MITIGATION ACTION PLAN

FOR THE

OREGON STATE UNIVERSITY WAVE ENERGY TEST PROJECT ENVIRONMENTAL ASSESSMENT

AUGUST 15, 2012

PREPARED TO ACCOMPANY DOE/EA 1917

U.S. Department of Energy
Golden Field Office
Office of Energy Efficiency and Renewable Energy

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
dB	decibel
dB RMS	decibel root mean squared
EA	environmental assessment
EMF	electromagnetic frequencies
ESA	Endangered Species Act
FONSI	finding of no significant impacts
LLC	Limited Liability Corporation
MAP	mitigation action plan
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NNMREC	Northwest National Marine Energy Center
ODFW	Oregon Department of Fish and Wildlife
OSU	Oregon State University
SEL	sound exposure level
USFWS	U.S. Fish and Wildlife Service
WEC	wave energy converter

1.0 INTRODUCTION

The United States Department of Energy (DOE) has issued a Final Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) for Oregon State University's (OSU) Wave Energy Test Project (Project) off the coast of Newport, Oregon. The EA for this Project was completed in compliance with the National Environmental Policy Act (NEPA) as required by 40 Code of Federal Regulations (CFR) 1508.18. The Final EA and the FONSI are available at:

http://www.eere.energy.gov/golden/NEPA_FEA_FONSI.aspx.

Through the environmental review process, DOE determined, via consultations with the National Marine Fisheries Service (NMFS) that there may be potential environmental impacts from the Project that will require mitigation to assure that the impacts will not become significant. Therefore, DOE prepared this Mitigation Action Plan (MAP) to establish conditions for issuing the FONSI as required by 10 Code of Federal Regulations (CFR) 1021.322, which stipulates that:

> *(b) In addition to the requirements found at 40 CFR 1508.13, a DOE FONSI shall include the following:*
>
> *(1) Any commitments to mitigations that are essential to render the impacts of the proposed action not significant, beyond those mitigations that are integral elements of the proposed action, and a reference to the Mitigation Action Plan prepared under 1021.331 of this part.*

The potential impacts requiring commitments and mitigation, beyond Applicant Committed Measures in the Final EA, relate to the following:

> **Marine Biological Resources** – Uncertainty of affects due to sound, electromagnetic frequencies (EMF), entanglements/collisions, and benthic habitat on marine species listed and protected under the Endangered Species Act, Marine Mammal Protection Act (MMPA), and Magnuson-Stevens Fishery Conservation and Management Act occurring within the project area.

Measures to reduce the potential impacts to these resources are defined as:

- **Applicant Committed Measures** – DOE defines applicant committed measure as activities or actions established as integral practices as part of the applicants proposed Project
- **Mitigation Measures** - Mitigation measures are activities or actions that will be taken in addition to or to enhance applicant committed measures and, therefore, are not integral to the design, deployment, and operation of OSU's proposed Project.
- **Adaptive Management Framework** – Adaptive management framework is defined as a structured, incremental process of decision making designed to address a substantial degree of uncertainty, with an aim to reducing uncertainty over time via system monitoring.

DOE and OSU completed three documents that analyzed the potential impacts to biological resources that may result from the Project. These documents include 1) Final EA DOE/EA 1917, 2) OSU Wave Energy

Test Project Biological Assessment, and 3) OSU Adaptive Management Framework and Adaptive Mitigation Plan, rev. July 23, 2012. These documents provide comprehensive discussion of applicant committed measures, adaptive management thresholds, and additional actions implemented by OSU as part of their Project. Readers are directed to these documents for specific information on OSU's Project, detailed descriptions of potentially affected marine biological resources, and the detailed Adaptive Management Framework and Adaptive Mitigation Plan collaboratively written by OSU, NMFS, Oregon Department of Fish and Wildlife (ODFW), and the US Fish and Wildlife Service (USFWS). These documents are hereby incorporated by reference.

