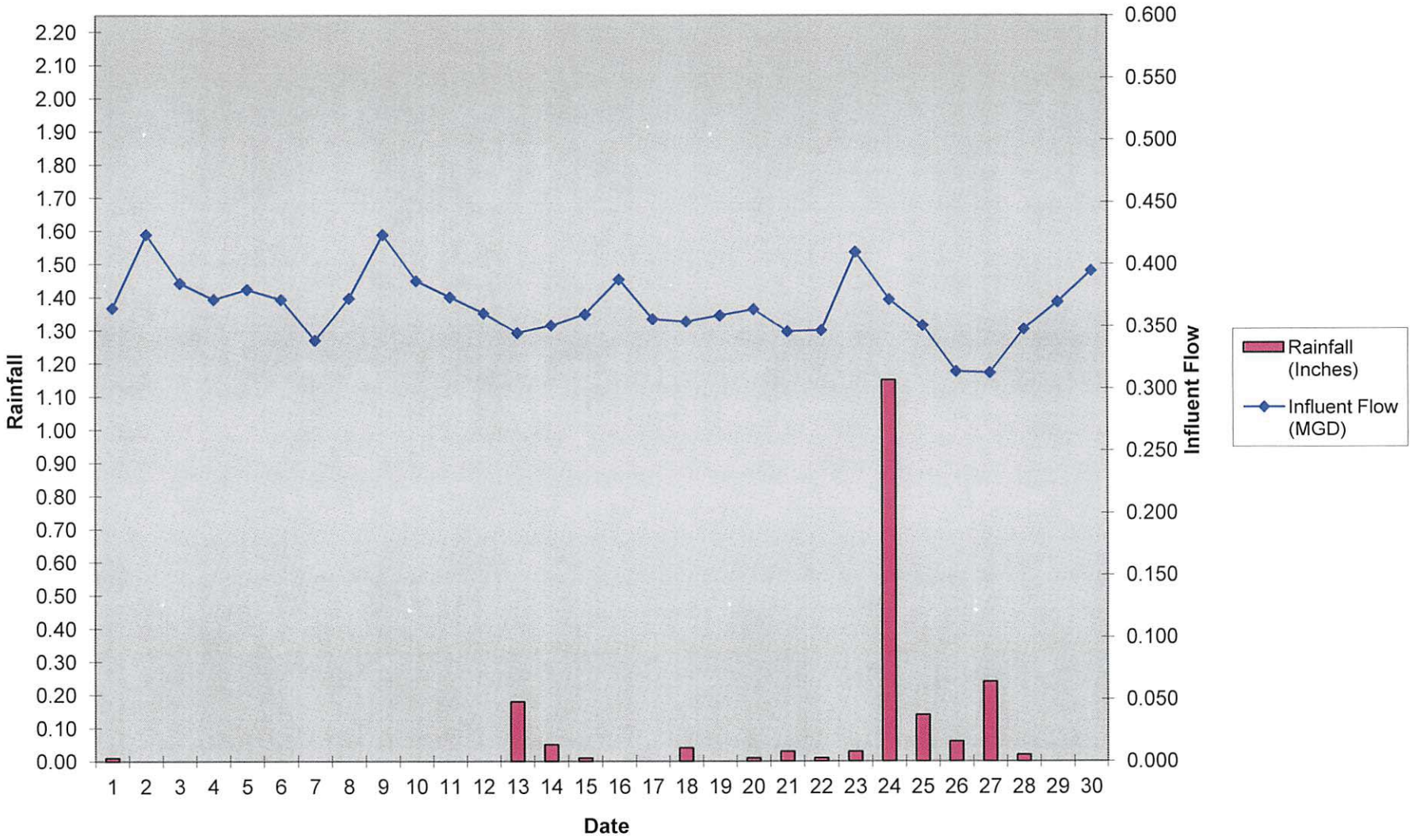


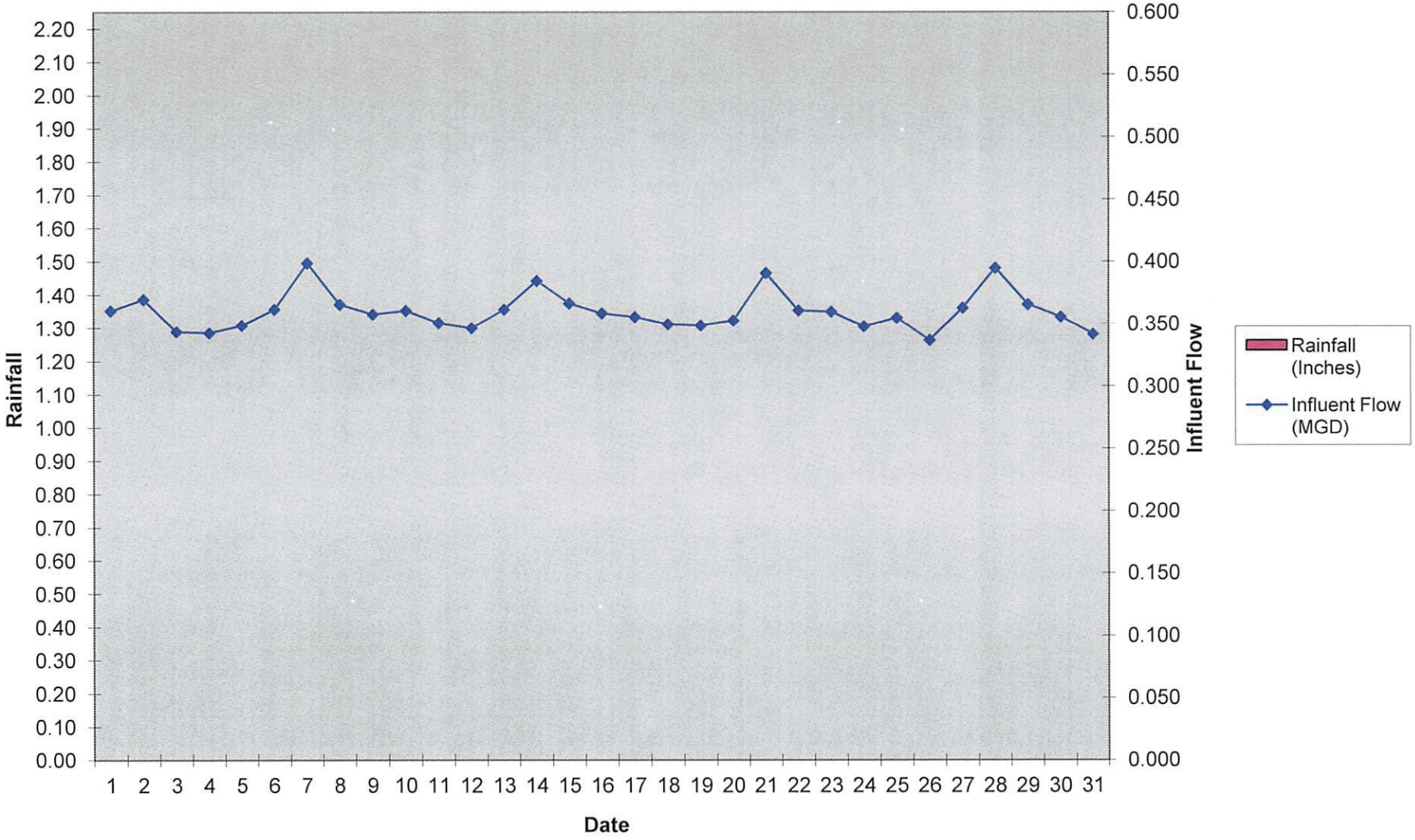
May 2012 Rainfall and Influent Flow



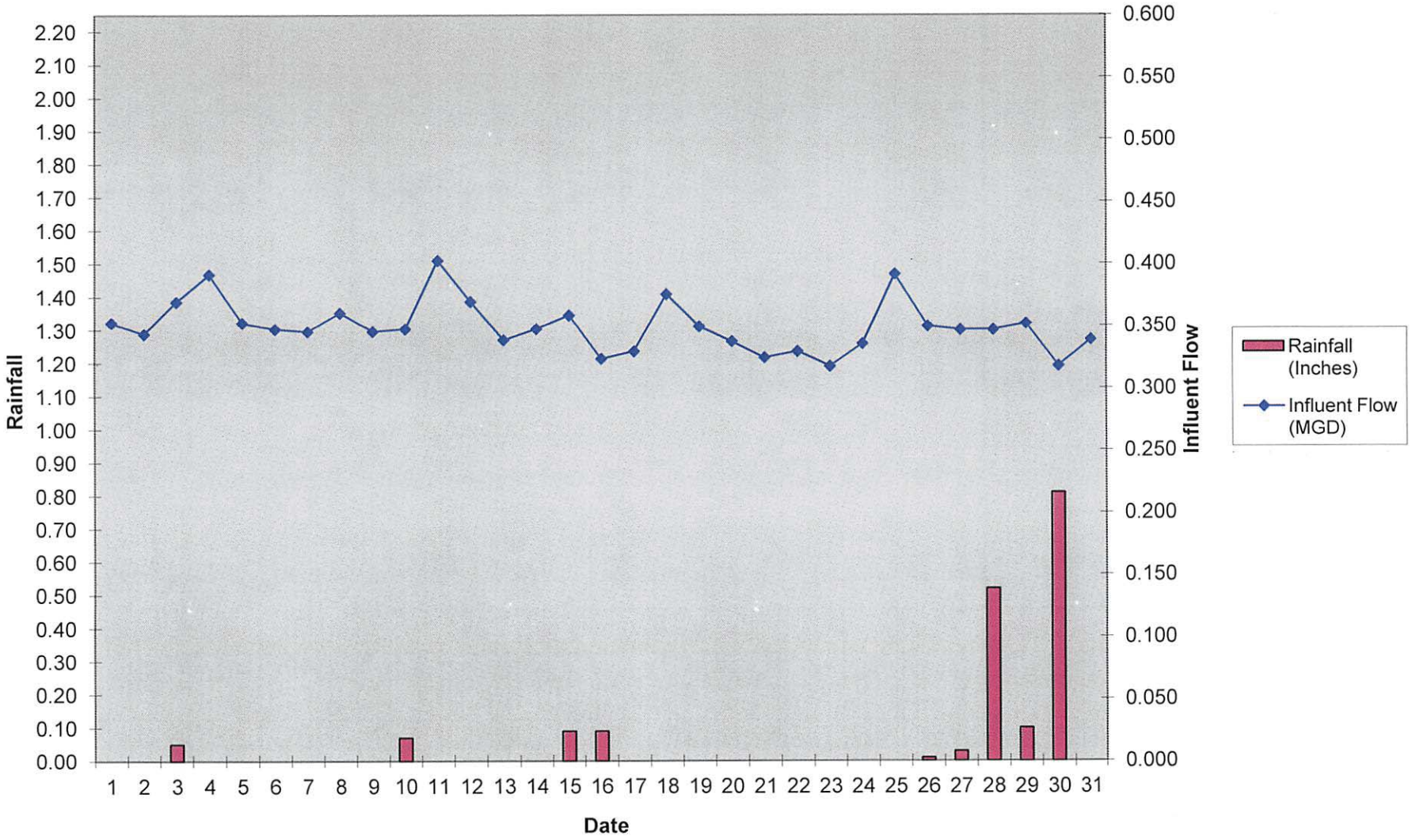
June 2012 Rainfall and Influent Flow



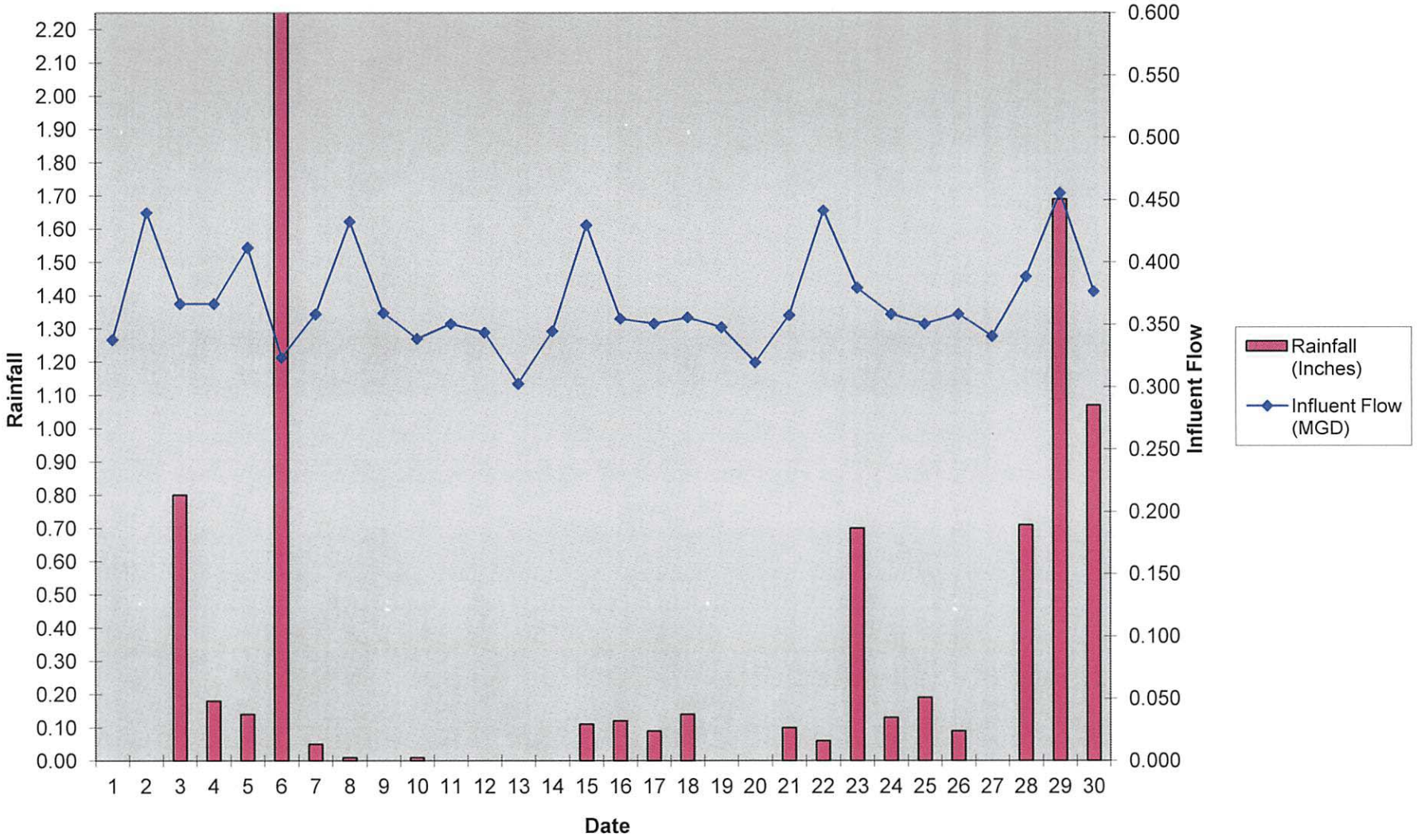
July 2012 Rainfall and Influent Flow



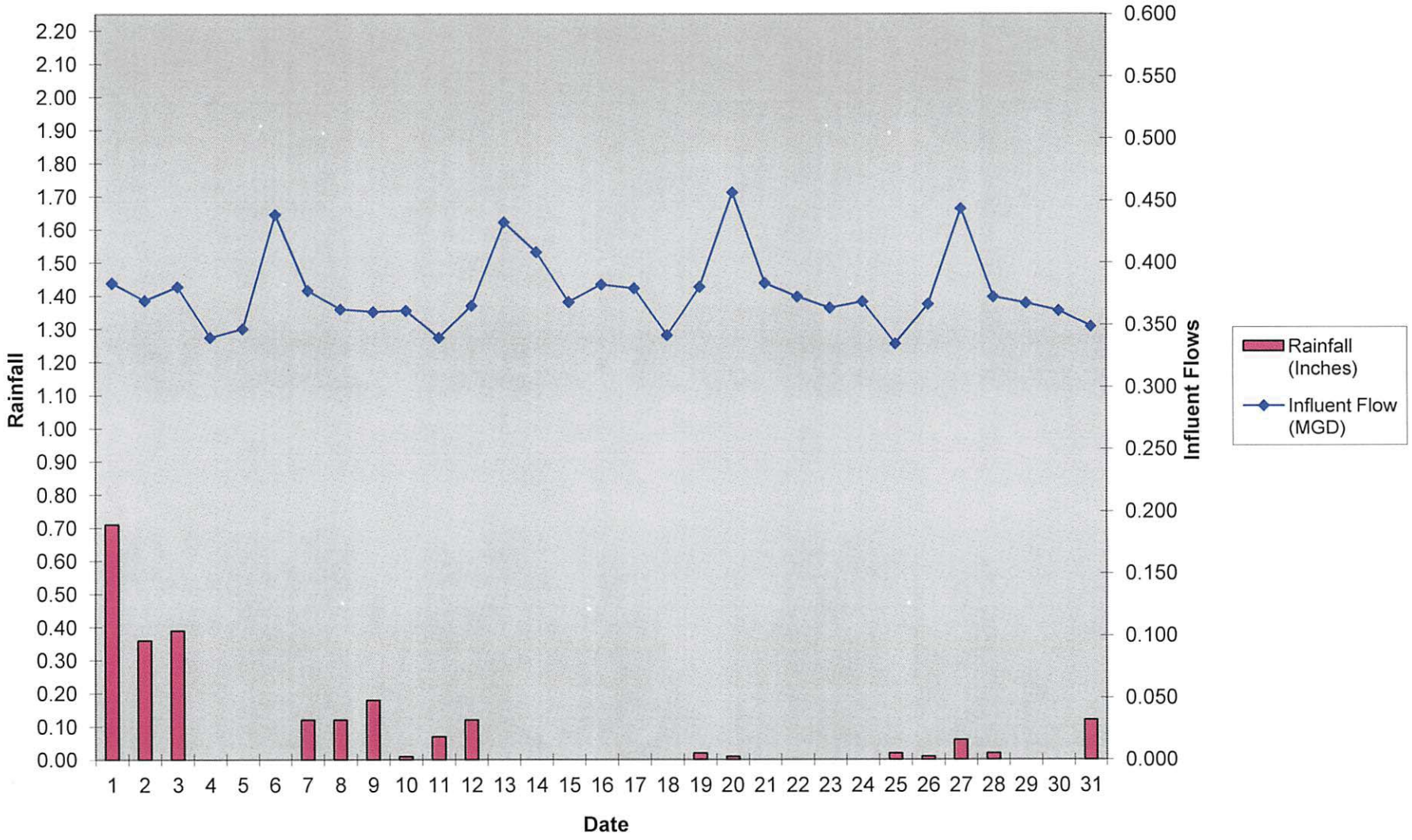
August 2012 Rainfall and Influent Flow

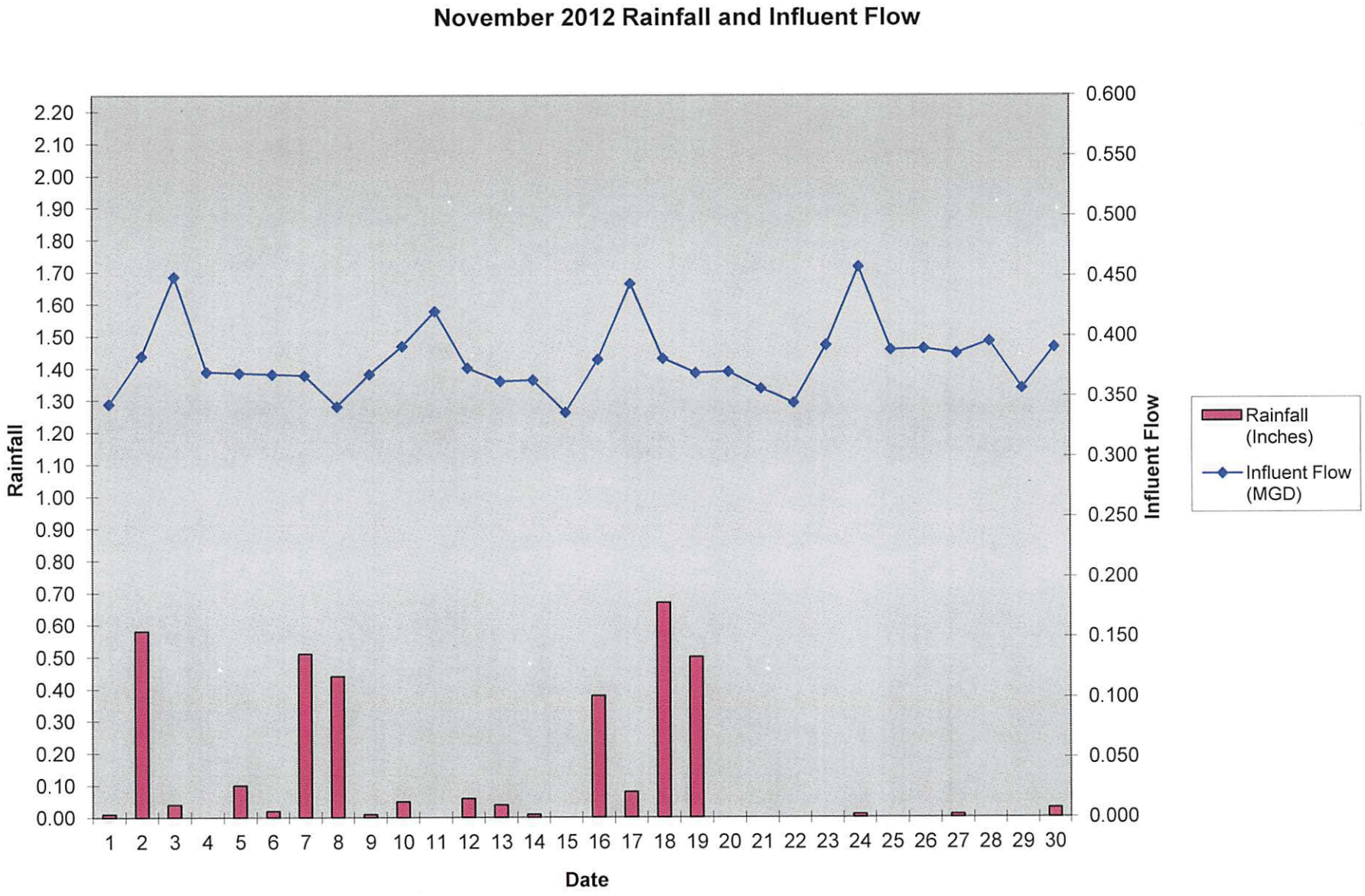


Sept. 2012 Rainfall and Influent Flow

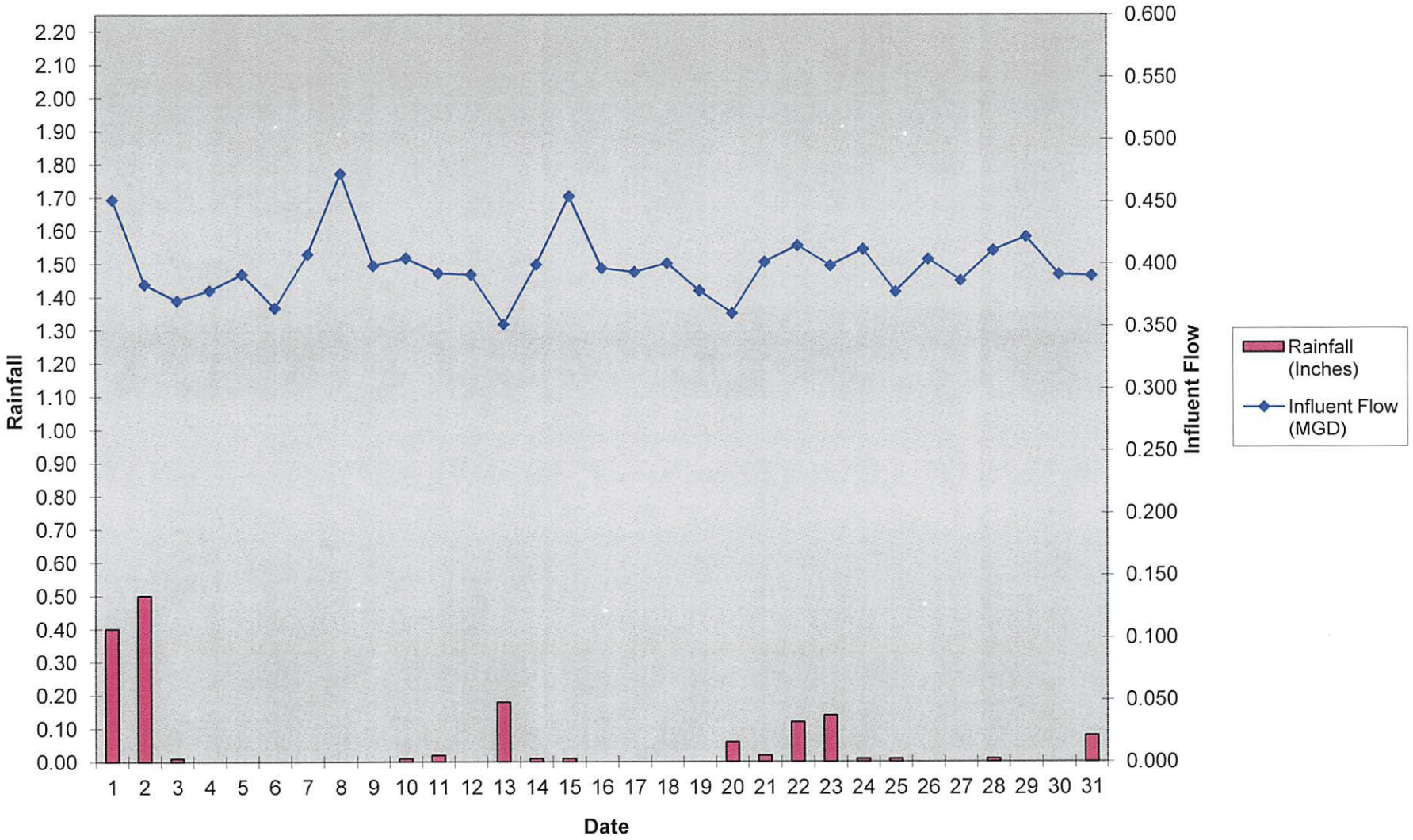


October 2012 Rainfall and Influent Flows




November 2012 Rainfall and Influent Flow
Rainfall
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Influent Flow
0.600
0.550
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Date
Rainfall (Inches)
Influent Flow (MGD)

December 2012 Rainfall and Flows



Appendix B

Yelm Comprehensive Plan: Public Facilities and Utilities

Chapter 5 of the *City of Yelm Comprehensive Plan and Joint Plan with Thurston County*

V. Public Facilities & Utilities

A. Introduction

Note: A list of the goals and policies applicable to the unincorporated portion of the Yelm Urban Growth Area is located in Exhibit G.

The purpose of this section is to identify relevant plans for public facilities (sewer and water) and private utilities (electricity, gas, phone, cable, and garbage) and to assure such plans serve the urban area in a manner consistent with this Plan.

B. County-Wide Planning Policies

The following county-wide policies are adopted within the Urban Growth Area to guide utility development:

2.1 Concentrate development in growth areas by:

a. Encouraging infilling in areas already characterized by urban growth that have the capacity to provide public services and facilities to serve urban development;

b. Phasing urban development and facilities outward from core areas;

. . .

e. Where urban services & utilities are not yet available, requiring development to be configured so urban growth areas may eventually infill and become urban.

. . .

2.2 Coordinate urban services, planning and standards through:

a. Coordinated planning and implementation of urban land use, parks, open space corridors, transportation, and infrastructure within growth areas;

. . .

e. Phasing extensions of urban services and facilities concurrent with development; and

f. No extensions of urban services and facilities, such as sewer and water, beyond urban growth boundaries except to serve existing development in rural areas with public health or water quality problems.

2.3 Provide capacity to accommodate planned growth by:

a. Assuring that each jurisdiction will have adequate capacity in transportation, public and private utilities, storm drainage systems, municipal services, parks and schools to serve growth that is planned for in adopted local comprehensive plans;

. . .

5.1 Develop financing methods for infrastructure which minimize the taxpayer's overall burden and fairly divide costs between existing and new development.

. . . .

Thurston County-Wide Policies, adopted August 16, 1993.

C. Public Facilities

1. General Policies

a. Location of Facilities

The City of Yelm is the sewer and water provider within the Urban Growth Area. It is the policy of the City to extend sewer and water facilities only within the City limits and to require annexation of unincorporated areas to receive public facilities. Exemptions will be made on a case-by-case basis, but only when (1) necessary to solve an existing environmental problem, (2) approved by Thurston County, and (3) adequately funded to avoid any costs to City, taxpayers, and ratepayers.

b. Funding of New Facilities

Development regulations must provide for adequate financing tools, including local improvement districts, latecomer agreements, impact fees, and other devices to assure that the cost of growth is fairly apportioned between existing and new development.

2. City Water

a. Current System/Capacity

The City of Yelm is served by three wells, two storage tanks, and a combination of old and newer distribution pipes. There is currently a need to repair some of the older distribution pipes. There is also an existing need for improvements to the disinfection system.

Water supply and storage capacity meet the present demand, since the City can physically serve 1,542 connections and has existing storage for at least 2,000 connections. A detailed description of the system is included in the Water Comprehensive Plan, dated August 1994, which is adopted as Appendix B, to this Comprehensive Plan.

As Yelm's population increases, however, new water sources, storage, and water lines will need to be expanded, upgraded, or acquired. Additionally, there are existing deficiencies in the fire flow capacity of properties located at the eastern and northwest ends of the service zone, as well as certain specialized uses, such as schools and industrial areas. The City has an ongoing program to acquire water rights to assure adequate capacity to serve the growing population. Yelm currently has adequate water rights in process to serve the existing population and the anticipated growth for at least 20 years. If adequate water cannot be obtained due to lack of resources, annexations would not proceed and development would be limited to existing rights. Under such circumstances the land use plans would have to be reconsidered.

Certain administrative improvements are recommended which will benefit the existing system as well as future expansion. These include establishing well-head protective zones around the City's wells in the Urban Growth Area in order to prevent contamination of the wells by incompatible land uses or activities conducted within the aquifer recharge area of the wells.

b. Proposed System Improvements

The water system improvements are identified in Chapter 3.0 of the Water Comprehensive Plan and funding sources are in Chapter 4.0 of the Plan. To summarize, there is in the near term a need for a fourth well, second and third storage reservoirs, and additional distribution lines to accommodate the anticipated population growth during the first part of this 20-year planning cycle. Mid-way through the 20-year planning cycle, it is anticipated that new population growth will require a fifth, high-yield well.

c. Levels of Service (LOS)

For planning and concurrency purposes, the City requires 300 gallons per day per connection and 750 gallons per minute peak fire flow capacity in residential areas and Uniform Fire Code criteria for industrial and commercial areas, together with a reserve capacity of 15%. Thirty percent of the City's existing water rights

are set aside for industrial development. Commercial and institutional users are required to meet Uniform Fire Code minimums and demonstrate capacity in the system without infringing on residential reserve and light industrial reserve flows.

3. City Sewer

a. Current System/Capacity

Detailed information about Yelm's sewage system can be found in the Comprehensive Sewer Plan, dated August 1994, which is incorporated herein as a stand-alone, Volume 4, Appendix C.

Yelm is presently served by a Septic Tank Effluent Pump (STEP) sewer plant permitted for 3 million gallons per day of discharge to the Centralia Power Canal. The system serves only a portion of the existing city limits. Thirty percent of the system capacity is allocated to non residential uses. The balance of the present system is designed to meet corrective needs in the existing city limits due to old or failing septic tanks.

b. Proposed System

Future waste water disposal to serve new growth outside the presently-sewered area is intended to be through reuse and recycling. The program is intended to be accomplished by treating the effluent to a reusable level and then recycling throughout the City. Irrigation, industrial use, and wetland recharge are all targeted uses. The plan is described in greater depth in the Pilot Project description outlined in Yelm's Comprehensive Sewer Plan (see Volume 4/ Appendix C.)

A priority of the City is to identify a variety of permitted disposal/irrigation sites which will allow growth areas to be designated for sewered growth. Site-specific reuse/recycle areas should be identified within all sewered Sub-Areas to reduce transportation costs. Up to 10% of the land area in a Sub-Area may be used to recycle treated water. Such land area may be in parks, open spaces, or critical areas, and will often be incorporated into a specific project.

The City is developing the treatment and storage facilities. These facilities serve the existing system and form the core of the new system. The key to system expansion will be identification and approval of recycle-reuse discharge areas. As new areas inside the City are identified for development and permitted for recycled

water discharge, land use designations identified on Map 3 will become effective.

Different strategies for waste water disposal will be used throughout the City. The mitigation and concurrency strategy for every proposed development will be to identify and fund a fair share of the costs of developing an approved discharge area.

The City will develop guidelines and mitigation requirements, as well as compensation and reimbursement mechanisms (such as local improvement districts and latecomers agreements) to facility development of such areas.

c. Level of Service (LOS)

Each residential unit will require the City to collect, treat, and discharge approximately 240 gallons per day per unit, together with an appropriate reserve area and buffers where required for discharge. Each commercial or light industrial user, outside the present discharge service area, shall be assessed based on the Equivalent Residential Unit (ERU) daily rate. Development standards shall identify the correlation to be used for industrial and commercial users.

d. Non-Sewered Areas

The City considers a septic system a temporary system within the urban area and incompatible with long-term urban densities. Development standards shall be developed to identify the timing and nature of funding and conversion obligations for septic systems in the urban area. Groundwater monitoring is appropriate in areas under septic tank management.

Most of Yelm is in an area of extreme aquifer sensitivity. The current sewage treatment plan was required due to groundwater pollution concerns. For this reason, development at urban levels of density on septic tanks is not in the public interest.

Many areas within the Urban Growth Area are already on septic tanks. In addition, some development will likely occur at one unit per five acres density on septic tanks within the unsewered areas of the City and the Urban Growth Area.

The City will permit development in non-sewered areas with low densities on septic tanks. Such installations must be prepared to transfer to the sewer line when facilities are available and hook-up

required under the criteria set forth in the development standards. The County would follow similar guidelines in the unincorporated Urban Growth Area.

The City should consider developing a septic tank maintenance program, directly or in connection with Thurston County, to monitor and maintain the septic systems in place or allowed in the urban areas. The City considers septic tanks in the Urban Growth Area as an interim use to be changed to sewer as identified in appropriate development regulations.

On a case-by-case basis, the County may identify areas proposed for outside the Urban Growth Area where existing development patterns are such that long-term septic service, with adequate public maintenance and supervision, may continue in the long term without sewer service. Such areas may require City water or sewer service should a public health problem arise and adequate funding be identified to avoid fiscal impact to the City.

4. Stormwater

Stormwater control is important for both flood protection and water quality and groundwater protection. Yelm has no specific detention/retention facilities as existing soils and ditches are adequate to meet present need. Development regulations should identify criteria for stormwater discharge, retention, and treatment on all new development. Such regulations should be coordinated with the wastewater reuse/recycling plans presently under study.

The basic stormwater program principles identified by the Puget Sound Water Quality Authority and the DOE-approved Thurston County Drainage Design and Erosion Control Manual should be considered a guide in the development regulations in establishing the Yelm Area Drainage Design and Erosion Control Manual for stormwater treatment, detention, and release.

5. School Districts

The Yelm School District and the Rainier School District serve the Urban Growth Area. The Rainier School District jurisdiction will be developed in conjunction with the overall plan for the Thurston Highlands' portion of the Southwest Sub-Area. The remaining planning area is within Yelm School District No. 2. That District currently has a high school, a middle school, an intermediate (grades 5-6) school, an alternative high school and three elementary schools within Yelm's Urban Growth Area. The Yelm School District has an additional elementary school in Pierce County and

approximately 20% of the students live in Pierce County. In 1994, the Yelm School District's growth was 180 students from last year and the District now instructs a total enrollment of 4,000 students. Based on current growth projections, student population will grow by approximately 6,000 students during the next 20 years. All future schools will need to be constructed within Yelm's Urban Growth Area to meet the requirements of utilities and land use. Within the next six years, a new intermediate school and a new elementary school will need to be built.

The District intends to identify and recommend appropriate and reasonable mitigation measures to be imposed upon approvals given and permits issued to those residential single-family and multi-family developments within the District boundaries that adversely impact the District. The City's policy is to encourage the adequate and timely development of facilities and will work with the District to identify development regulations to accomplish the District's objectives within the guidelines of Chapter 28.02 RCW.

