THE CLEAN STREAM MACHINE

by OCEANUS ROBOTICS of Clements HS, Elkins HS, Ridgepoint HS, and Fort Settlement MS

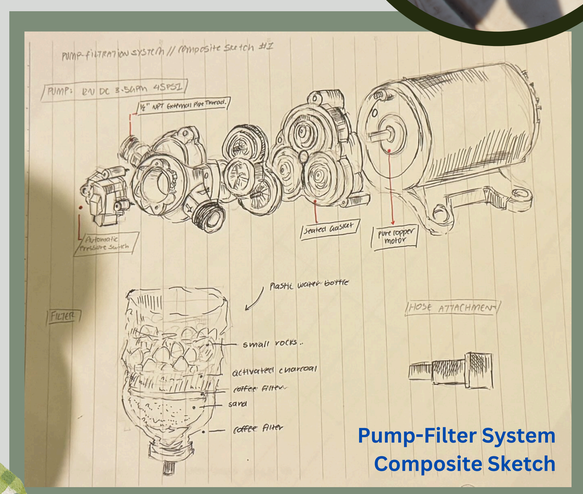
PROJECT OVERVIEW

Throughout the Houston Area, flooding and water quality has significantly impacted the community. Oceanus Robotics, being committed to assist families and individuals in our region, was able to utilize pumping system technology to gain access to filtered water from our local lakes. **This project outlines the success of a homemade filtration system** that enables users to access drinkable water during critical times. **By applying the engineering design process to identify the problem and brainstorm solutions, we deployed our ROV to filter water from distances that are often unreachable for humans. We gathered data on water purity at Hines Lake, giving us accuracy at the level necessary for further testing.**

BACKGROUND

Every year, the Houston area encounters floods, hurricanes, and thunderstorms. As pipes burst, obtaining clean water becomes a significant challenge due to the terrain, microplastics, and debris present in the water. Families frequently find it difficult to access safe drinking water, which increases the risks of dehydration, contamination, and exposure. In 2021, many Texans were issued a BOIL water alert, indicating that, **"390,000 Texans were still advised to boil their water due to safety concerns." With numerous families and individuals facing limited access to water, our team explored pumps and filtration systems that can transform contaminated water into a safe drinking source.**

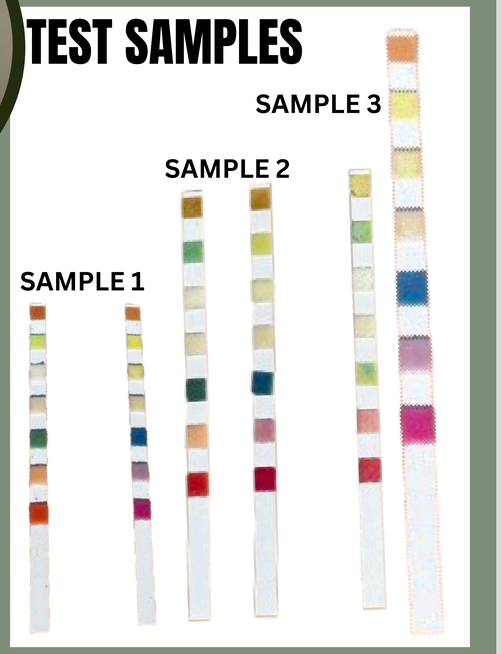
While the Houston area wasn't experiencing floods at the time, we visited Hines Lake, a densely populated location. **If our filtration system can effectively purify the water from Hines Lake, it could also be utilized during hurricanes and flooding events.**



Pump-Filter System Composite Sketch

DISCUSSION AND REASONING

During field testing at Hines Lake, the ROV successfully collected multiple water samples using the integrated pump and custom filtration system. **Each sample was tested before and after filtration using water quality test strips to measure parameters such as pH, alkalinity, hardness, and other chemical contaminants.** Across all trials, we observed **noticeable improvements in water quality after filtration. The presence of particulates was significantly reduced, and some chemical indicators shifted toward safer levels, demonstrating the effectiveness of our system.** These consistent results validated both the design and function of the ROV system, confirming that **it could carry out real time filtration in a natural environment.** Minor inconsistencies in test readings were attributed to the environmental variability, but overall, the filtration system proved reliable and efficient. These findings support the potential of our design to be applied in other small-scale or emergency water purification scenarios.

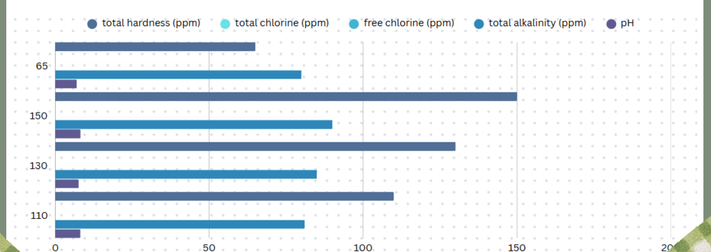


NEXT STEPS

We're excited to continue improving our filtration system to make it more efficient, scalable, and field-ready. Our next goals focus on refining the design, expanding testing, and exploring other real-world applications, such as:

- Test alternative filter materials for better performance
- Add sensors (turbidity, pH probes, conductivity meters) to monitor water quality in real time.
- Conduct extended trials in different water environments
- Explore partnerships for deployment in remote settings.
- Design a more compact and portable version of the system.

SAMPLES AFTER FILTRATION



APPROACH

Oceanus Robotics **applied the Engineering Design Process to develop a lightweight ROV capable of filtering contaminated water in the Houston area.** We began by identifying local problems and design constraints, including size, durability and portability. After generating multiple concepts, **we selected a 12V DC pump as the core of our filtration system. The pump draws water from the surrounding environment and forces it through our custom built filter, mimicking the flow rate and pressure needed for real-world filtration. We intentionally placed the pump before the filter chamber to ensure a steady intake and reduce backflow. Since commercial filters were too bulky or inefficient, we engineered our own using layers of gravel, pebbles, sand, activated charcoal, and coffee filters. Each layer serves a purpose–gravel and pebbles remove larger debris, sand filters finer particles, and activated charcoal absorbs chemical contaminants and improves taste and odor. (Lohner, S.)This design maximizes filtration efficiency while keeping the system lightweight, allowing the ROV to maintain its standard maneuverability.** Once integrated, the system was field-tested at Hines Lake, where the ROV collected and filtered water samples. Water quality strips measured pH, water hardness, and chlorine content before and after filtration. This results were recorded, analyzed, and used to refine our setup. We used an ROV to retriever water samples as it allows access to water sources that are deeper, safer, or more sanitary than what is available at the surface. In real-world scenarios–such as post disaster zones or flooded regions, surface water is usually heavily contaminated or difficult to reach. The ROV can navigate through debris or hazardous environments and collect water from targeted depths, making it a practical and safe tool for delivering cleaner water to those in need.

sugar land TX, USA