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Appendix L – Submerged Aquatic Vegetation Supplemental Material

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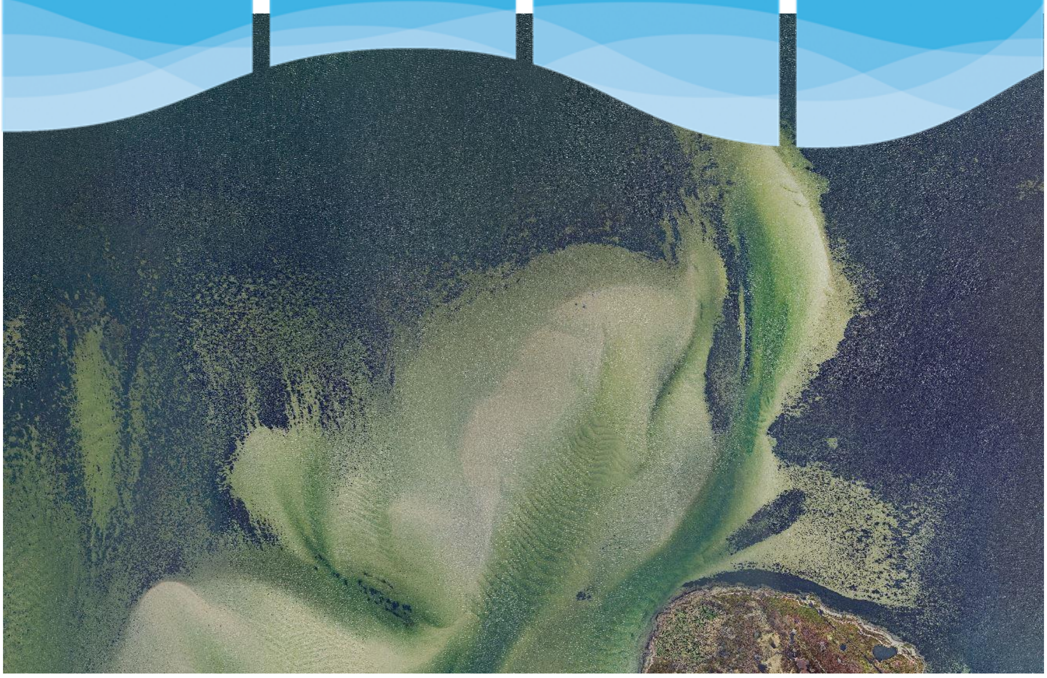
Phase 1 - Aerial Submerged Aquatic Vegetation Survey 2019



New Jersey Submerged Aquatic Vegetation Aerial Survey

HDR Engineering, Inc

APEM Ref: P00004340

December 2019

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1. Introduction

1.1 Project Background

APEM were commissioned by HDR Engineering, Inc (hereby referred to as HDR) to undertake an aerial survey of two coastal areas in New Jersey. The aim of the survey was to capture high-resolution aerial photography in order to map submerged aquatic vegetation (SAV) in the two areas.

1.2 Survey Locations

The project involved surveying two locations, one in Barnegat Bay, Ocean County and the other in Great Egg Harbor, Cape May County. An overview of the two locations is shown in Figure 1.

Figure 1. Location of the two sites surveyed in New Jersey. Yellow denotes the Barnegat Bay site and red the Great Egg Harbor site.

The Barnegat Bay site measured 28 square miles in area and is shown in more detail in Figure 2.

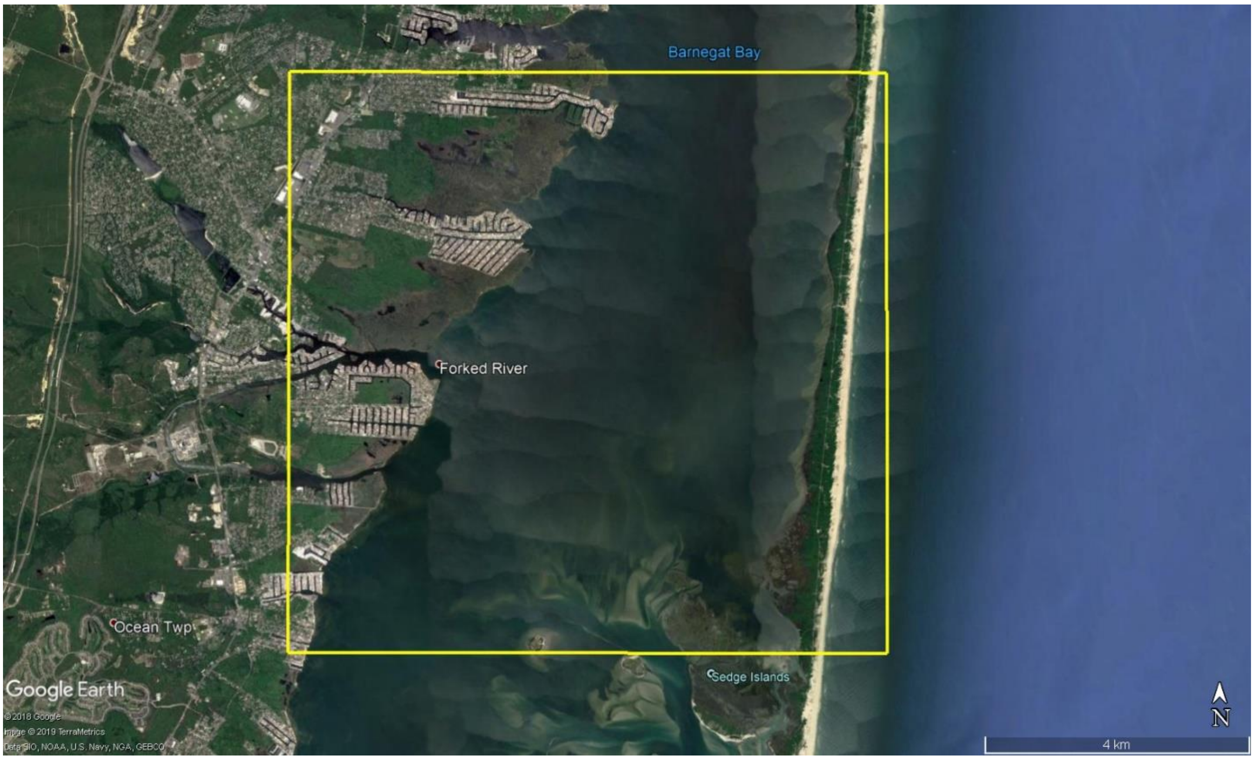

Figure 2. The Barnegat Bay survey area, outlined in yellow.

The Great Egg Harbor site measured approximately 13 square miles in area and is shown in more detail in Figure 3.

Figure 3. The Great Egg Harbor survey area, outlined in red.

2. Surveys and Data Processing

2.1 Aerial Survey

The aerial survey took place on October 7th 2019. The survey was carried out in a fixed wing aircraft using APEM's bespoke Shearwater III camera system surveying at an altitude of approximately 3,650ft above sea level. This allowed us to capture high-resolution imagery at a resolution of 4 cm ground sample distance (GSD). For Barnegat Bay, a total of 10,864 images were captured across 15 flight lines. For Great Egg Harbor a total of 7,299 images were captured across 10 flight lines. The survey was targeted to be complete within 1.5 hours either side of low tide, as this would allow for maximum intertidal exposure and help facilitate the mapping process.

Once the survey was complete, the data were downloaded and backed-up following APEM's stringent data management protocols.

2.2 Data Processing

The GPS data recorded on-board during the aerial survey were processed to produce location data for each aerial photograph's camera release point. These data were fed into photogrammetric processing software along with the imagery to produce georeferenced orthomosaics.

Over land, this photogrammetry process is able to create a seamless mosaic of the area. Over sea, however, it is often more problematic to generate the same type of seamless output due to the nature of the imagery (i.e. sun glint, changing wave patterns between adjacent imagery etc.). As such, a combination of automated processing and manual geo-referencing of images were required in order to achieve the required mosaic. This allowed a mosaic to be generated for all areas where the sea bottom could be seen within the imagery. For areas of deeper water where the sea bottom cannot be seen (typically in areas less than 7ft below mean sea level) in any of the imagery due to lack of light penetration, it was not possible to either georeferenced the imagery or map SAV. However, SAV has been documented to be very patchy and rare at depths of greater than 2m in New Jersey (Good *et al.,* 1978, Kennish *et al*., 2008). Therefore, it is unlikely these areas would contain SAV.

Once the mosaic was finalised, APEM marine biologists digitized areas of SAV using Geographic Information Software (GIS). Seagrass was mapped according to the following categories:

- Sparse cover; 10-40%
- Moderate cover; 40-80% cover
- Dense cover; 80-100% cover

The delineation of these categories was based on the data from the study by Lathrop *et al.* (2006), which mapped seagrass cover in the Barnegat Bay-Little Egg Harbor-Great Bay study area using these categories.

3. Results

The coverage maps for both survey areas are shown in Figures 4 and 5 below.

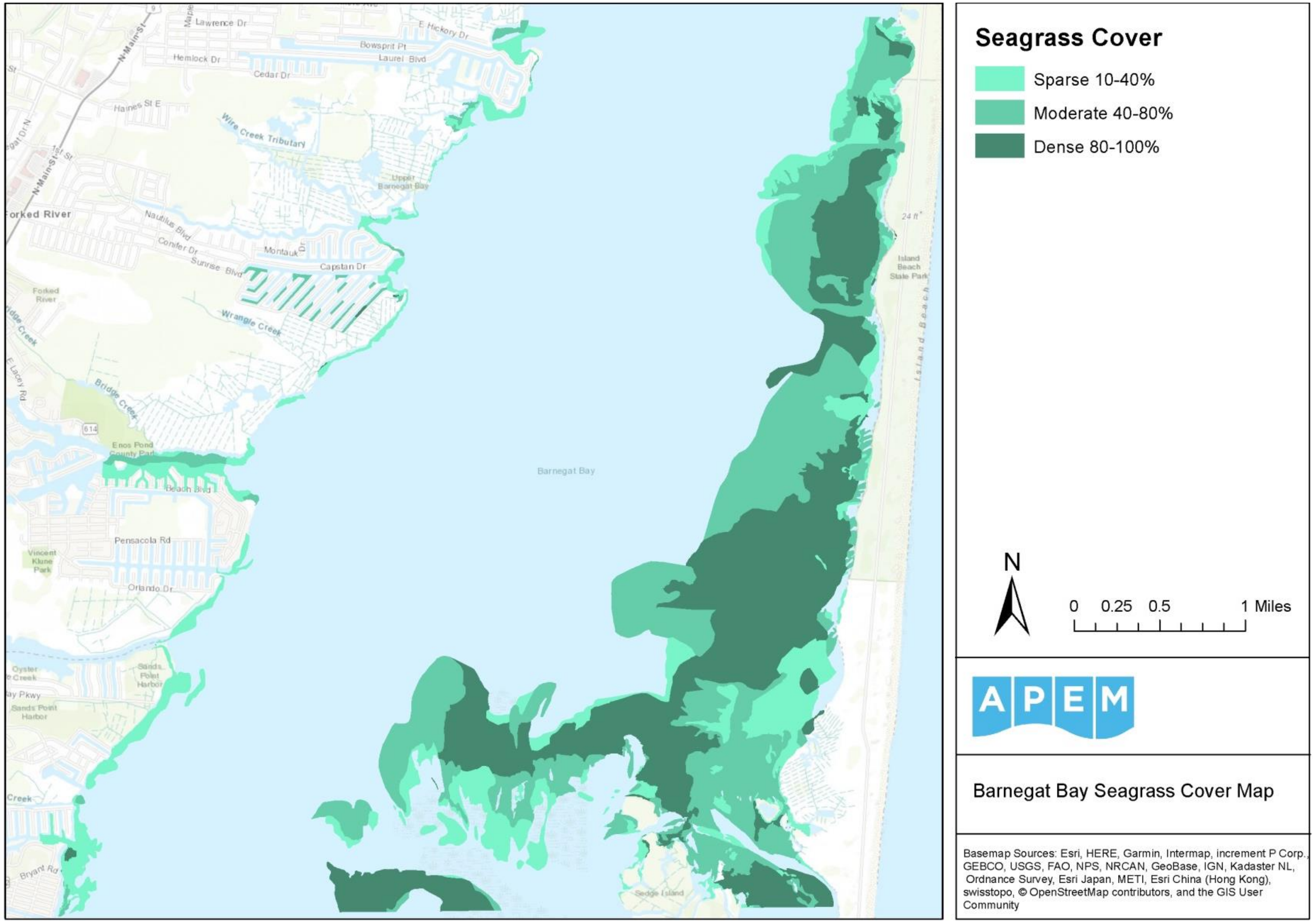

Figure 4 Seagrass coverage map of the Barnegat Bay survey area

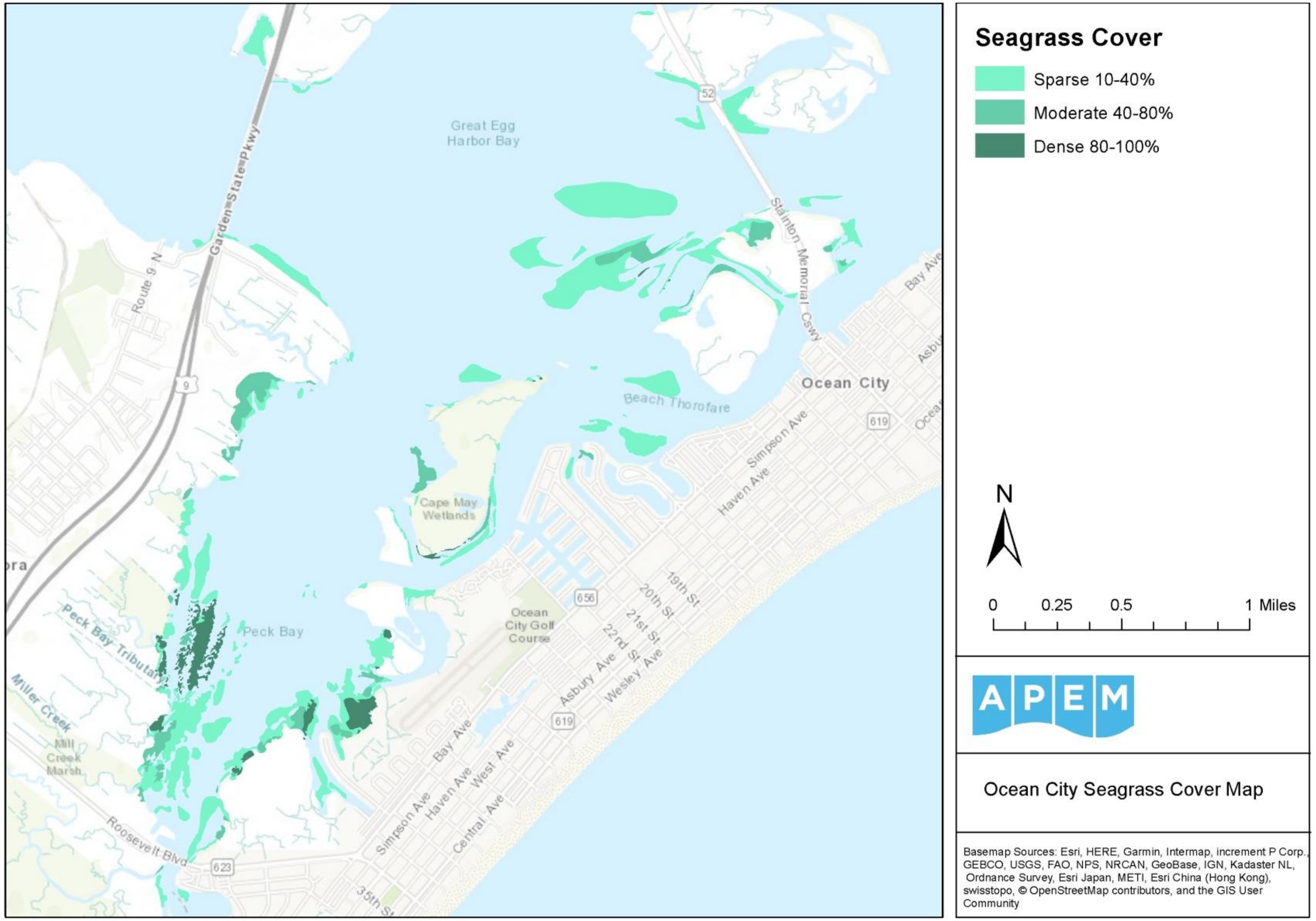

Figure 5 Seagrass coverage map of the Great Egg Harbor survey area

4. References

Good, R.E., Limb, J., Lyszczek, E., Miernik, M., Ogrosky, C., Psuty, N., Ryan, J. & Sickels, F. (1978) *Analysis and Delineation of the Submerged Vegetation of Coastal New Jersey.* Center for Coastal and Environmental Studies Rutgers. Available from: https://www.nj.gov/dep/dsr/barnegat/casestudy-littleegg.pdf [Accessed December 2019]

Kennish, M. J., Haag, S. M. & Sakowicz, G. P. (2008) Seagrass Demographic and Spatial Habitat Characterization in Little Egg Harbor, New Jersey, Using Fixed Transects. *Journal of Coastal Research: Special Issue.* 55, 148-170

Lathrop, R. G., Montesano, P. & Haag, S. (2006) A Multi-Scale Segementation Approach to Mapping Seagrass Habitats Using Airborne Digital Camera Imagery. *Photogrammetric Engineering & Remote Sensing*. 72 (6), 665-675

Ocean Wind
An Ørsted & PSEG project

Phase 2 – In-Water Submerged Aquatic Vegetation Survey 2020

Ocean Wind Offshore Wind (OCW01)

Submerged Aquatic Vegetation (SAV) Survey Report

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1. Introduction

Ocean Wind LLC (Ocean Wind), a subsidiary of Ørsted Wind Power North America LLC (Ørsted), is developing the Ocean Wind Offshore Wind Farm (Wind Farm Project or Project) to generate renewable power off the coast of New Jersey and transfer the electricity to load centers within New Jersey and the Mid-Atlantic region. Ocean Wind intends to develop, build, operate, and own a utility-scale offshore wind farm located approximately 15 miles off the of the coast of New Jersey within the OCS-A 0498 Lease Area (**Figure 1**). The Project will include turbines and infrastructure required to transmit power generated by the turbines to connection points with the Pennsylvania, Jersey, Maryland (PJM) electric transmission system or power pool. Up to two grid connections will be made at BL England and Oyster Creek. The offshore export cables will be buried below the seabed within federal and state waters and will connect with the onshore export cable at the onshore transition joint bays (TJBs) at the landfall location(s). For the Oyster Creek interconnection point, buried export cables from the wind farm area will make landfall at Island Beach State Park and then continue across Barnegat Bay and make landfall on the mainland at one of the three potential landfall locations (**Figure 2)**. The Project would be installed from 2023 through 2024 and commissioned and operational in 2024.

SAV along the New Jersey coast has been studied by various public and private entities over the last 40 years. Barnegat Bay has been extensively studied, with historical SAV mapping completed by the New Jersey Department of Environmental (NJDEP) from 1979 to 1987. Additional studies were completed by Rutgers University in the early 2000s (Lathrop and Haag, 2011). SAV beds provide shelter and forage habitat for a variety of estuarine fish and macrocrustacean species (State of New Jersey, 2017). Additionally, SAV beds provide dissolved oxygen to the water column and provides stability to sediments against erosion forces as a function of root/rhizome development and substrate binding (Bergstrom and Hurley, 2006). The SAV canopy modifies local hydrodynamics, promoting increased sedimentation by reducing water velocity and allowing fine particles to settle out of suspension.

Based on the desktop study review of existing SAV information, Ocean Wind developed a Project-specific SAV survey plan to collect additional information near potential landfall locations (Appendix A). The survey protocol was developed using existing state and federal agency protocols and those that were used for similar surveys in New Jersey. In addition, Ocean Wind coordinated with the NJDEP and the National Oceanic and Atmospheric Administration (NOAA) on the protocols and incorporated their feedback.

To fill in the data gaps from historical NJDEP and Rutgers University mapping and existing studies, Phase 1 Aerial Photography Surveys and Phase 2 In-water SAV surveys were conducted to identify the current presence and extent of SAV beds within the proposed export cable routes and landfall locations. The Phase 1 Survey is summarized below and has been included as Appendix B. Based on project design and changes to routing, a Phase 2 survey was not conducted for BL England study area. Phase 2 SAV surveys were targeted to focus on areas where the routes are likely to cross back bay areas where SAV habitat is present and therefore, only conducted in Barnegat Bay. Phase 2 SAV surveys are discussed in further detail below. Site photographs are provided in Appendix C and notable biological observations are provided in Appendix D.

2. Survey Area

The Phase 2 SAV surveys were conducted in Barnegat Bay, Ocean County, with a total survey area of approximately 0.08 square miles (approximately 200,000 m^2) (**Figure 2**). The SAV survey areas extend from the shoreline out to the edge of the SAV bed as identified in aerial surveys and confirmed on site. The Island Beach State Park (IBSP) survey area is located on the eastern side of the Bay and extends from the backside of the IBSP barrier island approximately 1,200 m (3,900 ft) out into the Bay. The Holtec Property landfall area is the northernmost potential landfall area located on the western side of the Bay north of the Oyster Creek mouth and extends approximately 200 m (650 ft) out into the Bay. The Bay Parkway landfall area is the middle potential landfall area on the western side of the Bay south of the mouth of Oyster Creek and the survey area extends 370 m (1,200 ft) out into the Bay. The Lighthouse Drive landfall area is the southernmost potential landfall area located on the western side of the Bay located north of Waretown Creek and extends 220 m (720 ft) out into the Bay.

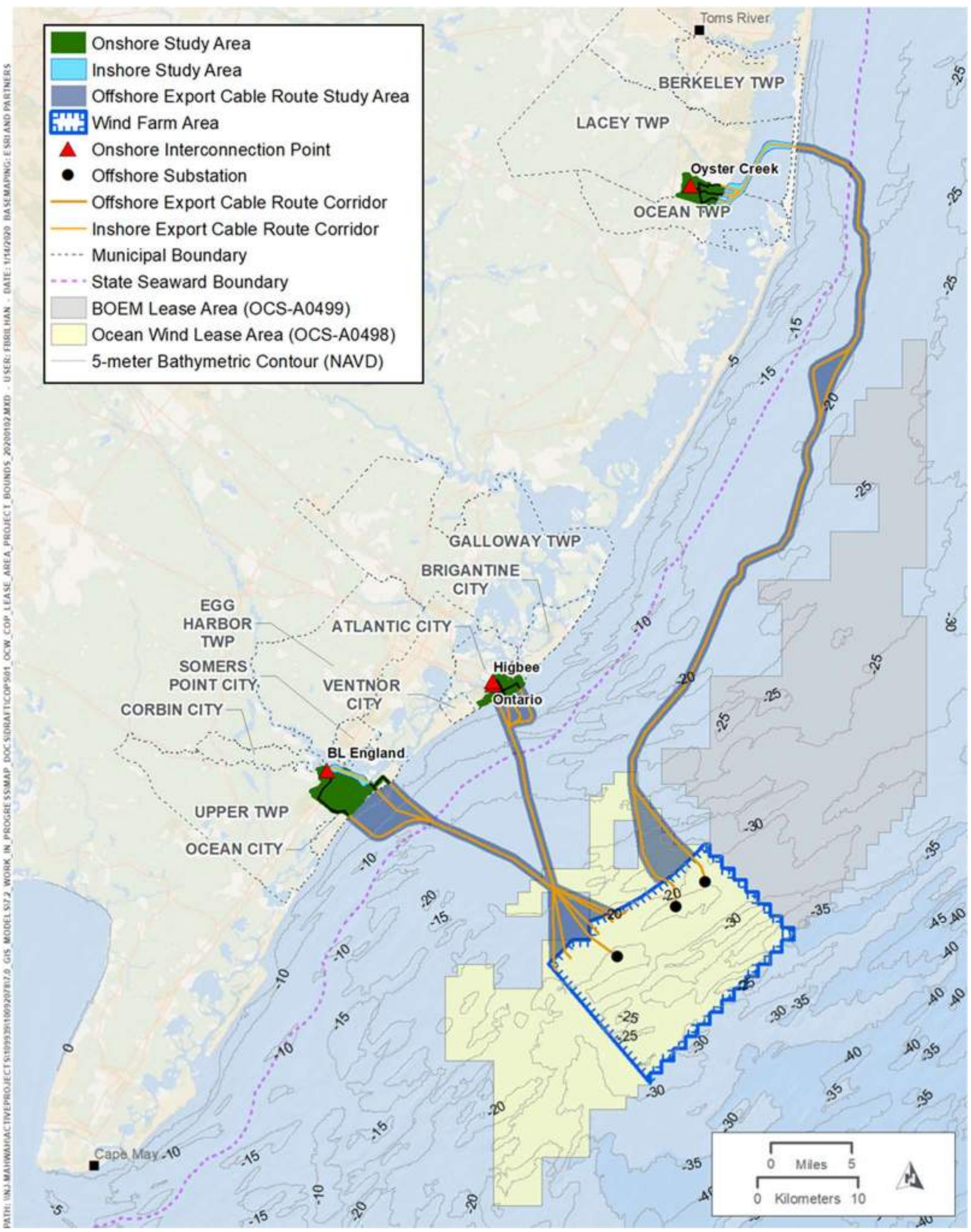

Figure 1. Project Area Overview Map.

Figure 2. Barnegat Bay Phase 2 SAV Survey Area

3. Methods

In October 2019 and October 2020, Phase 1 and Phase 2 SAV surveys were conducted at the anticipated project landfall area for Oyster Creek (**Figure 2**) to confirm the presence and extent of SAV beds located along proposed inshore export cable routes and potential landfall locations. The SAV survey method described here and provided in Appendix A, is based on methodology described in Lathrop et al. (2011) , the *Submerged Aquatic Vegetation Survey Guidance for the New England Region* protocol published in 2016 by a joint agency task force including the USEPA, NOAA, and the USACE (Colarusso and Verkade, 2016), and *Guidance for Submerged Aquatic Vegetation (SAV) Surveys as Related to the Submerged Vegetation Habitat Rule at NJAC 7:7E-3.6 (NJDEP 2015)*.

Surveying efforts were divided into two phases. The first phase of the survey (referred to as "Phase 1 SAV Survey") was conducted later in the growing season in October 2019 during periods of high visibility before the seasonal decline in water temperatures reduce growth of SAV. The presence/absence of SAV beds was determined within the study areas and their extents were mapped using aerial photography. The second phase of the survey (referred to as "Phase 2 SAV Survey") was conducted the week of 5 October 2020 and gathered more detailed information about the SAV beds identified in Phase 1 SAV Surveys using quadrat sampling along transect lines.

3.1 Phase 1 SAV Survey

The Phase 1 SAV Survey was carried out in a fixed wing aircraft using a Shearwater III camera system surveying at an altitude of approximately 1,112 m (3,650 ft) above sea level. High-resolution imagery was captured at a resolution of 4 centimeters (cm) (1.5 inches) ground sample distance (GDS) during 15 flight lines. Surveys were targeted to be complete within 90 minutes of either side of low tide to allow for maximum intertidal exposure and to facilitate the SAV mapping process. Global Positioning System (GPS) data were recorded for each aerial photograph's camera release point. The extent and estimated cover density of SAV beds were estimated from aerial photography of shallow areas (<6 ft water depth).

Due to the nature of the imagery collected over the Bay (i.e., sun glint, changing wave patterns between adjacent imagery), a combination of automated processing, which involved feeding the collected GPS data into photogrammetric processing software along with the imagery, and manual georeferencing of images, was required to produce mosaics. This allowed a mosaic to be generated for all areas where the bay bottom could be seen.[1] Once the mosaic was finalized, areas of SAV were digitized using Geographic Information System (GIS) Software (ArcMap Version 10.7.1).

Seagrass was mapped according to the following categories[2]:

- Sparse (10-40 percent cover)
- Moderate (40-80 percent cover)
- Dense (80-100 percent cover)

[1] For areas of deeper water where the sea bottom could not be seen (typically in areas more than 7 ft below mean sea level) in any of the imagery due to lack of light penetration, it was not possible to georeference the imagery or map SAV. Details for density for "patchy" SAV beds was documented in Phase 2 SAV Surveys.

[2] The delineation of these categories was based on the data from the study by Lathrop et al. (2006), which mapped seagrass cover in Barnegat Bay-Little Egg Harbor-Great Bay study area using these categories.

The resulting areas of SAV documented in the Phase 1 Survey were used to inform the more intensive Phase 2 SAV survey effort.

3.2 Phase 2 SAV Survey

The Phase 2 SAV Survey was conducted to gather more detailed information about the SAV beds using underwater camera/quadrat sampling along transect lines. The Phase 2 SAV Surveys documented the outer extents of the SAV beds identified in the Phase 1 SAV Survey and obtained representative information on SAV species and density from the outer edge of the beds into the shoreline. Beginning the survey with the identification of the outer edge of the SAV bed allows survey effort to be focused on those areas where SAV is actually present. The Phase 2 survey was confined to the 50 m (164 ft) areas on either side of the proposed cable route that overlaps with areas of SAV identified in the Phase 1 SAV Survey. The 50 m (164 ft) on either side of the potential cable route was surveyed as this is the potential area which could be impacted during cable installation. The survey was completed the week of 5 October 2020. Initial reconnaissance of the survey area was conducted using the following visual assessment methods: visual inspection from an elevated boat platform, bathyscope/viewing bucket from the surface, and a pole mounted underwater camera which provided a real time feed to an observer on the boat. This reconnaissance was performed to identify the presence/absence of SAV and to determine the outer edge of the SAV bed. Reconnaissance was conducted on sunny days, during a falling or lower tide, to facilitate optimal viewing capabilities

Following initial reconnaissance, transect lines were established in the SAV beds identified in the Phase 1 SAV Surveys. Transect lines were spaced 30 m (98 ft) apart and perpendicular to the export cable route and spanned the 50 m (164 ft) buffer on either side of the cable route. Within each transect line points for SAV sampling were spaced every 10 m (33 ft). At each transect point a GoPro Hero3 mounted to an adjustable pole secured above a 0.5 m x 0.5 m (0.25 m^2) quadrat frame divided into 4, 25 cm x 25 cm grid cells was lowered to the bottom to photo-document SAV and the benthic habitat (**Figure 3**). The camera was connected to a Wi-Fi extension cable to allow the camera feed to be viewed in real time by observers on the survey vessel. In the field and upon processing the photographs, the following data was recorded:

1. Date and time for each sampling transect.
2. Water depth at each sampling point (quadrat).
3. Water quality data (temperature, pH, salinity, dissolved oxygen, turbidity) at the beginning of each transect.
4. General sediment type characterized by visual observation (e.g., silt, mud, sand, shell hash) at each sampling point.
5. Estimated percent cover and density of SAV, per species, within a 0.25-m^2 quadrat divided into 25 cm x 25 cm grid cells.
6. Shoot length of 1-3 randomly chosen SAV blades within the quadrat, per species. Blades were estimated in place relative to reference markers on the quadrat. If, while watching the live camera feed, it was not possible to estimate blade length in place due to currents, samples were collected manually using a small three tine garden rake.
7. Estimated percent coverage (0-100 percent) per species. Surveyors recorded qualitative vegetative density as they surveyed SAV beds on the following scale:
    a. Sparse (1-10 percent cover);
    b. Low (11-25 percent cover);
    c. Moderate (26-50 percent cover), and
    d. High (>50 percent cover).
8. Notable biological observations (e.g., shellfish or algal beds, fish and macrocrustaceans) (Appendix D).

Based on field conditions and sampling logistics, the following modifications to the Project sampling protocol (Appendix A) were made:

- The quadrat size was modified from 1 m^2 to 0.25 m^2. Agency review of the sampling protocol requested 1 m^2 sampling quadrat size, if possible. However, for ease of equipment maneuverability during data collection and to ensure that the camera could be submerged with the entire quadrat frame in the camera view, quadrat size was modified (see **Figure 3** for equipment setup). Additionally, 0.25m^2 is consistent with sampling guidelines set forth by Colarusso and Verkade (2016).
- Transects were conducted perpendicular to the cable route instead of perpendicular to the shoreline. This change was made to better assess the potential impacts of the proposed export cable a linear feature and resulted in more sampling locations.
- Water quality measurements were collected at the beginning of each transect instead of at every point along the transect. Each transect point was spaced 10m apart, due to the close proximity of each point the collection of water quality information at each point would have resulted in hundreds of redundant water quality measurements.

3.2.1 Data Analysis

3.2.1.1 Percent Cover

To calculate the estimated percent coverage of the survey area, the SAV density results of the camera drops were divided into density categories based on visible percent coverage of SAV as part of Step 1:

- Absent (0 percent)
- Sparse (1-10 percent)
- Low (11-25 percent)
- Medium (26-50 percent)
- High (>50 percent)

In Step 2, the length and width of the survey areas were multiplied to get the total area (m^2). The percentage of each category generated in Step 1 were multiplied by the total area calculated in Step 2 to yield the representative percent cover per survey area.

3.2.1.2 Stem Density

Stem densities were determined during video reviews for the 0.25 m^2 quadrat sampling. The visible number of blades were counted within the 0.25 m^2 quadrat. When densities were very high and visibility of individual blades was limited, counts were capped at 250 stems/quadrat. These data were then multiped by 4 to extrapolate stem density per 1 m^2.

3.2.1.3 Blade Length

Blade length was estimated in place from the still images captured during the field survey using the ImageJ photo processing software. A custom macro was developed that set the scale of the image based on the length of the 25 cm (10 in) grid cell in the image. Once the scale was calibrated a reviewer manually drew a line over selected blades of the SAV. Stems selected for measurement were generally those where the grid cells of the SAV frame/grid or the currents in the area pushed the blades of SAV over horizontally such that the length of a stem could be estimated. The estimated length of the blade was recorded on the image and in a spreadsheet. In the instances where SAV was collected the blade length was measured on a ruler and photographed. Each blade length was measured to the nearest tenth of a centimeter. The SAV blades that were physically collected during the Phase 2 SAV survey were measured to the nearest tenth of a centimeter.

3.2.2 Sediment Sample Collection and Grain Size Analysis

Per the NJDEP (2015) SAV Survey Guidance document and the Project survey protocol, sediment samples were collected for grain size analysis. The sediment samples were collected on October 8, 2020, using a petite ponar grab from locations representative of the observed sediment types within each of the four potential landfall areas during the SAV survey (**Figure 4)**. The sediment samples were photographed, then homogenized, placed in glass jars, and sent to an analytical laboratory for grain size analysis consistent with the American Society for Testing and Materials (ASTM) methods D6913 and D7928. The results were reported according to the Wentworth (1922) grain size scale.

Figure 3. Quadrat Frame with Mounted GoProHero3 for SAV Sampling.

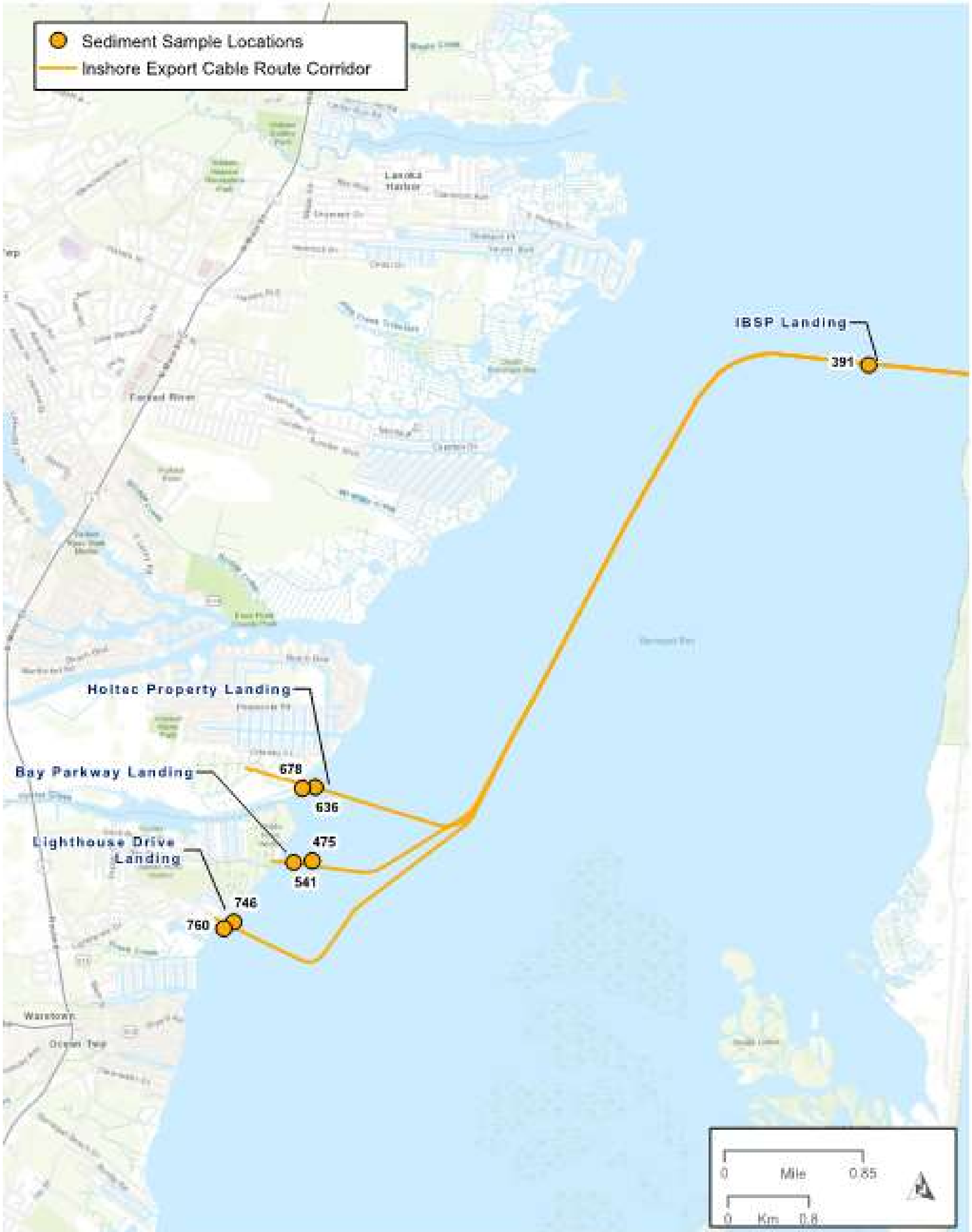

Figure 4. Sediment Sampling Locations.