6. Libraries

Yelm is served by the Timberland Regional Library. The City supports efforts to obtain levels of service established by the Timberland program for Yelm and surrounding rural areas. Target facilities for Yelm will include about 1.66 square feet of library space per capita or 20,000 feet to serve the 11,999 projected population. Yelm also supports innovative technology to achieve wider distribution without fixed facilities, including mobile programs and computer access technology.

D. Private Utilities

The purpose of this section is to identify the general existing location, proposed location, and capacity of all existing and proposed utilities affecting the Urban Growth Area, including but not limited to electrical lines, telecommunication lines, and natural gas lines (RCW 36.70A.070(4)). For Yelm, these utilities are provided by state regulated utilities, federally licensed communications companies, and a municipally franchised cable TV company. The electric utility that serves Yelm is Puget Sound Power & Light Company (Puget Power); the natural gas utility is Washington Natural Gas (WNG); the telephone utility is Yelm Telephone Company (YTC); cable services are provided under municipal franchise by VIACOM Cablevision and the Yelm Telephone Company. The electric, natural gas, and telephone utilities are regulated by the Washington Utilities and Transportation Commission (WUTC).

1. Electrical Utility

Puget Power builds, operates, and maintains the electrical system serving the City of Yelm. Puget Power is a private, investor-owned utility with the responsibility for providing service to approximately 800,000 metered customers in a nine county service area in Western and Central Washington.
The system serving Yelm is part of a larger service area called the Thurston County area, which is roughly the boundaries of Thurston County. The area includes the entire cities of Bucoda, Lacey, Olympia, Rainier, Tenino, Tumwater, and Yelm; and unincorporated Thurston County.

Puget Power imports electrical energy from generation sources in Canada, on the Columbia River, and from other generation sites inside and outside of Puget Power's service territory. Puget Power also owns and operates generation facilities.

Based on Thurston Regional Planning Council population and employment forecasts for the next 20-30 years, Puget Power estimates that there will be a peak winter load of approximately 753 MVA (Mega or million volts amperes) in the Thurston County area in the year 2010. In comparison, the winter peak load today is approximately 500 MVA. New facilities, including transmission lines and substations, and distribution systems, may have to be added or expanded in order to reliably transmit the electrical energy projected to be required in Puget Power's service areas.

The existing location of Puget Power facilities and lines is shown on the attached map, Appendix G-1A. A general estimate of current capacity of the Puget Power system within the Yelm Urban Growth Area is 17 MVA, plus or minus 2 MVA. Since the substations serving the Yelm proposed Urban Growth Area also supply power to customers outside of the area, a precise estimate is not available.

The general location of proposed future electrical transmission lines and substations are schematically depicted on the maps contained in Volume 5/Appendix G-1A. The exact locations of future facilities and transmission lines may vary. The proposed facilities are intended to improve both service reliability to existing customers and to accommodate future growth. It reflects Puget Power's projected future demand of approximately 30 MVA for a peak winter load in Yelm's proposed Urban Growth Area.

Descriptions, maps, and inventories of existing, in-progress, and proposed electrical transmission facilities improvements intended to serve local and

regional needs are presented and described more fully in Puget Power's Thurston County Draft GMA Electrical Facilities Plan, 1992" (see Volume 5/Appendix G-1).

2. Natural Gas Utility

Washington Natural Gas (WNG) builds, operates, and maintains natural gas facilities serving the City of Yelm. WNG is an investor-owned utility serving nearly 400,000 customers in five western Washington counties including King, Snohomish, Pierce, Thurston, and Lewis Counties.

Natural gas is supplied to the City of Yelm through a gate station from Northwest Pipeline Corporation. At the station, the gas is metered and becomes the responsibility of the Washington Natural Gas Company (WNG).

Yelm is served from the Yelm gate station through two inch mains operating at supply pressures between 200 and 250 pounds per square inch (psi). Distribution pressures are decreased to between 20 and 60 psi. The pressure varies depending on the weather and time of day.

Washington Natural Gas Company records show 176 customers in June 1982 and 278 customers as of June 1992. WNG's existing distribution is shown on the map included in Volume 5/Appendix G-2A. WNG's proposed improvements and expansion are shown on the map included in Volume 5/Appendix G-2B.

Generally, WNG engages in two types of construction activities:

a. Supplying natural gas to a new building
b. Converting a building from an alternate fuel to natural gas

Because the timing of this type of construction is difficult to predict, WNG responds on a case-by-case basis. Therefore, precise figures on the amount and type of new building or conversion-related construction are not available.

WNG also plans construction aimed at improving service to an area showing a need for increased capacity. From an engineering design standpoint, the minimum pressure at which natural gas can be delivered is 15 pounds per square inch (psi). If the pressure drops below 15 psi, there are several ways to increase the pressure in the line. Each method requires construction activity. Following are common methods for increasing supply to an area:

a. "Looping" the distribution and/or supply lines to provide an alternate route for the natural gas to travel to an area needing additional supply. This method often involved construction of high pressure mains, district regulators, and intermediate pressure gas mains.

b. Installing lines parallel to existing lines to supplement supply of natural gas to a particular service area.

c. Replacing existing gas mains to increase the volume of natural gas that can be supplied to a particular service area. However, this type of construction is rare, since it is usually more economical to loop gas mains. This increases the potential service area, and provides an alternate route for the natural gas to travel.

d. Recently, WNG has replaced existing gas mains if they are older and street resurfacing or widening would make it difficult to get to the gas mains at a later time.

There are plans to replace the two-inch supply main with an eight-inch main and loop the two-inch distribution main with a six-inch main from the south when developments south of Yelm justify the cost of construction.

There are also plans to service McKenna from the Yelm gate when main extensions are required. No date has been set for either plan.

3. Telephone Utilities

The entire Yelm Urban Growth Area is served by a single, independent telephone company: the Yelm Telephone Company (YTC). YTC has developed a five-year plan for its facilities and their growth and expansion. The five-year plan is included in Volume 5/ Appendix G-3. Because of uncertainty in the timing of growth and the resulting need for utility services, YTC has not planned beyond the five-year horizon.

4. Cable Utilities

Cable telephone services in the City of Yelm are generally provided by Viacom Cablevision. This service provides television broadcasting via a network of overhead and/or underground coaxial cables. Virtually all channels carried on the Yelm cable system originate at Viacom's primary transmitter site located in Tacoma.

Viacom's Yelm cable system has the technical capacity to serve any anticipated new development in the City, as well as any potential areas of annexation. The Viacom system in Yelm was designed at 550 mghz and

built to 450 mghz capacity. The total number of customers in the Yelm city limits, as of August 6, 1994 is 1,235.

The City of Yelm recently approved a franchise for the addition of a second cable utility, owned by Yelm Telephone Company. YTC has not yet developed a plan for its cable facilities.

5. Solid Waste Utility

The City of Yelm currently contracts with a private company for the collection and disposal of garbage and recyclables. Any and all properties within the City's limits are and will continue to be served by the services rendered under a solid waste contract. The City is presently exploring commercial recycling opportunities and alternatives.

The City's expansion of its city limits is dependent upon availability of adequate capacity for disposal of solid waste.

E. Overall Goals and Policies

GOAL 1: To facilitate the development and maintenance of all public facilities and utilities at the appropriate levels of service to accommodate the growth that is anticipated to occur in the City of Yelm.

Policy 1-1: The serving utility shall determine the sequence of implementing components of the utility plan as contained herein.

GOAL 2: To facilitate the provision of public facilities and utilities and to ensure environmentally sensitive, safe, and reliable service, that is aesthetically compatible with the surrounding land uses and results in reasonable economic costs to consumers.

Policy 2-1: Promote when reasonably feasible co-location of new public and private utility distribution facilities in shared trenches and coordination of construction timing to minimize construction-related disruptions to the public and reduce the cost to the public of utility delivery. Provide timely effective notice to utilities to encourage coordination of public and private utility trenching activities for new construction and maintenance and repair of existing roads.

Policy 2-2: Promote the joint use of transportation rights of way and utility corridors, where possible, provided that such joint use is consistent with limitations as may be prescribed by applicable law and prudent utility practice.

Policy 2-3: Require the undergrounding of all new electrical distribution and communication lines where reasonably feasible. Encourage the undergrounding of all existing electrical distribution and communication lines when it is reasonably feasible. Undergrounding shall be in accordance with rates and tariffs applicable to the serving utility.

Policy 2-4: Require the reasonable screening and/or architecturally compatible integration of all new site-specific above ground facilities.

Policy 2-5: Encourage directional pruning of trees and phased replacement of improperly located vegetation planted in the right-of-way. Pruning and trimming of trees should be performed in an environmentally sensitive and aesthetically acceptable manner and according to professional arboricultural specifications and standards.

Policy 2-6: Encourage the consolidation of utility facilities and communication facilities where reasonably feasible.

Policy 2-7: Facilitate the conversion to cost effective and environmentally sensitive alternative technologies and energy sources.

Policy 2-8: Facilitate and encourage conservation of resources.

Policy 2-9: Follow County guidelines in Chapter 7 of the County Comprehensive Plan for utility coordination between the Urban Growth Areas and rural areas within the unincorporated area.

GOAL 3: To process permits and approvals for public facilities and utilities in a fair and timely manner and in accord with development regulations which encourage predictability.

Policy 3-1: Encourage the cooperation with other jurisdictions in the planning and implementation of multi-jurisdictional public facility and utility additions and improvements. Decisions made regarding utility facilities shall be made in a manner consistent with and complementary to regional demand and resources and shall reinforce an interconnected regional distribution network.

Policy 3-2: Consideration of public facility and utility permits simultaneously with the proposals requesting service and, when

possible, approval of utility permits when the project to be served is approved.

Policy 3-3: Coordination among adjacent planning jurisdictions to ensure the consistency of each jurisdiction's utilities element and regional utility plans including: (i) coordinate the formulation and periodic update of the utilities element and relevant implementing development regulations and (ii) coordinate procedures for making specific land use decisions to achieve consistency of timing and substantive requirements.

Policy 3-4: Ensure that development regulations are consistent with and do not otherwise impair the fulfillment of public service obligations imposed by federal and State law.

Policy 3-5: Make decisions with respect to utility facilities so that safe, adequate, and efficient availability of electrical service in other jurisdictions is not negatively affected.

Policy 3-6: Interpret the map designations depicting the general location of proposed facilities as applying to a general corridor rather than to a specific site. Coordinate with utility providers to obtain updated information and, if necessary, revise the maps accordingly.

Appendix C

WRF NPDES Permit

FACT SHEET FOR NPDES PERMIT WA0040762

CITY OF YELM WASTEWATER TREATMENT AND WATER RECLAMATION FACILITY

6/24/05

TABLE OF CONTENTS

INTRODUCTION

The Federal Clean Water Act (FCWA, 1972, and later modifications, 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One of the mechanisms for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES) of permits, which is administered by the Environmental Protection Agency (EPA). The EPA has authorized the state of Washington to administer the NPDES permit program. Chapter 90.48 Revised Code of Washington (RCW) defines the Department of Ecology's (Department) authority and obligations in administering the wastewater discharge permit program.

The regulations adopted by the state include procedures for issuing permits [Chapter 173-220 Washington Administrative Code (WAC)], technical criteria for discharges from municipal wastewater treatment facilities (Chapter 173-221 WAC), water quality criteria for surface and ground waters (Chapters 173-201A and 200 WAC), and sediment management standards (Chapter 173-204 WAC). These regulations require that a permit be issued before discharge of wastewater to waters of the state is allowed. The regulations also establish the basis for effluent limitations and other requirements which are to be included in the permit. One of the requirements (WAC 173-220-060) for issuing a permit under the NPDES permit program is the preparation of a draft permit and an accompanying fact sheet. Public notice of the availability of the draft permit is required at least 30 days before the permit is issued (WAC 173-220-050). The fact sheet and draft permit are available for review (see Appendix A--Public Involvement of the fact sheet for more detail on the Public Notice procedures).

The fact sheet and draft permit have been reviewed by the Permittee. Errors and omissions identified in this review have been corrected before going to public notice. After the public comment period has closed, the Department will summarize the substantive comments and the response to each comment. The summary and response to comments will become part of the file on the permit and parties submitting comments will receive a copy of the Department's response. The fact sheet will not be revised. Comments and the resultant changes to the permit will be summarized in Appendix D--Response to Comments.

GENERAL INFORMATION	
Applicant	City of Yelm 105 Yelm Avenue West P.O. Box 479 Yelm, WA 98597-4079
Facility Name and Address	City of Yelm WWTP 931 N.P. Road NE Yelm, WA 98597-4079
Type of Treatment	STEP collection followed by secondary treatment (SBRs), and coagulation and flocculation with filtration to meet Class A reclaimed water requirements.
Discharge Locations	Outfall #001: Reclaimed water distribution for public and private uses throughout the City to include irrigation, constructed wetlands and surface percolation to ground water. Outfall #002: City of Centralia Power Canal 185 ft. downstream from the Burlington Northern Railroad bridge. The distance from the point of discharge into the canal back to the Nisqually river is

	~3.04 miles. (Standby Outfall) Latitude: 46º 57' 21" N Longitude: 122º 35' 08" W. Outfall #003: Nisqually River @ RM 19.8 (Used only when the power canal is shut down for inspection and unable to produce or use 100 percent reclaimed water upland) Latitude: 46º 57' 36" N Longitude: 122º 34' 21" W.
Water Body ID Number	WA-11-1020 (Nisqually River from Murray CR. @ RM 19.1 to Alder Dam @ RM 44.2)

BACKGROUND INFORMATION

DESCRIPTION OF THE FACILITY

HISTORY

The City of Yelm (City) is located approximately 15 miles southeast of Olympia. The City is bordered on the northeast by the Nisqually River and on the northwest by Fort Lewis. The existing corporate boundaries encompass about 5.4 square miles and the UGA covers about 9.5 square miles. The City population is currently 4,500 with a projected growth, to about 18,000 by the year 2014.

In 1988, due to high levels of nitrates from septic tank drainfields, the Thurston County Health Department cited the water supply of Yelm as a potential serious health hazard. The City of Yelm was required to install a sanitary sewer collection system and treatment plant to correct the problem. With the aid of state and federal grants and loans a Septic Tank Effluent Pump (STEP) sewer system and 0.3 MGD two-stage aerated lagoon treatment plant were constructed and put into service in January 1994. The STEP system replaced the septic tanks and drain fields that were the source of the nitrates found in the groundwater.

The treatment plant was constructed with an outfall to both the Centralia Power Canal as the primary discharge point, and to the Nisqually River as a standby discharge point. The shoreline permit (SH-TCO-92-012) for the project required that the discharge point to the Nisqually River be removed by March 1997, and the discharge to the Power Canal be converted to a standby outfall only, by March 1999 (extended to the year 2001). This stipulation prompted Yelm to pursue a water reuse program to treat its wastewater to tertiary levels and reuse 100 percent of the reclaimed water for landscape irrigation, ground water recharge by surface percolation and other uses around the City.

The lagoon treatment plant was not capable of providing the means for the necessary treatment to attain "Class A" reuse quality. Also, the treatment plants capacity of 0.30 MGD was not adequate to meet the projected growth demands of the City. Consequently the lagoon treatment system was replaced by a Sequence Batch Reactor (SBR) with tertiary facilities consisting of coagulation, flocculation and settling, rapid-sand filtration, and chlorine disinfection. The new facility increased capacity to 1.0 MGD with the ability to add an additional 1.2 MGD expansion to the treatment facility in the future to meet growth projections.

The City of Yelm does not currently have options for 100 percent reuse year round so the Shoreline Permit was renegotiated to allow the City to maintain the Nisqually River outfall as an emergency outfall only and the Centralia Power Canal outfall as a standby outfall.

COLLECTION SYSTEM STATUS

To replace the failing septic tanks and drain fields, a primary treatment and collection system was installed in January 1994. The system utilizes the STEP system consisting of septic tanks, effluent pumps, and force mains which transport the effluent from septic tanks to the wastewater treatment facility through a pressure collection system.

Each residence, apartment and commercial/industrial customer that is connected to the STEP system is furnished with a new STEP tank and pumping system which is owned and maintained by the City. This system provides a pressure collection system which reduces the problems of inflow and infiltration associated with gravity collection systems. The system to date has been very water tight.

There are approximately 720 connections and 16,000 lineal feet of STEP collection line servicing a population of about 2,000 people. The current STEP collection system serves the downtown area and the Kings View development NW of the treatment plant. Since 1991, several large annexations have added over 2,200 acres to the existing city limits. It is anticipated that the STEP service area will encompass the entire urban growth boundaries of the City by the year 2015.

TREATMENT PROCESSES

Wastewater enters the plant through a 12" PVC STEP force main at an influent control structure with an influent riser that has an overflow weir at elevation 347.50' which is higher than any point in the service area to keep all of the pressure collection force mains full. The wastewater then flows by gravity to the SBRs. There are three cells at 0.6 million gallons each, only two cells are needed at a time for the sequencing operation and the third is used as a standby. Decant water from the SBRs flows by gravity to the equalization basin with five surface aerators and a volume of 1.8 million gallons. Flow is pumped from the equalization basin to the tertiary treatment area where alum/polymer is added and mixed through an inline static mixer to the granular media (GM) (Dynasand) filters. Flow from the GM filters is then chlorinated and runs through a 34,000 gallon contact chamber before being discharged through an effluent weir. If the quality of the water meets the State's Water Reclamation Criteria and there is a demand for reuse water, the reclaimed water is pumped to its' beneficial use. If there is insufficient demand for the reuse water or the water does not meet the reclaimed water standards, but does meet the surface water standards, the water is dechlorinated and discharged through the standby outfall in the Centralia Power Canal. In emergency situations, secondary effluent could be discharged to the outfall located on the Nisqually River.

DISCHARGE OUTFALL

Outfall #001 Class A Reclaimed Water - The system to distribute reclaimed water to various points of application throughout the city consist of a primary pump station located at the plant and several miles of various sizes of Class 200 PVC piping and valving.

The points of application of reclaimed water consist of constructed wetlands located at Cochrane Park followed by infiltration basins. Irrigation projects include City Park, Cochrane Park, Yelm Middle School, Yelm High School, sidewalk planter strips, and rails to trails landscaping..

Outfall #002 Centralia Power Canal - The City of Yelm has a signed agreement with the City of Centralia to discharge effluent from the Yelm wastewater treatment plant to the Centralia Power Canal which then flows approximately 3.04 miles back to the Nisqually River. The agreement includes a condition that the City of Yelm shall cease discharge to the canal whenever the canal must be shut down for maintenance, inspection or anytime flow in the canal drops below 200 cfs.

The outfall is an open ended 12" HDPE pipe side bank discharge and facing downstream is located on the left bank of the canal. The outfall was not submerged to allow canal officials to inspect the outfall for debris entering the canal.

Outfall #003 Bypass Reach of the Nisqually River at the Yelm Hydroelectric Project - The Nisqually River outfall line is a submerged 7" HDPE pipe in a ductile iron sleeve with a tideflex check valve extending approximately 12 feet from the bank and facing downstream is located on the left bank of the Nisqually River.

7-Q-10 LOW FLOW

Low flow in the Nisqually River is controlled by Alder and LaGrande Dams. The dams are operated by Tacoma Power under an instream flow agreement and its FERC license. The Instream Flow Agreement was negotiated in context of Centralia's relicensing of the Yelm Diversion Hydroelectric project. This agreement was formally adopted by the Nisqually River Coordinating Council (NRCC) and recommended to FERC. The adoption of instream flows was preceded by nearly ten years of flow-related studies and negotiations by several agencies and the Tribe. This agreement and subsequent arbitration resulted in the promulgation of Chapter 173-511 WAC pursuant to Chapters 90.54 and 90.22 RCW. As a result of that agreement Tacoma City Light is required to release flows from LaGrande Dam which are sufficient to maintain minimum flows in the mainstem and the by-pass section of the Nisqually River at the Yelm Diversion Hydroelectric Project, as follows:

	Bypass	Mainstem
October 1 - December 15	550 cfs	700 cfs
December 16 - May 31	600 cfs	900 cfs
June 1 - July 31	500 cfs	750 cfs
August 1 - September 30	370 cfs	575 cfs

The lowest flow in the bypass section of the Nisqually River during the critical period from August 1, to September 30, must equal or exceed 370 cfs and will be used as the 7-Q-10 low flow for the bypass reach of the Nisqually River at the Yelm Diversion Hydroelectric Project.

The 7-Q-10 low flow in the Power Canal was based on the agreement signed by the City of Yelm and the City of Centralia for use of the canal by Yelm as a discharge point for their wastewater discharge. The use agreement signed November 26, 1991, stipulates that whenever the flow in the canal drops below 200 cfs the City of Yelm is required to divert their reclaimed water discharge to an alternate discharge point. Centralia is required to provide as much notice as is reasonably possible to Yelm whenever the flow in the canal might drop below 200 cfs and Yelm is required to immediately divert their effluent flow from the canal. Therefore the 7-Q-10 low flow for the Power Canal will be 200 cfs.

RESIDUAL SOLIDS

The first stage of treatment in a STEP system is the individual tanks located at residences and businesses throughout the City where residual solids accumulate. Residential tanks will be measured on a three-year average and commercial tanks on an as needed basis. Once accumulation of sludge in the tanks has reached a pre-determined level ($\pm$ 40 percent of volume) the sludge in the STEP tanks will be removed and properly disposed.

At the treatment plant, sludge will be generated through biological treatment using the SBR operating system which develops excess biological organisms or waste sludge. The total amount of sludge expected

to be produced, including alum sludge, is estimated as approximately equivalent in pounds per day as the BOD loading on the treatment plant.

Waste sludge from the SBRs are stored in a solids holding vault and periodically pumped to the solids handling facility which includes polymer addition and a gravity belt thickener to produce sludge with a three to four percent solids content.

The City has contracted with a Bio-recycling in Shelton to haul sludge from the WWTF away for further processing and land application by the sludge hauler. The STEP tank sludge is pumped and hauled away for processing by Bio-recycling in Ground Mound.

PERMIT STATUS

The previous permit for this facility was issued on October 5, 1999. The previous permit placed effluent limitations on the reclaimed water discharge for Class A Reuse, the Nisqually River and Centralia Power Canal discharge for secondary standards and water quality parameters, and ground water requirements for surface percolation of reclaimed water.

An application for permit renewal was submitted to the Department on December 4, 2003, and accepted by the Department on January 16, 2004.

SUMMARY OF COMPLIANCE WITH THE PREVIOUS PERMIT

The facility received its last inspection on April 7, 2004. The plant was operating well at the time of the inspection. It was noted the easement to the Nisqually River outfall was blocked and an alternative route would have to be secured. The easement blockage has since been removed and an alternative route secured.

During the history of the previous permit, the Permittee has had a few violations of total coliforms, ammonia and total nitrogen. The chlorine residual was increased above 4.5 mg/L in order to get a total kill on the coliform organisms. The coliforms were also speculated to determine the source and nature of the coliform organism. Work continues on determining why these occasional permit excursions occur for total coliforms. Other reclaimed water facilities have experienced similar problems with total coliforms. The ammonia and total nitrogen excursions seem to be weather related. Yelm has hired a consultant to look into process changes to help eliminate the nitrogen excursions.

WASTEWATER CHARACTERIZATION

The concentration of pollutants in the discharge was reported in the NPDES application and in discharge monitoring reports. The effluent is characterized as follows:

Table 1: Wastewater Characterization

Parameter	Annual Average Values
Discharge Flow	0.2 MGD AAF
Biochemical Oxygen Demand	2.7 mg/L
Total Suspended Solids	1.0 mg/L
Total Residual Chlorine	0.025 mg/L
Ammonia (as N)	0.8 mg/L
Dissolved Oxygen	9.3 mg/L
pH	Max. 8.5 s.u. – Min. 6.9 s.u.
Temperature	17ºC Summer – 9ºC Winter
Hardness	71 mg/L
Alkalinity	126 mg/L

Conductivity	515 UMHO/CM
TKN	3 mg/L
Nitrate	3 mg/L
Total Coliforms	0.0 org/100 mL

PROPOSED PERMIT LIMITATIONS

Federal and state regulations require that effluent limitations set forth in a NPDES permit must be either technology- or water quality-based. Technology-based limitations for municipal discharges are set by regulation (40 CFR 133, and Chapters 173-220 and 173-221 WAC). Water quality-based limitations are based upon compliance with the Surface Water Quality Standards (Chapter 173-201A WAC), Ground Water Standards (Chapter 173-200 WAC), Sediment Quality Standards (Chapter 173-204 WAC) or the National Toxics Rule (Federal Register, Volume 57, No. 246, Tuesday, December 22, 1992.) The most stringent of these types of limits must be chosen for each of the parameters of concern. Each of these types of limits is described in more detail below.

The limits in this permit are based in part on information received in the application. The effluent constituents in the application were evaluated on a technology- and water quality-basis. The limits necessary to meet the rules and regulations of the state of Washington were determined and included in this permit. The Department does not develop effluent limits for all pollutants that may be reported on the application as present in the effluent**.** Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, and do not have a reasonable potential to cause a water quality violation**.** Effluent limits are not always developed for pollutants that may be in the discharge but not reported as present in the application. In those circumstances the permit does not authorize discharge of the non-reported pollutants. Effluent discharge conditions may change from the conditions reported in the permit application. If significant changes occur in any constituent, as described in 40 CFR 122.42(a), the Permittee is required to notify the Department. The Permittee may be in violation of the permit until the permit is modified to reflect additional discharge of pollutants.

Due to conditions in the shoreline permit (SH-TCO-92-012) to maintain the outfall on the Nisqually River as an emergency outfall only and use of the outfall on the Power Canal as a standby outfall, the Permittee has committed to continuously generate and distribute Class A reclaimed water. The standards for reclaimed water are technology-based standards outlined in the states Water Reclamation and Reuse Standards, publication #97-23. For parameters addressed in the reclaimed water standards, the limitations are equal to or more stringent than the technology-based or water quality-based standards required by federal and state law. For those parameters not addressed in the reclaimed water standards, the appropriate technology-based or water quality-based standards have been applied.

DESIGN CRITERIA

In accordance with WAC 173-220-150 (1)(g), flows or waste loadings shall not exceed approved design criteria. The design criteria for the upgraded treatment facility were taken from the facilities plan prepared by Skillings/Connolly Inc., Consulting Engineers and are as follows:

Table 2: Design Standards for City of Yelm Water Reclamation Facility.

Parameter	Design Quantity
Monthly average flow (max. month)	1.0 MGD
Instantaneous peak flow	1.5 MGD
BOD_5 influent loading	1,500 lbs/day
TSS influent loading	430 lbs/day

Parameter	Design Quantity
Design population equivalent	7,423

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

Municipal wastewater treatment plants are a category of discharger for which technology-based effluent limits have been promulgated by federal and state regulations. These effluent limitations are given in the Code of Federal Regulations (CFR) 40 CFR Part 133 (federal) and in Chapter 173-221 WAC (state). These regulations are performance standards that constitute all known available and reasonable methods of prevention, control, and treatment for municipal wastewater.

The following technology-based limits for BOD_5, and TSS are taken from Chapter 173-221 WAC, the limit for Total Residual Chlorine is derived from standard operating practices according to the Water Pollution Control Federation (1976), the standards for Total Coliform Bacteria and Turbidity were taken from the states Water Reclamation and Reuse Standards, publication #97-23:

Table 3: Technology-based Limits.

Parameter	Limit
pH (Outfall #002)	Shall be within the range of 6 to 9 standard units
BOD_5 (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L
TSS (concentration)	Average Monthly Limit is the most stringent of the following: - 30 mg/L - may not exceed fifteen percent (15%) of the average influent concentration Average Weekly Limit = 45 mg/L
Total Residual Chlorine (Outfall #002)	Average Monthly Limit is 0.5 mg/L, and according to WAC 173-221-030(11)(b), the corresponding weekly average = 0.75 mg/L
Total Coliform Bacteria (Outfall #001)	Average Weekly Limit is 2.2 count/100 mL and the sample maximum is 23 count/100 mL.
Turbidity (Outfall #001)	Average Monthly limit is 2 NTU and the sample maximum is 5 NTU

The technology-based monthly average limitation for chlorine is derived from standard operating practices. The Water Pollution Control Federation's Chlorination of Wastewater (1976) states that a properly designed and maintained wastewater treatment plant can achieve adequate disinfection if a 0.5 mg/liter chlorine residual is maintained after fifteen minutes of contact time. See also Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Third Edition, 1991. A treatment plant that provides adequate chlorination contact time can meet the 0.5 mg/liter chlorine limit on a monthly average basis. According to WAC 173-221-030(11)(b), the corresponding weekly average is 0.75 mg/liter.

Federal and state regulations require Publicly Owned Treatment Works (POTW) to remove 85 percent of BOD and TSS from the influent wastewater. This removal requirement is difficult to assess in a STEP system which utilizes septic tanks as part of the treatment system. Septic tanks remove settleable solids and provide a limited amount of digestion of organic matter of domestic wastewater. For POTWs that receive domestic sewage after treatment in septic tanks (STEP system), the BOD_5 and solids removal in

the septic tanks is considered an integral part of the treatment process for BOD_5 removal. Since it is impractical to measure the actual BOD_5 and solids entering the septic tanks, compliance with the 85 percent removal requirement will be assumed if the effluent concentration for BOD_5 and TSS meets 30 mg/L, and there is no excessive inflow and infiltration (I/I). Excessive I/I is defined by U.S. EPA criteria:

> Infiltration is excessive when the highest 7-14 day average daily dry weather flow is greater than 120 gallons per capita per day.
>
> Inflow is excessive when the highest recorded daily flow during a storm event is greater than 275 gallons per capita per day or when hydraulic overloading of the treatment plant occurs.

If the EPA screening criteria for I/I is not exceeded, the presumption is that the raw sewage influent would be at least 200 mg/L if the septic tanks were not present. These screening criteria apply regardless of whether the I/I can be cost effectively removed. Therefore, complying with the 30 mg/L effluent BOD_5 concentration limit means that the 85 percent removal requirement is also achieved.

If the EPA screening criteria are exceeded, the City will be required to implement a rehabilitation program to reduce I/I. The program will be agreed upon between the Department and the City, and the details (schedules, work plan, financial commitment) will be incorporated into an administrative order.

The permit will require:

> Monitoring and reporting of the influent BOD_5 and the percent BOD_5 removal accomplished at the WWTP.
>
> Annual reporting of the highest 7-14 day average daily dry weather flow rate and the highest 24-hour per capita daily flow rate.
>
> Institute and continue an adequate operation and maintenance program for the entire sewerage system including the septic tanks in the STEP system.

The following technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b).

> Monthly effluent mass loadings for BOD_5 and TSS (lbs/day) were calculated as the maximum monthly design flow (1.0 MGD) x Concentration limit (30 mg/L) x 8.34 (conversion factor) = mass limit 250 lbs/day.
>
> The weekly average effluent mass loadings are calculated as 1.5 x monthly loading (250 lbs/day) = 375 lbs/day.

SURFACE WATER QUALITY-BASED EFFLUENT LIMITATIONS

In order to protect existing water quality and preserve the designated beneficial uses of Washington's surface waters, WAC 173-201A-060 states that waste discharge permits shall be conditioned such that the discharge will meet established Surface Water Quality Standards. The Washington State Surface Water Quality Standards (Chapter 173-201A WAC) is a state regulation designed to protect the beneficial uses of the surface waters of the state. Water quality-based effluent limitations may be based on an individual waste load allocation (WLA) or on a WLA developed during a basin-wide total maximum daily loading study (TMDL).

NUMERICAL CRITERIA FOR THE PROTECTION OF AQUATIC LIFE

"Numerical" water quality criteria are numerical values set forth in the state of Washington's Water Quality Standards for Surface Waters (Chapter 173-201A WAC). They specify the levels of pollutants allowed in a receiving water while remaining protective of aquatic life. Numerical criteria set forth in the Water Quality Standards are used along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limitations, they must be used in a permit.

NUMERICAL CRITERIA FOR THE PROTECTION OF HUMAN HEALTH

The state was issued 91 numeric water quality criteria for the protection of human health by the U.S. EPA (EPA 1992). These criteria are designed to protect humans from cancer and other disease and are primarily applicable to fish and shellfish consumption and drinking water from surface waters.

NARRATIVE CRITERIA

In addition to numerical criteria, "narrative" water quality criteria (WAC 173-201A-030) limit toxic, radioactive, or deleterious material concentrations below those which have the potential to adversely affect characteristic water uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health. Narrative criteria protect the specific beneficial uses of all fresh (WAC 173-201A-130) and marine (WAC 173-201A-140) waters in the state of Washington.

ANTIDEGRADATION

The state of Washington's Antidegradation Policy requires that discharges into a receiving water shall not further degrade the existing water quality of the water body. In cases where the natural conditions of a receiving water are of lower quality than the criteria assigned, the natural conditions shall constitute the water quality criteria. Similarly, when receiving waters are of higher quality than the criteria assigned, the existing water quality shall be protected. More information on the State Antidegradation Policy can be obtained by referring to WAC 173-201A-070.

The Department has reviewed existing records and is unable to determine if ambient water quality is either higher or lower than the designated classification criteria given in Chapter 173-201A WAC; therefore, the Department will use the designated classification criteria for this water body in the proposed permit. The discharges authorized by this proposed permit should not cause a loss of beneficial uses.

CRITICAL CONDITIONS

Surface water quality-based limits are derived for the waterbody's critical condition, which represents the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or characteristic water body uses.

MIXING ZONES

The Water Quality Standards allow the Department to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone. Mixing zones can only be authorized for discharges that are receiving all known, available, and reasonable methods of prevention, control and treatment (AKART) and in accordance with other mixing zone requirements of WAC 173-201A-100.

Outfall #002 - Discharge to the Centralia Power Canal - The water in the canal is used only for power production and the entrance is screened to prevent fish from entering. The distance from the point of discharge into the canal back into the Nisqually River is approximately 3.04 miles. All beneficial uses of the river will be protected, as described in WAC 173-201A-030(2) Class A surface waters as the canal flow re-enters the Nisqually River (RM 12.6).

Allowing full dilution of the canal flow to the effluent flow the dilution factors for the effluent into the Power Canal were calculated using a dynamic dilution model. The model calculated the acute dilution ratio at 172:1 and the chronic dilution ratio at 195:1. See Appendix C, for the dynamic dilution model results.

Outfall #003 - Discharge to the by-pass section of the Nisqually River at the Yelm Diversion Hydroelectric Project - The maximum boundaries of the mixing zones are defined as follows:

> Chronic Mixing Zone: 19.7 feet wide, extends 301.5 feet downstream and 100.0 feet upstream.
>
> Acute Mixing Zone: 19.7 feet wide, extends 30.15 feet downstream and 10.0 feet upstream.

The dilution factor for effluent discharged to the Nisqually River was determined through the use of a dynamic dilution model. The model calculated the acute dilution ratio at 6.5:1 and the chronic dilution ratio at 20:1. See Appendix C, for the dynamic dilution model results.

The National Toxics Rule (EPA, 1992) allows the chronic mixing zone to be used to meet human health criteria.

DESCRIPTION OF THE RECEIVING WATER

The facility has two surface water discharges, Outfall #003 is a direct discharge to the Nisqually River (RM 19.8) and Outfall #002 is a discharge to the Centralia Power Canal which returns to the Nisqually River some 3.04 miles downstream (RM 12.6).

The Nisqually River is designated as a Class A (excellent) freshwater receiving water from its' mouth to Alder Dam (RM 44.2). The discharge to the Centralia Power Canal discharges back into the Nisqually River a Class A surface water and shall not cause a violation of water quality criteria at the point of entry back into the Nisqually River.

Characteristic uses include the following:

> Water supply (domestic, industrial, agricultural); stock watering; fish migration; fish and shellfish rearing, spawning and harvesting; wildlife habitat; primary contact recreation; sport fishing; boating and aesthetic enjoyment; commerce and navigation.

Water quality of this class shall markedly and uniformly exceed the requirements for all or substantially all uses.

