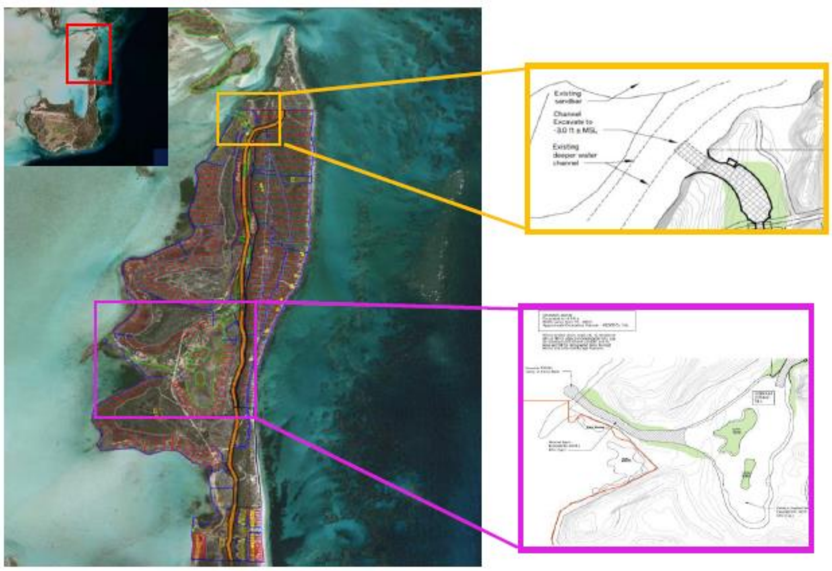
DRAFT COMPREHENSIVE ENVIRONMENTAL IMPACT ASSESSMENT (CEIA)

REPORT - BLUE WATER LAGOON BASIN, PENINSULA INLAND CANAL, ENTRANCE CHANNELS, AND BOAT DOCKS PROJECT

SC. 808 AND 809 - 20202/24, 257, 267, 269, 270, 334 & 356

SAIL ROCK PENINSULA

SOUTH CAICOS, TURKS AND CAICOS ISLANDS



SAIL ROCK DEVELOPMENT LIMITED

MARCH 2023

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COMPREHENSIVE ENVIRONMENTAL IMPACT ASSESSMENT (CEIA) BLUE WATER LAGOON BASIN, PENINSULA INLAND CANAL, ENTRANCE CHANNELS, AND BOAT DOCK DEVELOPMENT FOR PLANNING APPLICATION REFERENCE SC. 808 & SC. 809 - BLOCK AND PARCEL NUMBERS 2020/24, 257, 267, 269, 270, 334, AND 356 SAIL ROCK PENINSULA, SOUTH CAICOS TURKS AND CAICOS ISLANDS FOR SAIL ROCK ESTATES LIMITED

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SECTION I INTRODUCTION AND OVERVIEW

Non-technical Summary

1. This Comprehensive Environmental Impact Assessment (CEIA) study for the proposed Creation of a Blue Water Lagoon Basin, Peninsula Inland Canal system, Entrance Channels, and boat dock slips on block and parcel numbers 20202/24, 269, 270, 331, 334, 356 and 357, Sail Rock Peninsula, South Caicos, Turks and Caicos Islands was prepared by Caribbean Environmental Design Associates in conjunction with Smith Warner International, JNS Environmental Consulting, Sustainable International and EnvironmentalAll for Sail Rock Development Limited.

2. The proposed blue water lagoon basin, peninsula inland canal system, entrance channels, and boat dock slips are designed to enhance and provide recreational amenities for the anchored Sail Rock Boutique and Villa development situated in the same land area as the proposed development.

3. The proposed channel is designed to provide a low wave height, and a calm area for patrons to wade and conduct water sports activities and will be a rainwater reservoir that assists against flooding and will eventually flush into the coastal area.

4. The proposed blue water lagoon and associated development experienced a metamorphosis of design processes over the years, to the multi-entrance channels and the peninsula canal system, designed to provide adequate flushing. The initial design concept for an anchor development on South Caicos did not allow sufficient flushing of the lagoon basin, leading to stagnant waters and algae, hence, the modification of the design concept into a workable one.

5. The CEIA team conducted multi-comprehensive environmental impact assessment studies (CIAs) in the various environmental disciplines, including terrestrial and geological land base, marine, and coastal to collect, and analyze baseline data to address identified environmental impact associated with the proposed development and suggest mitigation and monitoring measures address identified adverse impacts.

6. The introduction of heavy earth-moving equipment and earth-moving activities will subject the physical environment to potential dust pollution over a short-term period. Increased traffic movements during construction will elevate localized dust levels.

7. Consequently, from the terrestrial baseline assessment the vegetative communities were categorized in accordance with the National Standardized Vegetation Classification, 2010 (TCINVC), and descriptions were provided for the unique communities.

8. Assessments of the landside ecology indicate that the site is composed of a mosaic of upland and wetland habitats that have been moderately disturbed by various natural and human-related activities.

9. Quantitative analysis defined and mapped the geometry of the canal system and developed suggestions for practices and/or techniques to minimize adverse impacts.

10. The coastal baseline assessment concluded that the Sail Rock Peninsula and Bell Sound shoreline shape is impacted by nearshore current conditions and wave climate. This information is portrayed in historical maps, surveys, aerial photos, and satellite imagery.

11. An analysis of the peninsula's shoreline position changes during a 6-year review period revealed that the shorelines are in a state of erosion, with erosion rates of 3.8 meters/year and 1.2 meters/year respectively. However, the shoreline is more stable closer to the northern entrance, with an erosion rate of approximately 1.0 meters/year.
12. The proposed inland canal system is intended to flush into the coastal area immediately north of the Bell Sound Nature Reserve and not directly into the reserve.

13. The hydrogeological environment of South Caicos is a semi-arid tropical region with long hot summers and relatively cooler winter seasons.

14. The Biological Environmental Baseline Assessment revealed the potential presence of 2,162 terrestrial and marine floral and faunal species that occur in the Turks and Caicos Islands, and which are designated as Critically Endangered, Endangered, Near Threatened, Vulnerable, Least Concern, and Data Deficient.

15. Additionally numerous species of terrestrial flora and fauna that were identified during the assessment have the potential to be affected by the proposed activities, and many of the species that are included on the CITES list for the TCI are also on the IUCN list.

16. Numerous tree species had a closed canopy and were found to be in good condition, with high floral diversity, hydrology intact, and evidence of recent hurricanes impacted.

17. The study observed that the qualitative conditions of the Shrubland were rated as Good, as it appeared to be in a mostly natural state and free of human-related and storm-related impacts.

18. The terrestrial assessment also revealed that the dominant vegetation species in this community were buttonwood trees, which varied in height from shrubs to mature, closed-canopy trees in the height range of 10-15 feet (3-4.5 m).

19. This terrestrial community provides nesting sites for passerine birds, and unoccupied nests from previous years suggest that yellow warblers, bananaquits, and Bahamas woodstar hummingbirds likely nest in this community.

20. It was also observed that the presence of dead and stressed buttonwood trees makes this and the adjoining Palustrine Non-vascular community highly variable based on seasonal conditions.

21. The salinity of a sample of surface water in this naturally occurring salt pond was high, more than 130 part-per-thousand (seawater is typically 30-35 ppt) when measured on April 23, 2022.

22. The presence of other foraging shorebirds in areas hydrologically connected to this area suggests that, as least seasonally, this community provides habitat for the suite of small aquatic organisms on which resident and migratory birds feed.

23. The proposed lagoon basin, canal, and the installation of the docks would impact approximately 80 acres of existing terrain, resulting in the conversion of existing native plant and animal communities into a shallow lagoon basin and canal.

24. The ecological assessment found that approximately 18.3 acres of Clear-Cut Land were in the south-central portions of the project site. Trees and shrubs were non-existent in areas of recently cleared lands, and groundcover weeds and grasses were colonizing formerly cleared areas.

25. According to the assessment the Sail Rock Peninsula is home to approximately six species of non-native plants and numerous faunal species.

26. The Bell Sound Nature Reserve is a shallow lagoon area enclosed by the central land mass and peninsula of South Caicos, surrounded by mangrove ecosystems and tidal flats.

27. The operational wave climate at the project site is characterized by day-to-day calm conditions and seasonal winter swells.

28. The coastal assessment discovered that the eastern coast of South Caicos mainly experiences 0.3m to 0.45m high waves approaching from the east, while the shallower western coast experiences much smaller waves (2- 5cm in height) that move offshore in a less uniform manner.

29. The Sail Rock Peninsula has a thin and fragile freshwater lens in isolated patches across the project site.

30. South Caicos is known for its historic ties to the fishing and boating industries, the study recommended that this unique cultural heritage attribute should be utilized to encourage rehabilitation and infill civic infrastructure and waterfront developments.

31. The proposed development will directly impact the coastal marine environment of South Caicos islands, as the two flushing channels that connect the blue lagoon basin and peninsula channel will discharge its waters directly into the marine environment.

32. Small boats operating at the facility would need to be licensed under the maritime requirements and would require routine inspections to ensure that maritime safety standards and operational procedures are met.

33. The study recognized that unless plants designated as Endangered, Threatened, and/or Endemic are salvaged, relocated, and/or protected in situ, they will be lost. However, recommendations are made to ensure that mitigation measures are taken to ensure that they are not lost.

34. Some direct impacts will occur in the southwestern part of the site, where existing mangroves are stunted/dwarfed. Additionally, secondary impacts will occur at the north-western boundary, where landside and marine communities meet.

35. Best Management Practices (BMPs) will ensure that erosion and sediment impacts associated with the overall development are minimized and mitigated.

36. Marine side-dredging operations are limited to the areas where the two entrances channel of the canal are located.

37. Excavated dredge material will be dewatered on the barge or pumped ashore and secure in berms as the excavation proceeds.

38. The channel entrances are to be surrounded by turbidity curtains during the dredging works to limit sediment plumes.

39. The spoils will be directly taken to the landing site, offloaded, and stockpiled in various locations on-site for future use.

40. The lagoon basin, inland canal, and entrance channels are designed to ensure that the sensitive organisms of the Bell Sound Nature Reserve and neighbouring properties are not negatively affected while promoting healthy water quality and minimizing algae formation inside the channel.

41. The swell assessment analysis showed that under swell conditions there are very small waves approaching the channel entrances.

42. The study concluded that maintenance dredging within the channel and near the channel entrances will not be required to maintain functionality.

43. Public access and recreational use are a public right guaranteed by law in the Turks and Caicos Islands, the study recommended that special areas should be set aside to ensure public access to open space, coastal areas, and the lagoon basins.

44. The proposed development will have a direct and positive impact on the local economy, by providing additional employment opportunities, enhancing the local tourism product, benefiting the fishing industry, providing additional water-based recreational activities, and supporting the boating culture and heritage of South Caicos.

45. Sail Rock Development Limited has invested over 100 million dollars in South Caicos thus far. Annually injecting over $500,000.00 into the local economy in salaries and wages and paying 12.5 million dollars and 20 million dollars directly to the government in land transfer, import duties, and other fees since its inception.

46. Additionally, the proposed development is expected to have a significant positive impact on the local tourism product due to the enhanced physical environment, increased opportunities for eco-tourism, and improved fishing and water-based recreational activities.

47. The proposed development has the potential to transform the area into an ecologically enhanced ecosystem with increased biodiversity and contribute to the overall productivity of the coastal waters.

48. Wetlands within the study area provide a variety of ecosystem functions, including soil stabilization, oxygen production, carbon sequestration, foraging, roosting, and/or nesting area for birds and other wildlife.

49. The conversion of previously impacted upland areas to the proposed open-water canal and new inter-tidal shoreline areas will have a positive effect on some faunal species and an adverse effect on other species.

50. Marine areas adjacent to the project site provide direct and indirect economic benefits due to their desirability for non-consumptive ecotourism.

51. Floral monitoring is recommended to salvage plants that are designated as "Protected" and which are relocatable with a reasonably high level of success.

52. Invasive species monitoring is recommended, as the extensive land clearing that is proposed has the potential to create scarified conditions into which invasive species could colonize and become established.

53. Bird surveys should be conducted at least four times per year and should follow a pre-set route and include documentation of both species observed and general abundance.

54. Water quality sampling should be conducted to bring attention to any degradation in water quality, which could pose a challenge to the biotic environment or swimmers.

55. Water quality tests can also shed light on the possible sources of pollution entering the canal if any, as well as validating flushing times.

56. Benthic monitoring should be conducted regularly to map the migration of biological creatures and quantify the populations of species inhabiting the newly formed canal.

57. To assess the post-construction impacts of the proposed works on the coastal and biotic environment, sediment grain size and composition analysis, water quality sampling and benthic monitoring should be conducted regularly.

58. A final inspection after the dredging and excavation works are completed should be carried out to ensure no construction debris is on the seabed before the project is turned over to the developers.

59. The study recommends that local personnel from South Caicos should be trained to conduct ongoing monitoring.

60. Government oversight should be approved by the Department of Environment and Coastal Resources and subjected to routine reporting.

61. The study recommended that to minimize and/or offset ecological impacts, potential activities include micro-siting the alignment of the canal to the west in the vicinity of the seasonal pond and re-aligning the canal to avoid the pond and a minimum 100-foot buffer around the pond.

62. Donkeys are a resource of historical/cultural significance, and Sail Rock development Limited should actively become engaged with the TCSPCA in their efforts to limit the expansion of the donkey population.

63. Field monitoring should be conducted to avoid impacts on nesting birds during land clearing.

64. Education materials should be developed to inform future residents and guests of the presence of species of notable plants and that the collection and transport of endemic, endangered, and/or threatened species are prohibited.

65. Coordination with the landscape team should ensure that no ornamental species on the list of invasive plants are introduced onto the property.

66. Periodic clean-ups should be scheduled and undertaken to remove any material that may accumulate in the canal and/or along its shoreline.

67. Sail Rock Development Limited should engage its engineering team to develop a proactive response plan to ensure an ecologically sensitive program can be implemented if Sargassum is drawn into the canal.

68. Sail Rock Development Limited should partner with the Turks and Caicos Government and others to rehabilitate the Salina, seek opportunities to create aquaculture and hydroponics facilities, and/or create native plant nurseries.

69. Floral diversity at the site includes eighteen species of plants that are notable for their inclusion on the TCIG's lists of Endemic Plants, Lucayan Archipelago Endemics, and/or Native Plants of Special Conservation Concern.

70. To minimize possible major impacts to the bottom community of organisms, a thorough benthic survey should be conducted, and an acceptable form of turbidity control installed.

71. Excavation of the channel within the Sail Rock Peninsula mainland should be completed before the channel entrances are opened to reduce the impact of the tides on construction and prevent turbid waters from escaping into the nearshore.

72. The groundwater component is predominantly saline and the creation of the inland waterway that provides for the ingress of seawater will have a nominal impact on the groundwater configuration.

73. The excavation can be done onsite using conventional land-based equipment such as loaders, excavators, and cranes.

74. The local armor stones/core material for the bank stabilization structures can be stockpiled at locations on land within the project site.

75. Packaging of armor stones in the canal stabilization is recommended to be done such that each boulder is in contact with two or three other boulders, and voids between the boulders can be left as voids and not filled with smaller rocks. The voids can provide habitats for marine animals.

76. Turbidity management techniques (sandbags, barriers etc.) must be used during dredging and during the installation of the temporary construction pad.

77. Invertebrates must be relocated immediately before excavation/construction work begins to prevent them from re-occupying the space during the project.

78. Loss of habitat/ biodiversity is a direct impact of the works proposed at the site, as well as loss of ecological function when the substrate is removed/smothered.

79. The submerged portions of protective structures used in the channel stabilization can serve as excellent fish and coral habitats for increasing biodiversity in the area.

80. impacts to tidal mangroves and the bottom substrate of the canal system and marina basin should be vacuumed to remove fines created during the construction phase.

81. There is presently no structured marina facility on the islands. The proposed boat dock slips at the northern entrance channel and the southern entrance channel will facilitate boating activities including scuba diving, snorkeling, and sport fishing excursions.

82. The proposed lagoon basin and boat dock slips will provide a positive impact on the fishing and boating heritage culture of South Caicos.

83. Sail Rock Development Limited is committed to the restoration and preservation of historical buildings in historic Cockburn. Large sums of money have already been invested in the preservation of historical buildings and have a plan for the enhancement and redevelopment of historic Cockburn Harbour.

84. It is recommended that a bird monitoring program be established, perhaps in association with the South Caicos-based School for Field Studies. Monitoring is recommended.

85. The study recommends that post-construction monitoring follow the pre-construction format on a quarterly basis and include an additional sample station within the constructed marina basin.

86. Debris left on the seabed from the construction activity can become a projectile during severe wave activity, and this may cause damage to sensitive benthic resources or to property on land. It is recommended that a final inspection be carried out to ensure that no construction debris is on the seabed before the completion of the construction/maintenance phase of the project.

87. The study recommends that back-ground water quality samples should be taken prior to the commencement of any work on site. The results should be used to establish a pre-construction baseline.

88. As a compensation measure, the submerged portions of protective structures themselves used in the channel stabilization can serve as an excellent fish and coral habitat for increasing biodiversity in the area.

89. Sail Rock's entire development concept is based on a low-density eco-system principle and the environment is the magnet that draws guests to the development and the island. Therefore, it is imperative that the developers take due care of the environment during the proposed dredging and excavation operations.

90. The result, the blue water lagoon basin will be an added blue water resource in South Caicos that will assist South Caicos and the Turks and Caicos Islands to significantly benefit from the "Blue Economy".

91. An important aspect of the proposed mitigation plan involves the establishment of coastal barriers at the inlet and outlet of the canal system to the north and lagoon basin to the south.

92. The study recommends that an acceptable form of turbidity control will be installed and maintained to prevent/control silt from entering the water column; these controls will always remain in place during the cutting of the proposed channel near the sea and dredging of the foreshore at the channel entrances.

93. During the dredging or cutting of the entrance channels it is recommended that at any point in time when turbidity readings exceed the stipulated NTU values, works should stop until adequate silt screens are implemented, and turbidity plumes are controlled.

94. Mitigation measures are to be carefully designed so that potential negative impacts are minimized as much as possible and any damage to the environment is reduced.

95. Mitigation measures are especially important when the nature of the impact has been identified as being irreversible, being of long duration, or being of large magnitude, or where the expression is likely to be wide in extent.

96. Potential for the *smothering* of animals and plants during the construction period, including the risk of covering them with dredged materials, including boulders or temporary construction pads.

97. Temporary smothering could also occur through the passage of heavy machinery over sensitive areas during the construction process. The nearshore area close to the proposed dredging footprint is at particular risk in this instance. To mitigate these risks, the animal and plant resources within the footprint of the structure should be relocated prior to construction.

98. There is also the potential for oil pollution stemming from fuel leaks or spills from equipment used for the dredging of the foreshore, canal stabilizing works, and inland excavation during refuelling or operation.

99. Identified environmental impacts were found to occur mostly during the construction phase of the project. They were found to be of small magnitude and likely to be expressed only in the vicinity of the proposed channel entrances. It is recommended that the mitigation measures listed within the mitigation section be followed to reduce smothering, turbidity, and oil pollution both during and after the construction phase of the project.

100. Other Environmental impacts, including the loss of habitat and biodiversity, were found to be of long duration, particularly if endangered flora and fauna are found occupying areas to be dredged. Additional mitigation is to provide compensation from the newly created seafloor and protective structures lining the banks of the canal. The proposed channel was found to have minimal impacts on the nearshore waves, currents, and sediment transport.

101. The original channel design is deemed to have moderate circulation and flushing capabilities. during worst-case tidal conditions. The alternative design discussed in the section was deemed to have good circulation. As such, it is expected that the proposed channel will promote the proliferation of a diversity of species within its banks, however, it is recommended that runoff and sewage are directed away from the channel and that water quality is monitored regularly for health and safety reasons.

102. Provided the recommendations identified in the Monitoring, Mitigation, and Recommendations are implemented, the creation of the blue water lagoon basin, inland canal, entrance channels and the construction and use of the docks can likely be performed without causing unacceptable ecological impacts to the landside and marine environment.

COMPREHENSIVE ENVIRONMENTAL IMPACT ASSESSMENT (CEIA) BLUE WATER LAGOON BASIN, PENINSULA INLAND CANAL, ENTRANCE CHANNELS, AND BOAT DOCKS DEVELOPMENT FOR PLANNING APPLICATION REFERENCE SC. 808 & SC. 809 – BLOCK AND PARCEL NUMBERS 2020/24, 257, 267, 269, 270, 334, AND 356 SAIL ROCK PENINSULA, SOUTH CAICOS, TURKS AND CAICOS ISLANDS FOR SAIL ROCK ESTATES LIMITED

SECTION I INTRODUCTION AND OVERVIEW

1.0 Introduction and Overview

Caribbean Environmental Design Associates (CEDA) was commissioned by Sail Rock Estates Limited to carry out a Comprehensive Environmental Impact Assessment (CEIA) study for the proposed Creation of a Blue Lagoon Basin and Peninsula Inland Canal, Entrance Channels, and Boat Docks on block and parcel numbers 20202/24, 269, 270, 331, 334, 356 and 357 and the proposed Boat Dock on block and parcel number 20202/236 Sail Rock Peninsula, South Caicos, Turks and Caicos Islands. The areas studied and the organization of this report is guided by the Terms of Reference issued by the Department of Planning (DoP) and Department of Environment and Coastal Resources (DECR) with respect to Planning Application reference number SC 808 – Creation of a Peninsula Channel and Planning Application reference SC 809 – Boat Dock.

This study entails a comprehensive impact assessment of the proposed development to determine the potential impact on the ecology/environment, and socio-cultural aspect of South Caicos and Bell Sound Nature Reserve in particular, and the Turks and Caicos Islands in general.

Caribbean Environmental Design Associates (CEDA) assembled a team of environmental local, regional, and international experts to aid with the preparation of this Comprehensive Environmental Impact Assessment (CIA) study for Sail Rock Peninsula Lagoon Basin, Peninsula Channel, and Boat Docks. The team, including their respective disciplines, are:

- Smith Warner International – Coastal aspects

- JSS Consulting, Environmental Consulting Services - Marine aspects
- Sustainable Ecosystems International - Terrestrial aspects
- EnvironmentalAll - Geology and Geomorphology aspects
- Caribbean Environmental Design Associates - Physical Planning & socio-economic aspects

D. Greg Braun of Sustainable Ecosystems International was assisted by Predensa Wilhelmina Moore of the Bahamas, who has experience in birds of the Caribbean region, particularly, the Bahamas.

The detailed Terms of Reference provided by the Department of Environmental and Coastal Resources and the Department of Planning provided the framework for the organization and structure of this report and the sections are structured accordingly, including:

- Section I – an introduction and overview of the study
- Section II – Baseline physical, biological, coastal process, and dynamics
- Section III – Project description and alternatives
- Section IV – Legislative and Regulative Context
- Section V – Environmental Management
- Section VI – Monitoring
- Section VII – Mitigation
- Section VIII – Environmental Management Plan
- Section IX – Recommendations and Conclusions
- Section X – Appendices

1.1 A brief description of the proposed development

The proposed development is designed and will be developed to enhance and provide recreational amenities to the anchored Sail Rock development on the island of South Caicos, in the Turks and Caicos Islands, includes a blue water lagoon basin, a peninsula channel (Canal), with a northern and southern entrance channel connecting the lagoon to the ocean, and boat dock slips.

1.1.1 The developers

The principal of the proposed development is CMK BWI Limited and Sail Rock Development Limited. The company is a major developer in South Caicos and had demonstrated its interest in the island by spearheading the anchored development project for that island.

1.1.2 Project location

Sail Rock Lagoon Basin, Peninsula Channel, and Boat Docks development are located on the remote Sail Rock Peninsula of South Caicos, Turks and Caicos Islands. Sail Rock Boutique Hotel, Villas, and residential development is the sole development within the area, and Sail Rock Development Limited is the principal owner of the development site and all surrounding land within the area.

The proposed Sail Rock Estates Development is located on South Caicos, an island situated along the southeast tip of the Caicos Bank between Plandon Cay to the North, Long Cay to the South, and Grand Turk to the East, in the Turks and Caicos Islands (TCI) as seen in Figure 1. The study area is confined to the Sail Rock Peninsula on the north of the island, bordered by the Atlantic Ocean to the East, Bell Sound, and the Caicos Banks to the west, the former Coast Guard Site to the North, and High Point Hotel Development site to the south. The boundaries of the study area are depicted in Figure 2.

South Caicos is the seventh-largest island in the Turks and Caicos archipelago. It is known for excellent scuba diving, deep-sea fishing, and bone fishing. The population was estimated at 1,139 in 2012. It is the fishing center of the Turks and Caicos Islands and is home to the School for Fields Studies. It was once home to the Coast Guard Station. The overarching purpose of the project is to develop this island as a major tourist resort destination with water-based sporting amenities, enhanced beaches, recreation and green space, and infrastructure in support of the resort and residences.

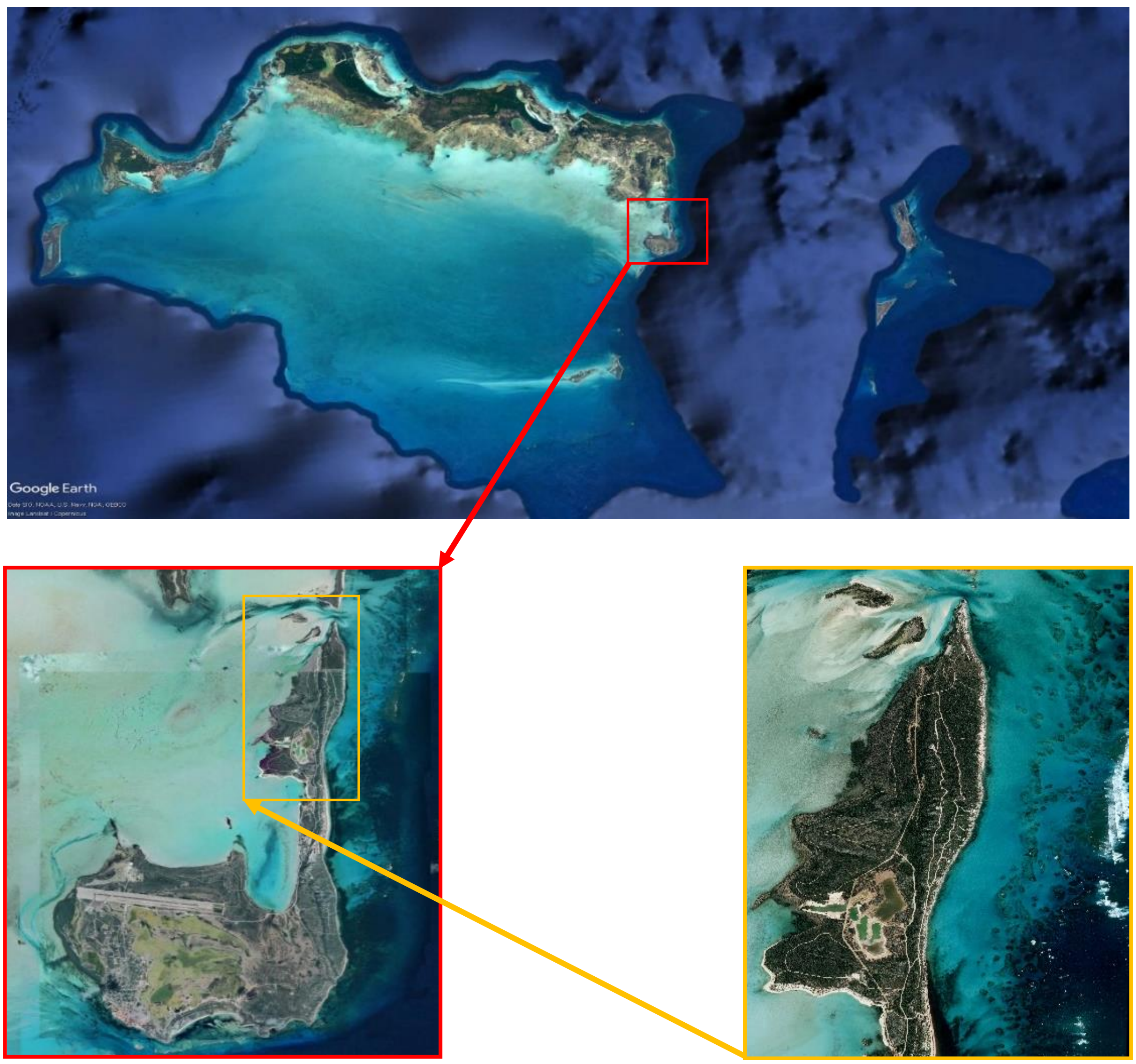


Figure 1 Location of Sail Rock Development

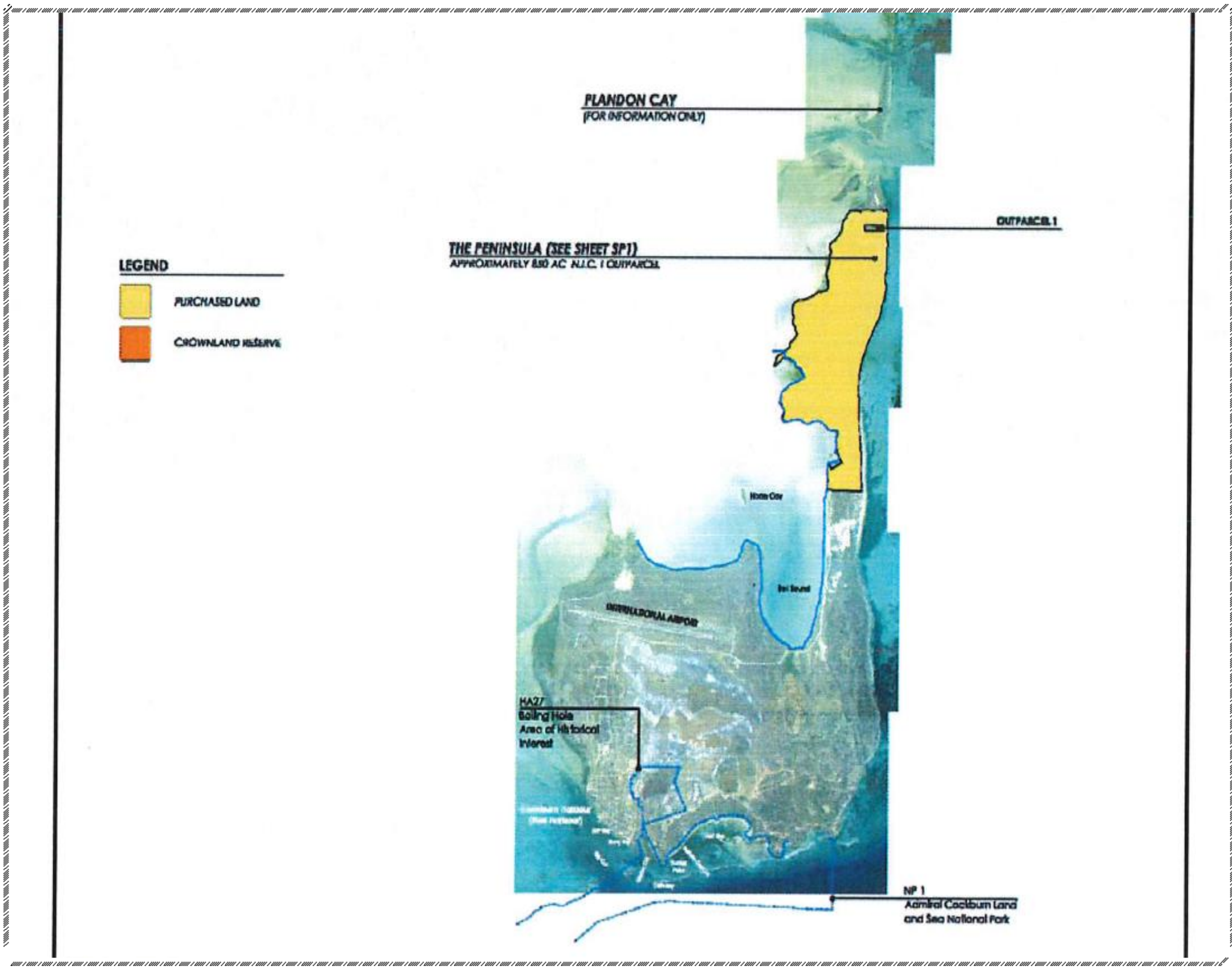


Figure 2 Location and Boundaries of Study Area

1.1.3 Project Concept and Description

The unique vision for the Sail Rock development started as early as 2005 when the developer (Sail Rock Development Limited) acquired both private and Crown land totaling some 2,400 acres of land, as shown in Figure 2. Initially, the developers developed a Master Plan for the Sail Rock Peninsula that articulated the developer's vision for the area, Figure 3. However, the initial plan has evolved over the years into what is shown in Figure 4, which is the latest version that includes the blue water lagoon basin, inland peninsula canal, two entrance channels (Northern and Southern) that flushes the lagoon basin and boat dock slips, which is the subject of this Comprehensive Environmental Impact Assessment study.

