Work for Others Agreement No. 64221 (Sponsor No. AA 13-210)

Between

BATTELLE MEMORIAL INSTITUTE, PACIFIC NORTHWEST DIVISION

Operating under Prime Contract No. DE-AC05-76RL01830
for the U.S. Department of Energy

and

STATE OF WASHINGTON DEPARTMENT OF NATURAL RESOURCES

Statement Of Work
PNNL No. 64221

Washington State Energy Suitability Mapping to Inform Coastal and Marine Spatial Planning Processes on Washington's Outer Coast

Introduction : At the direction of the state legislature, Washington state is engaging in coastal and marine spatial planning activities (MSP) with a focus on mapping and ecosystem assessment on the Pacific Coast. Ocean renewable energy is an emerging use of ocean space, with interest in tidal, ocean wave, and offshore wind growing in Washington state waters. Anticipating future potential growth in this area, the state legislature directed agencies engaging in the planning process to develop guidance to support siting and operation of energy facilities in the State's marine waters.

Washington state has the luxury of observing a similar process playing out in Oregon, which is updating its existing territorial sea plan to consider siting of renewable ocean energy. Oregon has worked closely with many stakeholders to define potential conflicts posed by renewable energy to existing uses. Early in the process, however, suitability for energy siting was not considered (suitability from the perspective of desirable or feasible locations for development of ocean energy). This resulted in preliminary maps that relegated future development to sites that were not realistic, economic, or desirable. Realizing this, the state has since worked closely with the ocean renewable energy industry to interject data on renewable energy suitability; this has led to consideration of sites that meet both energy needs while reducing effects on other use groups.

The first step in planning that considers any new or emerging use is to understand and identify the conditions necessary to support that use so that suitability can be considered against the back drop of existing uses and constraints. PNNL proposes to work closely with Washington state, the Outer Coast Advisory Committee, MRCs, and the ocean renewable energy industry to apply the lessons from the Oregon experience and develop geospatial data sets for renewable energy suitability for the Washington coast. PNNL proposes to partner with Parametrix (which developed OR's suitability layer as part of a larger project to identify cumulative effects of ocean renewables on the OR coast) and consult with the Oregon Wave Energy Trust and other industry groups such as Pacific Energy Ventures to apply accepted methodologies to the Washington

coast. The product of this activity will be a set of data layers for tidal, wave, and offshore wind technologies depicting economic suitability of representative technologies. These data layers can then be incorporated into other human use mapping activities to serve as an initial screen to identify areas for more detailed planning, as deemed appropriate by the State and stakeholders.

Team Members

- Pacific Northwest National Laboratory (PNNL) *Simon Geerlofs, Brie Van Cleve, Chaeli Judd*
- Parametrix (through a PNNL subcontract), *Kevin Halsey and Ann Radil*
- Advisory Committee: Oregon Wave Energy Trust, Pacific Energy Ventures, Pacific Ocean Energy Trust, Clean Tech West Sound, other industry members to be identified.

Scope and Schedule

Task 1: Convene project team and industry advisory committee to inform suitability conceptual models

PNNL proposes to work closely with Oregon Wave Energy Trust (OWET), Pacific Ocean Energy Trust, Pacific Energy Ventures, Clean Tech West Sound and other representatives of wave, tidal, and offshore renewable energy to inform the overall approach for suitability mapping. As described above, the approach will build on work carried out by Parametrix and OWET for wave energy suitability and will to the extent possible translate wave energy suitability models to tidal and offshore wind.

The industry advisory committee will be coordinated by PNNL and will provide feasibility criteria to inform geospatial analysis that follows. The advisory committee will meet through conference call, webinar, and when convenient, in-person at the outset of the project. Efficient communication and facilitation will be essential to ensure that downstream tasks have the information needed in a timely fashion.

Schedule: We anticipate 2 in-person meetings (potential travel to Portland, OR), up to five conference calls, and online document editing. While this advisory committee will be retained throughout the course of this project, the bulk of its work will be completed in the first month following notice to proceed.

