

Supplementary Material

Table S1. Water quality parameters (pollutants), units, methods, instrumentation, and detection limits.

Parameter	Units	Method	Instrument	Detection Limit
TSS	mg/L	US EPA gravimetric method	Desiccator, furnace	NA
Phosphorus	mg/L	PhosVer 3® ascorbic acid method (SM4500-P)	HACH® DR 2800	0.02 to 2.5
Nitrogen	mg/L	NitraVer® 5 cadmium reduction method (SM4500-NO ₃ ⁻)	HACH® DR 2800	0.3 to 30.0
Heavy metals	µg/L	Acid digestion/preparation	PerkinElmer NexION 350 ICP-MS	0.0005 and 0.001*

* Detection limit of 0.0005 µg/L for lead (Pb) and copper (Cu), 0.001 µg/L for zinc (Zn). The persulfate digestion method (SM4500P, SM4500N) coupled with HACH colorimetric methods were used to determine TN and TP.

Table S2. Mean influent and effluent concentration \pm standard deviation of measured water quality parameters – Phase I.

Water Quality Parameter	Mean Concentration \pm Standard Deviation							
	Sand		Man.Sand		Biofilter532		R.G.+Biofilter	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
TSS (mg/L)	85.5 \pm 8.99	7.35 \pm 17.3	78.8 \pm 40.5	7.35 \pm 13.7	69.0 \pm 42.3	13.4 \pm 9.33	206 \pm 88.7	12.9 \pm 16.4
Orthophosphate (mg/L P)	0.16 \pm 0.03	0.08 \pm 0.03	0.23 \pm 0.02	0.02 \pm 0.02	--	--	0.76 \pm 0.20	0.93 \pm 0.37
Total Phosphorus (mg/L P)	0.72 \pm 0.06	0.48 \pm 0.11	0.93 \pm 0.16	0.28 \pm 0.06	1.14 \pm 0.06	2.06 \pm 0.60	2.58 \pm 0.64	4.38 \pm 0.74
Nitrate (mg/L N)	0.87 \pm 0.05	1.81 \pm 1.04	0.80 \pm 0.18	1.08 \pm 0.52	--	--	--	--
Total Nitrogen (mg/L N)	1.16 \pm 0.16	1.24 \pm 0.34	1.69 \pm 0.16	2.25 \pm 1.14	1.86 \pm 0.75	1.51 \pm 4.06	2.98 \pm 0.21	3.64 \pm 1.62
Dissolved Lead (µg/L)	1.69 \pm 0.38	0.02 \pm 0.08	26.6 \pm 13.4	0.07 \pm 0.06	15.3 \pm 6.2	0*	4.35 \pm 1.1	0.98 \pm 0.67
Total Lead (µg/L)	117 \pm 14.6	1.09 \pm 0.45	94.5 \pm 75.2	0.17 \pm 0.14	51.6 \pm 24.6	0.35 \pm 0.18	102 \pm 94.0	3.58 \pm 2.99
Dissolved Copper (µg/L)	9.24 \pm 2.45	7.36 \pm 3.88	16.4 \pm 11.5	0.57 \pm 0.69	7.49 \pm 1.88	42.0 \pm 7.87	11.3 \pm 1.15	20.0 \pm 17.0
Total Copper (µg/L)	36.7 \pm 2.00	11.2 \pm 5.12	24.6 \pm 14.3	1.54 \pm 0.81	26.3 \pm 8.76	55.1 \pm 9.00	65.6 \pm 42.3	46.5 \pm 11.9
Dissolved Zinc (µg/L)	65.1 \pm 6.67	4.44 \pm 2.13	39.6 \pm 2.7	1.61 \pm 1.67	22.8 \pm 12.5	8.00 \pm 5.52	114 \pm 27.1	11.2 \pm 6.5
Total Zinc (µg/L)	147 \pm 5.68	16.2 \pm 8.02	48.2 \pm 16.2	5.83 \pm 0.68	90.0 \pm 56.4	12.9 \pm 13.2	138 \pm 102	15.9 \pm 13.2

* Under detection limit considered as zero. -- Missing values are due to color interference.

Table S3. Mean influent and effluent concentration \pm standard deviation of measured water quality parameters- Phase II.