1.1 Purpose of the Mitigation Action Plan

The purpose of this MAP is to specify the methods for implementing mitigation measures that address the potential significant environmental impacts identified in DOE/EA 1917 and by the NMFS Biological Opinion issued to DOE on August 2, 2012, in accordance with the Endangered Species Act (ESA) (16 U.S.C.1531 et seq.), and implementing regulations at 50 CFR 402 Subpart B and in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600 Subpart K. The development of these measures and an implementation plan, as a necessary condition for the DOE FONSI, is described by 40 CFR 1021.331(b) Mitigation action plans, as follows:

(b) In certain circumstances, as specified in §1021.322(b)(2), DOE shall also prepare a Mitigation Action Plan for commitments to mitigations that are essential to render the impacts of the proposed action not significant. The Mitigation Action Plan shall address all commitments to such necessary mitigations and explain how mitigation will be planned and implemented. The Mitigation Action Plan shall be prepared before the FONSI is issued and shall be referenced therein.

Mitigation measures identified herein shall be binding on the recipient through the National Environmental Policy Act Requirements clause of OSU's financial assistance award. DOE will require OSU to demonstrate successful metrics for the criterion identified in this MAP. OSU shall return to DOE any federal funds used for the construction, deployment or operation of the Project if they fail to meet the conditions of this MAP by the deadlines specified. In addition, cost shared funds for these activities will be disallowed. Noncompliance of the conditions set forth in the MAP will be considered a material failure to comply with the terms and conditions of the award as enforced through 10 CFR 600.162.

DOE will require OSU to demonstrate successful metrics for each criterion identified in this MAP. In the event that any of the metrics identified are not met successfully, DOE will require OSU to propose and implement additional mitigation measures until success is demonstrated.

The MAP is intended to be a living document and DOE may revise or reissue this MAP to reflect new understandings of the interaction of the project with the natural environment.

1.2 Structure of the Mitigation Action Plan

This MAP is organized as follows:

- Section 1 presents the introduction, purpose and structure;
- Section 2 presents the potential impacts, mitigation measures, metrics for defining success or noncompliance of the mitigation measures, and monitoring methods for the potential impacts to marine biological resources.

2.0 BIOLOGICAL RESOURCES

This section of the MAP presents the potential impacts, mitigation measures, metrics for defining success or noncompliance of the mitigation measures, and monitoring methods for marine biological resources, including ESA-listed, MMPA, and MSA protected species.

Mitigation measures discussed below will be applied to protect marine biological resources and ensure impacts are less than significant as a result of:

- Sound,
- EMF,
- Entanglements and collisions, and
- Benthic habitat alterations.

2.1 Potential Impacts

There are currently no operating wave energy conversion deployments that have conducted field studies analyzing all potential environmental effects at the Newport, Oregon Project site, and therefore there is a lack of information in which to determine the level of effects that may result in potential impacts to marine biological resources through the following pathways: (1) sound effects; (2) EMF; (3) entanglement and collision; and (4) benthic habitat alteration.

Sound

Underwater sound produced during the installation, operation and removal of OSU's Ocean Sentinel vessel, operation of wave energy conversion (WEC) devices (including the WET-NZ), and/or environmental monitoring equipment may affect fishes, sea turtles, and marine mammals in the area. The significance of these impacts depends on the characteristics of the underwater sound, as well as on the potential for each species to respond to that sound. Although sound sources will include installing anchors and anchor cables for the WEC devices and the Ocean Sentinel, the predominant source of sound during project installation of the Ocean Sentinel and WEC devices will originate from the propellers of support vessels involved in transport and placement of the anchoring and mooring system and during monitoring of the Project.

The acoustic signature of operating WEC devices is uncertain and may produce sounds with both impulse and continuous characteristics. High level, short duration, impulse sounds are known to cause behavioral changes, physical injury and in some instances are lethal depending on the level of sound and distance from the source. Species response to non-impulse or continuous sound such as vessel traffic or the continuous sound might range from no overt change in behavior, a startle response, to evidence of just a

mild awareness of the sound. These types of responses can be small, temporary movements for the duration of the sound or larger and more persistent movements that displace marine species from their normal locations

There is no acoustic data presently available for the WET-NZ device being tested in 2012-2013 and no definitive measurements of sound levels associated with the operation of hydrokinetic and ocean energy devices, including current WEC technologies. No acoustic data is also known at this time for any future WEC test. Impact levels to marine biological resources are unknown at this time and sound thresholds from the operation and testing of the OSU Ocean Sentinel, the WET-NZ WEC, and future WEC tests may have adverse effects to marine species.

