PUERTO RICO COASTAL

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT

APPENDIX G
Environmental

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US Army Corps of Engineers ®
Jacksonville District

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PURPOSE OF THIS DOCUMENT

Various alternatives were developed under the Puerto Rico Coastal Storm Risk Management (CSRM) Integrated Feasibility Report and Environmental Assessment (IFR/EA) to primarily address impacts from coastal inundation and erosion. The purpose of this document is to describe the rationale, assumptions, and methods for alternative screening, compensatory mitigation requirements, and/or Environmental Quality (EQ) benefits associated with the final array of alternatives.

HABITAT ASSESSMENT TOOL

The Visual Habitat Equivalency Analysis (HEA) software tool was created in 2006 to facilitate the assessment of losses and gains in ecosystem services related to compensatory mitigation under the United States National Resource Dam-age Assessment Act (NRDA). HEA is an ecological equivalence assessment method that can be performed using the Visual HEA software. The use of the HEA method to assess ecosystem services related to biodiversity effects is widely used due to the development of the user-friendly software and simplicity of required inputs (Kohler & Dodge 2006, Sylvain et al 2017). The HEA method provided in Visual HEA 2.6 was endorsed by the USACE's ECO-PCX for use on the Puerto Rico CSRM study on 03 June 2020.

The HEA is a means to determine the amount of compensatory restoration or Environmental Quality (EQ) benefits that a given alternative would induce. HEA includes a discounting procedure to account for asset valuation in that the total asset value is equal to the discounted value of the future stream of all services from the natural resource or the compensatory resource. Discounting is used to include the relative valuation of loss and gain of ecological services of the resources over time. HEA results are highly dependent upon assumptions and subsequently it is useful to examine sensitivity of results to a range of parameter values. The ability to calculate results for many scenarios allows comparisons that may assist in determining the least impactful alternative, appropriate compensatory action, or EQ benefits.

DETAILED BENTHIC HABITAT & SPECIES SURVEY

To perform the HEA, a solid basis in the spatial extent and quality of study area habitats and species is required. A team of marine scientists composed of qualified coral biologists and benthic ecologists experienced with coastal habitats occurring throughout Puerto Rico conducted *in situ* identifications of submerged resources (see Appendix G, Attachment 5). SAV and hardbottom habitat, ESA corals, and other important marine resources were delineated, mapped, and assessed within the San Juan (Figure 1) and Rincón (Figure 2) study areas. The benthic resource surveys were conducted during three separate field efforts occurring from 17 July to 9 October 2022. The HEA assessment utilizes the inventoried resources as the basis for spatial (acres) and quality (% diversity/health) effects per proposed alternative.

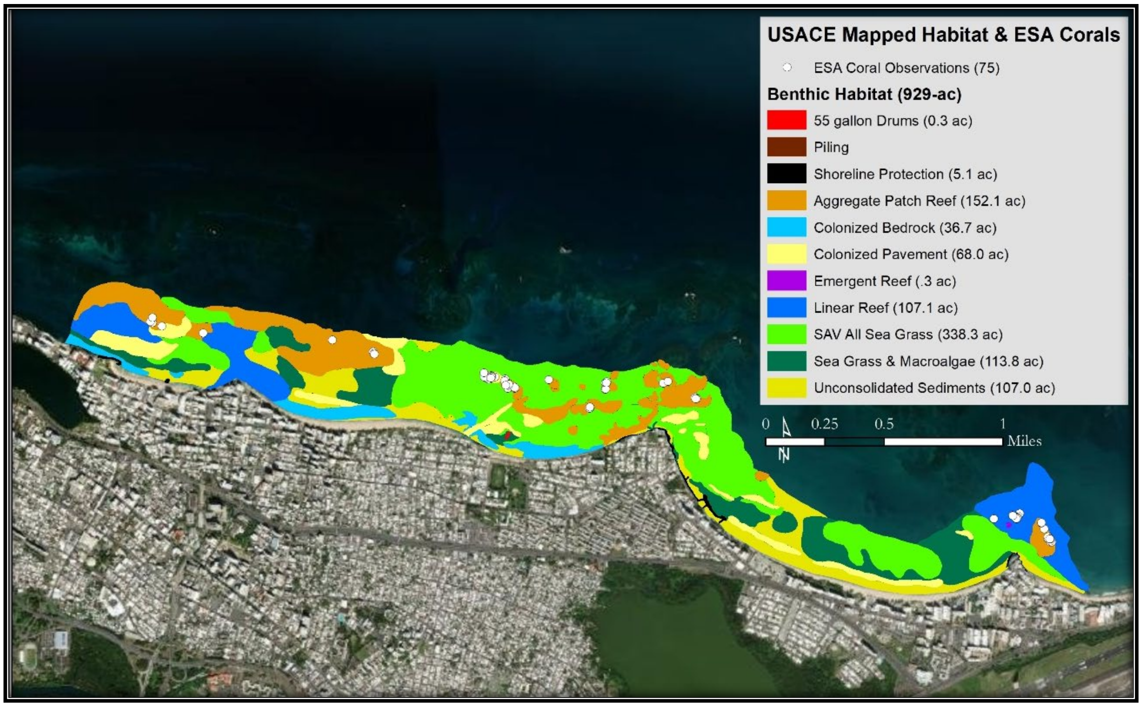

Figure 1: San Juan, PR Coral Reef Complex Habitats & ESA Coral Species, USACE Survey 2022

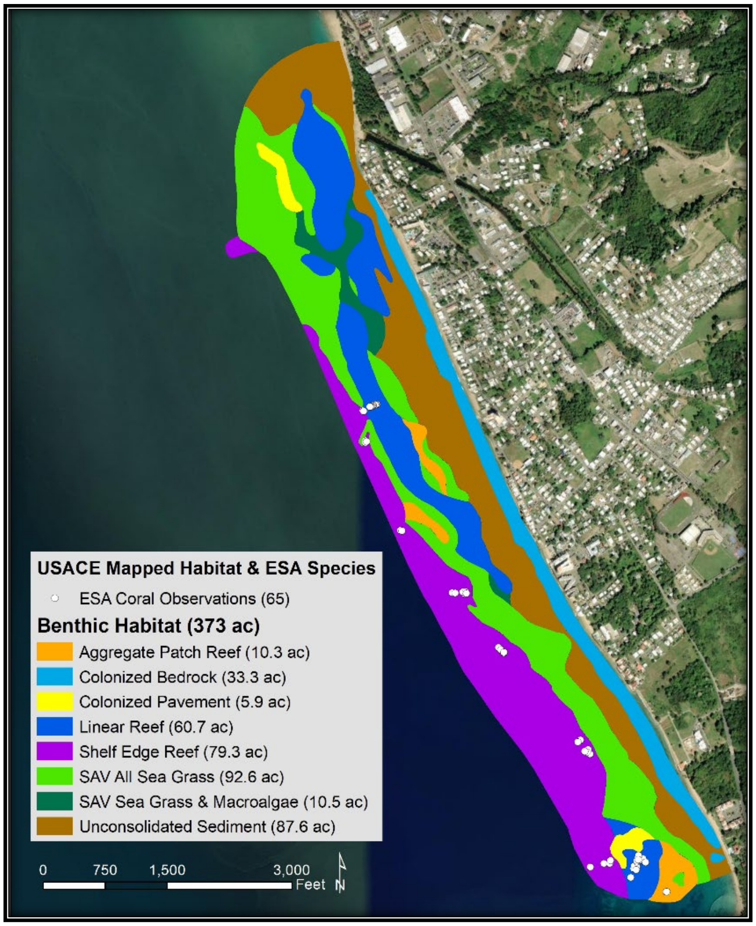

Figure 2: Rincón, PR Coral Reef Complex Habitats & ESA Coral Species, USACE Survey 2022

FINAL ALTERNATIVE ARRAY ANALYSIS

The following presents the information utilized to support alternative screening for the final array of study alternatives. Temporary effects were not assessed with the HEA tool, as existing land use and ecosystem conditions would return as construction is completed or shortly thereafter. Permanent effects when considered significant were assessed with the HEA tool to determine how much compensatory mitigation would be needed, or if there would be residual EQ benefits for a given alternative. All temporary and permanent effects of the TSP are fully disclosed in the Environmental Assessment of the Main Report and Appendix G, Attachment 2 404(b)(1) analysis. References to primary objective benefits of damages reduced are not discussed here and are considered inherent to the final array of study alternatives. Table 1 provides a summary of results on what would be discussed in the following analysis.

Table 1: Summary of Effects to Resources for the Final Array of Alternatives

	Ocean Park					Rincon			
Resource Category	**Alt-1 (NA)**	**Alt-2 (Floodwall)**	**Alt-3 (Floodwall & Nourishment)**	**Alt-4 (Extended Floodwall)**	**Alt-5 (Floodwall & Acquisition)**	**Alt-1 (NA)**	**Alt-2 (Revetment)**	**Alt-3 (Nourishment w/Groins)**	**Alt-4 (Acquisition)**
Air Quality									
Water Quality									
Shorelines & Native Vegetaion									
SAV									
Hardbottom Habitat									
Essential Fish Habitat & Nassau Grouper DCH									
ESA Species & Critical Habitat									
Corals, Queen Conch, & *Acropora* DCH									
Fishes									
Sea Turtles									
Antillean Manatee									
Sea Birds & Shore Birds									
Coastal Barrier Resources									
Invasive Species									
Environmental Justice									
HTRW									
Cultural Resources									
Aesthetics & Recreation									
Noise									

beneficial effects

nuetral effects

temporary adverse effects

premanent adverse effects

OCEAN PARK, SAN JUAN

Qualitative Comparison of Alternatives

Determinations and rational are provided in Table 2, where necessary, for the final array of alternatives at Ocean Park. These establish the basis for subsequent analysis for mitigation needed or residual environmental quality benefits, which coupled together inform the plan selection process presented in the Main Report.

Table 2: Comparison of Resource Effects for Final Alternative Array at Ocean Park, San Juan

	Ocean Park				
Resource Category	**Alt-1 (NA)**	**Alt-2 (Floodwall)**	**Alt-3 (Floodwall & Nourishment)**	**Alt-4 (Extended Floodwall)**	**Alt-5 (Floodwall & Acquisition)**
Air Quality	It is anticipated that air quality would remain the same or become slightly more impaired than the existing condition. It is possible efforts would be made during the next decade to abate/curtail anthropogenic sources of nutrient, chemical, and temperature type pollutions.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.
Water Quality	It is anticipated that water quality would remain the same or become slightly more impaired than the existing condition. It is possible efforts would be made during the next decade to abate/curtail anthropogenic sources of nutrient, chemical, and temperature type pollutions.	Minor, short-term effects to water quality are expected for this alternative. These effects include localized increases in turbidity stemming from removal of debris and old shoreline structures, and placement of new clean materials. Turbidity increases are expected to be less of that induced by natural storms and wind driven waves.	Minor, short-term effects to water quality are expected for this alternative. These effects include localized increases in turbidity stemming from removal of debris and old shoreline structures, and placement of new clean materials. Turbidity increases are expected to be less of that induced by natural storms and wind driven waves. The effects	Minor, short-term effects to water quality are expected for this alternative. These effects include localized increases in turbidity stemming from removal of debris and old shoreline structures, and placement of new clean materials. Turbidity increases are expected to be less of that induced by natural storms and wind driven waves.	Minor, short-term effects to water quality are expected for this alternative. These effects include localized increases in turbidity stemming from removal of debris and old shoreline structures, and placement of new clean materials. Turbidity increases are expected to be less of that induced by natural storms and wind driven waves.

			of beach nourishment are expected to be greater than the floodwall alternatives, but still temporary.		
Shorelines & Native Vegetation	It is anticipated that shoreline and native vegetation would remain relatively the same. Shoreline erosion and aggradation of longshore drift sands and shell hash are persistent throughout time within this planning reach and would continue to support dynamic pocket beaches are small foredunes. Some portions of the shoreline with revetment would likely remain stable while poorly constructed or outdated stabilization will likely fail. Reaches with exposed bedrock would remain naturally stable. Shoreline habitat is limited or moderately impaired within the study reach due to encroachment of structures into the natural shoreline zone and recreational uses of the beaches.	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions. No effects to native vegetation or are expected from this alternative.	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions. No effects to native vegetation are expected from this alternative. There would potentially be more beach recreation space and habitat during certain years for those species that utilize this zone of the shoreline. Although there would be minor shoreline benefits, it would come at	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions in terms of habitat. No effects to native vegetation are expected from this alternative.	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions. No effects to native vegetation are expected from this alternative. There would be potential native vegetation and recreation created by this alternative.

			the expense of covering hardbottom habitats.		
SAV	It is anticipated that SAV and macroalgae beds within the San Juan study area would remain relatively the same. There is potential for some species to be impacted by fine sedimentation and poor water quality, while other hardier species become more dominant. If hardbottom habitats were to become permanently silted in, more SAV beds may form.	No effects are expected from this alternative. This is based on the work primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Detailed mapping shows than this alternative does not overlap with SAV habitats or would not cause disturbance to associated species.	No effects are expected from the floodwall portion of this alternative. Temporary and permanent effects are expected from sand nourishment covering existing SAV habitats are expected. This is based on the equilibrated profile compared to the 2022 detailed mapping of benthic resources. Mitigation would be required.	No effects are expected from this alternative. This is based on the work primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Detailed mapping shows than this alternative does not overlap with SAV habitats or would not cause disturbance to associated species.	No effects are expected from this alternative. This is based on the work primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Detailed mapping shows than this alternative does not overlap with SAV habitats or would not cause disturbance to associated species.

Hardbottom Habitat	Overall, surveyed hardbottom habitats were diverse and healthy in 2022. Descriptions and results show that poor water quality, anthropogenic sedimentation, and physical disturbance are the three main future threats to declining habitat. These conditions also slow or limit recovery after natural disturbance by storms, herbivory/predation, and general habitat mosaic shifts. Global-wide issues of acidification and aerial deposited pollution also contributes to declining habitats. Should these effects continue to carry on into the future, it is anticipated that hardbottom habitats within the San Juan study areas would decline.	No effects to hardbottom habitats are expected from this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Mapping conducted in 2022 show that hardbottom habitat does not overlap with this alternative.	No effects are expected from the floodwall portion of this alternative. Temporary and permanent effects are expected from sand nourishment covering existing hardbottom habitats are expected. This is based on the equilibrated profile of sand placement compared to the 2022 detailed mapping of benthic resources. Mitigation would be required.	No effects to hardbottom habitats are expected from this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Mapping conducted in 2022 show that hardbottom habitat does not overlap with this alternative.	No effects to hardbottom habitats are expected from this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Mapping conducted in 2022 show that hardbottom habitat does not overlap with this alternative.
Essential Fish Habitat & Nassau Grouper DCH	Overall, surveyed essential fish habitats were diverse and healthy in 2022. Descriptions and results show that poor water quality, anthropogenic sedimentation, and physical disturbance are the three main future threats to declining habitat. These conditions also slow or limit recovery after natural disturbance by storms, herbivory/predation, and general habitat mosaic shifts. Global-wide issues of acidification and aerial deposited pollution also contributes to declining habitats. Should these effects continue to carry on into the future, it is anticipated that EFH within the study areas would decline.	No effects to EFH are expected from this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Mapping conducted in 2022 show that EFH habitat does not overlap with this alternative.	No effects are expected from the floodwall portion of this alternative. Temporary and permanent effects are expected from sand nourishment covering existing EFH habitats are expected. This is based on the equilibrated profile compared to the 2022 detailed mapping of benthic resources. Mitigation would be required.	No effects to EFH are expected from this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Mapping conducted in 2022 show that EFH habitat does not overlap with this alternative.	No effects to EFH are expected from this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Mapping conducted in 2022 show that EFH habitat does not overlap with this alternative.
ESA Species & Critical Habitat					

Corals, Queen Conch & *Acropora* DCH	It is anticipated that poor water quality and human induced sedimentation would continue to result in negative effects to listed corals, such as bleaching, disease, and low reproduction/recruitment rates. Sedimentation could smother these listed coral species, especially Orbicella, Mycetophyllia, and Dendrogyra, because they cannot shed the sediment like the fanlike species (Acropora; mucus sloughing). It is possible efforts would be made during the next decade to abate/curtail anthropogenic sources of nutrient, chemical, and temperature type pollutions.	No effect to ESA coral species or DCH is expected for this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Surveys conducted in 2022 show that all ESA coral species are located on the outer reefs. Therefore, direct or indirect contact with ESA coral species is not likely.	No effect to ESA coral species is expected for this alternative. This is based on the equilibrated profile of the nourishment not overlapping with mapped ESA coral species, which are located on the outer reefs. There may be affects considered for *Acropora* DCH, since hardbottom habitats fitting the description would be covered by sand.	No effect to ESA coral species or DCH is expected for this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Surveys conducted in 2022 show that all ESA coral species are located on the outer reefs. Therefore, direct or indirect contact with ESA coral species is not likely.	No effect to ESA coral species or DCH is expected for this alternative. This is based on the work being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Surveys conducted in 2022 show that all ESA coral species are located on the outer reefs. Therefore, direct or indirect contact with ESA coral species is not likely.
Fishes	It is anticipated that recovery efforts would be made for these species, especially in terms of overfishing and bycatch. In terms of the study area, it is anticipated that these three species would remain stable in their exiting conditions.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.
Sea Turtles	It is anticipated that recovery efforts would be made for these species, especially in terms of nesting habitat and bycatch. In terms of the study area, it is anticipated that these four species would remain stable in their exiting conditions.	No in-water effects are anticipated. Effects are not anticipated for beach habitat; however, there could be disturbance effects during nesting. Beach habitat would be the same before and after construction. Conservation measures would apply for work over or in the water and on the beaches.	Minor, indirect effects are anticipated via sand covering foraging habitat and sponges. Effects are not anticipated for beach habitat; however, there could be disturbance effects during nesting. Beach habitat would be the same before and after construction. Conservation measures would apply for work over or in the water and on the beaches. There would be additional beach habitat created by this alternative, but at the expense of covering hardbottom habitats.	No in-water effects are anticipated. Effects are not anticipated for beach habitat; however, there could be disturbance effects during nesting. Beach habitat would be the same before and after construction. Conservation measures would apply for work over or in the water and on the beaches.	No in-water effects are anticipated. Effects are not anticipated for beach habitat; however, there could be disturbance effects during nesting. Beach habitat would be the same before and after construction. Conservation measures would apply for work over or in the water and on the beaches. There would be additional potential beach nesting habitat created by this alternative.

Antillean Manatee	It is anticipated that recovery efforts would be made for these species, especially in terms of physical contact with marine vessels and machinery, and SAV foraging habitats. In terms of the study area, it is anticipated that these three species would remain stable in their exiting conditions.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals. Conservation measures would apply for work over or in the water.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals. Conservation measures would apply for work over or in the water.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals. Conservation measures would apply for work over or in the water.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals. Conservation measures would apply for work over or in the water.
Sea Birds & Shore Birds	It is anticipated native seabirds, shorebirds, and other native bird species and populations would remain relatively like the existing condition. Shoreline habitat for birds is limited or moderately impaired within the study reach due to encroachment of structures into the natural shoreline zone.	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions in terms of bird habitat. No effects to native vegetation or important bird habitat or vegetation are expected from this alternative.	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions in terms of bird habitat. No effects to native vegetation or important bird habitat are expected from this alternative. There would potentially be more beach habitat during certain years for those species that utilize this zone of the shoreline	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions in terms of bird habitat. No effects to native vegetation or important bird habitat are expected from this alternative.	Minor, temporary effects are expected from shoreline modification for this alternative. Temporary disturbance to the areas that will receive the floodwall measures stem from removing old infrastructure, debris, and grading slopes include noise and visual disturbance. It is anticipated after the floodwalls and toe stone are in place, covered/backfilled with beach sand, and cleaned up there would not be much difference from the existing shoreline conditions in terms of bird habitat. No effects to native vegetation or important bird habitat are expected from this alternative. There would be potential bird habitat created.
Coastal Barrier Resources	Coastal Barriers do not exist within the study are a or area of potential effect.	No effects anticipated.	No effects anticipated.	No effects anticipated.	No effects anticipated.

Invasive Species	In the future without-project condition, the potential will continue to exist for introduction of invasive species due to the mechanisms discussed above. Recent Federal regulations require the shipping industry to implement better controls to prevent the introduction of invasive species through the ballasts of vessels (USCG 2012). These regulations should decrease the rate at which invasive species are introduced to the study area. The USCG will continue to monitor, enforce, and revise regulations related to the discharge of ballast water while vessels are in port according to the USCG Ballast Water Management Final Rule Published 23 March 2012.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. Open areas would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. The covering of hardbottom habitat with sand may induce SAV beds that could be colonized by invasive sea grass species. Open areas and dune would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. Open areas would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. Open areas would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.
Environmental Justice	In the future without-project condition, environmental justice communities will continue to be negatively impacted by coastal storm risks.	The reduction of coastal storm risk experienced in this alternative positively impacts environmental justice communities. There are no disproportionate adverse impacts.	The reduction of coastal storm risk experienced in this alternative positively impacts environmental justice communities. There are no disproportionate adverse impacts.	The reduction of coastal storm risk experienced in this alternative positively impacts environmental justice communities. There are no disproportionate adverse impacts.	The reduction of coastal storm risk experienced in this alternative positively impacts environmental justice communities. There are no disproportionate adverse impacts.
HTRW	No significant effects to or from hazardous and toxic materials are anticipated from the FWOP condition. Phase I investigations and existing land uses do not indicate the potential for HTRW to be present.	No effects anticipated.	No effects anticipated.	No effects anticipated.	No effects anticipated.
Cultural Resources	Project-specific impacts would be avoided, but risk of storm damages to cultural resources may not be reduced.	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations

Aesthetics & Recreation	A key recreational landmark is Barbosa Park (also known as Último Trolley), which is owned by the municipality of San Juan. It consists of a recreational beach and park which are enjoyed by the community and some tourists. It is bounded by a sidewalk and a small access road. The large recreational park includes a track, various sports fields, as well as a police station. Overtopping of the existing wall from coastal storms wall occurs routinely, causing flooding both in the park and on access roads, which impacts recreational opportunities. The municipality of San Juan has plans to enhance features of Barbosa Park. Coastal flooding will continue to impact recreational opportunities after storms.	No permanent effects to existing aesthetics are anticipated from this alternative. The exiting wall will be replaced will a new functional wall and toe stone, where the toe stone will be covered in sand to maintain sandy habitat, recreational activities, and beach aesthetics.	No permanent effects to existing aesthetics are anticipated from this alternative. The exiting wall will be replaced will a new functional wall and toe stone, where the toe stone will be covered in sand to maintain sandy habitat, recreational activities, and beach aesthetics.	No permanent effects to existing aesthetics are anticipated from this alternative. The exiting wall will be replaced will a new functional wall and toe stone, where the toe stone will be covered in sand to maintain sandy habitat, recreational activities, and beach aesthetics.	No permanent effects to existing aesthetics are anticipated from this alternative. The exiting wall will be replaced will a new functional wall and toe stone, where the toe stone will be covered in sand to maintain sandy habitat, recreational activities, and beach aesthetics. Additional open space would be gained for recreation, habitat, and aesthetic improvement.
Noise	The San Juan study area is within an urban setting and noises related to beach recreation, recreational and commercial vessel traffic, dredging vessels, and dock side facilities would continue similar to the existing conditions.	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects once construction is complete.	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects once construction is complete.	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects once construction is complete.

			once construction is complete.		

Environmental Alternative Evaluation

Alternative 1 – No Action

This alternative is the existing and the future without project condition. In general, the ecology of the study area would remain in the existing condition into the foreseeable future. Buffering upland habitats have been removed or highly altered by urbanization. The existing shoreline where there is no beach has been highly altered by past armoring. Nearshore geology and hydrodynamics support a diverse physical and biological coral reef system, with extensive submerged aquatic vegetation (SAV) beds. As well, the natural sand source and aggradation of beach is consistent over time. However, conditions for nesting sea turtles, native birds, and native vegetation have been removed or are limited by human disturbance via old shoreline protection and residential and recreational activities on/near the beach, including clearing, lighting, and noise. Other influences include poor water quality from San Juan Harbor and other point sources that are contributing to unnatural siltation of coral and SAV habitats.

Based on the existing conditions of beach, coral and other nearshore habitats, large scale ecosystem restoration would generally be unnecessary. Smaller scale restoration could include improving water quality inputs, acquiring landto restore, restoring damaged or diseased coral reef, reducing nonnative sea grasses and terrestrial weeds, and small beach sustaining reef structures in limited locations. Local restoration efforts could include temporal or permanent limitations on human activities to reduce or eliminate disturbance for nesting sea turtles and native birds.

Alternative 2 – Floodwall at Barbosa Park & Skate Park

The spatial extent of this alternative includes features and construction work limits. Spatial extent of effects is shown on Figure 3, Figure 4, Figure 5, and Figure 6. Temporary effects anticipated for Barbosa Park include 0.2 acres public sidewalk; 1.0 acres public beach; 0.05 acres beach surf zone; 0.1 acres colonized bedrock. Temporary effects anticipated for the Skate Park include 0.7 acres shoreline protection; 1.1 acres unconsolidated sediments (sand/shell hash). Permanent effects anticipated at Barbosa Park include 0.5 acres of public road, which would be removed and turned into floodwall, toe stone, and sandy dune. Permanent effects anticipated for the Skate Park include 1.5 acres disturbed shoreline, which would be converted to floodwall and toe stone.

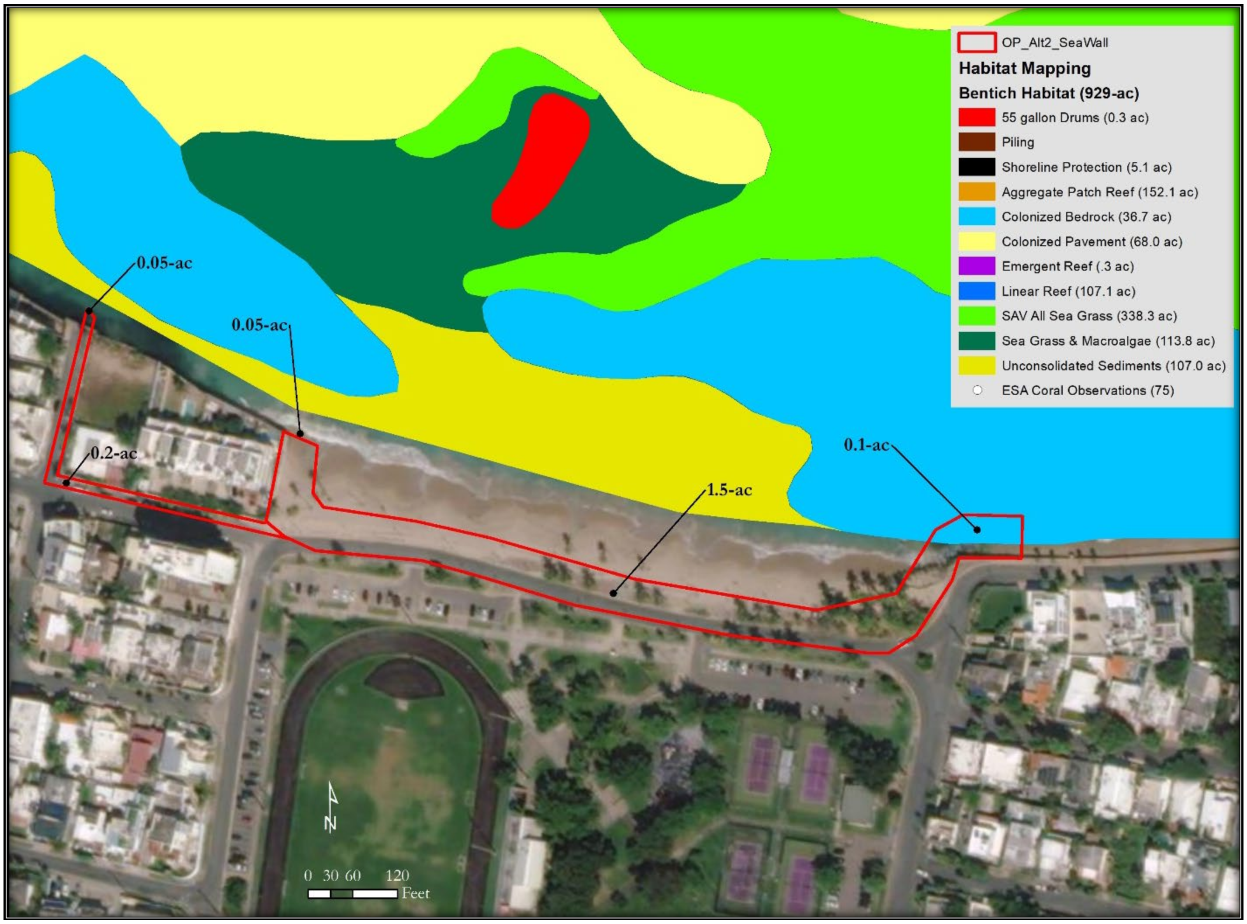

Figure 3: Ocean Park, San Juan Alternative 2 Barbosa Park Spatial Extent of Floodwall & Construction

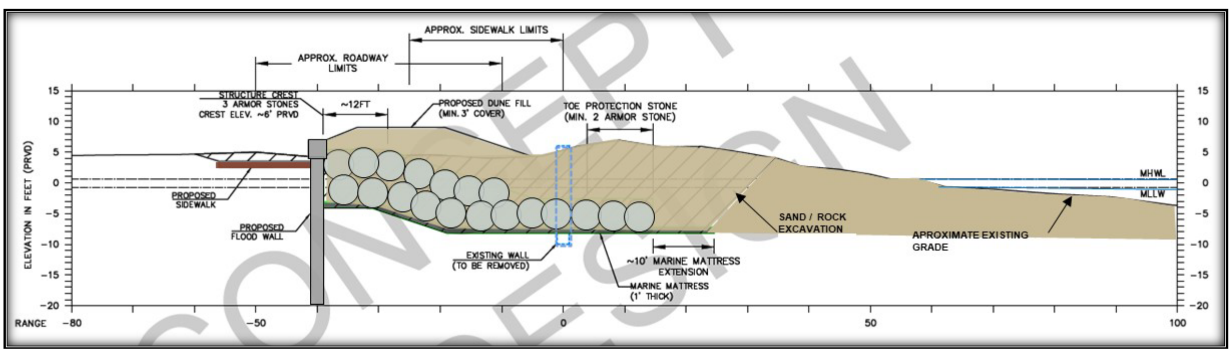

Figure 4: Ocean Park, San Juan Alternative 2 Barbosa Park Floodwall Typical Cross Section

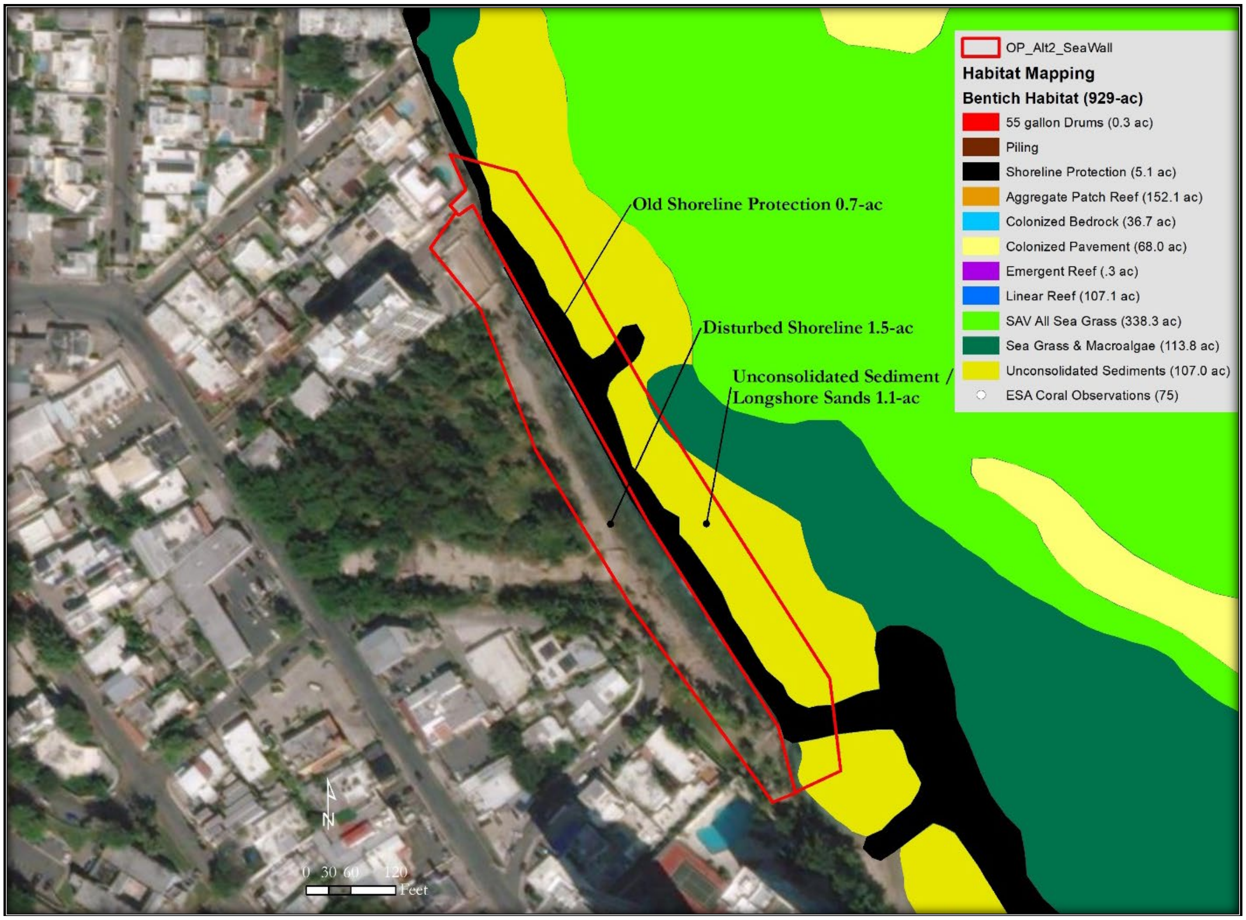

Figure 5: Ocean Park, San Juan Alternative 2 Skate Park Affected Area

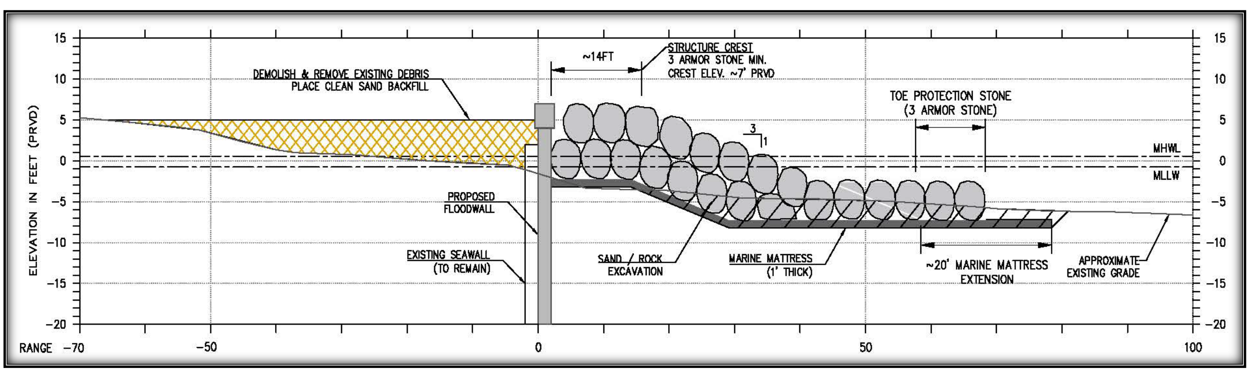

Figure 6: Ocean Park, San Juan Alternative 2 Skate Park Floodwall Typical Cross Section

Mitigation or Residual EQ

The HEA was not used to show potential Habitat Units lost or gained via implementing this alternative. The permanent effects anticipated as a result of this project are relatively small, considered insignificant under NEPA and 404, and wouldn't provide substantial habitat value. Converting the 0.5 acres of public road to the floodwall greatly reduces impacts to the public beach and does allow for a small amount of public beach to be gained but considering the small size and surrounding influences of tourism and recreation, habitat accrual would be quite minimal in this strip. Based on this, the only noticeable effect after the project would be that the road is no longer there for cars to drive on. This effect is addressed in the Environmental Assessment of the Main Report. As the road is not habitat, this permanent change does not require mitigation assessment. Residual EQ benefits are too small to quantify and are considered qualitatively as beneficial to larger adjacent habitats. The permanent change at the Skate Park is converting 1.5 acres of old shoreline protection to new shoreline protection. Although this change is considered permanent, they are essentially the same thing. As the new shoreline protection would eventually provide the same type of habitat and species as the old shoreline protection, mitigation assessment is not required. Residual EQ benefits would be too indecipherable to quantify and are considered qualitatively as no change and no influence on adjacent habitats.

Alternative 3 – Floodwall at Barbosa Park & Skate Park with 10-ft Beach & Vegetated Dune (5-year)

This alternative is the same as Alternative 2 for the floodwall component at Barbosa Park and the Skate Park, with the addition of beach nourishment and sand dune recurring every 5-years. As described in Alternative 2, permanent effects for the floodwall portion are considered negligible and do not have mitigation or residual EQ calculations. The addition of beach nourishment is looked at under this Alternative 3. The spatial extent of effect for the beach sand placement (Figure 7) is based on the construction and equilibrated profile (Figure 8). Temporary effects anticipated for Barbosa Park include 0.2 acres public sidewalk; 10.5 acres public beach; 0.05 acres beach surf zone; 2.3 acres unconsolidated sediments (sand/shell hash). Temporary effects anticipated for the Skate Park include 0.7 shoreline protection; 1.1 acres unconsolidated sediments (sand/shell hash) (Figure 5). Permanent effects anticipated for Barbosa Park include 0.5 acres public road; 0.1 acres aggregate patch reef; 4.9 acres colonized bedrock; 0.2 acres colonized pavement; 0.2 acres SAV. Permanent effects anticipated for the Skate Park include 1.5 acres disturbed shoreline (Figure 5).

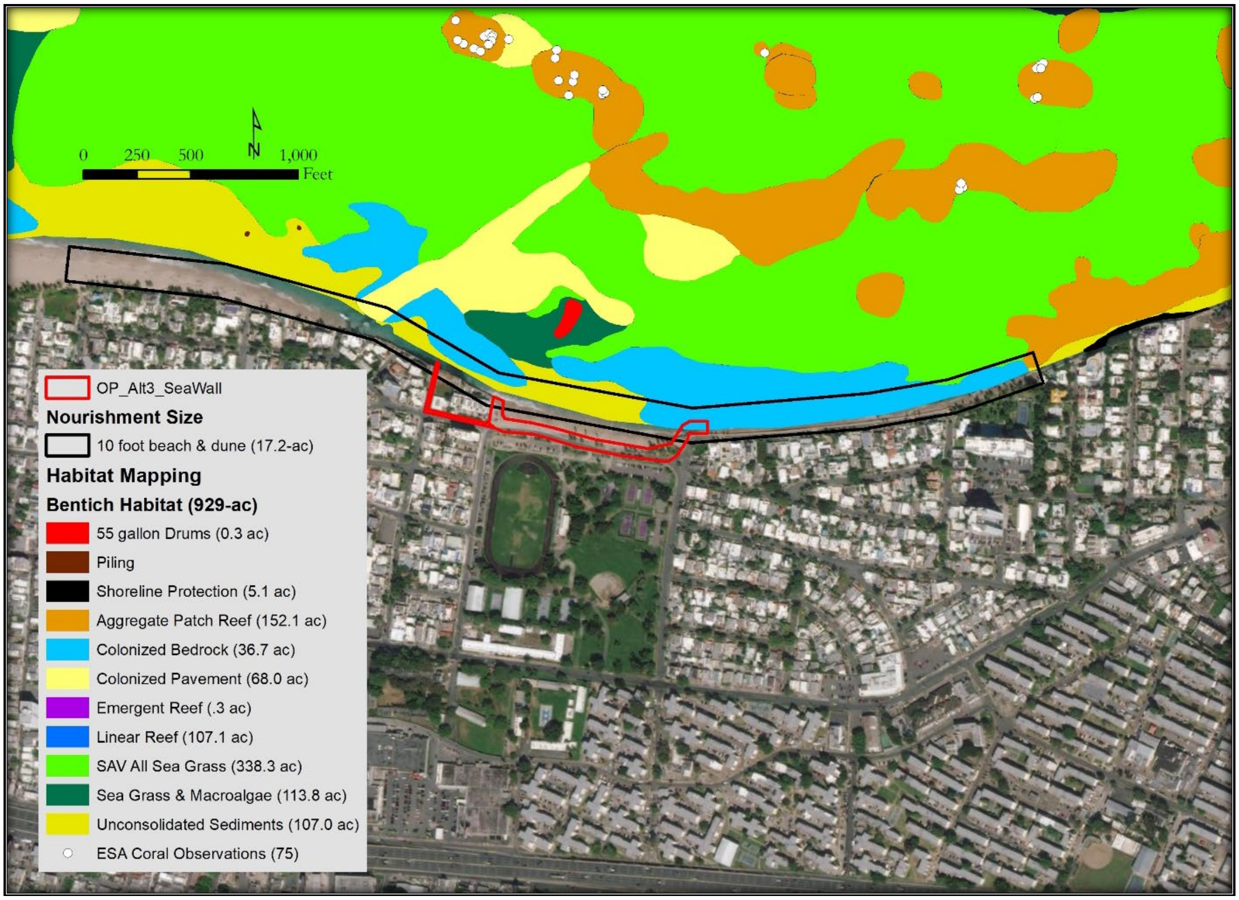

Figure 7: Ocean Park, San Juan Alternative 3 Spatial Extent of Beach Sand Placement & Movement

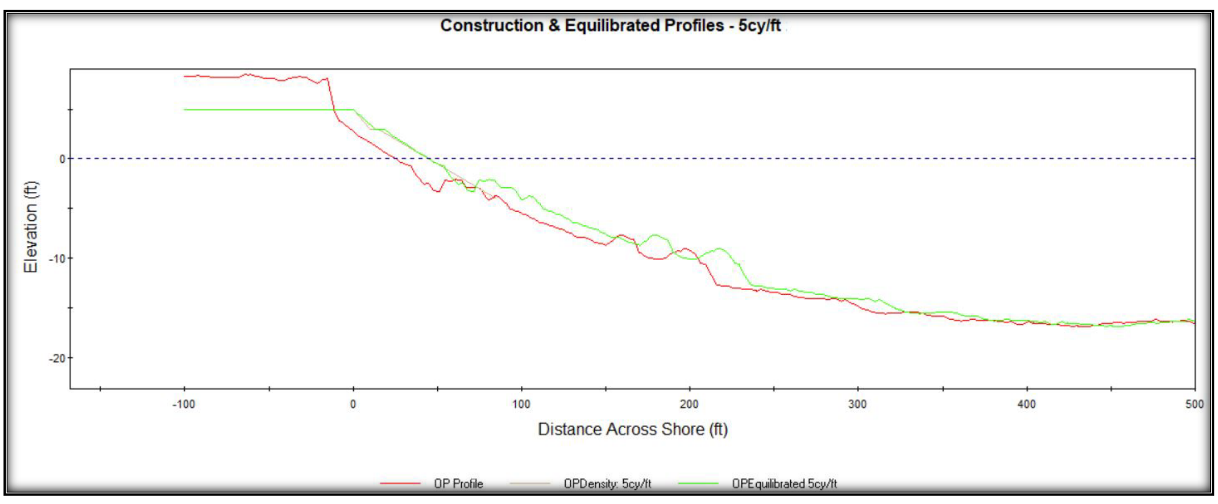

Figure 8: Ocean Park, San Juan Alternative 3 Beach Sand Placement Equilibrated Profile

Mitigation or Residual EQ

Assessment of the floodwall portion of this project is provided under Alternative 2 above. The HEA was used here to show potential Habitat Units lost via implementing beach nourishment at 5-year intervals this alternative proposes. It is anticipated that a total of 5.4 acres of nearshore habitat would be lost or altered to recurring sand cover every 5 years. Specifically, 0.1 acres aggregate patch reef, 4.9 acres colonized bedrock, 0.2 acres colonized pavement and 0.2 acres SAV. Based on the benthic habitat and species surveys (USACE 2022), the overall combined species richness, abundance, and health of the affected habitats are at about 80% of their potential. Mitigation ratios used were 1:1 for this plan formulation analysis; mitigation ratios could be higher for hardbottom habitats. Under this scenario (Table 1) there would be a loss of **2.45 AA Habitat Units** and **3.9 acres of mitigation required**.

Table 3: Ocean Park, San Juan Alternative 3 Mitigation Scenario

Data / Assumption Types	Data & Assumptions
Proxy	Sand placement for beach nourishment every 5 years. Equilibrated profile would be reestablished every 5 years maintain impacts to covered hardbottom and SAV. Covered habitats would retain about %5 of preinjury value. Injured habitats include colonized bedrock, aggregate patch reef, colonized pavement, and SAV.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	5.4
Annual discount rate	2.25%
Level of services supplied before the damage	80% (with anthropogenic influence)
Level of services supplied after the damage	5% (post Alt 3)
Regeneration pace	The pace of regeneration for hardbottom recovery is 0 based on recurring nourishments every 5 years. The pace of compensatory mitigation is about 12 years for hardbottom coral and sponge habitats.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	80%
Discounted Service Unit Years Gained per Acre (quality calculation only)	31.380
Total Discounted Service Unit Years Lost over 50 years (Habitat Units)	122.344
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	169.454
Total DSUYs / 50 years (AA Habitat Units)	**-2.45**
Acres of Mitigation Required	3.9

Alternative 4 – Floodwall at Barbosa Park & Skate Park with Extended Floodwall to East & West

This alternative is the same as Alternative 2 for the floodwall component at Barbosa Park and the Skate Park, with the addition of floodwall to the east and west of Barbosa Park. As described in Alternative 2, permanent effects for the floodwall portion are considered negligible and do not have mitigation or residual EQ calculations. The addition of more floodwall is looked at under this alternative. The spatial extent of this alternative includes features and construction work limits. Spatial extent of effects is shown on Figure 9, Figure 4, Figure 5, and Figure 6. Temporary effects anticipated for Barbosa Park include 0.2 acres public sidewalk; 4.4 acres public beach; 0.05 acres beach surf zone; 0.8 acres colonized bedrock. Temporary effects anticipated for the Skate Park include 0.7 acres shoreline protection; 1.1 acres unconsolidated sediments (sand/shell hash) (Figure 5). Permanent effects anticipated at Barbosa

Park include 0.5 acres of public road, which would be removed and turned into floodwall, toe stone, and sandy dune. Permanent effects anticipated for the Skate Park include 1.5 acres disturbed shoreline, which would be converted to floodwall and toe stone (Figure 5).

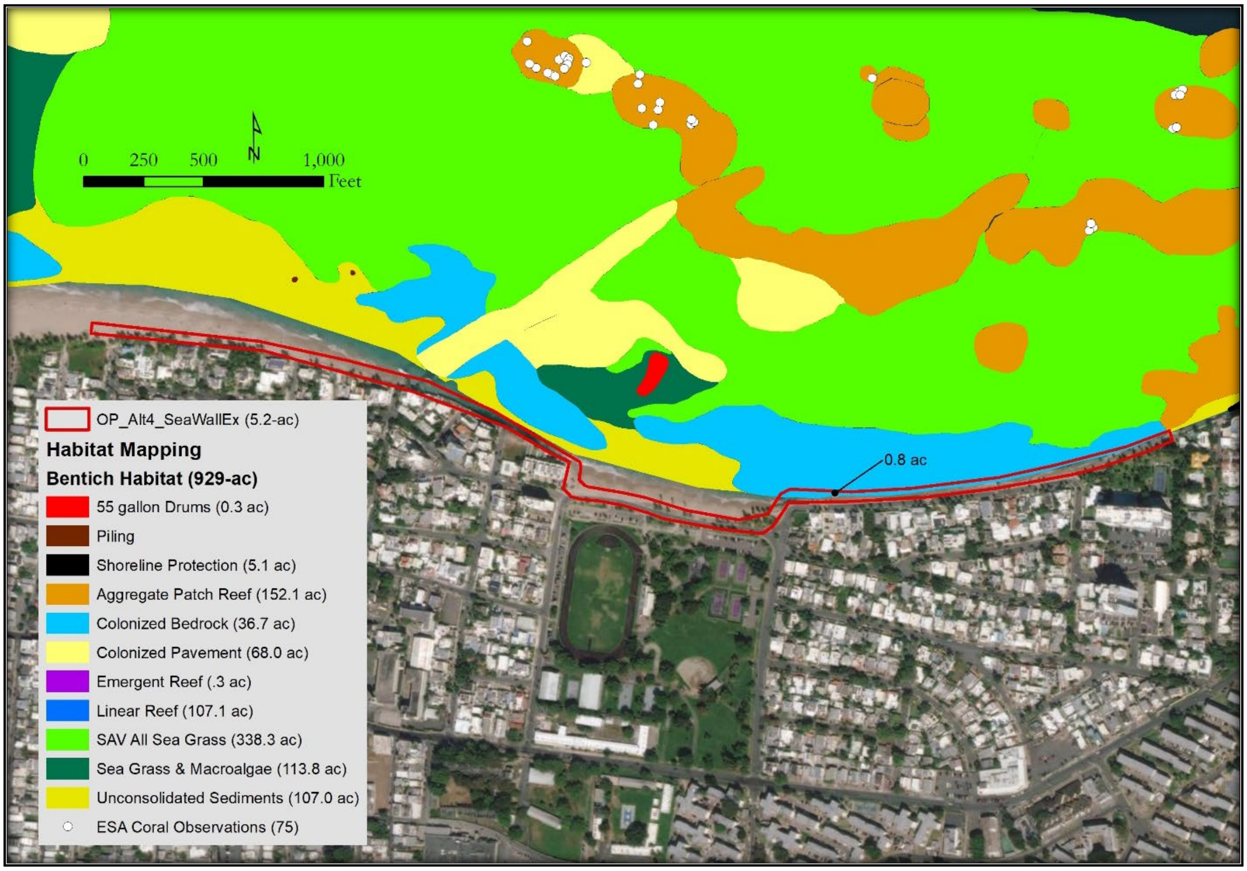

Figure 9: Ocean Park, San Juan Alternative 4 Showing Extended Floodwall from Barbosa Park

Mitigation or Residual EQ

The HEA was not used to show potential Habitat Units lost or gained via implementing this alternative. The permanent effects anticipated as a result of this project are relatively small, considered insignificant under NEPA and 404, and wouldn't provide substantial habitat value. Considerations are identical to Alternative 2 for both Barbosa Park and the Skate Park and are not further discussed here. The addition of floodwall east and west is considered here. Since the extended floodwalls would be placed where the old floodwall exists, and that the new floodwall and toe stone would be covered with beach quality sand, the with-project condition would be the same as the existing condition. The 4.5 acres of public beach disturbed during construction would be returned to the preexisting condition. The 0.8 acres of mapped colonized pavement lies within the surf zone and is ephemerally covered with longshore drifting sands depending on wave climates. The placement of karstic limestone here would likely experience these same conditions and ultimately be colonized by the same hardbottom species. Refinements made during design would likely avoid this habitat altogether.

Alternative 5 – Floodwall at Barbosa Park & Skate Park with Acquisition

The spatial extent of this alternative includes features and construction work limits. Spatial extent of effects is shown on Figure 10. Temporary effects anticipated for Barbosa Park include 0.2 acres public sidewalk; 0.8 acres public beach; 0.05 acres beach surf zone; 0.1 acres colonized bedrock. Temporary effects anticipated for the Skate Park include 0.7 acres shoreline protection; 1.1 acres unconsolidated sediments (sand/shell hash) (Figure 5). Permanent effects anticipated at Barbosa Park include 1.1 acres of residential/disturbed shoreline; 0.5 acres of public road, which would be removed and turned into floodwall, toe stone, and sandy dune. Permanent effects anticipated for the Skate Park include 1.5 acres disturbed shoreline, which would be converted to floodwall and toe stone (Figure 5).

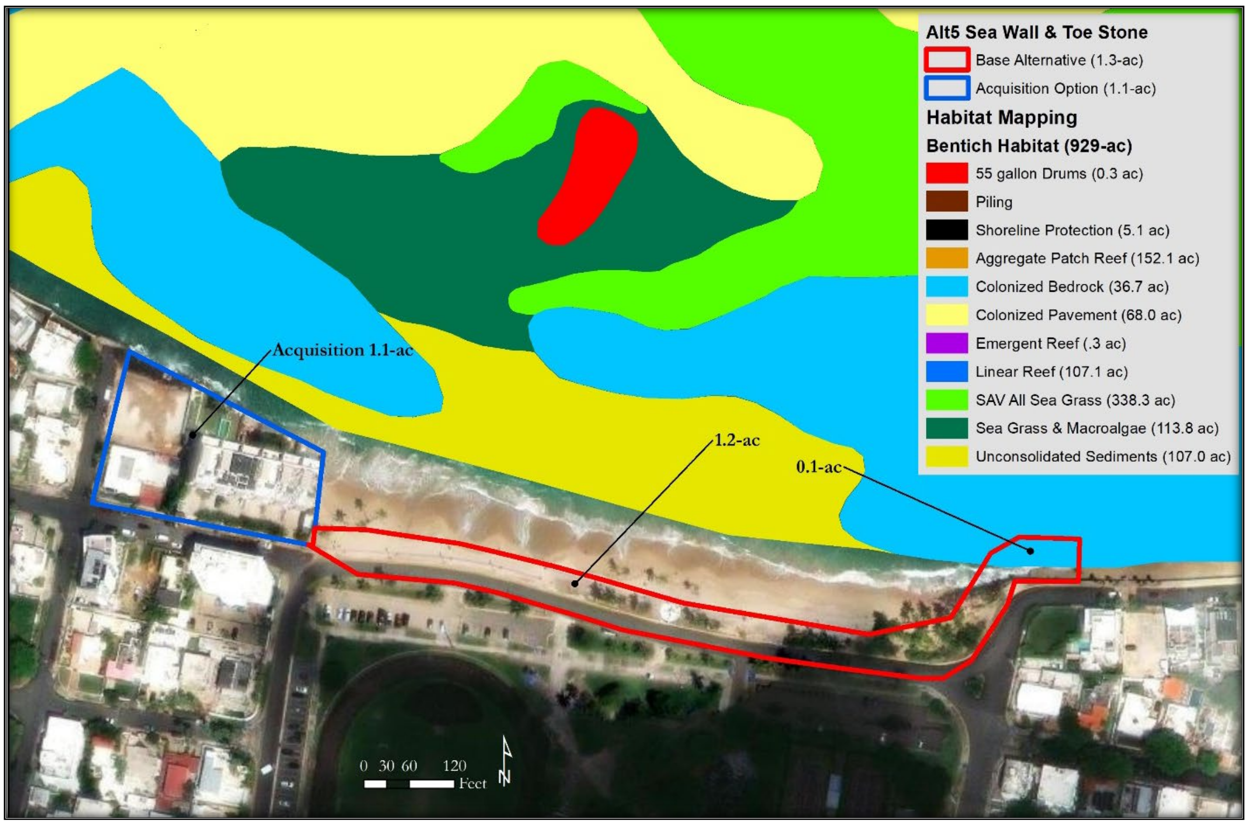

Figure 10: Ocean Park, San Juan Alternative 5 Floodwall with Acquisition of 1.1 Acres

Mitigation or Residual EQ

Assessment of the floodwall portion of this project is provided under Alternative 2 above. The HEA was used to show potential Habitat Units gained via implementing the inclusion of acquisition this alternative proposes. Two scenarios are provided. The first shows letting the land lie fallow, where the DNER does not implement further restoration and protection of land use to promote native habitat and species. The second scenario considers the DNER performing minor restorative actions and developing a conservation ordinance. Under Scenario 1 (Table 6) there would be **0.27 AA Habitat Units** gained with **no additive costs** for ecosystem restoration. Under Scenario 2 (Table 3) there would **0.48 AA Habitat Units** gained with non-Federal **additive costs (~$20,000/acres)** for ecosystem restoration.

Table 4: Ocean Park, San Juan Alt 5 Residual EQ Scenario 1

Data / Assumption Types	Data & Assumptions
Proxy	Nesting Leatherback Sea Turtle habitat; native dune vegetation; native birds, small mammals, and herpetofauna. The abandonment and demolition of structures on most of the smaller parcels would allow for a naturalized shoreline of beach and small foredunes.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	1.1
Annual discount rate	2.25%
Level of services supplied before the damage	100% (pre anthropogenic influence)
Level of services supplied after the damage	0% (post structure building)
Regeneration pace	The pace of regeneration is based on the long-term abandonment and demolition of identified structures per parcel. It is assumed all proposed parcels would be bought out. There would be no active ecological restoration, nor would there be restrictions placed on the parcels to support native species and habitats.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	50% (post Alt 2 & Acq. wo/ER)
Discounted Service Unit Years Gained per Acre (quality calculation only)	12.182
Total Discounted Service Unit Years Lost	0
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	13.401
Total DSUYs / 50 years (AA Habitat Units)	**0.27**

Table 5: Ocean Park, San Juan Alt 5 Residual EQ Scenario 2

Data / Assumption Types	Data & Assumptions
Proxy	Nesting Leatherback & Hawksbill Sea Turtle habitat; native dune vegetation; native birds, small mammals, and herpetofauna. The abandonment and demolition of structures on most of the smaller parcels would allow for a naturalized shoreline of beach and small foredunes; there could be opportunity to include additional habitats for other habitats in the several larger parcels.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	1.1

Annual discount rate	2.25%
Level of services supplied before the damage	100% (pre anthropogenic influence)
Level of services supplied after the damage	0% (post structure building)
Regeneration pace	The pace of regeneration is based on the long-term abandonment and demolition of identified structures per parcel. It is assumed all proposed parcels would be bought out. There would be minor ecological restoration by DNER and there would be restrictions placed on the parcels to support native species and habitats.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	90% (post Alt 2 & Acq. w/ER)
Discounted Service Unit Years Gained per Acre (quality calculation only)	21.839
Total Discounted Service Unit Years Lost	0
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	24.023
Total DSUYs / 50 years (AA Habitat Units)	**0.48**

Table 6: Ocean Park, San Juan Alternatives & Spatial Resource Effects Summary

Alternative		Spatial Resource Effects (acres)
Alt-1	No Action	N/A
Alt-2	Floodwall (Barbosa & Skate Park)	*Temporary* Barbosa Park: 0.2 public sidewalk; 1.0 public beach; 0.05 beach surf zone; 0.1 colonized bedrock Skate Park: 0.7 shoreline protection; 1.1 unconsolidated sediments (sand/shell hash) *Permanent* Barbosa Park: 0.5 public road Skate Park: 1.5 disturbed shoreline
Alt-3	Floodwall (Barbosa and Skate Park) + 10 ft Beach with Vegetated Dune (5-year)	*Temporary* Barbosa Park: 0.2 public sidewalk; 10.5 public beach; 0.05 beach surf zone; 2.3 unconsolidated sediments (sand/shell hash) Skate Park: 0.7 shoreline protection; 1.1 unconsolidated sediments (sand/shell hash) *Permanent* Barbosa Park: 0.5 public road; 0.1 aggregate patch reef; 4.9 colonized bedrock; 0.2 colonized pavement; 0.2 SAV Skate Park: 1.5 disturbed shoreline
Alt-4	Floodwall (Barbosa and Skate Park) w/ Extended	*Temporary* Barbosa Park: 4.4 public beach;

	Floodwall to the West and East	0.05 beach surf zone; 0.8 colonized bedrock Skate Park: 0.7 shoreline protection; 1.1 unconsolidated sediments (sand/shell hash) *Permanent* Barbosa Park: 0.5 public road Skate Park: 1.5 disturbed shoreline
Alt-5	Floodwall (Barbosa and Skate Park) + Acquisition	*Temporary* Barbosa Park: 0.2 public sidewalk; 0.8 public beach; 0.05 beach surf zone; 0.1 colonized bedrock Skate Park: 0.7 shoreline protection; 1.1 unconsolidated sediments (sand/shell hash) *Permanent* Barbosa Park: 1.1 residential/ disturbed shoreline; 0.5 public road Skate Park: 1.5 disturbed shoreline

Table 7: Ocean Park, San Juan Mitigation & Residual EQ Summary

	Alternative	Acres Permanently Effected	HEA Mitigation AAHUs	Mitigation Acres Required	HEA EQ AAHUs	Net Loss/Benefit AAHUs	Ecosystem Acres Gained
1	No Action	0	0		0	0	0
2	Floodwall (Barbosa & Skate Park)	0	0		0	0	0
3	Floodwall (Barbosa and Skate Park) + 10 ft Beach with Vegetated Dune	5.4	-2.45	3.9	0	-2.45	0
4	Floodwall (Barbosa and Skate Park) w/ Extended Floodwall to the West and East	0	0	0	0	0	0
5	S1 Floodwall (Barbosa and Skate Park) + Acquisition	1.1	0	0	0.27	0.27	1.1
5	S2 Floodwall (Barbosa and Skate Park) + Acquisition	1.1	0	0	0.48	0.48	1.1

STELLA, RINCÓN

Qualitative Comparison of Alternatives

Determinations and rational are provided in Table 2, where necessary, for the final array of alternatives at Rincón. These establish the basis for subsequent analysis for mitigation needed or residual environmental quality benefits, which coupled together inform the plan selection process presented in the Main Report.

Table 8: Comparison of Resource Effects for Final Alternative Array at Stella, Rincón

	Rincon			
Resource Category	**Alt-1 (NA)**	**Alt-2 (Revetment)**	**Alt-3 (Nourishment w/Groins)**	**Alt-4 (Acquisition)**
Air Quality	It is anticipated that air quality would remain the same or become slightly more impaired than the existing condition. It is possible efforts would be made during the next decade to abate/curtail anthropogenic sources of nutrient, chemical, and temperature type pollutions.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.	It has been determined that the activities proposed under this proposed alternative would not exceed de minimis (a level of risk too small to be concerned with) levels of direct or indirect emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153.
Water Quality	It is anticipated that water quality would remain the same or become slightly more impaired than the existing condition. It is possible efforts would be made during the next decade to abate/curtail anthropogenic sources of nutrient, chemical, and temperature type pollutions. There could be adverse effects, temporary or permanent, from buildings falling into the ocean, depending on what the contents of the building/structure was.	Minor, short-term effects to water quality are expected for this alternative. These effects include localized increases in turbidity stemming from removal of debris and old shoreline structures, and placement of new clean materials. Turbidity increases are expected to be less of that induced by natural storms and wind driven waves.	Minor, short-term effects to water quality are expected for this alternative. These effects include localized increases in turbidity stemming from removal of debris and old shoreline structures, and placement of new clean materials. Turbidity increases are expected to be less of that induced by natural storms and wind driven waves. The effects of beach nourishment are expected to be greater than the revetment alternative, but still temporary.	No effects are expected from this alternative.

Shorelines & Native Vegetation	It is anticipated that the shoreline would continue to erode landward until a dynamic equilibrium is met. The portions of the shoreline with riprap and seawalls would likely remain stable for a while, but ultimately protection and structures will likely succumb to the erosive hydrodynamics in this planning reach. Natural beach formation would continue to be ephemeral and short-lived. Shoreline habitat is very limited or highly impaired within the study reach due to encroachment of structures into the natural shoreline zone.	Minor, permanent effects are expected from shoreline modification for this alternative. Permanent disturbance to the areas that will receive the revetment measures stem from removing old infrastructure, debris, and placing rock materials include noise and visual disturbance. The small strips of beach would be permanently covered by rock. Effects to shoreline habitat or natural shorelines are not expected from this alternative because they are absent. Thus, alternative may prevent ephemeral beaches to form in this reach.	Minor, beneficial effects to the natural shoreline and vegetation for this alternative are expected. After a sandy beach shoreline would be established, there would potentially be more beach habitat during certain years for those species that utilize this zone of the shoreline. Although there would be minor shoreline benefits, it would come at the expense of covering hardbottom habitats.	Beneficial, long-term effects to the natural shoreline and vegetation for this alternative are expected. The restoration of parcels (considering compatible recreational uses) from residential to natural area would eventually provide beach, small foredune, and other natural shoreline habitats. This accrual of habitat comes from converting residential lands and does not come at the expense of covering up hardbottom habitats.
SAV	It is anticipated that SAV and macroalgae beds within the Rincón study area would remain relatively the same. There is potential for some species to be impacted by fine sedimentation and poor water quality, while other hardier species become more dominant. If hardbottom habitats were to become permanently silted in, more SAV beds may form.	No effects are expected from this alternative. This is based on the work primarily being upland, placed on old infrastructure/shoreline protection, or on hardbottom. Detailed mapping shows than this alternative does not overlap with SAV habitats or would not cause disturbance to associated species.	No effects are expected from the groin portion of this alternative. Temporary and permanent effects are expected from sand nourishment covering existing SAV habitats.	No effects are expected from this alternative. This is based on the work primarily being upland. Detailed mapping shows that this alternative does not overlap with SAV habitats or would not cause disturbance to associated species.
Hardbottom Habitat	Overall, surveyed hardbottom habitats were diverse and healthy in 2022. Descriptions and results show that poor water quality, anthropogenic sedimentation, and physical disturbance are the three main future threats to declining habitat. These conditions also slow or limit recovery after natural disturbance by storms, herbivory/predation, and general habitat mosaic shifts. Global-wide issues of acidification and aerial deposited pollution also contributes to declining habitats. Should these effects continue to carry on into the future, it is anticipated that hardbottom habitats within the Rincón study areas would decline.	Temporary adverse effects are expected from this alternative. Based on detailed mapping, colonize bedrock would be covered by rock. Although it is likely that the placed rock would eventually be colonized, mitigation may be required by regulatory agencies.	Permanent adverse effects are expected from this alternative. Based on detailed mapping, coral reef and colonized bedrock habitats would be covered by equilibrating sands. Mitigation would be required for loss of this significant resource. Although it is likely that the placed rock for groins would eventually be colonized, mitigation may be required by regulatory agencies.	No effects are expected from this alternative. This is based on the work primarily being upland. Detailed mapping shows that this alternative does not overlap with hardbottom habitats or would not cause disturbance to associated species.

Essential Fish Habitat & Nassau Grouper DCH	Overall, surveyed essential fish habitats were diverse and healthy in 2022. Descriptions and results show that poor water quality, anthropogenic sedimentation, and physical disturbance are the three main future threats to declining habitat. These conditions also slow or limit recovery after natural disturbance by storms, herbivory/predation, and general habitat mosaic shifts. Global-wide issues of acidification and aerial deposited pollution also contributes to declining habitats. Should these effects continue to carry on into the future, it is anticipated that EFH within the study areas would decline.	Temporary adverse effects are expected from this alternative. Based on detailed mapping, EFH would be covered by rock. Although it is likely that the placed rock would eventually be colonized, mitigation may be required by regulatory agencies.	Permanent adverse effects are expected from this alternative. Based on detailed mapping, EFH habitats would be covered by sand. Mitigation would be required for loss of this significant resource. Although it is likely that the placed rock for groins would eventually be colonized, mitigation may be required by regulatory agencies.	No effects are expected from this alternative. This is based on the work primarily being upland. Detailed mapping shows that this alternative does not overlap with EFH habitats or would not cause disturbance to managed species.
ESA Species & Critical Habitat				
Corals, Queen Conch & *Acropora* DCH	It is anticipated that poor water quality and human induced sedimentation would continue to result in negative effects to listed corals, such as bleaching, disease, and low reproduction/recruitment rates. Sedimentation could smother these listed coral species, especially Orbicella, Mycetophyllia, and Dendrogyra, because they cannot shed the sediment like the fanlike species (Acropora; mucus sloughing). It is possible efforts would be made during the next decade to abate/curtail anthropogenic sources of nutrient, chemical, and temperature type pollutions.	No effect to ESA coral species or DCH is expected for this alternative. This is based on the work being upland and on old infrastructure/shoreline protection. Surveys conducted in 2022 show that all ESA coral species and critical habitats are located on the outer reefs. Therefore, direct or indirect contact with ESA coral species is not likely.	No effect to ESA coral species is expected for this alternative. This is based on the equilibrated profile of the sand placement. Surveys conducted in 2022 show that all ESA coral species and critical habitats are located on the outer reefs. Therefore, direct or indirect contact with ESA coral species is not likely. Regulatory agencies may require mitigation for covering hardbottom habitat that could be considered *Acropora* DCH.	No effect to ESA coral species or DCH is expected for this alternative. This is based on the work being upland and on old infrastructure/shoreline protection. Surveys conducted in 2022 show that all ESA coral species are located on the outer reefs. Therefore, direct or indirect contact with ESA coral species is not likely.
Fishes	It is anticipated that recovery efforts would be made for these species, especially in terms of overfishing and bycatch. In terms of the study area, it is anticipated that these three species would remain stable in their exiting conditions.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.

Sea Turtles	It is anticipated that recovery efforts would be made for these species, especially in terms of nesting habitat and bycatch. In terms of the study area, it is anticipated that these three species would remain stable in their exiting conditions.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals. The existing beach area that would be covered is not sufficient	No effect to ESA sea turtle species is expected for this alternative. Sea turtles could benefit from an established beach provided by the periodic nourishment and groins. Surveys conducted in 2022 show that hardbottom and other benthic habitats would be covered by sand, in which sea turtles feed. Therefore, beach habitat would come at the expense of covering foraging habitats. Regulatory agencies may require mitigation for covering sea turtle foraging habitat.	No in-water effects are anticipated. Effects are not anticipated for beach habitat as well since there is currently a limited beach zone. There would be additional potential beach nesting habitat created by this alternative.
Antillean Manatee	It is anticipated that recovery efforts would be made for these species, especially in terms of physical contact with marine vessels and machinery, and SAV foraging habitats. In terms of the study area, it is anticipated that these three species would remain stable in their exiting conditions.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals. Conservation measures would apply for work over or in the water.	Effects would be anticipated during placement of groins. Although the groins would not overlap with critical SAV habitats, placement of rock into the water may affect, but not likely adversely affect this species. Conservation measures would apply for work over or in the water.	No effects anticipated. This alternative would not overlap with critical habitats or be able to come into contact with individuals.
Sea Birds & Shore Birds	It is anticipated native seabirds, shorebirds, and other native bird species and populations would remain relatively like the existing condition. Shoreline habitat for birds is very limited or highly impaired within the study reach due to encroachment of structures into the natural shoreline zone.	Minor, permanent effects are expected from shoreline modification for this alternative. Permanent disturbance to the areas that will receive the revetment measures stem from removing old infrastructure, debris, and placing rock materials include noise and visual disturbance. The small strips of beach would be permanently covered by rock. Effects to shoreline birds or bird habitat are not expected from this alternative because they are absent.	Minor, beneficial effects are expected to natural shoreline bird habitat for this alternative. After a sandy beach shoreline would be established, there would potentially be more beach habitat during certain years for those species that utilize this zone of the shoreline. Although there would be minor shoreline benefits, it would come at the expense of covering hardbottom habitats.	Beneficial, long-term effects to natural shoreline bird habitat are expected for this alternative. The restoration of parcels (considering compatible recreational uses) from residential to natural area would eventually provide 17 acres of beach, small foredune, and other natural shoreline habitats.
Coastal Barrier Resources	Coastal Barriers do not exist within the study are a or area of potential effect.	No effects anticipated.	No effects anticipated.	No effects anticipated.

Invasive Species	In the future without-project condition, the potential will continue to exist for introduction of invasive species due to the mechanisms discussed above. Recent Federal regulations require the shipping industry to implement better controls to prevent the introduction of invasive species through the ballasts of vessels (USCG 2012). These regulations should decrease the rate at which invasive species are introduced to the study area. The USCG will continue to monitor, enforce, and revise regulations related to the discharge of ballast water while vessels are in port according to the USCG Ballast Water Management Final Rule Published 23 March 2012.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. Portions of the rock revetment could be colonized by invasive plant species. Open areas and dune would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. The covering of hardbottom habitat with sand may induce SAV beds that could be colonized by invasive sea grass species. Open areas and dune would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.	No effects from invasive species are anticipated from this alternative. The contract set of plans and specifications would include measures to clean construction equipment before mobilization to the site, which would reduce the potential for the introduction and spread of invasive plant and invertebrate species. Open areas and dunes would be planted with native vegetation at the end of construction, which would help prevent invasive species from colonizing.
Environmental Justice	In the future without-project condition, environmental justice communities will continue to be negatively impacted by coastal storm risks.	This alternative reduces coastal storm risks to EJ communities. However, there are some adverse impacts accrued in the OSE account. The adverse impacts are not disproportionate to EJ communities. The overall net effects of this alternative were determined to be neutral.	The reduction of coastal storm risk experienced in this alternative positively impacts environmental justice communities. There are no disproportionate adverse impacts.	The reduction of coastal storm risk experienced in this alternative positively impacts environmental justice communities. There are no disproportionate adverse impacts.
HTRW	No significant effects to or from hazardous and toxic materials are anticipated from the FWOP condition. Phase I investigations and existing land uses do not indicate the potential for HTRW to be present.	No effects anticipated.	No effects anticipated.	No effects anticipated.
Cultural Resources	Project-specific impacts would be avoided, but risk of storm damages to cultural resources may not be reduced.	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations	The reduced risk may lead to development, but resources would continue to be protected by local laws and regulations

Aesthetics & Recreation	With no federal action, structures are expected to be completely lost to the ocean and/or condemned due to erosion, ultimately triggering forced relocations. Under devastating circumstances, property owners will be forced to move after their homes are condemned and large portions of the beach will be inaccessible due to the resulting safety issues with the remnants of the destroyed structures. Structures would become derelict and are unlikely to be removed which would further exacerbate wave energy, resulting in erosion on surrounding shorelines. Furthermore, residents are likely to relocate out of the area and potentially out of Puerto Rico, reducing not only the strength of the cultural identity of the community but also reducing the tax base and impairing the economy.	This alternative would install a rock revetment, which is not a very attractive feature when comparing it to a shoreline with beach and native vegetation. The study ready however is currently dominated by structures falling into the ocean, or near to it. Therefore, taking into consideration this condition, the aesthetics of a rock revetment wouldn't be much different than impacted buildings and structures.	This alternative would install small rock groins that would keep periodic beach nourishment in place, which would be an attractive feature somewhat comparable to a shoreline with beach and native vegetation. The study ready however is currently dominated by structures falling into the ocean, or near to it. Therefore, taking into consideration this condition, the aesthetics of this alternative would be much better than impacted buildings and structures.	This alternative would restore natural shoreline, which would be an attractive feature comparable to a shoreline with beach and native vegetation. The study ready however is currently dominated by structures falling into the ocean, or near to it. Therefore, taking into consideration this condition, the aesthetics of this alternative would be much better than impacted buildings and structures.
Noise	The Rincón study area is within a smaller urban setting though noises related to beach recreation, water sports, and recreational and commercial vessel traffic, would also continue similar to the existing conditions.	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects once construction is complete.	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects once construction is complete.	It is anticipated that machinery and rock placement noises could cause fish and wildlife to sporadically avoid the area during construction when noises are being made. There would be no long-term, significant effects once construction is complete. It is anticipated that most noise generated during construction would be within the current ambient conditions of the study area. Sudden loud noises would be anticipated during construction that would annoy humans, but none to the threshold of pain. There would be no long-term, significant effects once construction is complete.

Environmental Alternative Evaluation

Alternative 1 – No Action

This alternative is the existing and the future without project condition. In general, the ecology of the study area would remain in the existing condition into the foreseeable future, which is healthy and diverse. The existing shoreline, although modified in the past, supports a diverse physical and biological nearshore coral reef system. The natural sand source and aggradation of beach is ephemeral over time. Natural conditions for nesting Sea Turtles would be ephemeral, which is the nature of the beach. Leatherback Sea Turtle were recorded in the past nesting when a large enough beach would form. In general, conditions for nesting sea turtles, native birds, and native vegetation have been removed or are limited by human disturbance via residential and recreational activities on/near the beach, including clearing, lighting, and noise.

Based on the existing conditions of beach and nearshore habitats, ecosystem restoration would be unnecessary. To construct a permanent beach for nesting Sea Turtles would have a tradeoff of losing nearshore coral reef and hardbottom habitat. The USACE survey and USFWS indicate that the species and relative abundance of native sponges present provide a source of food for adult sea turtles. There are also extensive sea grass beds that were found to be providing Manatee with a food source. Therefore, the No Action would maintain high habitat quality by keeping the system in its current dynamic equilibrium.

Alternative 2 – Revetment

The spatial extent of this alternative includes features and construction work limits. Spatial extent of effects is shown on Figure 11 and Figure 12. Temporary effects anticipated include 9.5 acres colonized bedrock and 0.8 acres unconsolidated sediments (sand/shell hash/silt). Permanent effects anticipated include 9.0 acres public/private beach and 1.7 acres residential/ disturbed shoreline, which would be buried by revetment stone.

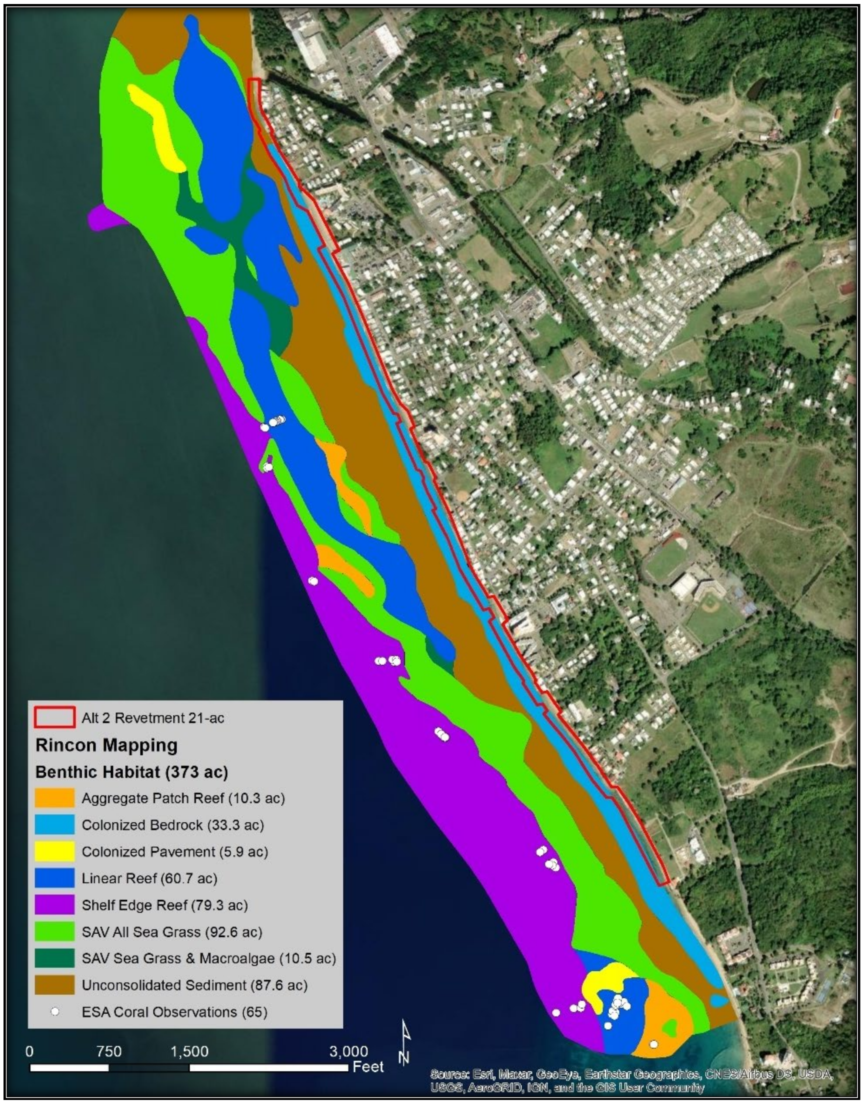

Figure 11: Stella, Rincón Alternative 2 Rock Revetment Spatial Extent

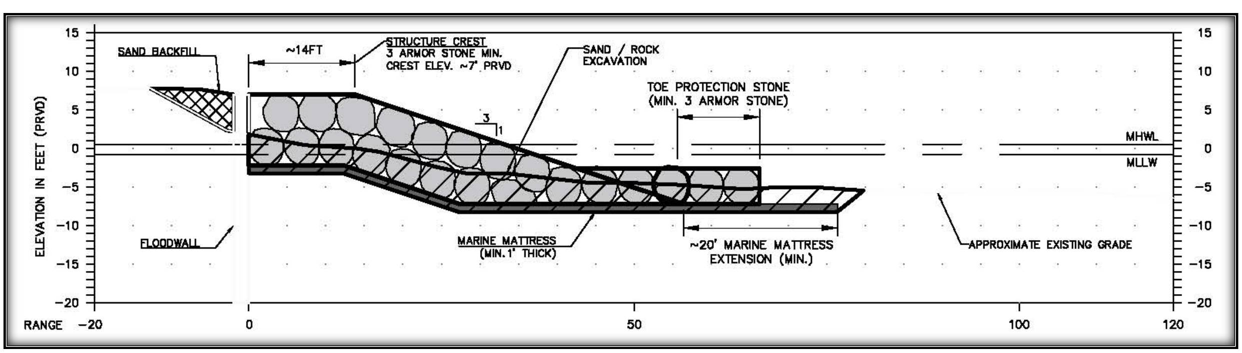

Figure 12: Stella, Rincón Alternative 2 Rock Revetment Typical Cross Section

The HEA was used here to show potential Habitat Units lost via implementing rock revetment. It is anticipated that a total of 9.0 acres of public/private beach habitat would be lost to being covered with rock. Based on the benthic habitat and species surveys (USACE 2022), the overall combined species richness, abundance, and health of the affected habitats are at about 40% of their potential. Mitigation ratios used were 1:1 for this plan formulation analysis; mitigation ratios could be higher for hardbottom habitats. Under this scenario (Table 1) there would be a loss of **2.15 AA Habitat Units** and **2.7 acres of mitigation required**.

Table 9: Stella, Rincón Alternative 2 Mitigation Scenario

Data / Assumption Types	Data & Assumptions
Proxy	Rock and marine mattress completely covers sandy beach. Covered habitats would retain about %0 of preinjury value. Injured habitats include beach. The existing beach is of moderate quality in terms of providing habitat, estimated to be about 40% of its total potential.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	5.4
Annual discount rate	2.25%
Level of services supplied before the damage	40% (with anthropogenic influence)
Level of services supplied after the damage	0% (post Alt2)
Regeneration pace	The pace of regeneration for beach recovery is 0 based on the permanence of the rock structure. The pace of compensatory mitigation is about 5 years for beach and dune habitat.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	90%
Discounted Service Unit Years Gained per Acre (quality calculation only)	40.111
Total Discounted Service Unit Years Lost over 50 years (Habitat Units)	107.424
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	361.003
Total DSUYs / 50 years (AA Habitat Units)	**-2.15**
Acres of Mitigation Required	2.7

Alternative 3 – 20' Beach Berm, (5-year interval) with Small Vegetated Dune +12 Groins

This alternative is beach nourishment and sand dune recurring every 5-years with the addition of groins to provide attenuation of sand loss to the longshore drift. The spatial extent of effect for the beach sand placement (Figure 13) is based on the construction and equilibrated profile (Figure 14). Temporary effects anticipated include 5.9 acres public/private beach and 1.7 acres unconsolidated sediments (sand/shell hash/silt). Permanent effects anticipated include 1.7 acres residential/ disturbed shoreline; 14.5 acres colonized bedrock; 0.3 acres linear reef; 0.2 acres SAV.

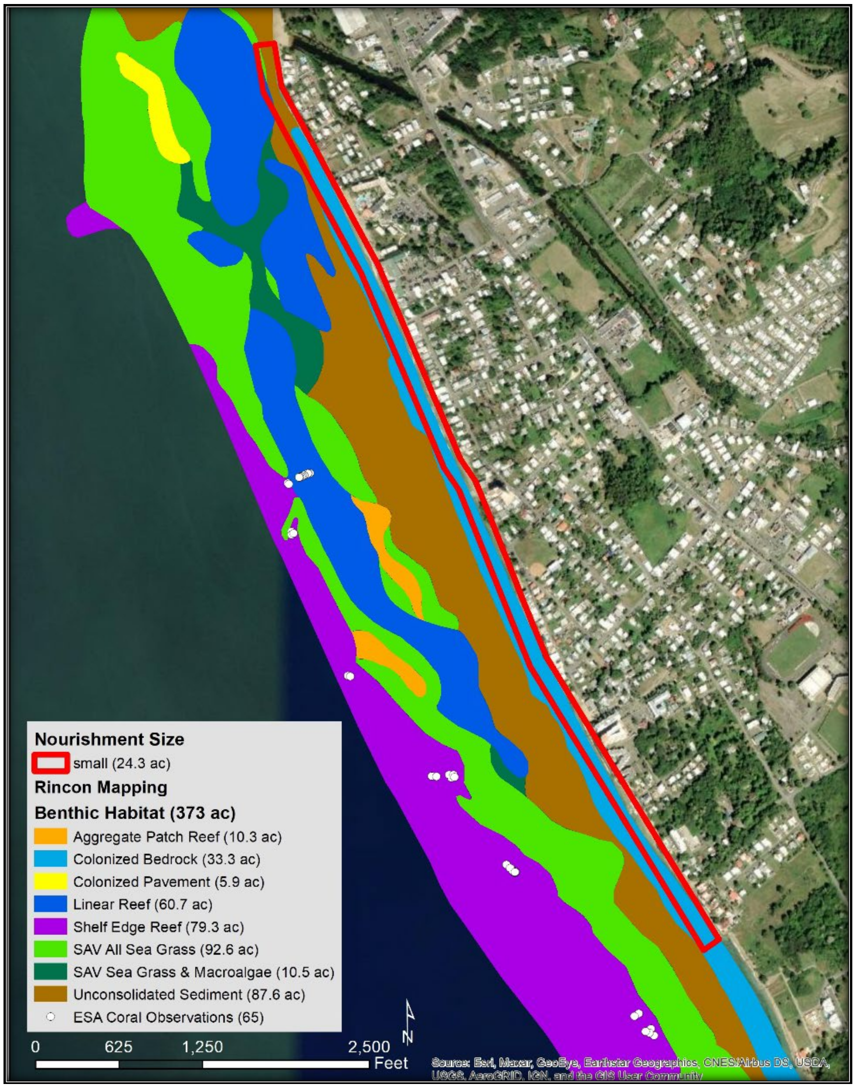

Figure 13: Stella, Rincón Alternative 3 Nourishment, Dune, & Groin Spatial Extent

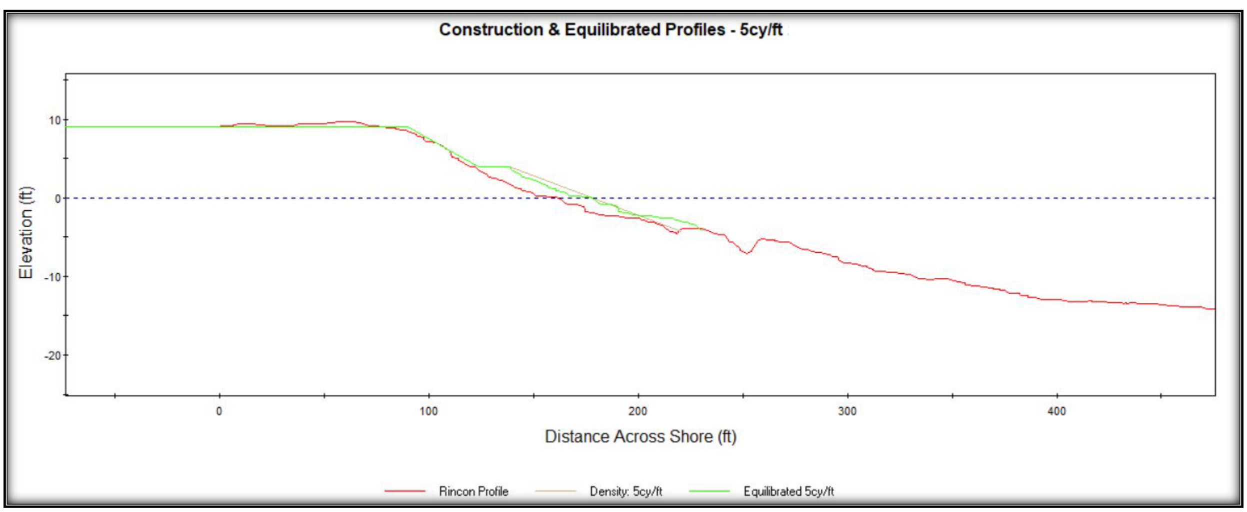

Figure 14: Stella, Rincón Alternative 3 Nourishment Equilibrated Profile

Mitigation or Residual EQ

The HEA was used here to show potential Habitat Units lost via implementing beach nourishment at 5-year intervals this alternative proposes. It is anticipated that a total of 15.0 acres of nearshore habitat would be lost or altered to recurring sand cover every 5 years. Specifically14.5 acres colonized bedrock; 0.3 acres linear reef; 0.2 acres SAV. Based on the benthic habitat and species surveys (USACE 2022), the overall combined species richness, abundance, and health of the affected habitats are at about 85% of their potential. Mitigation ratios used were 1:1 for this plan formulation analysis; mitigation ratios could be higher for hardbottom habitats. Under this scenario (Table 1) there would be a loss of **7.26 AA Habitat Units** and **10.9 acres of mitigation required**.

Table 10: Stella, Rincón Alternative 3 Mitigation Scenario

Data / Assumption Types	**Data & Assumptions**
Proxy	Sand placement for beach nourishment every 5 years. Equilibrated profile would be reestablished every 5 years maintain impacts to covered hardbottom and SAV. Covered habitats would retain about %5 of preinjury value. Injured habitats include colonized bedrock, linear reef, and SAV.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	15.0
Annual discount rate	2.25%
Level of services supplied before the damage	85% (with anthropogenic influence)
Level of services supplied after the damage	5% (post Alt 3)
Regeneration pace	The pace of regeneration for hardbottom recovery is 0 based on recurring nourishments every 5 years. The pace of compensatory mitigation is about 12 years for hardbottom coral and sponge habitats.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	85%
Discounted Service Unit Years Gained per Acre (quality calculation only)	33.241
Total Discounted Service Unit Years Lost over 50 years (Habitat Units)	362.97
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	498.615
Total DSUYs / 50 years (AA Habitat Units)	**-7.26**
Acres of Mitigation Required	10.9

Alternative 4 –Acquisition

The spatial extent of this alternative includes features and construction work limits. Spatial extent of effects is shown on Figure 15. Permanent effects anticipated at Stella include 17.0 acres of disturbed shoreline, which would be converted to natural beach. Probable adverse effects associated with this alternative include short-term noise, dust, traffic, and visual aggravations. Other indirect effects could include long-term colonization of nonnative invasive plant species post demolition and cleanup;

however, this effect is considered minor and a better environmental trade-off than having concrete in its place and would be offset by Scenario 2 presented below.

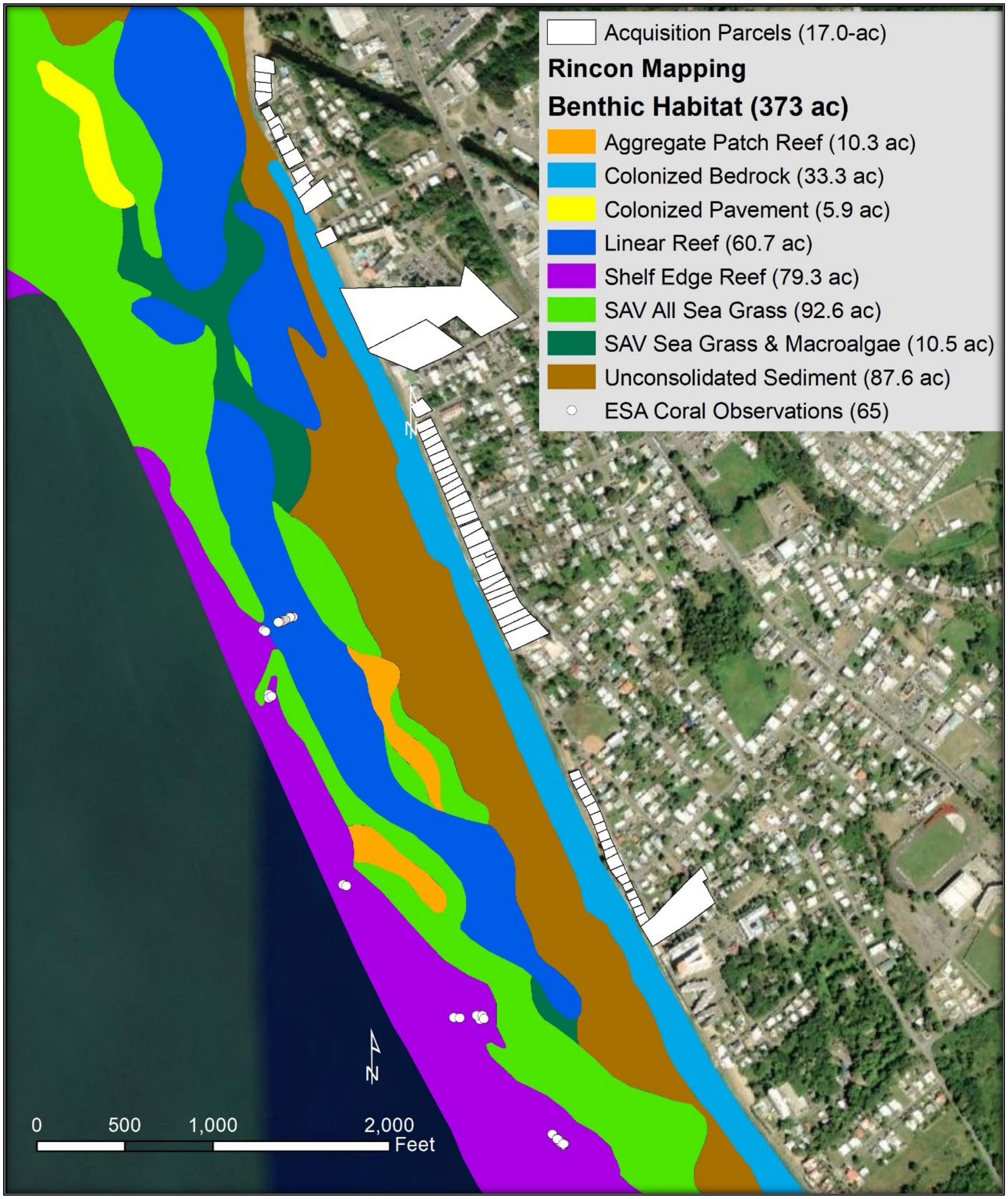

Figure 15: Stella, Rincón Alternative 4 Parcel Acquisition Spatial Extent

Mitigation or Residual EQ

The HEA was used to show potential Habitat Units gained via implementing this alternative. Two scenarios are provided. The first shows letting the land lie fallow, where the DNER does not implement further restoration and protection of land use to promote native habitat and species. The second scenario considers the DNER performing minor restorative actions and developing a conservation ordinance. Under Scenario 1 (Table 2) there would be **4.14 AA Habitat Units** gained with **no additive costs** for ecosystem restoration. Under Scenario 2 (Table 3) there would **7.43 AA Habitat Units** gained with non-Federal **additive costs (~$20,000/acres)** for ecosystem restoration.

Table 11: Stella, Rincón Alt 4 EQ Scenario 1

Data / Assumption Types	**Data & Assumptions**
Proxy	Nesting Leatherback Sea Turtle habitat; native dune vegetation; native birds, small mammals, and herpetofauna. The abandonment and demolition of structures on most of the smaller parcels would allow for a naturalized shoreline of beach and small foredunes; there could be opportunity to include additional habitats for other habitats in the several larger parcels.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	17
Annual discount rate	2.25%
Level of services supplied before the damage	100% (pre anthropogenic influence)
Level of services supplied after the damage	0% (post structure building)
Regeneration pace	The pace of regeneration is based on the long-term abandonment and demolition of identified structures per parcel. It is assumed all proposed parcels would be bought out. There would be no active ecological restoration, nor would there be restrictions placed on the parcels to support native species and habitats.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	50% (post Alt 4 Acq. wo/ER)
Discounted Service Unit Years Gained per Acre (quality calculation only)	12.182
Total Discounted Service Unit Years Lost	0
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	207.102
Total DSUYs / 50 years (AA Habitat Units)	**4.14**

Table 12: Stella, Rincón Alt 4 EQ Scenario 2

Data / Assumption Types	**Data & Assumptions**

Proxy	Nesting Leatherback & Hawksbill Sea Turtle habitat; native dune vegetation; native birds, small mammals, and herpetofauna. The abandonment and demolition of structures on most of the smaller parcels would allow for a naturalized shoreline of beach and small foredunes; there could be opportunity to include additional habitats for other habitats in the several larger parcels.
Year of reference for discounting or Claim Year	2029
Damaged or restored surface area (acres)	17
Annual discount rate	2.25%
Level of services supplied before the damage	100% (pre anthropogenic influence)
Level of services supplied after the damage	0% (post structure building)
Regeneration pace	The pace of regeneration is based on the long-term abandonment and demolition of identified structures per parcel. It is assumed all proposed parcels would be bought out. There would be minor ecological restoration by DNER and there would be restrictions placed on the parcels to support native species and habitats.
Lifetime of the compensatory/restoration measure or Period of Analysis	50 years (2029 - 2079)
Gains of service obtained from compensatory/restoration actions	90% (post Alt 4 Acq. w/ER)
Discounted Service Unit Years Gained per Acre (quality calculation only)	21.839
Total Discounted Service Unit Years Lost	0
Total Discounted Service Unit Years Gained over 50 years (Habitat Units)	371.263
Total DSUYs / 50 years (AA Habitat Units)	**7.43**

Table 13: Stella, Rincón Alternatives & Spatial Resource Effects Summary

Alternative		Resource Spatial Effects (acres)
Alt-1	No Action	N/A
Alt-2	Revetment (Rock)	*Temporary* 9.5 colonized bedrock; 0.8 unconsolidated sediments (sand/shell hash/silt) *Permanent* 9.0 public/private beach; 1.7 residential/ disturbed shoreline
Alt-3	Beach w/ Small, Vegetated Dune + 12 Groins (5-year)	*Temporary* 5.9 public/private beach; 1.7 unconsolidated sediments (sand/shell hash/silt) *Permanent* 1.7 residential/ disturbed shoreline; 14.5 colonized bedrock; 0.3 linear reef; 0.2 SAV;

Alt-4	Acquisition	*Permanent* 17.0 residential/ disturbed shoreline

Table 14: Stella, Rincón Mitigation & Residual EQ Summary

Acres Permanently Effected	HEA Mitigation AAHUs	Mitigation Acres Required	HEA EQ AAHUs	Net Loss/Benefit AAHUs	Ecosystem Acres Gained
0.0	0	0	0	0	0.0
9.0	-2.15	2.7	0	-2.15	0.0
15.0	-7.26	10.9	0	-7.26	0.0
17.0	0	0	4.14	4.14	17.0
17.0	0	0	7.43	7.43	17.0

ROM Mitigation Costs

Relative Order of Magnitude (ROM) costs were provided to cost engineering by PDT restoration ecologists Table 12. These costs were used to account for mitigation costs by acre per alternative for planning level screening. Measure costs for coral restoration were derived from Bayraktarov 2019 and Spurgeon J. P. G. & U. Lindahl 2000. Measure costs for reef restoration, SAV, beach, and were estimated by PDT ecologists based on past construction projects and restoration experience. Other habitats shown in Table 12 include beach, dune, and SAV. Table 16 provides the potential planting list considered for dune and sandy native plant communities.

Table 15: Relative Order of Magnitude Mitigation Measure Costs

	ROM US $ / ac			
Measures	**Low**	**High**	**Median**	**SD±**
Direct transplantation	$ 3,724	$ 3,393,787	$ 88,383	$ 947,210
Larval enhancement	$ 2,535	$ 1,754,585	$ 211,806	$ 760,686
Coral Establishment	$ 16,234	$ 627,143	$ 319,813	$ 426,843
a. Collection & Nursery Phase	*$ 3,750*	*$ 22,733*	*$ 11,366*	*$ 8,288*
b Nursery Transplantation	*$ 12,484*	*$ 604,410*	*$ 308,447*	*$ 418,555*
Artificial Reef / Substrates	$ 5,699	$ 57,760,244	$ 1,352,937	$ 17,854,309
Other Habitats	$ 20,000	$ 80,000	NA	NA
AM & M	$ 36,860	$ 10,566,802	$ 150,197	$ 3,660,293

Table 16: Recommended Native Plantings for Dune Restoration & Sand Stabilization (DNER)

Zone & Species	Common Name Spanish	Common Name English
Foredune		
Spartina patens	Yerba De Sal	Salt meadow Cordgrass
Sporobolus virginicus	Matojo De Playa	Seashore Dropseed
Ipomea pes-caprae	Batata O Bejuco De Playa	Beach Morning Glory

Ipomea imperati	Batatilla	Beach Morning Glory
Canavalia rosea	Haba De Playa	Beach Bean
Sesuvium portulacastrum	Verdolaga Rosada	Sea Purslane
Sesuvium maritimun	Verdolaga De Mar	Slender Sea Purslane
Cynodon dactylon	Bermuda Comun	Common Bermudagrass
Heliotropium curassavicum	Cotorrera De Playa	Chinese Parsley
Remirea maritima	Junco De Playa	Beachstar
Fimbristylis cymosa	Junquillo	Button Sedge
Hymenocallis caribaea	Lirio De Playa	Caribbean Spider Lily
Blutaparon vermiculare	Bledo De Sal	Sage Bud
Primary, Secondary, & Tertiary Dune Crests		
Suriana maritima	Temporana	Baycedar
Borrichia arborescens	Clavelon De Playa	Sea Oxeye
Scaevola plumieri	Borbon	Inkberry
Coccoloba uvifera	Uvero	Sea Grape
Euphorbia mesembrianthemifolia	Tartago De Playa	Coast Spurge
Argusia gnaphalodes	Tabaco De Mar	Sea Lavender
Ernodea littoralis	Trepadora De Playa	Beach Creeper
Dalbergia ecastaphyllum	Maraymaray	Coin Vine
Erithalis fruticosa	Jayabico	Candlewood
Borrichia arborescens	Clavelon De Playa	Sea Daisy
Stemodia maritima	Veronica De Playa	Seaside Twintip
Guilandina bonduc	Mato De Playa	Gray Nickerbean
Stenotaphrum secundatum	Cintillo	Buffalo Grass
Paspalum vaginatum	Cortadera	Siltgrass
Rear Dune / Coastal Forest		
Jacquina arborea	Barbasco	Braceletwood
Chrysobalanus icaco	Icaco	Cocoplum
Dodonea viscosa	Guitaran	Hopbush
Lantana involucrata	Cariaquillo	Buttonsage
Conocarpus erectus	Mangle Boton	Buttonwood
Thespesia populnea	Emajaguilla	Indian Tulip Tree
Oplonia spinosa	Espinosa	Princky Bush

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USACE. 2022. Submerged Aquatic Vegetation and Benthic Resource Survey Rincón and San Juan, Puerto Rico. USACE Project Number W912EP22F0060. (see Appendix G, Attachment 5).

HABITAT EQUIVALENCY ANALYSIS INPUTS & OUTPUTS

APPENDIX G – ENVIRONMENTAL

ATTACHMENT 2 – CLEAN WATER ACT SECTION 404(B)(1)

SECTION 404(b) EVALUATION

PUERTO RICO COASTAL STORM RISK MANAGEMENT (PR CSRM)
OCEAN PARK, SAN JUAN & STELLA, RINCÓN

I. Project Description

a. Location. The TSP includes structural measures for prevention/reduction of inundation by wave induced floodwaters at Barbosa Park and the Skate Park, Ocean Park; and non-structural measures for the elimination of erosion damages at Stella, Rincón. Figure 1, Figure 2 & Figure 3 show the vicinity, feasibility level work limits and feature locations, and general assessment area of each action location.

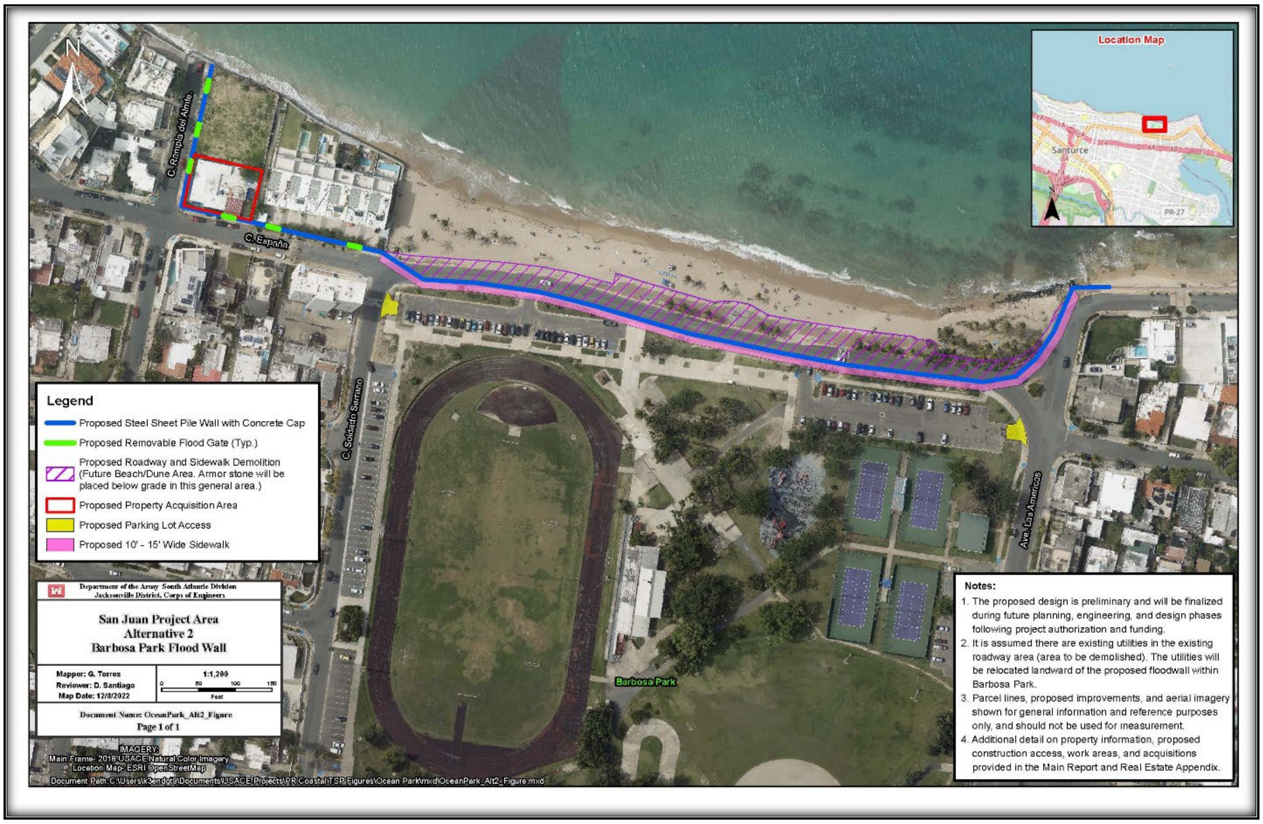


Figure 1: Barbosa Park Sea Wall, Toe Stone & Sand Placement Zone

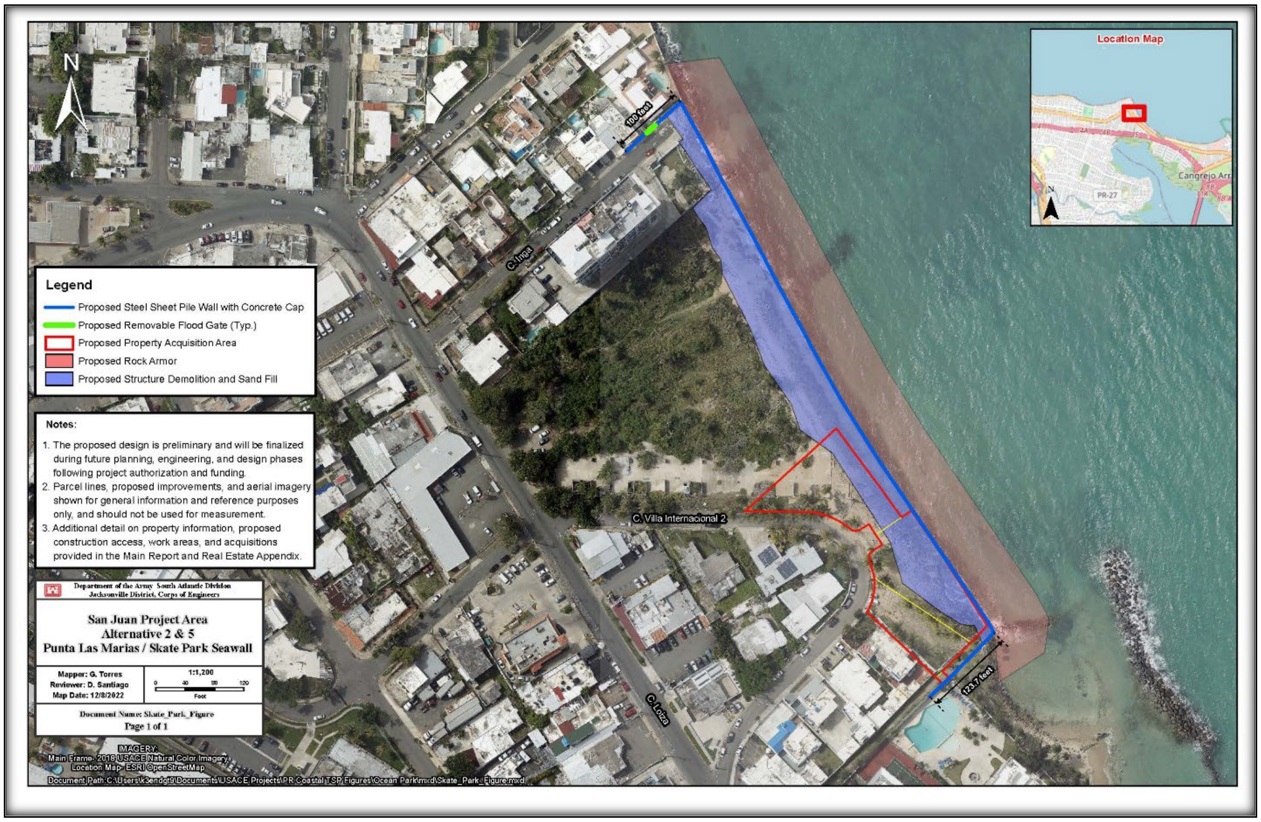


Figure 2: Skate Park Sea Wall, Toe Stone & Marine Mattress Placement Zone

Figure 3: Stella Demolition Zone

b. General Description.

The Corps has prepared a Feasibility Report to present results of its studies to address flooding problems Ocean Park and erosion problems at Stella. The Feasibility Report analyzed several possible alternatives that could potentially achieve the primary economic objectives. Alternatives and alternative analyses are provided in greater detail in the Feasibility Report and Appendix G – Attachment 1. For purposes of this Section 404(b)(1) evaluation, a summary description of the TSP is provided below as it pertains to fill activities. A more detailed description of the TSP is included in Appendix A - Engineering.

Existing Water & Sediment Conditions

The three areas for implementing recommended measures consist of Class SB waters, which includes coastal and estuarine waters according to PR Water Quality Standards Regulation No. 9079. The predominant without project conditions that adversely affects water quality in these areas is human induced sedimentation and eutrophication (abnormal nutrient types and levels). Coastal ecosystems are in tune with natural disturbances and resulting turbidity due to storm activity, rainfall, currents, and other natural phenomena. Adverse sedimentation (Photo 1) and water quality conditions are likely induced by runoff and effluent resulting in increased fine particulate matter and nutrients from human land uses and wastewater discharges (Photo 2). These typically stem from agriculture, urban, industrial, mining, timber harvesting, and other similar sources. Also, all three of these areas' shorelines have been modified in the past by revetments, sea walls, buildings, and other structures which are mostly defunct, and in some instances buried by longshore drift sands.

Photo 1: Linear Reef with High Sedimentation and Low Biodiversity (USACE Survey 2022)

Photo 2: Waster Water Discharge at Skate Park, Ocean Park, PR (Photo by NMFS 2022)

Barbosa Park, Ocean Park

The TSP for Barbosa Park is <u>Alternative 2 Sea Wall</u>, which would effectively stop or reduce upland inundation caused by waves (Figure 1 & Figure 4). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction work limits are almost entirely above the MHW. There may be a small square footage of toe stone needed at the ends of the sea wall placed below the MHW. To be conservative, this was accounted for under this analysis. Old stone and materials from defunct infrastructure and shoreline protection would be excavated and properly reused, recycled, or disposed. Toe stone placed above the MHW would be sufficiently covered with sand to maintain beach aesthetics and nesting sea turtle habitat.

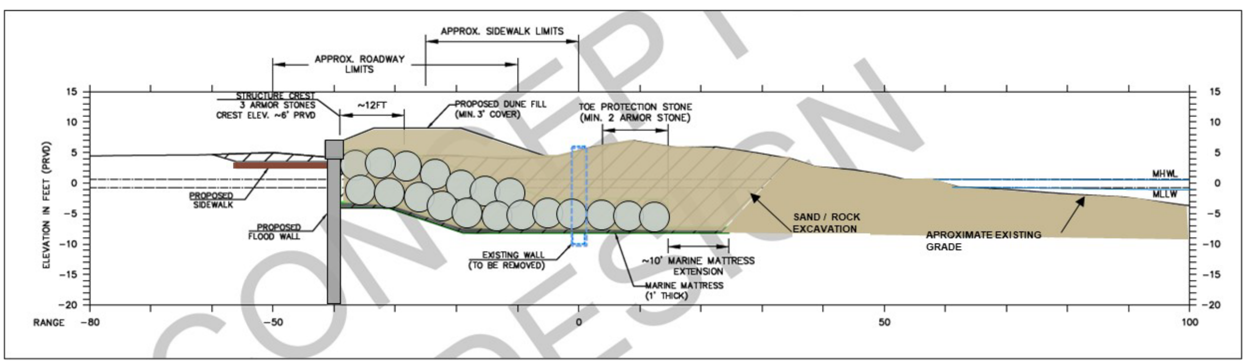


Figure 4: Barbosa Park Typical Cross Section of Sea Wall, Toe Stone Protection & Sand Cover

It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in this 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant by the application of conservation measures and monitoring for sea turtles within the beach zone of the work limits.

Skate Park, Ocean Park

The TSP for the Skate Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 2 & Figure 5). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction zone are within the MHW and below normal water levels. Old stone, sheet piles, wood piles, and materials from defunct infrastructure and shoreline protection may be excavated and properly reused, recycled, or disposed. Nearly all of the material placed would be upon the infrastructure/shoreline protection footprint, with potentially a small square footage on unconsolidated sands. Areas of unconsolidated sands are currently affected by the existing concrete sheet pile wall and rock armoring along the seaward edge of the project area, as well as old stone groins/jetties and a breakwater just to the southeast (Photo 7). Void areas created landward of the seawall would be backfilled with clean stone and/or sand materials.

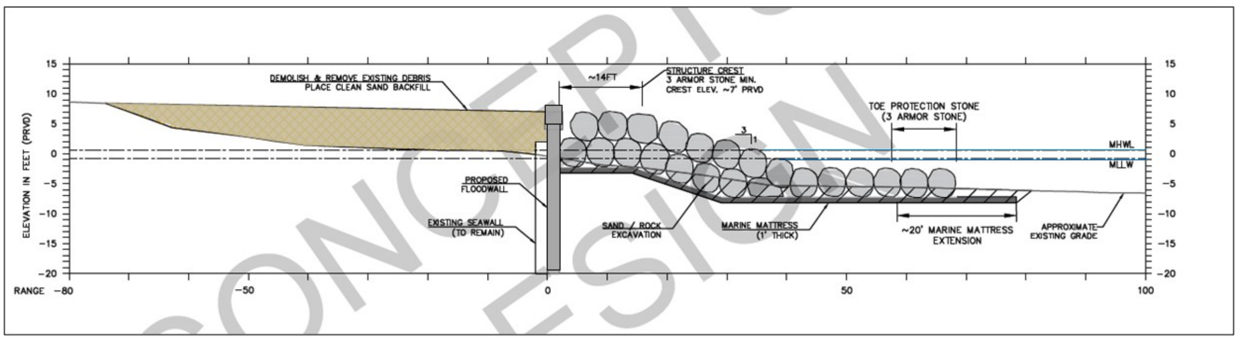


Figure 5: Skate Park Typical Cross Section of Sea Wall, Marine Mattress & Toe Stone

It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in this 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant since feature materials would be placed within the old revetment footprint and a small square footage on unconsolidated sediment (sands) that would eventually recover.

Stella, Rincón

The TSP for the Stella reach of Rincón is Alternative 4 Acquisition, which would effectively stop erosive damage to structures caused by waves (Figure 3). This alternative not only had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US, but also would eventually provide 17-acres of beach habitat and recreation. Demolition would take care by using techniques, sequencing, and appropriate Best Management Practices (BMPs) to avoid demolition debris from falling into Waters of the US. All materials generated from demolishing structures and defunct shoreline protection would be properly reused, recycled, or disposed. Void areas created by the removal of structures would be backfilled with clean/inert recycled materials, stone, and/or sand materials. Final surficial grades above and to the MHW would be sufficiently covered with beach quality sand to provide new beach aesthetics and nesting sea turtle habitat. Sand fill is not anticipated to be placed below the MHW.

It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in this 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant since the end result would be restoration of habitat, and BMPs would eliminate minor effects during demolition and clearing of shoreline structures.

c. Authority and Purpose. Authority for the PR CSRM study was granted under Section 204 of the Flood Control Act of 1970, Public Law 91-611. The purpose of this study is to determine whether there is economic justification and Federal interest in a TSP to reduce damages to infrastructure as a result of erosion, wave attack, and flooding from coastal storms and hurricanes along the Puerto Rico coastline.

d. Public Interest Factors. While USACE does not process and issue permits for its own activities, pursuant to 33 CFR 336.1, USACE authorizes its own discharges of dredged or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, and application of the section 404(b)(1) guidelines. As part of its review, the Corps evaluates the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof. These factors may include Conservation, Economics, Aesthetics, General Environmental Concerns, Wetlands, Historic Properties, Fish and Wildlife Values, Flood Hazards, Flood Plain Values, Land Use, Navigation, Shore Erosion and Accretion, Recreation, Water Supply and Conservation, Water Quality, Energy Needs, Safety, Food and Fiber Production, Mineral Needs, Consideration of Property Ownership, and Needs and Welfare of the People.

e. General Description of Dredged or Fill Material.

Dredging and beach nourishment measures are not included for implementation under the recommend plan.

(1) General Characteristics of Fill Material.

The design for Barbosa Park is nearly identical to the Skate Park. The described fill materials that follow are only those that would be considered as fill within the Waters of the US, which is different between the two. There would be upland fill materials, including beach quality sand, like those presented below that are not subject to this 404 and described in the Civil Engineering Appendix.

Barbosa Park, Ocean Park

Karstic Limestone – Toe stone material needed for the project would be quarried and sized according to requirements per feature; generally angular stones but could be block shaped for some applications.

Skate Park, Ocean Park

Concrete – General types of concrete following ASTM requirements per feature. Limestone, gravel, sand, lime, water.

Steel Sheet Pile – Corrugated marine grade steel piles. Piles are flat sheets about 1-inch thick that can be interlocked with each other.

Karstic Limestone – Toe stone material needed for the project would be quarried and sized according to requirements per feature; generally angular stones but could be block shaped for some applications.

Plastic Marine Mattress – Essentially a gabion filled with karstic limestone but made of plastic instead of metal. The plastic is UV-stabilized HDPE.

Stella, Rincón

No fill within Waters of US anticipated. A nominal amount of beach sand could be pushed below the MHW when the finish grades are matched between the demolition footprint and existing beach.

(2) Quantity of Material.

The quantities of fill materials will be refined during the design phase. Estimates for fill below the MHW presented here are conservative and are anticipated to be reduced during design phase refinements.

Barbosa Park, Ocean Park

Karstic Limestone for Toe Protection – 100 linear feet (25 feet west tie-in / 75 feet east tie-in); ~280sf x 100 LF = 1,040 cyd.

Skate Park, Ocean Park

Concrete/Steel Sheet Pile Sea Wall – 1,200 linear feet x 27 feet deep x 2 feet wide = 2,400 cyd.

Karstic Limestone Toe Protection – 1,200 linear feet x 325 ft^2 =14,450 cyd.

Plastic Marine Mattress – 1,200 linear feet x 80 width feet = ~2.2 acres.

Karstic Limestone for Marine Mattress – 12" Fill Stone 3,560 cyd.

Stella, Rincón

No fill within Waters of US anticipated.

(3) Source of Material.

Concrete – There are two options for acquiring concrete; 1) sourced from a licensed commercial vendor; 2) make concrete on site with quarried limestone, sands, gravels, and acceptable additives. Concrete would be made to meet environmental and commercial standards and statues.

Karstic Limestone – Would be acquired by contractor from commercial sources or directly from active and permitted quarry sites on the island.

Plastic Marine Mattress – Would be acquired by contractor from commercial sources.

f. Description of the Proposed Discharge Site(s).

(1) Location.

See Figure 1, Figure 2, and Figure 3 for location and zonation of construction material fill.

(2) Size.

Barbosa Park, Ocean Park – The general size of the total construction work limits of the site is about 2.5 acres. The specific size of fill placement below the MHW would likely be no greater than 0.2 acres, inclusive of both tie-in points.

Skate Park, Ocean Park – The general size of the total construction work limits of the site is about 3.5 acres. The specific size of fill placement below the MHW would likely be no greater than 2.0 acres.

Stella, Rincón – The area of construction is about 17-acres. No fill within Waters of US anticipated.

(3) Type of Site.

Barbosa Park, Ocean Park – The type within the proposed work limits is a recreational beach and public road (Photo 3 & Photo 4). There is an old sea wall running between the road and the beach (Photo 4), which would generally be the alignment for the new sea wall. Specifically, the wall will be setback approximate 30 – 50 ft landward from the existing sea wall and the rock would be seaward of the new alignment, which greatly reduces the potential for exposure and adverse impacts to recreation and beach habitat. There is old infrastructure, old shoreline protection debris, and natural bed rock beneath the long shore drift and beach sands. The site is heavily used for recreational purposes. The beach here is naturally dynamic in size but is persistent overtime.

Photo 3: Barbosa Park Beach Looking West (Photo by NMFS 2022)

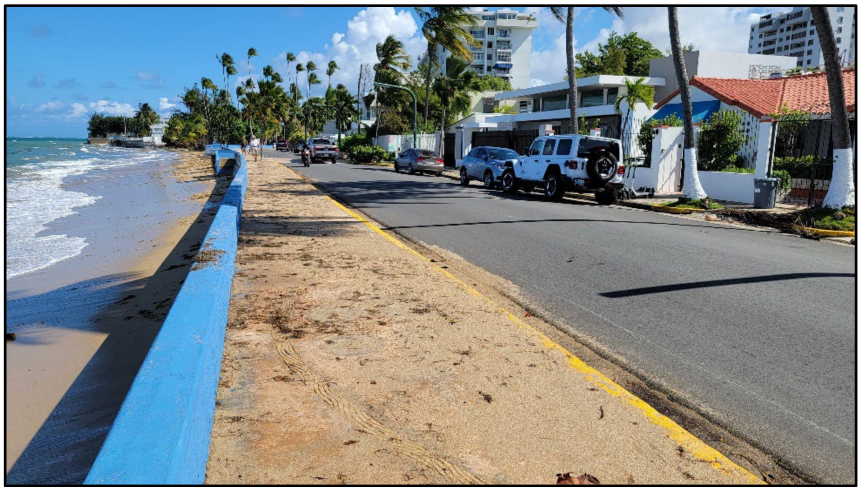


Photo 4: Barbosa Park Beach Looking East (Photo by NMFS 2022)

Skate Park, Ocean Park – The type within the proposed work limits is a recreational beach and public road (Photo 3 & Photo 4). There is an old sea wall running between the road and the beach (Photo 4), which would generally be the alignment for the new sea wall. There is old infrastructure, old shoreline protection debris, and natural bed rock beneath the long shore drift and beach sands. The site is heavily used for recreational purposes. The beach here is naturally dynamic in size but is persistent overtime.

Photo 5: Skate Park Looking West (Photo by NMFS 2022)

Photo 6: Skate Park Looking East (Photo by NMFS 2022)

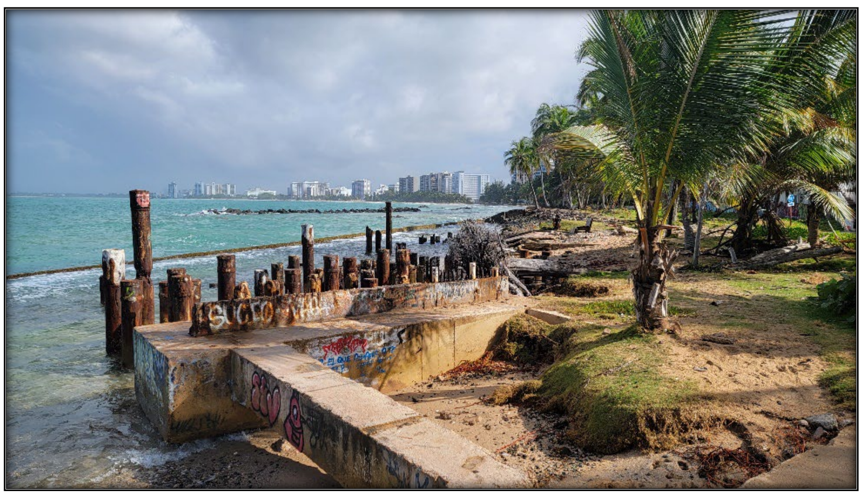


Photo 7: Skate Park Looking East at Old Shoreline Protection Features (Photo by NMFS 2022)

Stella, Rincón – The type within the proposed work limits is residential with minimal to no dry recreational beach (Photo 8). Some of the homes/structures are abandoned as they have fallen into the water (Photo 9). The shoreline is riddled with infrastructure and shoreline protection of different conditions. Natural bed rock is exposed at the shoreline, and is intermittently and ephemerally covered with longshore drift and beach sands.

Photo 8: Stella, Rincon Example of Shoreline Vulnerable Shoreline Structure & Limited Beach Zone

Photo 9: Stella, Rincon Example of Failed Structure in Beach Zone

(4) Type(s) of Habitat.

Barbosa Park – The existing habitat types potentially affected under 404/401 considerations include beach and surf zone unconsolidated sands, and surf zone colonized bedrock. Other offshore habitats in the vicinity are shown in Figure 6. The potential impacts under section 404 are estimated to be no greater than **0.2 acres** of unconsolidated sand and possibly colonized bedrock. The colonized bedrock habitat of **0.1 acre** is ephemeral, and quite often covered naturally by sand. The work here will tie in the new sea wall to the existing sea wall, and it is quite likely this habitat would be avoided with design refinements. The material placed here would be the marine mattress covered by large stones. The future with project condition would be very similar, if not the same, with rock bottom ephemerally covered with sand or exposed. There are two potential tie-ins on the west estimated to affect about **0.05** acres of unconsolidated sands.

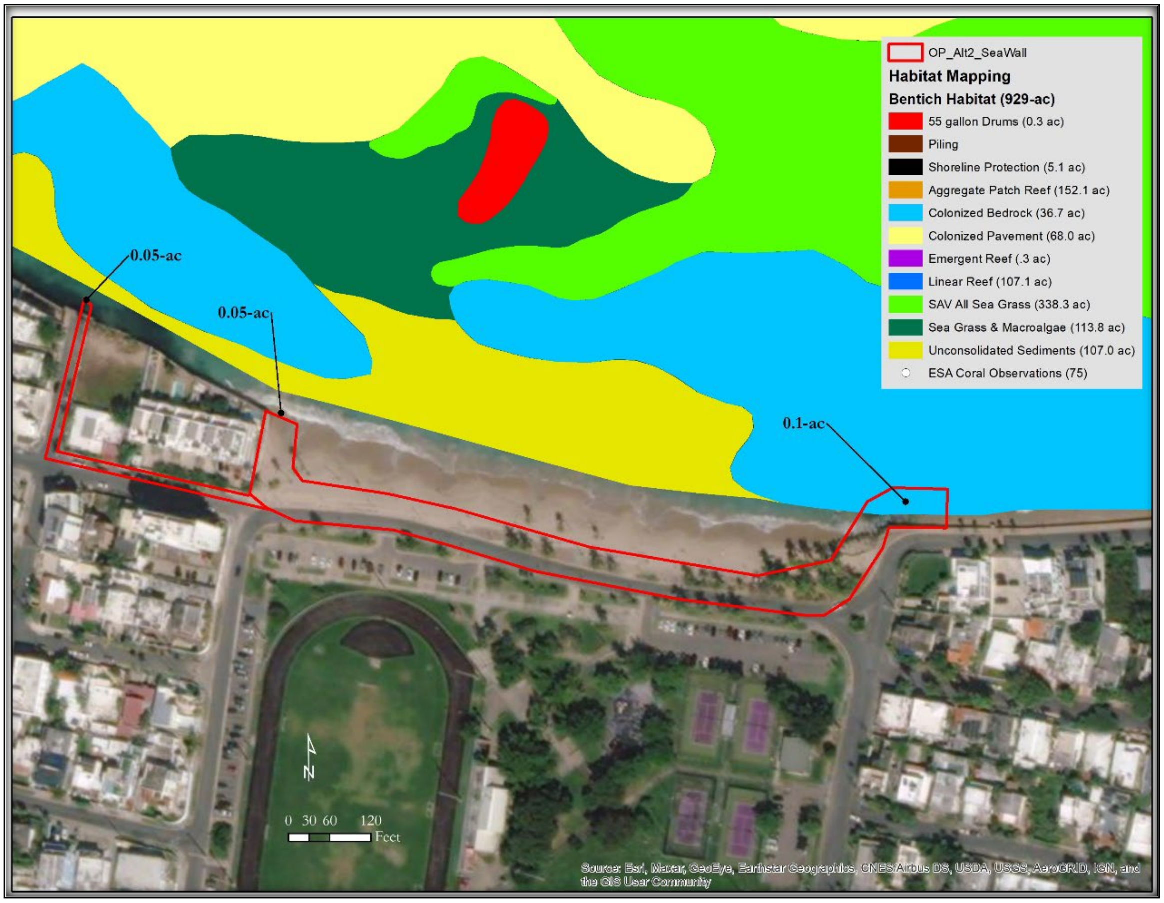


Figure 6: Nearshore Habitats Affected by and Adjacent to TSP Work Limits (USACE Survey, 2022)

Skate Park – The existing habitat types potentially affected under 404/401 considerations include modified/manmade shoreline and unconsolidated sands. Other offshore habitats in the vicinity are shown in Figure 7. The potential impacts under section 404 are estimated to be no greater than **2.0 acres** of existing old shoreline protection and unconsolidated sand. The existing old shoreline protection habitat of **0.7 acres** is confined with old timber cribbing and/or steel wall and is sometimes covered naturally by sand. Most of the new concrete sea wall, marine mattress, and toe stone will be placed in this zone. The future with project condition would be very similar, if not the same, with rock bottom ephemerally covered with sand or exposed. Further sea ward, the marine mattress and toe-stone may extend into unconsolidated sand habitats estimated to affect about **1.1** acres of unconsolidated sands. The effect of changing sand to stone is expected to be temporary, as longshore sands would eventually recover up the placed stone.

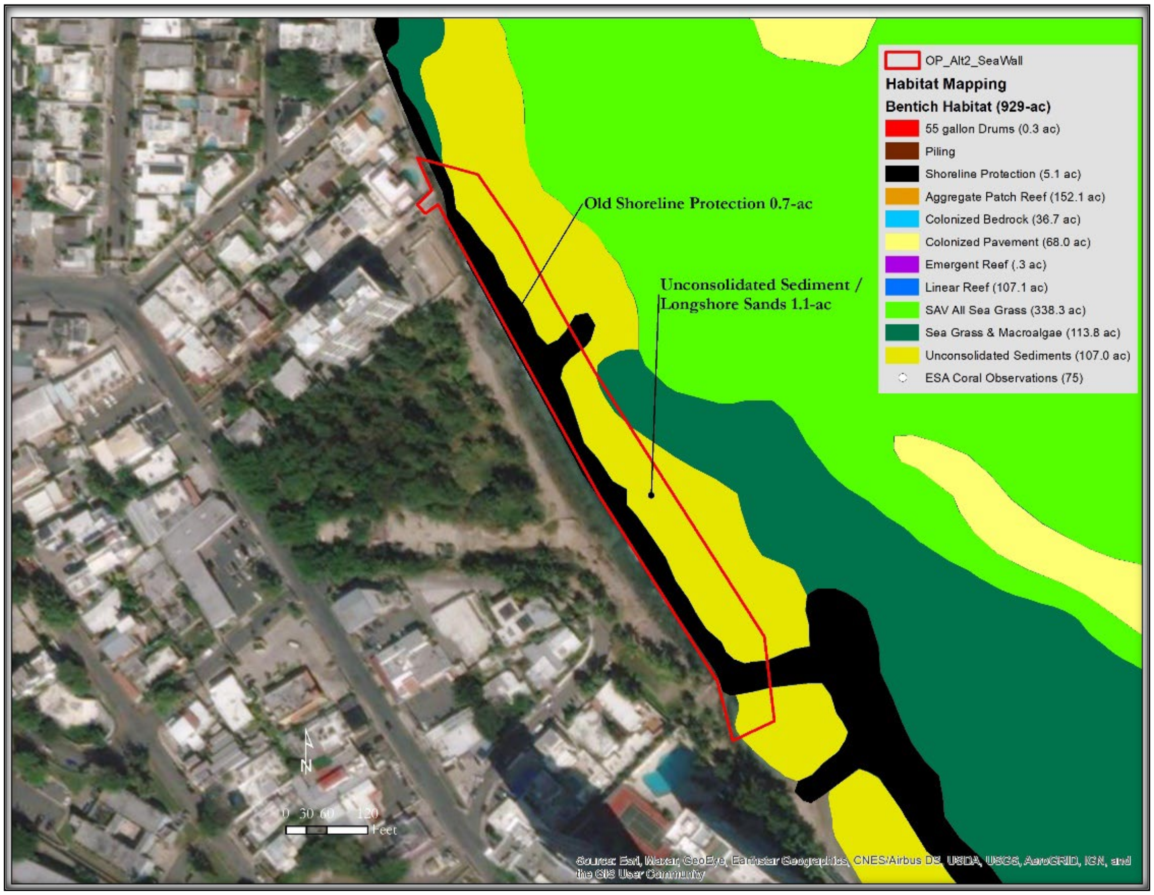


Figure 7: Nearshore Habitats Affected by and Adjacent to TSP Work Limits (USACE Survey, 2022)

Stella - Existing habitat types potentially affected under 404/401 are not anticipated. Other offshore habitats in the vicinity are shown in Figure 8.

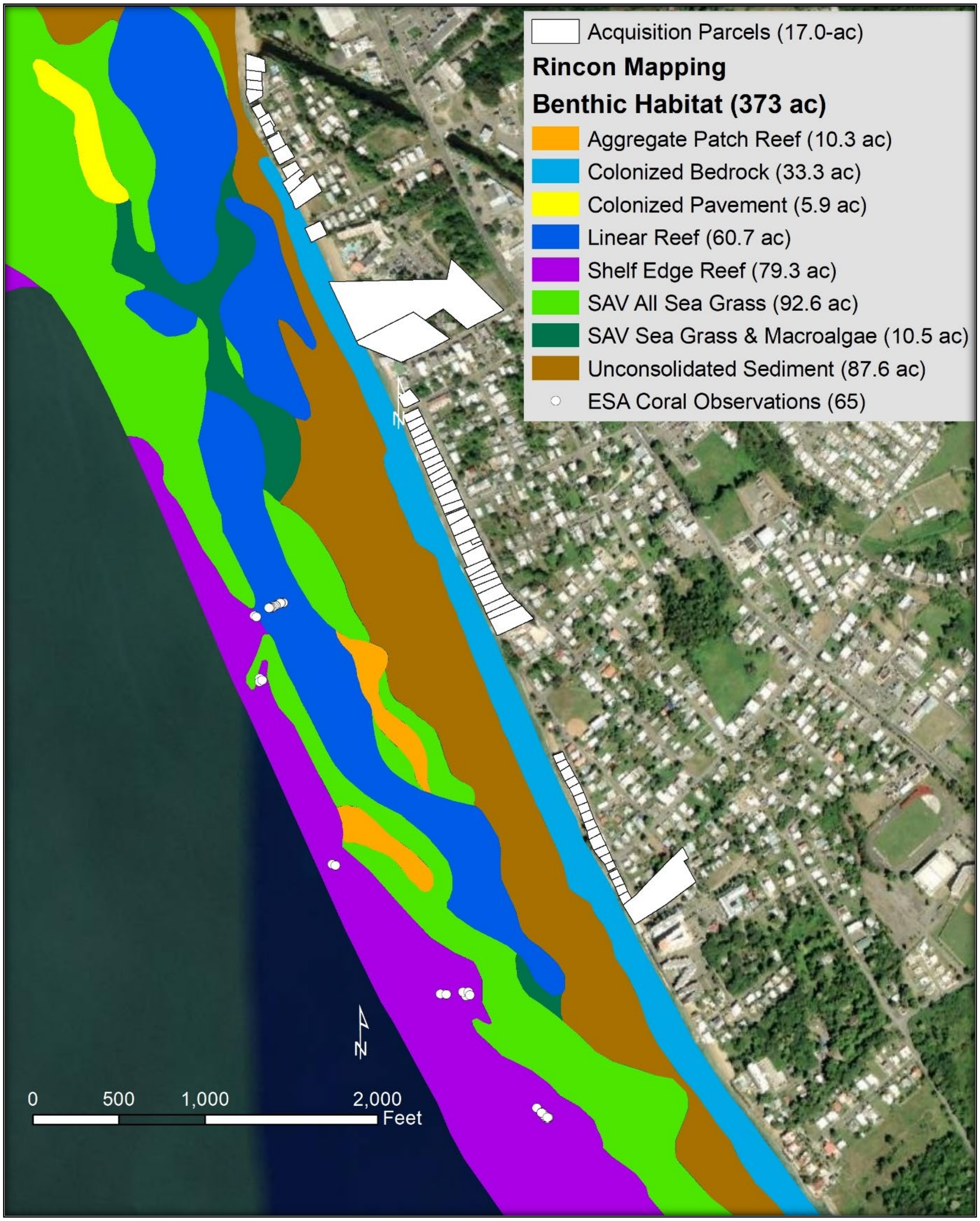


Figure 8: Nearshore Habitats Adjacent to TSP Work Limits (USACE Survey, 2022)

(5) Timing and Duration of Discharge.

Barbosa Park – The construction duration for Barbosa Park is estimated to be approximately 2 to 2.5 years. The work will all be performed utilizing land-based equipment. Notably, a large portion of the work will be performed outside of the beach and in-water areas (upland of the existing seawall and west of Barbosa Park, landward of existing developments). The in-water and nearshore work at Barbosa Park is anticipated to be complete within 1 to 1.5 years and in-water work will likely target the calmer months between spring and fall.

Skate Park – The construction duration for the Skate Park is estimated to be approximately 1 to 1.5 years. The work will all be performed utilizing land-based equipment. In-water and nearshore work is anticipated to be complete within a year and will likely target the calmer months between spring and fall.

Stella – No fill within Waters of US anticipated.

g. Description of Disposal Method.

All refuse materials generated would be properly reused, recycled, or disposed of at licensed facilities. Materials would be transported by truck.

II. Factual Determinations

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope.

Barbosa Park – In the area fill would be placed below the MHWL natural substrate and coastal armoring debris reside just above and below sea level. Slope is flat to slightly pitched seaward.

Skate Park – In the area fill would be placed below the MHWL natural substrate and coastal armoring debris reside just above and below sea level. Slope is flat to slightly pitched seaward.

Stella - No fill within Waters of US anticipated.

(2) Sediment Type.

All sites have remnants or debris of defunct shoreline protection projects, some reaches to a greater degree than others.

Barbosa Park – The existing sediment type is primarily longshore and beach sands as delineated on Figure 6. There may be a small area of ephemerally exposed bedrock affected as well. There is also a large volume of coastal armoring debris subsurface and exposed.

Skate Park – The existing sediment/substrate type is quarried rubble immediately adjacent to the shoreline, and unconsolidated longshore sands further seaward as delineated on Figure 7.

Stella – No fill within Waters of US anticipated. The existing adjacent sediment/substrate type is longshore and beach sands, and exposed bedrock as delineated on Figure 8.

(3) Dredged/Fill Material Movement.

Barbosa Park – Fill materials of marine mattress and toe stone would be designed not to move. Except for settling, significant movement of materials is not anticipated or acceptable for this type of project.

Skate Park – Fill materials of marine mattress and toe stone would be designed not to move. Except for settling, significant movement of materials is not anticipated or acceptable for this type of project. The natural movement and accumulation of unconsolidated longshore sands in this area are likely influenced by the existing old shoreline protection jetties and breakwater.

Stella – No fill within Waters of US anticipated.

(4) Physical Effects on Benthos.

Barbosa Park – During construction there is a potential of injury or mortality of benthic species that have colonized a small patch (0.1 acres) of bedrock (Figure 6). Based on the ephemeral nature of the bedrock being covered by sand certain times of the year, there is no significant coral or sponge growth here. The placement of rock on the bedrock would likely induce the same type of ephemeral community to recolonize. The low richness and abundance of benthos here would be expected to recover within several years after construction on top of and within the interstitial spaces of the placed stone. Therefore, physical effects on benthos are considered minimal and temporary.

Skate Park – During construction there is the potential of injury or mortality of benthic species that have colonized the old shoreline protection rubble and shifting sands. Based on the observed wave climate and condition of the rubble and shifting sands, there is no significant biological activity occurring in this zone. The low richness and abundance of benthos here would be expected to recover within several years after construction. Therefore, physical effects on benthos are considered minimal and temporary.

Stella – No fill within Waters of US anticipated.

(5) Actions to minimize impacts.

In order to minimize environmental impacts to benthic communities, a comprehensive benthic habitat and species survey was completed for San Juan and Rincón to guide project alternative design. Avoidance planning limited the alternatives to the minimum spatial extent and feature type required to meet the project's primary purpose. Further refinements to the plan during design could result in avoiding impacts to this small bedrock habitat patch.

b. Water Circulation. Fluctuation and Salinity Determinations.

(1) Water Column Effects.

(a) Salinity: No effects anticipated.
(b) Water Chemistry: No effects anticipated.
(c) Clarity: Localized turbidity would temporarily decrease clarity during construction.
(d) Color: No lasting effects anticipated.
(e) Odor: No effects anticipated.
(f) Taste: No effects anticipated.
(g) Dissolved Gas Levels: No effects anticipated.
(h) Nutrients: No effects anticipated.

(2) Current Patterns and Circulation.

(a) Current Patterns and Flow: No significant effects anticipated.
(b) Velocity: No effects anticipated.
(c) Stratification: No effects anticipated.
(d) Hydrologic Regime: No significant effects anticipated. Flooding by waves into uplands would be prevented at the project locations but would not affect natural area hydrology.

(2) Normal Water Level Fluctuations.

The TSP would not affect normal water level fluctuations.

(3) Salinity Gradients.

The TSP would not affect salinity gradients.

(4) Actions to minimize impacts.

Turbidity would be monitored per the water quality certificate (WQC) requirements. If at any point turbidity standards are exceeded, those activities causing the violation would cease. Upland materials targeted for disturbance would include techniques and be treated with appropriate BMPs to ensure materials do not enter Waters of the US.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

There will be an increase in suspended particulates and turbidity levels in the vicinity of the features during construction only. Turbidity sources would primarily be sandy substrates. Resulting turbidity is expected to be lower than levels experienced during natural storms or high wind conditions.

(2) Effects (degree and duration) on Chemical and Physical Properties of the Water Column.

(a) Light Penetration: Localized and temporary effects during construction anticipated.
(b) Dissolved Oxygen: No effects anticipated.
(c) Toxic Metals and Organics: No Hazardous or Toxic materials, or Radioactive Waste (HTRW) have been identified within the project area. No HTRW would be released in the project area during or after construction and therefore no impact to the existing sediment conditions is expected. This project would not cause any significant release of toxic metals or organics.
(d) Pathogens: This project would not cause any release or stimulation of pathogens.
(e) Aesthetics: Turbidity would temporarily impact aesthetic quality of the water in the vicinity of the construction area during construction, but nothing in excess of natural storms or high wind conditions.

(3) Effects on Biota.

(a) Primary Production, Photosynthesis: No effects anticipated.
(b) Suspension/Filter Feeders: No effects anticipated.
(c) Sight Feeders: No effects anticipated.

(4) Actions to minimize impacts. Turbidity would be monitored per the water quality certificate requirements. If at any point turbidity standards are exceeded, those activities causing the violation would cease. Best Management Practices (BMPs) would be implemented during construction to reduce the magnitude and extent of turbidity, and adverse effects on water quality are not expected. Turbidity would be monitored during construction to ensure that Puerto Rico's water quality standards are met. Due to the small spatial extent and short duration of project activities, no long-term effects are expected.

d. Contaminant Determinations.

All materials placed in the Waters of the US or on land draining into Waters of the US would consist of inert and clean materials. Contamination within the study area and work limits has not been identified. Effects associated with contamination are not expected to plankton, benthos, nekton, or the aquatic food web. Re-suspension of sediment within the construction areas would be derived from rocky and/or sandy substrates and is expected to have negligible impact on biota.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on Plankton: Effects are not anticipated.
(2) Effects on Benthos: Minor and temporary effects to benthic communities are expected. Benthos would be impacted by the project during construction activities, but

benthic organisms would be expected to begin recovery once construction operations have finished.

(3) Effects on Nekton: Effects are not anticipated.

(4) Effects on Aquatic Food Web: Effects to the study area ecosystem food web are not anticipated.

(5) Effects on Special Aquatic Sites:

(a) Sanctuaries and Refuges: No effects anticipated. Sanctuaries or refuges are not present within or adjacent to the zone of the TSP's influence.

(b) Wetlands: No occurrence within the study area.

(c) Mud Flats: No occurrence within the study area.

(d) Vegetated Shallows: There are vast vegetated shallows in the project area. Submerged aquatic vegetation communities have been delineated and described in terms of dominated species, endangered species, and relative health. No effects are anticipated. The TSP does not overlap spatially with this habitat type nor are indirect effects anticipated.

(e) Coral Reefs: There are vast coral reef communities within the project area. Coral reef communities have been delineated and described in terms of dominant species, endangered species, and relative health. Minor and short-term effects are anticipated for **0.1 acres** of colonized bedrock. The TSP does not further overlap spatially with this habitat type nor are indirect effects anticipated. The TSP for Barbosa Park may impact **0.1 acres** of colonized bed rock within the surf zone that is ephemeral in nature, meaning it is covered by shifting sands at different times of the year, or in different years. Refinements made during design will focus on further reducing spatial extent of stone placement here. Since this small patch likely has a low diversity of benthic organisms, limited to no coral colonies, and no endangered coral species, it is anticipated any disturbed areas within this patch would recolonize fully several years after construction is complete. To minimize indirect effects to coral reefs outside the work limits, best management practices will be utilized. In addition, turbidity monitoring will be conducted to ensure compliance with water quality standards.

(f) Riffle and Pool Complexes: No occurrence within the study area.

f. Threatened and Endangered Species.

USACE has proposed the following effect determinations for the TSP at Ocean Park, San Juan and Stella, Rincón:

- "No Effect" (NE) on Scalloped Hammerhead Shark, Nassau Grouper, and Giant Manta Ray.
- "No Effect" (NE) on Antillean Manatee.
- "No Effect" (NE) on Lobed Star Coral, Mountainous Star Coral, Boulder Star Coral, Rough Cactus Coral, Elkhorn Coral, Staghorn Coral, and Pillar Coral, and DCH for *Acropora* corals.
- "May Affect, but Not Likely to Adversely Affect" (MANLAA) on Loggerhead Sea Turtle, Hawksbill Sea Turtle, Leatherback Sea Turtle, Green Sea Turtle for Barbosa Park.

To guide alternative design in terms of minimizing environmental impacts to threatened/endangered species and designated critical habitat, a comprehensive benthic habitat and species survey was completed in 2022 for San Juan and Rincón. Refinements to the TSP during design could result in further reducing overall minor and temporary effects. Also, the implementation of standard monitoring and conservation/protection measures for nesting Sea Turtles at Barbosa Park would further reduce temporary effects and disturbance. Standard observation and avoidance measures would also be applied to marine work for the Antillean Manatee, Sea Turtles, and any other large-bodied creatures that could be harmed by boats or marine equipment. Biological assessments evaluating these determinations are included int as an update to NMFS and USFWS consultation under Section 7 of the ESA.

Summary of Effect Determination for Threatened and Endangered Species

PUERTO RICO COASTAL STORM RISK MANAGEMENT STUDY ESA			
Common Name	**Scientific Name**	**Status**	**Determination**
Marine Mammals			
Antillean Manatee	*Trichechus manatus*	T	NE
Sea Turtles			
Loggerhead Sea Turtle NW Atlantic DPS	*Caretta caretta*	T	MANLAA
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	MANLAA
Leatherback Sea Turtle	*Dermochelys coriacea*	E	MANLAA
Green Sea Turtle South Atlantic DPS	*Chelonia mydas*	T	MANLAA
Fish			
Nassau Grouper	*Epinephelus striatus*	T	NE
Scalloped Hammerhead Shark	*Sphyrna lewinii*	E	NE
Giant Manta Ray	*Manta birostris*	T	NE
Nassau Grouper DCH			NE
Invertebrates			
Elkhorn Coral	*Acropora palmata*	T	NE
Staghorn Coral	*Acropora cervicornis*	T	NE
Acroporid Coral Designated Critical Habitat			NE
Pillar Coral	*Dendrogyra cylindrus*	T	NE
Lobed Star Coral	*Orbicella annularis*	T	NE
Mountainous Star Coral	*Orbicella faveolata*	T	NE
Boulder Star Coral	*Orbicella franksi*	T	NE
Rough Cactus Coral	*Mycetophyllia ferox*	T	NE
Queen Conch	*Strobus gigas*	C*	NE

* Candidate

g. <u>Other Wildlife</u>.

Construction of the TSP could potentially displace shorebirds, small mammals, and other wildlife that are associated with the sites. USACE has documented effects to wildlife resources under NEPA in the integrated Environmental Assessment of this feasibility study.

h. Actions to Minimize Impacts.

Measures shall be taken, as well as recommendations and guidelines implemented to avoid and minimize impacts to threatened and endangered species as well as other wildlife.

i. Proposed Disposal Site Determinations

(1) Mixing Zone Determination: Mixing zones for solid rock and marine mattress are not anticipated.

(2) Determination of Compliance with Applicable Water Quality Standards: The work would be conducted in accordance with the project's WQC. All materials proposed to be placed in Waters of the US are considered clean, inert, or of the same type as the natural substrates within the study area.

(2) Potential Effects on Human Use Characteristic.

(a) Municipal and Private Water Supply: No effects are anticipated.
(b) Recreational and Commercial Fisheries: No effects are anticipated.
(c) Water Related Recreation: Construction activities would temporarily disrupt water and beach related recreation. As a public safety measure, swimming and other water related recreational activities would be prohibited near the operating construction equipment. Work limits may be fenced off for periods of time when construction equipment is active.
(d) Aesthetics: Construction would temporarily impact aesthetics.
(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves: No effects are anticipated.

j. Determination of Cumulative Effects on the Aquatic Ecosystem.

The cumulative effects of the TSP's proposed action, other projects, natural processes, and environmental responses between these have been considered. Cumulative effects are considered to be less than significant.

k. Determination of Secondary Effects on the Aquatic Ecosystem.

Secondary, or indirect effects to aquatic ecosystems, habitats, or species are not anticipated.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. Adaptation of the Section 404(b)(l) Guidelines to this Evaluation: No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem: No practical alternative exists to meet the project objectives that do not involve placement of fill material into waters of the United States.

c. Compliance with Applicable State Water Quality Standards: All construction activities will be performed in compliance with the WQC issued by the PR's Department of Natural and Environmental Resources (DNER).

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act: The proposed work operations would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. Compliance with Endangered Species Act of 1973: The proposed project would not jeopardize the continued existence of any species listed as threatened or endangered or result in the destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972: This act does not apply to this project.

g. Evaluation of Extent of Degradation of the Waters of the United States

(1) Significant Adverse Effects on Human Health and Welfare

(a) Municipal and Private Water Supplies: No effects anticipated.
(b) Recreation and Commercial Fisheries: No effects anticipated.
(c) Plankton: No effects anticipated.
(d) Fish: No effects anticipated.
(e) Shellfish: No effects anticipated.
(f) Wildlife: The TSP may temporarily displace some wildlife species associated with the sites.
(g) Special Aquatic Sites: Minor and temporary effects anticipated for 0.1 acre of colonized bedrock.

(2) Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems: Long-term, significant adverse effects are not anticipated. Biological assessments for EFH and TE Species are included in this report. Effects under NEPA for aquatic and terrestrial resources are included in the Integrated Environmental Assessment.

(3) Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity and Stability: Long-term, significant adverse effects are not anticipated. To guide alternative design in terms of avoiding or minimizing environmental impacts, a comprehensive benthic habitat and species survey was completed in 2022 for the San Juan and Rincón study areas.

(4) Significant Adverse Effects on Recreational, Aesthetic, and Economic Values: Temporary impacts to recreational activities during construction and a temporary reduction in the aesthetic appeal during construction are expected. No significant adverse effects on recreational, aesthetic, and economic values are anticipated. Economic and recreational benefits are anticipated for Barbosa Park and the Skate Park, Ocean Park, San Juan. Economic, recreational, and ecosystem benefits are anticipated for Stella, Rincón.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem:

Refinements to the TSP made during the design phase could further reduce overall minor and temporary effects. All appropriate and practicable measures shall be taken to minimize impacts during construction. Turbidity monitoring, and species monitoring and conservation measures as described in this analysis would be written into contract documents. Standard and unique BMPs would be utilized to protect Waters of the US and achieve compliance with commonwealth water quality protection requirements.

Barbosa Park, Ocean Park, San Juan, Alternative 2 Sea Wall – It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in this 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant by the application of conservation measures and monitoring for sea turtles within the beach zone of the work limits. Effects for potentially impacting **0.1 acre** of low diversity/low coral abundance colonized bedrock is considered temporary since stone placement would be fully colonized by the same species several years after construction.

the Skate Park, Ocean Park, San Juan, Alternative 2 Sea Wall – It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in this 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant since feature materials would be placed within the old revetment footprint (**0.7 acres**) and **1.1 acres** on unconsolidated sediment (sands) that would eventually recover.

i. On the basis of the guidelines, the proposed work is specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

FINDING OF COMPLIANCE
FOR
PUERTO RICO COASTAL STORM RISK MANAGEMENT

1. No significant adaptations of the guidelines were made relative to this evaluation.

2. All construction activities will be performed in compliance with the WQC issued by the PR's Department of Natural and Environmental Resources (DNER).

3. The discharge of fill material for construction of the proposed features will involve the use of heavy equipment such as cranes, barges and trucks. These discharge activities of fill material will be managed to control turbidity increases and maintain environmentally acceptable conditions. All appropriate steps shall be taken to minimize potential adverse impacts of the fill material discharge on aquatic systems.

4. In order to minimize environmental impacts, construction in the areas identified were limited to the minimum required to meet the project's purpose. During construction developed recommendations would be implemented to avoid or minimize impacts. All in-water operations would be monitored to ensure turbidity levels are within WQC parameters. If at any point turbidity standards are exceeded, those activities causing the violation would cease.

5. No Hazardous or Toxic materials, or Radioactive Waste (HTRW) have been identified within the project area. No HTRW would be released in the project area during or after construction. No significant impact on plankton, benthos, nekton, or the aquatic food web are expected. The re-suspension of sediment within the construction areas is expected to have minimal impact on these organisms. The construction operations will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

6. The proposed project would not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended. Consultation with the U.S. Fish and Wildlife Service will be completed.

7. The proposed project will not result in significant long-term adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. No significant adverse effects on life stages of aquatic life and other wildlife, aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values are expected.

8. Potential cumulative impacts on threatened or endangered species, other fish and wildlife, managed fishes, the estuarine water column, certain water quality parameters (turbidity and hazardous and toxic constituents), sediments (hazardous and toxic constituents), coastal barrier resources, aesthetics, and recreation, among others were considered as part of this proposed project and the majority of these resources were determined to have little risk of being cumulatively impacted.

9. Based on the guidelines, the proposed work is specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

Appendix G – Environmental

Attachment 3 – Coastal Zone Management Consistency (CZMA)

COASTAL ZONE MANAGEMENT PROGRAM FEDERAL CONSISTENCY EVALUATION PROCEDURES

Applicability of the Coastal Zone Management Act.

The following table summarizes the process and procedures under the Coastal Zone Management Act for Federal Actions and for non-Federal Applicants*.

Item	Non Federal Applicant (15 CFR 930, subpart D)	Federal Action (15 CFR 930, subpart C)
Enforceable Policies	Reviewed and approved by NOAA	Same
Effects Test	Direct, Indirect (cumulative, secondary), adverse or beneficial	Same
Review Time	6 months from state receipt of Consistency Certification (30-days for completeness notice) Can be altered by written agreement between State and applicant	60 Days, extendable (or contractible) by mutual agreement
Consistency	Must be Fully Consistent	To Maximum Extent Practicable**
Procedure Initiation	Applicant provides Consistency Certification to State	Federal Agency provides "Consistency Statement" to State
Appealable	Yes, applicant can appeal to Secretary (NOAA)	No (NOAA can "mediate")
Activities	Listed activities with their geographic location (State can request additional listing within 30 days)	Listed or Unlisted Activities in State Program
Activities in Another State	Must have approval for interstate reviews from NOAA	Interstate review approval NOT required
Activities in Federal Waters	Yes, if activity affects state waters	Same

* There are separate requirements for activities on the Outer Continental Shelf (subpart E) and for "assistance to an applicant agency" (subpart F).

** Must be fully consistent except for items prohibited by applicable law (generally does not count lack of funding as prohibited by law, 15 CFR 930.32).

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970 JACKSONVILLE,
FLORIDA 32232-0019

Planning Division
Environmental Branch

Ms. Rose A. Ortíz Diaz
Coastal Zone Management Consistency Office Puerto
Rico Planning Board
P.O. Box 41119, Minillas Station San
Juan, Puerto Rico 00940

Dear Ms. Ortíz Diaz:

I have enclosed seven copies of an application for Certification of Consistency with the Puerto Rico Coastal Management Program for the Puerto Rico Coastal Storm Risk Management Project. This project involves reducing damages to infrastructure as a result of coastal flooding and erosion from surge and waves generated by storms and hurricanes. The project consists of structural features at two locations at Ocean Park, San Juan, and non-structural measures at Stella, Rincón to reduce the risk of storm induced damages.

The structural and non-structural features would consist of:

- Barbosa Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,600 LF); Would be covered with beach quality sand to maintain beach aesthetics and habitat.
- the Skate Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,200 LF); Landward would be covered with beach quality sand to maintain grade, aesthetics, and habitat.
- Stella, Rincón: Acquiring compromised parcels/structures. Overtime would create about 17-acres of shoreline habitat and recreation space.

Compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in the companion 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant by the application of conservation measures and monitoring for sea turtles within the beach zone of the work limits. The following additional information on this project is available on the internet www.saj.usace.army.mil/PuertoRicoCSRMFeasibilityStudy/

- The Notice of Availability of the Draft Finding of NoSignificant Impact
- The Draft Integrated Feasibility Report and Environmental Assessment
- Maps, drawings, and other information

If you have any questions, please contact __________________.

Sincerely,

Gretchen S. Ehlinger, Ph.D.
Chief, Environmental Branch

Enclosures

JP-833

Rev. MAR 2005

Commonwealth of Puerto Rico
Office of the Governor
Puerto Rico Planning Board Physical Planning Area Land Use Planning Bureau

Application for Certification of Consistency with the Puerto Rico Coastal Management Program

General Instructions:

A. Attach a 1:20,000 scale, U.S. Geological Survey topographic quadrangular base map of the site.

A. **Attach a reasonably scaled plan or schematic design of the proposed object, indicating the following:**

1. **Peripheral areas**
2. **Bodies of water, tidal limit and natural systems.**

B. **You may attach any further information you consider necessary for proper evaluation of the proposal.**

C. **If any information requested in the questionnaire does not apply in your case, indicate by writing "N/A" (not applicable).**

D. **Submit a minimum of seven (7) copies of this application.**

DO NOT WRITE IN THIS BOX

Type of application:______________________________ Application Number: ____________________________

Date received:___________________________________ Date of Certification: ___________________________

Evaluation result: ☐ Objection ☐ Acceptance ☐ Negotiation

Technician: ______________________ Supervisor: ____________________________________

Comments: ____

1. **Name of Federal Agency:** U.S. Army Corps of Engineers, Jacksonville District

2. **Federal Program Catalog Number:** 12.106 Flood Control Projects CFDA

3. **Type of Action:**

   _X_ Federal Activity ___ License of Permit ___ Federal Assistance

4. **Name of Applicant:** Gretchen S. Ehlinger, Environmental Branch Chief for US Army Corps of Engineers

   Postal Address: 701 San Marco Blvd. Jacksonville, FL 32207-8175

   Telephone: 904-232-2336 Fax: 904-232-3442

5. **Project name:** Puerto Rico Coastal Storm Risk Management (CSRM) Project, Puerto Rico

6. **Physical Description of Project Location (area, facilities such as vehicular access, drainage, storm and sanitary sewer placement, etc.):**

The general location of the three (3) project sites are two (2) in the San Juan area (Figure 1) and one (1) in the Rincón area (Figure 2). The TSP includes structural measures for prevention/reduction of inundation by wave induced floodwaters at Barbosa Park and the Skate Park, Ocean Park; and non-structural measures for the elimination of erosion damages at Stella, Rincón. Figure 3, Figure 4 & Figure 5 respectively show the vicinity, feasibility level work limits and feature locations, and general assessment area of each action location.

Lambert Coordinates:

- Ocean Park X = 66.0523947°W Y = 18.4544986°N
- Rincón X = 67.2490924°W Y = 18.3245289°N

Barbosa Park, Ocean Park – The site type within the proposed work limits is a recreational beach and public road (Photo 1 & Photo 2). There is an old sea wall running between the road and the beach (Photo 2), which would generally be the alignment for the new sea wall. There is old infrastructure, old shoreline protection debris, and natural bed rock beneath the long shore drift and beach sands. The site is heavily used for recreational purposes. The beach here is naturally dynamic in size but is persistent overtime. There are currently 16 public beach access points to this area.

PHOTO 1: BARBOSA PARK BEACH LOOKING WEST (PHOTO BY NMFS 2022)

Photo 2: Barbosa Park Beach Looking East (Photo by NMFS 2022)

Skate Park, Ocean Park – The site type within the proposed work limits is a public skate park inland, and an old revetment/shoreline protection in-water along the shoreline (Photo 3 & Photo 4). The old revetment would generally be the alignment for the new sea wall and toe stone. There is old infrastructure, old shoreline protection debris, and natural bed rock exposed along the shorelines. There is a breakwater and jetties to the southeast (Photo 5). The site is moderately used for recreational purposes. There is no beach here.

Photo 3: Skate Park Looking West (Photo by NMFS 2022)

Photo 4: Skate Park Looking East (Photo by NMFS 2022)

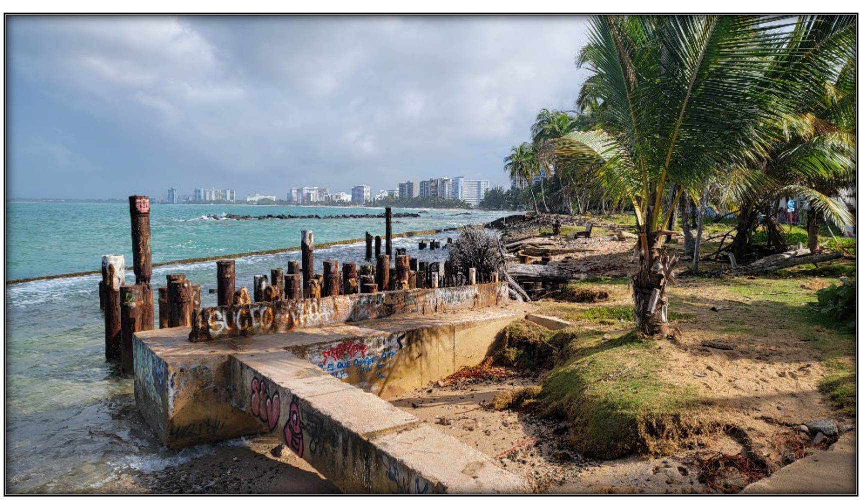


Photo 5: Skate Park Looking East at Old Shoreline Protection Features (Photo by NMFS 2022)

Stella, Rincón – The site type within the proposed work limits is residential with minimal to no dry recreational beach (Photo 6). This area is a mixture of single-family homes, condominiums, commercial structures, and hotels. Some of the homes/structures are abandoned as they have fallen into the water (Photo 7). The shoreline is riddled with infrastructure and shoreline protection of different conditions. Seawalls, revetments, and non-engineered armoring protection in front of homes and hotels represent most of the coastal protection structures already in place. Natural bed rock is exposed at the shoreline and is intermittently/ephemerally covered with longshore drift and beach sands. There are currently 10 public beach access points to this area.

PHOTO 6: STELLA, RINCON EXAMPLE OF SHORELINE VULNERABLE SHORELINE STRUCTURE & LIMITED BEACH ZONE

PHOTO 7: STELLA, RINCON EXAMPLE OF FAILED STRUCTURE IN BEACH ZONE

7. **Type of construction or other work proposed:**

__drainage	**__channeling**	**__landfill**	**__sand extraction**
__ pier	**__bridge**	**__residential**	**__tourist**

others (specify and explain): Structural: Sea Wall & Toe Stone for Flood Protection; Non-structural: Acquisition for Damage Reduction.

Description of proposed work: This project involves reducing damages to infrastructure caused by coastal flooding and erosion from storm surge and waves generated by storms and hurricanes. The project consists of structural features at two locations at Ocean Park, San Juan, and non-structural measures at Stella, Rincón to reduce the risk of storm induced damages.

The structural and non-structural features would consist of:

- Barbosa Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,600 LF); Would be covered with beach quality sand to maintain aesthetics and habitat.
- the Skate Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,200 LF); Landward would be covered with beach quality sand to maintain grade, aesthetics, and habitat.
- Stella, Rincón: Acquiring compromised parcels/structures. Overtime would create about 17-acres of shoreline habitat and recreation space.

The TSP for Barbosa Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 3 & Figure 6). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction work limits are almost entirely above the Mean High Watermark (MHW). There may be a small square footage of toe stone needed at the ends of the sea wall placed below the MHW. Old stone and materials from defunct infrastructure and shoreline protection would be excavated and properly reused, recycled, or disposed. Toe stone placed above the MHW would be sufficiently covered with sand to maintain beach aesthetics, recreational uses, and nesting sea turtle habitat.

The TSP for the Skate Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 4 & Figure 7). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction zone are within the MHW and below normal water levels. Old stone, sheet piles, wood piles, and materials from defunct infrastructure and shoreline protection may be excavated and properly reused, recycled, or disposed. Most of the material placed would be upon the infrastructure/shoreline protection footprint, with potentially a small square footage on unconsolidated sands. Areas of unconsolidated sands are currently affected by old stone groins/jetties and a breakwater just to the southeast. Void areas created landward of the seawall would be backfilled with clean stone and/or sand materials to maintain aesthetics, recreational uses, and habitat.

The TSP for the Stella reach of Rincón is Alternative 4 Acquisition, which would effectively stop erosive damage to structures caused by waves (Figure 5). This alternative not only had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US, but also would eventually provide 17-acres of beach habitat and recreation. Demolition would take care by using techniques, sequencing, and appropriate Best Management Practices (BMPs) to avoid demolition debris from falling into Waters of the US. All materials generated from demolishing structures and defunct shoreline protection would be properly reused, recycled, or disposed. Void areas created by the removal of structures would be backfilled with clean/inert recycled materials, stone, and/or sand materials. Final surficial grades above and to the MHW would be sufficiently covered with sand to provide new beach aesthetics, recreational uses, and nesting sea turtle habitat. Sand fill is not anticipated to be placed below the MHW.

8. **Natural, artificial, historic or cultural systems likely to be affected by the project (Place an X opposite any of the systems indicated below that are in the project area or its surroundings, which are likely to be affected by that activity. Indicate the distance from the project to any outside system that would likely be affected):**

System	Within Project	Outside Project	Distance (meters)	Local name of affected system
beach, dunes	X			Barbosa Park (1.5 acres). Temporary effects during construction. Restored to existing condition post construction. Stella (+17 acres). New beach and dune gained via removal of structures and parcel acquisition.
mangroves, wetlands				
coral, reefs	X			Barbosa Park (0.1 acres). Minor/temporary effects to colonized bedrock. Would recover in several years post construction.
river, estuary				
bird sanctuary				
pond, lake, lagoon				
agricultural unit				
forest, wood				
cliff, breakwater				
cultural or tourist area	X			Ocean Park Beach & Rincón.
other (explain)				
unconsolidated sands	X			Skate Park (1.1 acres). Minor/temporary effects to sandy habitat. Would recover soon after construction as stone would be covered by drifting sands.

See Figure 8 & Figure 9 for detailed habitat mapping for San Juan & Rincón. Detailed survey results are included in report format in this Appendix.

Describe the likely impact of the project on the identified system (s).

Positive ☒ **Negative** ☐

Explain: Overall, positive effects were determined to outweigh the minor and temporary effects associated with the construction of structural features.

Long-term, significant adverse effects are not anticipated. Biological assessments for EFH and TE Species are included in the companion report and consultation with NMFS and USFWS will be completed as part of the agency and public review. Effects under NEPA for aquatic and terrestrial resources are included in the companion Integrated Environmental Assessment. To guide alternative design in terms of avoiding or minimizing environmental impacts, a comprehensive benthic habitat and species survey was completed in 2022 for the San Juan and Rincón study areas. Temporary impacts to recreational activities during construction and a temporary reduction in the aesthetic appeal during construction are expected. No significant adverse effects on recreational, aesthetic, and economic values are anticipated. Economic and recreational benefits are anticipated for Barbosa Park and the Skate Park, Ocean Park, San Juan. Economic, recreational, and ecosystem benefits are anticipated for Stella, Rincón.

Refinements to the TSP made during the design phase could further reduce overall minor and temporary effects. All appropriate and practicable measures shall be taken to minimize impacts during construction. Turbidity monitoring, and species monitoring and conservation measures as described in main report would be written into contract documents. Standard and unique BMPs would be utilized to protect Waters of the US and achieve compliance with commonwealth water quality protection requirements.

Barbosa Park, Ocean Park, San Juan, Alternative 2 Sea Wall – It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in the 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant by the application of conservation measures and monitoring for sea turtles within the beach zone of the work limits. Effects for potentially impacting **0.1 acre** of low diversity/low coral abundance colonized bedrock is considered temporary since stone placement would be fully colonized by the same species several years after construction.

the Skate Park, Ocean Park, San Juan, Alternative 2 Sea Wall – It was determined that compensatory mitigation (40 C.F.R. § 230.93) would not be implemented for this action with regards to Clean Water Act compliance presented in the 404(b)(1) Analysis. As well, the effects under NEPA are considered less than significant since feature materials would be placed within the old revetment footprint (**0.7 acres**) and **1.1 acres** on unconsolidated sediment (sands) that would eventually recover.

9. **Indicate permits, approvals and endorsements of the proposal by Federal and Puerto Rican government agencies. Evidence of such support should be attached to the proposal.**

	Yes	No	Pending	Application Number
a. Planning Board	☐	☐	☒	
b. Regulation and Permits Administration	☐	☐	☐	
c. Environmental Quality Board	☐	☐	☒	
d. Department of Natural Resources	☐	☐	☒	
e. State Historic Preservation Office	☐	☐	☒	
f. U.S. Army Corps of Engineers	☐	☐	☐	
g. U.S. Coast Guard	☐	☐	☐	
h. Other (s) (specify)	☐	☐	☐	

CERTIFICATION

I CERTIFY THAT the Puerto Rico CSRM Project is consistent with the Puerto Rico Coastal Zone Management Program, and that to the best of my knowledge the above information is true.

Gretchen S. Ehlinger, Ph.D.	
Name (legible)	Signature
Chief, Environmental Branch	
Position	Date

FIGURE 1: PUERTO RICO COASTAL STORM RISK MANAGEMENT, SAN JUAN AREA, 1:20,000 SCALE TOPOGRAPHIC MAP.

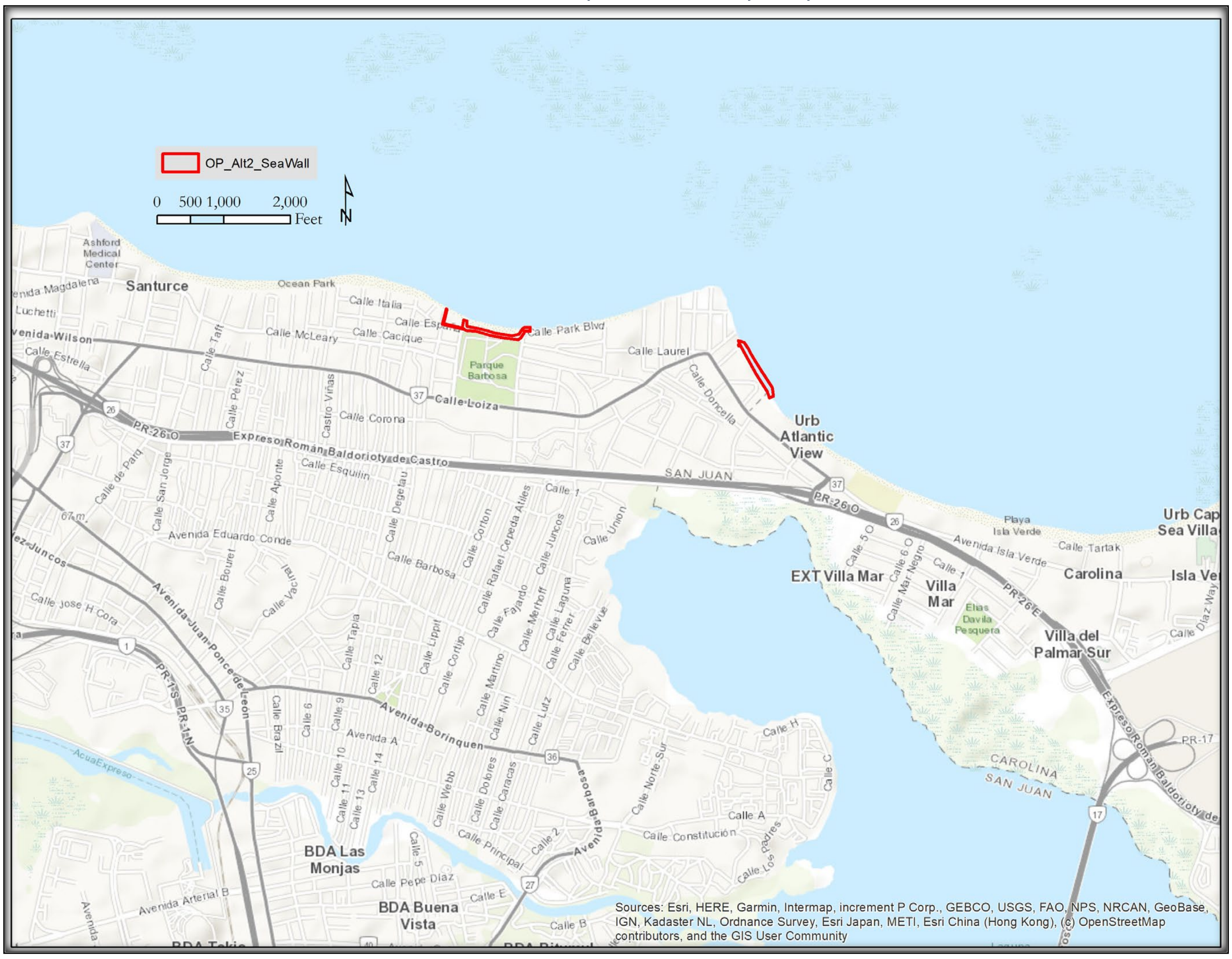


FIGURE 2: PUERTO RICO COASTAL STORM RISK MANAGEMENT, RINCÓN AREA, 1:20,000 SCALE TOPOGRAPHIC MAP.

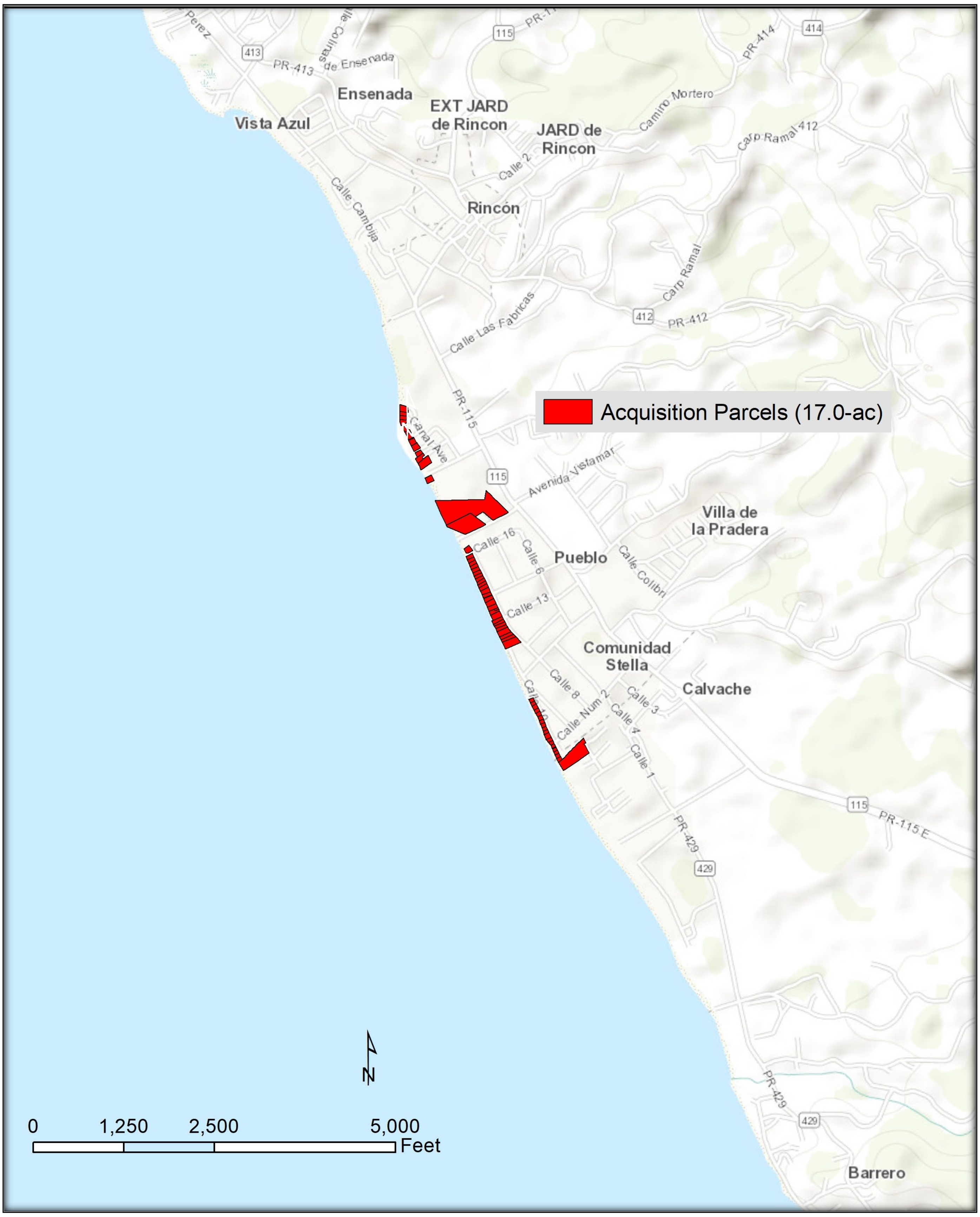


FIGURE 3: BARBOSA PARK SEA WALL, TOE STONE & SAND PLACEMENT ZONE

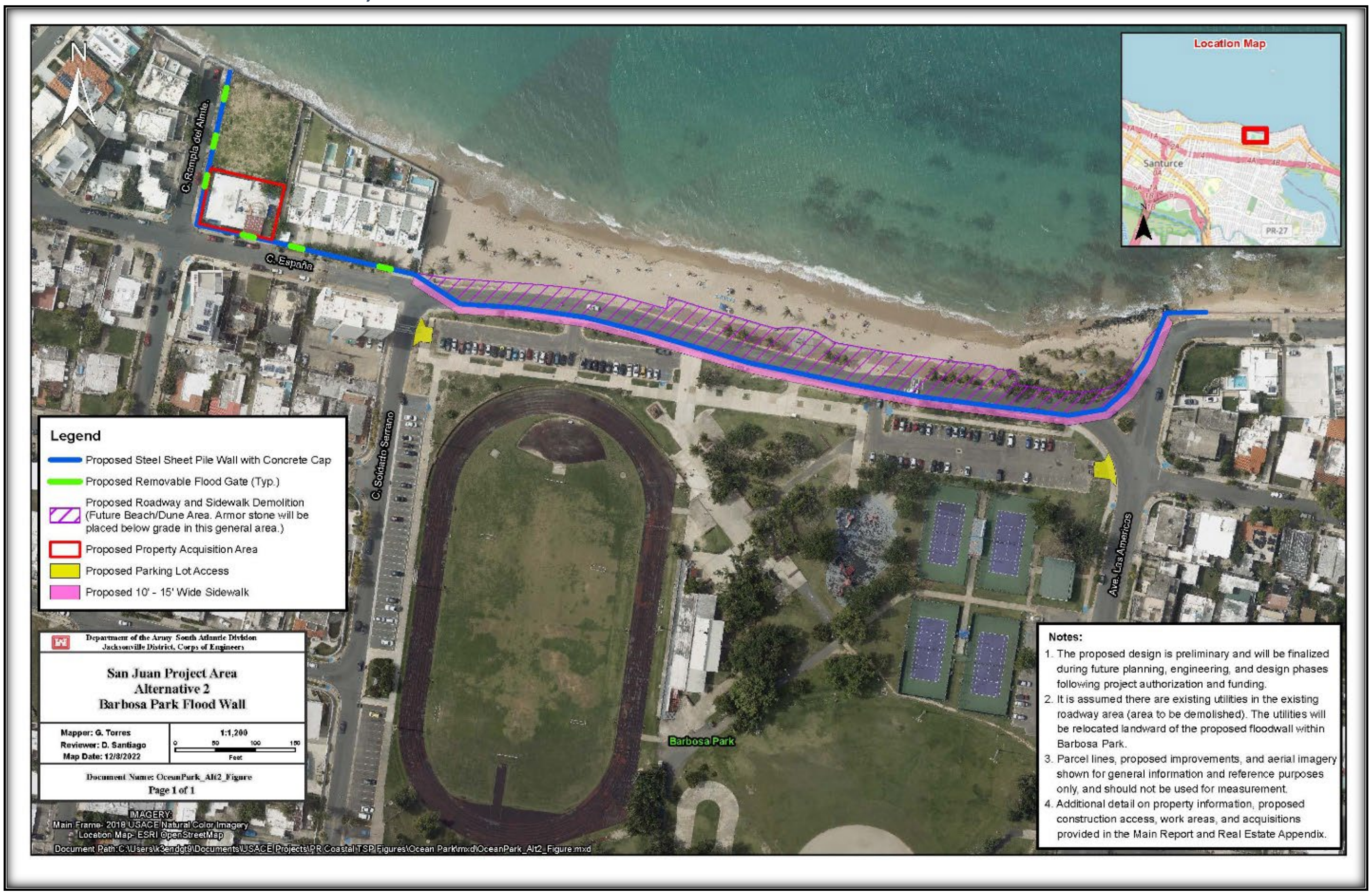


FIGURE 4: SKATE PARK SEA WALL, TOE STONE & MARINE MATTRESS PLACEMENT ZONE

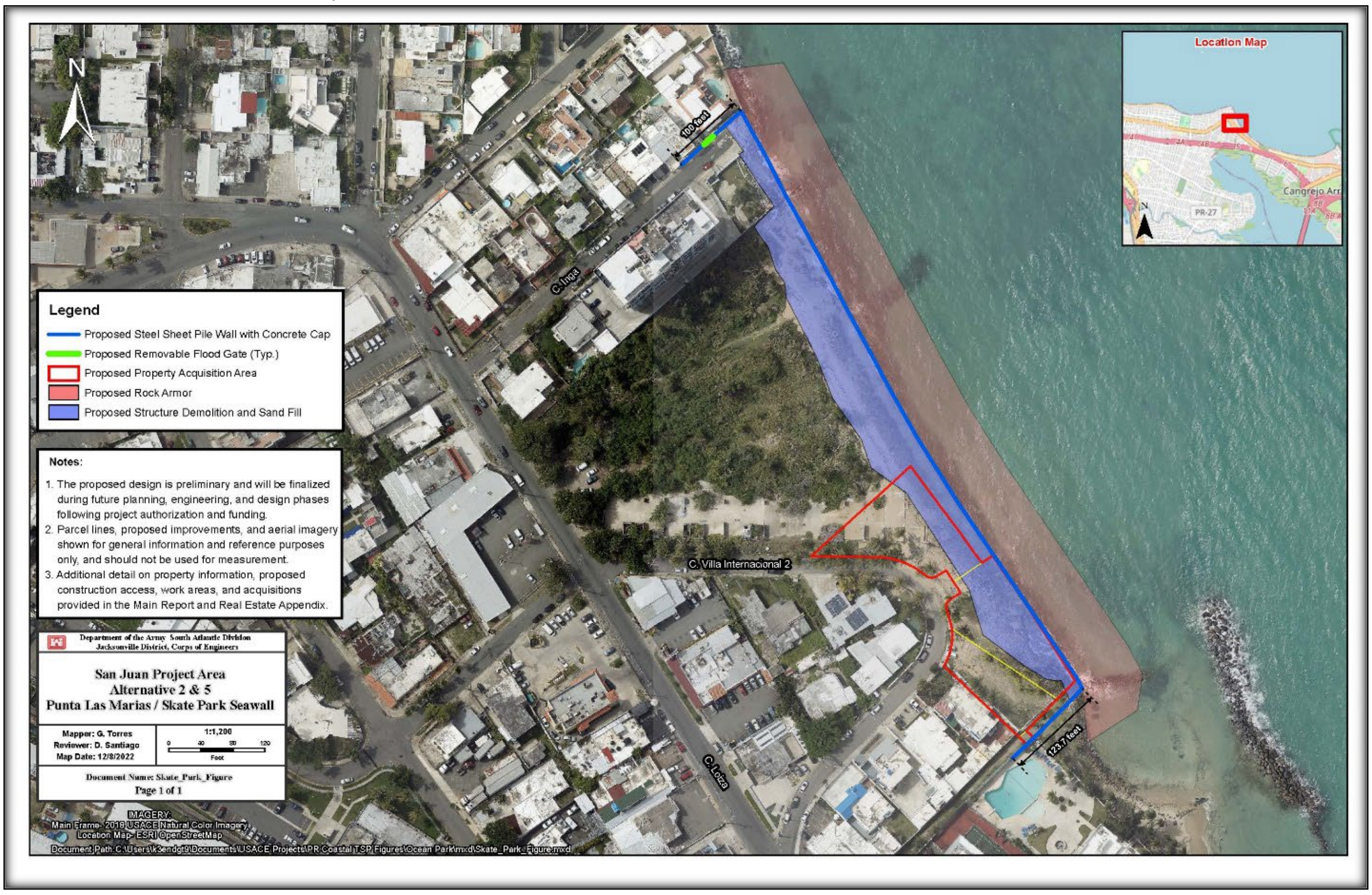


FIGURE 5: STELLA DEMOLITION ZONE

FIGURE 6: BARBOSA PARK TYPICAL CROSS SECTION OF SEA WALL, TOE STONE PROTECTION & SAND COVER

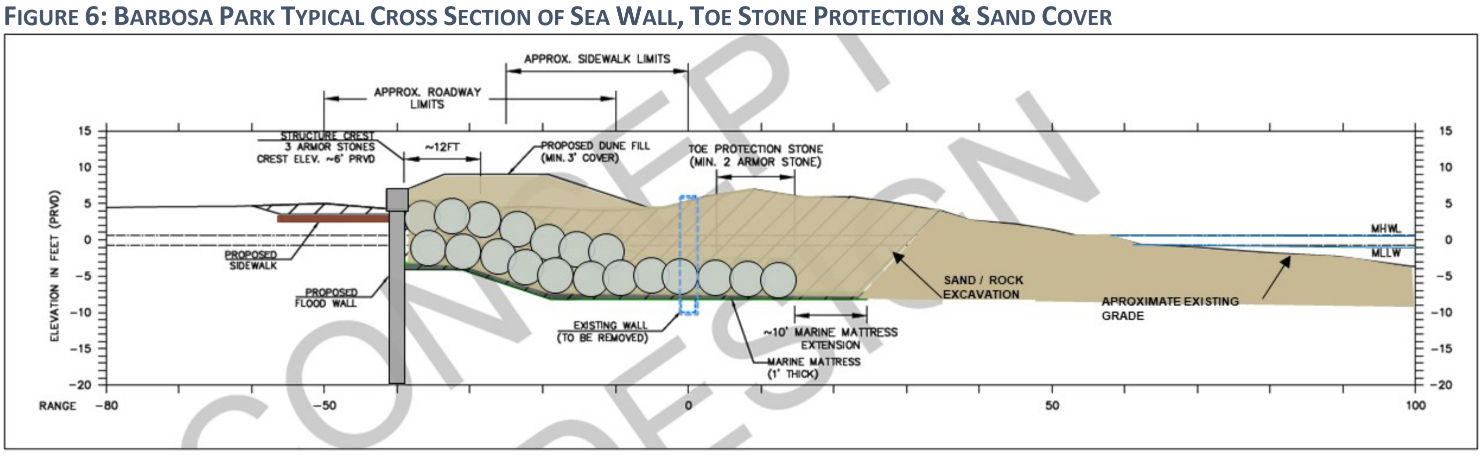


FIGURE 7: SKATE PARK TYPICAL CROSS SECTION OF SEA WALL, MARINE MATTRESS & TOE STONE

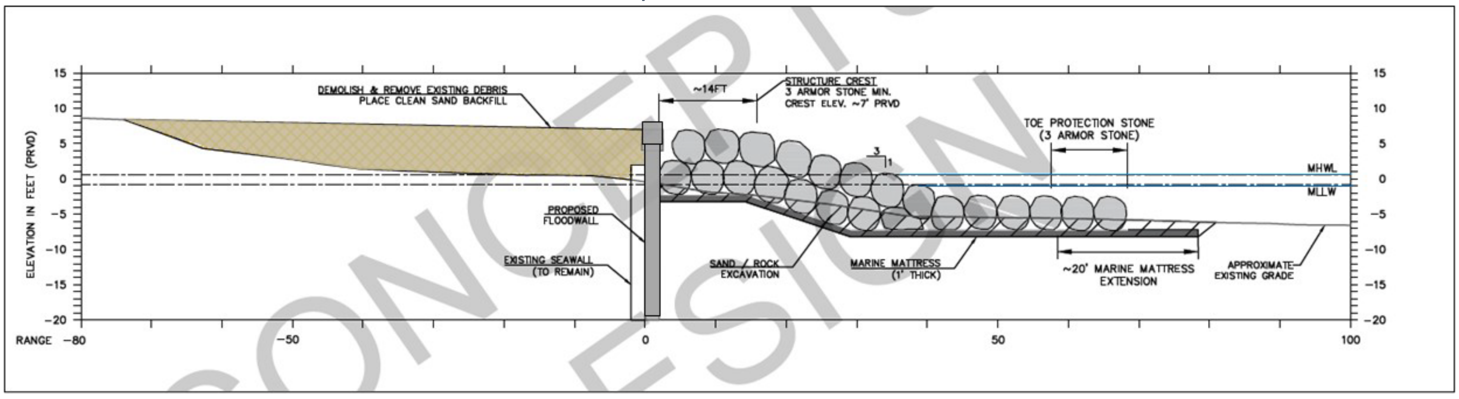


FIGURE 8: DETAILED BENTHIC SURVEY MAPPING FOR SAN JUAN

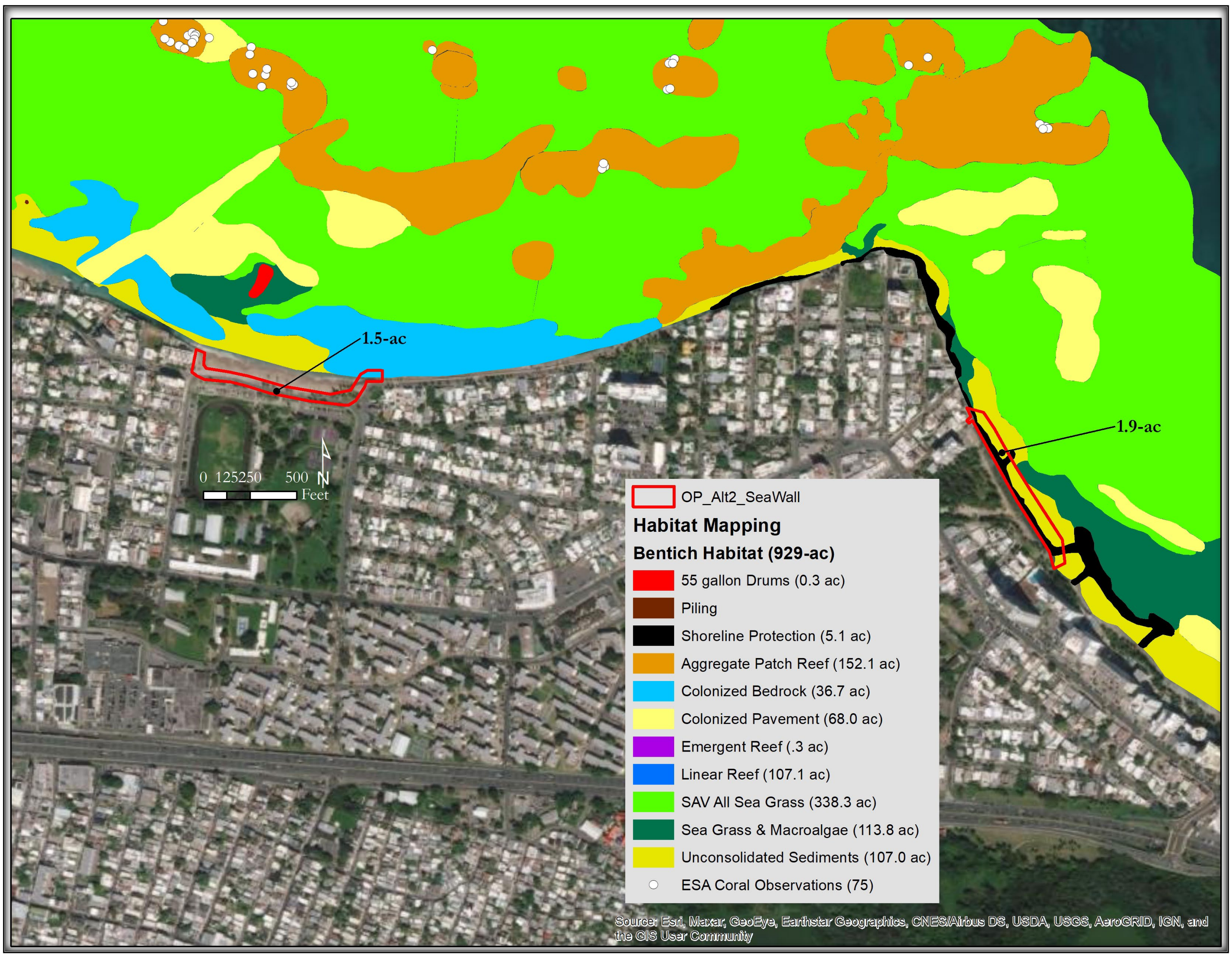
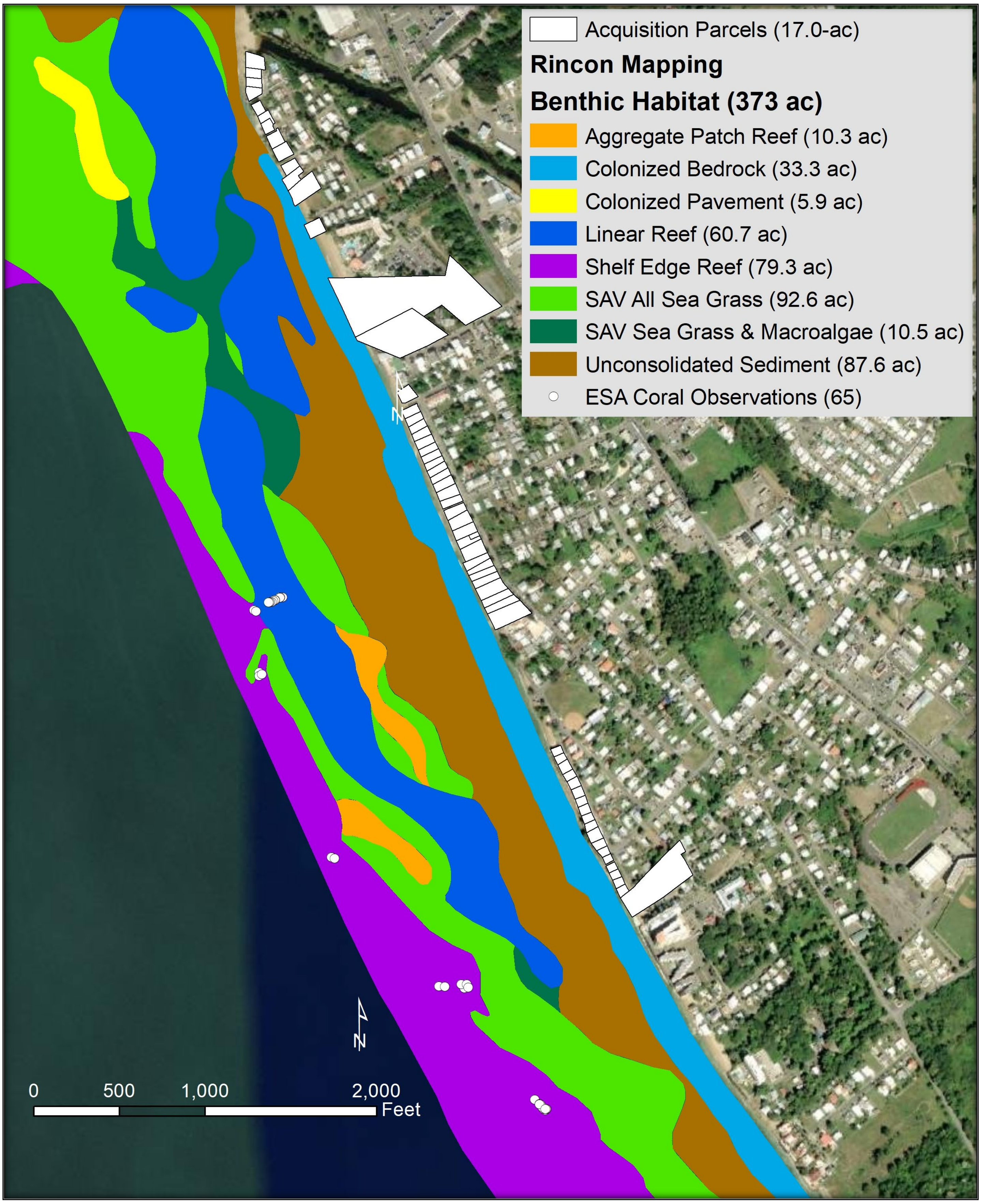


FIGURE 9: DETAILED BENTHIC SURVEY MAPPING FOR RINCÓN.



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APPENDIX G – ENVIRONMENTAL

ATTACHMENT 4A – SECTION 7 ENDANGERED SPECIES ACT BIOLOGICAL ASSESSMENTS & DETERMINATIONS

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BIOLOGICAL ASSESSMENT FOR EFH & ESA SPECIES

EXECUTIVE SUMMARY

The purpose of this Biological Assessment (BA) is to address the anticipated effects of the TSP at Ocean Park, San Juan and Stella, Rincón on federally listed species and their critical habitat under the Endangered Species Act (ESA) of 1973, as amended; and. The U.S. Army Corps of Engineers, Jacksonville District (USACE) is granted authority for this study under Section 204 of the Flood Control Act of 1970 (P.L. 91-611), and funds provided under the Bipartisan Budget Act (BBA) of 2018 (P.L. 115-123). Due to the low level of impact anticipated from the TSP and the additional beach habitat created, this document covers both National Marine Fisheries Service (NMFS) and US Fish & Wildlife Service (USFWS) Biological Assessments (BA) for ESA species.

The TSP would consist of:

- Barbosa Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,600 LF); Nearly all of this feature would be placed on old infrastructure and above Mean High Watermark (MHW). Would be covered with beach quality sand to maintain aesthetics and habitat.
- the Skate Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,200 LF); Nearly all of this feature would be placed on old shoreline protection and unconsolidated sediments already affected by old and existing shoreline protection. Landward would be covered with beach quality sand to maintain grade, aesthetics, and habitat.
- Stella, Rincón: Acquiring compromised parcels/structures. Overtime would create about 17-acres of shoreline habitat and recreation space.

The Corps has determined that the TSP would have **no effect** to the Scalloped Hammerhead Shark, Nassau Grouper, Nassau Grouper DCH, Giant Manta Ray, Elkhorn, Staghorn, Pillar, Rough Cactus, Lobed Star, Mountainous Star, Boulder Star Corals, DCH for *Acropora* corals, and the Antillean Manatee. The Corps has determined the TSP **may affect but would not likely adversely affect (MANLAA)** nesting Loggerhead, Hawksbill, Leatherback, Green Sea Turtles and the Queen Conch. Conservation measures for nesting Sea Turtles and Antillean Manatee would be utilized during construction at Barbosa Park and the Skate Park. Best management practices to protect water quality and habitat would be utilized during construction at Ocean Park and Stella. The TSP for Stella would provide 17 acres of additional nesting Sea Turtle beach, dune, and other habitats. Study area T&E species under jurisdiction of the NMFS and the USACE effects determinations for these species are summarized in Table 1, and USFWS jurisdictional species in Table 2.

Table 1: ESA Species Under Jurisdiction of the National Marine Fisheries Service

Common Name	Scientific Name	Status	Determination
Sea Turtles			
Loggerhead Sea Turtle	*Caretta caretta*	T	NE
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	NE
Leatherback Sea Turtle	*Dermochelys coriacea*	E	NE

Green Sea Turtle	*Chelonia mydas*	T	NE
Fish			
Nassau Grouper	*Epinephelus striatus*	T	NE
Scalloped Hammerhead Shark	*Sphyrna lewinii*	E	NE
Giant Manta Ray	*Manta birostris*	T	NE
Invertebrates			
Elkhorn Coral	*Acropora palmata*	T	NE
Staghorn Coral	*Acropora cervicornis*	T	NE
Pillar Coral	*Dendrogyra cylindrus*	T	NE
Lobed Star Coral	*Orbicella annularis*	T	NE
Mountainous Star Coral	*Orbicella faveolata*	T	NE
Boulder Star Coral	*Orbicella franksi*	T	NE
Rough Cactus Coral	*Mycetophyllia ferox*	T	NE
Queen Conch	*Strombus gigas*	C	NLAA
***Acropora* & Coral Designated Critical Habitat**			**NE**

Table 2: ESA Species Under Jurisdiction of the US Fish & Wildlife Service

Common Name	**Scientific Name**	**Status**	**Determination**
Nesting Sea Turtles			
Loggerhead Sea Turtle NW Atlantic DPS	*Caretta caretta*	T	MANLAA
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	MANLAA
Leatherback Sea Turtle	*Dermochelys coriacea*	E	MANLAA
Green Sea Turtle South Atlantic DPS	*Chelonia mydas*	T	MANLAA
Mammal			
Antillean Manatee	*Trichechus manatus manatus*	T	NE

DESCRIPTION OF PROPOSED ACTION

The TSP includes structural measures for prevention/reduction of inundation by wave induced floodwaters at Barbosa Park and the Skate Park, Ocean Park (Figure 1); and non-structural measures for the elimination of erosion damages at Stella, Rincón (Figure 2). The overall affected environment for the San Juan, Ocean Park and Stella, Rincon can be reviewed in the Main Report, Chapter 2, and the detailed Benthic Habitat & Species Survey in Appendix G, Attachment 5.

The TSP for Barbosa Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 3 & Figure 6). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction work limits are almost entirely above the MHW. There may be a small square footage of toe stone needed at the ends of the sea wall placed below the MHW. Old stone and materials from defunct infrastructure and shoreline protection would be excavated and properly reused, recycled, or disposed. Toe stone placed above the MHW would be sufficiently covered with sand to maintain beach aesthetics, recreational uses, and nesting sea turtle habitat. Conservation measures and monitoring for Sea Turtles would be specified for Barbosa Park. BMPs to protect water quality and habitat would be utilized during construction.

The construction duration for Barbosa Park is estimated to be approximately 2 to 2.5 years. The work will all be performed utilizing land-based equipment. Notably, a large portion of the work will be performed outside of the beach and in-water areas (upland of the existing seawall and west of Barbosa Park, landward of existing developments). The nearshore work at Barbosa Park is anticipated to be complete within 1 to 1.5 years and near water work will likely target the calmer months between spring and fall.

The TSP for the Skate Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 3 & Figure 6 and Figure 4 & Figure 7). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction zone are within the MHW and below normal water levels. Old stone, sheet piles, wood piles, and materials from defunct infrastructure and shoreline protection may be excavated and properly reused, recycled, or disposed. Most of the material placed would be upon the infrastructure/shoreline protection footprint, with potentially a small square footage on unconsolidated sands. Areas of unconsolidated sands are currently affected by old stone groins/jetties and a breakwater just to the southeast. Void areas created landward of the seawall would be backfilled with clean stone and/or sand materials to maintain aesthetics, recreational uses, and habitat. Conservation measures for Antillean Manatee would be specified for the Skate Park. BMPs to protect water quality and habitat would be utilized during construction.

The construction duration for the Skate Park is estimated to be approximately 1 to 1.5 years. The work will all be performed utilizing land-based equipment. In-water and nearshore work is anticipated to be complete within a year and will likely target the calmer months between spring and fall.

The TSP for the Stella reach of Rincón is Alternative 4 Acquisition, which would effectively stop erosive damage to structures caused by waves (Figure 5 & Figure 6). This alternative not only had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US, but also would eventually provide 17-acres of beach habitat and recreation. Demolition would take care by using techniques, sequencing, and appropriate BMPs to avoid demolition debris from falling into Waters of the US. All materials generated from demolishing structures and defunct shoreline protection would be properly reused, recycled, or disposed. Void areas created by the removal of structures would be backfilled with clean/inert recycled materials, stone, and/or sand materials. Final surficial grades above and to the MHW would be sufficiently covered with sand to provide new beach aesthetics, recreational uses, and nesting sea turtle habitat. Sand fill is not anticipated to be placed below the MHW.

Acquisition at Stella could possibly take many years to acquire properties and then subsequently demolish structures and restore the land surface. Duration for demolishing structures would vary on the size, type, and configuration, but would generally take several months once started. The demolition process will likely involve complete removal of the structure (including the subsurface foundation), utilities and coastal armoring (if present) to provide a natural beach area. Following full site demolition, a small quantity of beach-quality fill may be placed on the site and graded to blend in with the adjacent properties and/or shoreline. Additional improvements such as the planting of native vegetation may also be implemented. Of note, the recommended alternative does not include full beach restoration. A small amount of beach-quality fill will be placed within the structure and/or parcel footprint such that the property will naturally blend with adjacent areas and to avoid an initial eroded condition that may result from structure removal. The fill will only be placed within the footprint of the parcel (or structures) and will not extend any further seaward than the existing structure(s). The fill will be graded to represent a natural beach area to avoid potential environmental impacts and mitigation.

General Construction Equipment – Multiple pieces of heavy machinery of the same or different types may be used to expedite work or to accommodate varying conditions within the construction areas. Heavy equipment could include dozers, graders and off-road dump trucks, excavators (land based) would use a bucket-type device to dig and remove/reposition material from/within the construction site and, pile driving equipment (either impact or vibratory) would be required and would be land based.

AFFECTED CRITICAL HABITAT & LISTED SPECIES

Designated *Acropora* & Coral Habitat

NOAA Fisheries issued a final rule (2008) designating critical habitat for elkhorn (*Acropora palmata*) and staghorn (*A. cervicornis*) corals, which we listed as threatened under the Endangered Species Act of 1973, as amended. The Puerto Rico area of critical habitat (Figure 8) comprises approximately 1,383 square miles (3,582 sq km) of marine habitat, including the study areas of San Juan and Rincón.

Critical Habitat Description

The essential feature consists of natural consolidated hard substrate or dead coral skeleton that are free from fleshy or turf macroalgae cover and sediment cover. The essential feature can be found unevenly dispersed throughout the DCH area due to differential macroalgae coverage and naturally occurring unconsolidated sediment and seagrasses dispersed within the reef ecosystem. Based on data about their historical distributions, the corals are capable of successfully recruiting and attaching to available substrate anywhere within the boundaries of the Puerto Rico DCH area. The DCH includes all available potential settling substrate within the 98-ft (30 m) contour to maximize the potential for successful recruitment and population growth. Natural sites covered with loose sediment, fleshy or turf macroalgal covered hard substrate, or seagrasses do not provide the essential feature for elkhorn and staghorn corals. Additionally, all existing (meaning constructed at the time of this critical habitat designation) federally authorized or permitted man-made structures such as aids-to-navigation (ATONs), artificial reefs, boat ramps, docks, pilings, channels, or marinas do not provide the essential feature that is essential to the species' conservation. Substrates within the critical habitat boundaries that do not contain the essential feature are not part of the designation. Federal actions, or the effects thereof, limited to these areas do not trigger Section 7 consultation under the ESA for coral critical habitat, unless they may affect the essential feature in adjacent critical habitat.

Critical Habitat Survey Results

To perform an effects determination for *Acropora* and threatened coral DCH, a solid basis in the spatial extent and quality of study area habitats and species is required. Hardbottom habitat and ESA corals were delineated, mapped, and assessed within the San Juan (Figure 10) and Rincón (Figure 11) study areas. Surveyed habitats that qualify as Acropora DCH (**Error! Reference source not found.**) within the San Juan study area includes aggregate patch reef (152 acres), colonized bedrock (37 acres), colonize pavement (68 acres), emergent reef (0.3 acres), and linear reef (107 acres) (Figure 10). Mapped *Acropora* DCH within the Rincón study area includes aggregate patch reef (10 acres), colonized bedrock (33 acres), colonize pavement (6 acres), linear reef (61 acres), and shelf edge reef (79 acres) (Figure 11).

