

Trip To Fremont

Clear Water

Test	Time	Flow per filter pump	Total Flow	P measured	Storage Level	Elevatoin P1	Elevatoin Storage	Pressure Loss
Pre Filter Cleaning	12:57	2,98		0,651	4,71	252,588	250,68	1,908377
	13:08	5,99		0,685	5,13	252,935	251,1	1,835082
Post Filter Ripening	15:29	2,88		0,636	4,74	252,435	250,71	1,725419
	15:48	5,93		0,686	5,23	252,945	251,2	1,745279
Check Valve Test	17:04	1,48		0,608	4,68	252,15	250,65	1,499898
	17:14	2,97		0,643	4,77	252,507	250,74	1,7668
	17:16	2,97		0,641	4,8	252,486	250,77	1,716405
	17:26	5,96		0,678	5,25	252,864	251,22	1,643702
Post pipe filter pipe combination	17:35	5,95	23,8	0,534	5,7	251,395	251,67	-0,2747
	17:40	3,02	12,08	0,56	5,7	251,66	251,67	-0,00957
	17:51	1,55	6,2	0,554	5,61	251,599	251,58	0,019249

Storage Tank Info				
	Elev			Height at Overflow
Overflow at	251,7		Storage	5,73
Empty	245,97			
Pressure Reference point				
	Elevatoin			
Gauge	245,95			

Post Filter Pump(s)		
Section	Flow (l/s)	Avg. Loss (m)
Filter Pump to Storage	1,5	1,4998976
	3	1,7792503
	6	1,741354267
Filter Pump Collection to Storage	1,5	0,0192488
	3	-0,009568
	6	-0,2746952

Raw Water

Test	Time	Flow l/s	P measured (bar)	Storage Level (m)	Overflow Depth (m)	Elevatoin P1	Filter Elevation	Pressure Loss
Post Intake Pump, Gate Valve Fully Open	08:38	22	1,004	3,7	0,004	253,158	251,9	1,257989
	08:46	37	0,885	3,7	0,009	251,945	251,9	0,044522
Gate Valve Half Closed	08:56	37	0,882	3,7		251,914	251,9	0,01393
Post Pipe Combination	09:57	0	0,88	3,7		251,894	251,9	-0,00646
	10:04	22	0,891	3,7		252,006	251,9	0,105705
	10:14	37	0,905	3,7		252,148	251,9	0,248466
Post Pipe Combination, Pre Static Mixer	10:50	0	0,289	3,7		251,917	251,9	0,016991
	10:53	22	0,3	3,7		252,029	251,9	0,12916
	10:58	37	0,32	3,7		252,233	251,9	0,333104
2 Pumps Post Combination	11:02	68,07	0,37	3,7	0,018	252,743	251,9	0,842964

The test occuring at 8:38 has an unusually high pressure loss. A possible, and most likely probable explanation is that the check valve did not fully open. This is a likely explanation as the pump had not been in use for a period of time before testing was conducted. The check valve was most likey only opening part way, and did not completely open until a higher flow was tested.



Filter info				
	Elev			Height at Overflow
Overflow at	251,9		Filter	3,7
	Empty	248,2		
	Pressure Reference Point		Pressure Reference Point 2	
		Elevatoin		Elevatoin
	Gauge	242,92	Gauge	248,97

Test Point	Section	Flow (l/s)	Average Loss (m)	<p>Test on the pressure side of the pump were all preformed at different locatoins for the same flow, thus it is there is no average of loss from point A to B based on multiple tests. But rather a singe example and result. However, it is possible to calculate the loss between test points by viewing the observed pressures</p>
A	Post Intake Pump	22	1,2579888	
		37	0,044522	
A	Gate Valve Half Closed	37	0,0139304	
B	Post Pipe Combination	0	-0,006464	
		22	0,1057052	
		37	0,248466	
C	Post Pipe Combination /Pre Static Mixer	0	0,0169908	
		22	0,12916	
		37	0,333104	
C	2 Pumps	68,07	0,842964	

Pressure Loss between measuting points			Reason for negative values: The most logical and probably correct reason for these pressure isses are that the elevatoin of the gauge could have been incorrectly recorded
Section	Flow (l/s)	Loss (m)	
A-B	22	1,1522836	
A-B	37	-0,203944	
B-C	0	-0,0234548	
B-C	22	-0,0234548	
B-C	37	-0,084638	

