U.S. Department of Energy - Public Scoping Process for DOE/EA-2049
New England Aqua Ventus I - Proposed Project Description – Modification 001 – 03/06/2017

The U.S. Department of Energy (DOE) has made the following modification (001) to the proposed project description:

- On page 10, Lobster Cove Road has been revised to Black Head Road. Note: this change is highlighted in yellow.

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1.0 Description of the Proposed Project

The Proposed Project, New England Aqua Ventus I (Aqua Ventus), would consist of the design, construction, operation, maintenance, and eventual decommissioning of a 12 MW offshore wind advanced technology demonstration project. The design details provided in this Proposed Project description are preliminary pending completion of technical studies and final design processes. Aqua Ventus would consist of:

- Construction of a cofferdam, a water-tight enclosure, at an existing industrial facility along the Penobscot River in Hampden, Maine;
- Two 6 MW turbines supported on floating concrete foundations (see discussion below);
- Three or four steel drag embedment anchors per turbine or three or four gravity anchors (i.e. large weighted anchors) per turbine and associated mooring lines;
- Two 0.5-mile long submarine cables to interconnect each turbine to a seabed hub;
- One 16.2-mile long submarine cable, including a fiber optic communications cable (export cable) connecting Aqua Ventus from the seabed hub to an existing Central Maine Power (CMP) distribution line located in Port Clyde within the town of St. George, Maine; and
- Installation of a connection vault and a grounding transformer between the subsea cable and the CMP line, and construction of a Static Reactive Power Compensation System (required for voltage regulation or stability) between the subsea cable and the first CMP customer on the CMP line (described further in Section 3).

Considering the rapid advances in turbine technology that could result in energy production benefits, the University of Maine (UMaine) design team is also evaluating the possibility of upgrading from 6 MW to 8 MW turbines (16 MW total), which would be 5% - 10 % larger. However, use of the 6 MW turbine is more likely.

The offshore components of Aqua Ventus, including the turbines, seabed hub and associated cables, would be located in the Maine Offshore Wind Energy Research Center (Monhegan Test Site) approximately 2.5 miles south of Monhegan Island in Lincoln County, Maine and about 12 miles off the mainland (Figure 1). The export cable would traverse the seabed, mostly within an existing cable area, to a landing point in Port Clyde, which is part of the town of St. George, Maine, where it would interconnect with an existing CMP distribution line that terminates at a CMP substation in Rockland, Maine. CMP is planning to rebuild 8.8 miles of distribution line from the Route 73/Route 131 intersection to Port Clyde to accommodate the Proposed Project.

There are several locations under consideration for the cable landfall point at Port Clyde, approximately 1,200 feet apart.

Additional project components includes the construction of a cofferdam for use in the construction of the two floating foundations. The cofferdam would be built at an existing industrial facility along the Penobscot River in Hampden, Maine (Figure 1). Partial construction of the floating foundations would occur in the cofferdam and then the foundations would be towed down the Penobscot River to the Mack Point Marine Intermodal Cargo Terminal (Mack Point) in the town of Searsport, Maine (Figure 1). At Mack Point, assembly of the floating foundations and attachment of the turbine components to the foundations would be completed. The turbines/floating foundations would be towed to the Monhegan Test Site for deployment and operation for a period of approximately 20 years, subject to permitting.