4. Results

4.1 Phase 1 SAV Surveys

A total of 10,864 images were captured during the aerial survey. The coverage map for the Phase 1 SAV Survey area is shown in **Figure 5**.

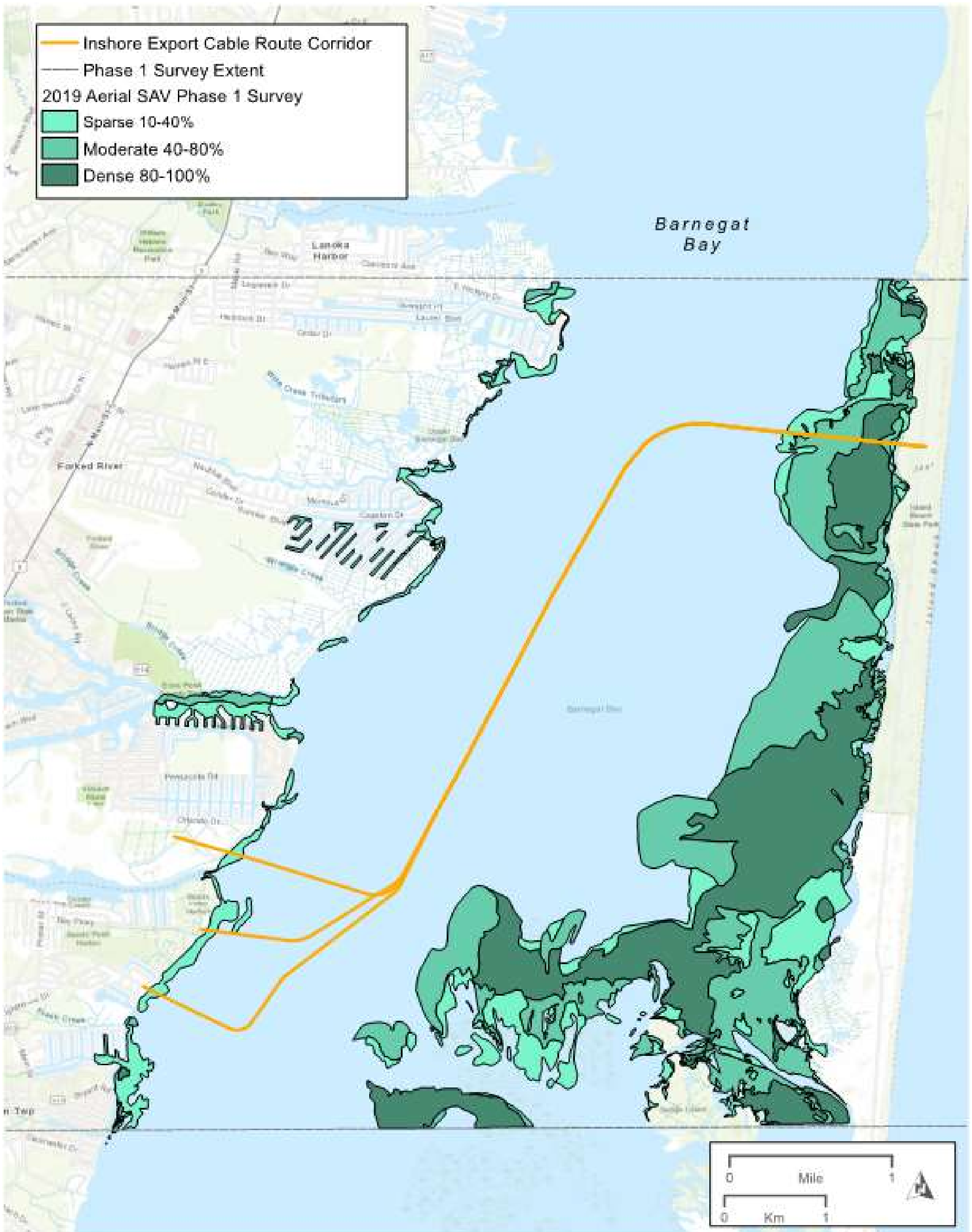

Figure 5. SAV Map of the Barnegat Bay Phase 1 SAV Survey Area

During the Phase 1 aerial survey, the area along the IBSP shoreline was mapped as predominantly moderate to dense SAV with an outer fringe of sparser coverage. Presumed SAV beds on the eastern shoreline extend more than 1,200 m (3,930 ft) from the shoreline in some locations based on the aerial imagery. For the three landfall areas along the western shoreline of the Bay a comparatively narrow band of sparse SAV extending from approximately 70-330 m (230-1,080 ft) was observed.

4.2 Phase 2 SAV Survey

At IBSP during the Phase 2 SAV survey, the outer edge of the SAV bed was observed 1,067 m (3,500 ft) from the shoreline and approximately 90 m (295 ft) from the edge of the SAV bed documented in the Phase 1 aerial survey. Depths in this area were 1-1.2 m (3-4 ft).

Due to shallower than anticipated depths, it was only possible to survey transects in the outer third of the IBSP landfall area. This area consists of a shallow shoal extending approximately 1,200 m (3,930) or more out from the shoreline of IBSP. To the north of IBSP, there appears to be an old channel with depths of up to 2.1 m (7 ft) based on nautical charts. The survey vessel had relatively shallow draft of ~0.6 m (~2 ft). To protect both the vessel and benthic habitat the survey vessel did not attempt to enter areas where depths were too shallow. Vessel counts and prop scars documented in Lathrop et al. (2017) are concentrated along the outer fringe of the shoal in the vicinity of the IBSP survey area, which indicates depths too shallow to be readily accessible by vessel (**Figure 6)**. Slightly to the south of IBSP survey area is a portion of Tice's Shoal which experiences heavy vessel traffic with greater vessel access closer to the shoreline.

SAV was documented in only one survey location within the Holtec Property survey area and had a depth of 1 m (3.2 ft). In the Bay Parkway survey area, the outer edge of the SAV beds was documented 60 m (197 ft) further out than what was documented in the Phase 1 survey and 380 m (1,248 ft) from the shoreline. The depth at the edge of the SAV bed was 1.6 m (5.2 ft). In the Lighthouse Drive survey area, the outer edge of the SAV bed is generally in the same area as what was documented in the Phase 1 survey and approximately 150 m (492 ft) from the shoreline. The depth at the edge of the SAV bed ranged from 1.2-1.4 m (3.9-4.7 ft).

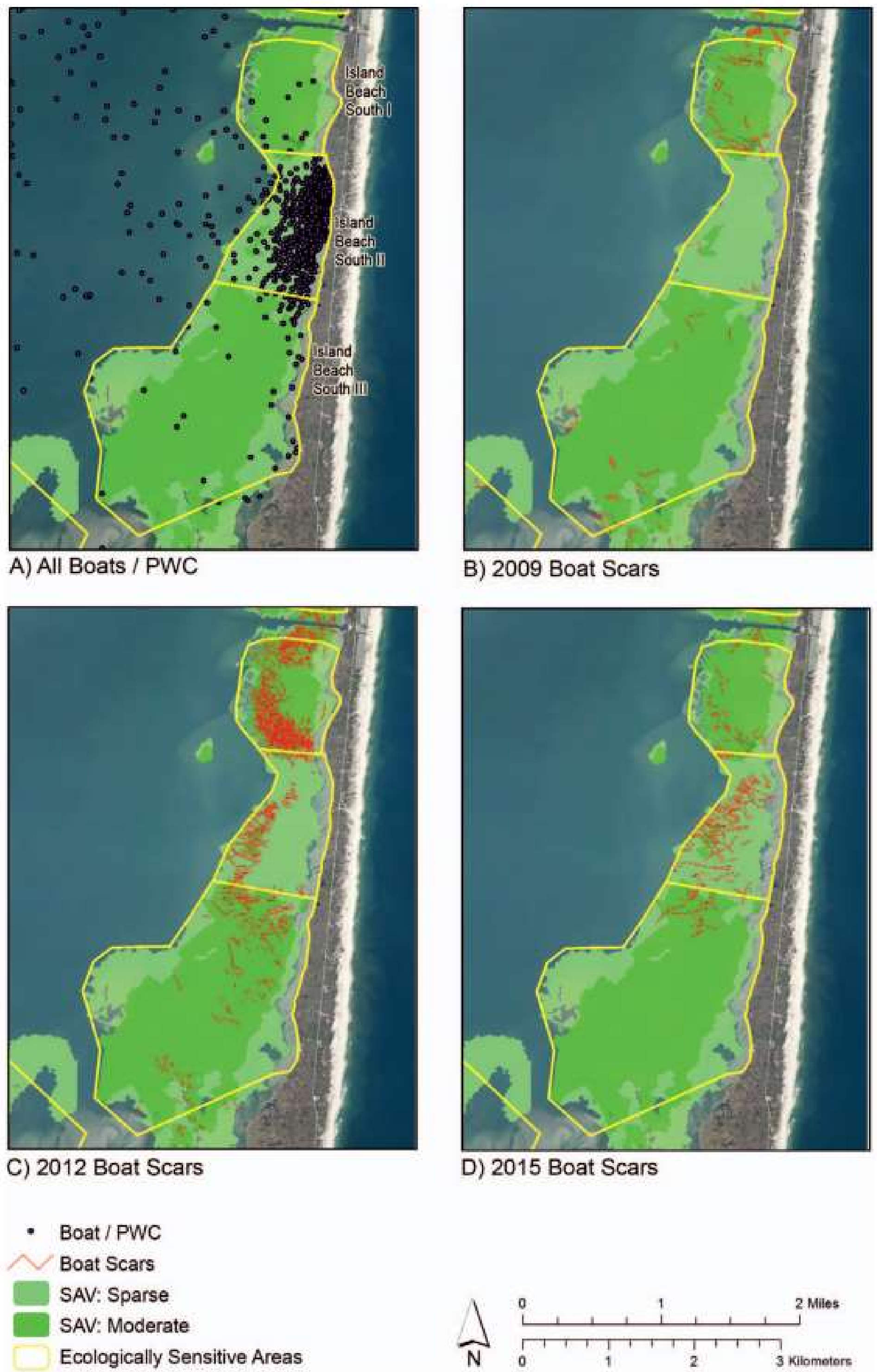

Figure 6. Figure excerpted from Lathrop et al. 2017 showing the distribution of watercraft and boat scar observations in the vicinity of the IBSP landfall area. The IBSP survey area is in the northern portion of each plot just to the south of the linear break in the SAV beds.

SAV was documented in only one survey location within the Holtec Property survey area and had a depth of 1 m (3.2 ft). In the Bay Parkway survey area, the outer edge of the SAV beds was documented 60 m (197 ft) further out than what was documented in the Phase 1 survey and 380 m (1,248 ft) from the shoreline. The depth at the edge of the SAV bed was 1.6 m (5.2 ft). In the Lighthouse Drive survey area, the outer edge of the SAV bed is generally in the same area as what was documented in the Phase 1 survey and approximately 150 m (492 ft) from the shoreline. The depth at the edge of the SAV bed ranged from 1.2-1.4 m (3.9-4.7 ft). Phase 2 SAV survey photograph is provided in Appendix C.

4.2.1 Water Depth and Quality

Water depths recorded for each sampling location and water quality measurements taken at the beginning of each transect are presented in **Table 1**. The average depth across sampling locations was 4.4 ft, average temperature was 18.4°C, average salinity was 26.7 ppt, average dissolved oxygen was 7.9 mg/L average pH was 7.9, and average turbidity was 2.9 NTU.

Table 1. Water Quality and Depth Summary.

Survey Area	Transect	Point ID	Depth (ft)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	pH	Turbidity (NTU)
IBSP	360-365	360	2.3	15.8	24.5	7.5	7.8	5.38
	376-366	376	3.6	17.2	25.8	7.8	8.2	4.46
	377-387	387	3.3	17.2	25.8	7.77	8	1.89
	388-389	398	3.2	17.2	25.8	7.6	8	2.26
	399-409	409	4.6	17.2	25.8	7.5	7.9	3.95
Bay Parkway	475-465	475	4.8	18.2	26.2	7.33	7.6	3.56
	475-465	465	5.6	18.2	26.4	7.27	7.6	11.46
	477-487	477	7.1	18.3	26.4	7.27	7.7	2.93
	477-487	487	4.5	18.4	26.4	7.52	7.6	2.2
	499-489	489	4.7	18.4	27	7.5	7.6	1.84
	510-500	510	4.7	18.5	26.8	7.43	7.7	3.55
	510-500	500	4.6	18.5	26.8	7.46	7.7	1.69
	522-512	512	4.8	18.5	27.4	7.7	7.7	1.63
	534-524	534	4.9	18.5	27.4	7.7	7.7	1.17
	545-535	545	4.1	18.6	27.4	7.8	7.8	2.06
	557-547	557	4.5	18.7	27.7	7.99	7.8	1.85
	569-559	567	3.8	18.8	27.7	8.5	7.9	1.38
	571-581	581	2.5	19	27.1	8.7	8.1	0.83
Holtec Property	619-629	619	5.9	17.2	25.8	7.5	7.9	3.95
	619-629	629	6.1	19.5	27	8.4	7.9	1.73
	631-641	641	5.7	19.7	26.7	8.5	7.9	2.67
	642-652	652	4.5	19.6	27	8.6	7.9	1.56
	663-663	663	4.1	19.7	26.7	8.7	7.8	2.38
	687-677	677	4.5	19.9	26.7	8.6	7.8	3.08
	687-677	687	2.9	19.9	26.6	8.92	7.7	2.39
	699-689	689	3.1	19.6	26.6	8.4	7.9	15.3

Survey Area	Transect	Point ID	Depth (ft)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	pH	Turbidity (NTU)
Lighthouse Drive	710-700	710	5	18.3	27	7.5	8.1	1.88
	712-722	712	5.7	18.5	26.7	7.52	8.2	0.94
	724-734	734	3.9	18.3	27.3	8.7	8.2	0.78
	736-746	746	3.2	18.5	27.3	8.38	7.9	2.15
	758-748	758	2.7	18.6	27.1	7.75	8	1.7
	770-760	770	2.3	18.8	26.5	8.2	8.1	0.99
	777-772	772	4.3	18.9	26.9	8.14	8.1	1.22

4.2.2 Sediment Type

Sediments varied from fine, silty sand to sand with scattered cobble or shell hash. At Bay Parkway Landing, the dominant sediment type observed was sand. Holtec Property Landing consisted predominately of silty sand and sand and IBSP Landing was dominated by silty sand. Lighthouse Drive Landing sediment consisted predominately of silty sand and sand. Overall, the Phase 2 SAV survey area sediments consisted of sand and silty sand.

4.2.3 Grain Size

The grain size analysis results from the sediment samples collected during the Phase 2 SAV Surveys are reported in Table 2. Laboratory grain size analysis results are provided in Appendix E. Most of the samples consisted of medium to fine sand. There were no noticeable trends between sediment type and SAV density.

Table 2. Grain Size Analysis Results.

Grain Size	Sample ID						
	636	678	475	541	760	746	391
% Gravel	0	0	0	0	0	0	0
% Coarse Sand	2	3	0	3	5	0	0
% Medium Sand	65	24	9	25	15	8	13
% Fine Sand	32	54	89	49	67	88	86
% Silt or Clay	1	19	2	23	13	4	1
Landfall	Holtec Property	Holtec Property	Bay Parkway	Bay Parkway	Lighthouse Drive	Lighthouse Drive	IBSP

4.2.4 SAV Species, Percent Cover and Density

During the Phase 2 SAV Survey, a total of 283 camera drops were completed. Of those camera drops, 118 had SAV present, accounting for 41.7 percent SAV presence for the entire survey area combined. SAV is known to form patchy beds with areas of exposed sediment which is consistent with the observed intermittent presence of SAV at the camera drops. SAV was present in 36 percent of the camera drops in the outer portion of the IBSP area (**Figure 7**). These findings are consistent with the narrow band of sparse SAV observed during the Phase 1 SAV survey. Based on review of the photographs collected during the field survey and the SAV samples collected, observed SAV consisted almost entirely of eelgrass (*Zostera marina)* with widgeon grass (*Ruppia maritima*) only documented at a single location (Station 691) at the Holtec Property survey area.

The Holtec Property did have substantial coverage of macroalgae in many of the sampled locations, but SAV was only observed at Station 691. The findings of the Phase 2 survey at the Holtec Property Landing were inconsistent with the findings of the Phase 1 aerial imagery survey. Extensive macroalgae was found to be present at the Holtec Property Landing survey area during Phase 2 survey efforts, not sparse coverage of SAV (10-40 percent). The macroalgae present likely accounted for the sparse coverage that was documented during the 2019 aerial imagery mapping of the Phase 1 survey (**Figure 8**).

The Bay Parkway Landing had the highest percentage of SAV at 67 percent (**Table 3**). Compared to the Phase 1 SAV survey, SAV was observed over a slightly larger area within the Bay Parkway Landing survey area. The findings of the Phase 2 survey at Bay Parkway Landing survey area were consistent with sparse SAV coverage identified during the Phase 1 survey. Macroalgae was also found to be present at this location (**Figure 9**).

The Lighthouse Drive Landing had SAV present in approximately 47 percent of survey stations. The number of stations with SAV present were relatively evenly distributed between the sparse, low, moderate, and high percent cover categories s of SAV (**Table 4, Figure 10**). During the Phase 1 Survey, the aerial imagery captured sparse coverage and did not reveal the higher densities identified during the Phase 2 Survey.

Figure 7. SAV Percent Cover Estimates at IBSP Landing.

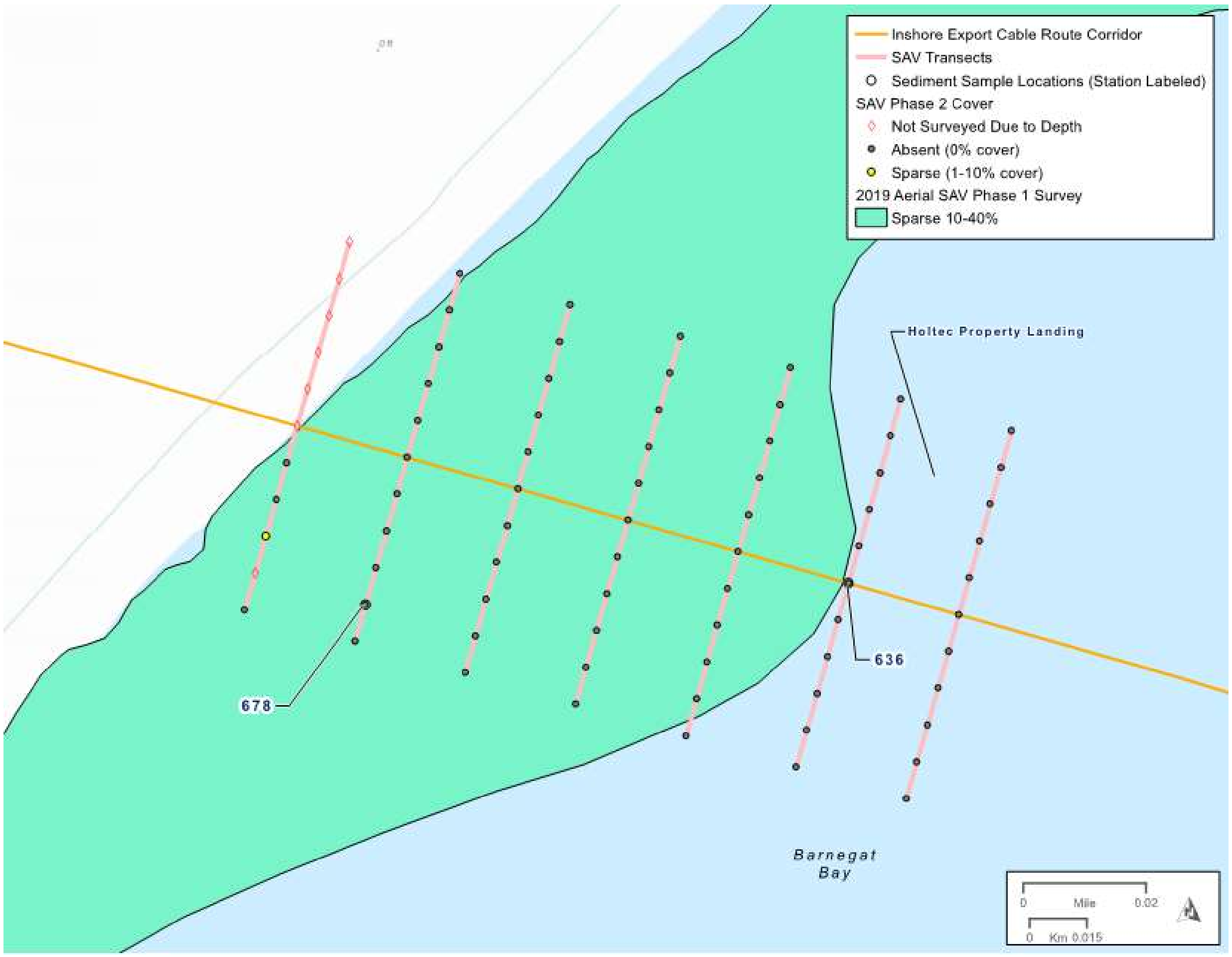

Figure 8. SAV Percent Cover Estimates at Holtec Property Landing.

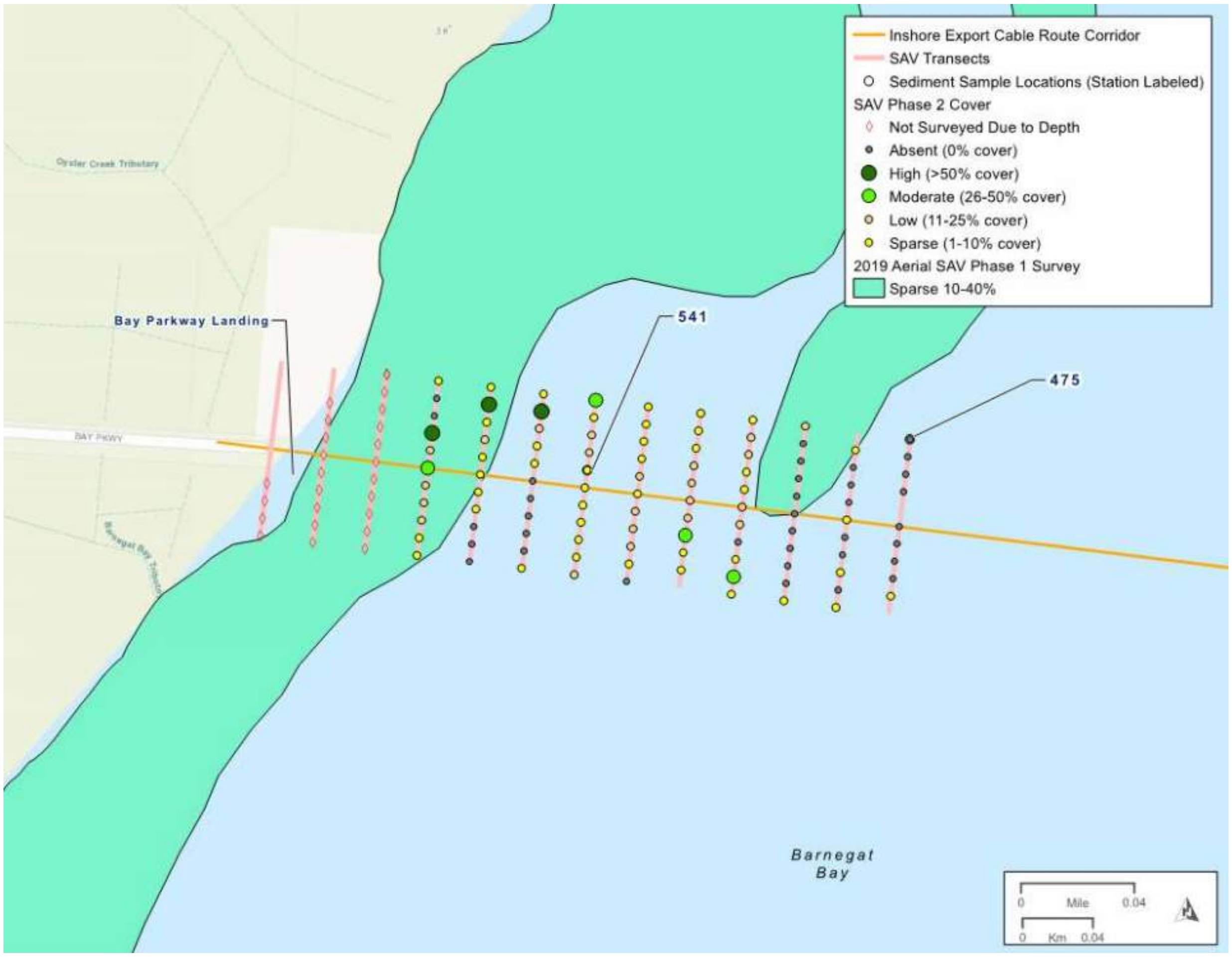

Figure 9. SAV Percent Cover Estimates at Bay Parkway Landing.

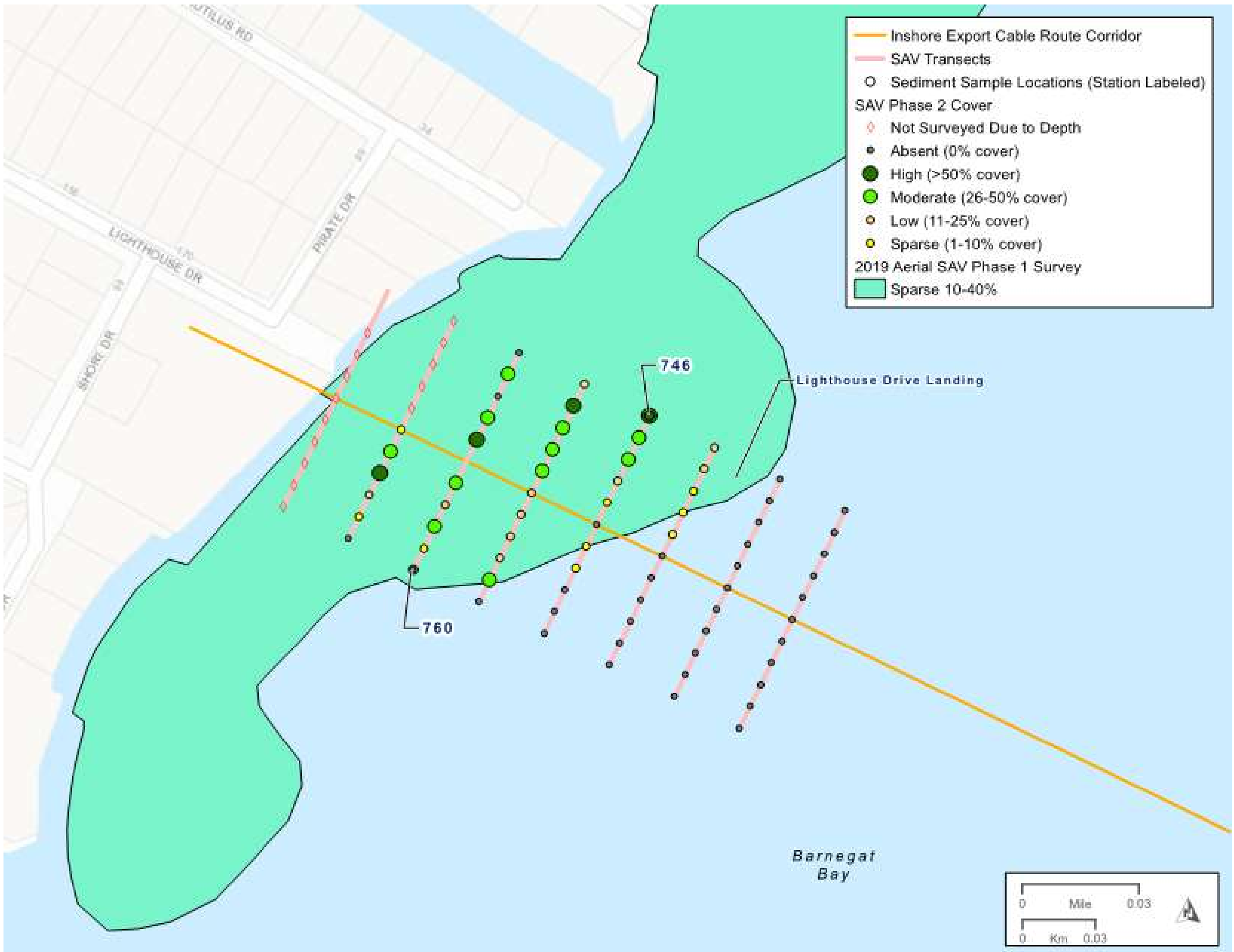

Figure 10. SAV Percent Cover Estimates at Lighthouse Drive Landing.

For IBSP Landing, the findings of the Phase 2 survey were consistent with the findings of the Phase 1 survey in the areas that were accessible by the vessel. There were patches of sparse to moderate SAV present in the outer fringe during the Phase 2 SAV survey, with smaller areas of high percent coverage. The outer edge of the SAV bed in the IBSP area was found to be closer to shore in the Phase 2 survey than documented in the Phase 1 aerial survey. (**Table 4, Figure 7**).

Table 3. Sampling Area SAV Presence and Percentage

Landing	Camera Drop Count	Drops with SAV Present	Percentage with SAV Present
IBSP	36	13	36.1
Bay Parkway	106	71	67.0
Holtec Property	70	1	1.4
Lighthouse Drive	71	34	47.9
Total	**283**	**119**	**42.0**

As discussed previously, Holtec Property Landing had SAV present at only one station and had the lowest percentage of stations with SAV present across all percent cover categories. The Bay Parkway Landing had the greatest percentage of stations in the sparse and low categories, at 39.6 and 20.8 percent, respectively (**Table 4**). Lighthouse Drive had the highest percent of stations in the moderate category and IBSP and Lighthouse Drive landings had the same percentage of stations at 5.6 percent in the high category. The locations with the greatest percentage of survey locations where SAV was absent were the Holtec Property Landing and IBSP, with 98.6 and 63.9 percent of sampled quadrats lacking SAV, respectively.

Table 4. Percentage of survey locations by estimated percent cover category of SAV by Survey Area.

Landing	Absent (0%)	Sparse (1-10%)	Low (11-25%)	Moderate (26-50%)	High (>50%)
IBSP	63.9	11.1	11.1	8.3	5.6
Bay Parkway	33.0	39.6	20.8	3.8	2.8
Holtec Property	98.6	1.4	0.0	0.0	0.0
Lighthouse Drive	52.1	12.7	14.1	15.5	5.6

The area of SAV in each of the percent cover categories was estimated by dividing the percentage of camera drop stations with SAV present in each percent cover category (**Table 4**) by the area (m^2) of each survey area. Due to the limited portion of the IBSP survey area that was able to be assessed for SAV during the Phase 2 survey, the estimates in **Table 5** are not representative of the unsampled areas.

Table 5. Area of SAV cover density by Survey Area.

Landing	Total Area (m^2)	Absent (0%) (m^2)	Sparse (1-10%) (m^2)	Low (11-25%) (m^2)	Moderate (26-50%) (m^2)	High (>50%) (m^2)
IBSP	120,000	76,680	13,320	13,320	9,960	6,720
Bay Parkway	37,000	12,210	14,652	7,696	1,406	1,036
Holtec Property	20,000	19,720	280	0	0	0
Lighthouse Drive	22,000	11,462	2,794	3,102	3,410	1,232

The minimum stem density was 0 (quadrats with no SAV present) for all four landings and the landing with the highest density was IBSP with >200 stems per meter squared (**Table 6**). There were a few IBSP Landing stations with high amounts of SAV present and the stem count was capped at 250 per 0.25 m^2 due to the density of the bed and difficulty reliably counting stems. The mean density was calculated for the sample stations where SAV was present. The highest mean stem density was at IBSP landfall, with 278 stems per m^2. Lighthouse Drive also had a high mean stem density at 219 stems per m^2.

Table 6. Stem Density Per 1 m^2.

Landing	Minimum	Maximum	Median	Mean for Stations With SAV Present
IBSP	0	>1000	0	278
Bay Parkway	0	448	20	85
Holtec Property	0	56	0	56
Lighthouse Drive	0	680	48	219

4.2.5 Blade Length

The total number of blades measured in place in reference to the quadrat frame was 254. The longest blade measured was in one of the quadrats from Bay Parkway at 50.3 cm (Table 7). The shortest length was at Bay Parkway Landing, with a length of 3.4 cm. Overall, the average length of the SAV blades was 13.8 cm.

Table 7. Number of Blades, Average Length, Minimum Length, and Maximum Length for Each Landing measured in place.

Landing	Number of Blades Measured	Average Length (cm)	Minimum Length (cm)	Maximum Length (cm)
IBSP	23	10.0	3.5	16.7
Bay Parkway	143	13.4	3.4	50.3
Holtec Property	2	5.2	4.8	5.5
Lighthouse Drive	88	15.5	5.0	27.5
Total	256	13.8	3.4	50.3

For the SAV blades that were physically collected, the longest blade measured was in one of the quadrats from Lighthouse Drive at 45.7 cm (**Table 8**). The shortest length was at IBSP, with a length of 8.9 cm. Overall, 103 SAV blades were measured with an average length of 25.1 cm.

Table 8. Number of Blades, Average Length, Minimum Length, and Maximum Length for blades physically collected for each landing.

Landing	Number of Blades Measured	Average Length (cm)	Minimum Length (cm)	Maximum Length (cm)
IBSP	24	20.4	8.9	35.6
Bay Parkway	44	24.9	10.2	35.6
Holtec Property	3	17.4	15.2	19.1
Lighthouse Drive	32	30.3	12.7	45.7
Total	103	25.1	8.9	45.7

5. Summary

The areas of SAV documented in the Phase 1 Survey completed in October 2019 were used to inform the more intensive Phase 2 survey effort. The Phase 2 SAV surveys were conducted to identify the presence, extent, density, and species composition of SAV beds within the proposed export cable routes at the four potential landfall locations. The Phase 2 SAV Survey was completed in October 2020 and a total of 283 camera drops were completed. SAV was documented in 41.7 percent of the survey locations. Of the three landfall areas on the western shoreline of the bay, the Holtec Property had the lowest percent cover of SAV, with SAV present at only a single survey station close to the shoreline. Based on review of the photographs collected during the field survey and the SAV samples collected, observed SAV consisted almost entirely of eelgrass with the exception of single location at the Holtec Property which contained widgeon grass. The results from this Phase 2 Survey provide the most recent information on SAV presence, density, and species composition along the export cable routes and will be used to support Project planning, routing and design.

6. Literature Cited

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Appendix A. OCW Submerged Aquatic Vegetation Survey Protocols

OCW Submerged Aquatic Vegetation Surveys

Background:

Submerged Aquatic Vegetation (SAV) occurs in shallow estuaries where sunlight can penetrate the water column and photosynthesis can occur. SAV beds provide shelter and a potential forage habitat for many organisms including spawning fish (NJDEP 2017). Additionally, SAV beds provide dissolved oxygen to the water which helps to stabilize sediment against erosion forces (EPA 2006). Buried export cables from the Ocean Wind Project will pass through coastal habitats and have the potential to intersect SAV beds, causing impacts to the vegetation. SAV surveys will be conducted to identify the presence and extent of SAV beds within the proposed export cable routes and landfall locations to determine the potential for impacts as a result of the proposed project. The planned surveys incorporate existing information on SAV generated by Rutgers University and the State of New Jersey as well as survey protocols from state and federal agencies (Attachment 1).

The proposed export cable route approach to B.L. England is approximately 17.0 miles long, originating from lease area OCS-A-0498. This route will make landfall along the coast of Ocean City, New Jersey. The cable will proceed though the coastal barrier to Peck Bay, part of the larger Great Egg Harbor Bay. While the exact layout of the proposed approach to Oyster Creek is in its conceptual planning phase, it will make landfall via horizontal directional drilling (HDD) at the barrier island containing Island State Park, emerging within a paved area where the Park Office Buildings are located (see Figure 1). The proposed HDD route will then be buried under the barrier island emerging in Barnegat Bay where it will continue west until making landfall on the New Jersey main land at one of four potential locations. Based on existing 1979 and 1986-1987 NJDEP SAV maps and studies conducted in 2009 by Rutgers University (Lathrop et al. 2011), SAV habitats could potentially exist in the shallow coastal areas (< 6 ft water depth) of the back-bay and costal shoreline areas along the proposed routes. SAV surveys will investigate the potential SAV habitat areas identified in Figures 1 and 2.

