Direct Intervention to Improve Hypoxic Conditions: A Baltimore Harbor Pilot Study

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The purpose of this Pilot Study was to deploy mixing and aeration to an area of Baltimore Harbor and to monitor the improvements provided. The project area is seasonally affected by anoxic conditions caused by increased nutrient loading as well as other factors. The information gathered could then be used to establish how these systems interact in 'real world' conditions. The ultimate goal of the pilot study is to establish design parameters of mixing and aeration systems which could assist in restoration efforts in Baltimore Harbor, Chesapeake Bay and around the world.

The first step in executing the pilot study involved establishing a location that reflected the conditions being encountered in the harbor. Hypoxic and anoxic conditions are defined as waters with dissolved oxygen (DO) of below 2 mg/l and 0.2 mg/l, respectively. These conditions significantly limit the water body's ability to sustain aquatic life, thus limiting productive areas, and can also result in fish kills.

Prior monitoring information near the project site was reviewed. This information included DO, temperature, and salinity. Additionally background monitoring was conducted by the team. Once the background conditions were understood, design of the pilot system began. This first included predictive modeling to describe the natural system and then evaluate how additive oxygen and mixing would change the dynamics at the site.

The devices chosen included a solar powered mixing system, the SolarBee® and a pipe diffuser system with oxygen delivered by land based compressor. Both were carefully selected based on the site and testing was carried out to establish how each affected oxygen transfer within the system and for differing power settings. Sampling was conducted on-water using sensors to measure DO, salinity, pH, and temperature.

The final report from the pilot study is being completed and seeks to establish the following:

- How much aeration and or mixing will it take to effectively increase the DO in an area located within a tidally influenced dead zone, such as exist in Baltimore Harbor?
- What are the dimensions of the volume of water so affected?
- How long will it take the aeration system to increase DO levels within the affected area to an equilibrium condition?
- How long will it take the prior low DO levels to return if mixing and aeration are ceased, and are there any lasting improvements once mixing and aeration have changed the ambient conditions?
- If aeration and mixing are varied, what corresponding water quality improvements will be seen?
- What is the capital and operating cost on a unit basis? What is the appropriate way to measure and express performance of such systems?

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