EMF

Electromagnetic fields originate from both natural and man-made sources. Natural sources include the earth's magnetic field and various biochemical, physiological, and neurological processes within organisms. EMF consists of both electric and magnetic field components.

The operation of WEC devices and the Project's use of underwater power cables will create additional EMF around the site of the Project. Even though EMF from power cables can be readily modeled and it is understood that many species exhibit sensitivity to EMF, very few studies have examined responses of marine species to EMF from undersea power cables.

EMF monitoring for marine renewable energy is a newly emerging field that requires the use of specific instrumentation. Due to the lack of previous studies and information on EMF created by wave energy converters, the impacts to marine biological species are unknown and may have the potential to create adverse effects.

Entanglements and Collisions

The deployment of the WEC devices, Ocean Sentinel and TRIAXYS™ buoy with individual mooring systems places anthropogenic objects in the open ocean 2 miles offshore, in waters about 150 feet deep. The Ocean Sentinel and WEC devices being tested will include structures that could cause a collision or entanglement hazard for whales and larger marine mammals. Additionally, derelict fishing gear could potentially become caught on the devices or mooring lines, contributing to the entanglement risk. Over the 10-year project period there is a possibility that marine mammals could become entangled or entrapped by cables or derelict gear that has been ensnared on any Project structure.

Benthic Habitat Alterations

Benthic invertebrate communities inhabiting the nearshore marine environment provide important secondary production in marine food webs, are integral to the breakdown and recycling of organic material in the marine ecosystem, and provide a key food source for important commercial and recreational fish, as well as for other protected or managed fish species.

The installation of OSU's Project at the test site will alter habitat in the project area by creating structure and hard surfaces in the water column and on the bottom. These factors will alter hydraulics around the

anchors, changing the distribution of sediment grain sizes due to scour/erosion and/or deposition. These structures and hard surfaces, which will be in place intermittently over the 10-year operation of the test center, may affect the composition of ecological communities within the Project test site.

2.2 Mitigation Measures

The following describes the measures OSU will be employed to achieve compliance with the thresholds, mitigations, and notifications as outlined in the Adaptive Management Framework, Adaptive Mitigation Plan, the NMFS Biological Opinion, and the Applicant Committed Measures found in Chapter 2 of the DOE Final EA.

OSU, with input from the Adaptive Management Committee (established as part of the Adaptive Management Framework and is a collaboration of federal and state resource agencies and OSU), and with approval by NMFS, will modify the monitoring, adaptive management thresholds, adaptive mitigation plan elements, and project operations as necessary to assure Project compliance with ESA, MMPA, and other relevant federal and state statutes. The Adaptive Management Framework will be updated as necessary to reflect changes. An Adaptive Mitigation Plan will be developed for each test and will reflect best available science and include thresholds and actions appropriate for the technology. Monitoring results and updated Adaptive Management Framework and Mitigation Plans will be submitted to DOE for assurance of compliance with Applicant Committed Measures and the Terms and Conditions set forth in the NMFS Biological Opinion.

OSU will be required to follow all requirements outlined in the Adaptive Mitigation Plan and Applicant Committed Measures including, but not limited to, all appropriate monitoring, reporting, and notifications to the appropriate authorities.

Sound

During the Ocean Sentinel and WET-NZ test, amplitude and frequency distribution through time of the ambient sound field will be characterized and sound sources will be identified. OSU will implement the following during this test:

- Initial monitoring will occur within two weeks following deployment of the Ocean Sentinel, WET-NZ, and future WEC testing based on the Adaptive Management Framework and Mitigation Plan. (This window may be modified if the health and safety of personnel is at risk due to unforeseen conditions such as weather or operational complications where approaching the device is not safe.)
- Results will be made available to NMFS, ODFW, and DOE within seven days of the completion of monitoring. If results cannot be transmitted to NMFS, ODFW, and DOE within seven days, OSU will contact DOE, NMFS, and ODFW with an updated delivery schedule and the reason for delay.
- Obtain documented approval from the designated representative for all changes to the OSU Adaptive Management Framework that affect ESA listed species or NMFS authorities. Copies of the approved response plan will be sent to DOE within a week of completion.

If monitoring results indicate that the sound produced by the Project are at or exceed the thresholds known to impact behavioral disturbances (a negative affect) for ESA marine fishes at a distance of 100 meters from the Ocean Sentinel and/or WEC device, then OSU will halt all testing activities and, in cooperation with DOE, reinitiate ESA consultation with NMFS as described in Section 2.10 of the Biological Opinion:

- 183 dB (SEL) re: 1µPa for fishes weighing up to 2 grams;
- 187 dB (SEL) re: 1µPa for fishes weighing over 2 grams; or
- 206 dB (peak) re: 1µPa

If acoustic monitoring indicates that sound pressure levels attributable to the Ocean Sentinel and the WEC device under test at or exceed Level A injury threshold criteria (either continuous or impulse of 180dB RMS for cetaceans and 190dB RMS for pinnipeds) or Level B harassment threshold criteria (120dB RMS continuous and 160dB RMS impulse) for marine mammals at a distance of 100 meters, OSU will, in consultation with and after approval by NMFS and ODFW pursuant to their respective statutory authority, implement the appropriate mitigation actions during testing to ensure Project compliance with ESA, MMPA, MSA, and other relevant federal and state statutes. Mitigation actions will include one or more of the following:

- OSU, in coordination with and after approval from NMFS and ODFW pursuant to their respective authority, will develop and implement a response plan within 14 days of acquiring monitoring results. A copy of the response plan will be sent to DOE;
- Modify the operation (or ensure modification) of the Ocean Sentinel and/or the WEC device under test to decrease its acoustic emissions (e.g., locking down the WEC device during high surf, increasing controls to slow the motion of the WEC device, or repairing the WEC device if sound is due to device malfunction) and conduct subsequent monitoring to verify sound abatement measures;
- Cease operations and testing activities, perform necessary modifications to minimize noise levels and conduct additional monitoring to verify sound abatement measures;
- Initiate MMPA coordination with NMFS, in cooperation with DOE, to assess the need to apply for an Incidental Harassment Authorization for acoustic emissions of the Ocean Sentinel and/or WEC device. If it is determined that an Incidental Harassment Authorization is needed, operations will cease until the authorization is issued and a copy is sent to DOE. If NMFS determines that an authorization is not required, notification of this decision will be sent to DOE and Project operations may recommence.
- Design and perform additional monitoring.

EMF

OSU, in consultation with and after approval by DOE, NMFS, and ODFW pursuant to their respective statutory authority will implement the following:

- Validate the effectiveness of the EMF Propagation Model and assess its efficacy for measuring EMF for future tests. If necessary, potential modifications to the model will be implemented.
- Evaluate both the ability to detect the level of EMF generated from project devices and determine whether there is a meaningful (i.e., biologically significant) source of EMF from the Project.

Based on the evaluation and assessment described above, OSU will, in consultation with and after approval by NMFS, and ODFW pursuant to their respective statutory authority, implement one or more of the following measures to ensure Project compliance with ESA, MMPA, MSA, and other relevant federal and state statutes:

- OSU will ensure that EMF monitoring will be completed in accordance with the Biological Opinion, Adaptive Management Framework and Mitigation Plan;
- Modified or additional monitoring techniques;
- Compare the EMF monitoring results with known values for impact on ESA-listed and MMPA-protected species known or likely to be present in the area;
    - If the results indicate that Project related EMF levels are within the documented magnetic or electric field sensitivity range of such species, OSU will work with NMFS and ODFW on an approach to reduce EMF levels during a test;
    - In the event that the monitoring shows EMF signatures at levels below concern, and after consulting with NMFS and ODFW, the EMF monitoring program will be modified accordingly. A copy of the approved modified monitoring program will be sent to DOE;
- Obtain documented approval from the designated NMFS representative for all changes to the OSU Adaptive Management Framework that affect ESA listed species or NMFS authorities. A copy of the approved modified monitoring program will be sent to DOE; and
- Use data and information from existing studies to estimate EMF emissions and perform potential effects analysis for future tests.