Statement of Work:

In October 2019 and May 2020, a SAV survey will be conducted at the anticipated project landfall areas for Oyster Creek and BL England (Figures 1 and 2) in order to identify the presence and extent of SAV beds located along proposed inshore export cable routes and potential landfall locations. The SAV survey method detailed here is based on methodology described in Lathrop et al. (2011) and the *Submerged Aquatic Vegetation Survey Guidance for the New England Region* protocol published in 2016 by a joint agency task force involving the USEPA, NOAA, and the USACE (Colarusso and Verkade, 2016).

Surveys will map the extent of SAV beds during the growing season which runs from May through October (Colarusso and Verkade, 2016). Surveying efforts will be divided into two phases. The first phase of the survey will be conducted later in the growing season in September/October during periods of clear water quality conditions before water temperatures reduce growth of SAV and will determine the presence or absence of SAV beds within the study areas and map their extents using aerial photography. The second phase will gather more detailed information about SAV using quadrat sampling along transect lines.

The proposed methodology has been modified from the aforementioned guidance documents to inform Project design and development in order to avoid, minimize and potentially mitigate impacts to SAV. Modifications include:

- Collection of updated aerial photography via aircraft will be conducted to accurately delineate the edges of SAV beds. Lathrop et al. (2011) utilized aerial photography via plane, while the joint agency New England SAV Guidance (Colarusso and Verkade, 2016) recommends using available aerial photography from the state or a university to determine the historical extents of SAV distribution.
- Spacing of the transects and quadrats for Phase 2 of the survey was modified based on size of the Project Area to collect representative SAV density and species data to support potential mitigation planning during permitting. Lathrop et al. (2011) utilized targeted transects and a stratified random sampling design to determine the location and spacing of their in-situ sampling locations while the joint agency New England SAV Guidance (Colarusso and Verkade, 2016) recommends transects running perpendicular to shoreline 5 meters apart (spacing dependent on size of the areas to be surveyed and type of project proposed) with 3 meter spacing of quadrats within the transects. , 50 m on either side was selected to capture a representative portion of the surrounding area in addition to the area where the cable will be placed as a conservative measure. As SAV growth is variable and can be patchy, the 50m buffer to be surveyed would provide information on the presence of SAV in the area surrounding the cable path. The 50m distance will encompass the bottom disturbance from cable installation and allow for the width of barges or other work vessels that would be performing the cable installation.
- No physical sampling or staging of equipment will occur on existing aquaculture leases. In the event that a sample transect were to intersect an aquaculture lease that transect would be shifted to the first available area beyond the lease or eliminated. The survey team will coordinate with MFA staff to ensure the lease areas are avoided.

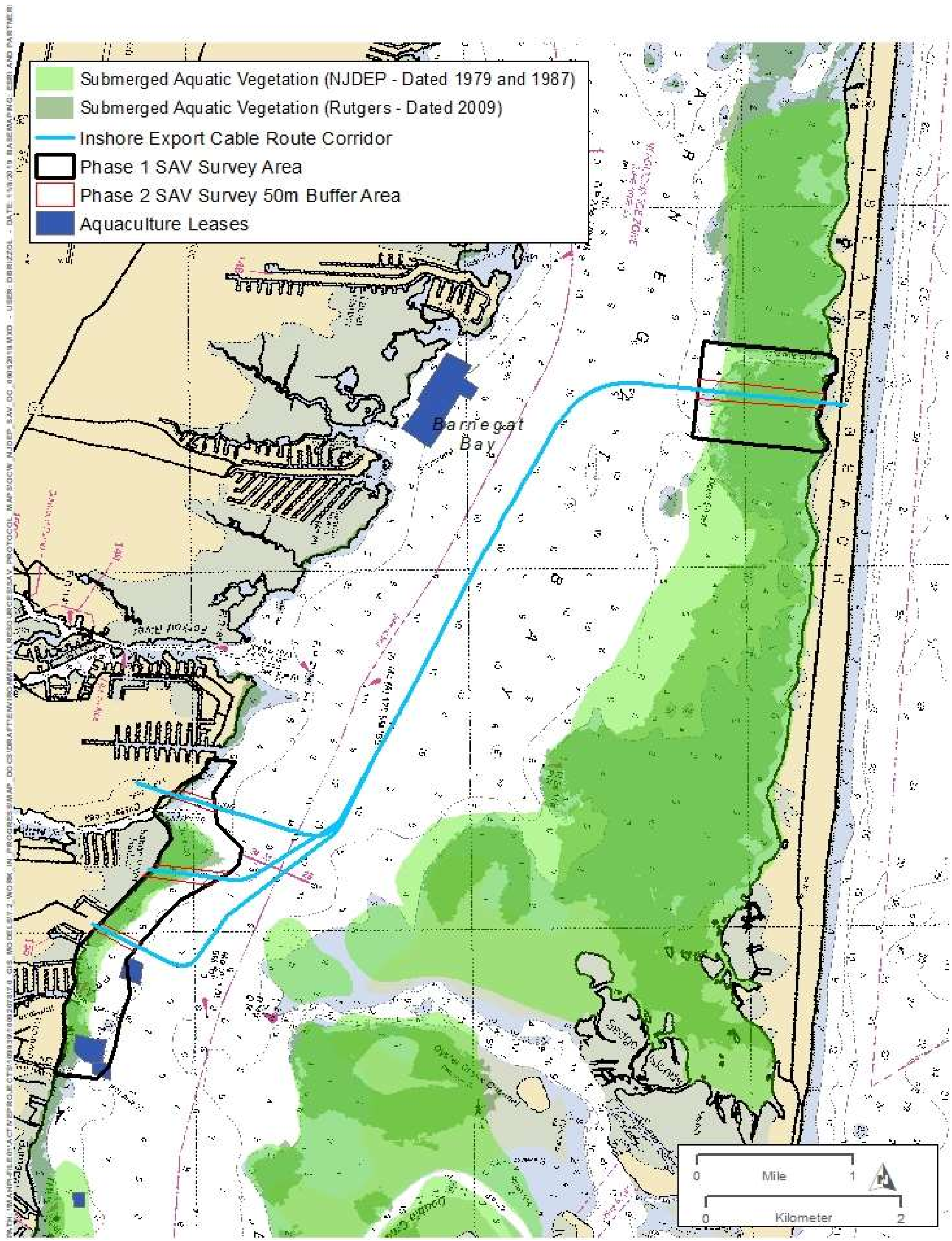

Figure 1. Barnegat Bay SAV Survey Limits

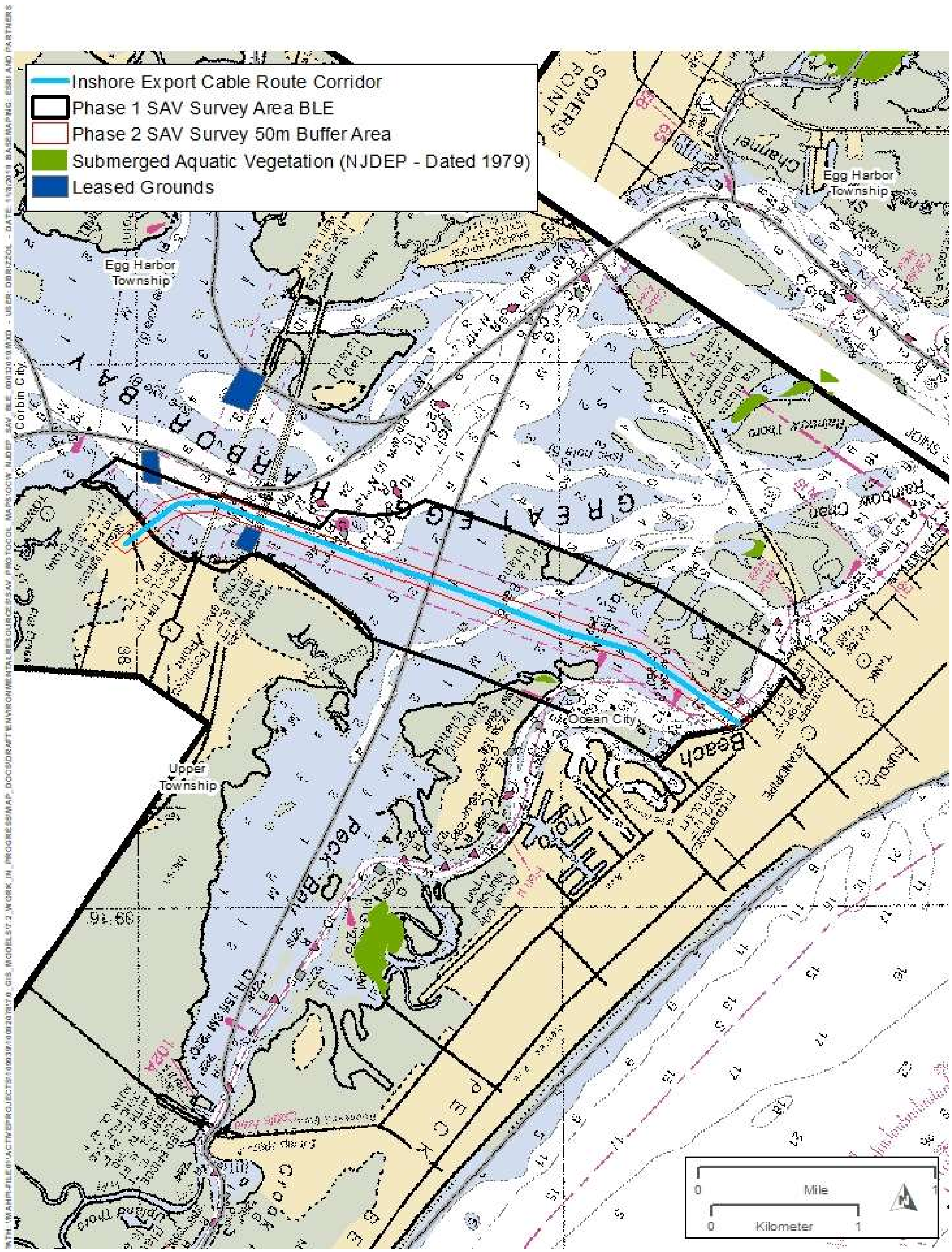

Figure 2. Great Egg Harbor SAV Survey Limits

SAV Survey Phase 1:

HDR will delineate SAV beds from aerial photography of shallow areas (<6 ft water depth) within an approximately 500m buffer of the proposed inshore export cable route and will extend sufficient distance from the shoreline to capture areas where SAV had been previously identified by the NJDEP and Rutgers studies. If weather conditions are suitable (calm winds, no precipitation, high visibility), a drone equipped with a camera will be used to support this survey. If weather conditions are not suitable for drone survey, aerial photography will be conducted using a plane will take place. Both drone and plane aerial surveys will yield high resolution, ortho-rectified imagery (direct overhead/plan view photography). Surveys will be conducted at low tide to facilitate viewing to the maximum depth possible. GPS coordinates will be taken along the SAV bed's perimeter, recording both the position and approximate water depth of each location. SAV beds will be surveyed as one continuous bed where applicable (details of density for "patchy" beds will be documented in phase 2).

SAV Survey Phase 2:

Phase 2 surveys will be conducted within the Phase 1 survey areas to "ground-truth" the extents of the SAV beds and obtain representative information on SAV species and density. The survey is anticipated to be completed in May 2020, when water clarity conditions are optimal. The goal of the Phase 2 survey is to gather more detailed information about the SAV beds identified in Phase 1 using a 0.5 square meter quadrat that is broken into 8 25cm x 25cm grid cells, along transect lines.

Phase 2 survey will begin with initial reconnaissance of the survey area from boat to confirm presence/absence of SAV using bathyscope/viewing bucket from the surface. The survey will be conducted on a sunny day, during a falling tide, when winds are calm to facilitate optimal viewing capabilities. Following initial reconnaissance, underwater photography will be utilized to document the SAV within each 0.5 square meter quadrat. This more detailed survey will be confined to the 50m area on either side of the proposed cable route that overlaps with areas of SAV identified in Phase 1 survey.

Transect lines will be established in SAV beds identified in Phase 1. Transect lines will be spaced approximately 30 meters apart and run perpendicular to the cable route . Start and end points of each transect line will be recorded using a GPS unit. Quadrat samples will be collected every 10 meters along each transect. Upon processing photographs, the following data will be recorded:

1. Date and time for each sampling transect.
2. Water depth at each sampling point (quadrat).
3. Water quality data (temperature, pH, salinity, dissolved oxygen, turbidity) will be collected at each sampling point.
4. General sediment type characterized by visual observation (e.g., silt, mud, sand, shell) will be collected at each sample point. Sediment samples will be collected for grain size analysis by sieving, at a frequency that is representative of the sediments within the survey area. A

minimum of 5 sediment samples will be collected per survey area. Results will be reported according to the Wentworth (1922) grain size scale.

5. Estimated percent cover and density of SAV, per species, within a 0.5-m^2 quadrat divided into 825cm x 25cm grid cells.
6. Shoot length of 1-3 randomly chosen SAV blades within the quadrat, per species. Blades will be estimated in place relative to reference markers on the quadrat. If it is not possible to estimate blade length in place, samples will be collected manually or using an appropriate tool, details regarding why a particular tool was chosen and a repeatable procedure will be provided in the report.
7. Estimated epiphyte percent coverage (0-100%) for each species. Surveyors will record qualitative vegetative density as they survey SAV beds on the following scale:
    a. Spare (1-10% cover);
    b. Low (11-25% cover);
    c. Moderate (26-50% cover), and
    d. High (>50% cover).
8. Notable biological observations (e.g., shellfish or algal beds, crabs or lobsters, and fish fauna).

Reporting

A SAV Survey Report will be prepared to summarize the findings of the field survey. The report will include the following:

- Description of the areas surveyed, results of desktop map review and summary of the habitat observed;
- Description of the survey methodology used to complete the field survey;
- Description and summary of areas of SAV identified in Phase 1 and Phase 2 surveys, including;
    - Date and time surveys were conducted.
    - Water depth at substrate for the shallowest and deepest edges of beds
    - General sediment type (e.g., silt, mud, sand, shell, etc.) and results of grain size analysis from sediment samples. Estimate of the percent cover of SAV and density within each 0.5-m^2 quadrat (for each species) and the mean for all quadrats across the entire area surveyed [e.g., barren, sparse (1-10% cover), low (11-25%), moderate (26-50%), high (> 50%, and shoots/blades per unit area.].
    - Shoot length measurement summary
    - Notable biological observations (e.g., shellfish or algal beds, crabs or lobsters, and fish fauna).
- Figures:
    - Figures showing the aerial photography of the Phase 1 survey areas, and areas of SAV that were identified.
    - Figures showing the Phase 2 transect lines and quadrat sample points and will include, depth, general sediment type, percent cover/density, estimated blade length, epiphyte coverage, and notable biological observations
- Tables summarizing the area of SAV within each of the survey areas.

Schedule:

Anticipated Project schedule and milestones are outlined in Table 1 below.

Table 1. Project Milestones

Item	Due Date
Survey plan approval by agencies	September 2019
Phase 1 Survey	September – October 2019
Phase 2 Survey	October2020
Data processing and analysis	October 2020
Draft Report	November 2020
Final Report	December 2020

Anticipated Project Staff and Qualifications:

The roster of anticipated project staff, their roles, and qualifications will be provided prior to performing survey and reporting activities.

References:

Colarusso, P. and Verkade, A. 2016. *Submerged Aquatic Vegetation Survey Guidance for the New England Region*. Joint Federal Agency Publication including NOAA, EPA, and USACE.

Lathrop, R.G. and S. Haag. 2011. Assessment of Seagrass Status in the Barnegat Bay - Little Egg Harbor Estuary: 2003 and 2009. CRSSA Technical Report#2011-01. Rutgers University, Grant F. Walton Center for Remote Sensing and Spatial Analysis, New Brunswick, NJ.

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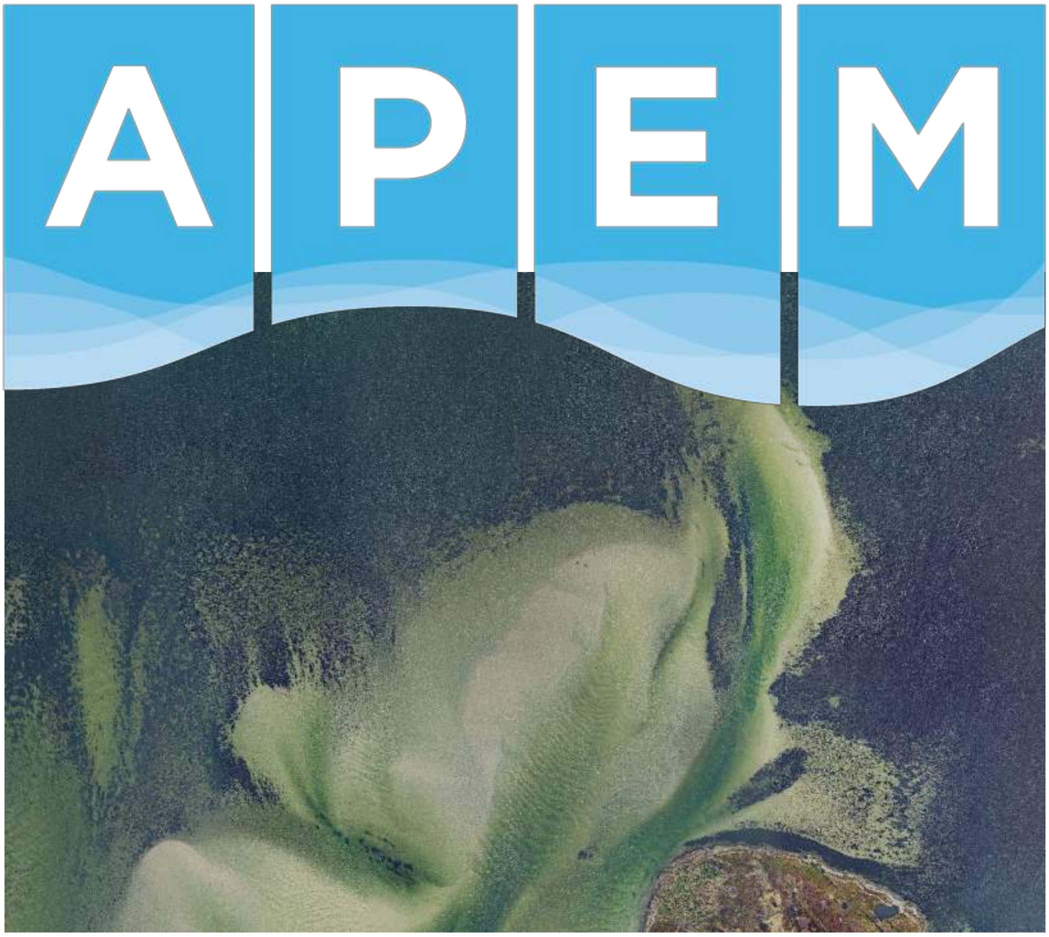
Appendix B. APEM New Jersey Submerged Aquatic Vegetation Aerial Survey



New Jersey Submerged Aquatic Vegetation Aerial Survey

HDR Engineering, Inc

APEM Ref: P00004340

December 2019

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Project reference: **P00004340**

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Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
1.0	11/29/19	All	All	Created	DC
1.2	12/10/19	All	All	Client amendments made	DC

Contents

List of Figures

1. Introduction

1.1 Project Background

APEM were commissioned by HDR Engineering, Inc (hereby referred to as HDR) to undertake an aerial survey of two coastal areas in New Jersey. The aim of the survey was to capture high-resolution aerial photography in order to map submerged aquatic vegetation (SAV) in the two areas.

1.2 Survey Locations

The project involved surveying two locations, one in Barnegat Bay, Ocean County and the other in Great Egg Harbor, Cape May County. An overview of the two locations is shown in Figure 1.

Figure 1. Location of the two sites surveyed in New Jersey. Yellow denotes the Barnegat Bay site and red the Great Egg Harbor site.

The Barnegat Bay site measured 28 square miles in area and is shown in more detail in Figure 2.

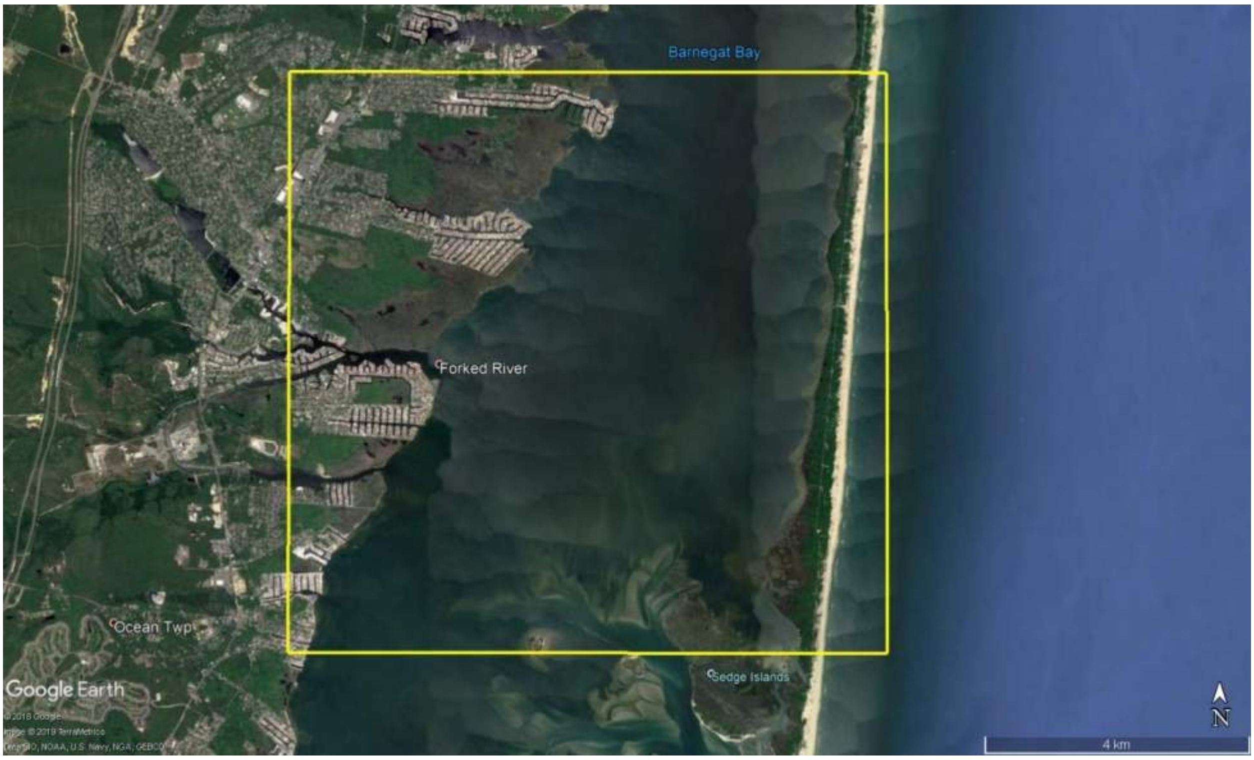


Figure 2. The Barnegat Bay survey area, outlined in yellow.

The Great Egg Harbor site measured approximately 13 square miles in area and is shown in more detail in Figure 3.

Figure 3. The Great Egg Harbor survey area, outlined in red.

2. Surveys and Data Processing

2.1 Aerial Survey

The aerial survey took place on October 7th 2019. The survey was carried out in a fixed wing aircraft using APEM's bespoke Shearwater III camera system surveying at an altitude of approximately 3,650ft above sea level. This allowed us to capture high-resolution imagery at a resolution of 4 cm ground sample distance (GSD). For Barnegat Bay, a total of 10,864 images were captured across 15 flight lines. For Great Egg Harbor a total of 7,299 images were captured across 10 flight lines. The survey was targeted to be complete within 1.5 hours either side of low tide, as this would allow for maximum intertidal exposure and help facilitate the mapping process.

Once the survey was complete, the data were downloaded and backed-up following APEM's stringent data management protocols.

2.2 Data Processing

The GPS data recorded on-board during the aerial survey were processed to produce location data for each aerial photograph's camera release point. These data were fed into photogrammetric processing software along with the imagery to produce georeferenced orthomosaics.

Over land, this photogrammetry process is able to create a seamless mosaic of the area. Over sea, however, it is often more problematic to generate the same type of seamless output due to the nature of the imagery (i.e. sun glint, changing wave patterns between adjacent imagery etc.). As such, a combination of automated processing and manual geo-referencing of images were required in order to achieve the required mosaic. This allowed a mosaic to be generated for all areas where the sea bottom could be seen within the imagery. For areas of deeper water where the sea bottom cannot be seen (typically in areas less than 7ft below mean sea level) in any of the imagery due to lack of light penetration, it was not possible to either georeferenced the imagery or map SAV. However, SAV has been documented to be very patchy and rare at depths of greater than 2m in New Jersey (Good *et al.,* 1978, Kennish *et al*., 2008). Therefore, it is unlikely these areas would contain SAV.

Once the mosaic was finalised, APEM marine biologists digitized areas of SAV using Geographic Information Software (GIS). Seagrass was mapped according to the following categories:

- Sparse cover; 10-40%
- Moderate cover; 40-80% cover
- Dense cover; 80-100% cover

The delineation of these categories was based on the data from the study by Lathrop *et al.* (2006), which mapped seagrass cover in the Barnegat Bay-Little Egg Harbor-Great Bay study area using these categories.

3. Results

The coverage maps for both survey areas are shown in Figures 4 and 5 below.

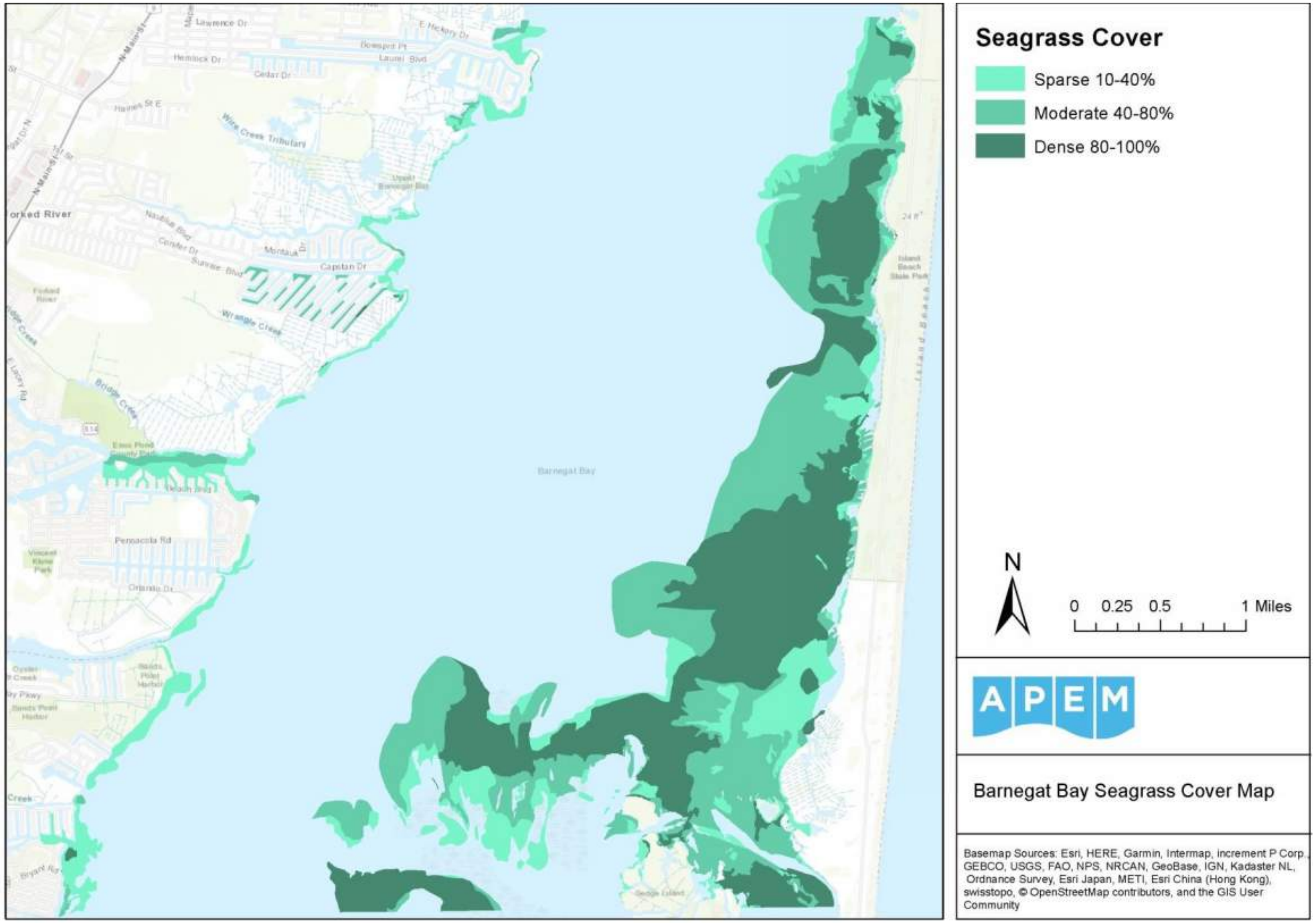


Figure 4 Seagrass coverage map of the Barnegat Bay survey area

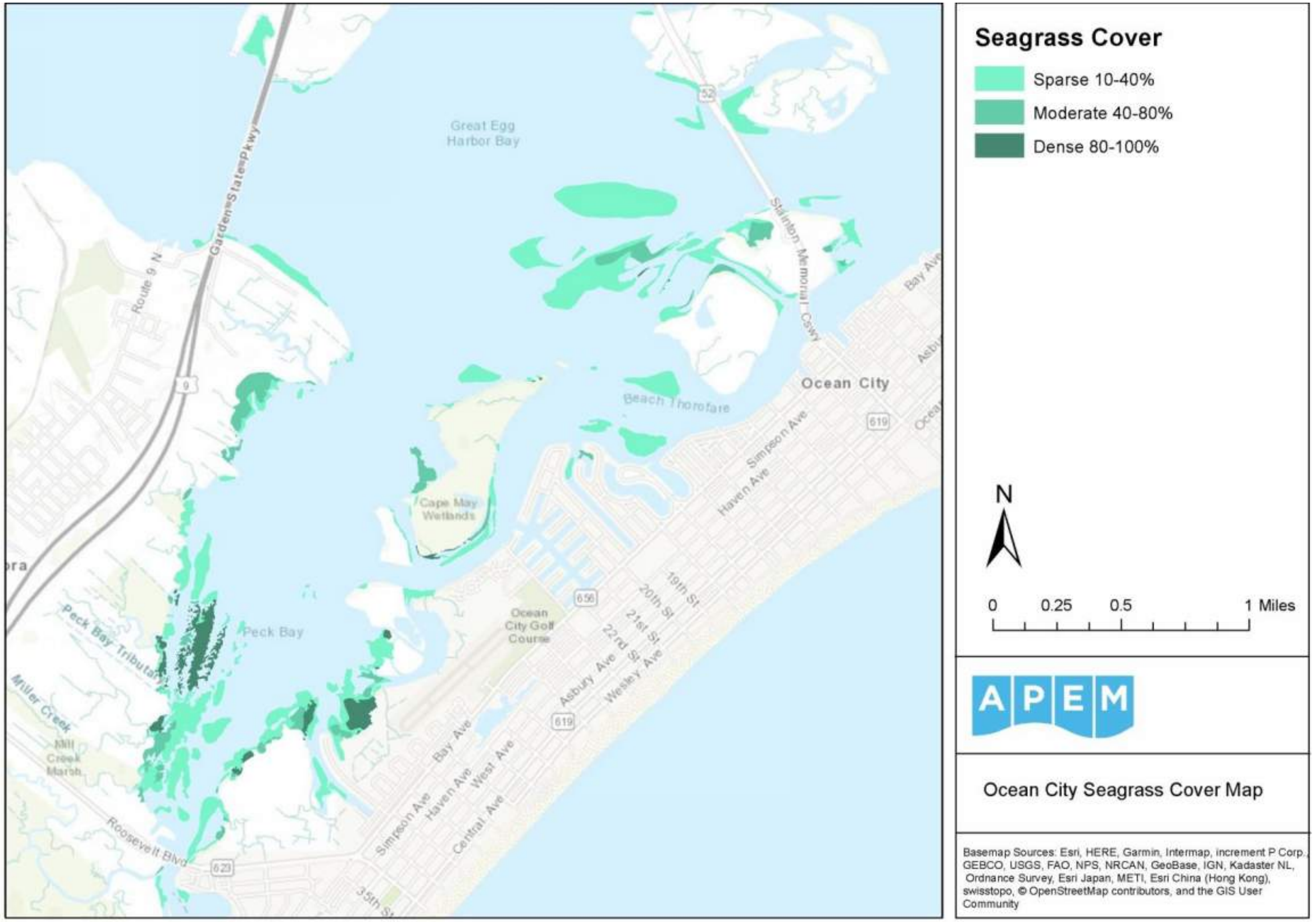


Figure 5 Seagrass coverage map of the Great Egg Harbor survey area

4. References

Good, R.E., Limb, J., Lyszczek, E., Miernik, M., Ogrosky, C., Psuty, N., Ryan, J. & Sickels, F. (1978) *Analysis and Delineation of the Submerged Vegetation of Coastal New Jersey.* Center for Coastal and Environmental Studies Rutgers. Available from: https://www.nj.gov/dep/dsr/barnegat/casestudy-littleegg.pdf [Accessed December 2019]

Kennish, M. J., Haag, S. M. & Sakowicz, G. P. (2008) Seagrass Demographic and Spatial Habitat Characterization in Little Egg Harbor, New Jersey, Using Fixed Transects. *Journal of Coastal Research: Special Issue.* 55, 148-170

Lathrop, R. G., Montesano, P. & Haag, S. (2006) A Multi-Scale Segementation Approach to Mapping Seagrass Habitats Using Airborne Digital Camera Imagery. *Photogrammetric Engineering & Remote Sensing*. 72 (6), 665-675

Appendix C. Survey Photography

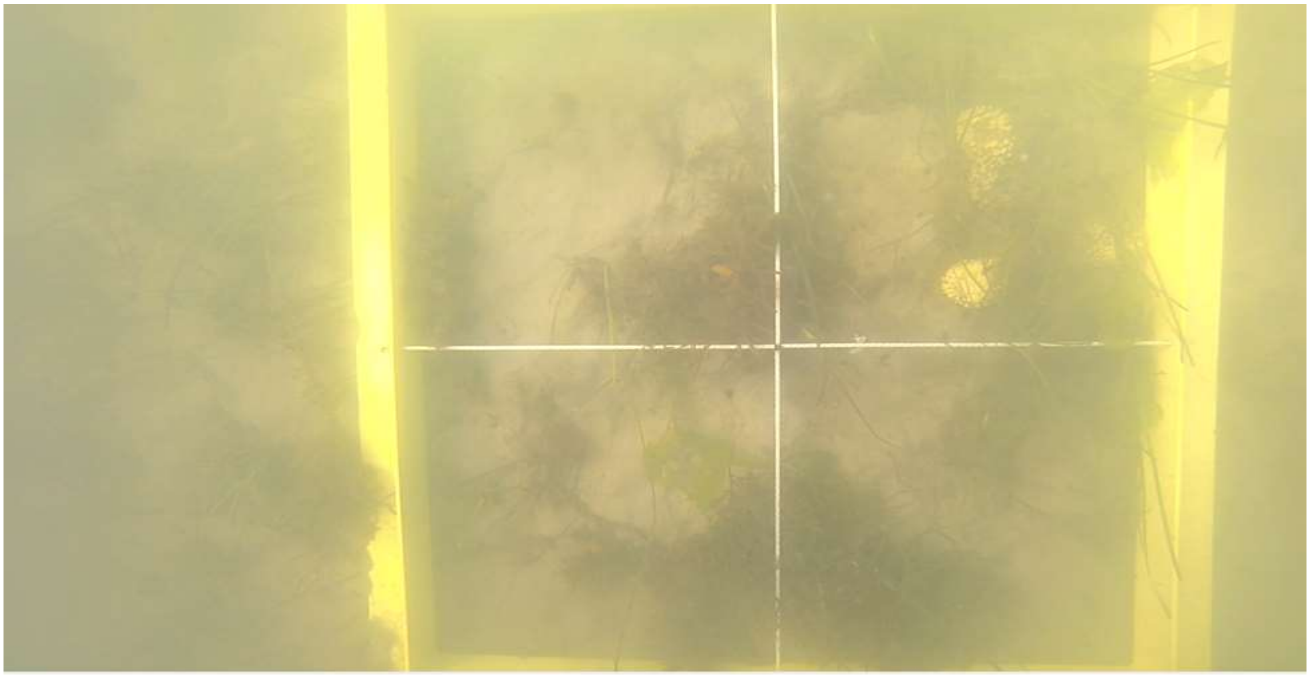


Photo 1: Bay Parkway Landing Station 507 with sponge, red, and green algae present.

