

A photograph of an offshore wind farm with several white wind turbines on blue ocean towers under a blue sky with scattered white clouds. The text is overlaid in white on the upper part of the image.

CONSIDERATIONS FOR SITING OFFSHORE WIND FARMS OFF NORTH CAROLINA



TETRA TECH EC, INC.

1.800.580.3765 • WWW.TTECI.COM

Michael Ernst
Jennifer Ghiloni
Tetra Tech

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Introduction to Tetra Tech

- **Tetra Tech, Inc.**
 - Publicly traded on NASDAQ (TTEK) with Annual FY09 revenue of \$2.29 billion
 - More than 10,000 employees in 280 offices worldwide
 - *ENR* #1 Wind Farm Development Firm and Top 10 Environmental Firms
- **Full-Service Firm Providing Integrated Services**
 - Consulting (Siting, Surveys and Permitting)
 - Engineering
 - Construction (20 Onshore Wind Farms)
- **Supported Development of more than 900 Energy Projects worldwide**
 - 100 transmission lines
 - 300 renewable electric generating facilities
 - 200 power generating facilities
 - 300 natural gas pipelines
- **Supporting Development of 6 Offshore Wind Farms**
 - Bluewater Wind Delaware, New Jersey & NYPA RFP
 - MMS Met Tower Leases & CZMA Certification, Army Corps and EPA Permits
 - Deepwater Wind Rhode Island Offshore Wind Farms
 - Offshore Avian & Bat Surveys
 - Outer Banks Ocean Energy – Siting used for APEX BOEMRE Lease Request off N.C.

