



Oregon Army National Guard Camp Rilea Armed Forces Training Center

Ocean Renewable Energy Feasibility Study



LTC Ken Safe, US Army National Guard, PE

Rick Williams, Captain, USN (Ret), PMP, NPDP



Agenda

- Introductions
- Background
- Ocean Energy Concept
- Feasibility Study
- Future



Wave Energy in Oregon Background

- Oregon has wave resources, grid and load close to shore, and a mature marine industry
 - Need for renewable energy and jobs
 - Need for a grid-connected test site
- Interest from Clatsop County
- Potential for Army Net Zero Program
- Camp Rilea and submarine cable are existing ocean uses
- Oregon Army National Guard manages facilities and has professional engineering, planning and environmental compliance staff



US Army Energy Program

Army Net Zero

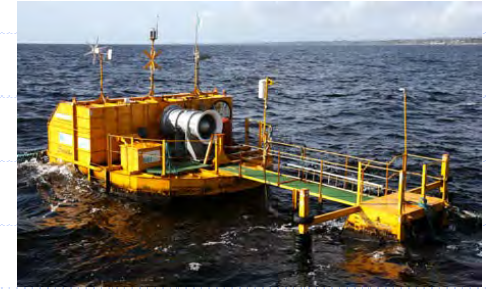
- Appropriately manage our natural resources
- Addresses energy security and sustainability
- Goal of net zero pilot installations
 - Net Zero Water
 - Net Zero Energy
 - Net Zero Waste
- Fort Oregon selected for Net Zero Energy Pilot
 - 20MW: estimate for Oregon Army National Guard in
 - 40MW: estimate for Oregon Army and Air Force National Guard
- Army goals to achieve total Net Zero by 2020





International Development Marine Energy

- United Kingdom
 - EMEC*
 - WaveHub*
 - Galway Bay, Irish Marine Institute
- Europe
 - DanWEC (Denmark), SEM-REV (France), Agucadoura* (Portugal)
- Australia
 - OceanLinx
- United States
 - US National Marine Renewable Energy Centers
 - Hawaii - Kaneohe Marine Corps Base Hawai'i*
 - Northwest (Oregon, Washington)
 - Southeast (Florida)



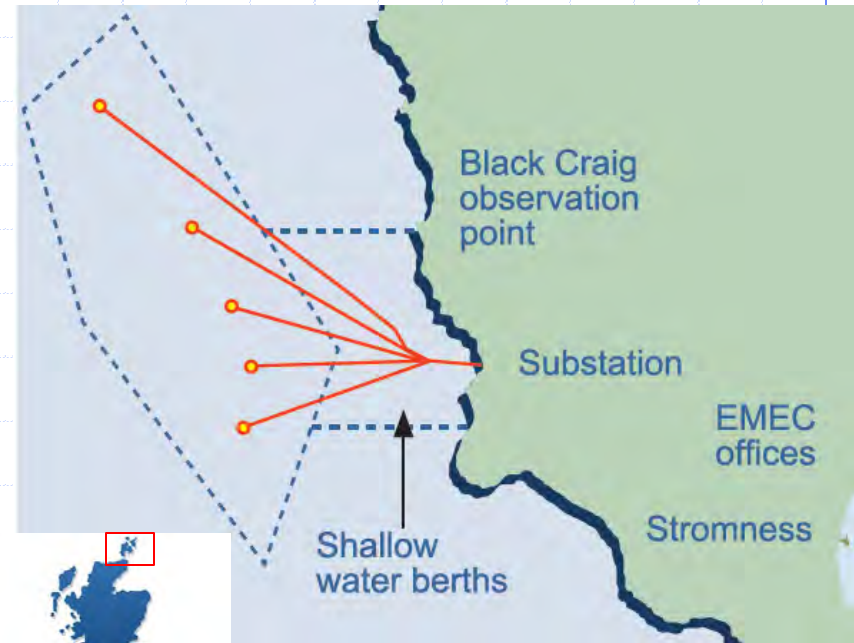
*OE Buoy Deployed in Galway Bay
Courtesy of OE Buoy*

