Carbon to Sea Initiative

August 16, 2024

Gayle Garbush
Washington State Department of Ecology
Southwest Region Office
P.O. Box 4775
Olympia, WA 98504-7775

RE: National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit for Project Macoma, Port Angeles, WA.

Dear Ms. Garbush:

The **Carbon to Sea Initiative** (CTS) is a nonprofit effort whose mission is to systematically assess whether and how ocean alkalinity enhancement (OAE) can deliver safe, cost-effective, and permanent CO_2 removal at scale. We are guided by a set of core principles that emphasize transparent outcomes, clear governance standards and sincere stakeholder engagement. CTS is not a funder of Project Macoma but has provided a **research grant** on a related topic to its parent company, Ebb Carbon.

As you are aware, Project Macoma is a proposed 18 month research pilot project in Port Angeles that seeks to evaluate an electrochemical process to remove legacy carbon pollution from the atmosphere by enhancing ocean alkalinity. The project will monitor atmospheric CO_2 removal from the discharge of enhanced alkalinity seawater as well as continuously monitor in water parameters to ensure regulatory compliance. **Project Macoma is the kind of research effort that is required to assess the effectiveness of OAE at drawing down and sequestering CO_2 from the atmosphere and upper ocean and its effects on the marine environment.** We're also encouraged that the project has committed to report findings from the research pilot and involvement of independent third parties for review of intended carbon removal.

The **Intergovernmental Panel on Climate Change (IPCC)** has recognized that, in addition to dramatically reduced emissions, billions of tonnes of carbon dioxide already in the atmosphere will need to be removed each year to limit global average temperature rise to 2° C or below. In its 2022 **Research Strategy for Ocean-based Carbon Dioxide Removal and Sequestration**, the National Academies of Sciences, Engineering and Medicine recommended demonstration-scale in-water experimentation as essential to assess the benefits, risks and potential scalability of ocean-based CDR (oCDR) approaches.

By increasing the pH of seawater, OAE causes seawater to draw down additional CO_2 from the atmosphere and convert it into harmless bicarbonate ions, similar to baking soda, which are already present in large quantities and remain in the ocean for thousands

of years. In addition to the climate benefits of drawing down atmospheric CO_2, moderately increasing the pH of receiving ocean waters may have the ecological co-benefit of locally reducing ocean acidification which is harmful to many forms of marine life, especially shellfish.

However, before OAE can be deployed at a scale that would have a meaningful impact on atmospheric CO_2 concentrations, critical research questions about its safety and efficacy must be addressed. A substantial body of laboratory and mesocosm research, along with limited field studies, shows the theoretical climate benefits of OAE with little impact on marine life.[1] Moreover, moderate elevation of pH in receiving waters resulting from such projects may provide an environmental benefit by locally and temporarily reducing ocean acidification in the receiving waters.

Encouraging results at small scales and short duration must be verified in the coastal and open ocean through rigorous trials where pH is temporarily elevated, with contemporaneous monitoring of biological and chemical parameters to measure effects in open water conditions. The proposed permit for Project Macoma includes protocols to monitor for potential harm to marine life and to modify or discontinue operation of the project to address any significant harm. These measures include:

- Implementation of an Ecology Safety Methodology approved by the United States Fish and Wildlife Service;
- Continuous monitoring of pH, dissolved oxygen, and turbidity;
- A requirement to reduce the pH of the proposed high-alkaline water prior to discharge and
- A protocol to ensure no acute toxicity of marine life at the concentration of effluent expected at the boundary of the mixing zone

We agree with and support the Department of Ecology's preliminary determination that the drawdown of atmospheric CO_2 potentially provided by Ebb's technology is necessary and in the overriding public interest. CTS is pleased that the department has made the preliminary decision to allow this important research pilot to proceed with reasonable and prudent effluent limitations and permit conditions to protect the environment. **We support the Department issuing Project Macoma a final NPDES permit for wastewater discharge so that this carefully planned research project can proceed.**

We respectfully suggest the following resources to supplement the record:

- Dupont, S. and Metian, M.: General considerations for experimental research on ocean alkalinity enhancement, in: Guide to Best Practices in Ocean Alkalinity Enhancement Research, edited by: Oschlies, A., Stevenson, A., Bach, L. T., Fennel, K., Rickaby, R. E. M., Satterfield, T., Webb, R., and Gattuso, J.-P., Copernicus Publications, State Planet, 2-oae2023, 4, https://doi.org/10.5194/sp-2-oae2023-4-2023, 2023.
- Cyronak, T., Albright, R., and Bach, L. T.: Field experiments in ocean alkalinity enhancement research, in: Guide to Best Practices in Ocean Alkalinity

[1] For a thorough summary of research thus far on effects on phytoplankton and zooplankton of elevated pH and alkalinity, see pages 16-21 in the **Phase 1 MPRSA Research Permit Application** for Woods Hole Oceanographic Institution's proposed LOC-NESS OAE experiment.

Enhancement Research, edited by: Oschlies, A., Stevenson, A., Bach, L. T., Fennel, K., Rickaby, R. E. M., Satterfield, T., Webb, R., and Gattuso, J.-P., Copernicus Publications, State Planet, 2-oae2023, 7, https://doi.org/10.5194/sp-2-oae2023-7-2023, 2023.

- Marín-Samper, L., Arístegui, J., Hernández-Hernández, N., Ortiz, J., Archer, S. D., Ludwig, A., and Riebesell, U.: Assessing the impact of CO2-equilibrated ocean alkalinity enhancement on microbial metabolic rates in an oligotrophic system, Biogeosciences, 21, 2859–2876, https://doi.org/10.5194/bg-21-2859-2024, 2024.
- Ferderer, A., Chase, Z., Kennedy, F., Schulz, K. G., and Bach, L. T.: Assessing the influence of ocean alkalinity enhancement on a coastal phytoplankton community, Biogeosciences, 19, 5375–5399, https://doi.org/10.5194/bg-19-5375-2022, 2022.
- Moras, C. A., Bach, L. T., Cyronak, T., Joannes-Boyau, R., and Schulz, K. G.: Ocean alkalinity enhancement – avoiding runaway CaCO3 precipitation during quick and hydrated lime dissolution, Biogeosciences, 19, 3537–3557, https://doi.org/10.5194/bg-19-3537-2022, 2022.

Sincerely,

Diane Hoskins
Global Policy Director
Carbon to Sea Initiative