Whilst the design concepts have evolved over the years, the objective of enhancing the low-lying seasonal pond into an ecologically enhanced environment to provide complementary water-based recreational activities for the Sail Rock Boutique Hotel and Villa Resort development remained unchanged. The initial design concept had its limitations. It did not allow sufficient flushing of the lagoon basin and would have resulted in greater stagnant waters and algae building up. Hence, the need to improve on the initial design concept to achieve a greater degree of flushing.

Figure 3 Blue Water Lagoon Basin – Initial Design Concept

The two entrance channels concept would allow greater flushing of the lagoon basin through the inland peninsula canal. Where tidal waters would enter the lagoon/canal system through the northern channel and flush through the southern channel depending on the tide cycle.

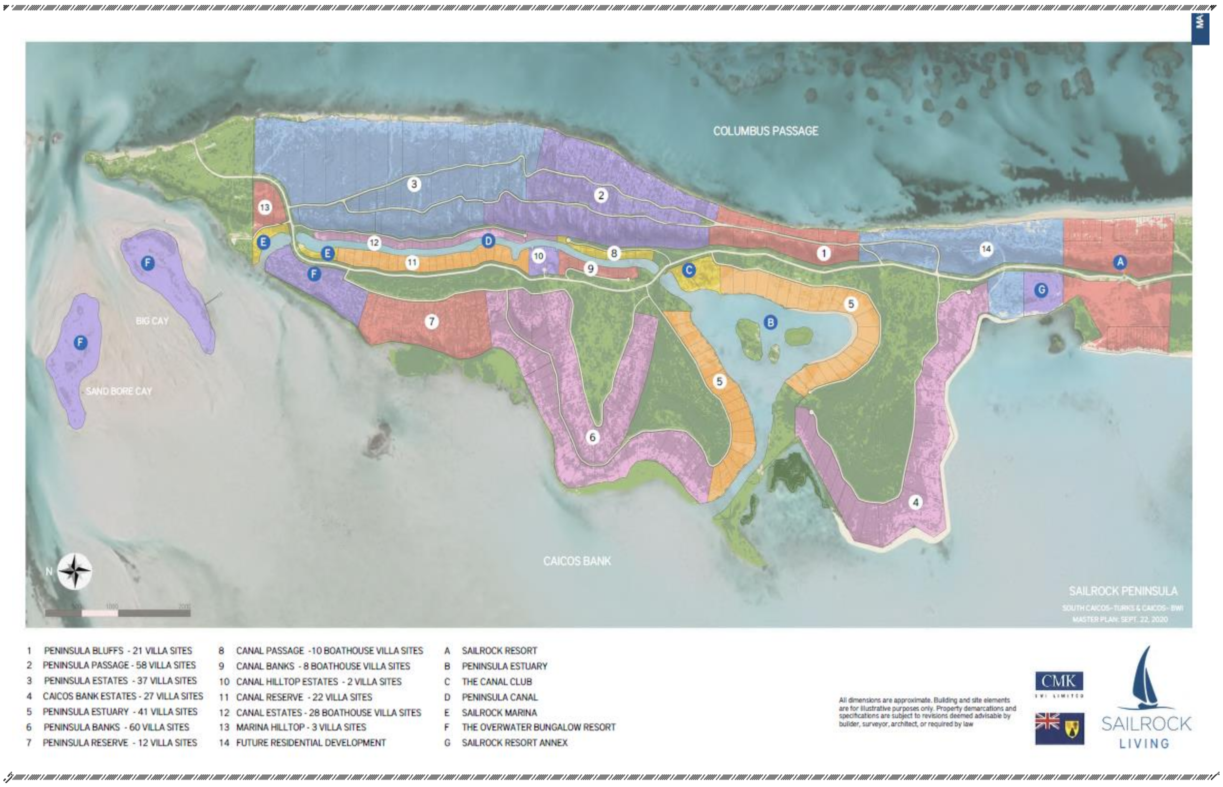


Figure 4 Blue Water Lagoon Basin – Modified Design Concept

A grant of Outline Development Permission (ODP) for Planning Application (SC.601) for the peninsula master plan was approved by the Physical Planning Board on June 9, 2007, Appendix XXXIII. This approval laid the groundwork for the anchor development in South Caicos, in accordance with the government's overall development policy.

According to Sail Rock Development Ltd, the initial Strategic Environmental Impact Assessment study was prepared for the development in accordance with the TOR issued on September 6, 2007. Some fifteen (15) years later, the developers were asked to carry out this Comprehensive Impact Assessment (CIA) for development. Figure 5 shows the various components of the development, including the blue water lagoon basin, the peninsula inland canal, and the northern and southern entrance channels, and bridges.

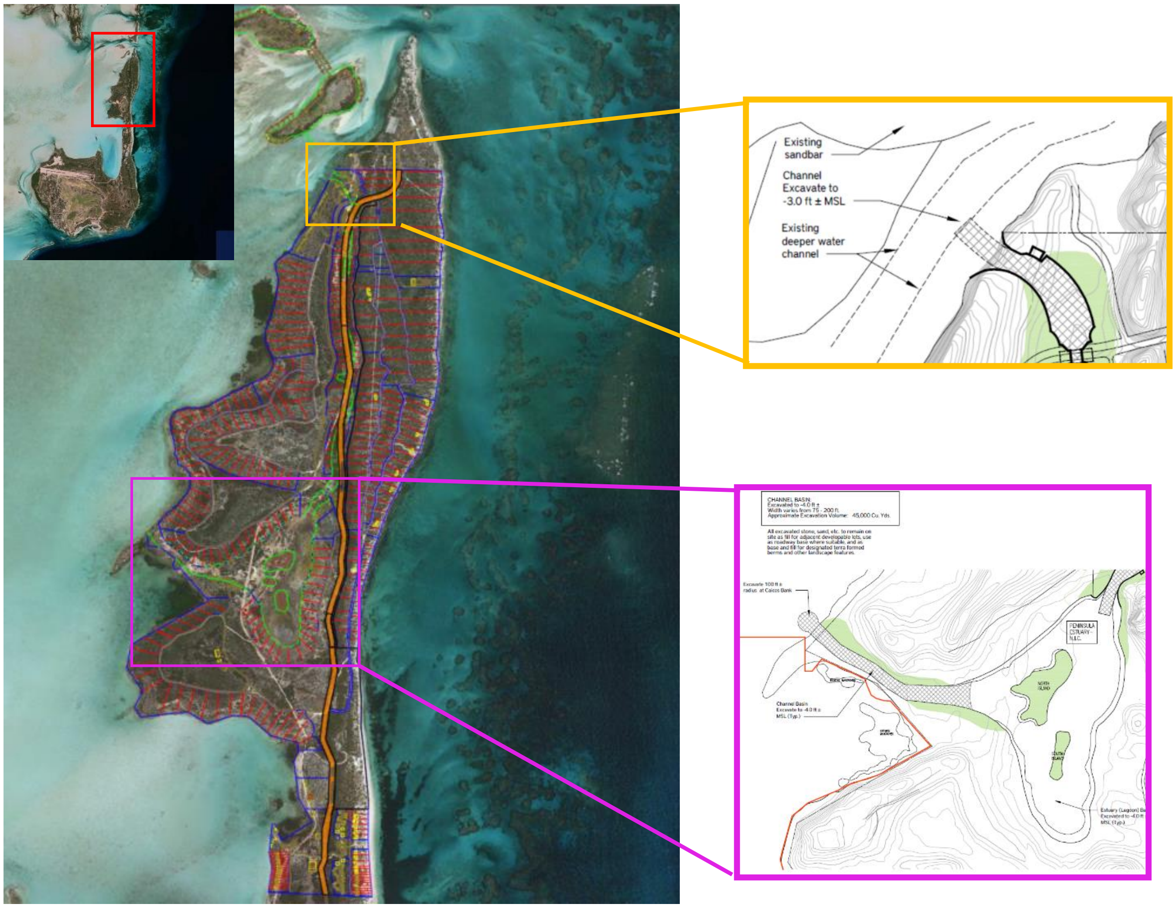


Figure 5 Sail Rock Masterplan - Development Components

1.2 Aims and Objectives.

The aim of this study is to conduct thorough investigations of the impact of the proposed development on the receiving environs, including the geological, terrestrial, marine, coastal, and socio-economic, and to collect valuable information to inform the project's design process and to utilize that information to develop strategies that would mitigate any potential impacts from the proposed development.

More specifically the purpose of the terrestrial field investigations was to identify the project's potential impacts on Endangered, Endemic, and/or Threatened species that may be present within the 120 acres (~ 43 ha) of the property that would be impacted if the project is approved as proposed.

The study also aims to meet the requirements of the Turks and Caicos Government-issued Terms of Reference (Appendix - XXXIX) and any other conditions specified in the Grant of Development Permission, planning application reference numbers SC.808 and SC. 809.

Overall, the objective of this Comprehensive Environmental Impact Assessment (CEIA) study is to determine the potential impact of the proposed construction on the lagoon basin, peninsula channel, and boat docks on the terrestrial, coastal environment, and socio-cultural aspects-economic aspects of South Caicos, particularly, the Bell Sound Nature Reserve (NR13) and the traditional settlement of Cockburn Harbour. This report includes:

Specifically, because a Strategic Environmental Impact Assessment that was conducted by Sustainable Ecosystems International at the site in 2008 revealed the presence of plant and animal species that are protected and/or notable on the overall site (~ 900 acres (362 ha)), the purpose of the field investigations was to identify the potential impacts of the project on Endangered, Endemic, and/or Threatened species that may be present within the 120 acres (~ 43 ha) of the property that would be impacted if the project is approved as proposed.

1.3 Organization of the CEIA Report

This Comprehensive Environmental Impact Assessment Report (CEIA) report is organized in accordance with the guidelines provided in the detailed Terms of Reference (TOR) issued by the Department of Environment and Coastal Resources (DECR), Ministry for Tourism, Environment, Heritage, Maritime, and Disaster Management on May 12, 2021.

A non-technical summary is provided at the beginning of the report.

Section I - introduces the development and provides an overview of the study, including, a description of the development, aims, and objectives of the assessment, an overview of areas/topics to be addressed, impact assessment methods, and analysis.

Section II - gives a historical overview of the site and existing development and provides a quantitative and quantitative baseline description of the site and surrounding environments, including the terrestrial, marine, and physical environments. Coastal

processes and dynamics, including tides, currents, and sediment transports; coastal water quality is also examined in this section.

Section III – includes a detailed description of the proposed development, including project components, construction methods, and project phasing, a description of the construction and operational phases of the development, and description of dredging operations. This section considers project justifications and suggests alternatives to the proposed development, whether site layout design or activity alternatives.

Section IV reviews the existing legislative and regulatory framework under which the proposed blue-lagoon basin, peninsula canal system, and boat docks project will be constructed and operated.

Section V – assesses the potential environmental impacts of the proposed development on the receiving environs during both the construction and operational phases of the development.

Section VII – outlines environmental monitoring programs to address identified environmental impacts generated by the proposed development. Monitoring programs are recommended for pre-, during, and post-construction periods.

Section VII – provides a description of mitigation measures recommended to avoid, minimize, or compensate for the predicted adverse impacts of the proposed development.

Section VIII – An Environmental Management Plan (EMP) is provided under separate cover.

Section IX – Recommendations and conclusions can be found in this section.

Section X – Appendices are addressed in this section but is submitted separately. These include the Terms of Reference (ToR), Resumes detailing the qualifications and experiences of the EIA Team, Government permits, and other relevant information.

1.4 Overview of the areas/topics to be addressed.

Overview of the areas/topics to be addressed in the CIA in addition to those outlined in the ToR is the areas identified in the scoping exercise. A list of people consulted is also included.

1.4.1 Overview of the Areas/Topics to be Addressed.

Stated topics of interest included the protection of native plants, with a focus on those identified as Endemic or Endangered, the protection of birds, and a keen desire to prevent adverse impacts to bonefish/bonefishing and ecotourism. Input from these resources was used to identify potential primary and secondary impacts, recommendations, and other portions of this EIA, where appropriate.

1.4.2 Results of the scoping exercise

The key issues addressed in the comprehensive environmental impact assessment study are as detailed in the Terms of Reference (ToR) issued by the Department of Environmental and Coastal Resources and the Department of Planning on May 12, 2021 (Appendix – XXXIX). Additionally, the CEIA team carried out two scoping exercises via Zoom meetings, the first on June 15, 2022, and the other on June 22, 2022. Out of the scoping exercise came the realization that the team should be strengthened with the inclusion of a bird specialist. Bahamian Predensa Wilhelmina Moore was added to the terrestrial's assessment team.

The team also recognized the need for the realignment of the southern entrance channel from discharging directly into the Bell South Nature Reserve. The team requested clarification from DECR on the ToR requirements for coastal profiles extending within 500 metres of the proposed development site in both directions along the shoreline.

1.5 Impact Assessment Methods/Analysis

Environmental impact methods/analysis are analytical processes for identifying and assessing the potential impact of development in its different phases, including construction, operation, and decommissioning. Different assessment tools were used in various disciples including the terrestrial, marine, and coastal environs.

The process for determining potential landside ecological impacts of the project involved a four-step process:

Step 1) Obtaining and reviewing baseline information. For the Sail Rock canal and boat dock project, this step involved.

a) Obtaining and analyzing recent, high-resolution aerial and drone photography of the project site, and

b) Conducting literature searches to determine the potential presence of various species of flora and fauna. Both steps are described hereafter.

a. ***Aerial Photography.*** High-resolution (i.e., 50 cm) satellite imagery of the site (Figure 6) shows some of the early developments in the area. Because some of the most recent images of the project area had unacceptably high levels of cloud cover, it was determined that an image dated February 10, 2021, would be most appropriate for the site.

Subsequent vegetative community mapping and analyses, therefore, included the use of all three of these aerial photography resources.

Figure 6 Aerial Photograph

1.5.1 Conducting literature searches.

The literature search involved querying historic databases for previous surveys at the site, including the Strategic Environmental Impact Assessment, fieldwork for which had been conducted in 2008 when the vacant property was known as “The Peninsula” and was being considered for future development by CMK BWI, Ltd., and fieldwork conducted in 2014 when Sail Rock was considering making various modifications.

It also included obtaining and analyzing information from the Government of the Turks and Caicos Islands DECR for potential pertinence to the site, including lists of terrestrial and aquatic flora and fauna designated for protection in a document entitled "The Schedules" (Appendix I). This ten-page undated document lists flora and fauna that are designated as "Protected", including categories of "Turks and Caicos Endemic Plants", "Endemic and vital species of fungi", "Lucayan Archipelago Endemic Plants", "Native Plants of Special Conservation Concern", "Turks and Caicos Endemic Fauna", "Protected Birds", "Protected Reptiles and Amphibians", "Protected Mammals" and "Protected Terrestrial Invertebrates". This document was used as the primary reference list for notable flora and fauna that could potentially be present on the site. The list is not specific to the project area, or even to South Caicos, but is applicable to all areas in the TCI. No response was received to a request to DECR for a list of the plants in South Caicos.

The literature searches also included querying protected species lists maintained by international conservation organizations to which the Turks and Caicos Islands are signatories, for notable species that have the potential to be present on the property and/or which could be affected by the canal excavation project. These include the International Union for the Conservation of Nature (IUCN) (Appendix IV) and the Convention on the International Trade of Endangered Species (CITES) (Appendix III).

The Turks and Caicos Islands chapter of the Important Bird Areas in the Caribbean was obtained and analyzed, with particular attention to its potential applicability to the subject property.

1.5.2 Field surveys

Field surveys were conducted by the consultants in their various fields of study using methodologies that were appropriate to their fields of study. Two team meetings were held to discuss the findings of the field surveys. The agenda of one of those meetings is attached as Appendix XLV.

Step 2) Performing on-the-ground field investigations to conduct bird surveys, and identify map, and assess the condition and comparative value of floral and faunal communities and species that are particularly notable (e.g., endangered, threatened, endemic, etc.).

The field assessments involved visual inspections of terrestrial portions of the site. This included upland areas, waterfront areas where the proposed canal would connect with the marine environment, and all wetland and open-water areas that could be present within the footprint of the proposed project. Per the TOR, the assessment area also included adjacent areas that could be affected by the proposed project.

The landside assessment involved direct visual observation of conditions in the area where the canal and boat docks are proposed.

An Olympus TG-870 and a Nikon 3A digital camera with a 50-300 mm zoom lens were used to photograph representative landside areas and to document notable flora and fauna. Additionally, a motion-activated wildlife camera (Wild Game Innovations Mirage 14) was deployed to capture activity in a small, reportedly important wetland area in the north-central part of the assessment area.

A hand-held Garmin GPSmap 62sc Global Positioning System (GPS) was used to record latitude and longitude waypoints at landside vegetation investigation plots and at locations where notable flora and/or fauna or community boundaries or other notable features were observed.

Nikon Monarch 10 x 42 binoculars were used during bird surveys, which included observations during periods of peak bird activity, including morning and late afternoon hours. Records were also kept of observations of birds and other wildlife that were seen and/or heard while qualitative and quantitative analyses of plots in land side transects were being conducted.

A hand-held Sper Scientific model 300011 optical refractometer was used to determine in-situ salinity values in various bodies of surface water.

To map and assess landside communities, 15 mostly canal-perpendicular transects were established along the length of the proposed canal (Figure 8). The transects were variable in length because the width of the proposed canal varied from a typical width of 80 ft (~24 m) to a large lagoon, approximately 1,800 feet (~550 m) in width. Along each transect, a series of 3m x 3m temporary vegetation analysis plots were established, where flora, fauna, and conditions were analyzed and recorded (Figure 7). Based on the TOR, the assessment area needed to include an area extending not less than 100

feet (~ 30 m) of the proposed edge of the channel. The approximate location of plots along a typical 80-foot-wide proposed canal width is shown below (Figure 8).

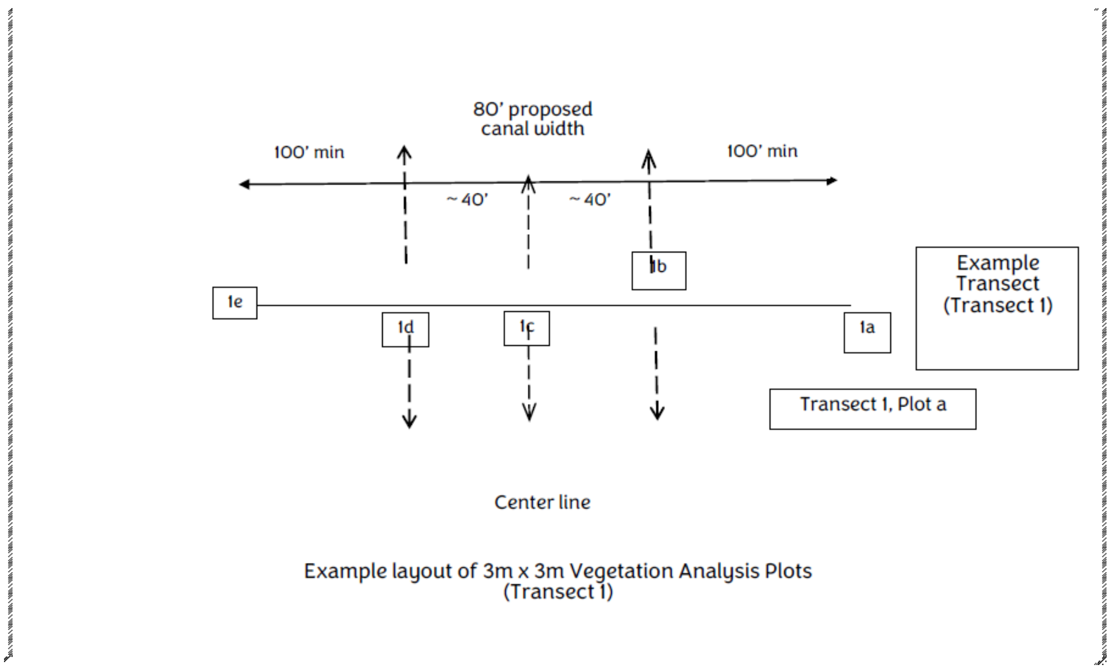


Figure 7: Example of Layout of 3m x 3m Vegetation Analysis Plots Transect 1

The approximate locations of proposed vegetation analysis plots were calculated from Google Earth and entered the hand-held Garmin GPS unit prior to conducting the fieldwork. After navigating in the field to the approximate GPS coordinates for an individual plot, the general area was assessed. The precise area for the plot was then selected to be representative of the area, at which time new latitude and longitude coordinates were recorded. Coordinates for the 75 plots are provided in Appendix VII.

A flexible, fiberglass tape measure was extended to visually designate the perimeter of each 3 m x 3 m plot, after which the flora and fauna within the plot were documented. The three-meter size was selected due to the ability to perform the assessment efficiently without unnecessary trampling of vegetation while being large enough to include the assemblage of trees, shrubs, groundcovers, vines, and epiphytes, which could not be documented if the plot size were smaller.

Inventorying flora and fauna also included documentation of observations along pedestrian transects that traversed other areas outside the transects but within the various vegetative communities that are present within the assessment area.

Within each plot, all plants were identified to species level, whenever possible. It is noted that some plant species, primarily herbaceous species, only have above-ground vegetative components during specific months of each year. Some of these (e.g., *Lepidium filicaule*) are reportedly present in South Caicos but do not have visible plant parts during the period when the field survey was conducted in April 2022. The absence of these plants in the data collected does not necessarily mean that they are not present, only that they were not visibly present during the data collection period.

The cumulative percent cover of all vegetation within each plot was estimated. Trees (woody species greater than 2 m (~7 feet) in height), and shrubs (woody species at heights between 0.3 m (~1 foot) and 2 m) were counted numerically. Plants less than one foot in height were "groundcover" species, even if they were young plants that could eventually grow to shrub or tree heights. The percentage cover of individual groundcover species and vines was estimated. Counts were made of individual epiphytes or orchid clusters. The presence of fauna observed within the plot or in the vicinity, including bird calls heard, was recorded. Evidence of human-related and natural (e.g., hurricanes) impacts was recorded to assist in determining the qualitative condition of the vegetative community in each plot.

The presence/absence and abundance of the plants that were encountered in the 75 vegetation analysis plots were used to estimate their relative quantitative abundance within the assessment area and proposed impact area.

Plant names follow the *Flora of the Bahamas Archipelago*, by D.S. H.B. Correll, *Flowers of the Bahamas and Turks and Caicos Islands* by K. McNary Wood, with updates of plant names warranted and known. Additional reference materials for landside flora and fauna included *Birding in Paradise - South Caicos* (Pienkowski, C. Wensink, and B Naqqi Manco, 2014), *The Birds of the Turks and Caicos Islands* (Ground, 2001), *Birds of the Bahamas and Turks and Caicos Islands* (Hallett, 2006), *Wildlife of the Caribbean* (Raffaele & Wiley, 2014) and *The Natural History of the Bahamas* (Currie, Wunderle et al., 2019). Additional reference materials accessed are identified in the "References and Literature Cited" section.

Vegetative communities were categorized in accordance with the National Standardized Vegetation Classification, 2010 (TCINVC) which was provided by DECR in July 2022, and descriptions were provided for the unique communities as they were encountered on the subject property.

Qualitative ratings were based on the best professional judgment considering factors such as biodiversity, location-appropriate floral, and faunal assemblages, the presence, absence, and/or abundance of notable floral and/or faunal species (e.g., endangered, endemic, etc.), the extent to which the natural hydrology appeared to be intact, and the extent to which the area appeared to have been subjected to damage as a result of human and/or natural processes. Note that Hurricanes Irma and Maria caused widespread damage in some areas of the TCI during October 2017.

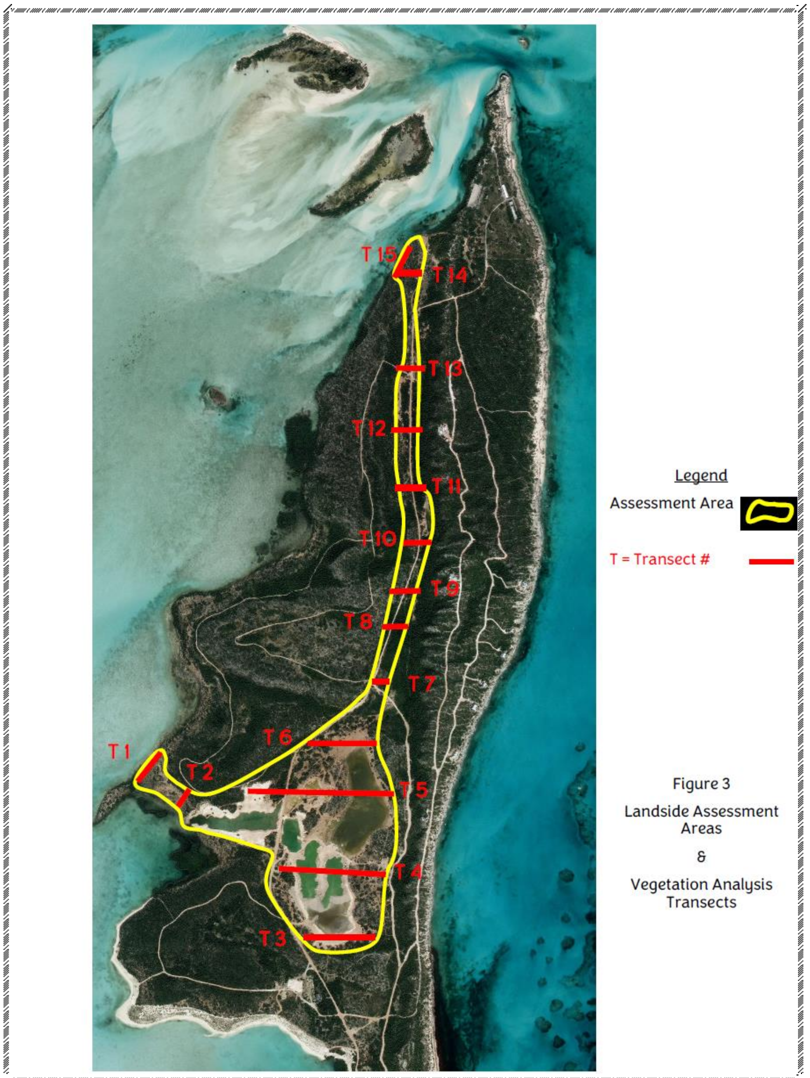


Figure 8: Location of Transects and Vegetation Analysis Plots

Explanations/descriptions of the four categories follow.

