

# MARINE ARCHAEOLOGICAL RESOURCES ASSESSMENT - REVOLUTION WIND FARM PROJECT, RHODE ISLAND

## Non-Technical Summary

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### Introduction

SEARCH, Inc. (SEARCH) completed a marine archaeological resources assessment (MARA) of geophysical and geotechnical survey data collected for Revolution Wind, LLC (Revolution Wind), at the proposed Revolution Wind Farm (RWF) and Revolution Wind Farm Export Cable (RWEC) areas in Rhode Island Sound and Narragansett Bay, Rhode Island. The purpose of the assessment was to identify submerged cultural resources or potential submerged cultural resources, that may be affected by seabed-disturbing Project activities, including site characterization surveys, and the construction, operation, and/or decommissioning of project facilities.

The U.S. Department of the Interior (DOI) is charged with managing the OCS under the Outer Continental Shelf Lands Act (43 U.S.C. 1337). DOI delegated certain responsibilities for regulation of renewable energy projects on the OCS to the Bureau of Ocean and Energy Management (BOEM), in the Energy Policy Act of 2005 (Pub. L. 109-58). Federal statutes and regulations require BOEM to identify historic properties and other significant cultural resources that may be affected by renewable energy projects on the OCS and to consider project effects to these properties prior to project approval. These requirements are established in the National Historic Preservation Act of 1966, as amended (NHPA; Title 54 U.S.C.), and the applicable procedures are outlined in the NHPA's implementing regulations (36 CFR § 800). The National Environmental Policy Act (NEPA; 42 U.S.C. 4321 et seq.) and NEPA's implementing regulations (40 CFR § 1500-1508) are also applicable. The Maximum Work Area for the wind farm represents the proposed area of potential effects (PAPE) for the Section 106 process and encompasses all areas of potential seabed disturbance associated with the wind turbine generators (WTGs), inter-array Cables (IACs) linking the WTGs, and the offshore substations. A corridor was defined along the RWEC to encompass the PAPE for construction, operation, and decommissioning of the export cable linking the wind farm to the terrestrial electrical grid.

BOEM has adopted regulations for the planning and development of renewable energy projects on the OCS in 30 CFR § 585. These regulations establish developers' responsibilities for the collection of information to support and facilitate the agency's compliance with the NHPA and NEPA. BOEM's Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR § 585 (May 2020) provides developers and their teams with information on how to comply with 30 CFR § 585. Additionally, stipulations in the OCS-A 0486 lease agreement, effective October 1, 2013, informed the work conducted by SEARCH.

The RWF is located in federal waters on the Outer Continental Shelf (OCS), within BOEM Renewable Energy Lease Area OCS-A-0486 (Lease Area). The Lease Area is located approximately 24.1 kilometers (km; 15.0 miles [mi]), 13.3 nautical miles [nm]) southeast of the coast of Rhode Island, and encompasses 33,480 ha (82,732 ac) with water depths ranging from 26 to 45 m (87 to 150 ft). The PAPE for the RWF measures approximately 21,526 ha (53,192 ac). To allow for flexibility in siting of the offshore components, a PAPE larger than the RWF footprint was assessed. Within the RWF, the project's PAPE is defined as the depth and

breadth of the seabed potentially affected by any proposed bottom-disturbing activities. The proposed RWF consists of up to 100 wind turbine generators (WTGs, turbines), submarine cables (IACs) connecting the WTGs, and up to two offshore substations (OSS) connected by an OSS interconnector cable.

The RWEC consists of two alternating current (AC) electric cables (275 kV each) that will connect the RWF to the existing mainland electric grid in North Kingstown, Rhode Island. The two submarine export cables are generally located within a single corridor measuring approximately 400 m (1,312 ft) wide and 80 km (50 mi) in length, encompassing approximately 4,116 ha (10,171 ac). Water depths range from 0 to 46 m (0 to 151 ft) within the RWEC and extends northwesterly through federal waters from the Lease Area, east of Block Island, and crosses into Rhode Island state waters approximately 12 km (7.5 mi) south of Newport, Rhode Island, making landfall at Quonset Point in North Kingstown, Rhode Island. Infrastructure utilized within the RWEC will be limited to transmission cables. The project PAPE along the RWEC is defined as the depth and breadth of the seabed potentially affected by any proposed bottom-disturbing activities.

The assessment was conducted to satisfy the federal regulatory requirements as outlined in the Bureau of Ocean Energy Management (BOEM) Offshore Renewable Energy Program's Guidelines on Providing Archaeological and Historic Property Information (30 CFR 585). Consistent with BOEM guidelines, Revolution Wind will seek to avoid cultural resources and potential cultural resources during project development, construction, operation, and decommissioning, where feasible. To accommodate alternate locations for turbine placement or cable routing required to avoid affecting potentially significant cultural resources, survey efforts included an area larger than the designed footprint of the RWF and the RWEC.

## Archaeological Assessment

The archaeological assessment for potential submerged resources included archival (background) research, geophysical (remote sensing) survey, geotechnical investigations, and laboratory analyses of sediment samples collected from the proposed RWF and RWEC corridor. Archaeological investigations and laboratory analyses were conducted in coordination with seven federally recognized Native American tribes. The methods and results of the integrated research are summarized below.

### Archival Research

Background research included a review of historical documents, previous research reports, state site files, shipwreck inventories, and historical maps. SEARCH coordinated with the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) to obtain materials concerning previous marine archaeological surveys and previously identified archaeological sites and shipwrecks within or near the PAPE. Relevant geological and paleoenvironmental sources were reviewed to assist in the effort to establish a baseline for the paleoenvironmental reconstruction of conditions during periods of potential pre-contact land use within the project area. Based on these studies, much of the region was under the glacial sheet during the Last Glacial Maximum (LGM) with coast lines hundreds of miles offshore of the modern day coast. Portions of the RWF now underwater would have been habitable dry land. Terrestrial landscapes existed in portions of the proposed wind farm between approximately 24,000 and 10,000 cal BP and may have been occupied by Native American people. As the glaciers retreated, additional portions of the project area became available for occupation until being submerged by rising sea levels. Portions of the RWEC would have been subaerially exposed until around 4,000 cal BP as sea levels reached near modern levels.

## Geophysical Surveys

Field investigations included a High Resolution Geophysical (HRG) marine survey utilizing a transverse gradiometer, side scan sonar, multibeam echo-sounder, single-channel and multichannel seismic, and shallow sub-bottom profilers. This instrument array provided data on objects and seabed features exposed on the seafloor as well as characteristics of buried sediments and potential preserved, ancient submerged landform features that may be affected by the Project.

The transverse gradiometer consists of two marine magnetometers connected in a rigid frame utilized to detect anomalies in the earth's magnetic field produced by ferrous objects. Magnetic data were collected, saved, edited, processed, and plotted, and anomalies tabulated according to magnetic intensity (total deviation of the magnetic background measured in gammas); detectable signature duration; signature characteristics (monopolar, dipolar, and multicomponent); and location. There were 46,462 anomalies of 5 gamma or greater identified within the PAPE during the 2017, 2018, and 2019-2020 geophysical surveys. Per BOEM guidelines, an amplitude threshold of  $\pm 5.0$  gammas was applied when analyzing magnetic anomaly significance. Most anomalies not meeting this threshold likely represent noise caused by a towfish heading error or an artifact of contouring. Actual sources producing such low-amplitude anomalies likely represent relatively small, insignificant debris sources. For the remaining magnetic anomalies above the  $\pm 5.0$  gamma threshold, analysis of the characteristics of each was undertaken and comparisons were made to verified examples of shipwreck magnetic signatures.

A side-scan sonar utilizes acoustic signals to produce an image of the seabed and any objects protruding above it. This image is ideal for detecting and recognizing submerged cultural resources exposed above the sediment. Side-scan sonar data were collected at a 30-m (98.5-ft) transect spacing, with the instrument set to collect imagery to a range of 50 m (164 ft) to either side of the towfish path (i.e., total swath width = 100 m [328 ft]). The combination of survey line spacing, range, vessel speed, and cable out allowed for nearly 100-percent imagery coverage between adjacent survey lines, including the nadir region beneath the towfish path. A total of 9,773 acoustic contacts (excluding contacts categorized as boulders) were identified. Side-scan sonar data from the PAPE was processed; acoustic imagery and mosaic images were reviewed to locate acoustic contacts indicative of potential submerged cultural resources exposed above the seabed. Side-scan sonar mosaics were mapped and layered to correlate with other Project data (e.g., magnetic contour maps, nautical charts, shipwreck databases, etc.). The acoustic characteristics of each individual contact were reviewed and compared to the acoustic characteristics of known shipwreck sites and other submerged cultural resources. This analysis includes the determination of linear objects, concentrated debris fields, or a potential ship-shaped outline. Potential submerged cultural resources identified in side-scan sonar imagery may have buried and or magnetic components and, therefore, correlation of the datasets is necessary when assessing acoustic contacts.

A multibeam echo-sounder assessed the current seabed conditions and collected bathymetric data throughout the project area. The seabed within the RWF is dominated by sandy sediments with high boulder field density across the central area that were deposited during the more recent glacial periods and subsequently submerged by marine transgression. Bathymetric changes appear gradual with the exception of a marked rise in seafloor topography near the RWF central area, due to the presence and erosional resistance of the moraine deposits.

A sub-bottom profiler utilizes soundwaves to penetrate the seabed in an effort to image the subsurface stratigraphy. Both shallow and deep penetration sub-bottom profiler systems were utilized during the HRG survey. Environmental conditions allowed for a maximum vertical penetration of 5-7 m (16-23 ft) by the shallow penetration sub-bottom systems which utilized 30-m (98-ft) spaced lines and up to 70 m (230 ft) by the medium penetration systems which utilized 150-meter spaced primary and 500-meter spaced tie lines. Processed sub-bottom profiler imagery as well as a preliminary ground-model of the PAPE were reviewed and analyzed. The spatial extents of the various horizons were reviewed, select individual profiles were analyzed, and the results of the available geotechnical results were compared to the geophysical data to identify potential geomorphic features of archaeological interest and man-made features that are indicative of potential submerged cultural resources buried beneath the seabed.

Sub-bottom imagery assists in the assessment of the preserved, submerged landscape and how it was affected by the dynamic environment. The sub-bottom horizons were mapped and layered with other Project data and correlated to the various datasets. Although the swath for data collected by the sub-bottom profiler is narrow, this subsurface dataset can also assist the assessment of potential submerged cultural resources observed in the magnetic and side-scan sonar records. If a potential resource is located directly beneath the sub-bottom, it may be displayed in the acoustic imagery. Processed sub-bottom profiler imagery could potentially indicate the burial depth of a magnetic anomaly's source or the buried extent of an acoustic contact.

The HRG survey data record displayed an abundance of natural (i.e., boulders and hard bottom) and man-made features (i.e., tires, navigation buoys, commercial fishing equipment, and trawling scours). The Project footprint crosses numerous submerged cable crossings, many of these cables were observed in the magnetic and acoustic record. The majority of remaining acoustic contacts and magnetic anomalies likely represent small debris objects. Sub-bottom profiler imagery captured four (4) geologic time spans within the Project footprint's buried stratigraphy: the Holocene and Pleistocene Epochs, and the Tertiary and Cretaceous periods. Within the PAPE, 9,773 acoustic contacts (excluding contacts categorized as boulders) and 46,462 magnetic anomalies were identified in the remote-sensing data. Many of the magnetic anomalies are considered geologic as their locations frequently correspond with the boulder fields detected during processing.

Analysis of the HRG survey data identified 19 potential submerged cultural resources (shipwrecks or potential shipwrecks) within the RWF and RWEC. Seven targets are located along WTG corridors in the RWF; seven targets are located in the IAC area in the RWF; one target spans both a WTG corridor and a portion of the IAC; and four targets are located along the proposed RWEC. SEARCH identified 13 geomorphic features of archaeological interest within the PAPE, eight of which are in the RWEC and five in the RWF.

## Geotechnical Investigations

The potential for geomorphic features of archaeological interest within the PAPE was assessed through the integration of vibracore sampling, ground modelling, and sub-bottom imagery. Geomorphic features of archaeological interest, now more commonly referred to as potential ancient submerged landform features, are former terrestrial surfaces that were preserved during marine transgression and buried under the seabed on the OCS. These features were capable of supporting human habitation and range from former river systems and their associated floodplains to upland terraces. Based on analyses of the HRG survey data (2019 geophysical survey campaigns) and in consultation with tribal representatives, 27 shallow geotechnical samples (vibracores) were obtained for geoarchaeological assessment. Coring was used to identify possible

geomorphic features of archaeological interest and ground truth the geophysical data. The combined geophysical and geotechnical datasets were critical in the development of the paleolandscape reconstruction describing the character of the once-exposed ancient landscapes within the project area and the refinement of the geologic context used by archaeologists to assess where parts of the ancient landscapes may be preserved.

