THE SALMON SAVER

Saving Salmon – One Drop at a Time

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Objectives

Primary

1. **Improve quality of stormwater** by removing contaminants & restabilizing pH levels from acidic runoff entering marine ecosystems.
2. **Collect water quality data** for SPU workers to identify target areas with acidic stormwater runoff.
3. Make our filter **cost-effective** so it can be widely implemented without cost restraints.
4. Use **eco-friendly filtration** methods to increase the pH while preserving water content.

Secondary

1. Incorporate **overflow prevention features** to ensure quality filter prototype performance during difficult weather conditions
2. **Store data** for future referral using an SD card
3. **Use water sensors** to pause data collection when no water is being filtered and limit excess data
4. Design a **durable filter** to combat clogging from heavy debris and improve functionality

User Requirements

Explicit Requirements:		Implicit requirements:
Accessible Data	1	Effective SD card and reader to relay regular pH data to user and store for later use
Durable and designed for heavy conditions	2	Overflow prevention and filtration layers to eliminate heavy debris and prevent clogging
Easy set up and maintenance	3	Straightforward installation and maintenance, with materials that don't require frequent replacement
Affordability	4	Low-cost materials that contribute optimally to design function while prioritizing cost

DESIGN PROCESS

Identification

We observed community concern for salmon health in Seattle and conducted a student survey to further understand how prevalent this issue is in our community.

Research

Through and research and interviews with our target user, we determined that tire chemicals like 6PPD-Q entering runoff were harmful to salmon, and one way to the address this is to target neutralizing acidic pH levels.

Initial Sketch

Plan & Design

After discussing different approaches on how to address our inequity, we drafted an initial design applying our research to its real-world application.

Create

Many prototypes were 3D printed before deciding on the exact model that easily incorporated pH sensors and filtration. Iteration 1 was a sketch, Iteration 2 added details and labels, and Iteration 3 was the final model, refined through 3D printing tests.

Improve

Through testing and feedback from interviews, we identified necessary modifications to each iteration such as dimensions, number of filtering materials, and sensor placement, which helped us improve to our final iteration.

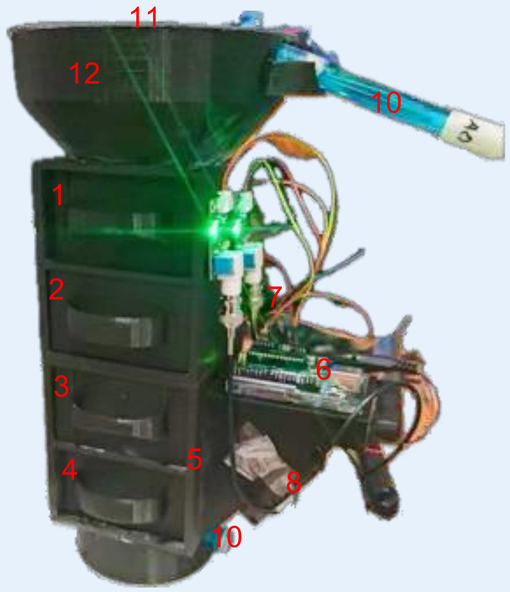
Test

Testing allowed us to refine the efficiency of our design with results from data collection and problems we encountered during the process like sensor placement and ease of hardware incorporation.

PROBLEM STATEMENT

Acidic stormwater runoff is detrimental to marine ecosystems and increases salmon mortality rates. Our filter addresses these issues (UNSDG-6.3) and optimizes current filtration systems to target vulnerable areas.

PROTOTYPE GRAPHIC

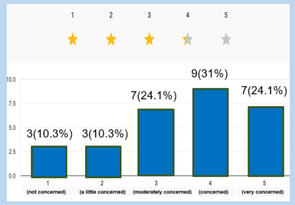


Prototype Details

1. Filter layer (Gravel)
2. Filter layer (Sand)
3. Filter layer (Calcite)
4. Filter layer (Biochar)
5. Prototype Structure
6. Arduino Uno
7. Breadboard
8. Battery Pack
9. SD Card
10. PH Sensors
11. Mesh
12. Funnel

Data 2: Community Concern

Of 30 anonymous North Seattle students surveyed, most were concerned about salmon health, with 56% rating their concern above 3 out of 5. This suggests salmon health is an important issue for many local students.