* *Grid Connected site.*



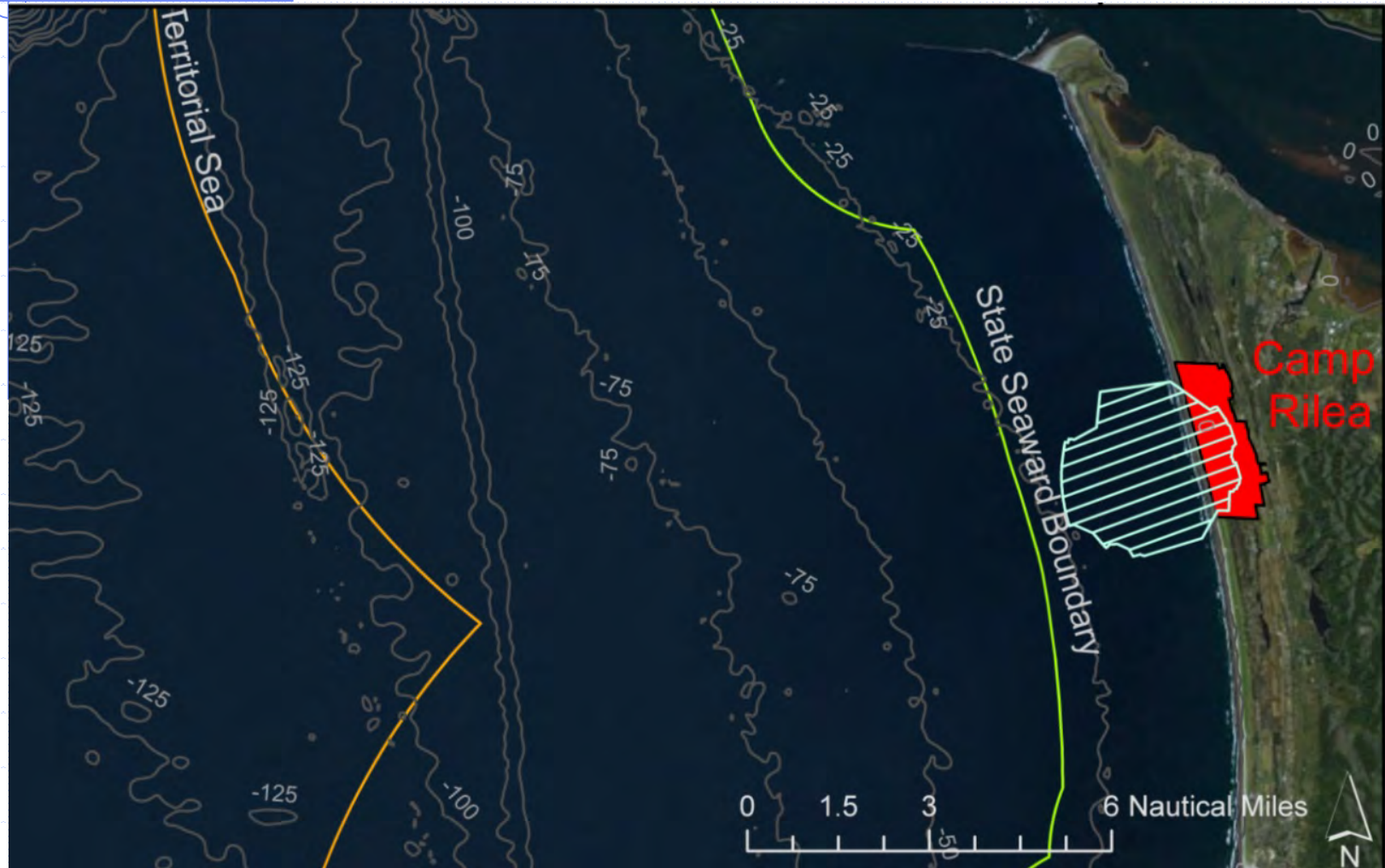
International Progress Marine Energy

- European Marine Energy Centre (EMEC)
- Founded in 2003
 - Crown Estate
- Full Grid Connection
 - 11 kV
 - 5 MW
- Current Capabilities
 - 5 MEC test berths
 - 7 Tidal test berths
 - Multiple “nursery” berths
- Currently all berths under lease





Camp Rilea Armed Forces Training Center Clatsop County, Oregon



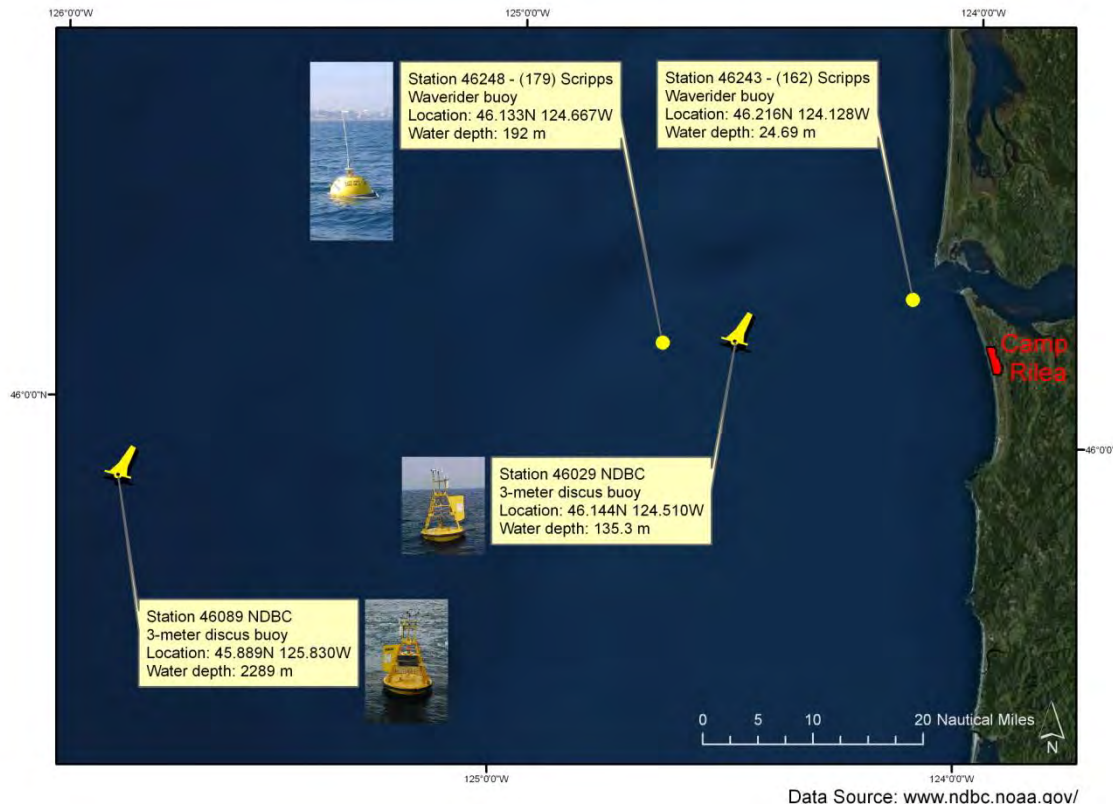
Depth in meters

Oregon Army National Guard



Wave Measurement near Camp Rilea Clatsop County, Oregon

Unique arrangement of wave measurement capabilities
off Clatsop County and Mouth of Columbia River



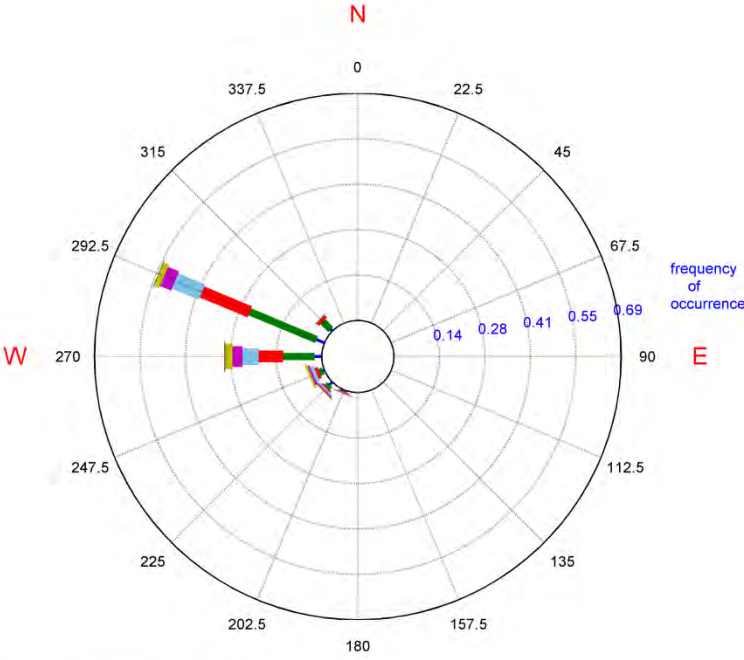


Wave Resource near Camp Rilea Clatsop County, Oregon

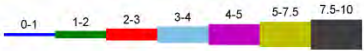


Pacific WIS Station 83015
01-Jan-2000 thru 31-Dec-2005
Long: -124.25° Lat: 46.166° Depth: 87 m
Total Obs : 52603