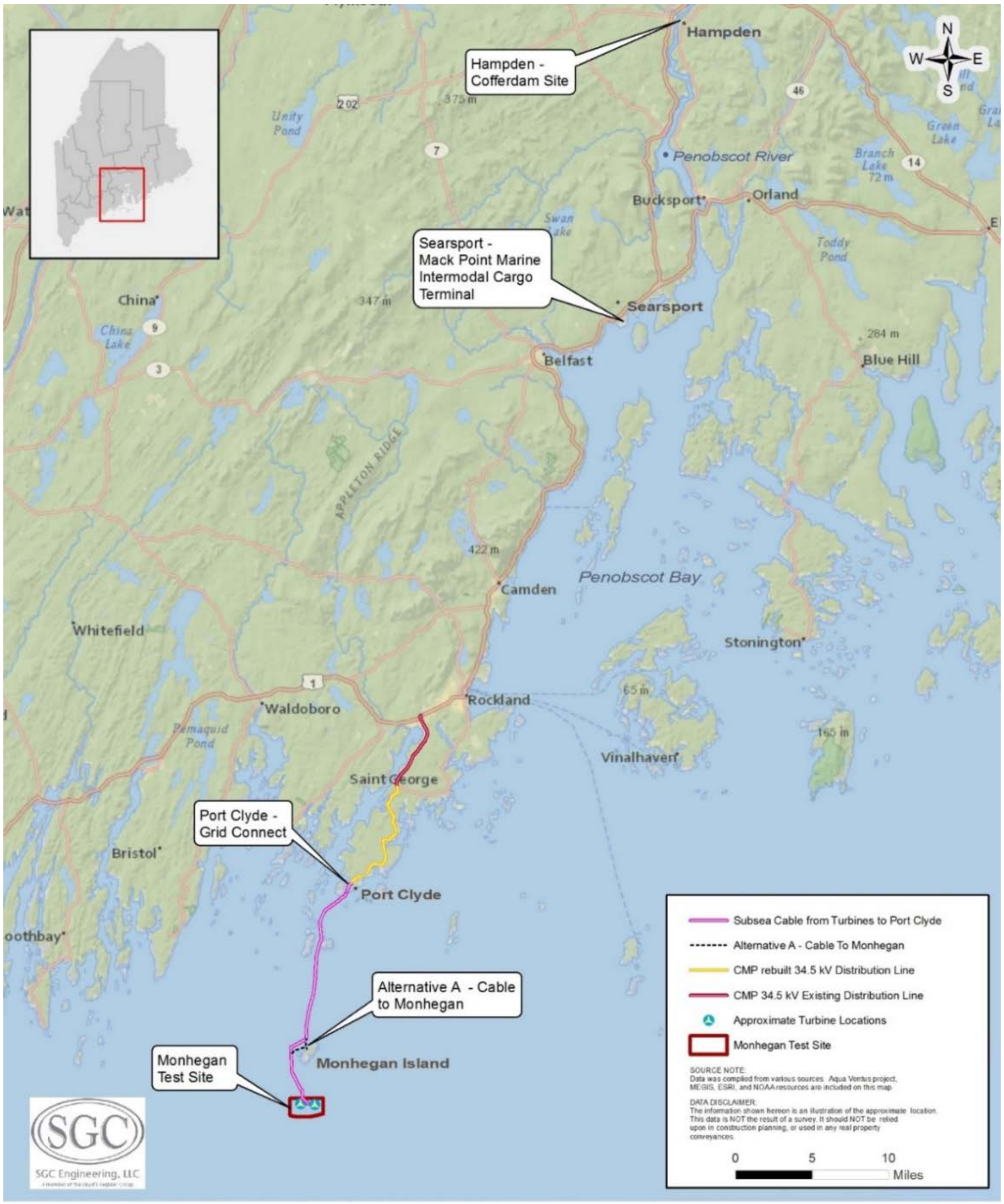


Figure 1. Proposed Location of New England Aqua Ventus I.

1.1 Alternative A: Cable to Monhegan Island

For Alternative A, the subsea export cable would run from the seabed hub to a landfall on Monhegan Island to provide a power source and fiber optic cable for high-speed internet to Monhegan Island. A second cable would run from Monhegan Island to a landing location at Port Clyde, most of which would be along the same route as described above in Section 1.0. From the landing point at Monhegan Island, the Proposed Project would connect to the Monhegan Plantation Power District (MPPD) generator/switchgear location. Other than the portion of the cable going to and from Monhegan Island and the MPPD location, the cable route, and all other project components would remain the same as described above in Section 1.0. This alternative is currently an option being negotiated by the residents of Monhegan Island as part of a community benefit agreement.

2.0 Monhegan Test Site

The Monhegan Test Site is approximately one mile wide and two miles long. Water depths in the area range from about 200 to 360 feet. This site was selected by the State of Maine under legislation implemented to encourage the development of offshore wind energy production in Maine (Title 12 M.R.S.A. Section 1868). The State of Maine identified this site after an intensive siting study, public outreach, and stakeholder engagement. The site is leased by the State to UMaine.

3.0 Wind Turbine, Floating Foundation, and Cable Design

Turbines

Aqua Ventus would consist of two turbines, each with a generating capacity of 6 MW. Offshore wind turbines typically operate 40% - 50% of the time throughout the year, depending on the site wind conditions. The turbines would be located about one mile apart in the Monhegan Test Site. The turbine rotor diameter would be approximately 495 feet and the center of the rotor would be at a height of approximately 328 feet above the waterline (hub height), for a maximum height of approximately 576 feet above the waterline (Figure 2). The tip of the blade, when at its lowest point would be about 81 feet above the waterline. As noted in Section 1, the UMaine design team is also evaluating the possibility of upgrading to 8 MW turbines (16 MW total), which would be 5% -10% larger than 6 MW turbines, The turbine and tower would be painted white. Lighting on the turbines would include two flashing red lights on top of the turbine to comply with Federal Aviation Act requirements.

Note: For an 8 MW turbine, approximate dimensions of the turbine would be: maximum height - 614 ft; rotor diameter - 538 ft; hub height - 345 ft. The floating foundation dimensions would be about 10% - 20% larger for an 8 MW turbine.