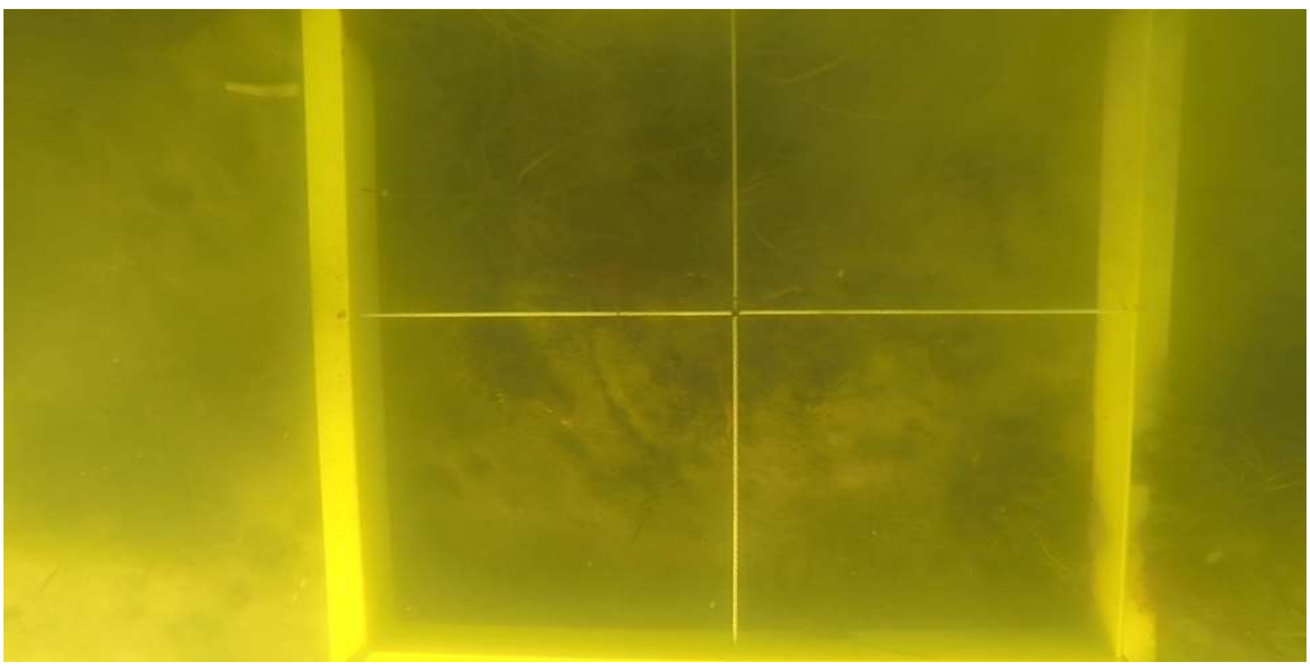


Photo 2: Bay Parkway Landing Station 521 with razor clam present.

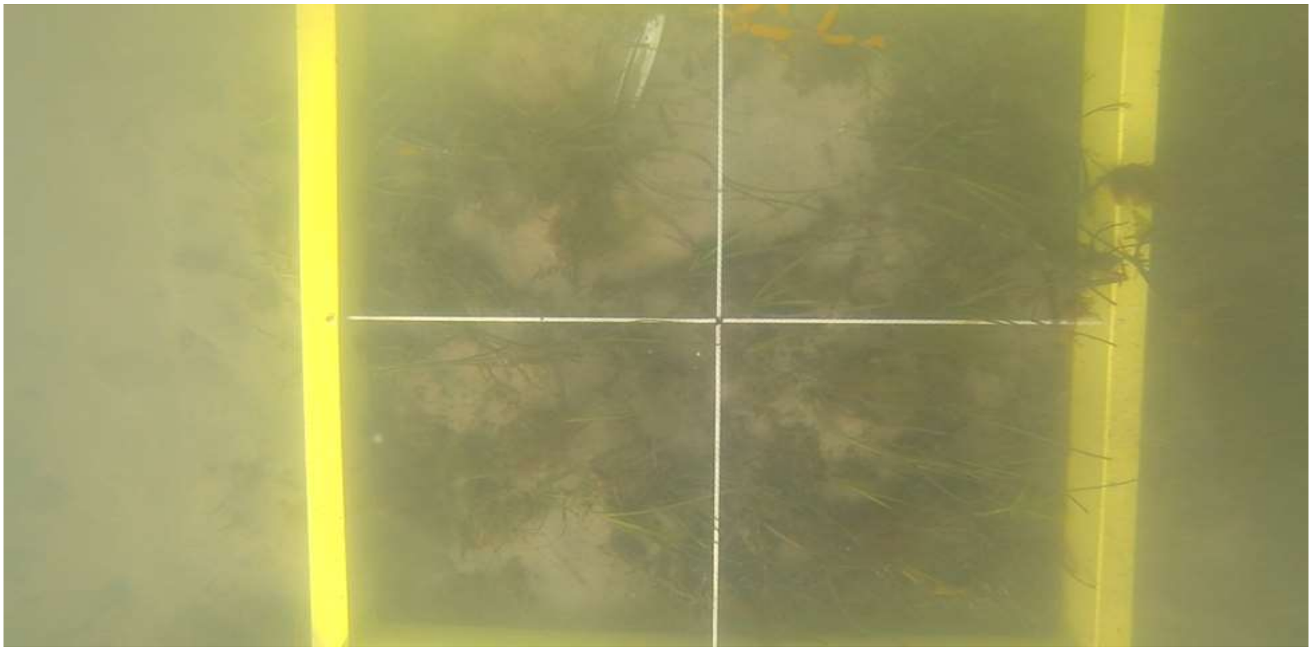


Photo 3: Bay Parkway Landing Station 560 with sponge, razor clam, and algae present.

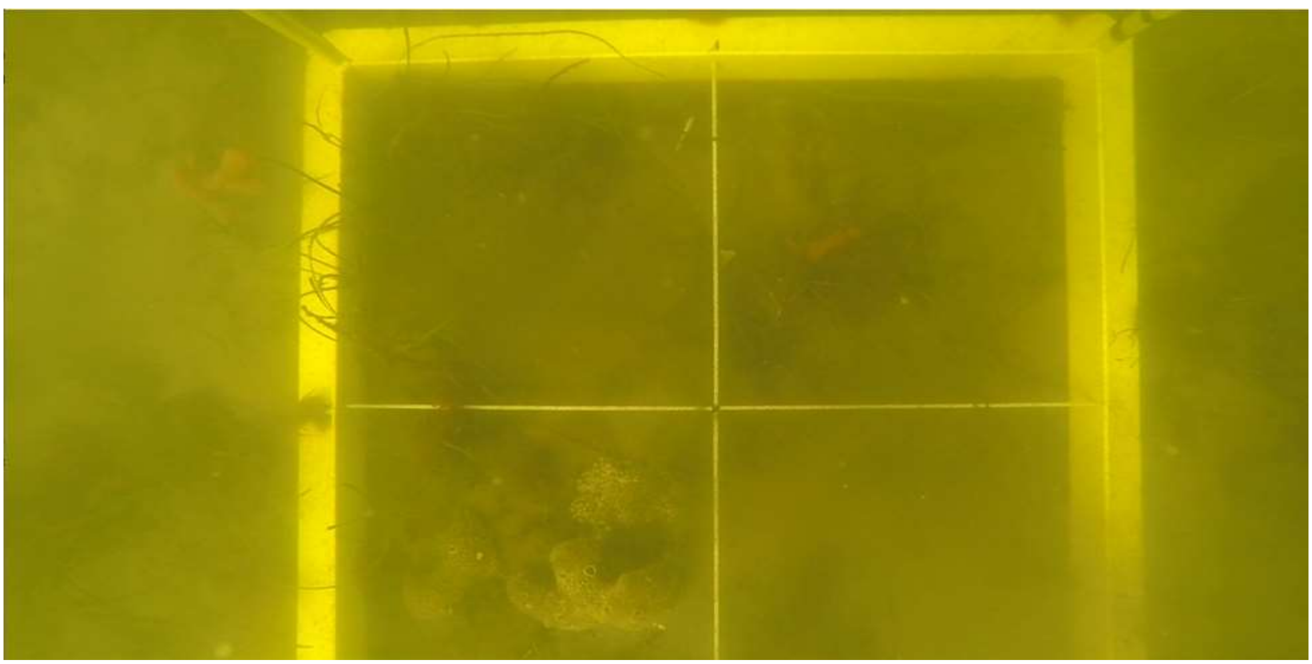


Photo 4: Bay Parkway Landing Station 535 with large sponge present.

Submerged Aquatic Vegetation Survey	**Ocean Wind Offshore Wind (OCW01)** **Oyster Creek SAV Survey Photographs**	DATE:	01/22/21	**PHOTO**
		CREATED BY:	JRC	**3 and 4**
		REVIEWED BY:	DJY	
		JOB NO:	10092078	

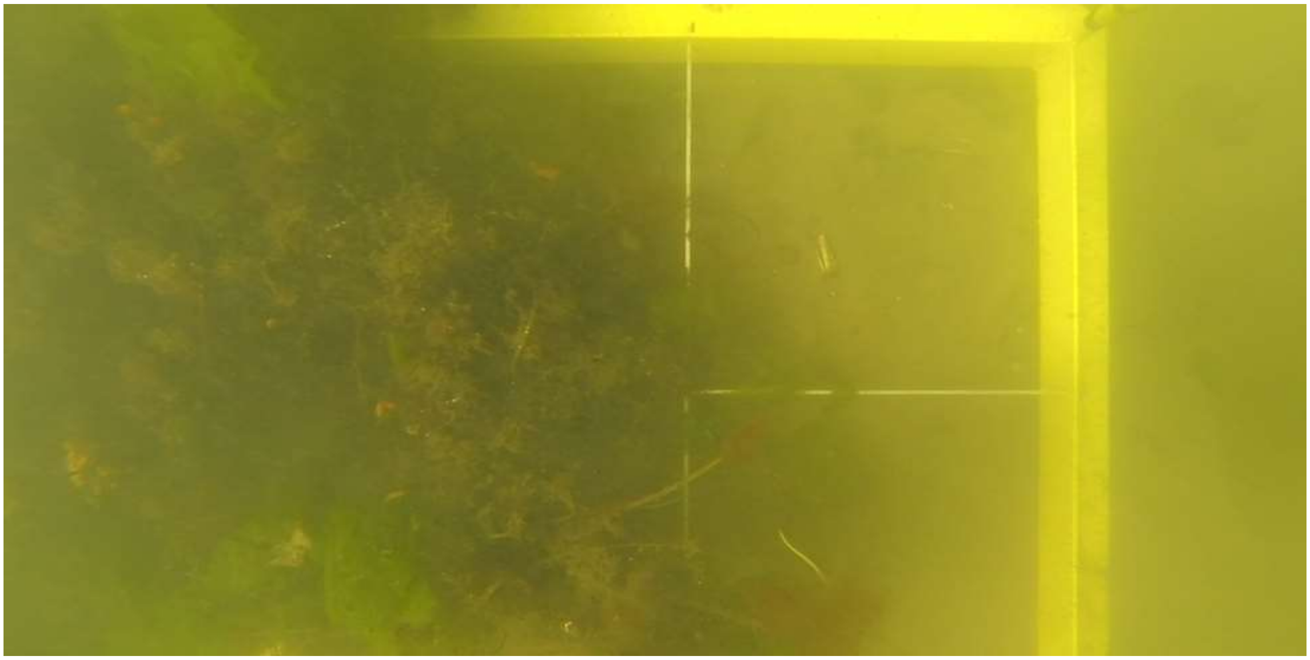


Photo 5: Bay Parkway Landing Station 557 with large algae growth and shell fragments present. Spare SAV growth.

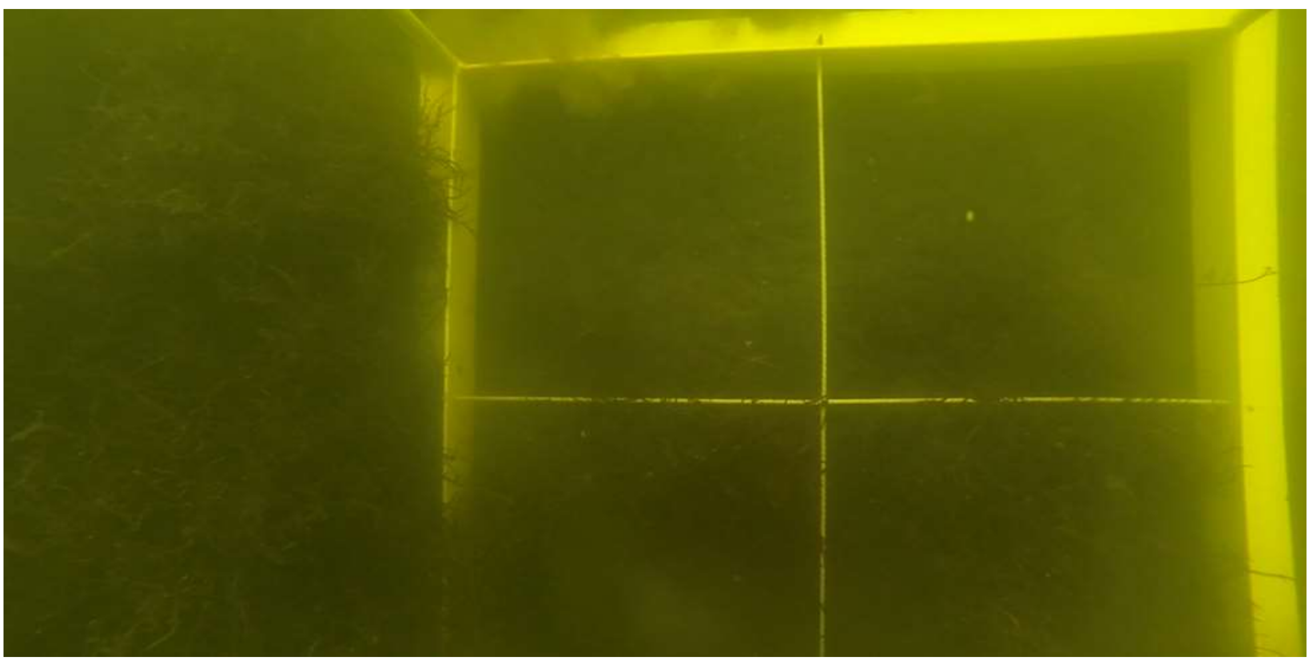


Photo 6: Holtec Property Station 638 with dense algae stand present.

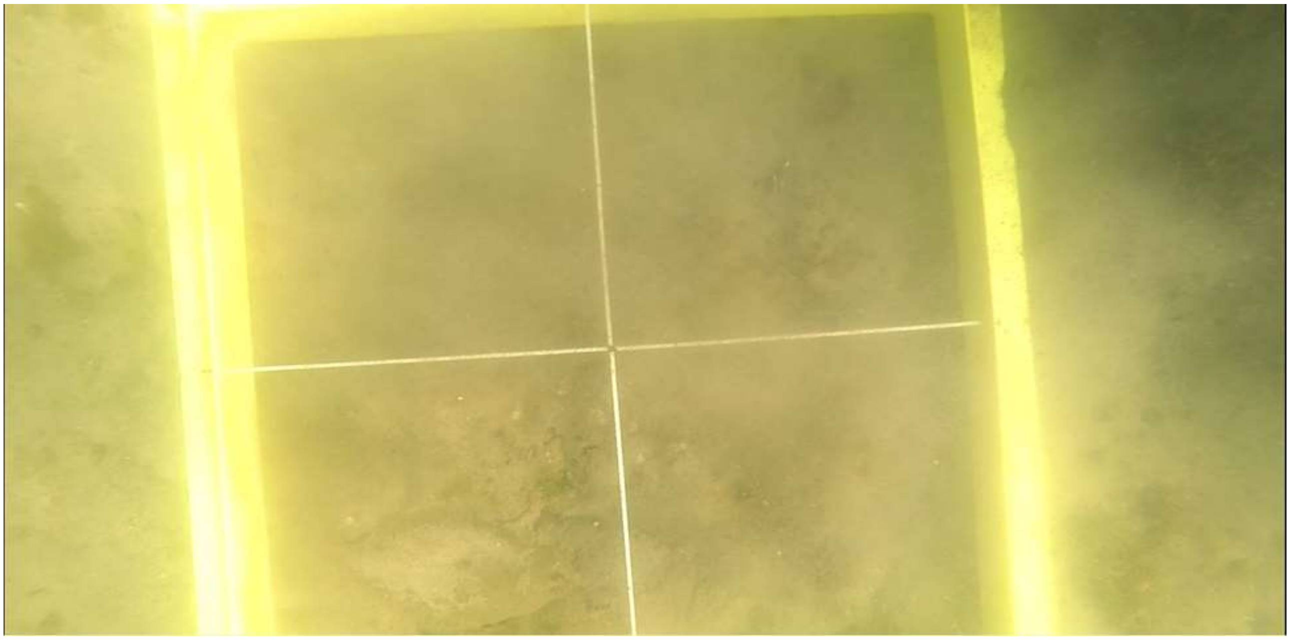


Photo 7: Lighthouse Drive Landing Station 715 with sandy bottom and juvenile summer flounder present.

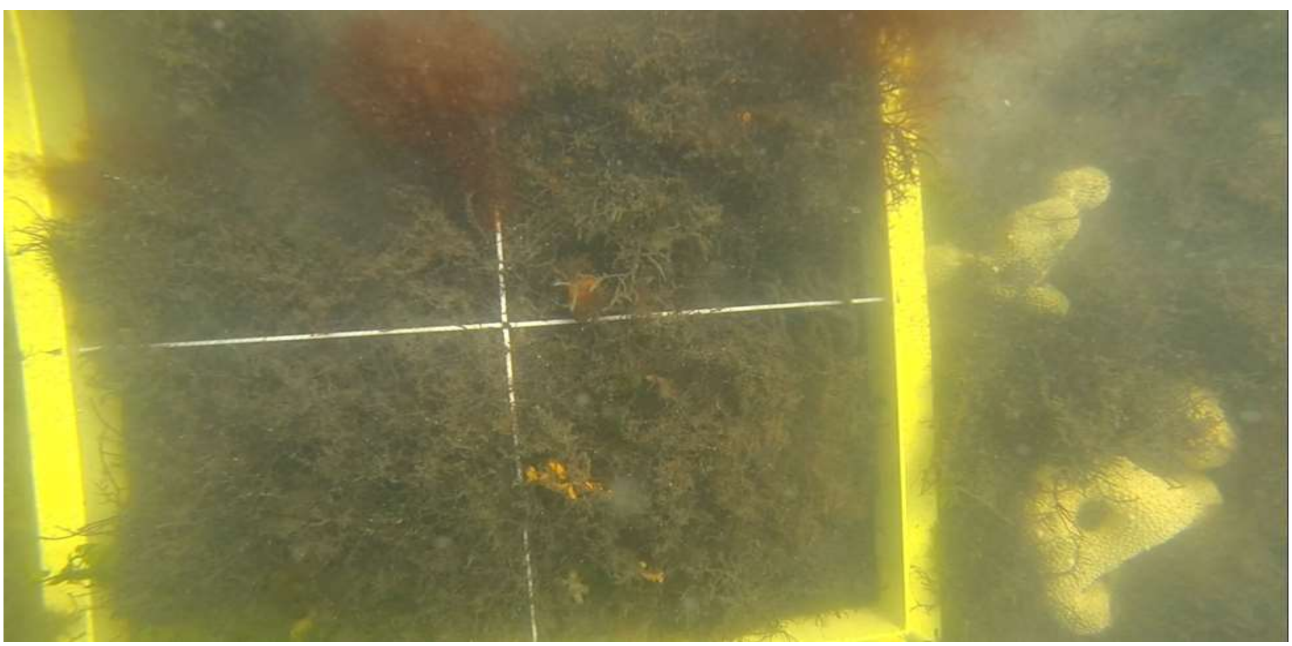


Photo 8: Lighthouse Drive Landing Station 724 with dense algae and large sponge present.

Submerged Aquatic Vegetation Survey	**Ocean Wind Offshore Wind (OCW01)** **Oyster Creek SAV Survey Photographs**	DATE:	01/22/21	**PHOTO**
		CREATED BY:	JRC	**7 and 8**
		REVIEWED BY:	DJY	
		JOB NO:	10092078	

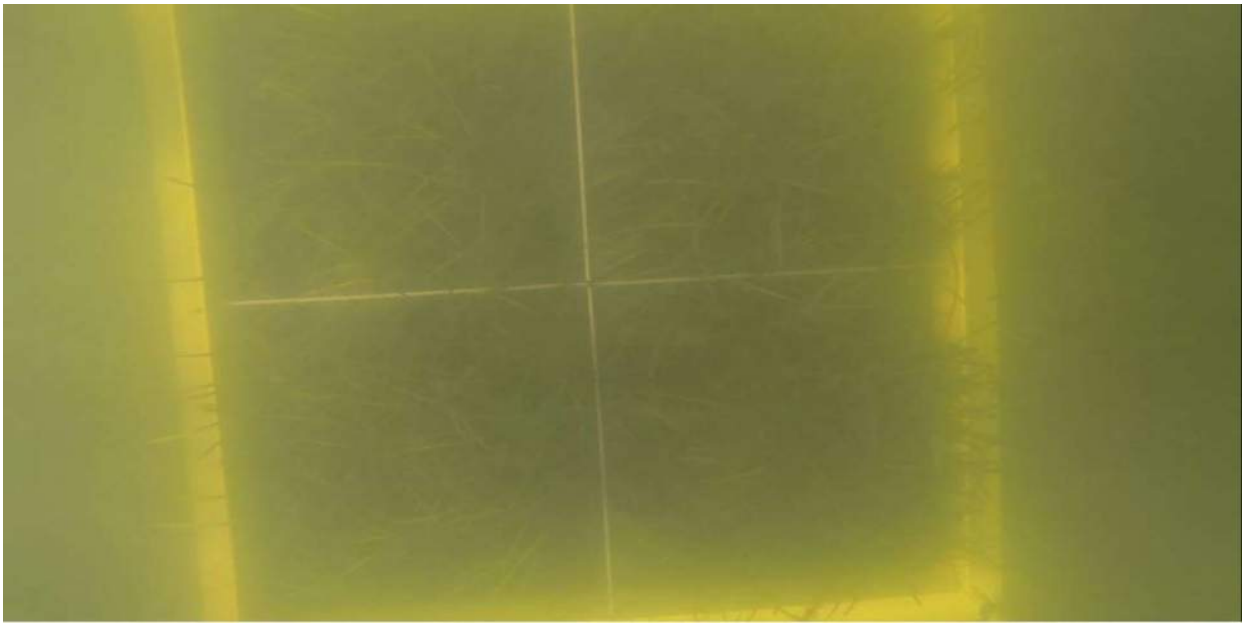


Photo 9: IBSP Landing Station 384 with thick patch of SAV present.

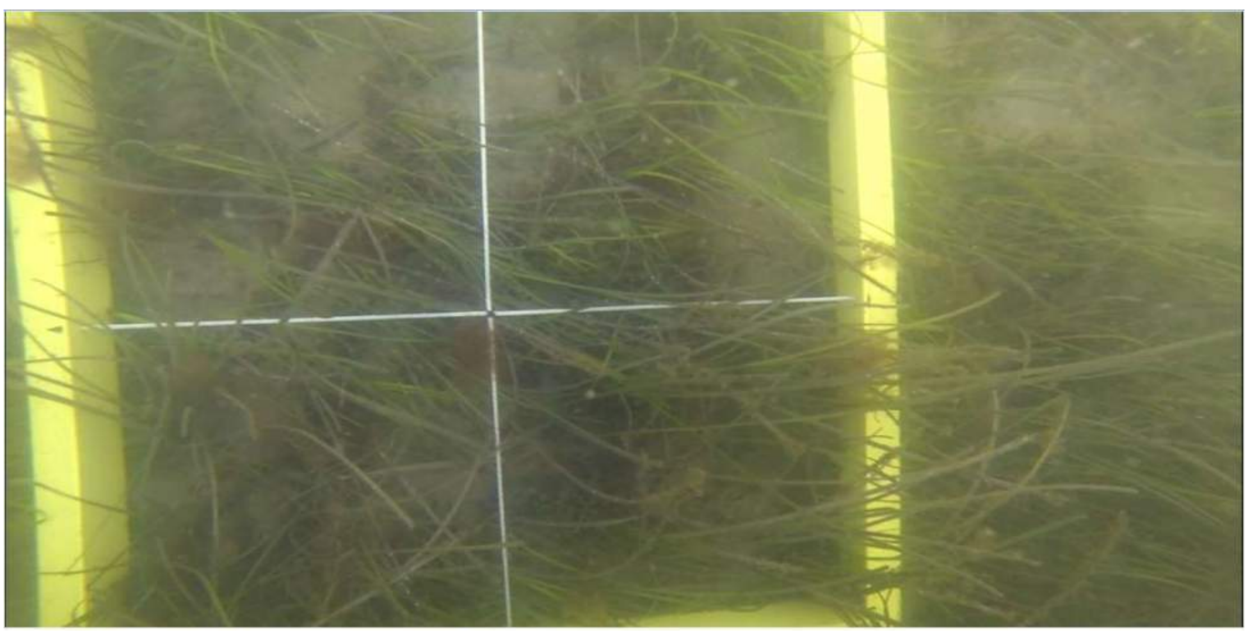


Photo 10: Lighthouse Drive Landing Station 757 with long stands of numerous SAV present.

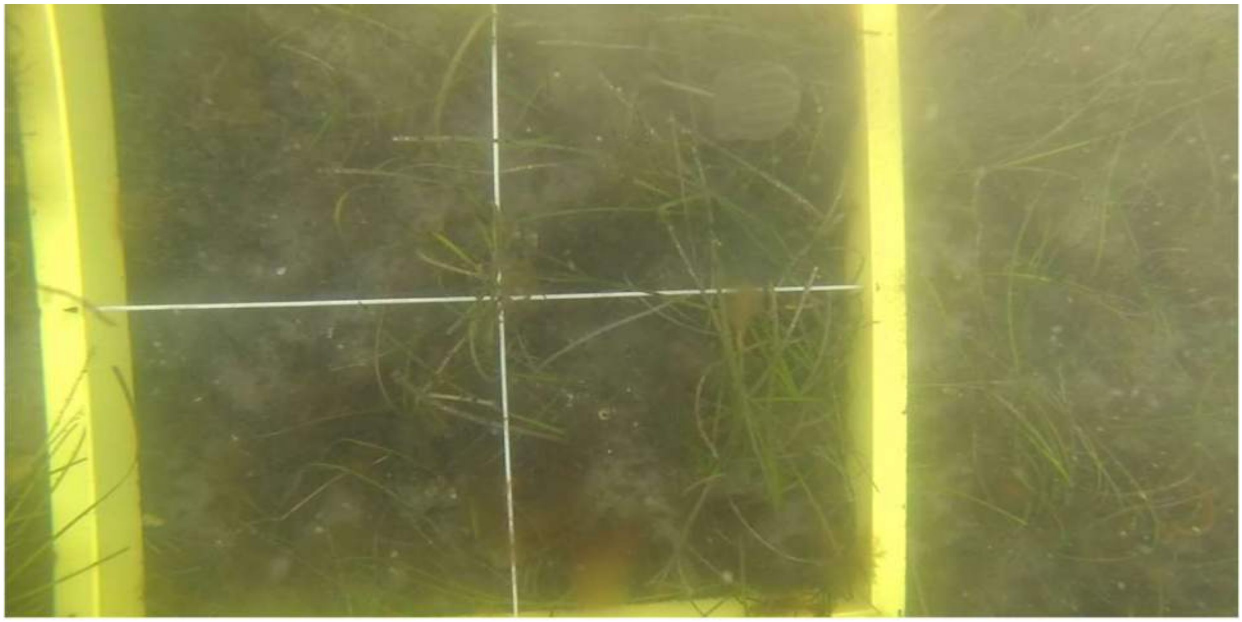


Photo 11: Lighthouse Drive Landing Station 753 with ctenophore, algae, and SAV present.

Photo 12: Photo of crab species brought up with Station 519 quadrant from Bay Parkway Landing.

Photo 13: Photo facing southwest at patchy SAV distribution at Lighthouse Drive Landing.

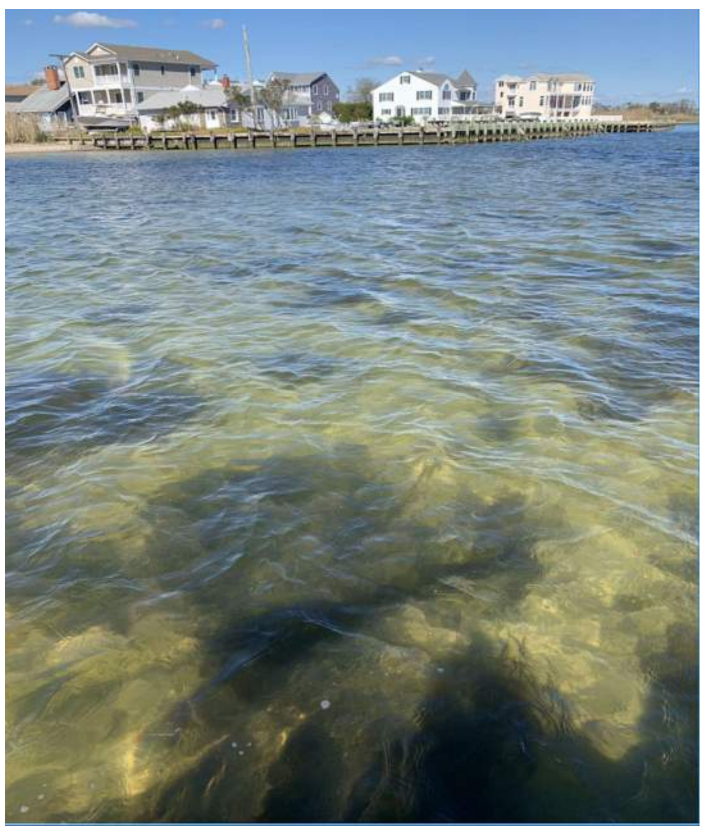


Photo 14: Photo facing northwest at patchy SAV distribution at Lighthouse Drive Landing.

Submerged Aquatic Vegetation Survey	**Ocean Wind Offshore Wind (OCW01)** **Oyster Creek SAV Survey Photographs**	DATE:	01/22/21	**PHOTO**
		CREATED BY:	JRC	**13 and 14**
		REVIEWED BY:	DJY	
		JOB NO:	10092078	

Photo 15: Photo showing Bay Parkway Landing shoreline, SAV rake, and camera frame in the water.

Photo 16: Photo facing west at Holtec Property Landing shoreline.

Submerged Aquatic Vegetation Survey	**Ocean Wind Offshore Wind (OCW01)** **Oyster Creek SAV Survey Photographs**	DATE:	01/22/21	**PHOTO**
		CREATED BY:	JRC	**15 and 16**
		REVIEWED BY:	DJY	
		JOB NO:	10092078	

Photo 17: Photo showing SAV blades and seahorse at Bay Parkway Landing Station 528.

Photo 18: Photo showing sediment sample collected at IBSP Landing Station 391.

Submerged Aquatic Vegetation Survey	**Ocean Wind Offshore Wind (OCW01)** **Oyster Creek SAV Survey Photographs**	DATE:	01/22/21	**PHOTO**
		CREATED BY:	JRC	**17 and 18**
		REVIEWED BY:	DJY	
		JOB NO:	10092078	

Photo 19: Photo showing sediment sample collected at Bay Parkway Landing Station 475.

Photo 20: Photo showing sediment sample collected at Bay Parkway Landing Station 541.

Photo 21: Photo showing sediment sample collected at Holtec Property Landing Station 636.

Photo 22: Photo showing sediment sample collected at Holtec Property Landing Station 678.

Photo 23: Photo showing sediment sample collected at Lighthouse Drive Landing Station 746.

Photo 24: Photo showing sediment sample collected at Lighthouse Drive Landing Station 760.

Appendix D. Notable Biological Observations

Notable Biological Observations

While on the survey vessel at multiple locations, schools of baitfish, including Atlantic silversides (*Menidia menidia*) and juvenile Atlantic menhaden (*Brevoortia tyrannus*), were observed being chased by predatory fish assumed to be striped bass (*Morone saxatilis*) and bluefish (*Pomatomus saltatrix*).

During the review of camera drops, ctenophores were observed floating over several quadrats. Several sponge species were observed directly adjacent to the quadrat frame. The shells of Atlantic jackknife clams (*Ensis leei*) and biogenic mounds were observed in multiple quadrats. One small summer flounder (*Paralichthys dentatus*) was observed within one of the Lighthouse Drive Landing quadrats. Survey photography and notable biological observations are provided in Appendix B.

Appendix E. Sediment Sampling Results

TerraSense, LLC
Geotesting Laboratory

10/28/2020
TerraSense Project Number: 7736-20079

Subresults
Hampton-Clarke, Inc.
175 US Hwy 46 West
Fairfield, NJ 07004

Dear Subresults:

Re: Laboratory Test Results for 0101203 AD19744

The purpose of this letter is to present the results of the laboratory tests performed on the samples delivered to the TerraSense laboratory on 10/13/20. Testing was performed based on the assignment dated 10/13/20 by TR.

Test Results

Test results are reported on the accompanying test pages.

Test Comments

Testing was performed in general accordance to the ASTM or other methods as listed on the test pages. Deviations from the test standards are noted on these pages.

Limitations

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no other warranty, expressed or implied, is made.

Sample Disposition

If we do not receive other instructions from you within thirty days, this material will be disposed of.

If you have any questions concerning the test results reported in this letter, please call us.

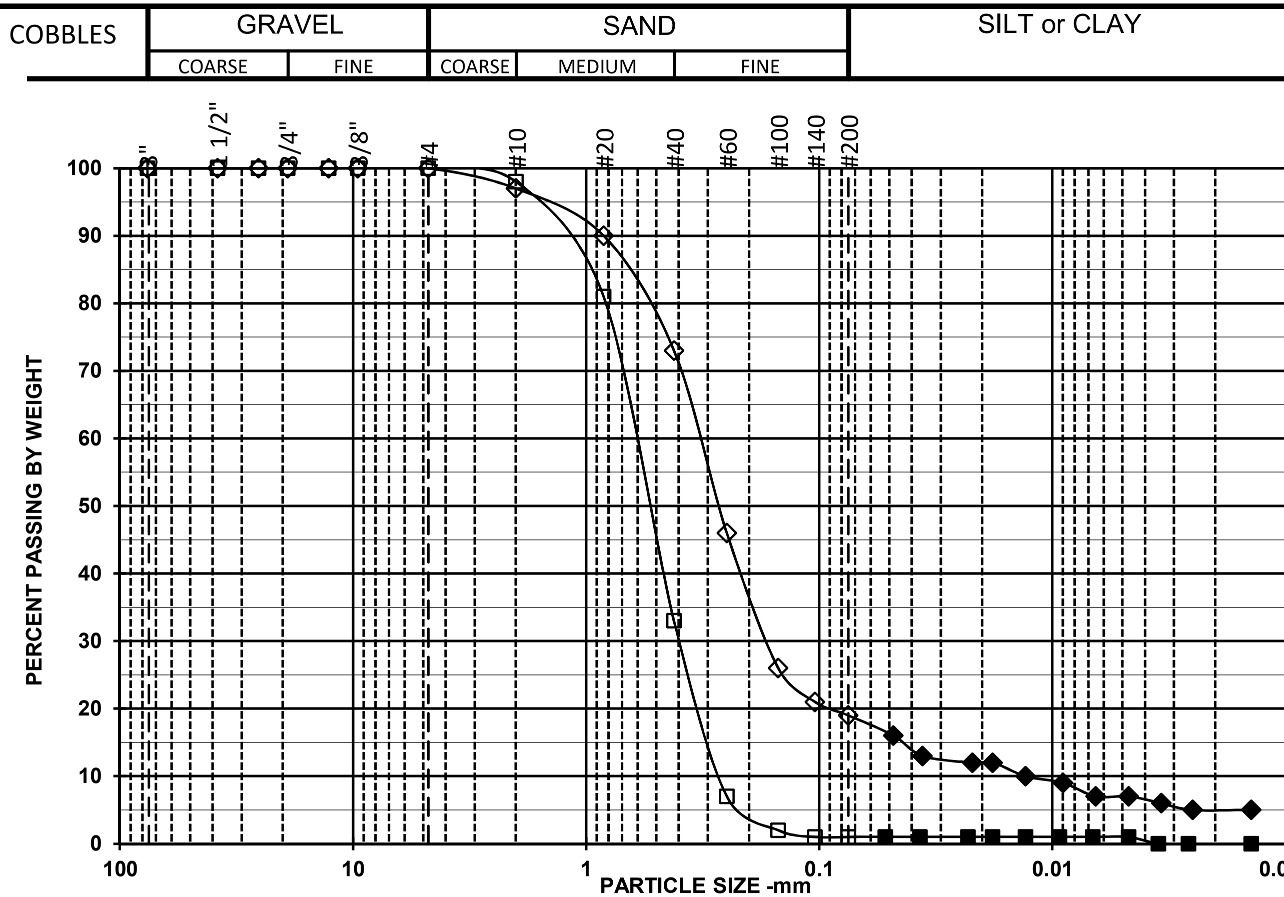
Sincerely,
TerraSense, LLC.
Rosella Thomas
Rosella Thomas
Managing Member

Enclosure:

Hampton Clarke #0101203
AD19744
LABORATORY TESTING DATA SUMMARY

GROUP ID	SAMPLE NO.	CLIENT ID	TEST DATE	IDENTIFICATION TESTS				REMARKS
				WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
AD19744	001	636	10/13/2020		SP	1	0	
AD19744	002	678	10/13/2020		SM	19	5	
AD19744	003	475	10/13/2020		SP	2	0	
AD19744	004	541	10/13/2020		SM	23	8	
AD19744	005	760	10/13/2020		SM	13	5	
AD19744	006	746	10/13/2020		SP	4	2	
AD19744	007	391	10/13/2020		SP	1	1	

Note: (1) USCS symbol based on visual observation and Sieve reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□					SP		Grayish brown, Poorly graded sand organic mat'l noted	10/13/20
◇					SM		Grayish brown, Silty sand organic mat'l noted	10/13/20
○								

Hampton Clarke #0101203

TerraSense, LLC #7736-20079

AD19744

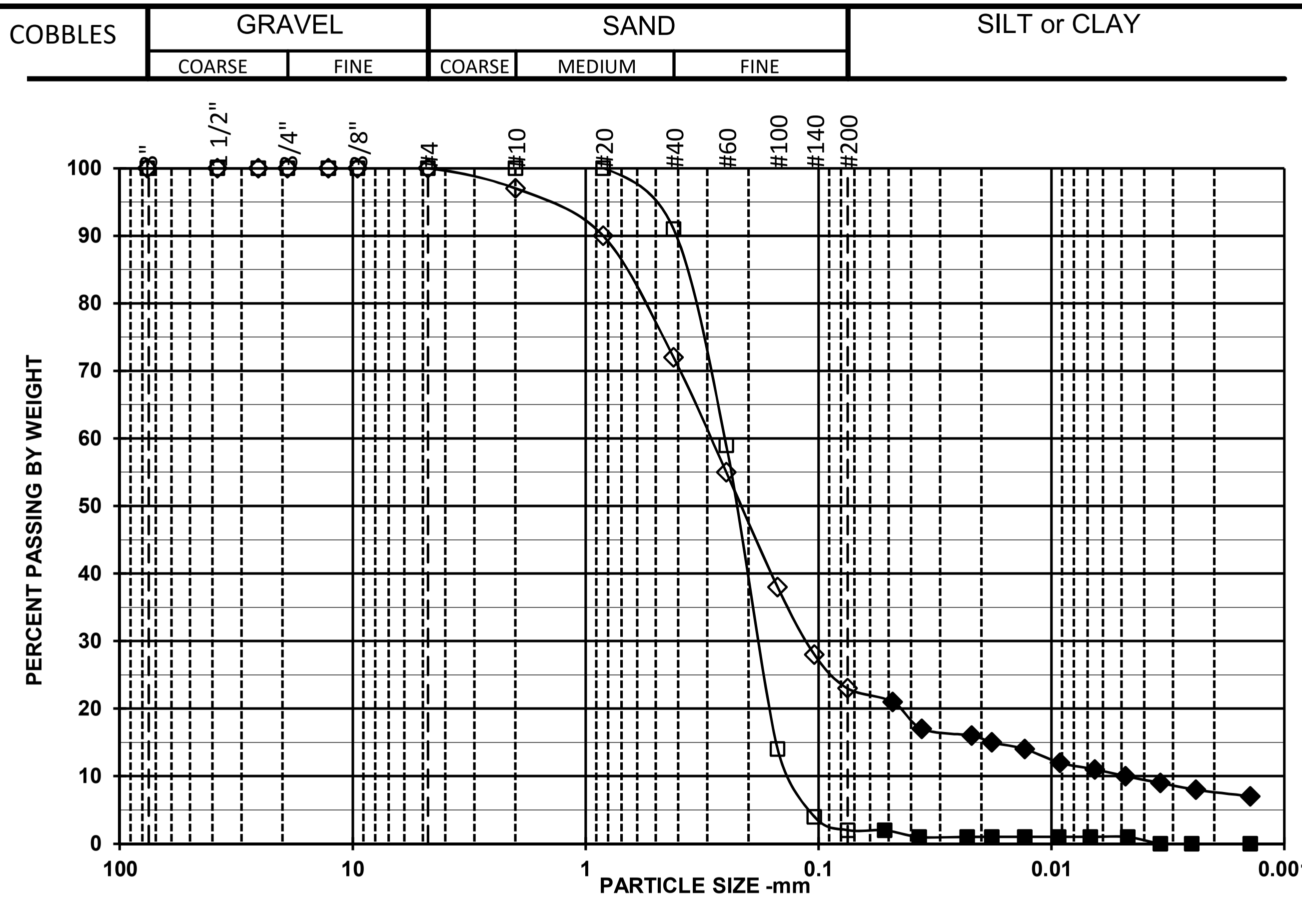
Symbol	□	◇	○
Group#	AD19744	AD19744	
ID	001	002	
Client ID	636	678	
% +3"	0	0	
% Gravel	0	0	
% SAND	99	81	
%C SAND	2	3	
%M SAND	65	24	
%F SAND	32	54	
% FINES	1	19	
D_{100} (mm)	9.53	4.75	
D_{60} (mm)	0.62	0.326	
D_{30} (mm)	0.39	0.17	
D_{10} (mm)	0.26	0.013	
Cc	0.9	6.8	
Cu	2.4	25.1	

Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	100	100	
3/4"	100	100	
1/2"	100	100	
3/8"	100	100	
#4	100	100	
#10	98	97	
#20	81	90	
#40	33	73	
#60	7	46	
#100	2	26	
#140	1	21	
#200	1	19	
5μ m	1	7	
2μ m	0	5	
1μ m	0	5	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a7 (09/20)

Siev1a.xlsx 10/27/2020



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□					SP		Grayish brown, Poorly graded sand organic mat'l noted	10/13/20
◇					SM		Grayish brown, Silty sand organic mat'l noted	10/13/20
○								

Hampton Clarke #0101203

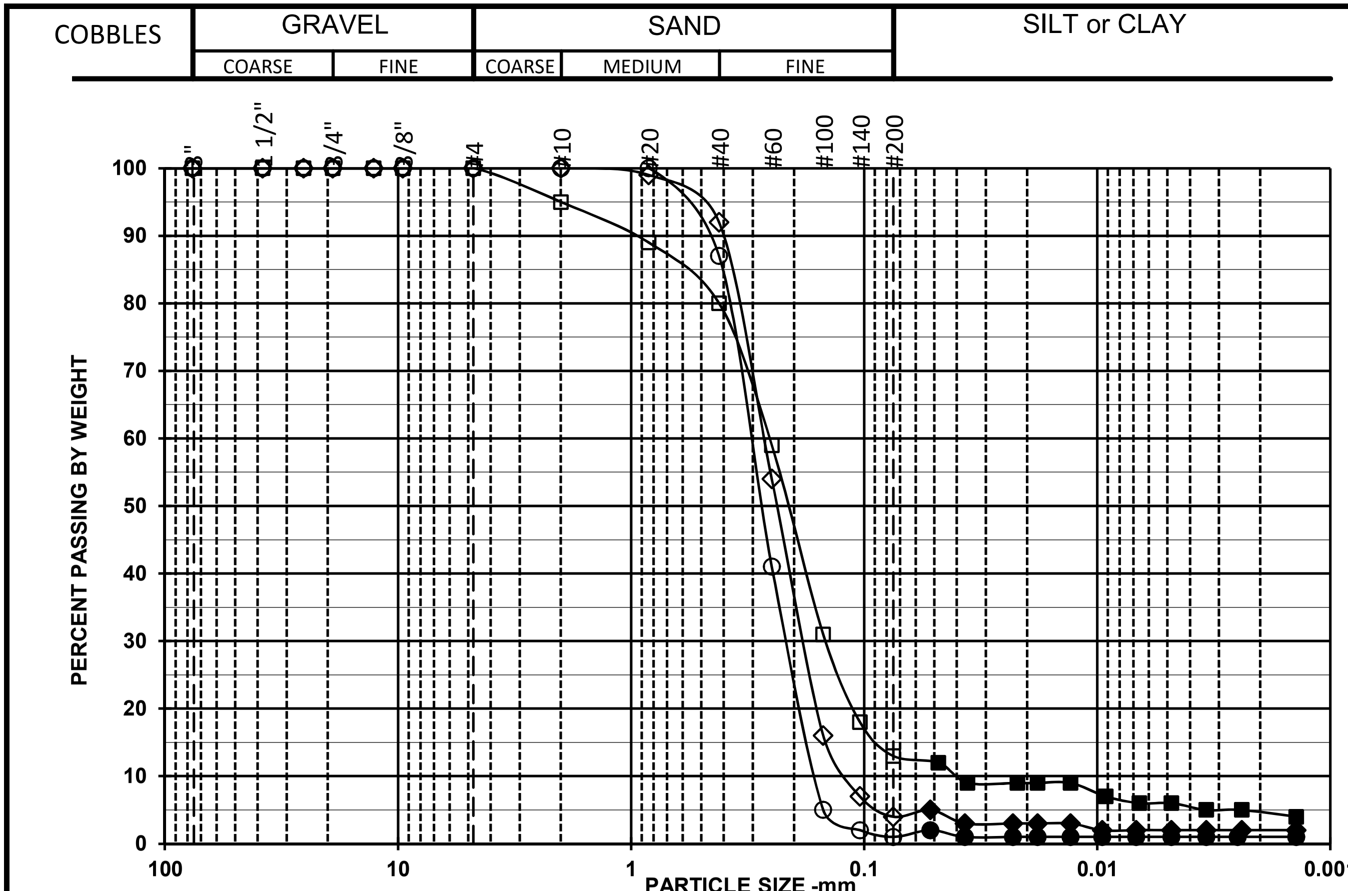
TerraSense, LLC #7736-20079

AD19744

Symbol	□	◇	○
Group#	AD19744	AD19744	
ID	003	004	
Client ID	475	541	
% +3"	0	0	
% Gravel	0	0	
% SAND	98	77	
%C SAND	0	3	
%M SAND	9	25	
%F SAND	89	49	
% FINES	2	23	
D_{100} (mm)	9.53	4.75	
D_{60} (mm)	0.253	0.29	
D_{30} (mm)	0.18	0.11	
D_{10} (mm)	0.13	0.005	
Cc	1	8.7	
Cu	1.9	60.4	

Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	100	100	
3/4"	100	100	
1/2"	100	100	
3/8"	100	100	
#4	100	100	
#10	100	97	
#20	100	90	
#40	91	72	
#60	59	55	
#100	14	38	
#140	4	28	
#200	2	23	
5µ m	1	10	
2µ m	0	8	
1µ m	0	6	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□					SM		Grayish brown, Silty sand organic mat'l noted	10/13/20
◇					SP		Grayish brown, Poorly graded sand shell fragments & organic mat'l noted	10/13/20
○					SP		Grayish brown, Poorly graded sand shell fragments & organic mat'l noted	10/13/20

Hampton Clarke #0101203

TerraSense, LLC #7736-20079

AD19744

Symbol	□	◇	○
Group#	AD19744	AD19744	AD19744
ID	005	006	007
Client ID	760	746	391
% +3"	0	0	0
% Gravel	0	0	0
% SAND	87	96	99
%C SAND	5	0	0
%M SAND	15	8	13
%F SAND	67	88	86
% FINES	13	4	1
D_{100} (mm)	4.75	9.53	9.53
D_{60} (mm)	0.255	0.27	0.309
D_{30} (mm)	0.15	0.18	0.21
D_{10} (mm)	0.04	0.12	0.16
Cc	2.2	1	0.9
Cu	6.4	2.3	1.9

Sieve Size/ID #	Percent Finer Data		
6"	100	100	100
4"	100	100	100
3"	100	100	100
1 1/2"	100	100	100
1"	100	100	100
3/4"	100	100	100
1/2"	100	100	100
3/8"	100	100	100
#4	100	100	100
#10	95	100	100
#20	89	99	100
#40	80	92	87
#60	59	54	41
#100	31	16	5
#140	18	7	2
#200	13	4	1
5μ m	6	2	1
2μ m	5	2	1
1μ m	3	2	1

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

CHAIN OF CUSTODY RECORD

Hampton-Clarke, Inc.
175 US Hwy 46 West
Fairfield, New Jersey, 07004
Ph:800-426-9992 Fax:973-439-1458

7736-20079

Report To:	Invoice To:	Project #:	CocID#:
Hampton-Clarke, Inc.:	Hampton-Clarke, Inc.:	0101203	6931
Attn:Reporting	Attn:Accounting		
175 Route 46 West	175 Route 46 West		
Fairfield, New Jersey 07004	Fairfield, New Jersey 07004		

FINAL RESULTS TO: subresults@hcvlab.com
PRELIM/VERBAL RESULTS TO: subresults@hcvlab.com

EDD: NEW JERSEY HAZRESULT OR EQUIS EZEDD REQUIRED FOR ALL DATA SUBMITTALS!

Turn Around Time: Standard **Preliminary Due Date:** 10/27/2020
Report Type: NJDEP-R (REDUCED) **Hard Copy Due Date:** 11/4/2020

Sample Number:	Client ID	Matrix:	Date Collected:	Time Collected:	Analysis Requested
AD19744-001	636	Soil	10/8/2020	10:20:00 AM	Grain Size with Hydrometer(ASTM D6913&D7928)
AD19744-002	678	Soil	10/8/2020	10:30:00 AM	Grain Size with Hydrometer(ASTM D6913&D7928)
AD19744-003	475	Soil	10/8/2020	10:48:00 AM	Grain Size with Hydrometer(ASTM D6913&D7928)
AD19744-004	541	Soil	10/8/2020	10:57:00 AM	Grain Size with Hydrometer(ASTM D6913&D7928)
AD19744-005	760	Soil	10/8/2020	1:58:00 PM	Grain Size with Hydrometer(ASTM D6913&D7928)
AD19744-006	746	Soil	10/8/2020	2:17:00 PM	Grain Size with Hydrometer(ASTM D6913&D7928)
AD19744-007	391	Soil	10/9/2020	8:21:00 AM	Grain Size with Hydrometer(ASTM D6913&D7928)

Relinquished By:	Accepted By:	Date:	Time:	Comments, Notes, Special Requirements, HAZARDS
[signature]	G Thomas	10/13/20	15:02	

R 10/13/2020

Cooler Temp:__________

HC Lab Use Only: Subcontracted Lab Id and Contact: TERRASENSE, Greg Thomas, (973) 256-0494, LabID: H, 45H Commerce Way, , Totowa, NJ, 07512

Ocean Wind
An Ørsted & PSEG project

Island Beach State Park Prior Channel Route Option
SAV Presence/Absence Survey

Island Beach State Park Prior Channel Route Option SAV Survey - Addendum to OCW COP, Appendix E, SAV Survey

Objectives

On October 22, 2021 a field survey was performed in Barnegat Bay (**Figures 1** and **2)** to assess the presence or absence of Submerged Aquatic Vegetation (SAV), general sediment characteristics, and water depth in the prior channel that extends west from the Island Beach State Park Maintenance Area.

Methods

To investigate the presence and absence of SAV in the area of the prior channel, an underwater camera mounted above a 0.25 m^2 steel quadrat frame was deployed at 27 stations in this area. A brief video was collected at each station; initial review was conducted in the field and a more detailed review of video was conducted on a computer. These stations were distributed across the shallow flats adjacent to the channel, the channel edge (transition from flats to channel), and the center portion of the channel. A long-handled rake was also used at each station to collect SAV (if present) at each station. SAV was also opportunistically collected from the edge of the camera frame; during retrieval the edge of the camera frame can dig into the sediment and collect SAV or macroalgae. In locations that were too shallow to deploy the camera frame, the rake was used to collect SAV (if present). A GPS point was collected at each point using the ArcGIS Field Maps Application and the internal antenna of an iPhone 10XR; a typical horizontal accuracy of 14-16 ft was achieved prior to collection. Where applicable, a photo was collected and tagged to each point and uploaded into the ESRI Field Maps Application. Each point was classified as flat, channel, or channel edge. At 4 locations a sample of benthic sediments was collected using a petite ponar. The sediments were visually inspected for texture and photographed.

To investigate the anomalous feature in the Holtec Farm landfall area the feature was visually inspected from the boat's surface, manually probed in several areas with the long handle of the SAV rake, and inspected with an underwater camera mounted to the handle of the rake as the survey boat drifted over the feature.

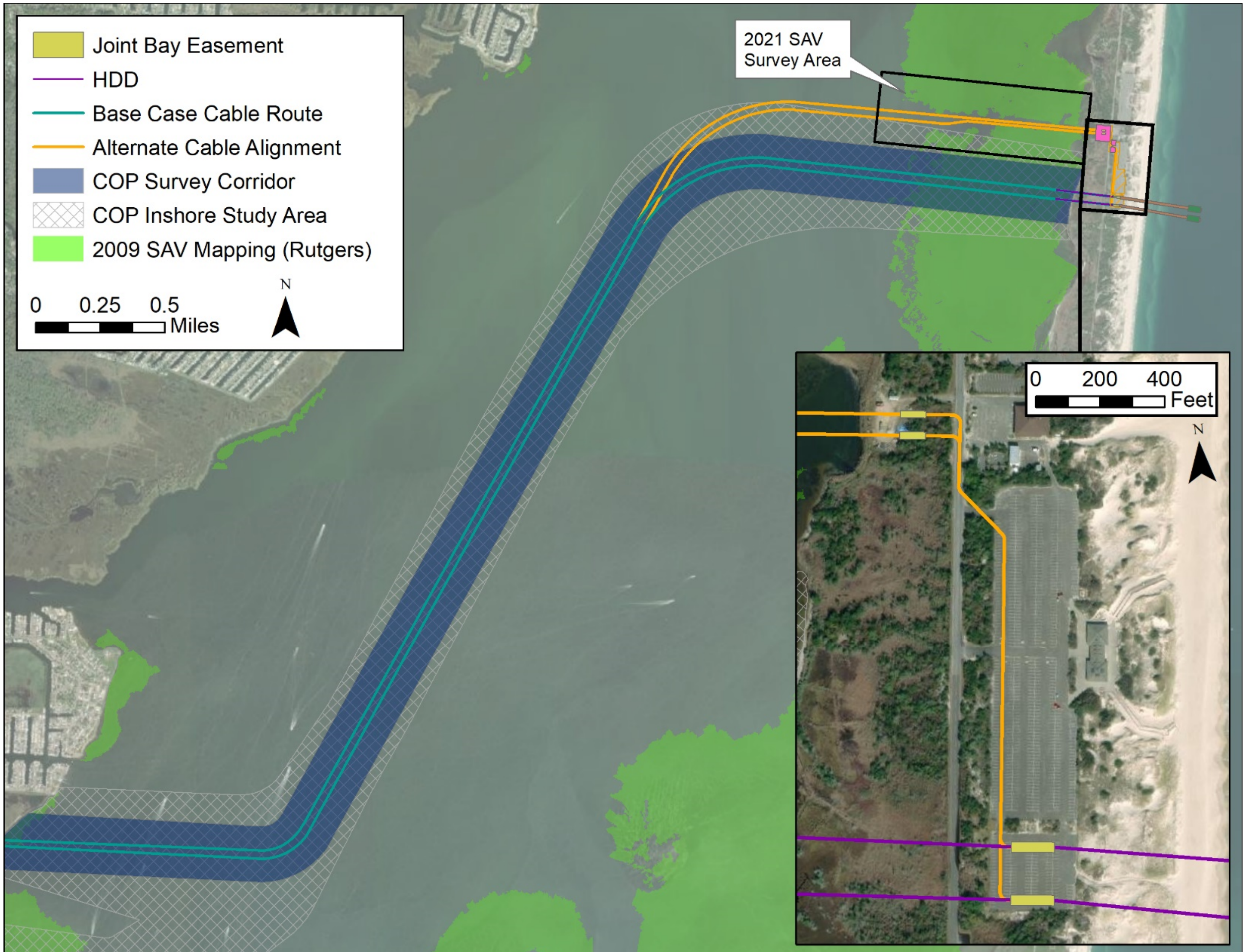
Results

The presence or absence of SAV at each sample point is provided in Table 1. SAV was present at 13 of 33 sample stations; all of these stations were on the adjacent flats or on the channel edge. Of the 21 samples collected in the channel, SAV was absent in 20, with one station inconclusive due to soft sediments in the channel causing turbid conditions as the metal quadrat frame hit the sea floor at that station. Both widgeon grass (*Ruppia maritima)* and eel grass (*Zostera marina)* were documented. The Point IDs in **Table 1** below correspond to the point labels in **Figure 2**. Representative photos of SAV presence or absence are provided in **Figures 3** through **21**.

Table 1. Presence or absence of SAV at each sample point.

Point ID	Gear	Location	SAV Present	Species	Latitude	Longitude
1	Rake	Nearshore Flat	Yes	Eelgrass	39.85269	-74.08982
2	Rake	Nearshore Flat	Yes	Widgeongrass	39.85244	-74.08977
3	Camera	Nearshore Channel	No		39.85228	-74.08955
4	Camera	Nearshore Channel	Yes	Accumulated Dead Eelgrass	39.85207	-74.08983
5	Rake	Nearshore Flat	Yes	Widgeongrass	39.85165	-74.09003

Point ID	Gear	Location	SAV Present	Species	Latitude	Longitude
6	Rake	Nearshore Flat	Yes	Widgeongrass	39.85151	-74.09010
7	Camera	Nearshore Channel	No		39.85210	-74.09022
8	Camera	Nearshore Edge	Yes	Widgeongrass	39.85224	-74.09016
9	Rake	Nearshore Flat	Yes	Widgeongrass	39.85265	-74.09028
10	Camera	Channel Edge	Yes	Widgeongrass	39.85250	-74.09124
11	Camera	Channel	No		39.85236	-74.09153
12	Camera	Flat	Yes	Eelgrass	39.85195	-74.09133
13	Camera	Channel	Inconclusive	Eelgrass	39.85238	-74.09230
14	Camera	Channel Edge	Yes	Widgeongrass	39.85267	-74.09268
15	Camera	Channel	No		39.85250	-74.09327
16	Camera	Channel Edge	Yes	Eelgrass	39.85222	-74.09315
17	Camera	Channel Edge	No		39.85242	-74.09446
18	Camera	Channel	No		0.00000	0.00000
19	Camera	Channel	No		39.85257	-74.09455
20	Camera	Channel Edge	Yes	Widgeongrass	39.85286	-74.09563
21	Camera	Flat	Yes	Eelgrass	39.85218	-74.09618
22	Camera	Channel	No		39.85255	-74.09634
23	Camera	Channel	No		39.85270	-74.09654
24	Camera	Channel	No		39.85278	-74.09684
25	Camera	Channel	No		39.85260	-74.09520
26	Camera	Channel	No		39.85247	-74.09376
27	Camera	Channel	No		39.85237	-74.09284
28	Camera	Channel	No		39.85232	-74.09208
29	Camera	Channel	No		39.85226	-74.09134
30	Camera	Nearshore Channel	No		39.85213	-74.09055
31	Camera	Nearshore Channel	No		39.85207	-74.09036
32	Camera	Nearshore Channel	No	Accumulated Dead Eelgrass	39.85203	-74.08995
33	Camera	Nearshore Channel	No	Accumulated Dead Eelgrass	39.85201	-74.08948



Document Path: \\nj-mahwah\ActiveProjects\109939\10092078\7.0_GIS_Models\7.2_Work_In_Progress\Map_Docs\Draft\RFI_Requests\Kayak_Route_Overview_20211112_small.mxd

Figure 1. Project location map for the October 201 SAV survey in the prior channel that extends west from the Island Beach State Park Maintenance Area.

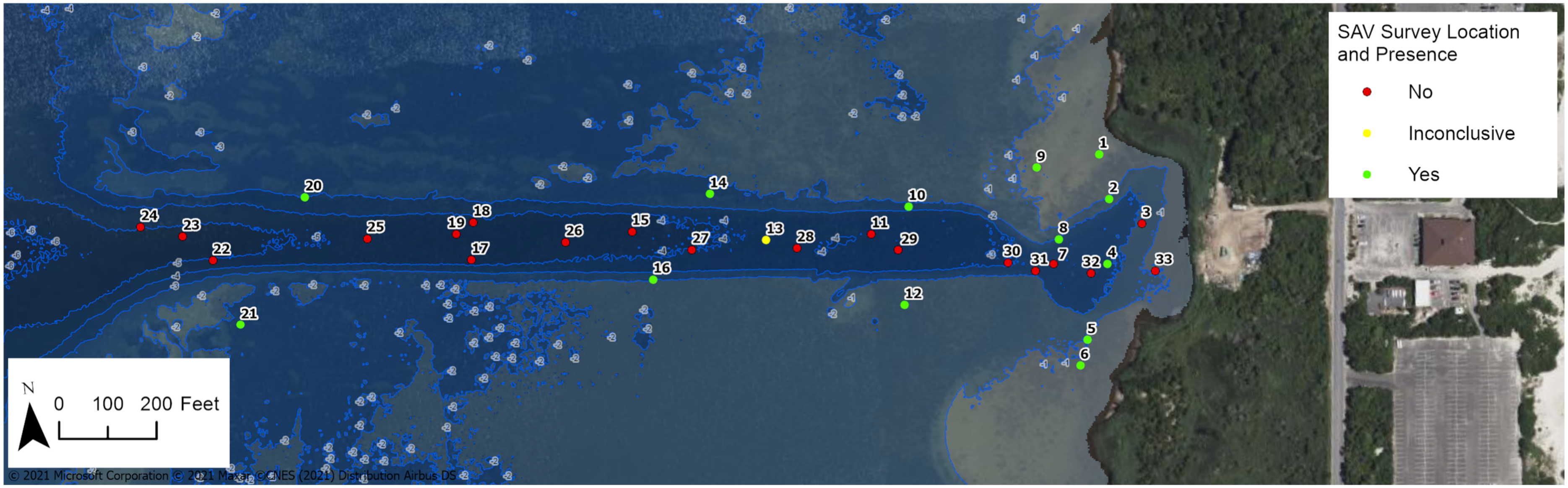


Figure 2. SAV presence and sample points collected in area of prior channel.

The sediments in the channel consisted of fine sands and dark muds with a sulfur odor. In the areas closer to shore a large quantity of organic material which was observed to be accumulated dead SAV and common reed (*Phragmites australis)* fragments. The sediments on the adjacent flats appeared to be fine sands.

Channel Water Depths

Depths on the flats adjacent to the bay were noticeably shallower than the channel and ranged from 1 to 3 feet. Within the channel itself, the eastern portions of the channel had depths ranging from 3 to 4 feet. Moving west, the channel deepened to a range of 5 to 7 feet. Depths were estimated via probing with a long-handled SAV rake.

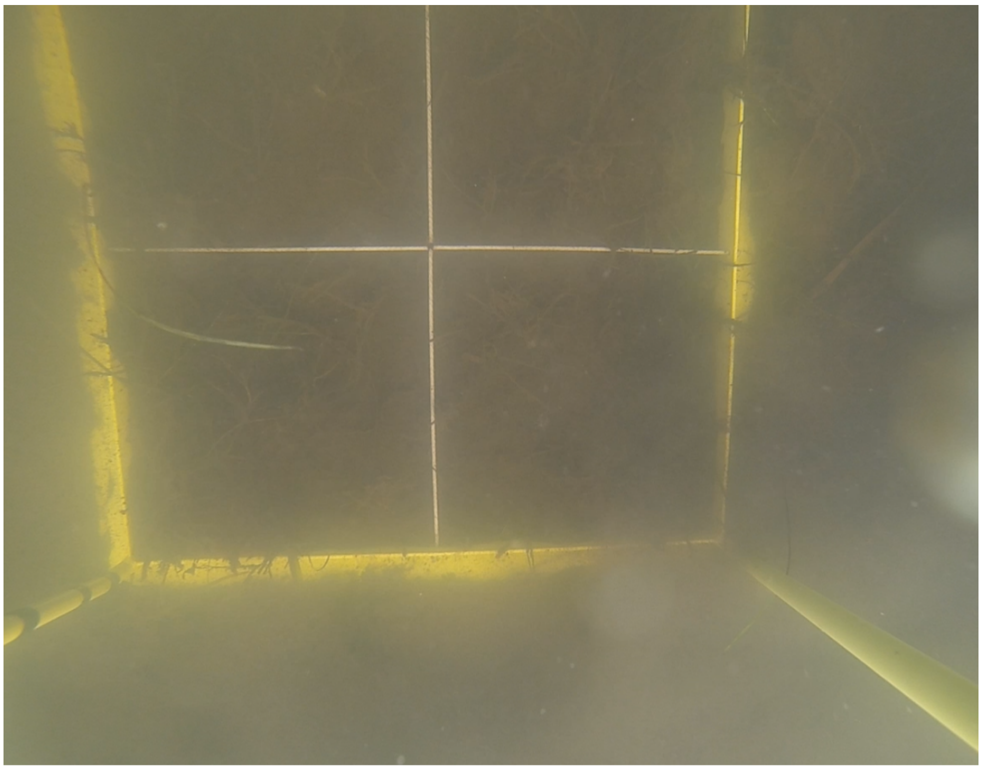


Figure 3. Dead grass and algae observed at Point ID 3 within the nearshore channel.

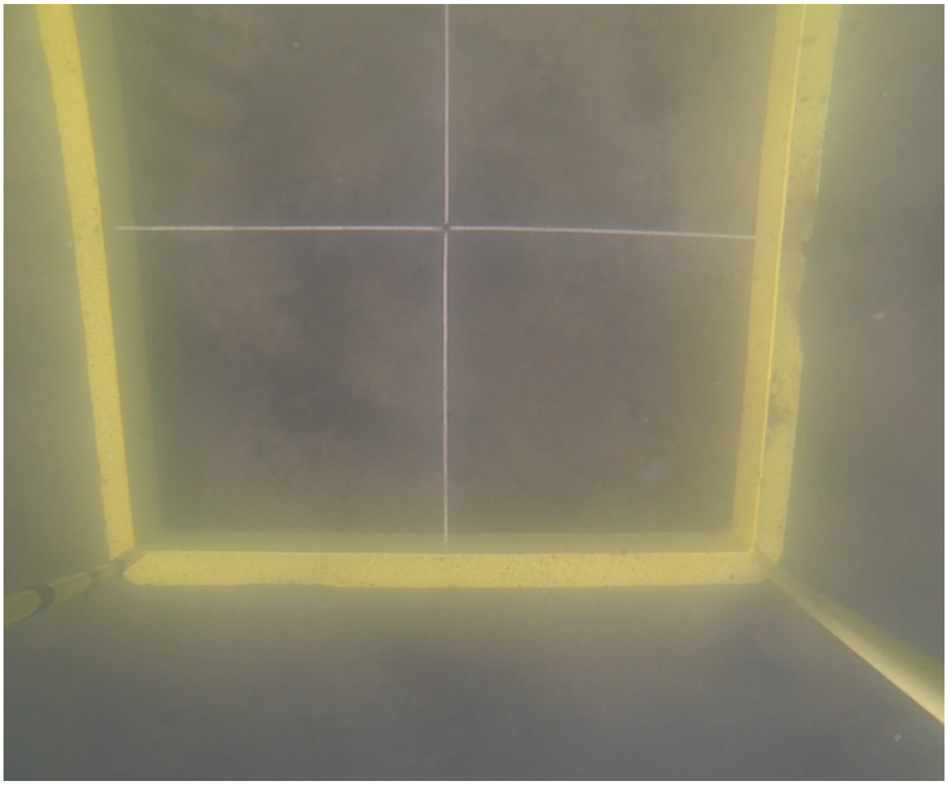


Figure 4. Bare patch of bottom at Point ID 7 within nearshore channel.

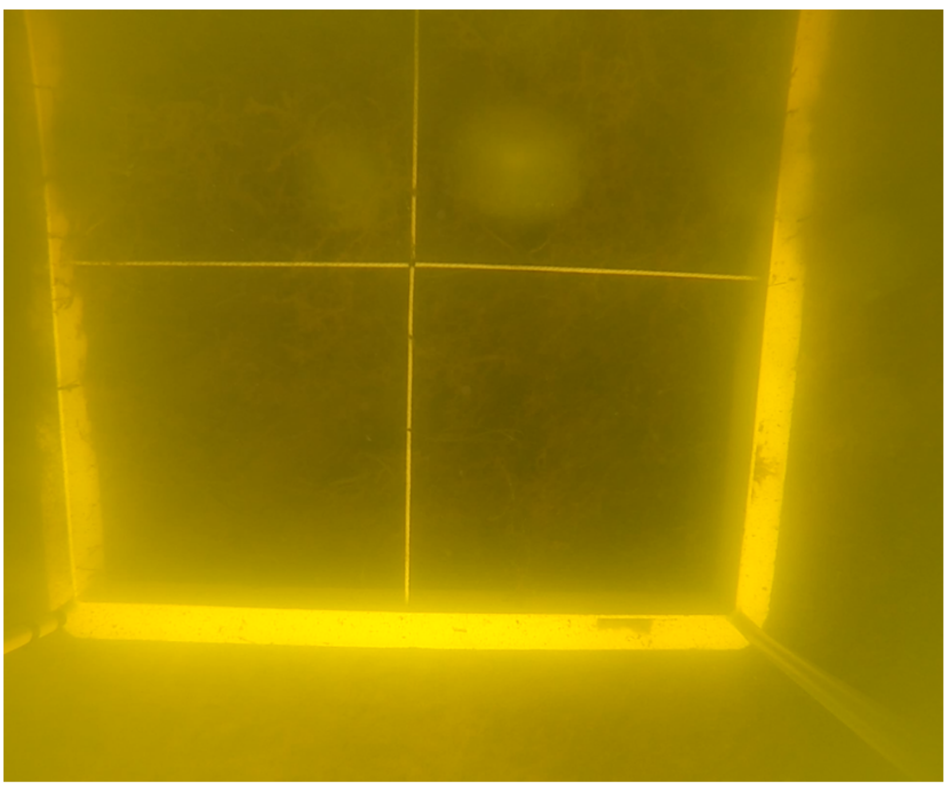


Figure 5. Widgeongrass at Point ID 10 along channel edge.

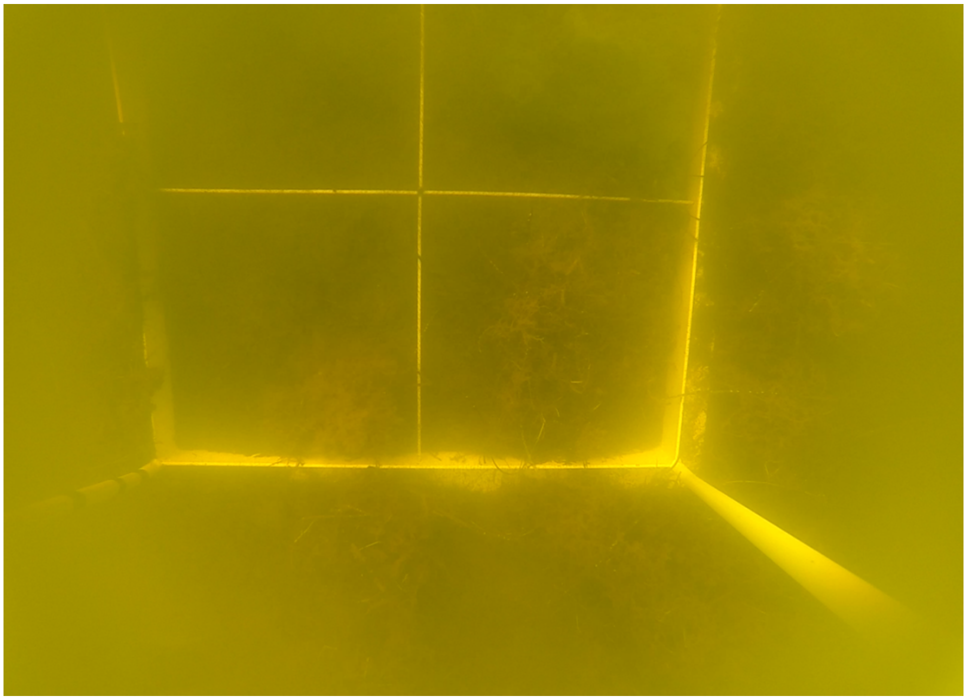


Figure 6. Eelgrass and algae present at Point ID 14 on channel edge.

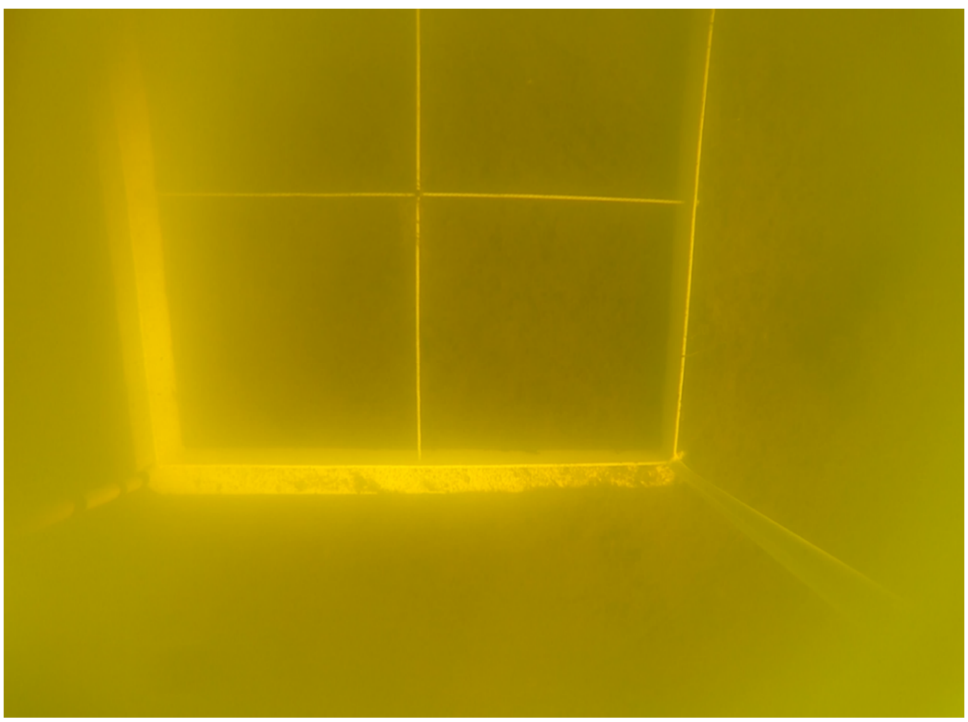


Figure 7. Bare patch of bottom at Point ID 15 within the channel.