SURFACE WATER QUALITY CRITERIA

Applicable criteria are defined in Chapter 173-201A WAC for aquatic biota. In addition, U.S. EPA has promulgated human health criteria for toxic pollutants (EPA 1992). Criteria for this discharge are summarized below:

Fecal Coliforms	100 organisms/100 mL maximum geometric mean
Dissolved Oxygen	8 mg/L minimum

Temperature	18 degrees Celsius maximum or incremental increases above background
pH	6.5 to 8.5 standard units
Turbidity	less than 5 NTUs above background
Toxics	No toxics in toxic amounts (see Appendix C for numeric criteria for toxics of concern for this discharge)

CONSIDERATION OF SURFACE WATER QUALITY-BASED LIMITS FOR NUMERIC CRITERIA

Pollutant concentrations in the proposed discharge exceed water quality criteria with technology-based controls which the Department has determined to be AKART. A mixing zone is authorized in accordance with the geometric configuration, flow restriction, and other restrictions for mixing zones in Chapter 173-201A WAC and are defined as follows:

> The dilution factors of effluent to receiving water that occur within these zones have been determined at the critical condition by the use of a dynamic dilution model. The dilution factors have been determined to be:

Outfall #002 – Centralia Power Canal	Acute	Chronic
Aquatic Life	172	195
Human Health, Carcinogen		250
Human Health, Non-carcinogen		153

Outfall #003 – Nisqually River	Acute	Chronic
Aquatic Life	6.5	20
Human Health, Carcinogen		44
Human Health, Non-carcinogen		22

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near field) or at a considerable distance from the point of discharge (far field). Toxic pollutants, for example, are near-field pollutants--their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as BOD is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

The derivation of water quality-based limits also takes into account the variability of the pollutant concentrations in both the effluent and the receiving water.

The critical condition for the Nisqually River is the seven day average low river flow with a recurrence interval of ten years (7Q10). The critical condition for the Centralia Power Canal is the minimum flow at which the canal can operate. The ambient data used for this permit includes data from a receiving water study conducted by the Permittee.

Parameter	**Effluent**	
Discharge (cfs)	1.547 cfs (1.0 MGD) Maximum Month Design	
Alkalinity	126 mg/L	
CBOD	19.3 mg/L = (29 mg/L * 0.66)based on BOD_5 from DMRs	
NBOD	26 mg/L = 4.57*(2.7 mg/L Ammonia + 3 mg/L Organic N)	
Dissolved Oxygen	9.3 mg/L	
Temperature ^oC	22 for DO analysis and 6 for pH analysis	
Parameter	**Power Canal Outfall #002**	**Nisqually River Outfall #003**
7Q10 low flow	200 cfs	370 cfs
Velocity	5.4 ft/sec	1.77 ft/sec
Depth	2.38 feet	1.83 feet
Width	12 feet bottom width	113 feet bottom width
Manning's n	n=0.03	n=0.025
Slope	0.0054 (0.309 degrees)	0.00041 (0.0235 degrees)
Nisqually River Receiving Water Data		
Dissolved Oxygen	10.5 mg/L	
Temperature	15 ^oC – 9 ^oC	
pH	6.5 s.u. – 6.0 s.u.	
Alkalinity	25 mg/L	
Hardness	21 mg/L	
NBOD	0.0 mg/L = 4.57*(0.0 mg/L Ammonia + 0.0 mg/L Organic N)	
Dissolved Cadmium	0.012 ug/L	
Dissolved Copper	0.758 ug/L	
Dissolved Lead	0.0322 mg/L	
Dissolved Mercury	0.0010 ug/L	
Dissolved Zinc	0.736 ug/L	

BOD_5--The impact of BOD on the receiving water was modeled using the Streeter-Phelps analysis of critical dissolved oxygen sag, at critical condition and with the technology-based effluent limitation for BOD_5 described under "Technology-Based Effluent Limitations" above. Under these critical conditions there is no predicted violation of the Water Quality Standards for dissolved oxygen in surface waters. Therefore, the technology-based effluent limitation for BOD_5 was placed in the permit. The calculations used to determine dissolved oxygen impacts are shown in Appendix C.

Temperature and pH--The impact of pH and temperature were modeled using the calculations from EPA DESCON program, 1988. The input variables were a dilution factor of 195:1 for Outfall #002 and 20:1 for Outfall #003. Upstream temperature 15ºC, upstream pH 6.0, upstream alkalinity 23.5 (as mg CaCO3/L), effluent temperature 22C, effluent pH of 5.6 as a worst case, and effluent alkalinity 78 (as mg CaCO3/L). The calculations used to determine temperature and pH impacts are shown in Appendix C.

Under critical conditions there was no predicted violation of the Surface Water Quality Standards for the pH standard and the temperature standard for Outfall #002. Therefore, the technology-based effluent limitations for pH were placed in the permit and temperature was not limited.

Under critical conditions there was no predicted violation of the Surface Water Quality Standard for the upper end of the pH criterion and the temperature standard for Outfall #003. However, there was a prediction of a violation of the lower end of the pH criteria for the receiving water at Outfall #003. Therefore the lower end of the surface water quality criterion for pH for a class A

receiving water was imposed for Outfall #003 and the technology-based effluent limit for the upper end of the pH criteria were placed in the permit for Outfall #003. Temperature was not limited for Outfall #003.

Fecal coliform bacteria -- This reach of the Nisqually River has been listed on the Ecology 1996 303(d) list as impaired for fecal coliform bacteria. Therefore the surface water criterion for fecal coliform for a class A (excellent) receiving water was imposed for Outfall #002 and Outfall #003 instead of the technology-based limitation for fecal coliforms.

Testing for fecal coliform bacteria will not be required as long as each daily result from the total coliform bacteria test for the effluent is less than the monthly average permit limit set for fecal coliform. When any result for total coliform exceeds the monthly limit for fecal coliform, the fecal coliform test shall be performed a minimum of twice a week until each result from the last seven tests for total coliform are less than the fecal coliform monthly limit.

In order to reduce the number of test performed at the facility the total coliform test results will be used to show compliance with the fecal coliform limit. This was deemed appropriate since fecal coliforms are a subset of total coliforms and the limit set for total coliforms is 45 times lower than the fecal limit. However, if the total coliform count rose above the monthly fecal limit then both a fecal and total coliform test would have to be performed until the total coliform count was less than the monthly average fecal limit for seven consecutive tests.

Toxic Pollutants--Federal regulations (40 CFR 122.44) require NPDES permits to contain effluent limits for toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. This process occurs concurrently with the derivation of technology-based effluent limits. Facilities with technology-based effluent limits defined in regulation are not exempted from meeting the Water Quality Standards for Surface Waters or from having surface water quality-based effluent limits.

The following toxics were determined to be present in the discharge: chlorine, ammonia, and heavy metals. A reasonable potential analysis (See Appendix C) was conducted on these parameters to determine whether or not effluent limitations would be required in this permit.

The determination of the reasonable potential for chlorine, ammonia, and heavy metals to exceed the water quality criteria was evaluated with procedures given in EPA, 1991 (Appendix C) at the critical condition. The critical condition in this case occurs during the low river flow period from August 1st to September 30th. The parameters used in the critical condition modeling are as follows: acute dilution factor for Outfall #002 is 172:1 and Outfall #003 is 6.5:1 , chronic dilution factor for Outfall #002 is 195:1 and for Outfall #003 is 20:1, receiving water temperature 15ºC, receiving water hardness 21mg/L (as mg $CaCO_3$/L), receiving water alkalinity 23.5 mg/L (as mg $CaCO_3$/L), the chlorine background was assumed to be zero and the ammonia-n was found to be non-detect.

The determination of reasonable potential of total chlorine residual and ammonia to exceed the water quality criteria was conducted using receiving water information and waste discharge conditions that represent the highest potential for toxicity in the receiving water environment. Under these critical conditions there was no predicted violation of the Surface Water Quality Standards for total residual chlorine or ammonia from Outfall #002 or Outfall #003.

Chlorine Outfall #002 - Under critical conditions there was no predicted violation of the Surface Water Quality Standards for total residual chlorine. Therefore, the technology-based effluent limitation for total residual chlorine was placed in the permit. The technology-based monthly average limitation for chlorine is derived from standard operating practices. The Water Pollution Control Federation's Chlorination of Wastewater (1976) states that a properly designed and maintained wastewater treatment plant can achieve

adequate disinfection if a 0.5 mg/liter chlorine residual is maintained after fifteen minutes of contact time. See also Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Third Edition, 1991. A treatment plant that provides adequate chlorination contact time can meet the 0.5 mg/liter chlorine limit on a monthly average basis. According to WAC 173-221-030(11)(b), the corresponding weekly average is 0.75 mg/liter. In addition total available (residual) chlorine shall be minimized. Residual chlorine discharged to the power canal shall not exceed the amount required to achieve the fecal coliform limit for the power canal discharge.

Chlorine Outfall #003 - Surface water quality limits calculated for total residual chlorine were below the technology limits described for Outfall #002. Therefore the calculated water quality limits will be imposed along with the requirement not to exceed the amount of total residual chlorine required to achieve the fecal coliform limit for the bypass reach of the Nisqually River.

Ammonia - Under critical conditions there was no predicted violation of the Surface Water Quality Standards for ammonia. According to the facilities plan the SBR facility is expected to produce an effluent with an ammonia nitrogen concentration of 3 mg/L or less. Therefore the monthly average limit of 3 mg/L for ammonia nitrogen imposed on Outfall #002 and #003 will be based on the expected performance of the facility as stated in the facilities plan.

Heavy Metals - Background concentrations for heavy metals were obtained from a receiving water study conducted during the previous permit term. Calculations using all applicable data resulted in a determination that there was a reasonable potential for lead in the effluent to cause a violation of water quality standards. No other metals in the effluent had a reasonable potential to cause a violation of the surface water standards. Therefore a permit limit for total lead was placed in the permit. See Appendix C.

Human Health

Washington's water quality standards now include 91 numeric health-based criteria that must be considered in NPDES permits. These criteria were promulgated for the state by the U.S. EPA in its National Toxics Rule (Federal Register, Volume 57, No. 246, Tuesday, December 22, 1992).

The Department has determined that the applicant's discharge is unlikely to contain chemicals regulated for human health, and thus will not be regulated for human health based criteria. The discharge will be re-evaluated for impacts to human health at the next permit reissuance.

GROUND WATER QUALITY LIMITATIONS

The Department believes the Permittee's discharge has the potential to impact ground water quality and has imposed the following conditions in the proposed permit:

A. Ground Water Monitoring

An up gradient well has been installed at Chochrane Park to characterize background water quality. Compliance wells have been located hydraulically down gradient of the discharge to reflect the activity's impacts to ground water quality.

B. Monitoring Requirements

Ground water monitoring is required to establish background conditions and to demonstrate compliance with ground water recharge criteria. Ground water is sampled from the approved monitoring wells at sites where reclaimed water is used to recharge ground water. Field parameters are required to be monitored in order to assess the general condition of ground water and to determine when enough water has been purged from the borehole so that a representative water sample may be collected from the aquifer. The nitrogen species, bacteria, chloride, total dissolved solids and total metals are all contaminants that are commonly found in domestic wastewater. Trihalomethanes are a chlorine disinfection by-product. The major cations and anions provide a chemical characterization of ground water quality and are used as a tool to determine the impacts from a discharge. The following parameters will be monitored quarterly: static water level, pH, temperature, dissolved oxygen, conductivity, nitrate-nitrogen, nitrite, total Kjeldahl nitrogen, total dissolved solids, total coliform bacteria, chloride and total trihalomethanes. The major ions and total metals are required to be monitored on a yearly basis. Purging of the monitoring wells and ground water sampling shall follow the protocol described in Chapter 5 of the Department's *Implementation Guidance for the Ground Water Quality Standards* (Publication #96-02).

C. Ground Water Limitations

The ground water limitations are established in accordance with RCW 90.46 and the *Water Reclamation and Reuse Standards* (publication #97-23). Ground water recharge criteria are the contaminant criteria found in the drinking water standards.

D. Ground Water Conditions

There are three main aquifers in the Yelm area which are separated by less permeable aquitards. These units include the recessional outwash aquifer, the upper aquitard, the advance outwash aquifer, the lower aquitard and deep aquifer. The recessional outwash aquifer is the uppermost aquifer and is the ground water reservoir which will be impacted first by surface activities. Ground water monitoring focuses on this uppermost aquifer to assess impacts. The recessional outwash was deposited by glacier meltwater as the Vashon glacier retreated and consists of loose mixtures of sand and gravel. The deposits are nearly continuous beneath the study area and range up to 35 feet thick. This aquifer is recharged primarily by infiltrated precipitation. Generally the ground water flows in a northerly direction towards the Nisqually River; however, localized flow patterns will develop as a result of variations in infiltration and recharge.

The City of Yelm is required to characterize background water quality as part of their permit requirements. Ground water quality for the area is generally good, but elevated nitrate-nitrogen concentrations have been attributed to septic systems and confined animal feeding operations. The City of Yelm has installed monitoring wells as part of their permit requirements and continues to assess the impacts of ground water recharge with reclaimed water on ground water quality.

Reclaimed water may be beneficially used for surface percolation provided the reclaimed water meets the ground water recharge criteria (drinking water quality standards) as measured in the ground water beneath or down gradient of the recharge project site. Reclaimed water used for ground water recharge shall be at all times of a quality that fully protects public health and the water quality of waters of the state.

> RCW 90.46.010 (10) "Ground water recharge criteria" means the contaminant criteria found in the drinking water quality standards adopted by the state board of health pursuant to chapter 43.20 RCW and the department of health pursuant to chapter 70.119A RCW.

MONITORING REQUIREMENTS

Monitoring, recording, and reporting are required (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and the effluent limitations are being achieved.

The monitoring schedule is detailed in the proposed permit under Condition S.2. Specified monitoring frequencies take into account the quantity and variability of discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of the Department's *Permit Writer's Manual* (July 1994) for a 1.0 MGD Sequencing Batch Reactor Plant with coagulation/filtration and chlorine disinfection.

LAB ACCREDITATION

With the exception of certain parameters the permit requires all monitoring data to be prepared by a laboratory registered or accredited under the provisions of Chapter 173-50 WAC, *Accreditation of Environmental Laboratories.* The laboratory at this facility is accredited for Ammonia SM 4500-NH_3 B+C, Biochemical Oxygen Demand SM 5210, Chlorine Total Residual SM 4500-Cl G, Dissolved Oxygen SM 4500-O G, pH SM 4500-H, Solids Total Suspended SM 2540 D, Fecal Coliforms 9222 D.

OTHER PERMIT CONDITIONS

REPORTING AND RECORDKEEPING

The conditions of S3 are based on the authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-220-210).

PREVENTION OF FACILITY OVERLOADING

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require the Permittee to take the actions detailed in proposed permit requirement S.4 to plan expansions or modifications before existing capacity is reached and to report and correct conditions that could result in new or increased discharges of pollutants. Condition S.4. restricts the amount of flow.

OPERATION AND MAINTENANCE (O&M)

The proposed permit contains Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, Chapter 173-230 WAC, and WAC 173-240-080. It is included to ensure proper operation and regular maintenance of equipment, and to ensure that adequate safeguards are taken so that constructed facilities are used to their optimum potential in terms of pollutant capture and treatment.

RESIDUAL SOLIDS HANDLING

To prevent water quality problems the Permittee is required in permit Condition S7 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and State Water Quality Standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by the Department under Chapter 70.95J RCW and Chapter 173-308 WAC.

PRETREATMENT

Federal and State Pretreatment Program Requirements

Under the terms of the addendum to the "Memorandum of Understanding between Washington Department of Ecology and the United States Environmental Protection Agency, Region 10" (1986), the Department has been delegated authority to administer the Pretreatment Program (i.e. act as the Approval Authority for oversight of delegated POTWs)**.** Under this delegation of authority, the Department has exercised the option of issuing wastewater discharge permits for significant industrial users discharging to POTWs which have not been delegated authority to issue wastewater discharge permits.

There are a number of functions required by the Pretreatment Program which the Department is delegating to such POTWs because they are in a better position to implement the requirements (e.g. tracking the number and general nature of industrial dischargers to the sewerage system). The requirements for a Pretreatment Program are contained in Title 40, part 403 of the Code of Federal Regulations. Under the requirements of the Pretreatment Program [40 CFR 403.8(f)(1)(iii)], the Department is required to approve, condition, or deny new discharges or a significant increase in the discharge for existing significant industrial users (SIUs) [40 CFR 403.8 (f)(1)(i)].

The Department is responsible for issuing State Waste Discharge Permits to SIUs and other industrial users of the Permittee's sewer system. Industrial dischargers must obtain these permits from the Department prior to the Permittee accepting the discharge [WAC 173-216-110(5)]. (Industries discharging wastewater that is similar in character to domestic wastewater are not required to obtain a permit. Such dischargers should contact the Department to determine if a permit is required.) Industrial dischargers need to apply for a state waste discharge permit 60 days prior to commencing discharge. The conditions contained in the permits will include any applicable conditions for categorical discharges, loading limitations included in contracts with the POTW, and other conditions necessary to assure compliance with State water quality standards and biosolids standards.

The Department requires this POTW to fulfill some of the functions required for the Pretreatment Program in the NPDES permit (e.g. tracking the number and general nature of industrial dischargers to the sewage system). The POTWs NPDES permit will require that all SIUs currently discharging to the POTW be identified and notified of the requirement to apply for a wastewater discharge permit from the Department. None of the obligations imposed on the POTW relieve an industrial or commercial discharger of its primary responsibility for obtaining a wastewater discharge permit (if required), including submittal of engineering reports prior to construction or modification of facilities (40 CFR 403.12(j) and WAC 173-216-070 and WAC 173-240-110, et seq.).

Wastewater Permit Required

RCW 90.48 and WAC 173-216-040 require SIUs to obtain a permit prior to discharge of industrial waste to the Permittee's sewerage system. This provision prohibits the POTW from accepting industrial wastewater from any such dischargers without authorization from the Department.

Requirements for Routine Identification and Reporting of Industrial Users

The NPDES permit requires non-delegated POTWs to "take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging to the Permittee's sewerage system." Examples of such routine measures include regular review of business tax licenses for existing businesses and review of water billing records and existing connection authorization

records. System maintenance personnel can also be diligent during performance of their jobs in identifying and reporting as-yet unidentified industrial dischargers. Local newspapers, telephone directories, and word-of-mouth can also be important sources of information regarding new or existing discharges. The POTW is required to notify an industrial discharger, in writing, of their responsibilities regarding application for a state waste discharge permit and to send a copy of the written notification to the Department. The Department will then take steps to solicit a state waste discharge permit application.

Annual Submittal of List of Industrial Users

This provision requires the POTW to submit annually a list of existing and proposed SIUs and PSIUs. This requirement is intended to update the Department on an annual basis of the status of industrial users in the POTWs service area, without requiring the POTW to go through the process of performing a formal Industrial User Survey. This provision is normally applied to POTWs not serving industrial or commercial users. Although this permit does not require performance of an Industrial User Survey, the Permittee is nevertheless required under the previous section, to take adequate continuous routine measures to identify existing and new industrial discharges.

Duty to Enforce Discharge Prohibitions

This provision prohibits the POTW from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer. The first portion of the provision prohibits acceptance of pollutants which cause pass through or interference. The definitions of pass through and interference are in Appendix B of the fact sheet.

The second portion of this provision prohibits the POTW from accepting certain specific types of wastes, namely those which are explosive, flammable, excessively acidic, basic, otherwise corrosive, or obstructive to the system. In addition wastes with excessive BOD, petroleum based oils, or which result in toxic gases, are prohibited to be discharged. The regulatory basis for these prohibitions is 40 CFR Part 403, with the exception of the pH provisions which are based on WAC 173-216-060.

The third portion of this provision prohibits certain types of discharges unless the POTW receives prior authorization from the Department. The discharges include cooling water in significant volumes, stormwater and other direct inflow sources, and wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Support by the Department for Developing Partial Pretreatment Program by POTW

The Department has committed to providing technical and legal assistance to the Permittee in fulfilling these joint obligations, in particular assistance with developing an adequate sewer use ordinance, notification procedures, enforcement guidelines, and developing local limits and inspection procedures.

OUTFALL EVALUATION

Proposed permit Condition S.8 requires the Permittee to conduct daily inspections of all public impoundment's and uses of reclaimed water and monthly inspections of the outfall locations located on the Centralia Power Canal and Nisqually River. These inspections shall be noted on the monthly DMRs submitted to the Department. The purpose of the inspection is to determine the condition of the discharge pipe and diffusers and to determine if sediment is accumulating in the vicinity of the outfall.

WATER RECLAMATION AND REUSE

Section S9 of the permit contains conditions by which Yelm shall comply to be able to distribute reclaimed water. The conditions were developed in coordination with the state Department of Health to satisfy reclaimed water use and other related regulations of Chapters 90.46 RCW, 90.03 RCW, 90.44 RCW, and 90.48 RCW.

The water reuse plan required by the permit will address potential uses for the reclaimed water. The plan will also address public health issues with the system and surface water and ground water quality issues with proposed reuse sites. Each reuse site not under the direct control of the Permittee requires a binding agreement between the Permittee and the user which addresses construction, operation and maintenance, and monitoring of the site.

Cochrane Park Wetlands:

The wetlands and fish pond at Cochrane Park are a utilization of the reclaimed water that provides an aesthetic value to the community and an educational opportunity for the City's students. The wetland and pond system also provides detention of the reclaimed water to allow natural treatment processes to act on the water prior to infiltration into the ground.

Constructed beneficial use and constructed treatment wetlands that are designed to receive reclaimed water must be incorporated within a locally adopted and state approved sewer or water comprehensive plan. Note: These planning documents may also be referred to as general sewer plans (WAC 173-240-050), facilities plans (40 CFR 35.2030), or water system plans and project reports (WAC 246-290).

Irrigation:

Management approaches for irrigation projects are directed to ensure irrigation water is used in a responsible manner and protects drinking water supplies. A project should be designed to utilize spray irrigation during times when possible human exposure is least likely to happen. While the reclaimed water is safe for direct exposure, irrigation during night and early morning hours ensures limited public contact and helps curb public perception issues with the reclaimed water.

Reclaimed water that is delivered to existing irrigation systems must include provisions for testing and a site survey be conducted to identify any faucet or hose bib that could be used for drinking water. Dye testing of existing systems to verify that no connection with potable water supplies is possible is a good design practice.

Infiltration:

The basic water quality requirement in RCW 90.46.080 for infiltration projects is that the reclaimed water must meet the groundwater recharge criteria (specifically, the contaminant criteria found in state drinking water quality standards) as measured in groundwater beneath or down-gradient of the recharge project site. The infiltration of reclaimed water for the purposes of ground water replenishment must also be incorporated within a locally adopted and state approved sewer or water comprehensive plan. Note: These planning documents may also be referred to as general sewer plans (WAC 173-240-050), facilities plans (40 CFR 35.2030), or water system plans and project reports (WAC 246-290).

GENERAL CONDITIONS

General Conditions are based directly on state and federal law and regulations and have been standardized for all individual municipal NPDES permits issued by the Department.

PERMIT ISSUANCE PROCEDURES

PERMIT MODIFICATIONS

The Department may modify this permit to impose numerical limitations, if necessary to meet Water Quality Standards, Sediment Quality Standards, or Ground Water Standards, based on new information obtained from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

The Department may also modify this permit as a result of new or amended state or federal regulations.

RECOMMENDATION FOR PERMIT ISSUANCE

This proposed permit meets all statutory requirements for authorizing a wastewater discharge, including those limitations and conditions believed necessary to protect human health, aquatic life, and the beneficial uses of waters of the state of Washington. The Department proposes that this permit be issued for five years.

REFERENCES FOR TEXT AND APPENDICES

Environmental Protection Agency (EPA)

1992. National Toxics Rule. Federal Register, V. 57, No. 246, Tuesday, December 22, 1992.

1991. Technical Support Document for Water Quality-based Toxics Control. EPA/505/2-90-001.

1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington, D.C.

1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water. EPA/600/6-85/002a.

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1991. Wastewater Engineering, Treatment, Disposal, and Reuse. Third Edition.

Tsivoglou, E.C., and J.R. Wallace.

1972. Characterization of Stream Reaeration Capacity. EPA-R3-72-012. (Cited in EPA 1985 op.cit.)

Washington State Department of Ecology.

Laws and Regulations(http://www.ecy.wa.gov/laws-rules/index.html)

Permit and Wastewater Related Information
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1994. Permit Writer's Manual. Publication Number 92-109

Water Pollution Control Federation.

1976. Chlorination of Wastewater.

Wright, R.M., and A.J. McDonnell.

1979. In-stream Deoxygenation Rate Prediction. Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

Washington State Department of Ecology, 1993. Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems, Ecology Publication # 93-36. 20 pp.

Washington State Department of Ecology and Department of Health, 1997. Water Reclamation and Reuse Standards, Ecology Publication # 97-23. 73 pp

Washington State Department of Ecology 1998. Chapter E-1, Criteria For Sewage Works Design, Ecology Publication # 98-37. 50 pp

Washington State Department of Ecology, 1996. Implementation Guidance for the Ground Water Quality Standards, Ecology Publication # 96-02.

Washington State Department of Health, 1994. Design Criteria for Muncipal Wastewater Land Treatment, 10 pp

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

The Department has tentatively determined to reissue a permit to the applicant listed on page 1 of this fact sheet. The permit contains conditions and effluent limitations which are described in the rest of this fact sheet.

Public notice of application was published on July 18, 2004, and July 25, 2004, in the *Daily Olympian* to inform the public that an application had been submitted and to invite comment on the reissuance of this permit.

The Department will publish a Public Notice of Draft (PNOD) on April 22, 2005, in the *Daily Olympian* to inform the public that a draft permit and fact sheet are available for review. Interested persons are invited to submit written comments regarding the draft permit. The draft permit, fact sheet, and related documents are available for inspection and copying between the hours of 8:00 a.m. and 5:00 p.m. weekdays, by appointment, at the regional office listed below. Written comments should be mailed to:

Carey Cholski
Water Quality Permit Administrator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775.

Any interested party may comment on the draft permit or request a public hearing on this draft permit within the 30-day comment period to the address above. The request for a hearing shall indicate the interest of the party and the reasons why the hearing is warranted. The Department will hold a hearing if it determines there is a significant public interest in the draft permit (WAC 173-220-090). Public notice regarding any hearing will be circulated at least 30 days in advance of the hearing. People expressing an interest in this permit will be mailed an individual notice of hearing (WAC 173-220-100).

Comments should reference specific text followed by proposed modification or concern when possible. Comments may address technical issues, accuracy and completeness of information, the scope of the facility's proposed coverage, adequacy of environmental protection, permit conditions, or any other concern that would result from issuance of this permit.

The Department will consider all comments received within 30 days from the date of public notice of draft indicated above, in formulating a final determination to issue, revise, or deny the permit. The Department's response to all significant comments is available upon request and will be mailed directly to people expressing an interest in this permit.

Further information may be obtained from the Department by telephone, (360) 407-6275, or by writing to the address listed above.

This permit and fact sheet were written by Glenn Pieritz.

APPENDIX B--GLOSSARY

Acute Toxicity--The lethal effect of a pollutant on an organism that occurs within a short period of time, usually 48 to 96 hours.

AKART-- An acronym for "all known, available, and reasonable methods of prevention, control, and treatment".

Ambient Water Quality--The existing environmental condition of the water in a receiving water body.

Ammonia--Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Average Monthly Discharge Limitation --The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month (except in the case of fecal coliform). The daily discharge is calculated as the average measurement of the pollutant over the day.

Average Weekly Discharge Limitation -- The highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. The daily discharge is calculated as the average measurement of the pollutant over the day.

Best Management Practices (BMPs)--Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5--Determining the Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in a receiving water after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass--The intentional diversion of waste streams from any portion of a treatment facility.

CBOD5 – The quantity of oxygen utilized by a mixed population of microorganisms acting on the nutrients in the sample in an aerobic oxidation for five days at a controlled temperature of 20 degrees Celcius, with an inhibitory agent added to prevent the oxidation of nitrogen compounds. The method for determining CBOD5 is given in 40 CFR Part 136.

Chlorine--Chlorine is used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic Toxicity--The effect of a pollutant on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean Water Act (CWA)--The Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Combined Sewer Overflow (CSO)--The event during which excess combined sewage flow caused by inflow is discharged from a combined sewer, rather than conveyed to the sewage treatment plant because either the capacity of the treatment plant or the combined sewer is exceeded.

Compliance Inspection - Without Sampling--A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance Inspection - With Sampling--A site visit to accomplish the purpose of a Compliance Inspection - Without Sampling and as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the percent removal requirement. Additional sampling may be conducted.

Composite Sample--A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing a minimum of four discrete samples. May be "time-composite"(collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Construction Activity--Clearing, grading, excavation and any other activity which disturbs the surface of the land. Such activities may include road building, construction of residential houses, office buildings, or industrial buildings, and demolition activity.

Continuous Monitoring –Uninterrupted, unless otherwise noted in the permit.

Critical Condition--The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Dilution Factor--A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the effluent fraction e.g., a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Engineering Report--A document which thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report shall contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal Coliform Bacteria--Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab Sample--A single sample or measurement taken at a specific time or over as short period of time as is feasible.

Industrial User-- A discharger of wastewater to the sanitary sewer which is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial Wastewater--Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

Infiltration and Inflow (I/I)--"Infiltration" means the addition of ground water into a sewer through joints, the sewer pipe material, cracks, and other defects. "Inflow" means the addition of precipitation-caused drainage from roof drains, yard drains, basement drains, street catch basins, etc., into a sewer.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal and;

Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Major Facility--A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum Daily Discharge Limitation--The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Method Detection Level (MDL)--The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

Minor Facility--A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing Zone--A volume that surrounds an effluent discharge within which water quality criteria may be exceeded. The area of the authorized mixing zone is specified in a facility's permit and follows procedures outlined in State regulations (Chapter 173-201A WAC).

National Pollutant Discharge Elimination System (NPDES)--The NPDES (Section 402 of the Clean Water Act) is the Federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the State of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both State and Federal laws.

Pass through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

pH--The pH of a liquid measures its acidity or alkalinity. A pH of 7 is defined as neutral, and large variations above or below this value are considered harmful to most aquatic life.

Potential Significant Industrial User--A potential significant industrial user is defined as an Industrial User which does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day or;

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

The Department may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation Level (QL)-- A calculated value five times the MDL (method detection level).

Significant Industrial User (SIU)--

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N and;

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

*The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

State Waters--Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, wetlands, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater--That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based Effluent Limit--A permit limit that is based on the ability of a treatment method to reduce the pollutant.

Total Suspended Solids (TSS)--Total suspended solids are the particulate materials in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset--An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water Quality-based Effluent Limit--A limit on the concentration or mass of an effluent parameter that is intended to prevent the concentration of that parameter from exceeding its water quality criterion after it is discharged into a receiving water.

APPENDIX C--TECHNICAL CALCULATIONS

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found on the Department's homepage at (http://www.ecy.wa.gov/programs/wq/wastewater/index.html

Water Year October to September Annual Dilution Factor - Nisqually River

Water Year	Log_{10} of Min Acute Dilution Ratio	Log_{10} of Min Chronic Dilution Ratio
1997	0.9317	1.4282
1998	1.0397	1.5206
1999	0.8243	1.3457
2000	0.8014	1.2971
2001	0.7766	1.2801
2002	0.7357	1.2426
2003	0.7547	1.2317

Log-Pearson type III frequency factor method	Estimated Using Excel's Statistical Functions climatic year
Number of data points	7
Mean of log10 transformed values	0.8377
Standard deviation of log10 transformed values	0.1097
Skew of log10 transformed values	1.2661
Recurrence Interval, years	3
Estimated K for Log Pearson type III method, 3-yr recurrence	0.234
Acute Annual Dilution Factor	6.5

Log-Pearson type III frequency factor method	Estimated Using Excel's Statistical Functions climatic year
Number of data points	7
Mean of log10 transformed values	1.3351
Standard deviation of log10 transformed values	0.1056
Skew of log10 transformed values	1.0038
Recurrence Interval, years	3
Estimated K for Log Pearson type III method, 3-yr recurrence	0.281
Chronic Annual Dilution Factor	20

Water Year October to September Annual Dilution Factor - Centralia Power Canal

Water Year	Log_{10} of Min Acute Dilution Ratio	Log_{10} of Min Chronic Dilution Ratio
1997	2.4880	2.5878
1998	2.2829	2.2954
1999	2.2288	2.2770
2000	2.3295	2.3959
2001	2.2175	2.2486
2002	2.1554	2.2145
2003	2.1440	2.1905

Log-Pearson type III frequency factor method	Estimated Using Excel's Statistical Functions climatic year
Number of data points	7
Mean of log10 transformed values	2.2637
Standard deviation of log10 transformed values	0.1186
Skew of log10 transformed values	1.1803
Recurrence Interval, years	3
Estimated K for Log Pearson type III method, 3-yr recurrence	0.248
Acute Annual Dilution Factor	172

Log-Pearson type III frequency factor method	Estimated Using Excel's Statistical Functions climatic year
Number of data points	7
Mean of log10 transformed values	2.3157
Standard deviation of log10 transformed values	0.1371
Skew of log10 transformed values	1.5666
Recurrence Interval, years	3
Estimated K for Log Pearson type III method, 3-yr recurrence	0.185
Chronic Annual Dilution Factor	195

Streeter-Phelps analysis of critical dissolved oxygen sag.
Based on Lotus File DOSAG2.WK1 Revised 19-Oct-93

Notes: City of Yelms Power Canal Outfall #002

INPUT

1. EFFLUENT CHARACTERISTICS

Discharge (cfs):	1.547
CBOD5 (mg/L):	45
NBOD (mg/L):	301.62
Dissolved Oxygen (mg/L):	1.1
Temperature (deg C):	23

2. RECEIVING WATER CHARACTERISTICS

Upstream Discharge (cfs):	200
Upstream CBOD5 (mg/L):	4.3
Upstream NBOD (mg/L):	0
Upstream Dissolved Oxygen (mg/L):	10.5
Upstream Temperature (deg C):	14
Elevation (ft NGVD):	250
Downstream Average Channel Slope (ft/ft):	0.0054
Downstream Average Channel Depth (ft):	2.38
Downstream Average Channel Velocity (fps):	5.4

3. REAERATION RATE (Base e) AT 20 deg C (day^-1): 13.94

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	13.94
O'Connor and Dobbins	.1 - 1.5	2 - 50	8.20
Owens	.1 - 6	1 - 2	13.44
Tsivoglou-Wallace	.1 - 6	.1 - 2	120.84

4. BOD DECAY RATE (Base e) AT 20 deg C (day^-1): 0.57

Reference	Suggested Value
Wright and McDonnell, 1979	0.77

OUTPUT

1. INITIAL MIXED RIVER CONDITION

CBOD5 (mg/L):	4.6
NBOD (mg/L):	2.3
Dissolved Oxygen (mg/L):	10.4
Temperature (deg C):	14.1

2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)

Reaeration (day^-1):	12.11
BOD Decay (day^-1):	0.43

3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU

Initial Mixed CBODU (mg/L):	6.8
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	9.1

4. INITIAL DISSOLVED OXYGEN DEFICIT

Saturation Dissolved Oxygen (mg/L):	10.199
Initial Deficit (mg/L):	-0.23

5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days): 0.33

6. DISTANCE TO CRITICAL DO CONCENTRATION (miles): 29.09

7. CRITICAL DO DEFICIT (mg/L): 0.28

8. CRITICAL DO CONCENTRATION (mg/L): 9.91

Streeter-Phelps analysis of critical dissolved oxygen sag.
Based on Lotus File DOSAG2.WK1 Revised 19-Oct-93

Notes: City of Yelms Nisqually River Outfall #003

INPUT

1. EFFLUENT CHARACTERISTICS

Discharge (cfs):	1.547
CBOD5 (mg/L):	45
NBOD (mg/L):	301.62
Dissolved Oxygen (mg/L):	1.1
Temperature (deg C):	23

2. RECEIVING WATER CHARACTERISTICS

Upstream Discharge (cfs):	370
Upstream CBOD5 (mg/L):	4.3
Upstream NBOD (mg/L):	0
Upstream Dissolved Oxygen (mg/L):	10.5
Upstream Temperature (deg C):	14
Elevation (ft NGVD):	250
Downstream Average Channel Slope (ft/ft):	0.00041
Downstream Average Channel Depth (ft):	1.83
Downstream Average Channel Velocity (fps):	1.77

3. REAERATION RATE (Base e) AT 20 deg C (day^-1): 10.35

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	7.34
O'Connor and Dobbins	.1 - 1.5	2 - 50	6.96
Owens	.1 - 6	1 - 2	10.35
Tsivoglou-Wallace	.1 - 6	.1 - 2	3.01

4. BOD DECAY RATE (Base e) AT 20 deg C (day^-1): 0.57

Reference	Suggested Value
Wright and McDonnell, 1979	0.57

OUTPUT

1. INITIAL MIXED RIVER CONDITION

CBOD5 (mg/L):	4.5
NBOD (mg/L):	1.3
Dissolved Oxygen (mg/L):	10.5
Temperature (deg C):	14.0

2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)

Reaeration (day^-1):	8.99
BOD Decay (day^-1):	0.43

3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU

Initial Mixed CBODU (mg/L):	6.6
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	7.9

4. INITIAL DISSOLVED OXYGEN DEFICIT

Saturation Dissolved Oxygen (mg/L):	10.206
Initial Deficit (mg/L):	-0.25

5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days): 0.41

6. DISTANCE TO CRITICAL DO CONCENTRATION (miles): 11.94

7. CRITICAL DO DEFICIT (mg/L): 0.32

8. CRITICAL DO CONCENTRATION (mg/L): 9.89

Calculation of pH of a mixture of two flows. Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

Based on Lotus File PHMIX2.WK1 Revised 19-Oct-93

Notes: City of Yelms Nisqually River Outfall #003

INPUT	
1. CHRONIC DILUTION FACTOR AT MIXING ZONE BOUNDARY	20
2. UPSTREAM/BACKGROUND CHARACTERISTICS	
Temperature (deg C):	15
pH:	6
Alkalinity (mg CaCO3/L):	23.50
3. EFFLUENT CHARACTERISTICS	
Temperature (deg C):	22
pH:	6.0
Alkalinity (mg CaCO3/L):	78

OUTPUT	
1. IONIZATION CONSTANTS	
Upstream/Background pKa:	6.42
Effluent pKa:	6.37
2. IONIZATION FRACTIONS	
Upstream/Background Ionization Fraction:	0.28
Effluent Ionization Fraction:	0.30
3. TOTAL INORGANIC CARBON	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	85.31
Effluent Total Inorganic Carbon (mg CaCO3/L):	260.21
4. CONDITIONS AT MIXING ZONE BOUNDARY	
Temperature (deg C):	15.35
Alkalinity (mg CaCO3/L):	26.23
Total Inorganic Carbon (mg CaCO3/L):	94.06
pKa:	6.42
pH at Mixing Zone Boundary:	6.00

Calculation of pH of a mixture of two flows. Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

Based on Lotus File PHMIX2.WK1 Revised 19-Oct-93

Notes: City of Yelms Power Canal Outfall #002

INPUT	
1. CHRONIC DILUTION FACTOR AT MIXING ZONE BOUNDARY	195
2. UPSTREAM/BACKGROUND CHARACTERISTICS	
Temperature (deg C):	15
pH:	6
Alkalinity (mg CaCO3/L):	23.50
3. EFFLUENT CHARACTERISTICS	
Temperature (deg C):	22
pH:	6.0
Alkalinity (mg CaCO3/L):	78

OUTPUT	
1. IONIZATION CONSTANTS	
Upstream/Background pKa:	6.42
Effluent pKa:	6.37
2. IONIZATION FRACTIONS	
Upstream/Background Ionization Fraction:	0.28
Effluent Ionization Fraction:	0.30
3. TOTAL INORGANIC CARBON	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	85.31
Effluent Total Inorganic Carbon (mg CaCO3/L):	260.21
4. CONDITIONS AT MIXING ZONE BOUNDARY	
Temperature (deg C):	15.04
Alkalinity (mg CaCO3/L):	23.78
Total Inorganic Carbon (mg CaCO3/L):	86.21
pKa:	6.42
pH at Mixing Zone Boundary:	6.00

Determining the Requirement for Permit Limits Through a Reasonable Potential Determination to Violate Standards at the Edge of the Mixing Zone.