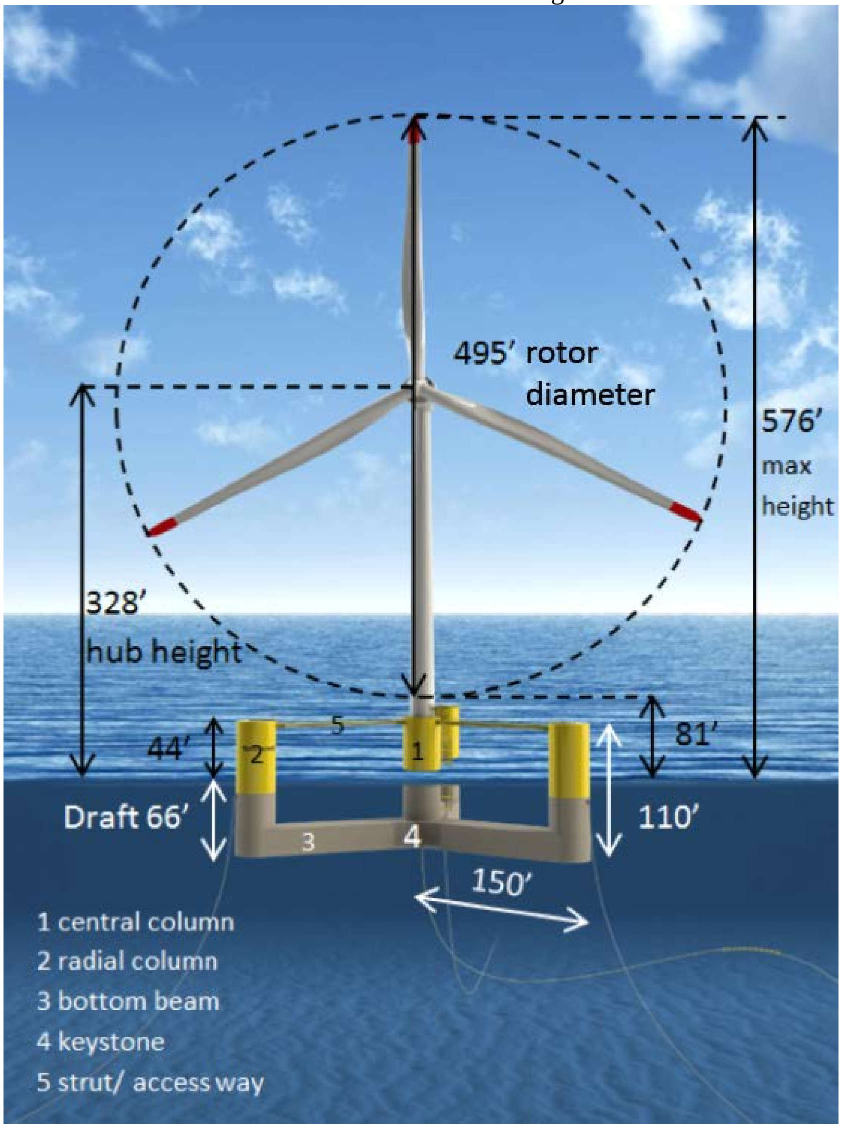


Figure 2. Anticipated Dimensions of Proposed Floating Offshore 6 MW Wind Turbines and Foundations (all dimensions are +/- 5 feet).

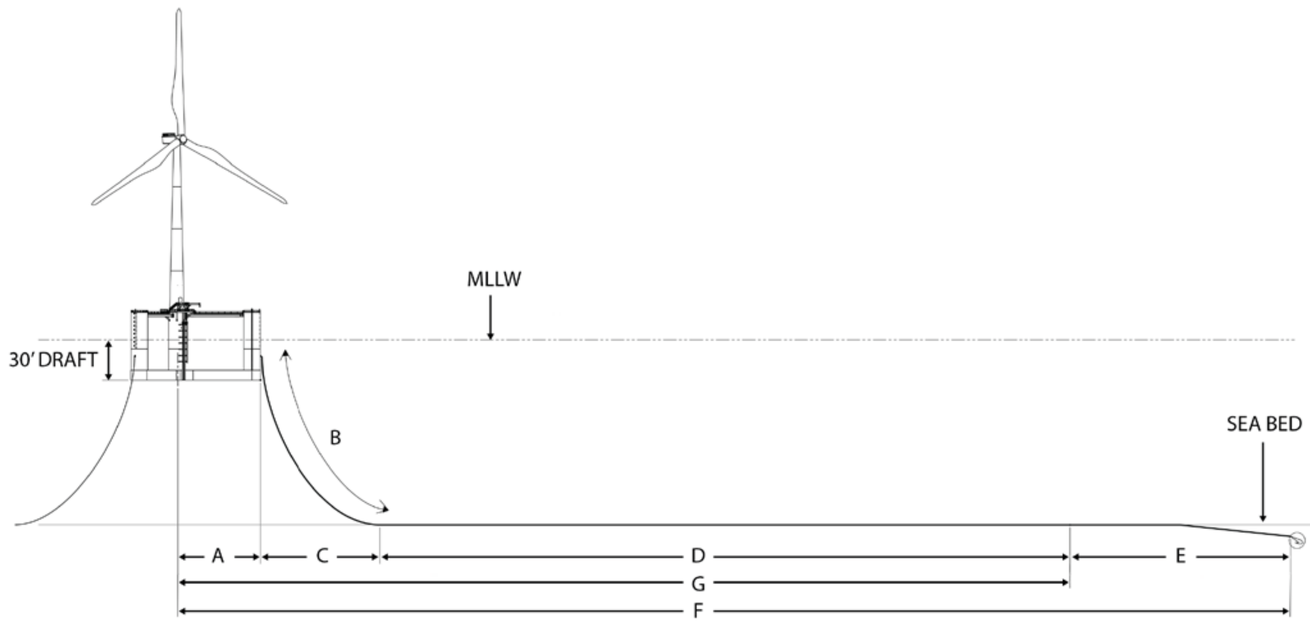
Floating Foundations

Each turbine would be supported by a reinforced concrete floating foundation. Each foundation consists of a central circular column supporting the wind turbine tower and three additional circular columns spaced radially from the center to form a tri-float configuration. This type of floating foundation is called a semi-submersible foundation. The floating foundation would extend approximately 66 feet below the waterline, extend 44 feet above the waterline (Figure 2), and would have a diameter of approximately 301 feet. There would be flashing lights on the floating foundations to comply with the U.S. Coast Guard navigation aid requirements.

