

Stormwater Treatment System Project Terminal 18 Port of Seattle



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400+ Catch Basins

200+ Manholes

19 Miles of Pipe

19 Outfalls

Off-site contribution

Sample Monitoring Results

Outfall M09	Bench	Q1-15	Q2-15	Q3-15	Q4-15	Q1-16	Q2-16	Q3-16	Q4-16	Average	Exceedance Frequency
Turbidity	25 NTU	20.9	34	23.1	24.6	12	10.1	27.4	29	22.6	2/8
Zinc	117 ug/L	463.3	300	500	178	190	360	217	289	312	8/8
Copper	14 ug/L	11.6	23	35.1	25.6	10	10	21.9	15.5	19	5/8
TPH	10 mg/L	0.42	1	2.2	1.4	0.65	0.51	0.707	0.423	0.9	0/8
TSS	30 mg/L	12.2	35.3	25.4	25.2	28.4	10.9	25.8	62.2	28.2	2/8

Phased Implementation Over Five Years

Phase One – End of Pipe treatment for at least 67 acres. Add two OWS at MNR. Complete by October 30, 2016

Phase Two - End of Pipe treatment for a total of at least 124 acres. Complete by October 30, 2018

Phase Three – Complete remainder of site, less any sub-basin qualifying for “off- ramp” with End of Pipe treatment. Complete by October 30, 2020

Phase One Treatment

87.2 Total Acres

Basin 19 / Expansion Area (Matson yard). 56.9 acres.

Basin 3 / CEM and Roadability 13.5 acres. Includes OWS.