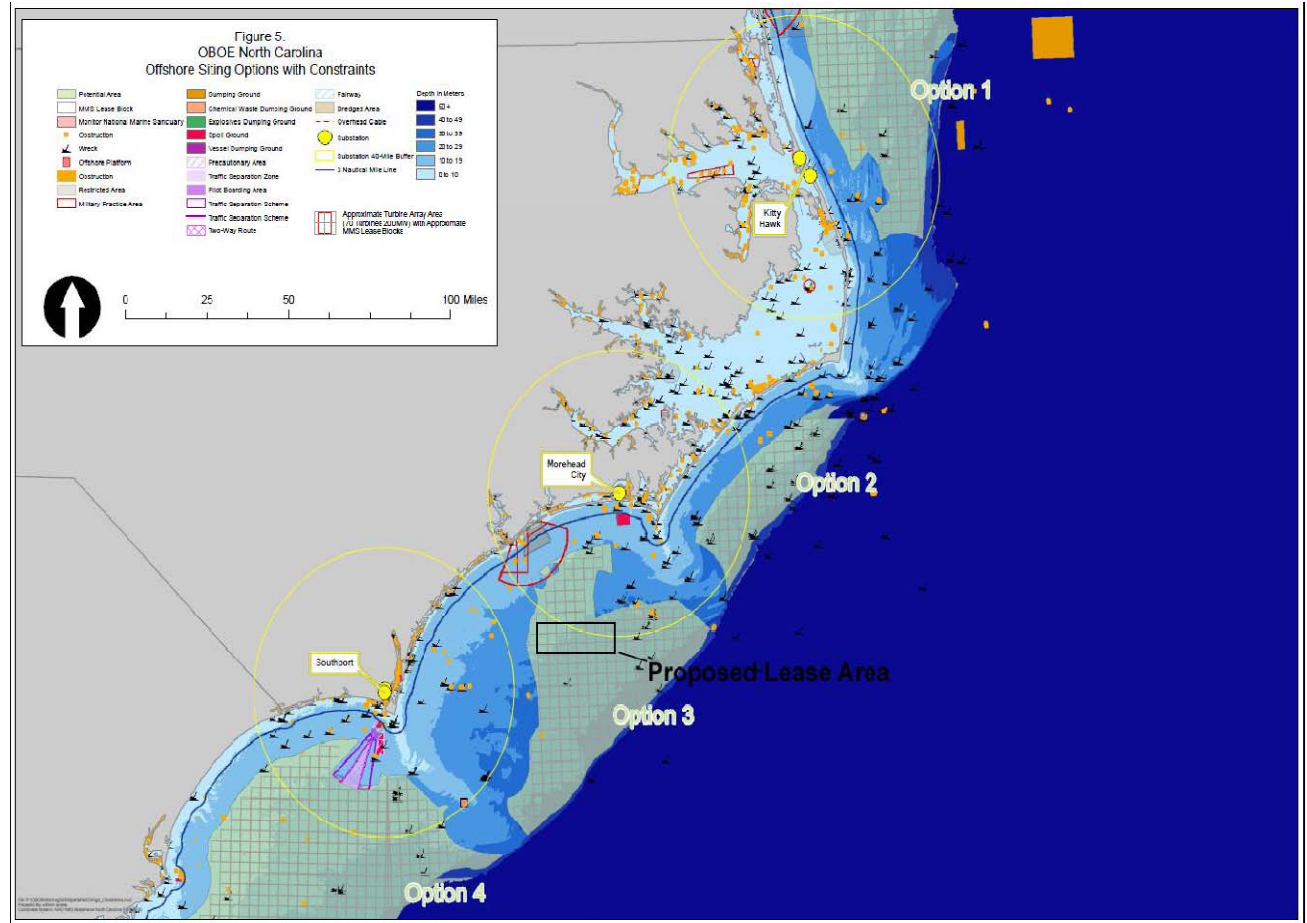


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N.C. Offshore Site Screening for Outer Banks Ocean Energy

Further Constraints
Analysis for OBOE
basis for APEX
Request for Lease
to BOEMRE



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Goals and Challenges Of Offshore Site Screening

■ **Goals for North Carolina Coastal Wind:**

- “North Carolina ranks **first** on the East Coast for **offshore wind energy potential...**” NREL; Oceana Report, September 2010.
- “North Carolina is well positioned to develop utility scale wind energy production and it is the opinion of the project team that the State should **pursue it aggressively.**” UNC Study 2009.

■ **Developer Goals**

- Avoid, minimize, and mitigate impacts to human uses and environmental resources to ensure broad public acceptance, permitability and constructability.

■ **Stakeholder Goals**

- Preserve and protect human uses and environmental resources

■ **Challenge of site screening is finding a balance between these goals to promote responsible development of a strong renewable resource.**



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Area of Interest Determination for BOEMRE RFI

Challenges of Determining Area of Interest for BOEMRE RFI:

- The UNC Study provides an excellent baseline assessment of the potential for offshore wind development off the coast of North Carolina including the preliminary identification of areas and resources that should be avoided, preserved and protected.
- The UNC acknowledges the need for further “site-specific studies and assessments” of impacts and it is important to consider each potential environmental and human use constraint at each site very carefully.