Excellent: Natural floral and faunal communities are intact; have little or no adverse impacts from non-native species; possess primarily natural hydrological conditions; and are free of adverse human-related (e.g., debris, previous construction) and/or natural (e.g., hurricane, wildfire) impacts. Species designated as Endangered, Endemic, and/or protected appear to be present in sustainable populations.

Good: Natural floral and faunal communities are present, but communities are not meeting optimal conditions due to adverse impacts from hydrological, human-related, or natural causes. Species designated as Endangered, Endemic, and/or protected may be present, but long-term population sustainability does not appear to be certain.

Fair: Natural floral and faunal communities are substantially impaired because of hydrological, human-related, and/or natural causes. Species designated as Endangered, Endemic, and/or protected are absent or minimally present, and their long-term population sustainability appears to be tenuous.

Poor: Native floral and faunal communities are absent or minimally present due to previous hydrological, human-related, and/or natural impacts. Species designated as Endangered, Endemic, and/or protected are either not present or are not present or do not appear to be present in sustainable populations.

Step 3) Impact Assessment. Overlaying the proposed project onto the results of vegetative community mapping (completed during step 2) was next performed to determine the extent to which the proposed project would impact various vegetative communities and species of note.

This component of the assessment included consideration of both the flora and fauna that were observed on the site during the field inspection, and the extrapolation of other floral and faunal species that may inhabit the property at other times of the year (e.g., migratory birds, and flowering plants). The assessment is to include landside and marine species that have the potential to be affected by the construction *and* operation of the project.

To determine the potential impacts of the proposed project on birds, scientific publications were sought which identified the size of home range territories and preferred habitat types for the resident species that were observed during the field investigation. Birds of the World, a continuously updated reference database compiled by the Cornell Laboratory of Ornithology was found to provide the most comprehensive information on this topic. In instances where these data were not available for the species of interest, closely related species for which data were available were used for reference (e.g., when no home-range territory size was published for the Bahama Woodstar hummingbird, data for ruby-throated hummingbirds were used.

No data were found that reference studies on species on South Caicos,

Because most migratory bird species do not maintain specific territories during the non-nesting season, impacts on migratory birds (both passers-by and seasonal residents) were based on the presence, absence, and/or abundance of the preferred habitat types,

Step 4) Impact minimization and mitigation. The final step was to develop suggestions for practices and/or techniques that could be considered to minimize adverse impacts and mitigate unavoidable impacts.

During the hydrogeology assessment six-(6) test pits situated within the project site and along the proposed pathway of the inland canal system were constructed using a Caterpillar Backhoe machine equipped with an 18" wide rock-cutting bucket. Each test pit was constructed at one-(1) foot intervals where samples of cutting samples were collected and examined. The total depth of investigation was approximately twelve-(12) feet below the land surface. The test pits were undisturbed for a minimum of five-(5) days to allow the groundwater in the test pits to equilibrate. After equilibration groundwater occurring in the test pits was evaluated and depths to the water surface were measured and recorded. Subsequently, depth versus salinity profiles were conducted in each test pit.

Additional geophysical logging techniques including temperature, pH, dissolved oxygen, odor, colour, and lithological profiles were conducted. Data collected was used to assess the groundwater configuration, depth to the water table, and subsurface geology.

Sieve analyses were conducted on samples from individual test pits and grain size distribution curves were generated to get a feel for the characteristics of the sand samples and materials to be used to backfill areas designated for residential development adjacent to the canal system.

Qualitative analysis was conducted to describe the subsurface geology and determine the status of surface and groundwater quality. Quantitative analysis (thickness of freshwater lens) was employed to define and map the geometry of the freshwater lens. Exercises in Physical Geology, 5th edition, were used to identify lithological samples from the test pits, and WHO standards for groundwater quality were used to ascertain water quality and define groundwater configuration.

Grain size distribution analysis was conducted on samples collected from the test pits to calculate the coefficient of uniformity (C_u) and coefficient of gradation (C_c) that are used to determine the classification of the earth materials as well-graded or poorly graded and well-sorted or poorly sorted.

Direct measurements of the salinity, temperature, pH, turbidity, and dissolved oxygen were obtained from individual water samples collected using a discrete 'hand grab' sampler and measured using a 'handheld' YSI Pro DSS Multiparameter Digital Water Quality Meter.

Marine (Benthic Assessment

During the marine assessment, the benthic assessment was conducted within the survey area outlined below (See Figure 9: Benthic Assessment Survey Area). The survey area covers approximately 8.5 square kilometers of marine area. It encompasses shallow waters.

Figure 9: Benthic Assessment Survey Area

The purpose of the investigation was to record the existing conditions within the survey area including habitat characterization, habitat mapping, species diversity, and habitat utilization. The Methodology to achieve the outlined scope is detailed in the sections that follow.

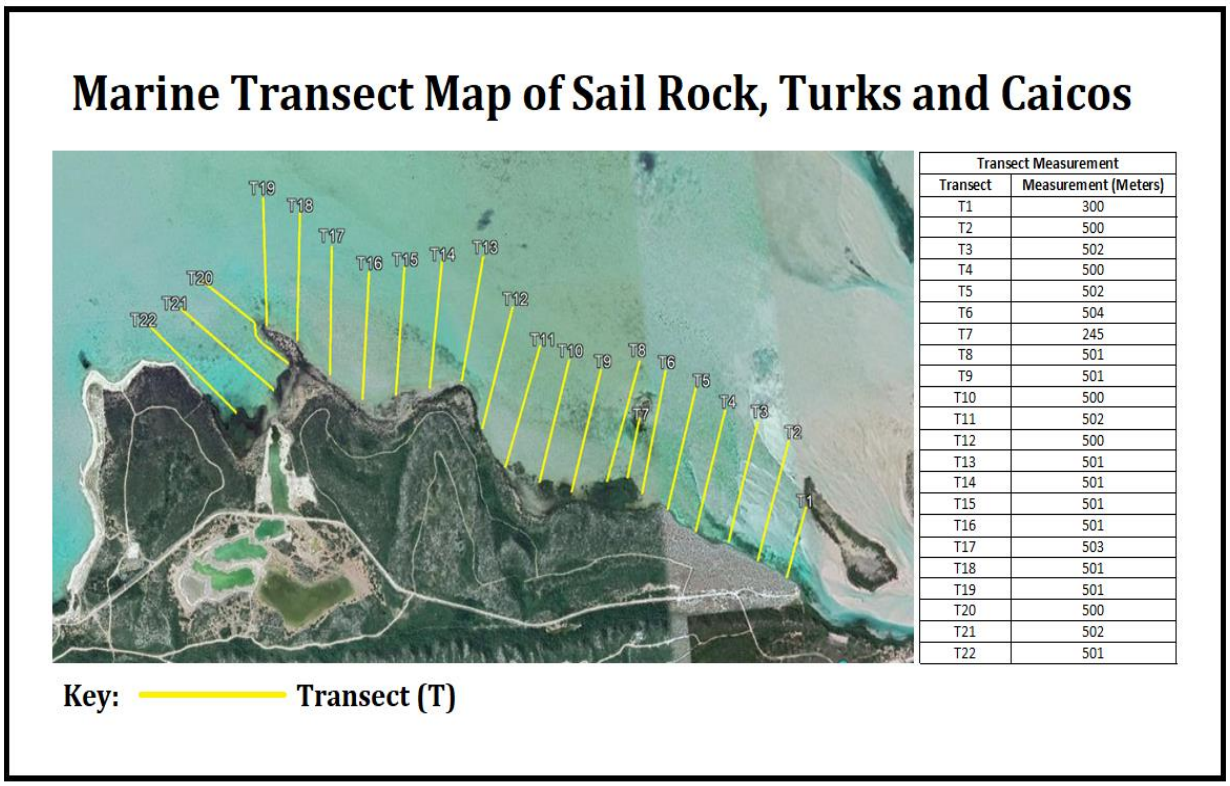
Nearshore Assessment

Twenty-two (22) transects were within the survey area (See Table 1 for transect coordinates). The transects were conducted in shallow near-shore waters (less than 1.0 meters in depth). See Figure 10 for Marine Transect Map.

The benthic ecosystem was assessed using snorkelling and underwater drone investigations in areas that may be directly and indirectly impacted by the proposed construction footprint. The transects were approximately 500 meters in length and approximately 150 meters apart.

A record was taken of all flora and fauna species and substrate types. General observations were made for the surveyed areas. There were random spot checks at the seagrass areas for epifauna present. Data was collected underwater on slates and transcribed at the end of the day. Photographs and videos were taken. Species identification was confirmed using Humann et al 2013, Reef Coral Identification, Humann et al. 2013, Reef Fish Identification, and Humann et al. 2013, Reef Creature Identification.

It is highly unlikely that this assessment identifies all the marine species, but it provides a representation of those present on the site.



Transect Measurement	
Transect	Measurement (Meters)
T1	300
T2	500
T3	502
T4	500
T5	502
T6	504
T7	245
T8	501
T9	501
T10	500
T11	502
T12	500
T13	501
T14	501
T15	501
T16	501
T17	503
T18	501
T19	501
T20	500
T21	502
T22	501

Figure 10: Marine Transect Map

Table 1: Sail Rock transects coordinates of the survey area.

Sail Rock Transect GPS Points				
Transect	**Start**		**nd**	
	Latitude	**Longitude**	**Latitude**	**Longitude**
T1	21° 34.080'N	71° 29.898'W	21° 34.148'N	71° 30.052'W
T2	21° 34.014'N	71° 29.944'W	21° 34.121'N	71° 30.211'W
T3	21° 33.944'N	71° 29.990'W	21° 34.050'N	71° 30.257'W
T4	21° 33.870'N	71° 30.024'W	21° 33.972'N	71° 30.296'W
T5	21° 33.807'N	71° 30.083'W	21° 33.900'N	71° 30.347'W
T6	21° 33.747'N	71° 30.129'W	21° 33.832'N	71° 30.395'W
T7	21° 33.716'N	71° 30.163'W	21° 33.758'N	71° 30.295'W
T8	21° 33.665'N	71° 30.153'W	21° 33.770'N	71° 30.424'W
T9	21° 33.577'N	71° 30.143'W	21° 33.672'N	71° 30.407'W
T10	21° 33.507'N	71° 30.176'W	21° 33.600'N	71° 30.435'W
T11	21° 33.424'N	71° 30.213'W	21° 33.532'N	71° 30.477'W
T12	21° 33.379'N	71° 30.305'W	21° 33.476'N	71° 30.575'W
T13	21° 33.341'N	71° 30.414'W	21° 33.414'N	71° 30.692'W
T14	21° 33.265'N	71° 30.407'W	21° 33.313'N	71° 30.684'W
T15	21° 33.186'N	71° 30.400'W	21° 33.223'N	71° 30.684'W
T16	21° 33.104'N	71° 30.394'W	21° 33.142'N	71° 30.683'W
T17	21° 33.034'N	71° 30.458'W	21° 33.057'N	71° 30.743'W
T18	21° 32.961'N	71° 30.540'W	21° 32.992'N	71° 30.825'W
T19	21° 32.896'N	71° 30.581'W	21° 32.909'N	71° 30.873'W
T20	21° 32.942'N	71° 30.494'W	21° 32.757'N	71° 30.694'W
T21	21° 32.899'N	71° 30.436'W	21° 32.706'N	71° 30.643'W

Habitat Characterization

A qualified survey team knowledgeable in marine benthic types and biota snorkeled along the transects covering five feet on either side of the transect line. Data was collected to identify sensitive marine habitats and commercially and ecologically important species utilizing the area. Habitat types along transects were also recorded every 3.048 meters (Figure 11). Data from diver surveys and a review of underwater drone images were used to assist in the creation of a GIS benthic habitat map of the survey area. Methods, analysis, and approaches are detailed in this section, the next section goes into more detail and documents the baseline physical conditions of the site of the proposed development.

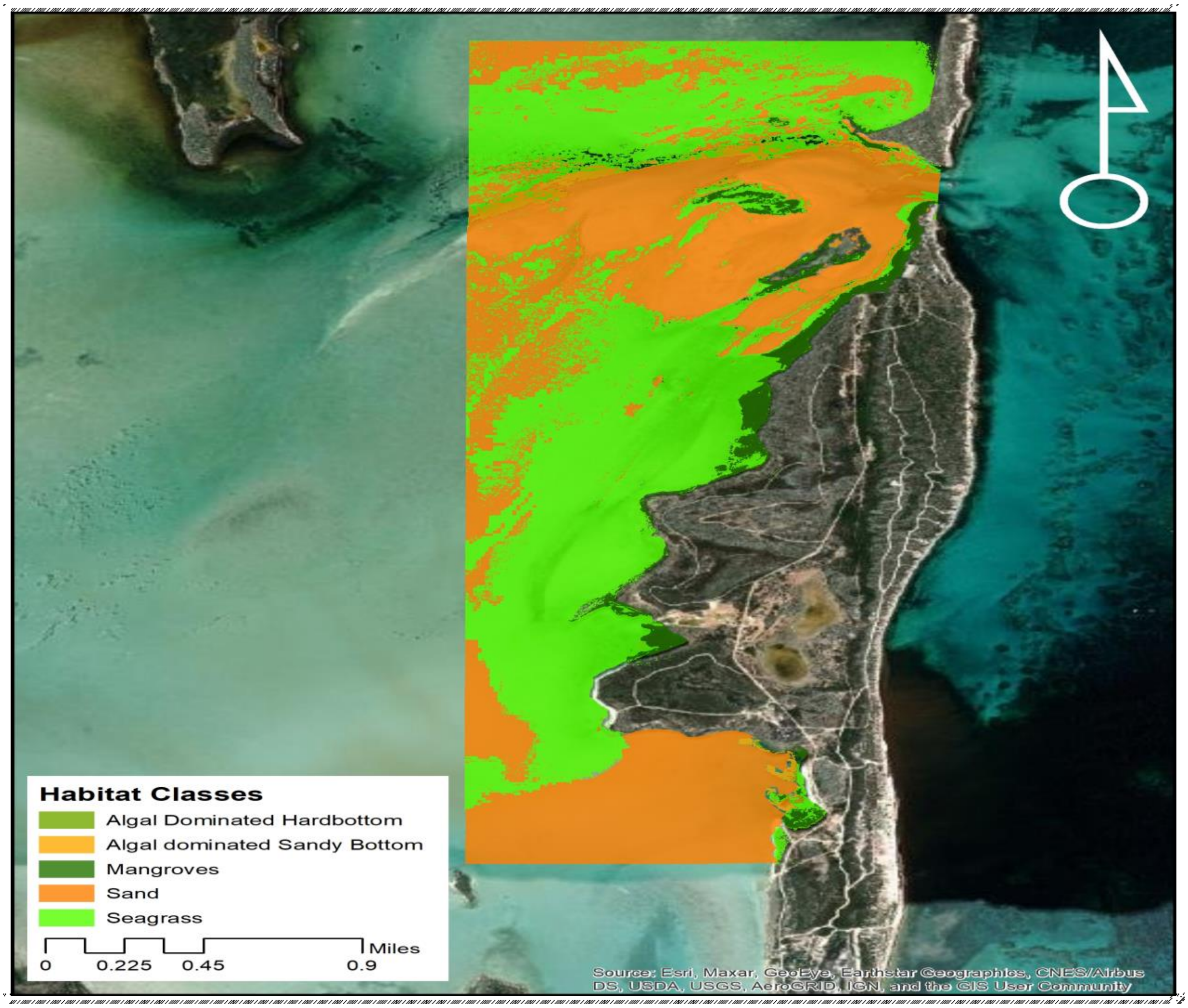


Figure 11: Benthic Habitat Map

SECTION II - BASELINE STUDIES

2.0 *Baseline Studies*

This section provided a detailed description of all baseline studies that were conducted during the field investigation. The data collected, analyzed, and interrupted has formed the basis for decision-making, including recommending changes to the originally designed concept. Baseline studies included physical, biological, and coastal assessments of the receiving environment. A description of the project is detailed, and alternatives are examined. Existing laws and regulations that are intended to regulate and control the proposed development were reviewed. Mitigation and monitoring measures are recommended to address identified direct and indirect impacts. And finally, recommendations are suggested for the overall implementation of the proposed development.

2.1 *Historical overview of the site and existing development*

This section (2.1) gives an in-depth historical overview of the challenging process in which the Sail Rock Lagoon Basin development application has taken to reach the uncertain present stage. Despite the guarantees given in Development Agreement dated and the amended Development Agreement dated August 19, 2013, and the many Grants of Outline Development Permission and Detailed Development Permission issued by the Physical Planning Board and the Department of Planning over the years.

Based on a review of the existing background information, the conceptualization of the peninsula started in 2008. Since then, the design and alignment of the peninsula have undergone several iterations. Figure 12 is an official government-generated cadastral map that illustrates the location of the proposed lots and channel alignment. The number of islands in the lagoon has since changed from three to two and the area to be dredged has been modified as shown in the orange and magenta boxes.

Figure 13 provides a time-series visualization of the Sail Rock Peninsula between 1985 to 2023. Only recently, the peninsula witnessed unmeaningful physical development with the development of the Sail Rock Boutiqie Hotel and Villa Resort. Figure 14 below is a recently captured drone image that depicts the present impact of development on the Sail Rock peninsula (April 2022).

To better understand the natural features of the site, its limitations, and potential for development, site visits were made, and data for the area were collected and reviewed. Field investigations were conducted, including shoreline profile surveys, aerial imagery, and drogue tracking. This research was supported by a review of the work done by previous consultants. This was essential to form a base map of the site, the critical starting point for any impact assessment. The following sections give an overview of the conditions on the site.

According to historical records, chronologically, the sequence of development events and the submission of planning applications, and the grant of planning permissions for the proposed Sail Rock Developments, including the lagoon basin and mile-long beach creation were as follows:

- Outline Planning approval for the overall development was received in June 2007.
- In late 2013 and early 2014, Sail Rock worked with Global Green Consultants on the initial Strategic Environmental Impact Assessment.
- On January 8, 2015, the Strategic Environmental Impact Assessment (SEIA) report was submitted by Global Green Consultants and Applied Technology and Management.
- On March 12, 2015, an Extra Ordinary Planning Board meeting was called to discuss the lagoon, and beach enhancement SEIA.
- On May 29, 2015, the Governor signed the development application for the lagoon and beach enhancement development.
- On May 29, 2015, the Grant of Detailed Development Permission (SC.733), creation of pocket beaches, and a lagoon basin was received.
- On September 7, 2015, the application for the dredging of the lagoon basin (SC. 733), Dredging for Sanding Mining for Beach Creation and Clearance of Block Canal/Restoration of Historical Canal (SC. 741), and Dredging of Three

  Swimming Basins and Creation of Mile Long Beach and Pocket Beaches were submitted to Dr. John Claydon, Director of DECR.

- According to Sail Rock developers, on September 24, 2016, DECR Director Dr. John Claydon states "As I understand, the justification for this process is that Sail Rock has sold properties or made its own financial commitments based on what TCIG led Sail Rock to believe was possible in a Nature Reserve. It turns out that certain aspects of these plans were never permissible under the National Parks Ordinance/Regulations, and so the pragmatic solution is to remove the area in question from the protected status".
- On August 11, 2017, Sail Rock is informed by TCIG that the National Park Ordinance which includes the removal of a DECR-approved section of Bell Sound from National Park status is going to Cabinet the second week of August 2017.
- Most recent submission, on December 11, 2019 (SC.796) Detailed Development Permission Excavation and Enhancement of Lagoon Basin.
- And on October 2, 2020 (SC. 808) Creation of a Lagoon Basin and Peninsula Channel.
- And on October 2, 2020, (SC. 809) Boat Docks.

Up to this point, Sail Rock Development Limited has acted in accordance with advice from its lawyers, professional planners, architects, and engineers and has invested a considerable amount of money to obtain various planning permissions. They also acted in accordance with the requirements of their Development Agreement and the Physical Planning Ordinance of the Turks and Caicos Islands. The action of government ministries, the Department of Planning, and the Department of Environment and Coastal Resources.

It was not until the former Director of the DECR recognized (2015) that Bell Sound had a designation under the National Parks Ordinance as a "Nature Reserve" and not a National Park as has been assumed by all parties involved. Recognizing the legal implications of the stalemate of the project and the level of investments made by Sail Rock Development Limited, and the economic benefits of the development to government and the residents of South Caicos and as well as the government's obligations under the Development Agreement between The Crown, Government of the Turks and Caicos Islands and Sail Rock Development Limited it was agreed that a mutual solution to the problem should be derived. Hence, it was agreed that the areas in question should be removed from the Bell Sound Nature Reserve. The required amendment to the National Parks Ordinance.

The former Director of the DECR wrote on September 24, 2016 "As I understand, the justification for this process is that Sail Rock has sold properties or made their own financial commitments based on what TCIG led Sail Rock to believe was possible in a Nature Reserve. It turns out that certain aspects of these plans were never permissible under the National Parks Ordinance/Regulations, and so the pragmatic solution is to remove the area in question from the protected status".

According to TC Invest, the Cabinet approved the seven-point pathway to remove the area from Bell Sound Nature Reserve. The Cabinet instructed the Attorney General to draft the appropriate legislation and to carry out a 6-week public consultation process. On January 3, 2017, the public consultation notice was published in the Gazette.

The recommended changes to the National Parks Ordinance are not required for the proposed blue water lagoon basin, inland peninsula canal, and boat dock slips to proceed because the areas in question are not located within the Bell Sound Nature Reserve. Previous plans call for the southern entrance channel to exit within the Bell Sound Nature Reserve, but this has been changed to avoid direct contact with Bell Sound Nature Reserve. The southern entrance channel has been realigned to exit to the north of Bell Sound Nature Reserve. Whilst this realignment of the southern entrance channel due to its proximity to the Bell Sound Nature Reserve will have some impact on the reserve, the impact would not be as great as it the southern entrance channel was discharging directly into the Bell South Nature Reserve.

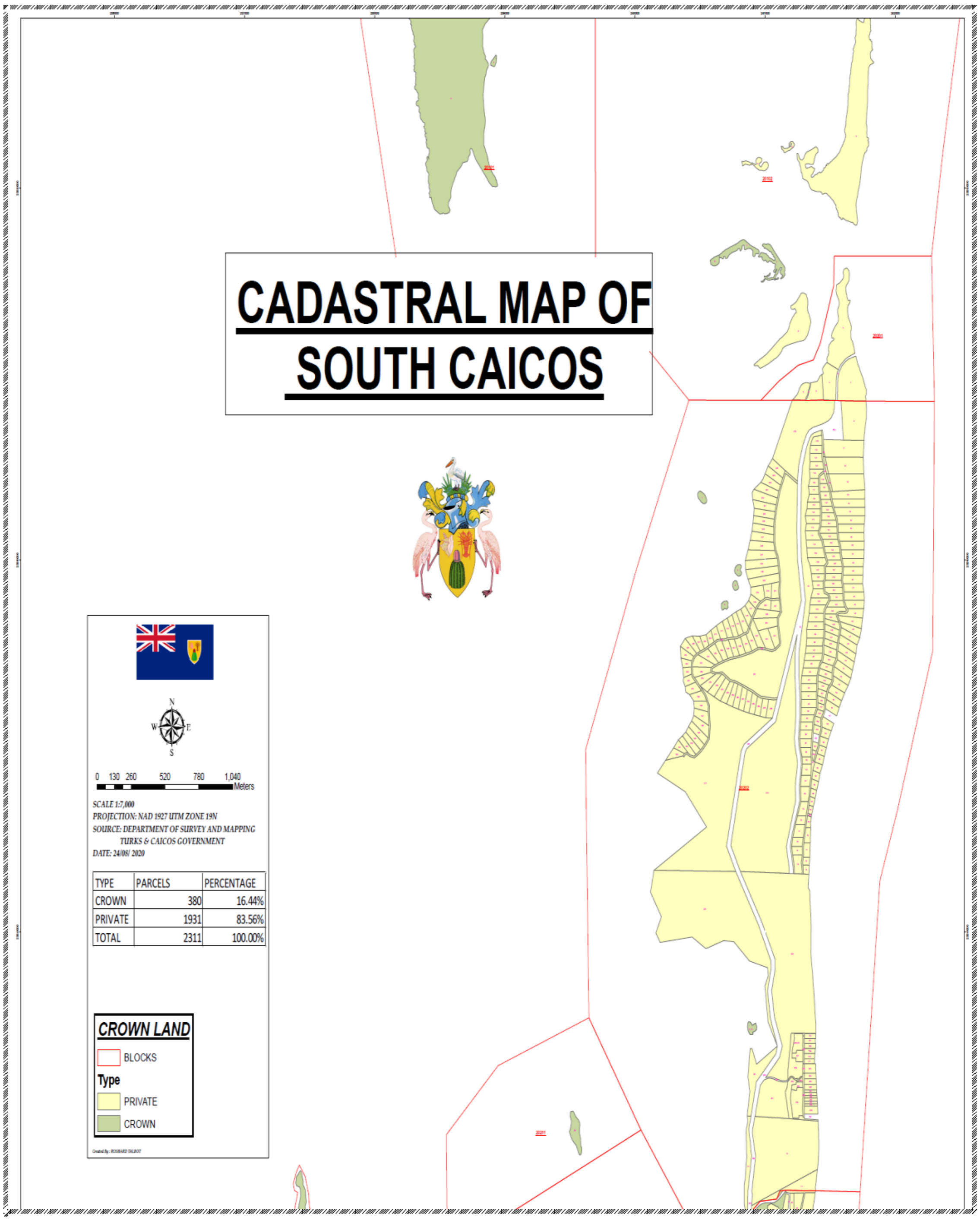


Figure 12: Cadastral Map of Sail Rock Peninsula - The Study Area

Google Map 12/1985 | Google Map 9/2004 | Google Map 3/2023

Figure 13: Historic Time-Series Visualization Google Maps of the Study Area - 1985 to 2023

Figure 14: Recent Drone Images of the Study Area - Date April 2022

2.2 Physical Environmental Baseline Assessment

The section provides a baseline assessment of the area to be affected by the proposed development, including the terrestrial, marine, and coastal environments.

2.2.1 Any areas to be affected by the proposed development.

Areas within the development footprint to be affected by the proposed development include the terrestrial, marine, and coastal environments.

Construction of the proposed lagoon basin, canal, and the installation of the docks would impact approximately 80 acres (~ 32 ha) of existing terrain, which will result in the conversion of existing native plant and animal communities into a shallow lagoon basin and canal. When side-slopes at a 2.5 (H): 1 (V) slope above existing natural ground elevations and adjacent areas that will be impacted are added, the total anticipated direct impact is calculated to be approximately 120 acres (~43 ha).

Therefore, the landside assessment, together with the results of a marine assessment allows environmental impacts to be understood and appropriate minimization and mitigation procedures to be developed to address and minimize impacts to local flora and fauna and to offer suggestions to mitigate unavoidable impacts.

2.2.2 Coastal profiles

The Sail Rock Estate development site is well protected from waves from the east by an offshore fringing reef, the first line of defense. This reef is located approximately 1.5km offshore and greatly reduces wave heights approaching the site. The site is further protected by Plandon Cay and Middle Creek Cay, which each allow only minimal waves to pass through their gaps. The site is also protected to the west by a large area of shallow banks/reefs that break larger waves (Figure 15).

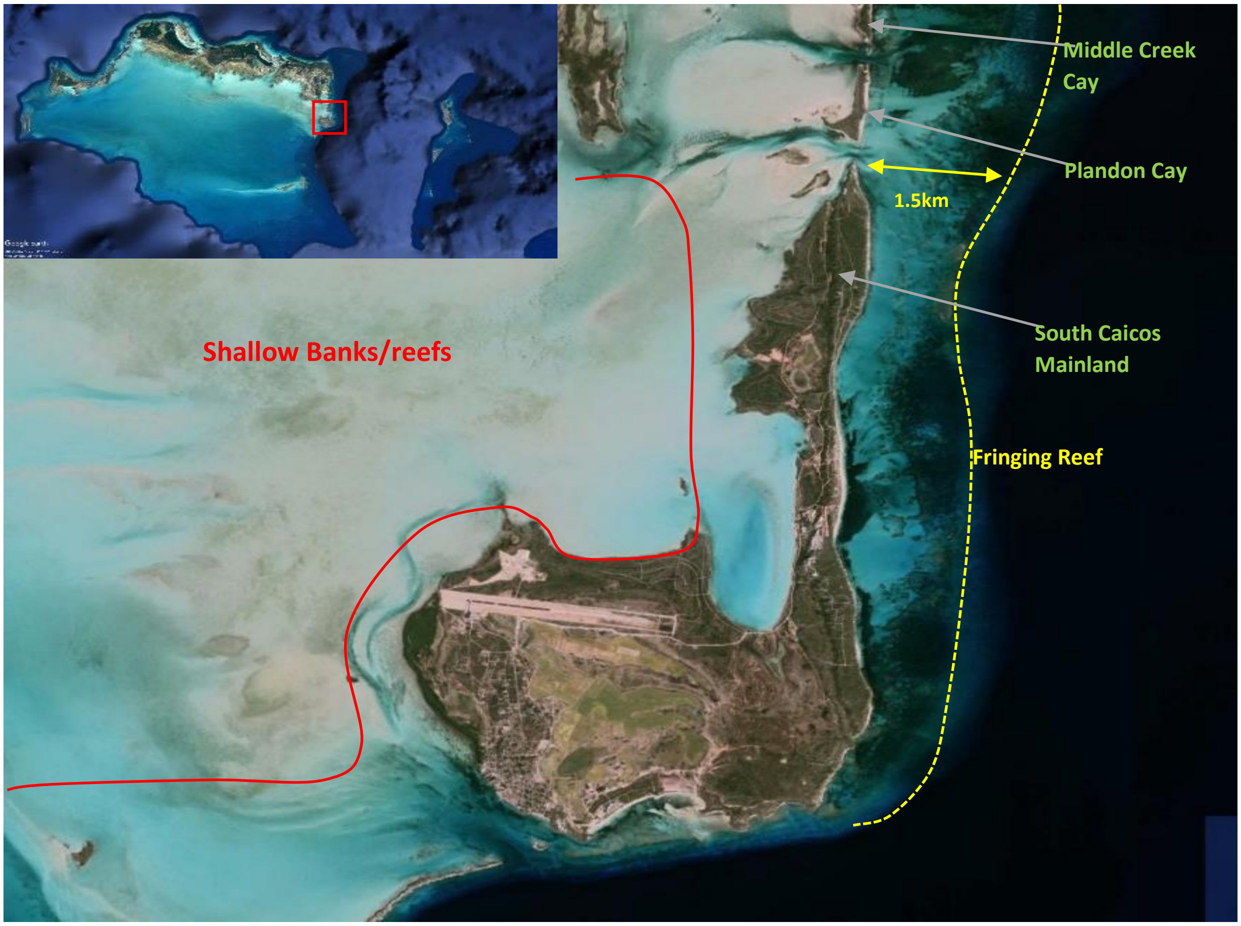


Figure 15: Offshore Protective features

During the site visit, the existing peninsula inlet channel that leads from the South Caicos basin to the Atlantic Ocean was examined via drone imagery. Figure 17 and Figure 18 below show the proposed location of the northern entrance of the proposed channel along with the location of gaps between the South Caicos mainland, Plandon Cay and Middle Creek Cay through which tidal currents ebb and flow. Figure 18 depicts the proposed location of southern channel entrance relative to the sensitive Bell Sound Nature Reserve.

The narrow gaps mentioned above cut between the impermeable Sail Rock mainland, Plandon Cay and Middle Creek Cay, which causes a phase lag as the tides change. This tidal phase lag then induces strong currents and every time the tide changes, these currents flow back and forth along the black paths indicated in Figure 16. The cays also break the waves coming from deeper water. West of the peninsula is a vast area of shallow banks approximately 0.3 – 0.6m deep.

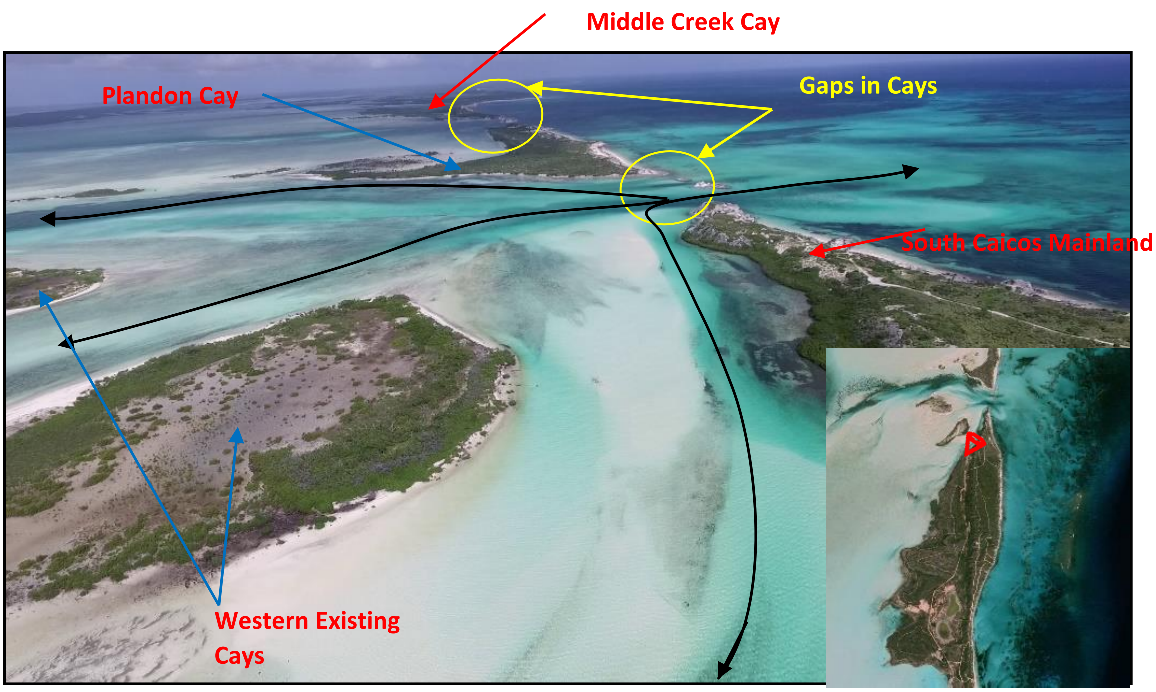


Figure 16: Oblique aerial image showing the peninsula inlet channels, main tide flow paths and Cays close to the northern channel entrance.

Figure 17 shows the approximate location of the proposed northern channel entrance; the topography of this area is quite steep. There are also patches of mangroves that have been carefully avoided.

Mangroves line the western shoreline of South Caicos with certain areas more thickly inhabited than others. For example, the mangroves of the Bell Sound Nature Reserve shown in Figure 16 have an extremely dense area of mangroves. Based on this image, the original excavation was trending towards this protected area, however, the current channel alignment (in blue) shows the southern channel entrance curving north, avoiding this sensitive area.

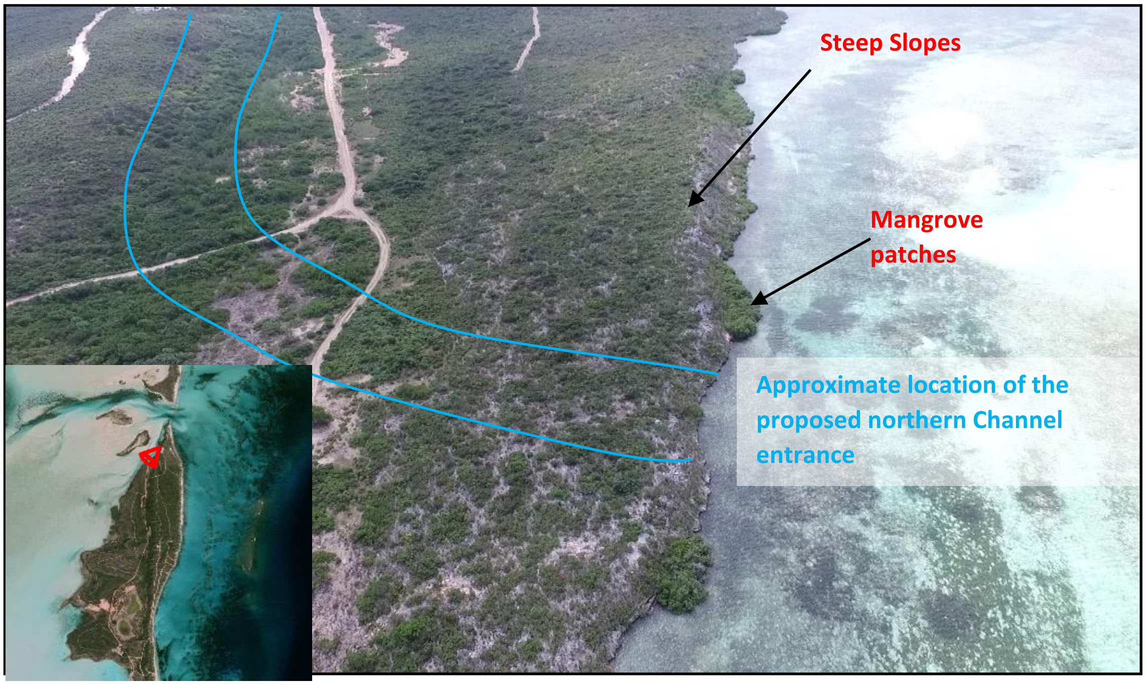


Figure 17: Oblique aerial of the proposed north channel.

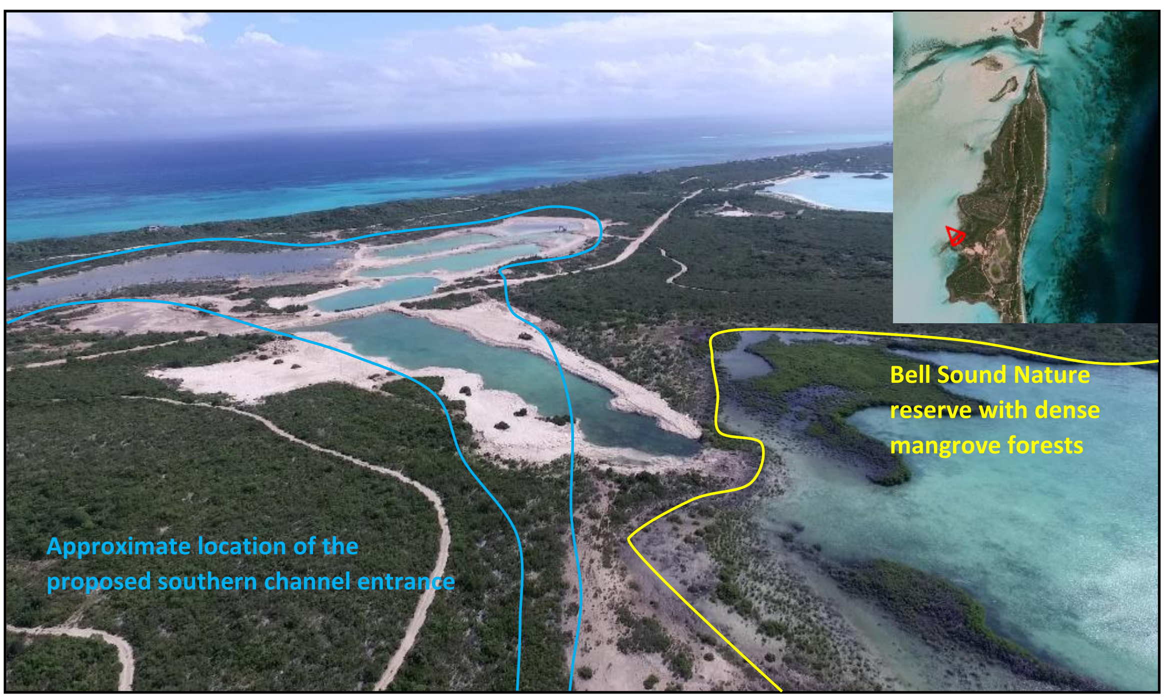


Figure 18: Oblique aerial photograph of the southern channel entrance

The shoreline shape is impacted by the nearshore current conditions and wave climate it is exposed to. A shoreline may accrete when the sediment volumes being transported to the beach are larger than those leaving the beach. Conversely, a shoreline may also erode when sediment volumes being transported to the beach are less than those leaving the beach.

The historical movement of a shoreline is a valuable tool in obtaining an initial understanding of the long-term changes of the shoreline. Shoreline morphology can be extracted from historical maps, surveys, aerial photos, and satellite imagery. The methodology used in this assessment was as follows:

- Identify suitable Google Earth satellite images of the shoreline.
- Georeferenced satellite images using ArcGIS.
- Trace the shoreline in each of the images.
- Compare the traced shorelines using fixed reference points.

There are limitations to this method and uncertainties that mostly centre on the nature of the shoreline position at the time the image is captured. Possible errors that could limit the accuracy of the analysis are summarized in the text box below.

Errors that could limit the accuracy of shoreline change analysis.

- Seasonal error – Many beaches have seasonal cycles of erosion and accretion. Because high-resolution satellite images are limited for Caribbean islands, images cannot be selected on seasonal time frames.
- Tidal fluctuation error – The satellite images were obtained without regard to tidal cycles, which can result in inaccuracies on the digitized shoreline.
- Digitizing error – The error associated with digitizing the shoreline.
- Pixel error – The pixel size in orthorectified images is 0.5m, which means anything within 0.5m cannot be resolved.
- Rectification error – Satellite images are corrected, or rectified, to reduce displacements caused by lens distortions, Earth curvature, refraction, camera tilt, and terrain relief using remote sensing software.

Shoreline position changes during a 6-year review period (June 2011 to January 2017) for areas close to the proposed northern channel entrance were analysed and are shown in Figure 19. From that map, it can be inferred that the shoreline at the two western cays (represented at Profile 1 and Profile 2) are quite dynamic and fluctuated between erosion and accretion throughout the years. However, the analysis revealed that the shorelines at Profile 1 and Profile 2 are, on average, in a state of erosion, with erosion rates of 3.8 meters/year and 1.2 meters/year respectively. Closer to the proposed northern channel entrance at Profile 3, the shoreline is more stable with an erosion rate of approximately 1.0 meter/year.

Similarly, the shoreline changes during an 11-year review period (June 2011 to January 2022) for areas close to the proposed southern channel entrance were analysed and are shown in Figure 20. From this map it can be argued that there is little to no long-term

shoreline change at the location of the southern channel entrance (Profile 4) or the Bell Sound Nature Reserve (Profile 5).

Figure 19: Historical shoreline positions close to the northern channel entrance

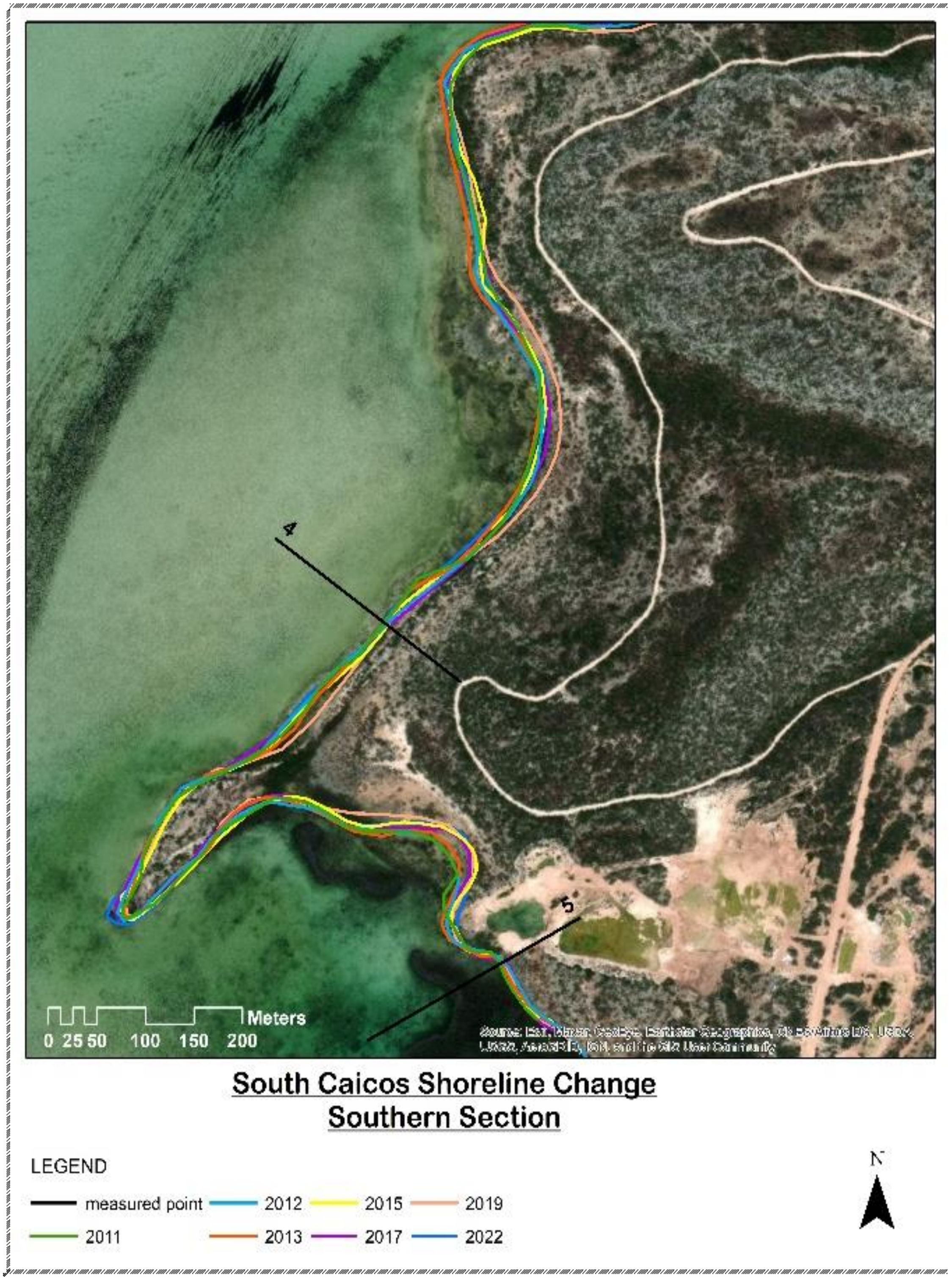


Figure 20: Historical shoreline positions close to the Southern channel entrance

2.2.3 Bathymetry extending to 500 metres from the coast.

Accurate maps of water depths in the nearshore area are essential when trying to understand coastal processes because hydrodynamics and wave patterns are strongly affected by the bathymetry and seafloor features.

A satellite-derived bathymetric (SDB) survey was undertaken to provide an accurate, high-resolution map of the sea floor. This data provides profiles and bathymetry extending well over 500m from the coast in both directions. The data gathered by this method was supplemented by surveyor-executed profile surveys of the nearshore at locations near the northern and southern channel entrances using an RTK GPS system along with tidal gauges. This surveyor profile data was then used to calibrate the satellite-derived bathymetry, particularly in the nearshore where satellite-derived bathymetry becomes less accurate. Topographic data up to 4 meters in elevation (to be used in storm surge and wave run-up analysis) were extracted from PDF maps that were provided by Sail Rock Estates as seen in Figure 21 below.

Figure 21: Contour maps that were digitized to produce topography points up to +4msl

The survey data plot showing the satellite-derived bathymetric points, nearshore profile points, and digitized topography can be seen below in Figure 22. As shown in Figure 22, the bathymetric and profile surveys were not the only data used in surface creation. Additional data inputs were from available nautical chart depth data (DHI gridded data).

All the data collected, (as outlined above) was input into the MIKE21 mesh generator and a surface was created using various interpolation techniques.

Figure 23 shows the interpolated surface, with contour lines indicating water depths. We combined data received from the shoreline profile survey, satellite-derived bathymetric data, gridded DHI, and the Client-provided topography to create a base map for use in modelling activities. The area in blue represents regions above +4.0m msl that are unlikely to have an impact on coastal and hydrodynamic modelling and were therefore not input to the model.

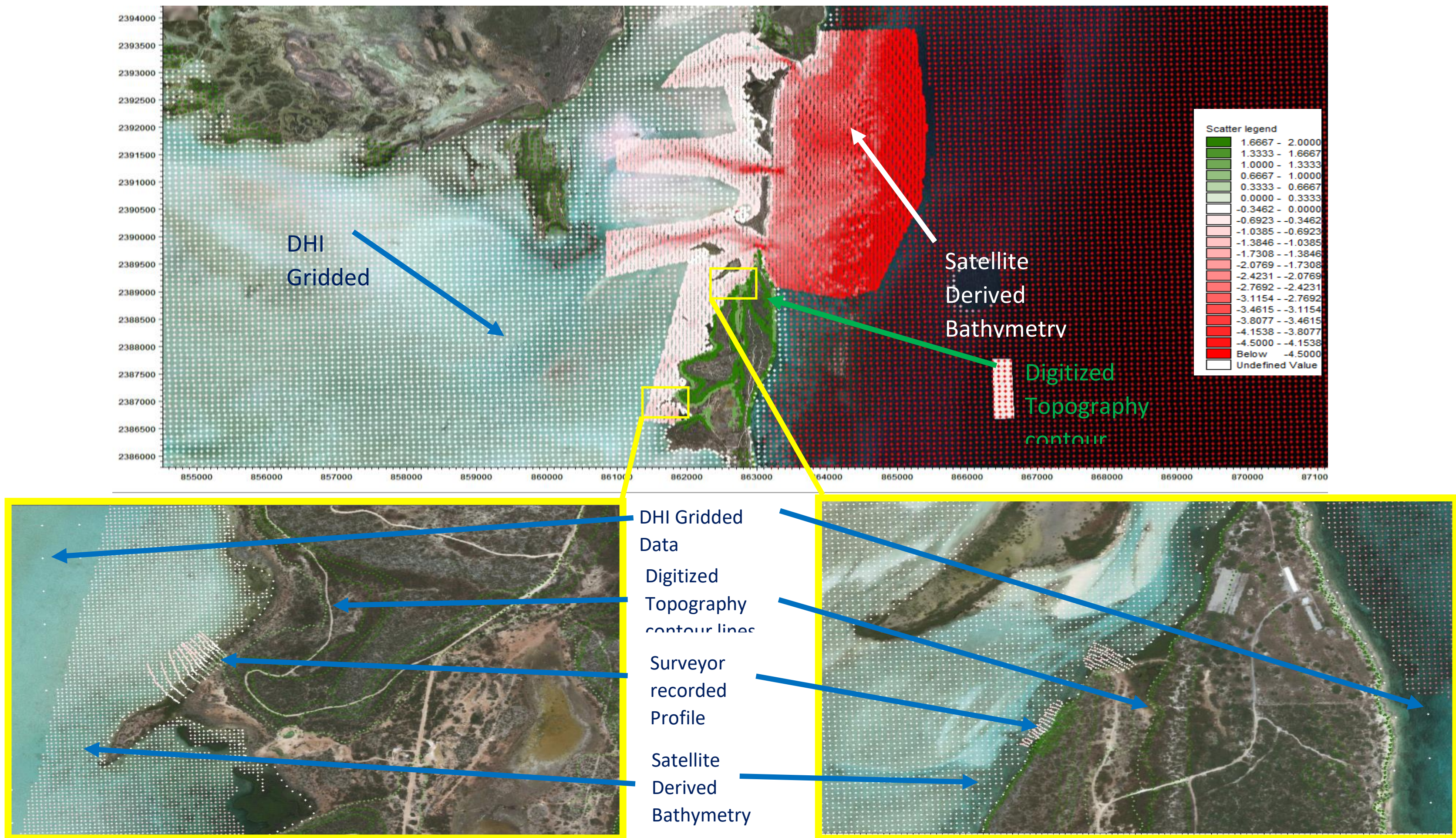


Figure 22: Points used in the creation of the numerical model. Sources of the various points highlighted in the image.

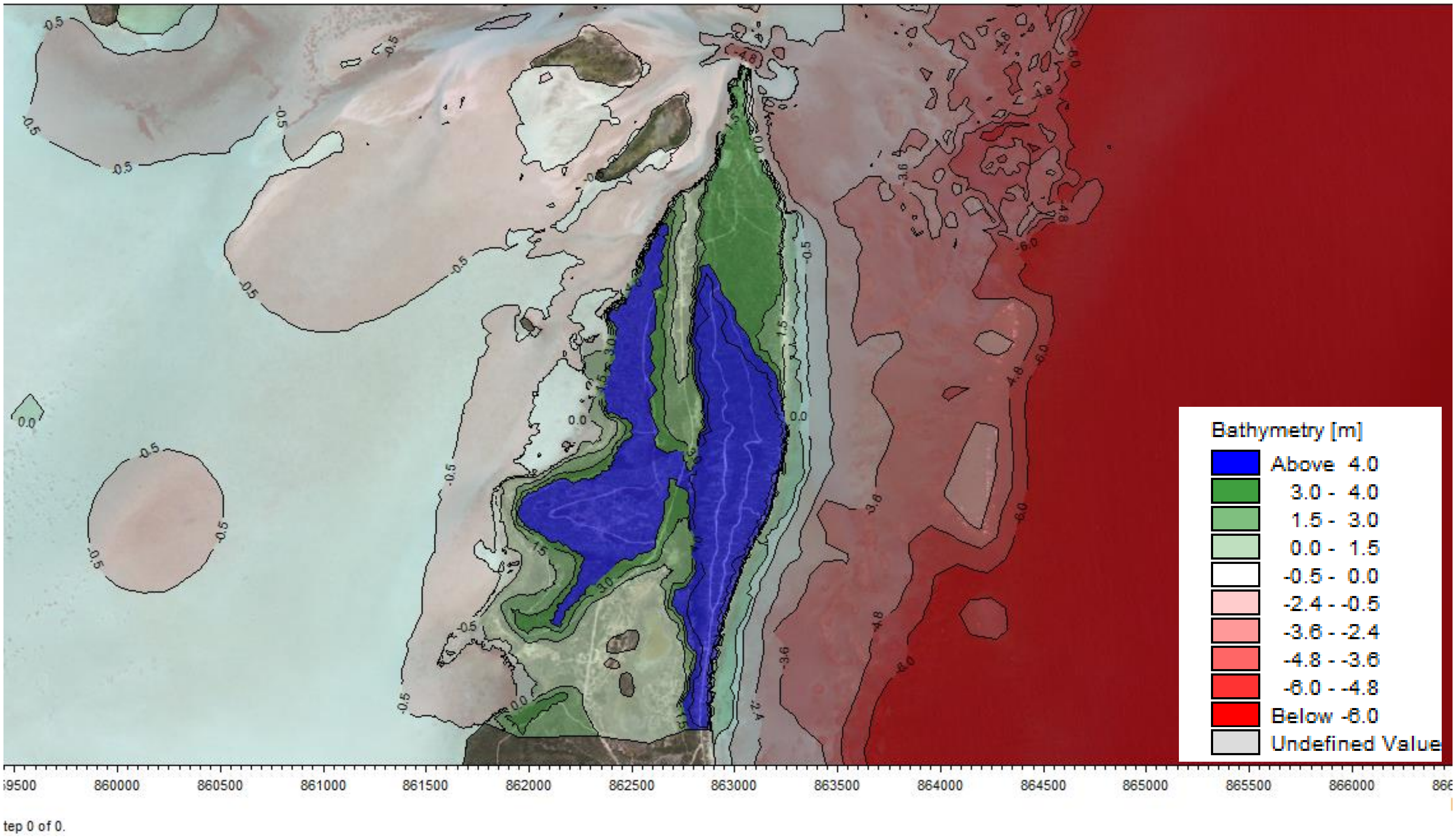


Figure 23: Interpolated surface with contour lines and colour

2.2.4 Geology and geomorphology of the terrestrial environment.

The geomorphological features of the project site are defined by a coastal ridge immediately to the east and coastal flat lands immediately to the west. The two geomorphological features create a topographic trough oriented in a north-south direction in the middle of the landmass. The topographic trough occurs across the full length of the proposed canal system and appears to have been subjected to the ingress of seawater during periods of high wave energy and/or elevated sea level during storms and hurricanes. Historical photographs of the occurrence of stranded surface water bodies at the southern extremity of the proposed canal system illustrate the isolation of the perennial surface water features from the surrounding marine environment.

During site visits, observations were made of dredging works that have altered the natural geomorphology of the project site, namely the excavation of a man-made open water body in the area proposed for the location of the marina basin. The new excavated feature occurred on both sides of the existing road network and remained isolated from the surrounding marine environment. The proposed inland canal system is intended to flush in a coastal area immediately north of the Bell Sound Nature Reserve. The west-facing coastline is dominated by a carbonate sequence of Limestone and sands that provide a substrate for the occurring stands of mangroves and are void of karst dissolution features.

2.2.5 Substrate and sediment analyses

Sediment analysis is quite important to the overall coastal assessment as it can reveal a lot about the coastal environment. Sediment was collected at two locations (Sediment sample 1 - SS1 and Sediment sample 2- SS2) as shown in Figure 24.

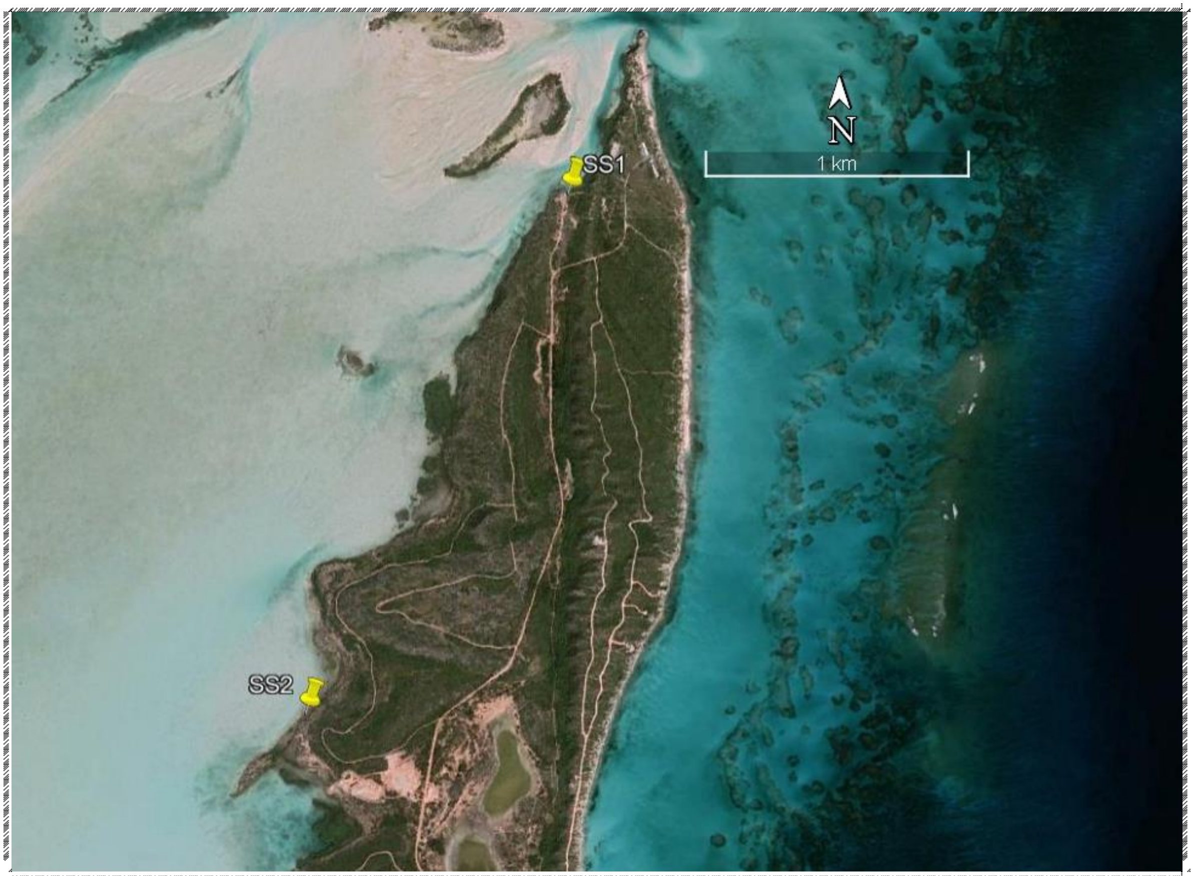
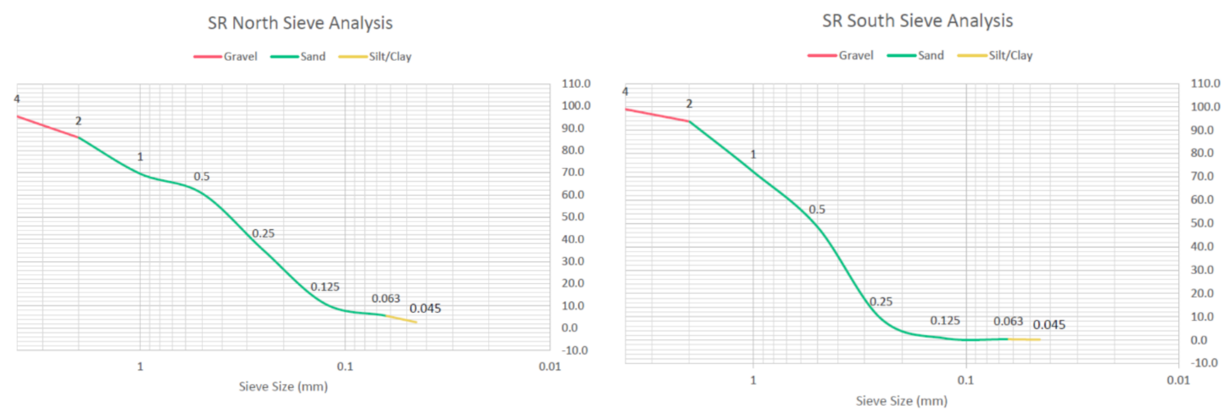


Figure 24: Location of Sediment extraction

The sediment present on a coast can provide insight when assessing the coastal processes and is an important component of the aesthetics and comfort of the beach or coastal zone. The surface sediment along the entire shoreline is mostly sandy as observed in Figure 25 which is indicative of a moderate wave energy environment. The extracted samples were taken for sieve analysis. Sieve testing was done at a geotechnical lab (see Appendix VIII) to visually inspect, and air dries the samples before subjecting them to a standard dry sieve analysis to determine the grain size distribution and other characteristic parameters. The results of the sieve analysis for SS1 and SS2 are shown in Figure 26.

Figure 25: Visual inspection of sand sample collected at SS1.



Sample	D10	D16	D30	D50	D60	D90
SR North	0.118	0.151	0.218	0.362	0.486	2.860
SR South	0.257	0.292	0.363	0.518	0.673	1.820

	%Gravel	%Sand	%silt/clay	Cc	Cu
SR North	14.2	80.2	5.6	0.829	4.119
SR South	6.3	93.3	0.4	0.762	2.619

Figure 26: Laboratory results for surface sediment analysis showing D50 values, percentage composition, gradation curves and sediment classification for the SR North (SS1) and SR South (SS2) samples collected.

The analysis indicated that the SS1 sample was moderately sorted coarse sand while SS2 was moderately sorted medium sand according to the Wentworth grain size classification. Both samples had sediment that fell mostly in the sand classification size group. These results were used in the beach response modelling to identify sediment transport patterns and will further guide the determination of areas that will likely experience erosion or accretion.

2.2.6 Topography of the area to be developed.

South Caicos is the smallest island in the Caicos archipelago. It rises off the ocean floor as a limestone plateau called the Caicos head. The 8 square mile island is mostly low and flat, with marches and mangrove swamps, intertwining with deserted beaches and soft limestone cliff dunes. The low-lying nature of the island was used to create salina that was once used in the salt industry, but today forms part of the island's natural landscape and is used as a tourist attraction.

The land elevation ranges from about 3 feet above sea level to some 154 feet above sea level. The Sail Rock peninsula, the site of the Sail Rock development shares typical topography as the rest of the islands. The Sail Rock boutique hotel, villa and residential are located on the east ridge of the peninsula, while the low-lying area to the west of the ridge is designated for the lagoon basin and peninsula channel development. Figure 27 below shows the topography of the Sail Rock peninsula area.

Figure 27: Contour map of the Sail Rock Peninsula Area, South Caicos

2.2.7 Geology and Geomorphology of the area to be affected.

The project site occurs mostly along the western coastline and interior spine of South Caicos Island. The island of South Caicos is situated on the eastern margin of the Turks and Caicos Bank. Holocene Sands and Pleistocene Limestones make up the geology of the island and indeed the project site. The carbonate sequence exhibited a lithological profile consistent with the geology of other islands of the Turks and Caicos Islands and the Southeast Bahamas. Soil layers were less than 1-2 inches thick and underlain by a well-compacted dense Limestone layer, Figure 28. At some test pit locations, the Limestone formations were extremely hard and proved difficult for the backhoe to excavate. Where softer and less dense Limestone formations occurred 'cave-in' of the subsurface formation was ongoing, Figure 29.

Figure 28: Hard Dense Limestone

Figure 29: Subsurface formation 'Cave-In'

The geomorphological features of the project site are defined by a coastal ridge immediately to the east and coastal flat lands immediately to the west. The two geomorphological features create a topographic trough oriented in a north-south direction in the middle of the landmass. The topographic trough occurs across the full length of the proposed canal system and appears to have been subjected to the ingress of seawater during periods of high wave energy and/or elevated sea level during storms and hurricanes. Historical photographs of the occurrence of stranded surface water bodies at the southern extremity of the proposed canal system, Figure 30, illustrate the isolation of the perennial surface water features from the surrounding marine environment.

During site visits, observations were made of dredging works that have altered the natural geomorphology of the project site, namely the excavation of a man-made open water body in the area proposed for the location of the blue water lagoon basin. The new excavated feature occurred on both sides of the existing road network and remained isolated from the surrounding marine environment, Figure 31. The proposed inland canal system is intended to flush out a coastal area immediately north of the Bell Sound Nature Reserve. The west-facing coastline is dominated by a carbonate sequence of Limestone and sands that provide a substrate for the occurring stands of mangroves and are void of karst dissolution features.

Figure 30: Areas of perennial Surface Water Bodies

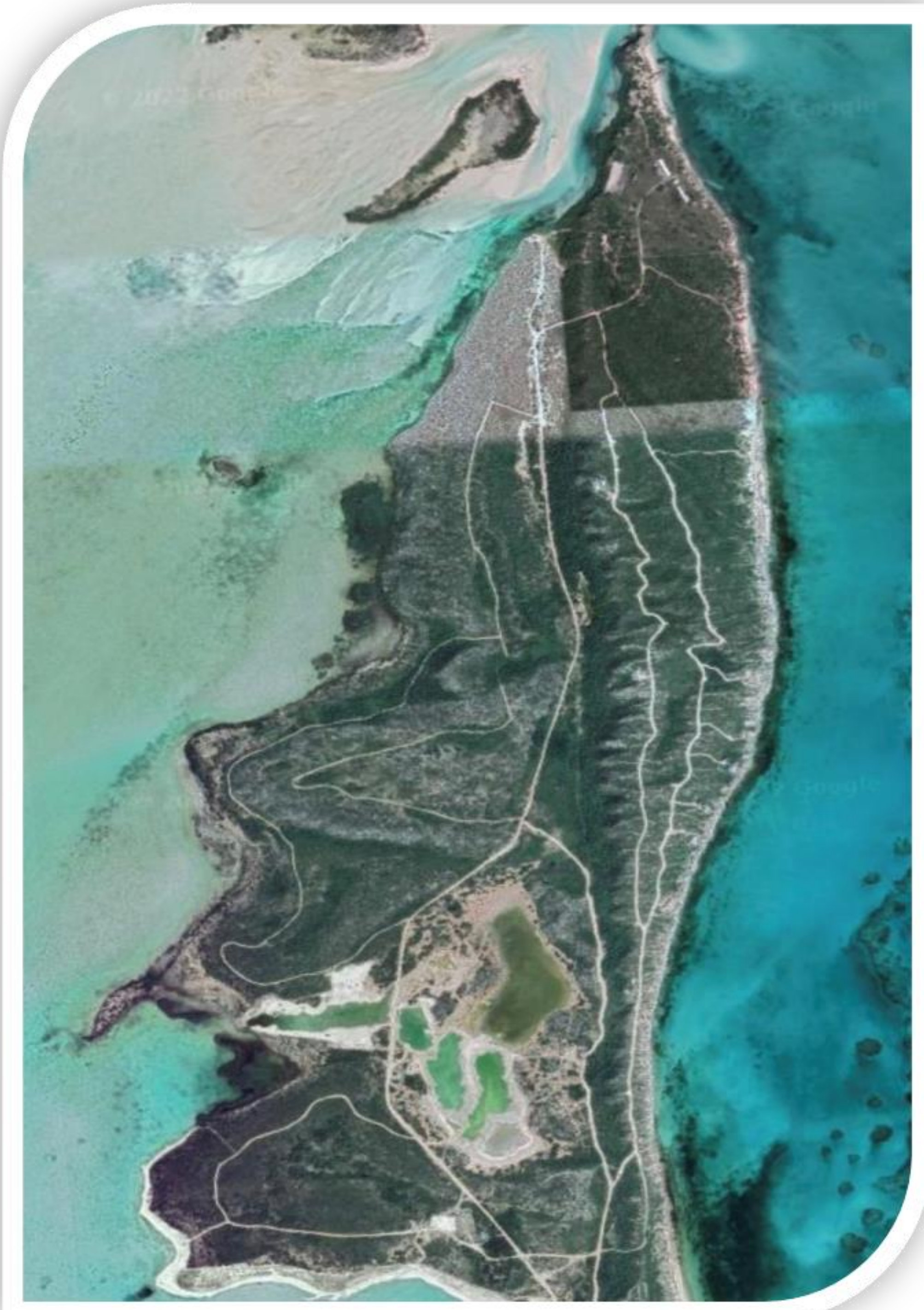


Figure 31: View of disturbed areas of surface water bodies

2.2.8 Climate and Meteorology

The Turks and Caicos Islands, like most of its Caribbean neighbours, lie directly in 'Hurricane Alley', an area of water in the Atlantic Ocean within which hurricanes typically form because of the warmer sea surface temperatures there. Figure 32 shows the historical paths of hurricanes in the North Atlantic basin, which tend to form between latitudes 5°N and 25°N off the west coast of Africa and then track across the Atlantic Ocean. Those formed at the lower latitudes are usually pushed on a westerly track by the north-east Trade Winds, whereas those of the higher latitudes track more to the north and north-west.

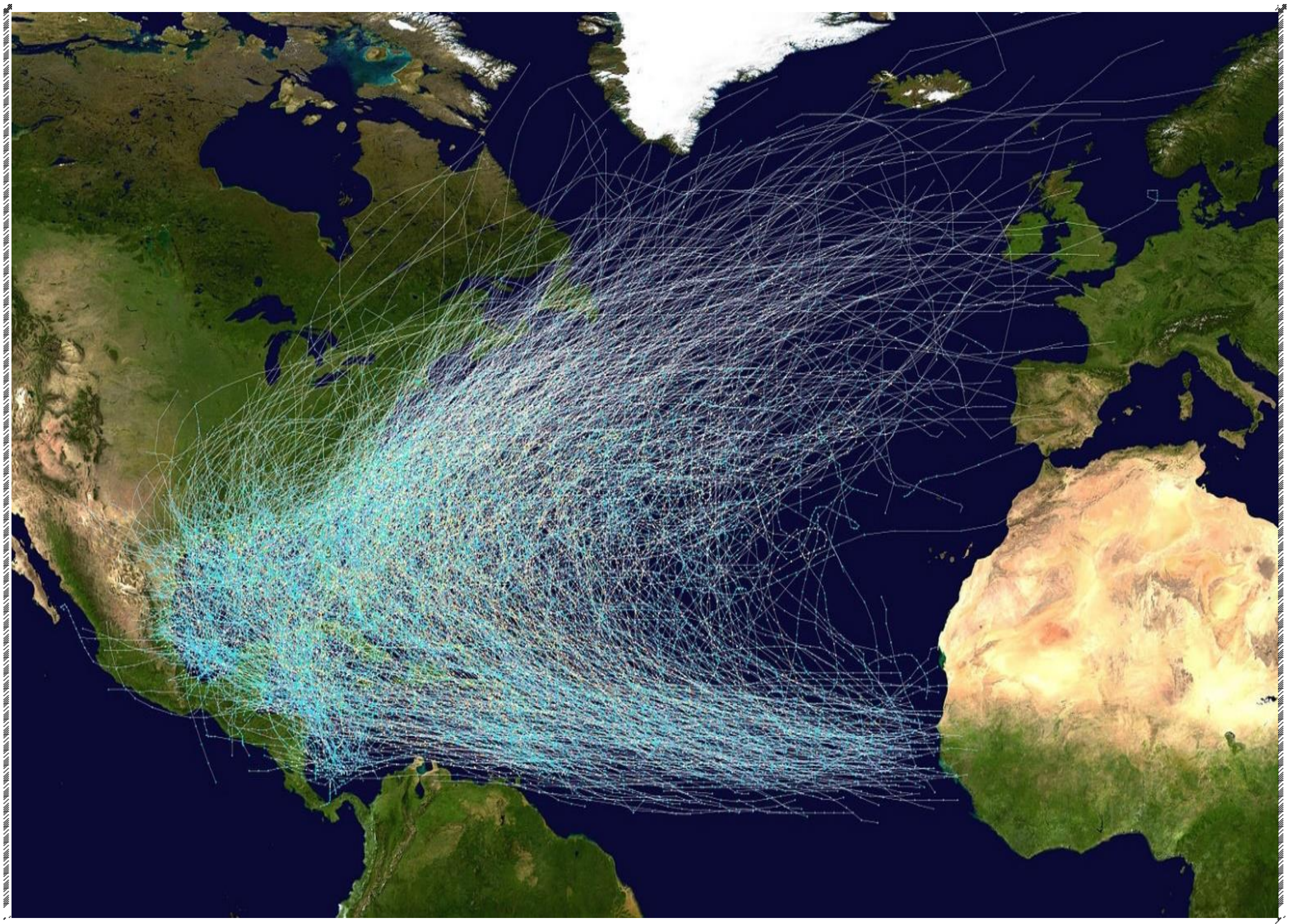


Figure 32: Atlantic hurricane tracks since 1851, the sweeping shape of which is commonly called 'Hurricane Alley'. The approximate location of the Turks and Caicos Islands is highlighted by an orange circle.

The hydrogeological environment of South Caicos can be described as a semi-arid tropical region, Figure 33. The climate conditions are characteristically long hot summers in contrast with relatively cooler winter seasons. On average rainfall is relatively low (20 inches per year) and occurs mostly from August to December.

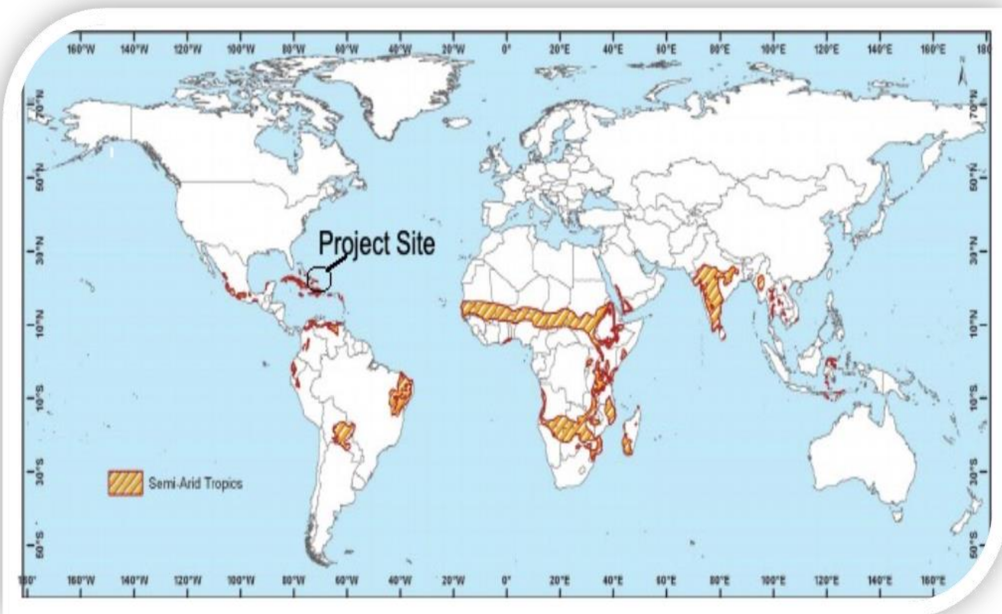


Figure 33: Areas of Semi-arid climates

(Source: http://www.fao.org/sd/EIdirect/climate/EIsp0002.htm)

Historical Hurricane Activity

Historical hurricane information from the NOAA's National Hurricane Centre (NHC) database was reviewed (for storms occurring between 1850 and 2021). All hurricanes passing within a 300km radius of the project site were extracted from the database. The results show that since the year 1850, 150 tropical storms and hurricanes have passed within this radius of South Caicos. The total number of storms can be broken down according to the categories described by the Saffir-Simpson scale as shown in Figure 34. The graph shows that the study.

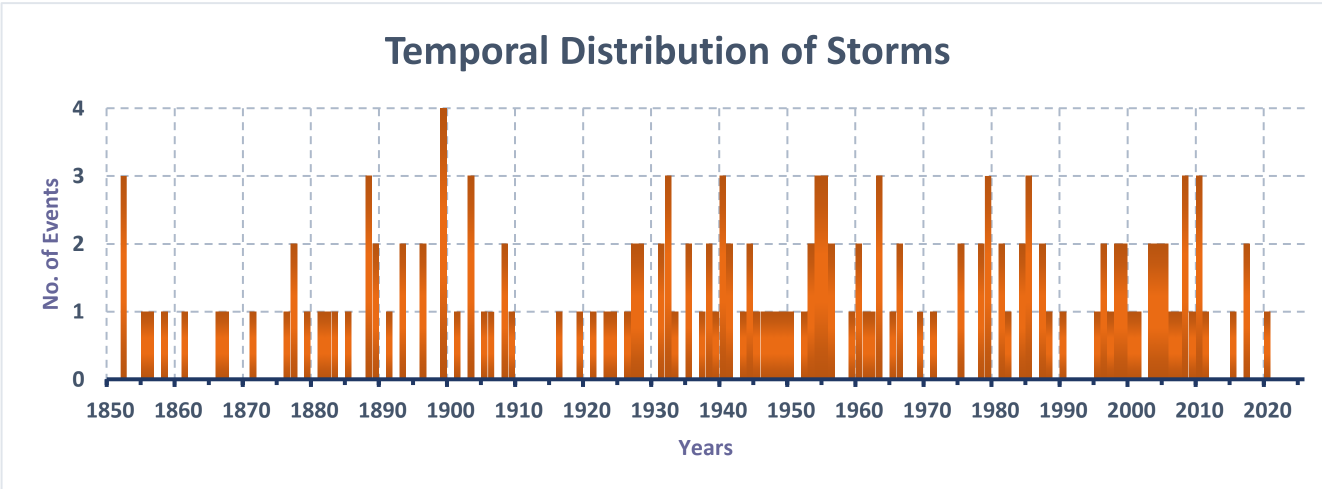


Figure 34: Storm distribution by year since 1850 showing storms that have passed within a 300km radius of the project site.

Figure 35 above shows the temporal distribution of storms. The graph shows that several years occasionally pass without a hurricane, but it also indicates that more than one storm can affect the project site in any given year.

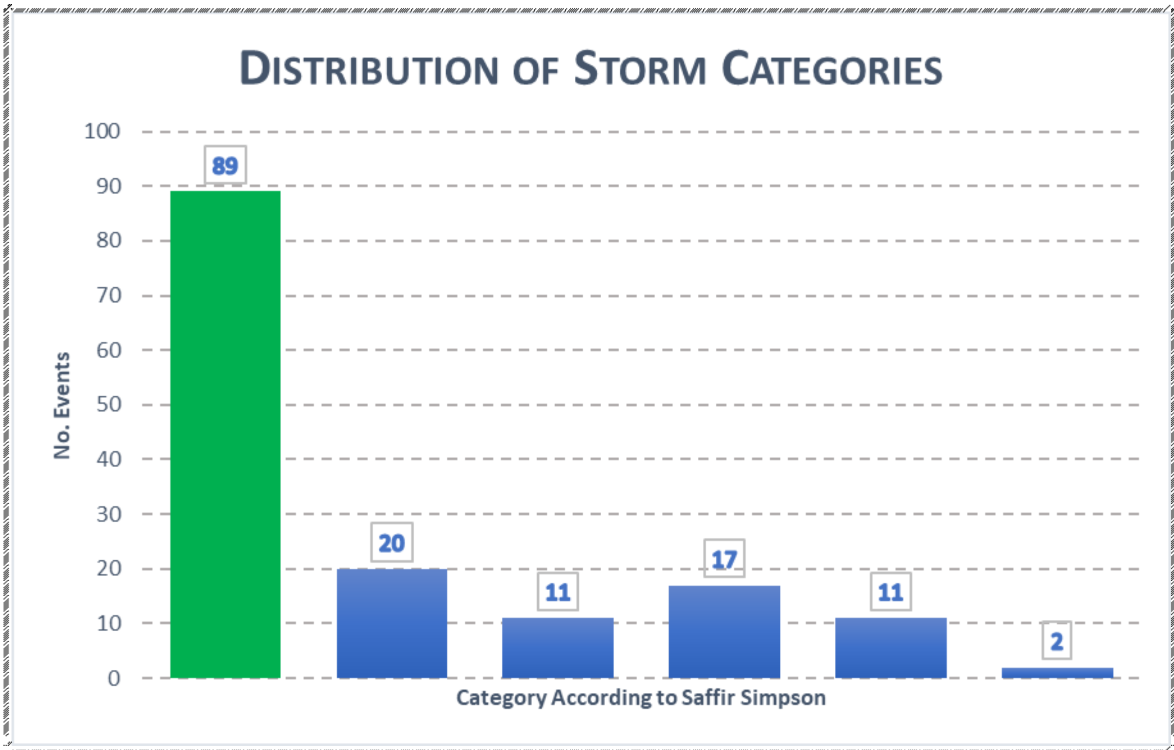


Figure 35: Storm distribution, according to Saffir Simpson classification, since 1850 showing storms that have passed within a 300km radius of the project site

2.2.9 Hydrology occurrences – distribution, connectivity, movement, and quality of water within the property

The occurrence and behaviour of groundwater relative to the proposed project site is subject to the relative densities of subsurface water bodies and water derived from local rainfall. Since salt water has a higher density of freshwater, it follows that the lesser-density fluid will float atop the greater-density fluid. Against this background, the classical occurrence of groundwater throughout the Turks and Caicos Islands is defined in accordance with the Ghyben-Hertzberg Principal to form a groundwater configuration of a layered pattern having freshwater, underlain by a mixture of fresh/saltwater (brackish) and lastly an infinitely thick saltwater layer. The layered configuration presents a salinity versus depth profile.:

- Potable water (<0.6ppt Cl^-)
- Brackish water layer (0.6 – 1.2ppt Cl^-)
- Saltwater layer (> 1.2 – 36 ppt Cl^-)

Surface geophysical groundwater exploration techniques including Electromagnetic Ground Conductivity Surveys were used to map the groundwater configuration of the proposed project site. The results from **the** investigation concluded that a thin and fragile freshwater lens occurred in isolated patches across the project site.

Surface geophysical groundwater exploration techniques including Electromagnetic Ground Conductivity Surveys were used to map the groundwater configuration of the proposed project site. The results from the investigation concluded that a thin and fragile freshwater lens occurred in isolated patches across the project site.

To validate the findings from the previous study, six new test pits were constructed to assess the subsurface geology, subsurface lithology, and depth to the water table and obtain a salinity versus depth profile of the groundwater body, the results from the field investigation are presented in Table 2. The results from field investigation showed the absence of a freshwater lens and contiguous occurrence of saline groundwater along the proposed footprint of the inland canal system.

Table 2: Test pits data

Test Pit	GPS Coordinates		Lithology	Water Level (ft)	Depth (ft)	Salinity (ppt Cl^-)
1	21°34’06” N	71°29’51 W	Limestone	2.8	3	28.4
					10.6	31.2
2	21°33’55”N	71°29’53 W	Limestone	2.9	3	18.2
					11.0	28.3
3	21°33’37”N	71°29’54W	Sand	Poorly cemented Sand. Cave in.		
4	21°33’22”N	71°29’58 W	Limestone	5.1	6.0	16.8
					10.0	28.4

5	21°33'00"N	71°30'23W	Limestone	2.6	3	27.8
					10	30.6
6	21°33'23"N	71°29'53W	Limestone	Very Dense Limestone. Excavation aborted – Rock too hard		

2.2.10 Historical and archaeological features (anthropogenic features and artifacts structures) from prior human habitation or use of the site

The three noted archaeological sites on South Caicos Island lie outside the footprint of the proposed development. These sites were discovered by Dr. Shaun Sullivan, who traversed the Caicos Islands and discovered a total of 11 archeological sites across the Turks and Caicos Islands. As published by William F. Keegan (Pre-Columbian Archaeology of the Turks and Caicos Islands), the archaeological sites were relatively small and suggested that the small sizes were indicative of a transient journey across the island.

2.3 Biological Environmental Baseline Assessment

The query of the database maintained by the International Union for the Conservation of Nature (IUCN) revealed the potential presence of 2162 terrestrial and marine floral and faunal species that occur in the Turks and Caicos Islands, and which are designated, in descending order of vulnerability, as Critically Endangered, Endangered, Near Threatened, Vulnerable, Least Concern, and Data Deficient. The IUCN database does not allow for filtering by island, so the list (Appendix II) is for all the Turks and Caicos Islands.

Although the IUCN list includes many species that exist in habitats that are not present on the subject property (e.g., coral reefs) or within the potential sphere of influence of the proposed project, it does include several species of terrestrial or wetland-related flora and fauna that were observed during the assessment and/or have the potential to be affected by the proposed activities. Species that were observed and/or are likely to occur on the subject site and/or within the sphere of influence of the project have been highlighted in the Appendices.

Additionally, columns have been added to the IUCN database to allow potential impacts to be identified as either "Direct" or "Indirect". Direct impacts are primarily to landside plants that were found to be present in areas where excavation of the canal is proposed. Impacts to individuals of these species could be ameliorated if plant salvage/relocation is undertaken.

Potential indirect impacts to terrestrial species are primarily due to habitat fragmentation impacts could occur because of bisecting existing vegetative communities and removal of plants that presently provide foraging, roosting, and/or nesting habitat for pollinators, birds, reptiles, amphibians, insects, and other wildlife species.

The TCI's list of protected flora and fauna does not include a designation of "Endangered" but individuals of one species that is designated by the IUCN as Endangered (i.e., *Guaiacum officinale*) were observed on the subject property. An additional species, *Lepidium filicaule*, is known to be present in South Caicos and a couple potentially exist within the assessment area. However, this herbaceous species only has above-ground plant parts visible during a short time of the year, which did not overlap with the period of the field assessment, so its potential presence (or absence) within the Assessment Area is unknown. Individuals of several other species, that are designated by IUCN as "Near Threatened" or "Least Concern" were also observed within the Assessment Area.

The Turks and Caicos Islands are not registered as a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), but a search of their database of listed species was conducted for this project because the TCI are a dependent territory of a signatory party and the DECR has been determined by CITES to be an "authority competent to issue comparable documentation" and "A scientific institution capable of advising that an export is not detrimental to the survival of the species concerned". Like the IUCN and DECR's "Schedules", the CITES database does not allow for filtering by island, so the list (Appendix VI) is for all the Turks and Caicos Islands. It identifies numerous species of terrestrial flora and fauna that have the potential to be affected by the proposed activities.

CITES-designated species that were observed and/or are likely to occur on the subject site and/or within the sphere of influence of the of the landside component of the proposed Sail Rock canal and dock project have also been highlighted in this Appendix VI. Many of the species that are included on the CITES list for the TCI are also on the IUCN list.

2.3.1 Baseline terrestrial (including wetlands) environment.

Baseline field surveys in the landside communities and discussions with individuals knowledgeable about the property and/or conditions on the property were conducted by the two-person team of experienced field ecologists from April 21-29, 2022. The results of the field assessments follow.

Lists of flora (Appendix VI) and fauna (Appendix V) observed and identified during the landside assessment are provided in the Appendices.

Using the Standardized Vegetation Classification System and based on the results of the property assessment, which included observations in the 75 vegetation analysis plots, along the 15 transects, between the plots and in areas between the transects, ten community types in four general categories were mapped as being present within the assessment area (Table 3).

Table 3: Existing Landside Communities within the Assessment Area

Community	Size	
	Acres	Hectares
Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous	7.1	2.9
Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous and Drought Deciduous, Upland	52.7	21.3
Forest, Broadleaf Evergreen Estuarine (Tidal)	1.7	0.7
Shrubland, Broadleaf Estuarine	4.6	1.9
Forest, Palustrine Broadleaf Evergreen	1.4	0.6
Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb	4.0	1.6
Palustrine – Nonvascular/ Saline/Hypersaline	12.1	4.9
Sparse, Clear-Cut Land	18.3	7.4
Dwarf Shrubland, Broadleaf Evergreen & Broadleaf Mixed … Coastal	0.9	0.4
Sparse – Created Open Water Areas	16.4	6.6

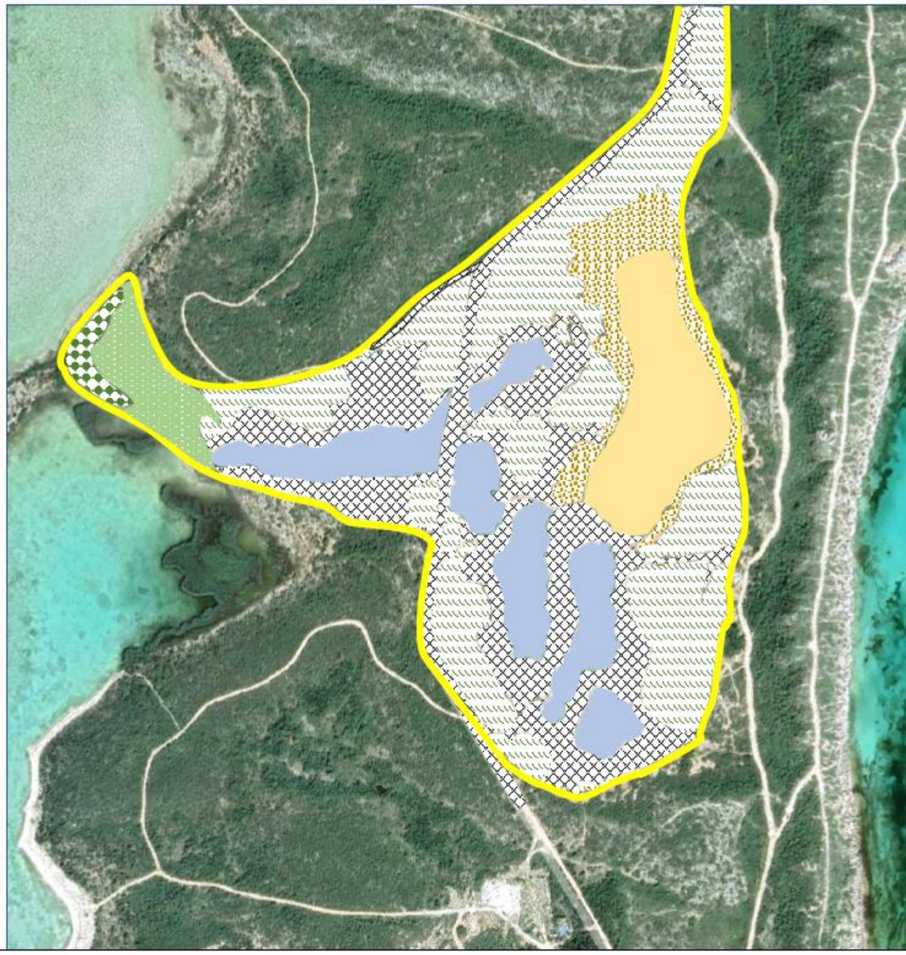
No bluffs, blue holes, caves, dissolution holes, or other particularly notable geologic formations were observed within the landside assessment area. However, additional vegetative communities over and above the ten listed are likely to be present on other portions of the ± 900-acre property that were not assessed because they were outside the area that will be impacted by the proposed canal and dock project.

The spatial distribution of each community is shown in Figures 36 – 40.

Descriptions and photographs of typical and/or notable conditions and the qualitative condition of each community type follow.

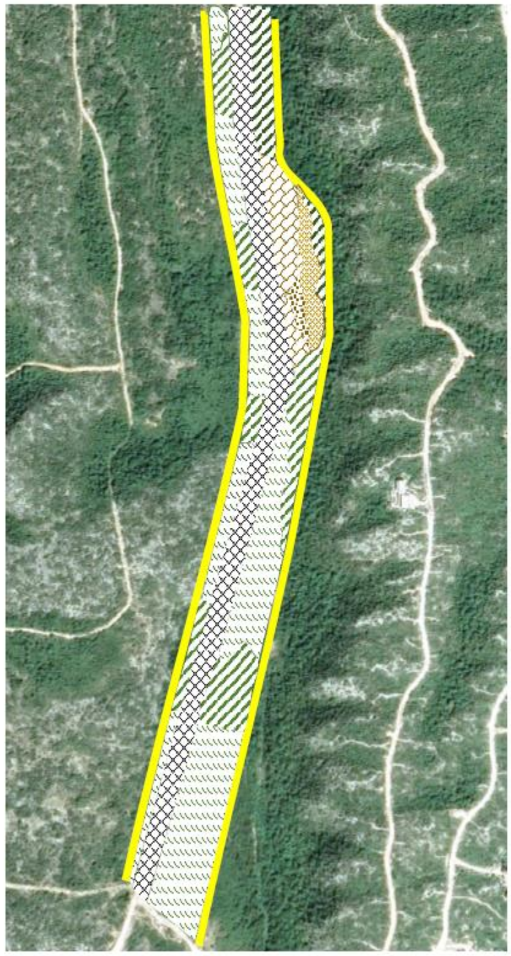
Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous (Code 131)

Approximately 7.1 ac (~ 6% of the Assessment Area) was found to best fit into the description of Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous.



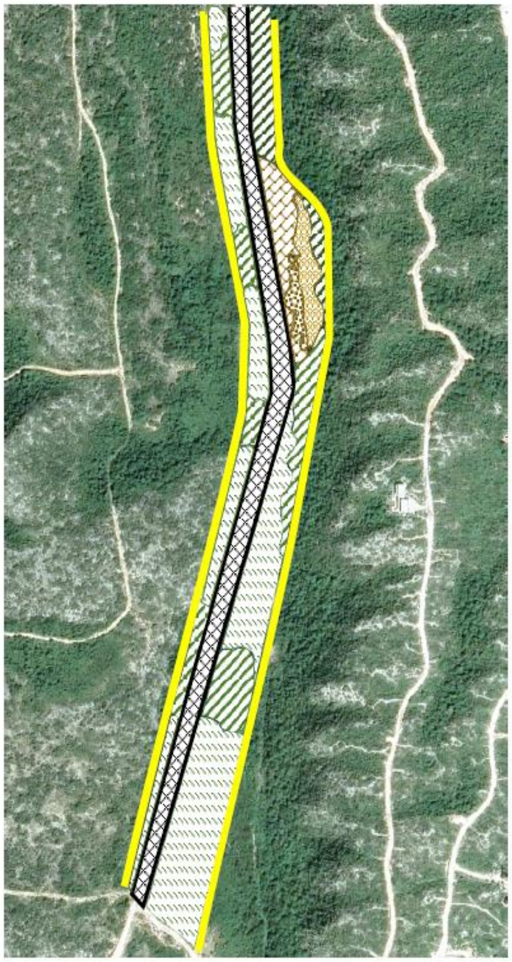
Legend	Acres (this sheet)	Total
Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous	0.0	7.1
Forest, Palustrine Broadleaf Evergreen	0.0	1.4
Palustrine – Nonvascular/ Saline/Hypersaline	11.6	12.1
Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb	3.7	4.0
Forest, Broadleaf Evergreen Estuarine (Tidal)	1.1	1.7
Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous,Upland	33.6	52.7
Shrubland, Broadleaf Evergreen, Estuarine	4.6........	6.0
Sparse, Clear-Cut Land	12.7	18.3
Sparse – Created Open Water Areas	16.4	16.4

Figure 36: Existing Landside Vegetative Community – South



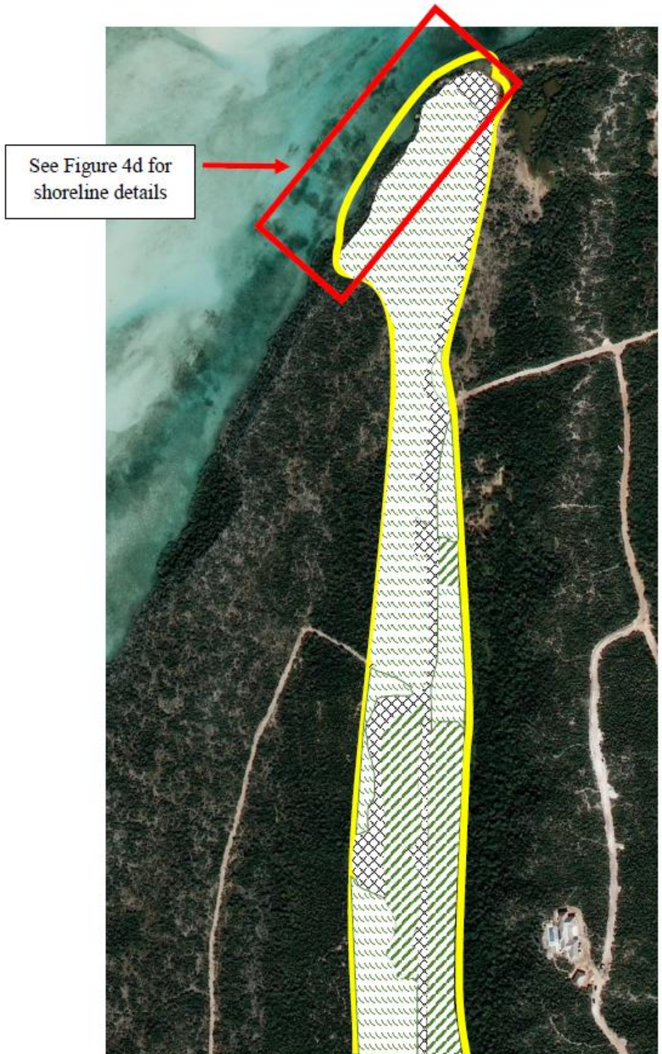
Legend	Acres (this sheet)	Total
Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous	3.7	7.1
Forest, Palustrine Broadleaf Evergreen	1.4	1.4
Palustrine – Nonvascular/ Saline/Hypersaline	0.5	12.1
Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb	0.3	4.0
Forest, Broadleaf Evergreen Estuarine (Tidal)	0.0	1.7
Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous, Upland	7.9	52.7
Dwarf Shrubland, Broadleaf Evergreen & Broadleaf Mixed ... Coastal	0.0	6.0
Sparse, Clear-Cut Land (incl roads)	2.2	18.3
Sparse – Created Open Water Areas	0.0	16.4

Figure 37: Existing Landside Vegetative Community – Central



Legend	Acres (this panel)
Upland – Mixed Evergreen/Drought Deciduous Forest	3.7
Palustrine Evergreen Woodland	1.4
Palustrine/Lacustrine – Nonvascular (Seasonal Pond)	0.5
Palustrine Mixed Graminoid/Forb Herbaceous	0.3
Coastal Mixed Evergreen/Drought Deciduous Woodland	0.0
Mixed Evergreen/Drought Deciduous Shrubland	7.9
Coastal – Rock Dwarf Shrubland	0.0
Human-Altered Landscape – Clear Cut (incl roads)	2.2
Human-Altered Landscape – Water	0.0

Figure 38: Existing Landside Vegetative Community - Central



Legend	Acres (this sheet)	Total
Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous	3.4	7.1
Forest, Palustrine Broadleaf Evergreen	0.0	1.4
Palustrine – Nonvascular/ Saline/Hypersaline	0.0	12.1
Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb	0.0	4.0
Forest, Broadleaf Evergreen Estuarine (Tidal)	0.0	1.7
Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous, Upland	11.2	52.7
Dwarf Shrubland, Broadleaf Evergreen & Broadleaf Mixed ... Coastal	0.5	6.0
Sparse, Clear-Cut Land (incl roads)	3.4	18.3
Sparse – Created Open Water Areas	0.0	16.4

Figure 39: Existing Landside Vegetative Community – North

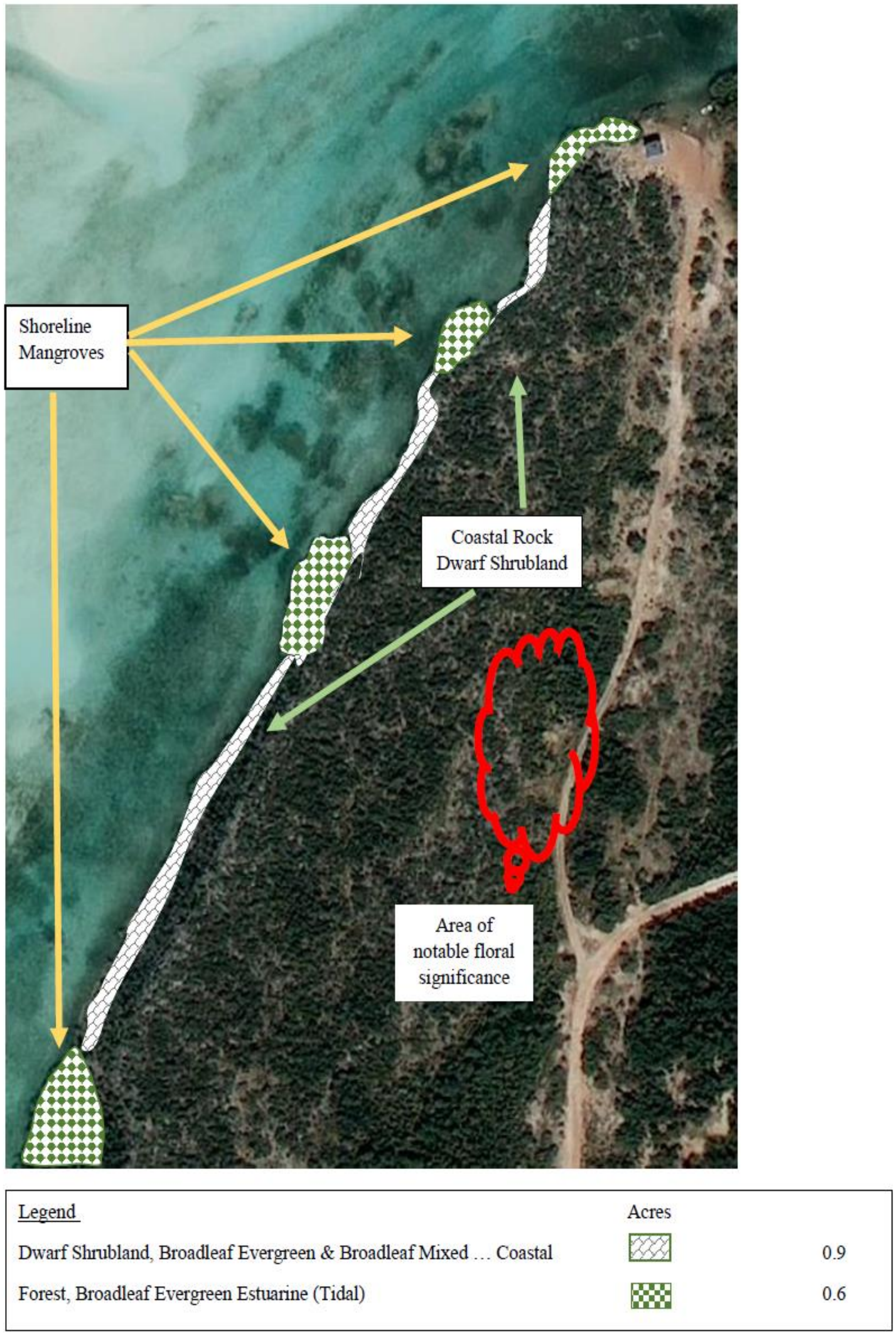


Figure 40: Existing Landside Vegetative Community - Shoreline

This community is commonly referred to as Tropical Dry Forest or Blackland. The TCINVS does not indicate that this community is present in South Caicos. However, this community's presence on the sheltered (west) side of the steep bluff/ridge that extends along the northeastern part of South Caicos shelters it from the salt spray that would otherwise create the conditions that are designated as "Coastal". On the subject property, this community was primarily present in areas east of the main north-south oriented existing road and west of the high ridge that forms the eastern spine of the island. Tree species, which had a closed canopy included poisonwood (*Metopium toxiferum*), gum elemi (*Bursera inaguense*), manchineel (*Hippomane mancinella*) strongback (*Bourerria ovata*), torchwood (*Amyris elemifera*), crabwood (*Ateramnus lucida*), lignum vitae (*Guaiacum sanctum*) and others. The sub-canopy included immature specimens of these species and shrubs, including blind-eye bush (*Helicteres jamaicensis*), blackbead (*Pithecellobium unguis-cati*), ratwood (*Erythoxylum rotundifolium*) and others. Vines included soldier vine (*Myriopus volubilis*), and wild apricot (*Passiflora pectinata*). Epiphytes and groundcover were absent, or minimally present. (Photo 1) is representative of this community.

Photo 1: Typical Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous
Sail Rock - April 2022 - (512) - Plot 11a - View looking South - Date of Photo: April 26, 2022

The vegetative cover was mostly too dense to see many birds or other wildlife, but thick-billed vireos and white-winged doves were frequently heard in the vicinity while the vegetational analyses were being conducted in this community. Cerion snails were present and a Turks Island leafwing butterfly was observed at Plot 11a.

This community was ranked as being in good condition. Floral diversity was comparatively high, hydrology appeared intact, evidence of recent hurricanes was non-existent or minimal and various species designated as endangered, threatened or endemic appeared to be present in sustainable populations.

Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous and Drought Deciduous (Code 331)

Approximately 52.7 acres (~ 44 % of the Assessment Area), was found to consist of a floral assemblage mostly closely fitting the TCINVC's description of Shrubland,

Broadleaf Mixed Evergreen/Drought Deciduous and Drought Deciduous, commonly referred to a "Scrub" or "Bush". Trees, which were mostly less than 10 feet (~ 3 m) in height were uncommon but included yellowwood (*Zanthoxylum flavum*) and gum elemi (*Bursera inaguense*). Shrubs were dominant and included Bread and Cheese (*Pithecellobium unguis-cati*), Joewood (*Jacquinia keyensis*), rong bush (*Wedelia bahamense*) (a plant species designated by the TCIG as a Lucayan Archipelago Endemic), sage cop (*Lantana involucrata*), black torch (*Erithalis fruticosa*) and grannybush (*Croton linearis*). Groundcover species included fanpetals (*Sida procumbens* and *S. ciliaris*) and various grasses (Poaceae). Vines in this community included love-vine (*Cassytha filiformis*) and wild apricot. Epiphytes varied in species and abundance from plot to plot, but included tall orchids (*Encyclia altissima*), silvery wild pine airplants (*Tillandsia circinnata*) and smooth mistletoe (*Dendropemon purpureus*).

Avifauna was common in this community; the calls of Bahama mockingbirds, `thick-billed vireos, bananaquits, grey kingbirds and/or white-winged doves were almost always within earshot.

Photo 2 is typical of this most-common vegetative community.

Photo 2: Typical Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous and Drought Deciduous - Date of Photo: April 26, 2022

Qualitative Condition of the Upland – Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous and Drought Deciduous Community.

This community was ranked as being mostly in good condition. Hydrology appeared intact, but decades of browsing by free-roaming donkeys appeared to have negatively affected floral diversity. Several species designated as endangered, threatened or endemic appeared to be present in sustainable populations.

Forest, Broadleaf Evergreen Estuarine (Tidal) (Code 113)

A comparatively small portion of the assessment area, approximately 1.7 acres (~ 1 %), was found to consist of a floral community most closely aligned with TCINVC's Forest, Broadleaf Evergreen Estuarine (Tidal) community, which is commonly referred to as a mangrove forest, or mangrove fringe. At the subject site, this community was dominated by a closed canopy.

mangrove community that includes red mangroves (*Rhizophora mangle*), black mangroves (*Avicenna germinans*), white mangroves (*Laguncularia racemosa*), and buttonwoods (*Conocarpus erectus*) – a west-facing (i.e., sound-fronting community) of small trees/large shrubs). Lower elevation areas were sub-tidal and inter-tidal, and higher elevation areas likely only get tidal inundation during peak times of the tidal and/or lunar cycle. (Although the TVINVC'c classification system correlates this community with estuaries, at the subject site, mixing of fresh water with tidal water is non-existent or minimal, so "Tidal" is the more accurate descriptive term). Shrubs were mostly juveniles of these species. Groundcover species included glasswort (*Salicornia virginica*) and *Distichlis* (formerly *Monanthochloe*) *littoralis*.

Wading birds, including great blue herons, yellow-crowned night herons, reddish egrets and green herons typically forage in these areas, and prey for these species, mud crabs (Panopeidae) and their burrows were observed. Photo 3 is representative of this community.

Photo 3: Typical Forest, Broadleaf Evergreen Estuarine (Tidal)
View looking south, toward Bell Sound Reserve - Date of Photo: April 22, 2022

Qualitative Condition of the Forest, Broadleaf Evergreen Estuarine (Tidal) Community

This community was ranked as being in good condition. Trees were mostly less than 15 feet in height but had a closed canopy; the hydrology and floral assemblages appeared intact, and no evidence was observed of hurricane/tropical storm impacts. Several species designated as endangered, threatened, or endemic (mostly birds) appeared to be present in sustainable populations.

Shrubland, Broadleaf Estuarine (Code 313)

Approximately 4.6 acres (~ 4% of the assessment area) were found to consist of Shrubland, Broadleaf Estuarine, commonly referred to as Mangrove Shrubland. Trees were absent in this community, but a natural assemblage of shrub-height, salt-tolerant vegetation was present. Red mangroves, black mangroves, white mangroves, and buttonwoods were common, although the percentage cover was mostly less than 50%. This area was mostly above the mean high-water elevation, and the shrubs appeared to be height-limited due to harsh conditions and the thin veneer of sand/mud on top of the prevailing rock substrate. Photo 4 is representative of conditions in this vegetative community.

Photo 4: Typical Shrubland, Broadleaf Estuarine - View looking southwest.
Date of Photo: April 23, 2022

Wading birds are well known to forage in this habitat, and the low mangroves provide nesting habitat for yellow warblers. Least terns and laughing gulls were heard in the distance, over Bell Sound.

Qualitative Condition of the Shrubland, Broadleaf Estuarine Community

This habitat was ranked as Good. Despite the absence of tall trees, this community appeared to be in a mostly natural state, and free of human-related and storm-related impacts. Several species designated as endangered, threatened or endemic appeared to be present in sustainable populations in this community.

Dwarf Shrubland, Broadleaf Evergreen and Broadleaf Mixed Evergreen Drought Deciduous, Coastal (Code 432)

Approximately 0.9 acres (~ 1% of the assessment area) were found to fit Shrubland the TCINVC's description of Dwarf most closely, Broadleaf Evergreen and Broadleaf Mixed Evergreen Drought Deciduous, Coastal, commonly referred to as Coastal Dwarf Shrubland. This community was present along shoreline areas where a combination of a predominant rock substrate and harsh environmental conditions (i.e., lack of fresh water, intermittently heavy abundant salt spray, etc.) prevent the establishment of a diverse floral assemblage. The only location within the assessment area where this community was encountered was at the far northern end, along the west-facing shoreline near the location where the proposed canal would meet the shallow waters of the Bank.

Trees were non-existent in this area, and shrubs were primarily species that can tolerate the lack of fertile soil and harsh conditions, including sandfly-bush (*Rhachicallis americana*), mosquito bush (*Strumpfia maritima*) Joewood, and hardhead (*Phyllanthis epiphylanthus*). Photo 6 is representative of conditions in this vegetative community.

Photo 5: Typical Dwarf Shrubland, Broadleaf Evergreen, and Broadleaf Mixed Evergreen Drought Deciduous, Coastal – View looking south – Date of Photo: April 27, 2022

This community does not provide much habitat for birds or other wildlife species. Antillean nighthawks may nest directly on the exposed rock under shade from existing vegetation, and shoreline mollusks (e.g., chitons, nerites) may be present on the rock substrate near the water line. Great blue herons, reddish egrets, and oystercatchers were visible in the nearshore shallows, and laughing gulls, least terns, and white-crowned pigeons could be heard or seen in the distance, over Bell Sound.

Qualitative Condition of the Dwarf Shrubland, Broadleaf Evergreen and Broadleaf Mixed Evergreen Drought Deciduous, Coastal

This habitat was ranked as Good. Despite a lack of tall trees, this appeared to be mostly natural, and free of human-related and storm-related impacts. Several species designated as endangered, threatened or endemic appeared to be present in sustainable populations.

Forest, Palustrine Broadleaf Evergreen (Code 114)

Approximately 1.4 acres (~ 2% of the assessment area) were found to most closely approximate TVINVC's description of Forest, Palustrine Broadleaf Evergreen, which is commonly referred to as a buttonwood swamp. The Dominant vegetation in this community was buttonwood trees, which, from place to place, varied in height from shrubs to mature, closed-canopy trees in the height range of 10 – 15 feet (3 – 4.5 m). Unlike shoreline tidal forests, these buttonwood stands were primarily present in a road-parallel corridor in the northern portion of the assessment area. No evidence of direct tidal inundation or surface water was observed in the areas investigated, but it is likely that intermittent astronomically (i.e., lunar) high tides may bring shallow depths of salt water into this area from the north. As the tide recedes, salt water would remain, which increases soil salinity, creating harsh conditions that only a select few hardy species can tolerate.

At several locations, the typical green buttonwoods (*Conocarpus erectus*) were interspersed with the variant "silver buttonwood" (*Conocarpus erectus* v. *sericea*) (Photo 6) which is often grown and sold commercially at plant nurseries and sold/planted for their aesthetic value.

Photo 6: Silver Buttonwoods growing interspersed with green buttonwoods
Date of Photo: April 27, 2022

At some locations, likely where soil salinities are not quite as high, buttonwoods were interspersed with other trees.

This community provides nesting sites for passerine birds, and unoccupied nests from previous years, suggesting that yellow warblers, bananaquits and Bahamas woodstar hummingbirds (Photo 7) likely nest in this community.

Photo 7: Woodstar hummingbird nesting in Buttonwood tree
Date of Photo: January 31, 2022 (Photo provided)

Qualitative Condition of the Forest, Palustrine Broadleaf Evergreen Community

This habitat was ranked as Good. Plant diversity is naturally low in this community, but trees appeared healthy and unaffected by human activities and storms and habitat for species designated as endangered, threatened or endemic appeared to be present in sustainable populations.

Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb (Code 534)

Approximately 4.0 acres (~ 3% of the assessment area) were found to consist of a community that most closely fits TCINVC's description of an Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb community, also known as salt marsh. This mapped community, which also included areas without significant vegetation, was present along the perimeter of an existing seasonally flooded salt pond, located in the southeastern quadrant of the Assessment Area. Transect 6 traversed this gently sloping community, which consisted primarily of *Distichlis* *littoralis* and *Batis maritima*. The rhizomatous Glasswort (*Saliconia virginica*) was intermittently abundant in this area. Stunted buttonwoods, mostly less than 3 ft (~1m) in height were occasionally present, many of which appeared to be in a stressed condition. It is likely that the percent cover of vegetation in this area varies naturally on a seasonal (wet season/dry season) basis. Soils with super-saturated salinity likely prevent the establishment of a more diverse floral community and are the most likely stressor of the buttonwoods.

Photo 8 is representative of conditions in this vegetative community.

Photo 8: Herbaceious, Palustrine, Perennial Mixed Graminoid/Forb Community - View looking southeast - Date of Photo: April 24, 2022

Due to its unique, highly saline characteristics and limited floral diversity, this community does not provide much habitat for most birds or other wildlife species. Donkeys obviously graze on the herbaceous vegetation, and trails from their meanderings extend through this and adjacent areas.

Two observations in this area are notable. During the April 2022 field investigations, a pair of Wilson's plovers were observed to be nesting in a shallow depression amid a patch of sprawling *Batis maritima* in this community. Plovers nest directly on the ground and the habitat mosaic created by short, brown (dry season) grasses and *Batis* created a camouflage effect where the birds' nest was well concealed. This was the only portion of the Assessment Area where these conditions exist, and the only location where Wilson's plovers were observed. This species is known to also nest on sandy beaches, so it is possible that the east-facing beaches on the east side of the Sail Rock property may also provide nesting habitat for this species. Other shorebird species, including killdeer (a different member of the plover family), black-bellied plovers, and lesser yellow legs were observed in this area during field assessments conducted in November 2013. Wading birds and waterfowl may also use this area when water levels are high.

According to a report by Applied Technology and Management, Inc. (2014), a notable observation in this vegetative community during fieldwork conducted by their staff in November 2013 was the presence of Turks Islands leafwing butterflies (*Memphis intermedia*). This is one of only four species designated as "Protected Terrestrial Invertebrates" in "The Schedules", the TCI's reference list of protected flora and fauna.

Qualitative Condition of the Herbaceious, Palustrine, Perennial Mixed Graminoid/Forb Community

This habitat was ranked as Good. Natural hydrology appeared to be largely intact, although it appeared likely that recent ground alterations in the vicinity (See section on Human Altered Landscape – Water) may have affected conditions in this area. The presence of dead and stressed buttonwood trees, and the known effects of alternately excessively dry, dry-season conditions, and seasonally flooded conditions that typically follow tropical storm events, make this and the adjoining Palustrine Non-vascular community highly variable based on seasonal conditions. Some salt ponds are known to give off objectionable odors during the dry season and have nearly intolerable insect problems periodically during the rainy season. In addition to the plovers, however, the presence of other foraging shorebirds in this area suggests that, at least seasonally, this community provides habitat for the suite of small aquatic organisms on which resident and migratory birds feed. Species designated as endangered, threatened or endemic were minimally present.

Palustrine – Nonvascular/ Saline/Hypersaline (Code 614.2)

Situated adjacent to, and at a slightly lower elevation than the previously described P-MG/FH community, approximately 12.1 acres (~ 10% of the assessment area) was found to consist of a

Palustrine Non-vascular hypersaline community. Two disjunct polygons of this community were found to be present within the Assessment Area. The largest of these was the large kidney-shaped salt pond located in the southern part of the Assessment Area. Analysis of historical aerial photography of this area indicates that the cover of surface water in this salt pond expands considerably during rainy seasons and shrinks considerably during dry seasons. Little or no vegetation was present in the portions of the area that were explored during the April 2022 field investigation.

The salinity of a sample of surface water in this naturally occurring salt pond was "off-the-scale" more than 130 part-per-thousand (seawater is typically 30-35 ppt) when measured on April 23, 2022. This hyper-saline condition explains the absence of vegetation in this area, as the salinity is too high for nearly all vascular plants.

Photo 9 is representative of conditions in this vegetative community.

Photo 9: Typical Palustrine - Nonvascular/ Saline/Hypersaline Community cropped View looking north - Date of Photo: April 22, 2022

Due to its unique, highly saline characteristics and limited floral diversity, in its current condition, this community did not appear to provide productive habitat for most birds or other wildlife species, at least during April 2022. As described hereafter, though, conditions are likely to change seasonally, and during the rainy season, if salinities decline to the extent that the pond provides habitat for greater diversity and abundance of aquatic life, this pond has the potential to provide habitat for a greater diversity of birds and other species.

The second area of this community type was a small (~ 0.6 acres (~ 0.24 ha) area located on the east side of the existing road approximately 0.6 miles (~1 km) to the north. What little surface water was present at the beginning of the 8-day assessment period had completely evaporated by the end of the assessment. The measurement of water salinity taken on April 24, 2022, was 72 parts per thousand (ppt). Although no water/wetland birds (i.e., ducks, wading birds …) were present in this pond on this day, photographs taken of this pond during the wet season indicate its high value for waterfowl during that period. Migratory species (e.g., blue-winged teal, wigeon) and resident species (e.g., black-necked stilts, white-cheeked pintails) were documented. Resident nesting birds included a yellow warbler (nest found April 2022) and woodstar hummingbird (observed nesting January 2022). It is likely that the salinity in this pond during the rainy season is suitable for the existence of populations of aquatic organisms such that this small pond becomes extremely valuable for birds (and perhaps other wildlife species) annually during certain times of the hydrologic cycle.

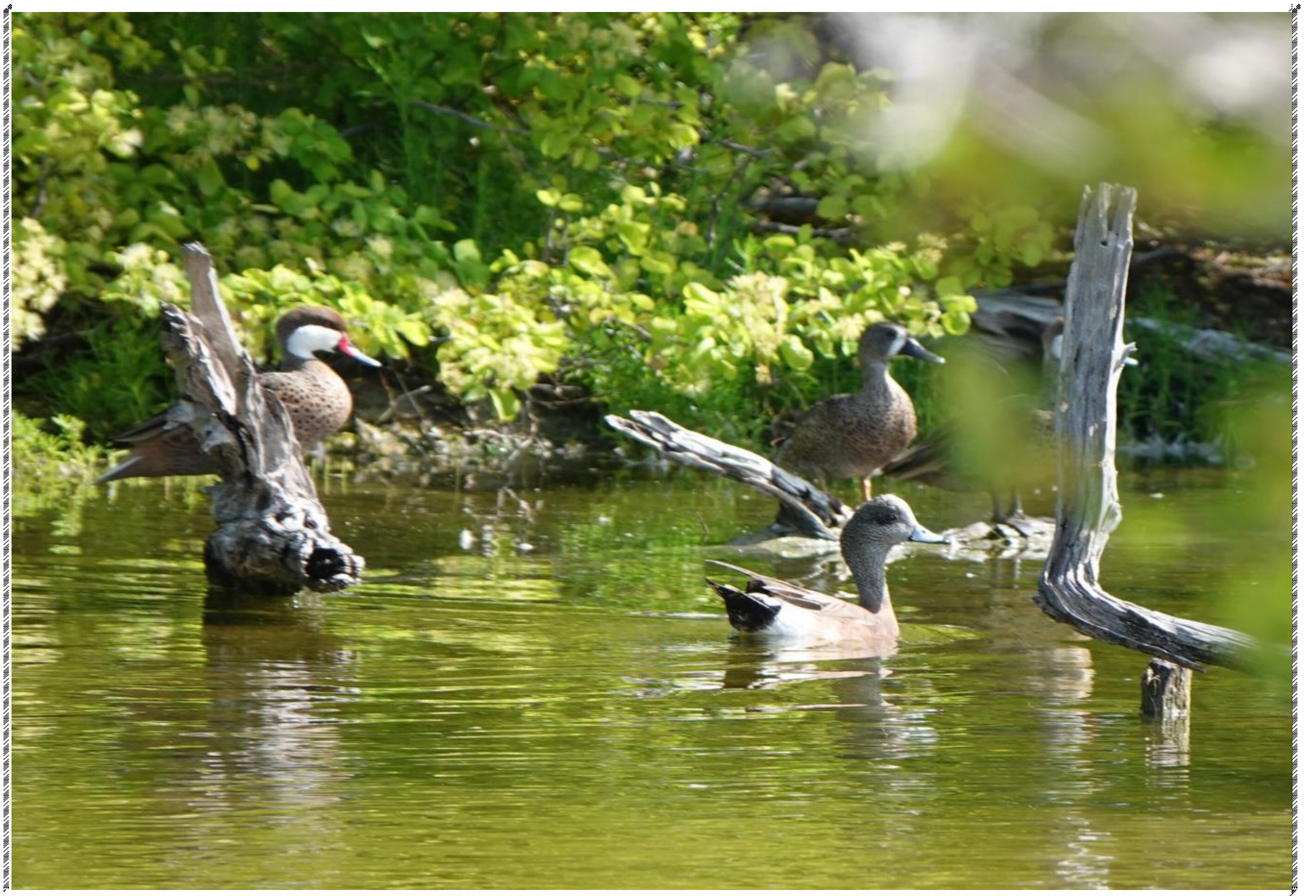


Photo 10a (Wet season) – Date of Photo: February 1, 2022

Photo 10b (Dry season) - Date of Photo: April 27, 2022

With a goal of documenting wildlife species that may occupy this habitat, but which may be too skittish to be observed by inquiring ecologists, a game camera was installed along the southwest periphery of this pond near the beginning of the assessment period. During the ensuing five days, the motion-activated camera recorded 34 animal images (numerous images showed no evidence of animals and may have been tripped either by wind-blown tree branches or birds flying too fast to be photographed by the motion-activated camera). Of the 43 animals photographed, 19 were of one or more donkeys, and 15 were of birds - common ground doves (n= 13) and killdeer (n=2).

A wildlife camera deployed for similar durations at different times of the year/hydologic cycle, is likely to yield equally highly variable results.

Qualitative Condition of the Palustrine – Nonvascular/ Saline/Hypersaline Communities

Based on the results of the assessments, the habitat ranking of this large area was ranked as Poor. Natural hydrology appeared to be largely intact, although it appeared likely that recent ground alterations in the vicinity (See section on Human Altered Landscape – Water) may have affected conditions in this area. However, the nearly total lack of vascular vegetation, and the presence of dead and stressed buttonwood trees, are symptomatic of the geologic conditions that contribute to this pond's poor conditions. As noted previously, some salt ponds are known to give off objectionable odors during the dry season and may create insect problems for human visitors, periodically during the rainy season.

In addition to the plovers, however, the presence of other foraging shorebirds in areas hydrologically connected to this area suggests that, as least seasonally, this community provides habitat for the suite of small aquatic organisms on which resident and migratory birds feed.

The ecological ranking of the small pond was Excellent. It appears large enough that it has its own unique character that makes it highly valuable during certain times of the year (i.e., the rainy season when salinity and low), and of low value during the dry season, when surface water is absent. In isolated ponds, wading birds forage most efficiently during natural dry-season draw-downs. Based on limited observations during this period at this site, it is likely that this pond provides valuable foraging habitat for migratory and resident waterfowl on an interim basis, and that the birds need to move elsewhere as the prey base changes with varying water and salinity values. It is likely that donkeys and other wildlife species also find this habitat critical during certain times of every year.

Sparse – Clear-Cut Land (Code 720)

Approximately 18.3 acres (~15% of the assessment area) were found to consist of sparsely vegetated Clear-Cut Land). Other than roads through the property that have been in existence for years/decades, human-altered landscapes within the assessment area were primarily located in the south-central portions of the project site. Based on previous site visits and analysis of historic aerial photography, it appears that limited land-clearing within the Assessment Area began in 2012 in areas west of the main north-south road. Google Earth images indicate that more substantive land clearing, apparently associated with the excavation of ponds, began anew in 2017, and pond excavation was ongoing during the April 2022 ecological assessment – See time-series images in Figure 41, below.

Figure 41: Google Earth Images showing cleared lands and created water bodies.

Trees and shrubs were non-existent in areas of recently cleared lands. Some groundcover weeds and grasses were colonizing formerly cleared areas. Photo 11 is representative of conditions in these recently cleared areas.

Photo 11: Typical recently cleared lands – View looking west
Date of Photo: April 24, 2022

This community does not provide much habitat for birds or other wildlife species, however, the least terns, which were observed in the vicinity, do nest on recently scarified lands. No evidence of nesting was observed during the April 2022 assessment.

Qualitative Condition of the Clear-Cut Land Community

This habitat was ranked as Poor. There was little evidence of natural hydrology, natural floral and faunal communities were absent, and there was no evidence of the presence of floral or faunal species that are designated as endangered, threatened, or endemic.

Human-Altered Landscape - Water

Approximately 16.4 acres (~ 14% of the assessment area) were found to consist of Human-Altered Landscape - Water. All areas of this community type observed during the assessment are shown in the Figure showing recently clear-cut areas.

Photo 12 is representative of conditions in these recently created open water areas.

Photo 12: Typical recently created Open Water Areas - View looking east
Date of Photo: April 23, 2022

None of the created ponds had a direct surface connection to the sea or Bell Sound, however, the termination of the westernmost pond was less than 60 feet (~16 m) from Bell Sound.

No fish or other marine life were observed in the ponds, and in their current, land-locked condition, this aquatic community does not provide much habitat for birds or other wildlife species.

To establish some baseline metrics of cursory water quality, measurements of salinity were taken in all the open water areas using an optical refractometer. Salinities varied from 38 to over 130 ppt (natural seawater typically varies appr. 33-35 ppt). An aerial photograph showing the salinities as they were measured during the week of April 22, 2022, is provided in Figure 42.

Figure 42: Salinity Measurements (parts per thousand) in natural man-made ponds at Sail Rock on April 23, 2022

It is notable that the three southernmost ponds overlap to varying extents with a large, previously existing salt pond, but that the salinity in these currently separated ponds varies considerably.

Qualitative Condition of the Human-Altered Landscape - Water Bodies

This habitat was ranked as Poor. There was no evidence of natural hydrology, natural floral, and faunal communities were absent, and no endangered, threatened, or endemic species were observed.

2.3.2 Quantitative description of terrestrial flora and fauna, including population estimates for any rare, threatened, endangered, or endemic species.

To meet this component of the TOR, data were collected from within seventy-five 3m x 3m vegetation analysis plots along 15 transects that were strategically located across the proposed project area.

Table 4 lists all the plant species that were identified on the site and provides metrics regarding the numbers of individuals of trees, shrubs, and epiphytes and the percent cover of groundcover and vine species that were present in the plots. Animals were present in the plots, in the vicinity, and birds within earshot of each plot are also included. Plants designated as Endangered species, threatened species, and Endemic species are shaded in green, following which is a summary of those species' presence/abundance within the Assessment Area.

Table 4a: Landside Flora in Vegetation Analysis Plots

Table. Plants in Plots

Scientific Name	Common Name	Transect 1 Plot a	Transect 1 Plot b	Transect 1 Plot c	Transect 1 Plot d	Transect 1 Plot e
Date of Investigation		April 22,2022	April 22,2022	April 22,2022	April 22,2022	April 22,2022
Latitude/Longitude		21° 33' 00.8 " 71° 30' 27.3"	21° 33' 00.3 " 71° 30' 27.7"	21° 32' 59.6 " 71° 30' 28.4"	21° 32' 58.9 " 71° 30' 28.8"	21° 32' 58.6 " 71° 30' 29.2"
Amyris elemifera	Torchwood					
Argythamnia candicans						
Ateramnus (fka Gymnanthes) lucida	Crabwood					
Avicennia germinans	Black Mangrove			0/1/0	0/1/0	
Batis maritima	Saltwort		0/0/5%	0/0/<1%		
Bontia daphnoides	White alling					
Borreria sp.						
Borrichia arborescens	Lavender, Sea Marigold					
Bourreria ovata	Strong-back					
Bursera inaugensis						
Buxus bahamensis	Box Wood					
Byrsonima lucida	Locust-berry					
Caesalpinia reticulata						
Capraria biflora	Goat Weed, Stow-weed					
Cassytha filiformis	Woe-vine, Love Vine					
Catesbaea parviflora	Catesbaea					
Centrosema angustifolium	Butterfly Pea, Wild Pea					
Centrosema virginianum	Butterfly Pea, Wild Pea					
Coccoloba krugii	Crabwood, Bow-pigeon, wild grape					
Coccoloba uvifera	Seagrape					
Coccothrinax inaguensis	Thatch Palm					
Conocarpus erectus	Buttonwood	0/5/1				1/0/0
Conocarpus erectus v. sericea	Silver Buttonwood					
Corchorus hirsutus	Wooly Corchorus, Jack Switch					
Crossopetalum rhacoma	Maiden Berry, Mating Berry					
Croton linearis	Granny-bush, Bay Wormwood					
Croton lucidus	Fire-Bush					
Cyperaceae	Sedge					
Dactyloctenium aegyptium	Crowfoot Grass					
Dendropemon purpureus	Smooth Mistletoe					
Distichlis (fka Monanthochloe)	Shoregrass	0/0/1%				
Dodonaea ehrenbergii	Dogwood, Swamp Bush					
Encyclia altissima	Tall Orchid					
Erithalis fruticosa	Black Torch, Candlewood					
Ernodea littoralis	Golden Creeper, Cough Bush					
Erythroxylum rotundifolium	Rat-wood					
Euphorbia gymnonota						
Euphorbia inaguaensis	Wild Thyme (per TCIG)					
Euphorbia tithymaloides bahamensis	Monkey-fiddle					
Euphorbia vaginulata						
Eustoma exalatatum	Marsh Gentian					
Evolvulus alsinoides						
Evolvulus bahamensis (fka E.	Broom Bush					
Evolvulus squamosus	Broom Bush					
Fimbristylis sp.	Sedge					
Galactia sp	Pink Milk-pea					
Genipa (fka Casasia) clusiifolia	Seven-year Apple					
Genus & species unidentified	Grass					
Guaiacum officinale	Lignum vitae					

Table 4b: Landside Flora in Vegetation Analysis Plots

Table. Plants in Plots

Scientific Name	Common Name	Transect 1 Plot a	Transect 1 Plot b	Transect 1 Plot c	Transect 1 Plot d	Transect 1 Plot e
Date of Investigation		April 22,2022	April 22,2022	April 22,2022	April 22,2022	April 22,2022
Guaiacum sanctum	Lignum vitae					
Guapira discolor	Blolly					
Guettarda elliptica	Common Velvet-seed					
Gundlachia corymbosa	Horse Bush					
Helicteres jamaicensis	Cow-bush, Blind Eye Bush					
Heliotropium angiospermum	Horse-bush, Scorpion-tail					
Heliotropium curassavicum	Seaside Heliotrope					
Herissantia crispa	Bladderpod					
Hippomane mancinella	Manchineel					
Jacquemontia cayensis	Black Wiss - Sandyplain					
Jacquemontia havanensis	Jacquemontia					
Jacquinia keyensis	Joe-wood, Ironwood					
Laguncularia racemosa	White Mangrove		0/1/0	0/3/0	0/2/0	4/2/<1%
Lantana involucrata	Sage Cop, Wild Sage					
Lasiacis divaricata	Wild Cane					
Launaea (Lactuca) intybacea	Wild Lettuce					
Limonium bahamense	Heather, Sea-lavender					
Lycium tweedianum	Inagua lycium					
Manilkara bahamensis	Wild Dilly					
Melocactus intortus	Turk's Cap Cactus					
Melochia tomentosa	Velvety Melochia					
Metastelma (fka Cynanchum) angustifol	Marsh Cynanchum					
Metastelma bahamense						
Metastelma (fka Cynanchum) inaguense	Marsh Cynanchum					
Metopium toxiferum	Poisonwood					
Mimosa bahamensis	Haulback					
Myriopus volubilis	Soldier-bush					
Opuntia bahamana	Bahama Prickly Pear					
Opuntia lucayana	Turk's Head Prickly Pear					
Passiflora pectinata	Wild Apricot					
Passiflora suberosa	Juniper-berry, Small Passion-flower					
Pentalinon luteum	Wild Unction, Lice Bush					
Phyllanthus epiphyllanthus	Abraham-bush, Hardhead					
Pilocereus polygonus	Old Man's Cactus					
Pithecellobium keyense	Blackbead					
Pithecellobium unguis-cati	Bread-and-Cheese, Cat's claw					
Pluchea odorata	Marsh Fleabane					
Plumeria obtusa	White Frangipani					
Poaceae, Un-id'd	Grass					
Quadrella (fka Capparis) cynophallopho	Black willow, Black Scrub					
Randia aculeata minor	Box briar					
Reynosia septentrionalis	Darling Plum					
Rhachicallis americana	Hog-bush, Sandfly-bush					
Rhizophora mangle	Red Mangrove	0/0/1%	0/2/0	0/3/1%	0/16/<1%	6/5/<1%
Rivina humilis	Wild tomato, Pigeon-berry					
Sarcocornia virginica	Woody Glasswort	0/0/10%	0/0/15%	0/0/25%	0/0/15%	0/0/5%
Senna (fka Cassia) chapmanii	Bahama Senna, Stinking Pea					
Senna sp	Pea					
Sesuvium portulacastrum	Pondweed, Sea purslane					
Sida ciliaris	Fringed Sida					
Sida procumbens	Creeping Sida					

Table 4c: Landside Flora in Vegetation Analysis Plots

Table. Plants in Plots

Scientific Name	Common Name	Transect 1 Plot a	Transect 1 Plot b	Transect 1 Plot c	Transect 1 Plot d	Transect 1 Plot e
Date of Investigation		April 22,2022	April 22,2022	April 22,2022	April 22,2022	April 22,2022
Sideroxylon (Bumelia) americana	Wild Saffron, Milk-berry					
Solanum bahamense	Canker Berry, Bahamas Nightshade					
Sophora tomentosa	Coast Sophora, Necklace pod					
Strumpfia maritima	Mosquito Bush, Candle Torch					
Stylosanthes hamata	Sweet Weed, Pencil Flower					
Suaeda conferta						
Suriana maritima	Bay Cedar	0/1/0				
Thouinia discolor	Nakedwood, quicksilver-bush					
Tillandsia circinnata	Silvery Wild Pine Air Plant					
Turnera diffusa						
Turnera ulmifolia	Buttercups, Yellow Alder					
Vachellia (fka Acacia) acuifera	Pork and Doughboy, Rosewood					
Vachellia (fka Acacia) macracantha	Porknut					
Wedelia bahamensis	Rong Bush					
Zanthoxylum flavum	Yellow-wood, Satin-wood					
Ziziphus taylorii	Taylor's jujube					
Fauna		Reddish egret in view; donkey feces	Hermit crab, fiddler crab holes,	Crab burrows	Crab burrows, BAMO	Crab burrows, Yl W, donkey trail, Littorina
Comments		Tidal wrack in plot	Donkey trail nrby	Short Ag pneumatorphor es; BAMO	N/A	Donkey trail follows shoreline
Percent Cover:	Percent Cover:	20%	20%	60%	85%	90%
Quality:	Quality:	Good	Fair	Good	Good	Good

Legend and Notes
plot size = 3 meter x 3 meter
Trees = > 7' tall
Shrubs = 1-7' tall
Groundcovers = % groundcover shown; Epiphtyes = #
Numbers = #Trees / # shrub size / % cover for groundcovers & vines, & seedlings less than 1' in height
% Groundcover provided when individual was < 1' tall, regardless of height when mature
% Groundcover listed as 1% includes those present at <1%
For species which have had name changes since they were designated as protected or invasive, the following apply
Vachellia acuifera (pork and doughboy) formerly known as Acacia acuifera
Encyclia orchid # based on avg of 15 peseudobulbs/cluster, unless otherwise counted
Species shown as having 0 occurrences were observed on the site during the assesssment, but did not occur in the vegetation monitoring plc
Occurrence Categories:
Abundant = Present in more than 30 of the 75 plots
Common = Present in 16-30 of the 75 plots
Uncommon = Present in 1-15 of the 75 plots
Occasional = Observed on the property, but was not present in any of the plots
Green shading = Species identified as protected in the TCIGs' "Schedules" or Endangered by CITES or IUCN
Pink shading = Species designated by TCIG as Invasive

Table 4d: Landside Flora in Vegetation Analysis Plots

Table. Plants in Plots

Scientific Name	Transect 2 Plot a	Transect 2 Plot b	Transect 2 Plot c	Transect 2 Plot d	Transect 2 Plot e	Transect 3 Plot a	Transect 3 Plot b	Transect 3 Plot c	Transect 3 Plot d	Transect 3 Plot e
Date of Investigation	April 22,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022
Latitude/Longitude	21° 32' 57.4 " 71° 30' 21.5"	21° 32' 56.5 " 71° 30' 21.5"	21° 32' 56.1 " 71° 30' 22.2"	21° 32' 55.9 " 71° 30' 22.5"	21° 32' 55.6 " 71° 30' 22.9"	21° 32' 40.2 " 71° 29' 56.3"	21° 32' 40.2 " 71° 29' 57.3"	21° 32' 39.4 " 71° 29' 59.8"	21° 32' 38.9 " 71° 30' 00.6"	21° 32' 38.5 " 71° 30' 04.9"
Amyris elemifera										
Argythamnia candicans										
Ateramnus (fka Gymnanthes) lucida										
Avicennia germinans				0/3/0	0/1/0					
Batis maritima				0/0/1%	0/0/<1%					
Bontia daphnoides										
Borreria sp.										
Borrichia arborescens										
Bourreria ovata										
Bursera inaugensis	1/0/0									0/1/0
Buxus bahamensis										
Byrsonima lucida										
Caesalpinia reticulata	0/1/0									
Capraria biflora										
Cassytha filiformis										
Catesbaea parviflora										
Centrosema angustifolium										
Centrosema virginianum										
Coccoloba krugii										
Coccoloba uvifera		0/1/0					0/5/0	0/1/0		
Coccothrinax inaguensis										
Conocarpus erectus	1/0/0		0/1/0	0/4/0			0/5/0		1/6/0	
Conocarpus erectus v. sericea										
Corchorus hirsutus										
Crossopetalum rhacoma										
Croton linearis		0/1/0								0/10/0
Croton lucidus	0/12/0									0/14/0
Cyperaceae		0/0/,1%	0/0/1%			0/0/1%	0/0/1%			
Dactyloctenium aegyptium										
Dendropemon purpureus			0/0/1%							
Distichlis (fka Monanthochloe)			0/0/1%							
Dodonaea ehrenbergii			0/1/0							
Encyclia altissima										
Erithalis fruticosa		0/6/1%				04/0	0/2/0			0/7/0
Ernodea littoralis										
Erythroxylum rotundifolium										
Euphorbia gymnonota										
Euphorbia inaguaensis		0/24/0	0/13/1%			0/10/0	0/6/0	0/9/0	0/1/0	0/5/0
Euphorbia tithymaloides bahamensis										
Euphorbia vaginulata										
Eustoma exalatatum										
Evolvulus alsinoides										
Evolvulus bahamensis (fka E.										
Evolvulus squamosus										
Fimbristylis sp.										
Galactia sp										
Genipa (fka Casasia) clusiifolia										
Genus & species unidentified										
Guaiacum officinale		0/2/0								

Table 4e: Landside Flora in Vegetation Analysis Plots

Table. Plants in Plots

Scientific Name	Transect 2 Plot a	Transect 2 Plot b	Transect 2 Plot c	Transect 2 Plot d	Transect 2 Plot e	Transect 3 Plot a	Transect 3 Plot b	Transect 3 Plot c	Transect 3 Plot d	Transect 3 Plot e
Date of Investigation	April 22,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022
Guaiacum sanctum										
Guapira discolor										
Guettarda elliptica										
Gundlachia corymbosa						0/2/0	0/1/0	0/3/0		0/3/0
Helicteres jamaicensis										
Heliotropium angiospermum										
Heliotropium curassavicum										
Herissantia crispa										
Hippomane mancinella										
Jacquemontia cayensis										
Jacquemontia havanensis										
Jacquinia keyensis		0/3/0	0/1/0			0/1/0		0/1/0		
Laguncularia racemosa					0/1/0					
Lantana involucrata										0/1/0
Lasiacis divaricata										
Launaea (Lactuca) intybacea										
Limonium bahamense										
Lycium tweedianum										
Manilkara bahamensis										
Melocactus intortus										
Melochia tomentosa										
Metastelma (fka Cynanchum) angustifol	0/0/1%									
Metastelma bahamense										
Metastelma (fka Cynanchum) inaguense										
Metopium toxiferum										
Mimosa bahamensis										
Myriopus volubilis										
Opuntia bahamana										
Opuntia lucayana										
Passiflora pectinata	0/0/1%						0/0/1%			
Passiflora suberosa										
Pentalinon luteum										
Phyllanthus epiphyllanthus	0/2/0					0/6/0				
Pilocereus polygonus										
Pithecellobium keyense	0/3/0						0/1/0			0/2/0
Pithecellobium unguis-cati										0/1/0
Pluchea odorata										
Plumeria obtusa										
Poaceae, Un-id'd										
Quadrella (fka Capparis) cynophallophora										
Randia aculeata minor	0/3/0									
Reynosia septentrionalis	0/5/0					0/2/0				0/1/0
Rhachicallis americana			0/12/0				0/1/0	0/27/0	0/43/0	
Rhizophora mangle				0/1/0	0/8/0					
Rivina humilis										
Sarcocornia virginica				0/0/1%	0/0/<1%					
Senna (fka Cassia) chapmanii										
Senna sp										
Sesuvium portulacastrum										
Sida ciliaris										
Sida procumbens										

Table 4f: Landside Flora in Vegetation Analysis Plots

Table. Plants in Plots

Scientific Name	Transect 2 Plot a	Transect 2 Plot b	Transect 2 Plot c	Transect 2 Plot d	Transect 2 Plot e	Transect 3 Plot a	Transect 3 Plot b	Transect 3 Plot c	Transect 3 Plot d	Transect 3 Plot e
Date of Investigation	April 22,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022	April 23,2022
Sideroxylon (Bumelia) americana										
Solanum bahamense										
Sophora tomentosa			0/1/0							
Strumpfia maritima										
Stylosanthes hamata										
Suaeda conferta										
Suriana maritima										
Thouinia discolor	0/1/0									
Tillandsia circinnata								2		
Turnera diffusa										
Turnera ulmifolia										
Vachellia (fka Acacia) acuifera										0/2/0
Vachellia (fka Acacia) macracantha										
Wedelia bahamensis	0/3/0	0/2/0				0/1/0	0/1/0			0/8/0
Zanthoxylum flavum										
Ziziphus taylorii										0/1/0
Fauna	BAMO, B'quit, Hemitrochus, Bl-gr Gnatcat	Thick-b V, B'quit, BAMO	BAMO, Yl W, Cerion	Woodstar, Yl W, BAMO, Bl-gr Gnatcat	BAMO, Kingbird, crab burrows, terns over water	Bl-gr Gnatcat, BAMO, Palm W, Cerion (166), Hemitrochus	Thick-b V, Bl-Gr gnatcat, Cerion, Yl W	Thick-b V, land crab shell nearby	G Kingbird, BAMO, Hemitrochus	Cerion, Hemitrochus
Comments	Slightly downslope from rd	N/A	Donkey trail nearby	N/A	Donkey trail nearby	Donkey trail nearby	possible hurricane damage	Immed S of cleared area	Excavator working nearby	Adj to cleared area to N
Percent Cover:	80%	75%	40%	60%	20%	70	90%	75%	80%	80%
Quality:	Good	Good	Fair	Good	Good	Fair	Fair	Fair	Fair	Good

Legend and Notes
plot size = 3 meter x 3 meter
Trees = > 7' tall
Shrubs = 1-7' tall
Groundcovers = % groundcover shown; Epiphtyes = #
Numbers = #Trees / # shrub size / % cover for ground
% Groundcover provided when individual was < 1' tall, regardless of height when mature
% Groundcover listed as 1% includes those present at <1%
For species which have had name changes since they
Vachellia acuifera (pork and doughboy) formerly
Encyclia orchid # based on avg of 15 peseudobulbs/cluster, unless otherwise counted
Species shown as having 0 occurrences were observed on the site during the assesssment, but did not occur in the vegetation monitoring plots

Species that are included on the IUCN and CITES lists for the Turks and Caicos Islands are included in Appendices IV and III. Species that were observed during the site investigation are highlighted in these Appendices.