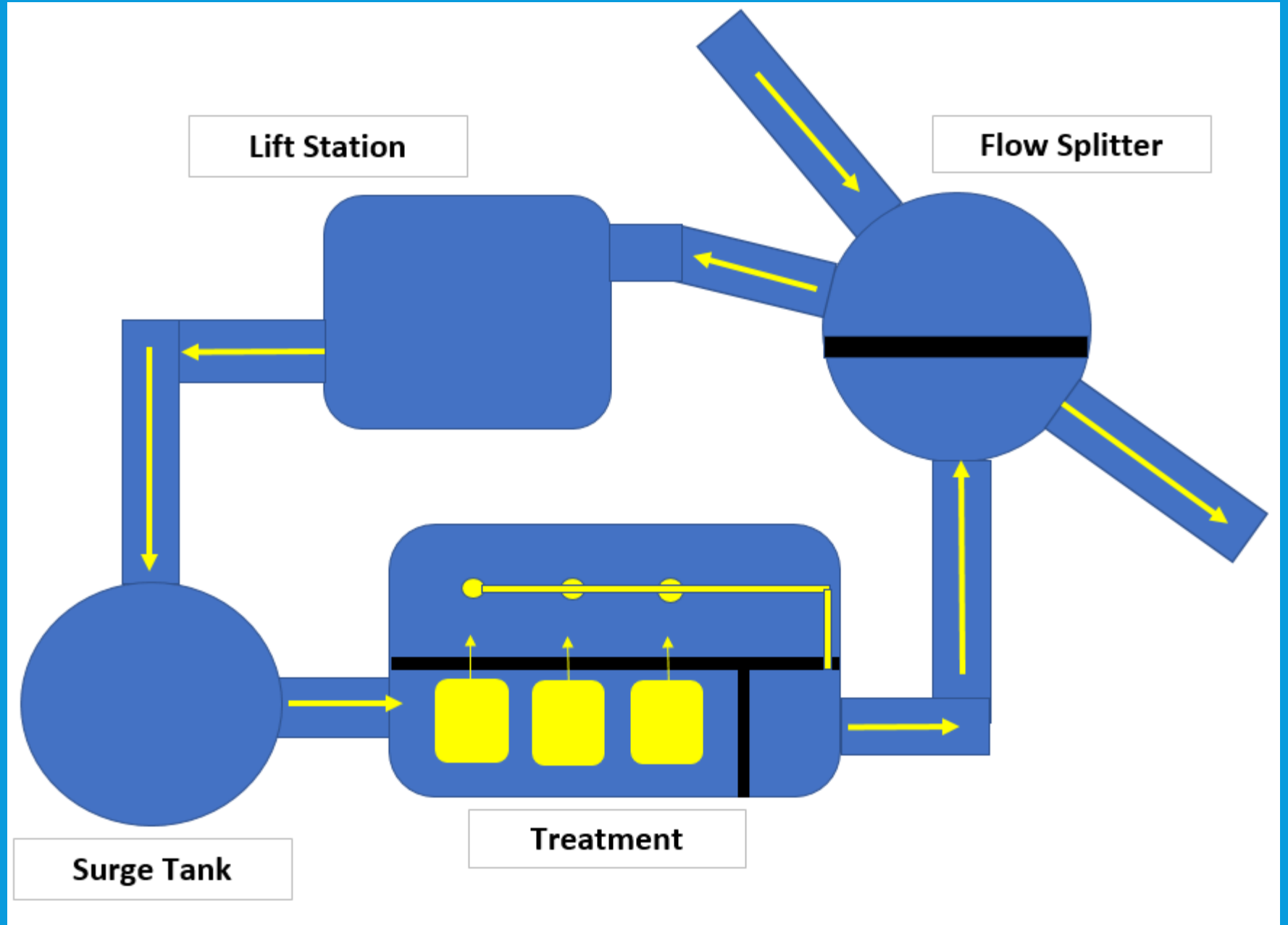


Basin 20. Combines with Basin 19 due to proximity of outfall. 10.3 acres.

Basin 15 / MNR. 4.2 acres. Includes OWS.

Basin 14 / MNR. 2.3 acres. Includes OWS.

Basic System Components



Modular Wetland

Basin 14



Chitosan Enhanced Sand Filtration System Basin 19/20







Ground water extraction pump.

De-watering manifold.

De-Watering "wells". Each pipe extends 4 feet below excavation level. Ground water is drawn up thru the wells, into the manifold and pumped to the Baker tanks and ultimately thru the sand filter system and then into the storm drain system.

Sand filtration system for ground water treatment.

"Baker Tanks" for pre-settling of ground water before treatment and discharge.