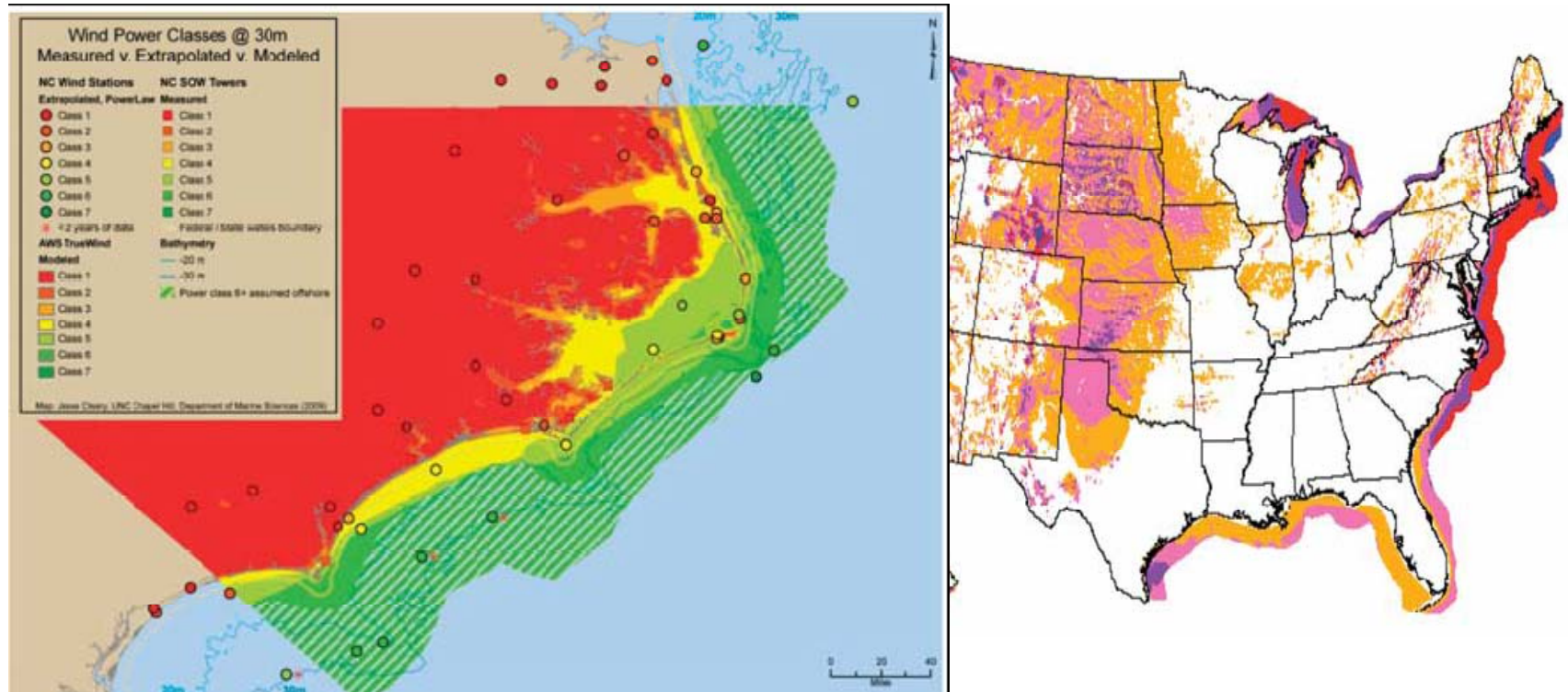


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Baseline Criteria for Area of Interest for BOEMRE RFI

- Wind Resource – Greater wind and energy resource further offshore



- Suitable Water Depths – Up to 50 meters



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Baseline Criteria for Area of Interest for BOEMRE RFI (cont.)

■ Coastal Buffer Zone

- UNC Study recommends 2-mile near shore buffer zone for visual impacts, shorebirds, migrating birds, coastal fishing and other impacts.
- Leave Developer discretion to site safe distance sensitive parks, wilderness areas, and conservation lands, e.g., Cape Hattaras, Cape Lookout & Bodie Island
- General visibility of offshore wind turbines is minimal at a distance of approximately 10 miles off shore.



Typical Site Screening Criteria

■ Human Use Constraints

- Traffic Separation Schemes and Fairways
- Precautionary and Caution Areas
- Military, Commercial and Private Aviation Flyways
- Restricted Areas
- Long Range Military & NEXRAD Radar
- Military Practice Areas
- Unexploded Ordnance
- Department of Defense Restricted Areas
- Cable and Pipeline Routes
- Commercial and Recreational Fishing Areas
- Dumping Grounds
- Mining or Sand Borrow Areas

■ Environmental Constraints

- Obstructions
- Submerged Cultural Resources
- Reefs – Natural and Artificial
- Sensitive/Critical Habitat or Biological Resource Areas
- Avian Resource Areas
- Bat Resources Areas
- Scenic Vistas
- National and State/ County Parks
- National Register of Historic Places (NRHPs)
- National Wildlife Refuges (NWRs)
- Wildlife Management Areas (WMAs)
- National Greenway and Greenbelt Corridors



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Fatal Flaw Areas to Exclude from Area of Interest