Photo 1: A Dead Elkhorn (*Acropora palmata*) Colony on Aggregate Patch Reef, Rincón

Acropora & Coral Critical Habitat Effects Determination

The USACE has determined that there would be **no effect** to *Acropora* DCH for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Detailed mapping and surveys conducted in 2022 show that both study areas are highly diverse in *Acropora* DCH. This same mapping shows that the TSP does not overlap with essential hardbottom or would not cause disturbance to existing *Acropora* colonies.

Corals

Species Descriptions

Elkhorn Coral (*Acropora palmata*) belong to the most abundant group of corals in the world (Acropora genus) and once represented the most dominant reef building species throughout Florida and the Caribbean. Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches and is found in shallow reefs, typically in water depths from 0-35 feet, as these corals prefer areas where wave action causes constant water movement. Colonies are fast growing: branches increase in length by 2-4 inches (5-10 cm) per year, with colonies reaching their maximum size in approximately 10-12 years. Over the last 10,000 years, elkhorn coral has been one of the three most important Caribbean corals contributing to reef growth and development and providing essential fish habitat. This species was listed under the ESA as threatened on May 9, 2006.

Elkhorn coral was formerly the dominant species in shallow water (3-16 ft. [1-5 m] deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet (6 m), although isolated corals may occur to 65 feet (20 m).

NMFS has designated critical habitat for elkhorn and staghorn corals in four areas: Florida, Puerto Rico, St. John/St. Thomas, and St. Croix. Figure 9 shows the DCH for Puerto Rico, which includes all areas containing consolidated hard substrate free of sand and macro-algal cover surrounding the islands of the Commonwealth of Puerto Rico, 98 ft. (30 m) in depth and shallower. In addition, a 4(d) rule (50 CFR Part 223) establishing “take” prohibitions for elkhorn and staghorn corals went into effect on November 28, 2008 for these areas. Take includes collecting, bothering, harming, harassment, damage to, death, or other actions that affect health and survival of listed species.

This species has been documented in the San Juan study area on the narrow, discontinuous linear or fringing “reef” consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, as discussed in Section 2.2.1.2 above, the Tres Palmas marine reserve is located north of the northern limit of the Rincon study area and contains shallow-water coral communities composed primarily of Elkhorn coral (*Acropora palmata*). DCH for this species occurs in both the San Juan and

Rincon study areas.

Staghorn Coral (*Acropora cervicornis*) is a branching coral with cylindrical branches ranging from a few centimeters to over 6.5 feet (2 m) in length. This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 4-8 inches (10-20 cm) per year. This species was listed under the ESA as threatened on May 9, 2006.

Staghorn coral occurs in back reef and fore reef environments from 0-98 feet (0 to 30 m) deep. In addition to growing on reefs, staghorn corals often form colonies on bare sand. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths of 15-80 feet (5-25 m) were formerly dominated by extensive single species stands of staghorn coral until the mid-1980s.

Staghorn coral is found in the Atlantic Ocean, Caribbean Sea, and western Gulf of Mexico. Specifically, staghorn coral is found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela. The northern limit of staghorn coral is around Boca Raton, Florida. The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will release millions of "gametes." The coral larvae (planula) live in the plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity is very low in the remnant populations. This species has been documented in the San Juan study area on the narrow, discontinuous linear or fringing “reef” consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, staghorn coral (*Acropora cervicornis*) occurs offshore north and south of the Rincon study area. DCH for this species occurs in both the San Juan and Rincon study areas.

Pillar Coral *(Dendrogyra cylindrus)* colonies form numerous, heavy, cylindrical spires, that grow upwards from an encrusting base mass. The colonies can attain a height of 10 feet (3 m), with a pillar diameter of more than 4 inches (10 cm). Polyps are normally extended during the day, giving the colony a fuzzy appearance. This species was listed under the ESA as threatened on 10 October 2014. Colonies are typically found on flat gently sloping back reef and fore reef environment in depths of 3-82 feet (1-25 m). The species does not occur in extremely exposed locations. This species occurs in the Caribbean, the southern Gulf of Mexico, Florida, and the Bahamas. In addition, it has been documented in the San Juan study area on the narrow, discontinuous linear or fringing “reef” consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, it does occur offshore Rincon but is not anticipated in the study area. NMFS has not yet proposed DCH for this species.

Rough Cactus Coral (*Mycetophyllia ferox*) colonies consist of flat plates with radiating valleys. It is a widely recognized valid species with colonies comprised of thin, weakly attached plates with interconnecting, slightly sinuous, narrow valleys. Tentacles are generally absent and corallite centers tend to form single rows. The walls of the valleys commonly join to form closed valleys; a feature not seen in other members of *Mycetophyllia*. The ridges are usually small and square, with a groove on top. The ridges, or walls between valleys, are commonly quite thin, and are irregular, and valleys are narrower. This species was listed under the ESA as threatened on 10 October 2014.

This species is most common in fore reef environments from 5-30 meters (but is more abundant from 10-20 meters), but also occurs at low abundance in certain deeper back reef habitats and deep lagoons. This species occurs in the Caribbean, southern Gulf of Mexico, Florida, and the Bahamas. In addition, it has been documented in the San Juan study area on the narrow, discontinuous linear or fringing "reef" consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, it does occur offshore Rincon but is not anticipated in the study area. NMFS has not yet proposed DCH for this species.

Lobed Star Coral (*Orbicella annularis*) colonies grow in several morphotypes that were originally described as separate species. The species occurs as long, thick columns with enlarged, dome-like tops; large, massive mounds; sheets with skirt-like edges; irregularly bumpy mounds and plates or as smooth plates. Colonies grow up to 10 feet (3 m) in diameter. The surface is covered with distinctive, often somewhat raised, corallites. This species was listed under the ESA as threatened on 10 October 2014.

Lobed star coral inhabits most reef environments and is often the predominant coral between 22-82 ft. (7-25 m). The flattened plates are most common at deeper reefs, down to 165 ft. (50 m). Common to Florida, Bahamas and Caribbean. In addition, it has been documented in the San Juan study area on the narrow, discontinuous linear or fringing "reef" consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, it does occur offshore Rincon but is not anticipated in the study area. NMFS has not yet proposed DCH for this species.

Mountainous Star Coral (*Orbicella faveolate)* has been called the "dominant reef-building coral of the Atlantic" (Brainard et al 2011). *Orbicella faveolata* buds extratentacularly to form head or sheet colonies with corallites that are uniformly distributed and closely packed, but sometimes unevenly exsert. Septa are highly exsert, with septocostae arranged in a variably conspicuous fan system, and the skeleton is generally far less dense than those of its sibling species. Active growth is typically found at the edges of colonies, forming a smooth outline with many small polyps. This species was listed under the ESA as threatened on 10 October 2014.

Orbicella faveolata is found from 3-100 feet (1-30 m) in back-reef and fore-reef habitats and is often the most abundant coral between 30-65 feet (10-20 m) in fore-reef environments. This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas. May also be present in Bermuda, but this requires confirmation. In addition, it has been documented in the San Juan study area on the narrow, discontinuous linear or fringing "reef" consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, it does occur offshore Rincon but is not anticipated in the study area. NMFS has not yet proposed DCH for this species.

Boulder Star Coral (*Orbicella franksi*) builds massive, encrusting plate or subcolumnar colonies via extratentacular budding. The characteristically bumpy appearance of this species is caused by relatively large, unevenly exsert, and irregularly distributed corallites. Boulder Star Coral is distinguished from its sibling *Orbicella* species by this irregular or bumpy appearance; a relatively dense, heavy, and hard skeleton (corallum); thicker septo-costae with a conspicuous septocostal midline row of lacerate teeth; and a greater degree of interspecies aggression. This species was listed under the ESA as threatened on 10 October 2014.

This species mostly grows in the open like other species of this genus, but smaller, encrusting colonies are common in shaded overhangs. It is uncommon in very shallow water but becomes common deeper. This species occurs in the Caribbean, the Gulf of Mexico, Florida, and the Bahamas. In addition, it has been documented in the San Juan study area on the narrow, discontinuous linear or fringing "reef" consisting of corals covering fossil sand dunes (i.e., eolianites) trending in an east-west direction and extending, in some sites, up to 0.9 miles offshore (CFMC, 2004; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011; Coll Rivera Environmental, 2005). In addition, it does occur offshore Rincon but is not anticipated in the study area. NMFS has not yet proposed DCH for this species.

<u>ESA Coral Survey Results</u>

San Juan – There was a total of twenty-one (21) ESA listed corals identified and measured during surveys in San Juan, which accounted for 2.3% of all stony corals sampled. Nineteen (19) were *Orbicella faveolta* and two (2) were *Orbicella annularis*. Numerous dead *Acropora palmata* colonies were observed during the San Juan survey. Although the colonies were dead and fully encrusted with macroalgae, some of the colonies still retained coral structure including branching. It is difficult to determine from simple observations how long these corals have been dead, but their presence indicates this may still be viable habitat for *Acropora palmata*. Appendix G (Attachment 5, Table 15) lists the sites where the ESA corals were located. Twenty (20) of these colonies were located on patch reef habitat (Figure 10). Many of the ESA listed stony corals were first observed during mapping efforts. Underwater visibility in San Juan was variable and changed with tide cycles, amount of rain and runoff, and sea conditions. Although scientists attempted to maximize good water quality conditions during favorable tidal cycles during in-water survey activities, there were occasions when sampling activities occurred in low visibility conditions. During periods of low visibility, scientists had reduced visual coverage which could affect identification of some ESA corals in and adjacent to sample sites. Although none were observed during this benthic resource survey, other biological monitoring studies have documented *Dendrogyra cylindicus* on hardbottom habitat offshore Isla Verde, Puerto Rico (Rivera 2014). Maximum dimensions of the ESA listed corals ranged from 14 to 448 centimeters, with an average maximum dimension of 142.7 centimeters. The average percent live tissue of ESA corals was only 68.1%, which may indicate corals are experiencing levels of stress that are impacting their health. Although no ESA listed corals were observed at the sites with high levels of sedimentation, 57.1% had sediment indicators present. ESA listed corals were often some of the largest corals observed during the San Juan survey. A larger sized coral colony provides more surface area and may have an increased susceptibility to sediment deposition. The most prominent signs of stress in ESA listed corals were algal overgrowth (90.5% of colonies) and endolithic borers (71.4% of colonies). For more details, see Attachment 5.

Rincón – A total of 33 ESA listed corals were identified during surveys in Rincón, which accounted for just 4.4% of all stony corals. Twenty-five (25) were *Orbicella faveolta*, seven (7) were *Dendrogyra cylindricus*, and one (1) was *Acropora cervicornis*. Appendix G (Attachment 5, Table 8) lists the sites where ESA listed corals were observed. Twenty-six (26) of the ESA listed corals were observed on linear reef habitats (Figure 11). Many of the ESA listed stony corals were first observed during mapping efforts. Underwater visibility in Rincón was variable and changed with tide cycles, amount of rain and runoff, and sea conditions. Although scientists attempted to maximize good water quality conditions during favorable tidal cycles during in-water survey activities, there were occasions when sampling activities occurred in low visibility conditions. During periods of low visibility, scientists had reduced visual coverage which could affect identification of some ESA corals in and adjacent to sample sites. The maximum dimensions of ESA listed corals ranged from 7.7 to 285 centimeters, with an average maximum dimension of 50.5 centimeters. The average percent live tissue of ESA corals was 84.8%, which supported in situ observations that corals appeared to be in relatively good health. Although no ESA corals were observed at sites with high levels of sedimentation, 15.2% of ESA listed corals observed in the Rincón survey area had visible sediment indicators. ESA listed corals were often some of the largest corals observed during the Rincón survey. A larger coral colony size provides more surface area and may be more susceptible to sediment deposition. The most prominent signs of stress in ESA corals were algal overgrowth (48.5% of colonies), endolithic borers (42.4% of colonies), and partial bleaching/paling (30.3%). For more details, see Attachment 5.

ESA Corals Effects Determination

The USACE has determined that there would be **no effect** to ESA coral species for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Surveys conducted in 2022 show that all ESA coral species are located on the outer reefs was not observed. Therefore, direct or indirect contact with ESA coral species is not likely.

Queen Conch

Species Descriptions

The queen conch is a large gastropod mollusk belonging to the same taxonomic group (Mollusca). Queen conch are slow growing and late to mature, reaching up to 12 inches in length and living up to 30 years. The Queen Conch occurs throughout the Caribbean Sea, the Gulf of Mexico, and around Bermuda. They are benthic-grazing herbivores that feed on diatoms, seagrass detritus, and various types of algae and epiphytes. Adult queen conch prefers sandy algal flats, but are also found on gravel, coral rubble, smooth hard coral, and beach rock bottom, while juveniles are primarily associated with seagrass beds. Queen Conch are highly sought after for their meat and are one of the most valuable species in the Caribbean. Learn more about their current fishing/harvest status. On September 7, 2022, we announced a proposed rule to list the queen conch as a threatened species under the Endangered Species Act.

ESA Queen Conch Survey Results

Specific Queen Conch surveys were not conducted during benthic surveys, however the survey team made notes of other species observed. The Queen Conch was not observed within the survey areas.

ESA Corals & Queen Conch Effects Determination

The USACE has determined that the TSP would **not likely to adversely affect** ESA Queen Conch for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Surveys conducted in 2022 did not observe Queen Conch individuals. Therefore, direct or indirect contact with ESA coral species is not likely.

Fishes

Of the three listed fish species, Nassau Grouper are most likely to occur in the vicinity of the project. However, in the late 1980s Nassau Grouper reached commercial extinction and a fishery moratorium was implemented in the 1990s, but commercial fishing continued in Florida and the U.S. Atlantic (including Puerto Rico) despite initial moratoriums (Frias-Torres 2008). The Scalloped Hammerhead Shark and Giant Manta Ray are migratory species commonly found offshore in the open ocean and outer continental shelf.

Species Descriptions

Scalloped Hammerhead Shark (*Sphyrna lewinii*), like other hammerhead sharks are recognized by their laterally expanded head that resembles a hammer. The Scalloped Hammerhead Shark is distinguished by a marked central indentation on the anterior margin of the head, along with two more indentations on each side of this central indentation, giving the head a “scalloped” appearance. The body is fusiform, with a large first dorsal fin and low second dorsal and pelvic fins. Coloration is generally uniform gray, grayish brown, bronze, or olive on top of the body that shades to white on the underside with dusky or black pectoral fin tips. This shark is a high trophic level predator and opportunistic feeder with a diet that includes a wide variety of teleost fishes, cephalopods, crustaceans, and rays. The northwest Atlantic Ocean DPS was listed under the ESA as threatened on September 2, 2014.

Estuaries and coastal embayment have been identified as particularly important nursery areas, while offshore waters contain important spawning and feeding areas. Adult habitat consists of continental shelf areas further offshore, with adult aggregations common over seamounts and near islands. This species can be found in coastal warm temperate and tropical seas worldwide. In the western Atlantic

Ocean, the species range extends from the northeast coast of the United States (from New Jersey to Florida) to Brazil, including the Gulf of Mexico and Caribbean Sea. It could occur along the north and northwest coasts of Puerto Rico but likely outside of the area of influence of the proposed action.

Nassau Grouper (*Epinephelus striatus*) is a long-lived (29 years max), moderate sized Serranid (Sea Bass) fish with large eyes and a robust body. The range of color is wide, but ground color is generally buff, with five dark brown vertical bars and a large black saddle blotch on top of caudal peduncle and a row of black spots below and behind its eye. There is also a distinctive dark tuning-fork mark beginning at the front of the upper jaw, extending dorsally (on top) along the interorbital region, and then dividing into two branches on top of the head behind the eyes; another dark band from the tip of the snout through the eye and then curving upward to meet its fellow just before the dorsal-fin origin. Juveniles exhibit a color pattern similar to adults. On 29 June 2016, NMFS issued a final rule (81 FR 42268) listing the Nassau Grouper as a threatened species under the ESA.

The Nassau Grouper is primarily a shallow-water, insular fish species that has long been valued as a major fishery resource throughout the wider Caribbean, South Florida, Bermuda and the Bahamas. The Nassau Grouper is considered a reef fish, but it transitions through a series of developmental shifts in habitat. The larvae are planktonic and after 35-40 days recruit from an oceanic environment into demersal habitats hiding in macroalgae, coral, and seagrass beds.

The Nassau Grouper's confirmed distribution currently includes Bermuda, Florida, throughout the Bahamas and Caribbean Sea. The species does occur along the north and northwest coasts of Puerto Rico possibly within the area of influence of the proposed action.

Giant Manta Ray (*Manta birostris/M. alfredi*) was listed as a threatened species under the ESA on January 12, 2017 (82 FR 3694). The distribution of the Giant Manta Ray is worldwide in tropical and temperate ocean waters. On the U.S. Atlantic Coast, the Giant Manta Ray has been documented as far north as New Jersey. The Giant Manta Ray is commonly encountered on shallow reefs or sighted feeding offshore at the surface. The Giant Manta Ray is occasionally observed in sandy bottom areas and seagrass beds. Regional sub-populations appear to be small and generally contain less than 1,000 adult individuals and are declining except for those areas where they are specifically protected (Hawaii, Maldives, Yap, Palau). The primary threats to *Manta* species are targeted fishing and fishery bycatch. This species is anticipated to occur outside the area of influence of the proposed action.

ESA Fish Survey Results

Specific fish surveys were not conducted during benthic surveys, but several species were photographed and noted as present in the Rincón study area, include unidentified Grouper spp. utilizing diverse hardbottom structure on a linear reef (Photo 2). These individuals were observed over sea grass beds (SAV) grazing.

Photo 2: Unidentified Grouper (Serranidae) Observed on Linear Reef, Rincón

<u>ESA Fish Effects Determination</u>

The USACE has determined that there would be **no effect** to ESA fish species or Nassau Grouper DCH for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Therefore, direct or indirect contact with fish species or natural habitat is not likely.

Sea Turtles

Four different sea turtle species could occur in the study area, Loggerhead, Leatherback, Hawksbill, and Green. Of the four species, the Hawksbill and Green are the most common in San Juan Bay. Although sandy beach habitat occurs within San Juan Bay along La Esperanza and in Condado Lagoon, DNER has not documented nesting there (Carlos Diez, Puerto Rico Department of Natural and Environmental Resources, San Juan, Puerto Rico, personal communication, July 12, 2016). Sea turtle nesting is limited to the sandy beaches along the north coast of Puerto Rico adjacent to San Juan Bay. Green and Hawksbill Sea Turtle foraging habitat occurs in San Juan Bay.

<u>Species Descriptions</u>

Leatherback sea turtles (*Dermochelys coriacea*) are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian oceans (Ernst and Barbour 1972). Leatherbacks are the largest living turtles and have a larger migration range than any other sea turtle species. The Leatherback is the most pelagic (open ocean) of the sea turtles and is often seen near the edge of the continental shelf; however, they are also observed just offshore of the surf line. They enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated.

Zug and Parham (1996) pointed out that the main threat to Leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Boat strikes are also a threat and source of mortality for Leatherbacks in Puerto Rico. There is potential for this species to be present off the north coast during migration and leatherback nesting has been documented on the sandy beach north of the Avenida Ashford (Dos Hermanos) Bridge (USFWS, 2005; Harberer 2005). No critical habitat has been designated for Leatherback turtles in the project area.

Loggerhead. The loggerhead (*Caretta caretta*) is characterized by a large head with blunt jaws. The carapace and flippers are a reddish-brown color; the plastron is yellow. Adults grow to an average weight of about 200 pounds. The USFWS and the NMFS listed the Northwest Atlantic Ocean distinct population segment (DPS) of the loggerhead sea turtle as threatened on September 22, 2011 (76 FR 58868). No loggerhead sea turtle nesting has ever been documented in Puerto Rico (Carlos Diez, Puerto Rico Department of Natural and Environmental Resources, San Juan, Puerto Rico, personal communication, July 12, 2016). The species feeds on mollusks, crustaceans, fish, and other marine animals. The loggerhead sea turtle can be found throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Coral reefs, rocky places, and ship wrecks are often used as feeding areas. This species could occur offshore of the San Juan Metro area. No critical habitat has been designated for loggerhead turtles in the project area.

Hawksbill. The hawksbill turtle (*Eretmochelys imbricata*) is small to medium-sized compared to other sea turtle species. Hawksbill turtles are unique among sea turtles in that they have two pairs of prefrontal scales on the top of the head and each of the flippers usually has two claws. This species was listed under the ESA as endangered in 1970.

Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with healthy coral reefs. The ledges and caves of coral reefs provide shelter for resting hawksbills both during the day and at night. Hawksbills are known to inhabit the same resting spot night after night. Hawksbills are also found around rocky outcrops and high energy shoals. These areas are optimum sites for sponge growth, which certain species are the preferred food of hawksbills. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent.

The nesting season varies with locality, nesting occurs all year long in Puerto Rico. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. They nest under the vegetation on the high beach and nests have been observed having the last eggs of the clutch as close as 3 inches from the sand’s surface. Hawksbill sea turtles have been reported in San Juan Bay and nesting has been documented on the sandy beach north of the Avenida Ashford (Dos Hermanos)

Bridge (USFWS, 2005 – Harberer 2005). Designated Critical Habitat (DCH) for this species occurs approximately 50 miles east of the project area around Culebra Island.

Green. The nesting range of green sea turtles in the southeastern United States includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina, the U.S. Virgin Islands (USVI) and Puerto Rico (NMFS and USFWS, 1991). Green turtles (*Chelonia mydas*) are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. Green turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses, including areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic (open ocean) organisms (Hirth 1997; NMFS and USFWS 1991). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs. DCH for this species occurs approximately 50 miles east of the project area around Culebra Island. The SAV habitat found in San Juan Harbor and Condado Lagoon are important grazing areas for the green sea turtle.

<u>ESA Sea Turtle Survey Results</u>

Specific sea turtle surveys were not conducted during benthic surveys but were noted as present in the study area. A Green Sea Turtle was observed on a diverse linear reef habitat (Photo 2) in San Juan.

Photo 3: A Green Sea Turtle (*Chelonia mydas*) Observed Along a Linear Reef, San Juan

<u>ESA Sea Turtle Effects Determination</u>

The USACE has determined that there would be **no effect** to ESA Sea Turtles under jurisdiction of NMFS for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. The USACE has determined the TSP **may affect but would not likely adversely affect (MANLAA)** USFWS jurisdictional nesting Loggerhead, Hawksbill, Leatherback and Green Sea Turtles. Conservation measures for nesting Sea Turtles would be utilized during construction at Barbosa Park and the Skate Park. Beneficial effects are anticipated resulting from about 17 acres of beach nesting habitat that would be created over time at Stella, Rincón. Therefore, direct or indirect contact with ESA Sea Turtles or their preferred habitats are not likely.

Mammals

Species Description

Antillean manatee (*Trichechus manatus manatus*) inhabits the coastal waters of Puerto Rico and has been documented both feeding and traveling in San Juan Bay and along the north coast of San Juan. Manatee sightings in Rincón are fewer though both habitat and Manatee population increase south of the Rincon study area (Atkins 2011). Seagrass beds in the bay and backreef zones provide suitable foraging habitat. The USFWS has jurisdiction for protection of the manatee under the ESA and the MMPA. On April 5, 2017, the USFWS published a final rule reclassifying the two subspecies of West Indian Manatee (Florida and Antillean) from endangered to threatened (82 FR 16680). This Antillean Manatee is also protected by Law Number 241 (Wildlife Law of the Commonwealth of Puerto Rico) and Regulation Number 6766, which regulates the management of threatened and endangered species in Puerto Rico. No DCH has been designated for this species in the project area.

The existing literature suggests that manatees in Puerto Rico are more commonly observed in coastal areas from San Juan, eastward to the east coast, (and including Culebra and Vieques Islands) and then south and west, past Jobos Bay, to the west coast, and then about as far to the northwest as Rincon. Manatees are concentrated in several “hot spots” including Ceiba, Vieques Island, Jobos Bay and Boquerón Bay, and are less abundant along the north coast, between Rincón and Dorado (West of San Juan). Aerial surveys to estimate the population size have been completed and current preliminary results estimate a mean population size of 532 individuals with a 95% confidence interval of 342 to 802 (Pollock et al. 2013). The Antillean manatee population in Puerto Rico is considered stable (USFWS 2016).

Manatees have been reported within the San Juan Bay from Isla de Cabras (at the mouth of SJH) to the Rio Puerto Nuevo channel (upstream of the port) mostly from public reports, dredging and construction project monitoring reports, USCG anecdotal reports from their dock area, and mortality reports. From August 16 to August 18, 2006 four male and one female adult Antillean Manatees were found dead in the San Juan Bay area. The cause of death for these animals was determined to be human related due to a large boat impact. This accident may have been prevented by following idle speed zones within the San Juan Bay and/or by having an observer on board while transiting in that area (USFWS 2017).

ESA Antillean Manatee Survey Results

Specific Manatee surveys were not conducted during benthic surveys, but individuals were photographed and noted as present in the Rincón study area (Photo 4). These individuals were observed over sea grass beds (SAV) grazing.

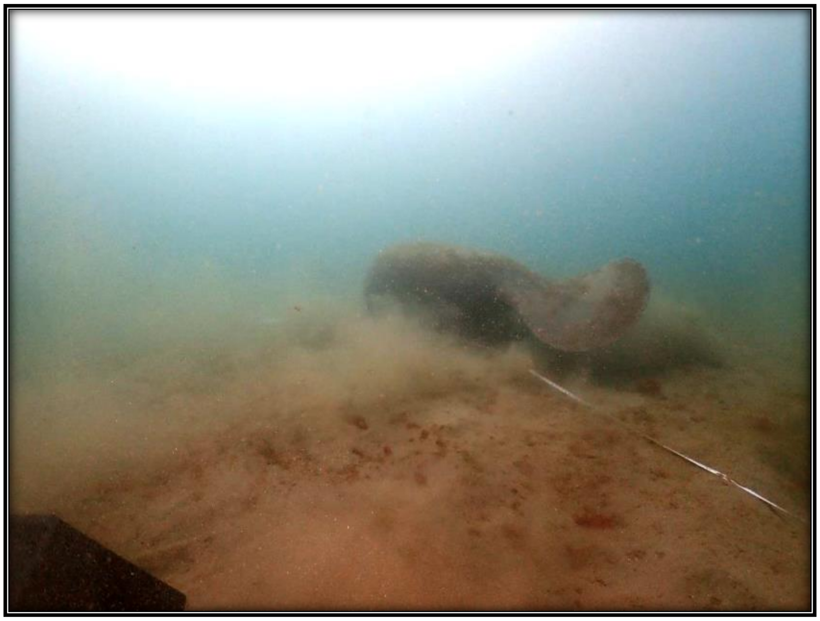


Photo 4: An Antillean Manatee (*Trichechus manatus manatus*) Observed on a Continuous Seagrass Bed, Rincón

ESA Antillean Manatee Effects Determination

The USACE has determined that there would be **no effect** to ESA Antillean Manatee for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Surveys conducted in 2022 show that Antillean Manatee are currently present within the study area. Conservation measures during construction at the Skate Park would be specified to ensure any Manatees swimming through the area would be avoided and undisturbed. Therefore, direct or indirect contact with ESA Antillean Manatee or its preferred habitats are not likely.

ENVIRONMENTAL COMMITMENTS

Efforts to eliminate or significantly reduce the potential impacts associated with construction activities, as well as avoidance and minimization measures (conservation measures) for USFWS listed Sea Turtles and Antillean Manatee include the following actions:

a. The contractor shall instruct all personnel associated with the project of the potential presence of these species, or any large sea creature for that matter, and the need to avoid collisions with them. All construction personnel are responsible for observing water-related activities for the presence of sea turtles.

b. The contractor shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or manatee, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or manatee cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or manatee entry to or exit from the area.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle, manatee, or any large- bodied sea creature is seen within 100 yards of the active construction or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle. Operation of any mechanical construction equipment shall cease immediately if an individual or group is seen within a 50ft radius of the equipment. Activities shall not resume until the individual or group has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or manatee shall be reported immediately to the USFWS and NMFS's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Observational monitoring for sea turtles during nesting periods would take place at the appropriate intervals and time of day specified in the contract.

h. The Contractor shall monitor water quality (turbidity) at the construction sites, as required by the 401 Water Quality Certification.

i. If turbidity values at the construction site exceed permitted values, the Contractor shall suspend all construction activities. Construction shall not continue until water quality meets state standards.

j. Best Management Practices (BMP) during construction to control erosion.

CONCLUSIONS

In summary, due to the inclusion of Best Management Practices and Protection Measures for In-Water

Work the Corps has determined that the TSP would have **no effect** to the Scalloped Hammerhead Shark, Nassau Grouper, Nassau Grouper DCH, Giant Manta Ray, Elkhorn, Staghorn, Pillar, Rough Cactus, Lobed Star, Mountainous Star, Boulder Star Corals, DCH for *Acropora* corals and non-*Acropora* corals, and the Antillean Manatee. The Corps has determined the TSP **may affect but would not likely adversely affect (MANLAA)** nesting Loggerhead, Hawksbill, Leatherback, Green Sea Turtles and Queen Conch. Conservation measures for nesting Sea Turtles and Antillean Manatee would be utilized during construction at Barbosa Park and the Skate Park. Best management practices to protect water quality and habitat would be utilized during construction at Ocean Park and Stella. The TSP for Stella would provide 17 acres of additional nesting Sea Turtle beach, dune, and other habitat.

FIGURES OF THE TSP

Figure 1: Puerto Rico Coastal Storm Risk Management, San Juan area, 1:20,000 scale topographic map.

Figure 2: Puerto Rico Coastal Storm Risk Management, Rincón area, 1:20,000 scale topographic map.

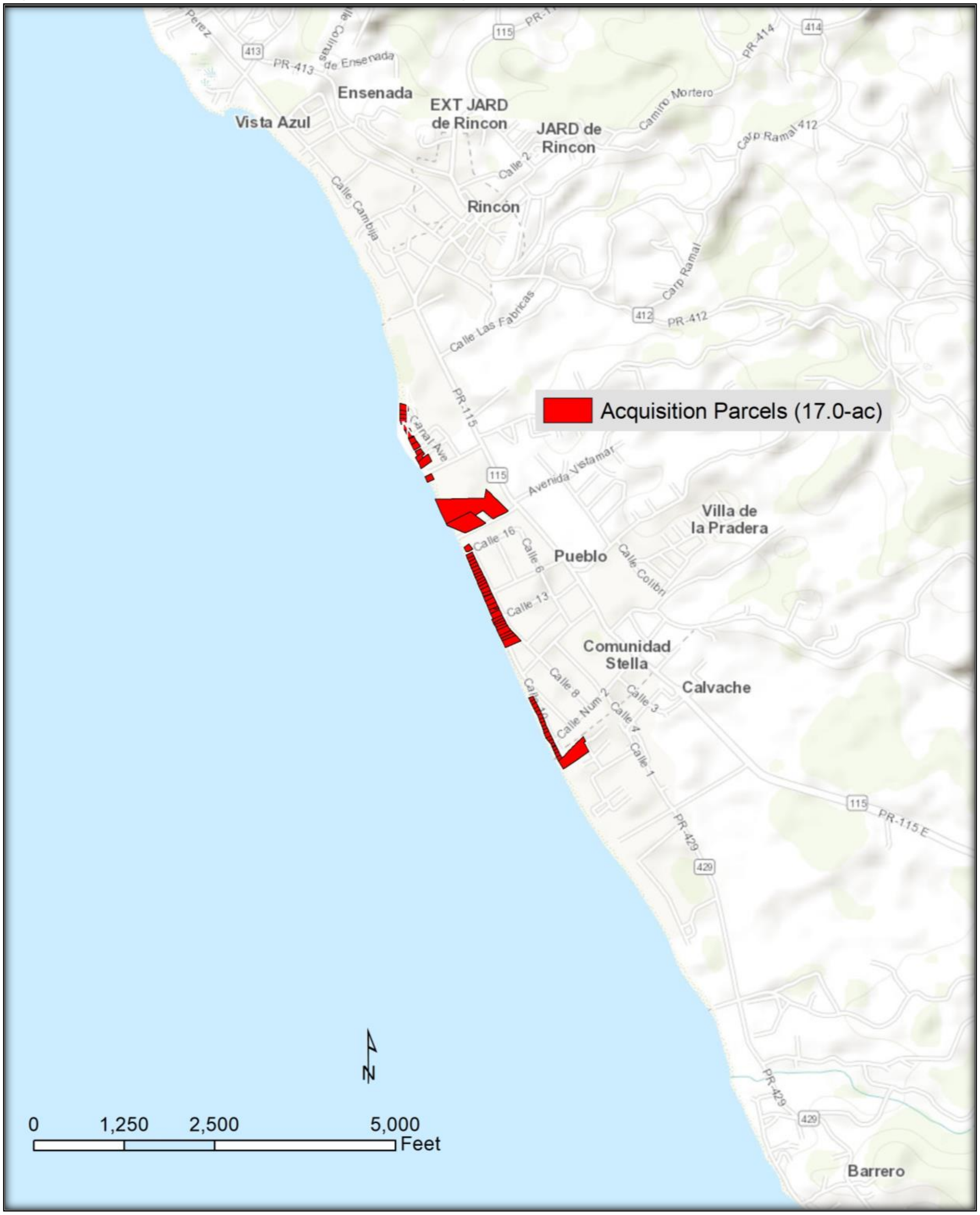


Figure 3: Barbosa Park Sea Wall, Toe Stone & Sand Placement Zone

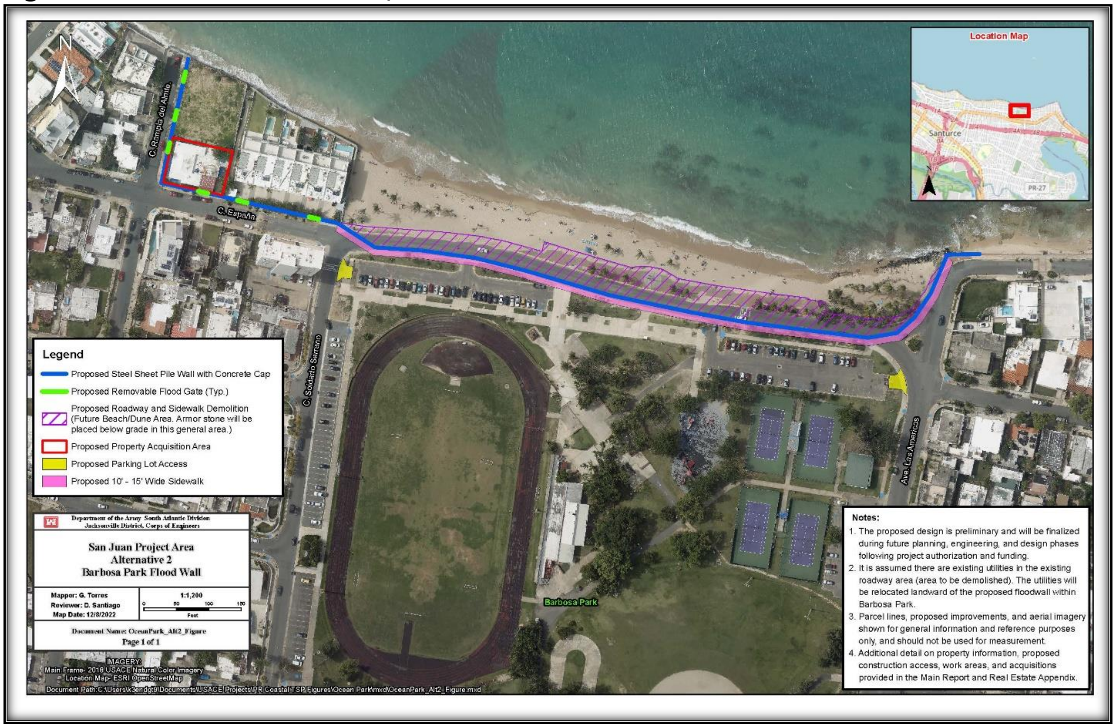


Figure 4: Skate Park Sea Wall, Toe Stone & Marine Mattress Placement Zone

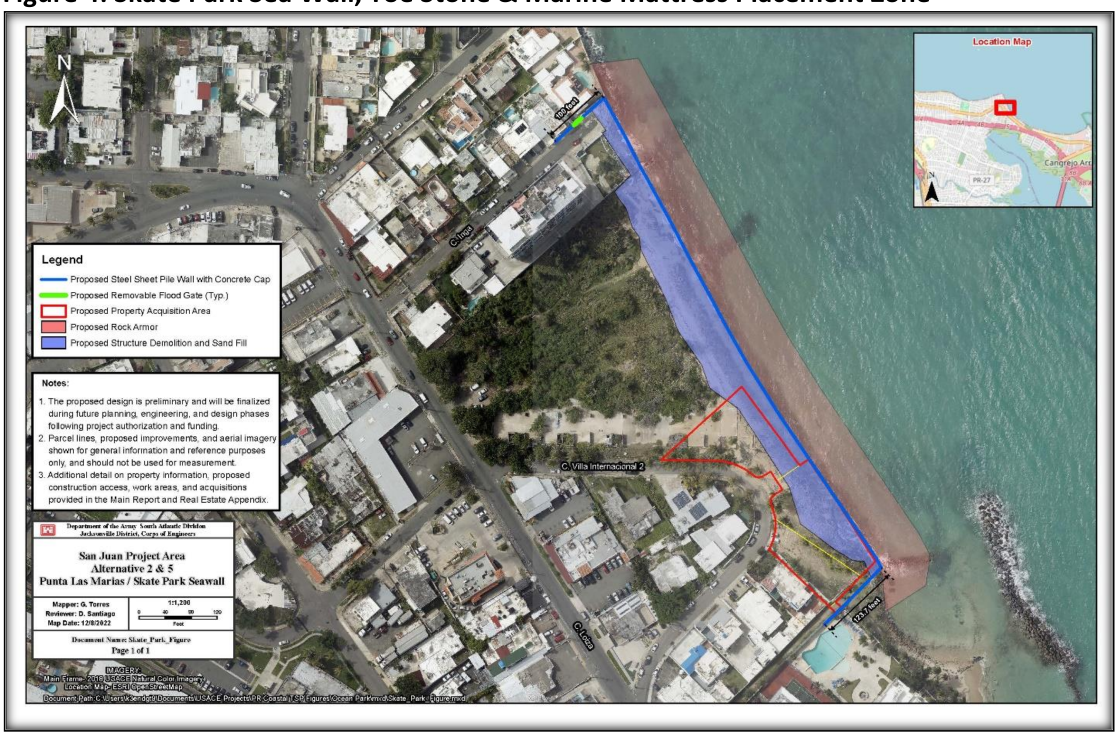


Figure 5: Stella Demolition Zone

Figure 6: Barbosa Park Typical Cross Section of Sea Wall, Toe Stone Protection & Sand Cover

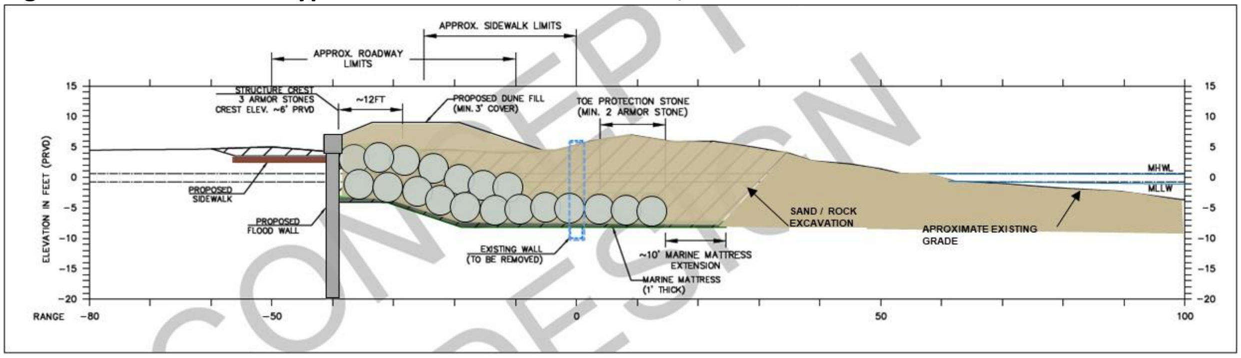


Figure 7: Skate Park Typical Cross Section of Sea Wall, Marine Mattress & Toe Stone

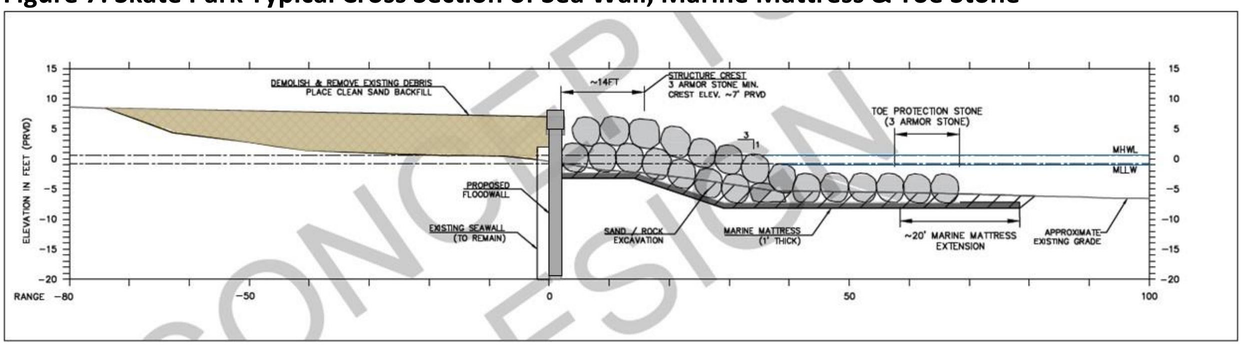


Figure 8: EFH for Species & Life stages of Spiny Lobster, Queen Conch, Reef Fish, & Coral

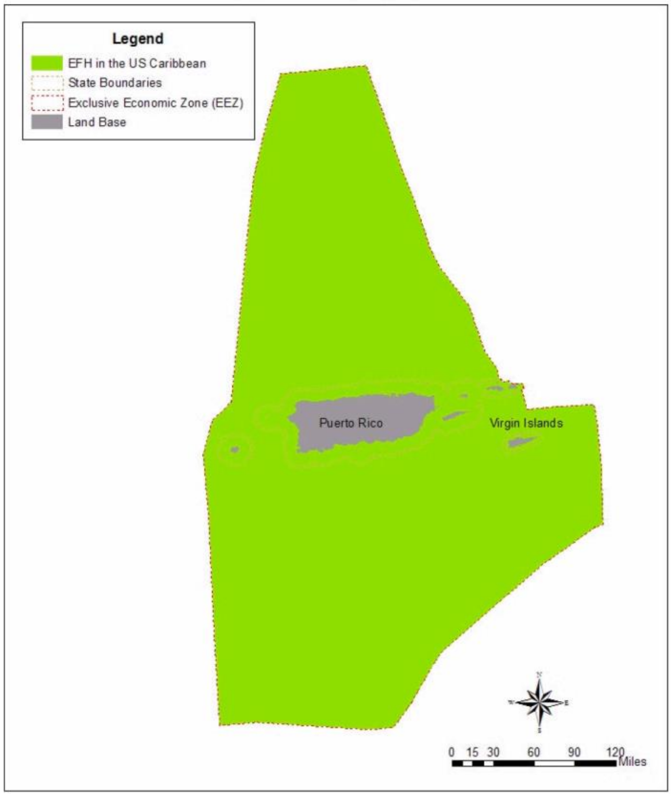


Figure 9: Elkhorn & Staghorn Corals Designated Critical Habitat (DCH)

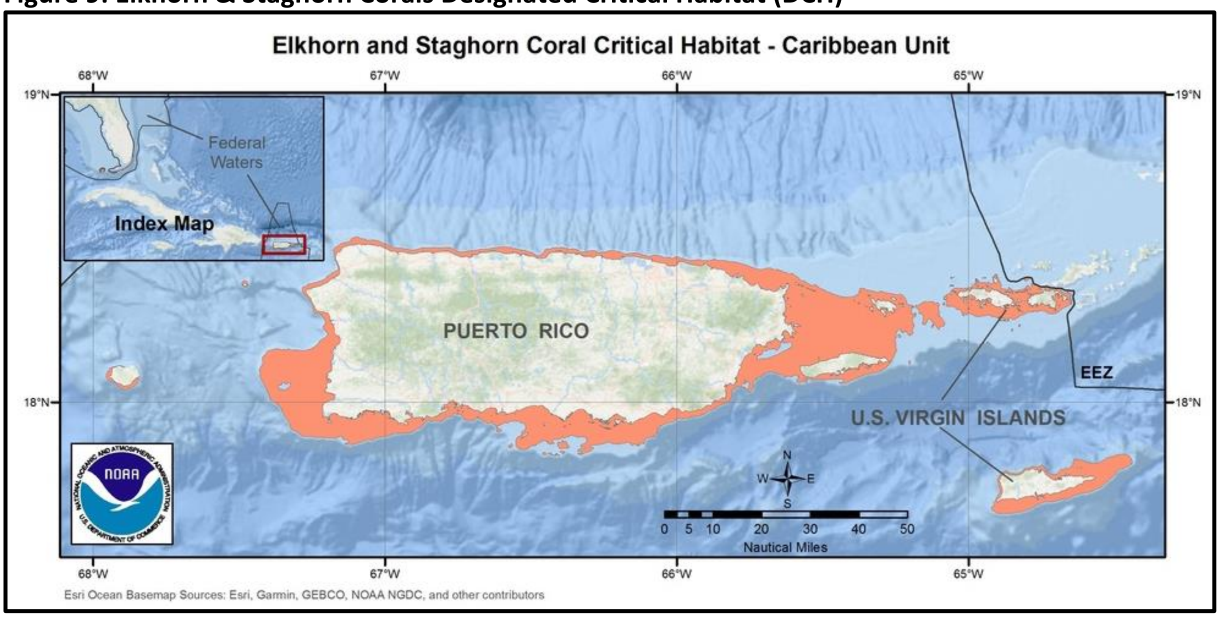


Figure 10: Detailed benthic survey mapping for Ocean Park, San Juan

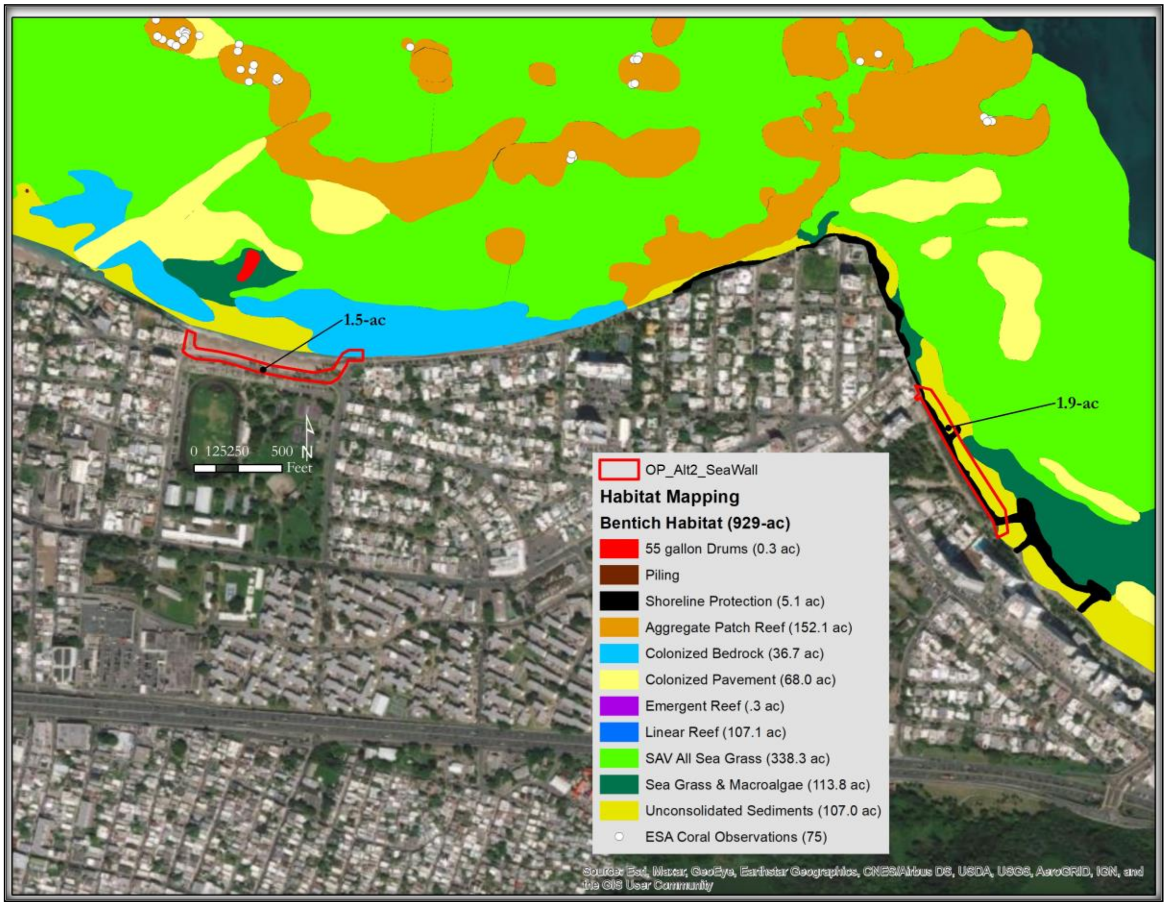
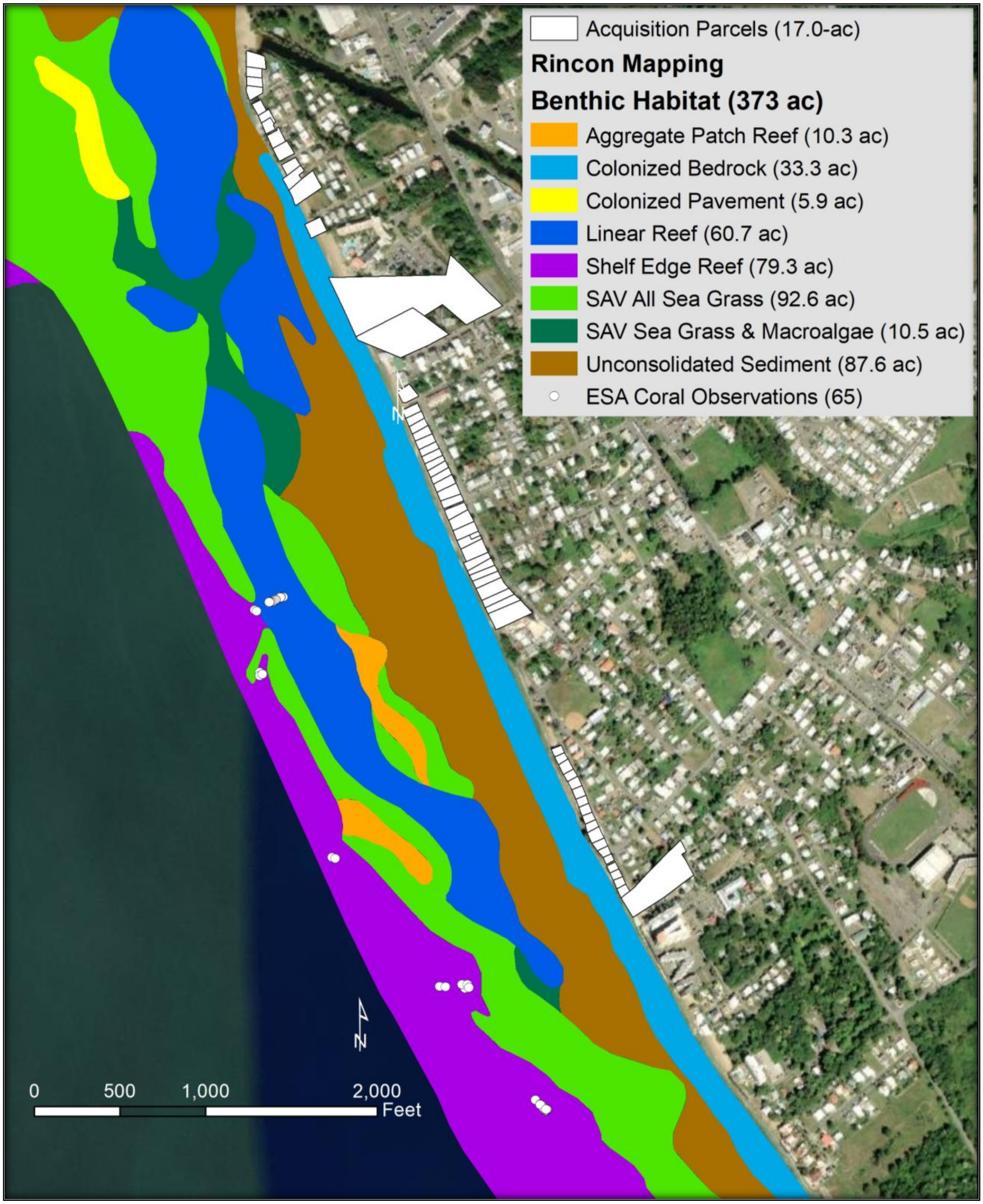


Figure 11: Detailed benthic survey mapping for Stella, Rincón.


Acquisition Parcels (17.0-ac)
Rincon Mapping
Benthic Habitat (373 ac)
Aggregate Patch Reef (10.3 ac)
Colonized Bedrock (33.3 ac)
Colonized Pavement (5.9 ac)
Linear Reef (60.7 ac)
Shelf Edge Reef (79.3 ac)
SAV All Sea Grass (92.6 ac)
SAV Sea Grass & Macroalgae (10.5 ac)
Unconsolidated Sediment (87.6 ac)
ESA Coral Observations (65)
N
0
500
1,000
2,000
Feet

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APPENDIX G – ENVIRONMENTAL

ATTACHMENT 4B – ESSENTIAL FISH HABITAT

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BIOLOGICAL ASSESSMENT FOR EFH & MANAGED SPECIES

INTRODUCTION

The purpose of this Biological Assessment (BA) is to address the anticipated effects of the TSP at Ocean Park, San Juan and Stella, Rincón on Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation & Management Act (P.L. 94-265), as amended by (P.L. 109-479). The U.S. Army Corps of Engineers, Jacksonville District (USACE) is granted authority for this study under Section 204 of the Flood Control Act of 1970 (P.L. 91-611), and funds provided under the Bipartisan Budget Act (BBA) of 2018 (P.L. 115-123).

The TSP would consist of:

- Barbosa Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,600 LF); Nearly all of this feature would be placed on old infrastructure and above Mean High Watermark (MHW). Would be covered with beach quality sand to maintain aesthetics and habitat.
- the Skate Park, Ocean Park, San Juan: Sea Wall and Toe-Stone (1,200 LF); Nearly all of this feature would be placed on old shoreline protection and unconsolidated sediments already affected by old and existing shoreline protection. Landward would be covered with beach quality sand to maintain grade, aesthetics, and habitat.
- Stella, Rincón: Acquiring compromised parcels/structures. Overtime would create about 17-acres of shoreline habitat and recreation space.

DESCRIPTION OF PROPOSED ACTION

The TSP includes structural measures for prevention/reduction of inundation by wave induced floodwaters at Barbosa Park and the Skate Park, Ocean Park (Figure 1); and non-structural measures for the elimination of erosion damages at Stella, Rincón (Figure 2). The overall affected environment for the San Juan, Ocean Park and Stella, Rincon can be reviewed in the Main Report, Chapter 2, and the detailed Benthic Habitat & Species Survey in Appendix G, Attachment 5.

The TSP for Barbosa Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 3 & Figure 6). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction work limits are almost entirely above the MHW. There may be a small square footage of toe stone needed at the ends of the sea wall placed below the MHW. Old stone and materials from defunct infrastructure and shoreline protection would be excavated and properly reused, recycled, or disposed. Toe stone placed above the MHW would be sufficiently covered with sand to maintain beach aesthetics, recreational uses, and nesting sea turtle habitat. Conservation measures and monitoring for Sea Turtles would be specified for Barbosa Park. BMPs to protect water quality and habitat would be utilized during construction.

The construction duration for Barbosa Park is estimated to be approximately 2 to 2.5 years. The work will all be performed utilizing land-based equipment. Notably, a large portion of the work will be performed outside of the beach and in-water areas (upland of the existing seawall and west of Barbosa Park, landward of existing developments). The nearshore work at Barbosa Park is anticipated to be complete within 1 to 1.5 years and near water work will likely target the calmer months between spring and fall.

The TSP for the Skate Park is Alternative 2 Sea Wall, which would effectively stop or reduce upland inundation caused by waves (Figure 3 & Figure 6 and Figure 4 & Figure 7). This alternative had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US. The sea wall alignment and construction zone are within the MHW and below normal water levels. Old stone, sheet piles, wood piles, and materials from defunct infrastructure and shoreline protection may be excavated and properly reused, recycled, or disposed. Most of the material placed would be upon the infrastructure/shoreline protection footprint, with potentially a small square footage on unconsolidated sands. Areas of unconsolidated sands are currently affected by old stone groins/jetties and a breakwater just to the southeast. Void areas created landward of the seawall would be backfilled with clean stone and/or sand materials to maintain aesthetics, recreational uses, and habitat. Conservation measures for Antillean Manatee would be specified for the Skate Park. BMPs to protect water quality and habitat would be utilized during construction.

The construction duration for the Skate Park is estimated to be approximately 1 to 1.5 years. The work will all be performed utilizing land-based equipment. In-water and nearshore work is anticipated to be complete within a year and will likely target the calmer months between spring and fall.

The TSP for the Stella reach of Rincón is Alternative 4 Acquisition, which would effectively stop erosive damage to structures caused by waves (Figure 5 & Figure 6). This alternative not only had the least impact to natural resources and the greatest avoidance/reduction in materials placed into Waters of the US, but also would eventually provide 17-acres of beach habitat and recreation. Demolition would take care by using techniques, sequencing, and appropriate BMPs to avoid demolition debris from falling into Waters of the US. All materials generated from demolishing structures and defunct shoreline protection would be properly reused, recycled, or disposed. Void areas created by the removal of structures would be backfilled with clean/inert recycled materials, stone, and/or sand materials. Final surficial grades above and to the MHW would be sufficiently covered with sand to provide new beach aesthetics, recreational uses, and nesting sea turtle habitat. Sand fill is not anticipated to be placed below the MHW.

Acquisition at Stella could possibly take many years to acquire properties and then subsequently demolish structures and restore the land surface. Duration for demolishing structures would vary on the size, type, and configuration, but would generally take several months once started. The demolition process will likely involve complete removal of the structure (including the subsurface foundation), utilities and coastal armoring (if present) to provide a natural beach area. Following full site demolition, a small quantity of beach-quality fill may be placed on the site and graded to blend in with the adjacent properties and/or shoreline. Additional improvements such as the planting of native vegetation may also be implemented. Of note, the recommended alternative does not include full beach restoration. A small amount of beach-quality fill will be placed within the structure and/or parcel footprint such that the property will naturally blend with adjacent areas and to avoid an initial eroded condition that may result from structure removal. The fill will only be placed within the footprint of the parcel (or structures) and will not extend any further seaward than the existing structure(s). The fill will be graded to represent a natural beach area to avoid potential environmental impacts and mitigation.

General Construction Equipment – Multiple pieces of heavy machinery of the same or different types may be used to expedite work or to accommodate varying conditions within the construction areas. Heavy equipment could include dozers, graders and off-road dump trucks, excavators (land based) would use a bucket-type device to dig and remove/reposition material from/within the construction site and, pile driving equipment (either impact or vibratory) would be required and would be land based.

Essential Fish Habitat

The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation & Management Act are intended to protect those waters and substrates necessary to fish for spawning, breeding, feeding, and growth to maturity. If a proposed action potentially affects EFH, then consultation with NMFS is required. The EFH consultation ensures the potential action considers the effects on important habitats and supports the management of sustainable marine fisheries.

EFH & Management Species Descriptions

In the Caribbean waters under the jurisdiction of the U.S., EFH is identified and described based on areas where the life stages of 17 managed species of fish and marine invertebrates occur (Figure 8). Fifteen of the 17 managed species have been documented in the study area and are listed in Table 1 below.
EFH for this study includes all waters and substrates (coral reef, submerged aquatic vegetation, hard bottom, and unconsolidated sediment) that are necessary for the reproduction, feeding, and growth of marine species.

Table 1: Managed Species Documented in the San Juan & Rincón Study Areas

Species	**Common Name**	**SPAG***	**FMP**
Chaetodon striatus	Banded Butterflyfish		Reef Fish - aquarium trade
Epinephelus guttatus	Red Hind		Reef Fish
Cephalopholis fulva	Coney		Reef Fish
Lutjanus analis	Mutton Snapper	X	Reef Fish
Lutjanus apodus	Schoolmaster	X	Reef Fish
Lutjanus griseus	Gray Snapper		Reef Fish
Ocyurus chrysurus	Yellowtail Snapper	X	Reef Fish
Haemulon plumieri	White Grunt		Reef Fish
Balistes vetula	Queen Triggerfish		Reef Fish
Sparisoma viride	Stoplight Parrotfish	X	Reef Fish
Holocentrus adscensionis	Squirrelfish		Reef Fish
Malacanthus plumieri	Sand Tile Fish		Reef Fish
Panulirus argus	Spiny Lobster		Spiny Lobster
Strombus gigas	Queen Conch		Queen Conch
Cnidarians	All Corals		Coral

Source: Rivera, 2015; CSA Architects & Engineers, 2014; ERM, 2013; Glauco A. Rivera & Associates, 2011. *SPAG: Potential Spawning Aggregation site in San Juan Bay (Ojeda et. al. 2007).

Per the Fishery Management Plan (FMP) for each of the four groups below, EFH is defined as (Caribbean Fisheries Management Council (CFMC) and NOAA 2004):

Spiny Lobster FMP: EFH in the U.S. Caribbean consists of all waters from MHW to the outer boundary of the EEZ- habitats used by phyllosoma larvae and seagrass, benthic algae, mangrove, coral, and live/hard bottom substrates from MHW to 100 fathoms depth used by other life stages.

Queen Conch FMP: EFH in the U.S. Caribbean consists of all waters from MHW to the outer boundary of the EEZ – habitats used by eggs and larvae and seagrass, benthic algae, coral, live/hard bottom and sand/shell substrates from MHW to 100 fathoms depth used by other life stages.

Reef Fish FMP: EFH in the U.S. Caribbean consists of all waters from MHW to the outer boundary of the EEZ – habitats used by eggs and larvae and all substrates from MHW to 100 fathoms depth used by other life stages.

Coral FMP: EFH in the U.S. Caribbean consists of all waters from mean low water (MLW) to the outer boundary of the EEZ – habitats used by larvae and coral and hard bottom substrates from MLW to 100 fathoms depth – used by other life *s*tages.

EFH Survey Results

To perform an effects determination for EFH, a solid basis in the spatial extent and quality of study area habitats and species is required. A team of marine scientists composed of qualified coral biologists and benthic ecologists experienced with coastal habitats occurring throughout Puerto Rico conducted *in situ* identifications of submerged resources (see Appendix G, Attachment 5). SAV and hardbottom habitat, ESA corals, and other important marine resources were delineated, mapped, and assessed within the San Juan (Figure 10) and Rincón (Figure 11) study areas. The benthic resource surveys were conducted during three separate field efforts occurring from 17 July to 9 October 2022.

Surveyed habitats likely support a high fish species richness and abundance because they provide diverse spawning substrates, food, and refuge (Photo 1). Mapped EFH within the San Juan study area includes aggregate patch reef (152 acres), colonized bedrock (37 acres), colonize pavement (68 acres), emergent reef (0.3 acres), linear reef (107 acres), submerged aquatic vegetation (338 acres), submerged aquatic vegetation mixed with macroalgae (114 acres), and unconsolidated sediment (107 acres) (Figure 10). Mapped EFH within the Rincón study area includes aggregate patch reef (10 acres), colonized bedrock (33 acres), colonize pavement (6 acres), linear reef (61 acres), shelf edge reef (79 acres), submerged aquatic vegetation (93 acres), submerged aquatic vegetation mixed with macroalgae (11 acres), and unconsolidated sediment (88 acres) (Figure 11). Many of these habitats are integral to producing healthy populations of commercially and recreationally important species.

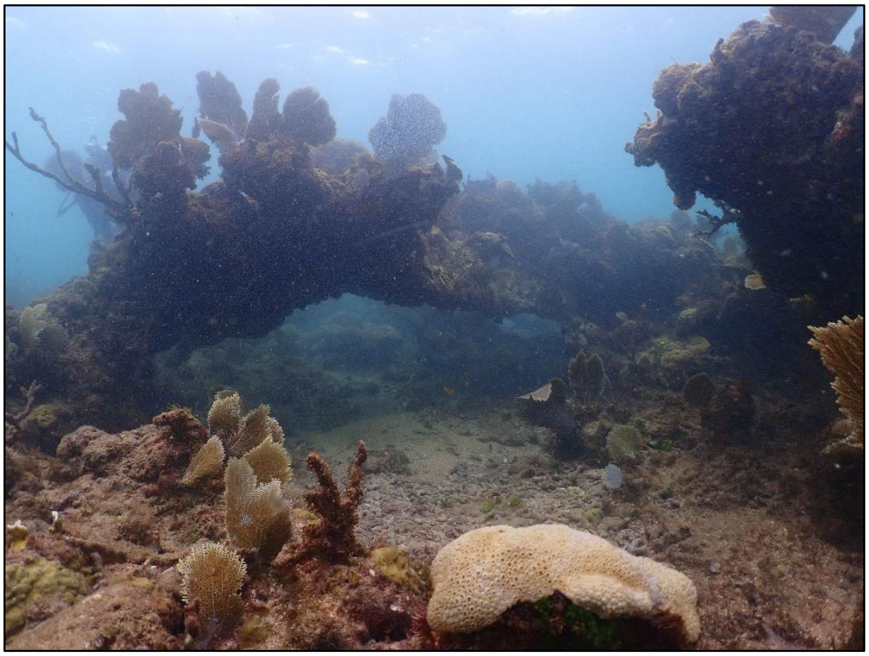


Photo 1: Complex Geomorphology of Aggregate Patch Reef Colonized by *Gorgonia* spp., San Juan

Different life history stages of fishery, ornamental, and other reef and reef-associated fish species inhabit the linear coral reef and backreef zones of the study area. A rich assemblage comprised by more than 60 species of coral reef fishes and commercially important shellfish, including Spiny Lobster (*Panulirus argus*) and Queen Conch (*Strombus gigas*) have been reported to inhabit these reef systems (García-Sais et al., 2005 a, b; 2013). Specific fish surveys were not conducted during benthic surveys, but some species were photographed and noted as present including the Caribbean Spiny Lobster (Photo 2), Squirrel Fish (Photo 3), and Peacock Flounder (Photo 4).

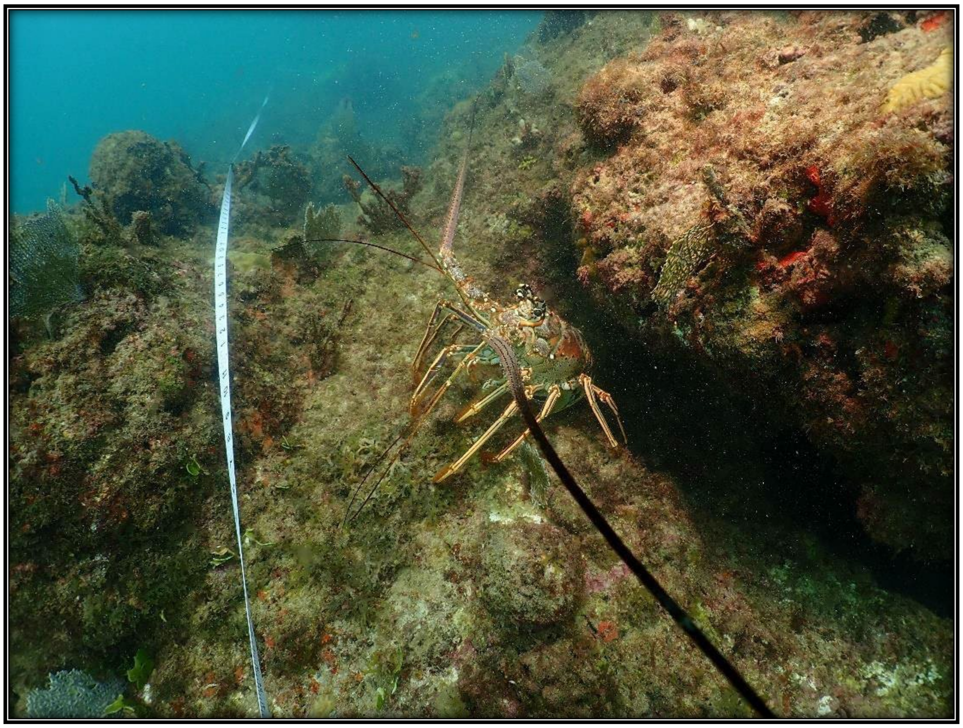


Photo 2: A Caribbean Spiny Lobster (*Panulirus argus*) Observed on Aggregate Patch Reef, San Juan

Photo 3: A Squirrel Fish (*Holocentrus adscensionis*) on Aggregate Patch Reef, San Juan

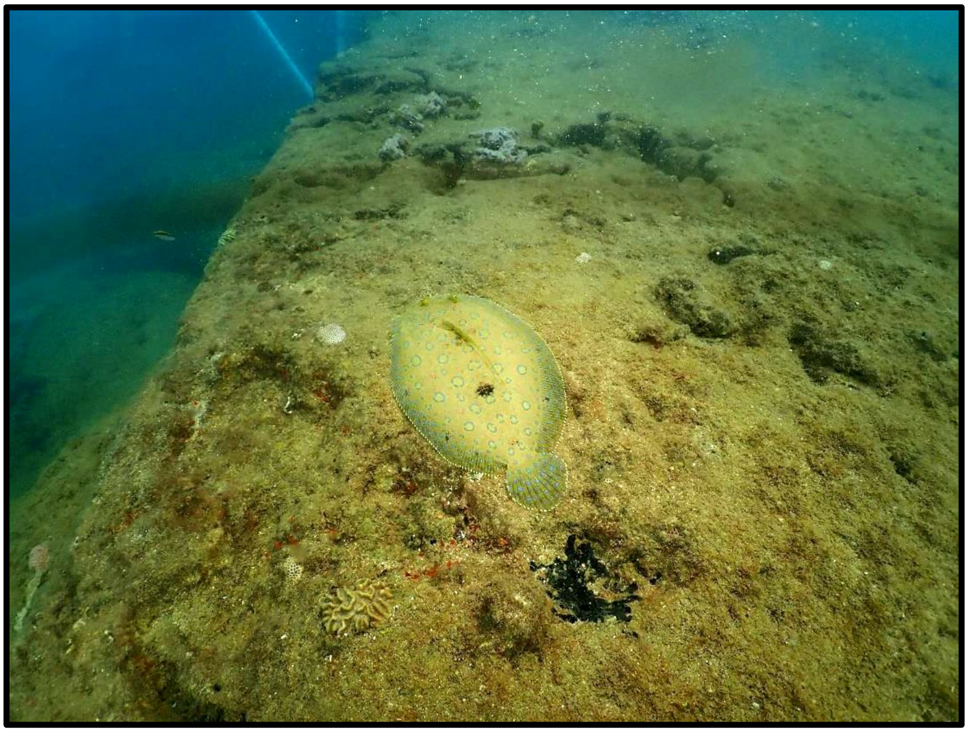


Photo 4: A Peacock Flounder (*Bothus lunatus*) Observed on Colonized Bedrock, Rincón

EFH & Species Effects Determination

The USACE has determined that there would be **no effect** to EFH for Barbosa Park and the Skate Park, Ocean Park and Stella, Rincón. This is based on the alternatives primarily being upland, placed on old infrastructure/shoreline protection, or in unconsolidated sediments. Detailed mapping and surveys conducted in 2022 show that both study areas are highly diverse in EFH habitat and species. This same mapping shows that the TSP does not overlap with these essential fish habitats or would not cause disturbance to managed species.

CONCLUSIONS

In summary, due to the avoidance of directly impacting natural habitats that are classified as EFH, and the inclusion of Best Management Practices and Protection Measures for In-Water Work the Corps has determined that the TSP would have **no effect** to EFH. Best management practices to protect water quality and habitat would be utilized during construction at Ocean Park and Stella. The TSP for Stella would provide 17 acres of naturalized shoreline.

FIGURES OF THE TSP

Figure 1: Puerto Rico Coastal Storm Risk Management, San Juan area, 1:20,000 scale topographic map.

Figure 2: Puerto Rico Coastal Storm Risk Management, Rincón area, 1:20,000 scale topographic map.

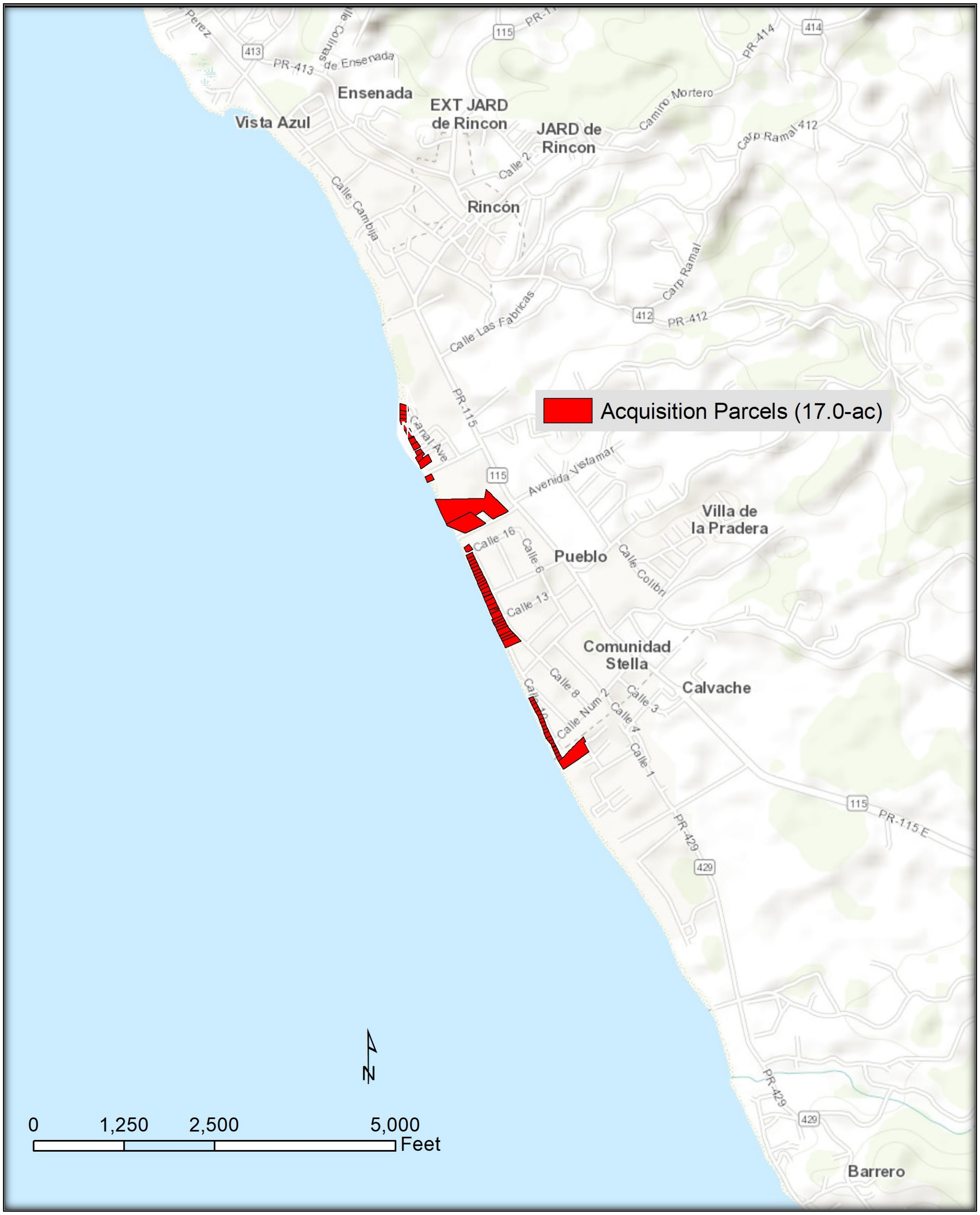

Acquisition Parcels (17.0-ac)
Ensenada
Vista Azul
EXT JARD de Rincon
JARD de Rincon
Rincón
Villa de la Pradera
Pueblo
Comunidad Stella
Calvache
Barrero
PR-413
PR-414
PR-412
PR-115
PR-115 E
PR-429
Calle Cambija
Calle Las Fabricas
Canal Ave
Avenida Vistamar
Calle 16
Calle 6
Calle 13
Calle Colibri
Calle 8
Calle Num 2
Calle 3
Calle 4
Calle 1
Camino Mortero
Carp Ramal
Calle 2
0
1,250
2,500
5,000
Feet
N

Figure 3: Barbosa Park Sea Wall, Toe Stone & Sand Placement Zone

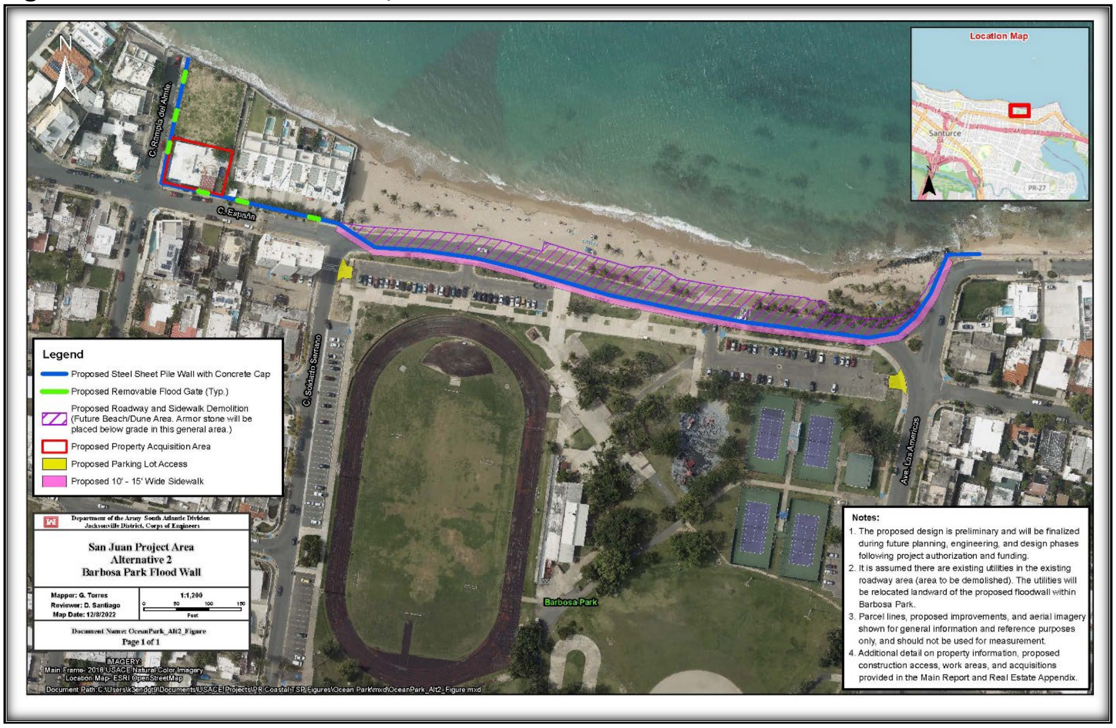


Figure 4: Skate Park Sea Wall, Toe Stone & Marine Mattress Placement Zone

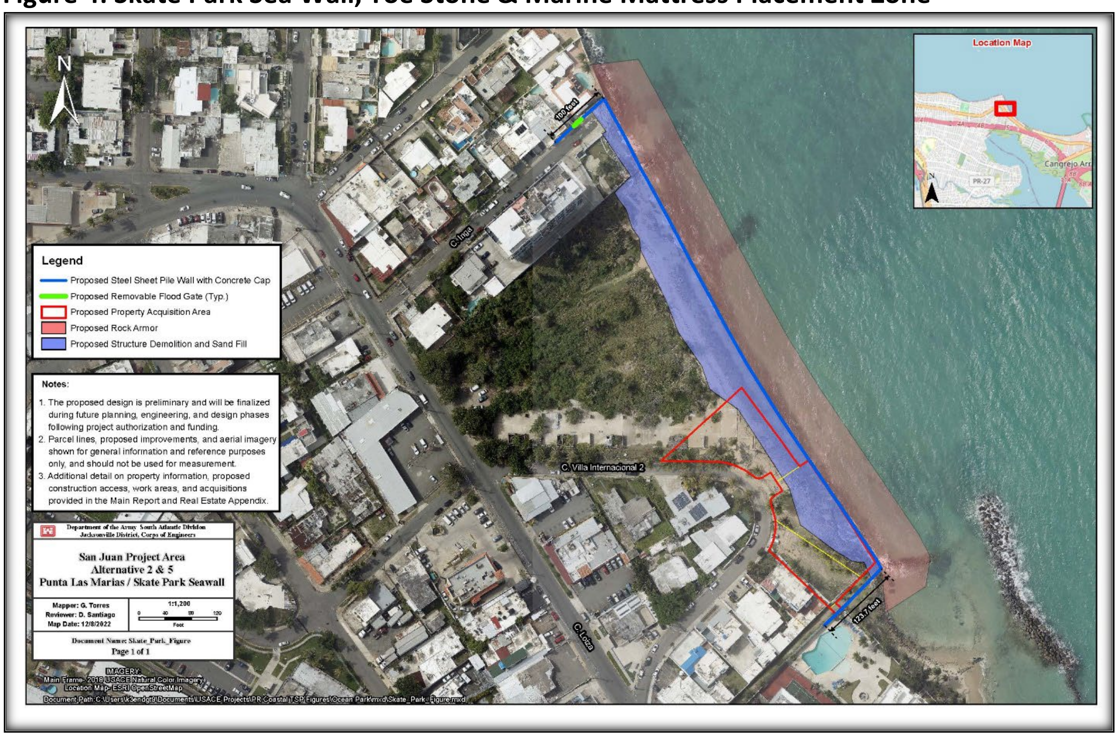


Figure 5: Stella Demolition Zone

Figure 6: Barbosa Park Typical Cross Section of Sea Wall, Toe Stone Protection & Sand Cover

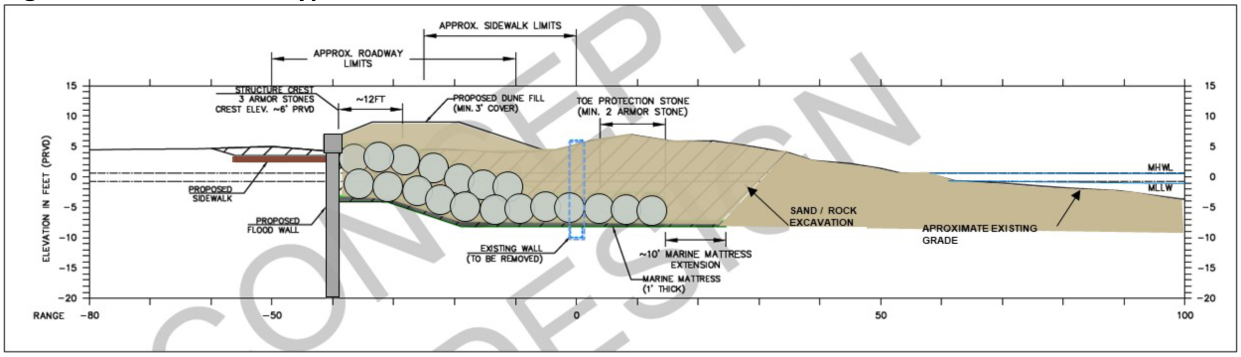


Figure 7: Skate Park Typical Cross Section of Sea Wall, Marine Mattress & Toe Stone

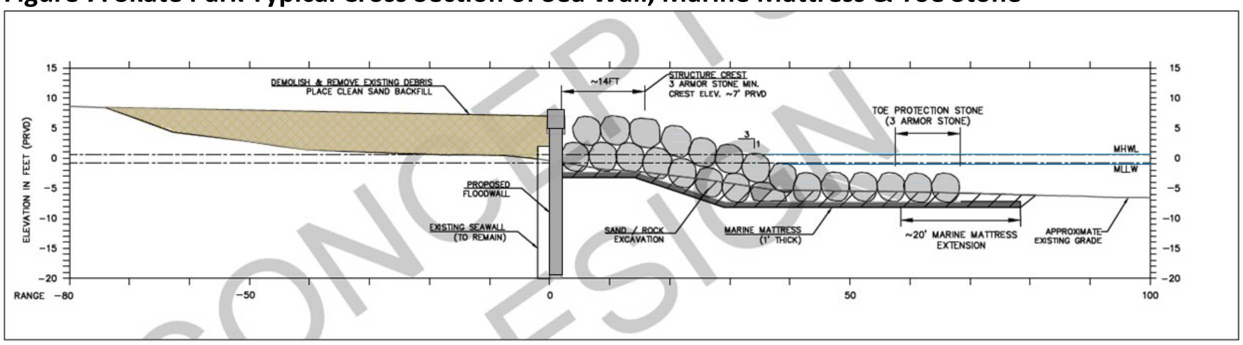


Figure 8: EFH for Species & Life stages of Spiny Lobster, Queen Conch, Reef Fish, & Coral

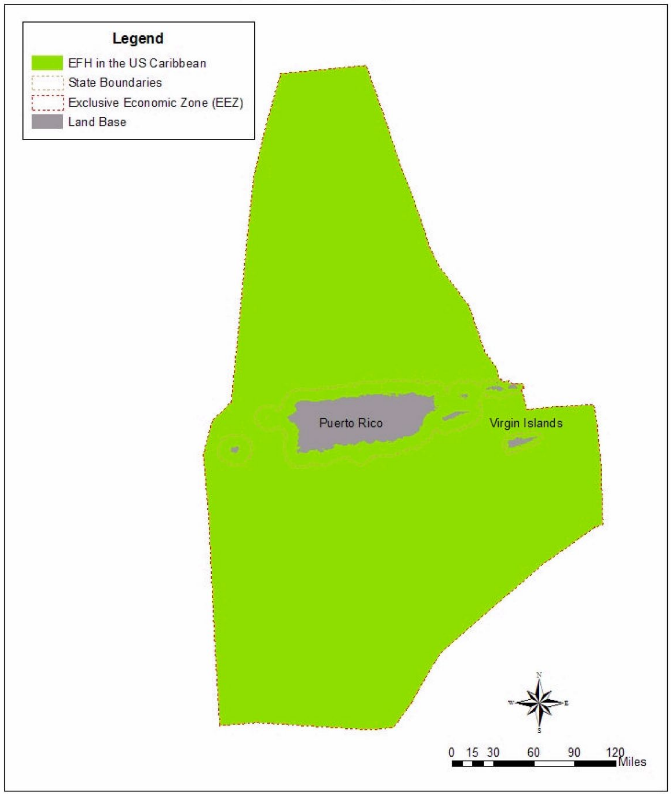


Figure 9: Elkhorn & Staghorn Corals Designated Critical Habitat (DCH)

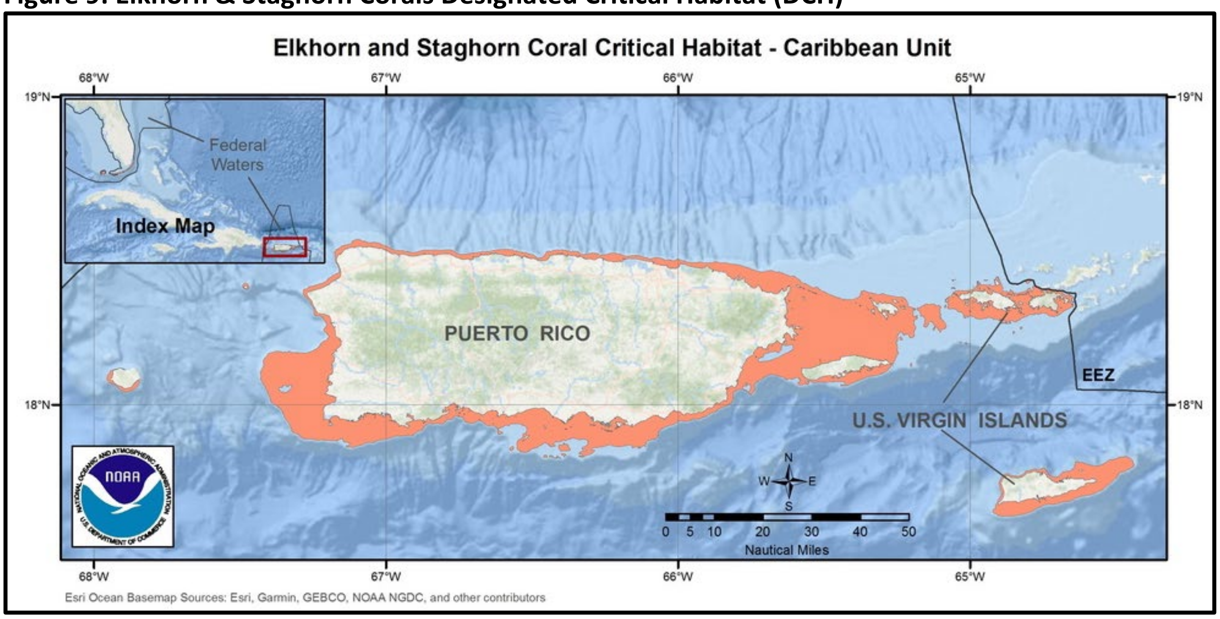


Figure 10: Detailed benthic survey mapping for Ocean Park, San Juan

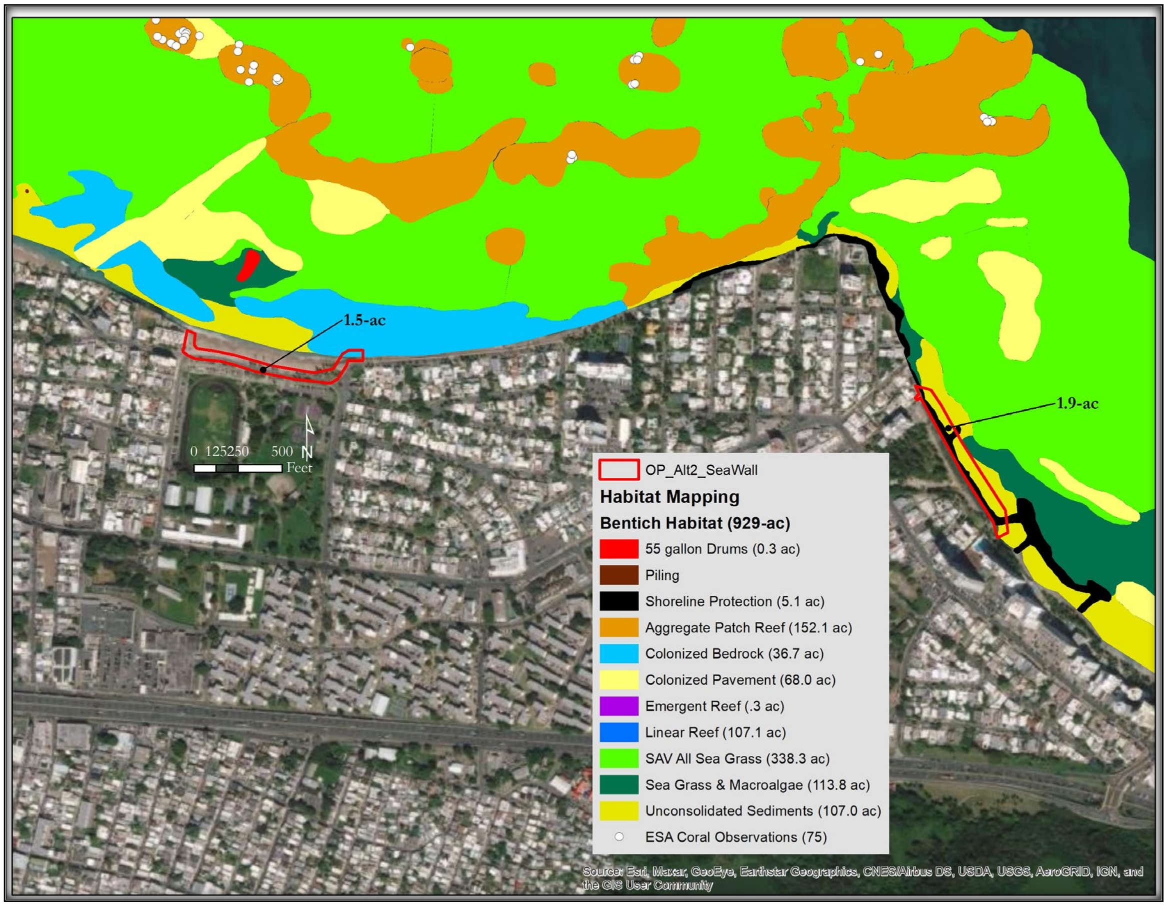
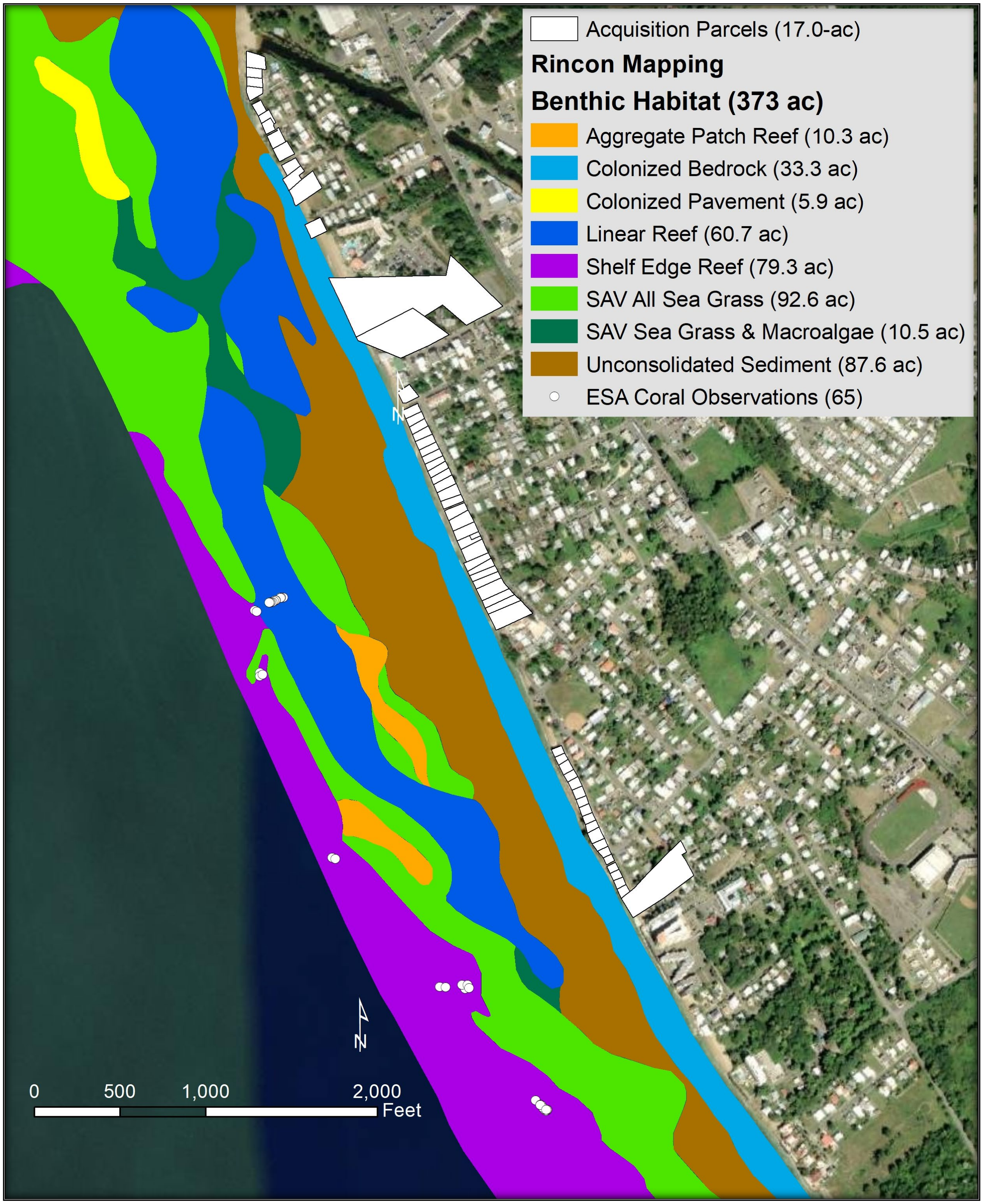


Figure 11: Detailed benthic survey mapping for Stella, Rincón.



Acquisition Parcels (17.0-ac)
Rincon Mapping
Benthic Habitat (373 ac)
Aggregate Patch Reef (10.3 ac)
Colonized Bedrock (33.3 ac)
Colonized Pavement (5.9 ac)
Linear Reef (60.7 ac)
Shelf Edge Reef (79.3 ac)
SAV All Sea Grass (92.6 ac)
SAV Sea Grass & Macroalgae (10.5 ac)
Unconsolidated Sediment (87.6 ac)
ESA Coral Observations (65)
N
0
500
1,000
2,000
Feet

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APPENDIX G – ENVIRONMENTAL

ATTACHMENT 5 – BENTHIC RESOURCES SURVEY

SUBMERGED AQUATIC VEGETATION AND BENTHIC RESOURCE SURVEY RINCÓN AND SAN JUAN, PUERTO RICO

FINAL

USACE Project Number W912EP22F0060 31 January 2023

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1.0 INTRODUCTION

On behalf of the United States Army Corp of Engineers (USACE), LG2 Environmental Solutions, Inc. (LG2) and Pinnacle Ecological, Inc. (Pinnacle) are pleased to submit the following benthic resource survey report. The report provides a summary of methods and results associated with the benthic resource surveys conducted at survey areas located offshore Rincón and San Juan, Puerto Rico (**Figure 1**). The benthic resource surveys were performed in support of the Puerto Rico Coastal Storm Risk Management (CSRM) feasibility study. The coastal areas of both Rincón and San Juan are densely populated and at risk of storm-induced flooding and erosion. In an effort to protect coastal residents, their property and infrastructure, the CSRM has proposed several options for protecting vulnerable communities and infrastructure against storm-induced shoreline erosion and coastal flooding. In addition to determining the economic justification, another goal of the CSRM feasibility study is to identify potential environmental concerns and alternatives to avoid and/or minimize impacts associated with construction of shoreline protection structures. The objectives of the benthic resource surveys included collection of data necessary for the National Marine Fisheries Service (NMFS) to complete consultation and prepare an updated Biological Opinion (BO), provide additional information for preparing the Environmental Assessment and related permit documentation, and for calculating functional habitat models. Survey activities included: delineation and mapping of benthic habitats including submerged aquatic vegetation (SAV), hardbottom habitat, and other essential fish habitat (EFH); and identifying and documenting the location of biota listed as threatened and/or endangered under the Endangered Species Act (ESA). Additionally, data was collected to quantify biotic cover in both seagrass and hardbottom habitats delineated during resource mapping.

The team of marine scientists that performed the surveys included highly qualified coral biologists and benthic ecologists experienced with the physical and biological components commonly associated with coastal habitats occurring throughout Puerto Rico. Marine scientists conducted *in situ* identifications of submerged resources, as well as delineated and mapped SAV and hardbottom habitat, ESA corals, and other important marine resources occurring throughout each of the survey areas. The benthic resource surveys were conducted during three separate field efforts occurring from 17 July to 9 October 2022. The following report provides a summary of survey methods, results, and a discussion of quantitative data and qualitative observations collected during the benthic resource survey. Representative photos of the benthic resource surveys conducted in Rincón and San Juan, Puerto Rico have been provided in **ATTACHMENTS A** and **B**, respectively.

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Table 1. List of acronyms and their definitions presented in the benthic resource survey report.

Acronym	Definition
BEAMR	Benthic Ecological Assessment for Marginal Reefs
CSRM	Coastal Storm Risk Management
DGPS	Differential and/or WAAS capable Global Positioning System
DNER	Department of Natural and Environmental Resources
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FDEP	Florida Department of Environmental Protection
HD	High Definition
HOPC	Habitat of Particular Concern
LG2	LG2 Environmental Solutions, Inc.
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NED	National Economic Development
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Pinnacle	Pinnacle Ecological, Inc.
PRCCC	Puerto Rico Climate Change Council
PVR	Preliminary Visual Reconnaissance
PWS	Performance Work Statement
QA/QC	Quality assurance and quality control
SAV	Submerged Aquatic Vegetation
TSP	Tentatively Selected Plan
USACE	United States Army Corp of Engineers

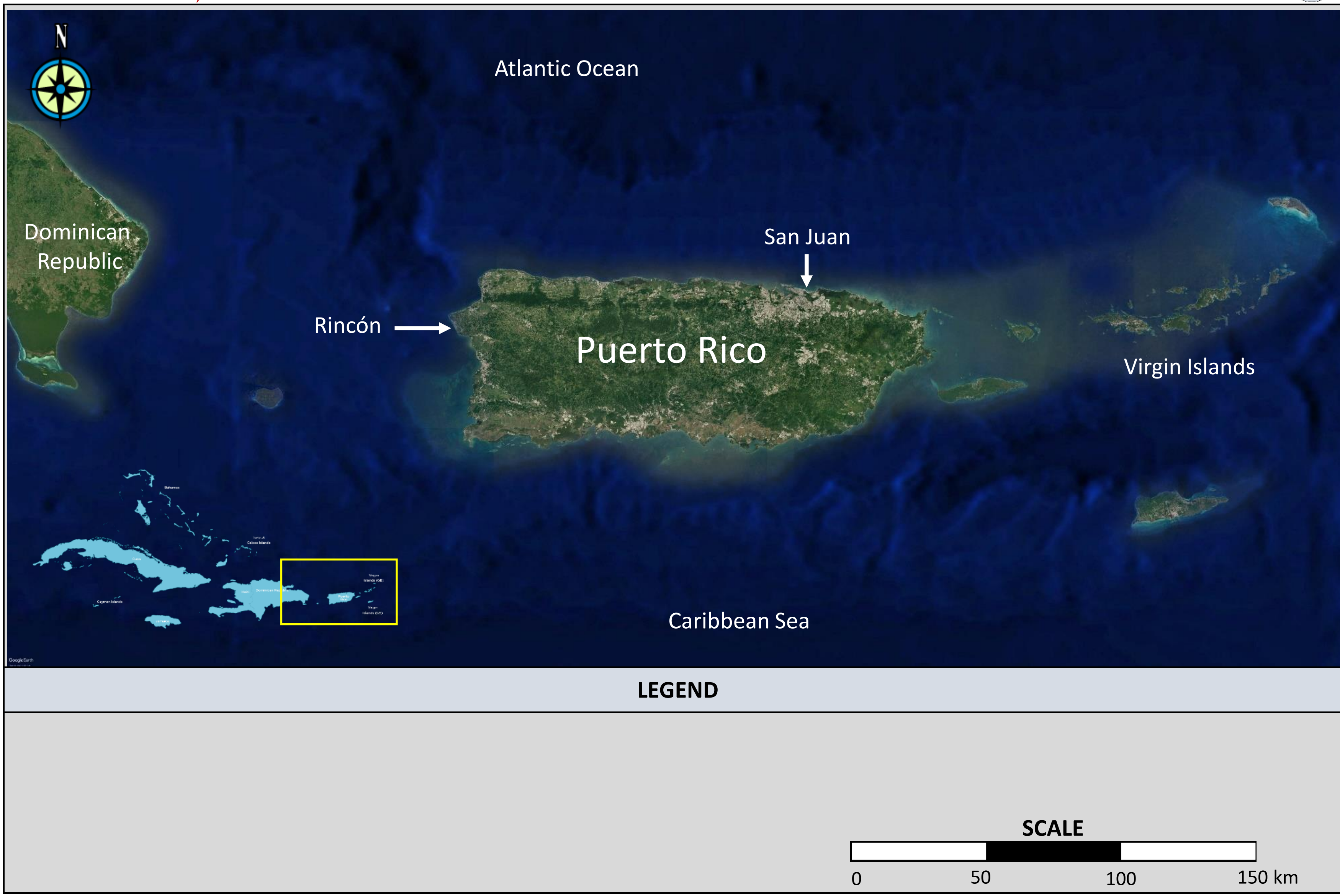


Figure 1. A map showing the survey area locations near Rincón and San Juan, Puerto Rico. Image credit: Google Earth, 2022

2.0 BACKGROUND

2.1 Puerto Rico Geography

As part of the Greater Antilles archipelago, Puerto Rico is located east of the Dominican Republic and west of the U.S. Virgin Islands. Composed of 143 islands, Puerto Rico has approximately 800 miles of shoreline bordering the Atlantic Ocean to the north and the Caribbean Sea to the south. As is typical on many Caribbean Islands, Puerto Rico can be impacted by frequent winter storms as well as tropical storms and hurricanes. Additionally, Puerto Rico faces numerous coastal management challenges, including, but not limited to: increasing development pressures, land-based sources of pollution, water quality concerns, wetlands and coral reef degradation, dune systems alteration, beach erosion and coastal hazards, excessive fishing pressure, global warming and ocean acidification, climate-based sea level rise, and increased tropical storm activity (Rogers and Ramos-Scharrón, 2022; Takesue et al., 2021; Norat-Ramírez et al., 2019; Bainbridge et al., 2018; and Bonkosky et al., 2008). The National Oceanic and Atmospheric Administration (NOAA) (2022) reports that average annual temperatures in Puerto Rico have increased nearly 2°F since 1950 and sea level has risen by 0.7 inches per decade since 1961. Historically unprecedented warming is projected during this century and is expected to increase precipitation with associated increases in the intensity and frequency of storm events and coastal flooding (NOAA, 2022).

2.2 CSRM Feasibility Study

Hurricanes and coastal storms are responsible for significant damages to coastal properties and infrastructure throughout the island of Puerto Rico. Storm events like Hurricane Maria (2017) threaten private and public property and critical infrastructure. Upon request from the Puerto Rico Department of Natural and Environmental Resources (DNER), the USACE decided to undertake the CSRM study as a partial response to Section 204 of the Flood Control Act of 1970, Public Law 91-611.Tittle IV, Subdivision B of the Bipartisan Budget Act of 2018, P.L. 115-123. The USACE implemented a planning strategy to identify the National Economic Development (NED) plan for potential construction of shore protection structures along select coastal areas in Puerto Rico. The USACE devised a Tentatively Selected Plan (TSP) which identified study areas along coastal municipalities where critical infrastructure and services were concentrated and most susceptible to storm-induced wave energy, flooding, and shoreline erosion (Diaz, 2012). Two areas identified by the TSP included 3.9 kilometers (2.4 miles) of coastline in Rincón and 11.3 kilometers (7.0 miles) of coastline in San Juan. The TSP recommended possible implementation of a combination of several shoreline structure protection features for each study area including beach nourishment, stone revetment, and breakwaters.

In support of the National Environmental Policy Act (NEPA) of 1969, the CSRM feasibility study will consider all engineering alternatives and their environmental effects. Furthermore, the NMFS will complete an updated BO and functional habitat models will be developed based on results of the benthic resource surveys presented in this report.

2.3 Natural Resources

The benthic resource surveys presented in this report have identified extensive coral reef and SAV resources in the survey areas (Pinnacle, 2022a, 2022b). Coral reef and SAV communities play an important role in the marine ecosystems of Puerto Rico, as they provide essential habitats supporting diverse assemblages of recreational and commercially important fishes and invertebrates as well as ESA-listed species. Particularly sensitive to environmental changes, these ecosystems are routinely influenced by natural and anthropogenic activities. Coral declines due to localized environmental stressors such as reduced water quality, seasonal temperature variation, and sedimentation have been exacerbated by the increasing threat of regional and global stressors such as increased nutrient loads, disease, climate change, and ocean acidification. As a result, protection of coral resources has increased in recent years. In 2006, the NMFS listed staghorn coral (*Acropora cervicornis*) and elkhorn coral (*Acropora palmata*) as threatened under the ESA. In 2009, the Center for Biological Diversity petitioned the NMFS to list an additional 83 coral species as threatened or endangered under the ESA (Brainard et al., 2011). Most (75) of the petitioned corals were Pacific species while the remaining eight (8) corals were Caribbean species, many of which are known to occur in coastal waters surrounding Puerto Rico (Pinnacle, 2022a, 2022b; Hernández Delgado, 2010). Corals included in the petition were selected based on a predicted decline in available habitat for the species, primarily due to various stress factors resulting from anthropogenic climate change, ocean acidification, coastal development, and water quality degradation (i.e., stormwater run-off, nutrients, and pesticides) (Brainard et al., 2011; Bonkosky et al., 2008). In 2012, five (5) additional species of Caribbean coral were listed as threatened by NMFS: pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). Three (3) Caribbean species (*Agaricia lamarcki*, *Oculina vericosa*, and *Dichocoenia stokesii*) were excluded from consideration and/or not listed as threatened because they did not meet the Critical Risk Threshold (CRT). Of the seven (7) Caribbean corals listed as threatened under the ESA, all have been observed in coastal waters surrounding Puerto Rico (Pinnacle, 2022a, 2022b; Hernández Delgado, 2010). Corals have also been designated as Habitat of Particular Concern (HOPC), which are resources regulated and protected under 305(b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

SAV resources, particularly seagrasses, are also of high ecological and economic importance. Not only do they provide essential habitat to diverse assemblages of recreational and commercially important fishes and invertebrates, but they also serve as a habitat and food source for the West Indian-Antillean manatee (*Trichechus manatus manatus),* which is federally listed as a threatened species under the ESA and is known to frequently occur in coastal areas of Puerto Rico. The range of seagrass growth is limited by light availability, and typically occurs in water less than 10-15 meters (32.8-49.2) feet in depth (Zieman, 1982). Seagrasses are sensitive to environmental disturbances such as decreases in light availability and dredging of sandy and muddy bottoms (Fourqurean et al., 2001). Their susceptibility to impacts resulting from degraded water quality conditions and anthropogenic activities (i.e., coastal development, unpaved roads, dredging, and vessel groundings) has led to regulations that protect seagrass habitat in addition to coral habitat. Numerous species of seagrasses have previously been observed and documented in vicinity of the Rincón and San Juan survey areas, including shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), turtle grass (*Thalassia testudinum*), paddle grass (*Halophila decipiens*), star grass (*Halophila engelmannii*), and an invasive species Arabian seagrass (*Halophila stipulacea*) (Pinnacle 2022a).

The benthic resource surveys presented in this report have also identified and delineated resources as EFH within the project area. The MSFCMA defines EFH as “waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” This includes substrate such as specific sediments, hardbottom, submerged structures, and associated biological communities (NMFS, 1999). Conservation of EFH is essential to support local fish populations that utilize these areas throughout their life history.

3.0 METHODS

The Performance Work Statement (PWS) from USACE (contract Number: W912EP22F0060) detailed two main service tasks: Task 1 – Field Investigations and Task 2 – Reporting. Task 1 – Field Investigations included the following sub-tasks: A, Side-scan Sonar; B, Biological Survey Design; C, Preliminary Visual Reconnaissance (PVR); D, Quantification of SAV resources; E, Hardbottom Biological Coverage Data Collection; and F, ESA Corals. LG2 and Pinnacle scientists followed the guidelines and recommendations set forth by the PWS (USACE) and NMFS (NMFS, 2011; Karazsia, 2010; NMFS, 2002; and NMFS, 1998) for SAV studies and benthic resource surveys. Quality assurance and quality control (QA/QC) measures were implemented to maximize scientific integrity and quality of data collection. The team of marine scientists that performed the surveys included highly qualified coral biologists and benthic ecologists experienced with the physical and biological components commonly associated with coastal habitats occurring throughout Puerto Rico. LG2 and Pinnacle marine scientists are scientific divers following standards of the American Academy of Underwater Sciences (AAUS) and have a high level of proficiency and extensive experience conducting *in situ* identifications of submerged resources, as well as delineating and mapping SAV and hardbottom habitat. Benthic resource data collected during the survey was reviewed by senior scientists to assess quality and ensure data are within expectations specific to regional habitat community structure. The benthic resource surveys were conducted during three separate field efforts occurring from 17 July to 9 October 2022 (**Table 2**).

Table 2. Date range of each field effort to complete the benthic resource surveys.

Field Efforts	Date Range	Total Number of Field Days	Survey Area
1	17 to 24 July 2022	8	Rincón
2	26 August to 7 September 2022	13	Rincón (5)/San Juan (8)
3	2 to 9 October 2022	8	San Juan

Species of special concern including seagrasses, ESA listed corals, dolphins, manatee, sea turtles, and grouper were noted when observed during all survey phases. Scientists collected High Definition (HD) quality underwater photographs and video to adequately represent habitats and associated resources observed during the benthic resource survey. Photographic and video data have been cataloged by survey area and data collection task (i.e., mapping, SAV quantification, and hardbottom data) for an efficient method of indexing. Over 20,000 digital media files collected during the benthic resource survey have been saved to an external hard drive and submitted separately to USACE. Additionally, copies of all field data sheets were saved to the external hard drive and submitted separately to USACE.

When possible, Scientists attempted to maximize good water quality conditions during favorable tidal cycles and periods of reduced vessel traffic throughout in-water survey activities. Due to variable underwater visibility conditions, in-water survey activities were conducted by scientific divers using a self-contained underwater breathing apparatus (SCUBA). When scientists encountered conditions that were unsafe or that would impact the quality of data collected, data collection was postponed until conditions improved.

3.1 Side-Scan Sonar Survey

A side-scan sonar survey was completed prior to initiating the benthic resource survey. The equipment used during the survey included a dual frequency Edgetech 4125 side-scan sonar equipped with Full

Spectrum CHIRP technology. During survey operations, the side-scan sonar was set at 600/1600 kHz with 50-meter range per channel to maximize 100% overlapping coverage between survey lines. Side-scan sonar data was collected with the sensor positioned above the seafloor at a height 10 to 20 percent of the range of the instrument. Navigation data was collected using Hypack® Navigation Software integrated with a Trimble® SPS356 Differential Global Positioning System (DGPS). The geodetic parameters used during the survey included: Grid, State Plane NAD-83; Ellipsoid, WGS-84; Zone, PR-5200 & VI Zone 1; and Unit of measure, US Survey Foot. Side-scan sonar data was collected along shore-parallel survey lines, spaced at 100-foot intervals for the Rincón and San Juan survey areas. To maximize data quality, the survey was only performed during calm sea conditions and the survey vessel speed did not exceed 5 knots. After completing the side-scan surveys, the acoustic data was processed and analyzed using SonarWiz 7 software. Consisting of both low and high frequency channels, the visual appearance of the side-scan sonar data was processed by averaging the acoustic gains to improve the ability to identify seabed features. Mosaics from side-scan sonar data were used to generate georeferenced polygons of seabed features using 0.5-meter resolution.

Separate mosaics of the side-scan sonar data were prepared showing the location of hardbottom habitat occurring within the Rincón and San Juan survey areas (**Figures 2** and **3**). Hardbottom features that were too shallow for the support vessel to navigate during the side-scan sonar survey were identified using Google Earth imagery. Marine scientists from LG2 and Pinnacle used the mosaics illustrating the extent of hardbottom features as a guide to plan in-water PVR surveys for the delineation and mapping of benthic resources.

3.2 Biological Survey Design

Prior to initiating field activities, LG2 and Pinnacle scientists conducted a comprehensive review of available peer-reviewed literature and environmental monitoring reports of research on coastal habitats occurring in or adjacent to the survey areas in Rincón and San Juan, Puerto Rico. Although the available research in these areas was limited, there were studies in similar habitats elsewhere in coastal regions of Puerto Rico. Information derived from the literature review was used to help design the resource mapping and biological data collection methodologies for the benthic resource survey. After receiving the side-scan sonar data, LG2 and Pinnacle scientists developed a tentative biological survey design which included data sheet templates for benthic resource mapping, quantification of SAV resources, and collection of biological coverage data in hardbottom habitat using the Benthic Ecological Assessment for Marginal Reefs (BEAMR) methodology. The biological survey design and data sheet templates were provided to USACE and NMFS for review. Following review, recommendations were implemented and/or addressed together with USACE and NMFS. Representative copies of field data sheets have been provided in **ATTACHMENT C**.

3.3 Preliminary Visual Reconnaissance (Mapping)

Preliminary Visual Reconnaissance (PVR) activities included: delineation and mapping of benthic habitats including SAV, hardbottom habitat, and other EFH; and identifying and documenting the location of stony corals, octocorals, sponges, and biota listed as threatened and/or endangered under the ESA. During PVR, scientific divers collected *in situ* data along survey lines that traversed the entirety of each survey area. In areas where hardbottom habitat was mapped during the side-scan sonar survey, additional survey lines were added to increase visual coverage in those areas. Additionally, areas where SAV resources and/or hardbottom habitat were observed during in-water delineation and mapping activities were marked with location data (latitude and longitude) so that scientists could return to those areas for additional visual observation and/or quantitative data collection.

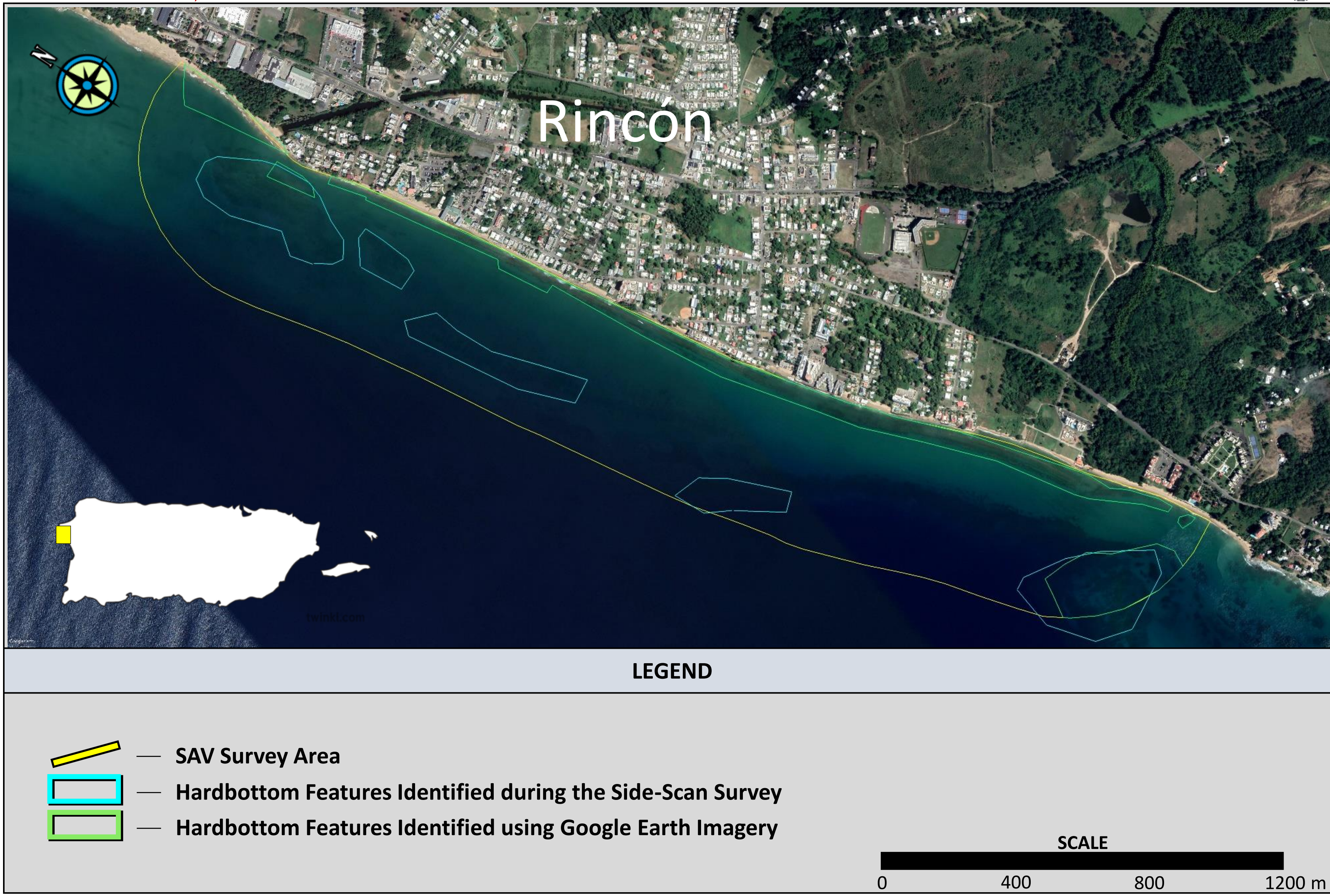


Figure 2. A map of hardbottom features identified during the side-scan survey within the survey area near Rincón, Puerto Rico. Additional features were identified using Google Earth imagery. Image credit: Google Earth, 2022

Figure 3. A map of hardbottom features identified during the side-scan survey within the survey area near San Juan, Puerto Rico. Additional features were identified using Google Earth imagery. Image credit: Google Earth, 2022

All delineation and mapping activities were conducted *in situ* by scientists with a high level of proficiency and experience at identifying a wide range of seagrasses and other marine species that commonly occur in coastal habitats of Puerto Rico. While conducting PVR activities, scientists wore full-faced masks equipped with wireless underwater telecommunications, which allowed scientists to report real-time observations of the occurrence of marine resources to surface support personnel, who recorded the observations and locations. A surface buoy equipped with a Differential and/or Wide Area Augmentation System (WAAS) capable DGPS navigation receiver antenna was towed directly above the scientists during all *in situ* delineation and mapping activities. The diver tracking DGPS antenna provided an accurate and continual position of the diving scientists throughout the survey areas. When marking the position of specific resources or the boundary edge of habitats, divers notified surface support personnel and held the tow-line as taut as possible to minimize the slope between the diver and surface buoy in order to achieve a position as close to vertical as possible. Divers reported real-time observations to a team of support scientists who recorded the details of each reported observation to delineate habitat boundaries, mark the position of ESA corals, or mark areas for further investigation during secondary phases of the survey. Support scientists recorded the time, depth, and description (e.g., presence of SAV resources, hardbottom habitat, species/genera observed, presence of ESA corals, substrate type, and general observations) of the observation on the datasheet. Real-time location data (latitude and longitude) of *in situ* observations were recorded electronically.

Following completion of field data collection activities, a preliminary draft of mapped resources from Rincón was submitted to USACE for review. Following review, the USACE requested whether habitat maps could be presented showing additional details for delineated resources and provided habitat classifications prepared by NOAA to use as a guide. Although mapping data was available to accommodate this request, some of the new benthic habitats were not specifically sampled for quantitative data. The quantitative data collected during the benthic resource surveys, however, did include habitats with similar resources.

3.4 Quantification of SAV Resources

Side-scan sonar data did not delineate SAV habitat in either the Rincón or San Juan survey areas. The success of seagrass habitat mapping using side-scan sonar relies on several potential factors including: substrate type, seagrass species, seagrass density, canopy height, water depths, equipment ground-truthing and calibration, surface conditions, salinity, water temperatures, and vessel stability (Sánchez-Carnero et al., 2012; Parnum and Gavrilov, 2009; and Mulhearn, 2001). The use of side-scan sonar for seagrass mapping is not 100% accurate and can be unreliable without appropriate ground-truthing (Sánchez-Carnero et al., 2023; Brown et al., 2011). Therefore, SAV resource habitats were delineated *in situ* by scientific divers while performing the PVR habitat mapping effort. Habitats with SAV resources were revisited for collection of detailed quantitative data. During the SAV quantification task of the benthic resource survey, information on percent cover, density (shoots/100-centimeter^2), and frequency of occurrence for SAV resources was collected using quantitative sampling methods. Data was collected along two 10-meter modified belt-transects deployed at sampling stations distributed across SAV resources that had been delineated during the PVR habitat mapping effort. Modified belt-transects were conducted *in situ* by scientific divers equipped with a 1.0-meter^2 (10.8-foot^2) quadrat divided into 100, 10 x 10-centimeter (100, 3.9 x 3.9-inch) sub-cells. Quadrat sampling locations were determined using a stratified random sampling design. Ten quadrats were sampled along each modified belt-transects for a total of 20 quadrats sampled at each quantitative sample site. Frequency of occurrence data was collected for seagrass (per species) and macroalgae by recording the total number of sub-cells containing at least one (1) shoot of seagrass or macroalgae within each quadrat. Density was determined by counting the number of seagrass shoots (per species) within three (3) randomly selected sub-cells (i.e., J4, A10, C2). In addition, blade length was measured (to the nearest 0.1 centimeter) from three (3) randomly selected seagrass blades (per species) within each quadrat, and canopy height was recorded by measuring the tallest piece of SAV within the quadrat. Estimated percent cover data for functional groups including seagrasses, macroalgae, corals, and sponges will be recorded using the Braun-Blanquet scale of abundance (Fourqurean et al., 2001; Kenworthy and Schwarzchild, 1998; and Braun- Blanquet, 1932). Braun-Blanquet (1932) abundance values are based on the following scale: 0.0 = not present; 0.1 = solitary specimen, 0.5 = few with small cover; 1.0 = numerous but less than 5% cover; 2.0 = 5-25% cover; 3.0 = 25-50% cover, 4.0 = 50-75% cover; or 5.0 = 75-100% cover.

The Braun-Blanquet scale of abundance technique was used for data collection, as this is the method that has historically been used in the region. However, an additional percent cover value was also recorded using guidelines recommended by the Florida Department of Environmental Protection (FDEP) (2020). The Ecological Assessment for Submerged Aquatic Vegetation (EASAV) method (Pinnacle, 2022a) of determining percent cover values for SAV habitats was also employed to improve the quality of SAV percent cover data. Using the EASAV method, each functional group was assigned a percent cover value from 0 – 100%; a minimum of 1% cover was given for any functional group present, and the total percent cover of all functional groups within a quadrat added up to 100%. Functional groups included each species of seagrass present, each genus of macroalgae present, corals, oysters, sponges, other sessile invertebrates, and substrate. Biota was identified to the lowest practical level in the field. The type of sediment (i.e., sand, shell-hash, and/or mud) present in each quadrat was also recorded. Scientists assessed the general health of each seagrass species present within the quadrat. SAV visual health was recorded using the following scale: 1 = very healthy, 2 = healthy, 3= fair, 4 = degraded, or 5 = very degraded. Seagrass flowering and epiphyte coverage was noted as presence or absence (**Figure 4**). Additional documentation included the type of habitat, the predominant substrate at each sampling site, and the presence or absence of flowering, epiphytes, sedimentation, and drift algae. Representative still photographs were collected to document environmental conditions, substrate, dominant biotic cover, and to support identification verification of observed biota during quantitative sampling.

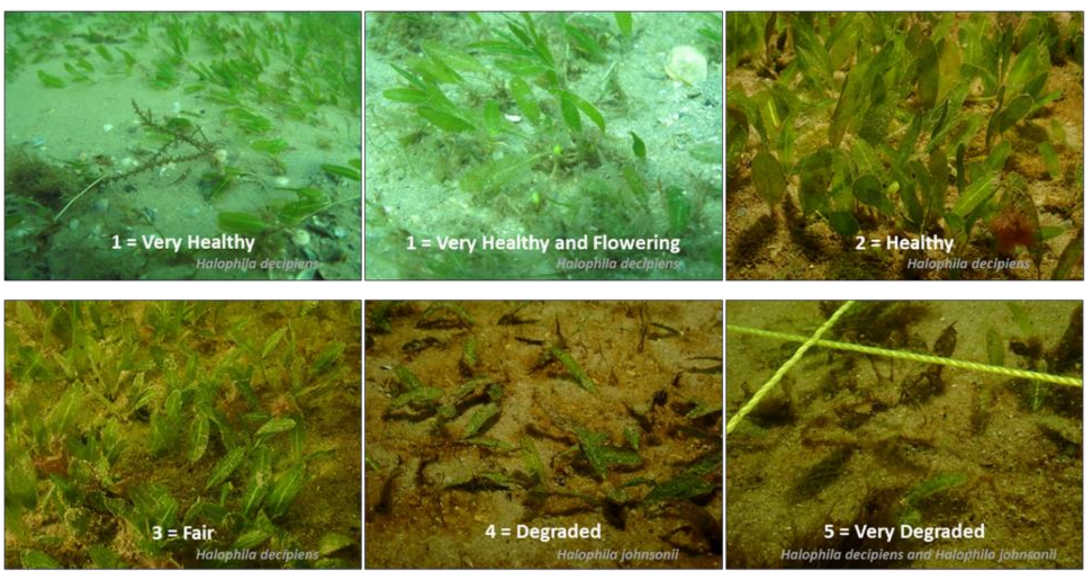


Figure 4. SAV visual health was recorded using the following scale: 1 = very healthy, 2 = healthy, 3= fair, 4 = degraded, or 5 = very degraded. Seagrass flowering and epiphyte coverage was noted as presence or absence.

3.5 Hardbottom Coverage Data Collection (BEAMR)

In areas identified as hardbottom habitat, benthic coverage data was collected along 30-meter modified belt-transects using the quadrat based BEAMR method (Lybolt and Baron, 2006). Data was collected using 1.0-meter² quadrats positioned along the transect. Quadrat spacing was every 5 meters for a total of seven (7) quadrats along each 30-meter modified belt-transects except Quantitative Sample Site R_B-06. Due to habitat limitations at Site R_B-06, two (2) 15-meter modified belt-transects were deployed with a total of eight (8) quadrats sampled. BEAMR data collection included: maximum hardbottom relief, sediment depth, and percent cover of sessile benthos within each quadrat. Maximum hardbottom relief (to the nearest 0.1 centimeter) was measured from the lowest to highest point within each quadrat. Sediment depth was measured at three random locations within each quadrat to determine the average sediment depth. Scientific divers made visual estimates of the percent cover of all sessile benthos. Sessile benthos was pooled into 21 major functional groups, including: sediment, bare hard substrate, rubble, macroalgae (fleshy and calcareous), turf algae, crustose coralline algae (encrusting red algae), cyanobacteria, sponges, hydroids, octocorals, stony (scleractinian) corals, tunicates, bryozoans, sessile worms, anemones, zoanthids, bivalves, *Millepora* spp., wormrock, echinoderms, and barnacles. Each functional group was given a percent cover value from 0-100%, and the total percent cover of all functional groups within a quadrat added up to 100%. Functional groups present within a quadrat with less than 1% cover were noted but were not counted towards the overall 100% cover. Biota was identified to the lowest practical level in the field. The type of sediment (i.e., sand, shell-hash, and/or mud) present in each quadrat was noted. Clionid sponge presence was also noted and given a percent cover value when 1% or more was observed. The overall percent cover of macroalgae observed was recorded and identified to the genus level. Each macroalgae genus present was given a percent cover value of <1% to 100% cover. Genera with <1% cover were noted and contributed to the overall macroalgae percent cover value. Octocorals were identified to the genus level, counted, and had the maximum dimension measured to the nearest tenth (0.1) centimeter (height for branching forms or width for encrusting forms). Stony corals were identified to species level and had the maximum dimension of each colony recorded to the nearest tenth (0.1) centimeter. However, several sample sites had coral colony dimensions measured using maximum diameter, minimum diameter, and height. The decision to collect three dimensions or just one dimension was typically driven by the overall biotic cover and total number of corals occurring at a sample site. For example, sample sites with large numbers of small colonies would require significantly more time to complete if measured using all three dimensions instead of one, ultimately reducing the number of sample sites that could be targeted in a field day. When ESA listed corals were encountered, all three colony dimensions were recorded including: maximum diameter, minimum diameter, and height. Additional stony coral data collected during the benthic resource survey included: percent (%) live tissue, percent (%) recent mortality, stress indicators, visible health, and the presence of coral disease. Sponges were identified by morphotype (i.e., encrusting, erect branching, tube/vase, massive/amorphous, and spherical) and counted by size class (i.e., 0 – 10 cm, >10 – 25 cm, >25 – 50 cm, >50 cm). X*estospongia muta* was identified to species level and counted by size classes (i.e., 0 – 1, 10.1 – 25, 25.1 – 50, >50 cm). Representative photographs were taken of each quadrat to supplement the BEAMR data collected along each transect.

Due to the large size and the overall east to west length (7.65 kilometers/4.75 miles) of San Juan's survey area, it was separated and classified into three (3) zones: eastern, central, and western. Average percent cover for major functional groups within each zone was averaged. Furthermore, major functional group data from San Juan was also presented by: 1) average percent cover of the entire survey area, 2) average percent cover by habitat type, and 3) average percent cover by sample site.

3.6 ESA Corals

ESA corals were identified and their positions recorded during the PVR habitat mapping effort. At each hardbottom sample site, a dedicated survey was conducted to identify and document ESA listed species. A team of scientific divers swam a 2-meter swath along each side of the 30-meter modified belt-transect used during hardbottom coverage data collection for a total visual cover of 136 meters^2/sample site. Additionally, multiple ESA only sample sites were surveyed to document presence and record colony dimensions and general conditions. ESA listed coral species had the maximum diameter, minimum diameter, and height of each colony recorded to the nearest tenth (0.1) centimeter. Additional data collected during ESA coral surveys included: percent (%) live tissue, percent (%) recent mortality, stress indicators, visible health, and the presence of coral disease.

3.7 Qualitative Data Collection

Scientists conducted *in situ* identifications of biota observed during benthic resource survey. Representative still photographs and/or video were collected to document environmental conditions, substrate, and dominant biota observed in SAV and hardbottom habitats in the survey area. Photos and video data collected during the field survey were also used to support species identification verification. Species of special concern including dolphins, manatee, sea turtles, and grouper were noted when observed or encountered during all survey phases. Additional data collected for species of special concern included species identification, location of sighting or encounter, size of animal and estimate of whether juvenile or adult, observed activity at the time of sighting, and direction of travel if determined. Representative photographs have been provided in **ATTACHMENTS A** and **B**.

4.0 Results and Discussion

4.1 Rincón

4.1.1 Rincón – Preliminary Visual Reconnaissance (Mapping)

Benthic habitats and resources were mapped from north to south in the Rincón survey area (**Figure 5**). **Table 3** provides a list of delineated habitats and the total coverage for each habitat. Overall, SAV habitat covered 418,649 meters^2 (103.5 acres) of the survey area, with 379,069 meters^2 (92.9 acres) consisting of continuous seagrass habitat. This habitat was characterized by continuous seagrass growth and varying density macroalgal growth. *Halophila decipiens, Halophila engelmannii*, *Halodule wrightii*, and *Syringodium filiforme* were the dominant seagrass species observed in these habitats. The remaining 42,580 meters^2 (10.5 acres) of SAV habitat was compromised solely of macroalgae. Typical genera observed in macroalgal habitat included *Halimeda* spp., *Udotea* spp., and *Caulerpa* spp. SAV habitats were mainly observed farther offshore in deeper water (20 to 40 feet) and were also found to be growing in small sand patches within hardbottom habitat. In some cases, seagrass was growing over sand veneered hardbottom in areas with high levels of sedimentation covering portions of the reef.

Table 3. Delineated habitats and their total coverage in the Rincón surveyed area.

Habitat	Total Meters^2	Total Acres	Percent (%) Cover
Unconsolidated Sediments	355,603	87.9	23.0%
SAV - Seagrass	376,069	92.9	24.4%
SAV - Macroalgae	42,580	10.5	2.8%
Aggregate Patch Reef	41,643	10.3	2.7%
Colonized Bedrock	135,018	33.4	8.7%
Colonized Pavement	24,050	5.9	1.6%
Linear Reef	246,293	60.9	16.0%
Shelf Edge Reef	321,781	79.5	20.9%
Derelict Pilings	122	0.0	0.0%

Hardbottom within the survey area covered 768,785 meters^2 (190.0 acres) and was comprised of five (5) different habitat types: aggregate patch reef, colonized bedrock, colonized pavement, linear reef, and shelf edge reef. Shelf edge reef covered 321,781 meters^2 (79.5 acres) and was located along the western edge of the survey area, where the shelf ends and water depths are > 200 feet. A common feature of these reefs were narrow sand channels that extend to the shelf's edge. These reefs were dominated by turf algae, sponges, macroalgae, and stony corals. Numerous ESA listed coral species were observed in this habitat, predominately in the southwestern portion of the survey area. Linear reefs covered the second largest area, with 246,293 meters^2 (60.9 acres), and was primarily located centrally (north to south) in the survey area. These reefs were commonly comprised of series of exposed medium to high relief shore perpendicular hardbottom outcrops separated by sand channels. The dominate biota was turf algae, sponges, stony corals, and macroalgae, and numerous ESA corals, including several *Dendrogyra cylindrus*, *Orbicella faveolata*, and *Acropora cervicornis* were observed. The remaining habitat with significant coverage was colonized bedrock (135,018 meters^2; 33.4 acres). This habitat was

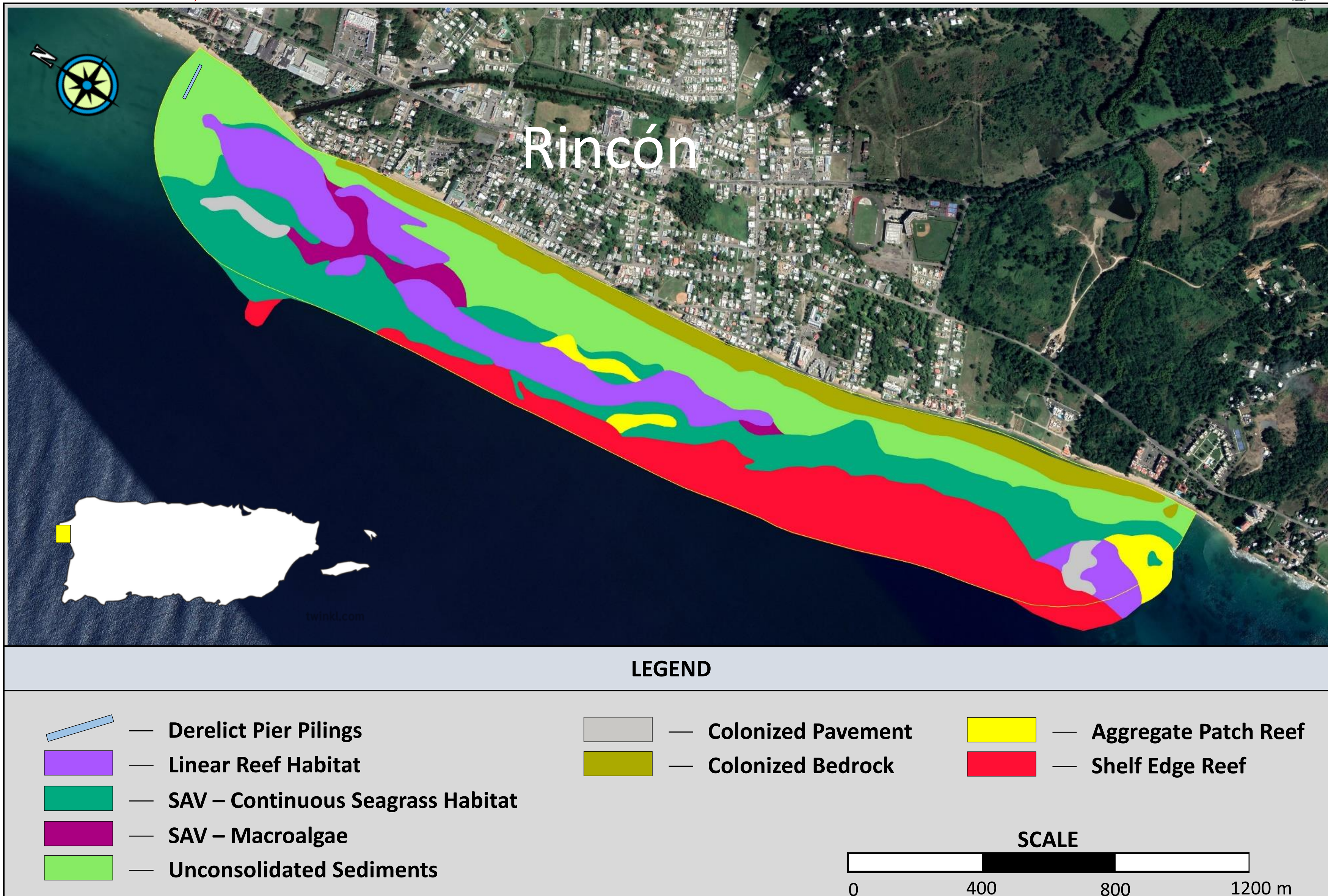


Figure 5. Mapped resources delineated within the survey area near Rincón, Puerto Rico. Image credit: Google Earth, 2022

observed nearshore in shallow water (< 8 feet) and was comprised of block-like pieces of bedrock. The predominant biota on colonized bedrock included turf algae and sponges.

Unconsolidated sediments covered 355,603 meters^2 (87.9 acres) of the survey area. This habitat type had no emergent epifauna observed and was typically comprised of one or more of the following sediments: sand, shell hash, and/or silt. This habitat was observed along a narrow shore parallel corridor that stretched north to south and extended from the edge of nearshore colonized bedrock to the start of other habitats farther offshore.

4.1.2 Rincón – Quantification of SAV Resources

Pinnacle scientists utilized the SAV survey data to identify and quantitatively assess SAV resources within the Rincón survey area (**Figure 6**). **Table 4** provides a list of sample sites and the habitats represented in Rincón. In total, quantitative SAV survey data was collected from 67 quadrats (67 meters^2) across the five (5) sample sites (**Figure 6**). **Figure 7** shows the average percent cover values obtained from both methods of quantitative data collection, the modified Braun-Blanquet scale of abundance and the EASAV method for estimating percent cover values. The EASAV values for most functional groups were lower than the Braun Blanquet values, but the differences were similar and insignificant.

Table 4. Sample sites and the habitats represented in Rincón.

Site	Habitat Type	Water Depth (feet)
R_SAV-01	SAV-Seagrass	38
R_SAV-02	SAV-Seagrass	32
R_SAV-03	SAV-Seagrass	29
R_SAV-04	SAV-Seagrass	22
R_SAV-05	SAV-Seagrass	27
R_B-01	Linear Reef	24
R_B-02	Linear Reef	28
R_B-03	Shelf Edge Reef	53
R_B-04	Linear Reef	10
R_B-05	Colonized Bedrock	7
R_B-06	Linear Reef	18

Based on the EASAV method for estimating percent cover data, SAV resources accounted for 46.4% of the sites sampled, with macroalgae accounting for just 5.1%. Substrate and other sessile invertebrates accounted for 52.3% and 1.3%, respectively. The most dominant macroalgae genera observed were *Dasya* spp. and *Dictyota* spp. Other macroalgae genera observed during the benthic assessment survey included *Chondria* spp., *Acanthophora* spp., *Halimeda* spp., *Laurencia* spp., *Penicillus* spp., and *Udotea* spp. Seagrass accounted for the remaining 41.3% of SAV resources observed. Three (3) of the six (6) species known to occur in Puerto Rico were recorded during quantitative data collection. A fourth species, *Syringodium filiforme,* was observed elsewhere in the survey area. *Halophila decipiens* had the highest average percent cover (40.0%), followed by *Halophila engelmannii* (0.9%), and *Halodule wrightii*

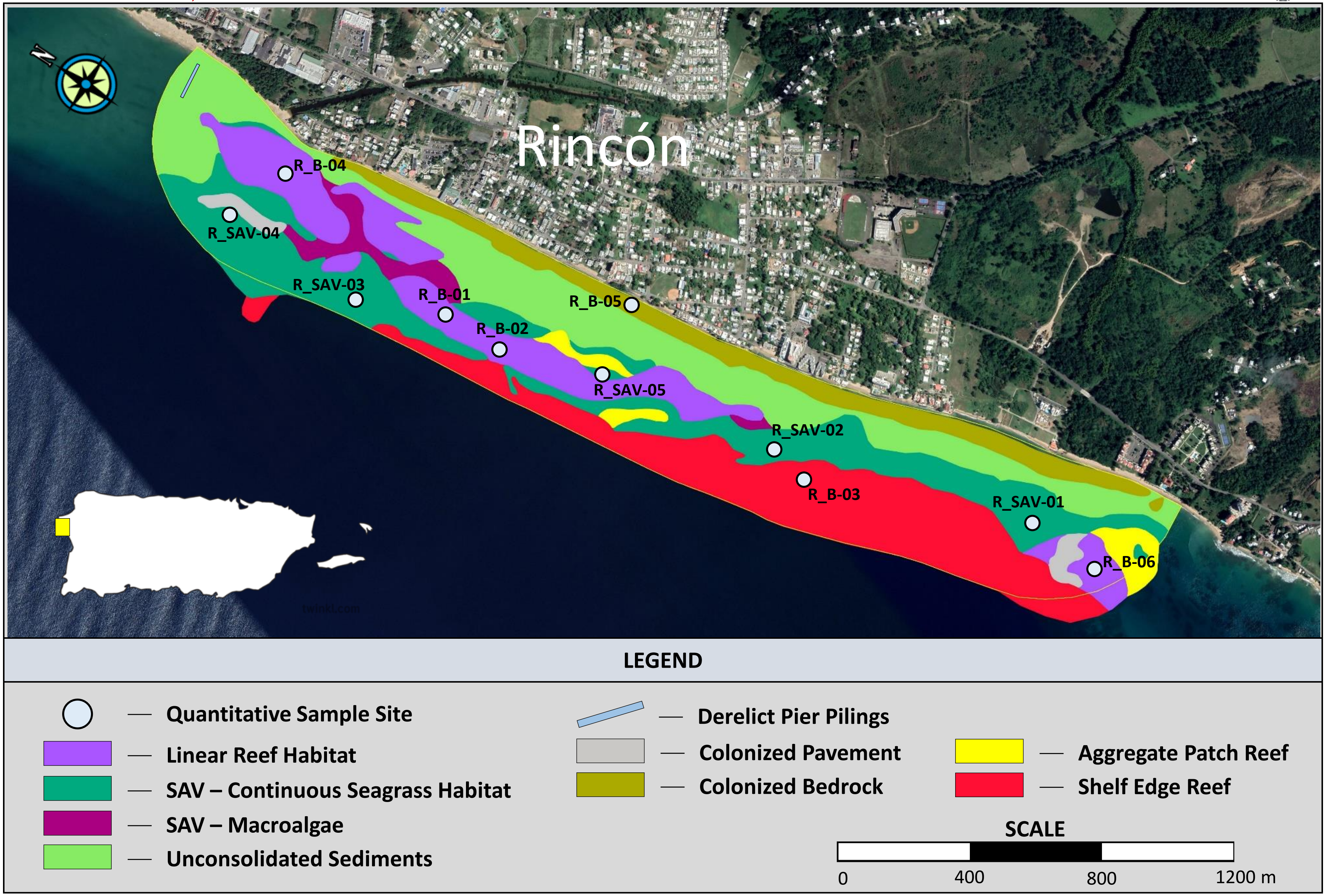
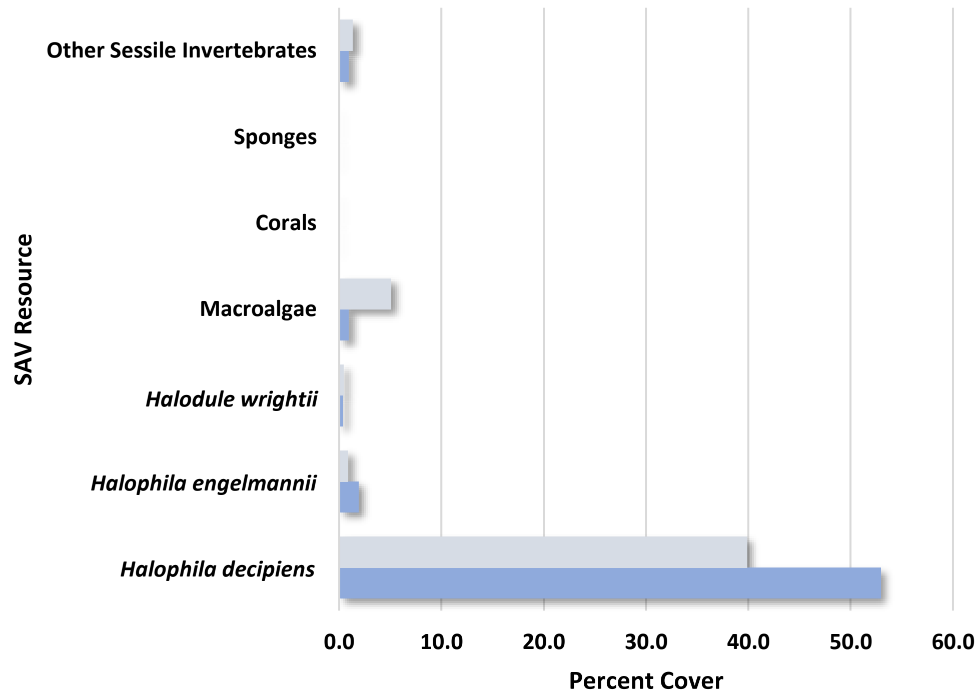


Figure 6. Quantitative sample sites and mapped resources delineated within the survey area near Rincón, Puerto Rico. Image credit: Google Earth, 2022

Braun-Blanquet vs. EASAV Estimated Percent Cover Values - Rincón

SAV Resource	BB Converted Percent Cover (%)	EASAV Estimated Percent Cover (%)
Halophila decipiens	52.9	39.9
Halophila engelmannii	1.9	0.9
Halodule wrightii	0.4	0.5
Macroalgae	0.9	5.1
Corals	0.0	0.0
Sponges	0.0	0.0
Other Sessile Invertebrates	0.9	1.3
Substrate	-	52.3



LEGEND

– EASAV Estimated Percent Cover

– Braun-Blanquet Converted Percent Cover

Figure 7. Comparison of percent cover values using the historical Braun-Blanquet method and the new EASAV method for estimating percent cover for each functional group in Rincón. All functional groups were surveyed using both methods, except for substrate, which only have EASAV estimated percent cover values.

(0.5%). *Halophila decipiens* also had the greatest density, which ranged from 17-66 shoots/100-centimeter^2. **Table 5** provides the range of seagrass density (shoots/100-centimeter^2) for each sample site.

Table 5. Range of seagrass density (shoots/100-centimeter^2) where seagrass was observed, at each quantitative sample site in Rincón.

Site	*Halophila decipiens*	*Halophila engelmannii*	*Halophila stipulacea*	*Halodule wrightii*	*Syringodium filiforme*	*Thalassia testudinum*	Total Range
R_SAV-01	2-23	1-7	0	0	0	0	1-23
R_SAV-02	17-66	0	0	0	0	0	17-66
R_SAV-03	3-31	0	0	0	0	0	3-31
R_SAV-04	2-32	0	0	0	0	0	2-32
R_SAV-05	1-12	0	0	4-4	0	0	1-12
Total Range	1-66	1-7	0	4-4	0	0	-

The average blade lengths for *Halophila decipiens*, *Halophila engelmannii*, and *Halodule wrightii* were 2.0 centimeters, 4.1 centimeters, and 7.4 centimeters, respectively. Seagrass health ranged from fair to very healthy and seagrass flowering was observed on *Halophila decipiens*. **Figure 8** shows the average relative seagrass percent covers (%), average blade lengths (cm), and average health scores for each seagrass species observed. Seagrass habitats in Rincón were observed with numerous invertebrate species including, but not limited to, queen conch (*Aliger gigas*), tulip (*Fasciolaria tulipa*), and penshell (*Pinna carnea*). Representative photos have been provided in **ATTACHMENT A.**

4.1.3 Rincón – Hardbottom Coverage Data

Coral Abundance

In hardbottom habitats previously delineated during the PVR habitat mapping effort, benthic coverage data was collected using the quadrat based BEAMR method (Lybolt and Baron, 2006). BEAMR data was collected at six (6) sample sites within the Rincón survey area (**Figure 6**). Hardbottom habitats sampled included linear reef, shelf edge reef, and colonized bedrock. The dominant biota observed across all habitats was turf algae, sponges, macroalgae, and stony corals. Scientists identified and measured 210 octocorals and 755 stony corals across sample sites in Rincón. The average number of octocorals and stony corals recorded in each 1-meter^2 sample quadrat was 4.9 and 17.3 colonies, respectively. **Table 6** lists the colony count and relative abundance for octocorals and stony corals identified at each sample site in Rincón. Ten (10) genera of octocoral were identified in the Rincón survey area, the most common of which included: *Gorgonia* spp. (18.6%), *Muricea* spp. (18.1%), *Antillogorgia* spp. (16.7%), *Erythropodium* sp. (16.7%), and *Eunicea* spp. (11.9%). Three (3) Sample Sites (R_B-06 (36.2%), R_B-02 (30.5%), and R_B-01 (20.5%)), each located in Linear Reef Habitat with a median water depth of 24 feet, together comprised over 87% of all the octocorals measured in Rincón. Although it occurred in Linear Reef Habitat, no octocorals were observed in quadrats at Sample Site R_B-04. Positioned relatively close to shore and with a water depth of 10 feet, Sample Site R_B-04 was located 170 meters (560 feet) south of Quebrada los Ramos and the surrounding hardbottom had a dense layer of sediment covering the surface. Sedimentation can impact octocoral and stony coral spawning, settlement, colonization, and long-term growth success (Rogers and Ramos-Scharrón, 2022; Takesue et al., 2021; Bainbridge et al., 2018; and Ramos-Scharrón et al., 2015).

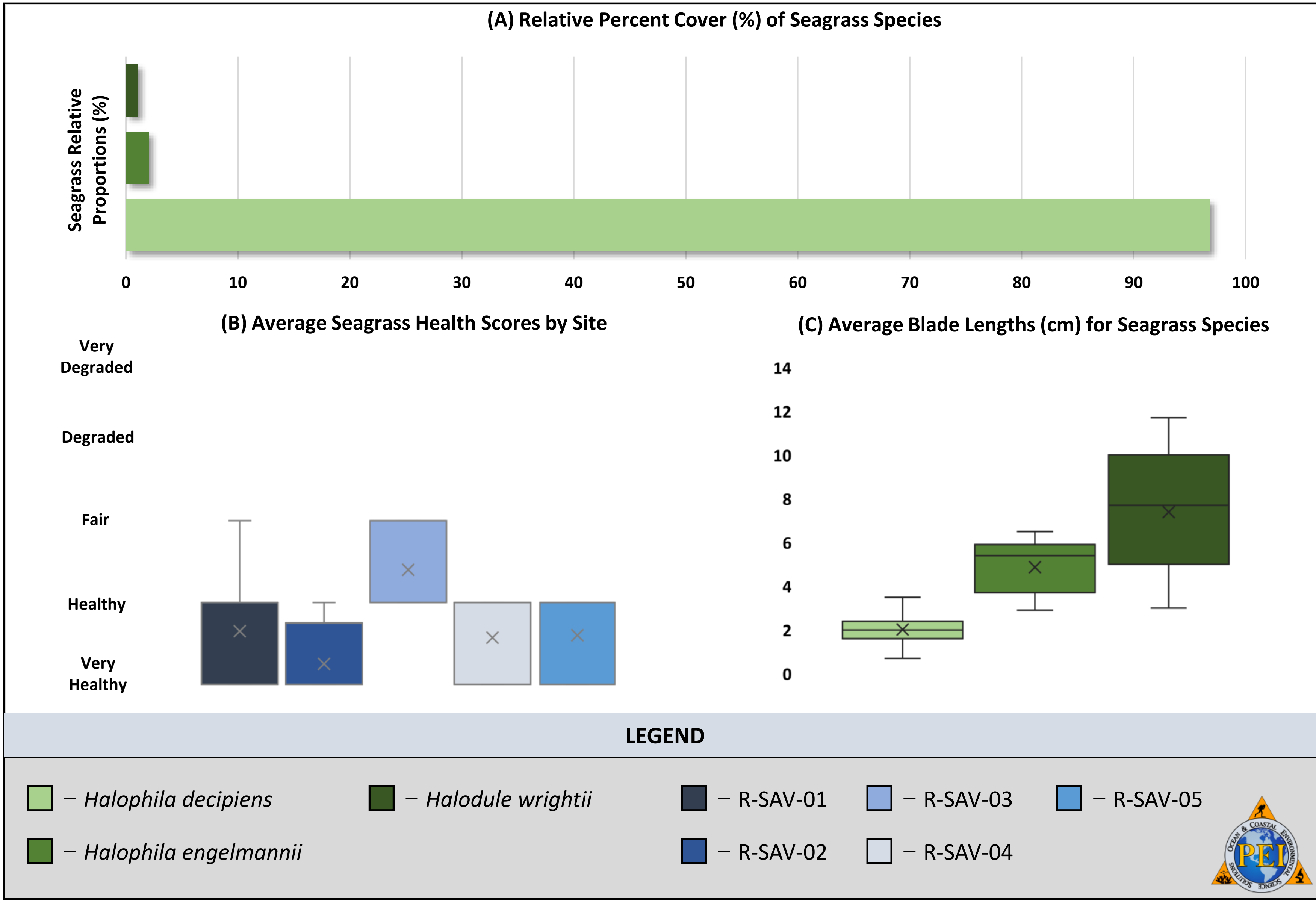


Figure 8. Statistics of seagrass species observed in Rincón. (A) Relative proportions of seagrass to each other; (B) Average health score, ranging from very degraded to very healthy; (C) Average blade lengths for each seagrass species, in centimeters.

Table 6. Colony count and relative abundance for octocorals and stony corals identified at sample sites in Rincón.

Species	R-B-01	R-B-02	R-B-03	R-B-04	R-B-05	R-B-06	Total	% Abundance
Antillogorgia sp.	5	15	-	-	-	15	**35**	16.7%
Briarium sp.	-	-	-	-	-	8	**8**	3.8%
Ellisella sp.	-	-	2	-	-	-	**2**	1.0%
Erythropodium sp.	6	8	12	-	-	9	**35**	16.7%
Eunicea sp.	8	4	3	-	-	10	**25**	11.9%
Gorgonia sp.	14	14	1	-	6	4	**39**	18.6%
Muricea sp.	6	15	1	-	-	16	**38**	18.1%
Muriceopsis sp.	-	-	-	-	-	-	**-**	0.0%
Plexaura sp.	1	2	-	-	-	7	**10**	4.8%
Plexaurella sp.	-	1	1	-	-	6	**8**	3.8%
Pseudoplexaura sp.	3	5	1	-	-	1	**10**	4.8%
Pterogorgia sp.	-	-	-	-	-	-	**-**	0.0%
Octocoral Total	43	64	21	0	6	76	**210**	100.0%
Acropora cervicornis	-	-	-	-	-	1	**1**	0.1%
Agaricia agaricities	5	30	38	-	-	4	**77**	10.2%
Agaricia fragilis	-	1	3	-	-	-	**4**	0.5%
Agaricia lamarcki	1	-	1	-	-	-	**2**	0.3%
Colpophyllia natans	1	1	1	-	-	-	**3**	0.4%
Dendrogyra cylindricus	-	-	-	-	-	7	**7**	0.9%
Dichocoenia stokesi	7	3	-	-	-	1	**11**	1.5%
Diploria labyrinthiformis	-	-	-	-	-	2	**2**	0.3%
Eusmilia fastiginia	-	1	2	-	-	-	**3**	0.4%
Favia fragum	-	-	-	-	-	-	**-**	0.0%
Isophyllia rigida	-	1	1	-	-	-	**2**	0.3%
Madracis decactis	3	5	18	-	-	1	**27**	3.6%
Madracis mirabilis	-	-	-	-	-	2	**2**	0.3%
Meandrina meandrites	7	2	13	2	-	2	**26**	3.4%
Montastraea cavernosa	9	15	8	1	-	7	**40**	5.3%
Mycetophyllia aliciea	1		5				**6**	0.8%
Mycetophyllia ferox		1				1	**2**	0.3%
Orbicella faveolata	-	11	9	-	-	5	**25**	3.3%
Phyllangia americana	-	3	-	-	-	-	**3**	0.4%
Porites astreoides	33	42	11	14	9	69	**178**	23.6%
Porites porites	-	-	-	-	-	-	**-**	0.0%
Pseudodiploria clivosa	1	-	-	-	-	-	**1**	0.1%
Pseudodiploria strigosa	15	16	1	14	4	30	**80**	10.6%
Scolymia cubensis	-	-	3	-	-	-	**3**	0.4%
Siderastrea radians	-	-	-	4	108	1	**113**	15.0%
Siderastrea siderea	9	15	27	10	1	29	**91**	12.1%
Siderastrea sp.	1	2	-	-	-	-	**3**	0.4%
Stephanocoenia intersepta	5	5	28	-	-	5	**43**	5.7%
Stony Coral Total	98	154	169	45	122	167	**755**	100.0%

For stony corals, *Porites astreoides* had the highest colony count and relative abundance (178 colonies, 23.6%), followed by *Siderastrea radians* (113 colonies, 15.0%), *Siderastrea siderea* (91 colonies, 12.1%), *Pseudodiploria strigosa* (80 colonies, 10.6%), and *Agaricia agaricites* (77 colonies, 10.2%). Among the six (6) BEAMR sample sites, R_B-03 (22.4%), R_B-06 (22.1%), and R_B-02 (20.4%) had the highest numbers of stony coral colonies, accounting for 64.9% of all corals surveyed in Rincón. Sample Site R_B-04 had the lowest number of stony corals (45 coral colonies observed within quadrats) and accounted for only 6.0% of all corals surveyed in Rincón. Located 170 meters (560 feet) south of Quebrada los Ramos, the dense sediment layer covering substrate at Sample Site R_B-04 has likely impacted coral spawning, settlement, colonization, and long-term growth success (Rogers and Ramos-Scharrón, 2022; Takesue et. al., 2021; Ramos-Scharrón et. al., 2015; and Bainbridge et. al., 2018). Excluding data from Sample Site R_B-04, coral abundance was highest in Shelf Edge Habitat (39.2%), followed by Linear Reef (32.4%) and Bed Rock (28.3%).

Coral Colony Size

Comprising 22.8% of the total coral cover in Rincón, octocorals were observed exhibiting the following morphologies: branching (95.2%), encrusting (4.7%), and whip-like (0.1%). Octocoral maximum height measurements ranged from 1.2 to 77.0 centimeters, with an average colony height of 18.5 centimeters. The majority of octocoral colonies (58.6%) had a maximum height greater than 10 centimeters, with 15 colonies (7.1%) exceeding 50 centimeters (Table 7). Stony coral colony sizes ranged from small *Siderastrea* spp. and *Phyllangia americana* colonies (0.4 centimeters) to large *Dendrogyra cylindrus* colonies (285 centimeters). The average stony coral colony size for the Rincón survey area was 10.5 centimeters. The majority of stony coral colonies (85.7%) had a maximum dimension less than 20 centimeters, with just 16 colonies exceeding 50 centimeters (**Table 7**). Larger stony coral colonies (>50 cm) included twelve (12) *Orbicella faveolata*, two (2) *Dendrogyra cylindrus*, and two (2) *Pseudodiploria strigosa*. Stony coral colonies ranging from 20.0 to 49.9 centimeters were predominantly comprised of the following coral species: *Pseudodiploria strigosa* (28.7%), *Montastraea cavernosa* (12.8%), *Agaricia agaricites* (10.6%), *Porites astreoides* (9.6%), *Orbicella faveolata* (8.5%), and *Siderastrea siderea* (7.4%). While conducting surveys and mapping, *Pseudodiploria* spp. were the most visually abundant stony corals observed.

Coral Health

Although there were signs of various stress indicators and numerous dead coral colonies observed within hardbottom habitat in Rincón, most living corals appeared to have healthy tissue and were generally in good condition. The average percent live tissue for stony corals measured at Rincón was 95.4%. Stress indicators observed during the benthic resource survey included extended polyps, endolithic borers, predation, macroalgal overgrowth, and bleaching. Corals typically extend polyps at night to feed on plankton, it is not uncommon to observe some species of coral in different habitats with extended polyps during daytime. In some cases, however, diurnally extended polyps can be a stress indicator (Levy et. al., 2006) and was observed in 25.3% of corals surveyed in Rincón. Macroalgal overgrowth was the next most common sign of stress, with 22.3% of corals impacted. This can occur when adjacent macroalgae comes in contact with coral tissue causing abrasions or other physical stresses. Additionally, when a coral experiences partial mortality, dead portions of the colony will be colonized by macroalgae which can contribute to further coral tissue degradation and receding margins. Paling or partial bleaching (loss of coral pigmentation) was observed in only 6.1% of stony corals. A summary of health indicators is shown in **Figure 9**.

Table 7. Coral Count categorized by size class for octocorals and stony corals from sample sites in Rincón.

Species-Rincon	Size Class (cm)						
	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50+	Total
Antillogorgia sp.	8	7	6	5	3	6	**35**
Briarium sp.	7	1	-	-	-	-	**8**
Ellisella sp.	-	-	-	-	1	1	**2**
Erythropodium sp.	25	7	3	-	-	-	**35**
Eunicea sp.	14	8	2	1	-	-	**25**
Gorgonia sp.	11	13	3	4	2	6	**39**
Muricea sp.	16	11	3	7	1	-	**38**
Muriceopsis sp.	-	-	-	-	-	-	**-**
Plexaura sp.	1	-	3	2	4	-	**10**
Plexaurella sp.	-	3	1	2	-	2	**8**
Pseudoplexaura sp.	4	5	1	-	-	-	**10**
Pterogorgia sp.	-	-	-	-	-	-	**-**
Octocoral Total	86	55	22	21	11	15	**210**
Acropora cervicornis	-	1	-	-	-	-	**1**
Agaricia agaricities	47	19	8	2	1	-	**77**
Agaricia fragilis	4	-	-	-	-	-	**4**
Agaricia lamarcki	2	-	-	-	-	-	**2**
Colpophyllia natans	2	-	1	-	-	-	**3**
Dendrogyra cylindricus	-	4	-	-	1	2	**7**
Dichocoenia stokesi	9	2	-	-	-	-	**11**
Diploria labyrinthiformis	-	-	1	-	1	-	**2**
Eusmilia fastiginia	2	-	-	1	-	-	**3**
Favia fragum	-	-	-	-	-	-	**-**
Isophyllia rigida	-	2	-	-	-	-	**2**
Madracis decactis	19	6	-	2	-	-	**27**
Madracis mirabilis	1	1	-	-	-	-	**2**
Meandrina meandrites	17	4	5	-	-	-	**26**
Montastraea cavernosa	18	10	8	4	-	-	**40**
Mycetophyllia aliciea	2	3	1	-	-	-	**6**
Mycetophyllia ferox	-	-	2	-	-	-	**2**
Orbicella annularis	-	-	-	-	-	-	**-**
Orbicella faveolata	1	4	2	4	2	12	**25**
Orbicella franksi	-	-	-	-	-	-	**-**
Phyllangia americana	3	-	-	-	-	-	**3**
Porites astreoides	115	54	7	2	-	-	**178**
Porites porites	-	-	-	-	-	-	**-**
Pseudodiploria clivosa	-	-	1	-	-	-	**1**
Pseudodiploria strigosa	40	11	14	8	5	2	**80**
Scolymia cubensis	3	-	-	-	-	-	**3**
Siderastrea radians	112	-	-	1	-	-	**113**
Siderastrea siderea	73	11	4	2	1	-	**91**
Siderastrea sp.	3	-	-	-	-	-	**3**
Stephanocoenia intersepta	33	7	2	-	1	-	**43**
Stony Coral Total	506	139	56	26	12	16	**755**

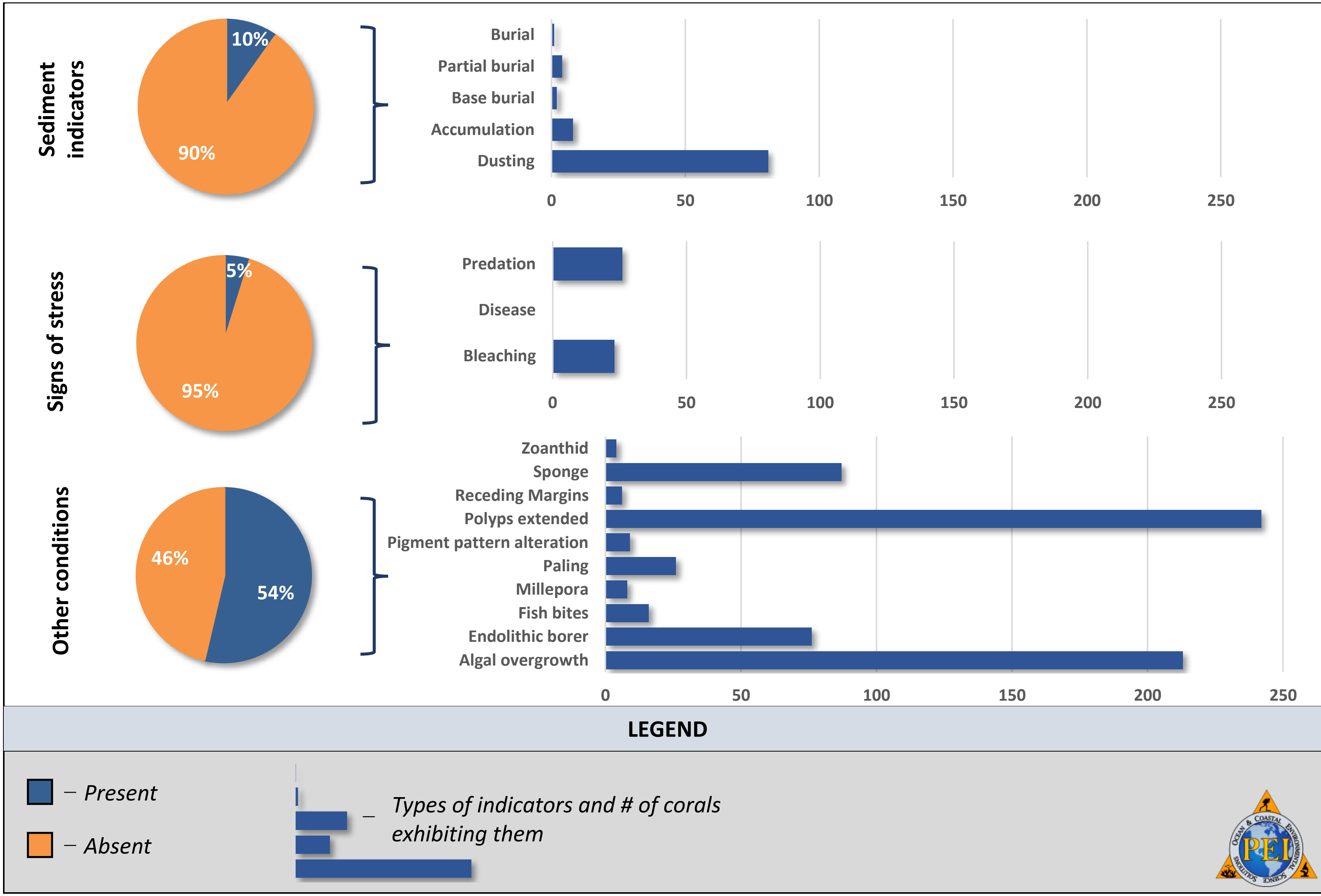


Figure 9. Signs of physiological stressors and other conditions observed among the corals surveyed in Rincón , Puerto Rico.

Sedimentation

Most of the hardbottom habitat observed in Rincón had a visible layer of silty sediment deposition. There are several sources for sediment in the Rincón survey area including: riverine, quebrada, and other storm water discharges, coastal erosion, storm-induced wave energy, and longshore sediment transport (Thieler et al. 2007). Additionally, the benthic resource assessment was conducted during Puerto Rico's wet season (June 1 through November 30), when riverine discharge and stormwater run-off are most prevalent. Sample sites with the thickest layer of average sediment deposition included R_B-03 (2.1 centimeters), R_B-02 (1.8 centimeters), R_B-04 (1.7 centimeters), and R_B-01 (1.2 centimeters). Several of these sample sites (R_B-01, R_B-02, and R_B-04) occurred within hardbottom habitat classified as linear reef which was recorded as having the highest average percent of sediment cover. Located 170 meters (560 feet) south of Quebrada los Ramos, Sample Site R_B-04 was located closest to a source of upland discharge and also had the lowest total number of corals (45) representing 4.7% of total coral count from sites sampled in Rincón. Across sample sites, 9.8% of corals surveyed had visible sediment indicators, with sediment dusting being the most prominent. Most of the corals (77.7%) with sediment indicators were located at Sample Sites R_B-01, R_B-05, and R_B-06. Sample Site R_B-05 occurred nearshore on colonized bedrock where wave energy was typically high and sediment cover low. Such shallow, high-energy environments can suspend sediments in the water column that eventually settle on substrate and colonizing biota. Therefore, the high number of sediment indicators at Sample Site R_B-05 may be contributed, in part, to suspended sediments settling onto the corals. Coral morphology is an important factor for consideration when measuring sediment deposition on coral resources (Jones et al., 2017; Whinney et al., 2017; and Lasker, 1980). Sample Site R_B-06 had some of the largest coral colonies observed during the Rincón survey which may contribute to its high degree of sediment indicators observed on corals. The increased surface area provided by larger boulder coral colonies may make them more susceptible to sediment deposition (Whinney et al., 2017 and Lasker, 1980). Excessive sedimentation (i.e., accumulation and burial) can lead to coral mortality (Rogers and Ramos-Scharrón, 2022; Takesue et al., 2021; Bainbridge et al., 2018; and Ramos-Scharrón et al., 2015). Sediment accumulation was observed on 8 colonies (0.8%) throughout the Rincón survey area. Only one (1) colony (0.1%) was observed buried and four (4) colonies (0.4%) partially buried.

Functional Groups

Sessile benthos was categorized into 21 major functional groups, which include: sediment, bare hard substrate, rubble, macroalgae (fleshy and calcareous), turf algae, crustose coralline algae, cyanobacteria, sponges, hydroids, octocorals, scleractinian corals, tunicates, bryozoans, sessile worms, anemones, zoanthids, bivalves, *Millepora* spp., wormrock, echinoderms, and barnacles. The four (4) major functional group categories considered to be critical coral reef indicator species include: sponges, macroalgae, stony corals, and octocorals. Additional detail regarding percent cover data for the four (4) major functional group categories has been presented in **Figure 10**. Sponge percent cover (18.9%) was second only to turf algae (29.4%) for the entire Rincón survey area. When sponge cover was presented by habitat type, the highest percent covers were on shelf edge reefs (22.0%) and linear reefs (19.5%). Located in linear reef, Site R_B-01 had the highest average sponge cover (22.9%) of all the sample sites surveyed. It is important to note that Sample Sites R_B-01, R_B-02, R_B-03, and R_B-04 all had average sediment depths of 1 – 2 centimeters which can cover and hide cryptic species like encrusting sponges, further complicating efforts to identify, estimate areal cover, and count colonies. Therefore, sponge counts and percent cover estimates could have been higher at these sample sites with high sedimentation. The most commonly observed sponge morphotypes were branching/erect (31.1%), encrusting (26.8%), and amorphous/massive (23.7%). While most sponges (68.1%) were < 10 centimeters in size, there were several morphotypes that measured >50 centimeters including:

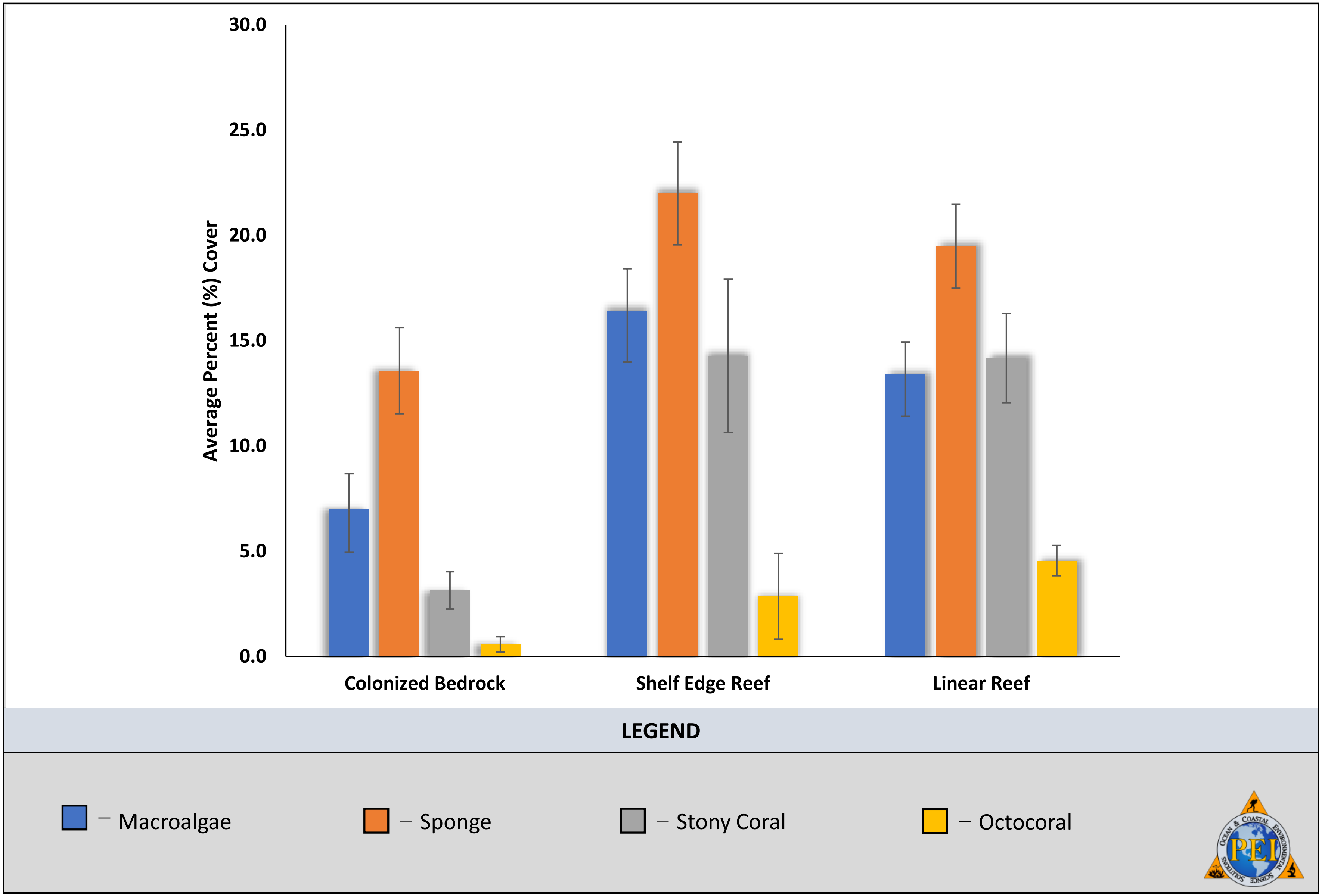


Figure 10. Average percent cover of the four major functional groups within each habitat type in Rincón. Error bars represent standard error.

branching/erect and amorphous/massive. There were also several *Xestospongia muta* colonies that measured > 50 centimeters. Only 33 *Xestospongia muta* were identified within BEAMR quadrats and 63.6% (21 sponges) were < 25 centimeters.

Macroalgae was observed on all hardbottom habitats and had an average percent cover of 12.9% for the entire Rincón survey area. When macroalgal cover was presented by habitat type, the highest average percent cover occurred on shelf edge reefs (16.4%) and linear reefs (13.4%). Sample Sites R_B-02 (20.0%), R_B-01 (17.6%), and R_B-03 (16.4%) had the highest average macroalgal cover out of all sample sites surveyed. The most dominant macroalgae genera observed in the Rincón survey area were *Amphiroa* spp., *Dictyota* spp., *Gelidium* sp., and *Halimeda* spp.

Stony corals were observed in all hardbottom habitats and had an average percent cover of 12.4% for the entire Rincón survey area. When stony coral cover was presented by habitat type, shelf edge reefs and linear reefs had a similar average percent cover of 14.3% and 14.2%, respectively. Sample Site R_B-06 had the highest average stony coral percent cover (21.6%) and had many of the largest coral colonies measured in Rincón including a *Dendrogyra cylindrus* with a maximum diameter of 285 centimeters.

Of the four major functional groups, octocorals had the lowest percent cover (3.6%) for the entire Rincón survey area. When octocoral cover was presented by habitat type, linear reefs had the highest percent cover (4.6%). Of all the sample sites in Rincón, R_B-02 had the highest average octocoral percent cover of 7.4%.

Other biota observed during BEAMR surveys were anemones, bivalves, bryozoans, corallimorphs, cnidarians, crustose coralline algae, cyanobacteria, echinoderms, hydroids, millepora, sessile worms, tunicates, and turf algae. Turf algae was commonly observed on all hardbottom habitats throughout the Rincón survey area. Turf algae had an average percent cover of 29.5% for the entire Rincón survey area, followed by sediment (5.1%), cyanobacteria (4.2%), zoanthid (3.7%), and crustose coralline algae (2.5%) (**Figure 11**). Turf algae was often observed mixed with a layer of sediment cover. Turf algal sediment mixes can impact successful coral recruitment and colonization as well as smother existing benthic biota (Tebbett and Bellwood, 2019; Birrell et al., 2005; and Steneck, 1997). The remaining functional groups all had average percent covers of < 2.0%. Sediment depths were taken as part of BEAMR data collection and ranged from averages of 0.1 centimeters (R_B-01) to 2.1 centimeters (R_B-03). Overall, the average sediment depth across all sample sites was 1.2 centimeters. Representative photos have been provided in **ATTACHMENT A**.

4.1.4 Rincón – ESA Corals

A total of 33 ESA listed corals were identified at sample sites in Rincón (**Figure 12**), which accounted for 4.4% of all stony corals. Twenty-five (25) were *Orbicella faveolota*, seven (7) were *Dendrogyra cylindrus*, and one (1) was *Acropora cervicornis*. **Table 8** lists the sites where ESA listed corals were observed. Twenty-six (26) of the ESA listed corals were observed on linear reef habitats. Many of the ESA listed stony corals were first observed during mapping efforts. Following completion of mapping activities, ESA corals were revisited to collect colony dimensions, document health characteristics, and record percent live tissue. Underwater visibility in Rincón was variable and changed with tide cycles, amount of rain and runoff, and sea conditions. Scientists attempted to maximize research efforts during good water quality conditions but there were several occasions when sampling activities occurred in low visibility conditions. During these periods of low visibility, reduced visual coverage may have affected relocation and collection of colony data for some ESA corals in and adjacent to sample sites. The maximum dimensions of ESA listed corals ranged from 7.7 to 285 centimeters, with an average of 50.5

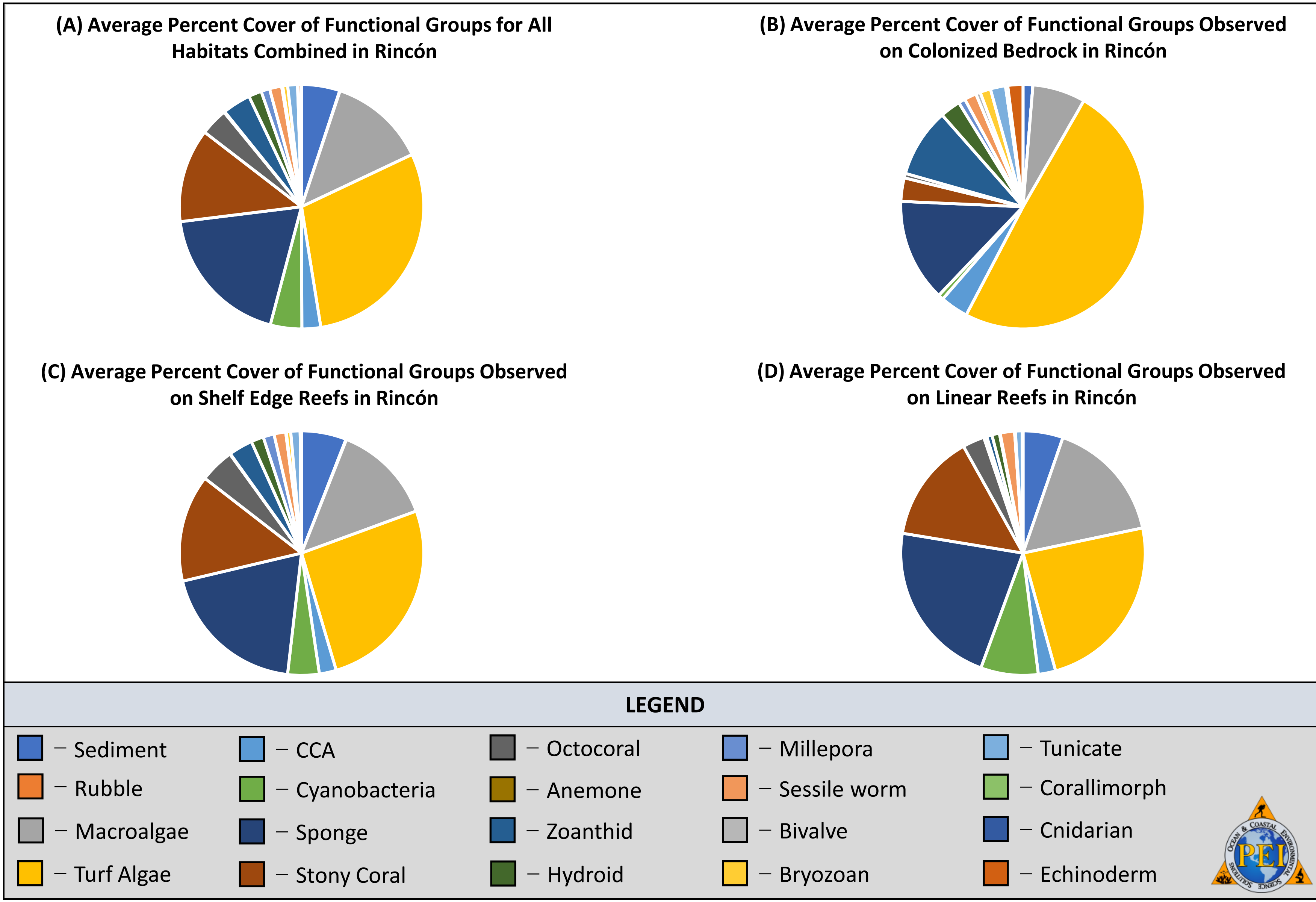


Figure 11. Average percent cover of functional groups observed on specific habitats in Rincón: (A) Average percent cover of functional groups for all habitats combined; (B) Average percent cover of functional groups observed on colonized bedrock; (C) Average percent cover of functional groups observed on shelf edge reefs; (D) Average percent cover of functional groups observed on linear reefs.

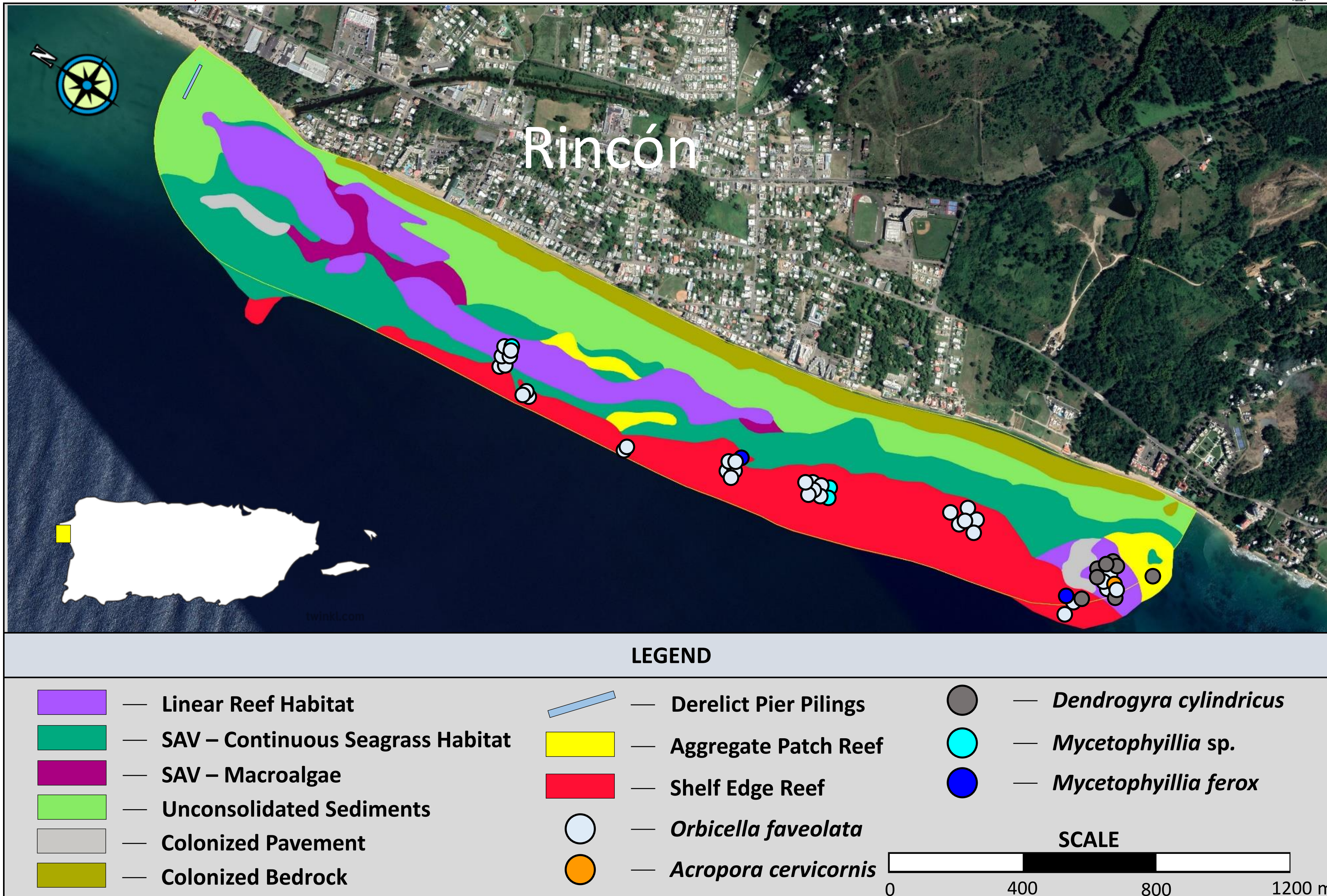


Figure 12. A Map of delineated resources including ESA listed corals within the survey area near Rincón, Puerto Rico. Image credit: Google Earth, 2022.

centimeters. The average percent live tissue of ESA corals was 84.8%, which supported *in situ* observations that corals appeared to be in relatively good health. Although no ESA corals were observed at sites with high levels of sedimentation, 15.2% of ESA listed corals observed in the Rincón survey area had visible sediment indicators. However, ESA listed corals were often some of the largest corals observed during the Rincón survey which may make them be more susceptible to sediment deposition due to their boulder morphology and larger surface area. The most prominent signs of stress in ESA corals were algal overgrowth (48.5% of colonies), endolithic borers (42.4% of colonies), and partial bleaching/paling (30.3%).

Table 8. ESA listed coral counts from Rincón sites where colonies were located.

Species	Rincón ESA Listed Corals Counts by Site				
	R_B-02	R_B-03	R_B-06	Total by Species	% Abundance out of Total ESA Corals
	Linear Reef	Shelf Edge Reef	Linear Reef		
Orbicella faveolata	11	9	5	**25**	75.8%
Dendrogyra cylindricus	0	0	7	**7**	21.2%
Acropora cervicornis	0	0	1	**1**	3.0%
Total by Site	**11**	**9**	**13**	**33**	
% Abundance out of Total ESA Coral by Site	**33.3%**	**27.3%**	**39.4%**		

4.1.5 Rincón – Qualitative Data

Qualitative data collection included *in situ* identifications of biota observed during the benthic resource survey (**Table 9**). Some of the most common biota observed colonizing habitats in the Rincón survey area included a diverse assemblage of macroalgae including: green algae (*Caulerpa mexicana*, *C. racemosa*, *C. sertularioides*, *C. verticillata*, *Codium* sp., *Halimeda* spp., *Penicillus* spp., *Neomeris* spp., and *Udotea* spp.), red algae (*Acanthophora* spp., *Amphiroa* sp., *Asparagopsis* sp., *Bryothamnion* spp., *Ceramium* spp., *Dasya* spp., *Dictyurus* sp., *Gelidium* sp., *Gracilaria* sp., *Heterosiphonia* spp., *Hypnea* sp., *Laurencia* spp., *Spyridea* spp., and *Wrangelia* spp.), and brown algae (*Dictyopteris* spp., *Dictyota* spp., and *Padina* spp.). Additional benthic resources observed colonizing hardbottom included numerous sponges (*Aplysina fistularis*, *Desmapsamma anchorata*, *Cinachyrella apion*, *Cliona* spp., *Iotrochota birotulata*, *Ircinia* spp., *Niphates* sp., *Callyspongia plicifera*, *Scopalina ruetzleri*, and *Xestospongia muta*), octocorals (*Antillogorgia* sp., *Erythropodium* sp., *Eunicea* spp., *Gorgonia* spp., *Muricea* spp., *Plexaura* sp., and), stony corals (*Acropora cervicornis*, *Dendrogyra cylindrus*, *Diploria labyrinthiformis*, *Eusmilia fastigiata*, *Montastraea cavernosa, Mycetophyllia aliciea, M. ferox, Orbicella faveolate*, *Porites astreoides*, *P. porites*, *Pseudodiploria strigosa*, *Siderastrea radians*, and *S. siderea*), and echinoderms (*Diadema antillarum*, *Echinometra lucunter,* and *Eucidaris tribuloides*). A variety of fish species were identified during the survey including: Atlantic spadefish (*Chaetodipterus faber*), brown garden eel (*Heteroconger halis*), porkfish (*Anisotremus virginicus*), blue tang (*Acanthurus coeruleus*), lane snapper (*Lutjanus synagris*), doctorfish (*Acanthurus chirurgus*), slippery dick (*Halichoeres bivittatus*), sergeant major (*Abudefduf saxatilis*), damselfish (Pomacentridae), southern stingray (*Dasyatis americana*), grunts (Haemulidae), graysby (*Epinephelus cruentatus*), French angelfish (*Pomacanthus paru*), rock hind (*Epinephelus adscensionis*), coney (*Cephalopholis fulva*) and blue chromis (*Chromis cyanea*). West Indian manatee (*Trichechus manatus manatus*), green turtles (*Chelonia mydas*), and queen conch (*Aliger gigas*) were also observed during the survey. Representative photos have been provided in **ATTACHMENT A**.

Table 9. Qualitative list of biota identified during the SAV and benthic resource survey.

Common Name	Scientific Name	Rincón	San Juan
Cyanobacteria	**Cyanophyta**	X	X
Algae			
Green Algae	**Chlorophyta**		
Mermaid's Wine Glass Algae	*Acetabularia* sp.	X	
Green Algae	*Avrainvillea* sp.	X	X
Green Algae	*Batophora* sp.		X
Sea Ferns	*Bryopsis* spp.	X	
Cactus Tree Algae	*Caulerpa cupressoides*	X	X
Fern Algae	*Caulerpa mexicana*	X	
Green Algae	*Caulerpa microphysa*	X	X
Green Blade Algae	*Caulerpa prolifera*	X	X
Sea Grapes	*Caulerpa racemosa*	X	X
Green Feather Algae	*Caulerpa sertularioides*	X	X
Green Algae	*Caulerpa* spp.	X	X
Green Algae	*Caulerpa verticillata*	X	X
Green Algae	*Chaetomorpha* sp.		X
Green Algae	*Cladophora* spp.		X
Dead Man's Fingers	*Codium isthmocladum*	X	X
Green Algae	*Codium* sp.	X	X
Green Algae	*Codium taylorii*		X
Green Algae	*Dasycladus vermicularis*		X
Green Bubble Algae	*Dictyosphaeria cavernosa*		X
Green Algae	*Dictyosphaeria* spp.		X
Green Algae	*Enteromorpha* spp.	X	
Green Algae	*Ernodesmis* spp.		X
Large-Leaf Hanging Vine	*Halimeda copiosa*	X	
Large Leaf Watercress Algae	*Halimeda discoidea*	X	X
Three Finger Leaf Algae	*Halimeda incrassata*	X	X
Green Algae	*Halimeda monile*	X	X
Watercress Algae	*Halimeda opuntia*	X	X
Green Algae	*Halimeda* spp.	X	X
Stalked Lettuce Leaf Algae	*Halimeda tuna*	X	
Network Algae	*Microdictyon marinum*		X
Green Algae	*Neomeris* sp.	X	X
Bristle Ball Brush Algae	*Penicillus dumetosus*	X	X
Flat Top Bristle Brush Algae	*Penicillus pyriformis*	X	X
Green Algae	*Penicillus* spp.	X	X
Green Algae	*Phyllodictyon* sp.	X	X
Pinecone Algae	*Rhipocephalus phoenix*	X	X
Green Algae	*Rhipocephalus* spp.		X
Green Algae	*Udotea* spp.	X	X
Bubble Algae	*Valonia ventricosa*	X	X
Bubble Algae	*Ventricaria ventricosa*	X	X
Green Algae	*Verdigellas* sp.		X
Brown Algae	**Phaeophyta**		
Brown Algae	*Dictyopteris* spp.	X	X
Forded sea tumbleweed	*Dictyota bartayresiana*		X
Brown Algae	*Dictyota cervicornis*	X	X
Brown Algae	*Dictyota ciliolata*		X
Brown Algae	*Dictyota crispata*		X
Brown Algae	*Dictyota mertensii*	X	X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Algae (continued)			
Brown Algae	**Phaeophyta**		
Y-Branching Algae	*Dictyota* spp.	X	X
Brown Algae	*Lobophora* spp.	X	X
Encrusting Fan-Leaf Algae	*Lobophora variegata*	X	
White Scroll Algae	*Padina sanctae-crucis*		X
Brown Algae	*Padina* spp.	X	X
Brown Algae	*Sargassum hystrix*		X
Brown Algae	*Sargassum* spp.		X
Red Algae	**Rhodophyta**		
Prickly seaweed	*Acanthophora spicifera*	X	X
Red Algae	*Acanthophora* spp.	X	X
Red Algae	*Aglaothamnion spp.*	X	
Red Algae	*Amphiroa fragilissima*	X	X
Red Algae	*Amphiroa* sp.	X	X
Red Sea Plume	*Asparagopsis taxiformis*	X	X
Red Algae	*Asparagopsis* sp.		X
Red Algae	*Bostrychia* spp.		X
Red Algae	*Bryothamnion seaforthii*	X	X
Red Algae	*Bryothanmnion triquetrum*	X	X
Red Algae	*Bryothamnion* spp.	X	X
Red Algae	*Callithamnion* spp.	X	X
Red Algae	*Ceramium* spp.	X	
Red Algae	*Champia* spp.		X
Encrusting Red Algae	*Melyvonnea sp.*	X	
Unidentified Crustose Coralline Algae	*Corallinales*	X	X
Red Algae	*Chondracanthus* spp.		X
Red Algae	*Chondria* spp.	X	X
Red Algae	*Chrysymenia enteromorpa*		X
Red Algae	*Dasya* spp.	X	X
Red Algae	*Dictyurus occidentalis*	X	X
Red Algae	*Dictyurus* sp.		X
Red Algae	*Flahaultia* spp.		X
Red Algae	*Galaxaura* spp.	X	X
Chaffweed	*Gelidiella acerosa*		X
Red Algae	*Gelidiella* spp.		X
Red Algae	*Gelidiopsis* spp.		X
Red Algae	*Gelidium americanum*	X	X
Red Algae	*Gelidium* spp.	X	X
Red Algae	*Gracilaria* spp.	X	X
Red Algae	*Haliptilon* spp.		X
Red Algae	*Halymenia* spp.		X
Red Algae	*Heterosiphonia gibbesii*	X	
Red Algae	*Heterosiphonia* spp.		X
Red Algae	*Hypnea* sp.	X	X
Red Algae	*Jania* spp.	X	X
Red Algae	*Laurencia* spp.	X	X
Red Algae	*Liagora* sp.	X	X
Red Algae	*Peyssonnelia boergesenii*	X	X
Red Algae	*Peyssonnelia* spp.	X	X
Red Algae	*Pterocladiella capillacea*		X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Algae (continued)			
Red Algae	**Rhodophyta**		
Red Algae	*Spyridea* spp.	X	X
Red Algae	*Titanoderma* sp.	X	X
Red Algae	*Wrangelia* spp.	X	X
Red Algae	*Wrightiella* spp.	X	X
Unidentified Algae			
Turf Algae	Turf Algae	X	X
Seagrass			
Shoal Grass	*Halodule wrightii*	X	
Paddle Grass	*Halophila decipiens*	X	
Star Grass	*Halophila engelmannii*	X	
Manatee Grass	*Syringodium filiforme*	X	
Turtle Grass	*Thalassia testudimum*		X
Porifera			
Sponge	*Agelas dispar*	X	X
Sponge	*Aiolochroia crassa*	X	
Row Pore Rope Sponge	*Aplysina cauliformis*	X	
Yellow Tube Sponge	*Aplysina fistularis*	X	
Branchlet Sponge	*Aplysina insularis*	X	X
Sponge	*Aplysina* sp.	X	
Yellow Sponge	*Biemna* sp.	X	
Azure Vase Sponge	*Callyspongia plicifera*	X	
Chicken Liver Sponge	*Chondrilla caribensis*		X
Sponge	*Chondrilla* sp.	X	
Ball Sponge	*Cinachyrella kuekenthali*	X	X
Ball Sponge	*Cinochyrella apion*	X	X
Coral Boring Sponge	*Cliona caribbaea*	X	X
Encrusting brown sponge	*Cliona caribbaea*	X	X
Red Boring Sponge	*Cliona delitrix*	X	
Sponge	*Cliona* spp.	X	
Pink Sponge	*Desmapsamma anchorata*	X	X
Brown Encrusting Octopus Sponge	*Ectyoplasia ferox*	X	X
Sponge	*Erylus formosus*	X	
Sponge	*Geodia neptuni*	X	
Green Finger Sponge	*Iotrochota birotulata*	X	
Sponge	*Ircinia* spp.	X	
Black Ball Sponge	*Ircinia strobilina*	X	
Orange Icing Sponge	*Mycale laevis*	X	
Sponge	*Neopetrosia carbonaria*	X	X
Pink Vase Sponge	*Niphates digitalis*	X	X
Lavender Rope Sponge	*Niphates erecta*	X	
Red Sieve Encrusting Sponge	*Phorbas amaranthus*	X	
Sponge	*Polymastia tenax*	X	
Orange Lumpy Encrusting Sponge	*Scopalina ruetzleri*	X	
Pitted Sponge	*Verongula rigida*	X	
Giant Barrel Sponge	*Xestospongia muta*	X	X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Cnidaria			
Hexacorallia			
Elegant Anemone	*Actinoporus elegans*		X
Berried Anemone	*Alicia mirabilis*		X
Corkscrew Anemone	*Bartholomea annulata*	X	X
Turtle Grass Anemone	*Bunodeopsis globulifera*	X	X
Giant Sea Anemone	*Condylactis gigantea*	X	X
Corallimorphs	Corallimorpharia	X	X
Beaded Anemone	*Epicystis crucifer*		X
Branching Anemone	*Lebrunia danae*	X	
Hidden Anemone	*Lebrunia* spp.		X
White Encrusting Zoanthid	*Palythoa caribaeorum*	X	X
Sponge Zoanthid	*Parazoanthus parasiticus*	X	X
Sun Anemone	*Stichodactyla helianthus*	X	X
Mat Zoanthid	*Zoanthus pulchellus*	X	X
Hydrozoa			
Feather Bush Hydroid	*Dentitheca dendritica*	X	X
Christmas Tree Hydroid	*Halocordyle disticha*	X	X
Unidentified Hydroid	Hydrozoa	X	X
Stinging Hydroid	*Macrorhynchia allmani*	X	
White Stinger	*Macrorhynchia philippina*	X	
Branching Fire Coral	*Millepora alcicornis*	X	X
Rose Lace Coral	*Stylaster roseus*		X
Unbranched Hydroid	*Thyroscyphus marginatus*	X	
Algae Hydroid	*Thyroscyphus ramosus*	X	X
Scyphozoa			
Upsidedown Jelly	*Cassiopea frondosa*		X
Octocorallia			
Sea Plume	*Antillogorgia* spp.	X	X
Corky Sea Finger	*Briareum asbestinum*	X	X
Sea Whip	*Ellisella* sp.	X	
Encrusting Gorgonian	*Erythropodium caribaeorum*	X	
Knobby Sea Rod	*Eunicea* spp.	X	X
Sea Fan	*Gorgonia* spp.	X	X
Deepwater Sea Fan	*Iciligorgia schrammi*	X	
Spiny Sea Rod	*Muricea* spp.	X	X
Sea Plume	*Muriceopsis flavida*	X	X
Sea Rod	*Plexaura homomalla*	X	X
Sea Rod	*Plexaurella* spp.	X	
Porous Sea Rod	*Pseudoplexaura* sp.	X	
Sea Whip	*Pterogorgia* spp.	X	X
Stony Corals			
Staghorn Coral	*Acropora cervicornis*	X	
Lettuce Coral	*Agaricia agaricites*	X	X
Fragile Saucer Coral	*Agaricia fragilis*	X	X
Dimpled Sheet Coral	*Agaricia grahamae*	X	
Whitestar Sheet Coral	*Agaricia lamarcki*	X	X
Boulder Brain Coral	*Colpophyllia natans*	X	
Pillar Coral	*Dendrogyra cylindrus*	X	
Elliptical Star Coral	*Dichocoenia stokesii*	X	X
Grooved Brain Coral	*Diploria labyrinthiformis*	X	X
Smooth Flower Coral	*Eusmilia fastigiata*	X	X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Stony Corals (continued)			
Golfball Coral	*Favia fragum*	X	X
Rough Star Coral	*Isophyllia rigida*	X	X
Sinous Cactus Coral	*Isophyllia sinuosa*	X	X
Yellow Pencil Coral	*Madracis auretenra*	X	
Ten-Ray Star Coral	*Madracis decactis*	X	X
Star Coral	*Madracis pharensis*	X	
Whitevalley Maze Coral	*Meandrina jacksoni*		X
Maze Coral	*Meandrina meadrites*	X	X
Great Star Coral	*Montastraea cavernosa*	X	X
Knobby Cactus Coral	*Mycetophyllia aliciae*	X	
Rough Cactus Coral	*Mycetophyllia ferox*	X	
Cactus Coral	*Mycetophyllia* sp.	X	
Diffuse Ivory Bush Coral	*Oculina diffusa*	X	
Lobed Star Coral	*Orbicella annularis*	X	X
Mountainous Star Coral	*Orbicella faveolata*	X	X
Hidden Cup Coral	*Phyllangia americana*	X	
Mustard Hill Coral	*Porites astreoides*	X	X
Branching Finger Coral	*Porites furcata*	X	
Clubtip Finger Coral	*Porites porites*	X	X
Knobby Brain Coral	*Pseudodiploria clivosa*	X	X
Symmetrical Brain Coral	*Pseudodiploria strigosa*	X	X
Artichoke Coral	*Scolymia cubensis*	X	X
Solitary Disk Coral	*Scolymia sp.*	X	
Lesser Starlet Coral	*Siderastrea radians*	X	X
Massive Starlet Coral	*Siderastrea siderea*	X	X
Smoothy Star Coral	*Solenastrea bournoni*	X	
Blushing Star Coral	*Stephanocoenia intersepta*	X	
Annelida			
Bristle Worm	*Amphinomidae*	X	
Split-Crown Feather Duster Worm	*Anamobaea orstedii*	X	X
Social Feather Duster Worm	*Bispira brunnea*	X	X
Spaghetti Worm	*Eupolymnia crassicornis*	X	X
Bearded Fireworm	*Hermodice carunculata*	X	X
Fan Worm	*Notaulax* spp.	X	X
Sabellariid Worm Rock	*Phragmatopoma lapidosa*		X
Star Horseshore Worm	*Pomatostegus stellatus*	X	X
Magnificent Feather Duster Worm	*Sabellastarte magnifica*	X	X
Sessile Worms	*Serpulidae*	X	X
Christmas Tree Worm	*Spirobranchus giganteus*	X	X
Arthropoda			
Barnacles	*Cirripedia* spp.	X	X
Caribbean Spiny Lobster	*Panulirus argus*	X	X
Peterson Cleaner Shrimp	*Periclimenes pedersoni*	X	X
Spotted Cleaner Shrimp	*Periclimenes yucatanicus*	X	X
Giant Hermit Crab	*Petrochirus diogenes*	X	
Neck Crab	*Podochela* sp.		X
Banded Coral Shrimp	*Stenopus hispidus*	X	X
Arrow Crab	*Stenorhynchus seticornis*	X	X
Squat Anemone Shrimp	*Thor amboinensis*	X	X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Bryozoa			
Bryozoan	*Gymnolaemata*	X	X
Mollusca			
Pen Shell	*Atrina rigida*	X	X
Leech Headshield Slug	*Chelidonura hirundinina*	X	
Rough Fileclam	*Ctenoides scaber*	X	X
Flamingo Tongue	*Cyphoma gibbosum*	X	X
Lettuce Sea Slug	*Elysia crispata*	X	X
Tulip	*Fasciolaria tulipa*	X	X
File Clam	*Lima scabra*	X	X
Milk Conch	*Lobatus costatus*	X	
Queen Conch	*Aliger gigas*	X	X
Common Octopus	*Octopus vulgaris*		X
Amber Pen Shell	*Pinna carnea*	X	X
Helmet Conch	*Strombus alatus*		X
Echinodermata			
Giant Basket Star	*Astrophyton muricatum*	X	X
Beaded Crinoid	*Davidaster discoideus*	X	
Long-Spined Urchin	*Diadema antillarum*	X	X
Rock-Boring Urchin	*Echinometra lucunter*	X	X
Pencil Urchin	*Eucidaris tribuloides*	X	X
Donkey Dung Sea Cucumber	*Holothuria mexicana*		X
Sea Cucumber	*Holothuroidea*	X	
Three Rowed Sea Cucumber	*Isostichopus badionotus*	X	X
Reticulated Brittle Star	*Ophionereis reticulata*	X	
Red Cushion Sea Star	*Oreaster reticulatus*		X
West Indian Sea Egg	*Tripneustes ventricosus*		X
Chordata			
Encrusting Tunicate	*Botrylloides* spp.	X	X
Painted Tunicate	*Clavelina picta*	X	
Bulb Tunicate	*Clavelina* sp.	X	X
Whitespeck Tunicate	*Didemnum conchyliatum*	X	
Encrusting Tunicate	*Didemnum* spp.	X	X
Starwberry Tunicate	*Eudistoma* sp.	X	X
Caribbean Spanish Dancer	*Hexabranchus morsomus*		X
Tunicates	*Tunicata*	X	
Fishes			
Sergeant Major	*Abudefduf saxatilis*	X	X
Ocean Surgeonfish	*Acanthurus bahianus*	X	X
Doctorfish Tang	*Acanthurus chirurgus*	X	
Blue Tang	*Acanthurus coeruleus*	X	X
Black Margate	*Anisotremus surinamensis*	X	X
Porkfish	*Anisotremus virginicus*	X	X
Twospot Cardinalfish	*Apogon pseudomaculatus*	X	
Trumpetfish	*Aulostomus maculatus*	X	
Spanish Hogfish	*Bodianus rufus*	X	X
Plate Fish	*Bothus lunatus*	X	
Blue Runner	*Caranx crysos*	X	
Bar Jack	*Caranx ruber*	X	X
Graysby Grouper	*Cephalopholis cruentata*	X	
Coney	*Cephalopholis fulva*	X	X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Fishes (Continued)			
Atlantic Spadefish	*Chaetodipterus faber*	X	X
Foureye Butterflyfish	*Chaetodon capistratus*	X	X
Spotfin Butterflyfish	*Chaetodon ocellatus*	X	X
Banded Butterflyfish	*Chaetodon striatus*		X
Blue Chromis	*Chromis cyanea*	X	
Creole Wrasses	*Clepticus parrae*	X	
Southern Stingray	*Dasyatis americana*	X	
Rainbow Runner	*Elagatis bipinnulata*	X	
Rock Hind Grouper	*Epinephelus adscensionis*	X	X
Red Hind Grouper	*Epinephelus guttatus*	X	
Nassau Grouper	*Epinephelus striatus*	X	X
Spotted Drum	*Equetus punctatus*	X	X
Yellowfin Mojarra	*Gerres cinereus*		X
Greenbanded Goby	*Gobiosoma multifasciatus*		X
Neon Goby	*Gobiosoma oceanops*	X	X
Fairy Basslet	*Gramma loreto*		
Blackcap Basslet	*Gramma melacara*		X
Spotted Moray	*Gymnothorax moringa*	X	X
Purplemouth Moray Eel	*Gymnothorax vicinus*	X	
Tomtate	*Haemulon aurolineatum*	X	X
French Grunt	*Haemulon flavolineatum*	X	X
Spanish Grunt	*Haemulon macrostomum*		X
Cottonwick Grunt	*Haemulon melanurum*	X	X
Bluestriped Grunt	*Haemulon sciurus*	X	X
Slippery Dick	*Halichoeres bivittatus*	X	X
Rainbow Wrasse	*Halichoeres pictus*	X	
Blackear wrasse	*Halichoeres poeyi*		X
Puddingwife Wrasse	*Halichoeres radiatus*	X	X
Brown Garden Eel	*Heteroconger longissimus*	X	X
Seahorse	*Hippocampinae*	X	
Longsnout Seahorse	*Hippocampus guttulatus*	X	
Squirrelfish	*Holocentrus adscensionis*	X	X
Unidentified Wrasse	*Labridae*	X	X
Wrasse	*Labridae*	X	
Hairy Blenny	*Labrisomus nuchipinnis*	X	X
Spotted Trunkfish	*Lactophrys bicaudalis*		X
Trunkfish	*Lactophrys* sp.	X	
Smooth Trunkfish	*Lactophrys triqueter*		X
Arrow Blenny	*Lucayablennius zingaro*	X	
Gray Snapper	*Lutjanus griseus*	X	X
Lane Snapper	*Lutjanus synagris*	X	X
Yellow Goatfish	*Mulloidichthys martinicus*	X	X
Blackbar Soldierfish	*Myripristis jacobus*	X	
Yellowtail Snapper	*Ocyurus chrysurus*		X
High Hat	*Pareques acuminatus*	X	X
Black Drum	*Pogonias cromis*	X	
Gray Angelfish	*Pomacanthus arcuatus*		X
French Angelfish	*Pomacanthus paru*	X	X
Spotted Goatfish	*Pseudupeneus maculatus*	X	X
Red Lionfish	*Pterois volitans*	X	X

Table 9. (continued)

Common Name	Scientific Name	Rincón	San Juan
Fishes (Continued)			
Molly Miller Blenny	*Scartella cristata*	X	X
Spanish Mackerel	*Scomberomorus maculatus*	X	
Cero	*Scomberomorus regalis*	X	
Spotted Scorpionfish	*Scorpaena plumieri*	X	X
Unidentified Sea Bass	*Serranus* sp.	X	
Harlequin Bass	*Serranus tigrinus*	X	
Great Barracuda	*Sphyraena barracuda*	X	X
Dusky Damselfish	*Stegastes fuscus*	X	X
Bicolor Damselfish	*Stegastes partitus*	X	X
Cocoa Damselfish	*Stegastes variabilis*	X	X
Pipefish	*Syngnathidae*	X	
Bluehead Wrasse	*Thalassoma bifasciatum*	X	X
Yellow Stingray	*Urobatis jamaicensis*	X	X
Razorfish	*Xyrichtys* sp.	X	
Sea Turtles			
Green Turtle	*Chelonia mydas*	X	
Hawksbill Turtle	*Eretmochelys imbricata*	X	

4.2 San Juan

4.2.1 San Juan – Preliminary Visual Reconnaissance (Mapping)

Benthic habitats and resources were mapped from west to east in the San Juan survey area (**Figures 13-16**). **Table 10** provides a list of delineated habitats and the total coverage for each. Delineated SAV habitat covered 1,832,208 meters^2 (452.8 acres) of the surveyed area, with 1,373,249 meters^2 (339.3 acres) consisting of continuous seagrass habitat. This habitat was characterized by continuous seagrass growth and varying density macroalgal growth. A total of six (6) species of seagrass were identified within the San Juan survey area including: *Halophila decipiens, Halophila engelmannii*, *Halophila stipulacea*, *Halodule wrightii, Syringodium filiforme,* and *Thalassia testudinum*. Generally considered keystone species, *Thalassia testudinum* and *Syringodium filiforme* occur across the Caribbean populating both estuaries and coastal environments (McDonald et al., 2016). Both *Thalassia testudinum* and *Syringodium filiforme* are among the slower growing seagrass species, but critically important for providing essential habitat for recreationally and commercially important species as well as stabilizing coastal sediments and reducing storm surge and coastal erosion (Fonseca, 1989). The majority of these seagrass habitats had dense growth and appeared to be generally healthy, mature, well-established beds. The remaining 458,959 meters^2 (113.4 acres) of SAV habitat was comprised solely of macroalgae. These macroalgal communities typically had a mix of the following species: *Halimeda* spp., *Udotea* spp., and *Caulerpa* spp. SAV habitats were observed in water depths that ranged from 5 to 25 feet and were also observed growing immediately adjacent to the base of patch reefs and other hardbottom habitats. In some areas, seagrass was observed mixed with sand veneered hardbottom and growing in small sand patches between hardbottom outcrops.

Table 10. Delineated habitats and their total coverage in the San Juan surveyed area.

Habitat	Total Meters^2	Total Acres	Percent (%) Cover
Unconsolidated Sediments	434,332	107.3	11.6%
SAV - Seagrass	1,373,249	339.3	36.6%
SAV - Macroalgae	458,959	113.4	12.2%
Aggregate Patch Reef	539,269	133.3	14.4%
Colonized Bedrock	149,158	36.9	4.0%
Linear Reef	434,651	107.4	11.6%
Colonized Pavement	338,073	83.5	9.0%
Emergent Reef	1,094	0.3	0.0%
55 Gallon Drums	1,193	0.3	0.0%
Derelict Pilings	80	0.0	0.0%
Shoreline Protection	20,642	5.1	0.6%

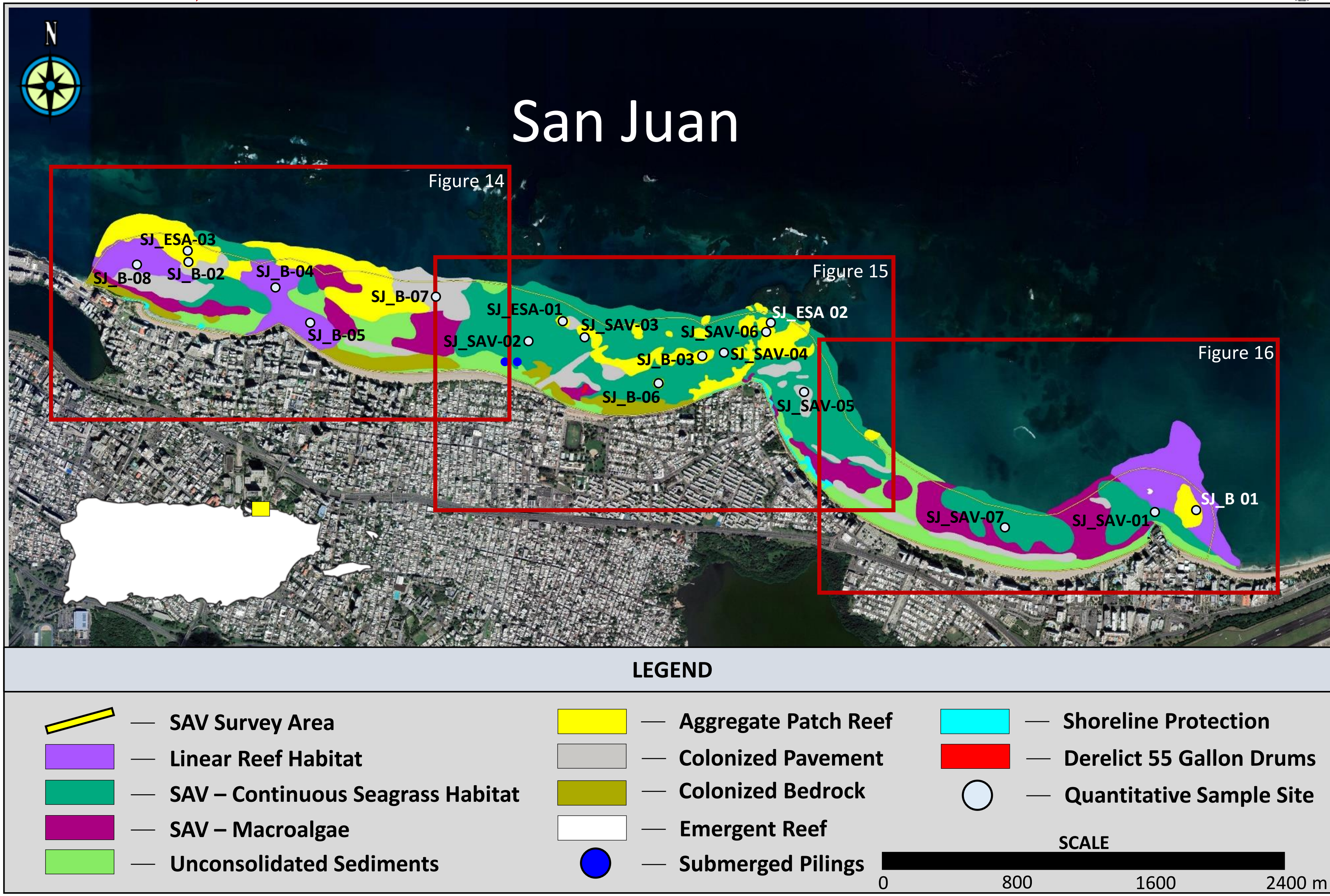


Figure 13. An index for **Figures 14, 15,** and **16** showing mapped resources delineated within the survey area near San Juan, Puerto Rico including quantitative sample site locations. Image credit: Google Earth, 2022

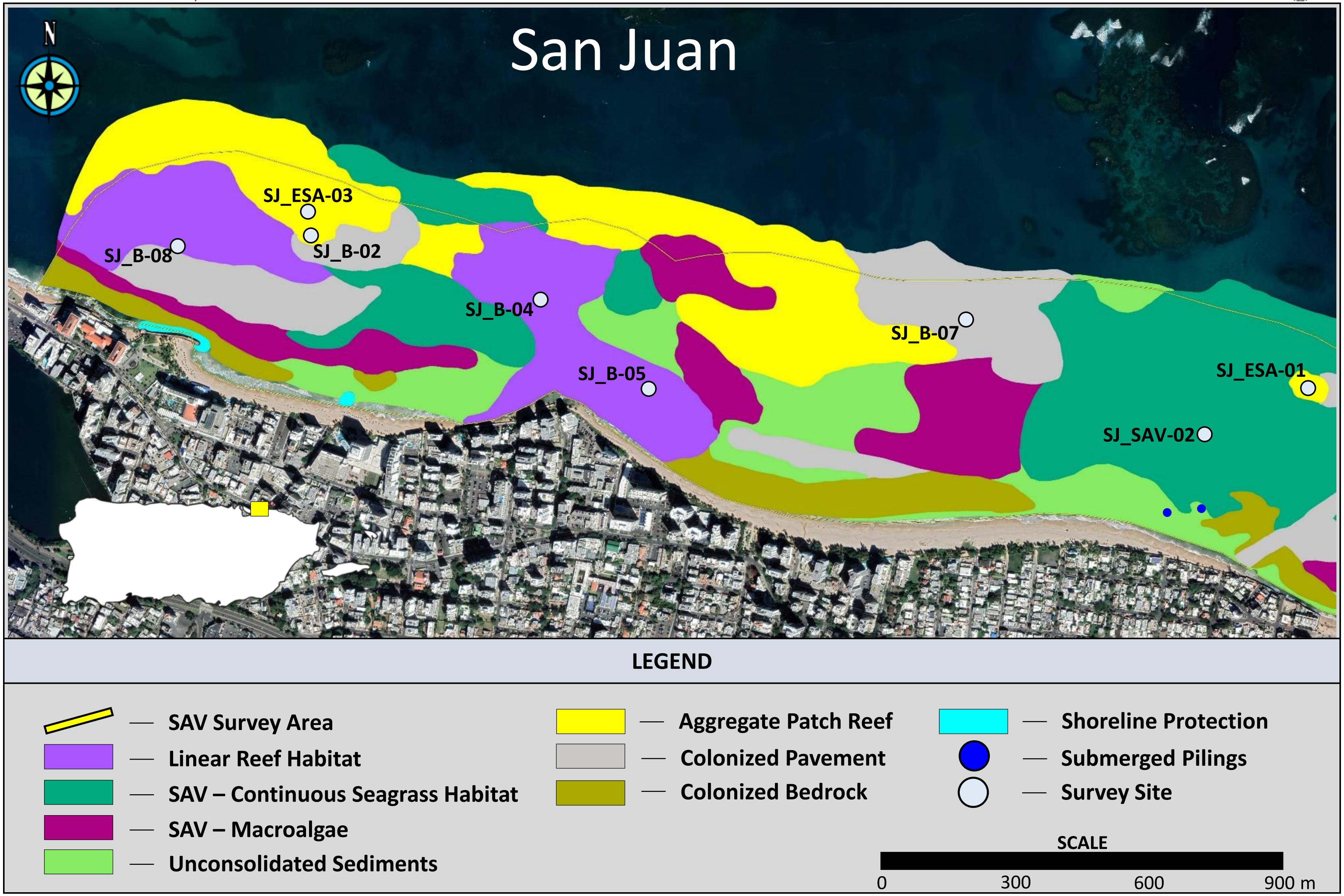


Figure 14. A map of delineated resources and quantitative sample site locations in the western zone of the San Juan survey area. Image credit: Google Earth, 2022

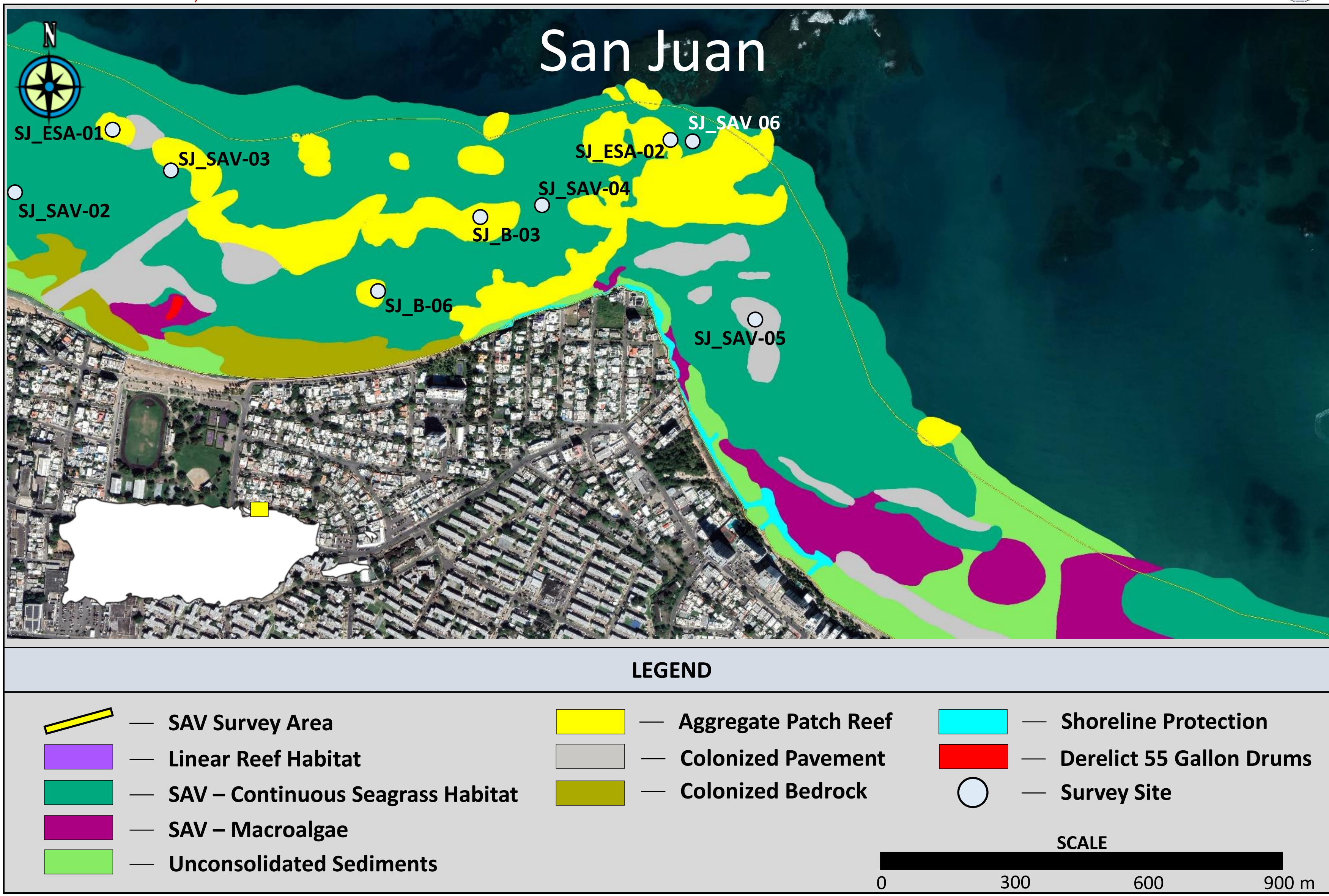


Figure 15. A map of delineated resources and quantitative sample site locations in the central zone of the San Juan survey area. Image credit: Google Earth, 2022

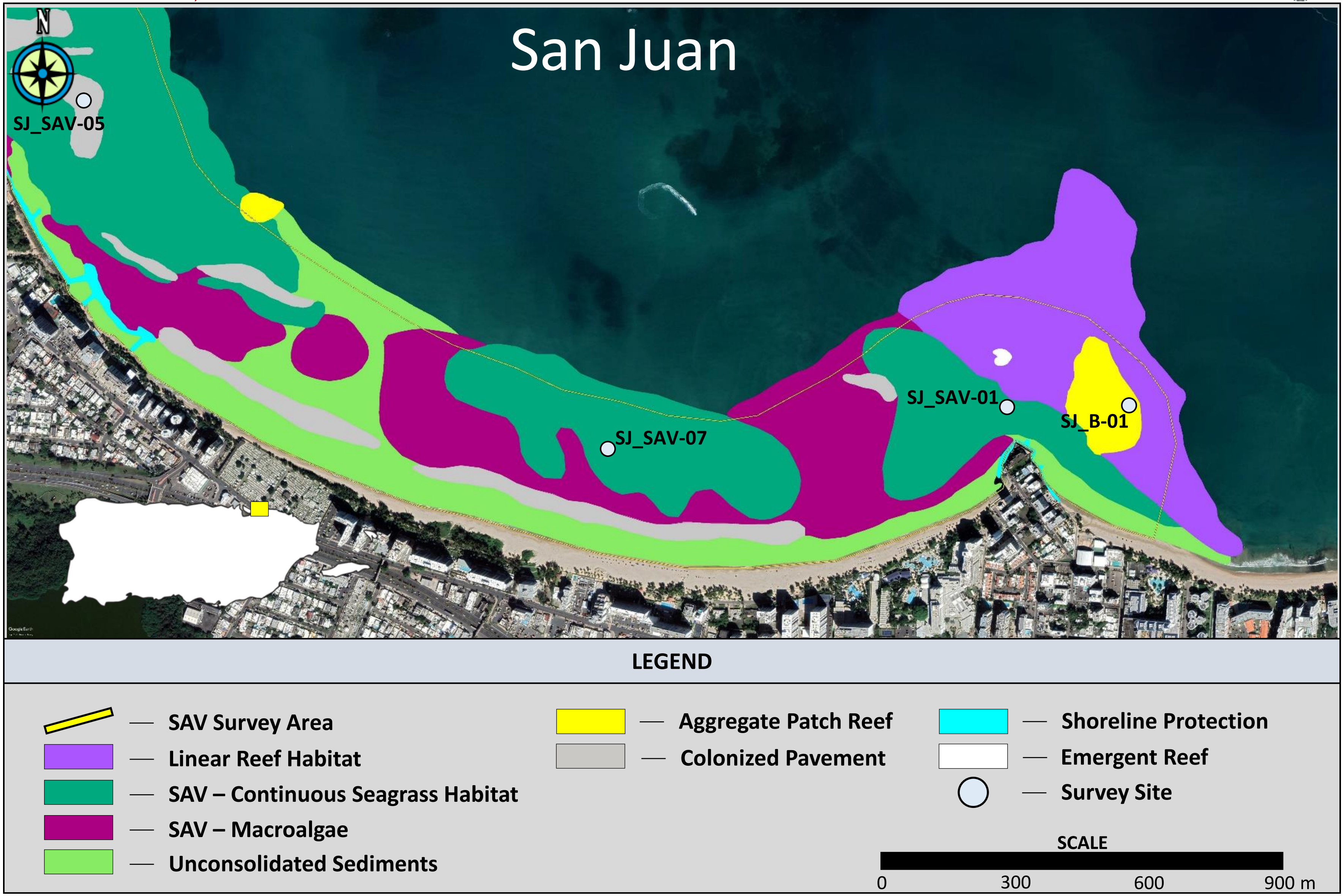


Figure 16. A map of delineated resources and quantitative sample site locations in the eastern zone of the San Juan survey area. Image credit: Google Earth, 2022

Hardbottom within the survey area covered 1,462,245 meters^2 (361.3 acres) and was comprised of five (5) different habitat types: aggregate patch reef, colonized bedrock, colonized pavement, linear reef, and emergent reef. Aggregate patch reefs covered 539,269 meters^2 (133.3 acres) and were predominately located within the central and western portions of the survey area. These patch reefs had complex geomorphology with high relief that ranged from water depths of 0.3 to 6.1 meters (< 1 to 20 feet). These reefs were dominated by macroalgae, turf algae, sponges, stony corals, and octocorals. Numerous ESA listed coral species were also observed in patch reef habitat. Patch reefs located in the center of the survey area were surrounded by dense beds of seagrass. Seagrass beds in the San Juan survey area were often observed growing immediately adjacent to the reef base, lacking the typical grazing halo expected surrounding patch reefs. Grazing halos are areas of bare sand surrounding coral reefs that are typically created by herbivorous fish that eat algae and sea grass (Madin et al., 2019). Scientists observed low numbers of reef fish on most hardbottom habitat in San Juan which may help to explain the absence of grazing halos. Linear reefs were the second largest hardbottom habitat in the survey area covering 434,651 meters^2 (107.4 acres) and were located primarily on the western and eastern ends of the survey area. The dominant biota on linear reefs was macroalgae, turf algae, sponges, and crustose coralline algae. Colonized pavement covered 338,073 meters^2 (83.5 acres) within the San Juan survey area. Colonized pavements were areas with relatively flat hardbottom that were dominated by macroalgae, turf algae, sponges, and crustose coralline algae. Some areas categorized as colonized pavement had sand veneered hardbottom that was colonized by various species of seagrass. The remaining habitat with significant coverage was colonized bedrock (149,158 meters^2; 36.9 acres). This habitat was observed nearshore, typically occurred in shallow water < 2.4 meters (< 8 feet), and was comprised of block-like pieces of bedrock. The predominant biota was macroalgae and turf algae.

Unconsolidated sediments are areas that had no emergent epifauna and were typically comprised of one or more of the following: sand, shell hash, and/or silt. Unconsolidated sediments covered 434,332 meters^2 (107.3 acres) of the surveyed area. Existing shoreline protection included rock revetments and seawall structures located in select areas along the shoreline between Condado and Isla Verde. The shoreline protection structures covered 20,642 meters^2 (5.1 acres), but these cover values were not included in the surveyed area totals.

4.2.2 San Juan – Quantification of SAV Resources

Surveys were conducted within SAV habitat previously delineated during the PVR habitat mapping in the San Juan survey area (**Figures 13** – **16**). Surveys included the identification and quantification of SAV resource from 140 quadrats (140 meters^2) at seven (7) sample sites. **Table 11** Provides a list of sample sites and the habitats represented in San Juan. **Figure 17** shows the average percent cover values obtained from both methods of quantitative data collection, the modified Braun-Blanquet scale of abundance and the EASAV method for estimating percent cover values. The EASAV values for most functional groups were lower than the Braun Blanquet values, but the differences were similar and insignificant. Based on data collected using the EASAV method for estimating percent cover, SAV resources accounted for 79.8% of the sites sampled in San Juan. Coral, sponges, and other sessile invertebrates accounted for the remaining 20.2%. Although SAV was comprised of both seagrasses and macroalgae, the macroalgal cover was low and accounted for only 4.6% of SAV percent cover. Predominate macroalgae genera observed during the San Juan survey included *Halimeda* spp., *Caulerpa* spp., *Gracilaria* spp., and *Udotea* spp. Other macroalgae genera observed during the benthic resource survey included *Chondria* spp., *Dictyopteris* spp., *Galaxuara* spp., *Laurencia* spp., *Penicillus* spp., *Amphiroa* spp., *Wrangelia* spp., *Hypnea* spp., and *Neomeris* spp. Seagrass accounted for the remaining 75.2% of SAV resources. Six (6) species of seagrass were identified in the San Juan survey area including:

Syringodium filiforme, *Halophila stipulacea*, *Thalassia testudinum*, *Halophila decipiens*, *Halodule wrightii*, and *Halophila engelmannii*. Each species was assessed for percent cover, density (shoots/100-centimeter^2), frequency of occurrence, blade length, canopy height, and visible health (i.e., the presence of flowering, epiphytes, sedimentation, and drift algae). Average percent cover for seagrasses delineated during the PVR habitat mapping, included: *Syringodium filiforme* with the highest average percent cover (34.5%), followed by *Halophila stipulacea* (11.9%), *Thalassia testudinum* (11.5%), *Halophila decipiens* (9.2%), *Halodule wrightii* (7.9%), and *Halophila engelmannii* (0.2%).

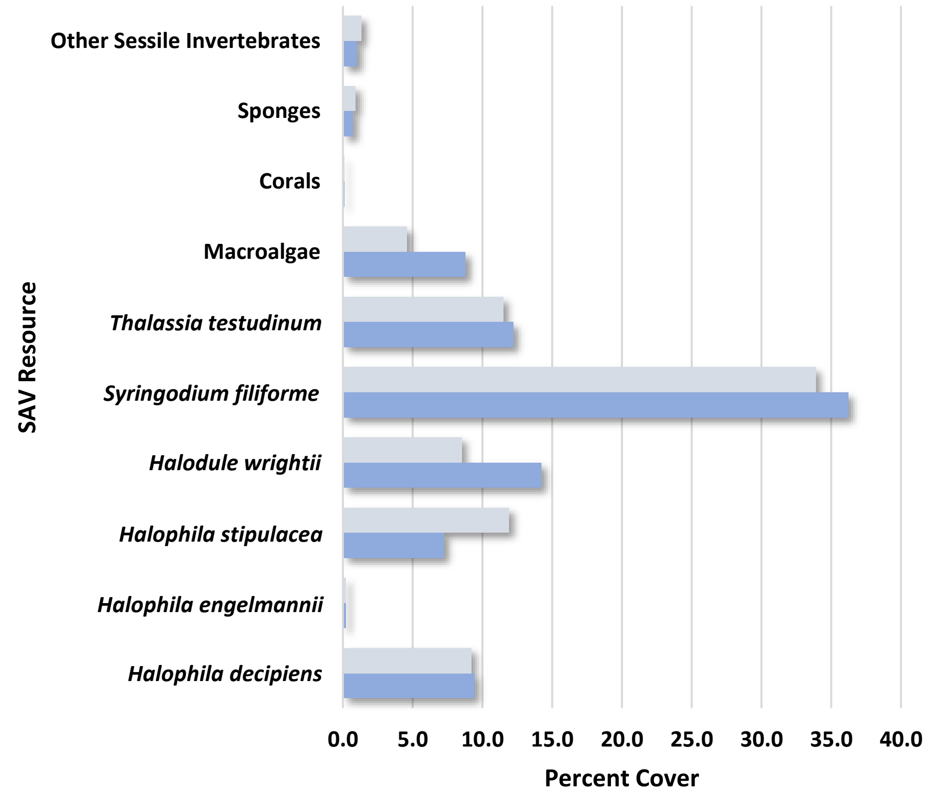
Table 11. Sample sites and the habitats represented in the San Juan survey area.

Site	Habitat Type	Zone	Water Depth (feet)
SJ-SAV-01	SAV-Seagrass	East	9
SJ-SAV-02	SAV-Seagrass	Central	18
SJ-SAV-03	SAV-Seagrass	Central	22
SJ-SAV-04	SAV-Seagrass	Central	13
SJ-SAV-05	SAV-Seagrass	Central	10
SJ-SAV-06	SAV-Seagrass	Central	14
SJ-SAV-07	SAV-Seagrass	East	19
SJ-B-01	Aggregate Patch Reef	East	19
SJ-B-02	Aggregate Patch Reef	West	16
SJ-B-03	Aggregate Patch Reef	Central	21
SJ-B-04	Linear Reef	West	17
SJ-B-05	Linear Reef	West	8
SJ-B-06	Aggregate Patch Reef	Central	4
SJ-B-07	Colonized Pavement	West	25
SJ-B-08	Linear Reef	West	22
SJ_ESA-01	Aggregate Patch Reef	Central	19
SJ_ESA-02	Aggregate Patch Reef	Central	7
SJ_ESA-03	Aggregate Patch Reef	West	12

Although quantitative data for *Halophila decipiens* and *Halophila engelmannii* were only collected at one sample site (SJ_SAV-03), these species were observed throughout the San Juan survey area in delineated seagrass habitats. In general, data collected for each seagrass species were representative of delineated seagrass habitat in San Juan. In areas where seagrass was observed, shoot density was generally high. *Halophila decipiens* had the highest density of shoots (2-37 shoots/100-centimeter^2), followed by *Halophila stipulacea* (2-26 shoots/100-centimeter^2), and *Syringodium filiforme* (2-26 shoots/100-centimeter^2). *Halophila engelmannii* (2-8 shoots/100-centimeter^2) had the lowest density of seagrasses

Braun-Blanquet vs. EASAV Estimated Percent Cover Values San Juan

SAV Resource	BB Converted Percent Cover (%)	EASAV Estimated Percent Cover (%)
Halophila decipiens	9.4	9.2
Halophila engelmannii	0.2	0.2
Halophila stipulacea	7.2	11.9
Halodule wrightii	14.2	8.5
Syringodium filiforme	36.2	33.9
Thalassia testudinum	12.2	11.5
Macroalgae	8.8	4.6
Corals	0.1	0.1
Sponges	0.7	0.9
Other Sessile Invertebrates	1.0	1.3
Substrate	-	17.9



LEGEND

– EASAV Estimated Percent Cover

– Braun-Blanquet Converted Percent Cover

Figure 17. Comparison of percent cover values using the historical Braun-Blanquet method and the new EASAV method for estimating percent cover for each functional group in San Juan. All functional groups were surveyed using both methods, except for substrate, which only have EASAV estimated percent cover values.

sampled in San Juan. **Table 12** provides the ranges of seagrass shoot density per species (shoots/100-centimeter²). Among the slower growing seagrass species, *Thalassia testudinum* and *Syringodium filiforme* were typically observed with high growth densities and in well-established seagrass beds. Seagrass habitats in San Juan were observed with numerous invertebrate species including, but not limited to, queen conch (*Aliger gigas*), tulip (*Fasciolaria tulipa*), and penshell (*Pinna carnea*).

Table 12. Range of seagrass density (shoots/100-centimeter²) per species at each quantitative sample site in San Juan.

Site	*Halophila decipiens*	*Halophila engelmannii*	*Halophila stipulacea*	*Halodule wrightii*	*Syringodium filiforme*	*Thalassia testudinum*	Total Range
SJ_SAV-01	0	0	0	1-18	2-21	1-8	1-21
SJ_SAV-02	0	0	0	1-16	4-21	0	1-21
SJ_SAV-03	2-37	2-8	3-21	5-17	2-15	1-3	1-37
SJ_SAV-04	0	0	0	1-18	2-19	2-12	1-19
SJ_SAV-05	0	0	0	2-10	1-15	1-16	1-16
SJ_SAV-06	0	0	2-26	0	3-16	1-2	1-26
SJ_SAV-07	0	0	0	1-14	1-1	0	1-14
Total Range	2-37	2-8	2-26	1-18	1-21	1-16	-

The average blade lengths for each species were: *Halophila decipiens* (1.6 centimeters), *Halophila engelmanni* (2.1 centimeters), *Halophila stipulacea* (5.0 centimeters), *Halodule wrightii* (12.6 centimeters), *Syringodium filiforme* (25.6 centimeters), *and Thalassia testudinum* (16.3 centimeters) (**Figure 18**). The dense growth and high canopy of *Thalassia testudinum* and *Syringodium filiforme* provide essential habitat for recreationally and commercially important species as well as stabilizing coastal sediments and reducing storm surge and coastal erosion (Fonseca, 1989). Seagrass health ranged from fair to very healthy. Flowering was observed on *Halophila decipiens* and *Syringodium filiforme*. Seagrass beds observed in San Juan were relatively dense, mature growth habitats that were visibly healthy. Some seagrass habitats occurred in sand veneered hardbottom or between hardbottom outcrops. The absence of grazing halos around many of the patch reefs in San Juan, may be indicative of the low numbers of herbivorous fish observed in the survey area (Madin et al., 2019). Several seagrass beds in the San Juan survey area were observed with significant erosion along the edge exposing rhizomes and sub-bottom sediments. Such erosion can be caused by natural events including bioturbation and storm-induced wave energy or anthropogenic impacts such as boat anchoring, dredging, vessel groundings or any combination of these factors (Fonseca, 1989). Erosion of seagrass beds can also be exacerbated in degraded seagrass beds resulting from low water quality (i.e., excessive nutrients, high turbidity, low ambient light levels, stormwater run-off, and global warming trends). Representative photos have been provided in **ATTACHMENT B**.

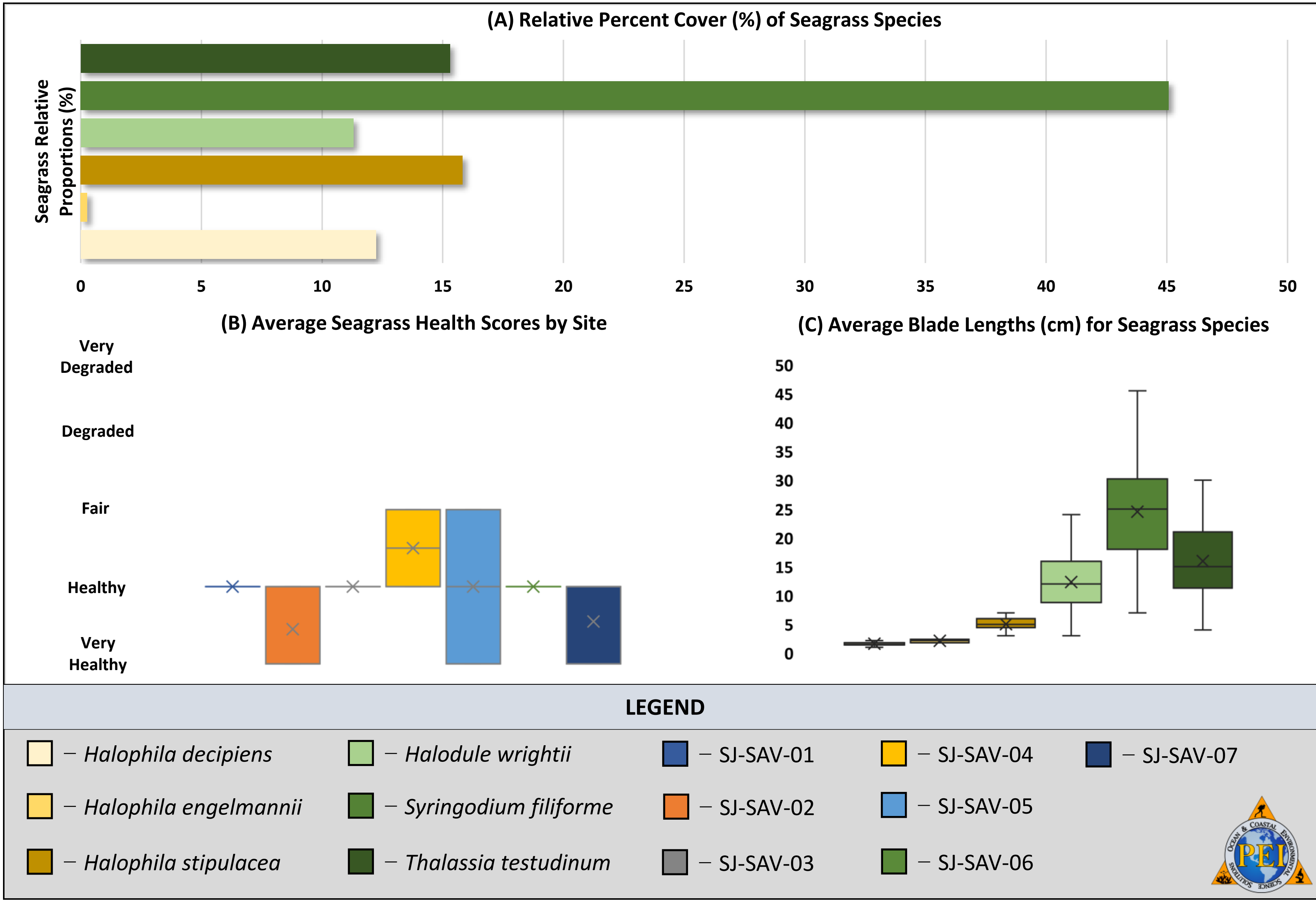


Figure 18. Statistics of seagrass species observed in San Juan. (A) Relative proportions of seagrass to each other; (B) Average health score, ranging from very degraded to very healthy; (C) Average blade lengths for each seagrass species, in centimeters.

4.2.3 San Juan – Hardbottom Coverage Data

Coral Abundance

In hardbottom habitats previously delineated during the PVR habitat mapping, benthic coverage data was collected using the quadrat based BEAMR method (Lybolt and Baron, 2006). Hardbottom habitats sampled in San Juan included linear reef, aggregate patch reef, and colonized pavement. The dominant biota observed across all habitats was macroalgae, turf algae, crustose coralline algae, and sponges. Scientists identified and measured 294 octocorals and 921 stony corals at eight (8) sample sites in San Juan (Figure 13 – 16). The average number of octocorals recorded in each 1-meter^2 sample quadrat was 5.2 colonies. The average number of octocorals in San Juan was only slightly higher than Rincón (4.9 colonies/1-meter^2 sample quadrat). The average number of stony corals recorded in San Juan in each 1-meter^2 sample quadrat was 16.2 colonies, which was less than the average number of stony corals reported for Rincón (17.3 colonies/1-meter^2 sample quadrat). **Table 13** lists the colony counts and relative abundance for octocorals and stony corals identified at sample sites in San Juan. *Porites astreoides* was the most abundant coral species (366 colonies; 30.1%), followed by *Siderastrea radians* (191 colonies; 15.7%), *Porites porites* (185 colonies; 15.2%), and *Gorgonia* sp. (151 colonies, 12.4%). Among the eight (8) BEAMR sample sites, SJ_B-02 and SJ_B-03 had the highest numbers of coral colonies accounting for 24.8% and 24.9% of observed corals, respectively. Sample Sites SJ_B-02 and SJ_B-03 were both aggregate patch reef habitats. Sample Sites SJ_B-04 (5.4%), SJ_B-05 (5.1%), and SJ_B-07 (5.3%) had significantly fewer corals. Sample Sites SJ_B-04 and SJ_B-05 were both located in linear reef habitat and Sample Site SJ_B-07 was located in colonized pavement. These sites had higher levels of sedimentation compared to the other sample sites, which could be a contributing factor for the lower coral numbers. Of all the sample sites in San Juan, SJ_B-05 was positioned closest to shore and required multiple site visits on separate field days to complete due to heavy surf and strong surge (2.0+ meters) conditions. When coral colony counts are presented by habitat type, aggregate patch reefs had the highest numbers of corals (945 colonies, 77.8%), followed by linear reefs (207 colonies, 17.0%) and colonized pavement (63 colonies, 5.2%).

Coral Colony Size

Most of the octocorals observed in San Juan were branching. Octocoral maximum height ranged from 1.0 to 47.0 centimeters, with an average colony height of 7.8 centimeters (**Table 14**). The majority of octocoral colonies (95.2%) had a maximum height of less than 20 centimeters. No octocoral colonies exceeding 50 centimeters were recorded at the sample sites in San Juan. For all sampled stony corals, maximum colony dimensions ranged from small *Siderastrea radians* colonies (0.4 centimeters) to large *Orbicella faveolata* colonies (448 centimeters), with the average stony coral colony size of 9.2 centimeters. The average stony coral size in San Juan was only slightly smaller than Rincón (10.4 centimeters). The majority of stony coral colonies (94.7%) had a maximum dimension less than 20 centimeters, with just 22 colonies exceeding 50 centimeters (**Table 14**). Large stony corals that exceeded 50 centimeters were comprised of sixteen (16) *Orbicella faveolata*, two (2) *Orbicella annularis*, two (2) *Pseudodiploria clivosa*, one (1) *Pseudodiploria strigosa,* and one (1) *Porites asteroides*. Stony coral colonies ranging from 20.0 to 49.9 centimeters were predominantly comprised of *Pseudodiploria* spp. (53.4%). While conducting surveys and mapping, *Pseudodiploria* spp. and *Porites* spp. were the most visually abundant corals observed. During mapping surveys and sample site reconnaissance, numerous large (3.0 – 4.0 + meter diameter) mature growth stony coral colonies were observed, however most were dead or with < 10% live tissue. Mature growth stony coral species observed during the San Juan survey included: *Orbicella faveolata*, *Orbicella annularis*, *Montastraea cavernosa*, *Pseudodiploria strigosa, Porites porites*, and *Siderastrea siderea*.

Table 13. Colony count and relative abundance for octocorals and stony corals identified at sample sites in San Juan.

Species	Coral Count Per Sample Site and Relative Abundance													
	SJ-B-01	SJ-B-02	SJ-B-03	SJ-B-04	SJ-B-05	SJ-B-06	SJ-B-07	SJ-B-08	SJ-SAV-03	SJ-ESA-01	SJ-ESA-02	SJ-ESA-03	Total by Species	Abundance by species
Antillogorgia sp.	-	-	-	-	-	-	-	1	-	-	-	-	**1**	0.3%
Briarium sp.	6	-	-	-	-	-	-	-	-	-	-	-	**6**	2.0%
Ellisella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erythropodium sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eunicea sp.	2	10	18	-	-	-	5	-	-	-	-	-	**35**	11.9%
Gorgonia sp.	9	52	72	2	11	5	-	-	-	-	-	-	**151**	51.4%
Muricea sp.	2	17	2	-	-	-	4	-	-	-	-	-	**25**	8.5%
Muriceopsis sp.	-	28	34	-	1	2	-	-	-	-	-	-	**65**	22.1%
Plexaura sp.	-	2	2	-	-	-	-	-	-	-	-	-	**4**	1.4%
Plexaurella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudoplexaura sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pterogorgia sp.	-	-	-	-	-	-	7	-	-	-	-	-	**7**	2.4%
Octocoral Total													**294**	**100.0%**
Acropora cervicornis	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Agaricia agaricities	28	-	-	-	-	-	-	-	-	-	-	-	**28**	3%
Agaricia fragilis	7	-	-	-	-	-	-	-	-	-	-	-	**7**	1%
Agaricia lamarcki	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Colpophyllia natans	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Dendrogyra cylindricus	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Dichocoenia stokesi	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Diploria labyrinthiformis	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Eusmilia fastiginia	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Favia fragum	11	-	-	-	4	8	-	-	-	-	-	-	**23**	2%
Isophyllia rigida	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Madracis decactis	-	-	-	-	-	-	5	-	-	-	-	-	**5**	1%
Madracis mirabilis	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Meandrina meandrites	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Montastraea cavernosa	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Mycetophyllia aliciea	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Mycetophyllia ferox	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Orbicella annularis	-	-	-	-	-	-	-	-	1	1	-	-	**2**	0%
Orbicella faveolata	1	3	-	-	-	-	-	-	2	11	2	-	**19**	2%
Orbicella franksi	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Phyllangia americana	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Porites astreoides	69	82	90	17	19	32	30	27	-	-	-	-	**366**	40%
Porites porites	14	38	23	5	3	92	2	8	-	-	-	-	**185**	20%
Pseudodiploria clivosa	3	3	2	2	16	13	-	-	-	-	-	-	**39**	4%
Pseudodiploria strigosa	2	15	4	4	4	6	-	-	-	-	-	-	**35**	4%
Scolymia cubensis	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Siderastrea radians	14	45	51	29	3	7	10	32	-	-	-	-	**191**	21%
Siderastrea siderea	-	2	-	6	-	-	-	13	-	-	-	-	**21**	2%
Siderastrea sp.	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Stephanocoenia intersepta	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-
Stony Coral Total	**149**	**188**	**170**	**63**	**49**	**158**	**47**	**80**	**3**	**12**	**2**	**0**	**921**	**100%**

Table 14. Coral Count categorized by size class for octocorals and stony corals from San Juan.

Species-San Juan	Size Class (cm)						
	0-9.9	10-19.9	20-29.9	30-39.9	40-49.9	50+	Total
Antillogorgia sp.	1	-	-	-	-	-	**1**
Briareum sp.	1	3	1	1	-	-	**6**
Ellisella sp.	-	-	-	-	-	-	-
Erythropodium sp.	-	-	-	-	-	-	-
Eunicea sp.	27	6	2	-	-	-	**35**
Gorgonia sp.	96	46	5	3	1	-	**151**
Muricea sp.	20	4	1	-	-	-	**25**
Muriceopsis sp.	64	1	-	-	-	-	**65**
Plexaura sp.	3	1	-	-	-	-	**4**
Pseudoplexaura sp.	-	-	-	-	-	-	-
Plexaurella sp.	-	-	-	-	-	-	-
Pterogorgia sp.	2	5	-	-	-	-	**7**
Octocoral Total	214	66	9	4	1	0	**294**
Acropora cervicornis	-	-	-	-	-	-	**0**
Agaricia agaricities	25	3	-	-	-	-	**28**
Agaricia fragilis	5	2	-	-	-	-	**7**
Agaricia lamarcki	-	-	-	-	-	-	**0**
Colpophyllia natans	-	-	-	-	-	-	**0**
Dendrogyra cylindricus	-	-	-	-	-	-	**0**
Dichocoenia stokesi	-	-	-	-	-	-	**0**
Diploria labyrinthiformis	-	-	-	-	-	-	**0**
Eusmilia fastiginia	-	-	-	-	-	-	**0**
Favia fragum	22	1	-	-	-	-	**23**
Isophyllia rigida	-	-	-	-	-	-	**0**
Madracis decactis	-	4	1	-	-	-	**5**
Madracis mirabilis	-	-	-	-	-	-	**0**
Meandrina meandrites	-	-	-	-	-	-	**0**
Montastraea cavernosa	-	-	-	-	-	-	**0**
Mycetophyllia aliciea	2	3	1	-	-	-	**6**
Mycetophyllia ferox	-	-	2	-	-	-	**2**
Orbicella annularis	-	-	-	-	-	2	**2**
Orbicella faveolata	-	1	-	2	-	16	**19**
Orbicella franksi	-	-	-	-	-	-	**-**
Phyllangia americana	-	-	-	-	-	-	**0**
Porites astreoides	290	72	3	-	-	1	**366**
Porites porites	155	23	3	2	2	-	**185**
Pseudodiploria clivosa	14	12	9	-	2	2	**39**
Pseudodiploria strigosa	23	6	2	2	1	1	**35**
Scolymia cubensis	-	-	-	-	-	-	**0**
Siderastrea radians	191	-	-	-	-	-	**191**
Siderastrea siderea	20	-	1	-	-	-	**21**
Siderastrea sp.	-	-	-	-	-	-	**0**
Stephanocoenia intersepta	-	-	-	-	-	-	**0**
Stony Coral Total	747	127	22	6	5	22	**929**

ESA coral counts are greater for size class data than the transect data because size class data was pulled from surveys conducted outside the delineated transect survey areas.

Coral Health

Although there were signs of various stress indicators and numerous dead coral colonies observed within hardbottom habitat in San Juan, most living corals appeared to have healthy tissue and were generally in good condition. The average percent live tissue for stony corals measured in San Juan was 95.4%, which was the same value for stony corals surveyed in Rincón. There were symptoms of various stress responses observed on stony corals throughout the San Juan survey area including extended polyps, excessive mucus, endolithic borers, predation, macroalgal overgrowth, and bleaching. Diurnally extended polyps can be a stress indicator and was observed in 54.5% of corals surveyed. Macroalgal overgrowth was the next most common sign of stress, with 19.0% of corals impacted. This can occur when adjacent macroalgae comes in contact with coral tissue causing abrasions or physical stresses. Additionally, when a coral experience partial mortality, dead portions of the colony will be colonized by macroalgae and can contribute to further coral tissue degradation and receding margins. Paling or partial bleaching (loss of coral pigmentation) was observed in 11.4% of stony corals. Numerous dead *Acropora palmata* colonies were observed in the San Juan survey area. Although the colonies were dead and fully encrusted with macroalgae, some of the colonies still retained coral structure including branching. It is difficult to determine from simple observations how long these corals have been dead, but their presence indicates this area may still be viable habitat for *Acropora palmata*. A summary of health indicators is shown in **Figure 19**.

Sedimentation

The average underwater visibility encountered during the San Juan survey (5 feet) was less than what was encountered during the Rincón survey (12 feet). This may have been due to an active storm season, particularly during September with the passing of Tropical Storm Earl, Hurricane Fiona, and Hurricane Ian. Additionally, there was a moderate swell during most field activities conducted in San Juan. Although the water in San Juan was generally more turbid than Rincón, hardbottom habitats had less sediment cover. The average sediment depth measured in San Juan was 0.8 centimeters and Rincón was 1.2 centimeters. Additionally, the benthic resource assessment was conducted during Puerto Rico's wet season (June 1 through November 30) when rivers and runoff are most common. There are several potential sources for sediment in the San Juan survey area including: riverine, estuarine, storm water discharges, coastal erosion, and storm-induced wave energy. Some of the local sources for runoff include the Rio Piedras watershed which empties into the San Juan estuary, the Condado Lagoon estuary, and the Carolina estuary. In San Juan, a total of 7.7% or 71 corals had sediment indicators present, with sediment dusting being the most prominent. The number of corals with sediment indicators in Rincón was similar with 9.8% or a total of 73 corals. The majority (68.8%) of corals with sediment indicators were located at Sample Sites SJ_B-02, SJ_B-04, and SJ_B-08. While SJ_B-02 was located in aggregate patch reef, the other Sample Sites, SJ_B-04 and SJ_B-08, were both located in linear reef habitat. Sample Sites SJ_B-04, SJ_B-05, and SJ_B-07 had significantly fewer corals than the other sites sampled in San Juan. Sample Sites SJ_B-04 and SJ_B-05 were both located in linear reef habitat. Sample Site SJ_B-07 was located in colonized pavement with some portions of the reef structure sand veneered and had the deepest average sediment depth of 2.7 centimeters. During the San Juan survey, fourteen (14) stony coral colonies (1.5% of all corals surveyed) were observed with sediment accumulation, base burial, and/or partial burial. Excessive sedimentation (i.e., accumulation and burial) can be a contributing factor leading to coral mortality (Rogers and Ramos-Scharrón, 2022; Takesue et al., 2021; Bainbridge et al., 2018; and Ramos-Scharrón et al., 2015).

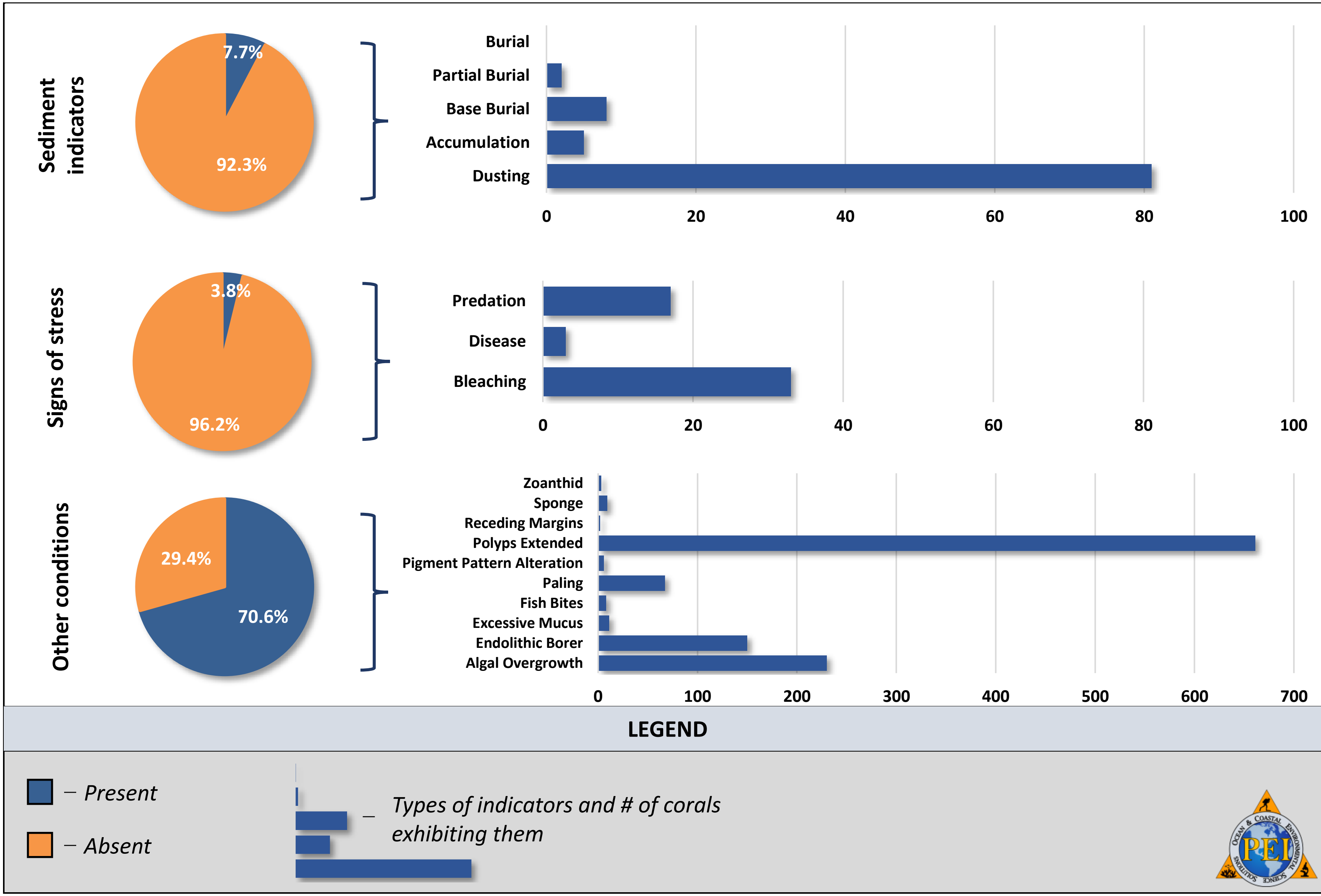


Figure 19. Signs of physiological stressors and other conditions observed among the corals surveyed in San Juan , Puerto Rico.

Functional Groups

Sessile benthos was categorized into 21 major functional groups, which include: sediment, bare hard substrate, rubble, macroalgae (fleshy and calcareous), turf algae, crustose coralline algae, cyanobacteria, sponges, hydroids, octocorals, scleractinian corals, tunicates, bryozoans, sessile worms, anemones, zoanthids, bivalves, *Millepora* spp., wormrock, echinoderms, and barnacles. **Figure 20** displays the major functional group average percent covers including stony corals, octocorals, sponges, and macroalgae. Macroalgae had the highest average percent cover (33.5%) for all of the sample sites in San Juan. When average macroalgae percent cover was separated by habitat type, aggregate patch reef had the highest (36.1%) followed by linear reef (34.1%), and colonized pavement (22.6%). When average macroalgae percent cover was separated by zone (i.e., west, center, and east), the center zone had the highest percent cover (44.9%) followed by the west zone (30.5%), and the east zone (26.1%). The most dominate macroalgae genera observed in San Juan was *Amphiroa* spp., *Caulerpa* spp., *Dictyota* spp., *Galaxaura* spp., *Halimeda* spp., and *Sargassum* spp. Sample Site SJ_B-06, which was located in aggregate patch reef and near the center of the survey area, had the highest average macroalgal percent cover of 54.4% out of all the sample sites surveyed in San Juan. Sample Site SJ_B-06 was located in a shallow patch reef (< 5 feet), dominated by brown macroalgae (primarily *Dictyota* spp. and *Sargassum* spp.), and had a high abundance of urchins.

Sponges had an average percent cover of 9.5% for all of the sample sites in San Juan. When average sponge percent cover was presented by habitat type, colonized pavement (17.6%) had the highest cover, followed by linear reef (12.2%), and aggregate patch reef (5.0%). When average sponge percent cover was separated by zone (i.e., west, center, and east), the west zone had the highest percent cover (12.9%) and both the center (4.2%) and east (2.0%) zones had relatively low sponge cover. Representing linear reef habitat, Sample Site SJ_B-07, located in the west zone, had the highest average sponge percent cover (17.6%) out of all the sample sites surveyed. Sample site SJ_B-07 was dominated by macroalgae (22.5%), sediment (18.5%), and crustose coralline algae (18.0%). SJ_B-07 also had a deep average sediment cover of 2.7 centimeters. The average stony coral cover (2.1%) at SJ_B-07 was among the lowest recorded in San Juan. The low stony coral cover may be contributed to higher levels of sedimentation occurring at this site. Sediment can often cover biota, making identification and counting difficult. Because of this, sponge counts could be higher at sites with high sedimentation. The most dominant sponge morphotypes were encrusting (46.8%), ball (24.4%), and amorphous/massive (23.1%). Most sponges (92.0%) in San Juan were < 10 centimeters in size. Twenty-one (21) *Xestospongia muta* were identified within BEAMR quadrats and all were < 25 centimeters.

Stony corals were observed in all hardbottom habitats and had an average percent cover of 5.8% for the entire San Juan survey area. When stony coral cover was presented by habitat type, patch reefs had the highest average stony coral percent cover (7.5%), followed by linear reefs (5.0%) and colonized pavement (2.1%). When stony coral cover was presented by zone (i.e., west, center, and east) the highest average percent cover (13.3%) occurred in the east zone of the survey area. Located in aggregate patch reef near the east end of the San Juan survey area, Sample Site SJ_B-01 had the highest average stony coral percent cover (13.3%). The average percent cover for macroalgae (26.1%) and turf algae (22.3%) were also relatively high at Sample Site SJ_B-01.

Of the four major functional groups, octocorals had the lowest average percent cover (1.7%) for the entire San Juan survey area. When octocoral cover was separated by habitat type, patch reefs had the highest average percent cover (2.8%). When octocoral percent cover data was separated by zone (i.e., west, center, and east), the center zone had the highest cover (3.2%), followed by the east zone (1.6%)

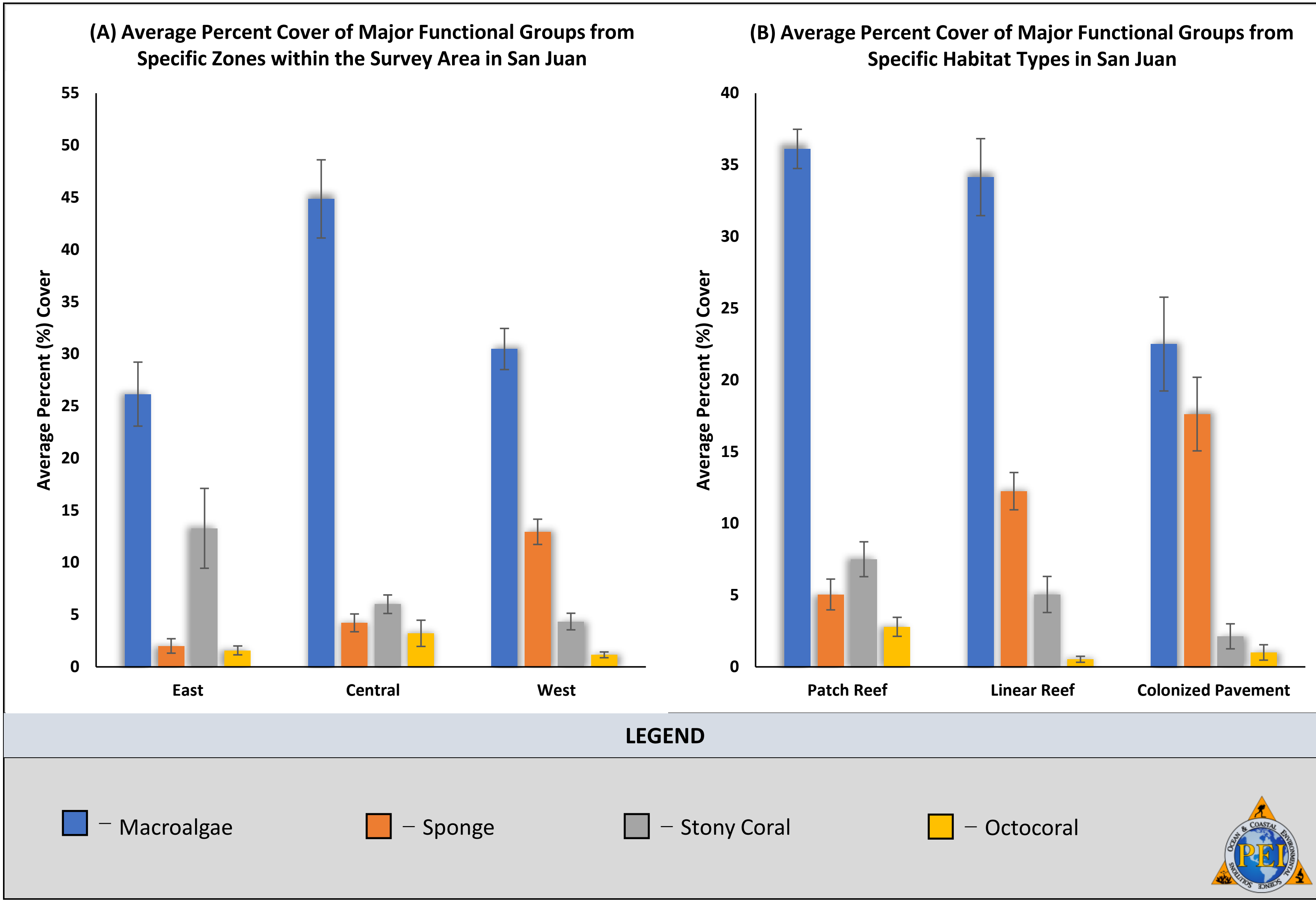


Figure 20. Average percent cover of the four major functional groups in San Juan: (A) Average percent cover of major functional groups from specific zones (i.e., east, central, and west) within the survey area in San Juan; (B) Average percent cover of major functional groups from specific habitat types in San Juan. Error bars represent standard error.

and the west zone (1.1%). Site SJ_B-03, located on an aggregate patch reef near the center zone of the survey area, had the highest average octocoral percent cover (5.7%). Octocoral cover in the Rincón survey area was generally higher than San Juan. Although there are likely several contributing factors, one possible explanation for low coral cover at some of the San Juan sample sites could be due to higher macroalgal cover outcompeting corals for available reef space. The higher macroalgal cover and low coral cover may be the result of fewer herbivorous fish on San Juan's hardbottom habitats. Herbivorous fish are an important component of a coral reef ecosystem and help to maintain macroalgal growth. Pinnacle scientists observed low numbers of reef fish throughout the survey area. Other possible factors contributing to high macroalgal cover and low coral cover include excess nutrients, high sedimentation, and issues resulting from climate change.

Other biota observed during BEAMR surveys were anemones, bivalves, bryozoans, corallimorphs, crustose coralline algae, cyanobacteria, echinoderms, hydroids, millepora, sessile worms, tunicates, turf algae, and zoanthids. **Figure 21** shows the average percent cover of each functional group across different zones (i.e., East, Central, and West) in the survey area. Turf algae was commonly observed on all hardbottom habitats throughout the San Juan survey area. Turf algae had the highest average percent cover (22.5%) for the entire San Juan survey area, followed by crustose coralline algae (9.8%), sediment (5.9%), stony corals (5.8%), and tunicates (2.8%). The remaining functional groups all had average percent covers of < 2.0%. **Figure 22** presents average percent cover data for the different habitats delineated in the San Juan survey area (i.e., Linear Reef, Colonized Pavement, and Patch Reef). Sediment depths were taken as part of BEAMR data collection and ranged from averages of 0.1 centimeters (SJ_B-06) to 2.7 centimeters (SJ_B-07). Overall, the average sediment depth across all sites was 0.8 centimeters. Representative photos have been provided in **ATTACHMENT B**.

4.2.4 San Juan – ESA Corals

There was a total of twenty-one (21) ESA listed corals identified and measured during surveys in San Juan (**Figure 23**), which accounted for 2.3% of all stony corals sampled. Nineteen (19) were *Orbicella faveolta* and two (2) were *Orbicella annularis*. Numerous dead *Acropora palmata* colonies were also observed. Although the colonies were dead and fully encrusted with macroalgae, some of the colonies still retained coral structure such as branching. It is difficult to determine how long these corals have been dead, but their presence indicates this may still be viable habitat for *Acropora palmata*. **Table 15** lists the sites where the ESA corals were located. Twenty (20) of these colonies were located on patch reef habitat. Many of the ESA listed stony corals were first observed during mapping efforts. Underwater visibility in San Juan was variable and changed with tide cycles, amount of rain and runoff, and sea conditions. Scientists attempted to maximize research effort during good water quality conditions but there were several occasions when sampling activities occurred in low visibility conditions. During these periods of low visibility, reduced visual coverage may have affected identification of some ESA corals in and adjacent to sample sites. Although none were observed during this benthic resource survey, other biological monitoring studies have documented *Dendrogyra cylindrus* on hardbottom habitat offshore Isla Verde, Puerto Rico (Rivera, 2014). Maximum dimensions of the ESA listed corals ranged from 14 to 448 centimeters, with an average of 142.7 centimeters. The average percent live tissue of ESA corals was only 68.1%, which may indicate corals are experiencing levels of stress that are impacting their health. Although no ESA listed corals were observed at the sites with high levels of sedimentation, 57.1% had sediment indicators present. ESA listed corals were often some of the largest corals observed during the San Juan survey, which provides more surface area and may result in an increased susceptibility to sediment deposition. The most prominent signs of stress in ESA listed corals were algal overgrowth (90.5% of colonies) and endolithic borers (71.4% of colonies).

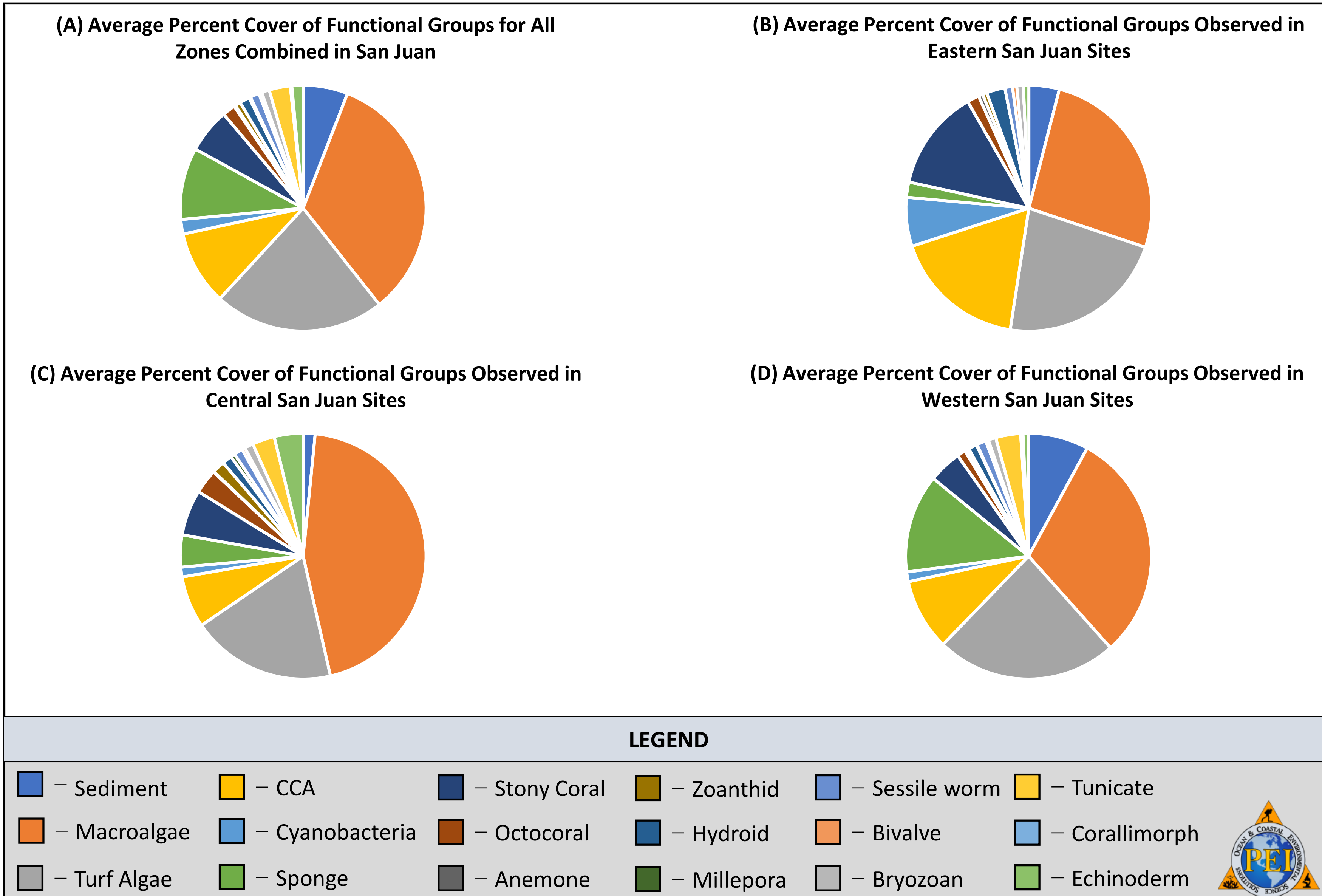


Figure 21. Average percent cover of the functional groups observed within specific zones in San Juan: (A) Average percent cover of functional groups for all zones combined; (B) Average percent cover of functional groups observed in the eastern zone; (C) Average percent cover of functional groups observed in the central zone; (D) Average percent cover of functional groups observed in the western zones.

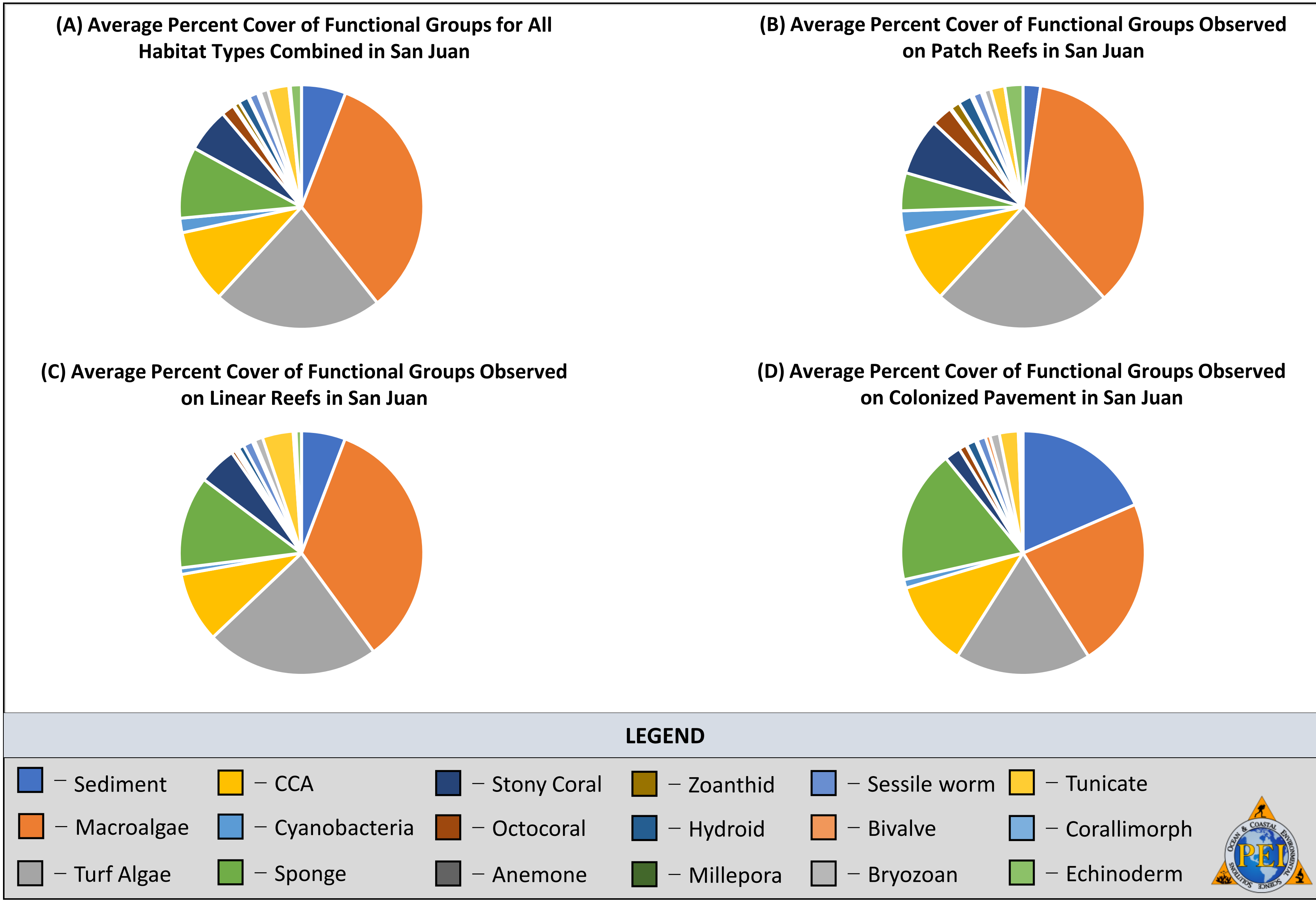


Figure 22. Average percent cover of the functional groups identified on specific habitats in San Juan: (A) Average percent cover of functional groups for all habitats combined; (B) Average percent cover of functional groups observed on patch reefs; (C) Average percent cover of functional groups observed on linear reefs; (D) Average percent cover of functional groups observed on colonized pavement.

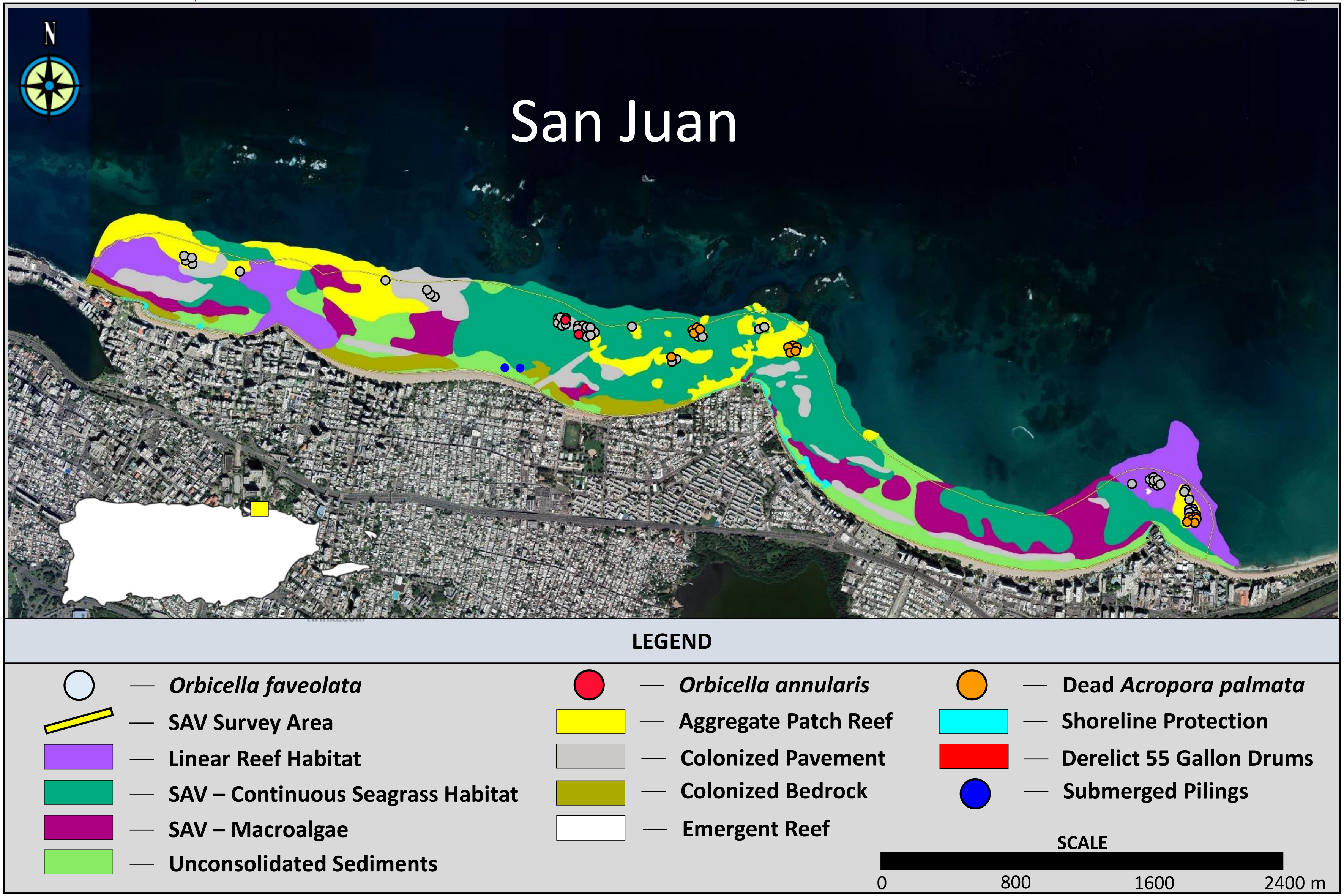


Figure 23. Mapped resources and ESA corals identified within the survey area near San Juan, Puerto Rico. Image credit: Google Earth, 2022

Table 15. ESA listed coral counts from San Juan sample sites.

Species	San Juan ESA Listed Coral Counts by Site						
	SJ_B-01	SJ_B-02	SJ_SAV-03	SJ_ESA-01	SJ_ESA-02	Total	% Abundance out of Total ESA Corals
	Patch Reef	Patch Reef	Patch Reef	Patch Reef	Patch Reef		
Orbicella faveolata	1	3	2	11	2	**19**	**90.5%**
Orbicella annularis	0	0	1	1	0	**2**	**6.1%**
Total by Site	**1**	**3**	**3**	**12**	**2**	**21**	
% Abundance by Site	**4.8%**	**14.3%**	**14.3%**	**57.1%**	**9.5%**		

4.2.5 San Juan – Qualitative Data

Qualitative data collection included *in situ* identifications of biota observed during the benthic resource survey (**Table 9**). Some of the most common biota observed colonizing habitats in the San Juan survey area included a diverse assemblage of macroalgae including: green algae (*Caulerpa mexicana*, *C. racemosa*, *C. sertularioides*, *C. verticillata*, *C. prolifera*, *Chaetomorpha* sp., *Codium* sp., *Dasycladus* spp., *Halimeda* spp., *Penicillus* spp., *Neomeris* spp., and *Udotea* spp.), red algae (*Acanthophora* spp., *Amphiroa* sp., *Asparagopsis* sp., *Bryothamnion* spp., *Ceramium* spp., *Chondria* spp., *Gelidiella* spp., *Dasya* spp., *Dictyurus* sp., *Gelidium* sp., *Gracilaria* sp., *Heterosiphonia* spp., *Hypnea* sp., *Laurencia* spp., *Spyridea* spp., and *Wrangelia* spp.), and brown algae (*Dictyopteris* spp., *Dictyota* spp., *Padina* spp., *Lobophora* sp., and *Sargassum* spp.). Additional benthic resources observed colonizing hardbottom included numerous sponges (*Amphimedon compressa*, *Aplysina fistularis*, *A. insularis*, *Desmapsamma anchorata*, *Cinachyrella apion*, *Cliona* spp., *Iotrochota birotulata*, *Ircinia* spp., *Niphates* sp., *Callyspongia plicifera*, *Scopalina ruetzleri*, and *Xestospongia muta*), octocorals (*Antillogorgia* sp., *Briareum* sp., *Eunicea* spp., *Gorgonia* spp., *Muricea* spp., *Muriceopsis* sp., *Plexaura* sp., and *Pterogorgia* spp.), stony corals (*Agaricia agaricities, Agaricia fragilis, Favia fragum, Madracis decactis*, *Pseudodiploria strigosa*, *Pseudodiploria clivosa*, *Montastraea cavernosa, Porites astreoides*, *P. porites*, *Orbicella faveolata*, *Orbicella annularis*, *Siderastrea radians*, and *S. siderea*), and echinoderms (*Diadema antillarum*, *Echinometra lucunter, Eucidaris tribuloides,* and *Tripneustes ventricosus*). A variety of fish species were identified during the survey including: cottonwick (*Haemulon melanurum*), tomtate (*Haemulon aurolineatum*), porkfish (*Anisotremus virginicus*), blue tang (*Acanthurus coeruleus*), yellow goatfish (*Mulloidichthys martinicus*), doctorfish (*Acanthurus chirurgus*), slippery dick (*Halichoeres bivittatus*), sergeant major (*Abudefduf saxatilis*), damselfish (Pomacentridae), grunts (Haemulidae), graysby (*Epinephelus cruentatus*), French angelfish (*Pomacanthus paru*), rock hind (*Epinephelus adscensionis*), coney (*Cephalopholis fulva*) and blue chromis (*Chromis cyanea*). Hawksbill turtles (*Eretmochelys imbricata*), green turtles (*Chelonia mydas*), and queen conch (*Aliger gigas*) were also observed during the survey. Representative photos have been provided in **ATTACHMENT B**.

5.0 References

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ATTACHMENT A

Puerto Rico SAV Survey:

Rincón Representative Photos

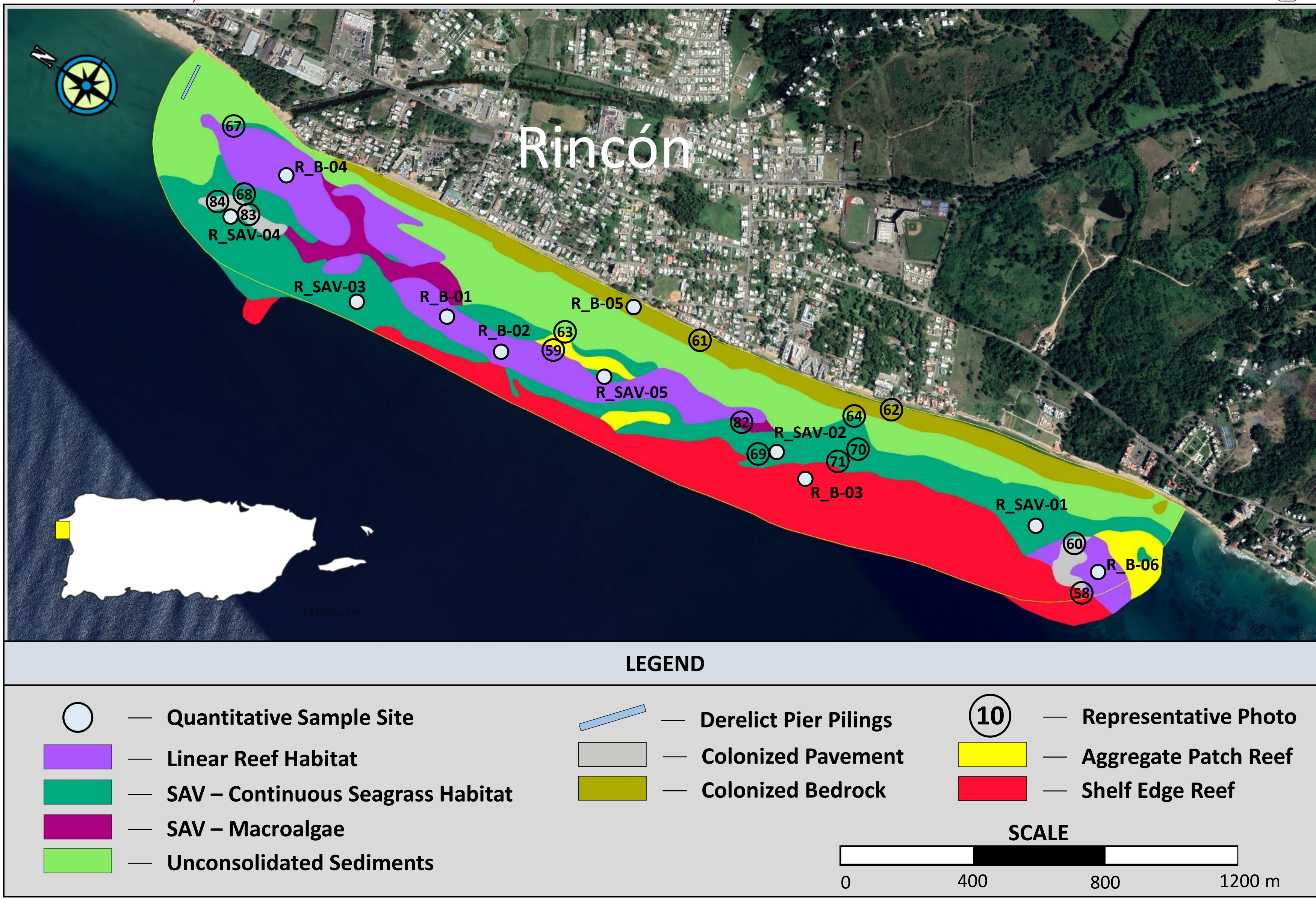

Figure 24. Quantitative sample sites, mapping representative photo numbers, and mapped resources delineated within the survey area near Rincón, Puerto Rico. Image credit: Google Earth, 2022

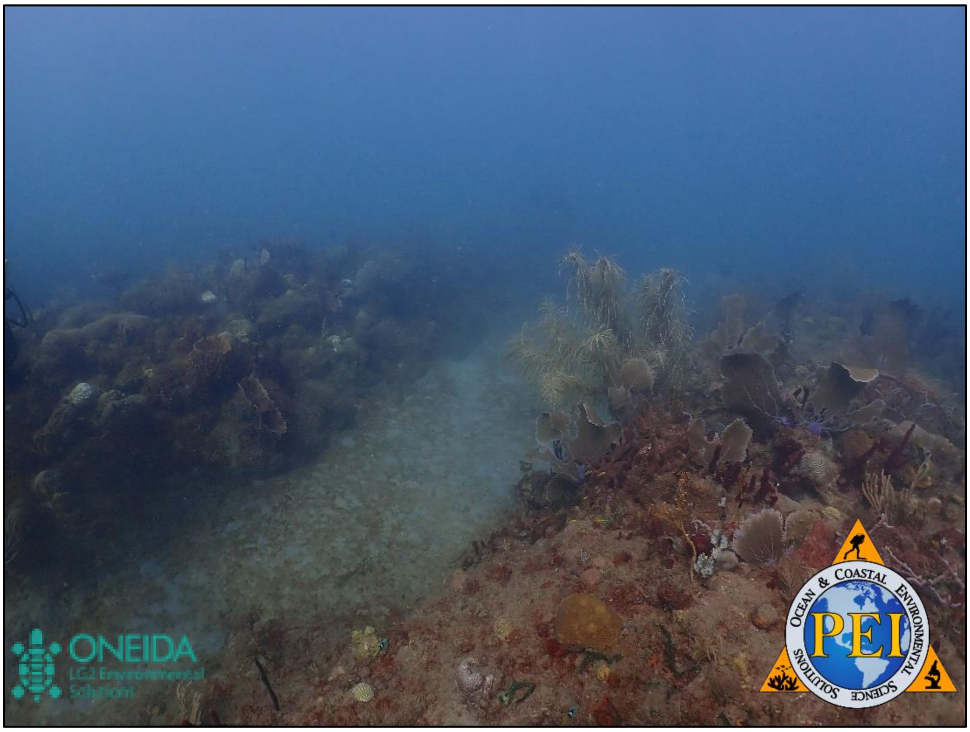

Photo 1. Linear reef with high biodiversity, separated by sand channels at site R_B-01.

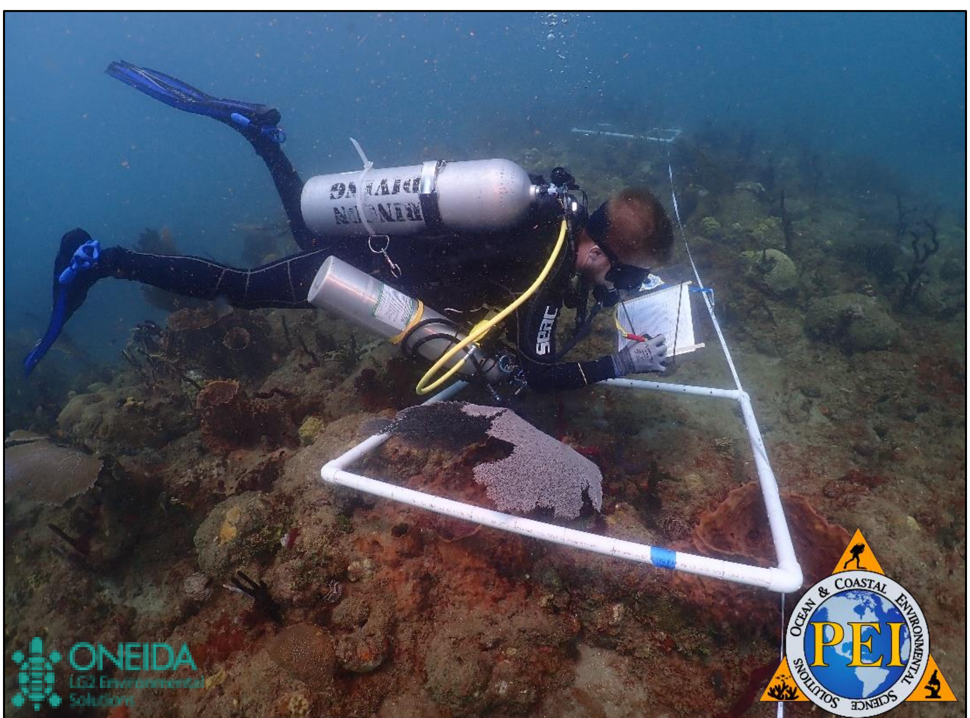

Photo 2. Pinnacle scientist collecting quantitative data along a transect deployed on a linear reef at site R_B-01.

Photo 3. Branching/rope sponges, octocorals, and *Porites astreoides* on a linear reef at site R_B-01.

Photo 4. Linear reef with high stony coral, octocoral, and sponge cover at site R_B-01.

Photo 5. An *Agaricia lamarcki* colony surrounded by macroalgae on a linear reef at site R_B-01.

Photo 6. A *Porites astreoides* colony with extended polyps on a linear reef at site R_B-01.

Photo 7. Feather duster worms next to a *Montastraea cavernosa* colony on a linear reef at site R_B-01.

Photo 8. *Diploria labyrinthiformis* and *Porites astreoides* colonies surrounded by macroalgae, sponges, octocorals, and fire coral on a linear reef at site R_B-01.

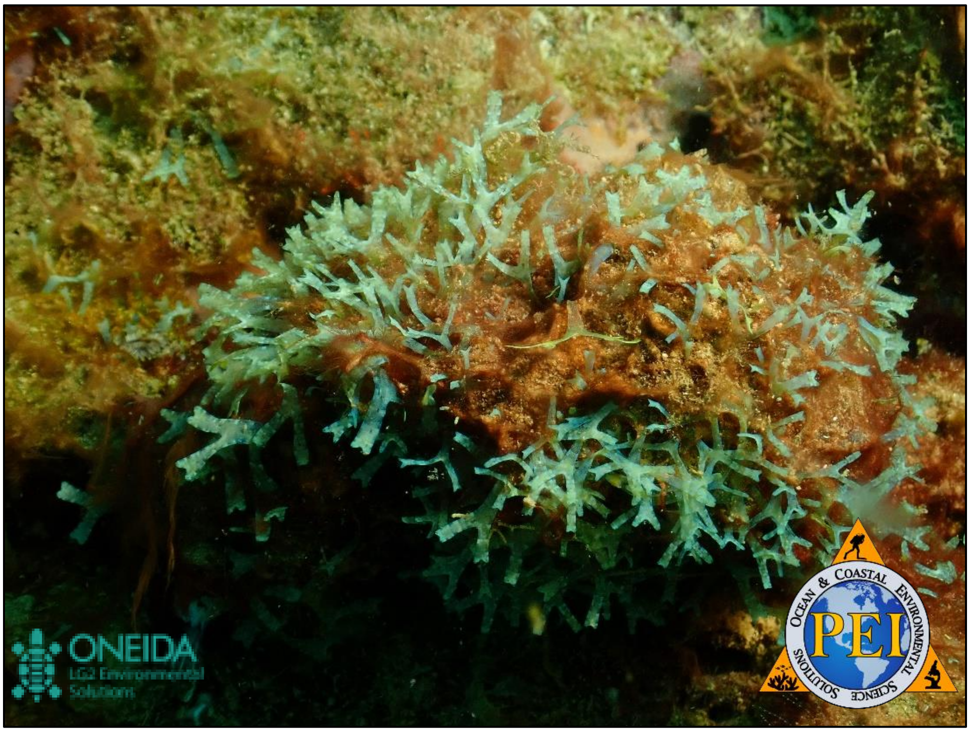

Photo 9. *Dictyota* sp. observed on a linear reef at site R_B-01.

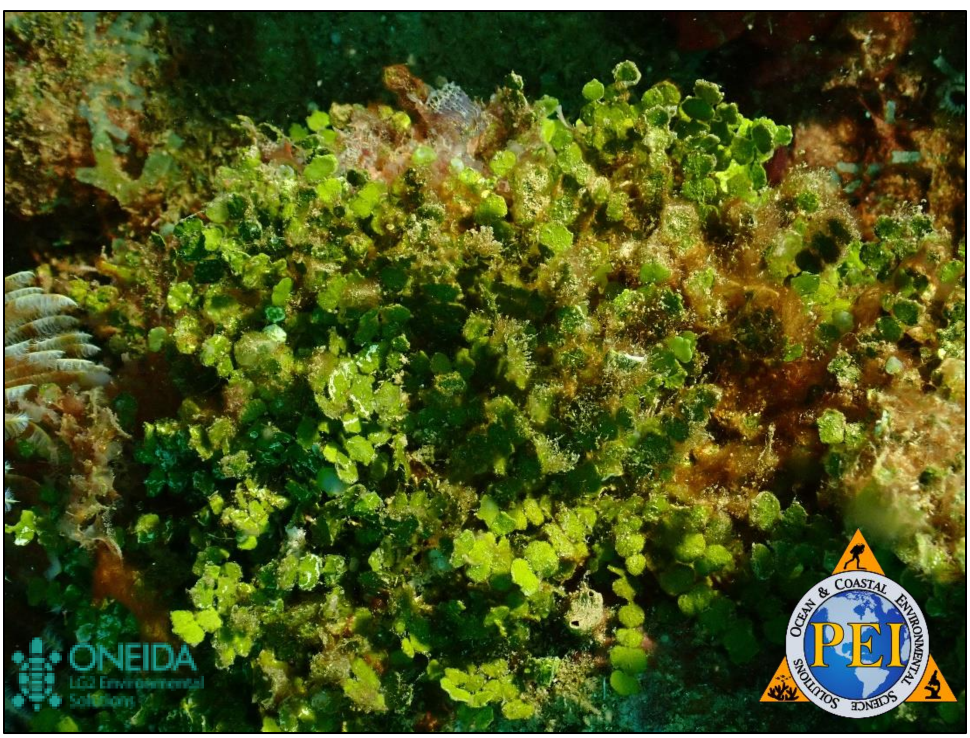

Photo 10. *Halimeda* sp. observed on a linear reefs at site R_B-01.

Photo 11. *Caulerpa verticillata* and orange icing sponge (*Mycale laevis*) on a linear reef at site R_B-01.

Photo 12. A *Mycetophyllia aliciae* colony surrounded by octocorals on a linear reef at site R_B-02.

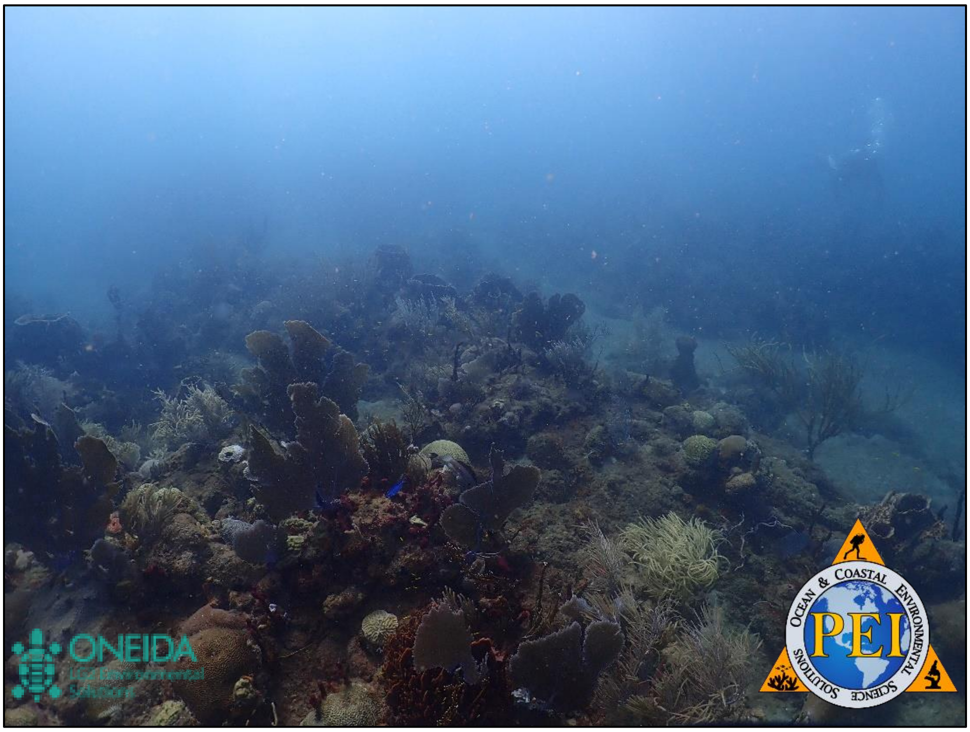

Photo 13. Linear reef with high levels of biodiversity at site R_B-02.

Photo 14. An *Orbicella faveolata* colony surrounded by dense octocoral and stony coral growth on a linear reef at site R_B-02.

Photo 15. An *Orbicella faveolata* colony with sponge growth around edges on a linear reef at site R_B-02.

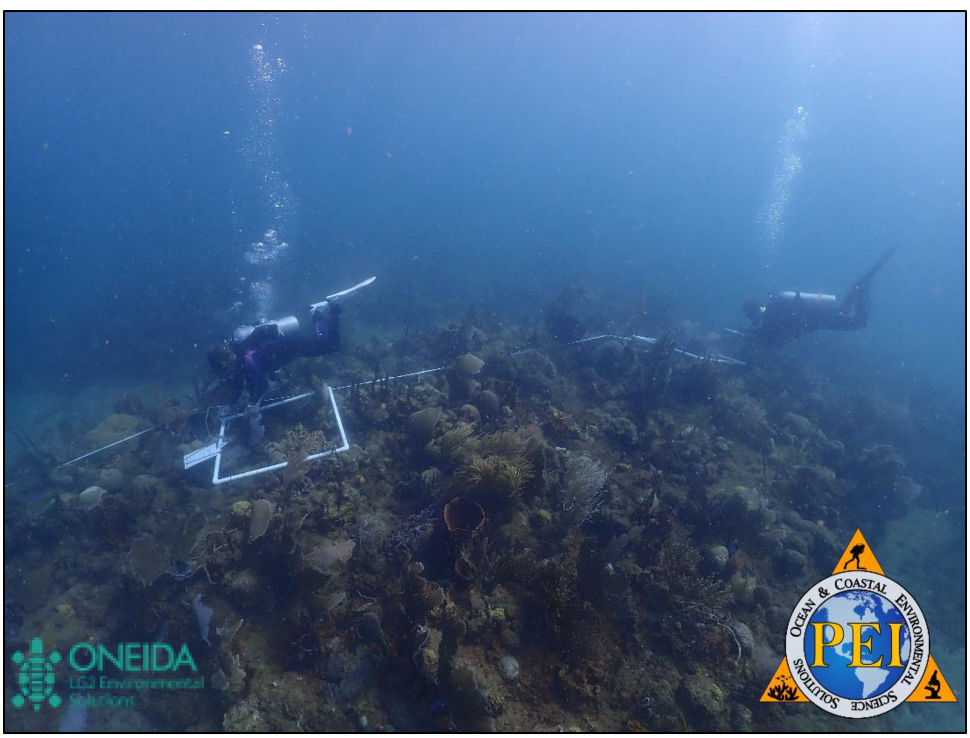

Photo 16. Pinnacle scientists collecting quantitative data along a linear reef at site R_B-02.

Photo 17. Pinnacle scientist collecting quantitative data on an *Orbicella faveolata* colony on a linear reef at site R_B-02.

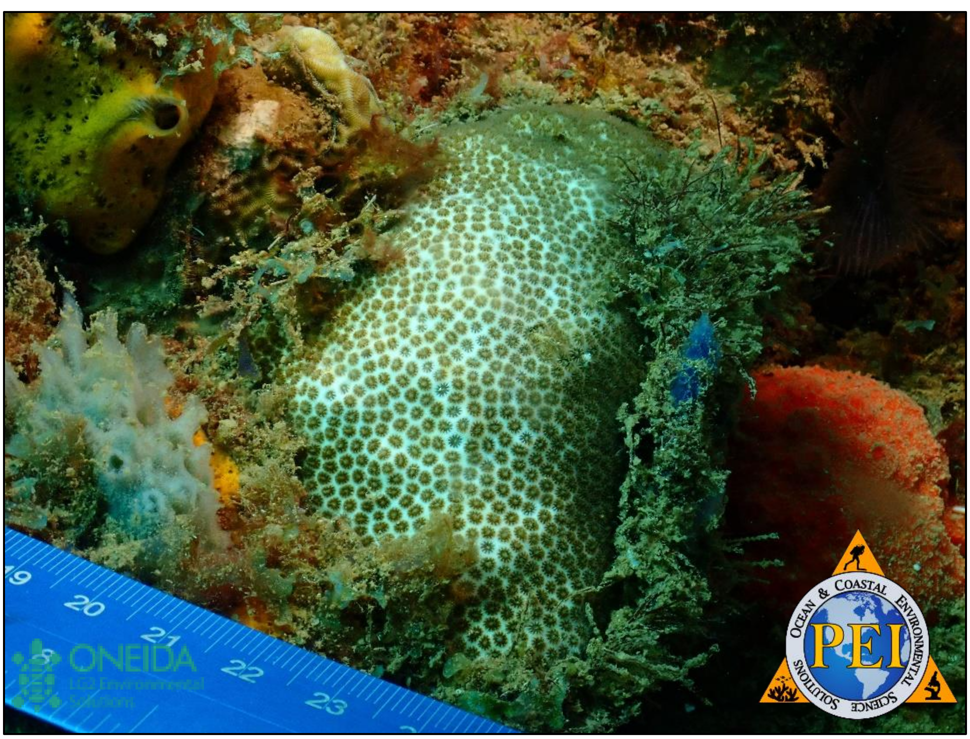

Photo 18. A *Stephanocoenia intersepta* colony surrounded by sponges and macroalgae on a linear reef at site R_B-02.

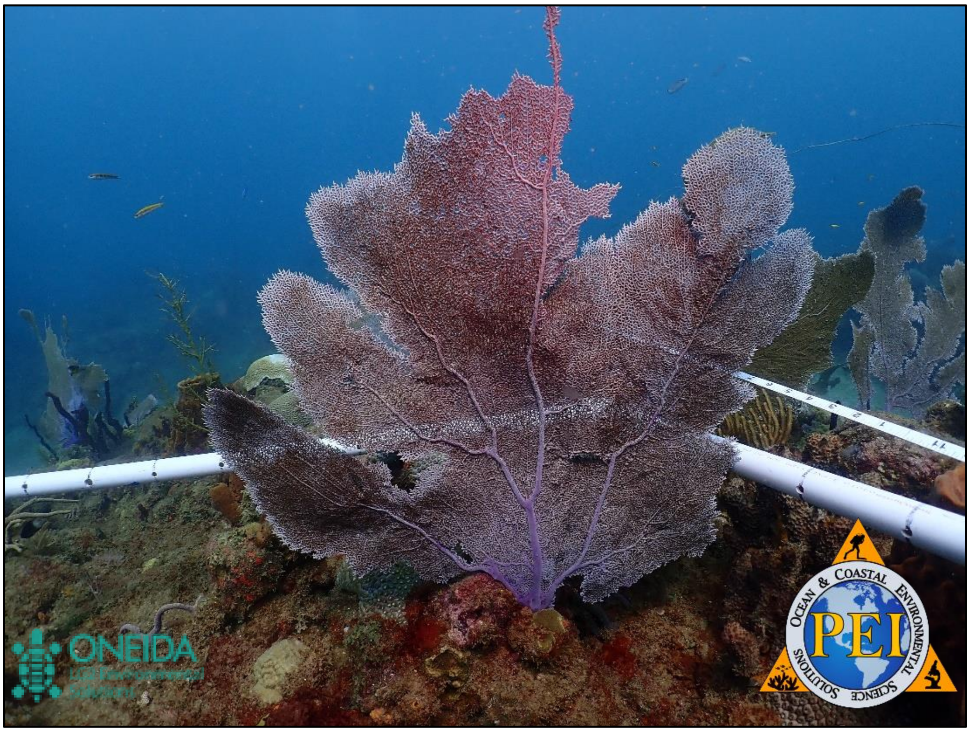

Photo 19. A large *Gorgonia* sp. colony on a linear reef at site R_B-02.

Photo 20. A large *Antillogorgia* sp. colony on a linear reef at site R_B-02.

Photo 21. A small *Siderastrea siderea* colony on a shelf edge reef at site R_B-03.

Photo 22. Two *Pseudodiploria strigosa* colonies, *Porites astreoides* colony, and an azure vase sponge (*Callyspongia plicifera*) on a linear reef at site R_B-04.

Photo 23. Narrow sand channels observed along shelf edge reefs at site R_B-03.

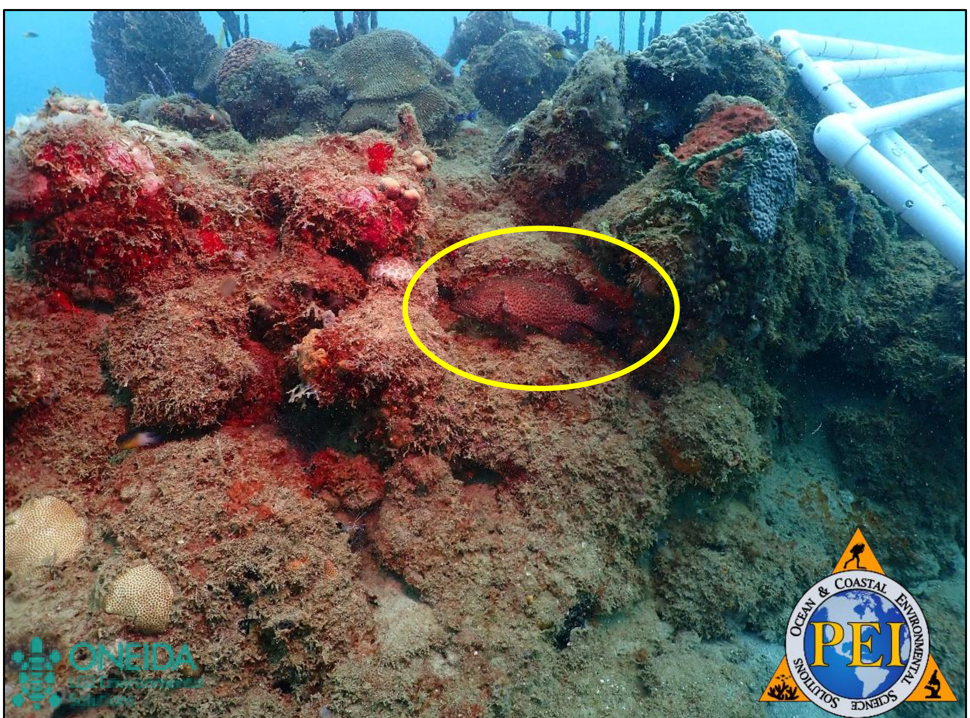

Photo 24. A grouper (*Cephalopholis cruentata*) observed on a shelf edge reef at site R_B-03.

Photo 25. The western end of the shelf edge reef, where depths sharply increase at site R_B-03.

Photo 26. A *Mycetophyllia aliciae* colony on shelf edge reef at site R_B-03.

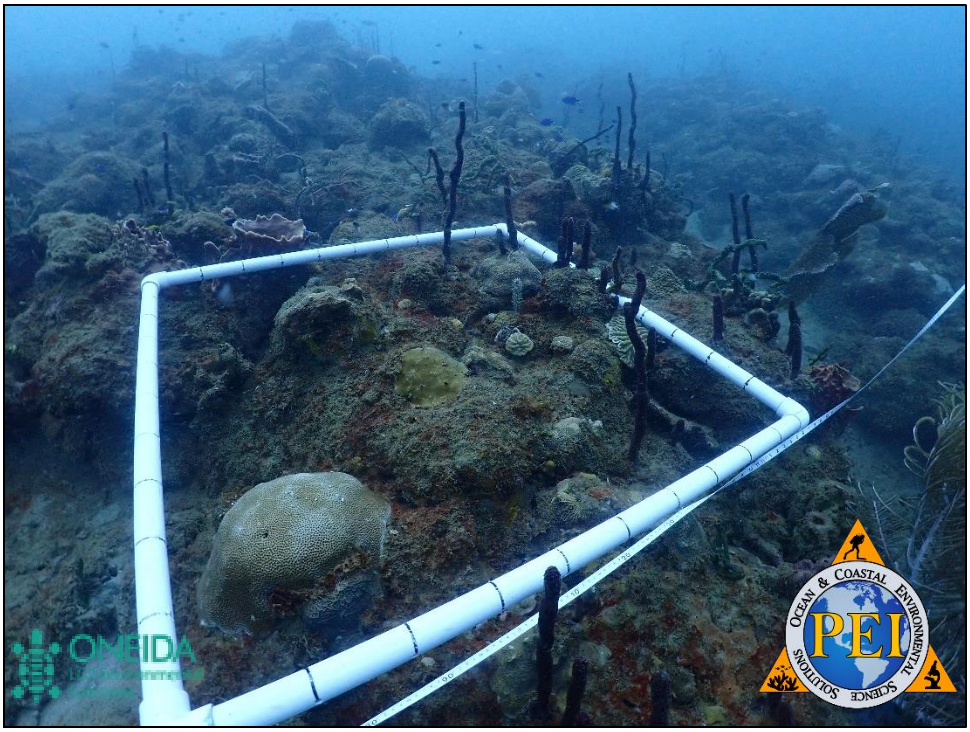

Photo 27. Shelf edge reef dominated by rope sponges, stony corals, and turf algae at site R_B-03.

Photo 28. A small *Meandrina meandrites* colony on a shelf edge reef at site R_B-03.

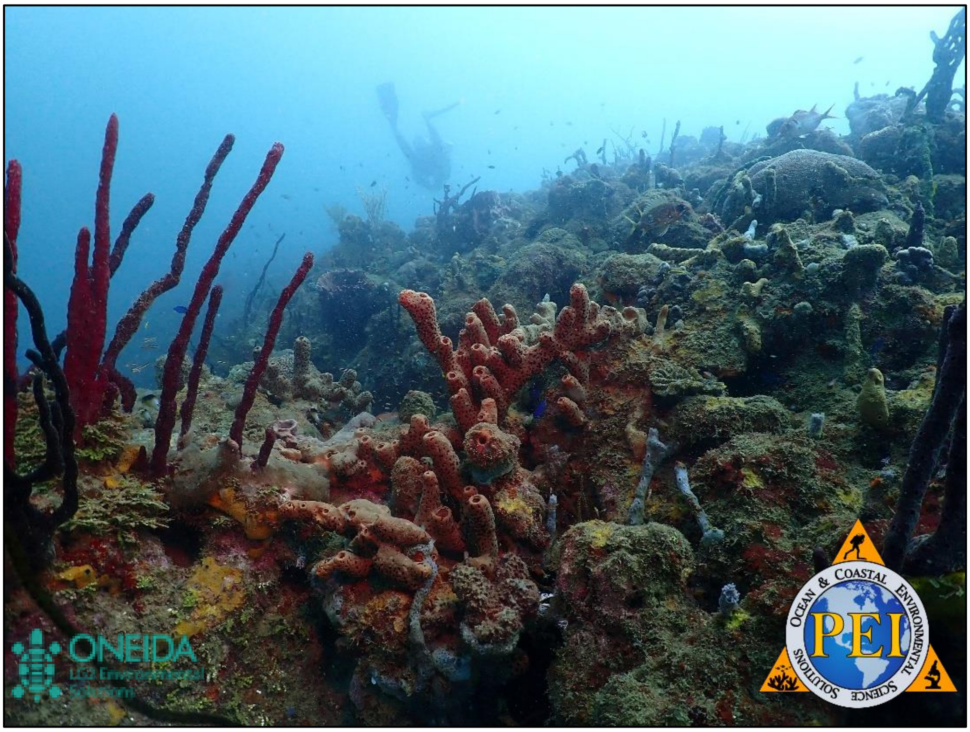

Photo 29. Diverse sponge growth on the shelf edge reef at site R_B-03.

Photo 30. A large barrel sponge (*Xestospongia muta), Orbicella faveolata*, and *Montastraea cavernosa* on the shelf edge reef at site R_B-03.

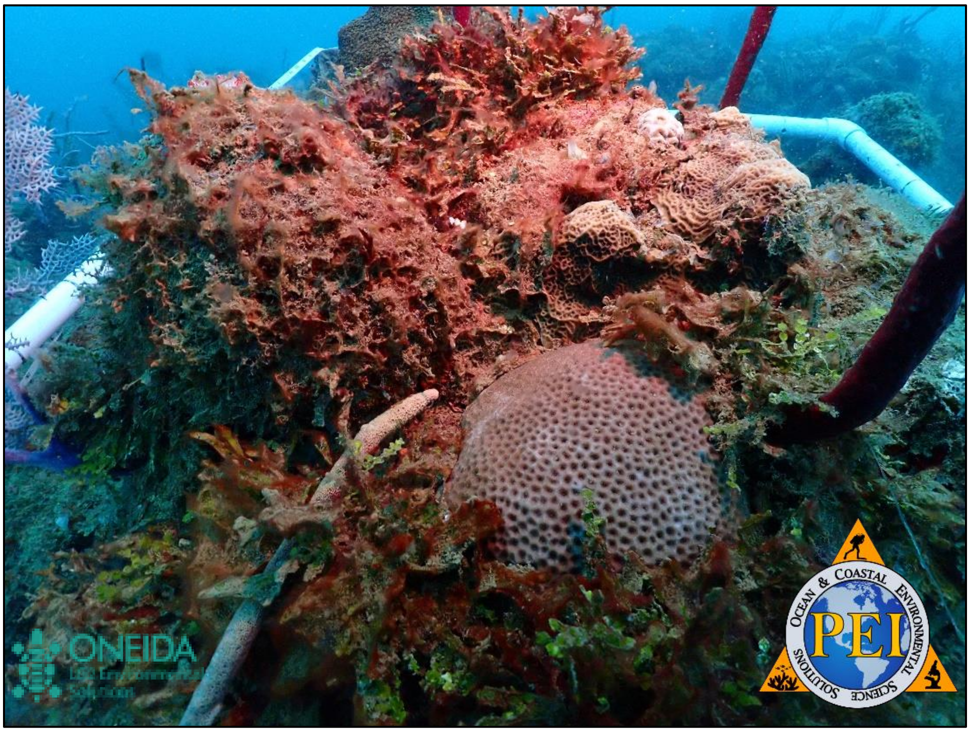

Photo 31. A *Siderastrea siderea* colony surrounded by dense macroalgal growth covered with cyanobacteria on the shelf edge reef at site R_B-03.

Photo 32. Barrel sponge (*Xestospongia muta*) on the edge of linear reef habitat near site R_SAV-05.

Photo 33. An orange ball sponge (*Cinachyrella* sp.) with heavy sedimentation on a linear reef at site R_B-04.

Photo 34. A barrel sponge (*Xestospongia muta)* with heavy sedimentation on a linear reef at site R_B-04.

Photo 35. A small *Montastraea cavernosa* colony with polyps extended on a linear reef at site R_B-04.

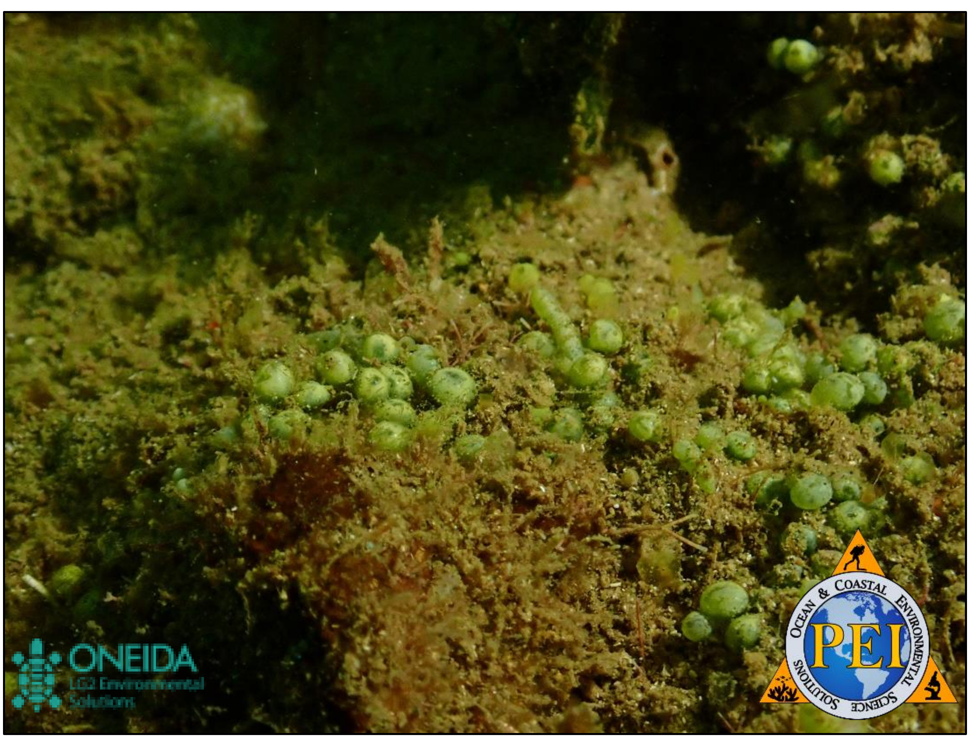

Photo 36. *Caulerpa racemosa* surrounded by dense turf algae growth on a linear reef at site R_B-04.

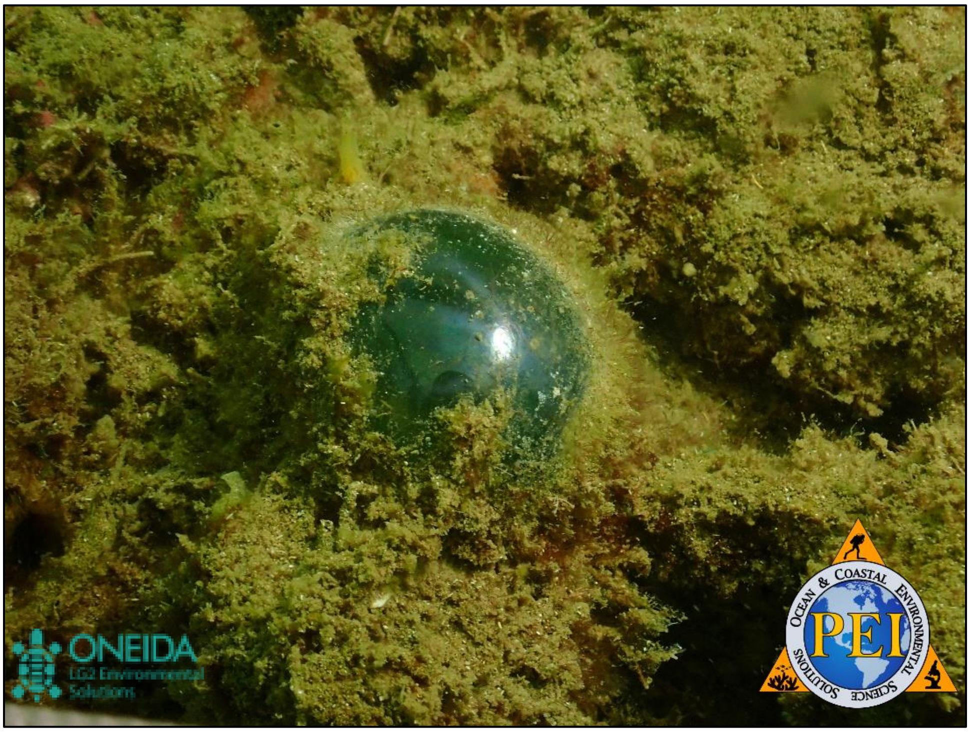

Photo 37. *Ventricaria ventricosa* surrounded by dense turf algae growth on a linear reef at site R_B-04.

Photo 38. Peacock flounder (*Bothus lunatus*) observed on colonized bedrock at site R_B-05.

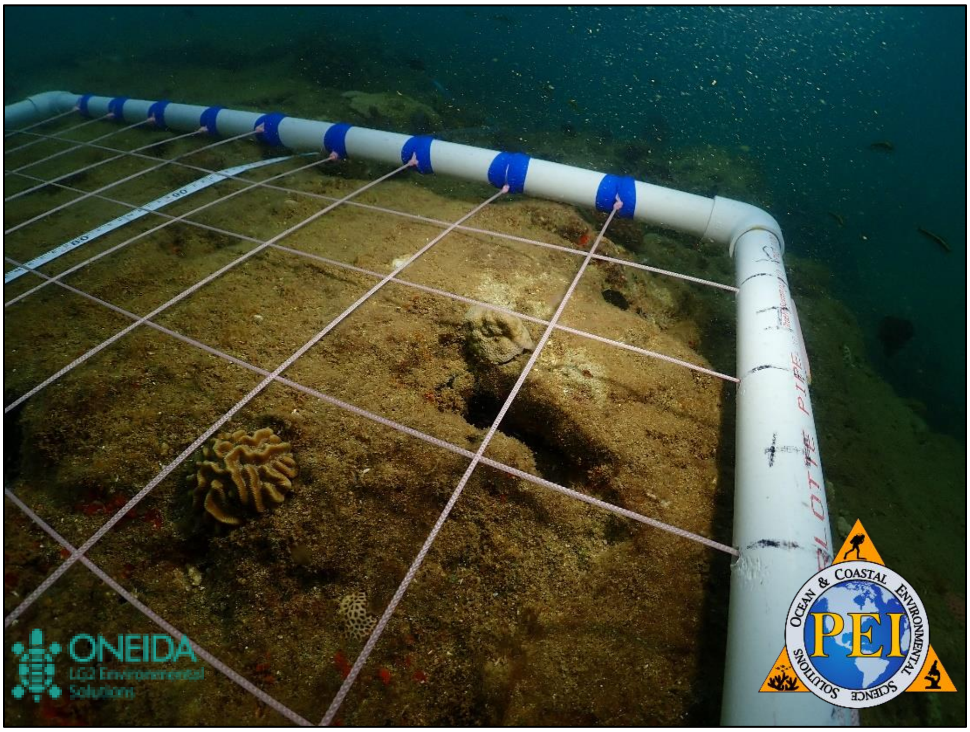

Photo 39. Several small stony coral colonies surrounded by dense turf algae on colonized bedrock at site R_B-05.

Photo 40. Rock-boring urchin (*Echinometra lucunter*) on colonized bedrock at site R_B-05.

Photo 41. Giant anemone (*Condylactis gigantea*) on linear reef at site R_B-04.

Photo 42. *Isophyllia rigida* and *Pseudodiploria strigosa* colonies on linear reef at site R_B-01.

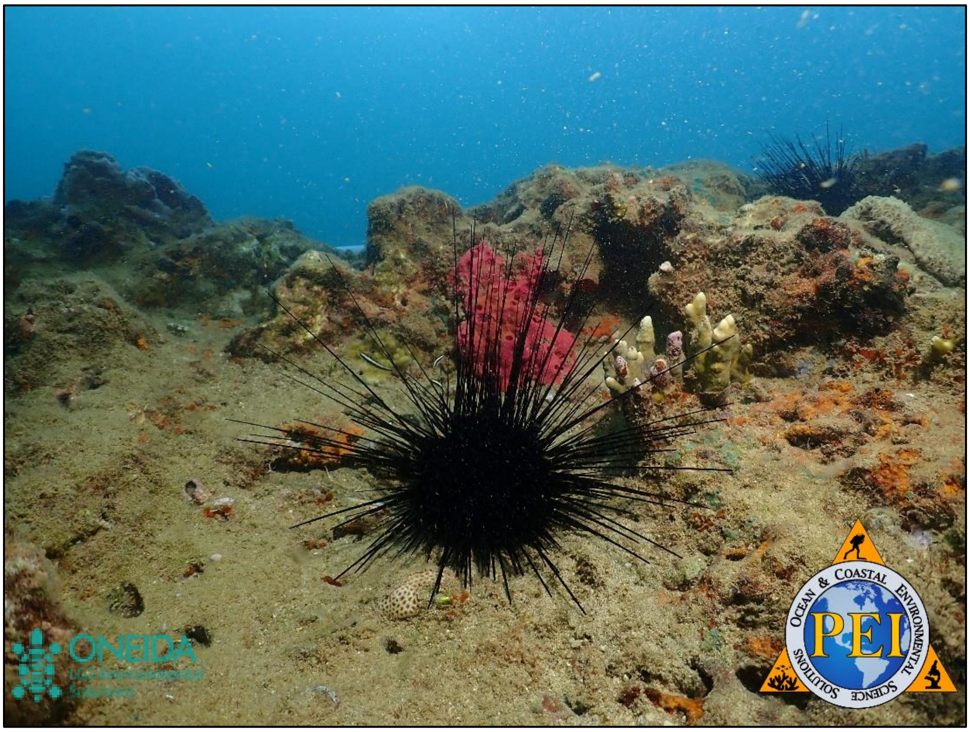

Photo 43. Long-spined urchin (*Diadema antillarum*) on colonized bedrock at site R_B-05.

Photo 44. A large *Dendrogyra cylindrus* colony with partial mortality and extended polyps on a linear reef at site R_B-06.

Photo 45. Aerial view of the large *Dendrogyra cylindrus* colony with partial mortality and extended polyps on a linear reef near site R_B-06.

Photo 46. Close up of the extended polyps on the large *Dendrogyra cylindrus* colony with partial mortality on a linear reef at site R_B-06.

Photo 47. An *Acropora cervicornis* colony on a linear reef at site R_B-06.

Photo 48. A small *Dendrogyra cylindrus* colony with polyps extended on linear reef at site R_B-06.

Photo 49. A small *Dendrogyra cylindrus* colony with polyps extended on a linear reef at site R_B-06.

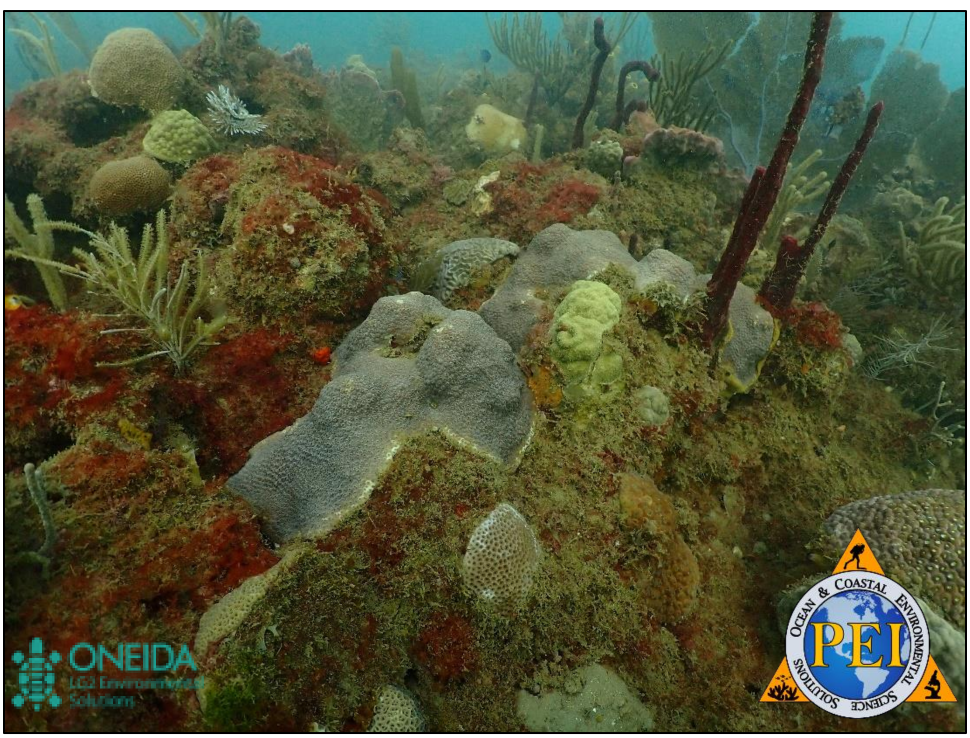

Photo 50. A large *Orbicella faveolata* colony with partial mortality and sponge/stony coral overgrowth at on a linear reef at site R_B-06.

Photo 51. Linear reef dominated by octocorals and turf algae with scattered stony coral cover at site R_B-06.

Photo 52. An *Eunicea* sp. colony on a linear reef at site R_B-06.

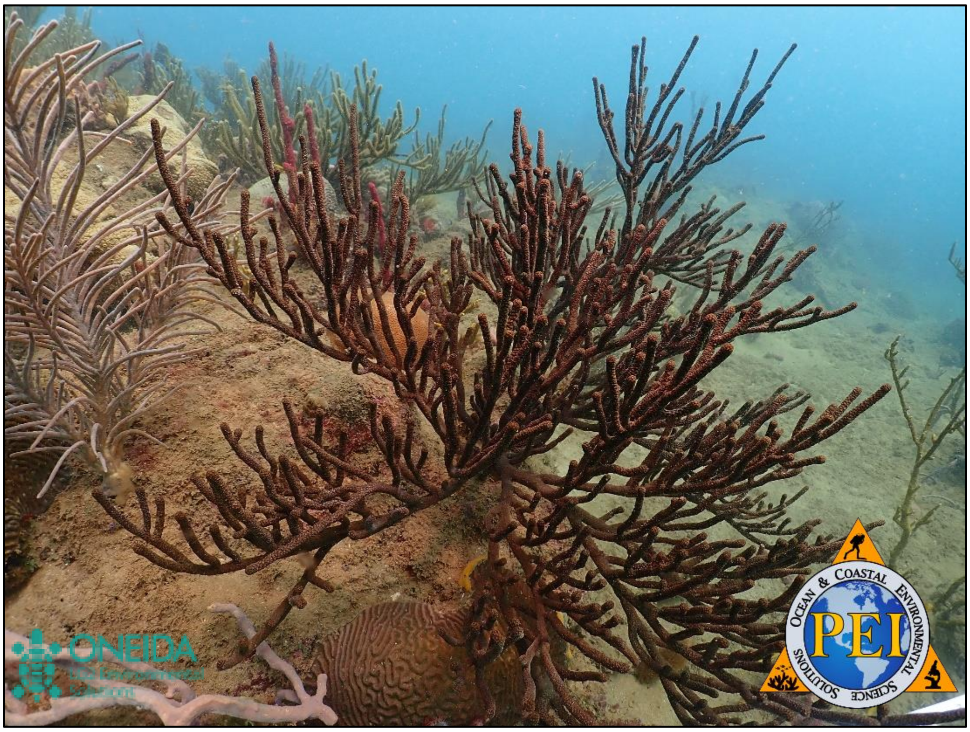

Photo 53. A *Plexaura* sp. colony on a linear reef at site R_B-06.

Photo 54. Sediment dusting observed on a *Siderastrea siderea* colony on a linear reef at site R_B-06.

Photo 55. A yellow tube sponge (*Aplysina fistularis*) surrounded by numerous stony coral colonies on a linear reef at site R_B-06.

Photo 56. A red lionfish (*Pterois volitans*) observed on a linear reef at site R_B-06.

Photo 57. Encrusting zoanthid (*Palythoa caribaeorum*) and magnificent feather duster (*Sabellastarte magnifica*) on a linear reef at site R_B-06.

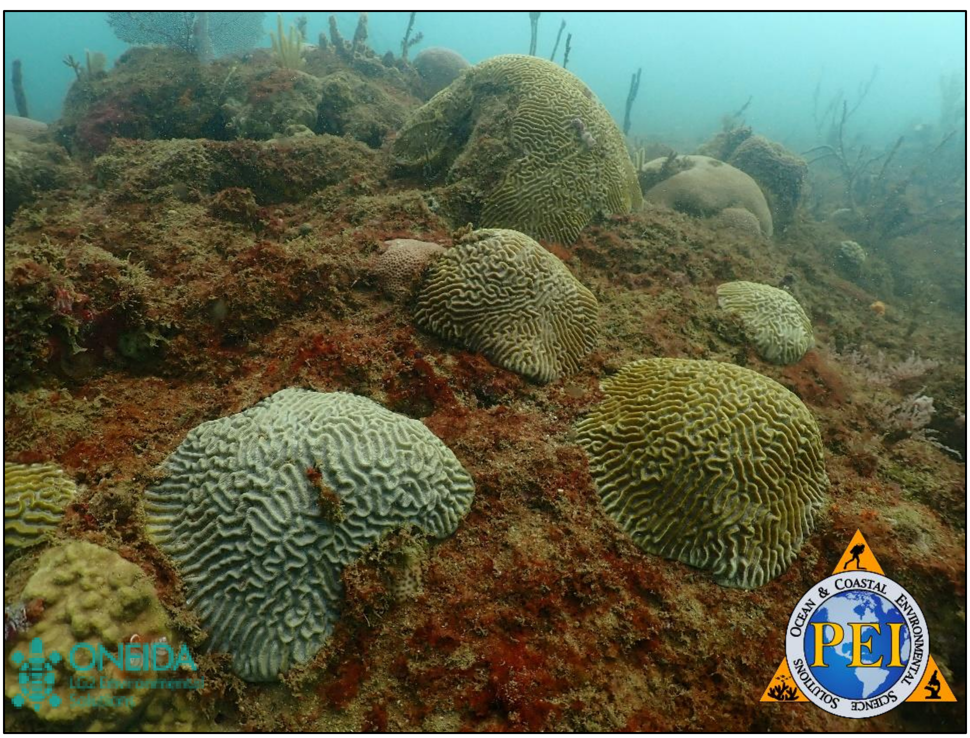

Photo 58. Numerous *Pseudodiploria strigosa* colonies on a shelf edge reef (**Figure 24**).

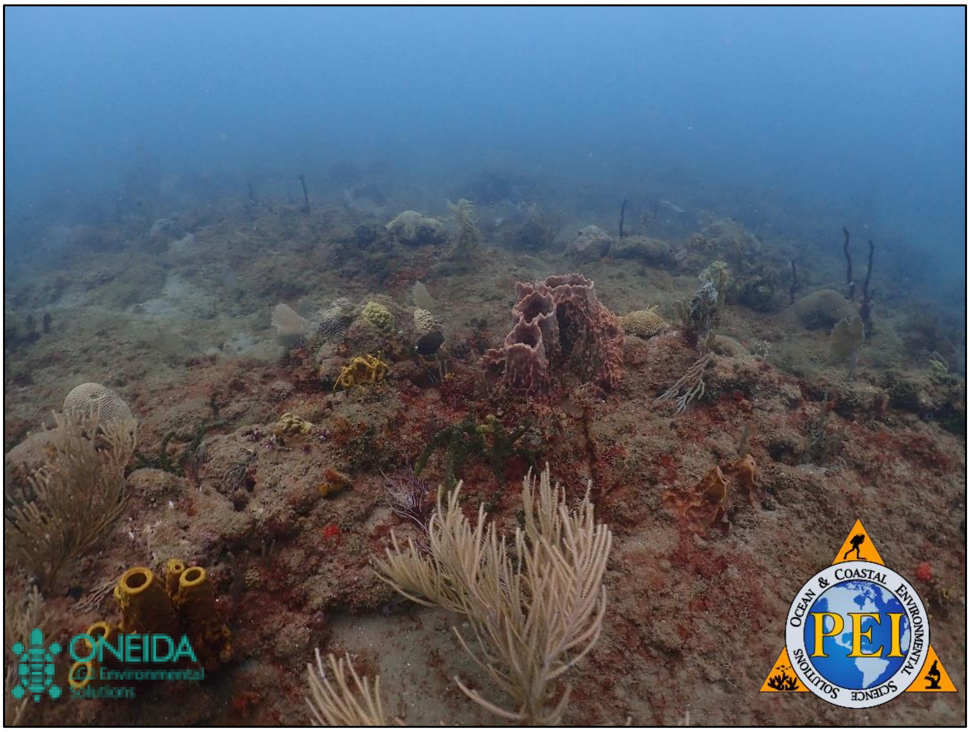

Photo 59. Patch reef with diverse cover of sponges, octocorals, and stony corals (**Figure 24**).

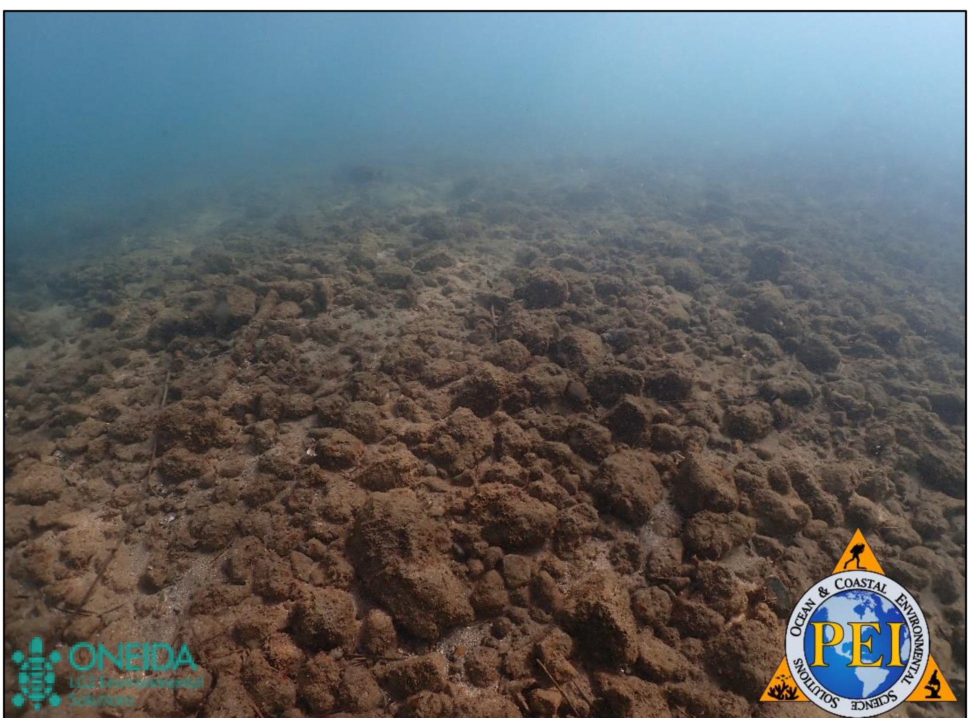

Photo 60. Area of rock rubble observed on colonized pavement (**Figure 24**).

Photo 61. Nearshore colonized bedrock observed while mapping benthic resources (**Figure 24**).

Photo 62. Nearshore colonized bedrock observed while mapping benthic resources (**Figure 24**).

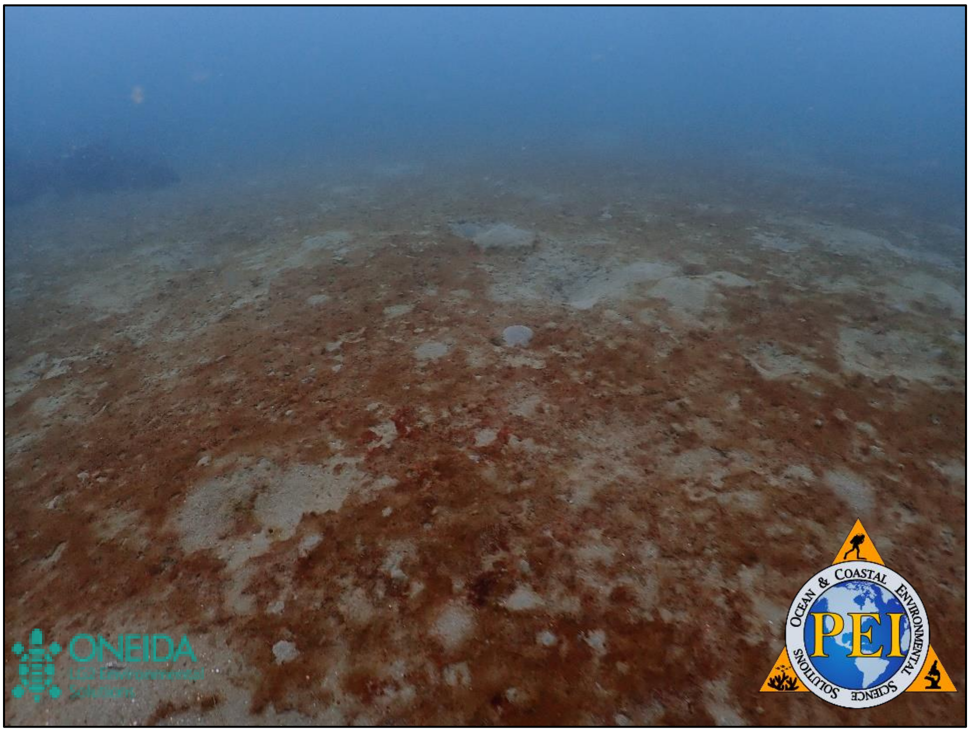

Photo 63. Cyanobacteria covering unconsolidated sediment (**Figure 24**).

Photo 64. A low-density continuous seagrass habitat with *Halodule wrightii* (**Figure 24**).

Photo 65. Low-density continuous seagrass habitat with *Halophila decipiens, Halodule wrightii,* and *Syringodium filiforme* at site R_SAV-04.

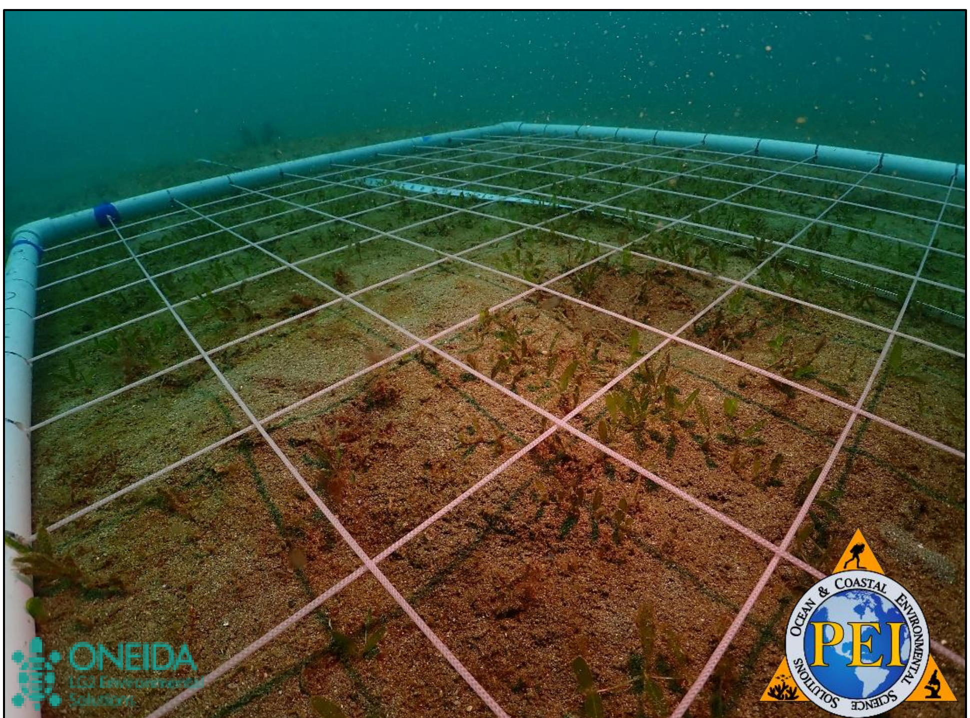

Photo 66. Moderate-density continuous seagrass habitat with *Halophila decipiens* at site R_SAV-05.

Photo 67. Continuous seagrass habitat with *Halodule wrightii, Halophila decipiens* and scattered *Halimeda* sp. (**Figure 24**).

Photo 68. Dense patches of *Halophila decipiens* (**Figure 24**).

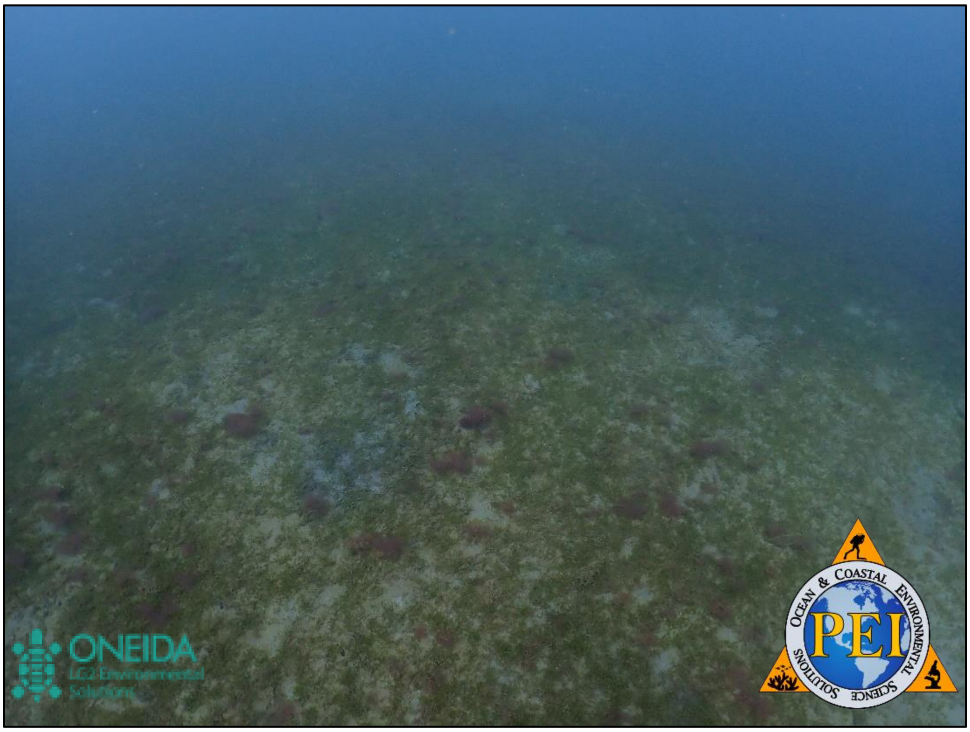

Photo 69. Dense continuous seagrass habitat with *Halophila decipiens* (**Figure 24**).

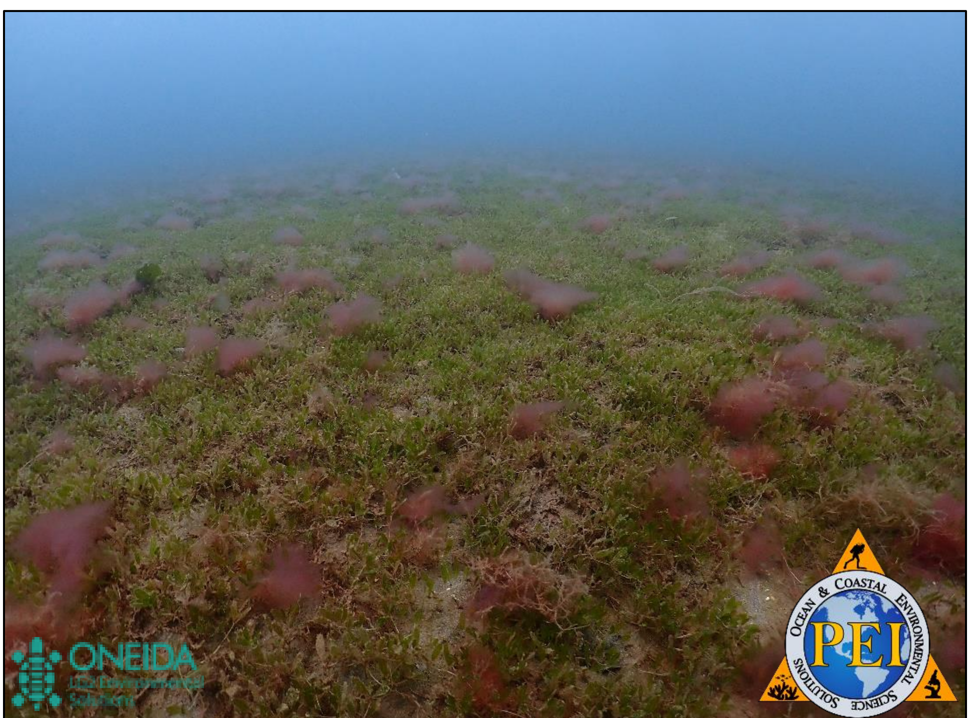

Photo 70. Dense continuous seagrass habitat with *Halophila decipiens* and epiphytic cyanobacteria (**Figure 24**).

Photo 71. The edge between bare unconsolidated sand substrate and dense continuous seagrass habitat with *Halophila decipiens* (**Figure 24**).

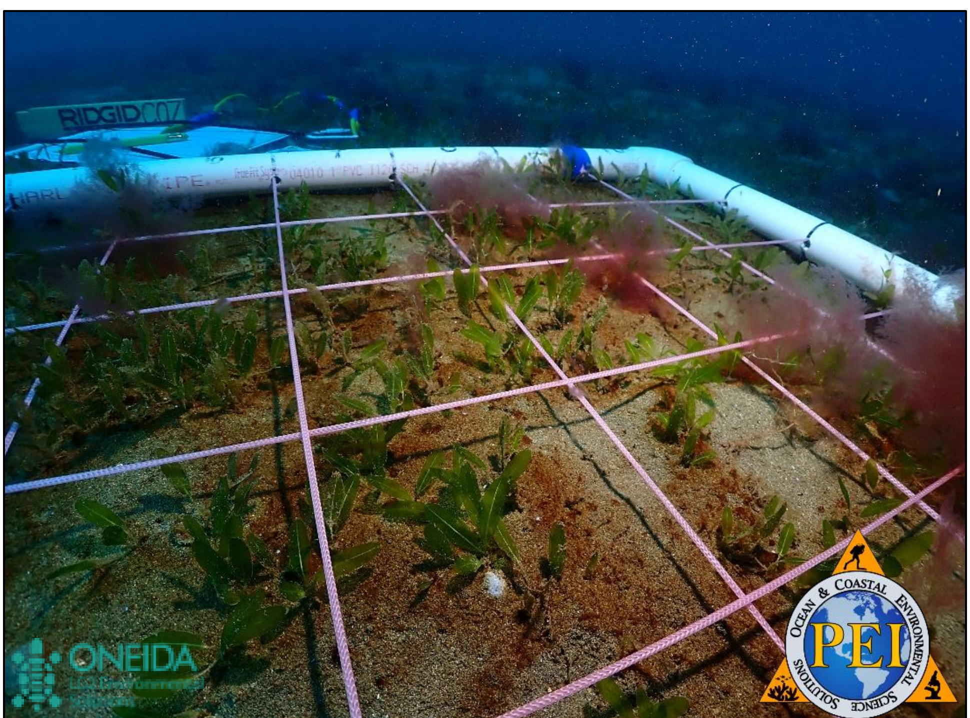

Photo 72. Dense continuous seagrass habitat with *Halophila decipiens* and epiphytic cyanobacteria at site R_SAV-01.

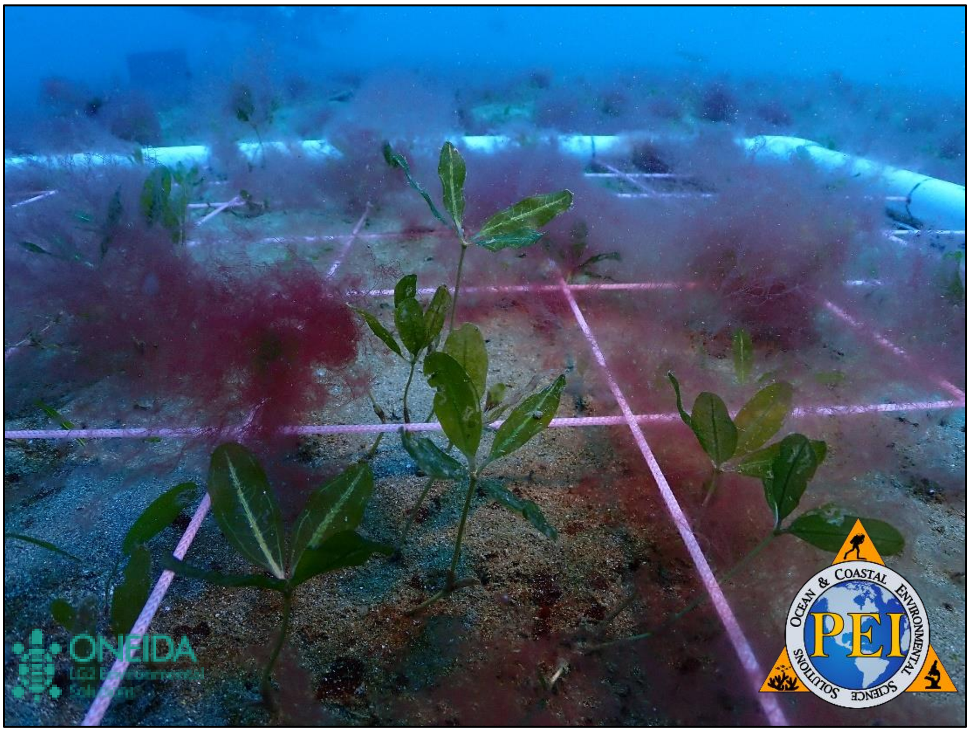

Photo 73. *Halophila engelmannii* with epiphytic cyanobacteria in a continuous seagrass habitat at site R_SAV-01.

Photo 74. Pinnacle scientist collecting quantitative data on a continuous seagrass bed at site R_SAV-02.

Photo 75. Pinnacle scientists collecting quantitative data on a continuous seagrass habitat at site R_SAV-02.

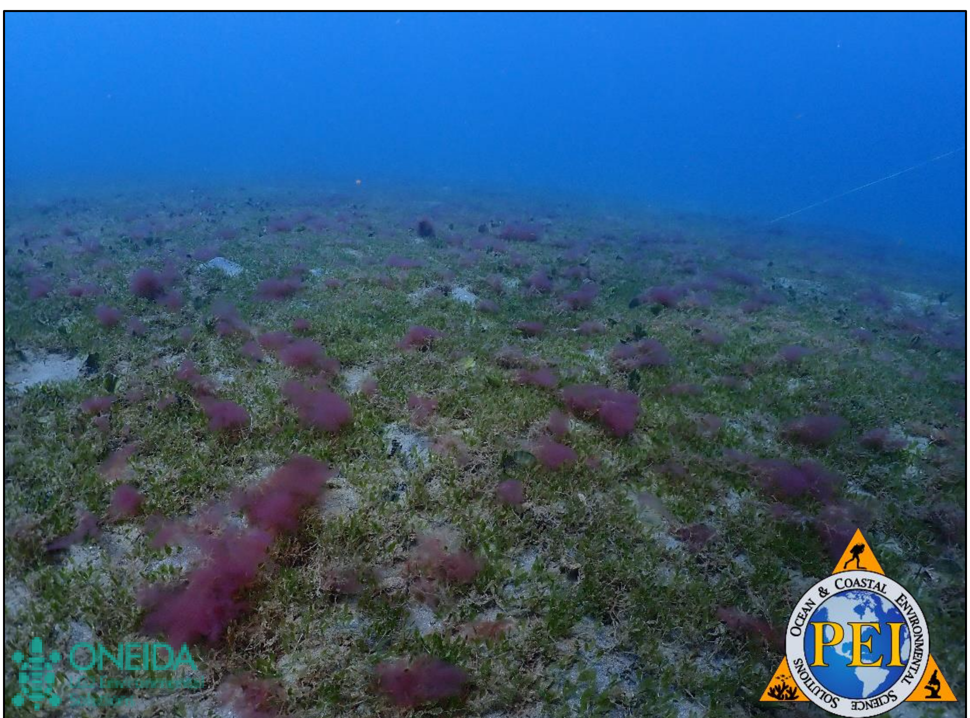

Photo 76. Dense continuous seagrass habitat with *Halophila decipiens* and epiphytic cyanobacteria at site R_SAV-02.

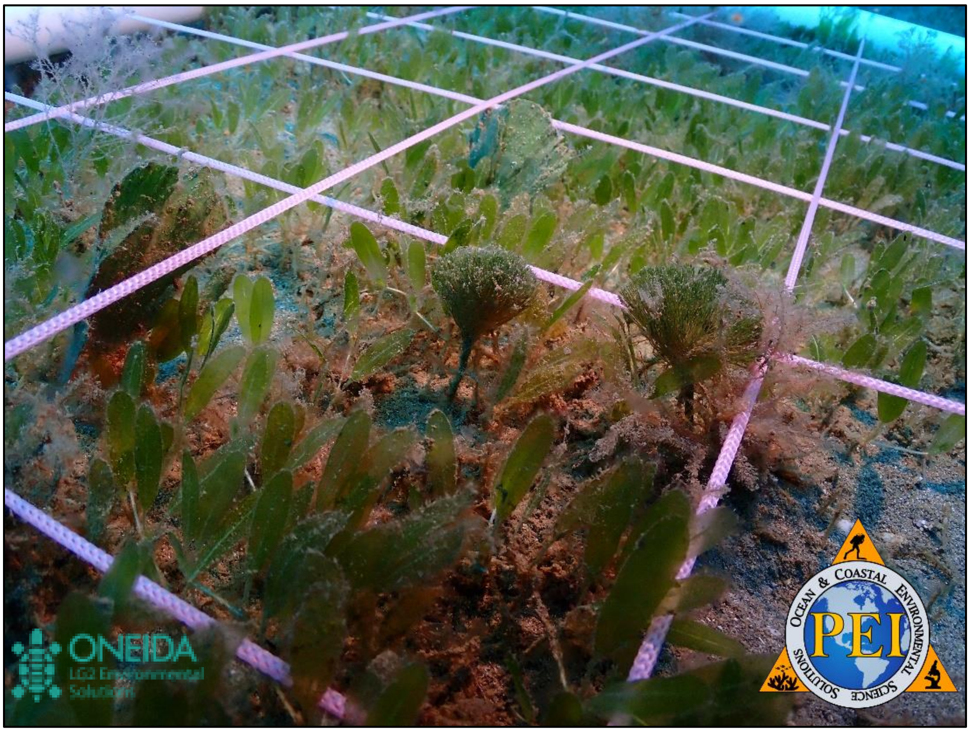

Photo 77. Dense continuous seagrass habitat with *Halophila decipiens* and scattered macroalgae (*Udotea* sp. and *Penicillus* sp.) at site R_SAV-02.

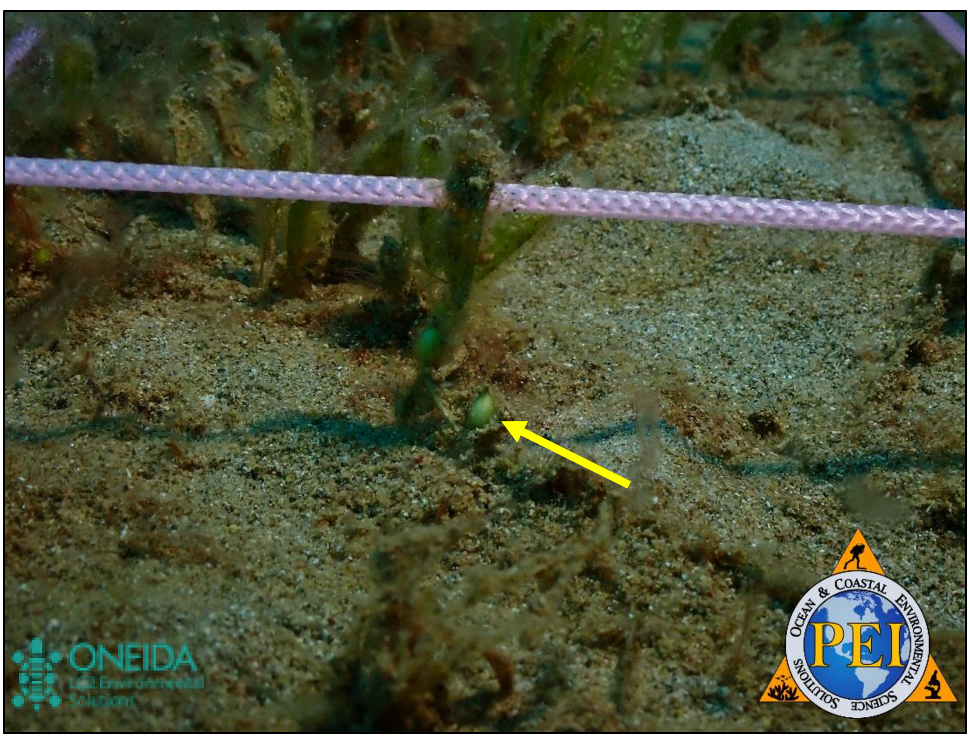

Photo 78. Flowering observed on *Halophila decipiens* in a continuous seagrass habitat at site R_SAV-03.

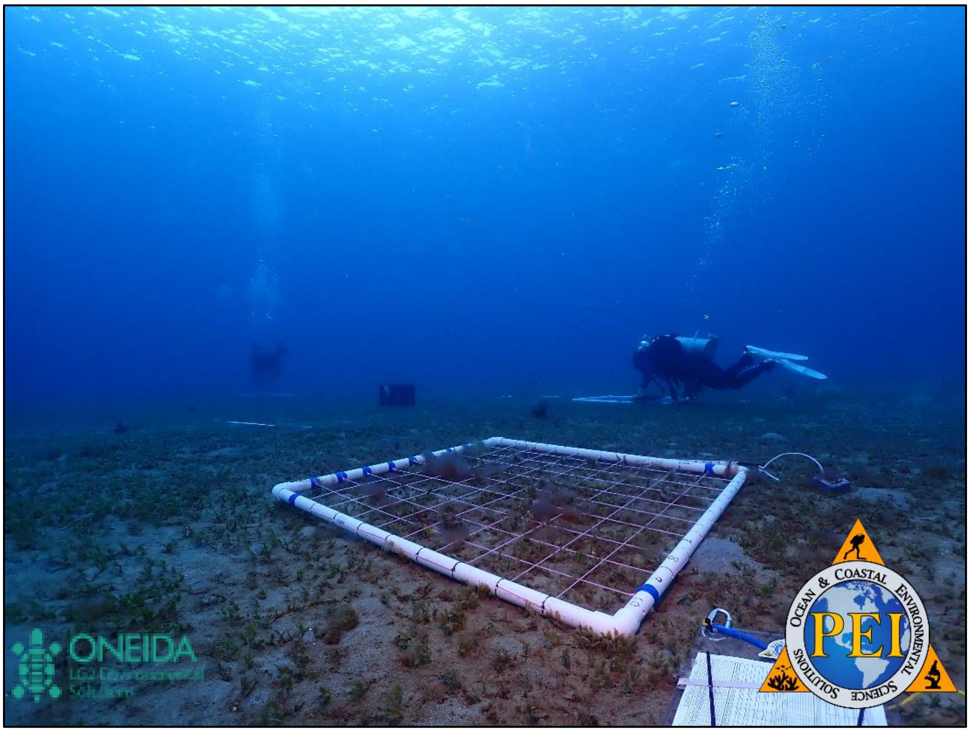

Photo 79. Pinnacle scientists collecting quantitative data in continuous seagrass habitat at site R_SAV-03.

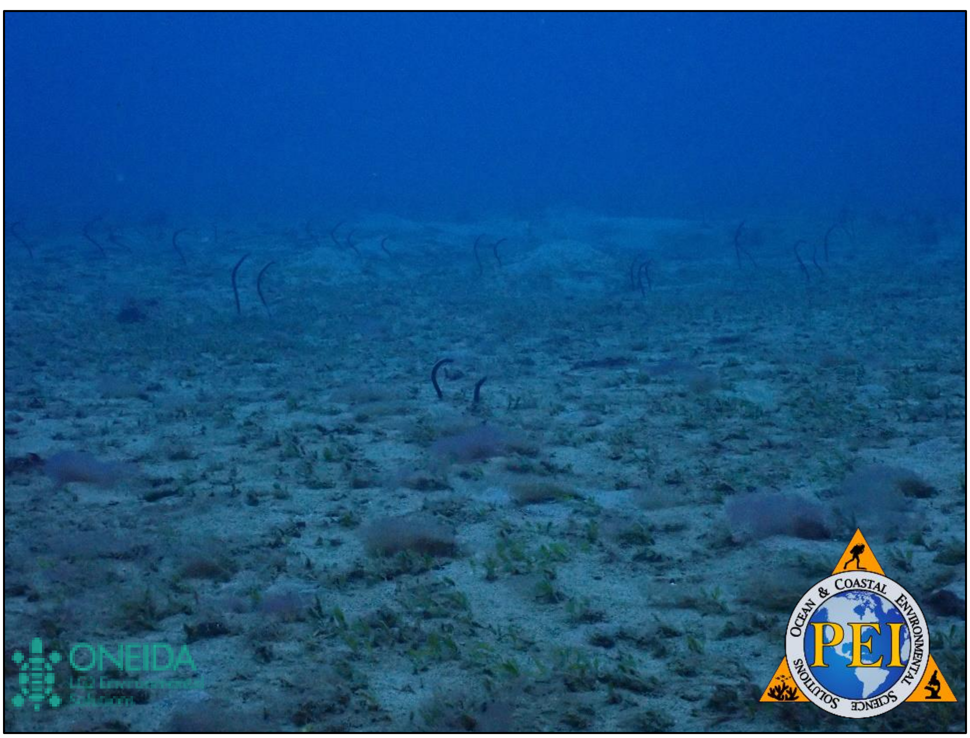

Photo 80. Colonies of garden eels (*Heteroconger longissimus*) within continuous seagrass habitat at site R_SAV-03.

Photo 81. A West Indian manatee (*Trichechus manatus*) observed while collecting SAV data on a continuous seagrass habitat at site R_SAV-05.

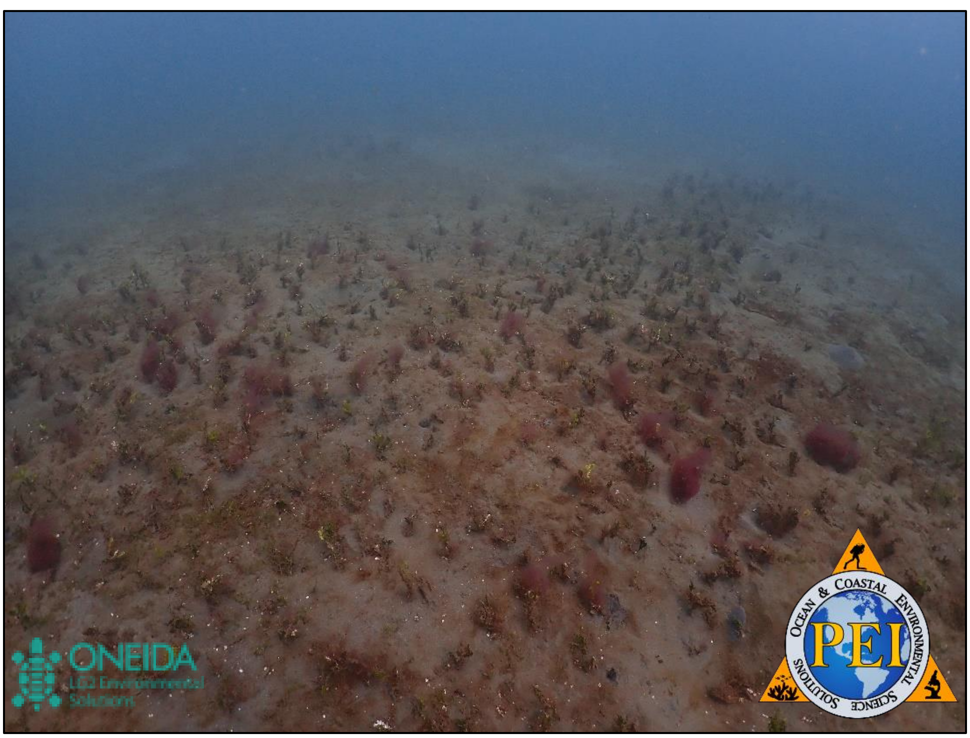

Photo 82. Macroalgal habitat dominated by *Halimeda* spp. (**Figure 24**).

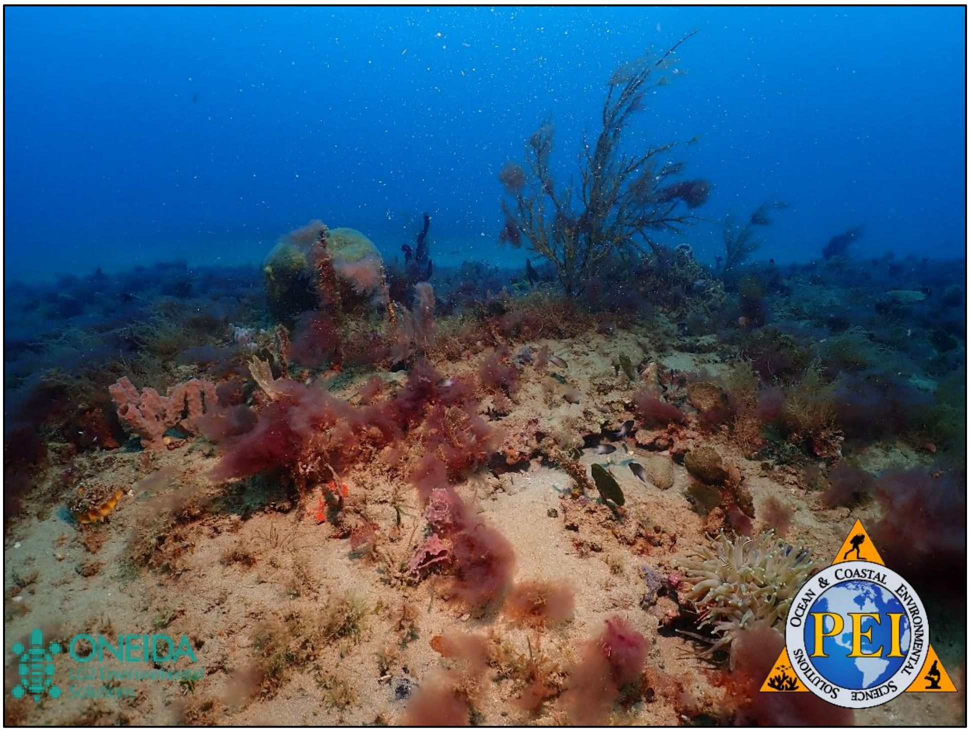

Photo 83. Colonized pavement with stony corals (*Solenastrea bournoni*), sponges, octocorals, macroalgae, and anemones (**Figure 24**).

Photo 84. A giant barrel sponge (*Xestospongia muta*) surrounded by dense macroalgae, anemones, and a grouper (*Cephalopholis fulva*) on colonized pavement (**Figure 24**).

ATTACHMENT B

Puerto Rico SAV Resource Survey:

San Juan Survey Area

Representative Photos

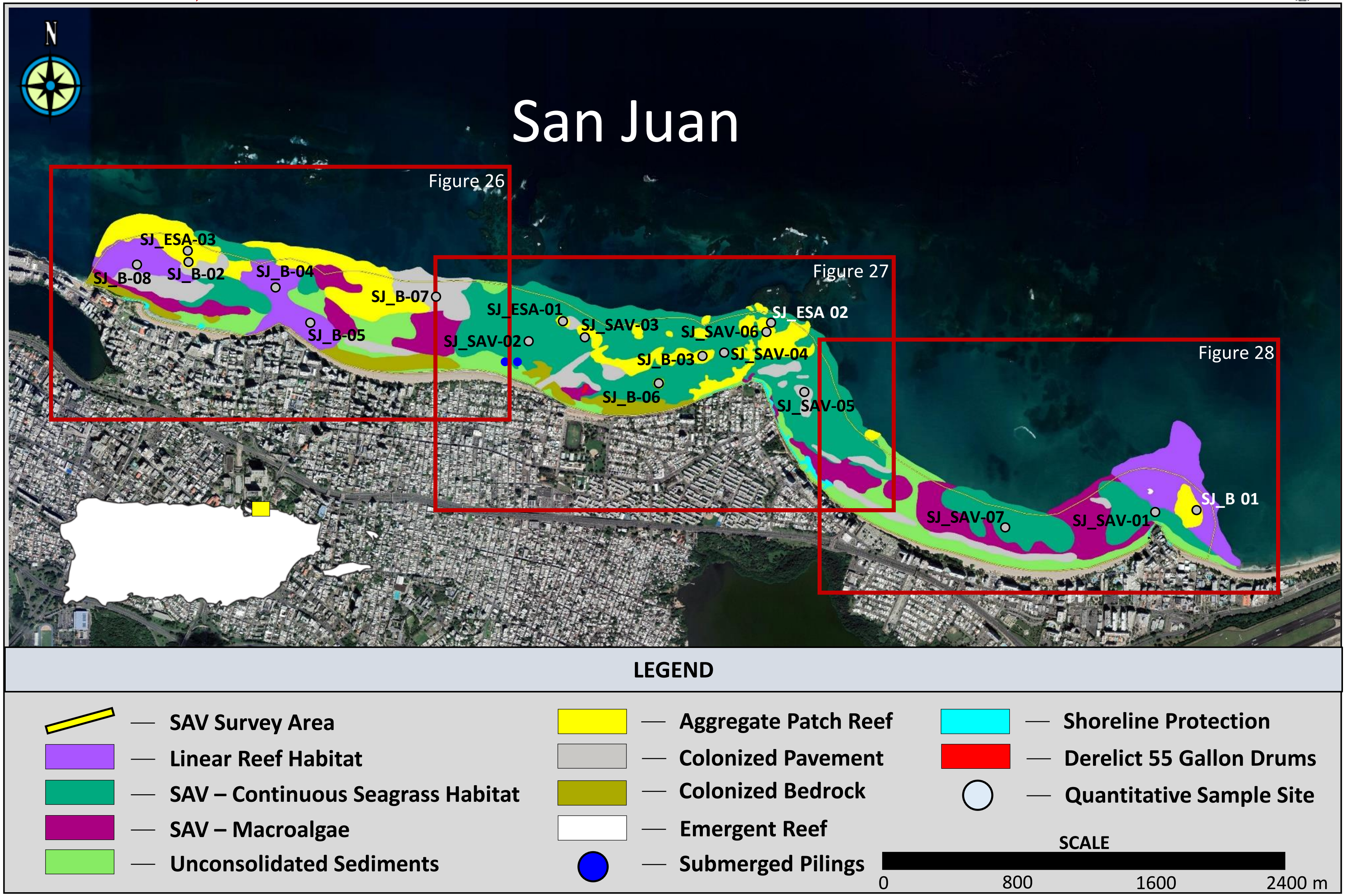

Figure 25. An index for **Figures 26, 27,** and **28** showing mapped resources and quantitative sample site locations for the San Juan survey area. Image credit: Google Earth, 2022

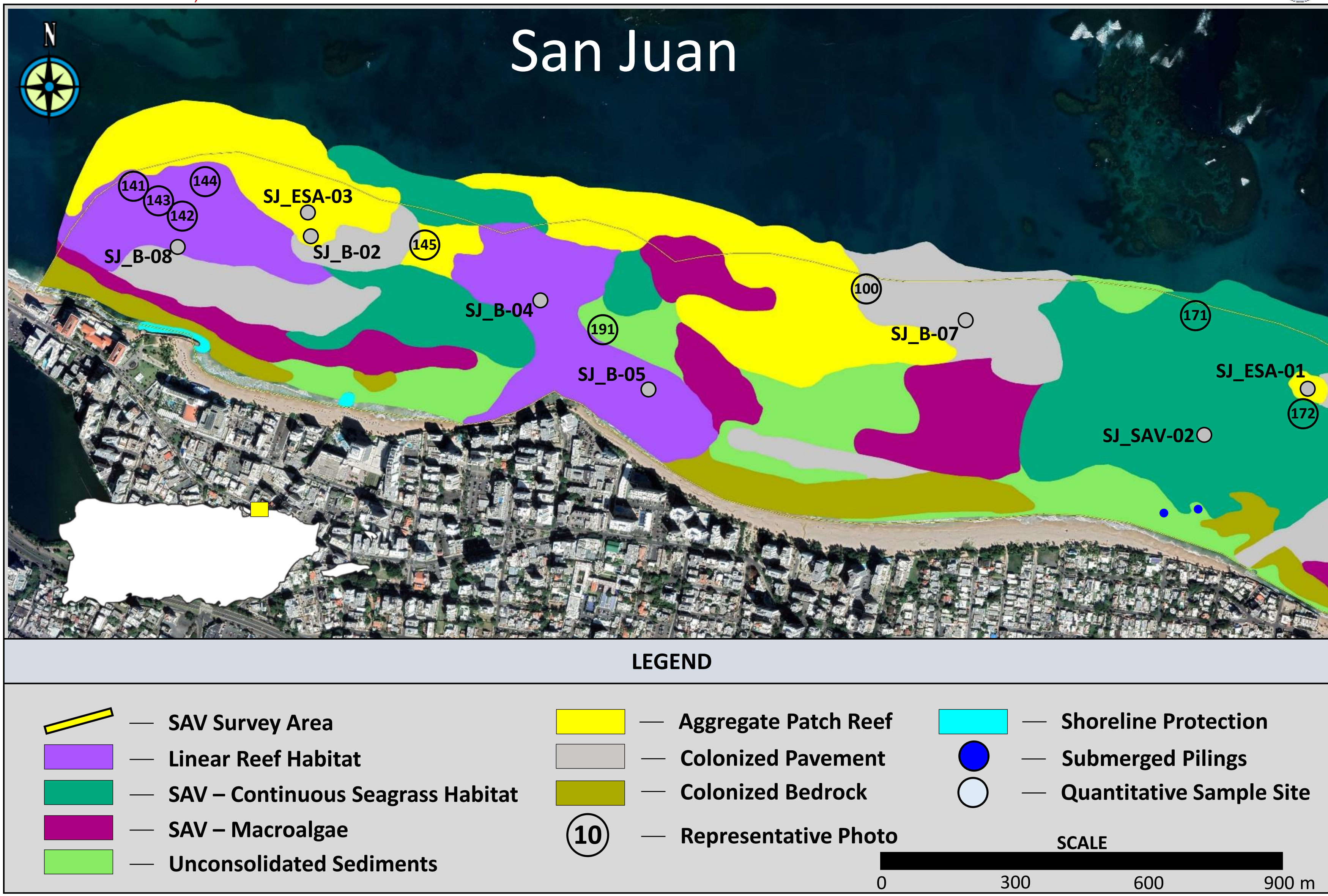

Figure 26. Quantitative sample sites, mapping representative photo numbers, and mapped resources delineated within the western zone of the San Juan survey area. Image credit: Google Earth, 2022

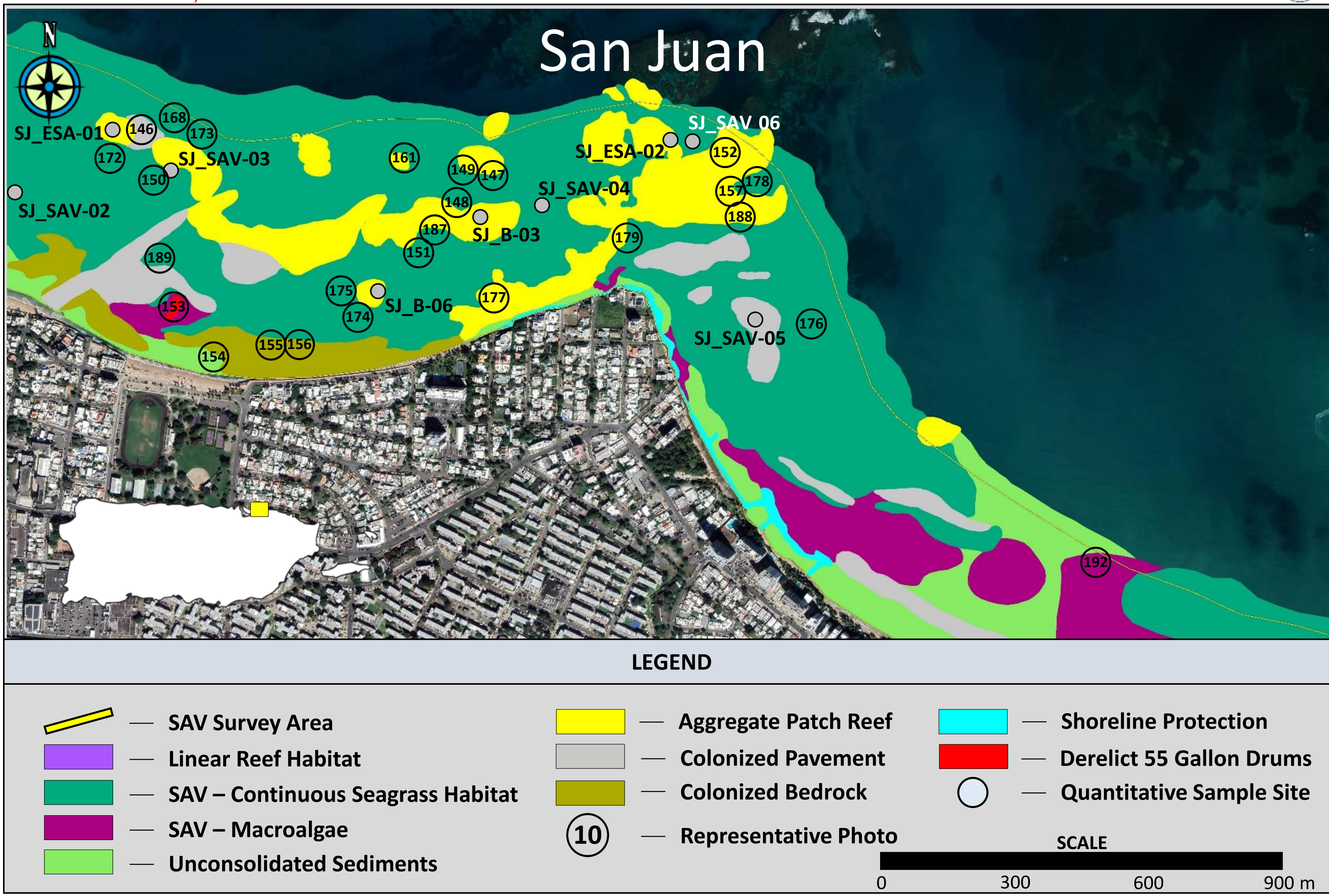

Figure 27. Quantitative sample sites, mapping representative photo numbers, and mapped resources delineated within the central zone of the San Juan survey area. Image credit: Google Earth, 2022

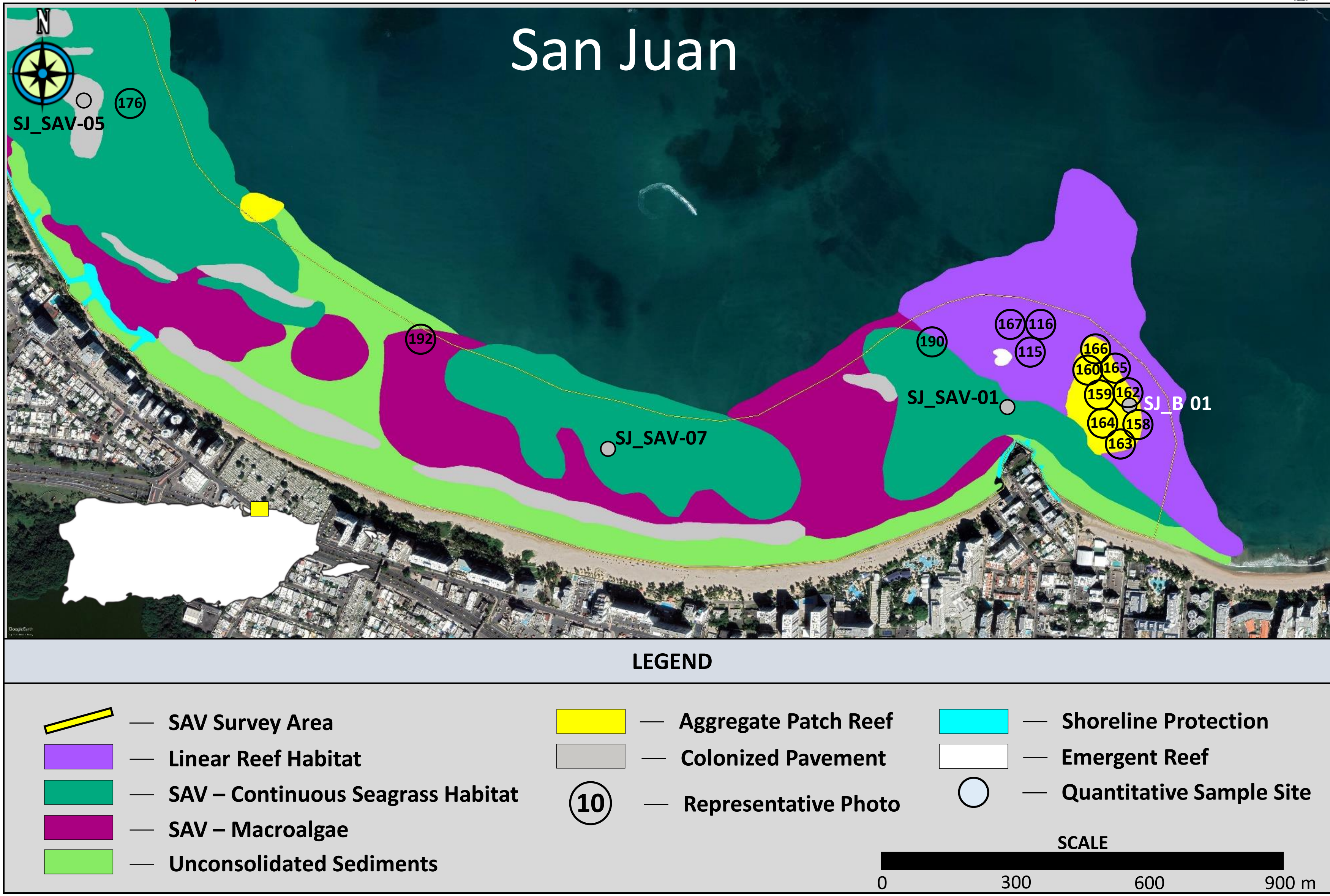

Figure 28. Quantitative sample sites, mapping representative photo numbers, and mapped resources delineated within the eastern zone of the San Juan survey area. Image credit: Google Earth, 2022

Photo 85. A large *Orbicella faveolata* colony with mostly live tissue, but showing signs of stress including partial bleaching and partial mortality on a patch reef at site SJ_B-01.

Photo 86. A *Porites astreoides* colony with extended polyps, surrounded by dense *Dictyota* sp. growth on a patch reef at site SJ_B-01

Photo 87. A small orange ball sponge (*Cinachyrella* sp.) with heavy sedimentation on colonized pavement at site SJ_B-07.

Photo 88. Octocoral (*Eunicea* sp.) colony on a patch reef at site SJ_B-01.

Photo 89. Complex geomorphology associated with a patch reef at site SJ-B-02. Note the cable crossing over the crest of the patch reef.

Photo 90. A *Porites porites* colony with extended polyps on a patch reef at site SJ_-B-01.

Photo 91. A *Montastraea cavernosa* colony on a patch reef at site SJ_B-02.

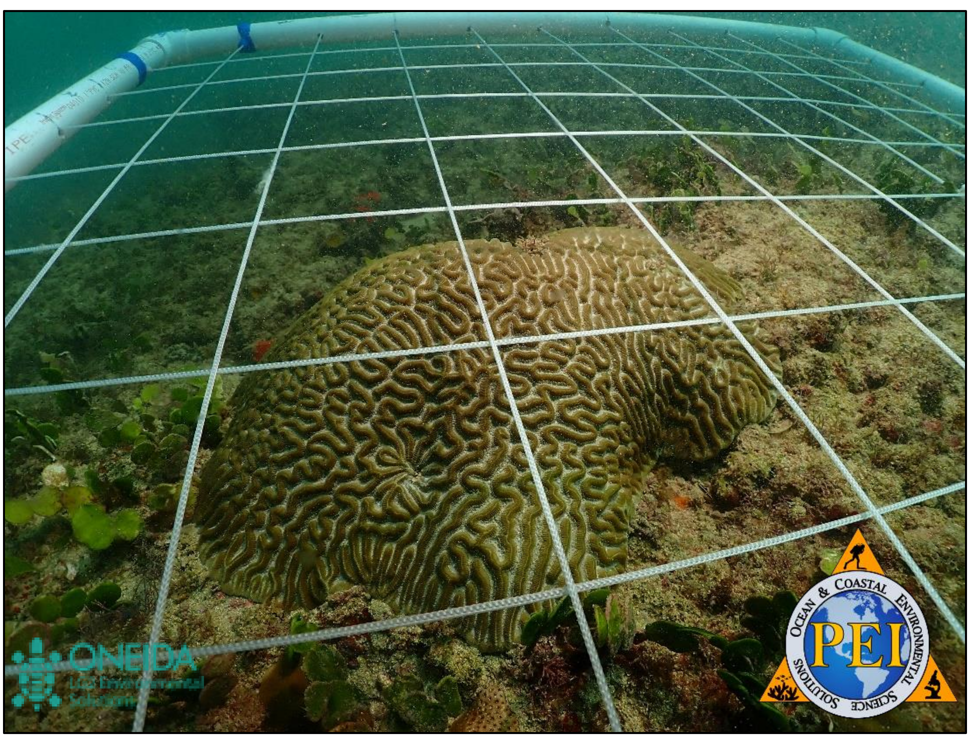

Photo 92. A *Pseudodiploria strigosa* surrounded by dense *Halimeda* spp. on a linear reef at site SJ_B-04.

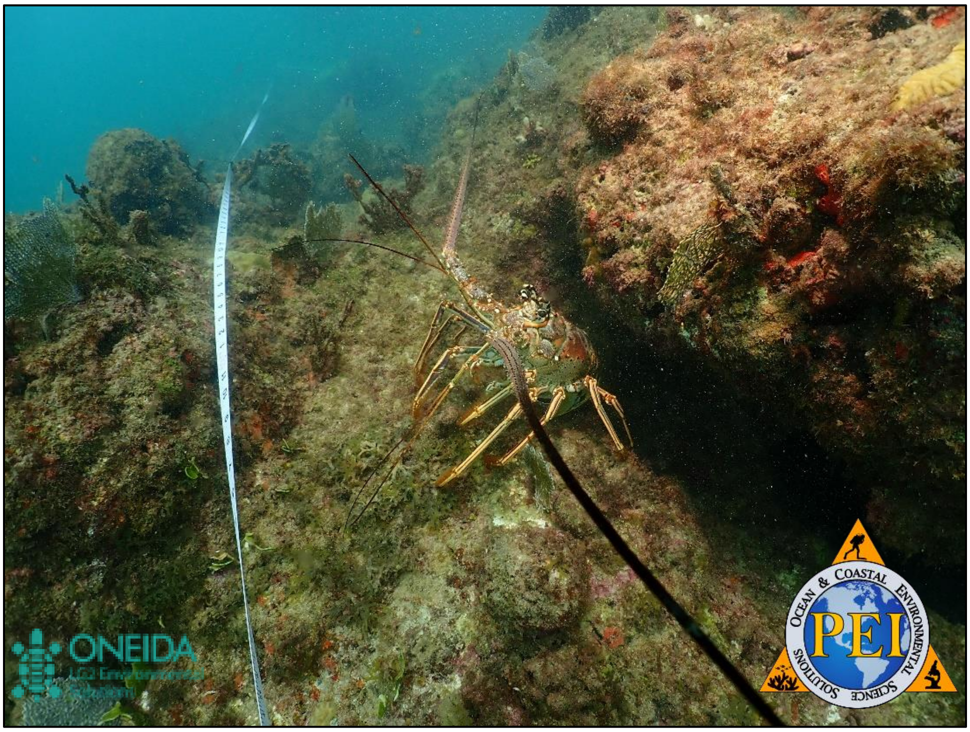

Photo 93. A Caribbean spiney lobster (*Panulirus argus*) observed on a patch reef at site SJ_B-02.

Photo 94. Macroalgae (*Halimeda* sp.) with epiphytes covering the blades located on a linear reef at site SJ_B-04.

Photo 95. A *Madracis decactis* colony with extended polyps on colonized pavement at site SJ_-B-07.

Photo 96. A cable stretching over the crest of a patch reef at site SJ_B-03 with a *Gorgonia* sp. colony and squirrelfish (*Holocentrus adscensionis*).

Photo 97. Macroalgae (*Dictyota* spp.) on a linear reef at site SJ_B-05.

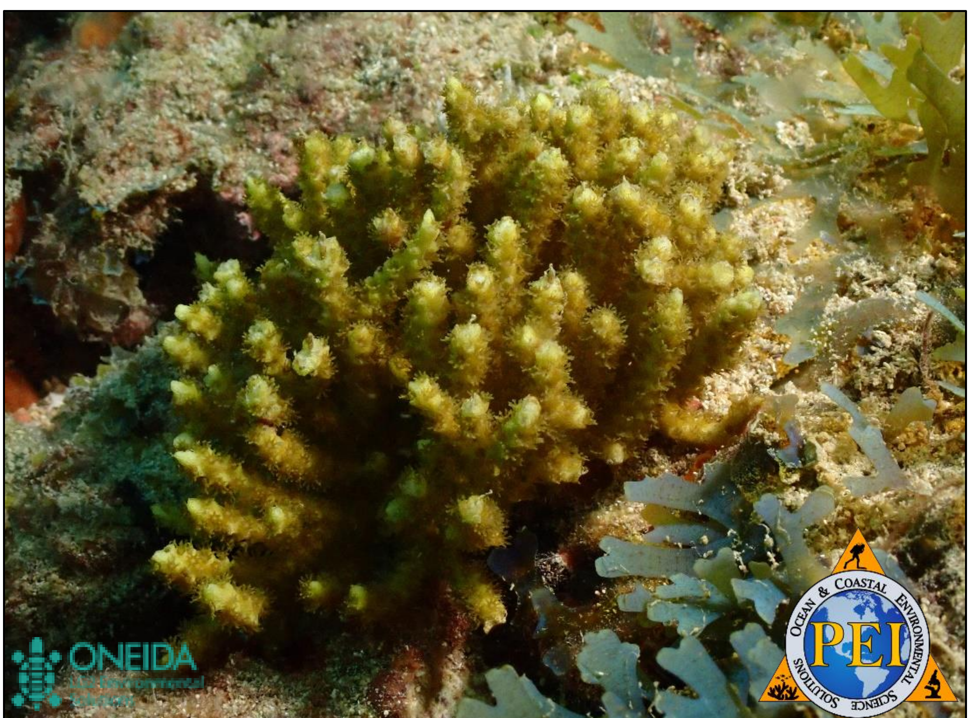

Photo 98. A small octocoral (*Muriceopsis* sp.) colony on a patch reef at site SJ_B-03.

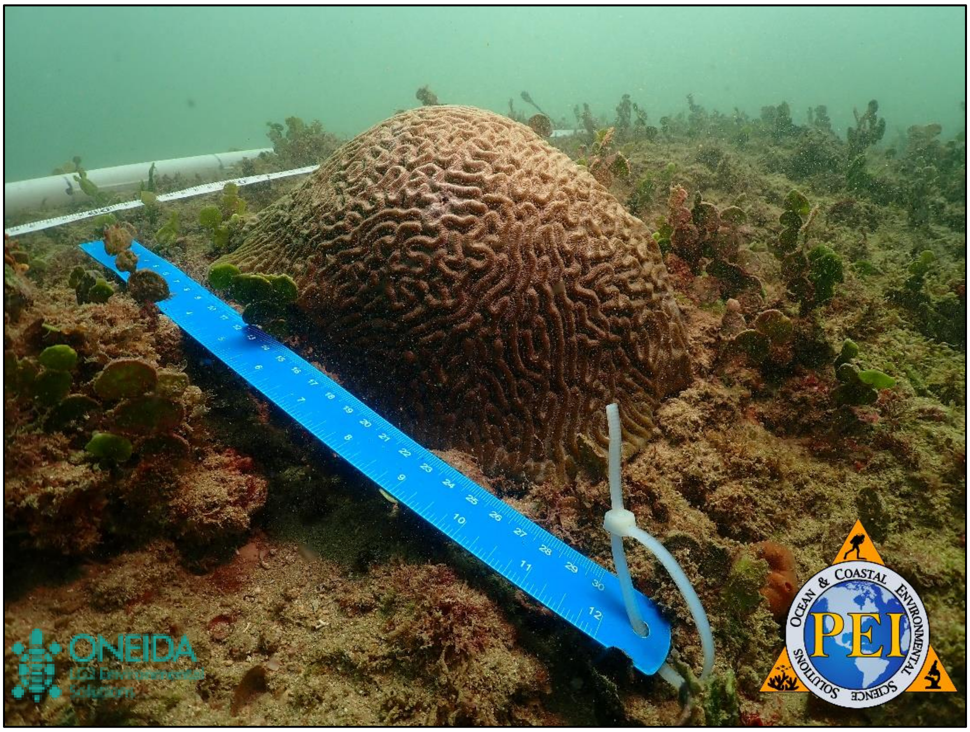

Photo 99. A *Pseudodiploria strigosa* colony on a linear reef at site SJ_B-04, surrounded by dense macroalgae (*Halimeda* sp.).

Photo 100. A *Montastraea cavernosa* colony with extended polyps on colonized pavement (**Figure 26**).

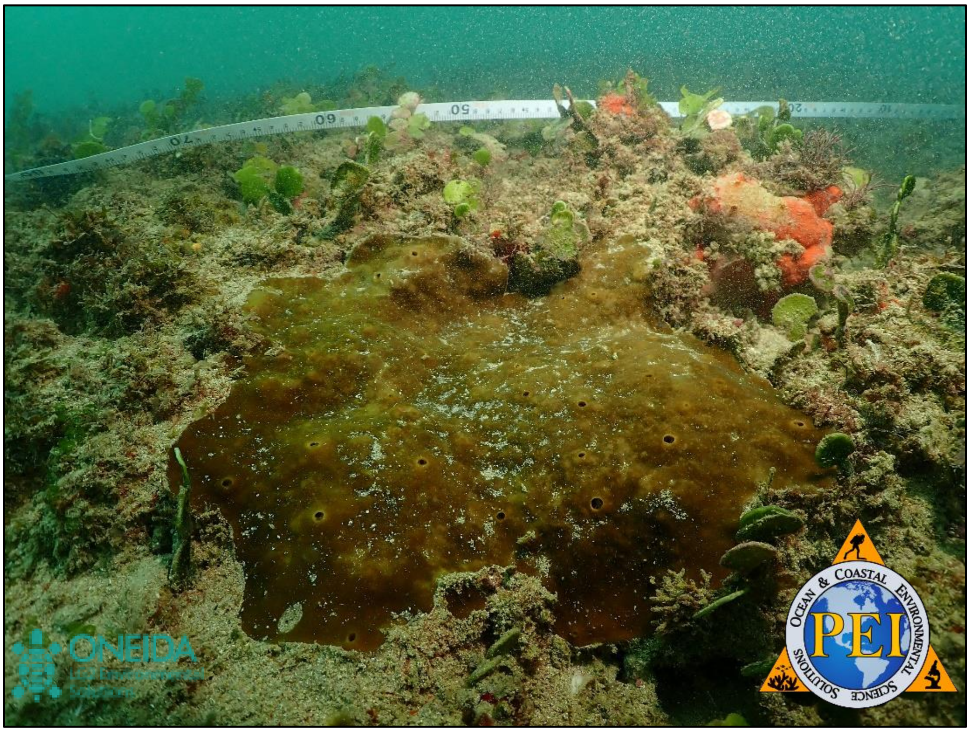

Photo 101. A large encrusting sponge (*Cliona caribbaea*) surrounded by dense macroalgae on a linear reef at site SJ_B-04.

Photo 102. An orange ball sponge (*Cinachyrella* sp.) and *Pseudodiploria strigosa* colony surrounded by dense macroalgal growth on a linear reef at site SJ_B-04.

Photo 103. *Porites astreoides* and *Pseudodiploria strigosa* colonies surrounded by dense macroalgae at on a patch reef at site SJ_B-06.

Photo 104. A large *Pseudodiploria clivosa* colony surrounded by dense macroalgal growth on a linear reef at site SJ_B-05.

Photo 105. *Amphiroa* sp. and a *Porites astreoides* colony on a linear reef at site SJ_B-05.

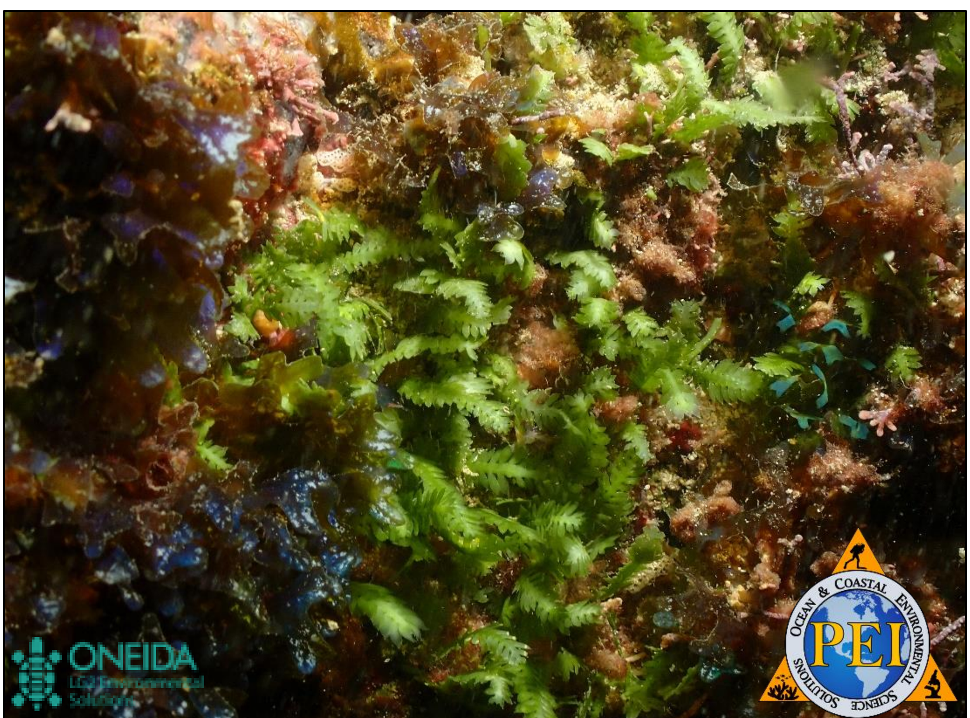

Photo 106. Dense macroalgal cover (*Caulerpa* spp. and *Dictyota* sp.) on a linear reef at site SJ_B-05.

Photo 107. A *Pseudodiploria strigosa* colony, *Halimeda* sp, and a rock-boring urchin (*Echinometra lucunter*) on a linear reef at site SJ_B-05.

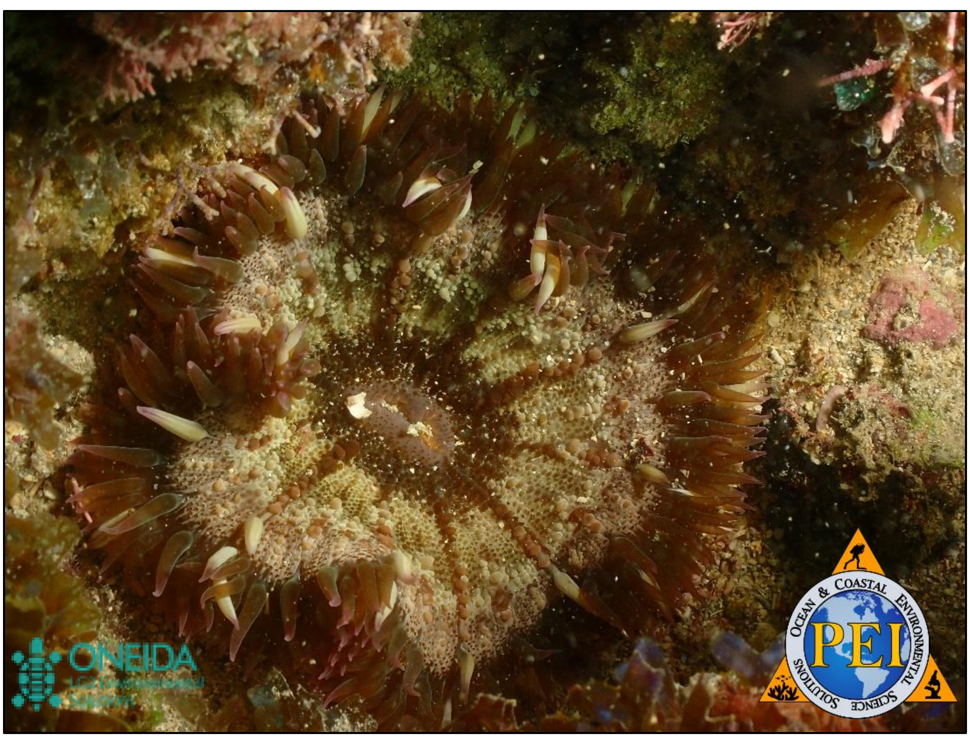

Photo 108. A corallimorph observed on a linear reef at site SJ_B-05.

Photo 109. A West Indian sea egg urchin (*Tripneustes ventricosus*) attached to *Sargassum* sp. on a patch reef at site SJ_B-06.

Photo 110. A rock-boring urchin (*Echinometra lucunter*) on a patch reef at sire SJ_B-06.

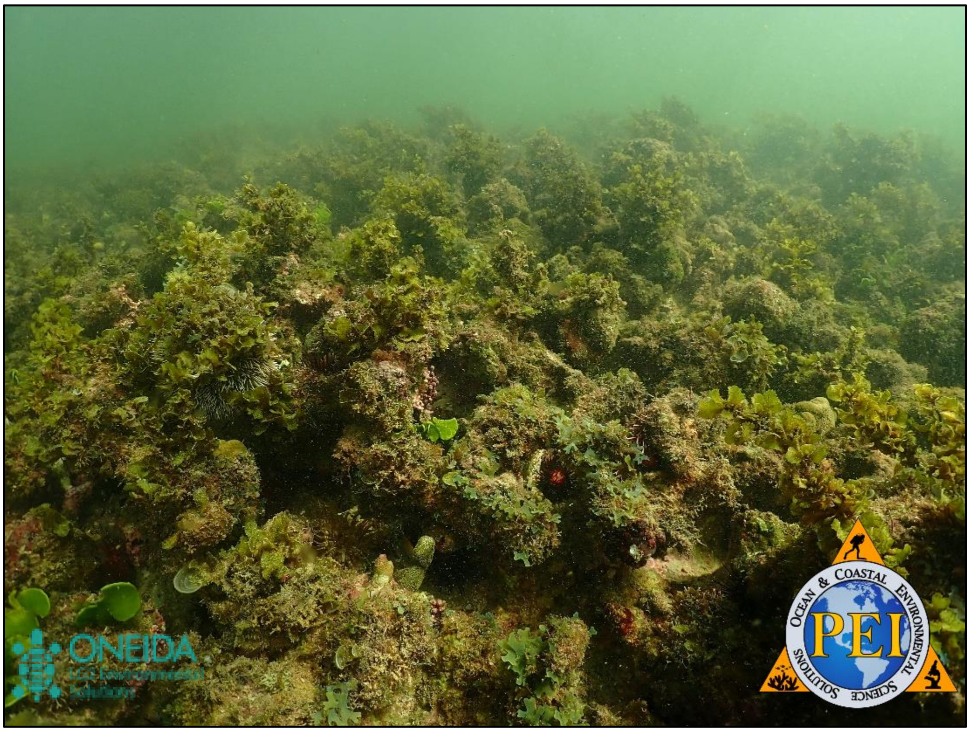

Photo 111. Dense brown macroalgal growth on a patch reef at site SJ-B-06.

Photo 112. A long-spined urchin (*Diadema antillarum*) on a patch reef at site SJ_B-06.