WAVE ROSE



SIG WAVE HEIGHT (m)



US Army Engineer Research & Development Center 13-Feb-2012



Existing Electrical Distribution Camp Rilea Clatsop County, Oregon

- Camp Rilea is a national security site and the disaster response site for the North Coast, needs multiple power sources for disaster resilience
- Camp Rilea has policy of co-use and co-location to avoid encroachment on live fire training mission
 - Electrical distribution system close to shore
 - Connects to local utility grid at Hwy 101
 - Willing to consider test site
 - Willing to consider cable landings
 - Professional staff
 - Culture of environmental compliance



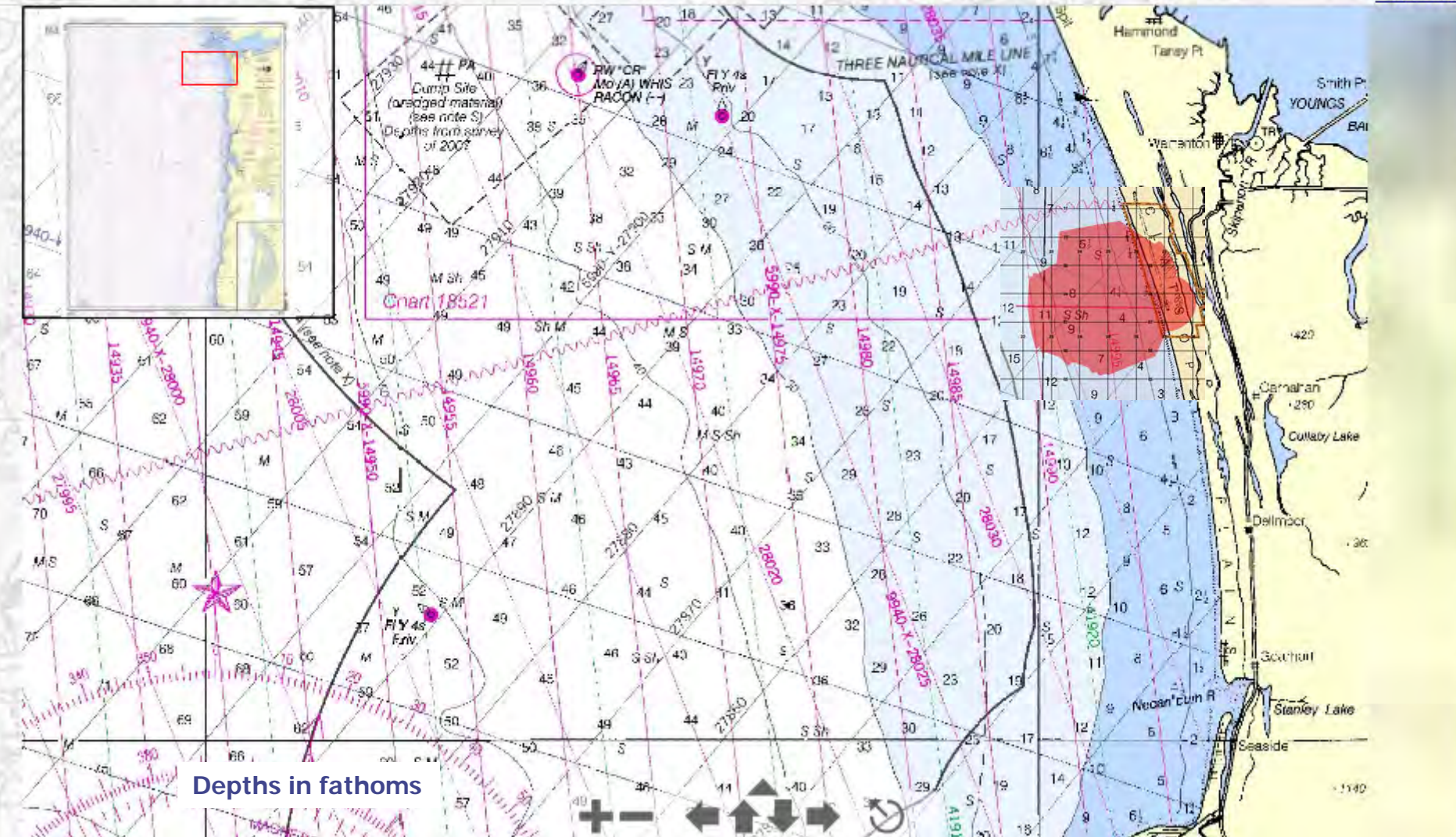


Camp Rilea Armed Forces Training Center Clatsop County, Oregon

charts.noaa.gov/OnLineViewer/18520.shtml

