Oregon State University

Ross Island Lagoon HAB Solutions

Design Team 8

THE OBJECTIVE OF THIS ANALYSIS IS TO IDENTIFY PRACTICABLE & FEASIBLE SOLUTIONS TO REDUCE THE FREQUENCY & DURATION OF HABS AT ROSS ISLAND LAGOON.

Design Team 8

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Alternatives Analyzed

1. **Hydraulic:** Construction of concrete channel within the southwest portion of lagoon
2. **Non- Hydraulic**: Solar powered ultrasonic pontoon devices placed within lagoon
3. **No action**

KEY FINDINGS AND RECOMMENDATIONS

The alternative analysis, with the goal to reduce the HAB at Ross Island lagoon, consisted of analyzing effectiveness, habitat disturbance, disturbance of wildlife, protection of CAD cells, cost, maintenance, and likelihood of failure. It was found that each alternative holds a great amount of uncertainty within the design, with need for future review and additional analysis. Due to constraints within the HEC- RAS modeling, the true effectiveness of the SW conveyance (#1) was difficult to fully model and understand. The uncertainty within the ultrasonic alternative (#2) includes that although the technology has been recognized as a highly effective blue/green removal method within industry, the literature of the topic still continues to be researched and understood.

> Following each the alternative analyses (shown on pg. 2), the ***non-hydraulic solution of ultrasonic technology is recommended as the most suitable and practicable solution***. The ultrasonic system is by far the more cost effective and less invasive solution. Additionally, the failure mode analysis concluded that the SW conveyance solution poses much higher risk compared to the ultrasonic alternative. The minimal literature on the effectiveness of ultrasonic technology used in practice is noted, though a rental- program provided by SonicSolutions could be a beneficial and cost-effective option to use as a trial.

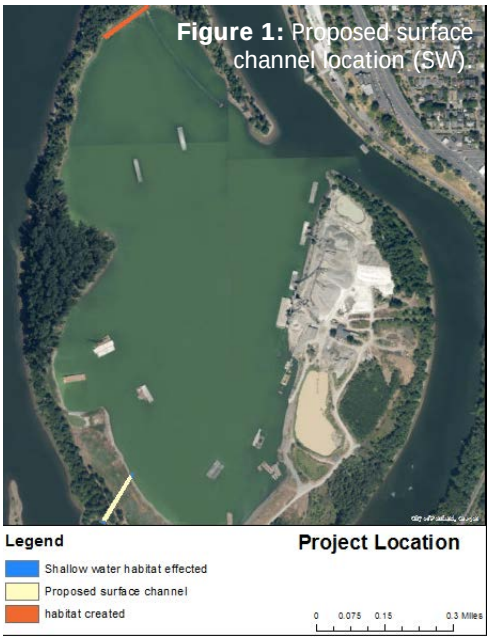

Figure 1: Proposed surface channel location (SW).

For more information, see: http://blogs.oregonstate.edu/rivers/ross-island-harmful-algal-bloom/

ALTERNATIVE 1 (Hydraulic)

The hydraulic alternative involves excavating a concrete channel with a tilting weir gate within the SW lagoon. The goal of this alternative is to redirect flow during the low flow season into the lagoon to increase mixing and breakup stratification. A HEC- RAS 2D model was used in modeling the effectiveness of the design and results concluded very low effectiveness. A velocity vector map (Figure 2) shows surface mixing only occurring up to about 300 feet away from the opening of the channel. Therefore, not only was the alternative modeled as ineffective, it is a costly and invasive design to shallow water habitat in the area.