Based on EPA/505/2-90-001

Notes: Nisqually River Chlorine Residual

INPUT	
	Annual
Confidence Level and Probability Basis:	**0.95**
Coefficient of Variation for the Effluent Concentration (CV)	
(0.6 or a calculated CV if there are more than 10 data points):	**0.60**
Number of Effluent Samples or Data Points (ND):	**57**
Highest Effluent Concentration or Value (HV):	**0.12**
Dilution Factors (1/{Effluent Volume Fraction}) or plumes model	
Acute Receiving Water Dilution Factor:	**6.5**
Chronic Receiving Water Dilution Factor:	**20**
Water Quality Standards (Concentration)	
Acute (one-hour) Criteria:	**0.019**
Chronic (n-day) Criteria:	**0.011**
Upstream Receiving Water Concentration:	
Upstream Concentration for Acute Condition (7Q10):	**0**
Upstream Concentration for Chronic Condition (7Q10):	**0**

MECB: 1-9 data points, highest value by 2; 10-50 the highest value; >50 calculate 90th %-tile

OUTPUT	
Percentile Represented by the Highest Concentration in Data Set	
$(p_n) = (1 - \text{confidence level})^{1/ND}$	0.948800516
Normal Distribution Value for 95th Percentile	1.644853476
Normal Distribution Value for 95th Percentile	1.633332943
$\sigma^2 = \ln(CV^2+1)$	0.3074847
C95 = exp(1.645Sigma -0.5Sigma^2)	2.134751686
C95 = exp(1.633Sigma -0.5Sigma^2)	2.121157751
Reasonable Potential Multiplier = C95/C95	1.0
Maximum Expected Concentration of Pollutant in Effluent (MEC):	0.120769048
Acute - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.018579854
Chronic - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.006038452
Reasonable Potential to Violate Acute Criteria at the Edge of the Mixing Zone (RP):	**NO**
Reasonable Potential to Violate Chronic Criteria at the Edge of the Mixing Zone (RP):	**NO**

Determining the Requirement for Permit Limits Through a Reasonable Potential Determination to Violate Standards at the Edge of the Mixing Zone.

Based on EPA/505/2-90-001

Notes: Centralia Power Canal Chlorine Residual

INPUT	
	Annual
Confidence Level and Probability Basis:	**0.95**
Coefficient of Variation for the Effluent Concentration (CV)	
(0.6 or a calculated CV if there are more than 10 data points):	**0.60**
Number of Effluent Samples or Data Points (ND):	**57**
Highest Effluent Concentration or Value (HV):	**0.12**
Dilution Factors (1/{Effluent Volume Fraction}) or plumes model	
Acute Receiving Water Dilution Factor:	**172**
Chronic Receiving Water Dilution Factor:	**195**
Water Quality Standards (Concentration)	
Acute (one-hour) Criteria:	**0.019**
Chronic (n-day) Criteria:	**0.011**
Upstream Receiving Water Concentration:	
Upstream Concentration for Acute Condition (7Q10):	**0**
Upstream Concentration for Chronic Condition (7Q10):	**0**

MECB: 1-9 data points, highest value by 2; 10-50 the highest value; >50 calculate 90th %-tile

OUTPUT	
Percentile Represented by the Highest Concentration in Data Set	
(p_n) = (1 - confidence level)^1/ND	0.948800516
Normal Distribution Value for 95th Percentile	1.644853476
Normal Distribution Value for 95th Percentile	1.633332943
$\sigma^2 = \ln(CV^2+1)$	0.3074847
C95 = exp(1.645Sigma -0.5Sigma^2)	2.134751686
C95 = exp(1.633Sigma -0.5Sigma^2)	2.121157751
Reasonable Potential Multiplier = C95/C95	1.0
Maximum Expected Concentration of Pollutant in Effluent (MEC):	0.120769048
Acute - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.000702146
Chronic - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.000619328
Reasonable Potential to Violate Acute Criteria at the Edge of the Mixing Zone (RP):	**NO**
Reasonable Potential to Violate Chronic Criteria at the Edge of the Mixing Zone (RP):	**NO**

Determining the Requirement for Permit Limits Through a Reasonable Potential Determination to Violate Standards at the Edge of the Mixing Zone.

Based on EPA/505/2-90-001

Notes: City of Yelm Ammonia-N - Nisqually River

INPUT	Annual	May to Oct.	Nov. to Apr.
Confidence Level and Probability Basis:	**0.95**	**0.95**	**0.95**
Coefficient of Variation for the Effluent Concentration (CV) (0.6 or a calculated CV if there are more than 10 data points):	**0.60**	**0.60**	**0.60**
Number of Effluent Samples or Data Points (ND):	**57**	**28**	**29**
Highest Effluent Concentration or Value (HV):	**3.38**	**0.5**	**3.38**
Dilution Factors (1/{Effluent Volume Fraction}) or plumes model			
Acute Receiving Water Dilution Factor:	**6.5**	**5.7**	**8.4**
Chronic Receiving Water Dilution Factor:	**20**	**18**	**27**
Water Quality Standards (Concentration)			
Acute (one-hour) Criteria:	**24.61**	**24.61**	**25.82**
Chronic (n-day) Criteria:	**2.11**	**2.11**	**2.21**
Upstream Receiving Water Concentration:			
Upstream Concentration for Acute Condition (7Q10):	**0**	**0**	**0**
Upstream Concentration for Chronic Condition (7Q10):	**0**	**0**	**0**

MECB: 1-9 data points, highest value by 2; 10-50 the highest value; >50 calculate 90th %-tile

OUTPUT			
Percentile Represented by the Highest Concentration in Data Set (p_n) = (1 - confidence level)^1/ND	0.948800516	0.898534264	0.901855372
Normal Distribution Value for 95th Percentile	1.644853476	1.644853476	1.644853476
Normal Distribution Value for 90th Percentile	1.633332943	1.273244372	1.292196438
$\sigma^2 = \ln(CV^2+1)$	0.3074847	0.3074847	0.3074847
C95 = exp(1.645Sigma -0.5Sigma^2)	2.134751686	2.134751686	2.134751686
C90 = exp(1.273Sigma -0.5Sigma^2)	2.121157751	1.737223664	1.755576708
Reasonable Potential Multiplier = C95/C90	1.0	1.2	1.2
Maximum Expected Concentration of Pollutant in Effluent (MEC):	3.40166152	0.61441475	4.110023029
Acute - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.523332542	0.107792061	0.489288456
Chronic - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.170083076	0.034134153	0.152223075
Reasonable Potential to Violate Acute Criteria at the Edge of the Mixing Zone (RP):	**NO**	**NO**	**NO**
Reasonable Potential to Violate Chronic Criteria at the Edge of the Mixing Zone (RP):	**NO**	**NO**	**NO**

Determining the Requirement for Permit Limits Through a Reasonable Potential Determination to Violate Standards at the Edge of the Mixing Zone.

Based on EPA/505/2-90-001

Notes: City of Yelm Ammonia-N - Centralia Power Canal

INPUT	Annual	May to Oct.	Nov. to Apr.
Confidence Level and Probability Basis:	**0.95**	**0.95**	**0.95**
Coefficient of Variation for the Effluent Concentration (CV) (0.6 or a calculated CV if there are more than 10 data points):	**0.60**	**0.60**	**0.60**
Number of Effluent Samples or Data Points (ND):	**28**	**28**	**29**
Highest Effluent Concentration or Value (HV):	**3.38**	**0.5**	**3.38**
Dilution Factors (1/{Effluent Volume Fraction}) or plumes model			
Acute Receiving Water Dilution Factor:	**172**	**154**	**158**
Chronic Receiving Water Dilution Factor:	**195**	**172**	**174**
Water Quality Standards (Concentration)			
Acute (one-hour) Criteria:	**24.61**	**24.61**	**25.82**
Chronic (n-day) Criteria:	**2.11**	**2.11**	**2.21**
Upstream Receiving Water Concentration:			
Upstream Concentration for Acute Condition (7Q10):	**0**	**0**	**0**
Upstream Concentration for Chronic Condition (7Q10):	**0**	**0**	**0**

MECB: 1-9 data points, highest value by 2; 10-50 the highest value; >50 calculate 90th %-tile

OUTPUT			
Percentile Represented by the Highest Concentration in Data Set (p_n) = (1 - confidence level)^1/ND	0.898534264	0.898534264	0.901855372
Normal Distribution Value for 95th Percentile	1.644853476	1.644853476	1.644853476
Normal Distribution Value for 90th Percentile	1.273244372	1.273244372	1.292196438
$\sigma^2 = \ln(CV^2+1)$	0.3074847	0.3074847	0.3074847
C95 = exp(1.645Sigma -0.5Sigma^2)	2.134751686	2.134751686	2.134751686
C90 = exp(1.273Sigma -0.5Sigma^2)	1.737223664	1.737223664	1.755576708
Reasonable Potential Multiplier = C95/C90	1.2	1.2	1.2
Maximum Expected Concentration of Pollutant in Effluent (MEC):	4.153443709	0.61441475	4.110023029
Acute - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.024147929	0.003989706	0.026012804
Chronic - Concentration of Pollutant at the Edge of the Mixing Zone (CP):	0.021299711	0.003572179	0.023620822
Reasonable Potential to Violate Acute Criteria at the Edge of the Mixing Zone (RP):	**NO**	**NO**	**NO**
Reasonable Potential to Violate Chronic Criteria at the Edge of the Mixing Zone (RP):	**NO**	**NO**	**NO**

Determining the Requirement for Permit Limits Through a Reasonable Potential Determination to Violate Standards at the Edge of the Mixing Zone.
Based on EPA/505/2-90-001

Notes: City of Yelm - Nisqually River Metals

		Arsenic	Cadmium	Chromium Hex	Chromium Tri	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
INPUT												
Confidence Level and Probability Basis:		**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**
Coefficient of Variation for the Effluent Concentration (CV) (0.6 or a calculated CV if there are more than 10 data points):		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Number of Effluent Samples or Data Points (ND):		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
Highest Effluent Concentration or Value (HV) or 95th%-tile:		**0**	**0**	**1.015**	**1.015**	**21**	**7.25**	**0**	**2.43**	**0**	**0**	**48.7**
Dilution Factors (1/{Effluent Volume Fraction}) or plumes model												
Acute Receiving Water Dilution Factor:	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**
Chronic Receiving Water Dilution Factor:	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
Water Quality Standards (Concentration)												
Acute (one-hour) Criteria:		**360**	**0.884**	**15.3**	**589**	**5.11**	**15.2**	**2.47**	**464**	**20**	**0.419**	**38**
Chronic (n-day) Criteria:		**190**	**0.356**	**10.4**	**61.8**	**3.35**	**0.486**	**0.012**	**45.2**	**5**	**---**	**30**
Upstream Receiving Water Concentration:												
Upstream Concentration for Acute Condition (7Q10): 95th%-tile		**0**	**0**	**0**	**0**	**0.790**	**0.0327**	**0.001**	**0**	**0**	**0**	**0.75**
Upstream Concentration for Chronic Condition (7Q10): 90th%-tile		**0**	**0**	**0**	**0**	**0.783**	**0.0280**	**0.001**	**0**	**0**	**0**	**0.73**
OUTPUT												
Percentile Represented by the Highest Concentration in Data Set (p_n) = (1 - confidence level)^1/ND		0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917
Normal Distribution Value for 95th Percentile		1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535
Normal Distribution Value for XXth Percentile		1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343
$s^2 = \ln(CV^2+1)$		0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847
C95 = exp(1.645Sigma -0.5Sigma^2)		2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517
CXX = exp(XX Sigma -0.5Sigma^2)		1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513
Reasonable Potential Multiplier = C95/CXX		1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Maximum Expected Concentration of Pollutant in Effluent (MEC):		0	0	1.3850051	1.3850051	28.655278	9.8928934	0	3.315825	0	0	66.452953
Acute - Concentration of Pollutant at the Edge of the Mixing Zone (CP):		0	0	0.2130777	0.2130777	5.0766132	1.5496881	0.001091	0.5101269	0	0	10.86031
Chronic - Concentration of Pollutant at the Edge of the Mixing Zone (CP):		0	0	0.0692503	0.0692503	2.1769305	0.5212447	0.0009966	0.1657912	0	0	4.0153961
Reasonable Potential to Violate Acute Criteria at the Edge of the Mixing Zone (RP):		**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**
Reasonable Potential to Violate Chronic Criteria at the Edge of the Mixing Zone (RP):		**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**YES**	**NO RP**	**NO RP**	**NO RP**	**---**	**NO RP**

Water Quality-Based Permit Limits for Acute and Chronic Criteria.
(based on EPA/505/2-90-001 Box 5-2).
Based on Lotus File WQBP2.WK1 Revised 19-Oct-93

Notes: City of Yelm WWTF Copper Limit

INPUT	
1. Water Quality Standards (Concentration)	
Acute (one-hour) Criteria:	**15.20**
Chronic (n-day) Criteria:	**0.486**
2. Upstream Receiving Water Concentration	
Upstream Concentration for Acute Condition (7Q10): 95th%-tile	**0.033**
Upstream Concentration for Chronic Condition (7Q10): 90th%-tile	**0.028**
3. Dilution Factors (1/{Effluent Volume Fraction}) or Plumes Model	
Acute Receiving Water Dilution Factor:	**6.5**
Chronic Receiving Water Dilution Factor:	**20**
4. Coefficient of Variation for Effluent Concentration	
(0.6 or a calculated CV if there are more than 10 data points):	**0.6**
5. Number of days (n1) for chronic average	
(usually four or seven; four is recommended):	**4**
6. Number of samples (n2) required per month for monitoring:	**1**
OUTPUT	
1. Z Statistics	
LTA Derivation (99%tile):	2.326
Daily Maximum Permit Limit (99%tile):	2.326
Monthly Average Permit Limit (95%tile):	1.645
2. Calculated Waste Load Allocations (WLA's)	
Acute (one-hour) WLA:	98.592
Chronic (n1-day) WLA:	9.185
3. Derivation of LTAs using April 1990 TSD (Box 5-2 Step 2 & 3)	
Sigma^2:	0.3075
Sigma^2-n1:	0.0862
LTA for Acute (1-hour) WLA:	31.650
LTA for Chronic (n1-day) WLA:	4.844
Most Limiting LTA (minimum of acute and chronic):	4.844
4. Derivation of Permit Limits From Limiting LTA (Box 5-2 Step 4)	
Sigma^2-n2:	0.3075
Daily Maximum Permit Limit:	**15**
Monthly Average Permit Limit:	**10**

Determining the Requirement for Permit Limits Through a Reasonable Potential Determination to Violate Standards at the Edge of the Mixing Zone.
Based on EPA/505/2-90-001

Notes: City of Yelm - Centralia Power Canal Metals

INPUT		Arsenic	Cadmium	Chromium Hex	Chromium Tri	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
Confidence Level and Probability Basis:		**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**	**0.95**
Coefficient of Variation for the Effluent Concentration (CV) (0.6 or a calculated CV if there are more than 10 data points):		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Number of Effluent Samples or Data Points (ND):		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
Highest Effluent Concentration or Value (HV) or 95th%-tile:		**0**	**0**	**1.015**	**1.015**	**21**	**7.25**	**0**	**2.43**	**0**	**0**	**48.7**
Dilution Factors (1/{Effluent Volume Fraction}) or plumes model												
Acute Receiving Water Dilution Factor:	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**	**172**
Chronic Receiving Water Dilution Factor:	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**	**195**
Water Quality Standards (Concentration)												
Acute (one-hour) Criteria:		**360**	**0.682**	**15.3**	**488**	**4.11**	**11.3**	**2.47**	**382**	**20**	**0.282**	**31**
Chronic (n-day) Criteria:		**190**	**0.335**	**10.4**	**58.1**	**3.14**	**0.441**	**0.012**	**42.4**	**5**	**---**	**28**
Upstream Receiving Water Concentration:												
Upstream Concentration for Acute Condition (7Q10): 95th%-tile		**0**	**0**	**0**	**0**	**0.790**	**0.0322**	**0.001**	**0**	**0**	**0**	**0.75**
Upstream Concentration for Chronic Condition (7Q10): 90th%-tile		**0**	**0**	**0**	**0**	**0.783**	**0.0280**	**0.001**	**0**	**0**	**0**	**0.73**
OUTPUT												
Percentile Represented by the Highest Concentration in Data Set (p_n) = (1 - confidence level)^1/ND		0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917	0.8608917
Normal Distribution Value for 95th Percentile		1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535	1.6448535
Normal Distribution Value for XXth Percentile		1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343	1.0843343
$s^2 = \ln(CV^2+1)$		0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847	0.3074847
C95 = exp(1.645Sigma -0.5Sigma^2)		2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517	2.1347517
CXX = exp(XX Sigma -0.5Sigma^2)		1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513	1.5644513
Reasonable Potential Multiplier = C95/CXX		1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Maximum Expected Concentration of Pollutant in Effluent (MEC):		0	0	1.3850051	1.3850051	28.655278	9.8928934	0	3.315825	0	0	66.452953
Acute - Concentration of Pollutant at the Edge of the Mixing Zone (CP):		0	0	0.0080524	0.0080524	0.9515932	0.0895296	0.0012819	0.0192781	0	0	1.1345353
Chronic - Concentration of Pollutant at the Edge of the Mixing Zone (CP):		0	0	0.0071026	0.0071026	0.9262664	0.0785892	0.0010436	0.0170042	0	0	1.0662538
Reasonable Potential to Violate Acute Criteria at the Edge of the Mixing Zone (RP):		**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**
Reasonable Potential to Violate Chronic Criteria at the Edge of the Mixing Zone (RP):		**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**NO RP**	**---**	**NO RP**

APPENDIX D--RESPONSE TO COMMENTS

This response to comments (RTC) is an appendix to the fact sheet for the above referenced NPDES permit. The RTC summarizes comments received during the 30-day public notice and comment period on the draft permit, and provides the Department response. All changes to the draft permit are noted below. The Department has determined to issue this permit as revised.

Comments were received from the City of Yelm and Skillings-Connolly.

Comments from the City of Yelm:

Comments 1,3,4,5:

1. Section S2 D "Monitoring Schedule: Outfall #003 – Nisqually River" Page 14. Under Category – Secondary Effluent, Parameter 'Total Lead' is followed by a footnote (1). This footnote could not be found.

3. Section S2 E "Monitoring Schedule: Ground Water Recharge by Surface Percolation" Page 15. Under Minimum Sampling Frequency, Several parameters show the footnote (2). This footnote could not be found.

4. Section S2 E "Monitoring Schedule: Ground Water Recharge by Surface Percolation" page 16. Footnote "a" makes reference to using ONPUG-MUG test. This footnote does not exist in the table.

5. Section S2 F "Monitoring Schedule: Influent to Cochrane Park Rapid Infiltration Basins" Page 16. In the Table under Minimum Sampling Frequency for Nitrate as N, a footnote (2) is shown, but no (2) exists to refer too.

Response 1, 3, 4, 5:

All of the footnote errors mentioned in the comments above have been fixed.

Comment 2:

2. Section S2 D "Monitoring Schedule: Outfall #003 – Nisqually river" Page 14. Footnote (b) refers to the maximum volume discharged during a 24-hour period. Please clarify this. Does this mean that we are to report the highest discharge rate, along with the daily total, and the average rate?

Response 2:

Footnote [b] will be changed to read as follows: The average daily flow of the discharge (MGD), the maximum day flow of the discharge (MGD), and the total flow discharged (MG), during the reporting period shall be reported on the DMR. The date and time of the start and termination of each discharge shall also be reported.

Comments from Skillings-Connolly:

Comment 1:

Page 5/Top of Page 6, Outfall #001, Footnote [c]

The current language requires a Total Residual Chlorine of 0.5 mg/L in storage ponds. This requirement should be eliminated. It should not be necessary. It would require the city to monitor the chlorine residual in the storage tank and add chlorine as required. (It is noted that the LOTT Reclaimed Water Permit does not require this.)

Response 1:

Footnote [c] has been changed to show that the 0.5 mg/L residual chlorine requirement only applies to the reclaimed water conveyance line and not the storage facility.

Comment 2:

Page 6, Outfall #002

Paragraph B Effluent Limitations states in the second paragraph that "Whenever flows in the Power Canal drops below 200 cfs, the City of Yelm must cease discharging effluent to the Centralia Power Canal. Most of the time the city is discharging reclaimed water to the canal. Reclaimed water is not considered wastewater effluent. How about if flow is reclaimed water? Should this still be a restriction if reclaimed water is being supplied as streamflow augmentation?

Response 2:

When the power canal flow approaches 200 cfs the canal is essentially shut down. Therefore the water quality limits for the Power Canal discharge were based on a minimum flow of 200 cfs. Two things would have to happen to allow a discharge when flows in the canal dropped below 200 cfs. The Canal operators would have to allow Yelm to discharge to the canal during shut down periods and Yelm's discharge would need to meet water quality standards at the end of pipe. Therefore there will be no change to the permit.

Comment 3:

Page 29, S9, B #3

The criteria listed in B. 3 is far in excess of what should be required for normal irrigation. If the water is used for irrigation, it should just state that the application will be at "normal agronomic rates". Current wording is too excessive for irrigation purposes. Normal agronomic rates should be defined, and irrigation should follow the reuse standards as it relates to ponding, overspray and timing of application.

Response 3:

Minor language changes were made to S9.B3 to separate out the hydro geological study required for surface percolation projects so that it won't be required for irrigation projects.

Comment 4:

Page 30, F #1

This paragraph is confusing. The permittee provides the treatment and distributes the water, but in most cases, does not own the re-use area. I don't think I understand what this paragraph is trying to say. Could it be clarified?

Response 4:

Minor language changes were made to S9.F1 to help clarify the intent of this special condition.

Comment 5:

Page 30, F #2

Change the word "shall" to "should."

Response 5:

Special Condition S9.F2 is a requirement to prevent runoff and overspray of the reclaimed water. Therefore there will be no change to the permit.

Comment 6:

The permit does not discuss industrial or commercial uses of reclaimed water such as cement plant, car wash, school bus washing or toilet flushing. Can some comments be added, as permitted use in the NPDES permit, that these commercial uses are acceptable, but subject to the use agreements as identified above?

Response 6:

Special Condition S9.A discusses the authorized uses and locations of the reclaimed water. All of the uses spelled out in the Ecology and Health approved engineering report are eligible under this permit. Ecology will add the comments "industrial and commercial uses" as described in the engineering report for clarification purposes.

ADDENDUM TO THE FACT SHEET
FOR NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM (NPDES)
PERMIT NO. WA0040762

I. GENERAL INFORMATION

Facility: City of Yelm Water Reclamation Facility
931 N.P. Road Northeast
Yelm, WA 98597

II. APPLICATION REVIEW

The city of Yelm submitted an application to Ecology on July 21, 2009, and May 25, 2010, for permit reissuance, and Ecology accepted it on June 10, 2010. Ecology has sufficiently reviewed the application, discharge monitoring reports, and other facility information in enough detail to ensure that:

- The city of Yelm has complied with all of the terms, conditions, requirements and schedules of compliance of the expired permit.
- Ecology has up-to date information on the waste treatment practices and the nature, content, volume, and frequency of its discharge.
- The discharge meets applicable effluent standards and limits, water quality standards, and other legally applicable requirements.

III. PERMIT REAUTHORIZATION

When Ecology reauthorizes a discharge permit it essentially reissues the permit with the existing limits, terms and conditions. Alternatively, when Ecology renews a permit it re-evaluates the impact of the discharge on the receiving water which may lead to changes in the limits, terms and conditions of the permit.

This fact sheet addendum accompanies the permit, which Ecology proposes to reauthorize for the discharge of wastewater to Nisqually River, Centralia Power Canal, and to the ground. The previous fact sheet explains the basis for the discharge limitations and conditions of the reauthorized permit and remains as part of the administrative record.

Ecology determined it does not need to change the existing permit requirements, including discharge limits and monitoring, to protect the receiving water receiving quality. The Drinking Water MCL's [Chapter 246-290 Washington Administrative Code (WAC)] have been updated since the previous permit was issued. To be consistent with

the current Drinking Water MCL's, Condition S1.D - Ground Water Recharge Criteria for Ground Water Recharge by Surface Percolation have been updated as follows:

Fecal Coliform Bacteria	Non Detect (ND)[c]
Total Trihalomethanes (TTHM)	80 µg/L
[c]Two consecutive exceedances of an enforcement limit are required for the same parameter at the same well in order to constitute a violation.	

Condition S2.E - Monitoring Schedule: Ground Water Recharge by Surface Percolation has been amended to require reporting of Total Trihalomethanes in units of "µg/L," consistent with the enforcement limit.

In addition a condition has been added to require a written site specific ground water monitoring plan/SOP to be submitted for review and approval within one year of the effective date of this reissued permit.

The previous fact sheet addressed conditions and issues at the facility at the time when Ecology issued the previous permit in 2005. Since the issuance of the current permit, Ecology has not received any additional information which indicates that environmental impacts from the discharge warrant a complete renewal of the permit. The reauthorized permit is virtually identical to the previous permit issued on June 24, 2005.

Ecology reviewed inspections and assessed compliance of the city of Yelm discharge with the terms and conditions in the previous permit and determined that it should not rank the facility as a high priority for permit renewal. Ecology assigns a high priority for permit renewals in situations where water quality would benefit from a more stringent permit during the next five-year cycle.

The permit reauthorization process, along with the renewal of high priority permits, allows Ecology to reissue permits in a timely manner and minimize the number of active permits that have passed their expiration dates. For permit reissuance planning purposes, Ecology follows a system of ranking that considers the benefit gained by renewing a permit rather than reauthorizing a permit during its annual permit planning process. Ecology assesses each permit that is expiring and due for reissuance and compares it with other permits due for reissuance. Ecology notifies the public and seeks input after it has tentatively established the initial draft ranking of the permits it plans to renew and those it plans to reauthorize. Ecology considers all relevant comments and suggestions before it makes a final decision.

Ecology carried over the discharge limits and conditions in effect at the time of expiration of the previous permit to this reauthorized permit. Ecology only changed the submittal dates for reports from those in the previous permit. Ecology removed the completed report requirements that do not require additional or continued assessment. It adjusted

the dates for the other standard compliance and submittal requirements that it carried over from the past permit into this reauthorized permit. Ecology considered these reports necessary in the previous permit and no information has come forward to cause it to reconsider.

Ecology must public notice the availability of the draft reauthorized permit at least 30 days before it reissues the permit [Washington Administrative Code (WAC) 173-220-050]. Ecology invites you to review and comment on its decision to reauthorize the permit (see Appendix A-Public Involvement for more detail on the Public Notice procedures).

After the public comment period has closed, Ecology will prepare a response to comments document that it will attach to this fact sheet addendum. The response to comments will include the resultant changes to the permit and either addresses each comment individually or summarizes the substantive comments and respond. Ecology sends a copy of the response to comments to all parties who submitted comments. Ecology will include the response to comments in this fact sheet addendum.

IV. RECOMMENDATION FOR PERMIT ISSUANCE

Ecology proposes to reissue this permit for five years.

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

Ecology proposes to reissue a permit to city of Yelm. The permit includes wastewater discharge limits and other conditions. This fact sheet addendum describes the facility and Ecology's reasons for reauthorizing the permit conditions.

Ecology placed a Public Notice of Application on June 4, 2009; June 12, 2009; June 16, 2010; and June 23, 2010, in the *Olympian* to inform the public about the submitted application and to invite comment on the reissuance of this permit.

Ecology will place a Public Notice of Draft on March 30, 2011, in the *Olympian* to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet addendum.

The Notice –

- Tells where copies of the draft Permit and Fact Sheet are available for public evaluation (a local public library, the closest Regional or Field Office, posted on our website.).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period
- Tells how to request a public hearing of comments about the proposed NPDES Permit.
- Explains the next step(s) in the permitting process.

Ecology has published a document entitled **Frequently Asked Questions about Effective Public Commenting** which is available on our website at http://www.ecy.wa.gov/biblio/0307023.html.

You may obtain further information from Ecology by telephone, 360-407-6279, or by writing to the permit writer at the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

The primary author of this permit and fact sheet is Carey Cholski.

Appendix D

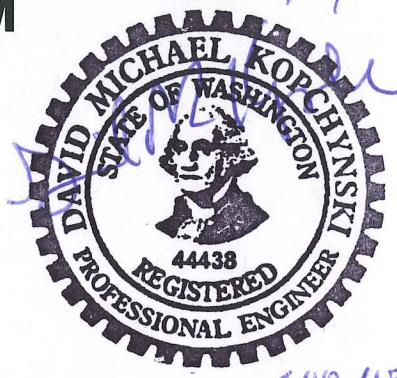
WRF Process Optimization and Capacity Analysis

Parametrix ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

1019 39th AVE SE, SUITE 100
PUYALLUP, WA 98374
T. 253.604.6600 F. 253.604.6799
www.parametrix.com

4/18/13

TECHNICAL MEMORANDUM



4/18/13

Date:	April 18, 2013
To:	Stephanie Ray, City of Yelm
From:	Ryan Johnstone, P.E., David Kopchynski, P.E., PhD
Subject:	Final WRF and Unit Process Capacity Analysis
cc:	Jim Doty, City of Yelm
Project Number:	216-1781-030
Project Name:	Water Reclamation Facility Process Optimization and Capacity Analysis

INTRODUCTION

This technical memorandum will present the findings of the capacity analysis conducted for the City of Yelm (City) Water Reclamation Facility (WRF). This capacity analysis not only looked at the treatment capacity of the sequencing batch reactors (SBRs) themselves, but also at each unit process that is part of the WRF treatment system. These unit processes are listed below:

1. SBR Activated Sludge Treatment
2. Intermediate Pump Station
3. Continuous Backwash Sand Filters
4. Chlorine Mixing Chamber and Contact Tank
5. Reclaimed Water Pump Station
6. Waste Activated Sludge Pump Station
7. Sludge Storage Tank
8. Gravity Belt Sludge Thickening Unit
9. Solids and Drain Pump Station
10. Reject Water Pump Station
11. Alkalinity Feed System
12. Dechlorination and Chlorination Feed Systems

Each of these items has been evaluated for flow and load capacity where appropriate. The following section presents the results of the capacity analysis evaluation.

CAPACITY ANALYSIS EVALUATION RESULTS

1. SBR Activated Sludge Treatment

The WRF is subject to permit compliance parameters or limits on chemical and biological loading. These limits are contained in the current NPDES and Reclaimed Water Discharge permit. These limits vary depending on the outfall that is used to dispose of the treated effluent. The outfalls defined in the permit are as follows:

- Outfall No. 001 – Reclaimed Water
- Outfall No. 002 – Centralia Power Canal
- Outfall No. 003 – Nisqually River

Treated effluent that is sent to Outfall No. 001 is subject to the maximum effluent limits shown in the Reclaimed Water Discharge permit. Treated effluent that is sent to Outfall No. 002 or No. 003 is subject to the maximum effluent limits shown in the NPDES permit. The limits from the NPDES/Reclaimed Water Discharge permit for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and Total Nitrogen (TN) are shown below.

		BOD	TSS	TN	Total Ammonia
Outfall No. 001	Reclaimed Water	30 mg/L	30 mg/L	10 mg/L	–
Outfall No. 002	Centralia Power Canal	30 mg/L	30 mg/L	–	3 mg/L
Outfall No. 003	Nisqually River	30 mg/L	30 mg/L	–	3 mg/L

In order to determine the treatment capacity remaining in the WRF, three scenarios were modeled utilizing the Biowin software. The model used to evaluate these scenarios was originally assembled by Brown and Caldwell and has been updated by Parametrix to reflect current WRF performance. The scenarios modeled were:

1. Under existing BOD, TSS, and TN load and flow conditions for both the winter and summer seasons with current reclaimed water effluent discharge (Outfall No. 001) requirements as shown above.

2. Under existing BOD, TSS, and TN load and flow conditions for both the winter and summer seasons with current NPDES permit discharge requirements (Outfall No. 002 or No. 003) as shown above.

3. Under existing BOD, TSS, and TN load and flow conditions for both the winter and summer seasons with modified reclaimed water permit effluent discharge requirements (Outfall No. 001 but with application of effluent for Turf Irrigation only, for example school and park irrigation). Unless modified by Washington State Department of Ecology (Ecology), recharge to Cochrane Park will still be required to meet the TN requirement.

It is important to note that some assumptions were required in order to complete the modeling of the scenarios. The first assumption is that side stream flow volumes will remain at their current volume. However, as influent flow increases it will be necessary to begin operating additional sand filter cells. These additional cells will require backwashing which will increase the volume of backwash water from the sand filter and increase the total side stream flow volume. Next, data used to calculate the capacity remaining in Equivalent Residential Units (ERUs) was taken from the DRAFT *General Sewer Plan* and it is assumed that this data will remain unchanged in the FINAL *General Sewer Plan*. ERU calculations are based on 2.98 people per ERU and a wastewater flow of 127.41 gallons per day (gpd)/ERU. Finally, influent flow and load values were collected from recent WRF monitoring data. Should these values change, this could impact the capacity remaining at the WRF. For this document, the current WRF influent flow from the City STEP system is assumed to be 0.36 million gallons per day (mgd).