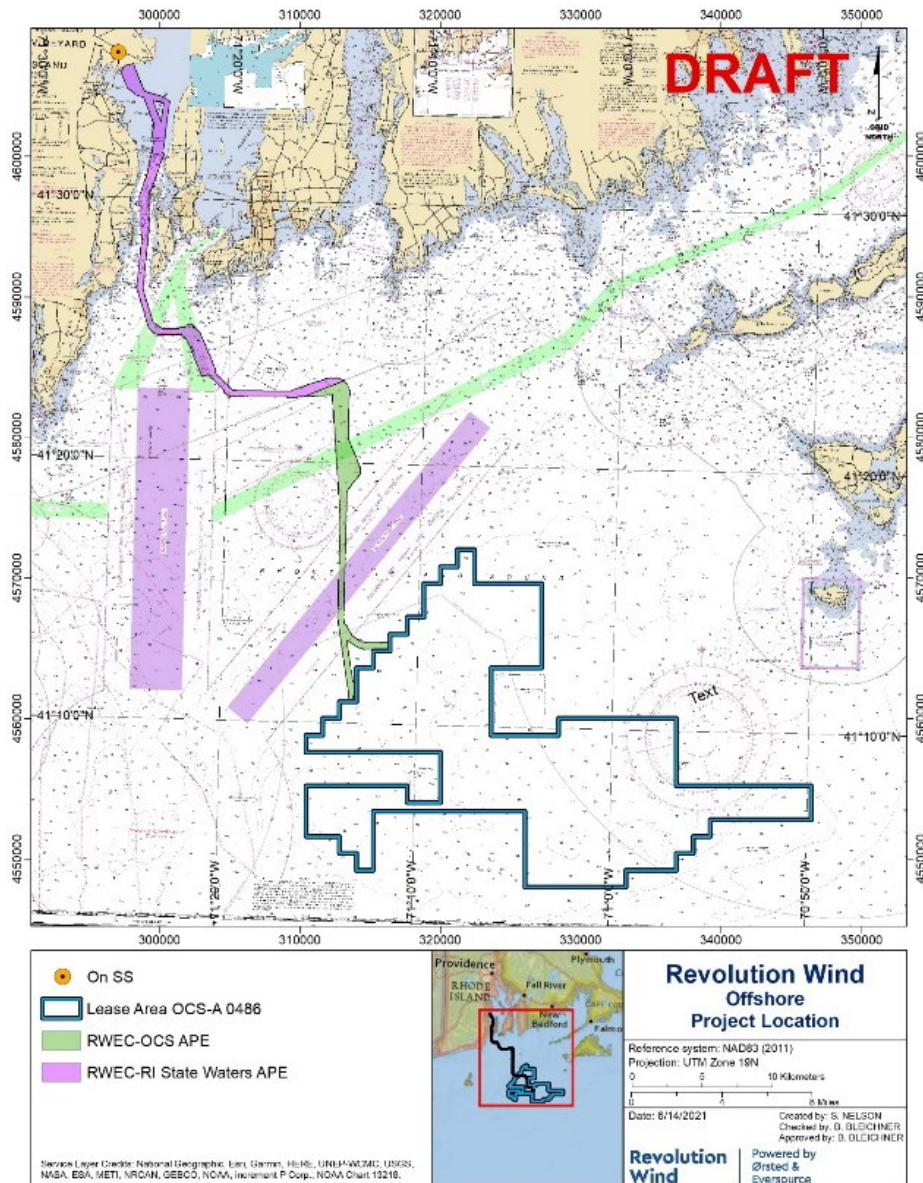
Additionally, bathymetric data and seabed characterization provide initial windows into the preservation potential of buried paleolandscape features. The RWEC route bathymetry increases fairly uniformly from 0 m (0 ft) mean lower low water (MLLW) at landfall to -46 m (151 ft) MLLW as it enters the RWF. Water depths within the RWF range from -30.0 m (-98.4 ft) to -48 m (-157.5 ft) MLLW with a marked rise in seafloor topography near the central area, due to the presence and erosional resistance of the moraine deposits. The seafloor along the RWEC is primarily a fine-grained muddy, sandy seafloor transitioning to more sandy sediments as it exits the West Passage. Along the RWEC, potential bedrock outcrops exist around Brenton Reef and south of West Passage. Seabed characterization of the RWF indicates the seafloor is dominated by sandy sediments with high boulder field density across the central area.

Extensive boulder fields were mapped throughout the PAPE. Boulder fields with low and medium density are presumed to have a subsurface component of smaller boulders, which have self-buried within the fluid Holocene sands. Evidence of this assumption and process can be observed in areas where the moraine deposits currently are experiencing erosion. The boulder fields present through the central region of the RWF are remnants of the Ronkonkoma/Nantucket Terminal Moraine, the terminal moraine most closely associated with the LGM. These deposits traverse the entire width of the southern half of the RWF from the southwest to the northeast. Human habitation of the landscape prior to glacial retreat would have been limited to areas well-beyond the terminal moraine deposits.