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Basin 19 Flow Splitter



Results

Chitosan Enhanced Sand Filtration System

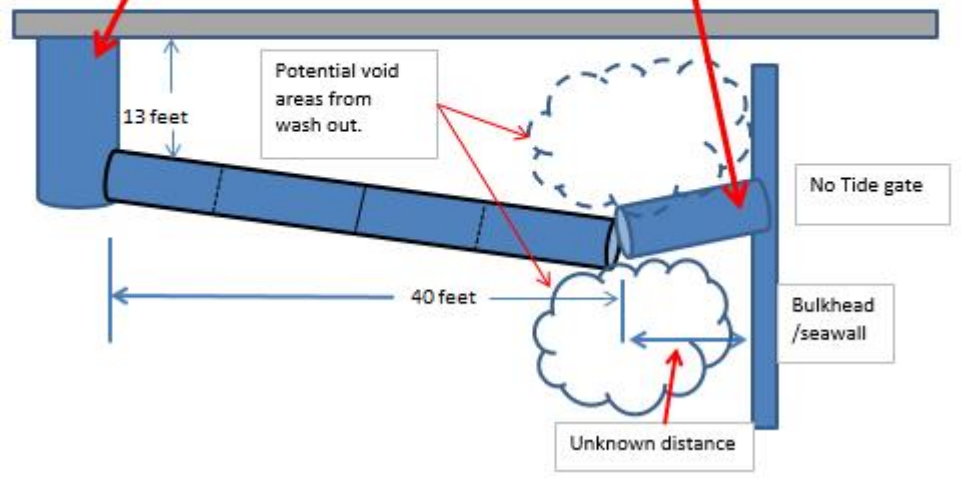
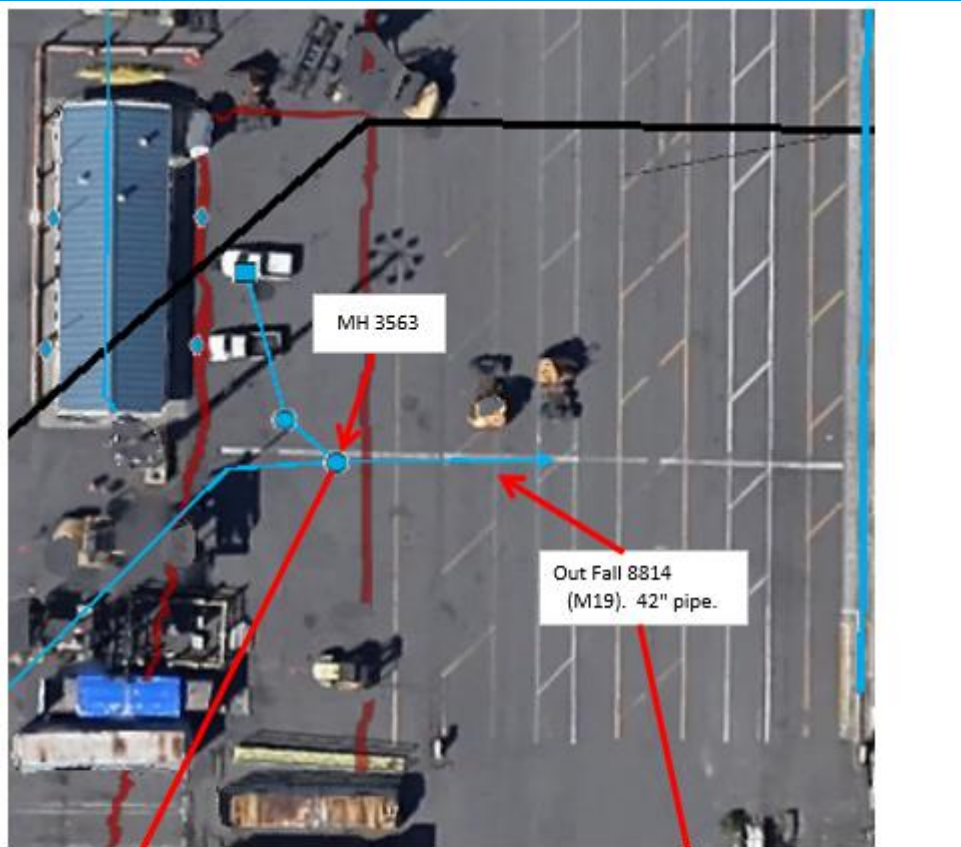
11/14/2016	Turbidity	Ph	Zinc	Copper	TSS
Bench	25 NTU	5.0-9.0 su	117 ug/L	14 ug/L	30 mg/L
M19 Raw	20.6	7.23	279	72.6	43.7
M19 Treated	0.31	6.93	40.9	5.46	0
% Reduction	98		85	92	100

Modular Wetland systems

11/15/2016	Turbidity	Ph	Zinc	Copper	TSS
Bench	25 NTU	5.0-9.0 su	117 ug/L	14 ug/L	30 mg/L
Raw Average	24.8	7.3	298	17.7	52.7
M15	8.44	7.6	76.4	1.87	0
% Reduction	66		74	89	100

Infrastructure Issues





07-08-15. Outfall pipe in Basin 19. Video inspection reveals break in pipe approximately 40 feet from the manhole. Pipe has settled and the joints along it's length are opening. Ground water infiltrates all along pipe. Tidal influx is substantial. There are likely significant voids above and below the break.



Questions?

Thank You