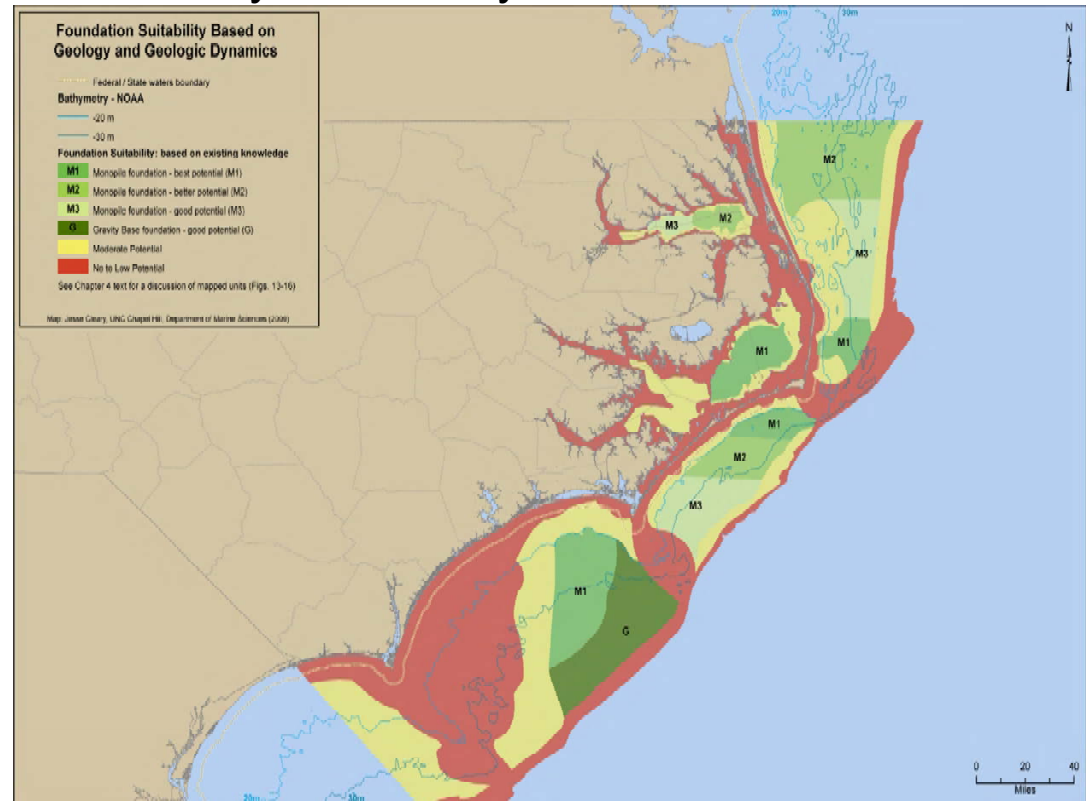
- UNC Study “No Build Zones”
 - Bathymetry: areas < 4 m in depth
 - Military Use Areas: radar zones, bombing ranges, special use air space (Navy use areas)
 - Dredged material disposal sites
 - Transportation corridors: shipping lanes, ferry routes, Intracoastal Waterway route (Traffic Separation Schemes and Fairways)
 - Sand Borrow Areas
 - Sensitive/Critical Habitat or Biological Resource Areas
 - Commercial and Private Aviation Flyways
- UNC Study Discrete No Build Points
 - Shipwrecks, artificial reefs, hard bottom
 - Cable and Pipeline Areas



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Challenges of Area of Interest Determination for RFI

- UNC Study acknowledges need for more “site-specific surveys and assessments” and some impact “boundary uncertainty”:
 - “detailed studies will be needed” of site geology
 - “evolving technology” for wind turbine foundations.
- Foundation Suitability Map Red: “No to Low Potential” →
- Developers prefer some flexibility to conduct further site-specific studies & consultations to identify specific characterization of subsurface and design appropriate foundations.

