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Subject: Water Quality Memo
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Intro:

The objective of this study is to determine water quality in several branches of the Waterways around HSU. On Friday, February 12, 2016 about 25 engineering students measured the waterways simultaneously. The students took readings from the campus fish hatchery, within Fern Lake near its outlet, in-stream several feet before the Fern Lake inlet, and finally in the Jolly Giant creek upstream of the dorms. The water quality readings included dissolved oxygen (DO), turbidity, pH, and temperature.

Materials and Methods:

During this lab DO, turbidity, pH, and temperature were measured using various instruments. To measure the DO, a device called YSI model 55 was utilized. This instrument measures the amount of dissolved oxygen (mg/L) in a water sample, it takes into consideration the salinity as well as the elevation of the water sample. It also measures the temperature of the water in Celsius. Since turbidity (NTU) is measuring the amount of undissolved particles, we use a HI93703, this device uses an infrared light source to determine the amount of light scattering by the turbidity in the water. The pH was measured with pH reader; since the pH is unit less, the function of the reader measured the amount of hydrogen activity in the sample and converted it to millivolts.

Results:

The data showed that each location had similar end results. Using the instruments listed above the data we accumulated was accurate. At the fish hatchery the recorded DO level was 10.4 (mg/L), temperature came out to be the highest at 13.2°C, a pH of 7.6 and turbidity of 8.63 NTU. At the upstream location in Fern Lake the lowest DO level of 7.69 (mg/L), temperature of 11.8 °C, pH of 7.6 and a turbidity of 9.22 NTU which was the highest of all three locations. The outlet of Fern Lake gave us the results of a DO at 9.87(mg/L), temperature of 11.3°C, pH of 7.07, which was the lowest of the results, and a turbidity of 9.22 NTU. In the last location (Jolly Giant creek upstream) produced a DO of 11.25 (mg/L), the lowest temperature of 11.2°C, pH of 7.90, and a final turbidity of 9.11 NTU.

Discussion:

Overall the resulted hypotheses for DO were fairly accurate, with the exception to Fern Lake. It was assumed the dissolved oxygen would be higher at the fish hatchery because of the pumps circulating the water, lower upstream of Fern Lake resulting from shallowness and low flow rate of the water, low at fern lake because of the decomposing organic matter in the still water, and high in Jolly Giant Creek due to the high flow rate of the water. A suspected source of error might be due to uneven DO levels within the water at Fern Lake. Samples were taken from the surface level of the outlet where water was leaving the lake; It would make sense that the outlet would be higher in DO because the water is moving at the outlet, compared to in the

middle of the lake or in deeper water where organic matter is being decomposed in relatively still water. The expected a temperature of 13°C for optimal fish farming at the hatchery, 12°C upstream of Fern Lake due to shaded forest conditions, 14°C at Fern Lake due to higher sun exposure and decomposition, and lastly 11°C at Jolly Giant Creek because of forest shading. Temperature followed the same trend as DO, being accurate with the exception of Fern Lake. This was likely the reason of uneven distribution of water temperature at the lake. Fish hatchery pH was predicted to be neutral at 7 because it is controlled with baking soda and vinegar, upstream and Jolly Giant Creek the prediction was of a slightly acidic pH because healthy water is slightly acidic, and at Fern Lake we predicted a low pH due to the settling of the acidic organic matter in the lake. It had been raining the day samples were taken, therefore high pH runoff was likely the cause for higher pH than anticipated at all the locations. Lastly the turbidity hypotheses were half right and half wrong. Turbidity was concluded to be low at the fish hatchery because it would make sense for optimal fish farming, higher upstream of Fern Lake because the water was shallow and running, lower at the Fern Lake outlet because of settling, and higher at Jolly Giant Creek because of the running water. The hypotheses were incorrect about Fern Lake turbidity, likely due to the large number of students dislodging sediment while sampling.

In a US Geological survey paper by Paul Woods titled, "*Interchange of Surface and Intergravel Water in Redwood Creek, Redwood national Park, California*," it was found that forested creek surface water DO ranged between 8.3 and 11.6 mg/L, with surface temperatures ranging from 9.0 to 26.0 degrees C. The resulted findings in the local campus waterways, ranging from 7.69 to 11.25 DO, and 11.2 to 13.2 degrees C, fall roughly within the same parameters as the Redwood Creek. Furthermore, according to the Georgia Watershed Protection Plan Development Guidebook by Brown and Caldwell, streams draining from coniferous woodlands tends to have a PH of 6.8 to 6.5, relatively close to our redwood stream's findings between 7.07 and 7.90. The guidebook also references a 10 NTU benchmark for clear streams, corroborating our range of 8.63 to 9.22 NTU.

Some errors that could have occurred in the experiment may have come from human or mechanical inaccuracies. Human error may include misuse of the instruments; For example the DO may have been compromised by moving the instrument up and down in the water. The turbidity may have been compromised by people stepping into the water and causing particles to move through the water where people were taking samples. For pH level, there may have been a recent event that caused an increase in acidity. Instrumental error may have occurred during the experiment or before the experiment, causing faulty data.

Conclusion

In the end results the conclusion found that the original estimates matched fairly similarly to the measured results. The DO calculations varied from 7.69 to 11.25 NTU's. The temperatures which were extremely close to the hypotheses ranged from 11.2°C to 13.2°C. The pH was much more basic than we believed it to be due to the high number of tannins in the area; the pH ranged from 7.07 to 7.90. The measured turbidity was fairly consistent, ranging from 8.63 NTU to 9.22 NTU. Further study of the area may yield useful information about water quality under different environmental conditions.

Appendices:

<u>Location</u>	<u>DO (dissolved oxygen)</u>	<u>Temperature</u>	<u>pH</u>	<u>Turbidity</u>
Fish Hatchery	Result: 10.4 mg/L Hypothesis: 10 mg/L - mid/high	Result: 13.2°C Hypothesis: 13°C - comfortable trout temperature	Result: 7.6 Hypothesis: 7-neutral	Result: -4.17 NTU -3.46 NTU -3.54 NTU 3.72 NTU AVG. Hypothesis: low: 5-6 NTU
Upstream Fern Lake	Result: 7.69 mg/L Hypothesis: 8 mg/L - mid	Result: 11.8°C Hypothesis: 12°C - Average water temperature in Humboldt	Result: 7.6 Hypothesis: 6.3 -slightly acidic	Result: -10.03 NTU -11.19 NTU -10.12 NTU 10.45 NTU AVG. Hypothesis: higher: 25 NTU
Fern Lake Outlet	Result: 9.87 mg/L Hypothesis: 7 mg/L -low/ mid	Result: 11.3°C Hypothesis: 14°C - warmer	Result: 7.07 Hypothesis: 6.0-slightly acidic	Result: -28.05 NTU -28.56 NTU -24.67 NTU 27.09 NTU AVG. Hypothesis: lower: 10 NTU
Jolly Giant Creek upstream	Result: 11.25 mg/L Hypothesis: 12 mg/L - high	Result: 11.2°C Hypothesis: 11°C cooler	Result: 7.90 Hypothesis: 6.5-slightly acidic	Result: -28.51 NTU -24.51 NTU -35.05 NTU 29.36 NTU AVG. Hypothesis: higher: 30 NTU

References:

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