Filter

Test



Test	Time	Operation duration	Volume Cleaned	Flow (l/s)	Flow (m3/s)	Velocity (m/s)	Test	Velocity (m/h)	Hz	Power (kW)
Before Backwash	June 27th						Before Backwash			
Test #1	12:57	72,3		2,98	0,00298	0,000582031	Test #1	2,0953125	17,4	0,19406
Test #2	13:08	72,5	194	5,99	0,00599	0,001169922	Test #2	4,21171875	24,1	0,41046
Ripening	14:18						Ripening			
Test #1	14:26			6,05	0,00605	0,001181641	Test #1	4,25390625	11,8	0,23664
Test #2	14:46			5,97	0,00597	0,001166016	Test #2	4,19765625	11,9	0,23351
Test #3	15:05			5,98	0,00598	0,001167969	Test #3	4,2046875	12	0,2339
After Ripening							After Ripening			
Test #1	15:29	0,1		2,88	0,00288	0,0005625	Test #1	2,025	13,8	0,18323
Test #2	15:48			5,93	0,00593	0,001158203	Test #2	4,16953125	21,3	0,40694

#### Filter Parameters

	Elev		Height at Overflow
Overflow at	251,9	Filter 4	3,72
Empty	248,18		

P1 (bar)	P2 (bar)	P1 (m)	P2 (m)	Test	Filter water surface height (m)	Storage Tank surface elevation	Pressure Gauge Elev.	P1 Elev	P2 Elev
				Before Backwash					
0,438	0,651	4,4663736	6,6383772	Test #1	3,3	4,71	245,95	250,41637	252,5883772
0,355	0,685	3,620006	6,985082	Test #2	3,16	5,13	245,95	249,57001	252,935082
				Ripening					
0,494	0,391	5,0374168	3,9871052	Test #1	3,4		245,95	250,98742	249,9371052
0,485	0,391	4,945642	3,9871052	Test #2	3,35		245,95	250,89564	249,9371052
0,482	0,391	4,9150504	3,9871052	Test #3	3,34		245,95	250,86505	249,9371052
				After Ripening					
0,518	0,636	5,2821496	6,4854192	Test #1	3,38	4,74	245,95	251,23215	252,4354192
0,466	0,686	4,7518952	6,9952792	Test #2	3,21	5,23	245,95	250,7019	252,9452792

Test	Filter Water Elev	Loss in Filter	Storage water Elev.	Loss Pump to Storage
Before Backwash				
Test #1	251,48	1,0636264	250,68	1,9083772
Test #2	251,34	1,769994	251,1	1,835082
Ripening				
Test #1	251,58	0,5925832	No water transported to storage tank under the ripening phase.	
Test #2	251,53	0,634358		
Test #3	251,52	0,6549496		
After Ripening				
Test #1	251,56	0,3278504	250,71	1,7254192
Test #2	251,39	0,6881048	251,2	1,7452792

Storage Tank Parameters				
	Elev			Height at Overflow
Overflow at	251,7		Storage	5,73
Empty	245,97			