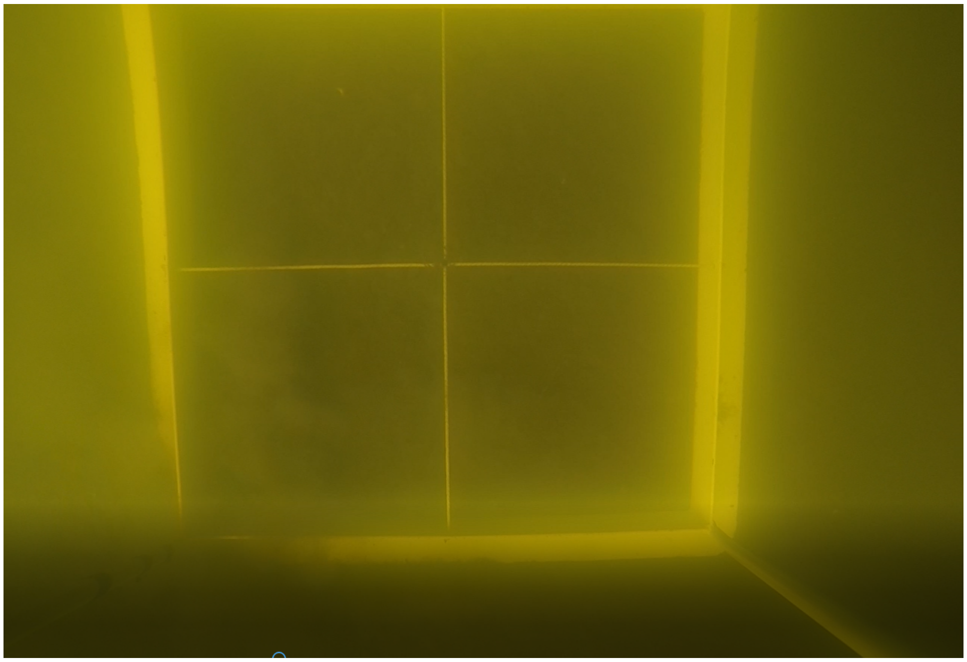


Figure 8. Bare patch of bottom Point ID 17 within the channel edge.

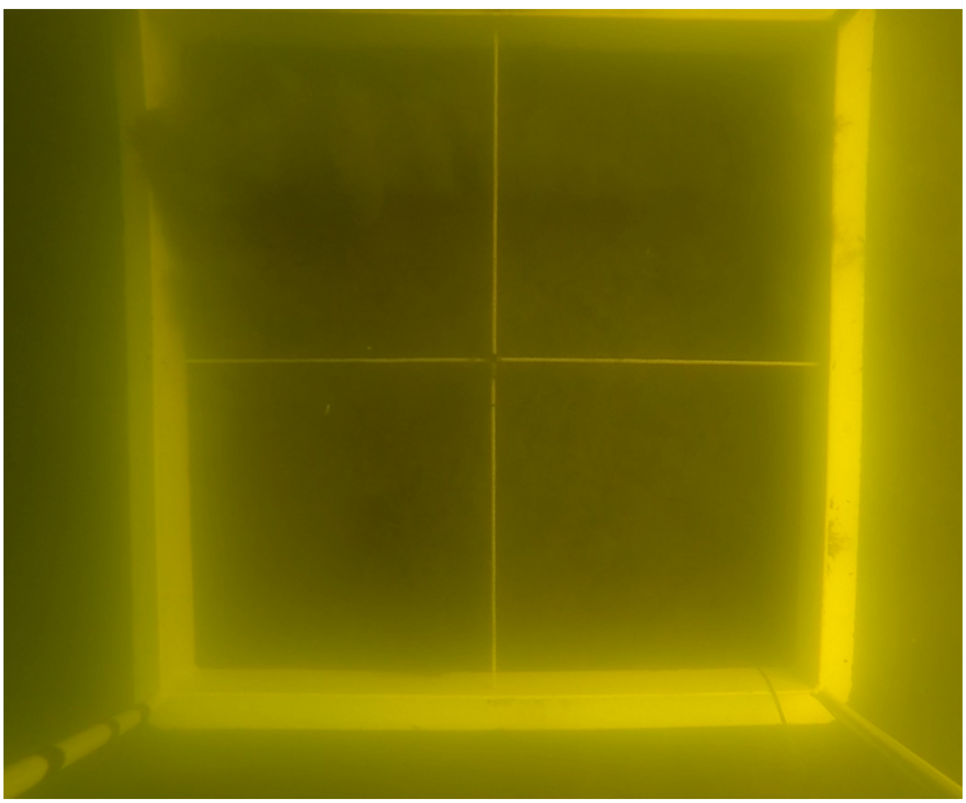


Figure 9. Bare patch of bottom Point ID 18 within the channel edge.

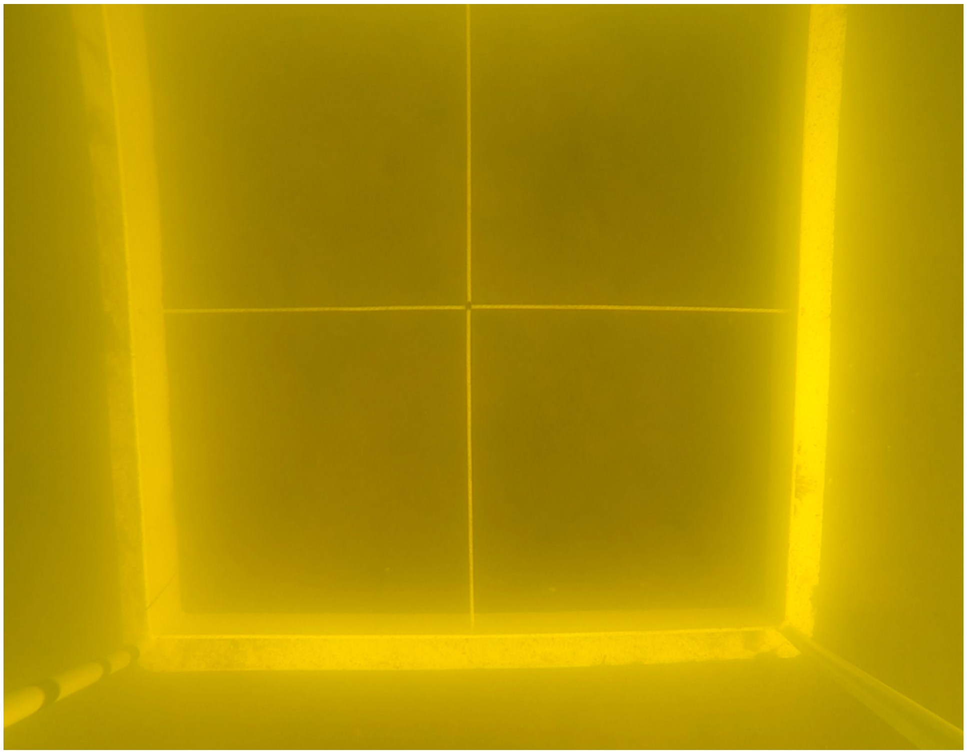


Figure 10. Bare patch of bottom Point ID 19 within the channel edge.

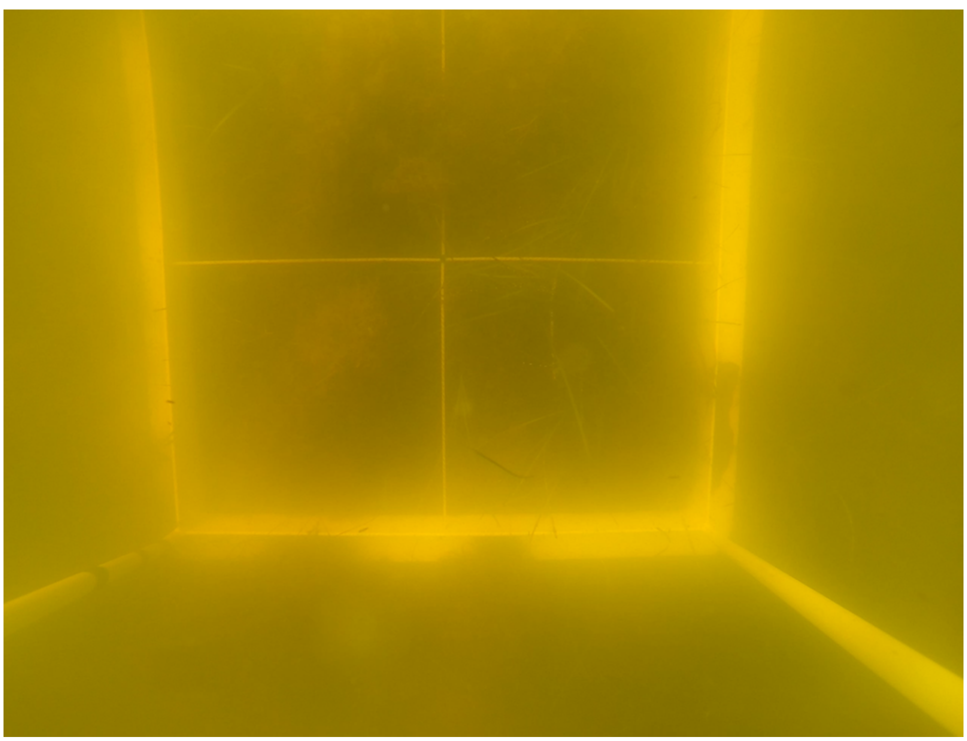


Figure 11. Widgeongrass along channel edge at Point ID 20.

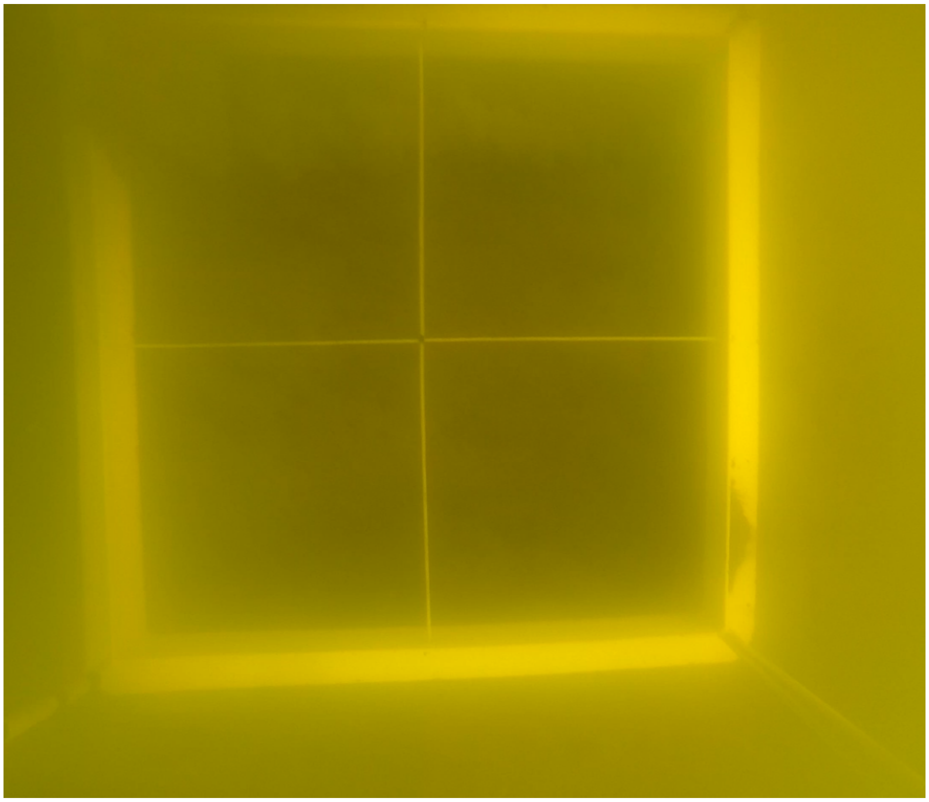


Figure 12. Bare patch of bottom at Point ID 22 within the channel.

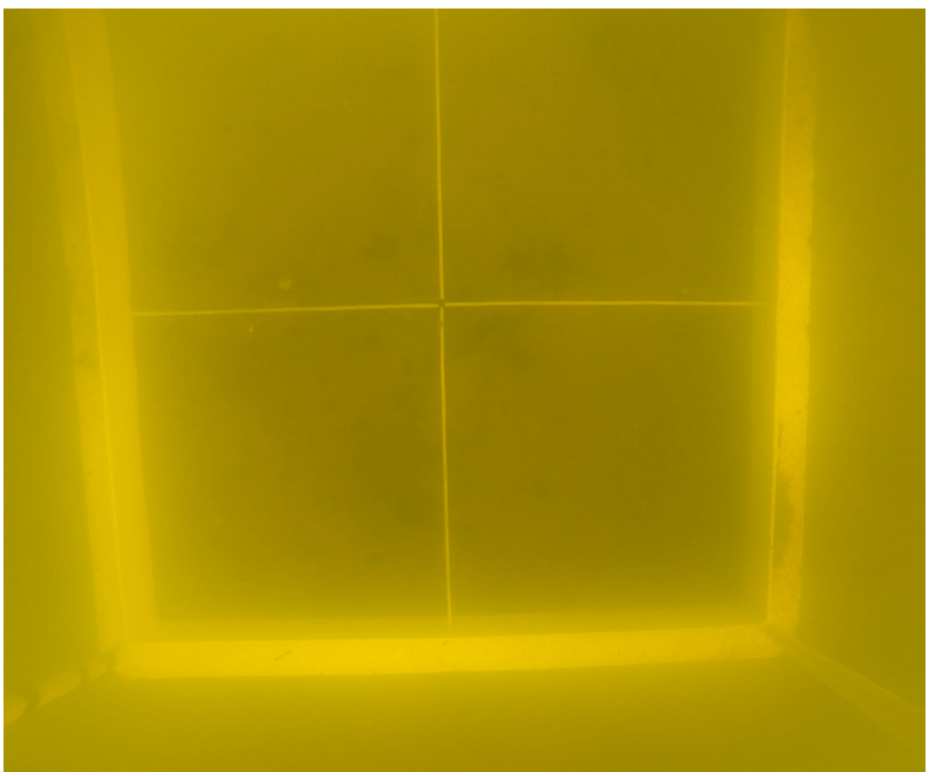


Figure 13. Bare patch of bottom at Point ID 23 within the channel.

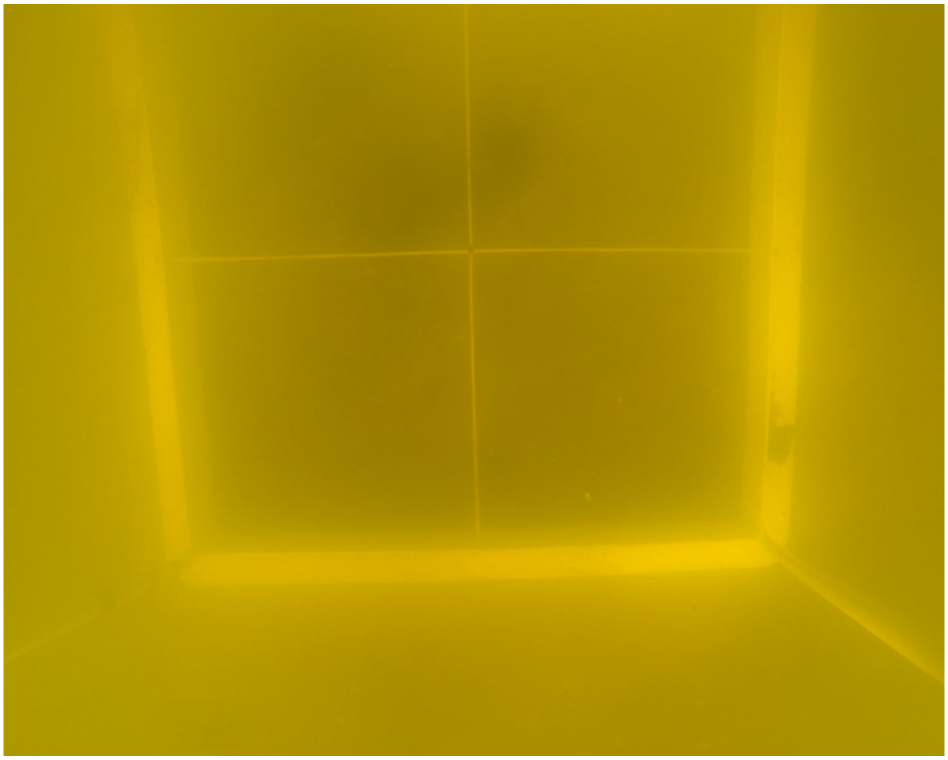


Figure 14. Bare patch of bottom at Point ID 24 within the channel.

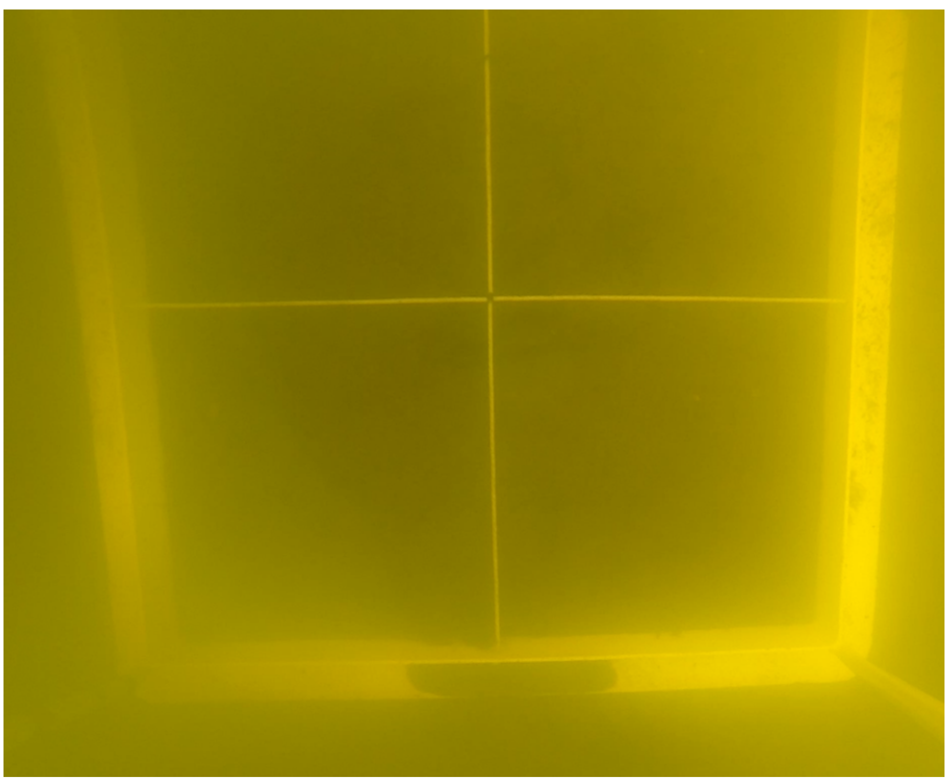


Figure 15. Bare patch of bottom at Point ID 25 within the channel.

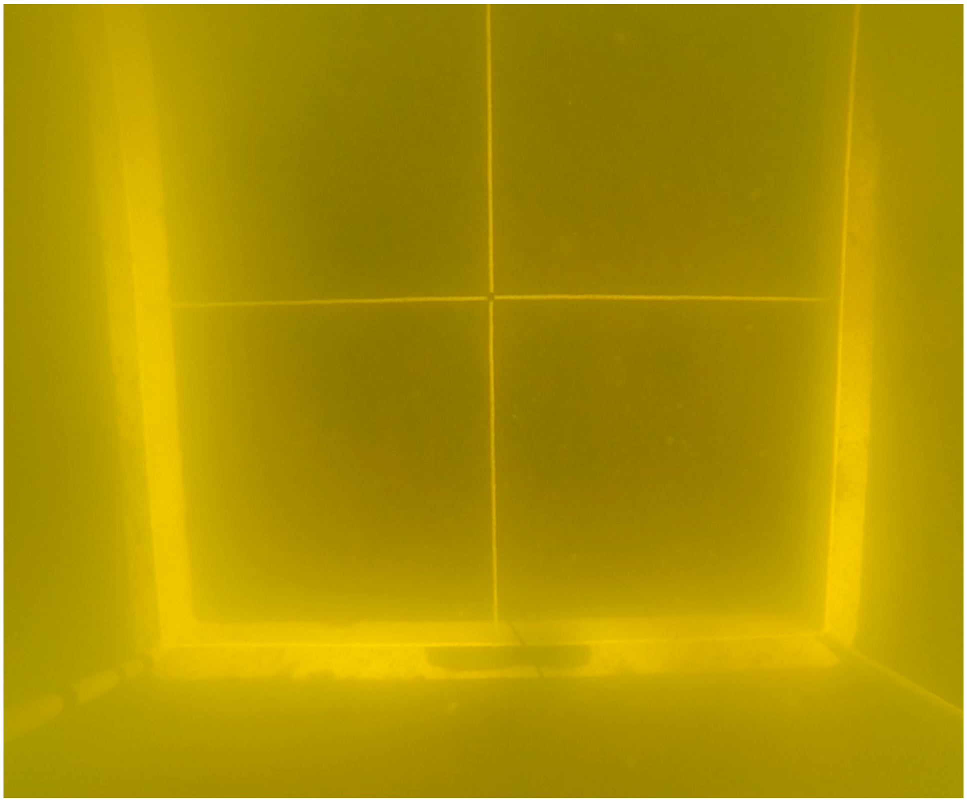


Figure 16. Bare patch of bottom at Point ID 26 within the channel.

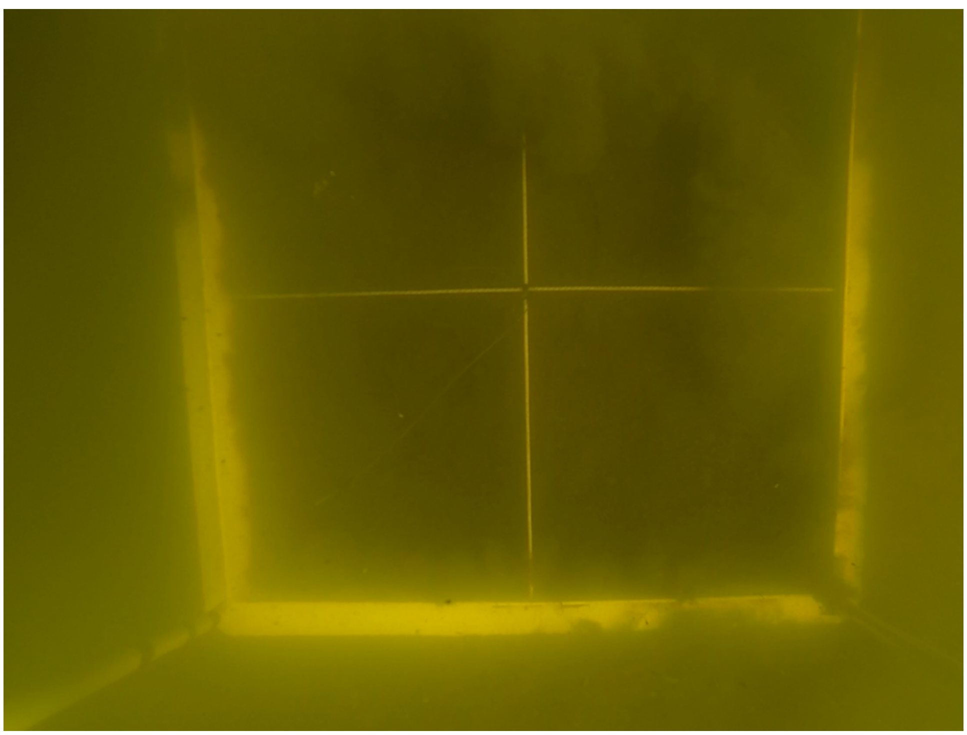


Figure 17. Bare patch of bottom at Point ID 27 within the channel.

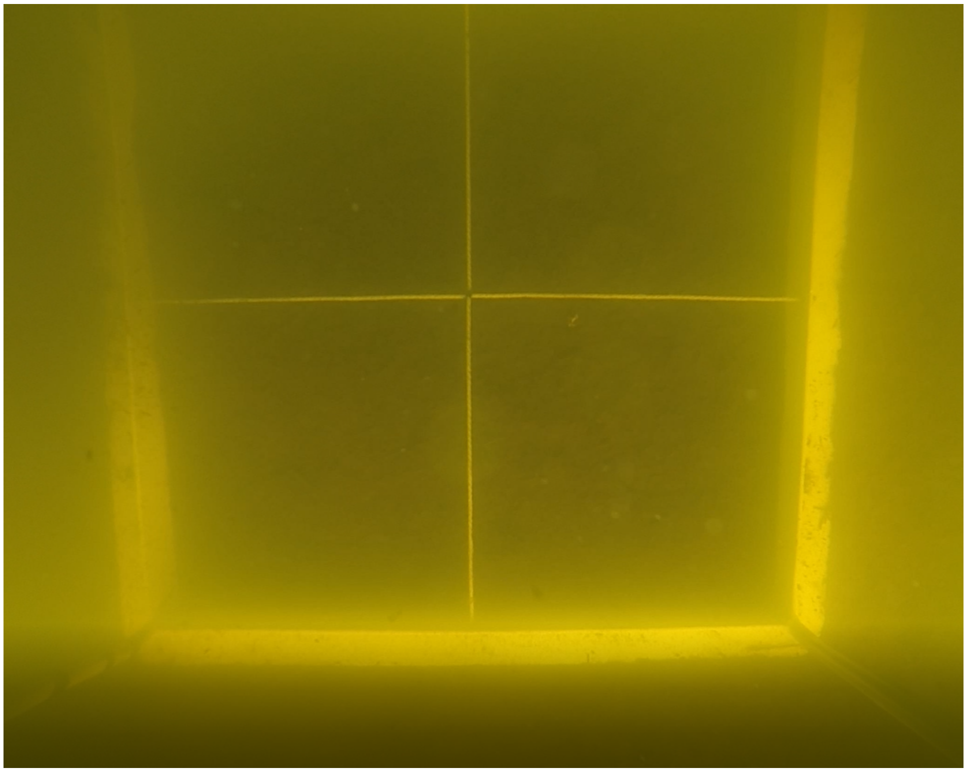


Figure 18. Bare patch of bottom at Point ID 28 within the channel.

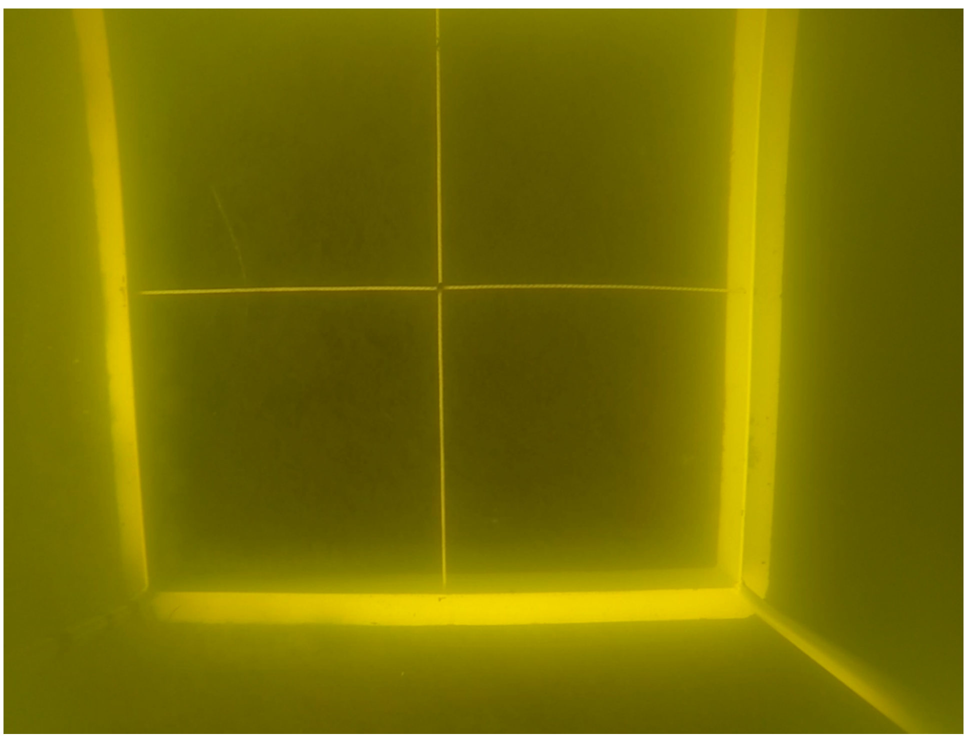


Figure 19. Bare patch of bottom at Point ID 29 within the channel.

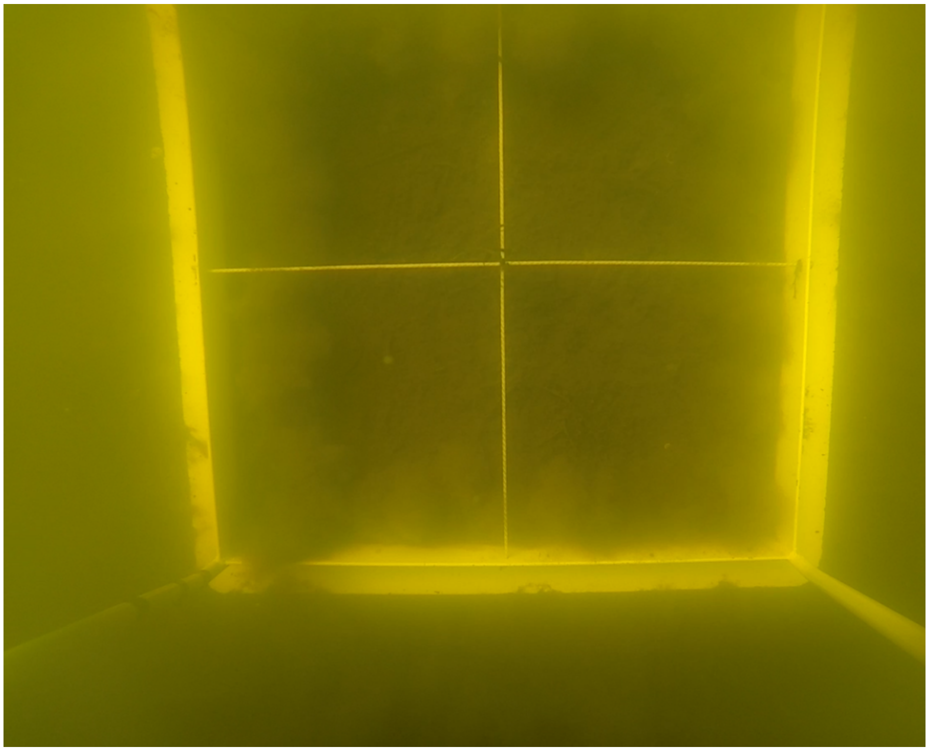


Figure 20. Bare patch of bottom at Point ID 30 within the nearshore channel.

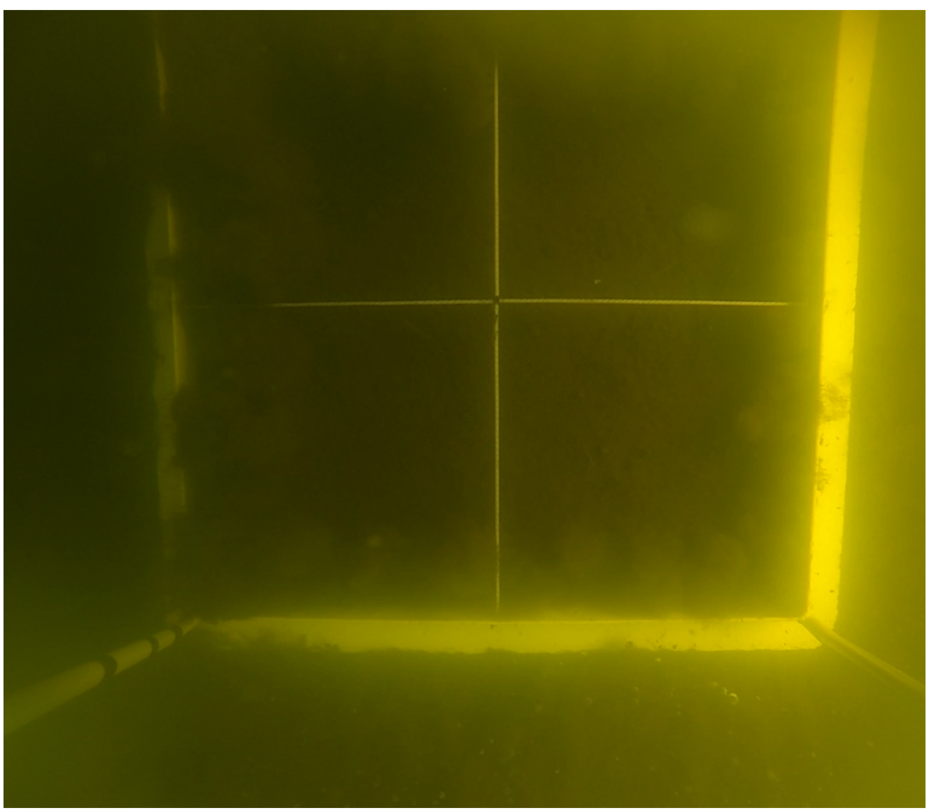


Figure 21. Bare patch of bottom at Point ID 31 within the nearshore channel.

Ocean Wind
An Ørsted & PSEG project

Submerged Aquatic Vegetation Monitoring Plan
June 2022

Ocean Wind Offshore Wind Farm
Submerged Aquatic Vegetation Monitoring Plan

Prepared for:

Ocean Wind
An Ørsted & PSEG project

Orsted, U.S.

Submitted by:

INSPIRE Environmental
513 Broadway
Newport, RI 02840

June 2022

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LIST OF ACRONYMS

BAG	Before-After-Gradient
BOEM	Bureau of Ocean Energy Management
COP	Construction and Operations Plan
GAM	Generalized Additive Model
GLM	Generalized Linear Model
HDD	Horizontal Directional Drilling
IBSP	Island Beach State Park
INSPIRE	INSPIRE Environmental, LLC
NOAA	National Oceanic and Atmospheric Administration
NJDEP	New Jersey Department of Environmental Protection
OCS	Outer Continental Shelf
OCW01	Ocean Wind Offshore Wind Farm
Project	Ocean Wind Offshore Wind Farm
ROSA	Responsible Offshore Science Alliance
SAV	Submerged aquatic vegetation
SAVMP	Submerged Aquatic Vegetation Monitoring Plan

1.0 Introduction

Ocean Wind, LLC proposed to construct and operate the Ocean Wind Offshore Wind Farm (OCW01 or Project) to generate renewable power off the coast of New Jersey. The wind farm portion of the Project will be located in federal waters on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0498 (Lease Area). The Lease Area is approximately 75,525 acres and is located approximately 13 nmi southeast of Atlantic City (Figure 1). In addition to the Wind Farm Area, the Offshore Project Area includes two offshore Export Cable Route Corridors and one inshore Export Cable Route Corridor:

- **BL England Offshore Export Cable Route Corridor**: The area between the wind farm and landfall near BL England in which an offshore export cable will be installed (Figures 1 and 2);
- **Oyster Creek Offshore Export Cable Route Corridor**: The area between the wind farm and the Atlantic Ocean side of Island Beach State Park (IBSP) in which up to two offshore export cables will be installed (Figures 1 and 3);
- **Oyster Creek Inshore Export Cable Route Corridor:** The area within Barnegat Bay from the Bay side of IBSP to the landfall near Oyster Creek in which up to two offshore export cables will be installed (Figures 1 and 3);

The proposed BL England Offshore Export Cable Route Corridor and the Oyster Creek Offshore Export Cable Route Corridor do not traverse protected inshore coastal waters (i.e., estuaries, bays). As such, these offshore cable routes will not be in the vicinity of any mapped submerged aquatic vegetation (SAV) or SAV habitat (Ocean Wind, LLC 2021). Note that throughout this document SAV is referring to submerged aquatic vascular plants and not macroalgal species. The focus of this SAV Monitoring Plan (SAVMP) will be on the Oyster Creek Inshore Export Cable Route Corridor that transits through Barnegat Bay, where SAV beds and SAV habitat are documented within the vicinity of the Project.

The proposed Oyster Creek Inshore Export Cable Route Corridor transits from the western side of IBSP to the Oyster Creek landfall on the western side of Barnegat Bay, as shown in Figure 3. The Oyster Creek Inshore Export Cable Route Corridor segment adjacent to IBSP was recently moved north from its original route to avoid direct impacts to continuous SAV beds in this area. This segment now transits through a formerly dredged navigation channel, hereafter referred to as the “prior channel”. The water depth of the prior channel limits light penetration to the seafloor, preventing the growth of SAV within the channel (Lathrop et al. 2017; Ocean Wind, LLC 2021). On the western side of Barnegat Bay, several landfall options are currently being considered. Generally, in this area SAV beds occur in the shallow waters fringing the shoreline (Figure 3).