The following table presents the results of modeling the three scenarios listed above.

Table 1. Modeling Results

	Maximum Daily Flow Into WRF (mgd)	Additional ERU Capacity[a]	Daily Side Stream Flow (mgd)	Side Stream ERUs[b]	Total Daily Flow (mgd)	Additional ERUs Converted To Population	Total Population[c]	Years Remaining Before Upgrades[d]
Scenario #1 (Winter Operation)	0.55	1,118	0.10	785	0.65	3,333	11,906	5
Scenario #1 (Summer Operation)	0.60	1,413	0.10	785	0.70	4,210	12,783	6
Scenario #2 (Winter Operation)	0.90	3,179	0.15	1,177	1.05	9,473	18,046	16
Scenario #2 (Summer Operation)	1.00	3,767	0.15	1,177	1.15	11,227	19,800	20+
Scenario #3 (Winter Operation)	0.60	1,413	0.15	1,177	0.75	4,210	12,783	6
Scenario #3 (Summer Operation)	0.65	1,707	0.15	1,177	0.80	5,087	13,661	8

[a] ERU values incorporate a factor of safety of 25% to account for the unknown increase in non-residential and school sanitary sewer flows.

[b] Number of ERUs being occupied by side stream flow volume.

[c] Total population is the population volume obtained from the ERUs added to the projected sewered population for 2013.

[d] Years remaining before upgrades was determined by comparing the total population to the population projects in the DRAFT GSP.

Source: All population projections are based on US Census data and data from the Thurston County Regional Planning Commission.

The maximum daily flow shown above is the total flow that can be treated by the WRF under the permitted limits stated for each scenario. The corresponding ERUs were calculated by taking this maximum flow and subtracting the current flow. This difference is then divided by the flow per ERU to yield the additional ERUs that can be served at the stated maximum flow.

To convert the ERUs to population, the ERU value was multiplied by 2.98. This population value was then added to the current population served by the existing sewer system to obtain a total population being served by the WRF. This population number was then matched to the population projections contained on the DRAFT *General Sewer Plan* in order to determine the years of treatment capacity remaining until upgrades to the WRF are necessary.

It is important to note the impact that current side stream flows have on available treatment capacity. Current side stream flow volume is approximately 100,000 gpd. This volume could be reduced by as much as 50 percent with additional process improvements and new equipment. If side stream flows are reduced to 50,000 gpd, an additional 50,000 gallons of treatment capacity is available to treat influent flows. This additional 50,000 gallons equates to approximately 350 ERUs.

Scenario No. 2 is valid only if Outfall No. 1 is completely shut down and there is no reclaimed water production. In addition, lime addition for control of pH would need to be employed, and all treated effluent be disposed of through Outfall No. 2 or No. 3. There is no TN compliance parameter if all water is disposed of at the Nisqually River or the Centralia Power Canal. Discharge to these outfalls is only required to meet a permit compliance parameter for ammonia.

Scenario No. 3 assumes that Ecology will modify the Reclaimed Water Discharge Permit for reclaimed water applied through turf irrigation. This permit modification would revise the TN permit limit to a Total Inorganic Nitrogen (TIN) permit limit removing total Kjeldahl nitrogen (TKN) from the Total Nitrogen calculation. It should be noted that Cochrane Park will still be required to meet TN permit limitations under this scenario. Please see the Reclaimed Water Discharge Permit Evaluation technical memorandum dated January 4, 2013, for a broader discussion of this potential permit modification.

2. Intermediate Pump Station

The capacity of a pump station is usually presented in terms of "firm capacity." Ecology defines firm capacity as the pumping capacity of the pump station with the largest pump out of service. The capacity of the various existing pump stations at the WRF will be measured with this in mind.

The intermediate pump station pumps treated effluent from the equalization basin through the static mixers and to the sand filters. This pump station is composed of two, 17.5 horsepower (hp) pumps that each have a pumping capacity of 872 gallons per minute (gpm). This equates to a firm capacity of 872 gpm for the intermediate pump station. The current volume being treated by the sand filters is approximately 430,000 gpd. This is approximately 300 gpm or 34 percent of the total intermediate pump station's firm capacity. Looking forward, if the WRF operates at the maximum design influent flow rate of 1 mgd, the intermediate pump station will be required to pump approximately 700 gpm from the equalization basin to the sand filters. This is approximately 80 percent of the intermediate pump station's firm capacity.

Based on these calculations, the existing intermediate pump station has adequate capacity to serve the WRF up to the maximum design flow rate of 1 mgd.

3. Continuous Backwash Sand Filters

The continuous backwash sand filter is composed of three cells with each cell having two filter modules. Each filter module has a design capacity of 5 gpm per square foot of filter area and each filter module has an area of 50 square feet. Based on this sizing, the existing sand filter system is designed to handle a maximum flow of 2.2 mgd. Currently, the sand filters are treating approximately 430,000 gpd. This is approximately 20 percent of the filters design capacity. At this time, due to the current flow through the sand filter, only one cell is being utilized.

Based on the calculation above, the existing sand filter has enough filtration capacity to serve the WRF up to the maximum design flow rate of 1 mgd.

Under one cell operation, the filter system generates approximately 73,000 gallons per day of backwash water that must be returned back to the SBR for treatment. This current backwash water flow rate, at an influent flow of 0.36 mgd, is already achieving the stated design backwash water flow of 71,000 gallons per day that was predicted for a 1.0 mgd raw influent flow. This side stream return flow has a direct impact on the treatment capacity of the WRF because treatment capacity that should be available to treat influent flow from the City collection system is, instead, treating this large side stream flow. By reducing the backwash water volume, additional capacity is regained for treating influent flow in the SBRs.

One method for reducing the backwash volume from the sand filter is to use an intermittent, rather than continuous, backwash system. This system could potentially reduce backwash volume by up to 50 percent. Further evaluation of this system will occur during the Facility Planning process.

4. Chlorine Mixing Chamber and Contact Tank

The current chlorine disinfection system is composed of a rapid mixing chamber, a distribution chamber, and two chlorine contact tanks.

The rapid mix chamber is designed to contain 750 gallons for one minute to ensure proper mixing of the chlorine disinfectant with the filter effluent. For a 24-hour period, that equates to 1.1 million gallons (MG) of disinfected filter effluent. The chlorine contact tanks are each sized to hold 34,080 gallons for 97 minutes. One tank can treat up to 0.5 mgd. Based on the current flow of 0.36 mgd, one tank has adequate capacity to disinfect the current volume of effluent. Once the flow increases beyond 0.5 mgd, it will be necessary to open the second tank which will increase the chlorine contact tank capacity to 1 mgd.

Based on these values, it is apparent that the chlorine mixing chamber and contact tank has enough physical capacity to serve the WRF up to the maximum design flow rate of 1 mgd.

5. Reclaimed Water Pump Station

The reclaimed water pump station takes the Class A reclaimed water produced at the WRF and pumps it into the reclaimed water system for use by the various reclaimed water customers located throughout the City and for groundwater recharge at Cochrane Park.

The pump station is a prepackaged system composed of four pumps; two 7.5 hp maintenance pumps and two 15 hp supply pumps. The supply pumps are controlled by variable frequency drives.

Under low flow operating conditions, the maintenance pumps are used to deliver reclaimed water into the reclaimed water distribution system and maintain a minimum system pressure of 65 psi. Once demand increases and the system pressure drops below 65 psi, the maintenance pumps shut off and the supply pumps take over. The supply pumps will then attempt to maintain 90 pounds per square inch (psi) in the reclaimed water distribution system.

Per the facility design criteria in the *Water Reuse Facility Operation and Maintenance Manual* completed in November 1999, the Monthly Average Design Flow for the reclaimed water system is 1.0 mgd. Currently, the reclaimed water pump station can pump up to 265 gpm which corresponds to 381,600 gpd. As the WRF influent flow increases, it will be necessary to upgrade the pumps to accommodate the increased production of reclaimed water. It should be noted that during the summer months, reclaimed water production is as high as 350,000 gpd. WRF staff has noticed that at these times the reclaimed water pump station has trouble keeping up with this demand.

As a result of this review, it appears that the reclaimed water pump station is sized adequately to handle the current flow of reclaimed water. However, as part of the City's plan to mitigate for additional groundwater withdrawals, an additional 50,000 gpd of reclaimed water will be conveyed to Cochrane Park between the months of October and May each year. This additional volume may necessitate upgrades to the reclaimed water pump station.

6. Waste Activated Sludge Pump Station

The Waste Activated Sludge (WAS) Pump Station is responsible for pumping sludge from the SBRs to the sludge holding tank during the settling phase of each SBR treatment cycle. This same pump station can also be used to transfer sludge from one SBR basin to another through a bypass pipe installed between the suction and discharge headers. The amount of sludge pumped during each cycle is dependent on the desired Mixed Liquor Suspended Solids (MLSS) concentration and the Solids Retention Time in the SBRs. Currently, 3,600 gpd of waste activated sludge is drawn from each operating SBR.

The pump station contains two 7.5 hp pumps that each have a pumping capacity of 150 gpm. This equates to a firm capacity of 150 gpm for the waste activated sludge pump station. Should the pumps be run at the same time, the pump station is capable of 300 gpm. With the pump station operating at its firm capacity of 150 gpm (only one pump in service), 48 minutes is required to waste up to 3,600 gallons of sludge per day from each operating SBR (7,200 gallons total). SBR sludge wasting rates will increase as the raw influent flow increases. Given that these pumps are used solely for the purpose of wasting sludge, the existing capacity of the pump station is considered adequate. However, careful planning should be used when determining the appropriate MLSS concentration to operate the SBRs at and how much sludge is to be wasted each cycle. Decreasing the MLSS concentration and increasing the volume of sludge to be wasted will increase WAS pump run times.

7. Sludge Storage Tank

The sludge storage tank receives waste activated sludge from the SBRs. Sludge is stored in this tank until the WRF operator is ready to begin processing sludge with the Gravity Belt Thickener (GBT).

The volume of the tank is 663,400 gallons. However, this tank is broken into two halves by a wall running in the middle of the tank. This creates two tanks with a volume of 331,700 gallons each. One of these tanks is of adequate size to handle WAS loads currently being pumped from the SBRs on a daily basis. The sludge storage tank is not seen as a limiting factor when considering WRF treatment capacity. As flows at the WRF increase and WAS feed volumes into the tank increase, then it may be possible to run the GBT unit more often in order to control the amount of sludge being held in the storage tank.

8. Gravity Belt Thickener (GBT)

The GBT receives sludge pumped from the sludge storage tank and thickens it. This process is accomplished by adding a coagulant to the sludge which causes the solids in the sludge to bind together more tightly, expelling any water in the sludge. The solids that remain are discharged from the GBT into a sludge hopper. From here, the solids are pumped to a truck for hauling off-site and disposal.

The GBT is sized for a maximum hydraulic feed rate of 180 gpm. The GBT currently receives approximately 22,000 gallons of sludge for thickening each time it runs (which is currently no more than three times each week). This corresponds to a run time of 122 minutes. From this, 3,500 gallons of thickened solids and 18,500 gallons of filtrate are produced. The GBT currently operates no more than three times a week.

It is assumed that the volume of sludge to be thickened will increase proportionately with the volume of raw influent flow into the WRF. Using this assumption, it is safe to assume that at or near 1 mgd of WRF influent flow, the GBT will be processing 66,000 gallons of sludge three times per week. This corresponds to a run time of 366 minutes. From this, 7,500 gallons of solids and 55,500 gallons of filtrate are produced.

These run times are well within the capability of the existing GBT and therefore, the assumption based on these calculations is that the GBT provides adequate capacity to process the sludge volumes produced by the WRF when treating an influent flow of 1 mgd. However, the filtrate produced by the GBT has to be returned back to the SBRs for treatment. It is this side stream return flow, in conjunction with backwash water from the sand filter, that is impacting the treatment capacity of the WRF.

8. Solids and Drain Pump Station

The Solids and Drain Pump Station has two purposes: the first is to pump sludge from the sludge storage tank to the GBT and the second is to pump water from the various drains located throughout the WRF back to the SBRs for treatment.

This pump station has two 6 hp submersible pumps with a pumping capacity of 150 gpm each. This equates to a firm capacity of 150 gpm for the solids and drain pump station. Using the assumption above regarding the current volume of sludge being pumped from the sludge storage tank to the GBT, the pump station will need to run 147 minutes, each time the GBT is scheduled to operate. The solids and drain pump station is expected to be able to meet this capacity requirement based on the assumption that the GBT runs three times per week.

The other flows that are handled by this pump station come from the various drains located throughout the WRF. Any wash water, spills, or other liquids that end up in the drain system are pumped by this pump station back to the SBRs for treatment. These flows are independent of the WRF influent flow and are intermittent in nature. Therefore this flow is not included as part of this capacity analysis.

9. Reject Water Pump Station

The Reject Water Pump Station receives filtrate from the GBT, backwash water from the sand filter, and scum from the SBR tanks and returns it to the head of the plant for treatment. All of these flows are considered “reject water” because they are flows that are generated on-site through other processes and are rejected, or returned, back to the SBRs for treatment.

The pump station has two pumps with a pumping capacity of 180 gpm each. The firm capacity of the pump station is 180 gpm. Currently the pump station is receiving approximately 91,500 gpd (64 gpm) from the sand filter backwash and GBT filtrate flows. No flow is being received from the SBR scum collectors because these are not currently in operation.

The 64 gpm of reject water flow equates to approximately 35 percent of the pump station’s firm capacity. With the anticipated decrease in sand filter backwash volume, and even though filtrate volume will increase somewhat over time, it is not anticipated that either of the flows will be great enough that the pump station capacity will be exceeded.

However, it is important to reiterate that from a WRF treatment capacity perspective, these flows must be reduced in order to regain treatment capacity that can be used to treat additional influent flow from the City STEP collection system.

10. Alkalinity Feed System

The Alkalinity Feed System administers caustic soda to add alkalinity and control the pH of the wastewater. Currently, this system is not used by the City and it is not anticipated that it will be used in the near future, because of this; we are not considering its capacity as a part of the unit process review presented here.

Because pH control is considered one of the alternatives for increasing capacity at the WRF, restarting the alkalinity feed system will be necessary. This will be evaluated as part of the Facility Planning process.

11. Dechlorination and Chlorination Feed Systems

Dechlorination feed is accomplished with the use of gaseous sulfur dioxide and chlorination feed is accomplished by the use of gaseous chlorine. Chlorine gas and sulfur dioxide gases are brought on-site in 150 pound cylinders.

For proper chlorination, the chlorine gas dosing volume is 17 pounds per day at the current influent flow volume. At this dose, the WRF requires delivery of new 150 pound chlorine gas cylinders every 8 days. At the design influent flow volume of 1 mgd, the chlorine gas dosing volume will be approximately 47 pounds per day. At this dose, the WRF will require delivery of new 150 pound gas cylinders every 3 days.

For proper dechlorination, the sulfur dioxide dosing volume is 12 pounds per day at the current influent flow volume. At this dose, the WRF requires delivery of new 150 pound sulfur dioxide cylinders every 12 days. At the design influent flow volume of 1 mgd, the sulfur dioxide dosing volume will be approximately 33 pounds per day. At this dose, the WRF requires delivery of new 150 pound sulfur dioxide cylinders every 4 days.

As influent flow volumes increase, it will be necessary for the City to purchase chlorine and sulfur dioxide on a more frequent basis. This will be an increase in cost that must be considered when planning future improvements. Because of this potential increase in cost, alternatives may be considered that could alleviate this issue. Sodium hypochlorite can be used for disinfection and can be purchased in larger totes for greater capacity and longer durations between replenishment. For dechlorination, ascorbic acid, sodium bisulfate, and UV are all options that may help reduce long term costs associated with dechlorination currently accomplished with sulfur dioxide.

Options for alternatives to using chlorine gas for chlorination and sulfur dioxide for dechlorination will be evaluated during the Facility Planning process.

SUMMARY OF RESULTS

As can be seen from Table 1 presented in the SBR Activated Sludge Treatment analysis, the controlling scenario for determining the capacity remaining at the WRF is Scenario 1. Under this scenario, there is enough remaining capacity at the WRF to treat an additional 1,118 ERUs. Key reasons for the significant reduction in SBR treatment capacity compared to the stated design flow capacity by US Filter of 1.0 mgd are:

- Low raw influent water temperature plays a major role negatively impacting nitrification rates and hence design total nitrogen removal capacity for the SBR system. This causes a significant reduction of the SBR design capacity during the winter. US Filter calculations were based on a water temperature of 25 degrees Celsius while plant records show the raw influent and SBR liquid temperatures consistently go as low as 9 degrees Celsius during winter operation. Significant influent diurnal flows are being received by the plant and these diurnal flows impact both winter and summer design capacity for the SBR system. Current influent flow data has indicated that sustained peak hourly flows (1 to 2 hour periods) can reach as high as 0.85 mgd and these sustained peak flow periods typically occur in the mid-morning and in the early evening dinner times. As the influent flow to the WRF continues to increase, the sustained peak hour flows are expected to rise well above 1.0 mgd. Elevated peak hour flows above 1.0 mgd will force the SBR system to operate one or two operating cycles a day well above stated design flow capacity while other operating cycles may receive little flow (during early morning periods). Under loading specific SBR cycles can also negatively impact the SBR biological activity and SBR sludge settleability. In order to eliminate the peaks and valleys associated with daily influent flow to the WRF, flow equalization through the use of an equalization basin placed ahead of the SBRs is proposed. This proposed basin will eliminate these peaks and valleys and make it possible for the SBRs to receive consistent flows throughout the day. This flow equalization strategy will be further evaluated during the Facility Planning process.

- The measured influent TKN concentrations are higher than the US Filter basis of design value of 57 mg/L and measured influent BOD values are typically lower than the US Filter basis of design value of 208 mg/L. Current influent TKNs are being measured in the 65 to 74 mg/L range and influent BODs have only been measured in the 140 to 155 mg/L range. Higher influent TKN and reduced influent BOD levels compared to basis of design values will also cause a reduction of the SBR treatment capacity.

Numerous short term operational opportunities using existing infrastructure or requiring minimal capital investment exist to increase SBR treatment capacity back to the stated design value. These opportunities include:

1. Carbon supplementation.
2. Cycle time adjustments.
3. Increase the SBR operational pH (Evaluate existing pH control feed facility for reactivation).
4. Bio-Augmentation for cold weather nitrification.
5. Reducing filter backwash reject water return flows to SBR by making adjustments to existing filter equipment.

It is also apparent as a result of the unit process analysis that the Reclaimed Water Pump Station is significantly undersized when compared to the Average Day Design Flow of 1.0 mgd. Currently, the station's maximum capacity is 381,600 gpd. Demand for reclaimed water in the summer months and increased reclaimed water flow to Cochrane Park in the fall and winter to mitigate for additional groundwater withdrawals is nearly exceeding the pump station's ability to fulfill this demand. As part of the Cochrane Park rapid infiltration basin (RIB) project that was recently started, the reclaimed water pump station will be evaluated and, if needed, upgrades will be designed to handle additional reclaimed water flow.

Finally, it is noted that as WRF influent flow increases, the WAS Pump Station, GBT, and Solids and Drain Pump Station may require longer operational durations in order to pump or process the increased volumes of sludge that may be generated. While it appears that these unit processes have enough capacity to handle the higher volumes, the increased operational durations may make operating this equipment more expensive due to the increased power consumption. Future facility planning may be able to examine upgrades or operational strategies in order to keep these unit processes operating as efficiently as possible.

NEXT STEPS

Many options exist for the treatment capacity issues at the WRF. In order to properly evaluate and prioritize these options, additional examination of the engineering and administrative aspects of the WRF must be initiated. The Facility Plan is the vehicle for completing this task.

Per the NPDES permit for the WRF, planning for continuing to maintain capacity is triggered when actual flow or waste load reaches 85 percent of any one of the design criteria listed in section S4.A of the permit for three consecutive months or when the projected increase would reach design capacity within 5 years. This capacity analysis has shown that the limit for influent flow may be reached in 5 years.

Appendix E

SBR BioWin Model Treatment Capacity

October 27, 2014

David Kopchynski, Parametrix
1019 39th Avenue SE, Suite 100,
Puyallup, WA 98374

Re: Yelm, WA—Existing Sequencing Batch Reactor
BioWin Model

Dear David Kopchynski:

We are pleased to present our BioWin Model findings for the existing SBR plant at Yelm, WA.

The main objective of this model was to determine the effectiveness and timing of adding supplemental carbon to the existing SBR plant to assist in denitrification during winter months. The model was optimized to meet the operational process parameters specified while satisfying process parameters seen in the plant's historical process data. The model was executed at the minimum temperature of 8 degrees C.

The current flows and loadings assumed are listed below in the Influent and Recycle columns. To account for the combined loadings from influent and recycle streams (filter backwash and belt filter filtrate), the combined loadings were used for the model as shown in green column below.

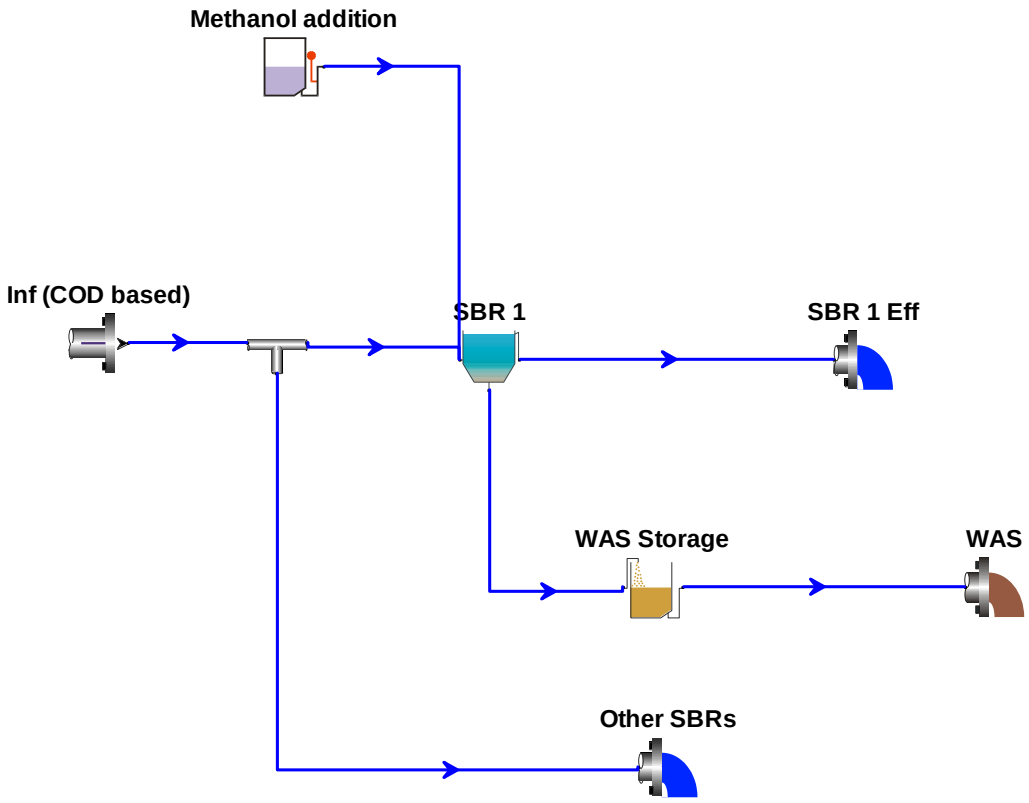
Loadings Assumptions for model:

	356,000 gpd (Influent)	**120,000 gpd (Recycle)**	**476,000 gpd (Combined)**
BOD	213 mg/L	100 mg/L*	190 mg/L
TSS	63 mg/L	100 mg/L	73 mg/L
NH3-N	42 mg/L	10 mg/L	34 mg/L
NO3-N & NO2-N	0 mg/L*	10 mg/L	2.5 mg/L
TKN-N	63 mg/L	15 mg/L*	51 mg/L
DO	0 mg/L*	2 mg/L*	0.5 mg/L

*Evoqua assumption

The flow assumption used for the model was based on 2 SBR operation (1 SBR offline) at a flow rate of 0.71 MGD. This flow rate was determined knowing that the plant was designed for 1.06 MGD in 1998 for 3 basins—Since 2 basins are in operation, the design flow rate is 0.71 MGD.

The process flow diagram for the 2 SBR model is as follows:

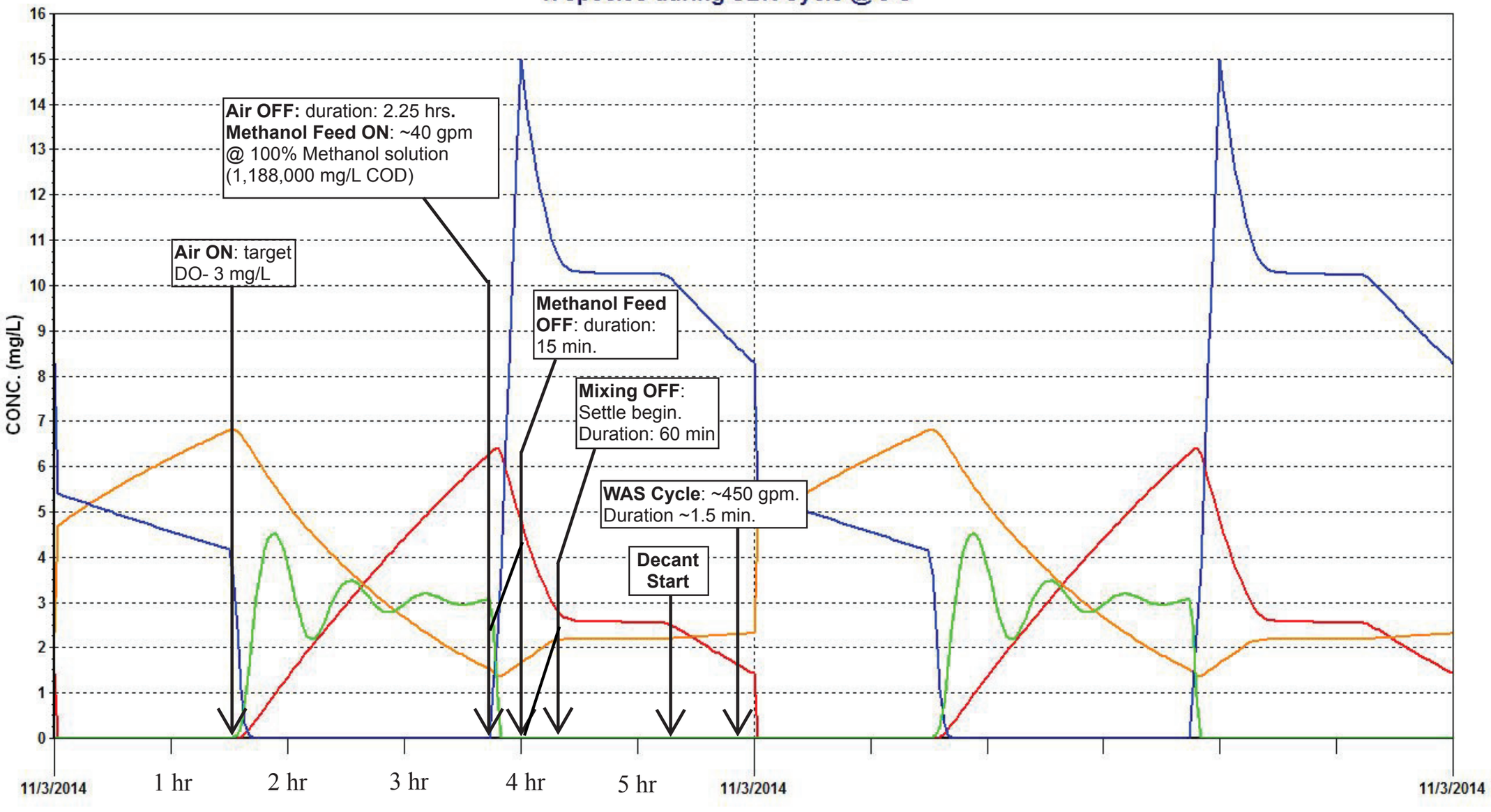


<u>The 6 hour cycle structure used in model is as follows:</u>

0 to 1.5 hr—Anoxic Fill
1.5 to 3 hr—Aerated Fill
3.0 to 3.75 hr—Aerated React
3.75 to 4.0 hr—Post-Anoxic Step-Methanol Addition
4.0 to 4.25 hr—Post-Anoxic Step-Mixing Only
4.25 to 5.25 hr—Settle (mixing off)
5.25 to 5.75 hr—Decant
5.875 to 5.9 hr—WAS discharge

Please see next page for a closer look at the Nitrogen response to methanol addition in the 6 hour cycle. Also shown is DO profile, assumed Methanol feed flow, assumed WAS flow. The subsequent pages show the effluent results and other key process parameters from the Biowin model using the assumptions I have previously explained.