Results

The Salmon Saver helps Seattle Public Utilities effectively filter water content and collect pH data by:

- **Providing accurate and usable data** about the pH of stormwater runoff
- **Sustainably filtering water** and raising the pH towards a safer level for salmon
- **Increasing accessibility** to stormwater filtration as an affordable and low-maintenance prototype

CONCLUSION

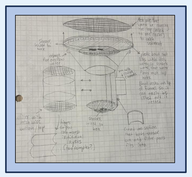
Salmon Saver is a cost- effective, low maintenance filtration system to improve water quality before the stormwater runoff reaches salmon habitats.

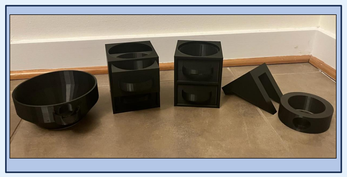
- **We plan to refine our design in the future by:** Creating an app which connects to the sensors using Arduino, increasing accessibility of data
- A database showing installed filters with displays of stats for each filter and a map of most acidic runoff locations to raise awareness
- Incorporate temperature sensors as suggested by our interviewee to deepen the understanding of impact of contamination
- Using biodegradable filament to increase convenience and sustainable advantages

Testing Process

We ran simulated stormwater through a model of our filter (a paper cup with of layers of gravel, sand, biochar, and calcite) and collected data on the pH level before and after. We used an analytical survey electrode wired to an Arduino to collect pH data. The mass of data from our testing made us realize we needed to use water sensors to only collect data when water is going through the filter to optimize ease of reading data. An interview with Chris Cunningham, and SPU worker our primary user gave us feedback on our design to incorporate overflow features.

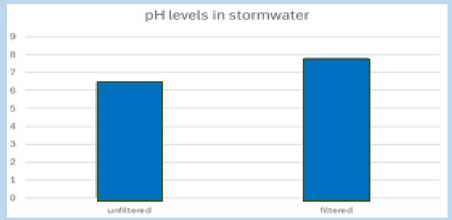
Design Iterations





Data 1: pH levels measured before and after filter

Filtered stormwater showed a higher pH than unfiltered stormwater, demonstrating the filter improved water quality and supported healthier conditions for salmon.



Without the Salmon Saver

Polluted runoff enters storm drains → High acidity & harmful chemicals → Poor water quality → Stress on salmon habitats

With the Salmon Saver

Stormwater passes through filter → Acidity reduced and pH improved → Cleaner water enters waterways → Healthier conditions for salmon habitats

Scalability & Global Impact

- Modular filter to adapt to urban waterways worldwide in cities like Vancouver, London, Tokyo and Sydney.
- Improves water quality to help species like salmon, trout, steelhead, Zebrafish & freshwater fish affected by toxic runoff

Citations

1. Brown, Marlee L, Nathan Ivy, Melissa Gonzalez, Justin B Greer, John D Hansen, Edward Kolodziej, and Jenifer K McIntyre. 2026. "Roadway Runoff Induced Acute Mortality in Juvenile Coho Salmon during Spring Storm Events" . *Environmental Science & Technology* 60 (2): 1723–32. https://doi.org/10.1021/acs.est.5c13992.

2. Bulfin, Gerry. 2013. "How to Neutralize Acidic Water". The Clean Well Water Report. October 2013. https://www.cleanwaterstore.com/blog/how-to-neutralize-acidic -water/?srsltid=AfmBOopfRb1rho5alqrdwB2GL6Knh1FVK3WaeU9PnFSwu9BJA65M7855.

3. Cunningham, Chris, personal communication, March 18, 2026.