The cable installation methodologies will vary along the proposed Oyster Creek Inshore Export Cable Route Corridor and will be selected for technical feasibility and to avoid and minimize impacts to the environment including SAV beds and habitat. The final installation methods to be used will be determined during the design and engineering phase of the Project and will be based on an assessment of topography, bathymetry, accessibility, tidal conditions, geotechnical situation, environmental constraints, and other parameters. Although cable installation methodologies have not been finalized, for the purposes of developing this SAVMP the following generalized cable installation plans are assumed (as illustrated in Figure 3). Cable installation from IBSP through the prior channel will be accomplished using an open cut (i.e., “trenching”) approach. When sufficient water depth exists, the cables will be installed through jet trenching for the cable segment that transits through Barnegat Bay until it reaches the western side of the Bay. Immediately prior tolandfall on the western side of the Bay and outside the SAV habitat, cable installation will occur via Horizontal Directional Drilling (HDD) (“trenchless” methods) (Figure 3).

This SAVMP was developed in close coordination and discussions with New Jersey Department of Environmental Projection (NJDEP) and Dr. Elizabeth Lacey of Stockton University. This SAVMP was developed through an iterative process, and specific survey protocols and methodologies will be refined and updated based on feedback received from stakeholder groups, including state agencies (NJDEP) and federal agencies (National Oceanographic and Atmospheric Administration [NOAA] and BOEM).

This SAVMP begins with a brief overview of the SAV beds located within the vicinity of the Project as informed by previously conducted baseline surveys. The plan then outlines specific objectives of the proposed pre-construction and post-construction surveys and describes the general approaches that will be used to meet these objectives. Generally, this SAVMP is designed to:

1. document baseline delineations and conditions of SAV beds,
2. assess potential impacts to these SAV beds as a result of the construction and operations of the inshore export cable(s) associated with the Project, and
3. track recovery of these SAV beds over time to inform potential mitigation strategies, if necessary.

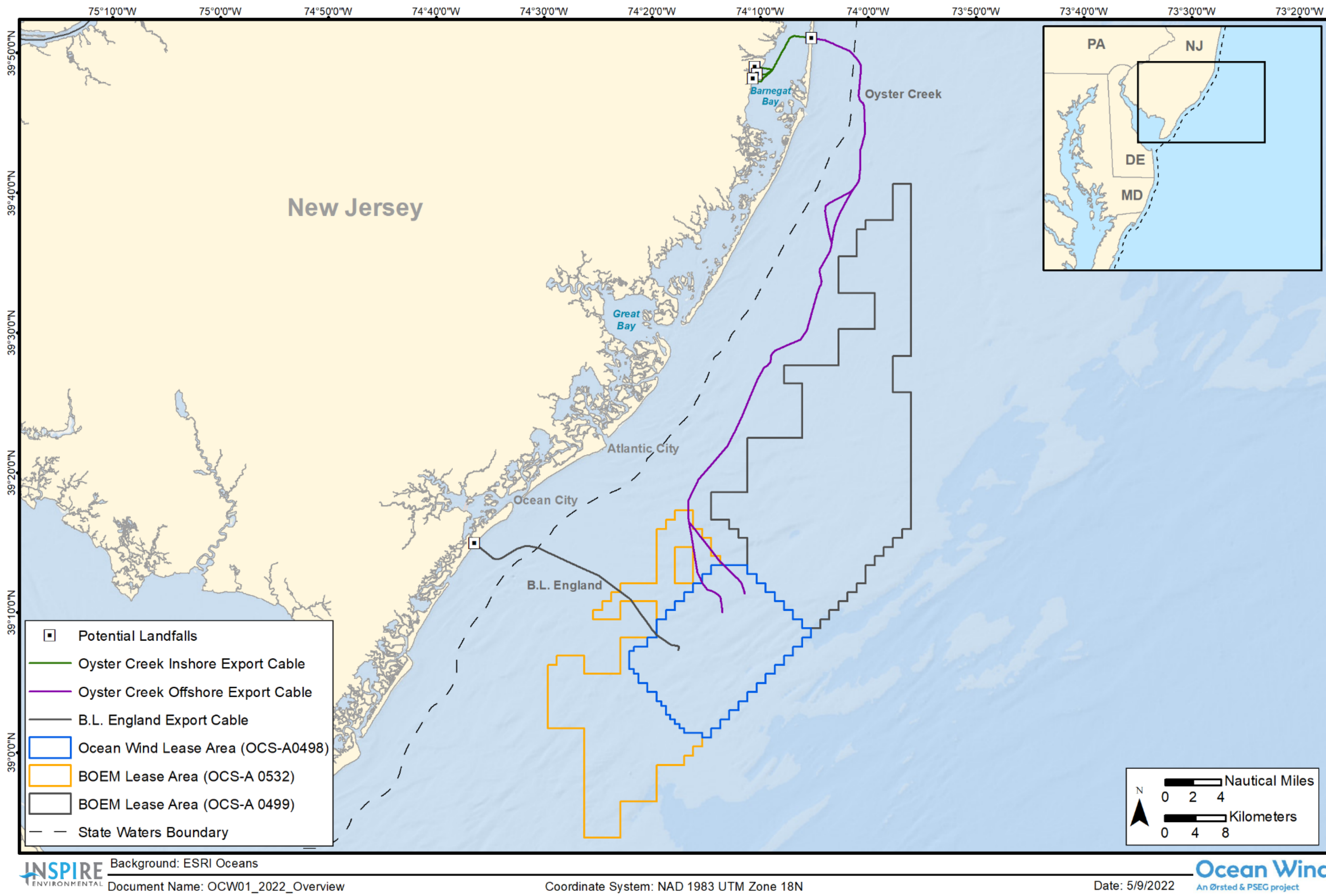

Figure 1. **Overview of the proposed Ocean Wind Project**

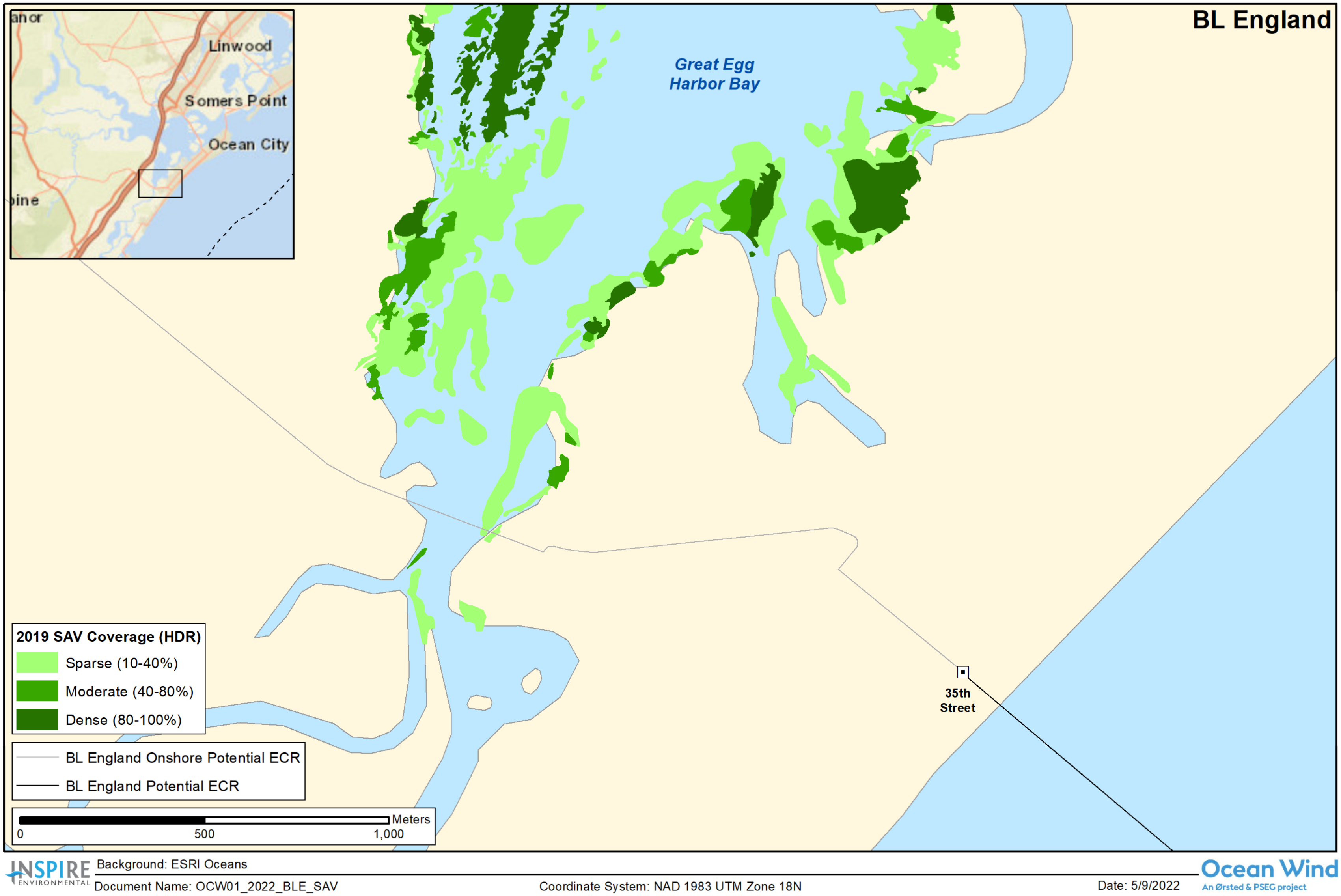

Figure 2. **Overview of the proposed installation methodologies along the BL England Offshore Export Cable Route and the delineation of SAV coverage from the 2019 aerial survey (Ocean Wind, LLC 2021)**

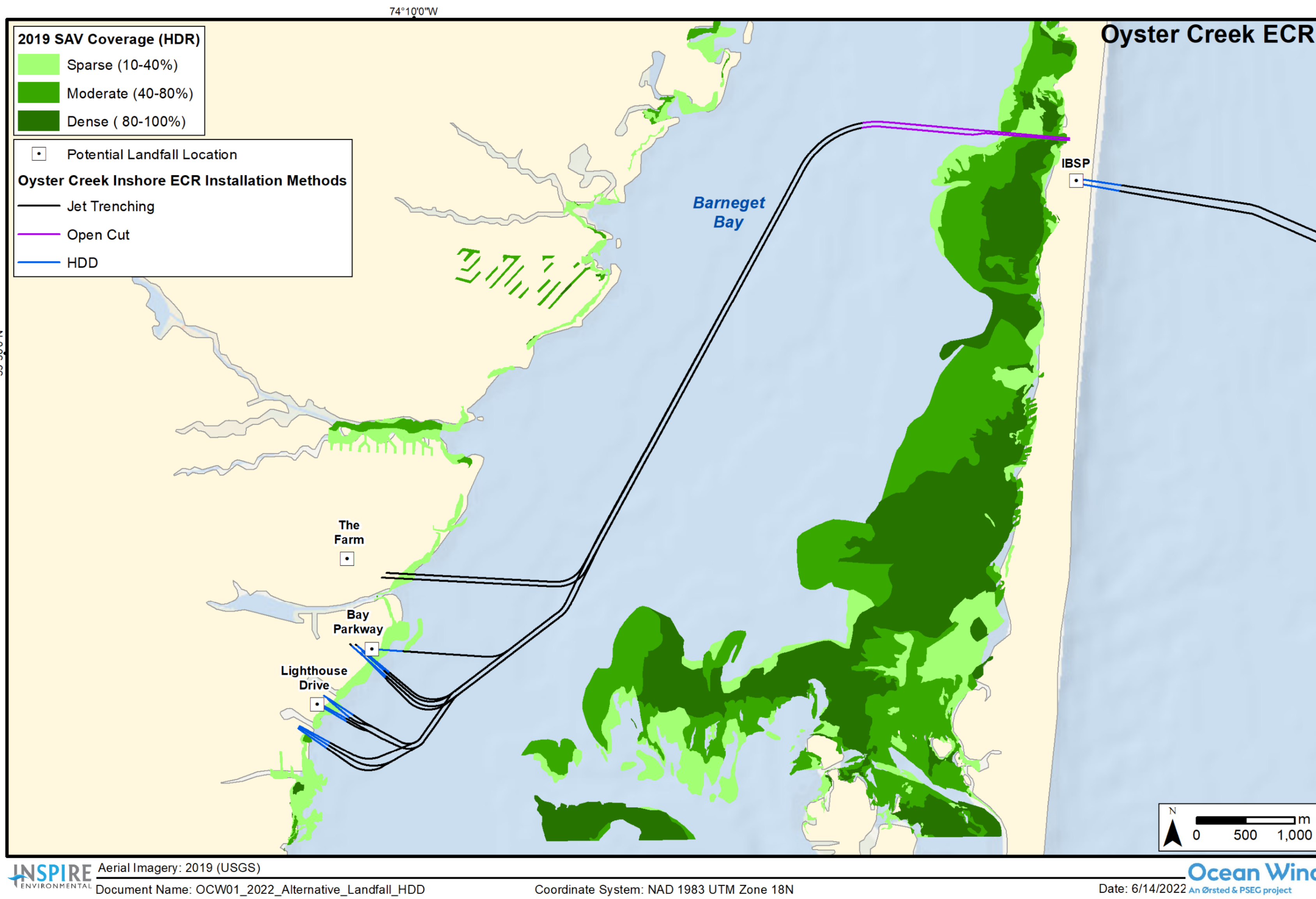

Figure 3. Overview of the proposed installation methodologies along the Oyster Creek Inshore Export Cable Route and the delineation of SAV coverage from the 2019 aerial survey (Ocean Wind, LLC 2021). Note that the open cut area cable method area is estimated based on water depth, occurring out to approximately the 8 ft contour line.

2.0 Baseline Submerged Aquatic Vegetation Mapping

Baseline SAV data were collected near the BL England Offshore Export Cable Route Corridor and the Oyster Creek Inshore Export Cable Route Corridor during several surveys conducted between 2019 and 2021. These surveys used aerial imagery and underwater drop camera imagery to delineate the extent and percent cover of SAV beds in the vicinity of the Project. These baseline data, were compiled, synthesized, and interpreted together with historical SAV datasets in the reports *Ocean Wind Offshore Wind Farm Benthic Habitat Mapping and Benthic Assessment to Support Essential Fish Habitat Consultation* (INSPIRE 2021) and *Ocean Wind Offshore Wind Farm Biological Survey Results* (Ocean Wind, LLC 2021; Figures 4 and 5). Provided here is a summary of the findings of these project-specific SAV surveys and the inshore benthic habitat mapping effort. Further details on the methods and results are described in Appendix E of the Ocean Wind Construction and Operations Plan (COP) (Ocean Wind, LLC 2021).

The recent SAV surveys used a combination of aerial photography (2019), systematic collection of underwater drop camera imagery (2020), and targeted underwater imagery collection (presence/absence) (2021). The aerial imagery survey documented SAV habitat within the vicinity of the Oyster Creek Inshore Export Cable Route Corridor in shallow waters fringing the coast, while no SAV beds were observed along the proposed BL England Export Cable Route Corridor (Figures 4 and 5; Appendix E of Ocean Wind, LLC 2021). Subsequent underwater imagery surveying (2020 and 2021) focused on the Oyster Creek Inshore Export Cable Route Corridor, specifically in the shallow waters to the west of IBSP and on the western side of Barnegat Bay where the cable will make landfall (Figures 4 and 5). The in-water imagery documented *Zostera marina* as the predominant SAV species throughout the surveyed area.

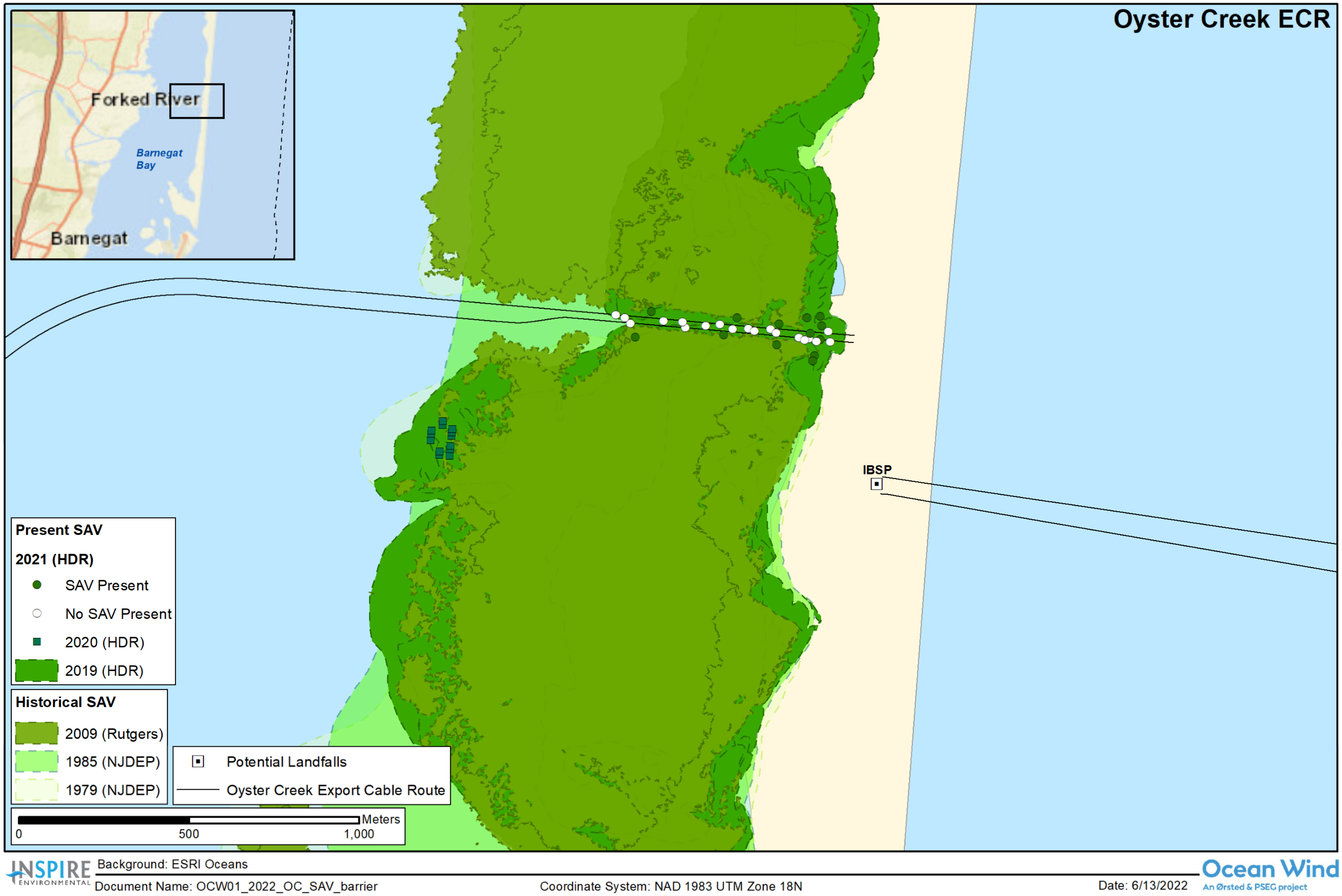

Figure 4. Distribution of historical and recent submerged aquatic vegetation documented along the Oyster Creek Inshore Export Cable Route Corridor on the western side of IBSP (Ocean Wind, LLC 2021).

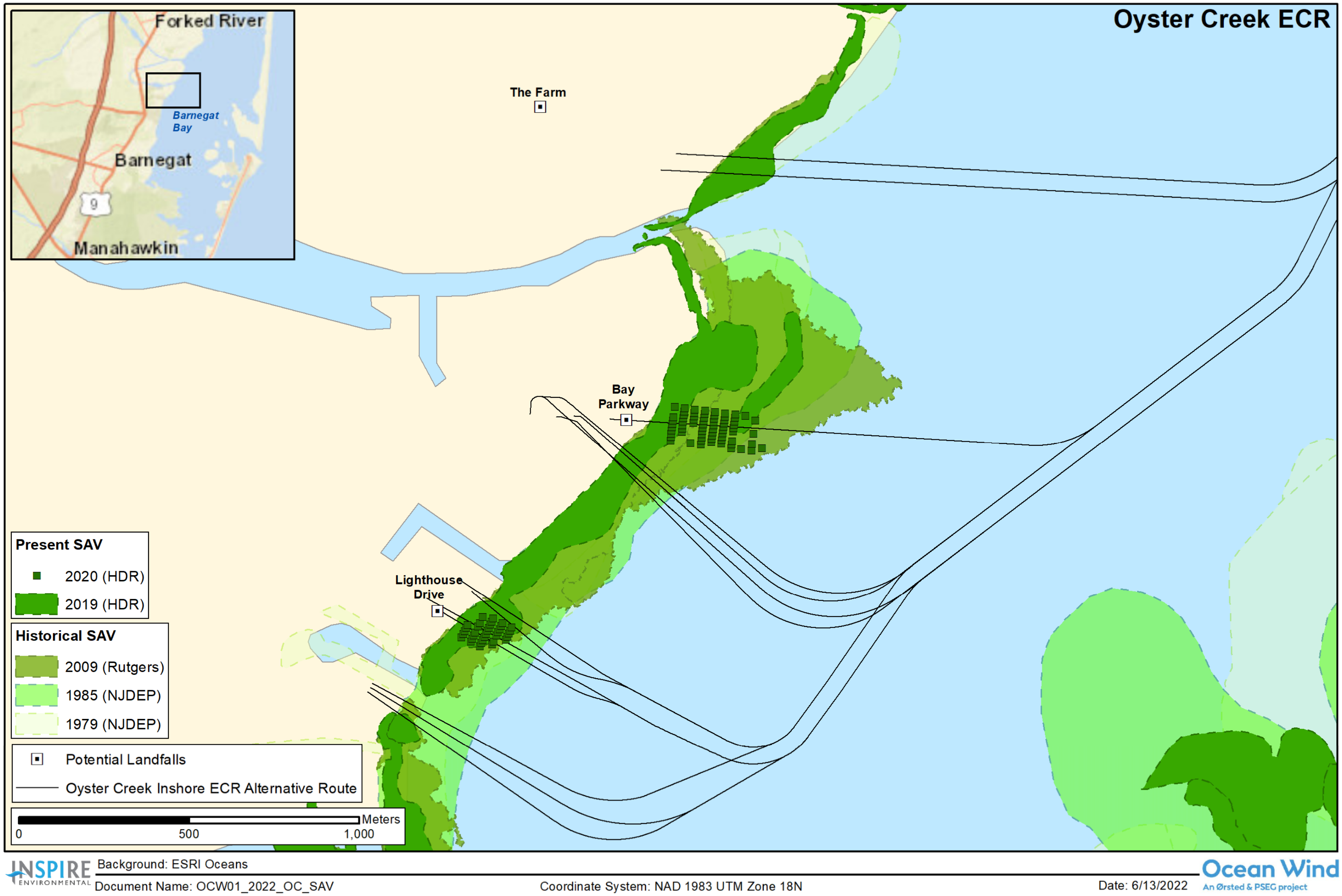

Figure 5. **Distribution of historical and recent submerged aquatic vegetation documented along the Oyster Creek Inshore Export Cable Route Corridor landfall options on the western side of Barnegat Bay (Ocean Wind, LLC 2021).**

A summary of the results of the 2019, 2020, and 2021 baseline SAV surveys is presented in Figures 6, 7, and 8. These figures provide SAV information in relation to the Project design as recommended by Colarusso and Verkade, 2016. This includes the SAV bed delineations derived from 2019 aerial imagery, the 2020 drop camera SAV percent cover data, the water depth of the deepest edge of each SAV bed surveyed (2020), and the sediment grain size distribution within each SAV bed (2020). The Project design information presented on Figures 6, 7, and 8 includes the proposed cable route(s) and installation methodologies, the area of potential project influence on SAV (i.e., 500 ft from the proposed cable route(s)), and the distance between the nearest SAV and the possible HDD exit locations for each alternate cable route.

The planned Oyster Creek Inshore Export Cable Route Corridor traverses a man-made channel on the western side of IBSP (prior channel), which is positioned perpendicular to the shore and measures approximately 50 m wide and 700 m long. The water depths within this prior channel limit SAV growth and no SAV was documented within this channel during the project specific baseline drop camera survey (2021). However, SAV (*Z. marina*) was observed along the shallower flanks of prior channel during the 2021 SAV survey and other studies (Figures 4 and 6) (Ocean Wind, LLC 2021; e.g., Lathrop et al. 2017). The deepest edge of the SAV bed in this area was documented in 2020 to be located in water depths of about 1.0 to 1.2 m (3 to 4 ft) (Figure 6).

Patches of historical and/or extant SAV occur along the shoreline of the western bank of Barnegat Bay at the Oyster Creek landfall options (Figures 5, 7, 8 and 9). The drop camera in-water survey in 2020 found the deepest part of the SAV bed near the Bay Parkway Landing option in about 1.6 m (5.2 ft) water depth (Figure 7). At the Lighthouse Drive landing option, the water depth of the deepest edge of the SAV bed ranged from 1.2 to 1.4 m (3.9 to 4.7 ft) (Figure 8). At the Holtec landing option, SAV were observed at one location during the 2020 survey at approximately 1 m (3.2 ft) (Figure 9). Although these data from 2020 are useful, the landfall options in this area have changed since this survey was conducted, so additional pre-construction in-water SAV surveying will be conducted to produce more resolved mapping of the SAV within the project area as described in Section 4.1.

In summary, historical and/or extant SAV made up ~14% of the habitat area mapped along the Oyster Creek Inshore Export Cable Route Corridor, which equated to a total of about 172 acres of SAV habitat (Figure 3; INSPIRE 2021). Of these 172 acres of SAV habitat, 121 acres were documented to have SAV in 2019 and/or 2020; the remaining 51 acres were documented to have SAV present prior to 2019 (historical SAV presence) (Figures 3, 4, and 5; INSPIRE 2021).

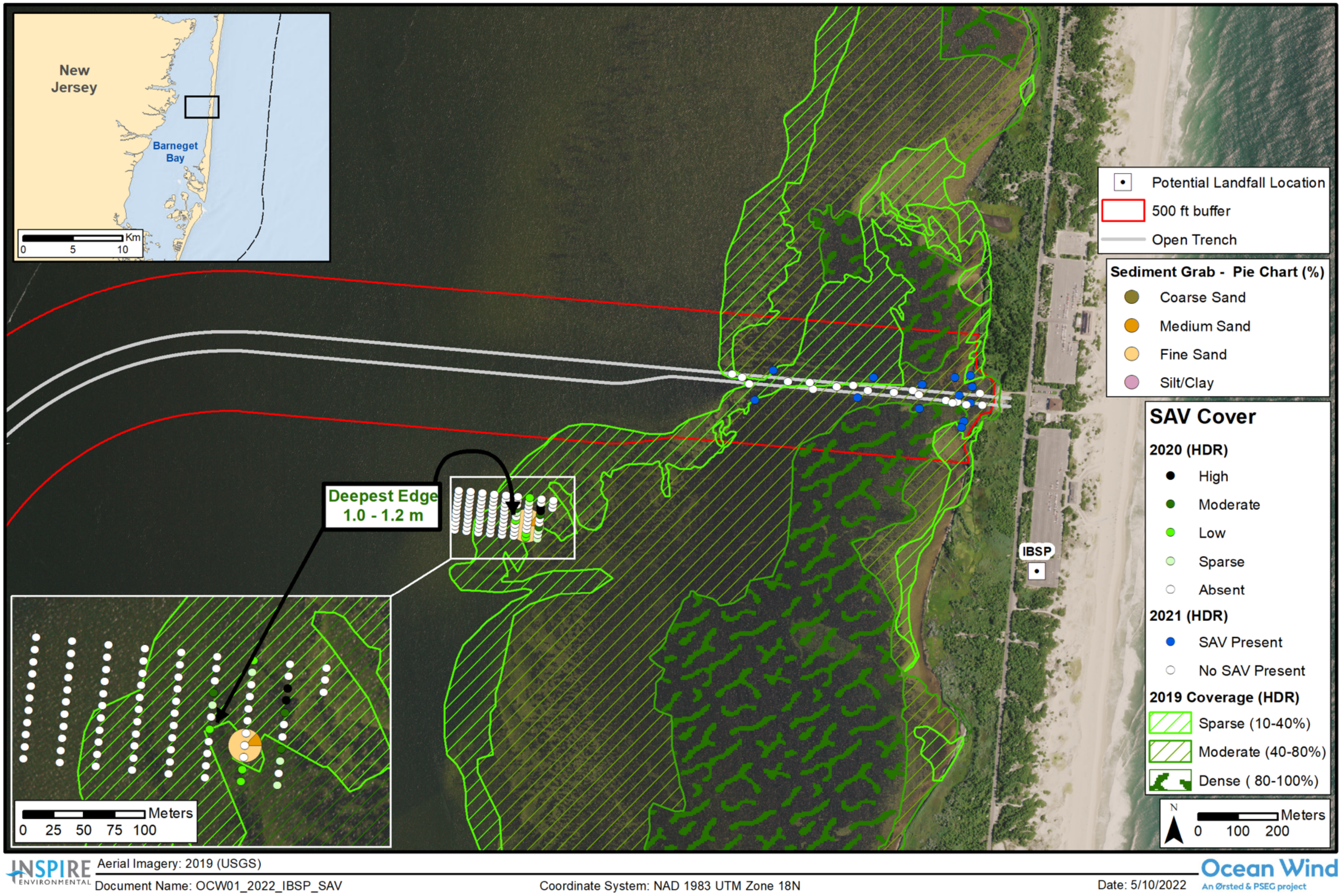

Figure 6. Distribution and estimated percent cover of submerged aquatic vegetation documented in 2019 and 2020 on the eastern side of IBSP along the Oyster Creek Inshore Export Cable Route Corridor (Ocean Wind, LLC 2021). Also included are the grain size data from a sediment grab sample collected near the outer edge of the SAV bed and the presence/absence of SAV data collected at the prior channel in 2021.

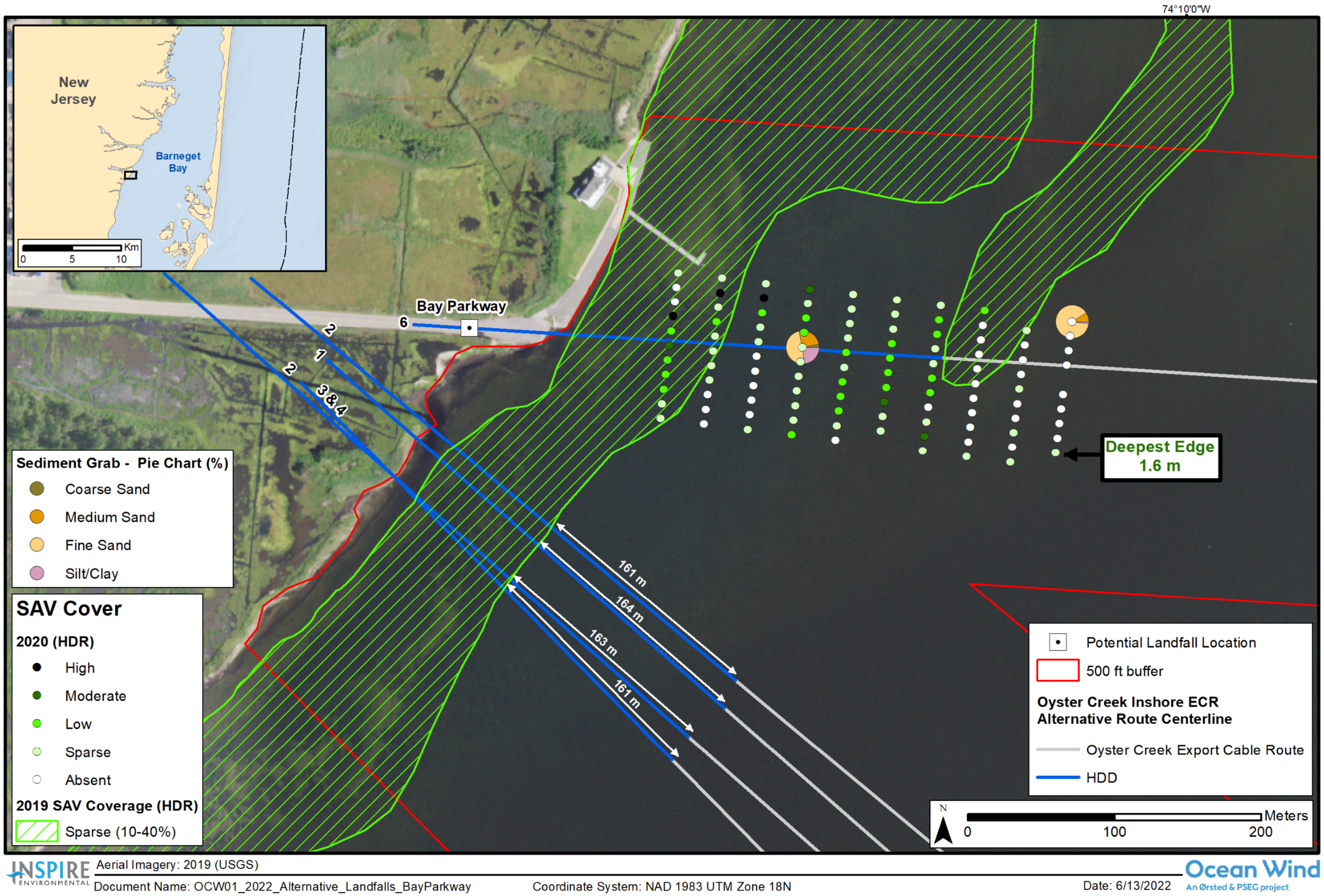

Figure 7. Distribution and estimated percent cover of submerged aquatic vegetation documented in 2019 and 2020 at the Bay Parkway Landfall options along the Oyster Creek Inshore Export Cable Route Corridor (Ocean Wind, LLC 2021). Also included are the grain size data collected in 2020.

