American Society of Civil Engineers (ASCE) Environmental Design Competition

Status Update 2

CENE 486C

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Project Summary

- Pacific Southwest Conference (PSWC) 2018 located in Tempe, Arizona [1]
- Design and construct a reusable, low-cost household water treatment system [1]
- Intended for the households of developing countries. The system will also be scalable to accommodate the needs of communities.

Figure 1: PSWC 2017 Environmental Competition in Irvine, CA
Photo courtesy of Celine Bannourah

Completed Schedule Status

Task	Original Date	Actual Start/End Date
~~1. Literature Review~~	9/14/17 - 12/14/17	9/14/17- 12/30/18
~~2. Unit Design~~	11/11/17 -12/10/17	11/11/17- 1/14/18
3. Acquisition of Materials	11/16/17- 2/9/18	11/16/17 - 2/10/18
3.1 Ordered Chlorine/ Ion Exchange Resin (Nitrate)	1/16/17- 2/9/18	1/16/17 - 2/10/18
3.2 Acquired System Materials	1/16/17- 2/9/18	1/16/17- 2/2/18
3.3 Reorder Materials	N/A	2//9/17-2/15/17

Current Schedule Status

Task	Original Date	Actual Start/End Date
4. Fabrication	12/11/17 - 2/1/18	12/11/17 - 2/7/18
5. Prototype Testing	12/11/17 - 1/18/18	12/14/17 - 2/19/18
6. 30% Report	2/8/17 - 2/15/18	2/9/17 - 2/15/18
7. Finalize Design	1/19/18 - 3/11/18	1/19/18 - 3/11/18
8. PSWC Requirements	2/12/18- 3/11/18	2/12/18- 3/11/18
8.1 Report	2/12/18 - 3/11/18	2/12/18 - 3/11/18
8.2 Process Flow Diagram	2/12/18 - 3/11/18	2/12/18 - 3/11/18

Future Schedule Status

Task	Original Date	Actual Start/End Date
9. Present at PSWC	4/12/18 - 4/14/18	4/12/18 - 4/14/18
9. 60% Report	3/14/18 - 3/29/18	3/14/18 - 3/29/18
10. 90% Webpage	4/19/18 - 4/24/18	4/19/18 - 4/24/18
11. Undergraduate Presentation	4/20/18 - 4/27/18	4/20/18 - 4/27/18
12. Final Paper /Final Website	5/1/18 - 5/10/18	5/1/18 - 5/10/18

Methods Used

- HACH Method 10127
- (Phosphorus, Total)
- Range mg/L (1.0 to 100.0)
- HACH Method 8039
- Cadmium Reduction Method
- Range mg/L (0.4 to 30.0)

Table 1: Contaminant Quantities Per 34 Liter Sample [2]

Contaminant	***Quantity Per Nine Gallon Sample***
Miracle Gro All Purpose Plant Food	1,000 g
Bulk Apothecary Kaolin Clay	1,000 g
Star Kay White Pure Lavender Extract	30 mL
Wastewater Treatment Plant (WWTP) Effluent	20 mL

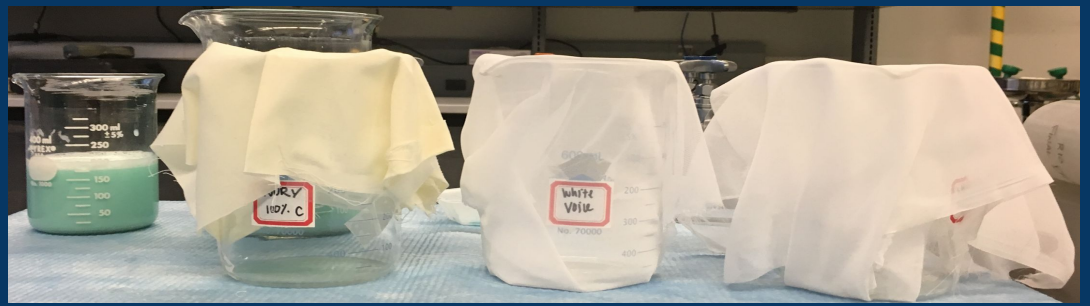

Figure 2: Testing Filtration Abilities of Fabrics
Photo courtesy of Cameron Rhodes

Work Completed

- Filled out farm usage form
- Ordered Materials
- Completed testing of raw wastewater
  - Lab testing
  - Simulated sample
  - Treatment device
- Tested parameters of simulated sample on a small scale
  - Chlorine still needed
- Began constructing system
  - Tested turbidity