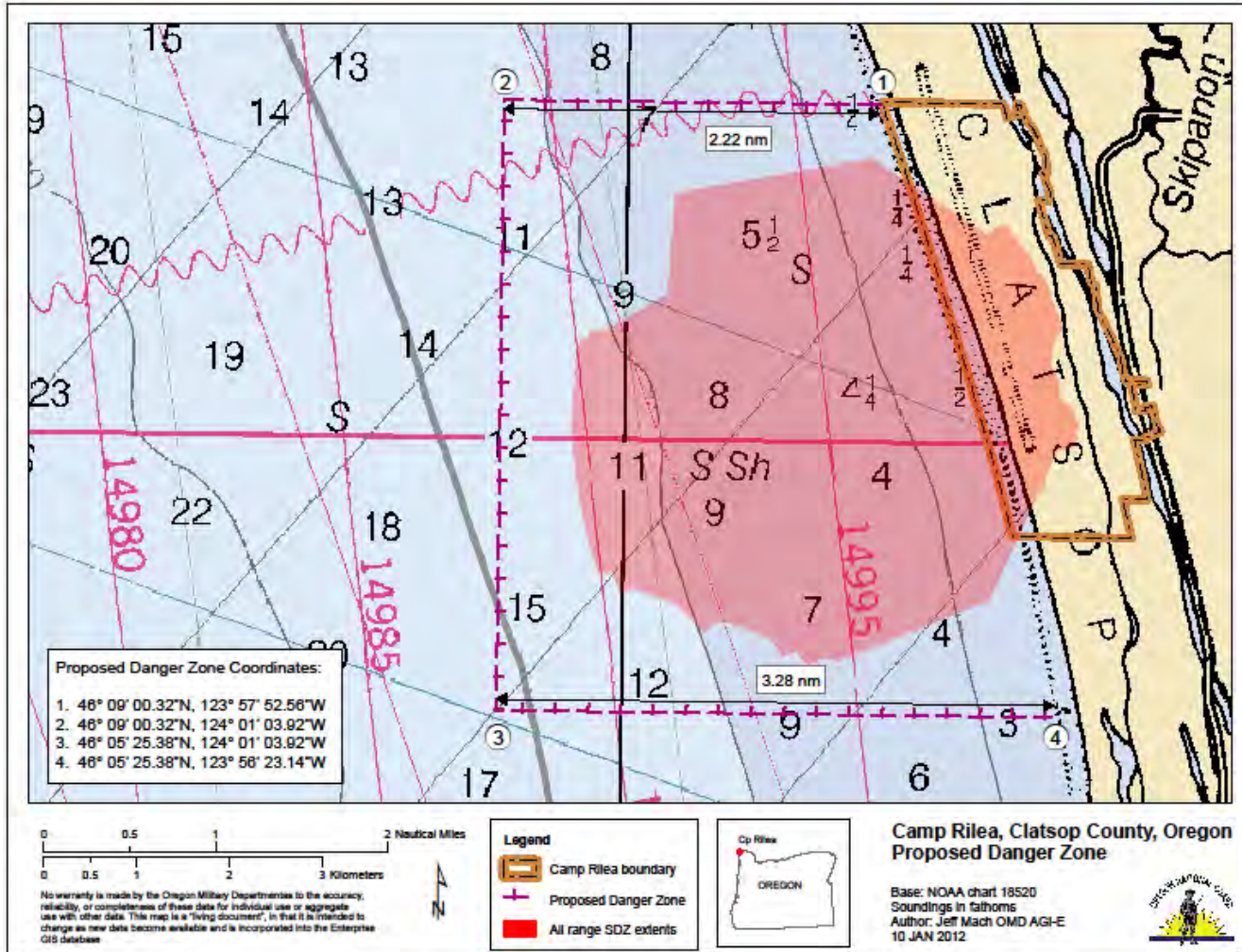
NOAA chart Astoria to

Notice List
Find A Chart





Camp Rilea Proposed Danger Zone Clatsop County, Oregon





Camp Rilea Ocean Renewable Energy Project Site Concept

Concept: Evaluate Viability of Ocean Energy

1. Generate renewable electricity with waves
2. Evaluate combination of wave-wind hybrid and offshore wind
3. Energy Security/Net Zero/Disaster Resilience



Camp Rilea Ocean Renewable Energy Project Site Concept

- Elements of Ocean Renewable Energy Sites
 1. Marine Energy Converters (MECs)
 - Multiple designs
 - Varying technology readiness levels (TRLs)
 2. Offshore Site Infrastructure
 - Deep
 - Mid
 - Shallow
 3. Shore Site Infrastructure + Interface to Grid



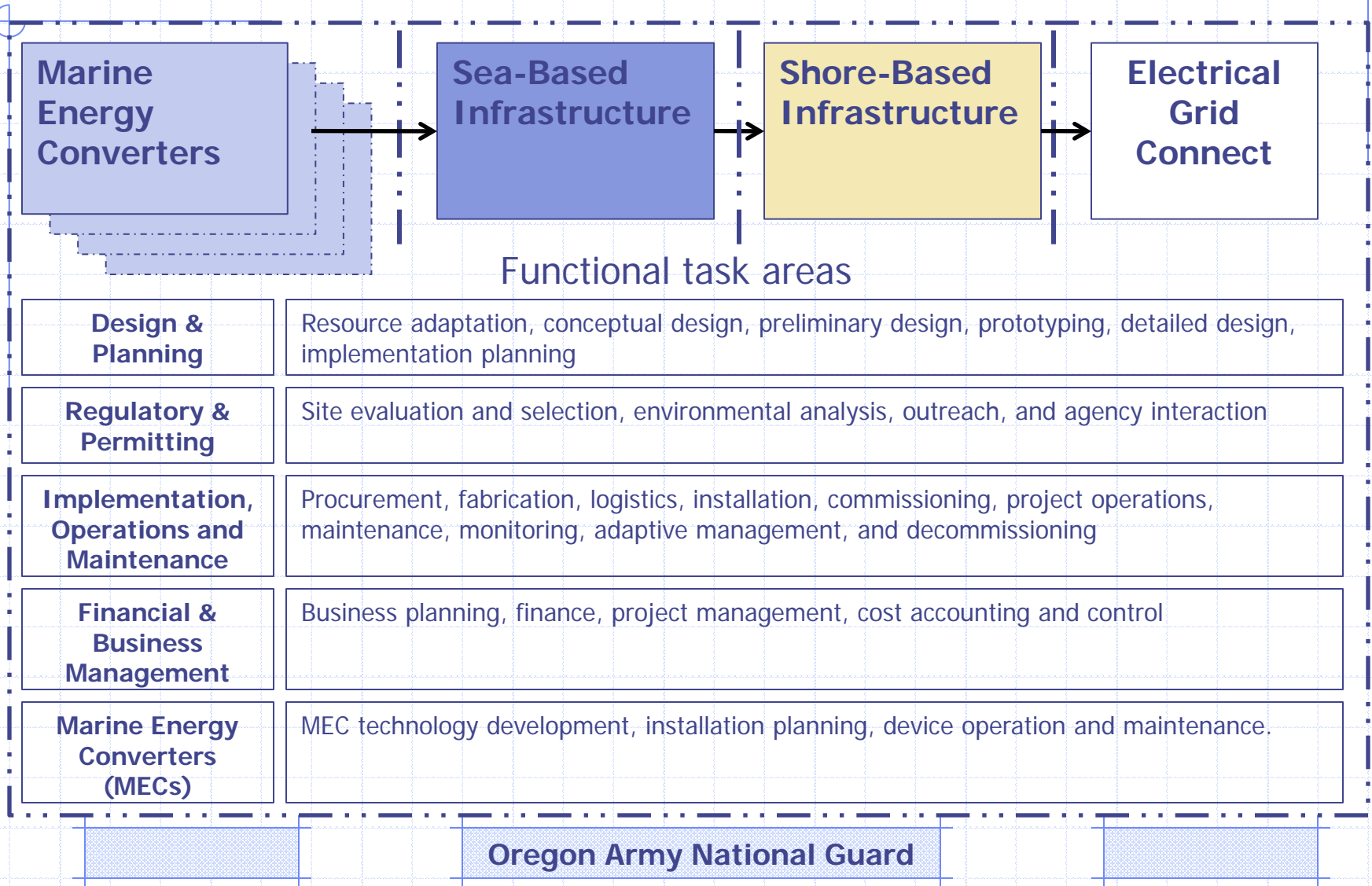
Camp Rilea Ocean Renewable Energy Project Site Concept