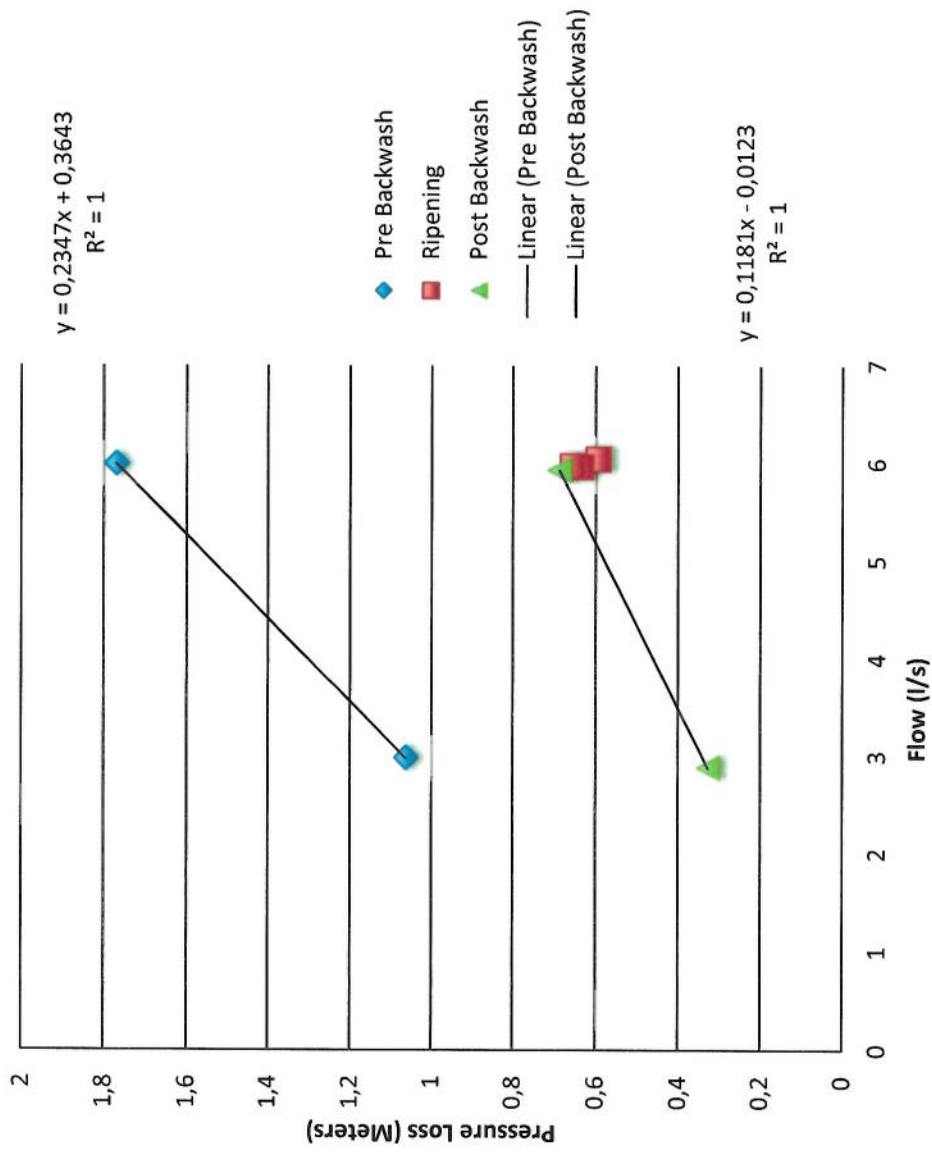
Calibration of 0 flow: Filter surface vs Pressure before valve, should be equal				
P (bar)	P (m)	Filter height	Filter surface elev.	Gauge/flo or Elev.
0,557	5,68127	3,48	251,66	245,95
				251,631272
				0,02872811

Pressure info	
P1	Post filter, pre pump
P2	Post pump

Pressure Change pre/post Backwashing Process			
Flow (l/s)	Pre (m)	Post (m)	Percent Change
3	1,0636264	0,3278504	69,17616938
6	1,769994	0,6881048	61,12389082