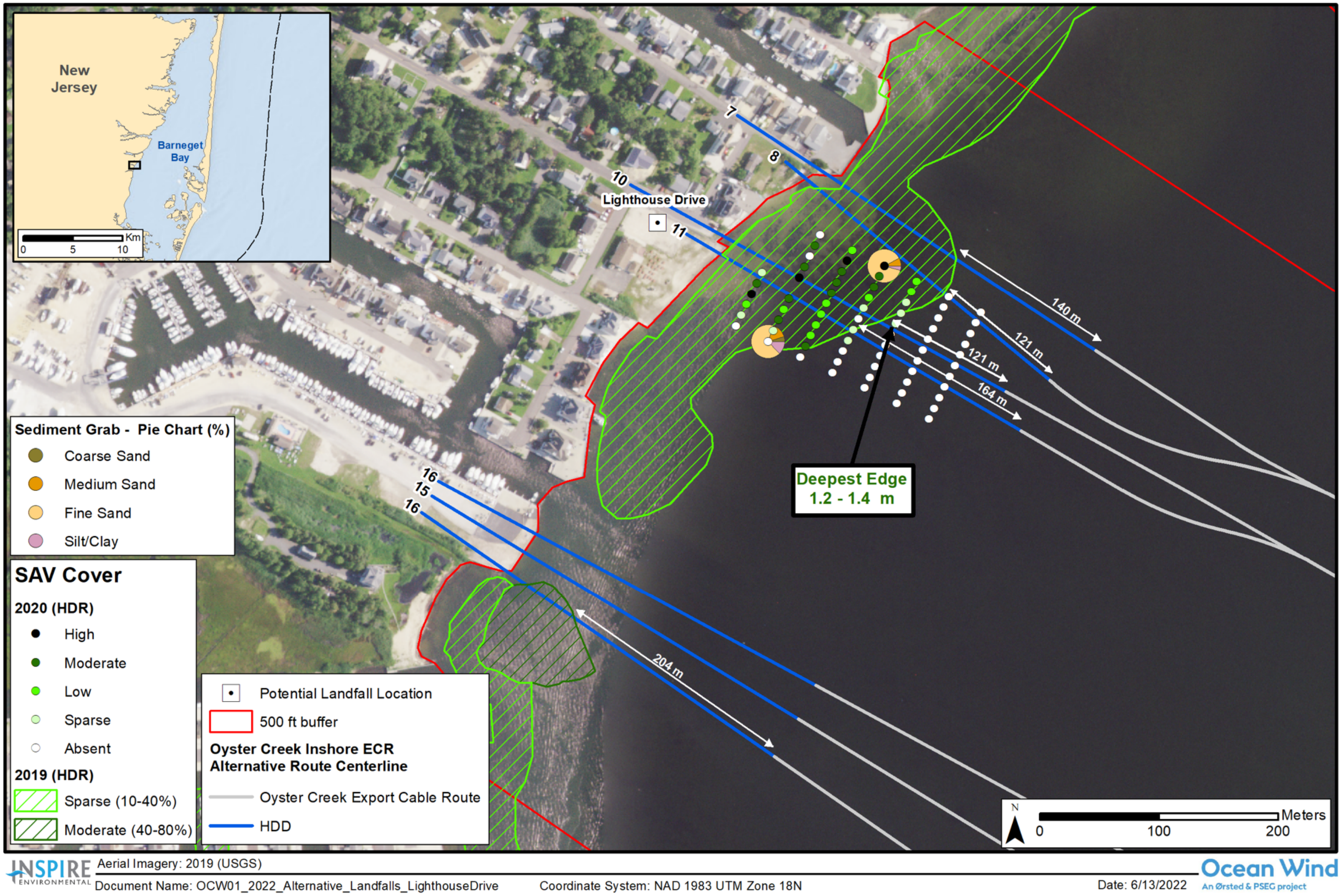

Figure 8. **Distribution and estimated percent cover of submerged aquatic vegetation documented in 2019 and 2020 at the Lighthouse Drive landfall options along the Oyster Creek Inshore Export Cable Route Corridor (Ocean Wind, LLC 2021). Also included are the grain size data collected in 2020.**

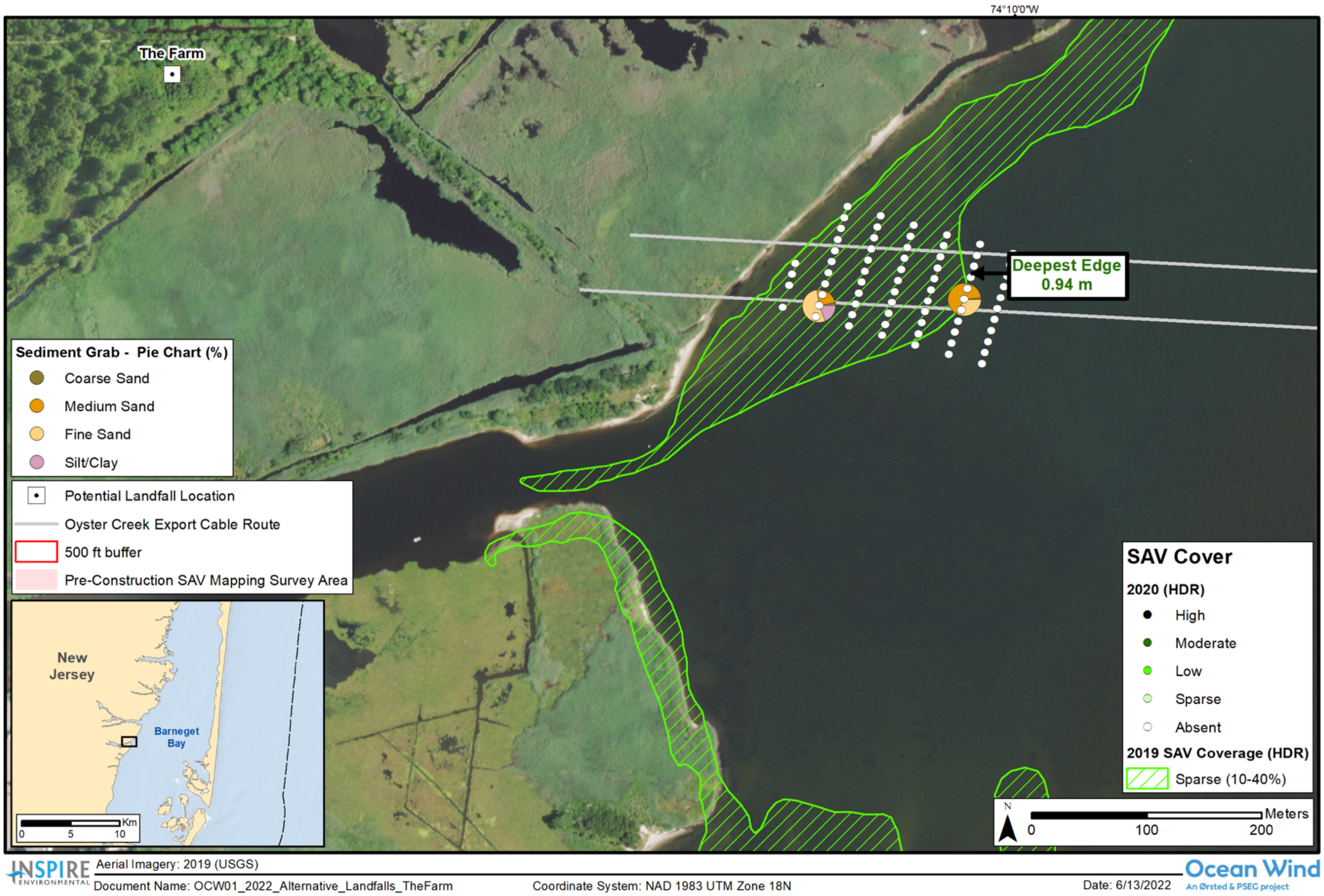

Figure 9. Distribution and estimated percent cover of submerged aquatic vegetation documented in 2019 and 2020 at the Holtec landfall options (also known as the Farm) along the Oyster Creek Inshore Export Cable Route Corridor (Ocean Wind, LLC 2021). Also included are the grain size data collected in 2020.

3.0 SAV Monitoring Objectives, Hypotheses, and Schedule

This SAV monitoring plan includes pre-construction and post-construction surveys aimed at further characterizing baseline SAV conditions and any potential impacts to SAV beds associated with the cable installation activities. In general, the purpose of the pre-construction SAV surveys is to provide estimates of total project acreage, SAV bed acreage, and total SAV habitat acreage, as well as species identification and measurements of SAV percent spatial cover and shoot density. The objective of the post-construction monitoring is to determine the impacts, if any, from the cable installation on a spatial scale and, if impacts are detected, to monitor the recovery of SAV following construction over time to determine if recovery occurs after three years.

Direct impacts to SAV will be avoided and minimized to the greatest extent possible during cable installation through several means related to cable installation methodology and cable routing. Cable installation will use HDD near the vicinity of SAV beds at the landfall area on the western side of Barnegat Bay; this will avoid any direct physical disturbance to SAV beds and SAV habitat in this area (Figures 3, 7, and 8). On the eastern side of Barnegat Bay, adjacent to IBSP, cable installation will occur using open trench methodology out to between the six and eight foot water depth contour lines where installation will change to jet trenching (Figures 3 and 6). However, direct impacts to SAV will be avoided because the cable in this area will be routed through a relatively deep channel (prior channel) that is not inhabited by SAV (Figures 4 and 6). These installation methods and the proposed cable routing avoid direct impacts to SAV (direct physical disturbance). However, there is a potential that SAV will be directly impacted by physical disturbance from anchoring and/or boat traffic (e.g., propeller scarring). The results of the initial pre-construction survey (see Section 4.1) will be used to identify designated areas away from SAV habitat for anchoring and vessel staging to avoid and minimize any direct impacts associated with these construction vessel activities.

During cable installation activities, SAV may be indirectly impacted as a result of sediment resuspension leading to short-lived increased water column turbidity and subsequent sedimentation. SAV is sensitive to both elevated water column turbidity (which decreases light availability to the seafloor) and excess sedimentation. Any construction activity that may result in sediment resuspension and deposition that occurs within 500 ft of any mapped SAV will be conducted during a time period when SAV is dormant. In addition, during construction the short-lived elevated water column turbidity is not expected to persist for extended periods of time and is not likely to influence SAV productivity or health. However, excess sedimentation can result in decreased SAV shoot density during the following growing season (as reviewed in Munkes et al. 2015). The distance from the cable installation activity (including HDD exit pit excavation) at which indirect effects from sedimentation on SAV may occur is expected to be a maximum of 500 ft, given this is the distance which activates a time of year restriction on construction activities (NJDEP 2015).

Given the proposed cable installation methods and cable routing discussed above, the following hypotheses were generated to frame this monitoring plan:

1. Indirect impacts (sedimentation) associated with cable installation activities through prior channel on the eastern side of Barnegat Bay may result in a decrease in SAV shoot density along the fringes of the prior channel but is expected to return to pre-disturbance conditions within three years (e.g., Erftemeijer and Lewis 2006; Munkes et al. 2015).

2. No direct impacts (physical disturbance) to SAV are expected to occur from cable installation activities through prior channel on the eastern side of Barnegat Bay. However, if direct impacts from vessel activity during construction (e.g., anchor or propeller scarring) do occur, recovery will likely take longer than three years (e.g., Lathrop et al. 2017).

3. Cable installation activities (planned HDD) at the landfall on the western side of Barnegat Bay are not expected to have direct or indirect impacts to nearby SAV habitat.

All SAV monitoring surveys will be conducted within the seasonal growing window, late April-October. A summary of the specific survey objectives, general approach, and survey(s) schedule is provided in Table 1. Details are provided in the following sections of this SAV monitoring plan.

Table 1. Summary of Planned SAV Surveys at Ocean Wind

	Pre-construction SAV Mapping	Pre-construction SAV Characterization	Post-construction SAV Characterization
Section of this Document	Section 4.1	Section 4.2	Section 5
Objective(s)	To refine the 2019 SAV mapping within the areas of potential influence of the Project	To characterize the condition of SAV within the areas of potential influence of the Project	To characterize the condition of SAV within the areas of potential influence of the Project to identify any impacts associated with construction spatially and document recovery of these areas over time
General Approach	Underwater imagery to estimate percent cover spatially	In-water snorkeler/diver-based (or other appropriate advanced imaging techniques) SAV characterization (shoot density and other parameters)	In-water snorkeler/diver-based (or other appropriate advanced imaging techniques) SAV characterization (shoot density and other parameters)
Outcome	• Baseline data on the extent and distribution of SAV and SAV habitat • Inform Project design and avoidance strategies (cable routing, designated moorings/anchoring locations) • Evaluate potential impacts from construction	• Baseline data on SAV shoot density (and potentially other quantitative parameters indicative and important to SAV health) • Evaluate potential impacts from construction	• Document extent of any indirect and/or direct impacts • Monitor recovery over time • Assess needs and strategy for potential mitigation
Survey(s) schedule	April-Oct 2022	April-Oct <6 months prior to the start of construction (Y0-pre)	April-Oct < 6 months post construction (Y0-post) 1 year post construction (Y1) 2 years post construction (Y2) 3 years post construction (Y3)

4.0 Pre-Construction Surveys

Pre-construction SAV baseline surveys were completed in 2019, 2020, and 2021, as described in Section 2.0. Additional pre-construction SAV surveys will be conducted to refine and update the results from these previous baseline surveys as described below.

The overarching goal of these pre-construction SAV surveys is to map and characterize the SAV within the areas of potential influence of the Project. The pre-construction monitoring will evaluate potential impacts to the SAV resource from cable installation activities. This will be used to identify possible means to minimize impacts (e.g., adjusting the cable route, establishing designated anchoring locations outside of SAV beds), and to refine post-construction monitoring protocols for documenting impacts and informing potential mitigation plans.

Specifically, this pre-construction SAV monitoring will include two surveys (Table 1). The first survey will provide refined estimates of SAV bed and SAV habitat acreage and delineation within the Project area of influence and the percent cover and species composition of the observed SAV. The second survey will measure specific SAV characteristics to document SAV health and condition, such as percent cover and shoot density. Both surveys will occur during SAV growing season (late April-October).

4.1 Pre-Construction SAV Mapping Survey

The historical aerial imagery and baseline data collected in 2019, 2020, and 2021, that were summarized together with historical SAV data in the habitat mapping report (INSPIRE 2021) and described in Section 2.0 above, will be used to inform the additional pre-construction SAV mapping survey. Using the results and interpretation of the 2019 aerial imagery that identified the SAV within the context of the Project, an in-water survey will be designed to further delineate and map the SAV habitat acreage within 500 ft of all the possible landfall areas of the Oyster Creek Inshore Export Cable Route. This survey work will define and map the shallowest and deepest points of SAV habitat within the influence of the Project using a combination of towed-video and visual observations by a person wading in the water. SAV habitat, defined as all SAV beds, patches of SAV, and bare interpatch areas between SAV beds, will be mapped within the area of Project influence. Because the Project design envelope is not finalized, the area of Project influence will include all possible landing options on the western side of Barnegat Bay. At this stage, a 500-ft buffer from every cable route option will be used as the area of potential influence from the Project (see ‘Pre-construction SAV Mapping Survey Area’ denoted in Figures 10, 11, 12, and 13).

4.1.1 Technical Approach

The pre-construction SAV mapping survey will follow a combination of Method 1 (visual observations from boat or on foot) and Method 3 (underwater imagery) of the Tier-1 Survey

Methodology in *Submerged Aquatic Vegetation Survey Guidance for the New England Region* protocol (Colarusso and Verkade 2016). The location and water depth of the perimeters of the SAV bed within the area of potential influence of the Project will be determined using a combination of drop camera, towed video imagery collection, and visual inspection. Data will be collected during the SAV growing season (late April-October) on a small vessel capable of transiting through waters as shallow as 2 ft. Generally, continuous towed video will be the primary method for data collection (Method 3 in Colarusso and Verkade 2016). However, in very shallow waters, the landward edges of the SAV beds will need to be delineated on-foot using visual inspection and a handheld GPS (Method 1 in Colarusso and Verkade 2016).

In all survey areas during the towed video collection the water depths will be recorded along the transects. Post-collection video analysis will include an estimate of percent cover of SAV across the transects (barren, sparse [1-10% cover], low [11-25% cover], moderate [26-50% cover], and high [>50% cover]). During visual inspection by a person wading in the shallowest parts of the SAV bed, water depth will be measured periodically and at the estimated shallowest SAV edge. Time of day will be recorded throughout the surveying event to account for tidal fluctuation.

4.1.2 Survey Design

On the western side of IBSP, the edges of the SAV beds that fringe the prior channel where the cable will be installed and along the deepest (bay-ward) and shallowest (landward) boundaries of the SAV bed will be delineated (Figure 10). An underwater video camera will be towed along transects that traverse the prior channel perpendicularly and extend to either side of the channel out to 500 ft from the cable centerlines. Each transect will be approximately 1000 ft in length (500 ft on either side of the cable route centerline) and spaced approximately 75 to 100 ft apart (within the 'Pre-Construction SAV Mapping Survey Area' denoted in Figure 10). Due to the relatively homogeneous nature of the SAV bed in this area based on the 2019 aerial imagery data, the transect spacing will be wide because variability in SAV percent cover is expected to be low for most of the area. In the shallow portions of the survey area the focus will be on documenting the edges of the SAV bed along the prior channel and along the shoreline where data will likely be collected on foot.

On the western side of Barnegat Bay, the SAV beds at each of the current landfall options will be mapped within the context of the planned location of the HDD exit pit and HDD cable route options (Figures 11, 12, and 13). For these landfall areas the underwater video transects will be set perpendicular to shore to capture a clear delineation of the deep and shallow edges of the beds. Similar to the IBSP SAV bed mapping, the area of influence of the Project will be conservatively assumed to be 500 ft on either side of the potential cable route and will extend to the proposed HDD exit pit where the marine cable will transition to an HDD cable (Figures 11, 12, and 13). Again, the focus of the survey will be to delineate the edges of the SAV beds within the area of influence of the Project, measuring the shallowest and deepest water depths where SAV are found and estimating percent cover of SAV. The landward edges of these SAV beds will likely need to be documented visually on foot using a handheld GPS.

The results of this mapping and preliminary characterization (percent cover) exercise within the Project areas of influence will be used to restrict and manage the movement and anchoring of vessels in the area during cable installation. The data will also be used to identify designated anchorage areas or temporary mooring locations to avoid and minimize impacts to SAV from vessel anchoring. The SAV delineations and percent cover measurements from this survey will also inform the decision about which landfall option to pursue on the western side of Barnegat Bay, in addition to other relevant factors that will influence the cable routing.

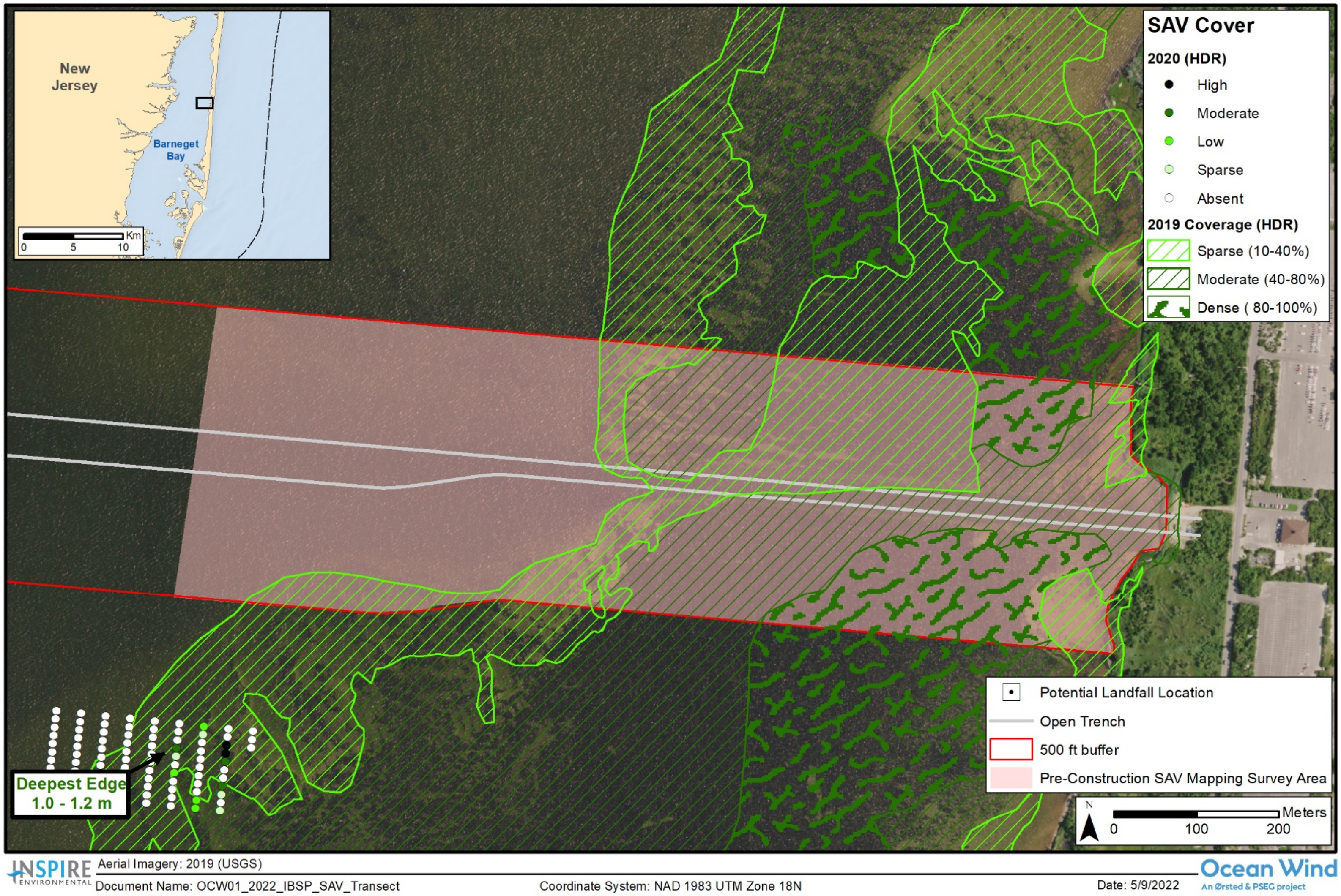

Figure 10. **Conceptual representation of the pre-construction SAV mapping survey area at the prior channel, a combination of continuous underwater video collection and visual inspection on foot in the shallow landward edge will be used.**

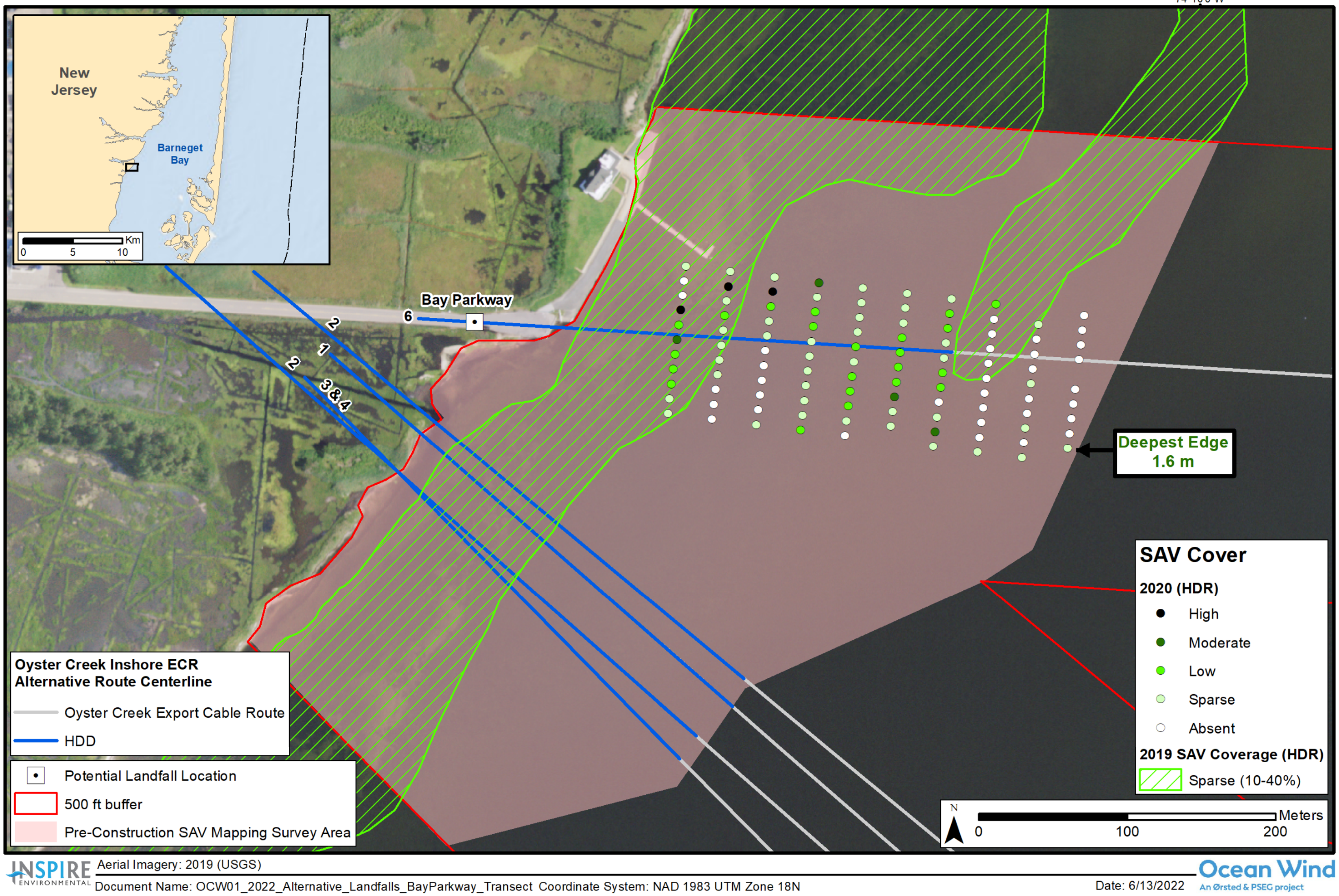

Figure 11. Conceptual representation of the pre-construction SAV mapping survey area at the Bay Parkway landfall options, a combination of continuous underwater video collection and visual inspection on foot in the shallow landward edge will be used.

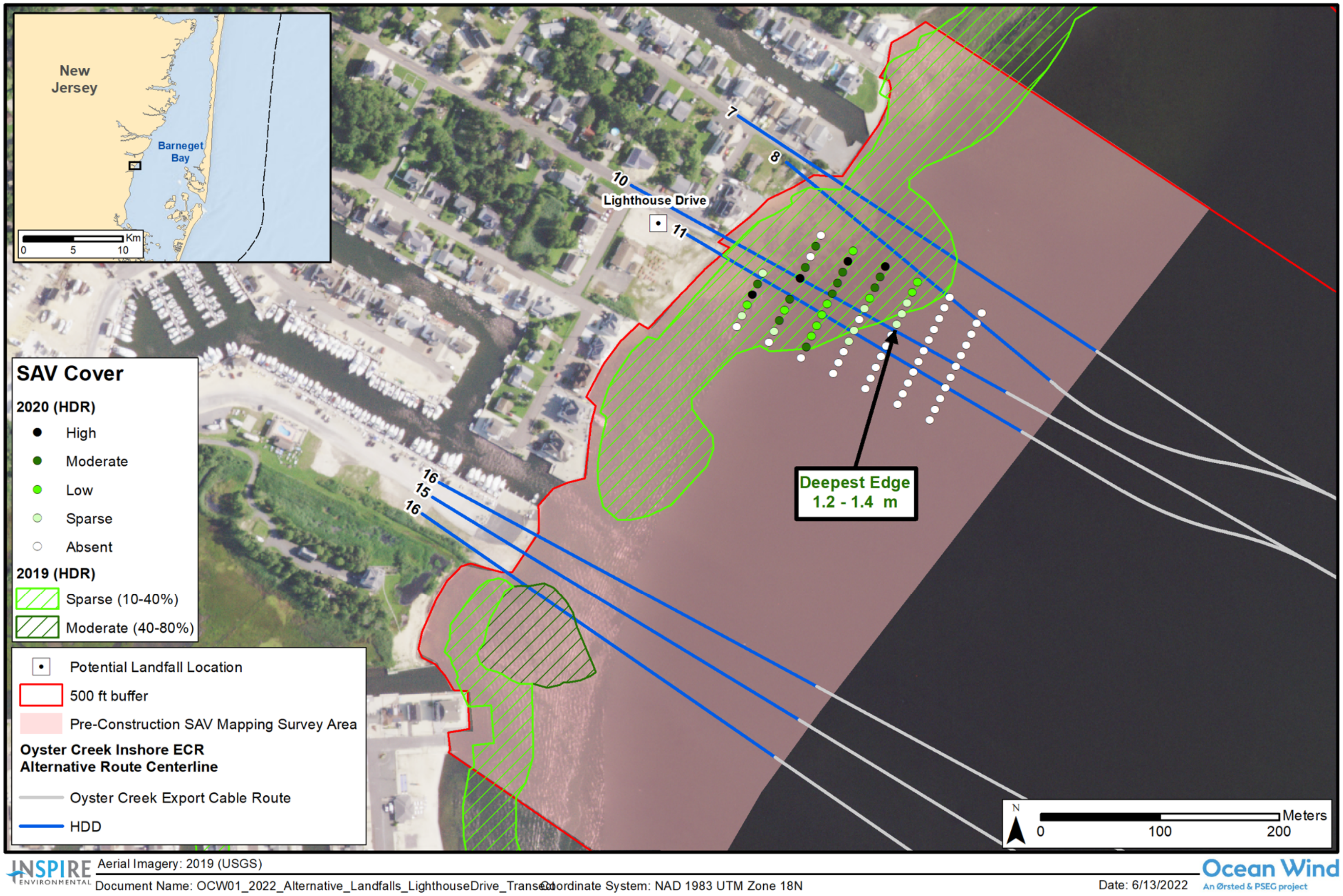

Figure 12. **Conceptual representation of the pre-construction SAV mapping survey area at the Lighthouse Drive landfall options, a combination of continuous underwater video collection and visual inspection on foot in the shallow landward edge will be used.**

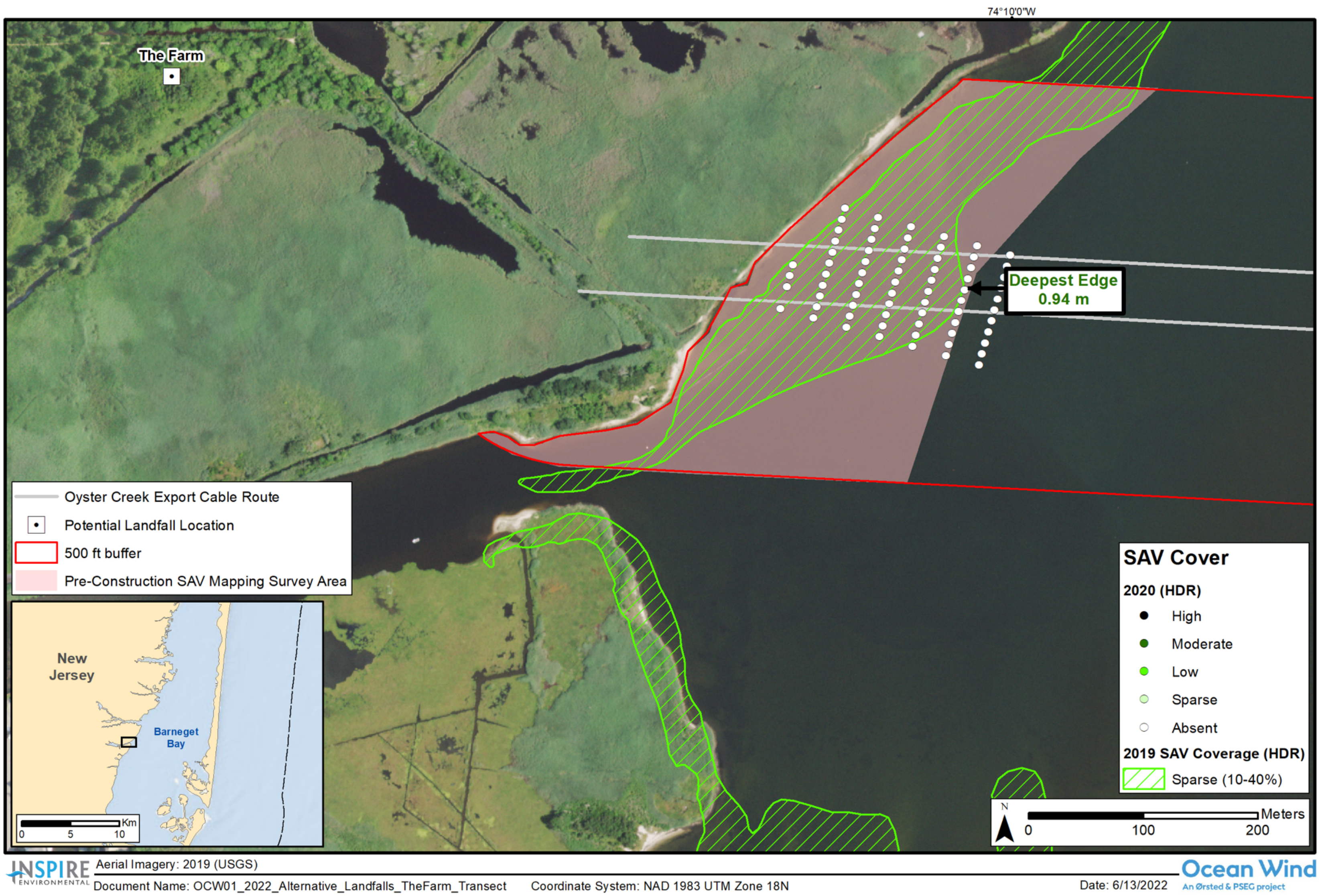

Figure 13. Conceptual representation of the pre-construction SAV mapping survey area at the Holtec landfall options (also known as the Farm), a combination of continuous underwater video collection and visual inspection on foot in the shallow landward edge will be used.

4.2 Pre-Construction SAV Characterization Survey

An additional pre-construction SAV survey will be conducted in order to document baseline SAV health and condition within the mapped SAV habitat associated with the area of influence of the Project on both sides of Barnegat Bay. This survey will use a systematic transect design aimed at characterizing the SAV across the meadows by measuring quantitative parameters indicative and important for SAV health (e.g., percent cover, shoot density, and/or biomass). The technical details of this pre-construction SAV characterization survey are being developed and will be refined following the results of the initial pre-construction SAV mapping survey described in Section 4.1 and as the Project design is further developed and finalized. Here, the general approach and timeline for this survey are described.

4.2.1 Technical Approach

Shoot density measurements will be collected by divers and/or snorkelers at each pre-determined location along each pre-determined transect. At each station a 1-m^2 quadrat demarcated with a 25-cm by 25-cm grid will be placed on the seafloor. A random number generator will be used to select three random grid cells of the 16 cells in the quadrat. Within each of the three random grid cells a complete shoot count will be conducted. This will be repeated at each station along each transect.

Additional quantitative parameters that are indicative and important for SAV health such as above and below ground biomass may also be collected. These additional parameters will be determined following consultation with NJDEP and local SAV expert, Dr. Elizabeth Lacey.

4.2.2 Survey Design

This pre-construction SAV characterization survey will be completed within six months prior to the commencement of cable installation activities, and within the SAV growing season (late-April to October) ("Y0-pre") (Table 1). Shoot density will be measured at discrete locations along pre-determined transects within the mapped SAV beds. In general, transects will be positioned perpendicular to the open trench cable route (i.e., within prior channel) and perpendicular to the HDD exit location (i.e., at the landfall on the western side of Barnegat Bay). Stations will be placed along these transects. The sampling resolution (density of stations) will be dependent on the results of the prior pre-construction SAV mapping survey described above. In SAV beds that are generally homogeneous in terms of percent cover, fewer stations will be required to characterize the SAV and estimate average shoot density across the SAV bed. However, in SAV beds that were observed to be patchier during the mapping survey (Section 4.1), a higher density of stations will be sampled to fully document this natural heterogeneity.

As discussed below in Section 5.0, this survey design will be repeated following construction completion; this will allow for a statistical analysis of change in SAV condition with distance from construction activity (Before-After-Gradient [BAG] design). Additionally, control sites will be sampled using the same approach in order to document any large-scale natural temporal variability in SAV condition within the greater Barnegat Bay area. Appropriate control sites will be identified at a later date in consultation with Dr. Elizabeth Lacey and NJDEP. Control sites will be selected that have been documented through the Barnegat Bay SAV Monitoring Program to be relatively stable over time (Lacey, 2021).

5.0 Post-Construction Surveys

The objective of the post-construction monitoring is to track any indirect and/or direct impacts to SAV resulting from cable installation activities. Specifically, any changes to SAV shoot density within the SAV beds as well as potential changes to the SAV percent cover in discrete areas (potential direct impacts from vessel activity) will be evaluated. The post-construction surveys will characterize the SAV condition within the areas of potential influence of the Project using the same approach and survey design as the pre-construction SAV characterization survey (Section 4.2). These data will be used to identify and assess any indirect impacts associated with cable installation activities (i.e., resuspension and sedimentation). Any potential direct impacts from unplanned vessel activity will be assessed using drone aerial imagery, which will be used to identify any distinguishable scars resulting from anchoring or propeller wash (e.g., Lathrop et al. 2017). An HDD inadvertent release mitigation plan will be developed prior to construction and separate from this monitoring plan.

5.1 Technical Approach

The post-construction monitoring approach will mirror that of the pre-construction SAV characterization survey described in Section 4.2.

5.2 Survey Design

The SAV condition monitoring will be based on a BAG design that will involve sampling before and after cable installation at locations with increasing distance from the cable. The monitoring will include collecting SAV shoot density (and potentially other quantitative SAV parameters indicative and important to SAV health) during the SAV growing season prior to any construction activity beginning (Y0-pre; Section 4.2), immediately following construction sampling within the SAV growing season (Y0-post), and annually for the next three years following construction (Y1, Y2, Y3) during the same month of the year (SAV growing season) (Table 1).

As described in Section 4.2, SAV data will be collected systematically along predetermined transects that are positioned perpendicular to the construction activities that are likely to result in sediment resuspension (i.e., open trench cable installation along the prior channel, and HDD exit pit excavation at the western landfall). Along each transect, a diver or snorkeler will collect shoot density at discrete stations previously determined based on measured variability in SAV percent cover within each area (derived from the pre-construction SAV mapping survey described in Section 4.1). As described above, control sites will also be sampled using the same approach in order to document any large-scale natural temporal variability in SAV condition within the greater Barnegat Bay area. Appropriate control sites will be identified at a later date in consultation with Dr. Elizabeth Lacey and NJDEP. Control sites will be selected that have been documented through the Barnegat Bay SAV Monitoring Program to be relatively stable over time (Lacey, 2022).

6.0 Statistical Analyses

The overall design of this monitoring plan is a BAG design and will be analyzed accordingly. Quantitative SAV condition parameters (e.g., shoot density) will be analyzed using parametric or non-parametric regression (e.g., generalized modeling such as Generalized Linear Model [GLM] or Generalized Additive Model [GAM]; or regression trees) will be applied if the data prove to be sufficient and appropriate for these tools. The model will include SAV shoot density as the dependent variable, with distance from the cable centerline and year since construction (prior to construction, 1 year post and 3 years post construction) as the explanatory variables. Covariates in the model for the SAV dataset will include distance from shore (continuous) and direction from cable (categorical); variability among transects will provide random error.

Additionally, graphical methods and descriptive statistics will be used to assess changes in the SAV shoot density over time and as a function of distance and direction from the export cable centerline. These graphical techniques may help to elucidate the spatial scale at which the greatest changes in benthic habitat condition occur. Although the BAG design explicitly incorporates gradient assessment to separate the potential SAV response from sources of change (i.e., project construction activity) and interannual variation, data collected at selected control sites will aid in interpretation of the results.

7.0 Data Management, Reporting, and Data Sharing

Data management and traceability is integral to analysis and accurate reporting. The surveys will follow a rigorous system to inspect data throughout all stages of collection and analysis to provide a high level of confidence in the data being reported. Following data entry, all digital logs will be proofread using the original handwritten field log. This review will be performed by someone other than the data entry specialist.

During field operations, daily progress reports will be reported through whatever means are available (email, text, phone). Upon completion of the survey all analyzed images as well as a data report with visualizations will be provided. Options for optimal data sharing, including images, video, and analysis results, will be considered and determined at a future date. Possible delivery methods include an Azure database, a secure file share, and/or an interactive popup map. Interactive popup maps allow users to explore still and video imagery concurrent with geophysical data, project-specific boundaries, and locations, and interpretative data obtained from the imagery.

Ocean Wind is working to create a data access process and protocols that are transparent and long-lasting. Through engagement with on-going discussions with the Responsible Offshore Science Alliance (ROSA), data access and regional data sharing guidance are being developed.

8.0 References

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