- Camp Rilea's mission is training and needs dependable power from multiple sources.
 - Fort Oregon represents load from all Oregon Guard sites
 - North coast communities will benefit from power generation and jobs and enhanced ability to support emergency service response at the Camp
 - Research hardening for disaster resilience





Camp Rilea Ocean Renewable Energy System Block Diagram





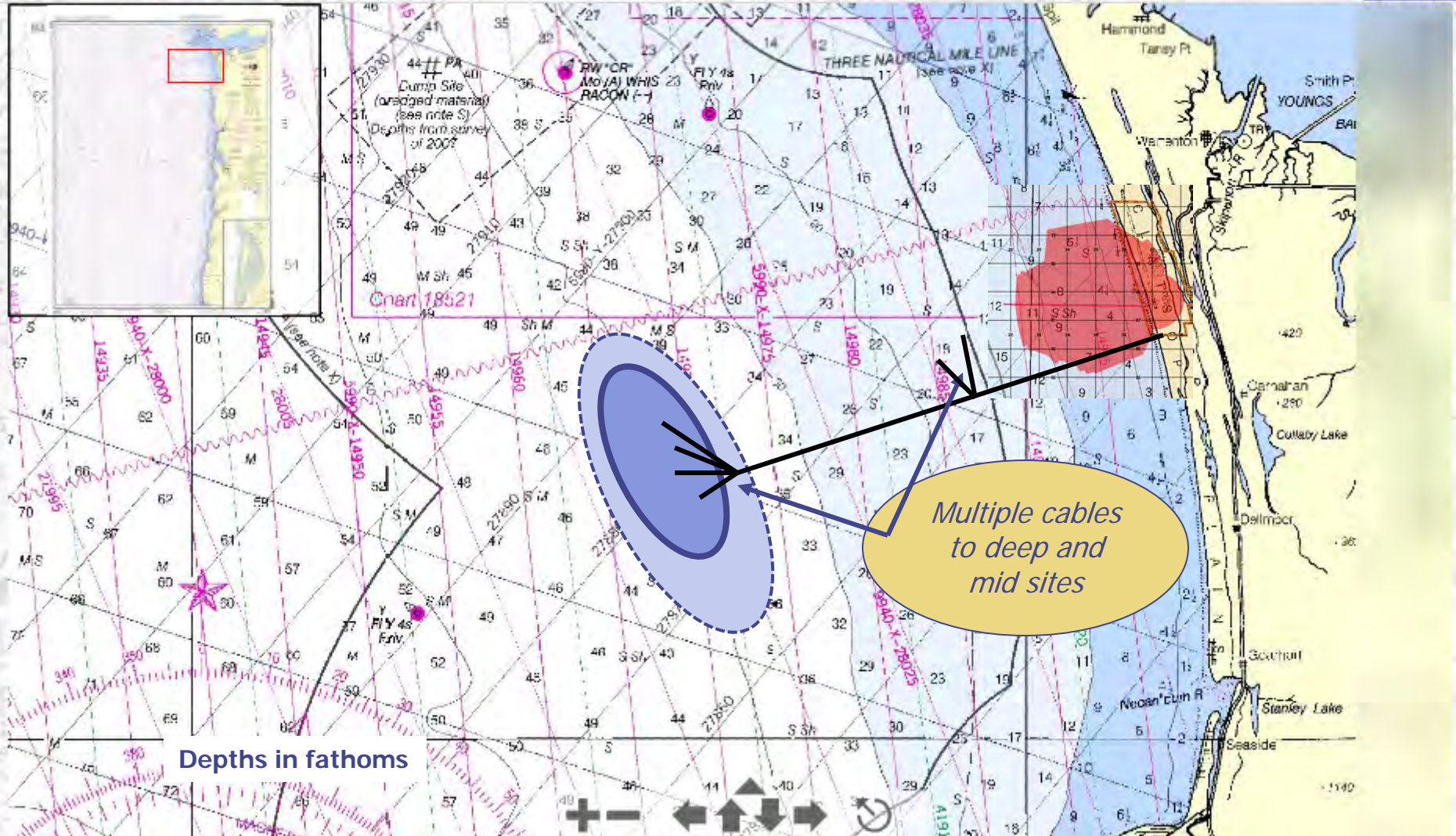
Camp Rilea Ocean Renewable Energy Conceptual Deep Project Site (OCS)

charts.noaa.gov/OnLineViewer/18520.shtml



NOAA chart Astoria to

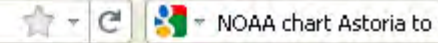
[Notice List](#)
[Find A Chart](#)