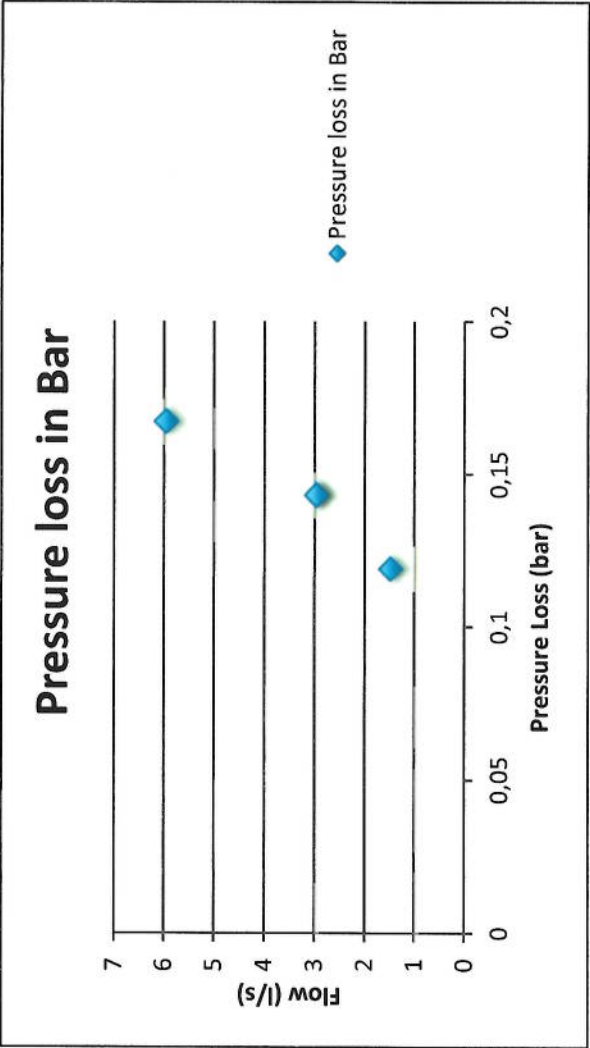
## Pressure Loss in a Filter



✓ valve

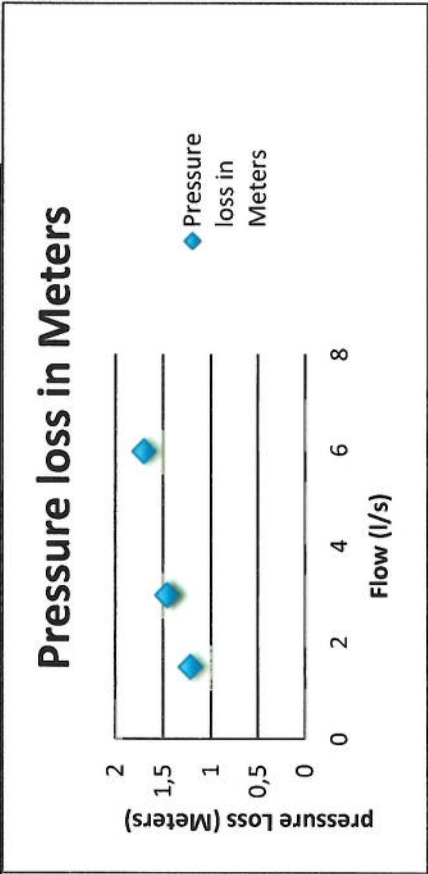


Test	Time	Flow	Hz	P1 (bar)	P2 (bar)	Head loss (bar)	P1 (m)	P2 (m)	Check Valve Loss (m)
Check Valve									
Test #1	17:04	1,48	8,8	0,608	0,489	0,119	6,1998976	4,9864308	1,2134668
Test #2	17:14	2,97	13,7	0,643	0,5	0,143	6,5567996	5,0986	1,4581996
Test #3	17:16	2,97	13,8	0,641	0,498	0,143	6,5364052	5,0782056	1,4581996
Test #4	17:26	5,96	21,2	0,678	0,511	0,167	6,9137016	5,2107692	1,7029324



Pressure info	
P1	Post Pump, pre check valve
P2	Post Check valve and elbow bend

Storage Tank Level (m)	Storage Tank WSE	P2 WSE	Loss P2 to Storage	Storage Tank Info			
					Elev		Height at Overflow
4,68	250,65	250,9364	0,2864308	Overflow at Empty	251,7	Storage	5,73
4,77	250,74	251,0486	0,3086		245,97	Vavle	57,7208
				Gauge Elevatoin		Bend	0,3
4,8	250,77	251,0282	0,2582056	Concrete	245,85	q=va	
				Added Slope	0,1	k sum	58,0208
5,25	251,22	251,1608	-0,0592308	=	245,95	d	0,1
						g	9,81
						v	
						hl	



Test	Area	Flow	Velocity	HI singular
1	0,00785398	0,00148	0,18843945	0,10500945
2	0,00785398	0,00297	0,37815214	0,42288068
3	0,00785398	0,00297	0,37815214	0,42288068
4	0,00785398	0,00596	0,75885077	1,70293263

Post Filter, Rec UV

[illegible]

Elevation tank water surface	Elevation of pre UV	Pressure loss	
251,67	255,445305	3,7753048	
251,67	255,710432	4,040432	
251,58	255,649249	4,0692488	

overflow	251,7	
over-5.73	245,97	Filter #4
Concrete	245,85	
Added Slope	0,1	
	245,95	

In-take      Pump



Test	Time	Flow	Hz	Amps	P1 (bar)	P2 (bar)	P1 (m)	P2 (m)
Intake Pump, 100% Open Valve								
Test #1	08:38	22	40,1	6,975	0,211	1,04	2,1516092	10,605088
Test #2	03:46	37	50	10,575	0,085	0,885	0,866762	9,024522
Valve Cloed by 10 revolutions, ~66%								
Test 1	08:56	37	50	10,575	0,095	0,882	0,968734	8,9939304
Pump turned off								
Test 1	09:05	0	0	0	0,283	0,281	2,8858076	2,8654132
Pressure info								
P1	Post pump filter, pre pump							
P2	Post pump							