Mooring and Anchoring System

Each floating foundation would be anchored to the seabed using three or four steel drag embedment anchors and chain mooring lines. Drag embedment anchors are similar to ship plow anchors, as shown in Figure 3. The mooring lines connect the anchors on the seafloor to the floating foundations, as shown in Figure 4. Chain mooring lines and drag embedment anchors are typically used for mooring large floating offshore structures, such as oil and gas platforms. In the event that the drag embedment anchors prove infeasible (e.g., because of lack of sufficient mud thickness on the seabed), the Proposed Project would instead use up to three or four large weighted anchors per turbine, called gravity anchors that would be placed on the seabed and connected to the floating turbine via chain mooring lines.

Figure 3. Example of a Drag Embedment Anchor.



DIMENSION	DESCRIPTION	EAST TURBINE			WEST TURBINE		
		E1	*E2*	*E3*	*W1*	*W2*	*W3*
A	DISTANCE FROM HULL CENTER TO MOORING ATTACHMENT (FT)	150	150	150	150	150	150
B	SUSPENDED CHAIN LENGTH (FT)	433	433	433	531	531	531
C	HORIZONTAL DISTANCE OF SUSPENDED CHAIN (FT)	329	345	350	306	306	306
D	MINIMUM REQUIRED LAID CHAIN LENGTH (FT)	1,339	1,339	1,339	1,362	1,362	1,362
E	DIFFERENCE OF F AND G (FT)	0	266	413	476	367	932
F	TOTAL HORIZONTAL FROM ANCHOR TO TURBINE CENTER (FT)	1,818	2,099	2,252	2,293	2,185	2,749
G	MINIMUM HORIZONTAL DISTANCE PER MMC: A+C+D (FT)	1,818	1,818	1,818	1,818	1,818	1,818

Figure 4. Elevation View of the Proposed Mooring Line Design (Not to Scale).

Cables

Each turbine would have an export cable for transmitting power at 34.5 kV, 3-phase Alternating Current (AC), and would be roughly four inches in diameter and armored (Figure 5). The cables would be supported in the water column with a series of clamp-on buoyancy modules or floats along the length of the cable to a seabed hub that would be installed on the sea floor. The seabed hub connects the 6 MW export cable from each turbine and the associated fiber optics to a 12 MW subsea export cable, approximately 5.5 inches in diameter (Figure 6). If 8 MW turbines are used, the cable would have a slightly greater diameter.

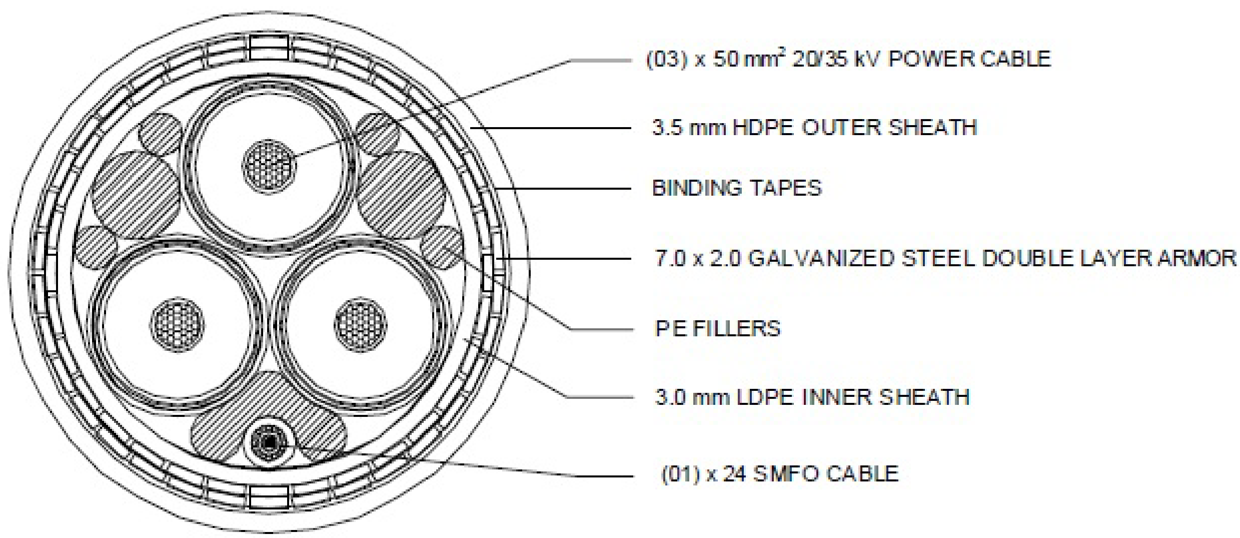


Figure 5. Cross-Section of Subsea Cable Showing Electrical Conductors and Fiber Optic Cable.

