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Summer 2013

North Creek Water Quality Analysis Report

Introduction

This project is a continuation of the project that began spring quarter 2013, to set a baseline of data that can be used in the future for studies that may involve pathogens in the wetland waters of North Creek. We are gathering data to have a better understanding of the fecal coliform and e-coli issues that are plaguing North Creek. It is possible that the numbers of crows roosting in the trees in the wetland are causing an increased influx of fecal coliform bacteria or that there is a sewage leak problem from a metro sewer line that intersects North Creek on the Universities campus or an intercept line of King Counties that resides upstream. It is the intention to continue collecting data and gathering enough information to see if conclusions can be drawn from the results on whether or not the Universities wetlands are adding to the problem. However this report is designed to be used as base line data in conjunction with the rest of the studies documentation both past and future. Three sites were chosen to study this quarter, all of which are located on the University of Washington Bothell's wetlands. Site 1 and 3 can be referenced in last quarter's report (A. Powers et., al. Spring 2013) as site 1 and 5. As for site 2 this quarter it is a new site picked for its relevance in accordance with the initial report presented at the beginning of this study indicating a spike in pathogens produced for the University of Washington. (Figure 1). Summer quarters data collection began July 1, 2013 and ended August 19, 2013 and was collected on a weekly basis. Site 1 is located on the southernmost boarder of the University of Washington Bothell wetlands nearest to highway 522 (Figure 2). Site 2 is located ~10m southeast of the boardwalk just south of the junction of the primary and secondary channels (figure 3). Site 3 is the northernmost site located just above the junction of the primary and secondary channels (figure 4).

Methods

In the Field

The first piece of equipment used to gather data at all sites was YSI 85 meter which detects Oxygen levels (% saturation and milligrams per liter), temperature (˚C), and conductivity (micro Siemens). Other equipment used was an Oakton pH Tester 10 and a 2100P Turbidimeter. First thing that was done each week before collecting data was calibrating the YSI 85 meter and

the Oakton pH meter in the lab before going into the field. At the beginning of the quarter the 2100P Turbidimeter was calibrated before going out in the field the on 7/1/2013. To collect data using the YSI 85 meter the probe was hung off a branch, lowered into the flowing water, and left while collecting other data, which allowed it to stabilize. To get a pH reading the Oakton pH meter was submerged roughly 4 inches into the stream and was held there for 2 minutes, allowing the pH to stabilize. To collect turbidity readings three glass vials and their lids were submerged to a depth of ~6 inches three times to rinse, then on the fourth time filled and the cap was put on. Before the readings were taken each vial was wiped clean and dry using Kimwipes then slowly inverted 5 times before placing in the 2100P Turbidimeter. To gather samples, disposable 20ml sterile containers were used to ensure there was no contamination. When the data was being gathered we started at the downstream site (site 1) and worked our way up to site 3 so that we did not stir up sediments since we had to get in the stream channel to collect samples and the other data. At each site, three replicates were taken as well as one control containing deionized (DI) water. The University of Washington Bothell supplied the DI water. All containers were filled and rinsed three times then on the fourth time the sample was collected and lids put on. For the North Creek samples, the vials were submerged ~6 inches to rinse as well as the final samples that would be filtered in the lab.

In the Lab

Once samples were brought back to the lab, they were immediately prepared for filtration by diluting them to 1%. This was done by using a 100ml graduated cylinder and adding 99ml of DI water then 1ml of sample was added by pipet to create 100ml of solution. The solution was poured into a 200ml beaker and swirled at least 25 times to ensure it was mixed. These diluted samples were then filtered through a Millipore 47mm membrane using a vacuum pump. The membranes were then placed into Millipore single use 47mm petri dishes which were pre-prepped with m-Coliblue broth culture medium. The petri dishes were then placed in an incubator that was preheated to 35°C and incubated for twenty four hours, then placed in a refrigerator. The samples were kept in the refrigerator for less than twenty four hours before counting was done. Using a Nikon SMZ1500 microscope, total coliform (red colonies) and e-coli (blue colonies) were counted. After counting was done, calculations to get total bacteria counts in 100ml were performed. The formula for the calculations is (total colonies counted / ml original solution)*100ml. Means of results are presented in Table 1 and totals for each date collected for each site in Appendix 1,2,3. All filtration equipment was sterilized in a 70% Ethyl alcohol solution after each site was filtered and allowed to air dry in a fume hood.

Results

Table 1. Variables measured along North Creek at University of Washington Bothell campus wetlands during summer quarter 2013. Means (n=8) are presented ± Standard Deviation. * indicates n=7 and ** indicates n=6.

Variables	Sample Site 1	Sample Site 2	Sample Site 3
Temperature (˚C)	16.51 ± 0.99	16.49 ± 1.04	16.33 ± 1.08
pH	7.4 ± 0.31*	7.5 ± 0.29*	7.5 ± 0.29*
Conductivity (uS)	167.48 ± 4.08**	172.47 ± 1.69**	170.13 ± 3.69**
Turbidity (NTU)	5.02 ± 1.59	4.22 ± 1.19	2.85 ± 0.43
Disolved Oxygen (%)	84.79 ± 5.59*	82.56 ± 5.40*	85.81 ± 5.47*
Disolved Oxygen (mg/l)	8.32 ± 0.71*	8.09 ± 0.60*	8.45 ± 0.66*
Total Coliform (colonies/100ml)	6192 ± 2888.99	6176 ± 3402.81	5555 ± 2264.29
E-Coli (colonies/100ml)	1938 ± 1253.09	1692 ± 947.27	1434 ± 1166.92

Discussion

Although most of the data is relatively close to spring quarter there were some interesting things that happened toward the end of summer quarter. On July 29, 2013 we noticed a new beaver dam downstream from site three (Figure 5). This would account for why we noticed turbidity levels decreasing at the lower sites the last few times we collected data (Appendix 2 and 3). Turbidity levels also significantly decreased at site three which is most likely due to the fact that stream velocity has significantly increased due to the water being impounded by the beaver dam. The fecal coliform data was also very interesting after the addition of the new dam. We noticed that the e-coli levels have dropped dramatically at all sites (Appendix 1, 2, and 3). This might be due to the fact that e-coli bacteria attach to sediment particles in the water and since the beavers are impounding the water the sediment /bacteria has a chance to settle out. One interesting fact to not is that even though the e-coli levels dropped it seems that the total coliform have not and on one occasion were significantly higher than previously recorded. We were told by the wetlands facilities guys that there is actually three dams on campus and on the last day we got to visit all three. In Figure 6 this dam is located at the site of the old beaver lodge. On the last day of sampling the turbidity levels at sites 1 and 2 were almost double what they had been the whole quarter. This might be because the beavers were packing there dams with material they collected or maybe there was a partial breach in the lower dam. In future quarters it will be interesting to see what effects the beaver dams have on the fecal coliform and turbidity data, if

the University allows them to stay. This research could aid in building a foundation for a petition on why the beavers should stay.

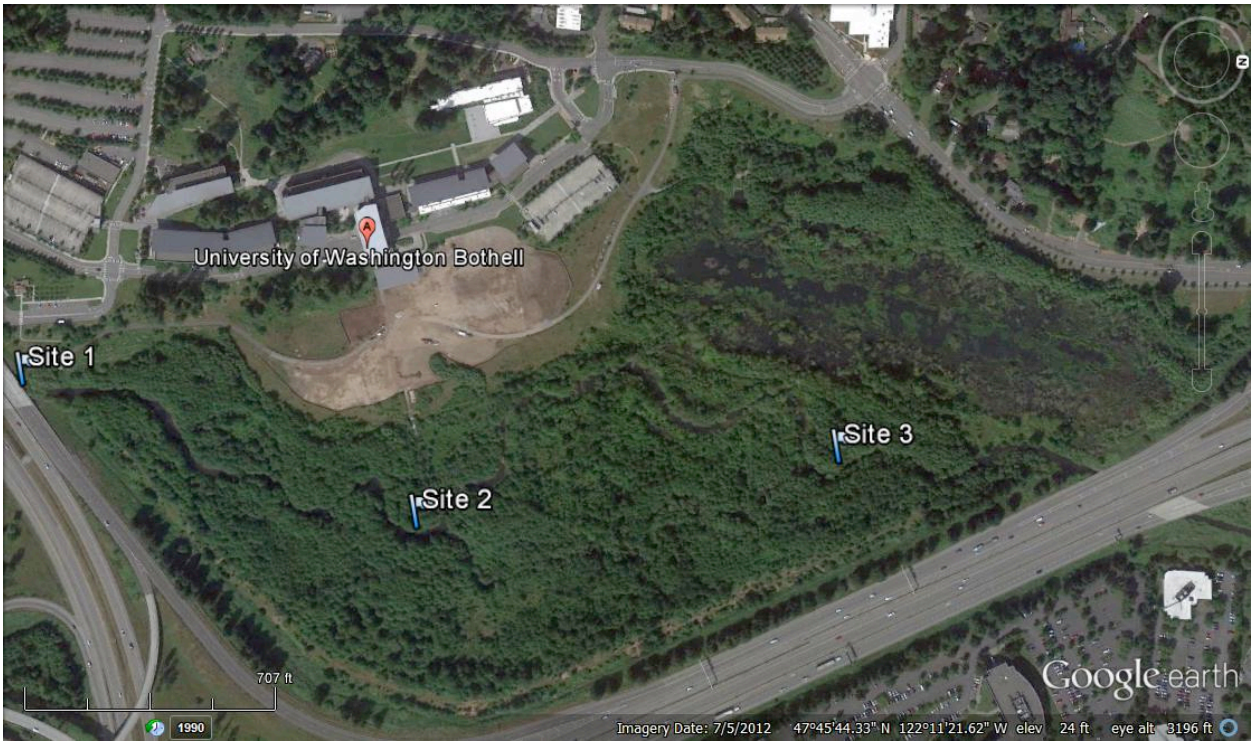

Figure 1. Water quality sample sites along North Creek on University of Washington Bothell campus wetlands.