Filter info			
	Elev		Height at Overflow
Overflow at	251,92	Filter 4	3,7
Empty	248,22		

Overflow of Filter	Filter #1 Level	Real filter height	Filter WSE	Gauge Elevation	Nisser Ref Elev	Nisser Level	Nisser WSE	P1 WSE	P2 WSE
0,004	3,7	3,704	251,92	242,92	243,815	2,5	246,315	245,0716092	253,525088
0,009	3,7	3,709	251,92	242,92	243,815	2,5	246,315	243,786762	251,944522
	3,7		251,92	242,92	243,815	2,5	246,315	243,888734	251,91393
	3,7		251,92	242,92	243,815	2,5	246,315	245,8058076	245,785413

Real Filter WSE with Overflow Calc	Pressure Loss to filter	Real Pressure Loss	Pressure loss from intake
251,924	1,605088	1,601088	1,2433908
251,929	0,024522	0,015522	2,528238
	-0,0060696		2,426266
	-6,1345868		0,5091924
Pressure at P1 is controlled by check valve not allowing full pressure from the pressure side of the pump.			

251.9439A

Pre Pump Filter

Test	Time	Flow	P1 (bar)	P2 (bar)	P1 (m)	P2 (m)	Pressure Loss
Pre Pump Filter							
Test #1	09:19	0	0,282	0,282	2,8756	2,8756	0
Test #2	09:27	22	0,248	0,215	2,5289	2,1924	0,3365076
Test #3	09:31	37	0,188	0,1	1,9171	1,0197	0,8973536

Elevation is not needed in this calculation as both points are measured from the same point, and the pressure loss through the filter is the focus

As long as nothing is clogging the pump, the loss should be relatively small

Pressure info	
P1	Pre Pump Filter
P2	Post Pump Filter

Post Pump / Fire filter



Test	Time	Flow	Hz	Amps	P intake (bar)	P1 (bar)	P2 (bar)	P1 (m)
Post pumps, pre filter								
Test #1	09:57	0	0	0	0,181	0,264	0,88	2,6920608
Test #2	10:04	22,25	40,1	6,975	0,181	0,207	0,891	2,1108204
Test #3	10:14	37,13	50	10,5	0,156	0,088	0,905	0,8973536
Pressure Info				a	0,19634954		z2	251,9
P1	Pre pumps, post pre pump filter			v	0,18910154			
P2	Post Parallel Pumps			z1	245,35			
				h1	245,351823			

Filter Info	
Filter	251,9
Empty	248,18

Gauge Info	
Elevation	242,92

P2 (m)	Lake Water Level	Reference Elevation	Filter Level	Gauge Elevatoin	WSE Post Pump	Filter Surface Elev	Loss to Filter	Loss to intake pump
8,973536	2,25	243,815	3,7	242,92	251,893536	251,88	0,013536	0,4529392
9,0857052	2,25	243,815	3,7	242,92	252,0057052	251,88	0,1257052	1,0341796
9,228466	2,25	243,815	3,7	242,92	252,148466	251,88	0,268466	2,2476464

Static Mixer

Test	Time	Flow	Hz	Amps	P intake (bar)	P1 (bar)
1 Pump						
Test #1	10:50	0	0	0	0,147	0,289
Test #2	10:53	22	40,1	6,975	0,181	0,3
Test #3	10:58	37	50	10,5	0,156	0,32
2 Pumps						
Test #1	11:02	68,07	50	10,2	0,079	0,37
			50	10,2	0,079	

Pressure info		Filter Info	
P1	Post filter, pre pump	Filter	251,9
P2	Post pump	Empty	248,18

Pump 2 had valve slightly closed, 50%			
Test No Flow, P1=P2			
P1	0,294	P2	0,292
		Difference:	0,002

P2 (bar)	P1 (m)	P2 (m)	Filter Level	Gauge Elevatoin	Pre Static Mixer WSE	Post Static Mixer WSE	Pressure Loss
0,283	2,94699	2,88581	3,7	248,97	251,9169908	251,8558076	0,0611832
0,288	3,05916	2,93679	3,7	248,97	252,02916	251,9067936	0,1223664
0,301	3,2631	3,06936	3,7	248,97	252,233104	252,0393572	0,1937468
0,33	3,77296	3,36508	3,7	248,97	252,742964	252,335076	0,407888