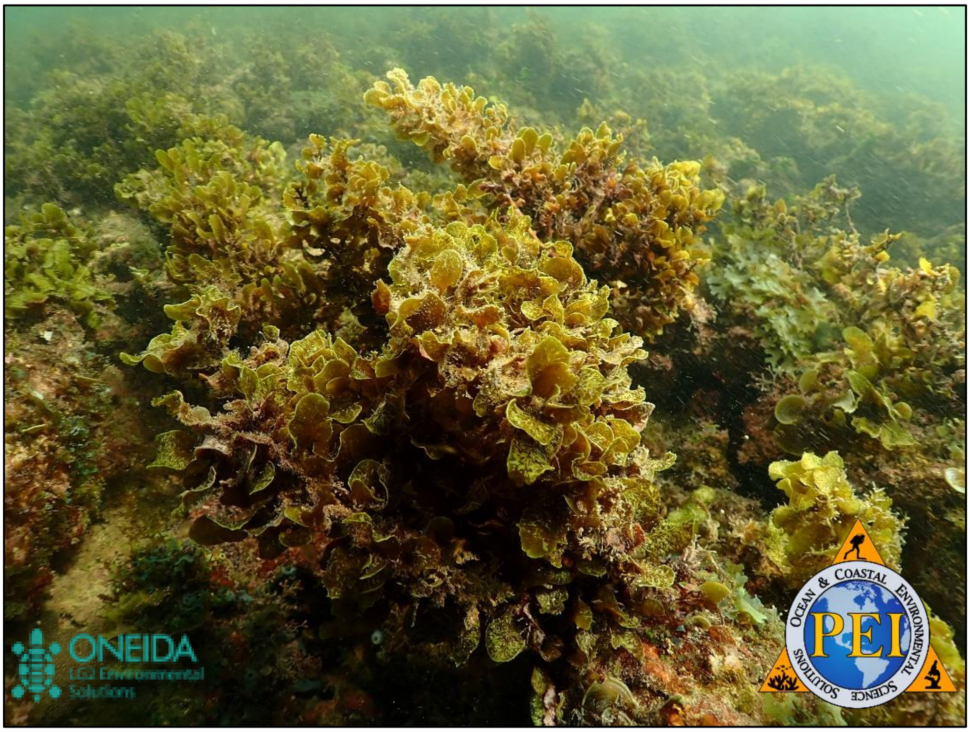

Photo 113. Dense *Sargassum* spp. growth on a patch reef at site SJ_B-06.

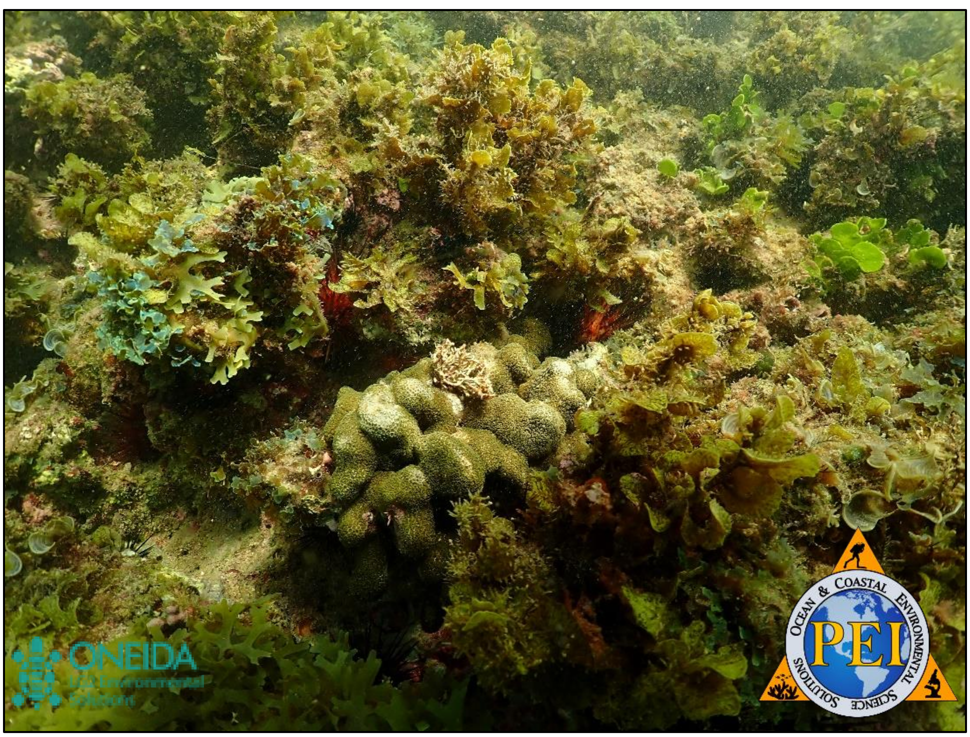

Photo 114. A *Porites porites* colony surrounded by dense brown macroalgal growth on a patch reef at site SJ_B-06.

Photo 115. Dense macroalgae (*Dictyota* spp. and *Sargassum* spp.) colonizing a linear reef (**Figure 28**).

Photo 116. Dense *Padina* spp. and *Sargassum* spp. on a linear reef (**Figure 28**).

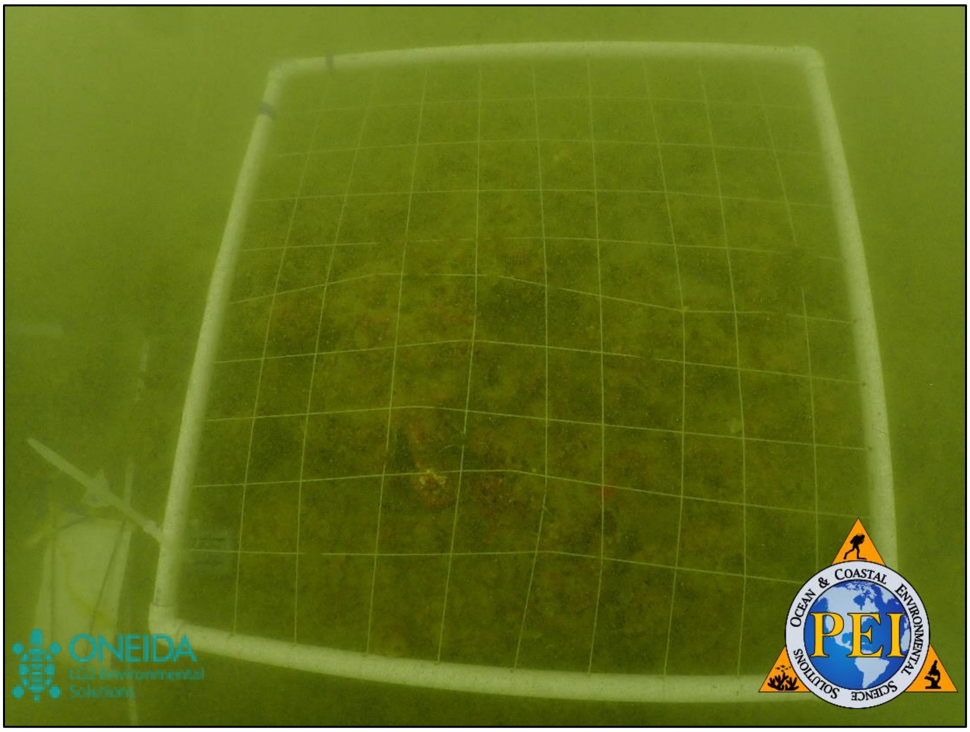

Photo 117. Low visibility conditions on colonized pavement at site SJ_B-07.

Photo 118. A giant barrel sponge (*Xestospongia muta*) surrounded by sponges and macroalgae on colonized pavement at site SJ_B-07.

Photo 119. A small *Porites astreoides* colony with multiple stressors including extended polyps, endolithic borers, and paling on colonized pavement at site SJ_B-07.

Photo 120. Several giant barrel sponges (*Xestospongis muta*) surrouned by dense macroalgal growth on colonized pavement at site SJ_B-07.

Photo 121. A giant barrel (*Xestospongia muta*) with heavy sedimentation on colonized pavement at site SJ_B-07.

Photo 122. Large *Siderastrea siderea* colony with partial mortality and sediment dusting on linear reef at site SJ_B-08.

Photo 123. A *Porites astreoides* colony with partial mortality and sediment dusting on colonized pavement at site SJ_B-07.

Photo 124. An anemone observed on colonized pavement at site SJ_B-07.

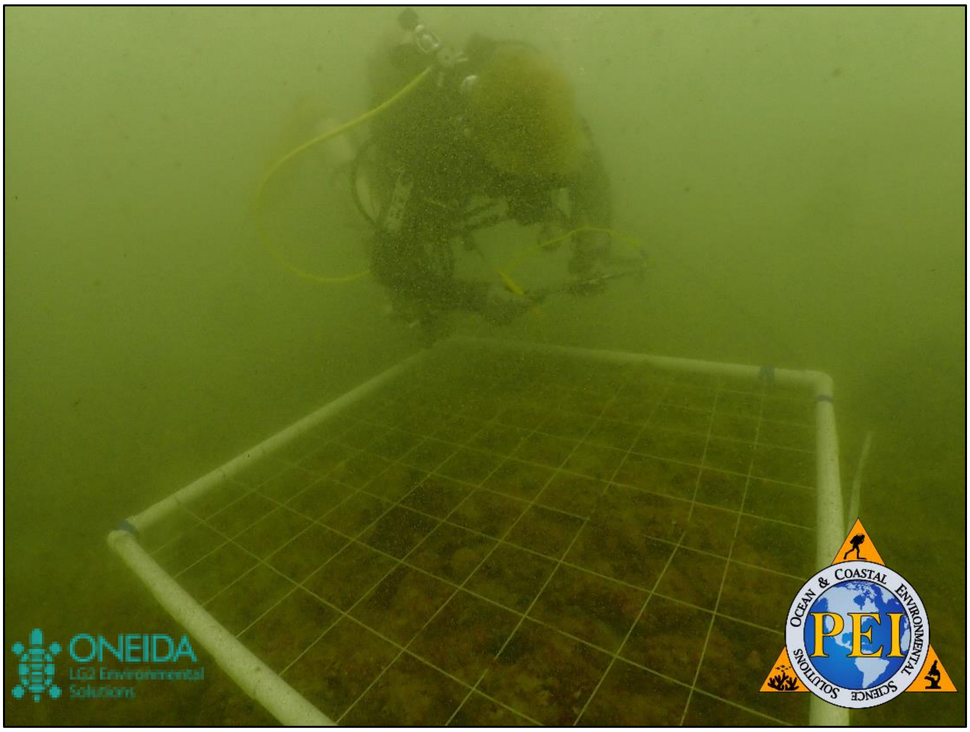

Photo 125. Pinnacle scientist collecting quantitative data in low visibility on colonized pavement at site SJ_B-07.

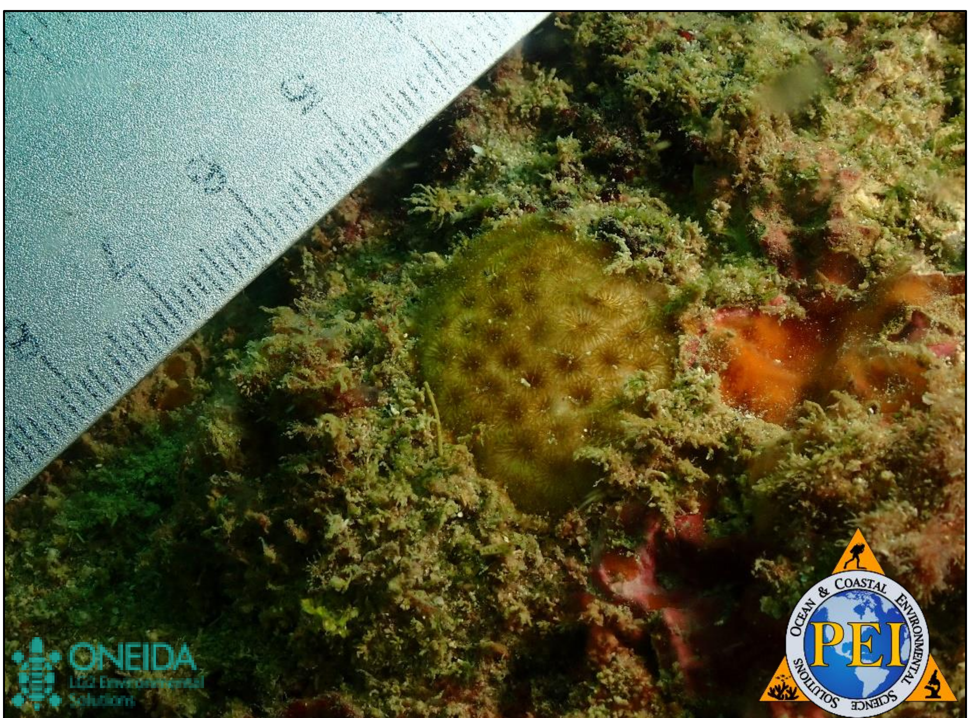

Photo 126. A *Siderastrea radians* colony with extended polyps on colonized pavement at site SJ_B-07.

Photo 127. An octopus tucked into a crevice on linear reef at site SJ_B-08.

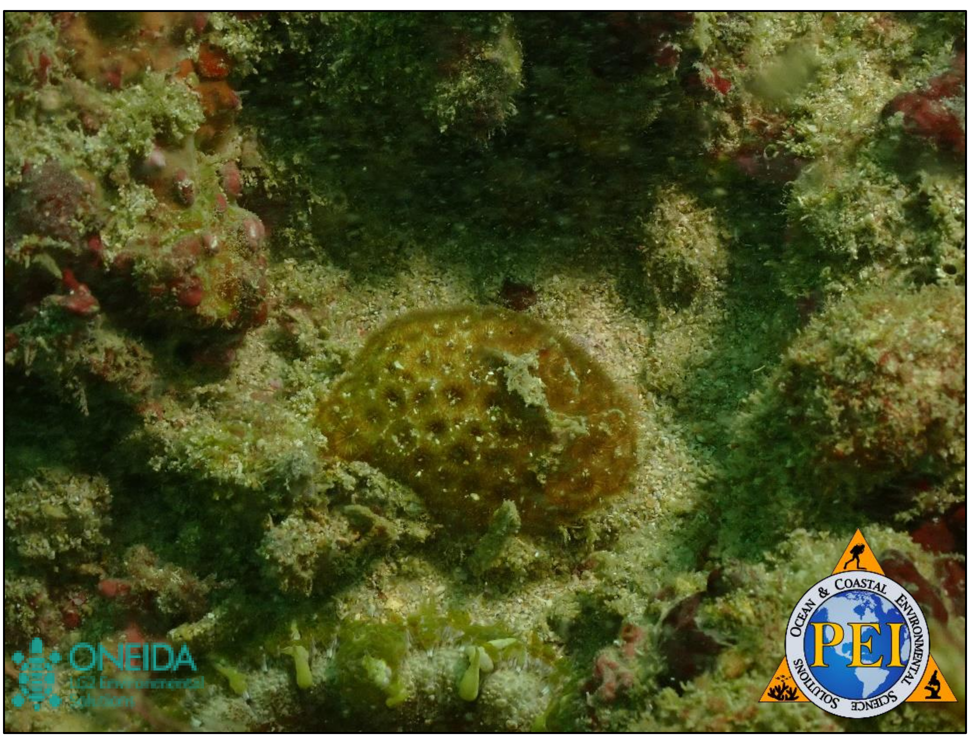

Photo 128. A small *Siderastrea radians* with extend polyps, excessive mucus, and sediment dusting on a linear reef at site SJ_B-08.

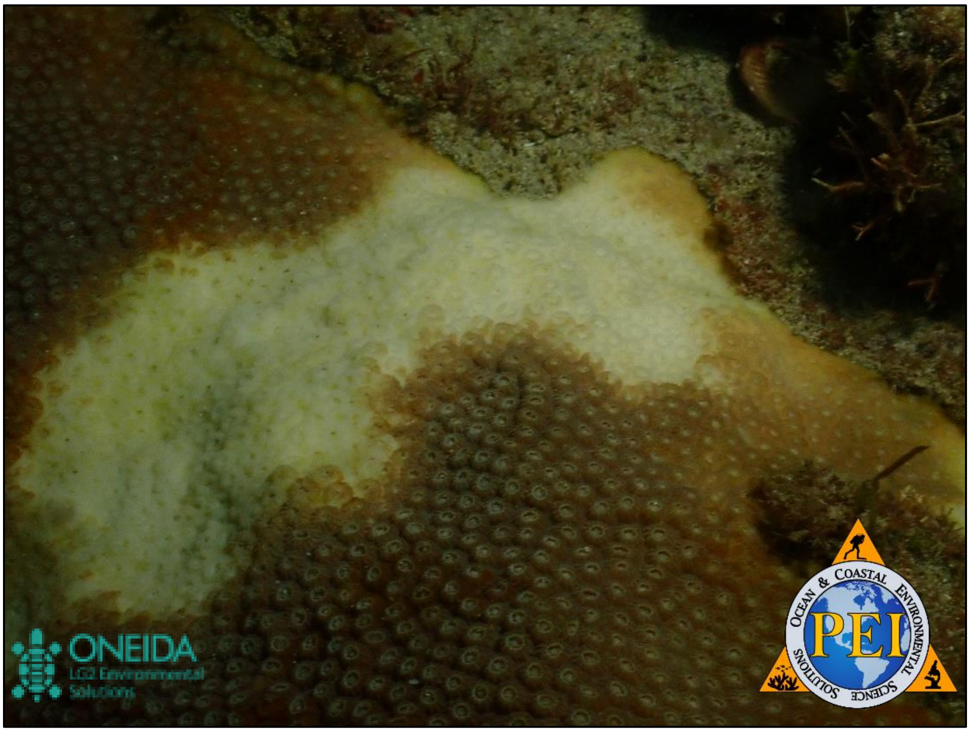

Photo 129. Partial bleaching on an *Orbicella faveolata* colony on a patch reef at site SJ_ESA-01.

Photo 130. A small *Orbicella faveolata* colony with partial mortality and sponge/macroalgae overgrowth on a patch reef at site SJ_ESA-01.

Photo 131. Complex geomorphology of a patch reef dominated by octocorals (*Gorgonia* sp.), sponges, macroalgae, and stony corals at site SJ_ESA-01.

Photo 132. Dark spot disease and partial mortality on a *Siderastrea siderea* colony on a patch reef at site SJ_ESA-01.

Photo 133. A large *Orbicella faveolata* colony appears healthy with mostly live tissue on a patch reef at site SJ_ESA-01.

Photo 134. An *Orbicella faveolata* colony in shallow water on the crest of a patch reef at site SJ_ESA-02.

Photo 135. A large *Orbicella faveolata* colony that appears healthy with mostly live tissue and a few scattered areas of partial mortality on a patch reef at site SJ_ESA-01.

Photo 136. A small *Orbicella faveolata* colony on a patch reef at site SJ_ESA-01.

Photo 137. Stony corals (*Porites astreoides, Porites porites,* and *Pseudodiploria strigosa*) colonies on a patch reef at site SJ_ESA-01.

Photo 138. A small *Orbicella faveolata* colony with signs of recent predation and partial bleaching on a patch reef at site SJ_ESA-01.

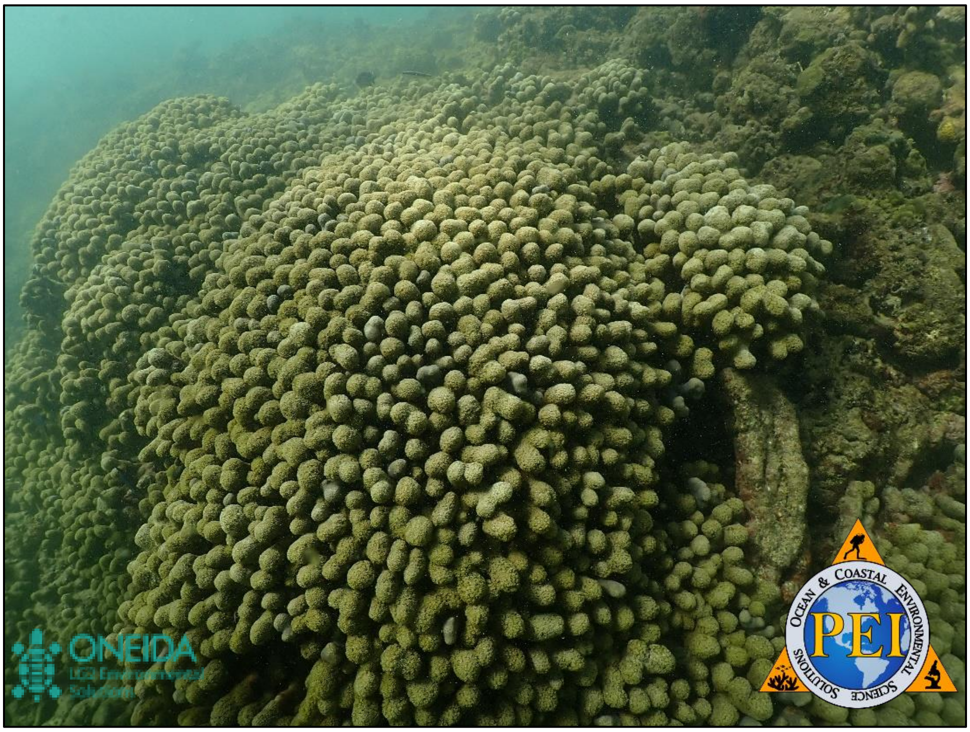

Photo 139. A large *Porites porites* colony on a shallow water patch reef at site SJ_ESA-02.

Photo 140. A *Gorgonia* sp. colony with predation from flamingo tongues (*Cyphoma gibbosum*) on a patch reef at site SJ_B-02.

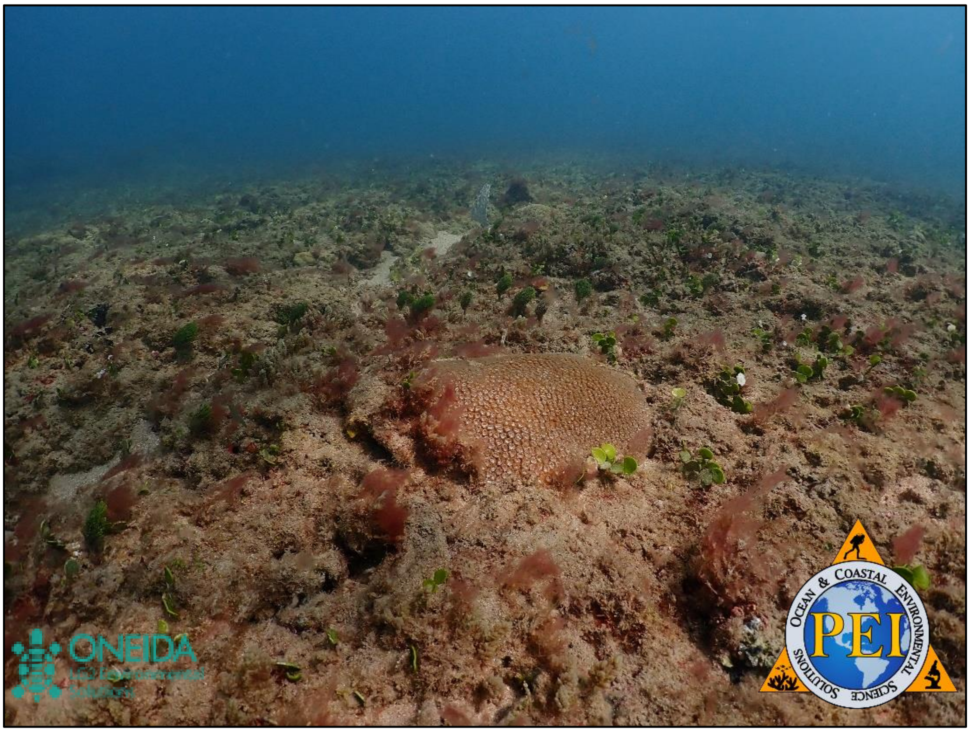

Photo 141. A *Montastraea cavernosa* colony surrounded by dense macroalgal growth on at linear reef (**Figure 26**).

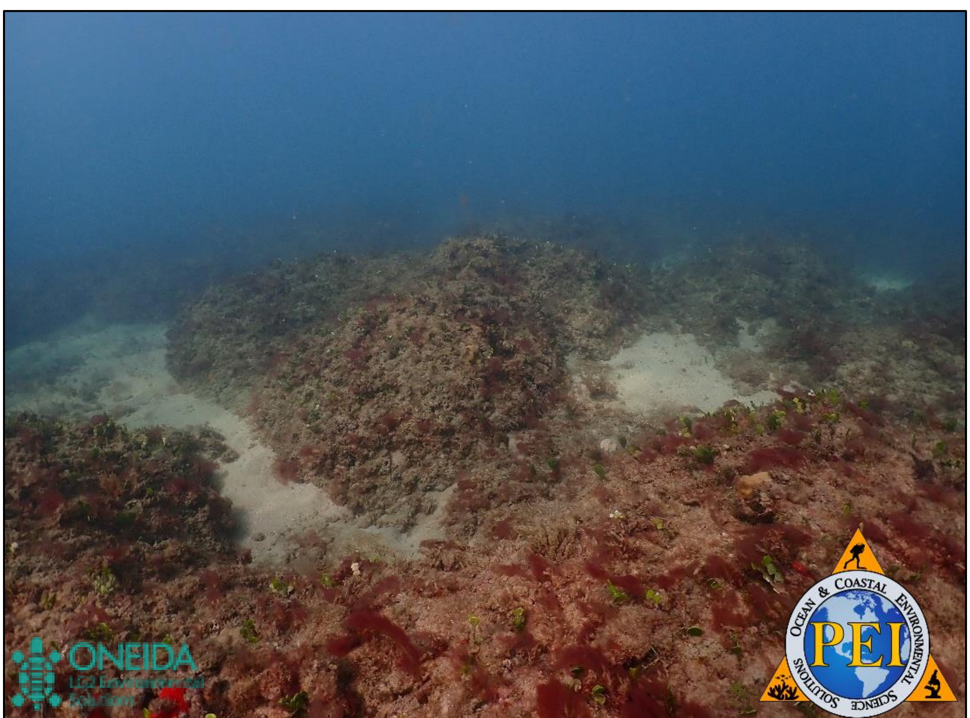

Photo 142. Linear reef dominated by macroalgae (**Figure 26**).

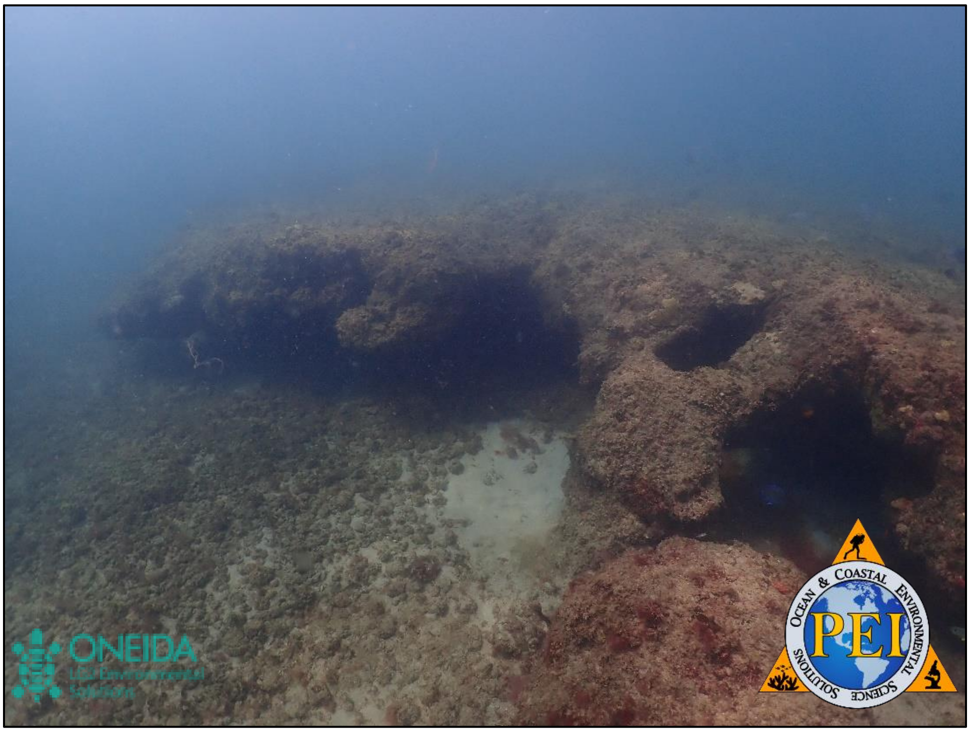

Photo 143. Complex geomorphology of a linear reef (**Figure 26**).

Photo 144. Linear reef with dense macroalgal growth and scattered stony corals. Several grouper species were observed during the survey (*Cephalopholis cruentata*, *Cephalopholis fulva*, *Epinephelus adscensionis*) (**Figure 26**).

Photo 145. A patch reef with dense octocoral (*Gorgonia* sp.) cover (**Figure 26**).

Photo 146. A patch reef with dense octocoral (*Gorgonia* sp.) and stony coral (*Porites astreoides*) cover (**Figure 27**).

Photo 147. A patch reef with numerous dead octocoral colonies (**Figure 27**).

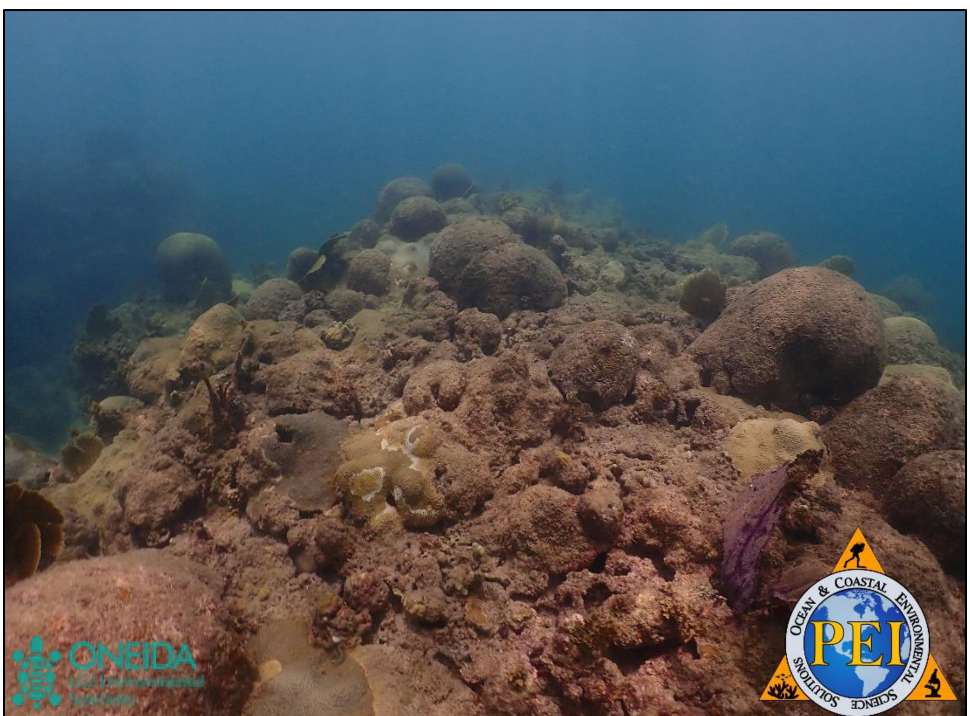

Photo 148. A patch reef with numerous dead stony coral colonies (**Figure 27**).

Photo 149. A patch reef with numerous dead octocoral colonies (**Figure 27**).

Photo 150. High relief patch reef habitat commonly observed throughout the survey area (**Figure 27**).

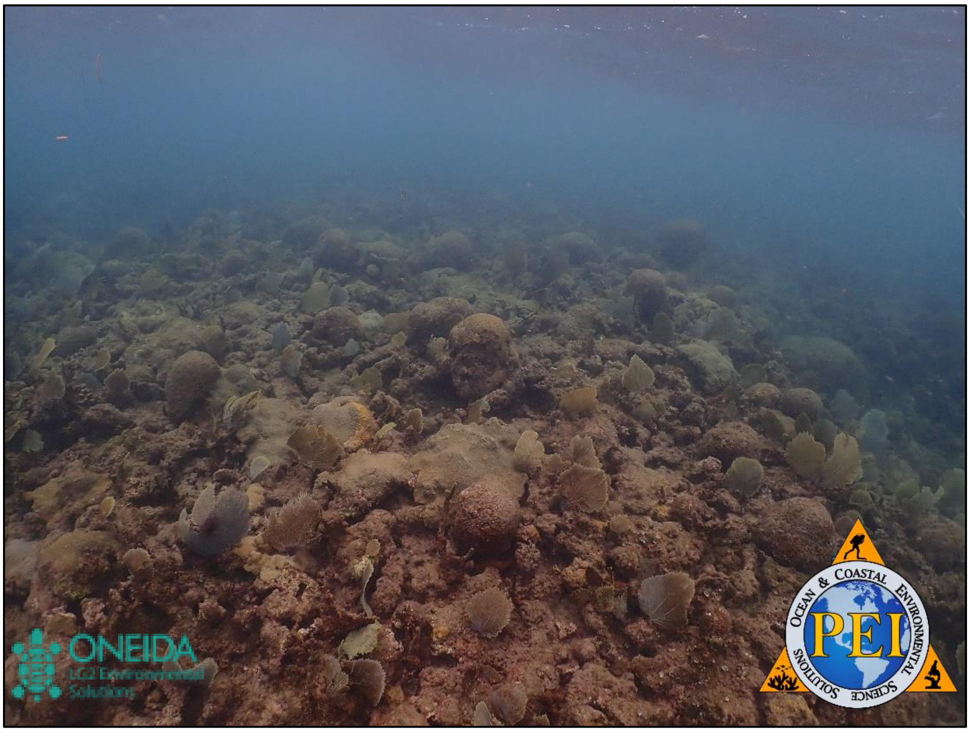

Photo 151. A shallow water patch reef with numerous dead stony coral colonies (**Figure 27**).

Photo 152. A large *Porites porites* colony on a patch reef (**Figure 27**).

Photo 153. 55-gallon drums observed while mapping benthic resources (**Figure 27**).

Photo 154. Unconsolidated sediments comprised of sand and shell hash (**Figure 27**).

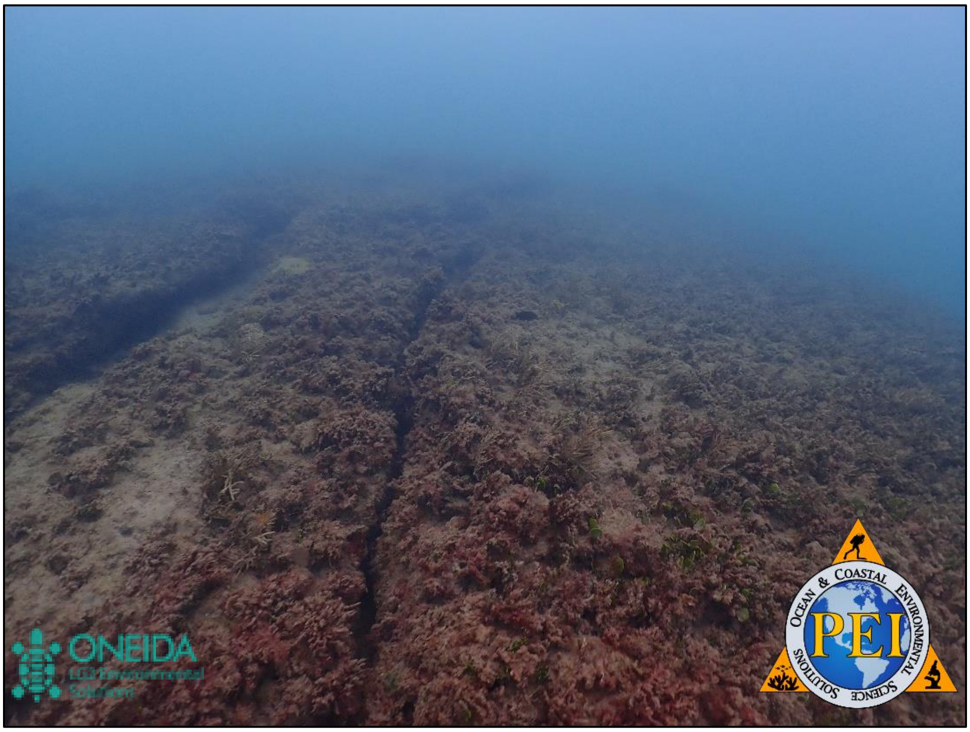

Photo 155. Colonized bedrock dominated by dense macroalgal growth (**Figure 27**).

Photo 156. Several large *Pseudodiploria clivosa* colonies surrounded by dense macroalgae on colonized bedrock (**Figure 27**).

Photo 157. An *Acropora palmata* colony with 100% mortality observed on the crest of a patch reef in shallow water (**Figure 27**).

Photo 158. A large *Pseudodiploria strigosa* colony with over 50% mortality on a patch reef (**Figure 28**).

Photo 159. A large *Acropora palmata* colony with 100% mortality observed on the crest of a patch reef in shallow water (**Figure 28**).

Photo 160. Stony coral tissue loss disease on a *Pseudodiploria strigosa* colony at a patch reef (**Figure 28**).

Photo 161. Large *Siderastrea siderea* colony with >70% mortality on a patch reef (**Figure 27**).

Photo 162. A large *Orbicella faveolata* colony with partial mortality on a patch reef (**Figure 28**).

Photo 163. The crest of a patch reef dominated by octocorals (*Gorgonia* sp.) (**Figure 28**).

Photo 164. A *Porites porites* colony on a shallow water patch reef (**Figure 28**).

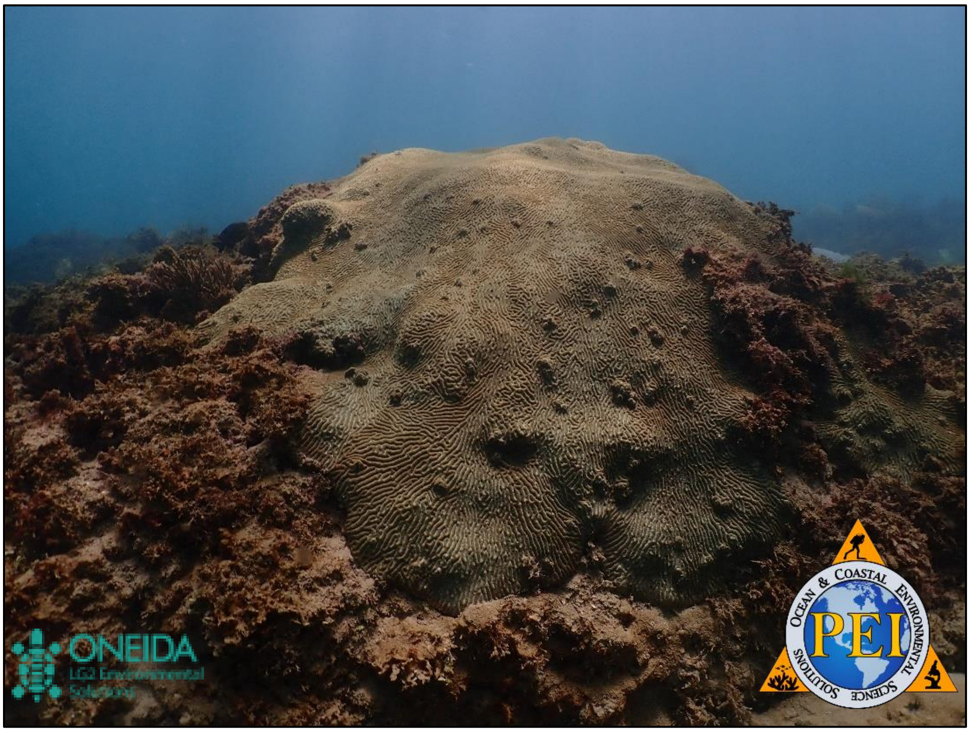

Photo 165. A large *Pseudodiploria clivosa* colony on a patch reef (**Figure 28**).

Photo 166. A large *Pseudodiploria strigosa* colony on a patch reef (**Figure 28**).

Photo 167. A hawksbill sea turtle (*Eretmochelys imbricata*) observed along a linear reef (**Figure 28**).

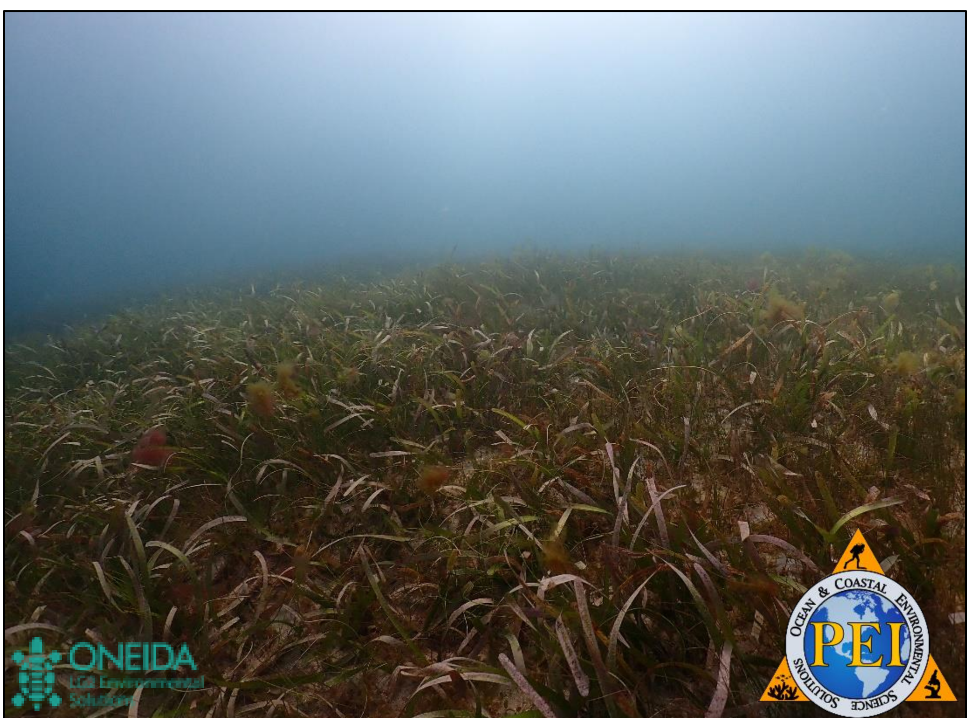

Photo 168. Dense seagrass habitat (*Thalassia testudinum* and *Syringodium filiforme*) *with* crustose coralline algae present on seagrass blades (**Figure 27**).

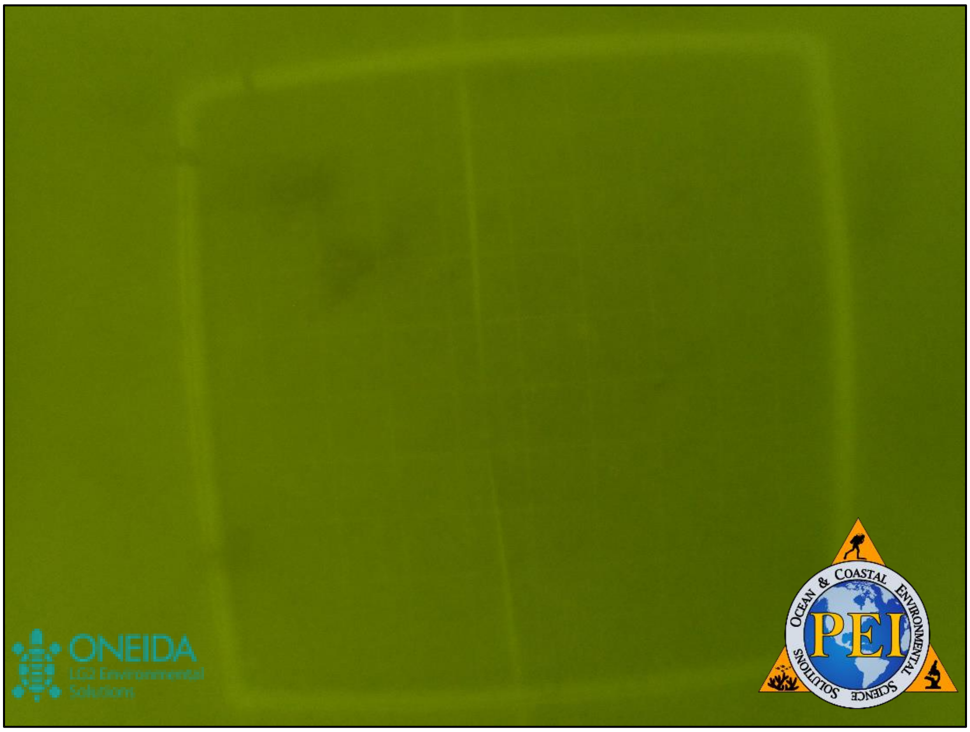

Photo 169. Low visibility conditions observed during SAV survey of low density *Halodule wrightii* habitat at site SJ_SAV-07.

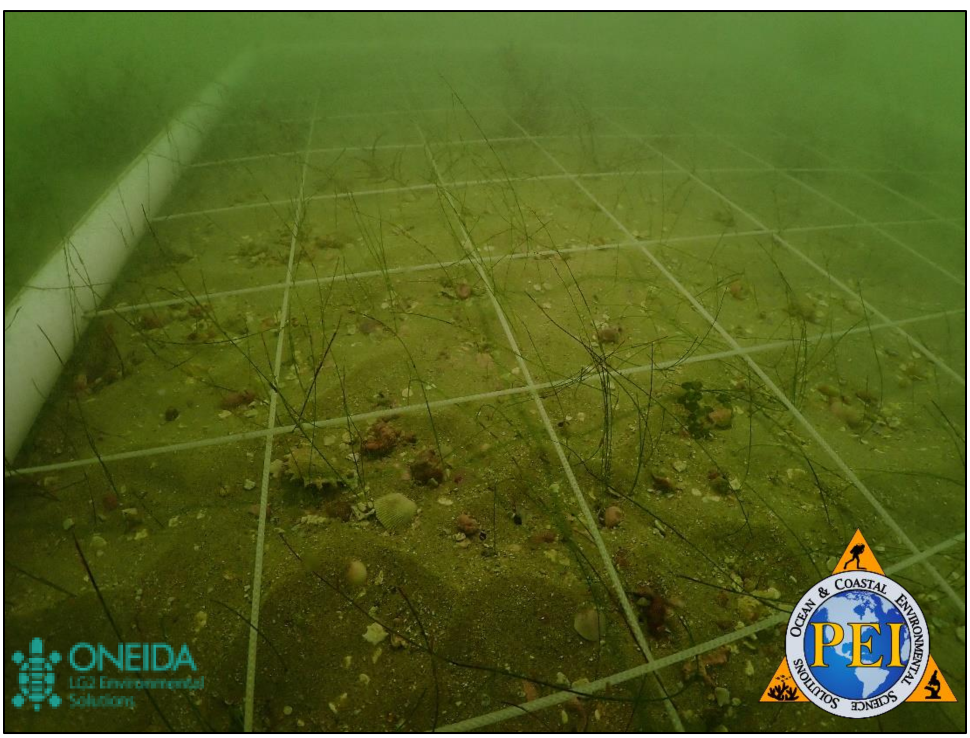

Photo 170. Low-density seagrass habitat (*Halodule wrightii*) at site SJ_SAV-07.

Photo 171. Low density *Halodule wrightii* habitat with epiphytic cyanobacteria (**Figure 26**).

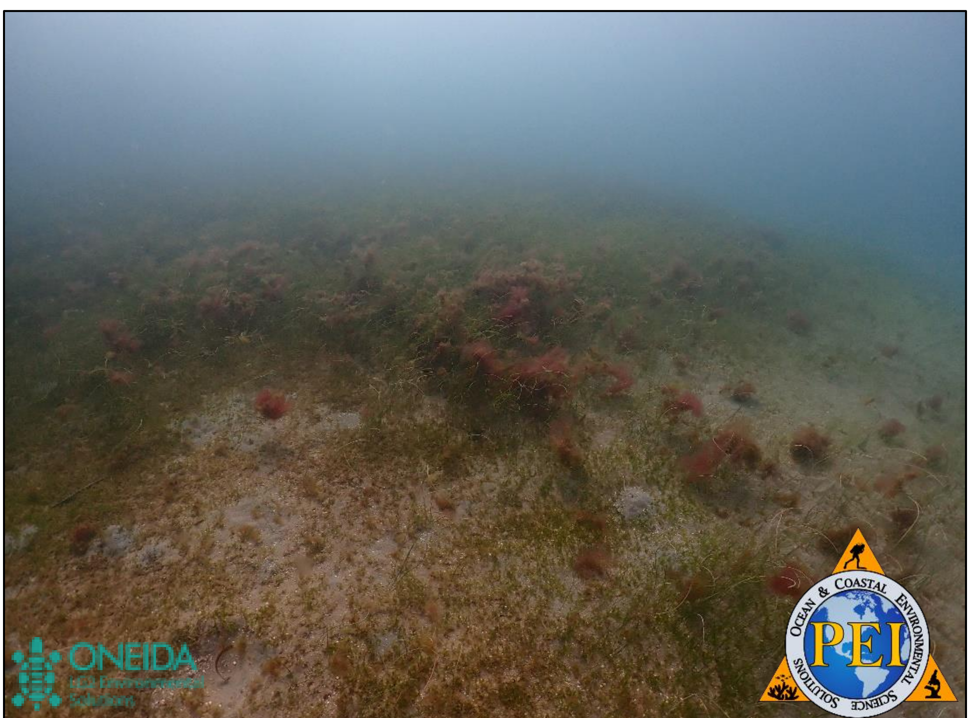

Photo 172. Dense seagrass habitat with multiple species present but dominated by *Syringodium filiforme.* Epiphytic cyanobacteria present on seagrass blades (**Figure 26**).

Photo 173. Expansive and dense continuous seagrass habitat dominated by *Syringodium filiforme* (**Figure 27**).

Photo 174. Dense seagrass habitat dominated by *Thalassia testudinum* (**Figure 27**).

Photo 175. Dense seagrass habitat with *Syringodium filiforme* and *Thalassia testudinum* (**Figure 27**).

Photo 176. Dense seagrass habitat dominated by *Thalassia testudinum* (**Figure 27**).

Photo 177. Dense seagrass growing on top of and between hardbottom outcrops (**Figure 27**).

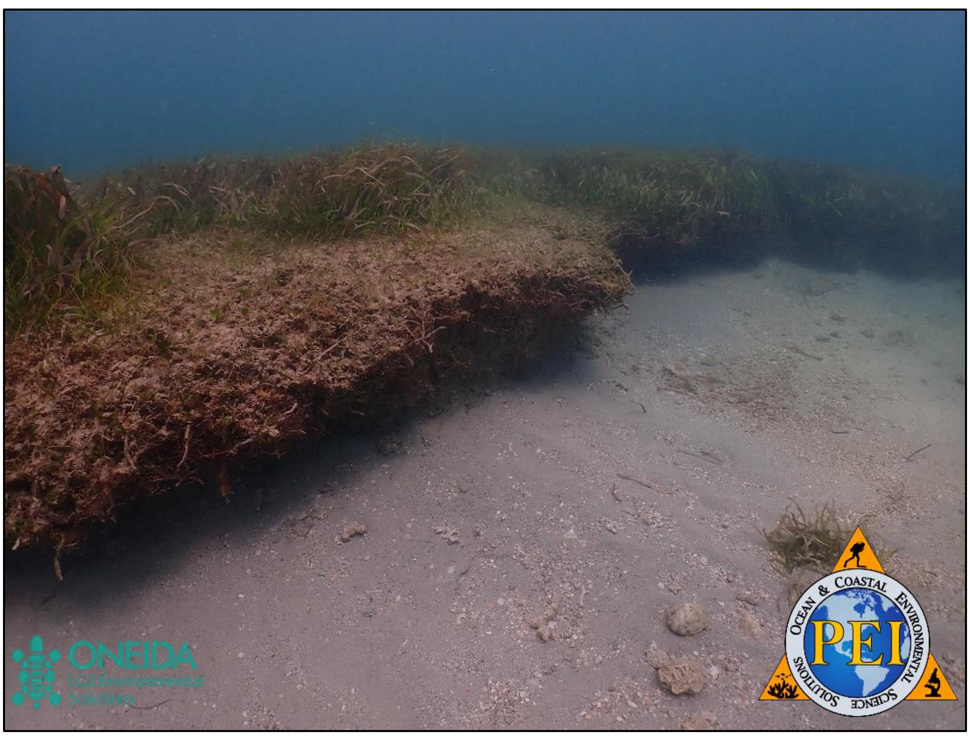

Photo 178. Erosion along the edge of a seagrass habitat, exposing dense roots and rhizomes (**Figure 27**).

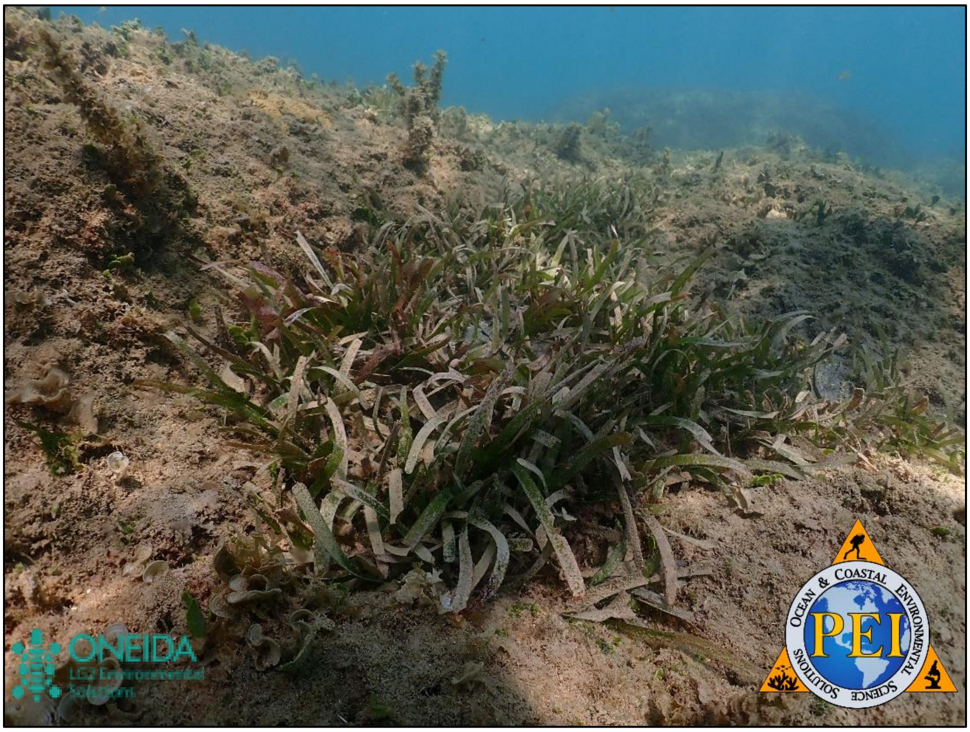

Photo 179. *Thalassia testudinum* growing on top of and between hardbottom reef (**Figure 27**).

Photo 180. Flowering observed on *Syringodium filiforme* at site SJ_SAV-02.

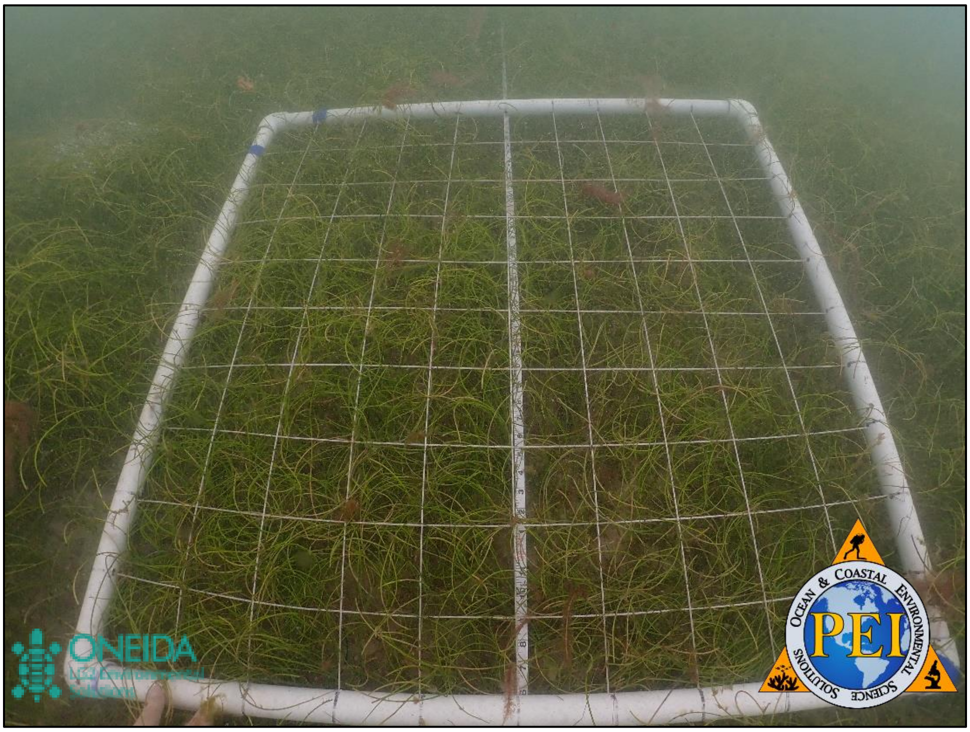

Photo 181. Dense seagrass habitat dominated by *Syringodium filiforme* at site SJ_SAV-02.

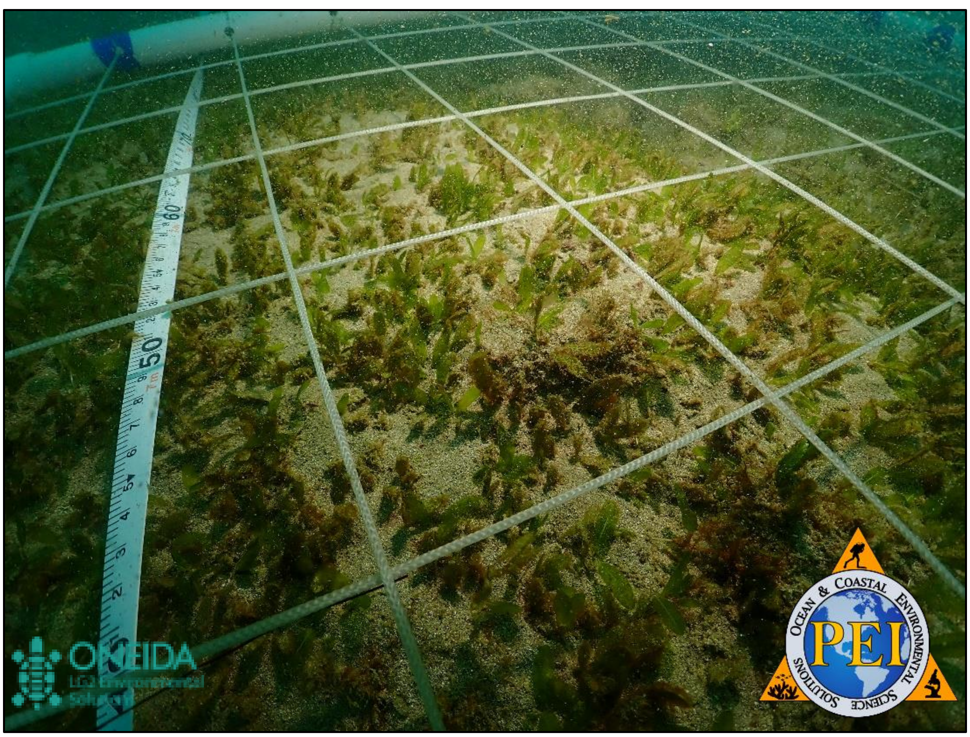

Photo 182. *Halophila decipiens* growing on a thin veneer of sand sediment covering hardbottom at site SJ_SAV-03.

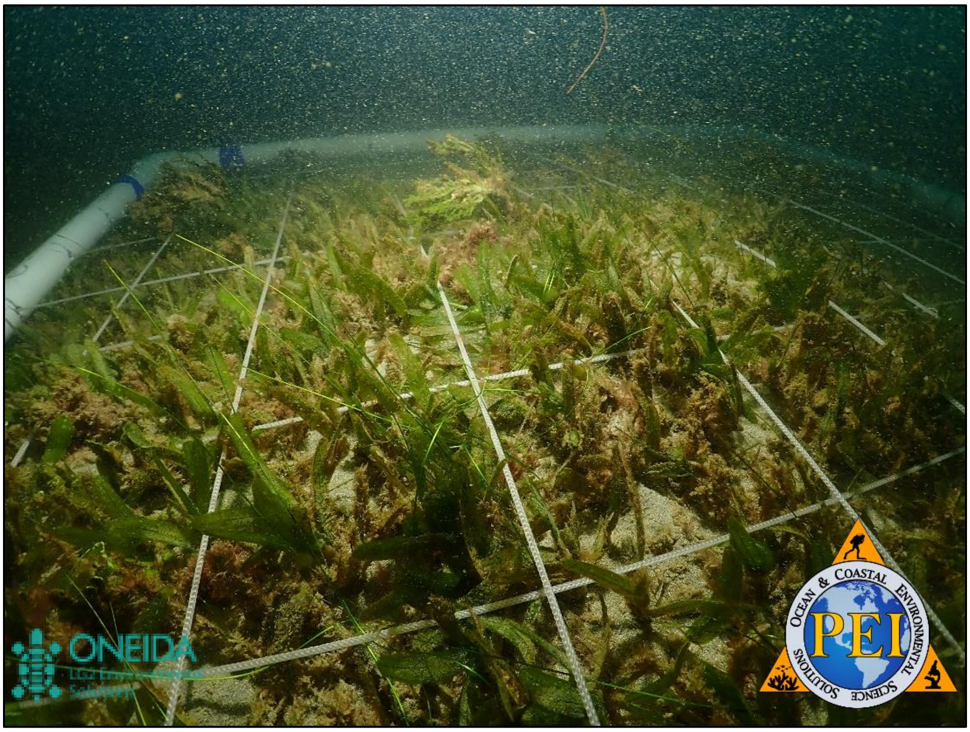

Photo 183. Dense seagrass habitat with *Halophila stipulacea* and *Halodule wrightii* at site SJ_SAV-03.

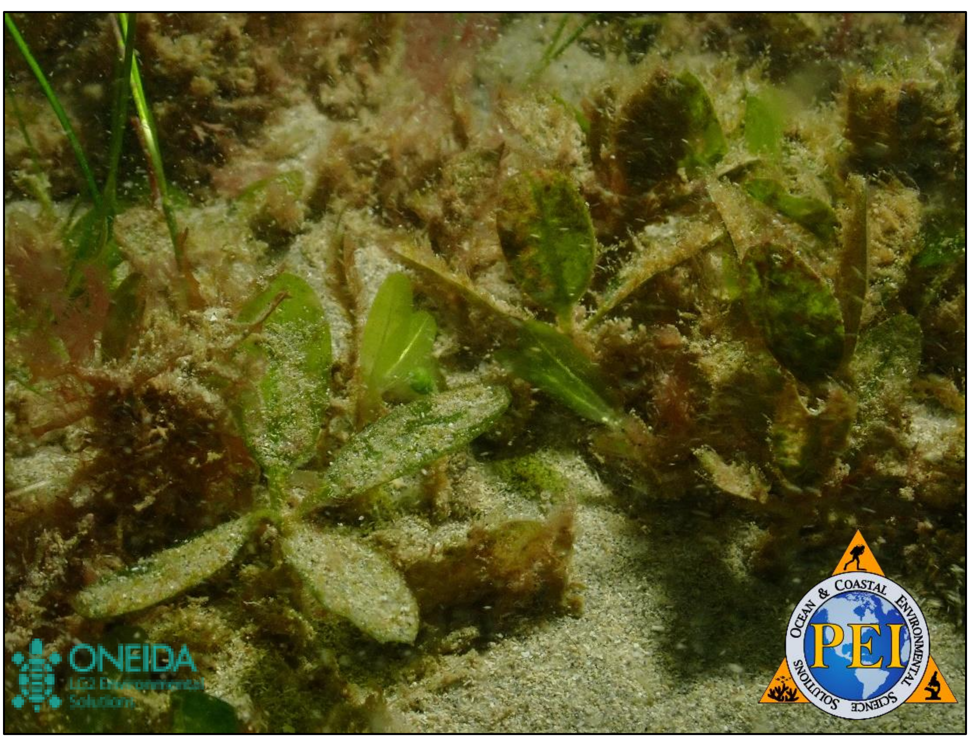

Photo 184. *Halophila engelmannii* with epiphytic growth and sedimentation at site SJ_SAV-03.

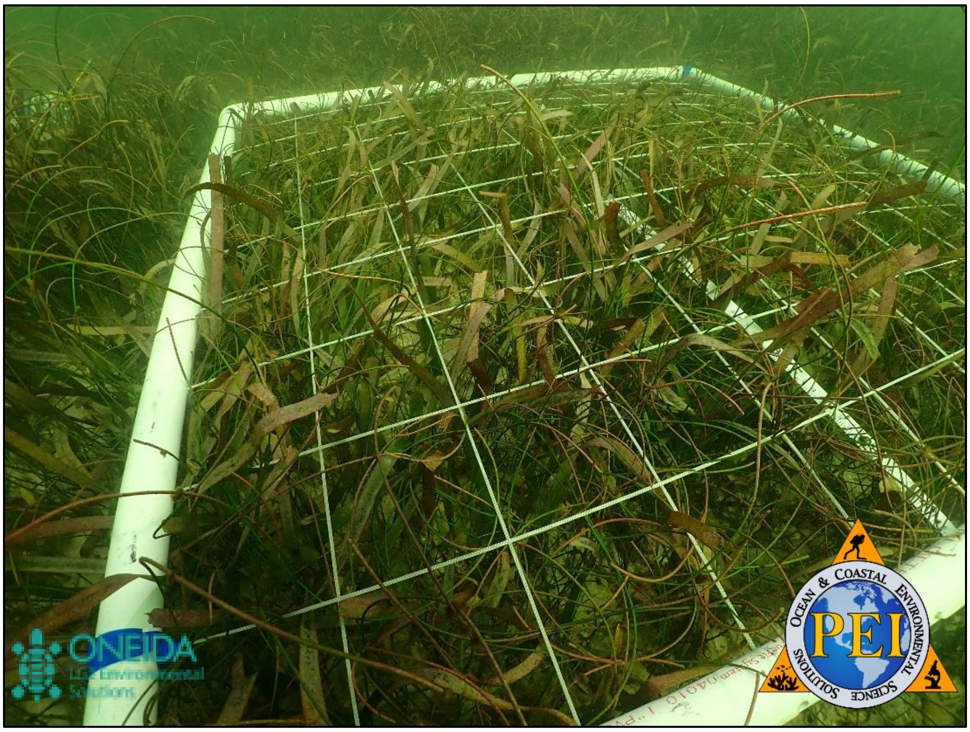

Photo 185. Dense seagrass habitat (*Thalassia testudinum* and *Syringodium filiforme*) with crustose coralline algae visible on seagrass blades at site SJ_SAV-04.

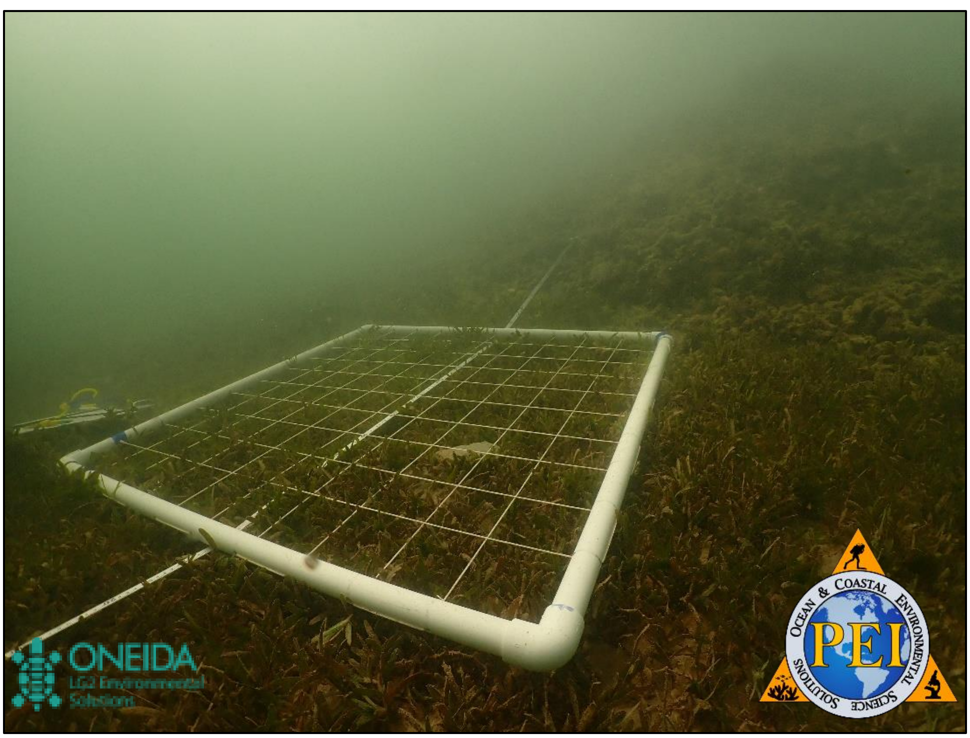

Photo 186. Dense seagrass habitat with *Halophila stipulacea* growing at the base of a high relief patch reef at site SJ_SAV-06.

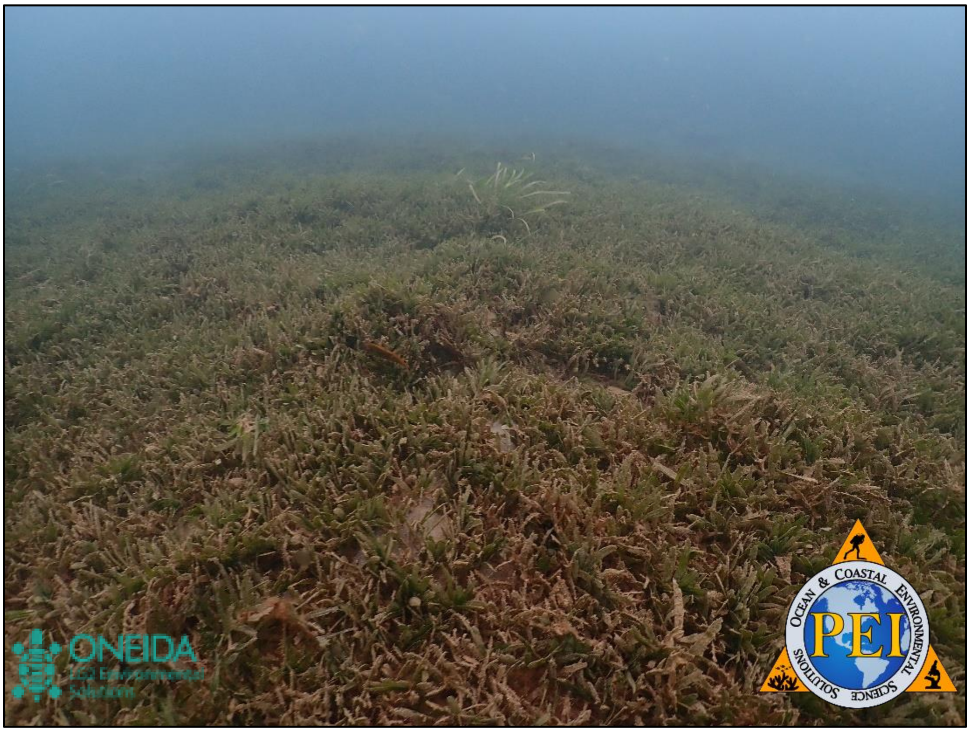

Photo 187. Dense seagrass habitat dominated by *Halophila stipulacea* (**Figure 27**).

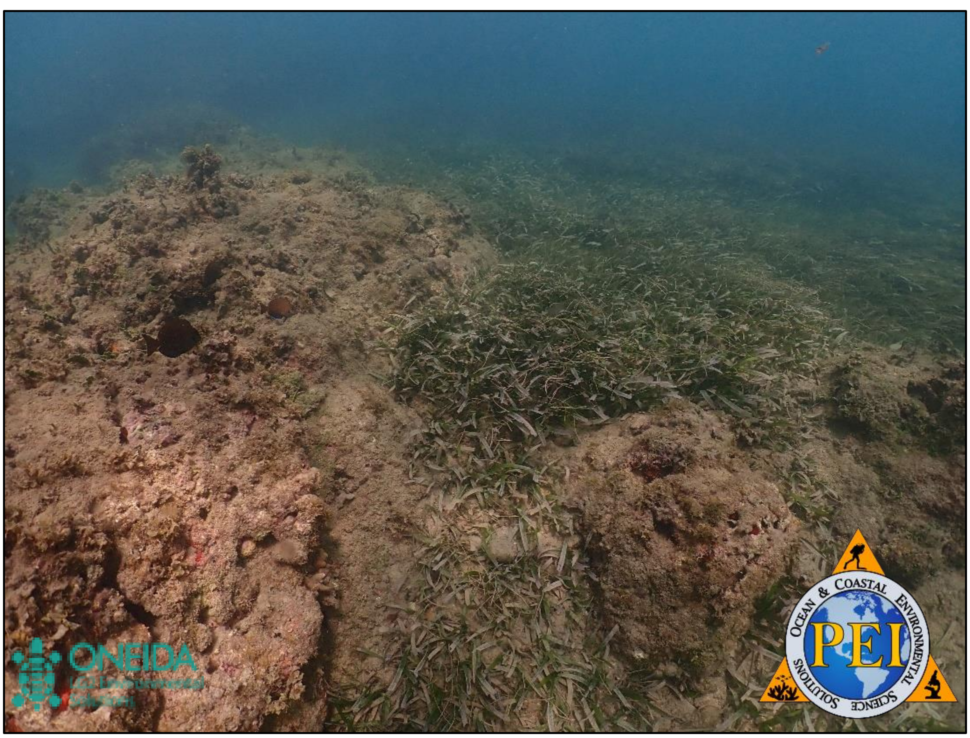

Photo 188. Dense seagrass habitat with *Thalassia testudinum* growing on top of and between hardbottom outcrops (**Figure 27**).

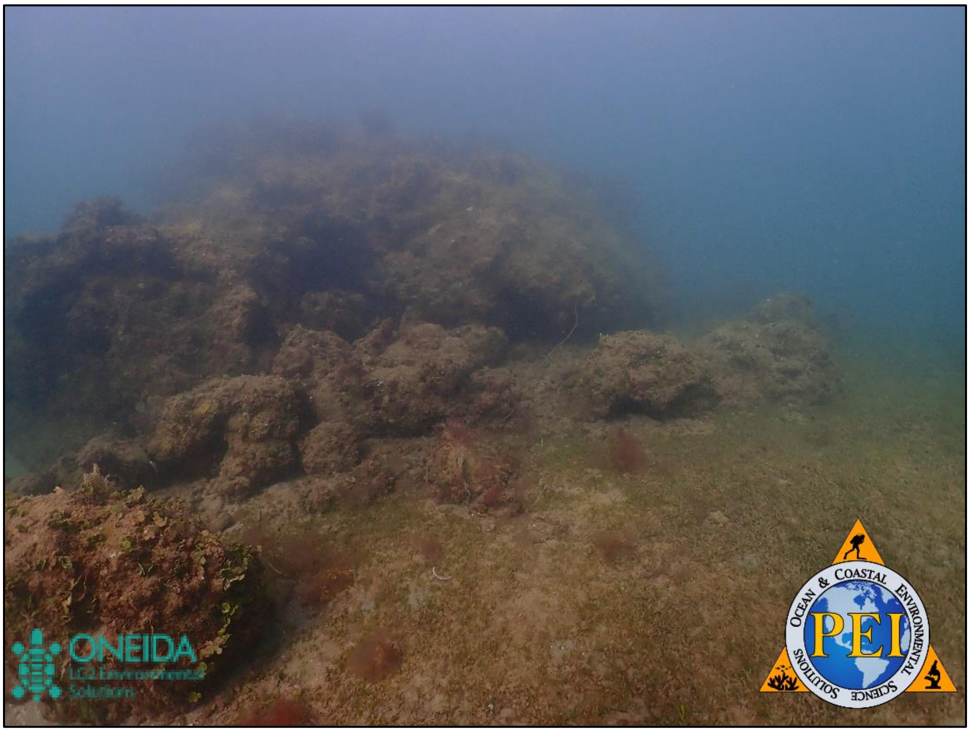

Photo 189. Dense seagrass growth immediately adjacent to the base of colonized pavement (**Figure 27**).

Photo 190. *Syringodium filiforme* colonizing patch of sand veneered hardbottom in linear reef habitat with dense brown macroalgal cover (**Figure 28**).

Photo 191. Unconsolidated sediment comprised of sand and shell hash (**Figure 26**).

Photo 192. Unconsolidated sediment comprised of sand and shell with scattered moderately dense macroalgal cover (**Figure 28**).

ATTACHMENT C

Puerto Rico SAV Resource Survey: Field Data Sheets

San Juan / Rincón, Puerto Rico – SAV Survey

PINNACLE ECOLOGICAL, INC.
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Scientist:	Date:	Depth:	Visibility:	Temperature:
Current:	Datsheet QA/QC:		Data Entry:	Data Entry QA/QC:

Transcect and Quadrat:	
Maximum Relief Quad (cm):	
Sediment Depth (cm) (3x):	
Sessile Benthos	**% Cover**
Sediment (circle all: sand shell mud rubble)	
Bare Substratum	
Macroalgae **List % cover for any genera with >5% cover**:	
Turf Algae	
Encrusting Red Algae	
Cyanobacteria	
Sponges	
Stony Corals	
Octocorals	
Hydroids	
Sessile Worms	
Tunicates	
Bryozoans	
Other (list and % of each):	

Total Must = 100%

Other: Anemones, Barnacles, Bivalves, Hydrocorals/Millepora sp., Echinoderms, Zoanthids, Seagrass, etc.

	Size Classes (cm)			
Sponge Morphotypes	0 - 10	10.1 - 25	25.1 - 50	> 50
Branching/Erect				
Tube/Vase				
Encrusting				
Amorphous/Massive				
Ball				
Xestospongia muta				

Coral ID	Max (mm)	Min (cm)	Height (cm)	% Live Tissue*	% Recent Partial Mortality/Health/Notes

* Record % Live Tissue and % Recent Partial Mortality in 10% Increments

Notes/Species Observed:

Transcect and Quadrat:	
Maximum Relief Quad (cm):	
Sediment Depth (cm) (3x):	
Sessile Benthos	**% Cover**
Sediment (circle all: sand shell mud rubble)	
Bare Substratum	
Macroalgae **List % cover for any genera with >5% cover**:	
Turf Algae	
Encrusting Red Algae	
Cyanobacteria	
Sponges	
Stony Corals	
Octocorals	
Hydroids	
Sessile Worms	
Tunicates	
Bryozoans	
Other (list and % of each):	

Total Must = 100%

Other: Anemones, Barnacles, Bivalves, Hydrocorals/Millepora sp., Echinoderms, Zoanthids, Seagrass, etc.

	Size Classes (cm)			
Sponge Morphotypes	0 - 10	10.1 - 25	25.1 - 50	> 50
Branching/Erect				
Tube/Vase				
Encrusting				
Amorphous/Massive				
Ball				
Xestospongia muta				

Coral ID	Max (mm)	Min (cm)	Height (cm)	% Live Tissue*	% Recent Partial Mortality/Health/Notes

* Record % Live Tissue and % Recent Partial Mortality in 10% Increments

Notes/Species Observed:

Macroalgae Genera: Acetabularia, Caulerpa, Ceramium, Dictyota, Dasycladus, Dasya, Gracilaria, Halimeda, Hypnea, Neomeris, Padina, Sargassum, Udotea, Galaxaura, Laurencia, Chaetomorpha, Dictyurus, Geldium, Codium, Bryothamnion
Stony Coral Species: ACER, APAL, APRO, AAGA, AFRA, ALAM, CNAT, DCYL, DSTO, DLAB, FFRA, MARE, MDEC, MPHA, MJAC, MMEA, MCAV, MALI, MDAN, MFER, MLAM, OAA, OFAV, OFRA, PAST, PPOR, PCLI, PSTR, SCOL, SRAD, SSID, SBOU, SINT
Octocoral Genera: Antillogorgia, Briareum, Erythropodium, Eunicea, Gorgonia, Plexaura, Plexaurella, Pseudoplexaura, Muricea, Muriceopsis, Pterogorgia

PINNACLE ECOLOGICAL, INC.

San Juan / Rincón, PR- SAV Survey

Name of Biologist:____________________ Date:____________________
Temperature:______________ Visibility:__________________ Current:__________________
Datasheet QA/QC:______________ Data Entry:______________ Data Entry QA/QC:________________

Station/Transect No. =

ALL QUADRATS: Braun-Blanquet Data

Quad #	Depth (ft)	Drift Algae (Y/N)	Seagrass										Macro-algae	Sponge	Coral	Other Inverts	Habitat Type	Substrate Type	Sediment (none, light, heavy)	Notes: Macroalgae Genera, Inverts Observed, etc.
			Hd	*He*	*Hs*	*Hw*	*Sf*	*Tt*	Total Seagrass	Health	Epipyhtes (Y/N)	Flowering (Y/N)								
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

FIVE (5) RANDOM QUADRATS: Percent Cover Per Biota (total must = 100%), **Frequency of Occurrence** (# sub-cells with seagrass/macroalgae, overall total and per seagrass species total) **, Shoot Counts & Blade Length** (per species of seagrass)**, and Canopy Height** (overall)

Quad #	% Cover Seagrass		% Cover Macroalgae		% Cover Sponge	% Cover Coral	% Cover Substrate	% Cover Other Sessile Inverts (List and % for each)	Total % Cover	Seagrass Frequency of Occurrence		Macroalgae Frequency of Occurrence
10	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Segrass Species	E6	D8		J3			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
8	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	D8	E1		J8			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
3	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	B2	E6		H6			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
2	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	B3	H7		I3			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
5	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	D10	A3		D7			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				

Station/Transect No. =

ALL QUADRATS: Braun-Blanquet Data

Quad #	Depth (ft)	Drift Algae (Y/N)	Seagrass										Macro-algae	Sponge	Coral	Other Inverts	Habitat Type	Substrate Type	Sediment (none, light, heavy)	Notes: Macroalgae Genera, Inverts Observed, etc.
			Hd	*He*	*Hs*	*Hw*	*Sf*	*Tt*	Total Seagrass	Health	Epipyhtes (Y/N)	Flowering (Y/N)								
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

FIVE (5) RANDOM QUADRATS: Percent Cover Per Biota (total must = 100%), **Frequency of Occurrence** (# sub-cells with seagrass/macroalgae, overall total and per seagrass species total) **, Shoot Counts & Blade Length** (per species of seagrass)**, and Canopy Height** (overall)

Quad #	% Cover Seagrass		% Cover Macroalgae		% Cover Sponge	% Cover Coral	% Cover Substrate	% Cover Other Sessile Inverts (List and % for each)	Total % Cover	Seagrass Frequency of Occurrence		Macroalgae Frequency of Occurrence
9	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Segrass Species	B9	I2		J4			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
7	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	H10	G6		D3			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
9	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	H2	J2		F2			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
9	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	H5	B7		F8			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				
1	Total:	Per Species:	Total:	Rank top 3 Macroalgae genera:						Total:	Per Species:	
Shoot Counts: Per Species	B9	D6		H9			Canopy Height (cm):	Blade Length x 3 per seagrass species (cm):				

Braun-Blanquet scale: 0 = Not present, 0.1 = Solitary, 0.5 = Few with small cover, 1 = Numerous but < 5% cover, 2 = 5 to 25% cover, 3 = 25 to 50% cover, 4 = 50 to 75% cover, 5 = 75 to 100% cover
Seagrass species: Hd = Halophila decipiens, He = H. engelmanni, Hs = H. stipulacea, Hw = Halodule wrightii, Sf = Syringodium filiforme, Tt = Thalassia testudinum
Macroalgae genera: Cal = Calerpa spp., Hal = Halimeda spp., Pen = Penicillus spp., Acet = Acetabularia spp., Dict = Dictyota spp., Gra = Gracilaria spp., Pad = Padina spp., Cer = Ceramium spp., Hyp = Hypnea spp.

Sedimentation: None, Light, Heavy (Light = minimal sediment present/ "dusted", Heavy = thin layer of sediment present/sediment build up between blades)
Habitat Type: CS = Continuous Seagrass, PS = Patchy Seagrass, Macro = Macroalgae Only, Mixed = Seagrass and Macroalgae (Continuous (C) or Patchy (P))
Seagrass Health: 1 = Very healthy, 2 = Healthy, 3 = Fair, 4 = Degraded, 5 = Very degraded
Substrate Type: A = Silt, B = Sand, C = Shell hash, R = Rubble, HB = Hardbottom

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COASTAL AND OCEAN ENVIRONMENTAL SCIENCE
WWW.PINNACLEECOLOGICAL.COM

San Juan / Rincón, PR- ESA Listed Corals

Scientist:____________________ Date:______________ Station/Transect:_____________________________
Visibility:____________________ Temperature:_____________ Datasheet QA/QC (Initials):________________
Data Entry (Initials/Date):____________________ Data Entry QA/QC (Initials/Date):______________________

Time (hh:mm:ss)	Water Depth (ft)	Coral Species	Max (mm)	Min (mm)	Height (mm)	% Live Tissue (10% increments)	% Recent Partial Mortality (10% increments)	Sediment Indicators	Presence of Other Conditions: (BL, D, P, C)	Stress, Predation/Overgrowth	Comments/ Observations

ESA Listed Corals: APAL, ACER, DCYL, OANN, OFAV, OFRA, MFER

****List % Live Tissue and % Recent Partial Mortality in 10% Increments****

Presence of Other Conditions: (**BL**) = Bleaching (note: bleaching % or note: partial, paling, spots, etc.); (**D**) = Disease (include type if present); (**P**) = Predation; (**C**) = Cliona

Stress Indicators: (**PE**) = Polyps Extended; (**PPA**) = Pigment Pattern Alteration; (**TS**) = Tissue Sloughing; (**SW**) = Swelling; (**TH**) = Thinning; (**EM**) = Excessive Mucus Production; (**O**) = Other - provide details in "Comments/Observation" column

Coral Predation/Competition/Overgrowth Conditions: (**FB**) = Fish Bites; (**S**) = Snail; (**FW**) = Fireworm; (**D**) = Damselfish Garden/Nest Mortality; (**T**) = Tunicate; (**SP**) = Sponge; (**OC**) = Octocorals; (**Z**) = Zoanthid; (**A**) = Algal Overgrowth; (**EB**) = Endolithic Borers; (**O**) = Other

Sediment Indicators: (**SD**) = Sediment Dusting ; (**SA**) = Sediment Accumulation; (**PB**) = Partial Burial; (**BB**) = Burial of the Base; (**B**) = Burial; (**H**) = Sediment Halo

General Notes: (**OH**) = Otherwise Healthy; (**NG**) = New Growth

Diseases/Syndromes: (**BB**) = Black Band; (**RB**) = Red Band; (**WB**) = White Band; (**WP**) = White Plague; (**WS**) = White Patches/ White Pox/Patchy Necrosis; (**YB**) = Yellow Band; (**BEG**) = White Beggiotoa Mats; (**DSD**) = Dark (Purple) Spot/Blotch; (**GR**) = Growth Anomalies; (**RTL**) = Rapid Tissue Loss; (**NB**) = Non-Specific Bands; (**NS**) = Non-Specific Spots; (**MM**) = Microbial Mats; (**CB**) Cyanobacteria; (**UNK**) = Unknown - provide observation details in "Comments/Observations" column

APPENDIX G – ENVIRONMENTAL

ATTACHMENT 6 – PERTINENT NATIONAL HISTORIC PRESERVATION ACT COMPLIANCE AND CORRESPONDENCE

This appendix contains pertinent correspondence related to Section 106 of the National Historic Preservation Act (NHPA). A brief description of pertinent correspondence is provided below. Copies of the correspondence received follow.

Section 106 of the NHPA Consultation Letters

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8915

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

OCT 16 2018

To Whom It May Concern:

This scoping letter is being promulgated by the U.S. Army Corps of Engineers, Jacksonville District (Corps) in compliance with public coordination requirements of the National Environmental Policy Act (NEPA). The purpose of this correspondence is to formally initiate the scoping process as defined by 40 CFR 1501.7 for the Puerto Rico Coastal Storm Damage Reduction Study. The purpose of the scoping period is to commence the public process for the generation of a NEPA document to assess the effects of the potential alternatives to reduce coastal storm damages to infrastructure along the coastline of the Commonwealth of Puerto Rico (Attachment 1).

A public scoping meeting will be held on November 6, 2018, at the El Teatro Manuel Mendez Ballester, 5th Floor of la Casa Alcadia, Ave. San Carlos #11, Aguadilla, Puerto Rico from 2:00 PM to 4:00 PM. Additional information is available on our Environmental Documents Web Page at <http://www.saj.usace.army.mil/About/DivisionsOffices/Planning/EnvironmentalBranch/EnvironmentalDocuments.aspx>.

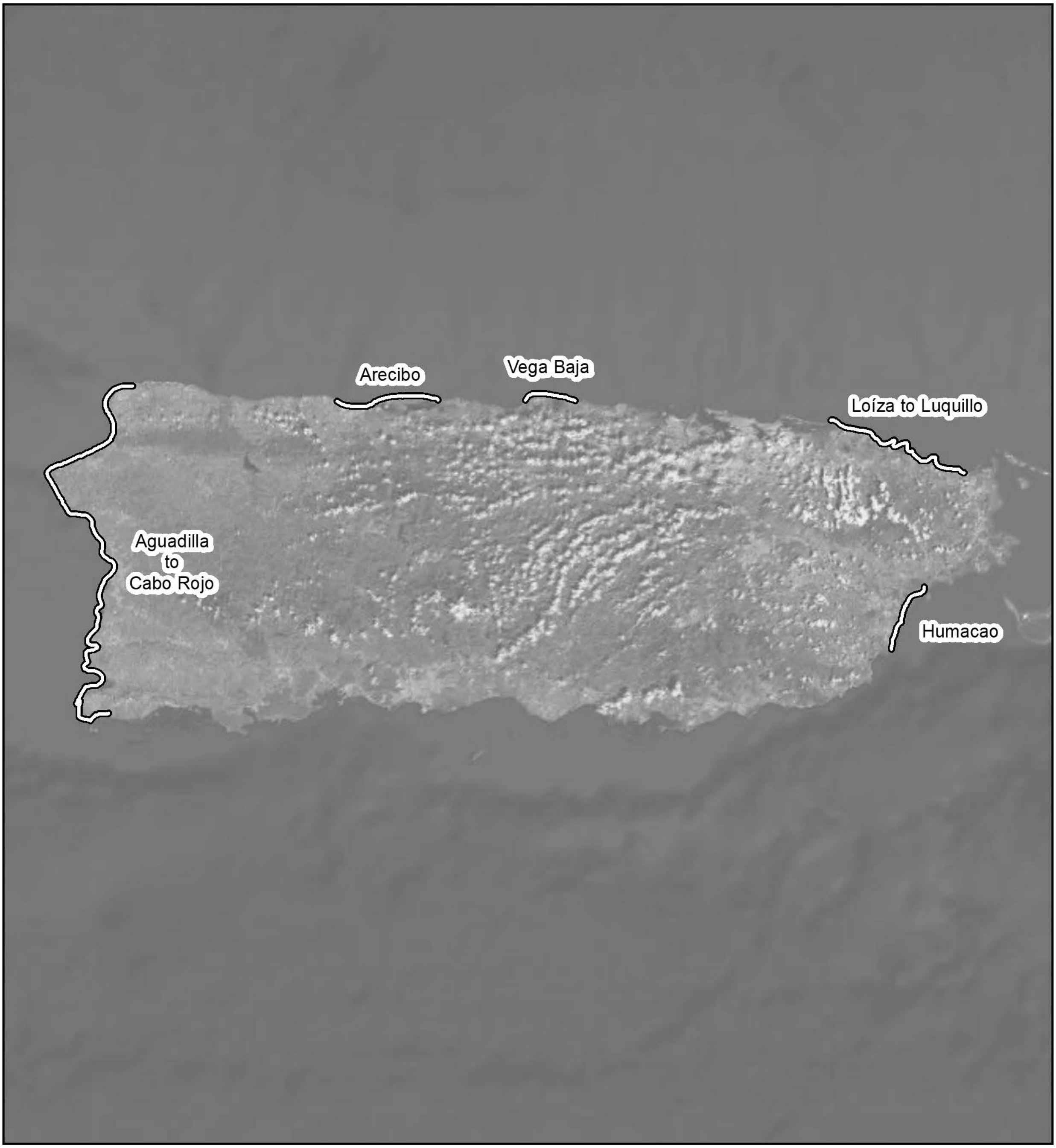
Preliminary alternatives under consideration include, but are not limited to, shoreline revetment, breakwaters, and sand placement as well as non-structural measures. We welcome your views, comments and information about environmental and cultural resources, study objectives and important features within the described study area, as well as any suggested improvements. Responses received will aid in determining the scope of the analysis and any potentially significant issues associated with coastal storm damage reduction in Puerto Rico. Letters of comment or inquiry should be addressed to the letterhead address to the attention of the Planning Division, Environmental Branch and received by this office within 30 days of the date of this letter.

If you have any questions, contact Mr. Paul DeMarco at 904 232-1897 or at paul.m.demarco@usace.army.mil.

Sincerely,

Gina Paduano Ralph, Ph.D.
Chief, Environmental Branch

Enclosure



US Army Corps of Engineers ®
Jacksonville District

Puerto Rico Coastal Study:
Coastal Storm Risk Management
Possible Study Areas

Puerto Rico

Possible Study Area

0 20 Miles

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8915

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

OCT 16 2018

A quien corresponda:

Esta carta de investigación inicial es publicada por el Distrito Jacksonville del cuerpo de Ingenieros de U.S (Corps) en cumplimiento de los requisitos de coordinación pública de la legislación nacional de política ambiental (NEPA). El propósito de esta correspondencia es iniciar formalmente el proceso de investigación y alcance según lo definido por 40 CFR 1501,7 para el estudio de reducción de daños por tormentas costeras en Puerto Rico. El propósito del período de investigaciones es iniciar el proceso público para la elaboración del documento NEPA para evaluar los efectos de las alternativas potenciales para reducir los daños causados por tormentas costeras a la infraestructura a lo largo de ciertos sectores costeros en Puerto Rico (Anejo 1).

La reunión de alcance público se llevará a cabo en Noviembre 6, 2018, en el Teatro Manuel Mendez Ballester, quinto piso de la Casa Alcadia, Avenida San Carlos #11, Aguadilla, Puerto Rico de 2:00 PM a 4:00 PM. Información adicional se encuentra disponible en nuestra página web de documentos ambientales en <https://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/>.

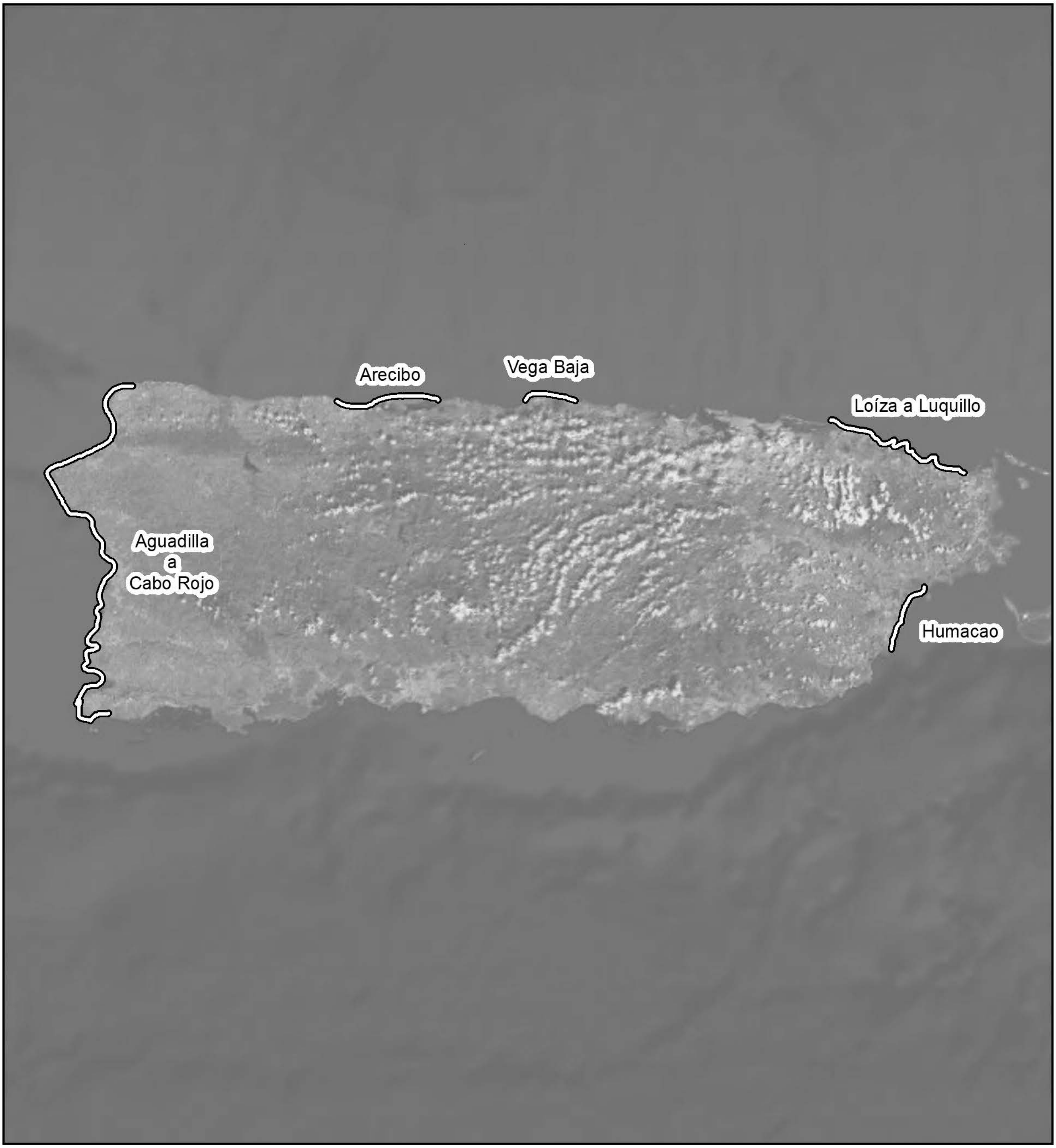
Las alternativas preliminares que se consideraran incluyen, pero no se limitan a, medidas de protección como revestimiento costero, rompeolas, y depósito de arena, así como medidas no estructurales. Recibiremos cordialmente sus opiniones, comentarios e información sobre los recursos ambientales y culturales, los objetivos de estudio y las características importantes dentro del área de estudio descrita, así como cualquier mejora sugerida. Las respuestas recibidas ayudarán a determinar el alcance del análisis y cualquier problema potencialmente significativo asociado con la reducción de daños por tormentas costeras en Puerto Rico. Las cartas con comentarios o peticiones deben ser enviadas a la dirección del membrete de esta carta, con atención a la División de Planificación de la Rama Ambiental y deben ser recibidas por esta oficina dentro de los 30 días siguientes a la fecha de la presente carta.

Para preguntas adicionales por favor comunicarse con Ms. Carolina Burnette al 904-232-1428 o enviar correo electrónico a carolina.burnette@usace.army.mil.

Sinceramente,

Gina Paduano Ralph, Ph.D.
Jefe, Rama Ambiental

Anejo



US Army Corps of Engineers ®
Jacksonville District

Estudio costero de Puerto Rico
Manejo de Riesgos de tormentas costeras
Posibles áreas de studio

Puerto Rico

Area de estudio

0 30 Kilometros

0 20 Millas

N

GOBIERNO DE PUERTO RICO
Oficina Estatal de Conservación Histórica
State Historic Preservation Office

Wednesday, November 28, 2018

Gina Paduano Ralph, Ph.D.
Chief, Environmental Branch
Attn. Planning Division
Corps of Engineers, Jacksonville District
Department of the Army
701 San Marco Boulevard
Jacksonville, Florida 32207-8915

SHPO: 10-23-18-02 PUERTO RICO COASTAL STORM DAMAGE REDUCTION STUDY, ISLANDWIDE, PUERTO RICO

Dear Dr. Paduano Ralph,

We acknowledge the receipt of your letter on October 31, 2018 regarding the above referenced project, supported with an aerial photograph depicting the possible study areas. The purpose of your letter is to formally initiate the scoping process for the above referenced undertaking. During this process, a NEPA document will assess the effects of the potential alternatives under consideration to reduce coastal storm damages along segments of the coastline in 5 areas labeled *Loíza to Luquillo*, *Humacao*, *Aguadilla to Cabo Rojo*, *Arecibo* and *Vega Baja*.

The proposed project comprises areas with a high density of terrestrial and submerged archaeological sites, historic buildings and structures, as well as historic districts, included and eligible to be included in the **National Register of Historic Places**. Moreover, there are vast extensions of the Puerto Rico coastline that have not been previously surveyed and the probability for identifiying unknown historic properties is high as well.

Our Office is committed to helping the US Army Corps of Engineers fulfill its historic preservation responsibilities. Considering the above, we encourage you to continue communicating with our office so we may advise and assist you properly during the early planning stages of this endeavor. If you have any questions concerning our comments, do not hesitate to contact our Office at (787) 721-3737 or ediaz@prshpo.pr.gov.

Sincerely,

Carlos A. Rubio-Cancela
State Historic Preservation Officer

CARC/GMO/MC

Cuartel de Ballajá (Tercer Piso),
Calle Norzagaray, Esquina Beneficencia, Viejo San Juan, P.R. 00901

PO Box 9023935, San Juan, P.R. 00902-3935
Tel: 787-721-3737 Fax: 787-721-3773
www.oech.pr.gov

SHPO OECH
OFICINA ESTATAL DE CONSERVACIÓN HISTÓRICA
OFICINA DEL GOBERNADOR
STATE HISTORIC PRESERVATION OFFICE
OFFICE OF THE GOVERNOR

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
701 San Marco Boulevard
JACKSONVILLE, FLORIDA 32207-8175

REPLY TO
ATTENTION OF

Planning and Policy Division
Environmental Branch

FEB 28 2019

Mr. Carlos Rubio-Cancela
State Historic Preservation Officer
Office of the Governor
P.O. Box 9023935
San Juan, Puerto Rico 00902-3935

Re: Data access to Site Files at the State Historic Preservation Office

Dear Mr. Rubio-Cancela:

The purpose of this letter is for the U.S. Army Corps of Engineers, Jacksonville District (Corps) to request digital access to the site file data of the Puerto Rico State Historic Preservation Office (SHPO). As part of the Bipartisan Budget Act of 2018 (PL-115-123), the Corps has been instructed to expeditiously repair, rehabilitate, study, design, and construct numerous long-term flood and storm damage reduction projects in Puerto Rico. These data are requested in support of these projects and will be used in planning and to aid in consultation with SHPO under Section 106 of the National Historic Preservation Act. The Corps does not intend for the data to replace compliance with Section 106 and consultation with SHPO. The Corps acknowledges the data may be incomplete and that some of the data may be out of data or inaccurate. The data are intended to develop expectations and ensure known historic properties are considered during Corps planning processes. The Corps understands that additional site file research, cultural resources surveys, and consultation with the SHPO will still be required.

The data requested are the shapefiles of archaeological sites, surveys, historic structures, and other cultural resources to include information indicating the type of cultural resource, location data, and SHPO determination of eligibility for the National Register of Historic Places. The Corps also requests the Access database of cultural resources. Only the Registered Professional Archaeologists within the Corps will have access to this information. These data will not be shared with other agencies or contractors. The Corps appreciates your consideration. If there are any questions, please contact Mr. Christopher Altes at 904-232-1694 or e-mail at Christopher.F.Altes@usace.army.mil.

Sincerely,

Andrew LoSchiavo
Acting Chief, Environmental Branch

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BLVD
JACKSONVILLE, FL 32207-8175

Planning and Policy Division
Environmental Branch

MAR 1 2 2020

Mr. Carlos Rubio-Cancela
State Historic Preservation Officer
Office of the Governor
P.O. Box 9023935
San Juan, Puerto Rico 00902-3935

Re: Puerto Rico Coastal Storm Risk Management Project, Carolina, and San Juan, Puerto Rico (SHPO No.: 10-23-18-02)

Dear Mr. Rubio-Cancela:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along the shoreline of Santurce Barrio, San Juan Municipality, and Cangrejo Arriba Barrio, Carolina Municipality, Puerto Rico. Coastal storms in this region threaten life safety and have significant economic consequences. The current study is evaluating an array alternatives that include a combination of sand placement on the shoreline, coastal hardening, and constructing breakwaters to reduce the risk of damages associated with coastal storms.

Pursuant to Section 106 of the National Historic Preservation Act (NHPA) (54 U.S.C. § 306108), and its implementing regulations (36 CFR § 800), the Corps has determined that the Puerto Rico Coastal Storm Risk Management Project (Project) constitutes an undertaking as defined in 36 CFR 800.16(y). The Corps previously initiated consultation with your office on this Project by letter dated October 16, 2018. The feasibility study for the Project is ongoing, and a tentatively selected plan has not been identified. However, as part of the continuation of consultation for the Project, the Corps has tentatively identified the areas of potential effects (APE) for the undertaking to encompass all areas of proposed ground disturbance for all measures under consideration, including access, staging, and construction areas (Figure 1). As the measures include the placement of sand on the shoreline, the Corps will include locations identified as potential offshore sand sources in the APE (Figure 2). The APE will be subject to further refinement as the study progresses.

