Design Proposal Template:

School: Ingraham High School **State:** Washington

Division: High School

Team Members' Names: Sylvie Sylvander, Anish Naraynan, Ava Keppel-Power advised by Ms. Erika Rasmussen

Project Title: Should be creative and give readers a general sense of what the project is about and want to read more. (20 word maximum)

The Fintastic Four: Salmon Saver – Saving Salmon, One Drop of Water at a Time

Community Challenge Being Addressed: Describe the community challenge that you will attempt to address with your proposed solution. (75 word maximum)

- Seattle stormwater runoff contains pollutants that are the highest contributors to salmon death.
- Salmon death has a detrimental effect on Tribal communities, who've always relied on salmon for food and culture. Salmon also supports over 130 species and is therefore essential to local ecosystems.
- Salmon Saver filters out harmful pollutants in stormwater runoff, which benefits the health of this keystone species and the species it supports, plus maintains the rich culture surrounding Washington's salmon.

Community Research and User Identification: Explain the process used to identify the community challenge and select your user. Include any research done to identify issues in your community and understand which groups face challenges because of these issues. (150 word maximum)

Our team identified stormwater runoff and its impact on salmon as a major community challenge in the Pacific Northwest. Salmon are culturally significant to indigenous communities.

Our research shows that runoff from roads carries 6PPD-quinone, a chemical from tire particles that is deadly to salmon. We researched that pH monitoring is an affordable way to detect the acidity of stormwater. While pH does not measure 6PDD-quinone and other toxic chemicals, it is still an important measurement of water quality. Monitoring pH levels detects the acidity of stormwater.

We interviewed Amirah Casey (UW Fisheries) and Chris Cunningham (SPU).

User Identification:

- Primary users are stormwater engineers at the Seattle Public Utilities; who need low-cost efficient filtration systems.
- Secondary users are public communities, organizations, and fisheries that rely on salmon populations.
- Our users need an affordable solution to filter the pollutants from road runoff before they reach salmon habitats.

Sources:

- https://www.sciencedaily.com/releases/2023/08/230824111839.htm
- 6PPD | Washington Department of Fish & Wildlife
- What if salmon disappeared? – The Institute for Environmental Research and Education
- https://pubs.acs.org/doi/10.1021/acs.est.5c13992

User Profile: Provide a detailed description of your selected user. Include information about challenges they face, how those challenges impact their lives, and specific project needs based on user feedback. (150 word maximum)

Our primary user is the Seattle Public Utilities department. Their job is to design and maintain sewage systems that manage stormwater runoff before it reaches the Puget Sound. A major challenge they face is reducing harmful pollutants such as 6PPD-quione from stormwater runoff without causing their drainage systems to overflow. If these drainage systems get clogged or take too long to filter, runoff can back up to the streets and cause a major safety hazard.

These challenges make their job harder to design drainage systems that balance filtration, flow rate, affordability, and maintenance. Through our interviews with Amirah Casey and Chris Cunningham, we identified that our user needed a filtration system that is low-cost, easy to maintain and replace, and has a good flow rate to stop water from overflowing during storms.

Project Goals: List your project goals and explain how these goals will address the community challenge. Project goals should define the desired outcomes, not specific features of the proposed solution. (150 word maximum)

- Reduce chemicals and improve pH levels in stormwater runoff that are detrimental to salmon health in the Puget Sound.
- Decrease salmon mortality rates caused by toxic chemicals such as 6PPD-quinone
- Help communities that are affected by polluted storm drains, especially neighborhoods that experience frequent stormwater runoffs.
- Improve the overall ecosystem by reducing sediment, pollutants, pH and turbidity in water that harms aquatic life in Seattle.
- Increase community awareness about how stormwater pollution affects both people and wildlife.
- Provide Stormwater Engineers with a low-cost filtration system (under $150) that is easy to maintain and replace within existing storm drains.
- Create a system that has a balance of both water flow and filtration so that the salmon saver can work in actual storms without causing flooding.
- Install Salmon savers across multiple neighborhoods in Seattle.
- Give stormwater engineers access to real-time water quality data so that they can make quicker and logical decisions.

Proposed Solution: Describe your proposed solution, including any innovative and unique features, and explain how this solution will address your users' needs and the challenges they face. (150 word maximum)

	Our proposed solution is the Salmon Saver; a storm drain filtration system designed to improve water quality before storm runoff reaches the Puget Sound. The Salmon Saver filter is designed to maintain proper water flow but is also situated around 2 inches below the catch basin grate to ensure overflow prevention. Storm water runoff passes through a mesh layer to capture debris, then enter a chamber with a pH sensor to measure initial water quality. The runoff drains through a funnel leading to removable filtration layers. Gravel and sand reduce the overall turbidity; biochar absorbs pollutants like 6PPD-quione, and calcite restabilizes the runoff pH. A second pH sensor measures the post-filtration of pH, allowing users to observe pH changes. Monitoring pH is important because runoff can increase toxicity that raises pH above the recommended range for salmon of 6.5-8. Overall, the Salmon Saver improves water quality and provides useful data.

Initial Design: A single graphic of your first design idea with key features adequately labeled. It should be easy to understand, and the reader should have a general understanding of how the prototype functions by looking at the graphic. Max size 8.5” x 11”. May contain up to 4 views of the design.