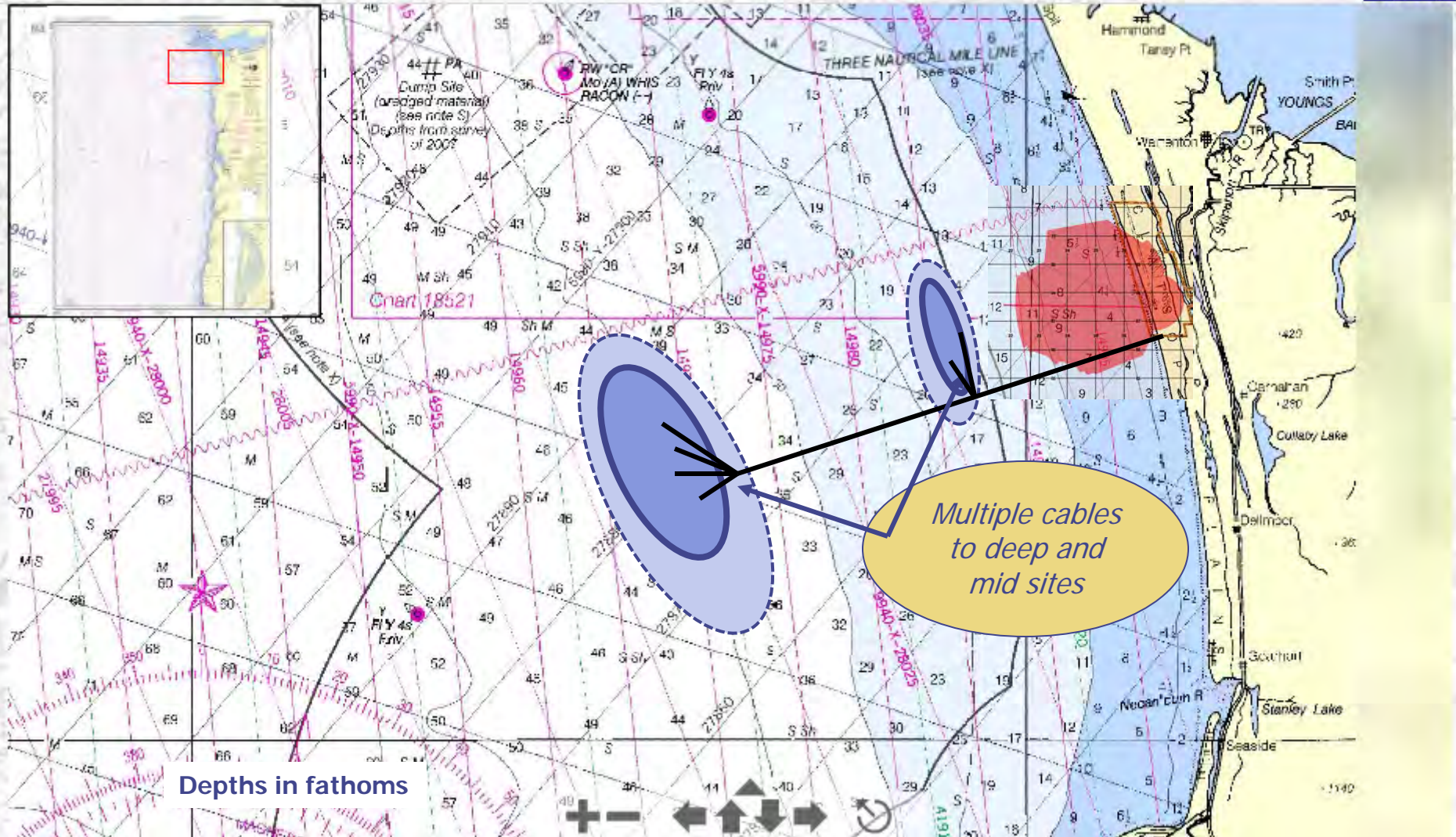


Camp Rilea Ocean Renewable Energy Conceptual Deep & Mid Project Sites

charts.noaa.gov/OnLineViewer/18520.shtml



Notice List
Find A Chart S



Depths in fathoms

Multiple cables to deep and mid sites

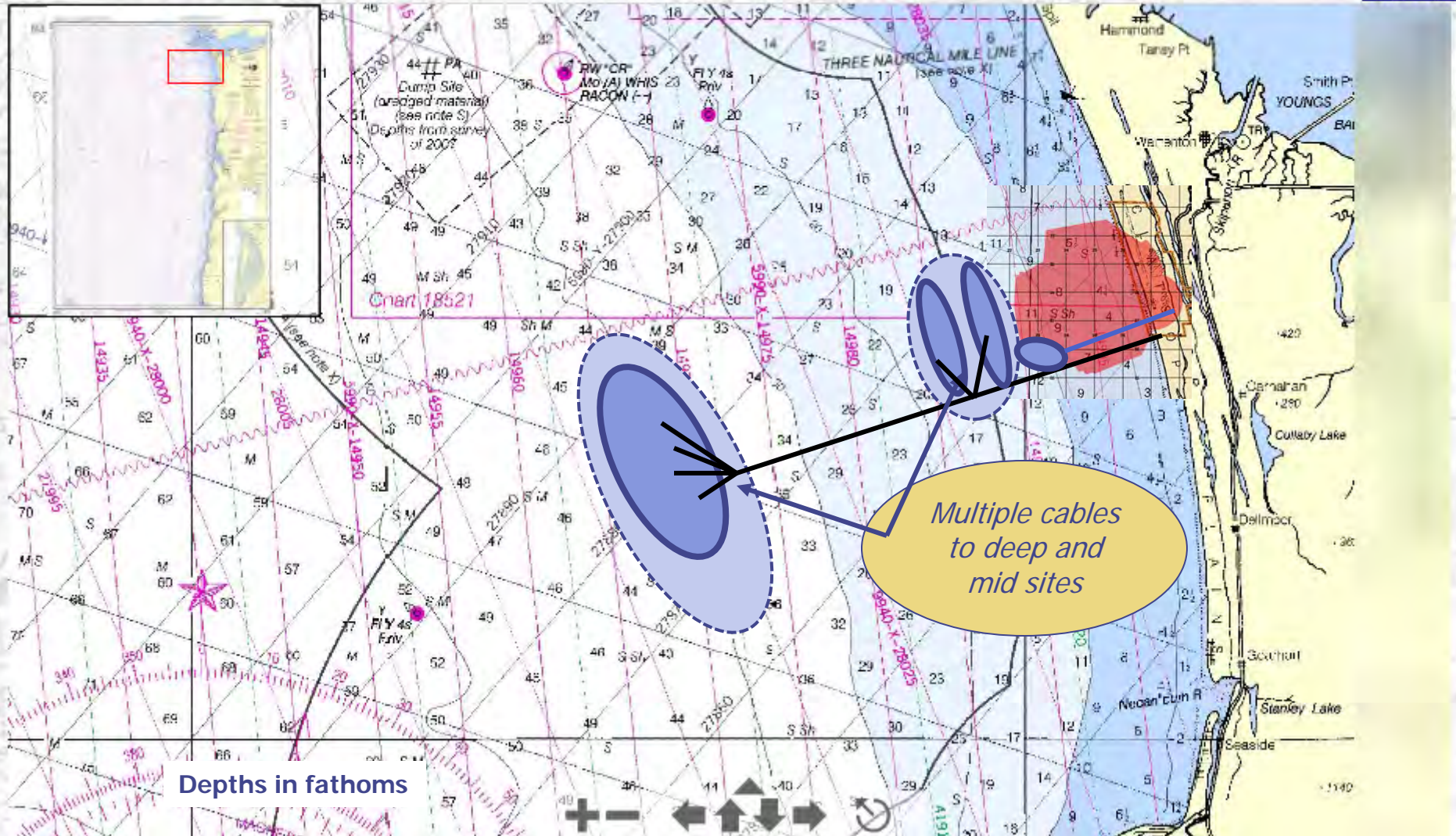


Camp Rilea Ocean Renewable Energy Conceptual Deep/Mid/Shallow Project Sites

charts.noaa.gov/OnLineViewer/18520.shtml

NOAA chart Astoria to

Notice List
Find A Chart S



Depths in fathoms



Camp Rilea Ocean Renewable Energy Marine Energy Converters

- Marine Energy Converter (MEC) Types
 - Point Absorber - Vertical Motion
 - PowerBuoy[®], CPT, Wavebob[™]
 - Attenuator – Longitudinal Motion
 - Pelamis, Anaconda
 - Focusing – Directing Waves to Center Location
 - Wave Dragon
 - Bottom Mounted
 - M3, Oyster[®], Archimedes Waveswing[™],
 - Wind/Wave Combination
 - Floating Power Plant
- Evolving industry