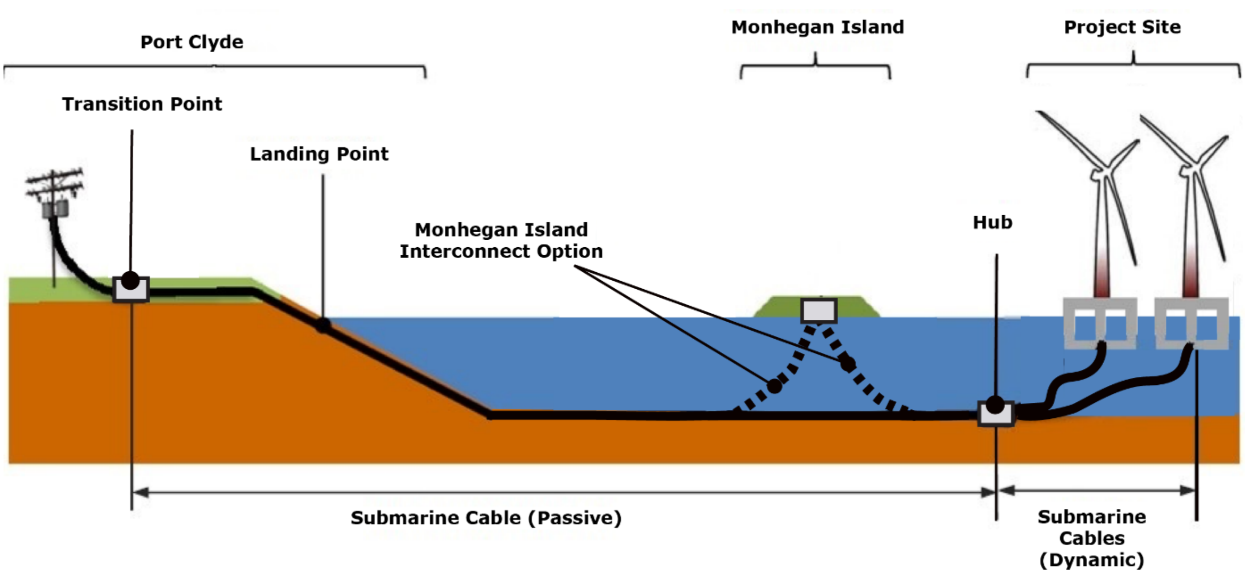


Figure 6. Components of Project Electrical Interconnection (Not to Scale).

Much of the Monhegan/Port Clyde cable route would be in an existing cableway formerly used for a communication cable. From the landing point in Port Clyde (as noted, several options, about 1,200 feet apart, are being considered) the cable would be routed underground for approximately 775 feet and overhead for 725 feet to the point of interconnect with an existing CMP distribution line.

A Static Reactive Power Compensation System would be required by CMP for voltage regulation or stability. It would be located at a site still to be determined adjacent to the rebuilt CMP line in Port Clyde, between the subsea cable and the first CMP customer on that line. The facility would consist of a fenced area, measuring 80 feet x 80 feet, surrounded by a 16 foot-wide access road. The fenced area would contain electronics packaged in a steel container, two or three transformers mounted on concrete pads, and a breaker (to separate the Aqua Ventus Project from the CMP line).

Alternative A, Cable to Monhegan Island – From a landing point on Monhegan Island, the subsea export cable from the seabed hub and the subsea cable to Port Clyde would be buried below ground for about 300 feet to a vault. At that location, the two cables would be spliced to a third cable, for connection to the MPPD. The landing point would be in Deadman's Cove, or possibly some other nearby location and the cable would be routed to take advantage of the existing subsea cable ROW to the degree feasible. If located in Deadman's Cove, the Monhegan cable likely would be connected from the splice to a transformer then run underground or overhead on a rebuilt pole line, formerly used by the telephone utility, for approximately 680 feet to Black Head Road, and then underground approximately 650 feet, parallel to an existing MPPD line. This line would terminate at the MPPD generator/switchgear location (Figure 7).