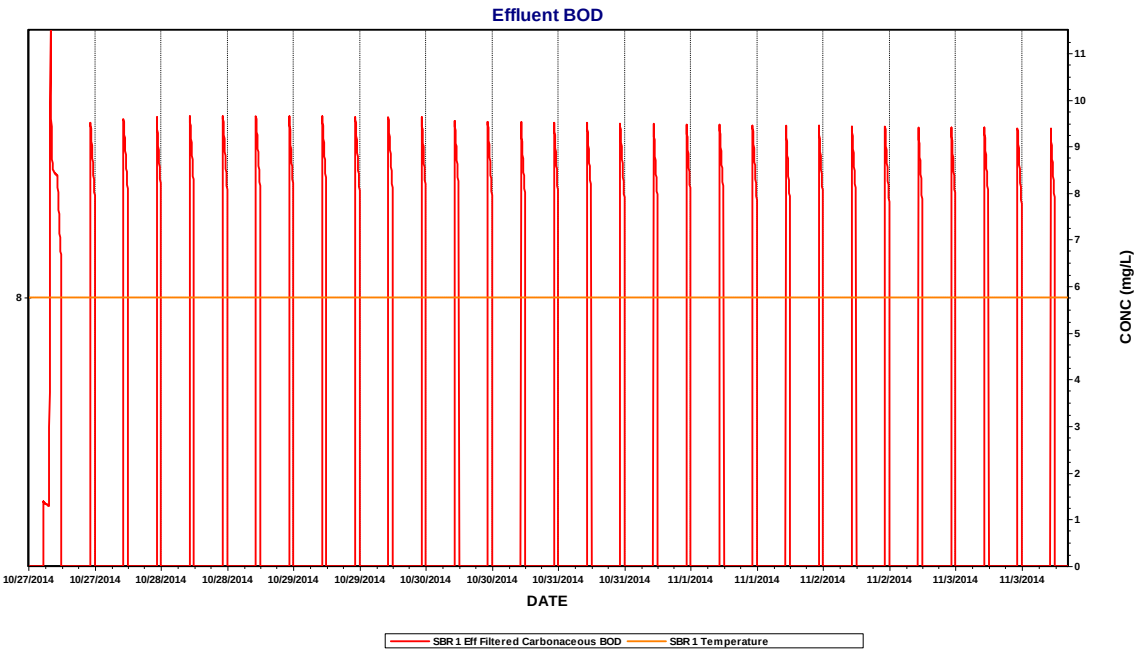
N species during SBR Cycle @ 8 C



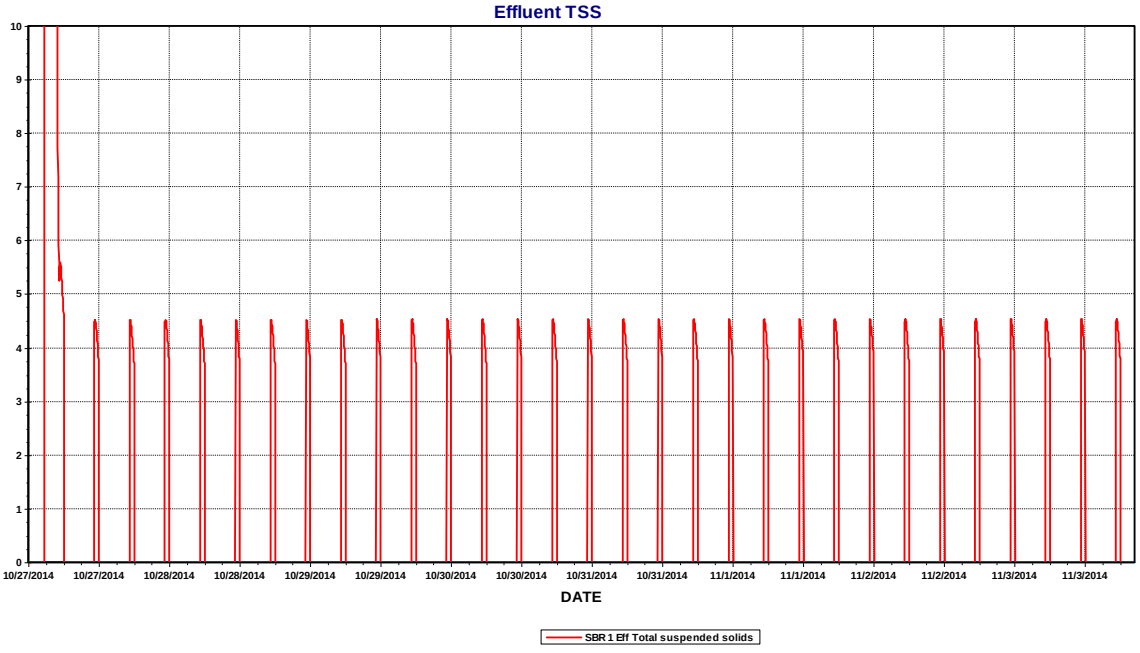
1 hr 2 hr 3 hr 4 hr 5 hr

BioWin Album

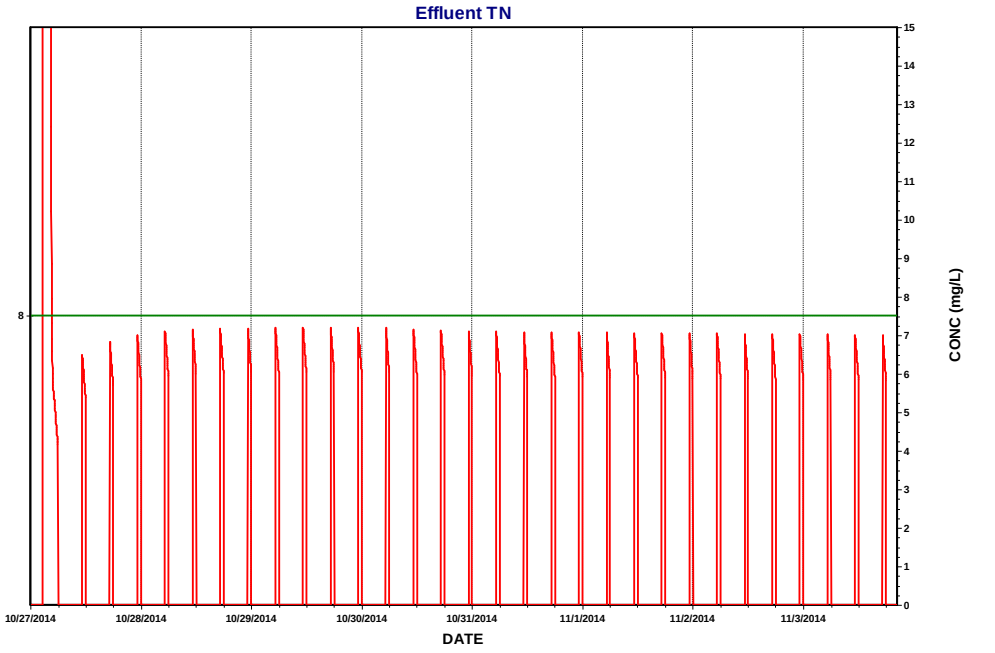
Album page - Eff BOD



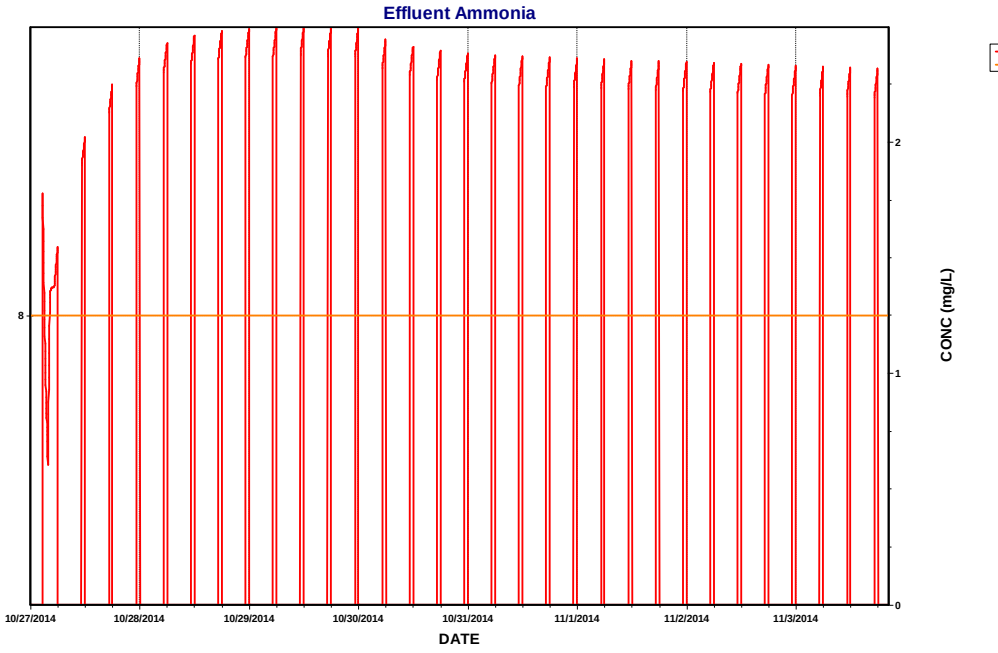
Album page - Eff TSS



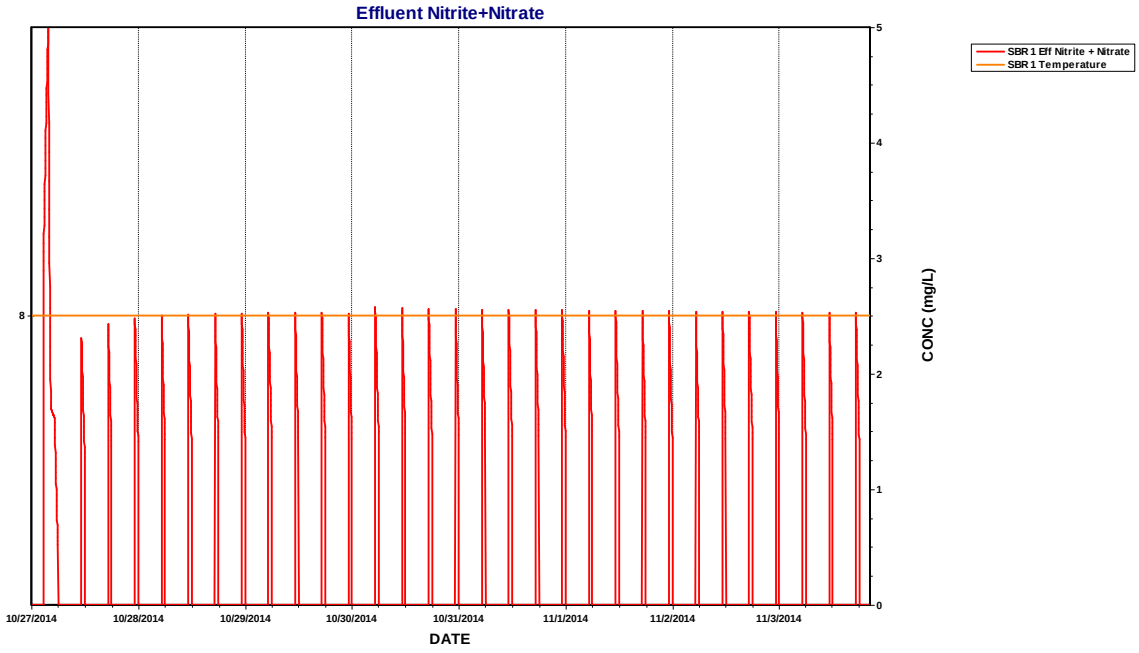
Album page - Eff TN



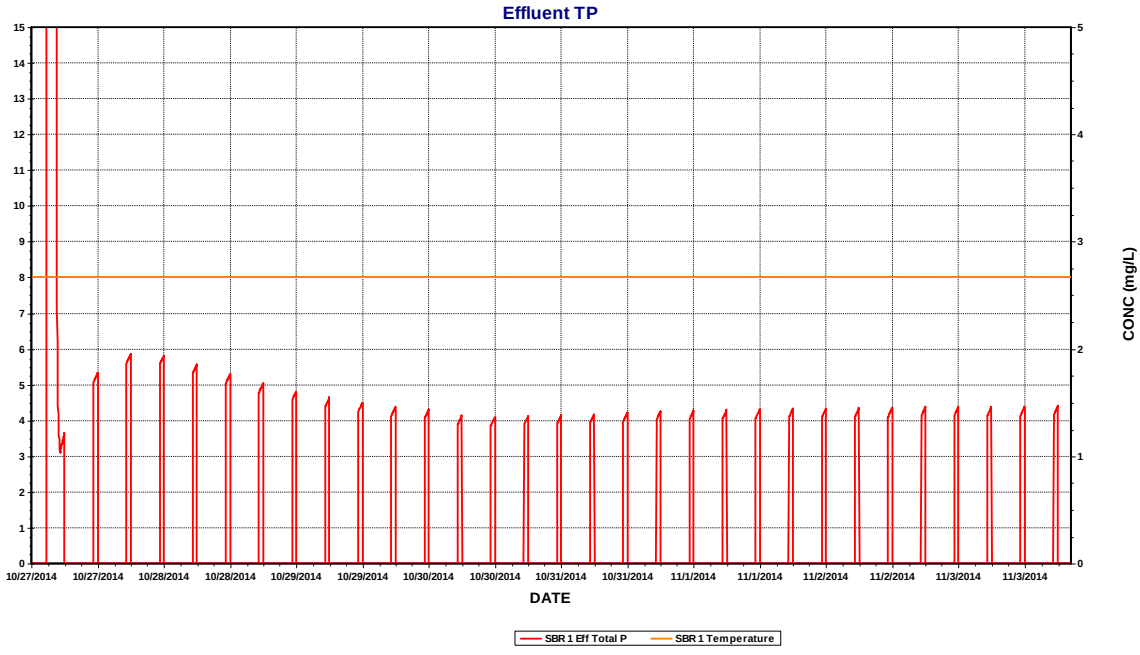
Album page - Eff Ammonia



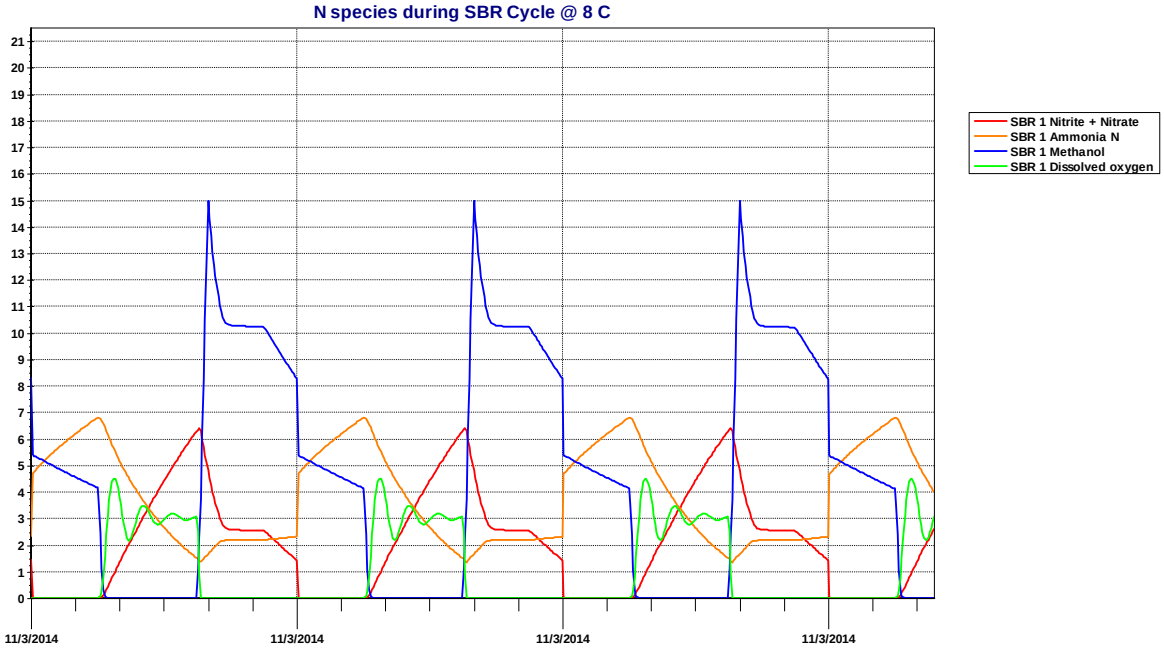
Album page - Eff Nitrate/Nitrite



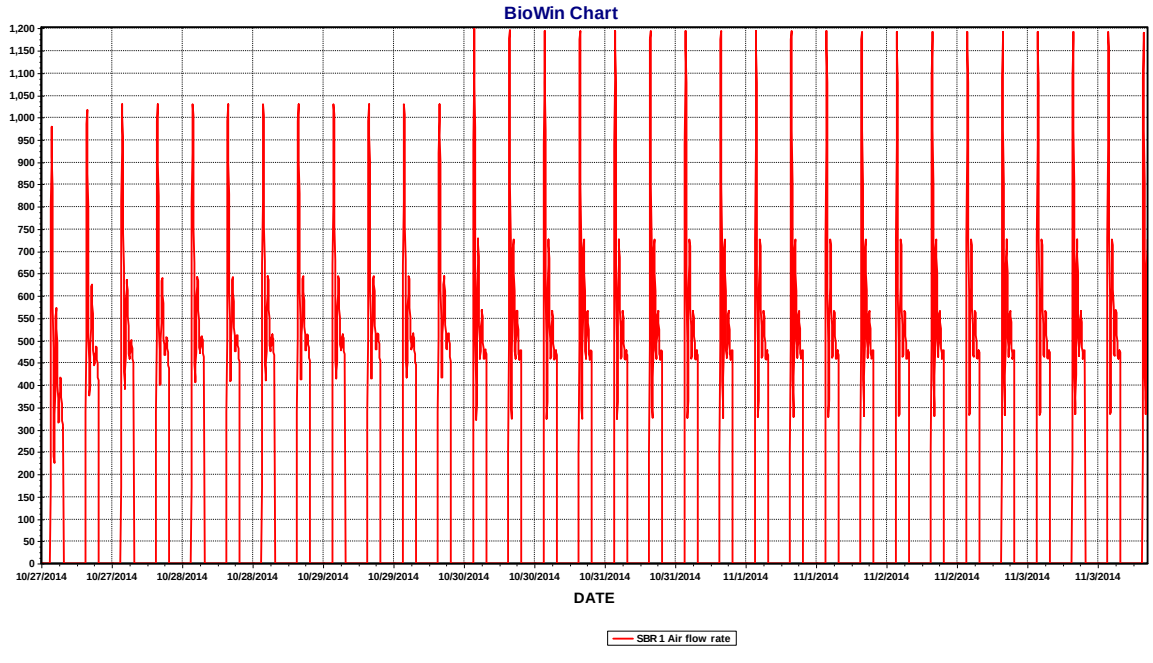
Album page - Eff TP



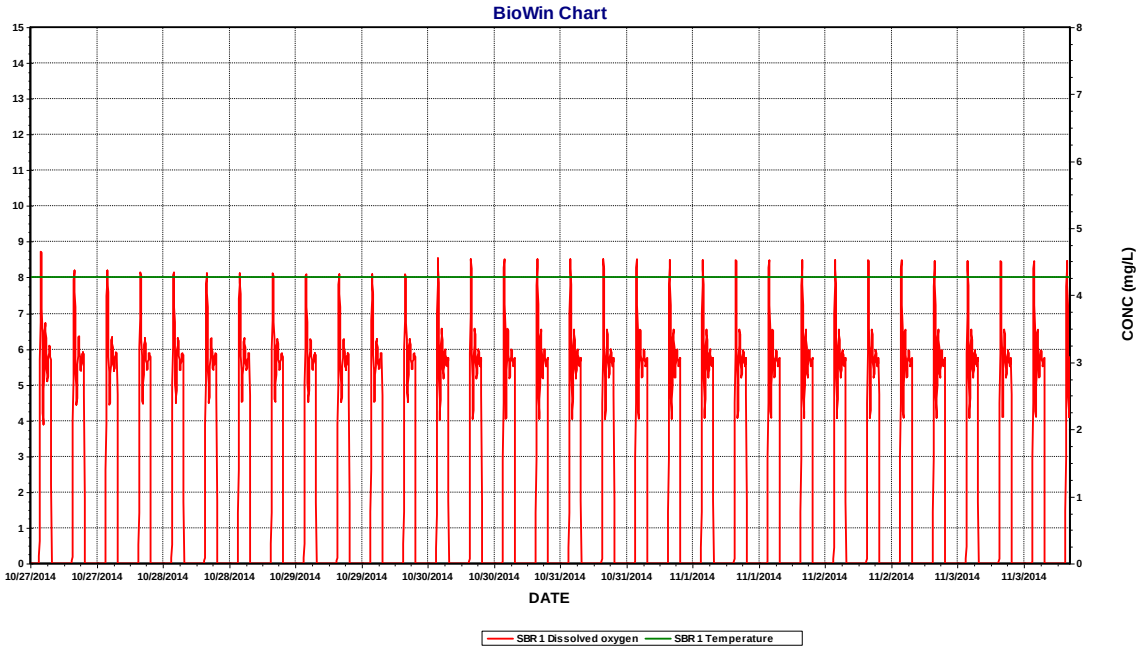
Album page - N species in SBR



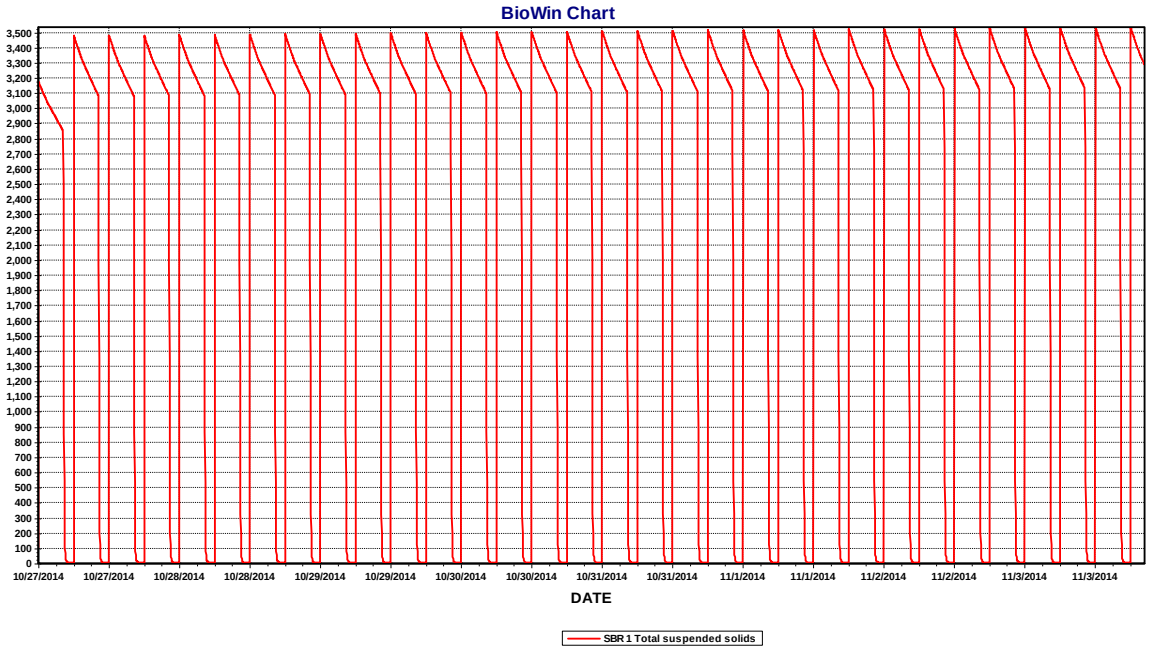
Album page - SBR Airflow



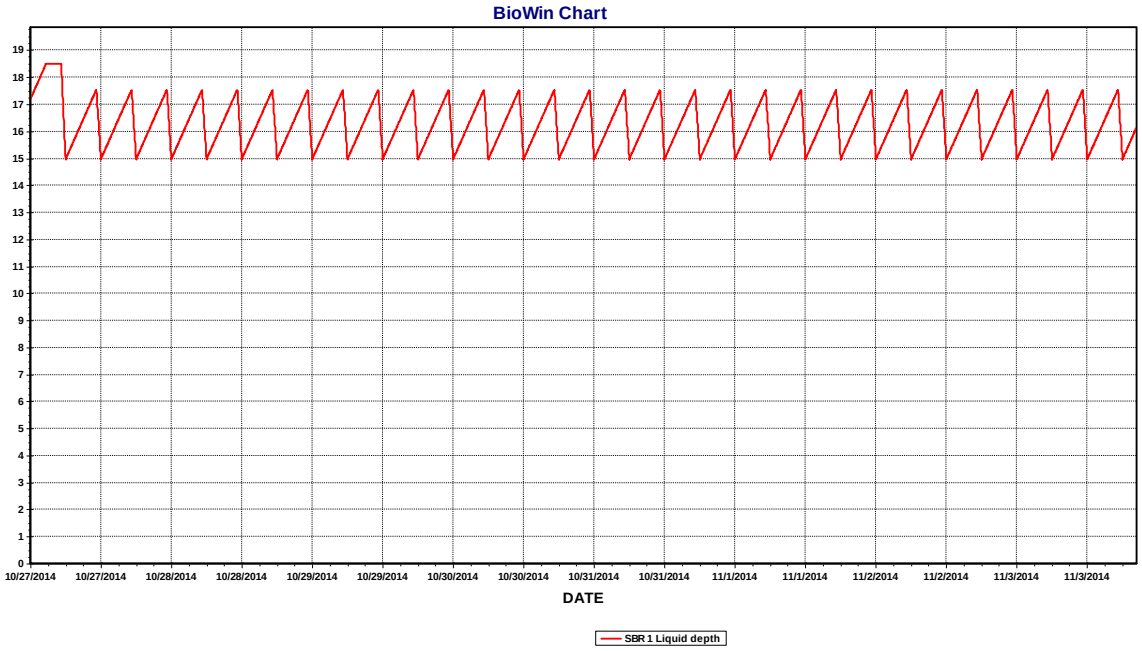
Album page - SBR DO



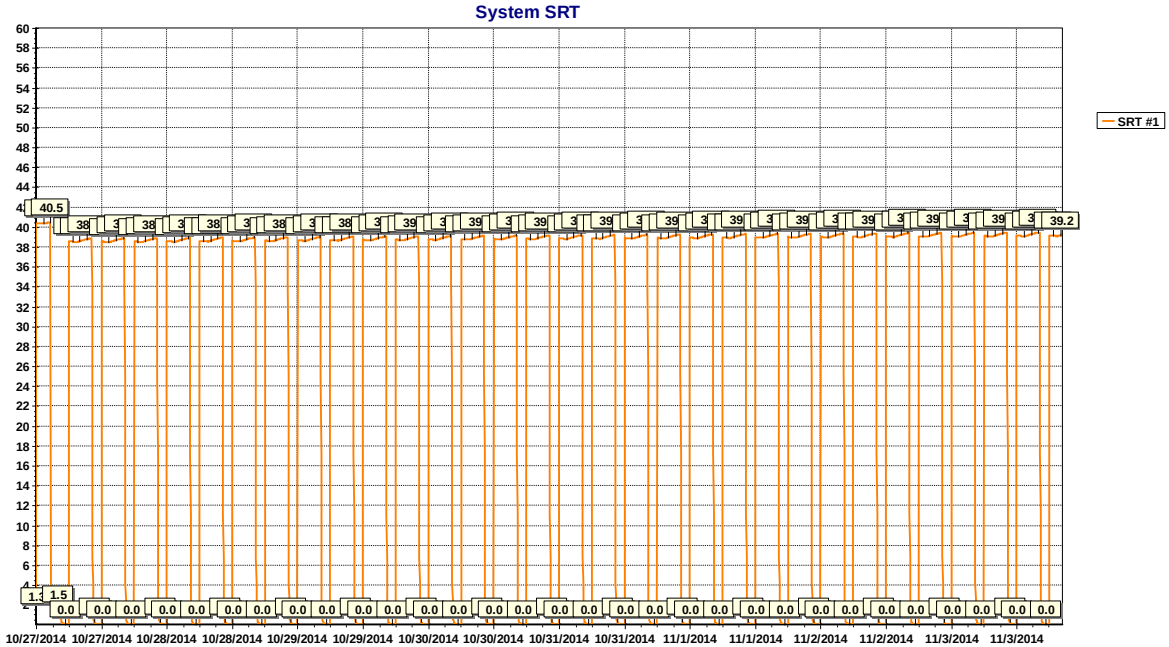
Album page - SBR MLSS



Album page - SBR Level



Album page - SBR SRT



Overall, the effluents resulted in meeting the specified requirements. In order to nitrify sufficiently, I bumped up the target DO from 2 to 3 mg/L. You can see the actual required air (500-1000 SCFM) required to maintain this DO setpoint in the Biowin album output plots which is much lower than what the existing blowers are specified for (2600 SCFM). I extended the aeration time from 99 minutes to 135 minutes as you indicated in email which helped out a lot in the model to nitrify down to 2-3 mg/L NH3-N. While you note that the plant uses a minimum of 120 minutes anoxic fill time, I used an anoxic fill time of 90 minutes. While there is value in applying more anoxic fill time, I believe there is more value in provided extended aerated react for nitrification at this low of a temperature. We have typically designed for 90 minutes in the past and have seen positive results. We can always look further into modifying the cycle structure if needed.

Please let me know your thoughts and if you would like any of the stated assumptions to be further looked into or modified. We very much appreciate the opportunity to offer our services for this project. If you have any questions, or desire additional information, please do not hesitate to contact us. Thank you for considering Evoqua Water Technologies LLC.

Sincerely,

Pat Kelly
Applications Engineer

Cc: Sergio Pino Jelcic, Jamey Steffen, Nathan Antonneau, Mark Pamperin- Evoqua,
Bill Reilly- Wm. H. Reilly & Co.

Enclosures: Full Biowin Report

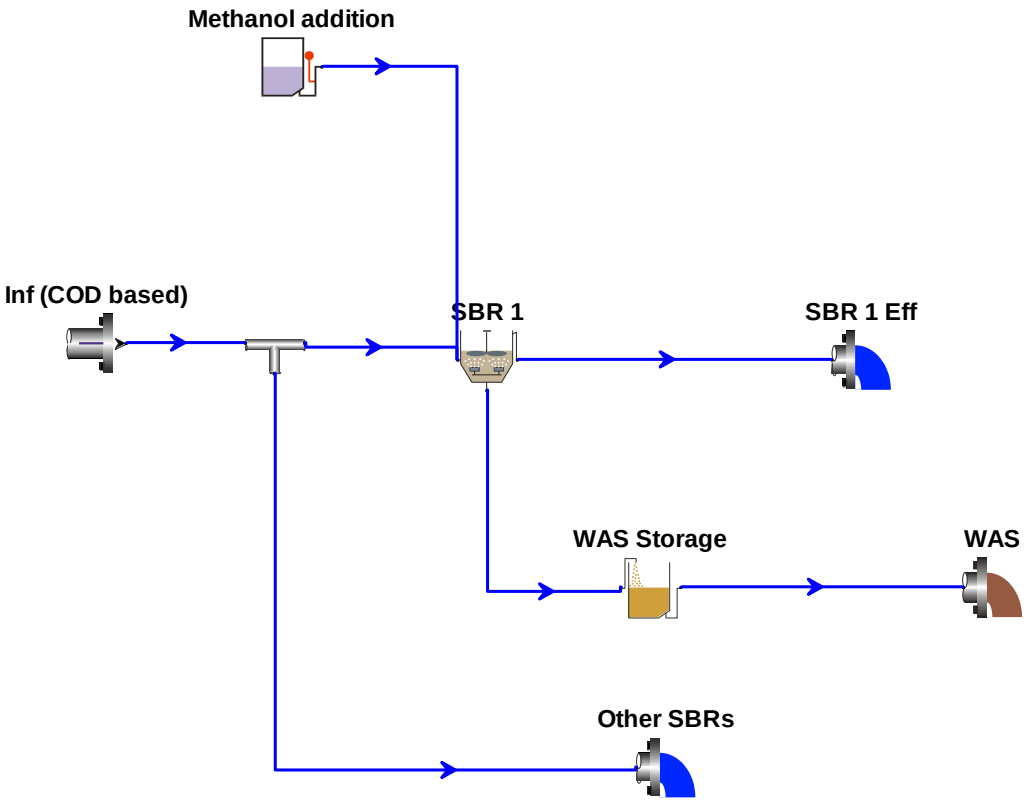
BioWin user and configuration data

Project details
Project name: Yelm, WA SBR **Project ref.: Yelm_v2_0.71 MGD w recycle_135 min AIR**
Plant name: Unknown **User name: Pat Kelly**

Created: 6/29/2010 **Saved: 10/27/2014**

Dynamic simulation on
SRT #1: 39.24* days
Temperature: 8.0°C

Flowsheet



Configuration information for all Methanol addition units

Operating data Average (flow/time weighted as required)

Element name	Methanol addition
Ordinary heterotrophic organisms (OHO) mgCOD/L	0
Methylotrophs mgCOD/L	0
Ammonia oxidizing biomass (AOB) mgCOD/L	0
Nitrite oxidizing biomass (NOB) mgCOD/L	0
Anaerobic ammonia oxidizers (ANAMMOX) mgCOD/L	0
Polyphosphate accumulating organisms (PAO) mgCOD/L	0
Propionic acetogens mgCOD/L	0
Methanogens - acetoclastic mgCOD/L	0
Methanogens - hydrogenotrophic mgCOD/L	0
Endogenous products mgCOD/L	0
Slowly bio. COD (part.) mgCOD/L	0
Slowly bio. COD (colloid.) mgCOD/L	0
Part. inert. COD mgCOD/L	0
Part. bio. org. N mgN/L	0
Part. bio. org. P mgP/L	0
Part. inert N mgN/L	0
Part. inert P mgP/L	0
Stored PHA mgCOD/L	0
Releasable stored polyP mgP/L	0
Fixed stored polyP mgP/L	0
Readily bio. COD (complex) mgCOD/L	0
Acetate mgCOD/L	0
Propionate mgCOD/L	0
Methanol mgCOD/L	1188000.00
Dissolved H2 mgCOD/L	0
Dissolved methane mg/L	0
Ammonia N mgN/L	0
Sol. bio. org. N mgN/L	0
Nitrous Oxide N mgN/L	0
Nitrite N mgN/L	0
Nitrate N mgN/L	0
Dissolved nitrogen gas mgN/L	0
PO4-P (Sol. & Me Complexed) mgP/L	0
Sol. inert COD mgCOD/L	0
Sol. inert TKN mgN/L	0
ISS Influent mgISS/L	0
Struvite mgISS/L	0
Hydroxy-dicalcium-phosphate mgISS/L	0
Hydroxy-apatite mgISS/L	0
Magnesium mg/L	0
Calcium mg/L	0
Metal mg/L	0
Other Cations (strong bases) meq/L	5.00
Other Anions (strong acids) meq/L	5.00
Total CO2 mmol/L	0
User defined 1 mg/L	0
User defined 2 mg/L	0
User defined 3 mgVSS/L	0
User defined 4 mgISS/L	0
Dissolved oxygen mg/L	0
Flow	3.7512E-5

Configuration information for all Effluent units

Configuration information for all COD Influent units

Operating data Average (flow/time weighted as required)

Element name	Inf (COD based)
Time	0
Flow	0.706
Total COD mgCOD/L	380.00
Total Kjeldahl Nitrogen mgN/L	51.00
Total P mgP/L	8.00
Nitrate N mgN/L	2.50
pH	7.30
Alkalinity mmol/L	6.00
ISS Influent mgISS/L	14.60
Calcium mg/L	80.00
Magnesium mg/L	15.00
Dissolved oxygen mg/L	0.50

Element name	Inf (COD based)
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.2540
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1450
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.7800
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0360
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1100
Fna - Ammonia [gNH3-N/gTKN]	0.6670
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	1.000E-4
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	1.000E-4

Configuration information for all Single-tank SBR units

Physical data

Element name	Volume [Mil. Gal]	Area [ft2]	Depth [ft]	# of diffusers
SBR 1	0.5535	3999.5779	18.500	906

Operating data Average (flow/time weighted as required)

Element name	Average DO Setpoint [mg/L]
SBR 1	1.1

Element name	Average Temperature [deg. C]
SBR 1	8.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
SBR 1	2.5656	0.0432	0.8200	0.4413	10.0000

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Splitter5	Flow paced	50.00 %

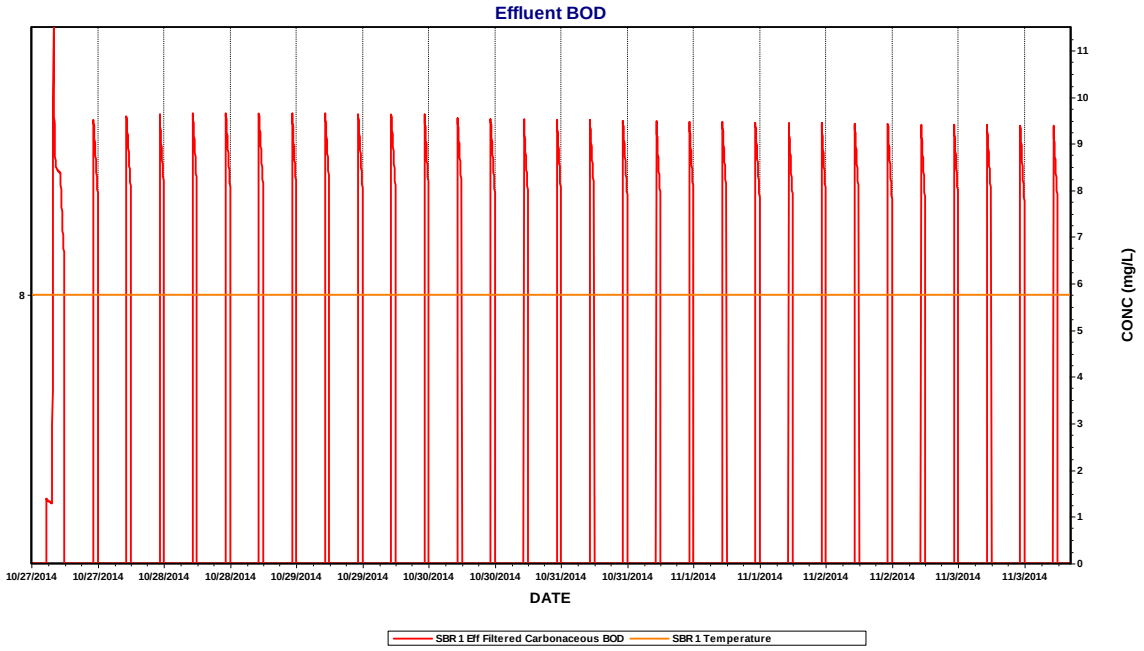
Configuration information for all Equalization Tank units

Physical data

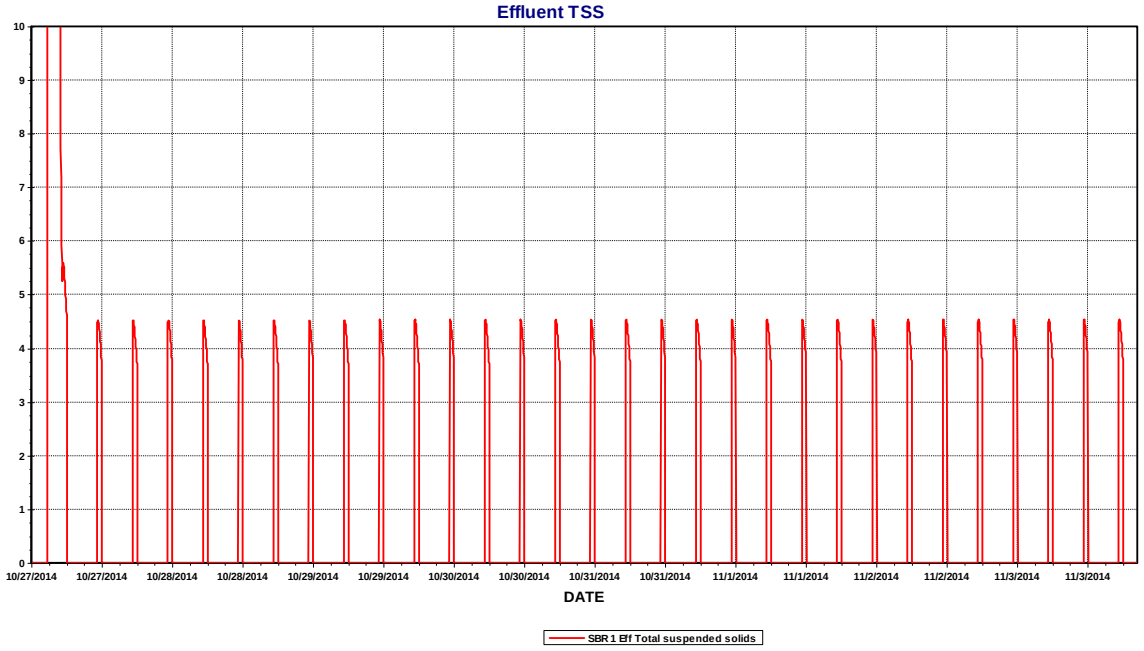
Element name	Volume[Mil. Gal]	Area[ft2]	Depth[ft]
WAS Storage	0.0500	509.3369	13.123

BioWin Album

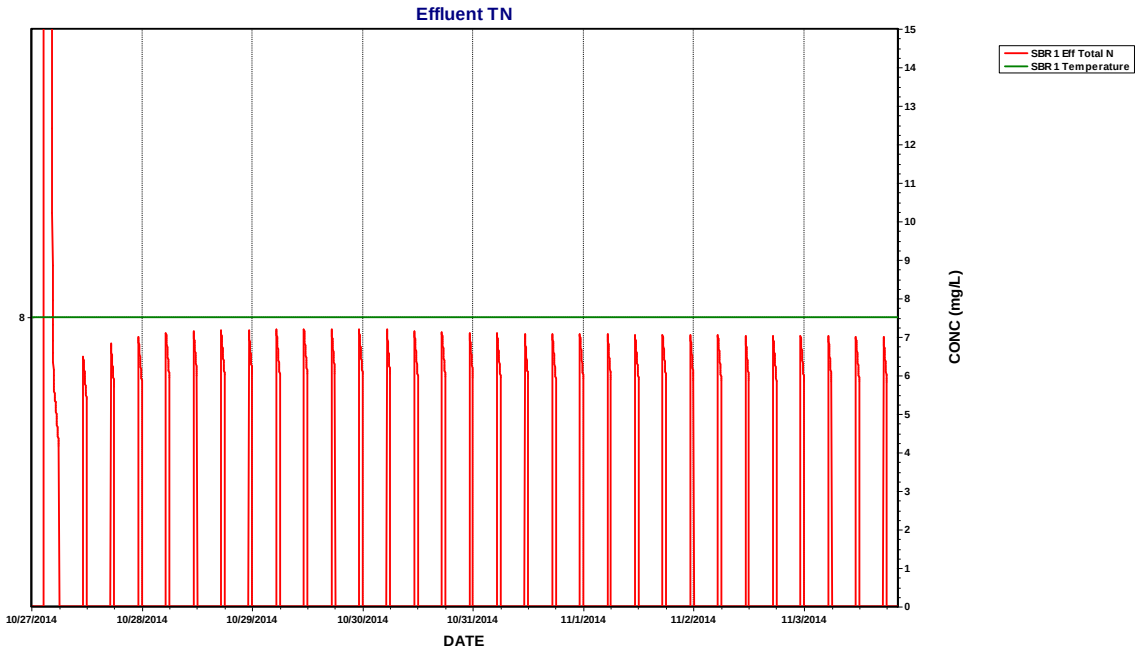
Album page - Eff BOD



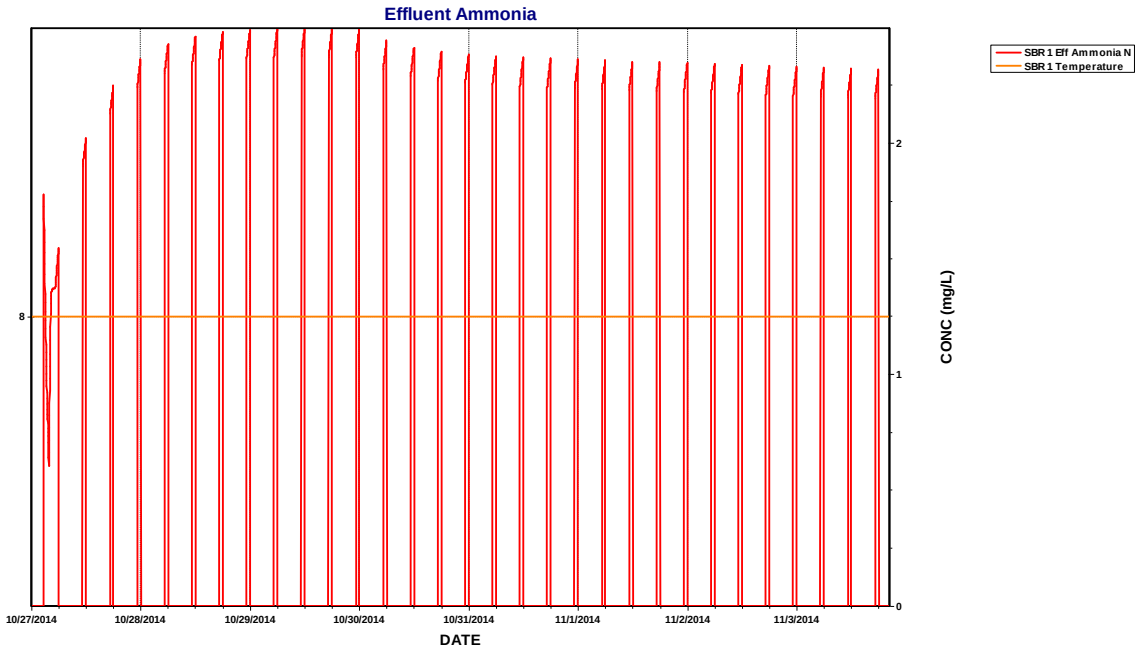
Album page - Eff TSS



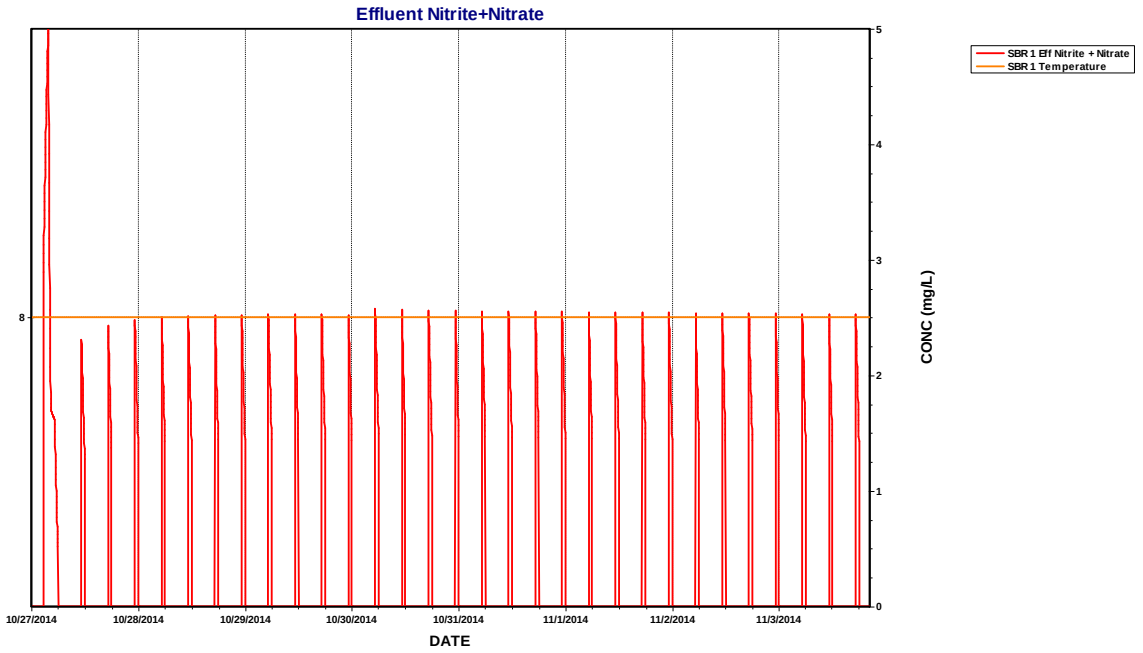
Album page - Eff TN



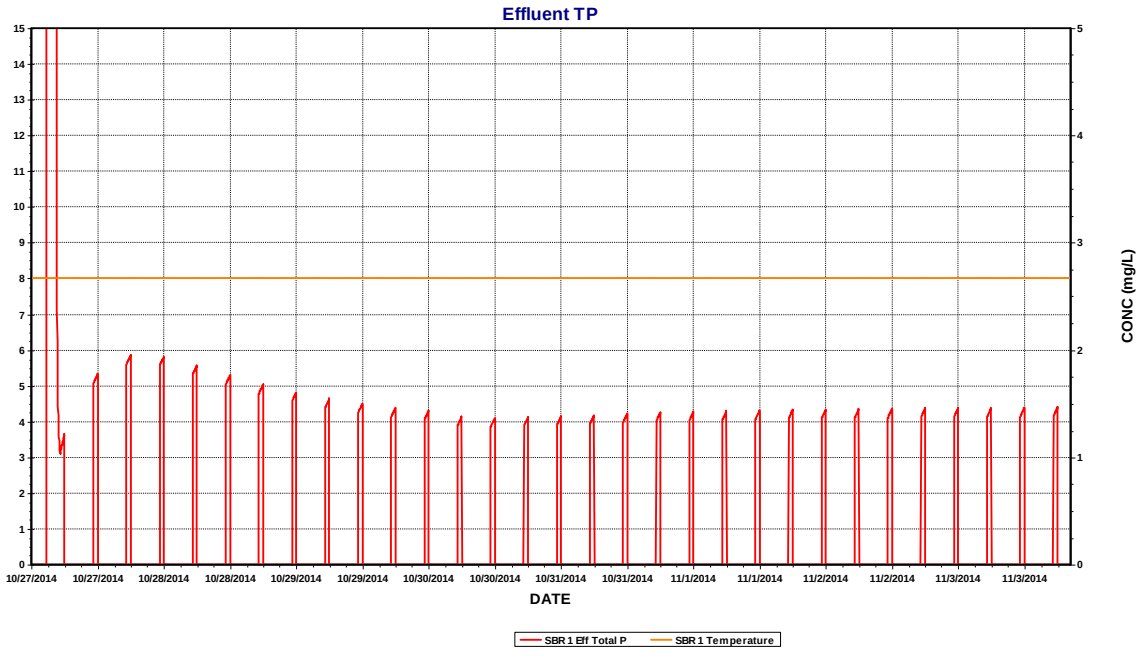
Album page - Eff Ammonia



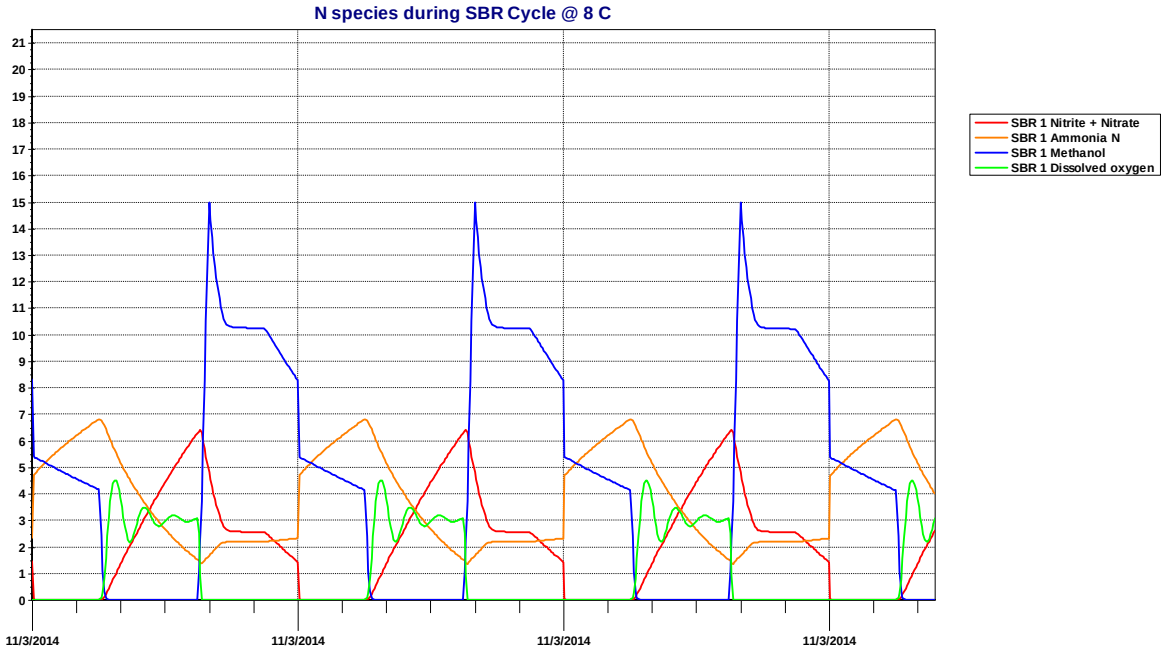
Album page - Eff Nitrate/Nitrite



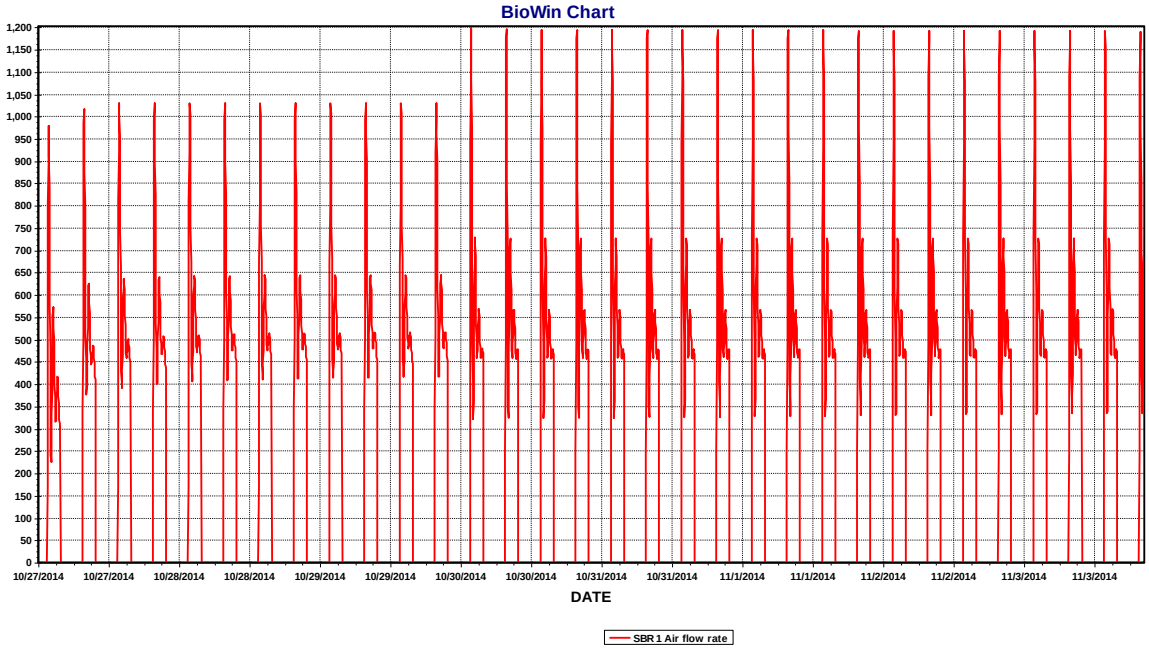
Album page - Eff TP



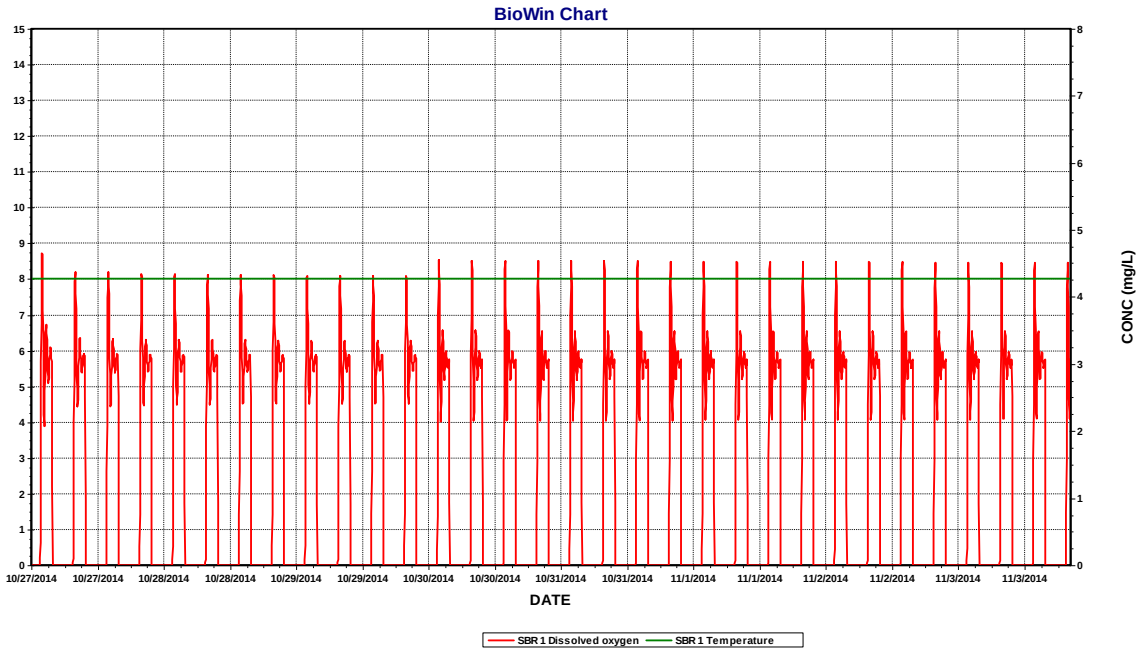
Album page - N & P in SBR



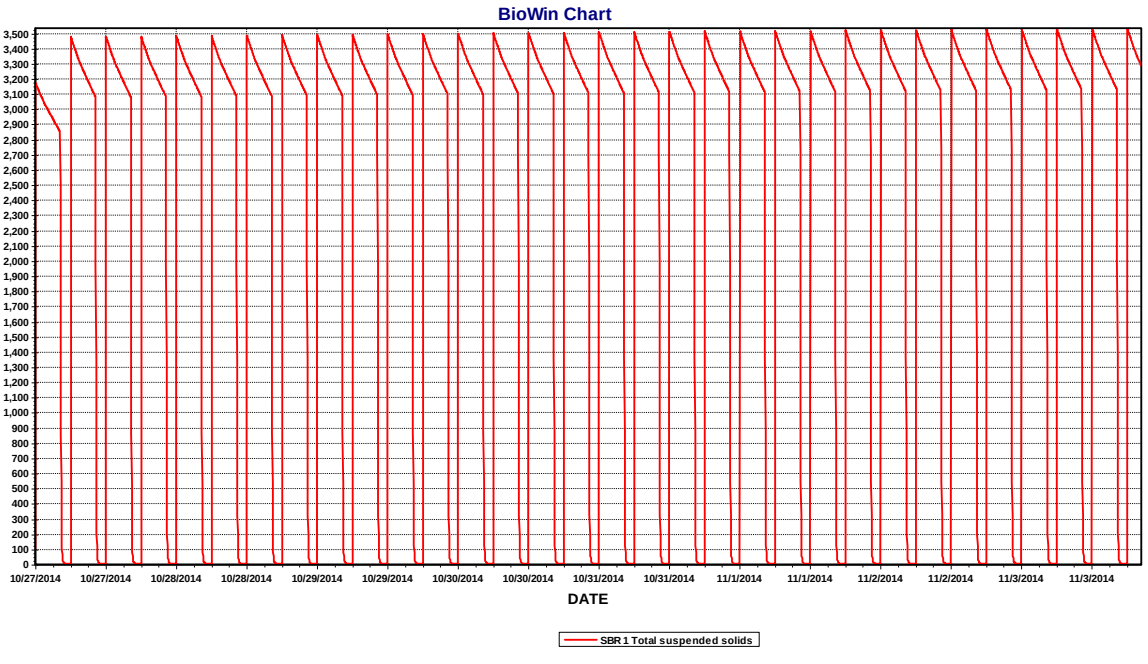
Album page - SBR Airflow



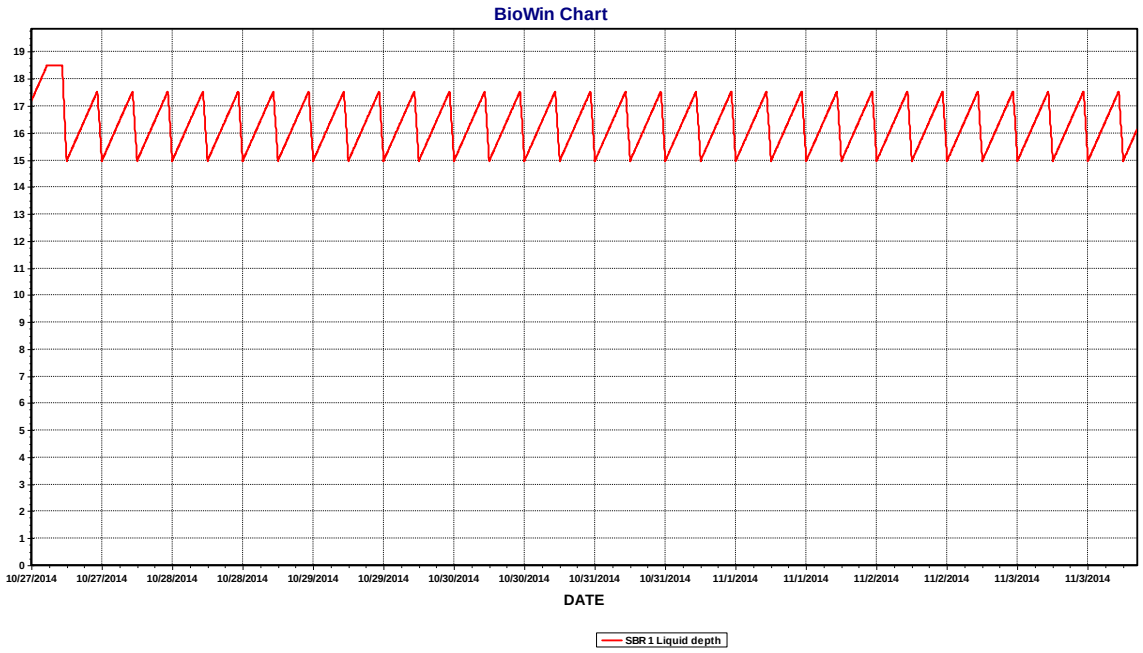
Album page - SBR DO



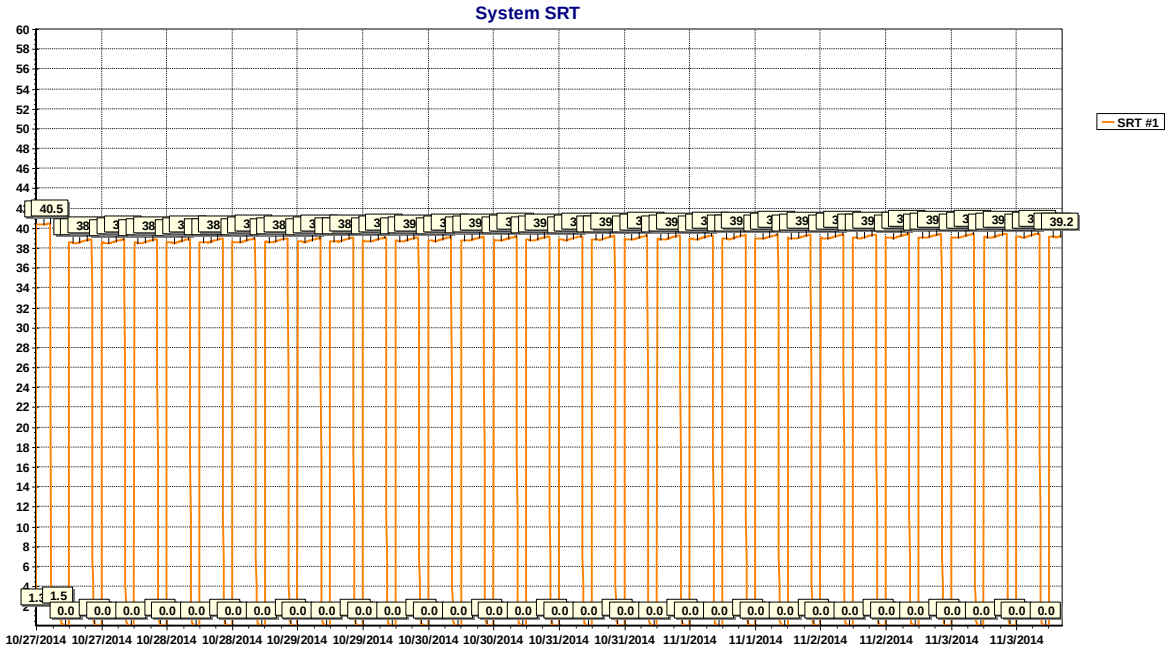
Album page - SBR MLSS



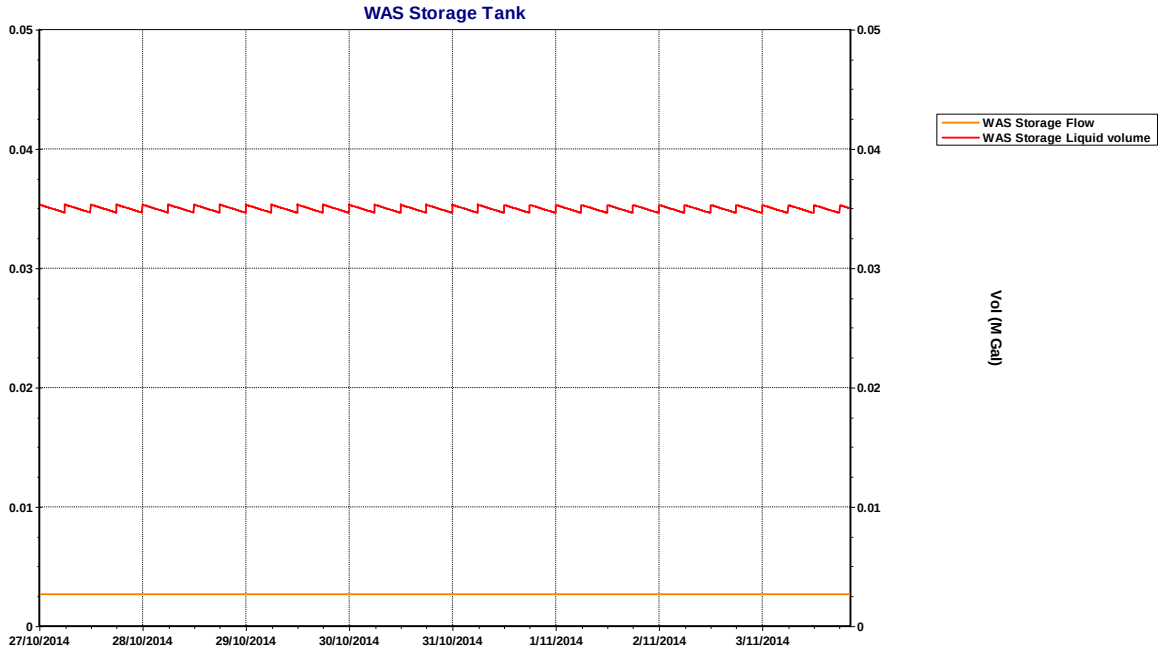
Album page - SBR Level



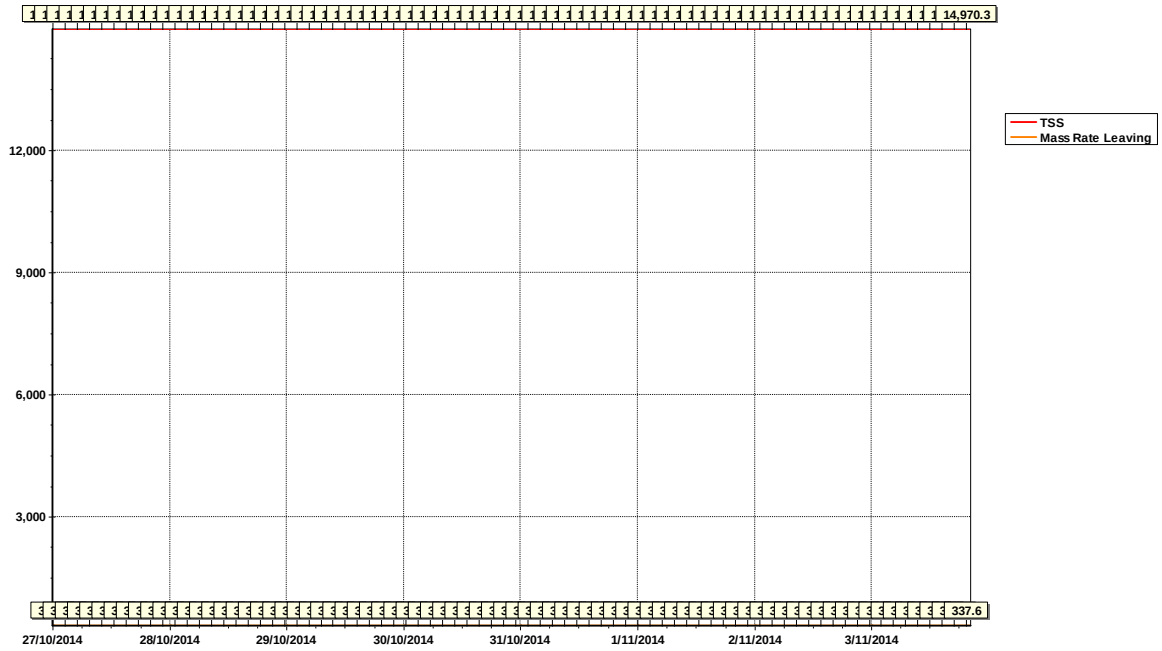
Album page - SBR SRT



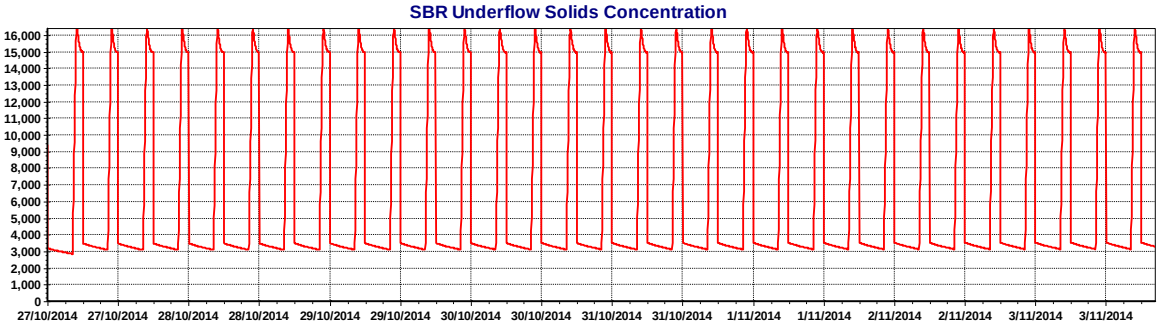
Album page - WAS Tank Flows



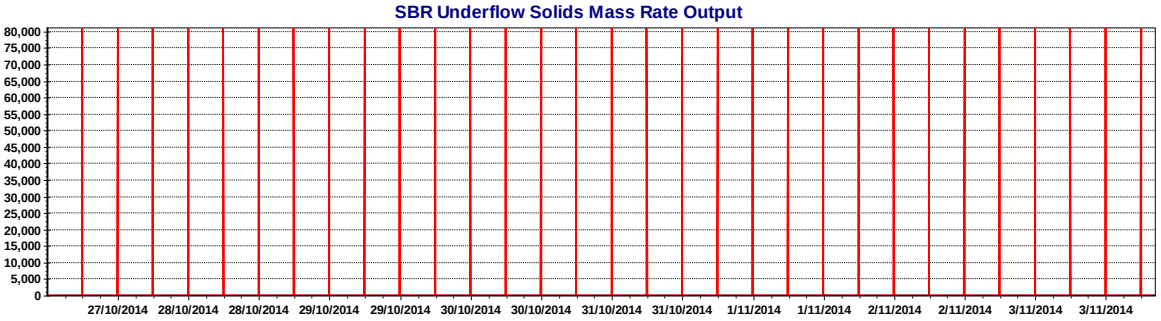
Album page - WAS Tank Conc



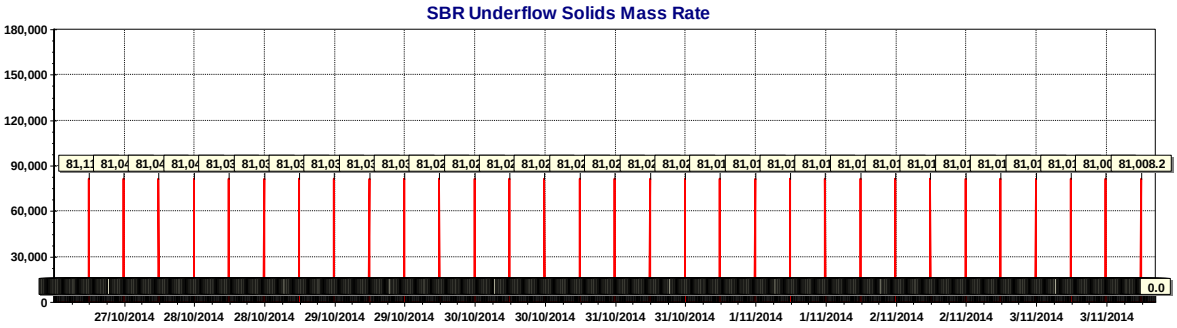
Album page - SBR UF



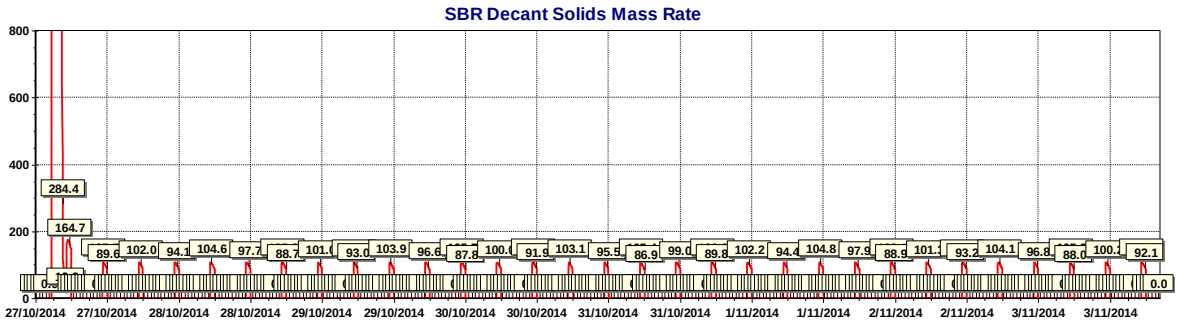
Album page - SBR UF



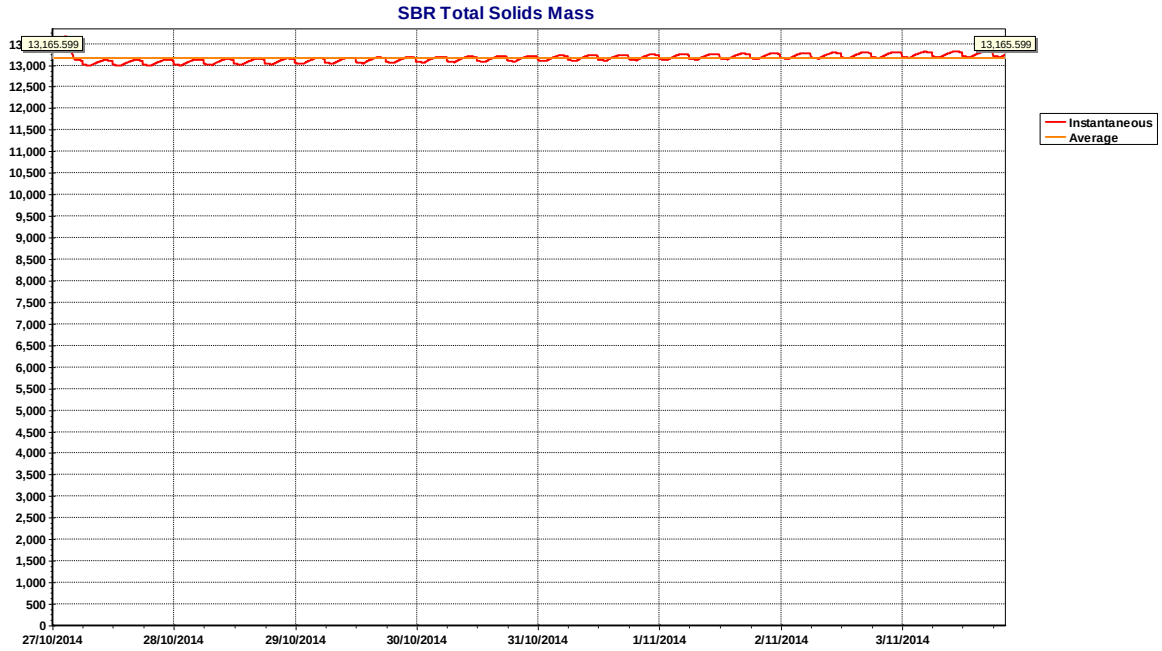
Album page - SBR Solids Outflows



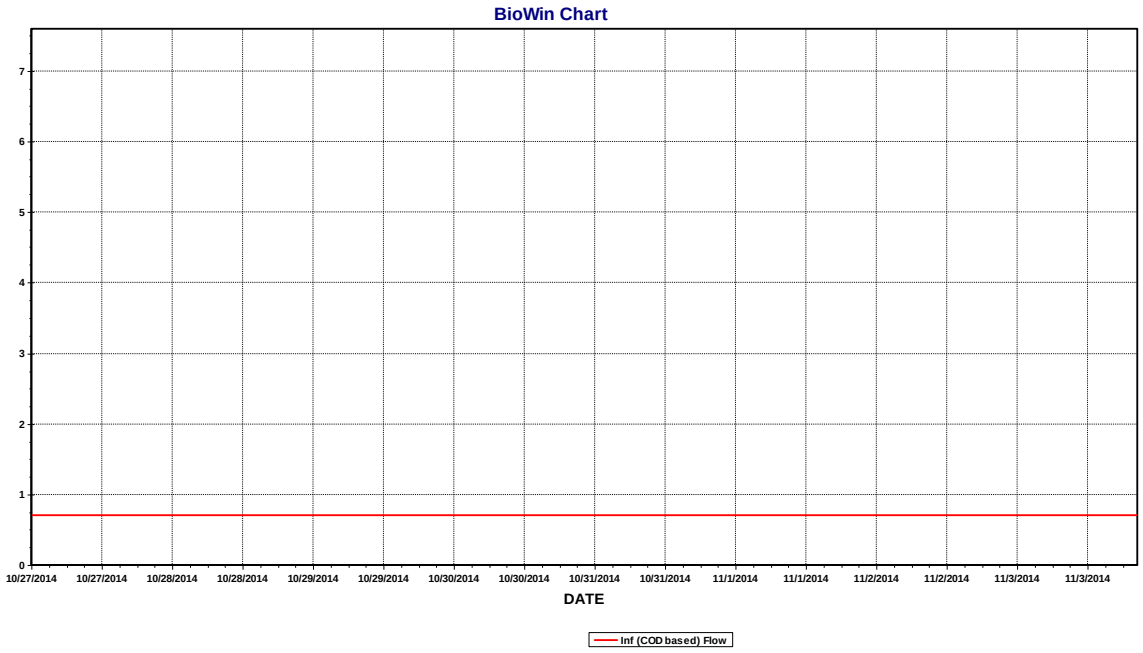
Album page - SBR Solids Outflows



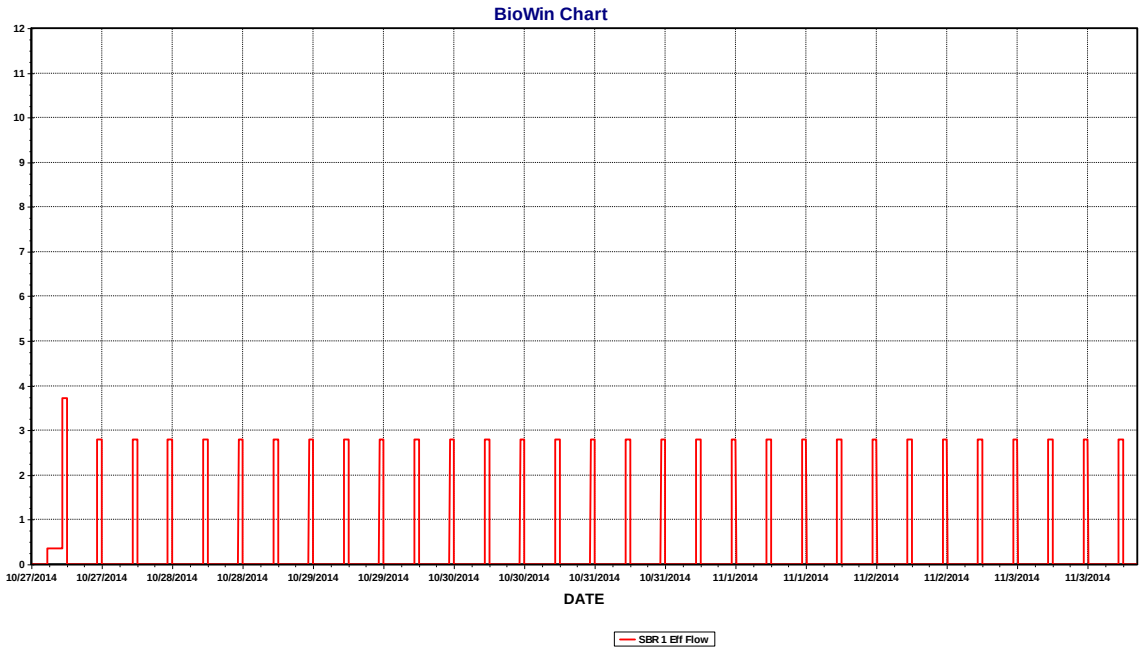
Album page - SBR Mass



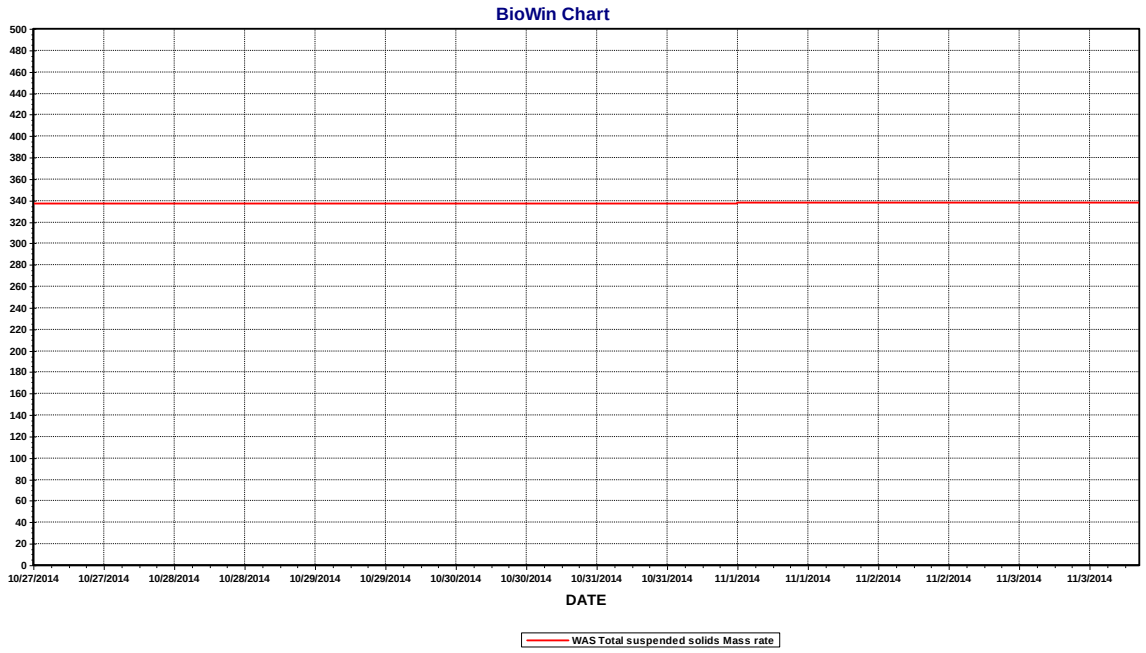
Album page - Inf Flow



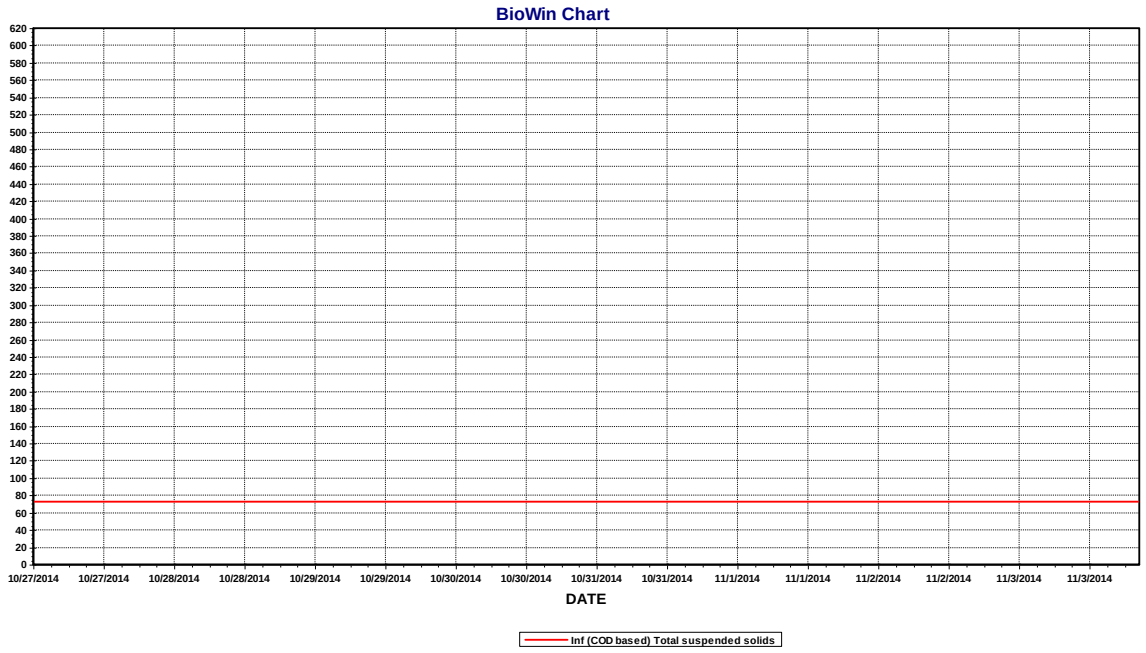
Album page - Total Eff Flow



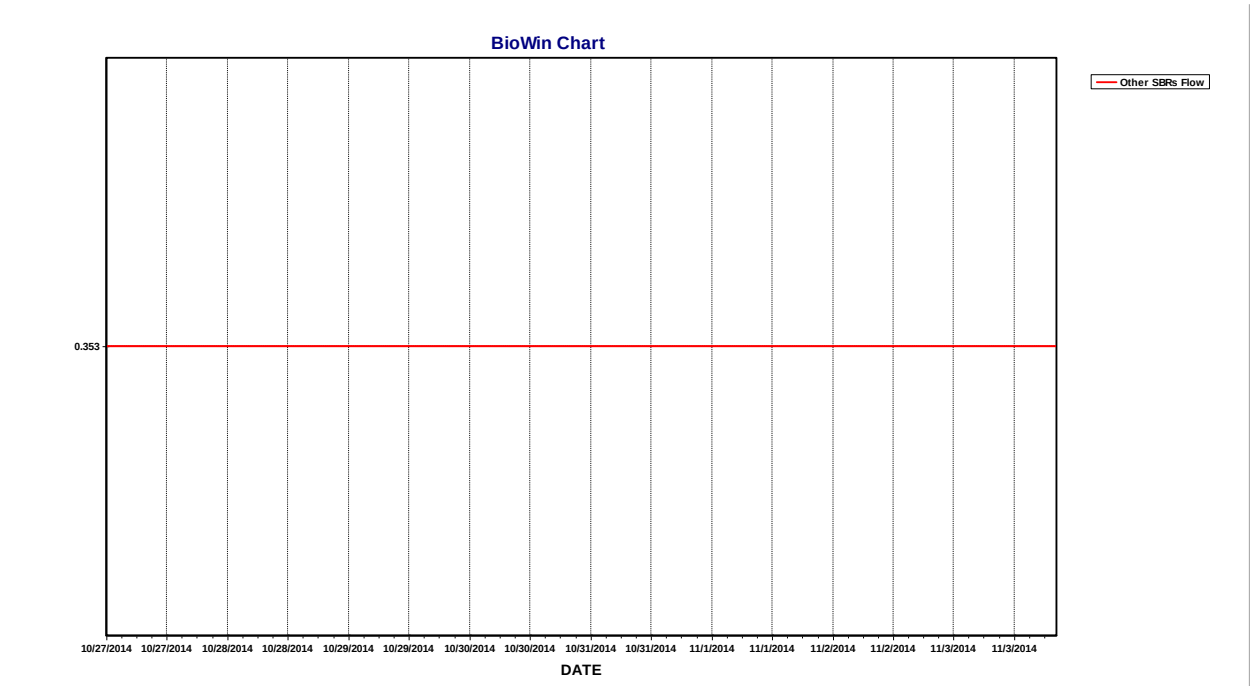
Album page - WAS Flow



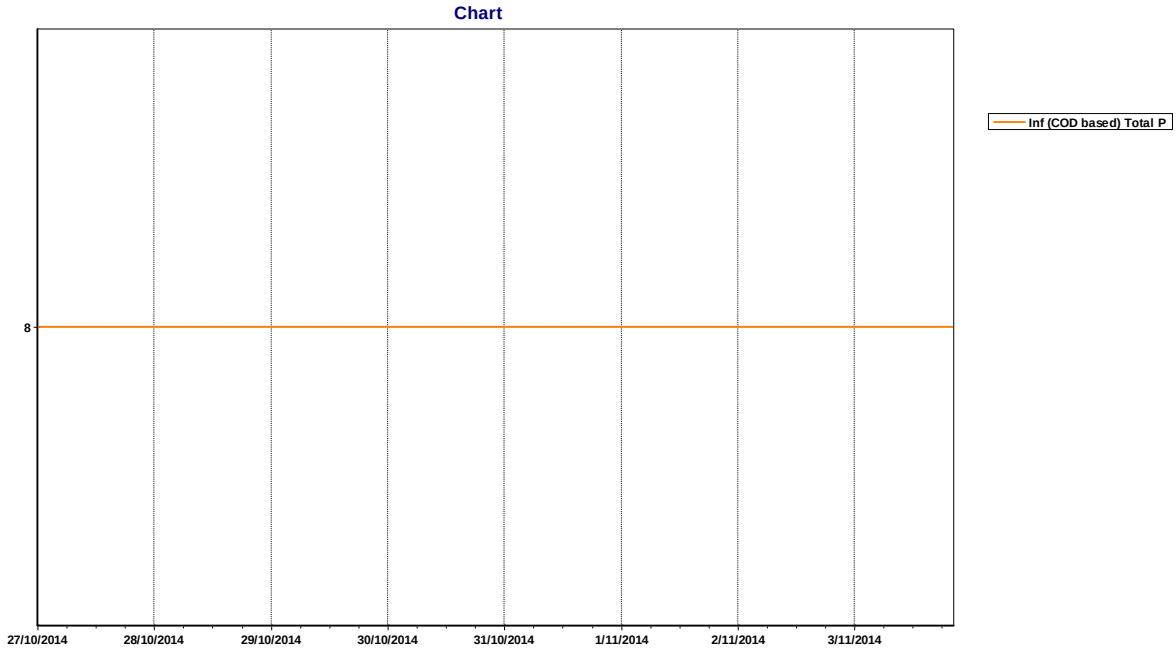
Album page - Influent TSS



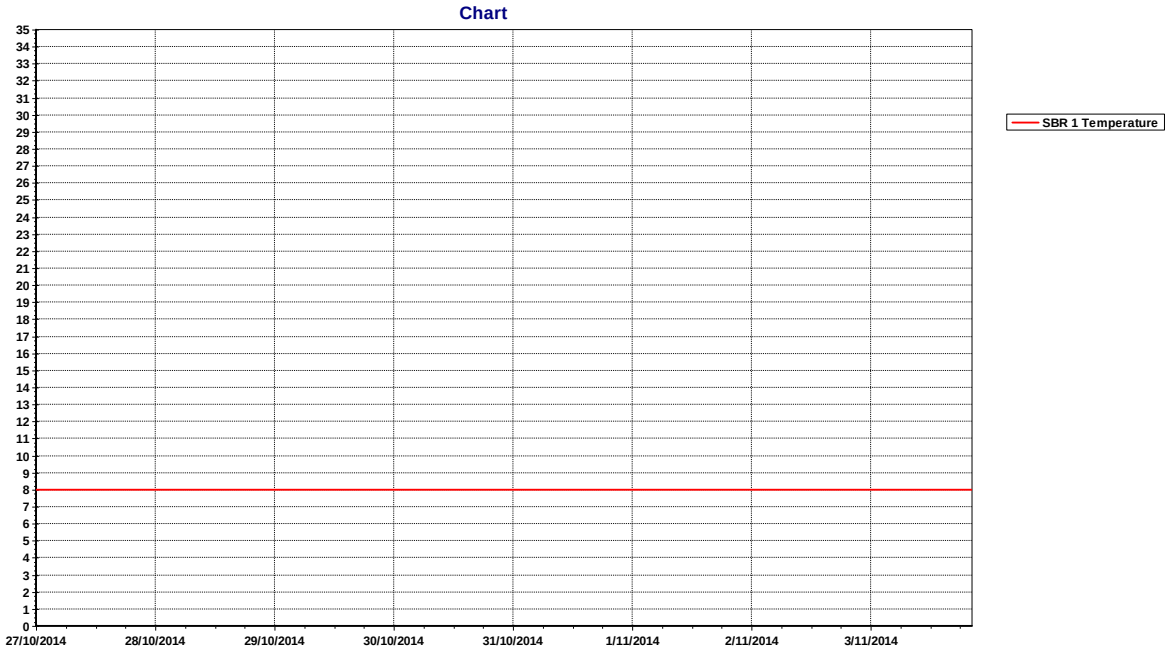
Album page - Other SBRs Flow



Album page - Inf TP



Album page - SBR Temp



Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

NOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.7000	0.7000	1.0600
Substrate (NO2) half sat. [mgN/L]	0.1000	0.1000	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiNH3 [mmol/L]	0.0750	0.0750	1.0000

ANAMMOX

Name	Default	Value	
Max. spec. growth rate [1/d]	0.1000	0.1000	1.1000
Substrate (NH4) half sat. [mgN/L]	2.0000	2.0000	1.0000
Substrate (NO2) half sat. [mgN/L]	1.0000	1.0000	1.0000
Aerobic decay rate [1/d]	0.0190	0.0190	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0095	0.0095	1.0290
Ki Nitrite [mgN/L]	1000.0000	1000.0000	1.0000
Nitrite sensitivity constant [L / (d mgN)]	0.0160	0.0160	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.2000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000
Fermentation rate [1/d]	1.6000	1.6000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.2500	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000

Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Methylotrophs

Name	Default	Value	
Max. spec. growth rate [1/d]	1.3000	1.3000	1.0720
Methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.0400	0.0400	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0300	0.0300	1.0290
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

PAO

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9500	0.9500	1.0000
Max. spec. growth rate, P-limited [1/d]	0.4200	0.4200	1.0000
Substrate half sat. [mgCOD(PHB)/mgCOD(Zbp)]	0.1000	0.1000	1.0000
Substrate half sat., P-limited [mgCOD(PHB)/mgCOD(Zbp)]	0.0500	0.0500	1.0000
Magnesium half sat. [mgMg/L]	0.1000	0.1000	1.0000
Cation half sat. [mmol/L]	0.1000	0.1000	1.0000
Calcium half sat. [mgCa/L]	0.1000	0.1000	1.0000
Aerobic/anoxic decay rate [1/d]	0.1000	0.1000	1.0000
Aerobic/anoxic maintenance rate [1/d]	0	0	1.0000
Anaerobic decay rate [1/d]	0.0400	0.0400	1.0000
Anaerobic maintenance rate [1/d]	0	0	1.0000
Sequestration rate [1/d]	4.5000	4.5000	1.0000
Anoxic growth factor [-]	0.3300	0.3300	1.0000

Acetogens

Name	Default	Value	
Max. spec. growth rate [1/d]	0.2500	0.2500	1.0290
Substrate half sat. [mgCOD/L]	10.0000	10.0000	1.0000
Acetate inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Anaerobic decay rate [1/d]	0.0500	0.0500	1.0290
Aerobic/anoxic decay rate [1/d]	0.5200	0.5200	1.0290

Methanogens

Name	Default	Value	
Acetoclastic max. spec. growth rate [1/d]	0.3000	0.3000	1.0290
H2-utilizing max. spec. growth rate [1/d]	1.4000	1.4000	1.0290
Acetoclastic substrate half sat. [mgCOD/L]	100.0000	100.0000	1.0000
Acetoclastic methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
H2-utilizing CO2 half sat. [mmol/L]	0.1000	0.1000	1.0000
H2-utilizing substrate half sat. [mgCOD/L]	0.1000	0.1000	1.0000
H2-utilizing methanol half sat. [mgCOD/L]	0.5000	0.5000	1.0000
Acetoclastic propionic inhibition [mgCOD/L]	10000.0000	10000.0000	1.0000
Acetoclastic anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
Acetoclastic aerobic/anoxic decay rate [1/d]	0.6000	0.6000	1.0290
H2-utilizing anaerobic decay rate [1/d]	0.1300	0.1300	1.0290
H2-utilizing aerobic/anoxic decay rate [1/d]	2.8000	2.8000	1.0290

pH

Name	Default	Value
OHO low pH limit [-]	4.0000	4.0000
OHO high pH limit [-]	10.0000	10.0000
Methylotrophs low pH limit [-]	4.0000	4.0000
Methylotrophs high pH limit [-]	10.0000	10.0000
Autotrophs low pH limit [-]	5.5000	5.5000
Autotrophs high pH limit [-]	9.5000	9.5000
PAO low pH limit [-]	4.0000	4.0000
PAO high pH limit [-]	10.0000	10.0000
OHO low pH limit (anaerobic) [-]	5.5000	5.5000
OHO high pH limit (anaerobic) [-]	8.5000	8.5000
Propionic acetogens low pH limit [-]	4.0000	4.0000
Propionic acetogens high pH limit [-]	10.0000	10.0000
Acetoclastic methanogens low pH limit [-]	5.0000	5.0000
Acetoclastic methanogens high pH limit [-]	9.0000	9.0000
H2-utilizing methanogens low pH limit [-]	5.0000	5.0000
H2-utilizing methanogens high pH limit [-]	9.0000	9.0000

Switches

Name	Default	Value
Aerobic/anoxic DO half sat. [mgO2/L]	0.0500	0.0500
Anoxic/anaerobic NOx half sat. [mgN/L]	0.1500	0.1500
AOB DO half sat. [mgO2/L]	0.2500	0.2500
NOB DO half sat. [mgO2/L]	0.5000	0.5000
ANAMMOX DO half sat. [mgO2/L]	0.0100	0.0100
Anoxic NO3(->NO2) half sat. [mgN/L]	0.1000	0.1000
Anoxic NO3(->N2) half sat. [mgN/L]	0.0500	0.0500
Anoxic NO2(->N2) half sat. (mgN/L)	0.0100	0.0100
NH3 nutrient half sat. [mgN/L]	0.0050	0.0050
PolyP half sat. [mgP/mgCOD]	0.0100	0.0100
VFA sequestration half sat. [mgCOD/L]	5.0000	5.0000
P uptake half sat. [mgP/L]	0.1500	0.1500
P nutrient half sat. [mgP/L]	0.0010	0.0010
Autotroph CO2 half sat. [mmol/L]	0.1000	0.1000
H2 low/high half sat. [mgCOD/L]	1.0000	1.0000
Propionic acetogens H2 inhibition [mgCOD/L]	5.0000	5.0000
Synthesis anion/cation half sat. [meq/L]	0.0100	0.0100

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	3.7700
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	3.7700

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025

N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

ANAMMOX

Name	Default	Value
Yield [mgCOD/mgN]	0.1140	0.1140
Nitrate production [mgN/mgBiomassCOD]	2.2800	2.2800
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.6660
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000
Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Methylotrophs

Name	Default	Value
Yield (anoxic) [-]	0.4000	0.4000

N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Max fraction to N2O at high FNA over nitrate [-]	0.1000	0.1000
Max fraction to N2O at high FNA over nitrite [-]	0.1500	0.1500

PAO

Name	Default	Value
Yield (aerobic) [-]	0.6390	0.6390
Yield (anoxic) [-]	0.5200	0.5200
Aerobic P/PHA uptake [mgP/mgCOD]	0.9300	0.9300
Anoxic P/PHA uptake [mgP/mgCOD]	0.3500	0.3500
Yield of PHA on sequestration [-]	0.8890	0.8890
N in biomass [mgN/mgCOD]	0.0700	0.0700
N in sol. inert [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous part. [-]	0.2500	0.2500
Inert fraction of endogenous sol. [-]	0.2000	0.2000
P/Ac release ratio [mgP/mgCOD]	0.5100	0.5100
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield of low PP [-]	0.9400	0.9400

Acetogens

Name	Default	Value
Yield [-]	0.1000	0.1000
H2 yield [-]	0.4000	0.4000
CO2 yield [-]	1.0000	1.0000
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

Methanogens

Name	Default	Value
Acetoclastic yield [-]	0.1000	0.1000
Methanol acetoclastic yield [-]	0.1000	0.1000
H2-utilizing yield [-]	0.1000	0.1000
Methanol H2-utilizing yield [-]	0.1000	0.1000
N in acetoclastic biomass [mgN/mgCOD]	0.0700	0.0700
N in H2-utilizing biomass [mgN/mgCOD]	0.0700	0.0700
P in acetoclastic biomass [mgP/mgCOD]	0.0220	0.0220
P in H2-utilizing biomass [mgP/mgCOD]	0.0220	0.0220
Acetoclastic fraction to endog. residue [-]	0.0800	0.0800
H2-utilizing fraction to endog. residue [-]	0.0800	0.0800
Acetoclastic COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
H2-utilizing COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

General

Name	Default	Value
Molecular weight of other anions [mg/mmol]	35.5000	35.5000
Molecular weight of other cations [mg/mmol]	39.1000	39.1000

Mg to P mole ratio in polyphosphate [mmolMg/mmolP]	0.3000	0.3000
Cation to P mole ratio in polyphosphate [meq/mmolP]	0.1500	0.3000
Ca to P mole ratio in polyphosphate [mmolCa/mmolP]	0.0500	0.0500
Cation to P mole ratio in organic phosphate [meq/mmolP]	0.0100	0.0100
Bubble rise velocity (anaerobic digester) [cm/s]	23.9000	23.9000
Bubble Sauter mean diameter (anaerobic digester) [cm]	0.3500	0.3500
Anaerobic digester gas hold-up factor []	1.0000	1.0000
Tank head loss per metre of length (from flow) [m/m]	0.0025	0.0025

Mass transfer

Name	Default	Value	
Kl for H2 [m/d]	17.0000	17.0000	1.0240
Kl for CO2 [m/d]	10.0000	10.0000	1.0240
Kl for NH3 [m/d]	1.0000	1.0000	1.0240
Kl for CH4 [m/d]	8.0000	8.0000	1.0240
Kl for N2 [m/d]	15.0000	15.0000	1.0240
Kl for N2O [m/d]	8.0000	8.0000	1.0240
Kl for O2 [m/d]	13.0000	13.0000	1.0240

Henry's law constants

Name	Default	Value	
CO2 [M/atm]	0.0340	0.0340	2400.0000
O2 [M/atm]	0.0013	0.0013	1500.0000
N2 [M/atm]	6.500E-4	6.500E-4	1300.0000
N2O [M/atm]	0.0250	0.0250	2600.0000
NH3 [M/atm]	58.0000	58.0000	4100.0000
CH4 [M/atm]	0.0014	0.0014	1600.0000
H2 [M/atm]	7.800E-4	7.800E-4	500.0000

Physico-chemical rates

Name	Default	Value	
Struvite precipitation rate [1/d]	3.000E+10	3.000E+10	1.0240
Struvite redissolution rate [1/d]	3.000E+11	3.000E+11	1.0240
Struvite half sat. [mgTSS/L]	1.0000	1.0000	1.0000
HDP precipitation rate [L/(molP d)]	1.000E+8	1.000E+8	1.0000
HDP redissolution rate [L/(mol P d)]	1.000E+8	1.000E+8	1.0000
HAP precipitation rate [molHDP/(L d)]	5.000E-4	5.000E-4	1.0000

Physico-chemical constants

Name	Default	Value
Struvite solubility constant [mol/L]	6.918E-14	6.918E-14
HDP solubility product [mol/L]	2.750E-22	2.750E-22
HDP half sat. [mgTSS/L]	1.0000	1.0000
Equilibrium soluble PO4 with Al dosing at pH 7 [mgP/L]	0.0100	0.0100
Al to P ratio [molAl/molP]	0.8000	0.8000
Al(OH)3 solubility product [mol/L]	1.259E+9	1.259E+9
AlHPO4+ dissociation constant [mol/L]	7.943E-13	7.943E-13
Equilibrium soluble PO4 with Fe dosing at pH 7 [mgP/L]	0.0100	0.0100
Fe to P ratio [molFe/molP]	1.6000	2.0000
Fe(OH)3 solubility product [mol/L]	0.0500	0.0500
FeH2PO4++ dissociation constant [mol/L]	5.012E-22	5.012E-22

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.7500
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.550
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.300
Clarification switching function [mg/L]	100.000	50.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

Emission factors

Name	Default	Value
Carbon dioxide equivalence of nitrous oxide	296.0000	296.0000
Carbon dioxide equivalence of methane	23.0000	23.0000

Biofilm general

Name	Default	Value	
Attachment rate [g / (m2 d)]	80.0000	80.0000	1.0000
Attachment TSS half sat. [mg/L]	100.0000	100.0000	1.0000
Detachment rate [g/(m3 d)]	8.000E+4	8.000E+4	1.0000
Solids movement factor []	10.0000	10.0000	1.0000
Diffusion neta []	0.8000	0.8000	1.0000

Thin film limit [mm]	0.5000	0.5000	1.0000
Thick film limit [mm]	3.0000	3.0000	1.0000
Assumed Film thickness for tank volume correction (temp independant) [mm]	0.7500	0.7500	1.0000
Film surface area to media area ratio - Max.[ ]	1.0000	1.0000	1.0000
Minimum biofilm conc. for streamer formation [gTSS/m2]	4.0000	4.0000	1.0000

Maximum biofilm concentrations [mg/L]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	5.000E+4	5.000E+4	1.0000
Methylotrophs	5.000E+4	5.000E+4	1.0000
Ammonia oxidizing biomass (AOB)	1.000E+5	1.000E+5	1.0000
Nitrite oxidizing biomass (NOB)	1.000E+5	1.000E+5	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E+4	5.000E+4	1.0000
Polyphosphate accumulating organisms (PAO)	5.000E+4	5.000E+4	1.0000
Propionic acetogens	5.000E+4	5.000E+4	1.0000
Methanogens - acetoclastic	5.000E+4	5.000E+4	1.0000
Methanogens - hydrogenotrophic	5.000E+4	5.000E+4	1.0000
Endogenous products	3.000E+4	3.000E+4	1.0000
Slowly bio. COD (part.)	5000.0000	5000.0000	1.0000
Slowly bio. COD (colloid.)	4000.0000	4000.0000	1.0000
Part. inert. COD	5000.0000	5000.0000	1.0000
Part. bio. org. N	0	0	1.0000
Part. bio. org. P	0	0	1.0000
Part. inert N	0	0	1.0000
Part. inert P	0	0	1.0000
Stored PHA	5000.0000	5000.0000	1.0000
Releasable stored polyP	1.150E+6	1.150E+6	1.0000
Fixed stored polyP	1.150E+6	1.150E+6	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.000E+10	1.000E+10	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	1.300E+6	1.300E+6	1.0000
Struvite	8.500E+5	8.500E+5	1.0000
Hydroxy-dicalcium-phosphate	1.150E+6	1.150E+6	1.0000
Hydroxy-apatite	1.600E+6	1.600E+6	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.000E+10	1.000E+10	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	5.000E+4	5.000E+4	1.0000
User defined 4	5.000E+4	5.000E+4	1.0000
Dissolved oxygen	0	0	1.0000

Effective diffusivities [m2/s]

Name	Default	Value

Ordinary heterotrophic organisms (OHO)	5.000E-14	5.000E-14	1.0290
Methylotrophs	5.000E-14	5.000E-14	1.0290
Ammonia oxidizing biomass (AOB)	5.000E-14	5.000E-14	1.0290
Nitrite oxidizing biomass (NOB)	5.000E-14	5.000E-14	1.0290
Anaerobic ammonia oxidizers (ANAMMOX)	5.000E-14	5.000E-14	1.0290
Polyphosphate accumulating organisms (PAO)	5.000E-14	5.000E-14	1.0290
Propionic acetogens	5.000E-14	5.000E-14	1.0290
Methanogens - acetoclastic	5.000E-14	5.000E-14	1.0290
Methanogens - hydrogenotrophic	5.000E-14	5.000E-14	1.0290
Endogenous products	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (part.)	5.000E-14	5.000E-14	1.0290
Slowly bio. COD (colloid.)	5.000E-12	5.000E-12	1.0290
Part. inert. COD	5.000E-14	5.000E-14	1.0290
Part. bio. org. N	5.000E-14	5.000E-14	1.0290
Part. bio. org. P	5.000E-14	5.000E-14	1.0290
Part. inert N	5.000E-14	5.000E-14	1.0290
Part. inert P	5.000E-14	5.000E-14	1.0290
Stored PHA	5.000E-14	5.000E-14	1.0290
Releasable stored polyP	5.000E-14	5.000E-14	1.0290
Fixed stored polyP	5.000E-14	5.000E-14	1.0290
Readily bio. COD (complex)	6.900E-10	6.900E-10	1.0290
Acetate	1.240E-9	1.240E-9	1.0290
Propionate	8.300E-10	8.300E-10	1.0290
Methanol	1.600E-9	1.600E-9	1.0290
Dissolved H2	5.850E-9	5.850E-9	1.0290
Dissolved methane	1.963E-9	1.963E-9	1.0290
Ammonia N	2.000E-9	2.000E-9	1.0290
Sol. bio. org. N	1.370E-9	1.370E-9	1.0290
Nitrous Oxide N	1.607E-9	1.607E-9	1.0290
Nitrite N	2.980E-9	2.980E-9	1.0290
Nitrate N	2.980E-9	2.980E-9	1.0290
Dissolved nitrogen gas	1.900E-9	1.900E-9	1.0290
PO4-P (Sol. & Me Complexed)	2.000E-9	2.000E-9	1.0290
Sol. inert COD	6.900E-10	6.900E-10	1.0290
Sol. inert TKN	6.850E-10	6.850E-10	1.0290
ISS Influent	5.000E-14	5.000E-14	1.0290
Struvite	5.000E-14	5.000E-14	1.0290
Hydroxy-dicalcium-phosphate	5.000E-14	5.000E-14	1.0290
Hydroxy-apatite	5.000E-14	5.000E-14	1.0290
Magnesium	7.200E-10	7.200E-10	1.0290
Calcium	7.200E-10	7.200E-10	1.0290
Metal	4.800E-10	4.800E-10	1.0290
Other Cations (strong bases)	1.440E-9	1.440E-9	1.0290
Other Anions (strong acids)	1.440E-9	1.440E-9	1.0290
Total CO2	1.960E-9	1.960E-9	1.0290
User defined 1	6.900E-10	6.900E-10	1.0290
User defined 2	6.900E-10	6.900E-10	1.0290
User defined 3	5.000E-14	5.000E-14	1.0290
User defined 4	5.000E-14	5.000E-14	1.0290
Dissolved oxygen	2.500E-9	2.500E-9	1.0290

EPS Strength coefficients [ ]

Name	Default	Value	
Ordinary heterotrophic organisms (OHO)	1.0000	1.0000	1.0000
Methylotrophs	1.0000	1.0000	1.0000
Ammonia oxidizing biomass (AOB)	5.0000	1.0000	1.0000
Nitrite oxidizing biomass (NOB)	25.0000	1.0000	1.0000
Anaerobic ammonia oxidizers (ANAMMOX)	10.0000	1.0000	1.0000
Polyphosphate accumulating organisms (PAO)	1.0000	1.0000	1.0000
Propionic acetogens	1.0000	1.0000	1.0000
Methanogens - acetoclastic	1.0000	1.0000	1.0000
Methanogens - hydrogenotrophic	1.0000	1.0000	1.0000
Endogenous products	1.0000	1.0000	1.0000
Slowly bio. COD (part.)	1.0000	1.0000	1.0000
Slowly bio. COD (colloid.)	1.0000	1.0000	1.0000

Part. inert. COD	1.0000	1.0000	1.0000
Part. bio. org. N	1.0000	1.0000	1.0000
Part. bio. org. P	1.0000	1.0000	1.0000
Part. inert N	1.0000	1.0000	1.0000
Part. inert P	1.0000	1.0000	1.0000
Stored PHA	1.0000	1.0000	1.0000
Releasable stored polyP	1.0000	1.0000	1.0000
Fixed stored polyP	1.0000	1.0000	1.0000
Readily bio. COD (complex)	0	0	1.0000
Acetate	0	0	1.0000
Propionate	0	0	1.0000
Methanol	0	0	1.0000
Dissolved H2	0	0	1.0000
Dissolved methane	0	0	1.0000
Ammonia N	0	0	1.0000
Sol. bio. org. N	0	0	1.0000
Nitrous Oxide N	0	0	1.0000
Nitrite N	0	0	1.0000
Nitrate N	0	0	1.0000
Dissolved nitrogen gas	0	0	1.0000
PO4-P (Sol. & Me Complexed)	1.0000	1.0000	1.0000
Sol. inert COD	0	0	1.0000
Sol. inert TKN	0	0	1.0000
ISS Influent	0.3300	0.3300	1.0000
Struvite	1.0000	1.0000	1.0000
Hydroxy-dicalcium-phosphate	1.0000	1.0000	1.0000
Hydroxy-apatite	1.0000	1.0000	1.0000
Magnesium	0	0	1.0000
Calcium	0	0	1.0000
Metal	1.0000	1.0000	1.0000
Other Cations (strong bases)	0	0	1.0000
Other Anions (strong acids)	0	0	1.0000
Total CO2	0	0	1.0000
User defined 1	0	0	1.0000
User defined 2	0	0	1.0000
User defined 3	1.0000	1.0000	1.0000
User defined 4	1.0000	1.0000	1.0000
Dissolved oxygen	0	0	1.0000