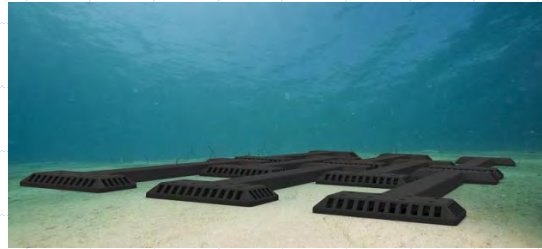


Camp Rilea Ocean Renewable Energy Marine Energy Converters

Point
Absorbers



OPT



Bottom Mounted
M3 Wave Energy Systems

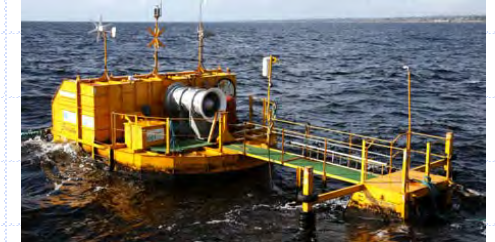


Wave-Wind Hybrid
Floating Power - Poseidon

CPT



Near Shore, Pumper
Aquamarine Oyster



Oscillating Water Column - OE

WaveBob

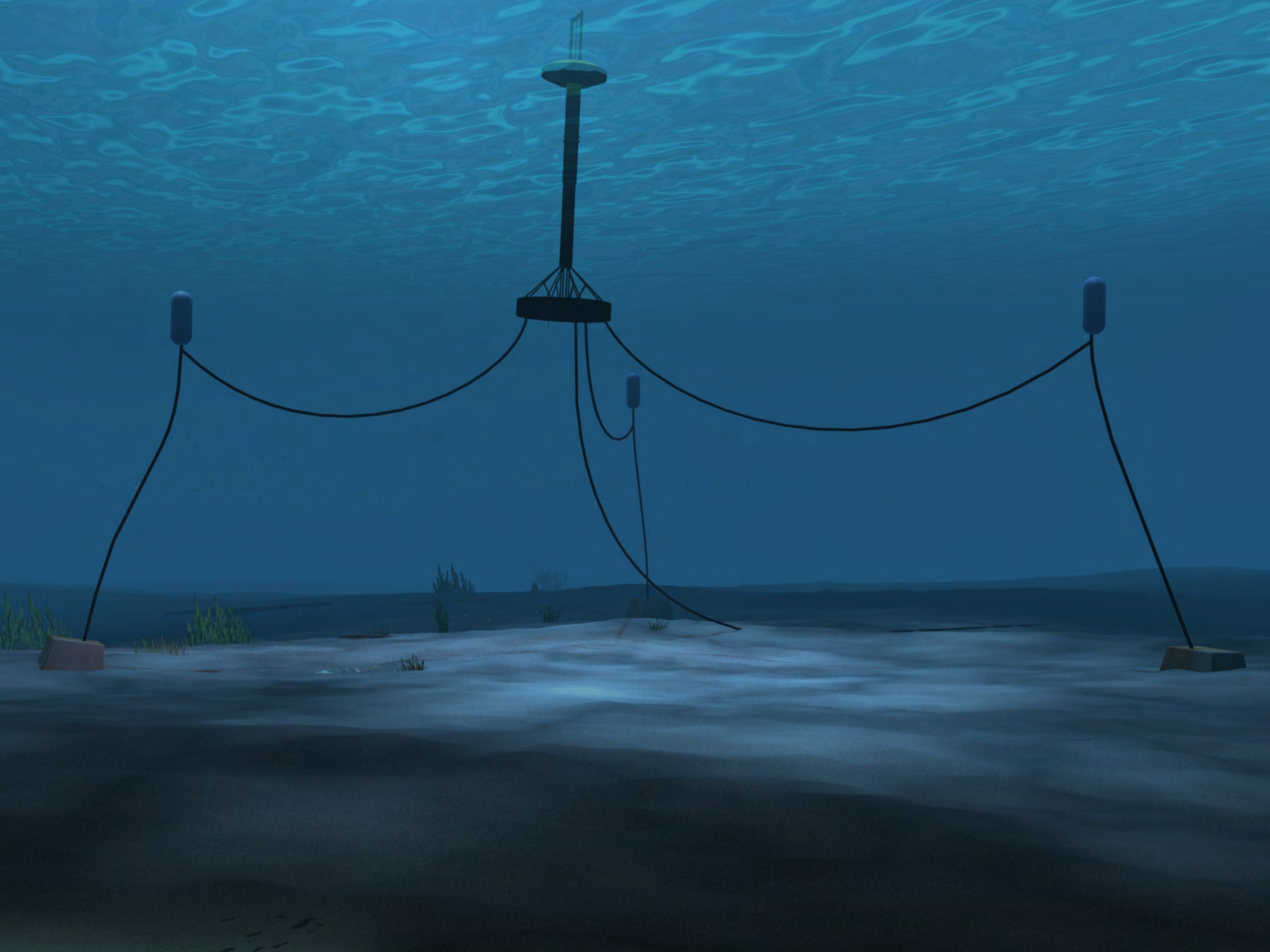


Overtopping -Wave Dragon

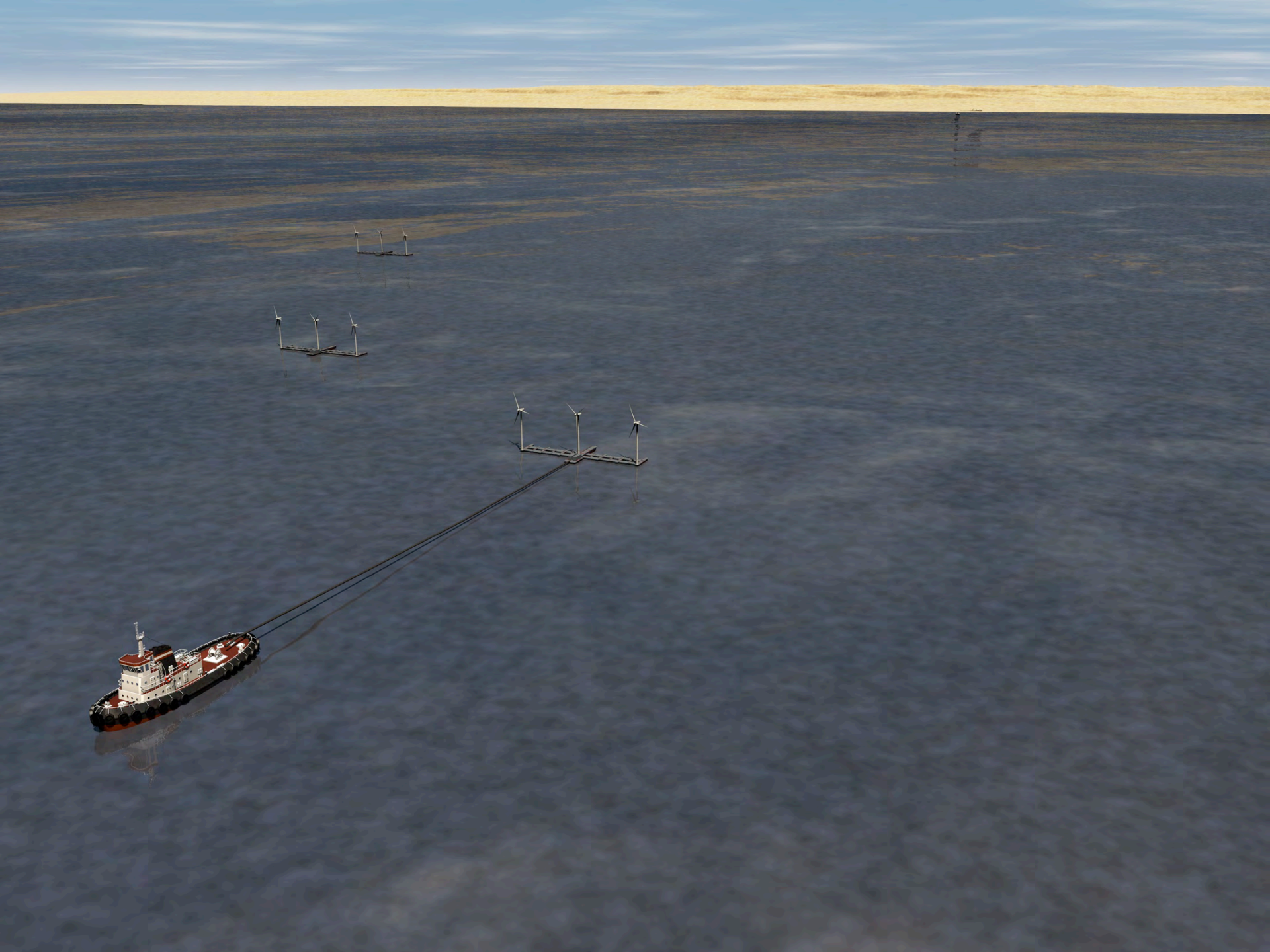


Linear Attenuator - Pelamis











Camp Rilea Ocean Renewable Energy Draft Proposed Concept

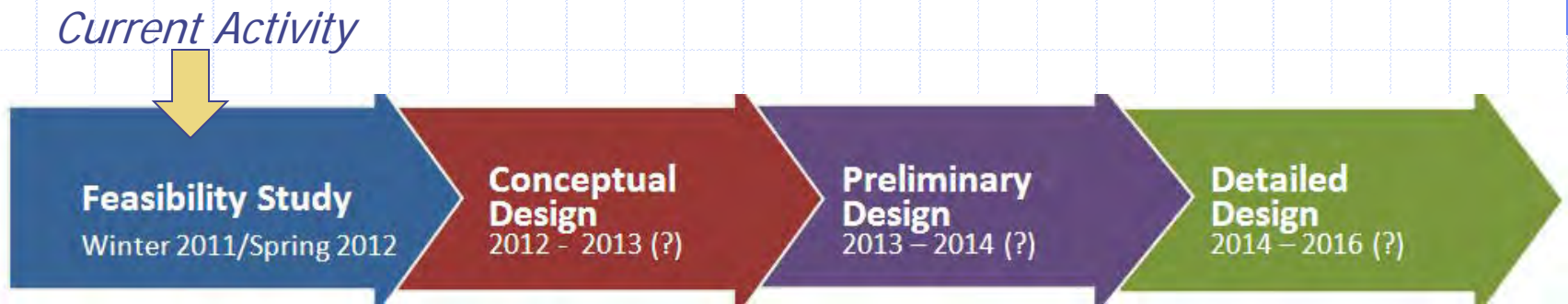
If project proceeds, one possible design approach is:

- Concept of multiple berths in different water depths:
 - Most for National Guard, some for NNMREC
 - Construction of first site in 2016-2018?
- Initially single device operation, conservative mooring
 - Array operation after technology proven
 - Demonstrate reliability of power generation
- Community comment and support is needed with feedback and coordination from early stage
 - Start small, be conservative
 - Additional build-out in 10+ years if needed and after community and industry outreach



Camp Rilea Ocean Renewable Energy Draft Proposed Concept

- If project proceeds, one possible timeline is:





Camp Rilea Ocean Renewable Energy Current Activities

- Feasibility Study
 - Electrical & Marine Infrastructure
 - Wave Energy Resource Assessment
 - Regulatory Framework
 - Business/Financial Analysis
- Community Outreach and Consultation
- Agency Outreach and Consultation



Camp Rilea Ocean Renewable Energy Proposed Coordination

If project proceeds, opportunities work with community:

- Cooperation with Clatsop County
- Cooperation with Fishing Industry and OFCC
- Cooperation with NNMREC and OSU
- Cooperation with Clatsop Community College & Job Corps
 - Marine and Environmental Research and Training Station (*MERTS*)
 - Tongue Point Job Corps Seamanship Training Program
- Cooperation with Local, State and Federal Agencies
- Cooperation with Ocean Energy Companies in Oregon
- Others



Camp Rilea Ocean Renewable Energy Concept Development Stages

- If project proceeds, activities in the timeline include:

