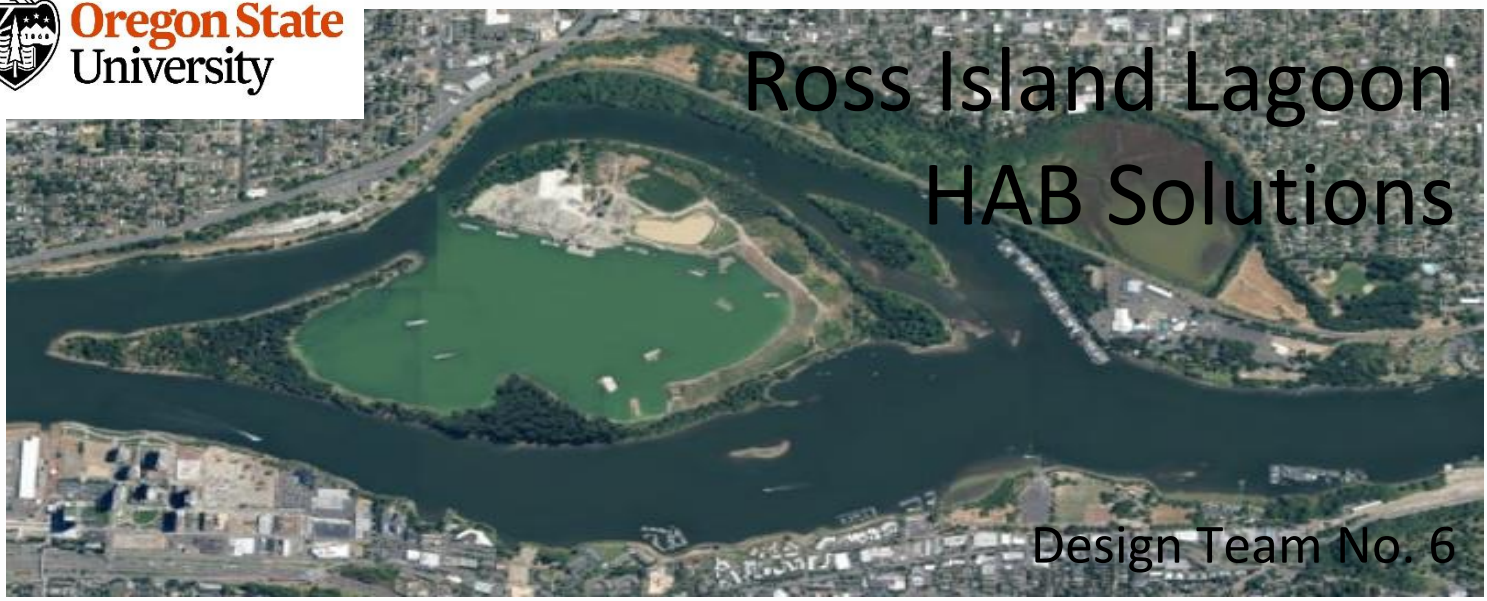

Ross Island Lagoon HAB Solutions

Design Team No. 6

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

Design team No. 6

Contact:

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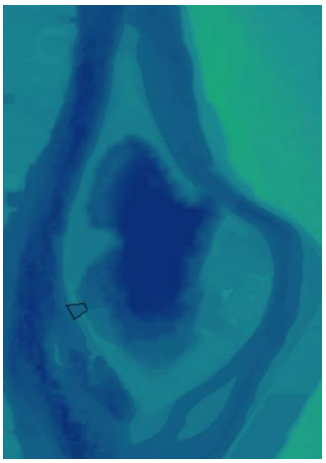
Alternatives analyzed

1. Constructing a surface channel in the southwest corner of the lagoon to increase flow and mixing
2. Implementing artificial floating islands of plants to decreases excess nutrients and temperature in the lagoon
3. No action

Three alternative treatment methods were evaluated to reduce the frequency and duration of harmful algal blooms (HABs) in Ross Island Lagoon. The alternatives include leaving the lagoon unchanged, implementing artificial floating islands of aquatic plants to remove excess nutrients, and constructing a surface channel in the southwest corner of the lagoon to increase flow and mixing. Each alternative was evaluated based on capital cost, operation and maintenance costs, displaced shallow water habitat, effect on HABs, likelihood of failure, risk to CAD cells, and benefit to aquatic species.