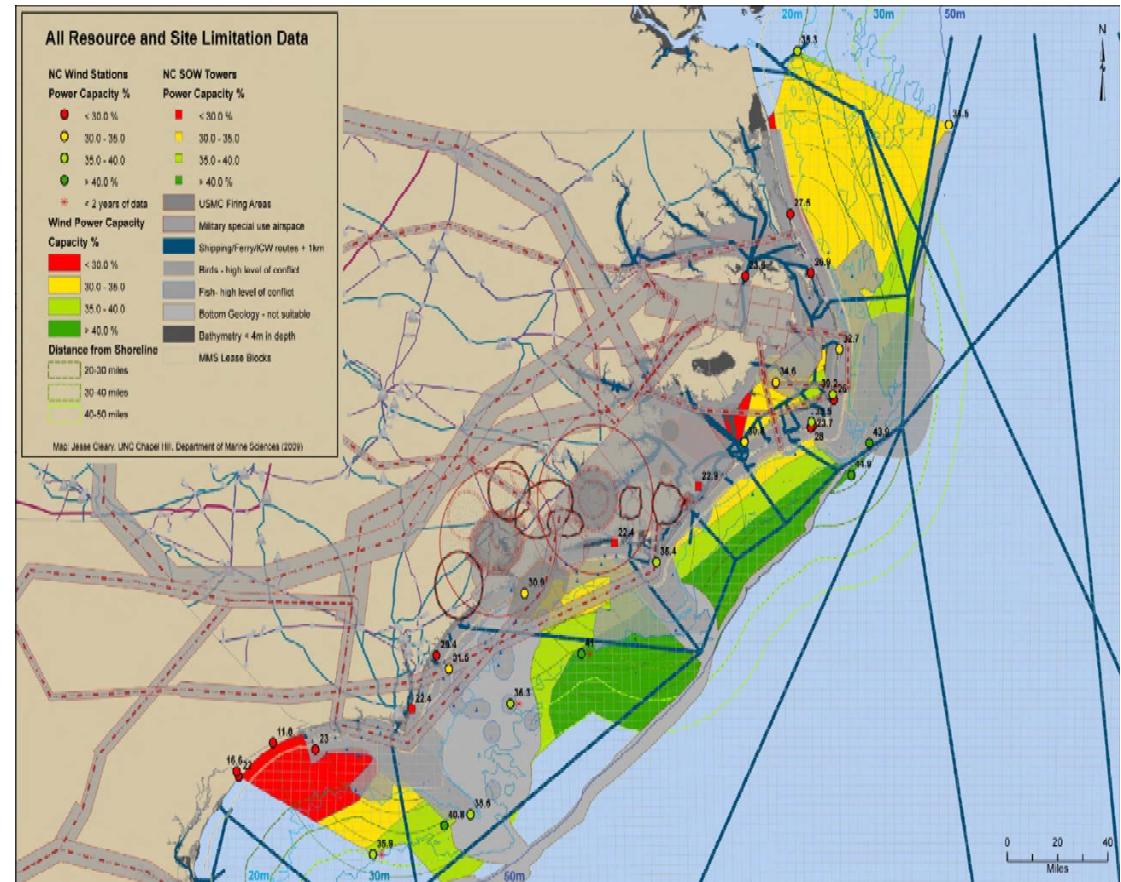


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Challenges of Area of Interest Determination for RFI

- UNC Study Study Area excludes any lease that touches any portion of a No Build Zone; BOEMRE allows leasing such blocks if no turbines within obstruction area.
- Developers prefer some flexibility to conduct further site-specific studies & consultations to identify specific characterization of subsurface and design appropriate foundations.



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Proposed Area of Interest for BOEMRE North Carolina RFI

- UNC Study provides an excellent and sufficient baseline identification of No Build Zones and preliminary evaluation of the human use and environmental factors to establish final Area of Interest for RFI.
- Some potential site-specific conflicts and impacts can be avoided, minimized or mitigated by wise investigation, analysis and siting outside of “No Build Zones”:
 - No Build Points to be excluded within turbine layout design
 - All other areas within 50 miles should be considered potential compatible use areas that should not be automatically restricted from development
 - Partial lease blocks may be nominated provided No Build constraints are avoided within turbine layout design
 - Developers should be afforded the opportunity to further investigate foundation suitability and other issues via site-specific analyses plus agency and stakeholder consultations.



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