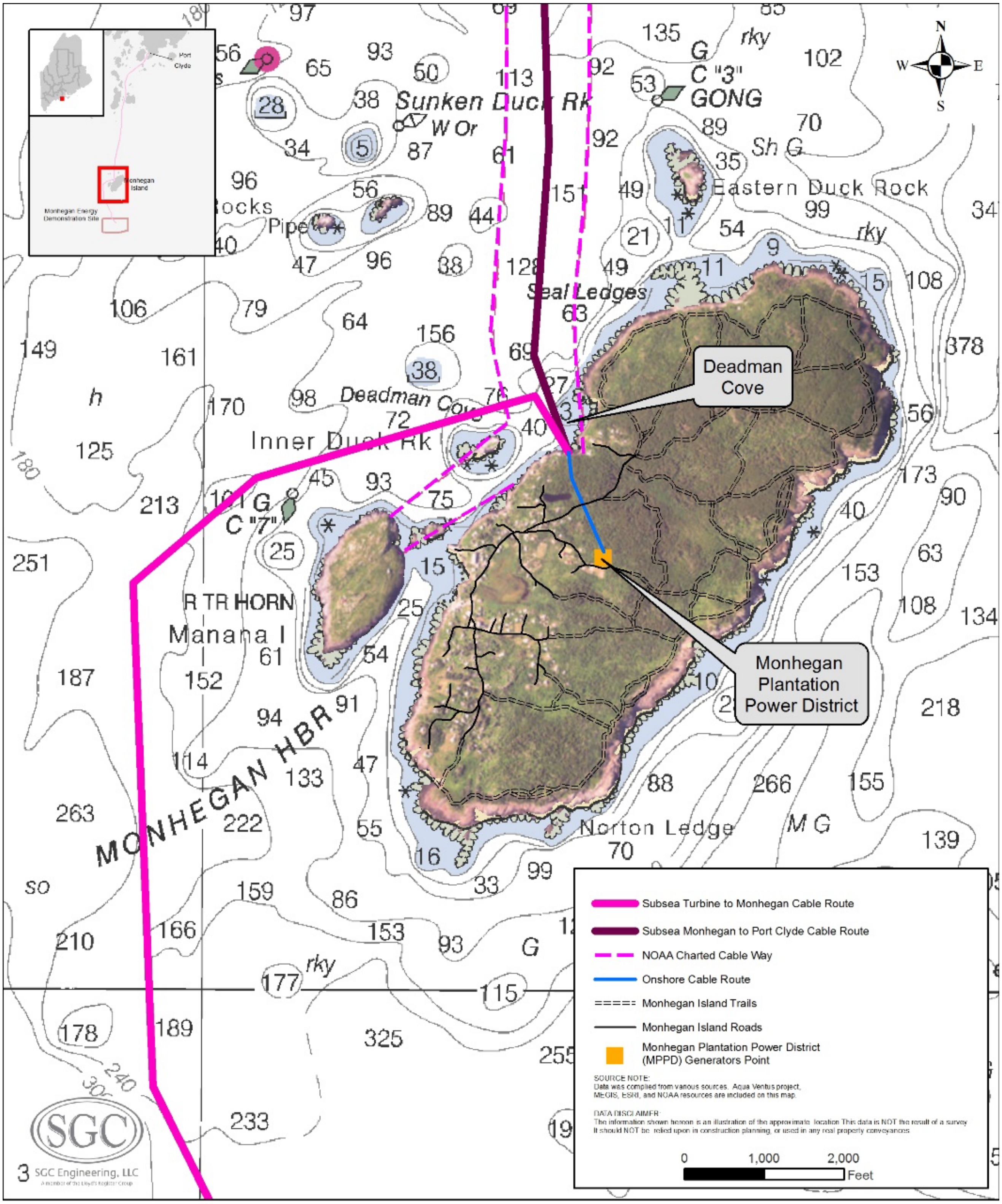


Figure 7. Proposed Cable Route, Monhegan Island.

4.0 Assembly and Installation

Assembly

The floating foundations would be constructed and partially assembled in a cofferdam. The cofferdam would be constructed along a tidal portion of the Penobscot River in Hampden, Maine at an existing industrial facility (Figures 8 and 9). Access to the Aqua Ventus assembly site would be through an existing entrance from U.S. Route 1 - Main Road North. The existing access road to the concrete batch plant, which is within the interior of the industrial facility and part of which runs parallel to the river, might be relocated slightly to the west (away from the river).

The cofferdam would be approximately 380 feet by 370 feet. The top of the cofferdam would be slightly higher than the river's elevation at high tide, whereas the base of the cofferdam would be below the elevation of low tide. Approximately 38,000 square feet (0.9 acre) of river bottom, some of which is exposed during low tide, would be dredged adjacent to the cofferdam to provide sufficient depth to float the foundations into the river channel. Dredging would occur over about four weeks. Excavation of the cofferdam would take about two to three weeks and construction of the cofferdam would take about four months. Blasting might be required to loosen or break up rock that cannot be removed in its current form during cofferdam excavation. Construction of the two foundations is expected to take about a year. If 8 MW turbines are selected for the project, the cofferdam would need to be about 10% - 20% larger to accommodate construction of larger floating foundations.

The floating foundation bases would be towed using a tugboat down the Penobscot River to Mack Point. The upper columns of the foundations would be shipped separately on barges, from the cofferdam to Mack Point.

At Mack Point assembly of the floating foundations would be completed and the turbine tower, nacelle (houses the shaft, gearbox, generator and controls), and blades would be installed on each floating foundation. The Maine Department of Transportation is planning to upgrade the Mack Point Facility to accommodate a larger crane capacity, and this Proposed Project would be one of the first customers to use the upgraded facility. Once assembly is complete, the turbines/floating foundations would be temporarily moored at state owned oil transfer areas next to Mack Point, to await suitable conditions and timing for deployment at the Monhegan Test Site. Assembly activities at Mack Point would take about six months, and the duration of mooring at the transfer areas is currently not known but would not exceed one year.