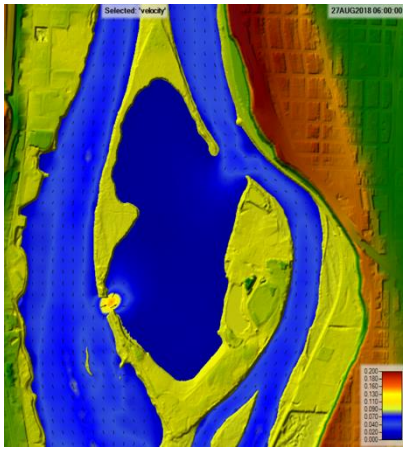
Our findings indicate that the biological solution is more feasible considering its lower likelihood of failure. However, the hydraulic alternative is the most feasible solution based on capital cost, operation and maintenance costs, effect on reducing HABs, and benefit to aquatic species. The recommended hydraulic solution is to construct a trapezoidal surface channel in the southwest corner of the lagoon that has a 300 ft wide entrance from the Willamette and a 122 ft wide exit into the lagoon. The channel is 10 ft below sea level and 14 ft below ordinary low water level. Gravel with a diameter of 0.6 inches is recommended to stabilize the banks.

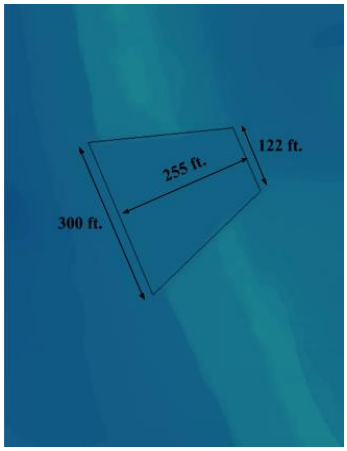


For more information, see: http://blogs.oregonstate.edu/rivers/ross-island-harmful-algal-bloom/

ALTERNATIVE 1

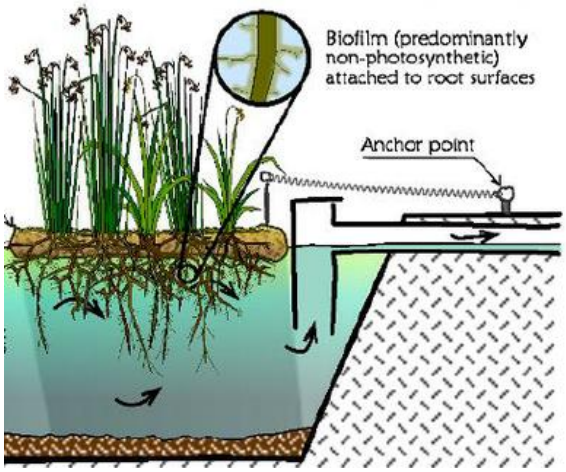
Alternative 1 modifies the hydraulics of the lagoon by constructing a surface channel in the southwest corner of the lagoon. It will be combined with bank stabilization structures to reduce erosion. Three different channel geometries were modeled using HEC-RAS 2D, where the bed of each channel was modeled 14 ft below the ordinary low water surface. Flow velocities and shear stresses generated by these scenarios were compared to examine the impact of the channel on the lagoon under both high and low flow conditions. The most effective channel geometry found was a trapezoidal channel, where for low flows, the maximum velocity is 0.24 ft/s, maximum shear is 0.0004 lb/ft^2, mixing depth is 1.35 ft, and bed material (D50) required for stability is >0.005 inches.





ALTERNATIVE 2

Alternative 2 aims to reduce excess nutrient levels in the lagoon and to provide shading to reduce water temperatures by implementing artificial floating islands of Australian Canna. These plants are known to remove nitrogen at 98.7% and phosphorous at 91.8% (Chen, 2009). The rafts will be anchored to the lagoon bank, and will cover 20% of the lagoon, or 17 million plants required. To maximize removal of phosphorous and nitrogen, concentrations of these nutrients in the lagoon need to be known to make precise calculations for how much coverage is required.



ALTERNATIVES ANALYSIS RESULTS

Evaluation criteria	1. Hydraulic Solution	2. Biological Solution	3. No action
Capital cost ($)	$702,920	$4,346,431	$0
O&M ($, frequency)	$89,676 , yearly	$4,346,431 , 5 years	$0
Loss and creation of shallow water habitats (acres)?	+1.76 acres shallow water habitat	+1.52 acres shallow water habitat	+1.24 acres shallow water habitat
Expected effectiveness at controlling HAB (unknown, low, med, high)?	Med	Low	Low
Likelihood of failure during flood events (unknown, low, med, high)			
Risk to CAD cells (USACE likelihood scale)	Low	none	none
Likely benefit to widest range of aquatic taxa (Steelhead, chinook, lamprey, sturgeon, mussels)	Salmon, steelhead, sturgeon, amphibians, water fowl	Invertebrates, salmon, steelhead, sturgeon, amphibians	none
List any unintended impacts (List species, infrastructure, RISG operations, etc.)	none	none	none

References:

Chen, Y., Bracy, R., Owings, A. & Merhaut, D. (Oct. 2009). Nitrogen and Phosphorous Removal by Ornamental and Wetland Plants in a Greenhouse Recirculation Research System" HortScience, 44 (6), 1704-1711. Retrieved from https://journals.ashs.org/hortsci/view/journals/hortsci/44/6/article-p1704.xml