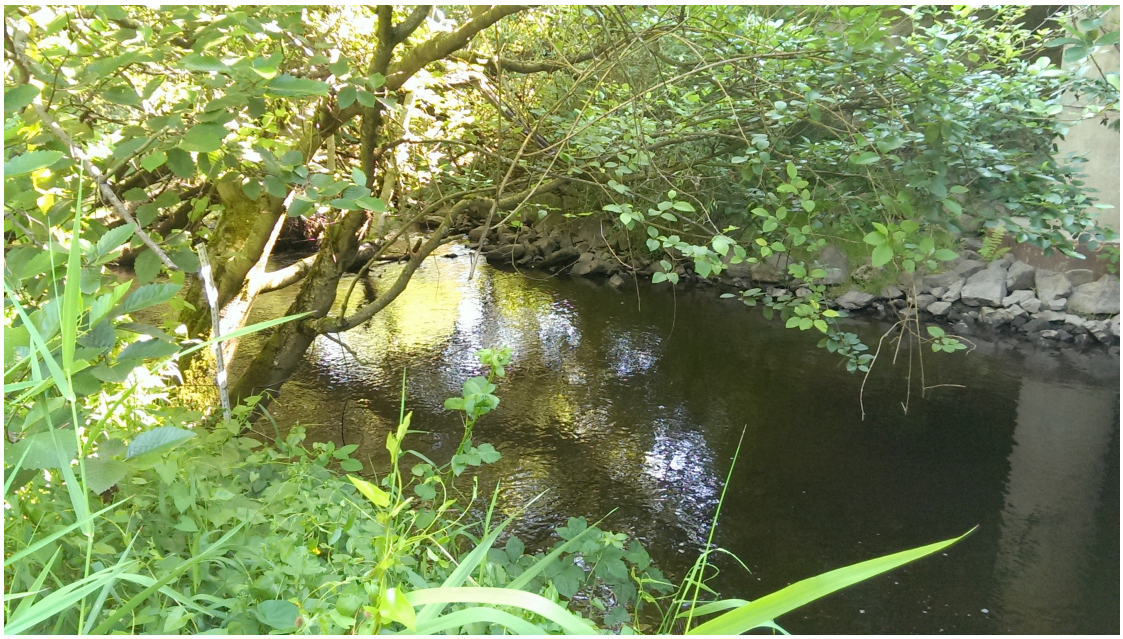

Figure 2. Site 1 located on southernmost edge of the University of Washington Bothell campus wetlands.

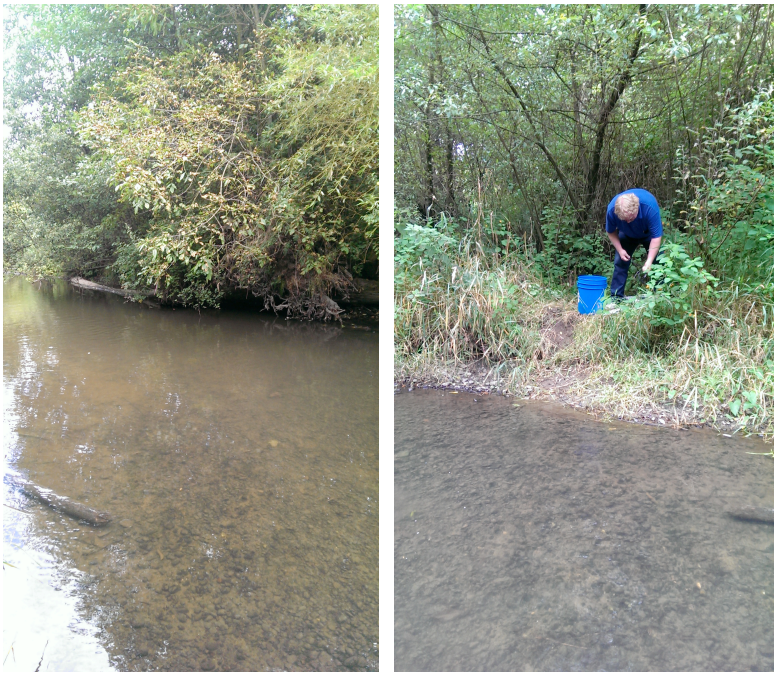

Figure 3. Site 2 located southeast of the Boardwalk ~10 meters down from junction of primary and secondary channel on the University of Washington Bothell campus wetlands.

Figure 4. Site 3 located to the north just above junction of primary and secondary channels on the University of Washington campus wetlands.

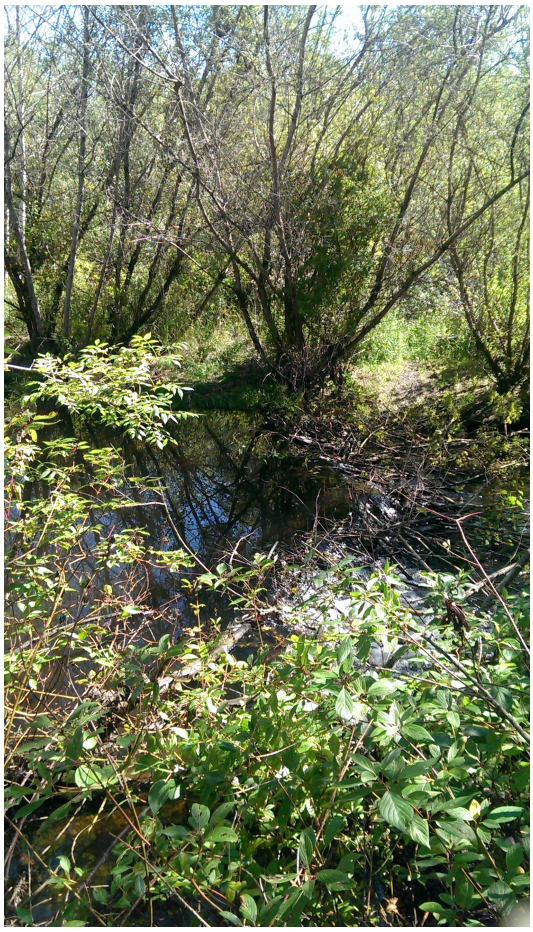

Figure 5. First beaver dam noticed 7/29/2013. Located 150-200 yards south of site 3 on University of Washington Bothell campus wetlands.