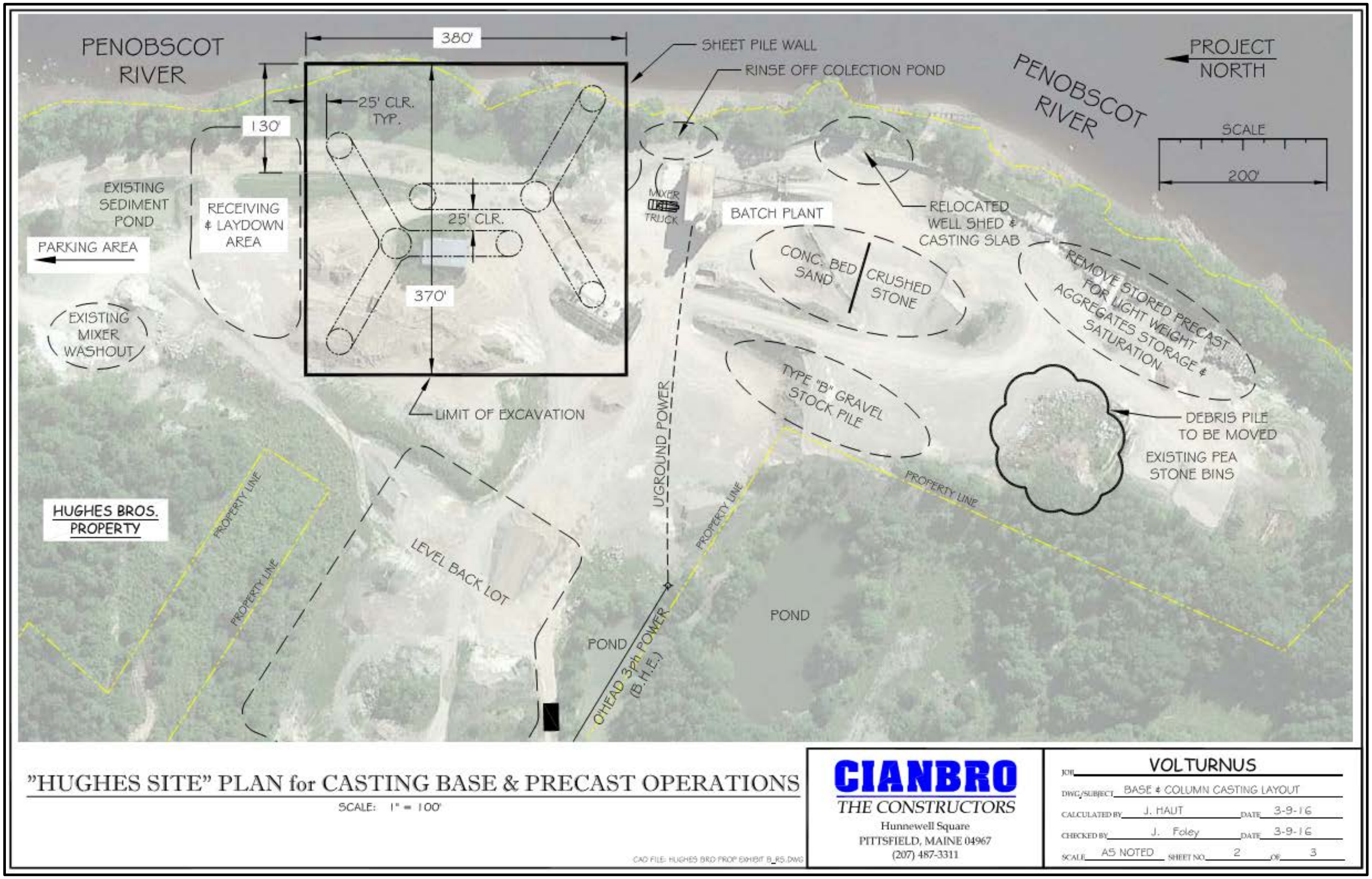


Figure 8. Proposed Cofferdam for Construction of Floating Foundations.

Note: Areas indicated as "to be moved" or "removed" would be relocated on-site at a location still to be determined. If 8 MW turbines are selected for the project, the cofferdam would need to be about 10% - 20% larger to accommodate construction of larger floating foundations.