Table 2: Prototyping Test Results and Batch Results

Parameters	**Testing Results**	**Raw Water Sample**
Total P-PO_4^{3-}	236.2 mg/L	2,100 mg/L
Total N-NO_3^-	49.1 mg/L	50 mg/L
Turbidity	193 NTU	> 1,000 NTU
Chlorine	N/A	N/A
Total coliforms	Non conclusive	Present
Odor	Present	Present

Total Coliforms Testing

Figure 3: DI Water Sample for Total Coliforms Photo courtesy of Cameron Rhodes

Figure 4: Secondary Effluent for Total Coliforms Results Photo courtesy of Cameron Rhodes

Figure 5: Results Without Extract for Total Coliforms Test Photo courtesy of Cameron Rhodes

Testing

Figure 6: Results With Extract for Total Coliforms Test
Photo courtesy of Cameron Rhodes

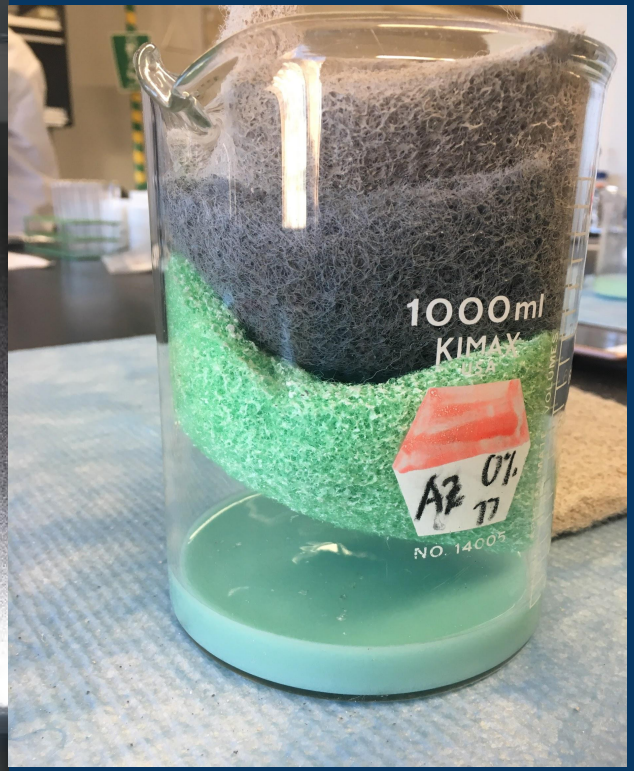

Figure 7: Water Treatment Results Through All Filter Media Photo courtesy of Cameron Rhodes

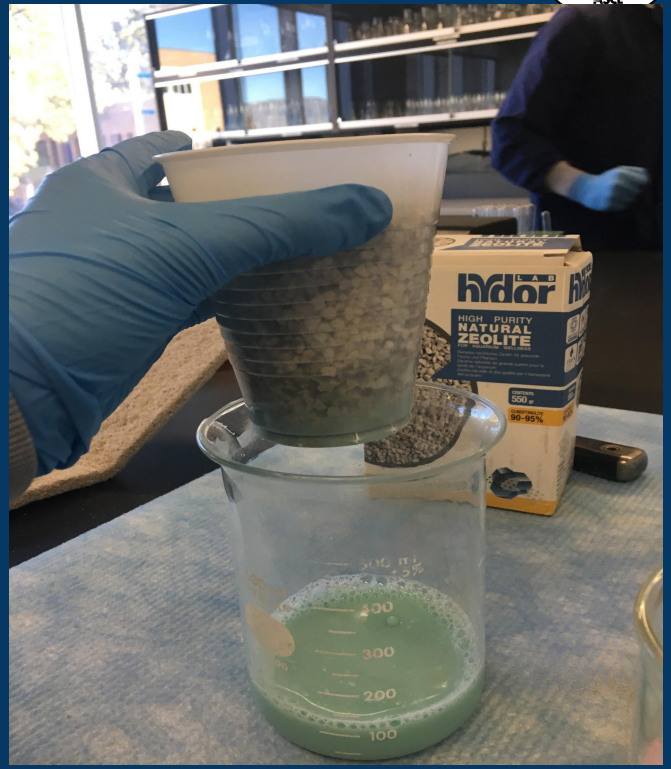

Figure 8: Zeolite Treatment Results After Settling
Photo courtesy of Cameron Rhodes