If monitoring results indicate that EMF attributable to the project components is in excess of levels known to have an adverse impact on marine life, OSU will, in consultation with and upon approval by NMFS and ODFW pursuant to their respective statutory authority, develop and implement a response plan that outlines the appropriate mitigation action. A copy of the approved response plan will be sent to DOE. Actions may include, but are not limited to:

- Additional shielding of cables or other project components;
- Delaying subsequent deployment of tests until resolution of the issue is achieved;
- Adoption of new timeframe restrictions designed to address specific resource conflicts (e.g. green sturgeon); or
- Decommissioning the site and terminating the test.

If monitoring results indicate that EMF attributable to the project components is in excess of levels documented to have an adverse impact on marine resources beyond a 500-meter radius from deployed WEC test components the reinitiation provisions of the NMFS Biological Opinion will be triggered and OSU will halt all testing activities and, in cooperation with DOE, reinitiate ESA consultation with NMFS as described in Section 2.10 of the Biological Opinion. OSU will also initiate MMPA coordination with NMFS, in cooperation with DOE, to assess the need to apply for an Incidental Harassment Authorization for EMF levels from the Project. If it is determined that an Incidental Harassment Authorization is needed, operations will cease until the authorization is issued and a copy is sent to DOE. If NMFS determines that an authorization is not required, notification of this decision will be sent to DOE and Project operations may recommence.

Entanglement and Collision

To reduce the potential impacts to marine life, OSU will implement the following:

- Perform underwater visual monitoring at least three times for each WEC test: once prior to device deployment, once during active deployment, and once after device removal. Video lander monitoring of anchors and reference locations will continue for the duration of the project (i.e., when any project related structure or equipment is in the water). In addition, OSU will make visual observations from the water surface, at least bi-weekly, during all visits to the project site to identify any derelict gear.
- If monitoring shows that derelict gear has become ensnared or collected on any Project structure and has entangled or poses the risk of entanglement to organisms, OSU will remove the gear as soon as feasible, notify NMFS, USFWS, DOE, and ODFW within two days, and provide a report with all available information on the case. OSU will then, after consulting with NMFS, USFWS, and ODFW, and approval by NMFS, modify the Project and/or monitoring plan if necessary. Any modified plans will be provided to DOE.
- If monitoring shows marine mammals entangled in fishing gear or marine debris, OSU will report the incident as soon as practical and remove the gear consistent with the Reporting Protocol for Injured or Stranded Marine Mammals. OSU will then, after consulting with NMFS, USFWS, and ODFW, and approval by NMFS, modify the Project and/or monitoring plans, if necessary. Any modified plans will be provided to DOE.
- If monitoring shows that derelict gear has become ensnared or collected on any Project structure, but no organisms are caught within it and the gear poses no threat to navigational safety or marine species, OSU will remove the derelict gear during removal of the test devices.
- If marine mammals or sea turtles are observed entangled, injured or impinged at the Project structure(s), OSU will immediately follow the Reporting Protocol for Injured or Stranded Marine Mammals and give NMFS, ODFW, DOE all available information on the incident. In addition, OSU will contact NMFS, and ODFW as soon as practical within 24 hours to consult with them regarding modifying the Project and/or monitoring plans.

OSU will implement, as outlined in the OSU Adaptive Management Framework and Adaptive Mitigation Plan, the following NMFS protocols in the event an injured or stranded marine mammal is observed:

- Live marine mammals or sea turtles observed swimming but appearing debilitated or injured. OSU monitors will record the sighting as part of the monitoring report and provide the information to the Oregon Marine Mammal Stranding Network.
- Live marine mammals or sea turtles observed entangled in fishing gear or marine debris. OSU monitors will immediately contact the Hatfield Marine Science Center for mammal disentanglement. If an entanglement is observed and, if possible, the reporting vessel should remain on scene while contact is made.
- Dead marine mammals or sea turtles observed floating at sea. Dead floating marine mammals fall within the definition of "stranded" under the MMPA. OSU monitors will report strandings to the Oregon Marine Mammal Stranding Network.