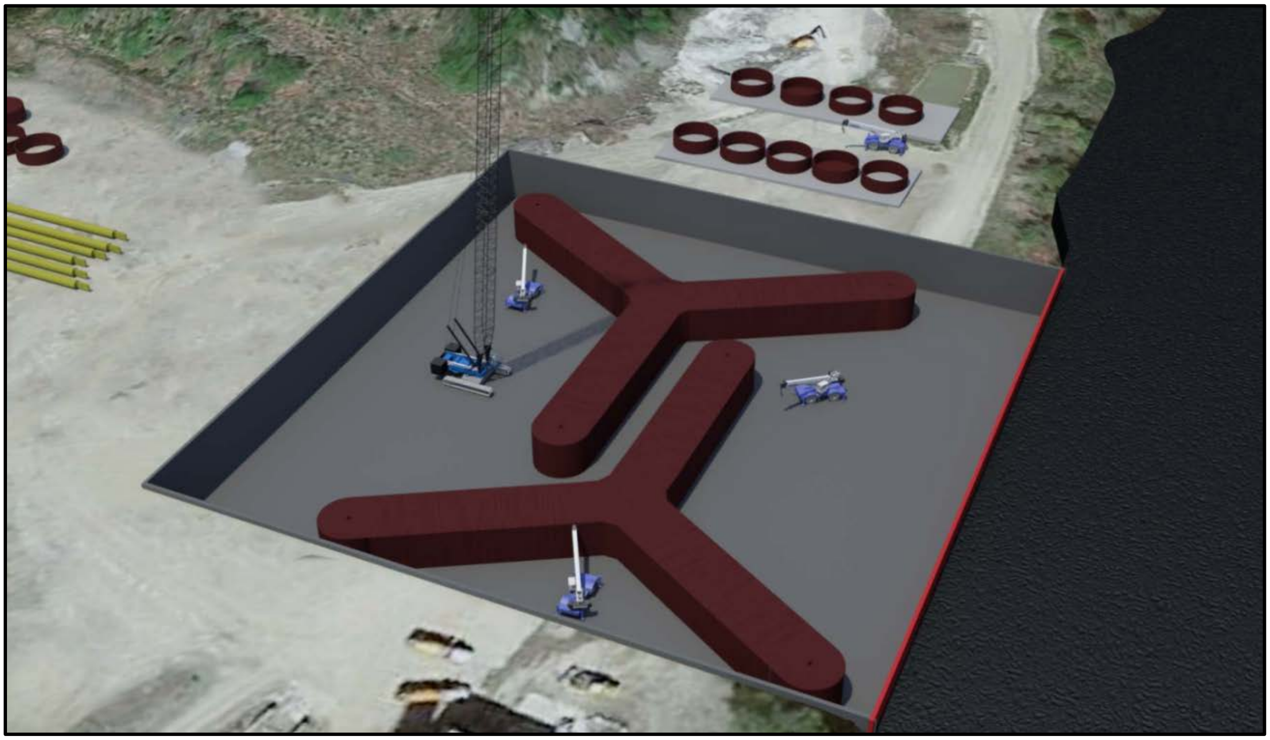


Figure 9. Rendering of Cofferdam.

Anchor and Turbine Installation

Drag embedment anchors would be installed in the seabed at the Monhegan Test Site prior to deployment of the turbines. The drag embedment anchors would be dragged along the seabed by an anchor handling/installation vessel until they reach the required depth. As the anchor penetrates the seabed, soil resistance holds it in place. Gravity anchors, if used, would be placed directly on the seabed in an appropriate manner (not on a steep grade or other undesirable base). Each turbine/floating foundation would be towed to the site with a tugboat and connected to the chain mooring lines attached to the anchors.

Subsea Cable Installation

In water depths less than 100 feet, the subsea cable, including the alternative option for the cable to Monhegan Island (Alternative A), would be buried by a cable installation vessel trenching to a depth of at least three feet. The cable would be laid on the seabed and protected with rock or concrete mattresses if bedrock will not allow for burial. Deeper burial of up to six feet would be required in short sections where the cable crosses shipping lanes or harbor areas in water depths of less than 100 feet. Where the water is deeper than 100 feet, the cable would be placed on the seabed. Near shore, in water too shallow for the cable installation vessel (less than 15 feet deep), an excavator working from a barge would first dig a trench along the cable route and deposit excavated sediment next to the trench. The cable would be placed in the trench, and then the excavator would move the side-cast sediment back into the trench, covering the cable. Currently, site geology at the Monhegan Island (Alternative A) and Port Clyde cable landings is not fully known. Future geotechnical studies would be completed to determine the most appropriate installation method. It is anticipated that a shore-based excavator would be used to dig a trench and install the cable in the same manner as described above for shallow water. However, it may be necessary to use other installation methods such as horizontal directional drilling at the cable landings. Revegetation of disturbed areas would occur following completion of installation activities.

Onshore Transmission Line Installation

In Port Clyde, the cable would be installed with underground and overhead portions as discussed in Section 3, to the CMP overhead distribution line. Roadwork, such as grading and paving, would be performed as needed to return the roadway to its previous condition.

Alternative A, Cable to Monhegan Island - In Monhegan, the cable would be routed underground to a splice to be located in a precast concrete vault. As noted, from the vault and adjacent stepdown transformer, the Monhegan cable would be buried in an excavated trench, or placed overhead on a rebuilt pole line, to reach the MPPD generator/switchgear.

5.0 Operation and Maintenance

Following deployment of the turbines, the Proposed Project would include collecting performance data on the turbines and floating foundations for approximately five years. The Proposed Project would operate for approximately 20 years.

During operation, the turbines would be inspected regularly both remotely and through onsite visits. The schedule of monitoring would be developed as part of an operations and maintenance plan. The structures' responses to waves, currents, and wind would be monitored remotely via on-board sensor, data acquisition, and communications systems. In addition, periodic visits to the turbine would be completed by boat to visually inspect the structure, perform maintenance, and address other issues as they arise. Environmental monitoring would occur following installation, including monitoring of bats and birds, marine life, and noise within and in the region surrounding the test site. The duration of environmental monitoring would be determined in consultation with resource agencies.

A base location for operations and maintenance (O&M) has not been selected. The O&M base, which may be an existing facility, would include an O&M building with car park. The O&M building would be used for remote monitoring and analysis, storage and repair of small and medium parts, and operation and maintenance team meetings. The O&M building would be located near, and have access to, a dock for workboat loading and unloading. The dock would need to have a crane to load components up to two tons onto the workboat.

6.0 Decommissioning

A Project Removal Plan would be developed for the Proposed Project as part of the state permit application. The floating foundations and turbines and associated moorings would be removed using similar equipment and vessels used in the assembly process. Project components would be reused, or disposed of in compliance with applicable requirements. In addition, drag embedment anchors would be removed. If gravity anchors are used, they would be removed, or they could be left in place for future use if appropriate regulatory authorization was received. It is expected that the subsea cable and the onshore transmission line would be left in place for possible continued use of the Monhegan Test Site and by area residents.

After construction activities related to the floating foundations are completed, the cofferdam would be decommissioned and the Penobscot River shoreline would be restored to previous conditions.