Dilution Readings and Samples

Figure 9:NTU Reading After Settling Test

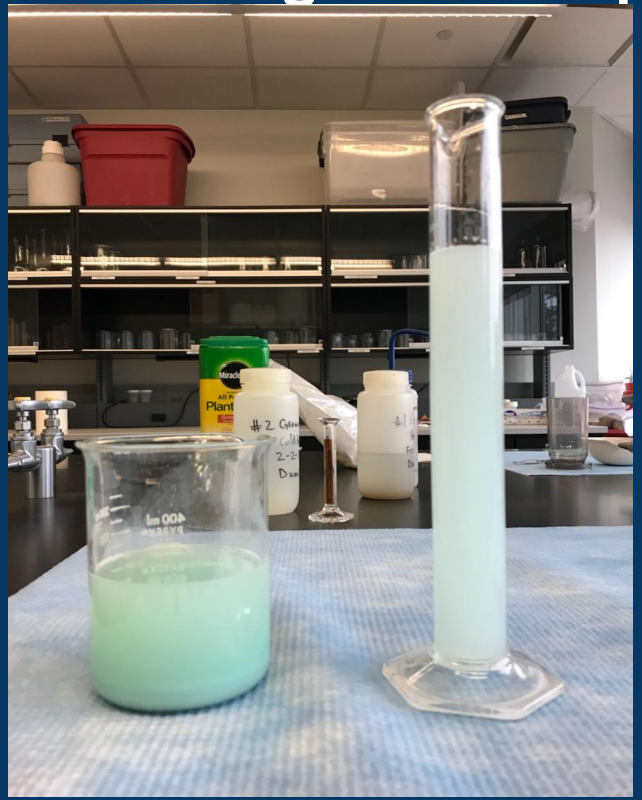

Figure 10: Dilution Of Sample
Photo courtesy of Cameron Rhodes

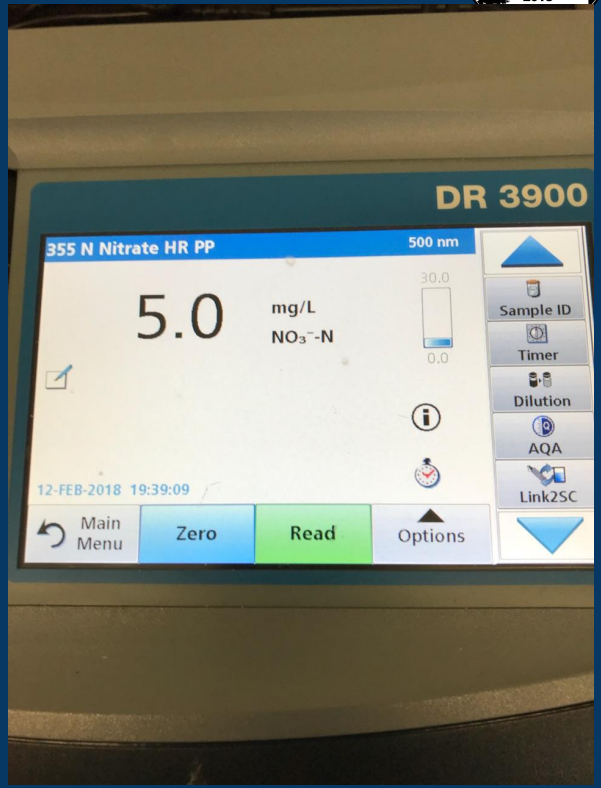

Figure 11: Nitrate Results After Dilution
Photo courtesy of Cameron Rhodes

Dilution Readings

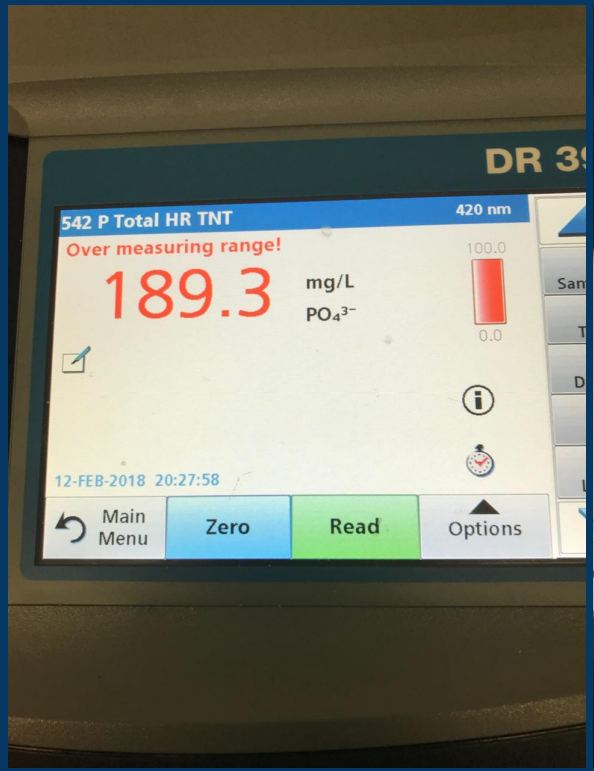

Figure 12: Phosphate Reading Factor of 10
Photo courtesy of Cameron Rhodes

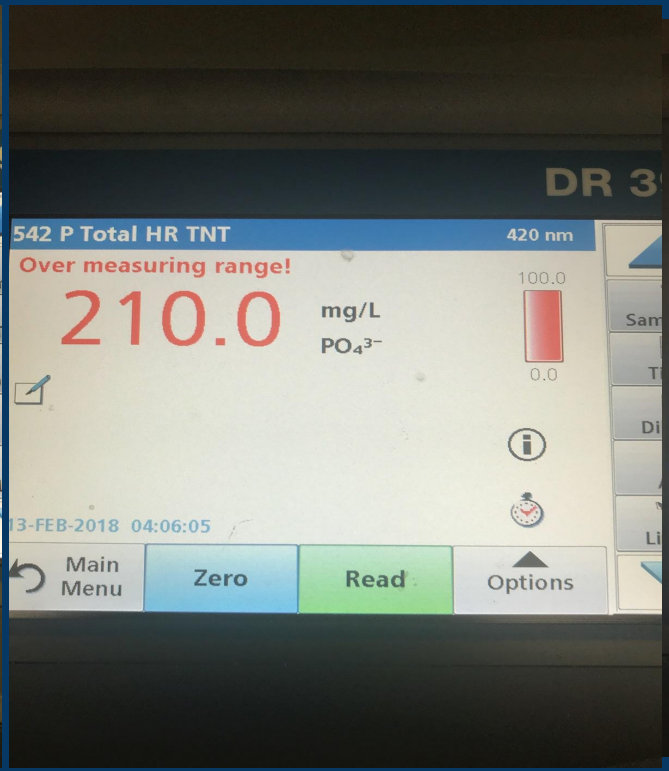

Figure 13: Phosphate Reading Factor of 10
Photo courtesy of Cameron Rhodes

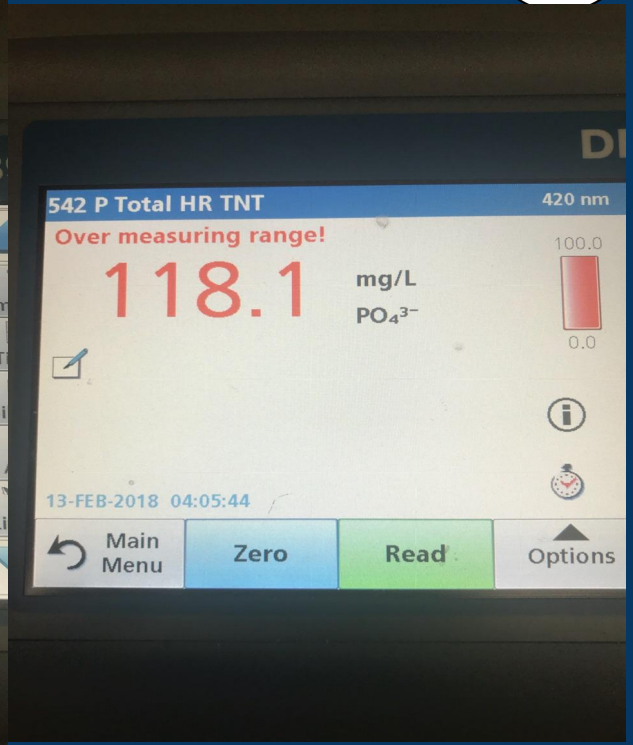

Figure 14: Phosphate Reading Factor of 20
Photo courtesy of Cameron Rhodes

Current and Future Work

February 8th - March 6th

- Integrate Ion Exchange resin, and chlorine into final design
- Integrate activated carbon in final design
- Acquire testing results large scale system
- Finish testing turbidity on a large scale
- Begin PSWC Report
- Begin PSWC Process Flow Diagram
- Redo Unit design testing

Figure 15: Lab Work

References

[1] American Society of Civil Engineers Environmental Design Competition. (2017). Flagstaff: Northern Arizona University, pp.1-9.

[2] "WHO | Environment and health in developing countries", Who.int, 2017. [Online]. Available: http://www.who.int/heli/risks/ehindevcoun/en/. [Accessed: 17- Oct- 2017].

[3] "Water and Development — Global Issues", Globalissues.org, 2017. [Online]. Available: http://www.globalissues.org/article/601/water-and-development. [Accessed: 17- Oct- 2017]

[4] Earth Habitat. (2017). Fresh Water Scarcity and Pollution. [online] Available at: https://earthhabitat.wordpress.com/2010/02/23/fresh-water-scarcity-and-pollution/ [Accessed 30 Nov. 2017].

Appendix

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Figure 16 : Receipt From Walmart