The Corps is initiating survey of the APE, but current uncertainty regarding the tentatively selected plan and timing constraints for the study may mean the Corps may not complete all of the necessary surveys to identify and evaluate cultural resources and determine effects of the Project prior to completing the appropriate National Environmental Policy Act (NEPA) documentation. If the Corps is unable to complete identification and evaluation efforts, the Corps will proposes to develop a programmatic agreement with your office to comply with Section 106 of the NHPA for the feasibility study. Pursuant to 54 U.S.C. § 306108 and 36 CFR § 800.4(b)(2), it may be necessary for the Corps to defer final identification and evaluation of historic properties until after the Project is congressionally authorized, funding is appropriated, and prior to construction by executing a programmatic agreement with the SHPO and the ACHP, if inclined to participate. The Institute of Puerto Rican Cultural would be invited to participate in any agreements as a Consulting Party. The programmatic agreement would outline the efforts and schedule for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing, and/or mitigating the effects of the measures on historic properties.

Pursuant to 36 CFR § 800.4(a)(1) the Corps kindly requests your comments on the proposed APE within 30 days from receipt of this letter. If there are any questions, please contact Mr. Christopher Altes by telephone at 904-232-1694 or e-mail at Christopher.F.Altes@usace.army.mil.

Sincerely,

Angela E. Dunn
Chief, Environmental Branch

Enclosure

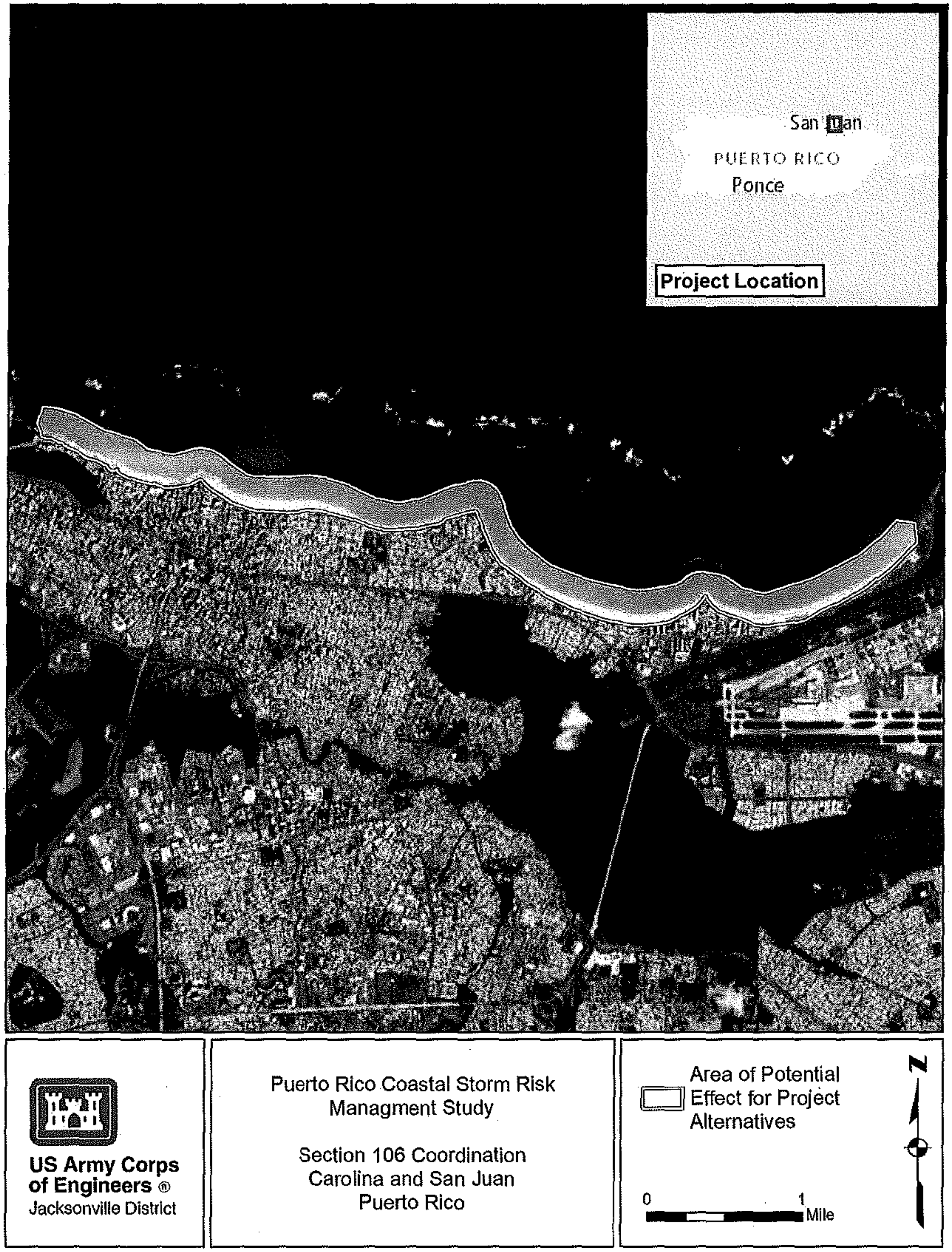


Figure 1. Approximate footprint of measures under consideration in the Puerto Rico Coastal Storm Flood Risk Management Project.

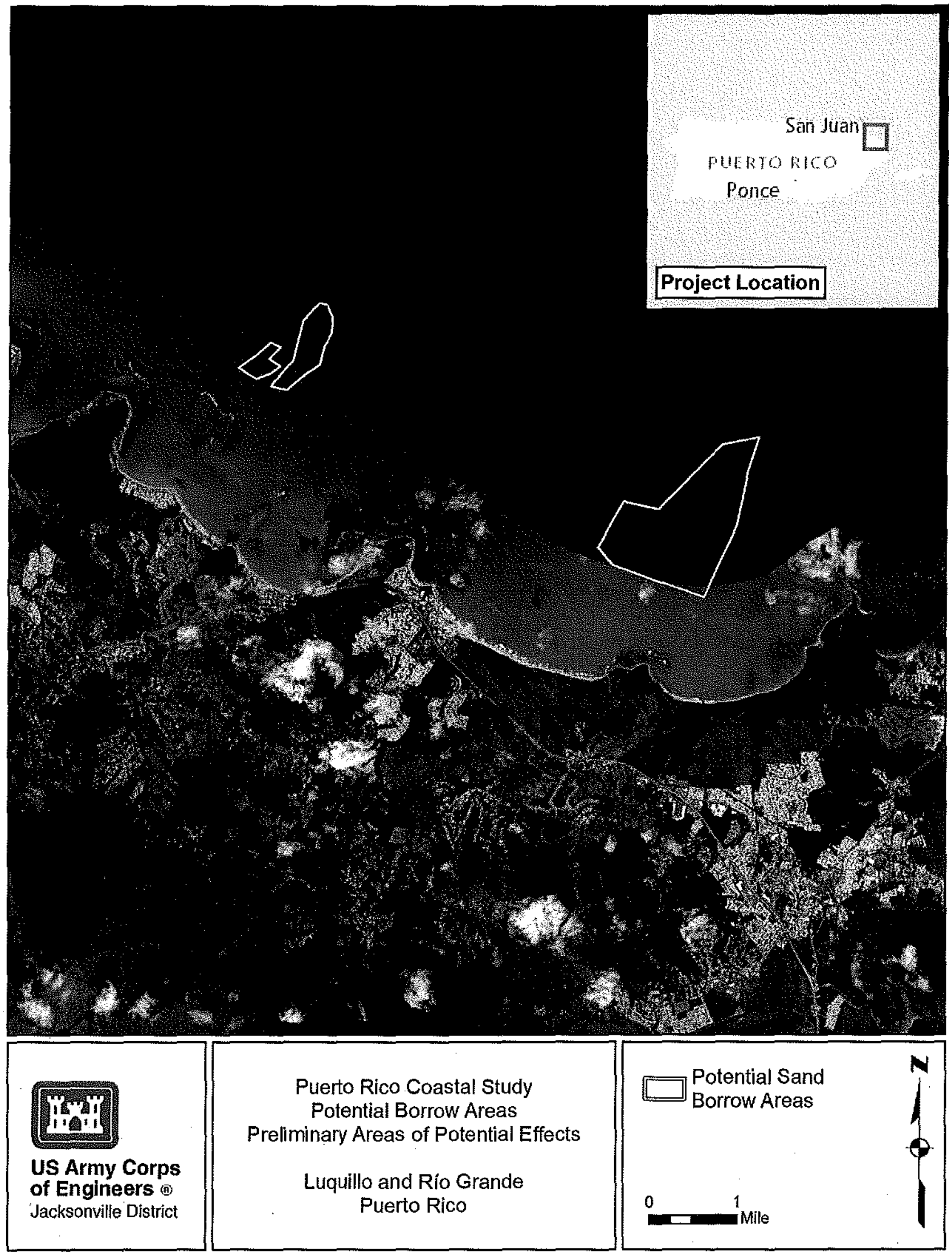


Figure 2. Approximate area of potential effect of areas under investigation as sediment sources for the Puerto Rico Coastal Storm Flood Risk Management Project.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BLVD
JACKSONVILLE, FL 32207-8175

Planning and Policy Division
Environmental Branch

MAR 1 2 2020

Prof. Carlos R. Ruiz Cortés
Executive Director
Instituto de Cultura Puertorriqueña
Apartado 9024184
San Juan, Puerto Rico
00902-4184

Re: Puerto Rico Coastal Storm Risk Management Project, Carolina, and San Juan, Puerto Rico (SHPO No.: 10-23-18-02)

Dear Prof. Ruiz:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along the shoreline of Santurce Barrio, San Juan Municipality, and Cangrejo Arriba Barrio, Carolina Municipality, Puerto Rico. Coastal storms in this region threaten life safety and have significant economic consequences. The current study is evaluating an array alternatives that include a combination of sand placement on the shoreline, coastal hardening, and constructing breakwaters to reduce the risk of damages associated with coastal storms.

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The Corps is initiating survey of the APE, but current uncertainty regarding the tentatively selected plan and timing constraints for the study may mean the Corps may not complete all of the necessary surveys to identify and evaluate cultural resources and determine effects of the Project prior to completing the appropriate National Environmental Policy Act (NEPA) documentation. If the Corps is unable to complete identification and evaluation efforts, the Corps will proposes to develop a programmatic agreement with your office to comply with Section 106 of the NHPA for the feasibility study. Pursuant to 54 U.S.C. § 306108 and 36 CFR § 800.4(b)(2), it may be necessary for the Corps to defer final identification and evaluation of historic properties until after the Project is congressionally authorized, funding is appropriated, and prior to construction by executing a programmatic agreement with the SHPO and the ACHP, if inclined to participate. The Institute of Puerto Rican Cultural would be invited to participate in any agreements as a Consulting Party. The programmatic agreement would outline the efforts and schedule for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing, and/or mitigating the effects of the measures on historic properties.

Pursuant to 36 CFR § 800.4(a)(1) the Corps kindly requests your comments on the proposed APE within 30 days from receipt of this letter. If there are any questions, please contact Mr. Christopher Altes by telephone at 904-232-1694 or e-mail at Christopher.F.Altes@usace.army.mil.

Sincerely,

Angela E. Dunn
Chief, Environmental Branch

Enclosure

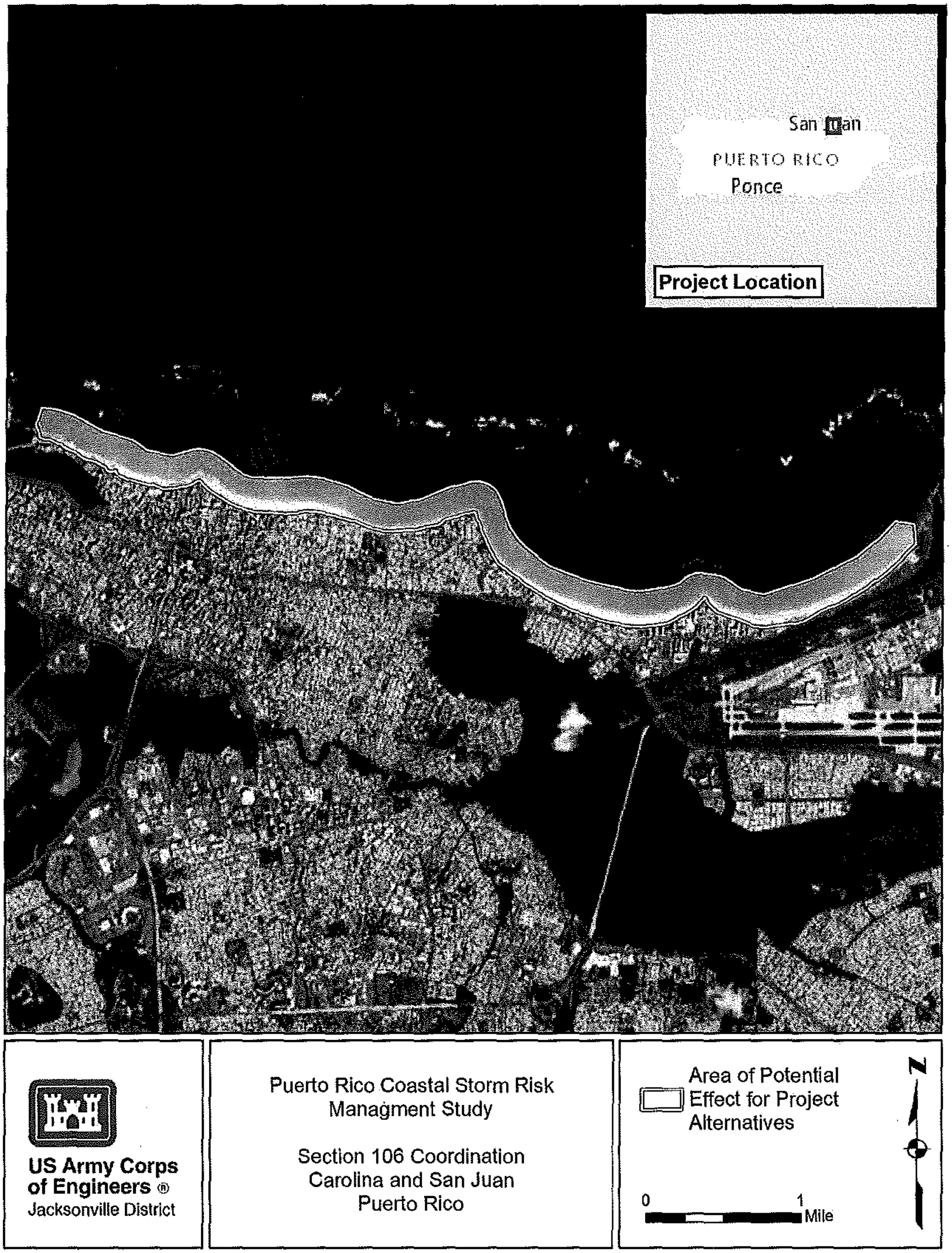

Figure 1. Approximate footprint of measures under consideration in the Puerto Rico Coastal Storm Flood Risk Management Project.

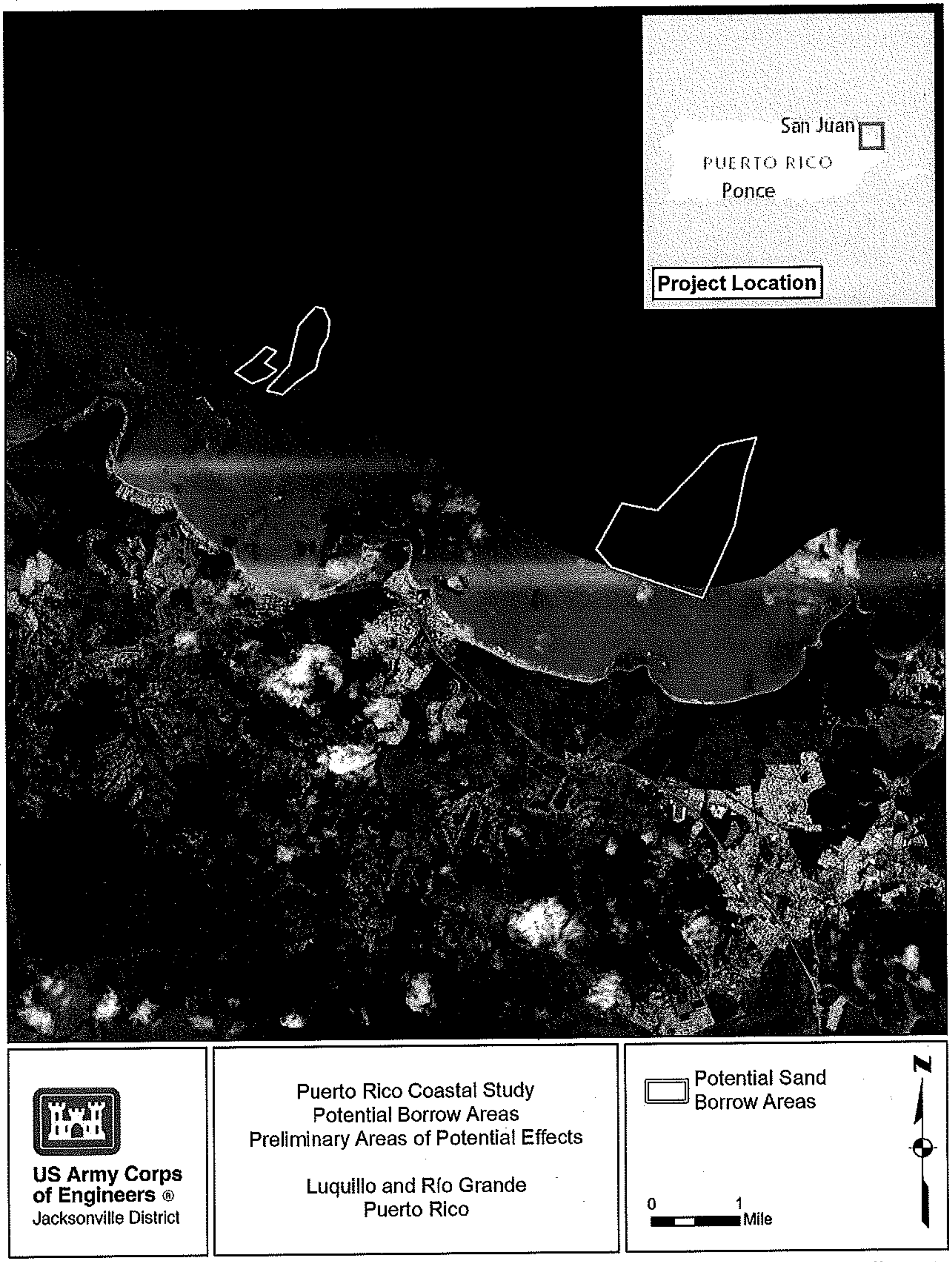

Figure 2. Approximate area of potential effect of areas under investigation as sediment sources for the Puerto Rico Coastal Storm Flood Risk Management Project.

Wednesday, May 20, 2020

Angela E. Dunn
Chief, Environmental Branch
Department of the Army
Corps of Engineers, Jacksonville District
701 San Marco Blvd.
Jacksonville, FL 32207-8175

SHPO: 10-23-18-02 PUERTO RICO COASTAL STORM RISK MANAGEMENT PROJECT, ISLANDWIDE, PUERTO RICO

Dear Ms. Dunn,

We acknowledge the receipt of your letter dated March 12, 2020 related to the above referenced undertaking, supplemented with two satellite photographs depicting its approximate footprint and approximate Area of Potential Effects (APE).

Your letter establishes the undertaking and notifies the US Army Corps of Engineers (Corps) is currently carrying out feasibility and environmental effects studies of alternatives. The Corps proposes the development of a Programmatic Agreement (PA) to comply with Section 106 of the National Historic Preservation Act for the feasibility study. This would provide for a phased approach in the completion of identification and evaluation efforts, the determination of project's effects, as well as avoiding, minimizing and/or mitigating the effects on historic properties after authorization and appropriation of funds, and before construction.

Regarding the proposed approximate APE, we believe that once the scope of the project is refined, we will be in a better position to assist you in defining the APE. The SHPO agrees with the Corps recommendation for the development of a PA for the feasibility study and will be looking forward to continuing supporting your agency with this undertaking.

If you have any questions concerning our comments, do not hesitate to contact our Office.

Sincerely,

Carlos A. Rubio-Cancela
State Historic Preservation Officer

CARC/GMO/MC

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

June 5, 2020

Mr. Carlos Rubio-Cancela
State Historic Preservation Officer
Office of the Governor
P.O. Box 9023935
San Juan, Puerto Rico 00902-3935

Re: Puerto Rico Coastal Storm Risk Management Project, Luquillo, Rincon, Río Grande, Carolina, and San Juan, Puerto Rico

Dear Mr. Rubio-Cancela:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along the shoreline of Calvache and Pueblo barrios, Rincon Municipality, Santurce Barrio, San Juan Municipality, and Cangrejo Arriba Barrio, Carolina Municipality, Puerto Rico (Figures 1 and 2). The Puerto Rico Coastal Storm Risk Management Project (Project) is evaluating an array alternatives that include a combination of sand placement on the shoreline, coastal hardening, and constructing breakwaters to reduce the risk of damages associated with coastal storms. A possible offshore sand source is being evaluated (Figure 3).

The Corps previously initiated consultation with your office on this Project pursuant to Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108), and its implementing regulations (36 CFR § 800) by letter dated October 16, 2018. The Corps provided an area of potential effects and invited your office to participate in the development of a programmatic agreement (Agreement) as a Consulting Party by letter dated March 12, 2020.

Enclosed is a draft Agreement for your review and comment. The Agreement outlines the efforts and schedule for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing, and/or mitigating the effects of the measures on historic properties. Pursuant to 36 CFR 800.14, the Corps kindly requests your comments on the draft Agreement within 30 days from receipt of this letter. If there are any questions, please contact Mr. Christopher Altes by telephone at 904-232-1694 or e-mail at Christopher.F.Altes@usace.army.mil.

Sincerely,

Angela E. Dunn
Chief, Environmental Branch

Encls

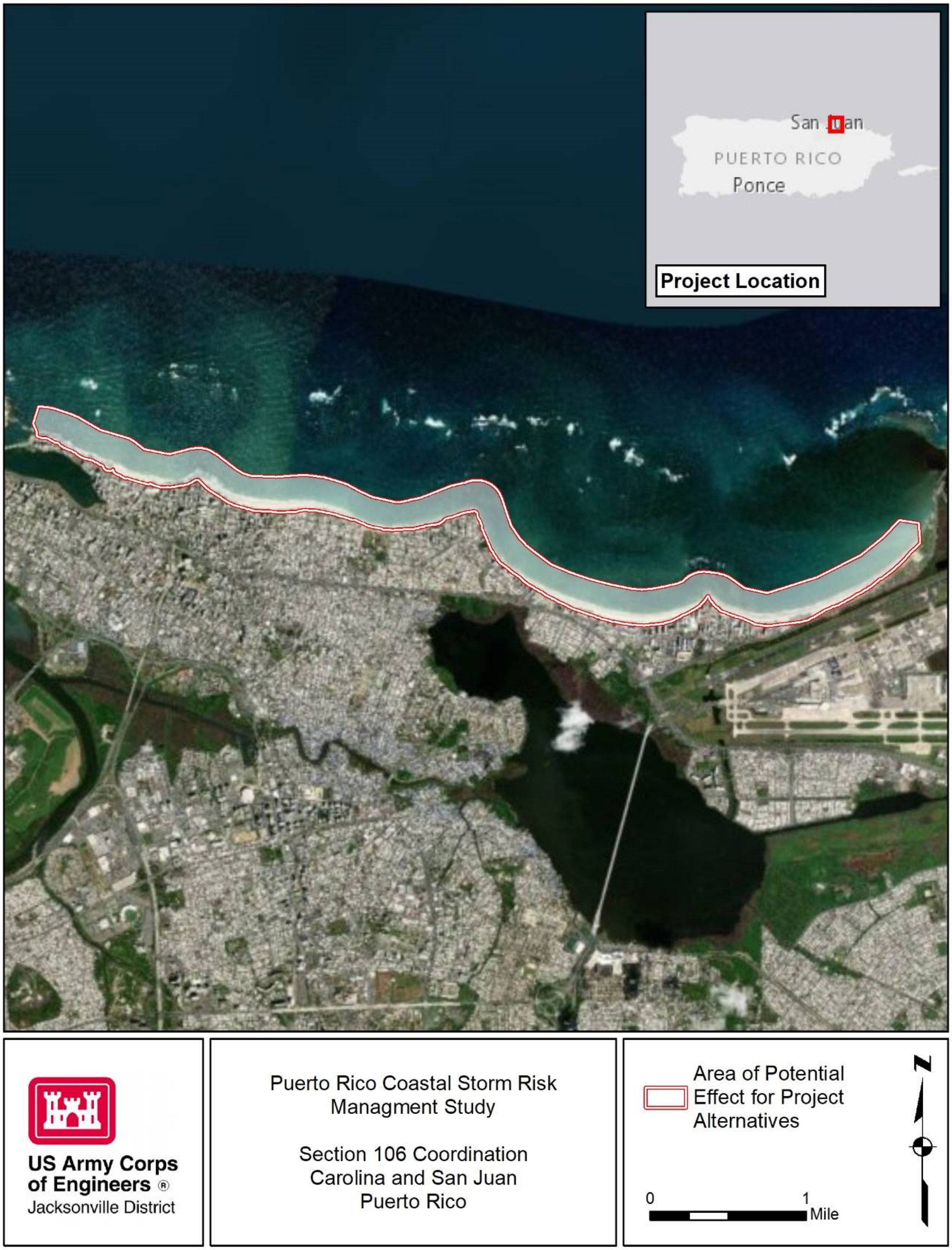

Figure 1. Approximate footprint of measures under consideration in the Puerto Rico Coastal Storm Flood Risk Management Project in Carolina and San Juan

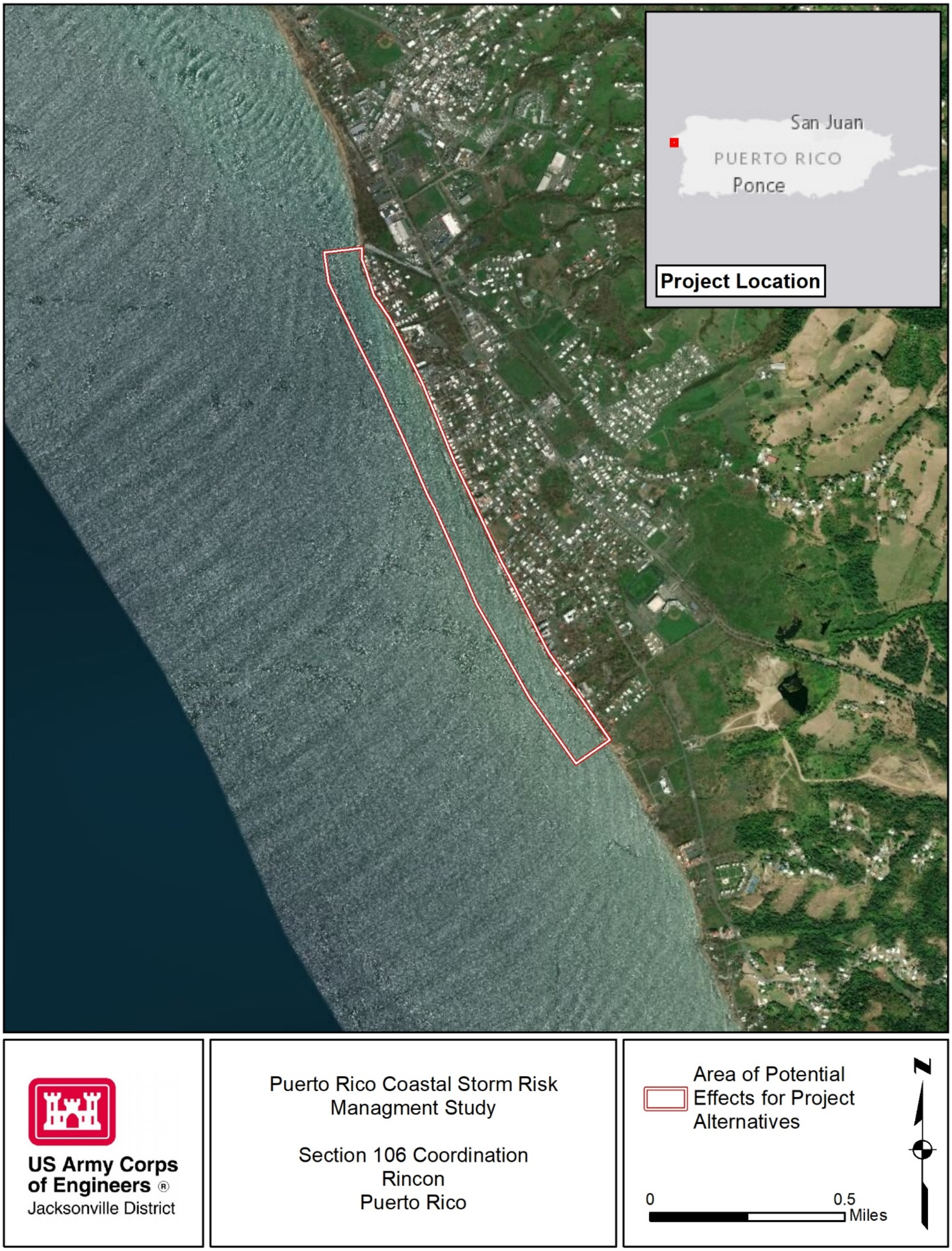

Figure 2. Approximate footprint of measures under consideration in the Puerto Rico Coastal Storm Flood Risk Management Project in Rincon

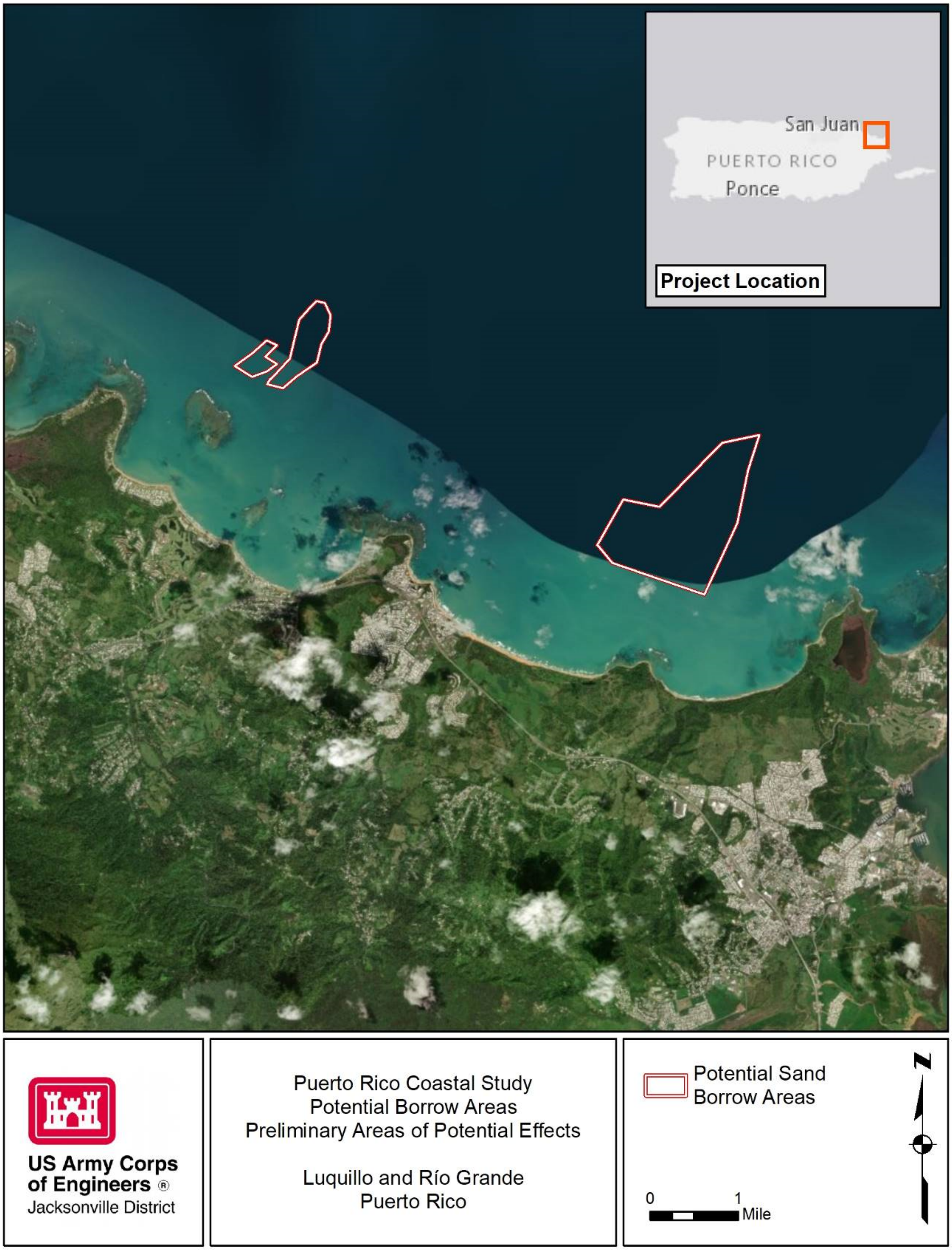

Figure 3. Approximate area of potential effect of areas under investigation as sediment sources for the Puerto Rico Coastal Storm Flood Risk Management Project

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8915

Planning and Policy Division
Environmental Branch

June 5, 2020

Prof. Carlos R. Ruiz Cortés
Executive Director
Instituto de Cultura Puertorriqueña
Apartado 9024184
San Juan, Puerto Rico
00902-4184

Re: Puerto Rico Coastal Storm Risk Management Project, Luquillo, Rincon, Río Grande, Carolina, and San Juan, Puerto Rico

Dear Prof. Ruiz:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along the shoreline of Calvache and Pueblo barrios, Rincon Municipality, Santurce Barrio, San Juan Municipality, and Cangrejo Arriba Barrio, Carolina Municipality, Puerto Rico (Figures 1 and 2). The Puerto Rico Coastal Storm Risk Management Project (Project) is evaluating an array alternatives that include a combination of sand placement on the shoreline, coastal hardening, and constructing breakwaters to reduce the risk of damages associated with coastal storms. A possible offshore sand source is being evaluated (Figure 3).

The Corps previously initiated consultation with your office on this Project pursuant to Section 106 of the National Historic Preservation Act (54 U.S.C. § 306108), and its implementing regulations (36 CFR § 800) by letter dated October 16, 2018. The Corps provided an area of potential effects and invited your office to participate in the development of a programmatic agreement (Agreement) as a Consulting Party by letter dated March 12, 2020.

Enclosed is a draft Agreement for your review and comment. The Agreement outlines the efforts and schedule for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing, and/or mitigating the effects of the measures on historic properties. Pursuant to 36 CFR 800.14, the Corps kindly requests your comments on the draft Agreement within 30 days from receipt of this letter. If there are any questions, please contact Mr. Christopher Altes by telephone at 904-232-1694 or e-mail at Christopher.F.Altes@usace.army.mil.

Sincerely,

Angela E. Dunn
Chief, Environmental Branch

Encls

Figure 1. Approximate footprint of measures under consideration in the Puerto Rico Coastal Storm Flood Risk Management Project in Carolina and San Juan.

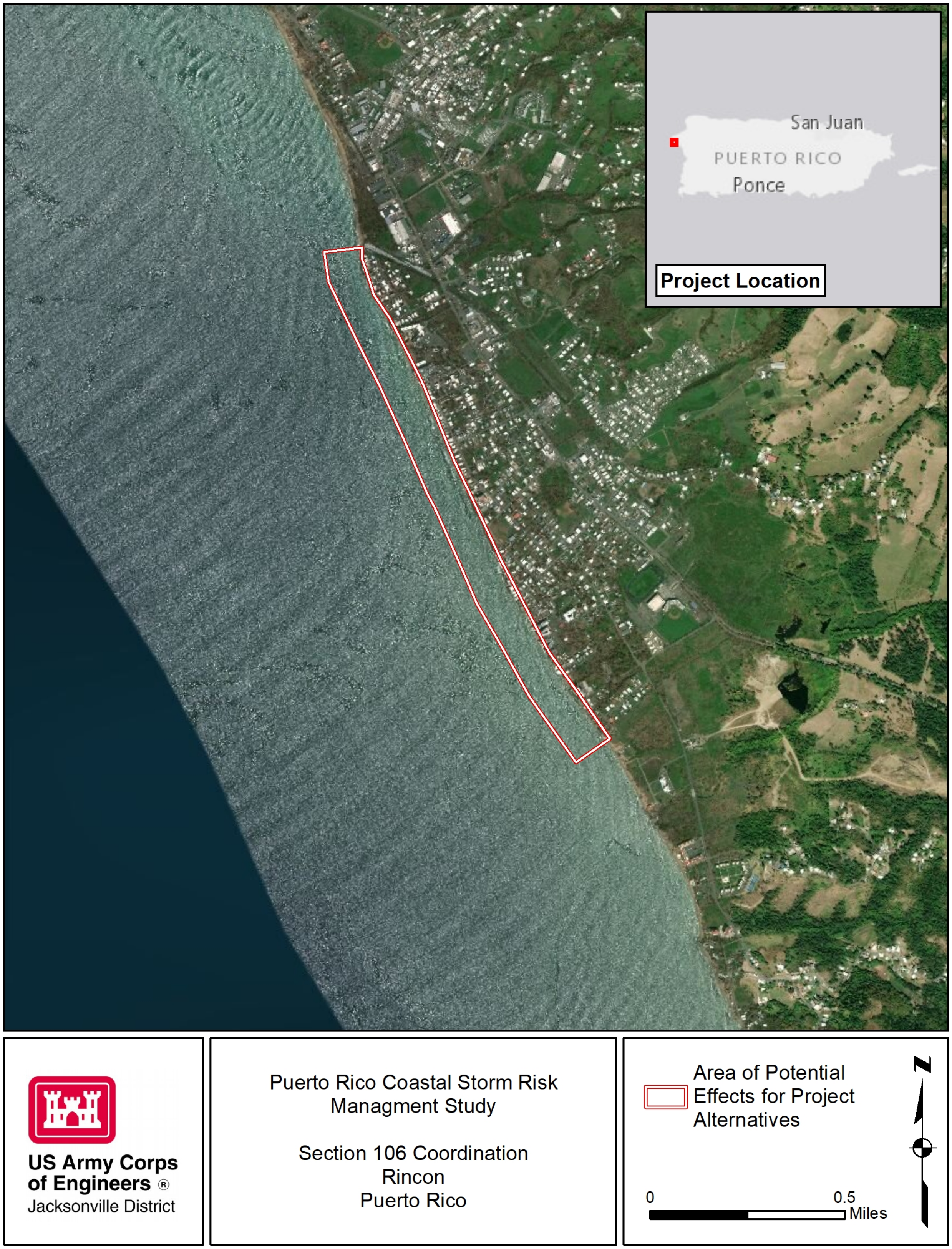

Figure 2. Approximate footprint of measures under consideration in the Puerto Rico Coastal Storm Flood Risk Management Project in Rincon.

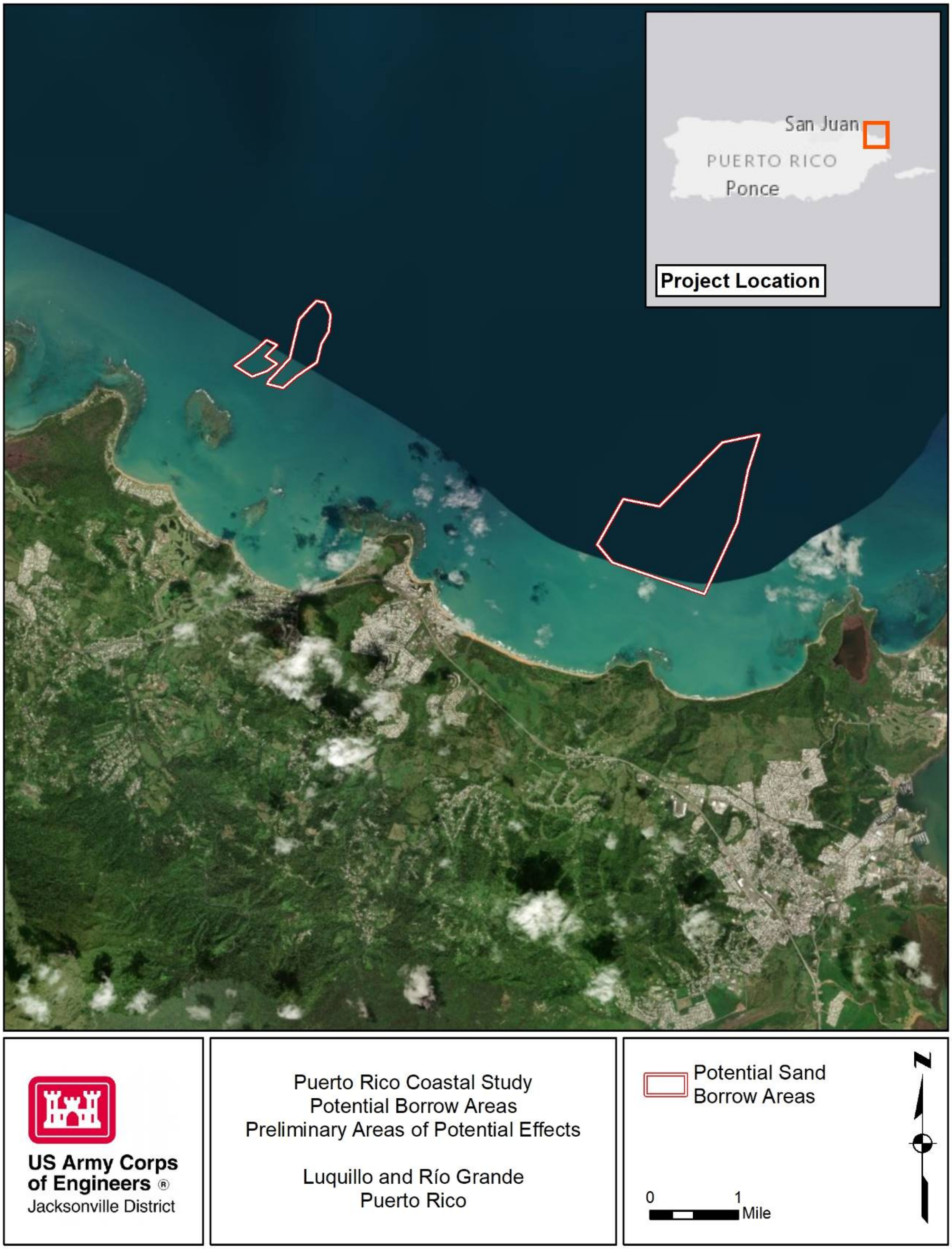

Figure 3. Approximate area of potential effect of areas under investigation as sediment sources for the Puerto Rico Coastal Storm Flood Risk Management Project.

GOBIERNO DE PUERTO RICO
Instituto de Cultura Puertorriqueña

30 de junio de 2020

Ms. Angela E. Dunn
Planning and Policy Division, Environmental Branch
701 S.Marco Blvd. Jacksonville, Florida 32207-8175

Christopher.F.Altes@usace.army.mil
Vía email

Ref: Puerto Rico Coastal Strom Risk Management Project, Carolina and San Juan, Puerto Rico

Estimada Ms. Dunn:

El Programa de Arqueología y Etnohistoria, como parte de los requisitos para los procesos de permisos de construcción de la ley 161 de la Oficina de Gerencia de Permisos (OGPe), su Reglamento Conjunto para la Evaluación y Expedición de Permisos, la agencia del estado Instituto de Cultura Puertorriqueña y el Consejo Para la Protección del Patrimonio Arqueológico Terrestre de Puerto Rico, ha recibido el documento que informa su intención de realizar el proyecto en referencia. La ley federal de Protección a Propiedades Históricas de 1966, le requiere cumplir con la ley del estado, tal como lo exige la Sección 106, 36 CFR Parte 800 Subparte C 800.16 (k), entre otras que le complementan.

Para cumplir con la ley del estado no. 89 de 1955, según enmendada, así como la ley 112 de 1988, según enmendada, que regula la práctica de la arqueología en Puerto Rico, y que, creó el Consejo para la Protección del Patrimonio Arqueológico Terrestre de Puerto Rico, necesitará someter los documentos requeridos ya establecidos en el Reglamento Núm.8932, Reglamento para la Radicación y Evaluación Arqueológica de Proyectos de Construcción y Desarrollo 2016, de dicha ley, aprobado el 8 de febrero de 2017, que son los requisitos para cumplir las leyes antes citadas:

1. Someter para nuestra evaluación y determinación un Estudio Arqueológico Fase 1A-1B que cumpla con el Reglamento No. 8932 de la ley del estado núm. 112, antes citada Artículos 6 y 7 (páginas 12-25).
2. Dicho estudio deberá ser realizado por un arqueólogo cualificado por el Consejo para la Protección del Patrimonio Arqueológico Terrestre de Puerto Rico de la Ley núm. 112, antes citada. Si el arqueólogo no está cualificado, deberá someter sus documentos para cualificación por el estado, especificados en dicho Reglamento, para las diversas fases arqueológicas (p.19; 25; 33; 43).

Deberá cumplir con la ley de Compatibilidad Federal del Programa de Manejo de la Zona Costanera Federal de 1972 (CZMA por sus siglas en inglés) (PL92-583), que establece la política pública y las medidas de planificación y manejo para el uso adecuado, la protección y el desarrollo de los recursos costaneros de Puerto Rico, de la Administración Nacional Oceánica y Atmosférica (NOAA por sus siglas en inglés), en vigor desde 1978. Esta ley requiere del Cuerpo de Ingenieros cumplir con el Instituto de Cultura Puertorriqueña, entre otras agencias.

Por otra parte, el objetivo de esta misiva es orientar y ayudar al Cuerpo de Ingenieros de los Estados Unidos hacia el cumplimiento con la ley del estado, en lo referente a la protección de los recursos arqueológicos en Puerto Rico. De no cumplir con todos los requisitos antes señalados, estaría en violación a las leyes del estado. Cualquier información adicional, quedamos en la mejor disposición, puede escribir a este servidor, al correo electrónico cperez@icp.pr.gov

Cordialmente,

DIGITAL SIGN 631
Dr. Carlos Pérez Merced
Director Interino

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

24 February 2023

Planning and Policy Division
Environmental Branch

Mr. Carlos Rubio-Cancela
State Historic Preservation Officer
Office of the Governor
P.O. Box 9023935
San Juan, Puerto Rico 00902-3935

Re: Puerto Rico Coastal Storm Risk Management Project, Rincón and San Juan Municipalities, Puerto Rico (SHPO No.: 10-23-18-02)

Dear Mr. Rubio-Cancela:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along sections of shoreline within the municipalities of Rincón and San Juan, Puerto Rico. The shoreline under consideration is defined by the Ocean Park Planning Reach, which includes Barbosa Park and a skate park in the municipality of San Juan, and the Rincón Planning Reach, which includes approximately 1.1 miles of developed coastline in the municipality of Rincón. The current study has identified a Tentatively Selected Plan (TSP) that includes floodwalls with rock armor toe protection and removable flood gates in the Ocean Park Planning Reach and managed retreat in the Rincón Planning Reach.

The Corps previously initiated consultation with your office on this Project by letter dated October 16, 2018. As part of the continuation of consultation for the Project, the Corps has tentatively identified the areas of potential effects (APE) for each planning reach based on the TSP (Figures 1 and 2). The tentative APE for each reach encompasses the locations of floodwalls and flood gates in the Ocean Park Planning Reach and the structures that are recommended for removal in the Rincón Planning Reach. These measures, as well as all access, staging, construction areas, and associated viewsheds, will be further refined during the Pre-Construction, Engineering, and Design (PED) phase before a final APE can be established.

Due to the design uncertainties referenced above, the Corps proposed the development of a programmatic agreement (PA) with your office to comply with Section 106 of the NHPA for the feasibility study phase of the Project by letter on March 12, 2020. Concurrence with this plan was receive by letter on May 20, 2020 (SHPO No.: 10-23-18-02). The Puerto Rico Department of Natural and Environmental Resources and the municipalities of Rincón and San Juan will be invited to participate in the PA as concurring parties. The Institute of Puerto Rican Cultural was previously invited to participate as a consulting party but was non-responsive in electing to participate. The PA will outline the efforts and procedures for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing,

and/or mitigating the effects of the measures on historic properties. The current draft of the PA is included with this letter for review.

Pursuant to 36 CFR § 800.4(a)(1) the Corps kindly requests your comments on the proposed tentative APE and draft PA within 30 days from receipt of this letter. If there are any questions, please contact Mr. Jon Simon Suarez by telephone at 904-232-3634 or e-mail at JonSimon.C.Suarez@usace.army.mil.

Sincerely,

Meredith A. Moreno, M.A., RPA
Cultural Resources Chief
Deputy, Environmental Branch

Enclosure:

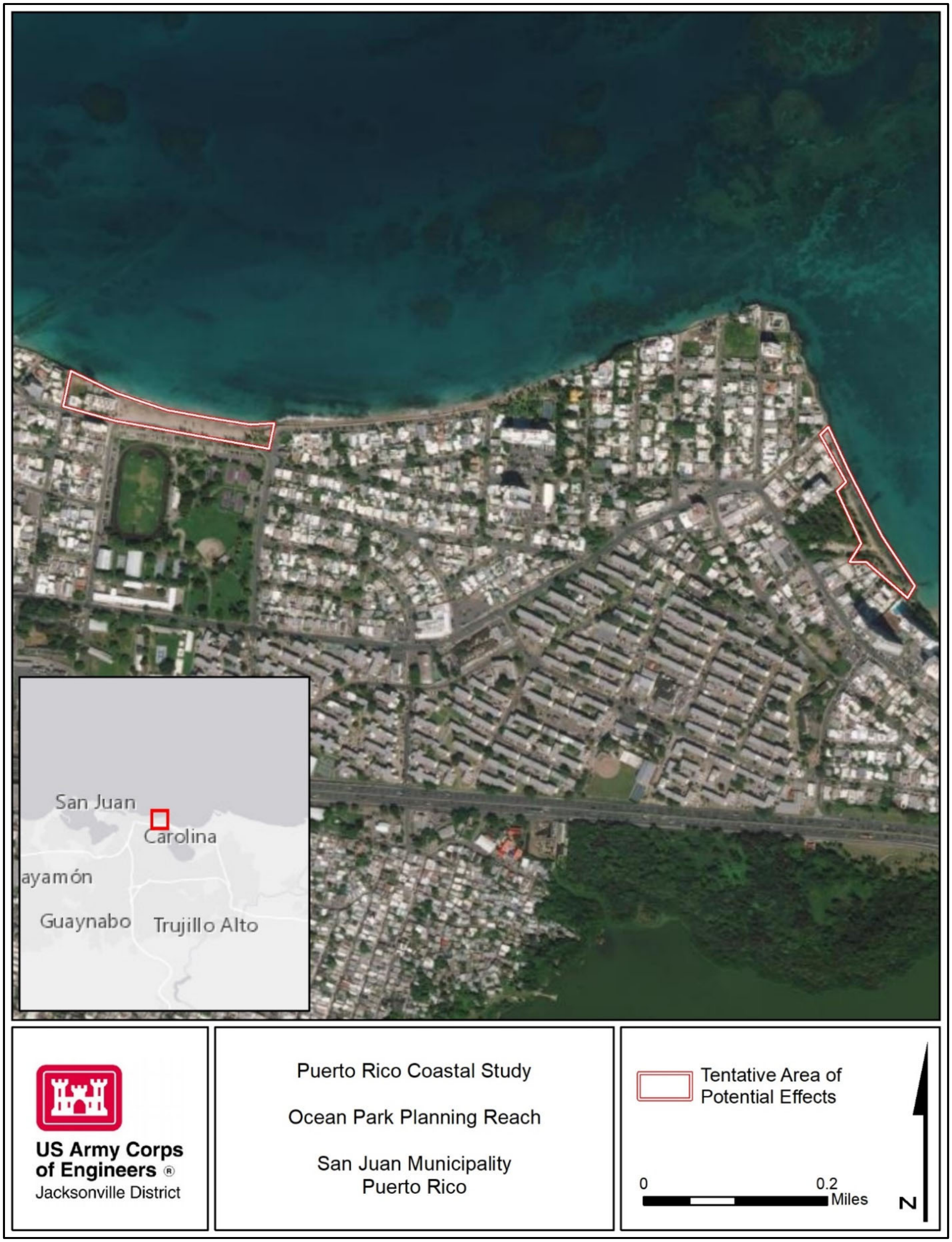

Figure 1. Ocean Park Planning Reach Tentative Area of Potential Effects.

Figure 2. Rincón Planning Reach Tentative Area of Potential Effects.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

24 February 2023

Planning and Policy Division
Environmental Branch

Anais Rodriguez-Vega
Secretary
Department of Environmental and Natural Resources
P.O. Box 366147
San Juan, Puerto Rico 00936

Re: Puerto Rico Coastal Storm Risk Management Project, Rincón and San Juan Municipalities, Puerto Rico (SHPO No.: 10-23-18-02)

Dear Ms. Rodriguez-Vega:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along sections of shoreline within the municipalities of Rincón and San Juan, Puerto Rico. The shoreline under consideration is defined by the Ocean Park Planning Reach, which includes Barbosa Park and a skate park in the municipality of San Juan, and the Rincón Planning Reach, which includes approximately 1.1 miles of developed coastline in the municipality of Rincón. The current study has identified a Tentatively Selected Plan (TSP) that includes floodwalls with rock armor toe protection and removable flood gates in the Ocean Park Planning Reach and managed retreat in the Rincón Planning Reach.

The Corps has tentatively identified the areas of potential effects (APE) for each planning reach based on the TSP (Figures 1 and 2). The tentative APE for each reach encompasses the locations of floodwalls and flood gates in the Ocean Park Planning Reach and the structures that are recommended for removal in the Rincón Planning Reach. These measures, as well as all access, staging, construction areas, and associated viewsheds, will be further refined during the Pre-Construction, Engineering, and Design (PED) phase before a final APE can be established. Through consultation with the State Historic Preservation Office, the Corps has developed a programmatic agreement (PA) to outline procedures to conduct phased compliance with Section 106 of the National Historic Preservation Act (NHPA) during the PED phase pursuant to 54 USC § 306108 and 36 CFR § 800.4(b)(2).

The Corps invites the Puerto Rico Department of Natural and Environmental Resources to participate in the PA as a concurring party. An invitation has also been extended to the municipalities of Rincón and San Juan. Your office is invited to sign the PA as a concurring party or receive documents as a consulting party to this Agreement but neither is required to remain part of the process. If your office would not like to participate as a concurring or consulting party to the PA, the Corps can provide additional reports and information as requested. The PA will outline the efforts and procedures for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing,

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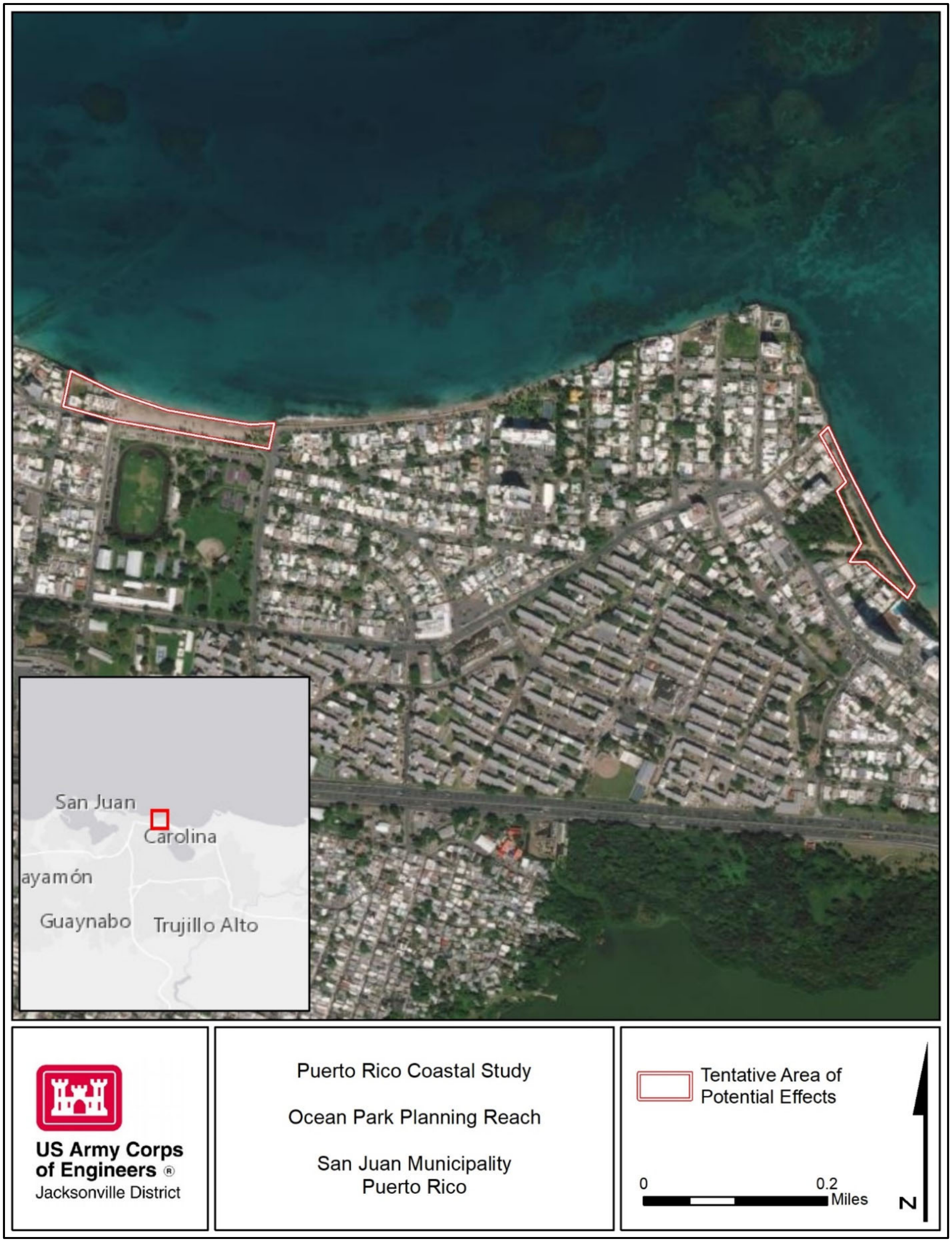

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

24 February 2023

Planning and Policy Division
Environmental Branch

Honorable Carlos López Bonilla
Mayor, Municipality of Rincón
Rincón Municipal Building
P.O. Box 97
Rincón, Puerto Rico 00677

Re: Puerto Rico Coastal Storm Risk Management Project, Rincón and San Juan Municipalities, Puerto Rico (SHPO No.: 10-23-18-02)

Dear Mr. López Bonilla:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along sections of shoreline within the municipalities of Rincón and San Juan, Puerto Rico. The shoreline under consideration is defined by the Ocean Park Planning Reach, which includes Barbosa Park and a skate park in the municipality of San Juan, and the Rincón Planning Reach, which includes approximately 1.1 miles of developed coastline in the municipality of Rincón. The current study has identified a Tentatively Selected Plan (TSP) that includes floodwalls with rock armor toe protection and removable flood gates in the Ocean Park Planning Reach and managed retreat in the Rincón Planning Reach.

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The Corps invites the Puerto Rico Department of Natural and Environmental Resources to participate in the PA as a concurring party. An invitation has also been extended to the municipalities of Rincón and San Juan. Your office is invited to sign the PA as a concurring party or receive documents as a consulting party to this Agreement but neither is required to remain part of the process. If your office would not like to participate as a concurring or consulting party to the PA, the Corps can provide additional reports and information as requested. The PA will outline the efforts and procedures for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing,

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Cultural Resources Chief
Deputy, Environmental Branch

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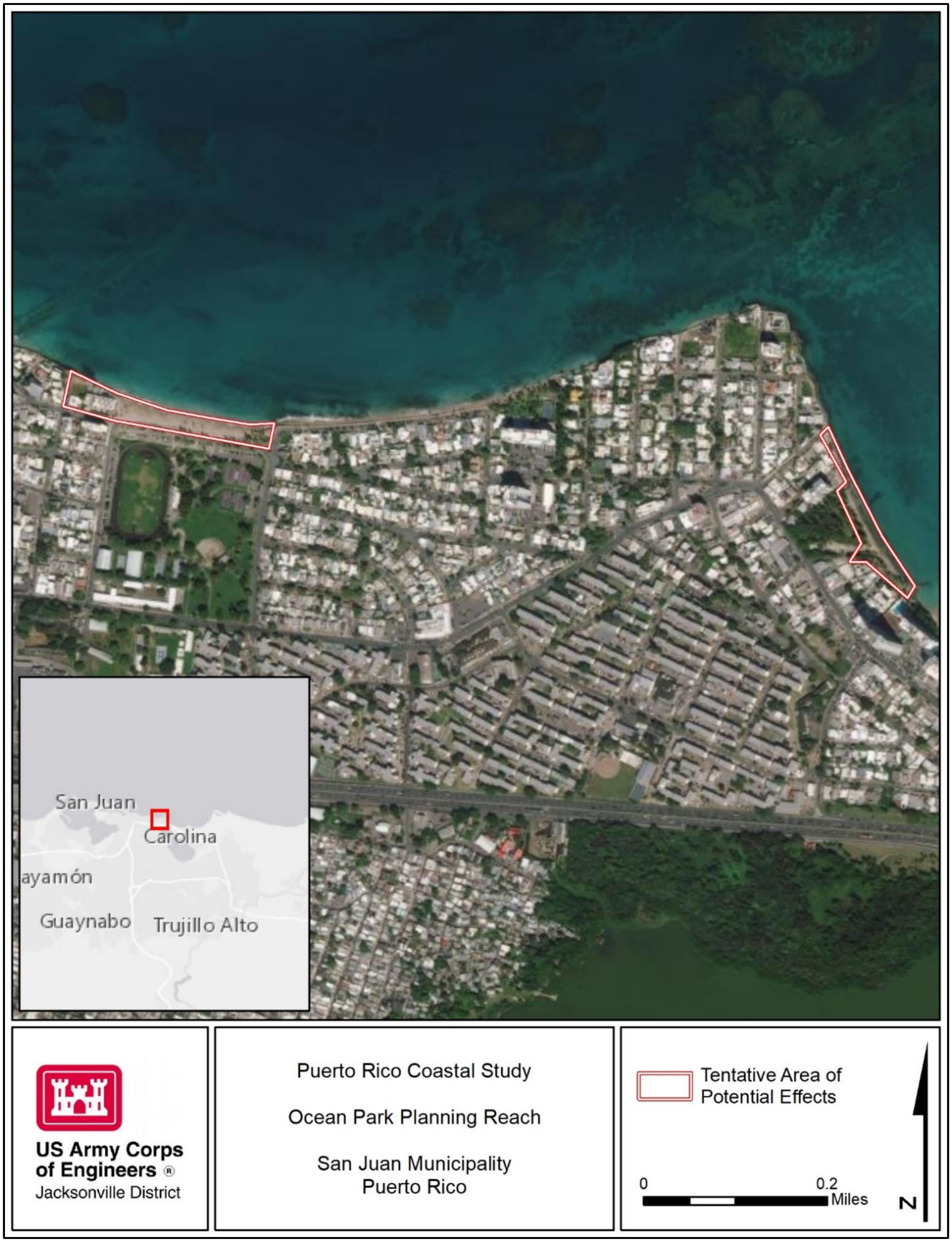

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

24 February 2023

Planning and Policy Division
Environmental Branch

Honorable Miguel Romero
Mayor, Municipality of San Juan
P.O. Box 70179
San Juan, Puerto Rico 00936-8179

Re: Puerto Rico Coastal Storm Risk Management Project, Rincón and San Juan Municipalities, Puerto Rico (SHPO No.: 10-23-18-02)

Dear Mr. Romero:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is currently studying the feasibility and environmental effects of alternatives proposed to manage risks associated with coastal storms along sections of shoreline within the municipalities of Rincón and San Juan, Puerto Rico. The shoreline under consideration is defined by the Ocean Park Planning Reach, which includes Barbosa Park and a skate park in the municipality of San Juan, and the Rincón Planning Reach, which includes approximately 1.1 miles of developed coastline in the municipality of Rincón. The current study has identified a Tentatively Selected Plan (TSP) that includes floodwalls with rock armor toe protection and removable flood gates in the Ocean Park Planning Reach and managed retreat in the Rincón Planning Reach.

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The Corps invites the Puerto Rico Department of Natural and Environmental Resources to participate in the PA as a concurring party. An invitation has also been extended to the municipalities of Rincón and San Juan. Your office is invited to sign the PA as a concurring party or receive documents as a consulting party to this Agreement but neither is required to remain part of the process. If your office would not like to participate as a concurring or consulting party to the PA, the Corps can provide additional reports and information as requested. The PA will outline the efforts and procedures for identifying historic properties, assessing the effects of proposed measures on historic properties, and avoiding, minimizing,

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Pursuant to 36 CFR § 800.4(a)(1) the Corps kindly requests your comments on the draft PA within 30 days from receipt of this letter. If there are any questions, please contact Mr. Jon Simon Suarez by telephone at 904-232-3634 or e-mail at JonSimon.C.Suarez@usace.army.mil.

Sincerely,

Meredith A. Moreno, M.A., RPA
Cultural Resources Chief
Deputy, Environmental Branch

Enclosure:

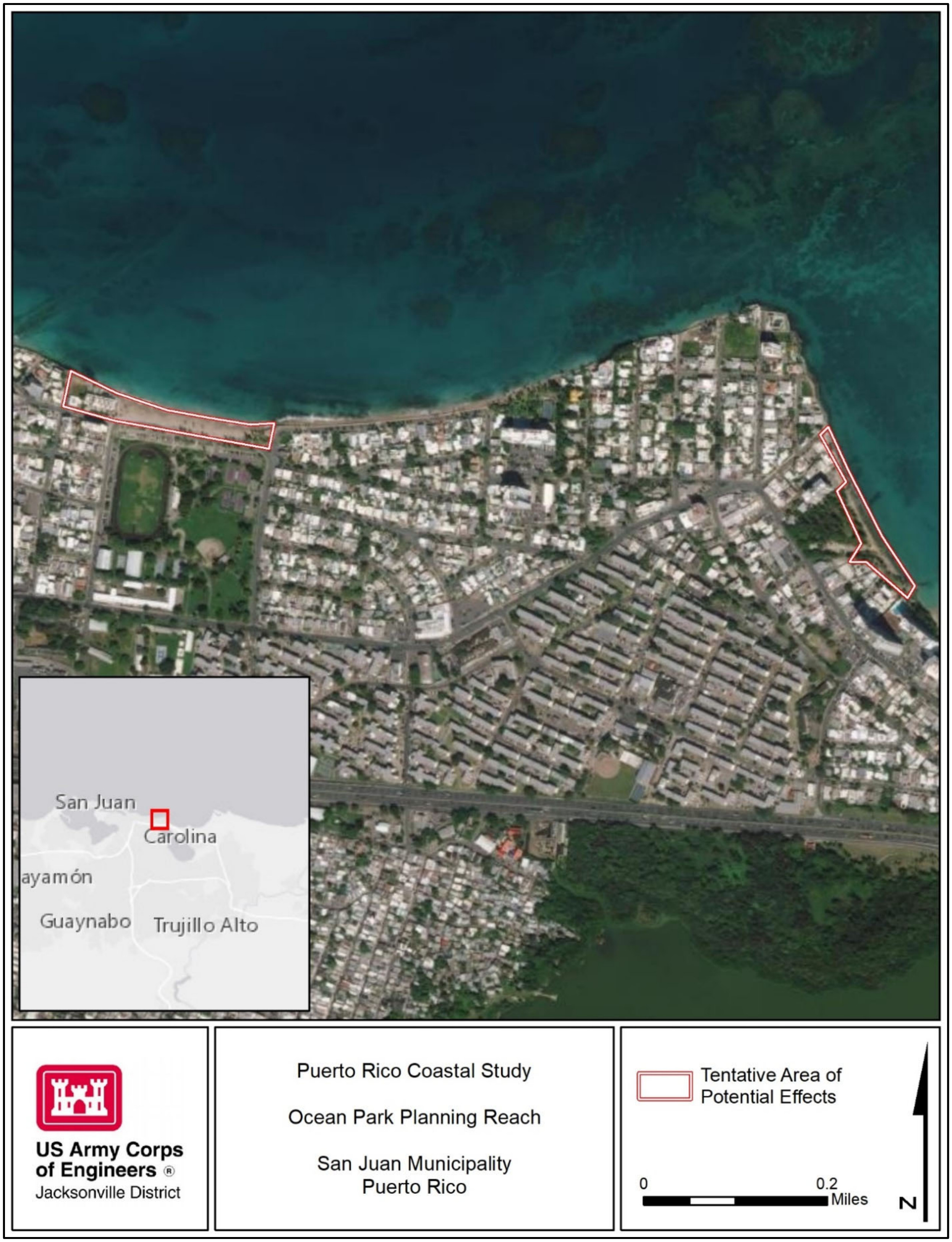

Figure 1. Ocean Park Planning Reach Tentative Area of Potential Effects.

Figure 2. Rincón Planning Reach Tentative Area of Potential Effects.

From:	Samuel Sanchez Tirado
To:	Suarez, Jon Simon C CIV USARMY CESAJ (USA)
Subject:	[Non-DoD Source] Re: Puerto Rico Coastal Revised Draft Programmatic Agreement
Date:	Friday, February 24, 2023 3:21:06 PM

Hello,
Hope you are ok, thanks for the information.

On 2023-02-24 10:33 am, Suarez, Jon Simon C CIV USARMY CESAJ (USA) wrote:
> Hello,
>
> I hope your week is going well!
>
> As part of the Puerto Rico Coastal feasibility study, the United
> States Army Corps of Engineers has refined the project area of
> potential effects (APE) to reflect the tentatively select plan. The
> attached letter presents the refined APE and a revised draft of the PA
> for phased compliance with Section 106 of the National Historic
> Preservation Act. Pursuant to 36 CFR § 800.4(a)(1) the Corps kindly
> requests your comments on the proposed tentative APE and draft PA
> within 30 days from receipt of this letter.
>
> Regards,
>
> Jon Simon Suarez, M.A., RPA
>
> Archaeologist
>
> Planning and Policy Division
>
> US Army Corps of Engineers, Jacksonville District
>
> 904-232-3634 (Office) - Forwarded when teleworking or traveling
>
> JonSimon.C.Suarez@usace.army.mil

--
Samuel Sanchez Tirado
Sacretaria de Operaciones y
Desarrollo Economico
Municipio de Rincon
787-823-2180 Ext.2020

From: Suarez, Jon Simon C CIV USARMY CESAJ (USA)
Sent: Friday, February 24, 2023 11:10 AM
To: PRSHPO Submissions
Subject: RE: Puerto Rico Coastal Revised Draft Programmatic Agreement

¡Gracias!

Qué tenga un buen fin de semana.

Regards,

Jon Simon Suarez, M.A., RPA
Archaeologist
Planning and Policy Division
US Army Corps of Engineers, Jacksonville District
904-232-3634 (Office) – Forwarded when teleworking or traveling
JonSimon.C.Suarez@usace.army.mil

From: PRSHPO Submissions <submissions@prshpo.pr.gov>
Sent: Friday, February 24, 2023 10:34 AM
To: Suarez, Jon Simon C CIV USARMY CESAJ (USA) <JonSimon.C.Suarez@usace.army.mil>
Subject: [Non-DoD Source] Fw: Puerto Rico Coastal Revised Draft Programmatic Agreement

GOBIERNO DE PUERTO RICO
OFICINA ESTATAL DE CONSERVACIÓN HISTÓRICA

Saludos!

Acusamos el recibo de su correo electrónico, próximamente uno de nuestros especialistas evaluará su proyecto.

Cordialmente,

Solimar Resto Feliciano

Asistente Administrativa
P.O. BOX 00902-3935

San Juan, P.R. 00902-3935

T. (787) 721-3737 x.2025

F.(787) 721-3773

SHPO OFICINA ESTATAL DE CONSERVACIÓN HISTÓRICA OFICINA DEL GOBERNADOR STATE HISTORIC PRESERVATION OFFICE OFFICE OF THE GOVERNOR OECH

From: Suarez, Jon Simon C CIV USARMY CESAJ (USA) <JonSimon.C.Suarez@usace.army.mil>
Sent: Friday, February 24, 2023 9:44 AM
To: PRSHPO Submissions <submissions@prshpo.pr.gov>
Cc: Gloria Ortiz <gmortiz@prshpo.pr.gov>; Altes, Christopher F CIV USARMY CESAJ (USA) <Christopher.F.Altes@usace.army.mil>
Subject: Puerto Rico Coastal Revised Draft Programmatic Agreement

Hello,

I hope your week is going well!

As part of the Puerto Rico Coastal feasibility study, the United States Army Corps of Engineers has refined the project area of potential effects (APE) to reflect the tentatively select plan. The attached letter presents the refined APE and a revised draft of the PA for phased compliance with Section 106 of the National Historic Preservation Act. Pursuant to 36 CFR § 800.4(a)(1) the Corps kindly requests your comments on the proposed tentative APE and draft PA within 30 days from receipt of this letter.

Regards,

Jon Simon Suarez, M.A., RPA

Archaeologist
Planning and Policy Division
US Army Corps of Engineers, Jacksonville District
904-232-3634 (Office) – Forwarded when teleworking or traveling
JonSimon.C.Suarez@usace.army.mil

From: Miguel Bonini <mbonini@prshpo.pr.gov>
Sent: Thursday, March 23, 2023 5:27 PM
To: Suarez, Jon Simon C CIV USARMY CESAJ (USA)
Cc: Altes, Christopher F CIV USARMY CESAJ (USA); Gloria Ortiz; PRSHPO Submissions
Subject: [Non-DoD Source] FW: SHPO: 10-23-18-02 DRAFT PROGRAMMATIC AGREEMENT - PUERTO RICO COASTAL STORM RISK MANAGEMENT PROJECT, RINCON AND SAN JUAN
Attachments: 2023-02-24_USACEtoSHPO_PRCoastalRevisedAPEPA.pdf; DRAFT_PR-Coastal-PA_02-24-23.pdf

Greetings,

I have gone over the draft PA submitted for our review. Here are my observations:

Stip. I.B – Construction should be "ground disturbing or demolition activities" associated with the undertaking. The phrase "which have the potential to effect" should be deleted, because any ground disturbing or demolition activity has the potential to affect historic properties.
Stip. VIII – The phrase "or electronic mail at the contact information below" (underline added), I didn't see any contact info, per se, so the underlined should best be deleted.
Stip. IX – The phrase "amendments to the Project's APE" should be changed to "modifications [or revisions] to the Project's APE." Any amendments are to the PA as a whole.

Should any of the invited concurring parties accept, there should be spaces made available for them to affix their concurrence.

Any questions, please do not hesitate to contact me.

Mickey

Miguel A. Bonini
Senior Historic Property Specialist
P.O. Box 9023935
San Juan, P.R. 00902-3935
T. (787) 721-3737 Ext.2005
F. (787) 721-3773

From: PRSHPO Submissions <submissions@prshpo.pr.gov>
Sent: Friday, February 24, 2023 11:39 AM
To: Miguel Bonini <mbonini@prshpo.pr.gov>
Subject: SHPO: 10-23-18-02 DRAFT PROGRAMMATIC AGREEMENT - PUERTO RICO COASTAL STORM RISK MANAGEMENT PROJECT, RINCON AND SAN JUAN

Saludos!

Para evaluar, gracias.
SHPO: 10-23-18-02 ISLANDWIDE

From: PRSHPO Submissions <submissions@prshpo.pr.gov>
Sent: Friday, February 24, 2023 10:33 AM
To: JonSimon.C.Suarez@usace.army.mil <JonSimon.C.Suarez@usace.army.mil>
Subject: Fw: Puerto Rico Coastal Revised Draft Programmatic Agreement

GOBIERNO DE PUERTO RICO
OFICINA ESTATAL DE CONSERVACIÓN HISTÓRICA

Saludos!

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OFICINA ESTATAL DE CONSERVACIÓN HISTÓRICA
OFICINA DEL GOBERNADOR
STATE HISTORIC PRESERVATION OFFICE
OFFICE OF THE GOVERNOR

From: Suarez, Jon Simon C CIV USARMY CESAJ (USA) <JonSimon.C.Suarez@usace.army.mil>
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Regards,

Jon Simon Suarez, M.A., RPA
Archaeologist
Planning and Policy Division
US Army Corps of Engineers, Jacksonville District
904-232-3634 (Office) – Forwarded when teleworking or traveling
JonSimon.C.Suarez@usace.army.mil

DRAFT PROGRAMMATIC AGREEMENT
AMONG
THE U.S. ARMY CORPS OF ENGINEERS, THE PUERTO RICO STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION (IF PARTICIPATING)
REGARDING THE PUERTO RICO COASTAL STORM RISK MANAGEMENT PROJECT, RINCÓN AND SAN JUAN, PUERTO RICO

WHEREAS, the U.S. Army Corps of Engineers, Jacksonville District (Corps), is studying the effects of constructing coastal storm risk management features in the municipalities of Rincón and San Juan, Puerto Rico as part of the Puerto Rico Coastal Storm Risk Management Project (Project), as authorized by the Bipartisan Budget Act of 2018 (Public Law 115-123);

WHEREAS, the Project is being developed to reduce the risk of the coastal storm damage from hurricanes and large storms which result in danger to residents and damage to residential, public, and commercial property in the municipalities of Rincón and San Juan;

WHEREAS, the Corps has determined that the Project constitutes an undertaking, as defined in 36 CFR § 800.16(y), and therefore is subject to Section 106 of the National Historic Preservation Act of 1966, 54 USC § 306108 (NHPA);

WHEREAS, the Corps identified a Tentatively Selected Plans (TSP) from an array of alternatives assessed as part of the Project and developed tentative areas of potential effects (APE) for the TSP, which consists of coastal areas in the municipality of San Juan (Ocean Park Planning Reach) and the shoreline in the municipality of Rincón (Rincón Planning Reach), as shown in **Attachment 1**;

WHEREAS, the Project identified the TSP as floodwalls with rock armor toe protection and removable flood gates within the Ocean Park Planning Reach and managed retreat within the Rincón Planning Reach;

WHEREAS, the APE may be revised and further defined as a result of planned economic and engineering analyses to determine the most effective methods, designs, and footprints of the Project features during the Preconstruction Engineering and Design (PED) phase, which may require additional surveys to identify and evaluate cultural resources and determine effects of potential impacts;

WHEREAS, the Corps has determined that the Project has the potential to affect properties eligible for listing in the National Register of Historic Places (NRHP) and has consulted with the Puerto Rico State Historic Preservation Officer (SHPO) pursuant to Section 106 of the NHPA;

WHEREAS, the Corps, with the concurrence of SHPO, will comply with Section 106 of the NHPA for the undertaking through the execution and implementation of this Programmatic Agreement (Agreement), following 36 CFR § 800.14(b);

WHEREAS, the Institute for Puerto Rican Culture (Instituto de Cultura Puertorriqueña) (ICP) was invited to participate in this agreement as a Concurring Party and the ICP was non-responsive in electing to participate in this agreement;

WHEREAS, the non-federal sponsor for the Project, the Puerto Rico Department of Environmental and Natural Resources (DNER), has been invited to participate in this agreement as a Concurring Party, and the DNER has accepted/declined;

WHEREAS, the municipalities of San Juan and Rincón have been invited to participate in this agreement as a Concurring Party, and have accepted/declined;

WHEREAS, in accordance with 36 CFR § 800.14(b), the Corps invited the Advisory Council on Historic Preservation (ACHP) to participate in this Agreement as a Signatory and the ACHP elected (or declined) to participate as a Signatory;

WHEREAS, in accordance with 36 CFR § 800.6(a)(4) and 36 CFR § 800.14(b)(2)(ii), the Corps has conducted public meetings for the Project to provide opportunities for members of the public to comment on cultural resources in Aguadilla on November 6, 2018, in Rincón on June 18, 2019, September 13, 2022, and March 28, 2023, in San Juan on November 8, 2018, June 20, 2019, September 14, 2022, and March 30, 2023, and in public webinars, and the Corps maintains public websites for the studies at https://www.saj.usace.army.mil/PuertoRicoCSRMFeasibilityStudy/;

WHEREAS, the Corps has included information on the Section 106 process, including a draft Agreement, in the Project's Draft Environmental Assessment, which was provided for public review and an opportunity to comment on November 20, 2020, and March 10, 2023; and

NOW, THEREFORE, the Corps, SHPO, and the ACHP (if participating) (hereinafter referred to as Signatories) agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

The Corps shall ensure that the following measures are carried out:

I. TREATMENT OF HISTORIC PROPERTIES

A. AREA OF POTENTIAL EFFECTS
As plans and designs are refined, the Corps may revise the APE. The Corps shall consult on that revision in accordance with Stipulation III (Timeframes and Review Procedures), and the Corps shall determine the potential for Project activities in a revised APE to affect potential historic properties pursuant to 36 CFR §§ 800.3 - 800.5. If the Corps determines that changes to the APE will affect historic properties, the Corps shall consult on this finding of effect in accordance with Stipulation I.C (Determination of Effects).

B. IDENTIFICATION AND EVALUATION
The Corps shall complete any identification and evaluation of historic properties in consultation with the SHPO prior to beginning construction, defined as ground-disturbing activities which have the potential to effect historic properties. If the Project is authorized and receives appropriations for the Preconstruction Engineering and Design, the Corps will see the following steps are carried out. This will be prior to any ground-disturbing construction activities.

1. Identification of historic properties: An inventory of properties within the final APE, agreed to under Stipulation I.A (Areas of Potential Effects), consistent with the *Secretary of Interior's Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716–44740) will be

initiated for the undertaking when the Project received authorization and appropriation.

a. All cultural resources surveys and associated reporting will comply with all applicable SHPO guidelines (*Guía para Preparar Informes Arqueológicos, Fases I, II, III*). Survey recordation shall include features, isolates, and re-recordation of previously recorded sites, as necessary. The survey shall ensure that historic properties such as historical structures and buildings, historical engineering features, landscapes, viewsheds, and traditional cultural properties (TCPs), are recorded in addition to archaeological sites. Recordation of historic structures, buildings, objects, and sites shall be prepared using the SHPO Site File forms (*Hoja de Registro de Yacimientos Arqueológicos)*. If the guidelines or forms are updated during the implementation of this project, the updated documents will be incorporated without the need to amend this agreement.

b. The Corps shall submit Identification and Evaluation reports for SHPO and Signatories for review and comment consistent with Stipulation III (Timeframes and Review Procedures).

2. Determinations of Eligibility: The Corps shall review or determine NHRP eligibility based on identification and evaluation efforts and consult with the Signatories regarding these determinations. Should SHPO disagree with the determination of eligibility, the Corps shall either:

   a. Elect to consult further with the objecting party until the objection is resolved; or

   b. Obtain a formal determination of eligibility from the Keeper of the National Register, . 36 CFR § 63.4.

C. DETERMINATION OF EFFECTS

1. Findings of **No Historic Properties Affected**:

   a. Basis for Finding. The Corps shall make a finding of "no historic properties affected" under the following circumstances:

      i. If no historic properties are present in the APE; or

      ii. The undertaking shall avoid effects to historic properties (including cumulative effects).

   b. The Corps shall notify Signatories of this finding and provide supporting documentation in accordance with 36 CFR § 800.11(d). Unless the Signatories objects to the finding within 30 days, the review of the undertaking will have concluded.

   c. If the Signatories object to a finding of "no historic properties affected," the Corps shall consult with the objecting party to resolve the disagreement.

      i. If the objection is resolved, the Corps either may proceed with the undertaking in accordance with the resolution or reconsider effects on the historic property by applying the criteria of adverse effect pursuant to 36 CFR § 800.5(a)(1).

      ii. If the Corps is unable to resolve the disagreement, it will forward the finding and supporting documentation to ACHP and request that ACHP review the Corps' finding in accordance with the process described Stipulation VII (Dispute Resolution). The Corps shall prepare a summary of its decision that contains the rationale for the decision and evidence of consideration of the ACHP's opinion and provide this to the Signatories. If the Corps' final determination is to reaffirm its "no historic properties affected" finding, the Section 106 review of the undertaking will have concluded. If the Corps revises its finding then it shall proceed to Stipulation I.C.2 or Stipulation I.C.3 (below).

2. Findings of **No Adverse Effect:** If the Corps determines that the undertaking does not meet the adverse effect criteria, the Corps shall propose a finding of "no adverse effect" and consult with

the Signatories in accordance with 36 CFR § 800.5(b) and following steps a-c below.

a. The Corps shall notify Signatories of its finding; describe any project specific conditions and/or modifications required to the undertaking to avoid or minimize effects to historic properties; and provide supporting documentation pursuant to 36 CFR § 800.11(e).
b. Unless a Signatory objects within 30 days, the Corps will proceed with its "no adverse effect" determination and conclude the review.
c. If a Signatory objects to a finding of "no adverse effect," the Corps will consult with the objecting party to resolve the disagreement.
   i. If the objection is resolved, the Corps shall proceed with the undertaking in accordance with the resolution; or
   ii. If the objection cannot be resolved, the Corps shall request that ACHP review the findings in accordance with 36 CFR § 800.5(c)(3)(i)-(ii) and submit the required supporting documentation. The Corps shall, pursuant 36 CFR § 800.5(c)(3)(ii)(B), prepare a summary of its decision that contains the rationale for the decision and evidence of consideration of the ACHP's opinion, and provide this to the Signatories. If the Corps' final determination is to reaffirm its "no adverse effect" finding, the review of the undertaking will have concluded. If the Corps will revise its finding then it shall proceed to Stipulation I.C.3 below.
d. Avoidance and Minimization of Adverse Effects: Avoidance of adverse effects to historic properties is the preferred Historic Properties Treatment Plan (HPTP) approach. The Corps will consider redesign of elements of the undertaking in order to avoid and/or minimize historic properties and Project effects that may be adverse. If the Corps determines that the undertaking cannot be modified to avoid or minimize effects, the Corps will make a determination of Adverse Effect.

3. **Determination of Adverse Effects**: If the Corps determines that an undertaking may adversely affect a historic property, it shall notify Signatories of the determination and consult to resolve the adverse effects as outlined in Section I.D Historic Properties Treatment Plan.

D. HISTORIC PROPERTIES TREATMENT PLAN

1. If the Corps determines that the Project will result in adverse effects, the Corps, in consultation with the Signatories, shall develop a HPTP to resolve all adverse effects resulting from the Project, which would be attached to this Agreement as **Attachment 2**. The HPTP shall outline the minimization and mitigation measures necessary to resolve the adverse effects to historic properties. Proposed mitigation measures may include, but are not limited to, historic markers, interpretive brochures, data recovery, documentation, and publications, depending on their criterion for eligibility. Development of appropriate measures shall include consideration of historic property types and provisions for avoidance or protection of historic properties where possible. If it is determined that archaeological monitoring is appropriate, the HPTP shall include a Monitoring Plan. Should the Signatories be unable to agree on a HPTP, the Signatories shall proceed in accordance with Stipulation VII (Dispute Resolution)
2. If adverse effects are identified, the HPTP shall be in effect before construction commences. The Corps would submit the HPTP for review, in accordance with Stipulation III (Timeframes and Review Procedures). The Corps shall ensure that the provisions of the HPTP, as outlined in the consultation and agreed to by SHPO, are documented in writing and implemented. The use of a HPTP shall not require the execution of an individual Memorandum of Agreement or Programmatic Agreement (Agreement) and follow the provisions below (a-e).

a. Review: The Corps shall submit the Draft HPTP to the Signatories for review and comment pursuant to Stipulation III (Timeframes and Review Procedures).
b. Reporting: Reports and other data pertaining to the treatment of effects to historic properties will be distributed to Signatories and other members of the public, consistent with Stipulation VI (Confidentiality) of this Agreement, unless a Signatory(s) have indicated through consultation that they do not want to receive a report or data. Reports will be consistent with the procedures outlined in the SHPO's *Guía para Preparar Informes Arqueológicos, Fases I, II, III.*
c. Amendments/Addendums/Revisions**:** If a historic property that is not covered by the existing HPTP is discovered within the APE subsequent to the initial inventory effort, or if there are previously unexpected effects to a historic property, or if the Corps and SHPO agree that a modification to the HPTP is necessary, the Corps shall prepare an addendum to the HPTP. If necessary, the Corps shall then submit the addendum to the Signatories and follow the provisions of Stipulation III (Timeframes and Review Procedures). The HPTP may cover multiple discoveries for the same property type.
d. Data Recovery: When data recovery is proposed, the Corps, in consultation with the Signatories, shall ensure that specific Research Designs are developed consistent with the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation*, SHPO's *Guía para Preparar Informes Arqueológicos, Fases I, II, III*, and the ACHP's "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites" (ACHP, May 18, 1999).
e. Final Report Documenting Implementation of the HPTP: Within one (1) year after the completion of all work for the Project, the Corps shall submit to the Signatories a Final Report documenting the results of all work prepared under the HPTP, and the information learned from each of the historic properties. The submittal of the Final Report shall be in accordance with Stipulation III (Timeframes and Review Procedures).

II. QUALIFICATIONS

A. PROFESSIONAL QUALIFICATIONS

All technical work required for historic preservation activities implemented pursuant to this Agreement shall be carried out by or under the direct supervision of a person or persons meeting, at a minimum, the *Secretary of the Interior's Historic Preservation Professional Qualification Standards* for archeology, history, or architecture as appropriate (48 FR 44738-44739). "Technical work" here means all efforts to inventory, evaluate, and perform subsequent treatment such as data recovery excavation or recordation of potential historic properties that is required under this Agreement. This stipulation shall not be construed to limit peer review, guidance, or editing of documents by SHPO and associated Project consultants.

B. HISTORIC PRESERVATION STANDARDS

Historic preservation activities carried out pursuant to this Agreement shall meet the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as standards and guidelines for historic preservation activities established by the SHPO. The Corps shall ensure that all reports prepared pursuant to this Agreement will be provided to the Signatories, are distributed in accordance with Stipulation VI (Confidentiality), and meet published standards of the Puerto Rico State Historic Preservation Office, specifically, the Puerto Rico SHPO's

Guía para Preparar Informes Arqueológicos, Fases I, II, III.

III. TIME FRAMES AND REVIEW PROCEDURES

For all documents and deliverables produced in compliance with this Agreement, the Corps shall provide a hard copy draft document via mail to the Signatories for review and concurrence. If Signatories agree, draft documents may be sent electronically for formal review and for communications amongst themselves for activities in support of this Agreement. Any written comments provided by the Signatories within 30 calendar days from the date of receipt shall be considered in the revision of the document or deliverable. If no comments are received from the Signatories within the 30 calendar-day review period, the Corps may assume that the non-responsive party has no comment. The Corps shall document and report any written comments received for the document or deliverable and how comments were addressed. If comments were received and incorporated into the final document or deliverable, the Corps shall provide a revised final to the SHPO for concurrence. The Signatories shall have 30 calendar days to respond. Failure of the Signatories to respond within 30 calendar days of receipt of any document or deliverable shall not preclude the Corps from moving to the next step in this Agreement. A copy of the final document shall be provided to the Signatories, subject to the limitations in Stipulation VI (Confidentiality).

IV. TREATMENT OF HUMAN REMAINS

Human remains and grave goods encountered during the Undertaking that are located on non-federal lands will be treated in accordance with the February 23, 2007 ACHP *Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects*.

V. PUBLIC CONSULTATION AND PUBLIC NOTICE

The interested public will be invited to provide input during the implementation of this Agreement. The Corps shall carry this out through letters of notification, public meetings, environmental assessment/environmental impact statements, site visits and/or other appropriate methods. The Corps shall ensure that any comments received from members of the public are taken under consideration and incorporated where appropriate. Review periods shall be consistent with Stipulation III (Timeframes and Review Procedures). In seeking input from the interested public, locations of historic properties will be handled in accordance with Stipulation VI (Confidentiality). In cases where the release of location information may cause harm to the historic property, this information will be withheld from the public in accordance with Section 304 of the NHPA (54 USC § 307103).

VI. CONFIDENTIALITY

The Signatories to this Agreement acknowledge that historic properties are subject to the provisions of Section 304 of the NHPA (54 USC § 307103) and 36 CFR § 800.11(c), relating to the disclosure of information about the location, character or ownership of a historic property, and will ensure that any disclosure of information under this Agreement is consistent with the terms of this Agreement and with Section 304 of the NHPA (54 USC § 307103), 36 CFR § 800.11(c), and the Freedom of Information Act (5 USC § 552), as amended. Confidentiality regarding the specific nature and location of the archaeological sites and any other cultural resources discussed in this Agreement shall be maintained to the extent allowable by law. Dissemination of such information shall be limited to appropriate personnel within the Corps (including their contractors), the Signatories, and those parties involved in planning, reviewing, and implementing this Agreement. When information is provided to the Corps by SHPO or others who wish to control the dissemination of that information more than described above, the Corps will make a good faith effort to do so, to the extent permissible by federal law.

VII. DISPUTE RESOLUTION

A. OBJECTION BY A SIGNATORY

Should any Signatory to this Agreement object at any time to any actions proposed or the manner in which the terms of this agreement are implemented, the Corps shall consult with such party to resolve the objection. If the Corps determines that such objection cannot be resolved, the Corps will:

1. Forward all documentation relevant to the dispute, including the Corps' proposed resolution, to the ACHP. The ACHP shall provide the Corps with its advice on the resolution of the objection within 30 days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the Corps shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP and Signatories and provide them with a copy of this written response. The Corps will then proceed according to its final decision.
2. If the ACHP does not provide its advice regarding the dispute within the 30-day time period, the Corps may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the Corps shall prepare a written response that takes into account any timely comments regarding the dispute from the Signatories to the Agreement and provide them and the ACHP with a copy of such written response.
3. The Corps' responsibility to carry out all other actions subject to the terms of this Agreement that are not the subject of the dispute remain unchanged.

B. OBJECTION BY THE PUBLIC

At any time during implementation of the measures stipulated in this Agreement, should an objection pertaining to the Agreement be raised by a member of the public, the Corps shall notify the Signatories and take the objection under consideration, consulting with the objecting party and, should the objecting party request, any of the Signatories to this Agreement, for no longer than 15 calendar days. The Corps shall consider the objection, and in reaching its decision, will consider all comments provided by the other Signatories. Within 15 calendar days following closure of the comment period, the Corps will render a decision regarding the objection and respond to the objecting party. The Corps will promptly provide written notification of its decision to the other Signatories, including a copy of the response to the objecting party. The Corps' decision regarding resolution of the objection will be final. Following issuance of its final decision, the Corps may authorize the action that was the subject of the dispute to proceed in accordance with the terms of that decision. The Corps' responsibility to carry out all other actions under this Agreement shall remain unchanged.

C. OBJECTION ON NRHP ELIGIBILITY

Should any Signatory Party to this Agreement object in writing to the determination of National Register eligibility, the objection will be addressed pursuant to 36 CFR § 800.4(c)(2) and Stipulation I.B.2.

VIII. NOTICE

All notices, demands, requests, consents, approvals, or communications from all parties to this Agreement to other parties to this Agreement shall be either personally delivered, sent by United States Mail, or electronic mail at the contact information below. All parties shall be considered in receipt of the materials on the day after it being sent by electronic mail.

If Signatories agree in advance, in writing or by electronic mail, facsimiles, copies, or electronic versions of signed documents may be used as if they bore original signatures.

If Signatories agree, hard copies and/or electronic communications may be used for formal communication amongst themselves for activities in support of Stipulation III (Time Frames and Review Procedures).

IX. AMENDMENTS AND TERMINATION

A. AMENDMENT
Any Signatory Party to this Agreement may propose that the Agreement be amended, whereupon the Corps shall consult with the Signatories to consider such amendment. This Agreement may be amended when such an amendment is agreed to in writing by all Signatories. The amendment will be effective on the date a copy signed by all of the Signatories is filed with the ACHP.

All appendices to this Agreement, and other instruments prepared pursuant to this Agreement including, but not limited to, the maps of the APE may be individually revised or updated through consultation consistent with Stipulation III (Timeframes and Review Procedures) and Agreement in writing of the Signatories without requiring amendment of this Agreement, unless the Signatories through such consultation decide otherwise. In accordance and Stipulation V (Public Consultation and Public Notice), the Signatories and interested members of the public, will receive amendments to the Project's APE as appropriate, and copies of any amendment(s) to the Agreement.

B. TERMINATION
Any Signatory to this Agreement may terminate this Agreement. If this Agreement is not amended as provided for in Stipulation IX.A., or if any Signatory proposes termination of this Agreement, the Signatory proposing termination shall notify the other Signatories in writing, explain the reasons for proposing termination, and consult with the other Signatories to seek alternatives to termination, within 30 calendar days of the notification.

1. Should such consultation result in an agreement on an alternative to termination, the Signatories shall proceed in accordance with that agreement and amend the Agreement as required.
2. Should such consultation fail, the Signatory proposing termination may terminate this Agreement by promptly notifying the other Signatories in writing.
3. Beginning with the date of termination, the Corps shall ensure that until and unless a new agreement is executed for the actions covered by this Agreement, such undertakings shall be reviewed individually in accordance with 36 CFR §§ 800.4-800.6.

X. DURATION

This Agreement shall remain in effect for a period of 10 years after the date it takes effect and shall automatically expire and have no further force or effect at the end of this 10-year period unless it is extended by the Signatories prior to that time. No later than ninety (90) calendar days prior to the expiration date of the Agreement, the Corps shall initiate consultation to determine if the Agreement should be allowed to expire automatically or whether it should be extended, with or without amendments, as the Signatories may determine.

XI. EFFECTIVE DATE

This Agreement shall take effect on the date a copy signed by all of the Signatories is filed with the ACHP.

XII. EXECUTION

Execution of this Agreement by the Signatories and the implementation of its terms evidence that the Corps has taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

SIGNATORIES TO THIS Agreement:

U.S. ARMY CORPS OF ENGINEERS, JACKSONVILLE DISTRICT

BY: ____ DATE: _________________

James L. Booth, Colonel, U.S. Army Corps of Engineers, District Commander

PUERTO RICO STATE HISTORIC PRESERVATION OFFICER

BY: ____ DATE: _________________

Carlos A. Rubio Cancela, State Historic Preservation Office, State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY: ____ DATE: _________________

Reid J. Nelson, Executive Director (acting) (If Participating)

Attachment 1

Maps of the Tentative Area of Potential Effects in the Planning Reaches

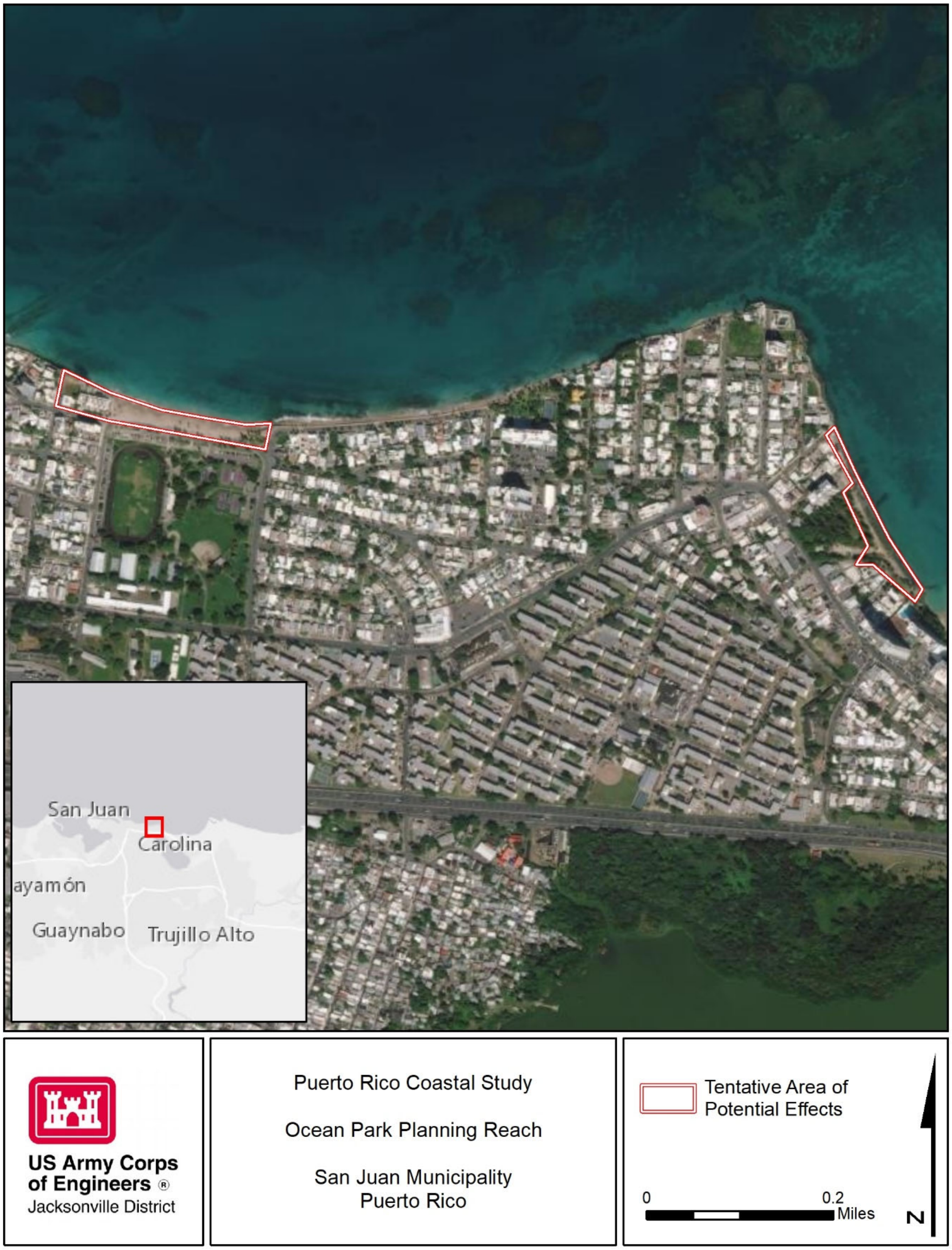

Figure 1. Ocean Park Planning Reach Tentative APE

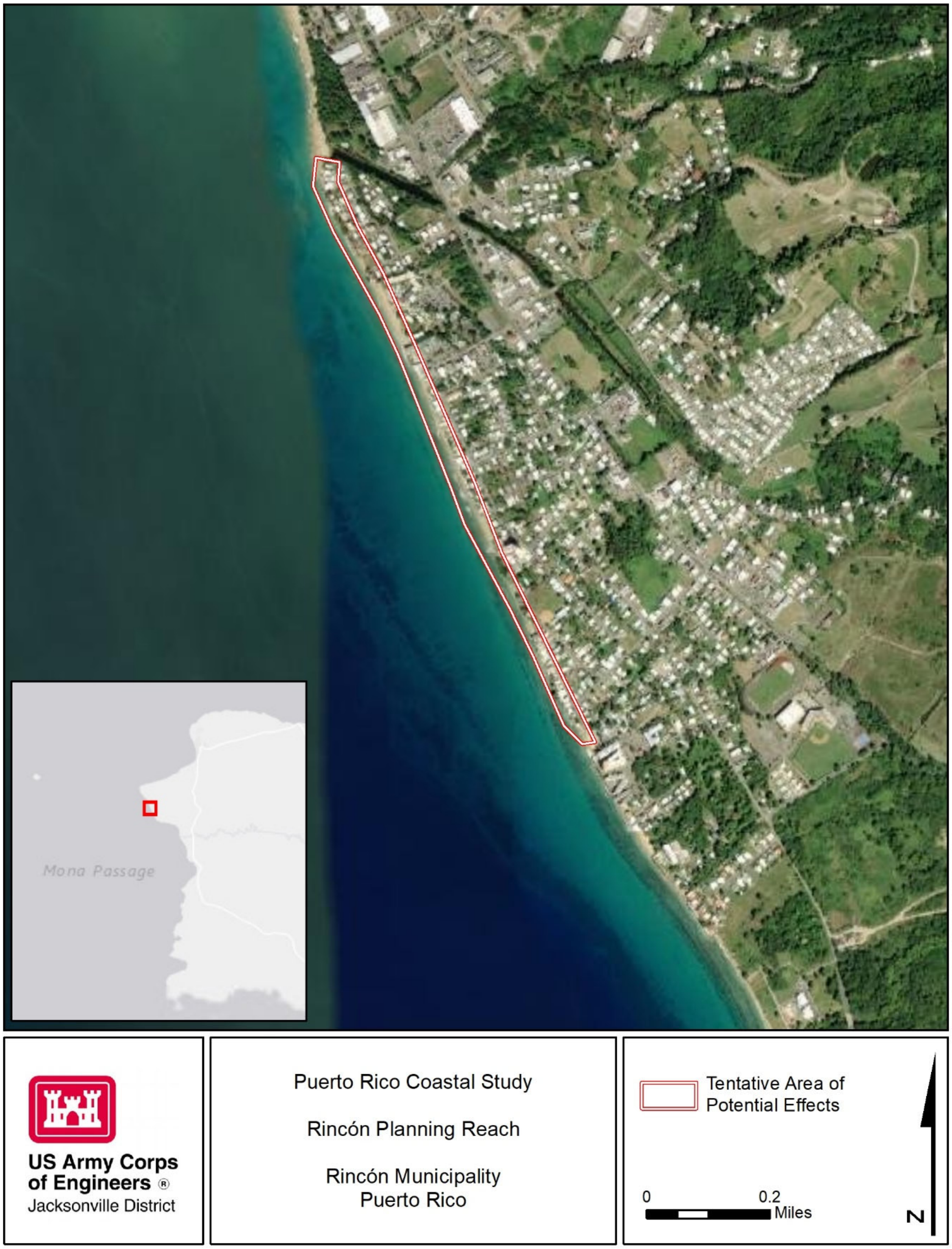

Figure 2. Rincón Planning Reach Tentative APE

Attachment 2

Historic Properties Treatment Plan