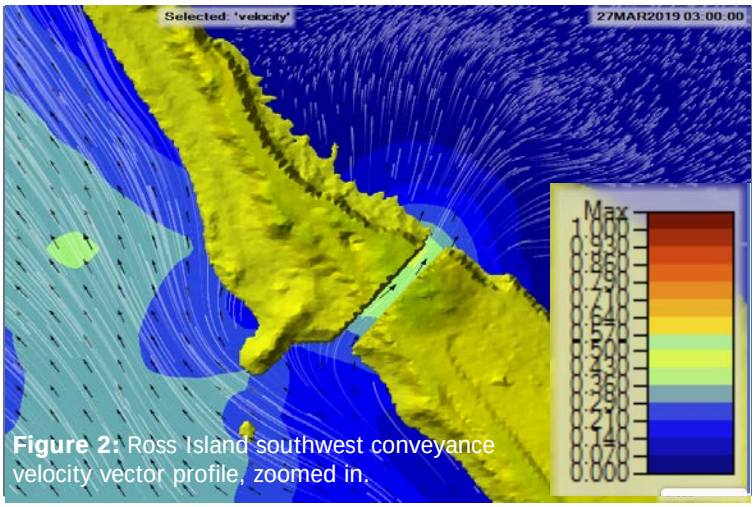

Figure 2: Ross Island southwest conveyance velocity vector profile, zoomed in.

ALTERNATIVE 2 (Non- Hydraulic)

The goal of solar powered- ultrasonic technology (Figure 3) is to allow ultrasound waves to disrupt the buoyancy of the algae, resulting in the algae cells sinking to the bottom and dying due to an inability to photosynthesize [1]. Though not a well-known technology, ultrasound has been recognized to be an extremely effective blue/green algae removal method in large bodies of water, including many drinking water reservoirs [2]. Ultrasound has been found to be safe for fish, birds, and aquatic plants, though while targeting blue/green algae, it can also harm diatoms at certain ranges [1][2].

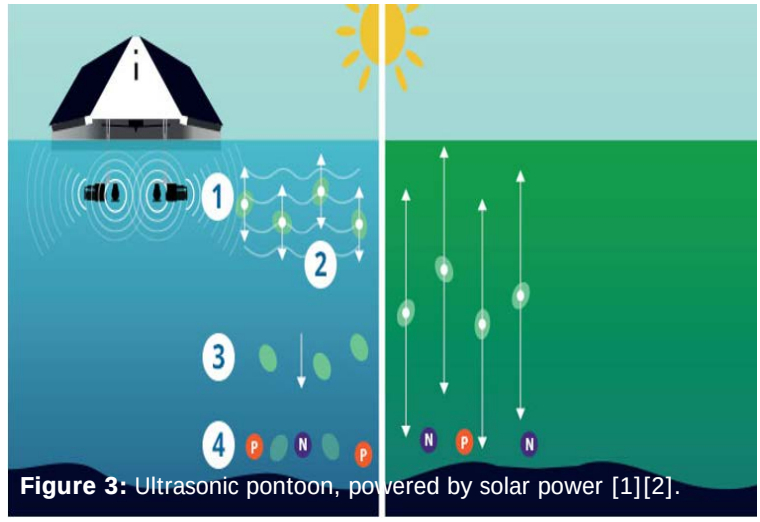

Figure 3: Ultrasonic pontoon, powered by solar power [1][2].

ALTERNATIVES ANALYSIS RESULTS

Evaluation criteria	1. SW Conveyance	2. Ultrasonic	3. No action
Capital cost ($)	$388,420.00	$28,340.00	$0.00
O&M ($, frequency)	$25,578.00/yr.	N/A, Monthly	$0.00, None
Loss and creation of shallow water habitats (acres)?	+0.16 (-0.08)	+0 (-0)	N/A
Expected effectiveness at controlling HAB (unknown, low, med, high)?	Low/Unknown	Medium	Low
Likelihood of failure during flood events (unknown, low, med, high)	Low	Low	N/A
Risk to CAD cells (USACE likelihood scale)	3	1	1
Likely benefit to widest range of aquatic taxa (Steelhead, chinook, lamprey, sturgeon, mussels)	Chinook, lamprey, coho salmon, steelhead, sturgeon	Chinook, lamprey, coho salmon, steelhead, sturgeon	None
List any unintended impacts (List species, infrastructure, RISG operations, etc.)	Shallow water species, CAD cells	Diatoms, Daphnia, Snails	Recreational use downstream

References:
[1] LG Sonic. (2017, November 28). How LG Sonic Ultrasound Technology Controls Algae.https://www.lgsonic.com/blogs/how-ultrasound-controls-algae/.
[2] Assael, D., Hutchinson, G., and SonicSolutions (2019, March). Applying Ultrasound Technology to Control Algae and Biofilm.