Water Quality Parameter	Mean Concentration \pm Standard Deviation									
	Lime-Mix		Blend#1		Blend#2		Biofilter433MS		Biofilter433	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
TSS (mg/L)	15.9 \pm 15.4	4.46 \pm 6.43	31.0 \pm 5.87	11.1 \pm 6.34	102 \pm 74.9	12.2 \pm 11.9	85.8 \pm 44.5	22.3 \pm 8.8	46.8 \pm 23.2	11.7 \pm 5.59
Orthophosphate (mg/L P)	0.16 \pm 0.01	0.04 \pm 0.01	0.12 \pm 0.04	0.16 \pm 0.05	0.20 \pm 0.02	0.02 \pm 0.01	0.14 \pm 0.05	0.94 \pm 0.28	0.15 \pm 0.01	0.55 \pm 0.30
Total Phosphorus (mg/L P)	0.73 \pm 0.06	0.34 \pm 0.02	0.60 \pm 0.04	0.72 \pm 0.14	0.85 \pm 0.16	0.29 \pm 0.04	0.65 \pm 0.08	3.13 \pm 0.86	0.69 \pm 0.04	1.92 \pm 0.92
Nitrate (mg/L N)	0.42 \pm 0.17	0.4 \pm 0.09	0.63 \pm 0.18	0.67 \pm 0.41	0.68 \pm 0.13	0.7 \pm 0.33	0.93 \pm 0.08	1.04 \pm 0.82	0.73 \pm 0.04	0.30 \pm 0.23
Total Nitrogen (mg/L N)	2.02 \pm 0.80	1.42 \pm 0.20	1.77 \pm 0.62	1.98 \pm 0.74	1.74 \pm 0.38	1.72 \pm 0.63	1.19 \pm 0.25	1.32 \pm 0.29	1.66 \pm 0.04	1.44 \pm 0.23
Dissolved Lead (μ g/L)	1.1 \pm 0.8	0*	2.4 \pm 0.8	0*	11.9 \pm 3.5	0*	35.4 \pm 31.1	0.97 \pm 0.44	3.9 \pm 0.8	0.01 \pm 0.03
Total Lead (μ g/L)	64.3 \pm 52.2	---	36.7 \pm 50.7	0*	139 \pm 64.9	0*	190 \pm 98.6	1.2 \pm 1.7	119 \pm 79.1	1.8 \pm 2.5
Dissolved Copper (μ g/L)	8.8 \pm 1.4	7.96 \pm 2.3	6.7 \pm 2.3	11.4 \pm 21.6	7.7 \pm 2.9	8.5 \pm 13.9	12.4 \pm 2.9	15.9 \pm 16.2	4.4 \pm 0.7	11.6 \pm 33.1
Total Copper (μ g/L)	18.5 \pm 13.9	5.7 \pm 3.3	40.8 \pm 7.7	14.9 \pm 7.5	43.9 \pm 18.2	9.1 \pm 2.8	50.2 \pm 29.5	17.9 \pm 6.4	130 \pm 113	31.2 \pm 30.3
Dissolved Zinc (μ g/L)	195 \pm 42.3	20.0 \pm 15.4	152 \pm 15.6	12.0 \pm 15.8	165 \pm 55.5	2.9 \pm 3.3	134 \pm 30.9	8.2 \pm 9.3	56.4 \pm 3.7	7.3 \pm 6.0
Total Zinc (μ g/L)	190 \pm 82.1	---	334 \pm 90.7	18.0 \pm 10.1	231 \pm 122	28.3 \pm 8.0	299 \pm 144	24.9 \pm 8.7	286 \pm 132	10.8 \pm 10.2

* Under detection limit considered as zero. -- Missing values are due to technical issues with ICP-MS.

Table S4. Mean effluent concentration \pm standard deviation of water quality parameters - Phase III.

Water Quality Parameter	Phase III with Plants						Phase II	
	Blend#1			Biofilter433			No Plants	
	Sea Oats	Frogfruit	Muhly	Sea Oats	Frogfruit	Muhly	Blend#1	Biofilter433
TSS (mg/L)	53 \pm 76.6	77.3 \pm 55.4	111 \pm 41.1	53.2 \pm 31.5	94.7 \pm 72.6	99.8 \pm 57.8	11.05	11.7
Orthophosphate (mg/L P)	0.03 \pm 0.01	0.03 \pm 0.01	0.04 \pm 0.01	0.76 \pm 0.31	0.83 \pm 0.36	0.85 \pm 0.33	0.16	0.55
Total Phosphorus (mg/L P)	0.30 \pm 0.08	0.32 \pm 0.16	0.35 \pm 0.11	2.58 \pm 0.91	2.82 \pm 1.39	2.87 \pm 1.05	0.72	1.92
Nitrate (mg/L N)	0.31 \pm 0.10	0.26 \pm 0.11	0.39 \pm 0.16	0.19 \pm 0.16	0.25 \pm 0.11	0.22 \pm 0.13	0.67	0.30
Total Nitrogen (mg/L N)	1.86 \pm 0.33	1.51 \pm 0.26	1.73 \pm 0.24	1.62 \pm 0.18	2.06 \pm 0.17	1.80 \pm 0.17	1.98	1.44
Dissolved Lead (μ g/L)	0.43 \pm 1.08	0*	0.06 \pm 0.19	0.31 \pm 0.64	0*	0.45 \pm 1.00	0*	0.01
Total Lead (μ g/L)	1.28 \pm 2.07	2.33 \pm 1.75	1.56 \pm 0.88	1.40 \pm 1.06	3.5 \pm 3.05	3.29 \pm 2.68	0*	1.8
Dissolved Copper (μ g/L)	10.4 \pm 3.47	6.29 \pm 2.61	8.86 \pm 5.74	13.2 \pm 6.42	16.8 \pm 15.3	11.2 \pm 6.62	11.4	11.6
Total Copper (μ g/L)	12.0 \pm 4.38	10.9 \pm 3.62	10.2 \pm 2.40	15.4 \pm 5.92	21.2 \pm 13.4	18.9 \pm 6.67	14.9	31.2
Dissolved Zinc (μ g/L)	4.38 \pm 2.21	5.32 \pm 3.50	7.05 \pm 5.05	8.20 \pm 6.76	4.99 \pm 5.15	5.16 \pm 6.25	12.0	7.3
Total Zinc (μ g/L)	6.18 \pm 7.67	10.9 \pm 5.11	9.96 \pm 6.46	9.36 \pm 3.98	14.8 \pm 11.7	14.9 \pm 11.8	18.0	10.8

* Under detection limit considered as zero.