Figure 6. Second beaver dam noticed 8/19/2013. Located by previous beaver lodge on University of Washington Bothell campus wetland.

Appendix

Appendix 1. Raw data of North Creek Site 1 located just before highway 522 overpass on University of Washington Bothell campus wetlands. NDC signifies no data collected.

Date	Temp (°C)	pH	Conductivity (uS)	Mean Turbidity (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat)	Mean Total Coliform Colonies per 100 mL	Mean E Coli Colonies Per 100 mL
7/1/2013	18.4	7.6	169.6	4.11	6.98	74.7	8800	3200
7/8/2013	16.7	7.7	167.6	5.78	8.27	84.5	2800	1534
7/15/2013	15.4	7.7	168.0	4.53	8.81	88.4	5000	1600
7/22/2013	16.1	7.5	170.8	4.85	8.42	86.1	5034	3334
7/29/2013	15.7	7.5	169.4	5.03	7.99	80.8	4567	3567
8/5/2013	16.4	7.1	159.5	3.68	8.56	87.2	11134	900
8/12/2013	NDC	NDC	NDC	3.65	NDC	NDC	3834	300
8/19/2013	16.9	6.9	NDC	8.53	9.20	91.8	8367	1067

Appendix 2. Raw data of North Creek Site 2 located ten meters southeast of boardwalk on University of Washington Bothell Campus wetlands. NDC signifies no data collected.

Date	Temp (°C)	pH	Conductivity (uS)	Mean Turbidity (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat)	Mean Total Coliform Colonies per 100 mL	Mean E Coli Colonies per 100 mL
7/1/2013	18.5	7.7	171.8	3.67	7.05	75.4	5167	2300
7/8/2013	16.6	7.7	173.9	4.86	8.35	86.5	3100	1300
7/15/2013	15.4	7.6	169.6	3.62	8.66	86.8	4467	1767
7/22/2013	16.0	7.5	173.8	4.53	8.44	86.0	5734	2500
7/29/2013	15.6	7.6	173.7	4.14	7.79	78.5	5467	3300
8/5/2013	16.4	7.1	172.0	3.00	8.64	87.9	13967	800
8/12/2013	NDC	NDC	NDC	3.20	NDC	NDC	4034	600
8/19/2013	16.9	7.0	NDC	6.71	7.72	76.8	7467	967

Appendix 3. Raw data of North Creek Site 3 located in the northern section of North Creek before entrance of secondary channel on the University of Washington Bothell wetlands. NDC signifies no data collected.

Date	Temp (°C)	pH	Conductivity (uS)	Mean Turbidity (NTU)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% Sat)	Mean Total Coliform Colonies per 100 mL	Mean E Coli Colonies Per 100 mL
7/1/2013	18.5	7.7	163.6	2.77	7.30	78.0	7000	2334
7/8/2013	16.4	7.8	173.0	3.49	8.77	89.4	2867	767
7/15/2013	15.2	7.7	168.4	2.97	9.32	92.6	3867	1834
7/22/2013	15.9	7.5	173.0	3.42	8.75	88.4	5934	2367
7/29/2013	15.5	7.6	172.6	2.80	8.23	82.4	5734	3267
8/5/2013	16.2	7.2	170.2	2.62	8.77	89.4	9967	400
8/12/2013	NDC	NDC	NDC	2.31	NDC	NDC	3534	167
8/19/2013	16.6	7.0	NDC	2.44	8.00	80.5	5534	333