Dead protected species found entangled or otherwise impinged at the project. OSU monitors will report, as part of the monitoring report to NMFS and ODFW, all available information on the siting. In the event that any marine mammal is injured, stranded, or dead due to collision or entanglement from the Project, OSU, in cooperation with DOE, will cease all Project operations and testing activities and reinitiate ESA consultation with NMFS immediately. OSU will also initiate MMPA coordination with NMFS, in cooperation with DOE, to assess the need to apply for an Incidental Harassment Authorization. If it is determined that this is needed, operations will cease until the authorization is issued and a copy is sent to DOE. If NMFS determines that an authorization is not required, notification of this decision will be sent to DOE and Project operations may recommence.

Benthic Habitat Alterations

To reduce the potential impacts to marine life, OSU will implement the following monitoring activities:

- Determine how benthic organism respond to WEC-induced changes to habitat;
- Investigate whether the introduction of these kinds of hard surfaces encourage colonization by marine invertebrates and attracts fish and whether fishes that may be attracted to the structures affect those considered "resident"; and
- Monitor for derelict gear which may become entangled on project structures and pose an entanglement risk for marine species.

If monitoring conducted as described in the Benthic Species and Habitat Monitoring Plan (DOE/EA 1917, Appendix E) shows substantial differences or significant trends, as defined in consultation with ODFW and NMFS, in benthic habitat or associated ecological communities between the action area sites and reference sites, or at any one site over time, OSU will, in consultation with and after approval by NMFS and ODFW pursuant to their respective statutory authority, implement one or more of the following actions to ensure Project compliance with ESA, MMPA, MSA, and other relevant federal and state statutes:

- Modify the monitoring plan and/or sampling frequency to determine if ecological interactions have negative effects on protected species, benthic habitat or associated ecological communities;

- Modify the Project to mitigate for adverse effects;
- Conduct additional sampling or studies; and/or
- Make determination that no changes to monitoring plans or test center operations are needed; and
- Obtain documented approval from the designated NMFS representative for all changes to the OSU Adaptive Management Framework that affect ESA listed species or NMFS authorities.

2.3 Metrics for Determining Success or Noncompliance with the Mitigation Measures

The metrics for determining success will be the submission of the following documents by OSU for all WEC devices to the assigned DOE Golden Field Office Project Officer and NEPA Specialist for review and approval:

1. Submissions of the Adaptive Mitigation Plan, the U.S. Army Corps permit, Spill Contingency and Emergency Response Plan, and the mooring plan for each individual WEC devise testing prior to deployment and testing throughout the life of the ten-year Project.
2. As a member of the Adaptive Management Framework's established Adaptive Management Committee, OSU will submit the Annual Operations and Monitoring Report to DOE by December 30th of each year and throughout the life of the ten-year Project.
3. Submit meeting minutes and Adaptive Management Committee recommendations from the annual meeting. Documents must be submitted to DOE no later than April 30th of each year.
4. Submission of the results summary of the following studies planned by OSU's Northwest National Marine Energy Center (NNMREC):
    - OSU/NNMREC Ocean Test Facility Short-Term Acoustic Test
    - OSU/NNMREC Ocean Test Facility Benthic Monitoring Studies
    - OSU/NNMREC Electric and Magnetic Field Monitoring of WET-NZ and all future WEC EMF monitoring studies

The metrics for determining noncompliance will be OSU's failure to submit the above referenced documents, additional documents as referenced in 2.2 mitigation measures, and provide notifications to DOE for events as described in 2.2 by the dates indicated, unless prior approval from DOE has been obtained.

2.4 Monitoring Techniques for Mitigation Measures

The Annual Report and all aforementioned deliverables will be submitted to the assigned DOE Golden Field Office Project Officer and NEPA Specialist for review and approval.

Monitoring of mitigation measures will be accomplished through DOE's review of the reports, studies, and verifications submitted by OSU as metrics for determining success or noncompliance as identified in Section 2.3. No additional monitoring measures are anticipated