The completed MARA indicates that geomorphic features of archaeological interest (potential ancient submerged landforms) are present within the RWF and RWEC. A total of 13 geomorphic features of archaeological interest were identified within the PAPE, eight within the RWEC and five within the RWF. The destructive processes of glacial advance and subsequent retreat, followed by Holocene sea level rise and marine transgression, obliterated the majority of the paleolandforms often associated with human occupation.

The majority of the Project's seafloor disturbance is limited to 3.0 m (10 ft) below seabed (bsb), except between kilometer post 2.5-20, where the seafloor disturbance is limited to 4.0 m (13 ft) bsb. The stratigraphic unit overlying horizon H20, the shallowest lithostratigraphic unit with the potential to possess geomorphic features of archaeological interest, falls within this range throughout the RWF and minimally in the RWEC. Due to marine transgression and heavy reworking or erosion of the surficial sediments by nearshore processes, the majority of the flanking features associated with these channels, i.e., those available for human habitation, have been erased from the geologic record. Discontinuous channels with their margins removed represented the H20 horizon and stratigraphic unit overlying it. These features do not represent the totality of preservation within the RWF or RWEC, as many well-preserved and defined features were observed below the vertical PAPE. Moreover, the possibility for discrete localities to exist within the data is possible (i.e., glaciolacustrine features not mapped due to limited, observable spatial extent). The targets selected as geomorphic features of archaeological interest derive from the overlap of the PAPE and the ground model's interpolated horizons/grids.

In general, the RWF and RWEC have experienced heavy erosion and reworking by glacial and marine processes. Large swaths of the RWF are void of any potential for geomorphic features of archaeological interest due to non-deposition and marine transgression. Boulder fields present across the RWF represent terminal moraines from the LGM and from a possible later recessional moraine (H27) (Charlestown Moraine). Two targets represent the post-glacial/pre-inundation landforms (paleochannels and margins) partially preserved in the RWF south of the projected terminal moraine. Three targets, all present in the northern portion of the RWF, consist of post-glacial/pre-inundation landforms (paleochannels and margins) north of the projected terminal moraine. This area also would have undergone partial inundation by the expansive glacial lakes until they began draining west of the RWF. Kettles and other small glacial lakes may have remained, offering a favorable biome for human occupation. Eight targets are all within the RWEC, with extents that may extend outside of the PAPE. Several channels are quite deep (max of depth of 18.8 m [61.7 ft] bsb) and may have been subaerially exposed for an extended period of time, as the RWEC is believed to have been inundated much later than the RWF. The extent of the intact geomorphic features of archaeological interest within the PAPE is relatively minimal due to the relatively shallow impacts of the cable installation process, wind turbine layout, and marine transgression.



## Conclusions and Recommendations

SEARCH's analyses indicate 13 preserved geomorphic features of archaeological interest (ancient submerged landform features) identified in the 2017, 2018, and 2019-2020 surveys exist within the RWEC and RWF. Along the RWEC, these potentially sensitive settings are confined to deep streams or river channels and associated margins on the formerly exposed landscape. Within the RWF, the geomorphic features of archaeological interest include paleochannels and margins both north and south of the projected LGM terminal moraine.

While no direct evidence of pre-contact Native American settlements or other types of cultural sites was identified within the PAPE, the survey did indicate that the majority of the RWF project area was an exposed terrestrial landscape following the LGM approximately 24,000 years ago, and before being inundated during marine transgression. A small segment of the RWF was a pro-glacial setting before and during the LGM.

Portions of the RWEC were exposed subaerial landforms until 4,000 years ago when sea levels neared modern levels. This suggests that the landscape could have supported Native American populations during the Paleoindian and Archaic periods. The identified geomorphic features of archaeological interest within the RWF and RWEC have the potential to contain Native American sites associated with settlements or other uses of the formerly terrestrial landscapes. SEARCH recommends avoidance of the 13 identified geomorphic features of archaeological interest located within the PAPE. Further consultations among BOEM, Revolution Wind, Native American tribes, and other parties are needed if the landforms cannot be avoided as part of the Section 106 process.

Analysis of the HRG survey data identified 19 potential submerged cultural resources (shipwrecks or potential shipwrecks) within the RWF and RWEC. SEARCH recommends that all identified shipwreck sites be avoided by a minimum 50-meter (164-foot) buffer calculated from the maximum discernable extent of the remains to avoid potential adverse effects to these resources. No further archaeological investigations of the shipwrecks or possible shipwrecks are recommended unless these resources cannot be avoided.