Products: Information on suitability for wave, tidal, and offshore wind representative devices to inform construction of conceptual siting models.

Task 2: Develop suitability conceptual models

Working closely with the industry advisory committee described in Task 1, PNNL and Parametrix will develop conceptual models for tidal, wave, and wind representative device suitability. A representative sample of potential devices and technologies will be selected, and for each device or class of devices, PNNL and Parametrix will determine basic siting feasibility factors based on economic and technical feasibility and input from the industry advisory committee. Such factors as appropriate depth, substrate, distance from shore, distance from port,

and distance from transmission will be considered. Should accurate data be available, the project team will also consider wave, tidal, and wind resource suitability. Additional resource characterization modeling, however, is outside the scope of this proposal.

Schedule: Conceptual models will be produced based on input from the industry advisory committee, as well as existing data and information from Parametrix' work in Oregon. We anticipate model develop will be completed within 3 months of notice to proceed.

Products: Conceptual models for wave, tidal, and offshore wind suitability.

Assumptions: Conceptual models will consider up to 4 representative wave devices (shore-based, shallow water, midwater, deepwater), 2 representative tidal devices (crossflow, horizontal axis), and up to two deepwater wind turbine designs (floating platform, spar buoy).

Task 3: Identify Data Availability

Parametrix will evaluate existing data to provide the necessary information for the feasibility attributes identified in the conceptual models. Where data does not exist, the project team will need to evaluate the suitability of derivative data sets or surrogates. The project team will coordinate with the industry advisory committee, as well as other stakeholders and mapping experts involved in Washington's planning activities to utilize accepted and well vetted data sets.

Schedule: This task will commence after development of conceptual models in task 2, and take between 2-3 weeks to complete.

Products: A set of appropriate data files to match the conceptual model feasibility attributes.

Task 4: Develop Attribute Scoring

Once feasibility attributes have been identified for representative technologies and conceptual models have been refined based on availability of data, the team can then begin to assign scoring for feasibility attributes. Generally we use scoring tables from 0 to 10, or 1 to 10 (since scoring is not additive within the models, 0 is only used if it represents a condition that would absolutely preclude siting of a device). As an example, if the ideal depth for a device is 60 to 75 meters, then depths within that range would score a 10. If depths outside this range would still potentially support a device, but are not as good, then the decline in suitability would be captured within the table. This task will require additional coordination with the stakeholders identified in Task 2 and 3.

Schedule: This task will commence after task 3, we anticipate this task will take 3-4 weeks to complete.

Products: A set of up to 8 final concept models (wave (4), tidal (2), offshore wind (2)) with scoring tables for each attribute.

Task 5: Develop Database

Based on the final concept models, the project team (Parametrix and PNNL) will develop a database linked to GIS that can display suitability attributes for each of the models developed. PNNL will coordinate with Parametrix to produce both a set of flat maps and data files that can be imported into a chosen decision support system (such as Parametrix' cumulative impacts assessment tool, or MarineMap, or the State's coastal atlas, or PNNL's *Tethys* knowledge management system for marine renewable energy).

The database and maps will be vetted with the industry advisory committee, MRCs, and Outer Coast Advisory Committee to identify anomalies.

Schedule: This task will commence after completion of Task 4 and take approximately 3-5 weeks to complete.

Products: An excel database, GIS dataset and a set of maps showing suitability for up to 8 renewable energy device types. Import of database into PNNL's web mapping platform and *Tethys* database.

Task 6: Reporting and Outreach

We anticipate this task to be iterative, although the bulk of work will follow completion of initial maps and database to ensure their usefulness to the Outer Coast Advisory Committee, MRCs, the renewable energy industry, and other stakeholders involved in CMSP in Washington state. PNNL will lead this subtask.

Schedule: This task will be iterative, but focused outreach will occur following task 5.

Products: At least one presentation to the Outer Coast Advisory Council, and one each to the Coastal MRCs.

Schedule: We anticipate technical tasks can be completed within 5 months of notice to proceed—project reporting and outreach will require an additional month.