Eighteen plant species that are notable because they are on DECR's "The Schedules" list and one species designated as Endangered, or Threatened by the IUCN were encountered within the Assessment Area (Table 5).

It is possible that additional plant species that are designated as Endangered, Threatened or Endemic also occur on the property but were not seen during the field investigation for the canal and boat dock project.

Table 5: Floral Species Identified in "The Schedules" by the Turks and Caicos Government that were observed on the Site[1]

Common Name	Scientific Name	Designating Entity	Abundance within the assessment area
Turks and Caicos Endemic Plants			
Limoniumm bahamense	Turks & Caicos Heather	DECR	Uncommon, only encountered in Coastal Mixed Evergreen Shrubland
Opuntia x lucayana	Lucayan Pear	DECR	Several observed in Upland Mixed Evergreen Shrubland
Lucayan Archipelago Endemic Plants			
Thouinia disolor	Haulbark	DECR	Several observed in Upland – Mixed Forest and Shrubland
Bursera inaguensis	Inagua gum-elemi	DECR	Common, observed in Upland – Mixed Forest & Shrubland
Lantana involucrata	Sea Sage, Wild Sage	DECR	Common, observed in Upland Mixed Evergreen Shrubland
Coccothrinax inaguensis	Inagua Silver-top Palm	DECR	Common, observed in Upland Mixed Evergreen Shrubland
Euphorbia gymnonota	Nakedback	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland
Euphorbia inaguaensis	Wild Thyme	DECR	Common, observed in Upland Mixed Evergreen Shrubland
Caesalpinia reticulata		DECR	Occasional, observed in Upland – Mixed Forest and Shrubland
Wedelia bahamensis	Rong-bush	DECR	Abundant, observed in Upland Mixed Evergreen Shrubland

Native Plants of Special Conservation Concern			
Encyclia altissima	Tall Orchid	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland
Opuntia bahamana	Smooth pear	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland
Cephalocereus royenii	Dildo cactus, old man cactus	DECR	Occasional, Occasional, observed in Upland Mixed Evergreen Shrubland
Guaiacum sanctum	Holy Lignum Vitae	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland
Guaiacum officinale	True Lignum Vitae	DECR IUCN	Occasional, observed in Upland Mixed Evergreen Shrubland
Euphorbia tithymaloides	Monkey-Fiddle	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland
Vachellia (fka Acacia) acuifera	Pork-and-doughboy	DECR	Occasional, Occasional, observed in Upland Mixed Evergreen Shrubland
Dendropemon purpureus	Mistletoe	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland
Ziziphus taylori	Taylor's jujube	DECR	Occasional, observed in Upland Mixed Evergreen Shrubland

Lists of species of flora and fauna that are designated by the International Union for the Conservation of Nature and the Convention on International Trade in Endangered Species of Wild Fauna and Flora are included as Appendices B and C, respectively.

Brief descriptions of the presence and abundance of these notable plant species within the assessment area and photos of some of these species follow, in the order of Endangered; Threatened, TCI Endemic, Lucayan Endemic, and Native Plants of Special Conservation Concern.

Turks & Caicos Heather (Limoniumm bahamense)

Designated by DECR as a Turks and Endemic Plant, this species (Photo 13) was uncommon within the Assessment Area, being only found at one location, in the Shrubland, Broadleaf Evergreen Estuarine (Tidal) community, at approximately 21º 48' 37.09" North latitude; 072º 09' 48.69" West longitude. It was not present in any of the 75 vegetation analysis plots. Some individuals were in bloom during the April 2022 (dry season) investigation.

Photo 13 – Turks & Caicos Heather (Limoniumm bahamense)
Date of Photo: April 23, 2022

Lucyan pear (*Opuntia x lucayana*) (Photo 14), designated by DECR as a TCI Endemic was uncommon on the subject property. It was present in two of the 75 vegetation analysis plots, and was present in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Photo 14 – Opuntia x lucayana – Lucayan pear Cactus
Date of Photo: April 23, 2022

Broom Bush (*Evolvulus bahamensis*), designated by DECR as a TCI Endemic was uncommon on the subject property. It was not present in any of the 75 vegetation analysis plots. It was encountered in the Shrubland, Broadleaf Mixed

Evergreen/Drought Deciduous Upland community. Some individuals were in bloom during the April 2022 (dry season) investigation.

Haulback (*Thouinia discolor*) (Photo 15), designated by DECR as a Lucayan Endemic was uncommon on the subject property. It was present in three of the 75 vegetation analysis plots. It was present in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community, and some individuals were in bloom during the April 2022 (dry season) investigation.

Photo 15 – Thouinia discolor – Haulbark Quicksilver-bush –
Date of Photo: April 23, 2022

Inagua gum-elemi (*Bursera inaguensis*) (Photo 17), designated by DECR as a Lucayan Endemic Plant, was common within the Assessment Area, being present in 17 of the 75 vegetation analysis plots. It was present in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community – the most abundant community type present within the Assessment Area. Most had temporarily lost their leaves during the April (dry season) 2022 investigation.

Photo 16 – Inagua gum-elemi (Bursera inaguensis)
Date of Photo: April 27, 2022

Lantana involucrata (Sea Sage) (Photo 17), designated by DECR as a Lucayan Archipelago Endemic Plant was abundant within the Assessment Area. It was present in 17 of the 75 vegetation analysis plots, all in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community. Some were in bloom during the April 2022 (dry season) investigation.

Photo 17- Lantana involucrata (Sea Sage)
Date of Photo: April 24, 2022

Coccothrinax inaguensis (Inagua silver-top palm) designated by DECR as a Lucayan Archipelago Endemic Plant was uncommon within the Assessment Area. It was present in 5 of the 75 vegetation analysis plots, primarily in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Euphorbia gymnonota (Nakedback) (Photo 17), designated by DECR as a Lucayan Archipelago Endemic Plant was uncommon within the Assessment Area. It was not present in any of the 75 vegetation analysis plots. All were encountered in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community. Flowers of several individual plants that were in bloom during the April 2022 investigation were being visited by woodstar hummingbirds, migratory warblers and bananaquits.

Photo 18: Euphorbia gymnonota – Date of Photo: April 27, 2022

A particularly sizeable population of this species was noted to be present in the northerly portion of the Assessment Area – See Figure 39.

Euphorbia inaguensis (no common name) (Photo 18), designated by DECR as a Lucayan Archipelago Endemic Plant was abundant within the Assessment Area. It was one of the most frequently encountered species in the 75 vegetation analysis plots, being present in Figure 39 (~39%). All were encountered in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Photo 19: Euphorbia inaguaensis - Date of Photo: April 26, 2022

Numerous plants of this species appeared to have re-populated following the clearing of roads that were subsequently unused used, as was the situation shown in Photo 19.

Brasiletto, (*Caesalpinia reticulata*) is designated as a Lucayan Archipelago Endemic by the TCI's Department of Environment and Coastal Resources. It was uncommon within the Assessment Area, being present in 7 of the 75 plots. They were in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Rong-bush, (*Wedelia bahamensis*) (Photo 20) is designated as a Lucayan Archipelago Endemic by the TCI's Department of Environment and Coastal Resources. It was the most frequently encountered species in the 75-vegetation analysis, being present in 42 (56%) of the plots, all of which were in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Photo 20: Rong-bush - Wedelia bahamensis - Date of Photo: April 24, 2022

The Tall Orchid, (*Encyclia altissima*) (Photo 21) is designated as a Native Plant of Special Conservation Concern by the TCI's Department of Environment and Coastal Resources. It was uncommon within the Assessment Area, being present in only one of the 75 plots, all of which were in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Photo 21: Encyclia altissima & Pilocereus polygonus) Tall Orchid, (Encyclia altissima)
Date of Photo: April 23, 2022

The Old Man's Beard Cactus, (*Pilocereus royenii*) (Photo 22) is designated as a Native Plant of Special Conservation Concern by the TCI's Department of Environment and Coastal Resources. It was uncommon within the Assessment Area, being present in only one of the 75 vegetation analysis plots, in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community.

Photo 22: Old Man's Beard Cactus, (Pilocereus royenii) – Date of Photo: April 26, 2022

Holy lignum vitae (*Guaiacum sanctum*) and True lignum vitae (*Guaiacum officinale*) both of which are designated as Native Plants of Special Conservation Concern by the TCI's Department of Environment and Coastal Resources were both uncommon within the Assessment area, being present in only 5 and 3 of the 75 vegetation analysis plots, respectively, all of which were in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community. None were tall, large-diameter trees,

Monkey-fiddle *(Euphorbia tithymaloides var bahamensis (fka Pedilanthus tithymalodes*)) (Photo 23) is designated as a Native Plant of Special Conservation Concern by the TCI's Department of Environment and Coastal Resources. It was present in only one of the 75 vegetation analysis plots, all of which were in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community. Several were in bloom during April (dry season).

Photo 23: Monkey-fiddle (Euphorbia tithymaloides var bahamensis)
Euphorbia tithymaloides var bahamensis - Date of Photo: April 26, 2022

Vachellia (*formerly Acacia*) *acuifera* (Pork and doughboy) (Photo 24) shrubs were mostly less than 2 meters (~6 feet) in height. This species is also designated as a Native Plant of Special Conservation Concern by the TCI's Department of Environment and Coastal Resources. They were encountered in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community, where they were present in 9 of the 75 vegetation analysis plots.

Photo 24: Vachellia acuifera - Date of Photo: April 23, 2022

The parasitic Smooth Mistletoe (*Dendropemon purpureus*) (Photo 25) is also designated as a Native Plant of Special Conservation Concern by the TCI's Department of Environment and Coastal Resources. It was encountered as a parasite on shrubs in the Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous Upland community. It was present in 2 of the 75 vegetation analysis plots. Neither was flowering during the April 2022 Assessment, but both plants had immature fruits.

Photo 25: Smooth Mistletoe, Dendropemon purpureus - Date of Photo: April 23, 2022

Lists of flora and fauna observed within the Assessment Areas are provided in Appendices VI and V, respectively. These include both the species present within the vegetation analysis plots and other species that were encountered within the Assessment Area.

Invasive Plants

Surprisingly, despite significant levels of previous disturbance throughout much of the Assessment Area, no individuals of any of the six species of non-native plants that are designated by the TCI Government as invasive (Appendix I) were observed within the Assessment Area.

In addition to the notable plants, numerous faunal species that are listed in "The Schedules" were observed on the site (Table 6). Species on the IUCN Red List and CITES list and which were seen on the site are highlighted in yellow in Appendix II and III, respectively.

Table 6: Faunal Species Identified in "The Schedules" which were observed within the Assessment Area

Protected Fauna Observed during Sailrock EIA Assessment

Scientific Name	Common Name	Habitat	Abundance
BIRDS			
Phaethon lepturus	White-tailed Tropicbird	Observed over open water to the east	Uncommon Aerial Only
Fregata magnificens	Magnificent Frigatebird	Observed over ridge to the east	Uncommon Aerial only
Larus atricilla	Laughing Gull	Shorelines, scavenger, numerous sightings of small numbers. In breeding plumage, but nesting on subject property unlikely	Common
Sterna antillarum	Least Tern	Nearshore open waters, roosts on beaches and open disturbed area. Potentail nesting habitat presently exists, and proposed land clearing could create additional nesting habitat.	Uncommon
Sterna sandvichensis	Sandwich Tern	Nearshore open waters, roosts on beaches. Only observed from a distance. Unlikely to nest on the subject property.	Uncommon
Egretta thula	Snowy Egret	Shorelines & shallow inland wetlands Not observed on subject property, but seen nearby, and suitable habitat appears to be present	Uncommon
Ardea herodias	Great Blue Heron	Shorelines & shallow inland wetlands Not observed on subject property, but seen nearby, & suitable habitat appears to be present	Uncommon
Egretta rufescens	Reddish Egret	Coastal wetlands, sand flats. Observed on shallow tidal flats west of proposed north channel connection	Common
Egretta tricolor	Tri-colored Heron	Shorelines & shallow inland wetlands Not observed on subject property, but seen nearby & suitable habitat appears to be present.	Uncommon
Bubulcus ibis	Cattle Egret	Herbaceous & other low-growing vegetation. Not observed on subject property, but seen nearby, and could be attracted by land-clearing activities	Common

Protected Fauna Observed during Sailrock EIA Assessment

Butorides virescens	Green Heron	Shorelines & shallow inland wetlands. Observed in mangroves near proposed north channel connection.	Common
Nyctanassa violacea	Yellow-crowned Night-heron	Shorelines & shallow inland wetlands. Observed in vicinity, & crab parts indicate presence	Common
Phoenicopterus ruber	Flamingo	Salinas. Not observed on property, but seen in vicinity	Common on Salina
Rallus longirostris coryi	Clapper Rail	Mangrove wetlands. Heard in area west of proposed north channel entrance	Uncommon
Pluvialis squatarola	Black-bellied Plover	Sandy Shorelines, Salinas. Observed along salina edge to south. Potentially suitable habitat on subject property minimal.	Uncommon
Charadrius vociferus	Killdeer	Sandy beaches, saline flats, Heard in flight over subject property	Uncommon
Charadrius wilsonia	Wilson's Plover	Sandy beaches. Observed nesting along fringe of salt pond along Transect 5	Uncommon
Charadrius semipalmatus	Semi-palmated Plover	Sandy Shorelines, Salinas. Observed along salina edge to south. Potentially suitable habitat on subject property minimal.	Uncommon
Charadrius melodus	Piping Plover	Sandy beaches, salt pond fringes. Reportedly documented on snady beaches in vicinity. Potentially suitable habitat on subject property minimal, or non-existent.	Unlikely on property
Charadrius alexandrinus	Snowy Plover	Sandy beaches, salt pond fringes. Observed in salina to south, potentially suitable habitat on subject property minimal, or non-existent.	Unlikely on property
Calidris minutilla	Least Sandpiper	Shorelines, wetland. Observed in salina to south. Potentially suitable habitat on subject property.	Unlikely on property

Protected Fauna Observed during Sailrock EIA Assessment

Arenaria interpres	Ruddy Turnstone	Sandy beaches, rocky shorelines. Observed in salina to south. Potentially suitable habitat on subject property	Common
Tringa flavipes	Lesser Yellowlegs	Shallow inland wetlands. Observed in salina to south.	Unlikely on property
Catoptrophorus semipalmatu	Willet	Tidal flats, beaches, mangroves, shorelines. Observed in salina to south. Potentially suitable habitat on subject property minimal, or non-existent.	Unlikely on property
Haematopus palliatus	American Oystercatcher	Rocky Shorelines. Observed foraging in Sound, west of proposed north channel entrance	Occasional
Himantopus mexicanus	Black-necked Stilt	Saline ponds, observed on property, nesting unlikley	Occasional
Anas bahamensis	White-cheeked Pintail	Freshwater and moderate-salinity ponds	Occasional
Anas discors	Blue-winged Teal	Freshwater and moderate-salinity ponds. Not observed in April 2022, but confirm ID from photos taken within project area during Feb 2022 [1]	Occasional, Migrant
Pandion haliaetus	Osprey	Coastal areas, feeds on fish, nests nr water. Two seen repeatedly in vicinity. Nests typically built at prominent locations, but no nests observed.	1 pair seen daily
Falco sparverius sparverioides	Kestrel	Observed frequently in semi-open coppice areas. Likely year-round nesting resident within project area.	Common, likely nesting
Columba leucocephala	White-crowned Pigeon	Coastal hammock, usu roosts & nests on islands. Observed repeatedly in flight, and roosting near northern tip of island. Unlikely to nest in project area.	Common
Columba passerina	Common Ground-dove	Sparsely-vegetated uplands. Frequently observed on site, including w/ young-of-the-year. Likely to nest within project area.	Abundant

Protected Fauna Observed during Sailrock EIA Assessment

Zenaida aurita	Zenaida Dove	Typically in urban/residential areas, but heard frequently; likely to nest within project area.	Occasional
Zenaida asiatica	White-winged Dove	Scrublands, mangrove swamps, woodlands. Heard abd seen frequently. Likley nests in project area, but no occupied nests observed.	Common
Zenaida macroura	Mourning Dove	Typically in urban/residential areas, but heard frequently; likely to nest within project area.	Occasional
Crotophaga ani	Smooth-billed Ani	Open areas, bushes, golf courses. Heard in vicinity.	Occasional
Chordeiles gundlachii	Antillean Nighthawk	Semi-open areas, including rocky shores. Heard aerially. Potentially suitable nesting habitat present in project area.	Uncommon
Calliphlox evelynae	Bahama Woodstar	Coppice, typically nr nectar-producing flowers. Observed frequently, including feeding on Euphorbia gymnonota. Likely nests in project area.	Uncommon
Tyrannus dominicensis	Gray Kingbird	Coppice & semi-open areas, insect-eater. Observed frequently; likely to nest in project area.	Common
Polioptila caerulea	Blue-gray Gnatcatcher	Coppices, forests, woodlands. Frequently heard and seen. Likely nests in project area.	Common
Mimus polyglottos	Northern Mockingbird	Typically in urban/residential areas, but seen & heard frequently. Potentially nests within project area.	Occasional
Mimus gundlachii	Bahama Mockingbird	Coppice, Scrub, woodlands. Seen & heard frequently. Likely nests within project area.	Abundant
Dumetella carolinensis	Gray Catbird	Thickets, shrublands. Migrant, heard occasionally. Likely non-nesting presence from fall thu spring.	Occasional, Migrant

Protected Fauna Observed during Sailrock EIA Assessment

Vireo crassirostris	Thick-billed Vireo	Thick coppice, bushy forest edges. Frequently heard & seen. Likley nests within project area.	Common
Corvus nasicus	Cuban Crow	Coppice. Two individuals occasionally seen. Potentially nests on subject property, but unlikely to nest in project area.	Uncommon
Dendroica palmarum	Palm Warbler	Coppice, thicket, urban areas, agricultural areas. Migrant, nests at northerly latitudes, but likely present on site fall through spring, &/or during migration	Migrant, Uncommon
Dendroica petechia petechia	Yellow Warbler	Resident species typically nests in low-growing coastal mangroves. Heard & saw ocassionally. Potentially suitable nesting habitat occurs on subject orioerty, but limited within project area.	Common
Dendroica tigrina	Cape May Warbler	Coppices, thickets & woodlands. Migrant, nests at northerly latitudes, but likely present on site fall through spring, &/or during migration	Migrant, Uncommon
Coerba flaveola	Bananaquit	Coppice, thicket & forest. Year-round, breeding resident. Heard & seen frequently. Likley nests in project area.	Abundant
Tiaris bicolor	Black-faced Grassquit	Semi-open grasslands. Year-round, breeding resident. Heard & seen frequently. Likley nests in project area.	Common
Icterus glabula	Baltimore Oriole	Woodlands & semi-open areas. Migrant, nests at northerly latitudes, likely present on site only during migration.	Occasional
REPTILES and AMPHIBIANS			
Chilabothrus chrysogaster	Turks & Caicos Rainbow Boa	Coppices; photos taken on subject property in Feb. 2022 [1]	Uncommon
INSECTS			
Memphis intermedia [1]	Turks Island Leafwing Butterfly	Feeds on *Metopium* ; observed on *Rhizophora*	Uncommon

Bird species confirmed to nest, or which are likely to nest within the Assessment Area include least tern, green heron, yellow-crowned night heron, Wilson's plover, osprey, kestrel, common ground dove, white-winged dove, mourning dove, Antillean nighthawk, Bahama woodstar, gray kingbird, blue-gray gnatcatcher, northern mockingbird, Bahama mockingbird, thick-billed vireo, bananaquit, and black-faced grass quit.

Several unoccupied nests that appeared to be from nesting in previous years were observed. The nest sizes and shapes suggested that most of these single-use nests were potentially made by common ground doves, thick-billed vireos, gray kingbirds, bananaquits, and woodstar hummingbirds. Additional species of migratory birds (e.g., plovers, sandpipers, warblers) may also use portions of the property seasonally but were not observed during the April 2022 investigation.

A photograph was provided of a Turks & Caicos Rainbow Boa that had been documented at a location up-slope of the Assessment Area, and this species could certainly have a range that includes the project area.

Turks Island Leafwing butterflies (Photo 26) were seen in two habitats within the Assessment Area: The Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous community, and the Forest, Broadleaf Evergreen, Estiarone (Tidal) community. This species had previously been seen (in 2018) in the Herbaceous, Palustrine Mixed Graminoid/Forb habitat.

Photo 26: Turks Island Leafwing Butterfly – Date of Photo: April 26, 2

2.3.3 Baseline marine environment

Habitat Characterization

A qualified survey team knowledgeable in marine benthic types and biota snorkeled along the transects covering five feet on either side of the transect line. Data was collected to identify sensitive marine habitats and commercially and ecologically important species utilizing the area. Habitat types along transects were also recorded every 3.048 meters. Data from diver surveys and a review of underwater drone images were used to assist in the creation of a GIS benthic habitat map of the survey area, Figure 43.

Figure 43: Benthic Habitat Map

2.3.4 Quantitative Description of the marine habitats, Flora, and Fauna

The weather conditions during this assessment were clear to partly cloudy skies with 13 to 15-knot winds. The water depth averaged 0 to 1.8 meters in the observed areas.

Photo 27: Hardbottom with Spiny Algae, Acanthophora spicifera mats

Photo 28: Sandy Bottom with Patches of Fuzzy Finger Algae, Neomeris annulata and Coralline algae, Order Corallinales

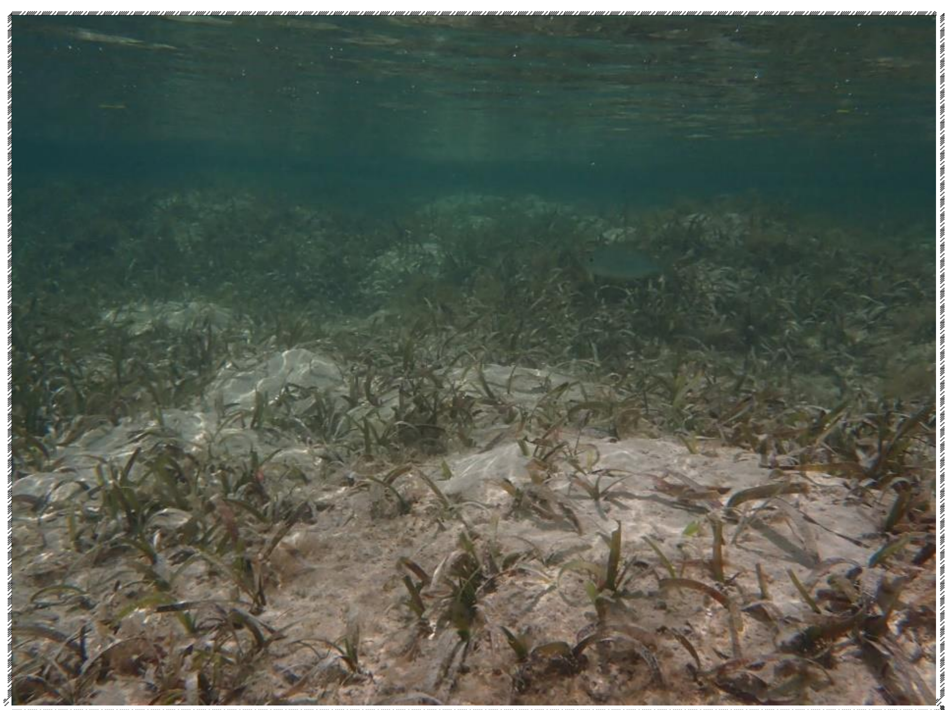


Photo 29: Thalassia testudinum, Seagrass bed

Photo 30: Syringodium filiforme, Seagrass bed

Benthic Habitat Types

The following sections provide descriptions of the benthic habitats observed along the 22 transect lines along the Sail Rock Coastline. The habitats encountered were separated into two generalized categories and three variations:

- Algal dominated hardbottom
- Sand
  - Algal dominated the sandy bottom.
  - Seagrass, and
  - Mangroves.

Overall, the benthic habitats appeared healthy and consisted of typical flora and floral populations. Although human activity was observed during the assessments the was minimal human-related debris observed. This was limited to an abandoned fishing trap at the northern end of the site near the existing launching ramp. There was no evidence of degraded water quality.

Algal Dominated Hardbottom

The benthic habitat in the nearshore northern shoreline consisted of hardbottom dominated by corals, and algae and intermixed with sand. Water depths were relatively low (0.3 to 0.6 meters) with low rugosity.

Corals found in this area included finger coral (*Porities porities*), mustard hill coral (*Porities astreoides*), and Lesser Starlet Coral (*Siderastrea radians*). The benthic habitat was in good condition with little evidence of damaged or diseased corals. It represents approximately 30% of the observed habitat. The northern channel entrance is dominated by this benthic type.

Sand

Almost 50% of the entire site was dominated by a variety of sandy bottom habitats, which included bare saalgae-dominatedated, seagrass-dominatedated. The least amount of activity was observed in the bare sand and consisted of mainly fish species moving from one area to the next.

Algal Dominated Sandy Bottom

This sandy area supported the growth of macroalgae including *Neomeris annulate, Halimeda spp., Caulerpa cupressoides, Halimeda spp.,*and others.

Seagrass

Two species of seagrass were observed Turtle grass and Manatee grass dominated in varying amounts and areas. Seagrass diversity was low, but the abundance varied from patches of Turtle grass dense beds with little to no Manatee grass and vice versa but most of the seagrass beds were dominated by turtle grass. In some cases, each species was monotypic. Various species of macroalgae including *Halimeda spp.* and *Caulerpa spp*. were found dispersed.

Mangroves

There were dominant types of mangrove species present at the site that represented approximately 20% of the area observed: Tidal Red mangrove and Dwarf Red Mangrove. These areas were characterized by fine silty sand with low energy.

Tidal Red Mangrove

Tidal Red Mangroves were observed along the Northern coastline near the existing boat ramp and along the Southern coastline in the Bell Sound Reserve. These are tall and dense in waters less than 0.6 meters with low visibility. There was significant fish activity amongst the prop roots but none over the bare sand areas.

Dwarf Red Mangrove

Dwarf Red Mangroves were observed along the Southern shoreline at the proposed channel entrance site. Water depths in this area were less than 0.4 meters and supported no fish activity and a high abundance of *Cassiopea frondose*. The southern channel entrance is dominated by this benthic habitat.

Species List

Fish Species

The assessment was conducted in an area of approximately 2.39 square kilometres including a portion of the Bell Sound Nature Reserve.

Roving Diver visual fish surveys were conducted using a modified Atlantic and Gulf Rapid Reef Assessment (AGRRA) Protocol Fish observed were identified and given a frequency rating (based on occurrence) of Single (1 individual), Few (2-10 individuals), Many (11-100 individuals), or Abundant (>100 individuals).

There were nineteen (19) species of fish observed during the assessment, table 7. The significant fish activity was observed mainly around the reef systems with little to no activity observed. The reef fish observed were typical of a reef system and varied in size classes from 5cm up to 25cm.

Marine Survey

Fauna Species

Table 2 Key: X = Single, **XX** = Few (2 – 10), **XXX** = Many (10+)

Table 2 Habitat Type Key:

ADHB = Algal Dominate Hardbottom

ADSB = Algal Dominate Sandy bottom

TRM = Tidal Red Mangrove

DRM = Dwarf Red Mangrove

SD = Sand

SG = Seagrass

Fish Species

Table 7: Fish species observed during the assessment.

Common Name	Scientific Name	Habitat Type					
		ADHB	ADSB	TRM	DRM	SD	SG
Foureye Butterflyfish	*Chaetodon capristatus*	X				X	
Bar Jack	*Caranx cuber*	XX		XX			XX
Needlefish	*Belonidae spp.*		XX			X	X
Great Barracuda	*Sphyraena barracuda*	X	X				X
Bonefish	*Albula vulpies*					XX	
Yellowfin Mojarra	*Gerres cinereus*		XX	XX		X	
Silversides, Herrings, Anchovies	*Atherinidae, Clupeidae*	XXX	XXX			XXX	XXX
Grunt sp.	*Haemulon sp.*						
Schoolmaster	*Lutjanus apodus*	XX	XX	XX			
Snapper	*Lutjanus spp.*			XX		XX	
Yellow-tail Snapper	*Ocyurus Chrysurus*	XX	XX	XX		XX	XX
Beaugregory	*Stegastes leucostictus*	XX				XX	XX
Cocoa Damselfish	*Pomacentridae spp.*	XX					XX
Sergeant Major	*Abudefduf saxatilis*	XX	XX				XX
Nassau Grouper	*Epinephelus striatus*	X					
Slippery Dick	*Halichoeres bivittatus*	XX					
Wrasse	*Labridae spp.*	XX					
Goby	*Gobiidae spp.*	X					XX
Lemon Shark	*Negaprion brevirostris*					X	

**Note: The common name Silverside refers to a group of fish from several different families that are usually found together. It is difficult to distinguish any one species when in a large group.*

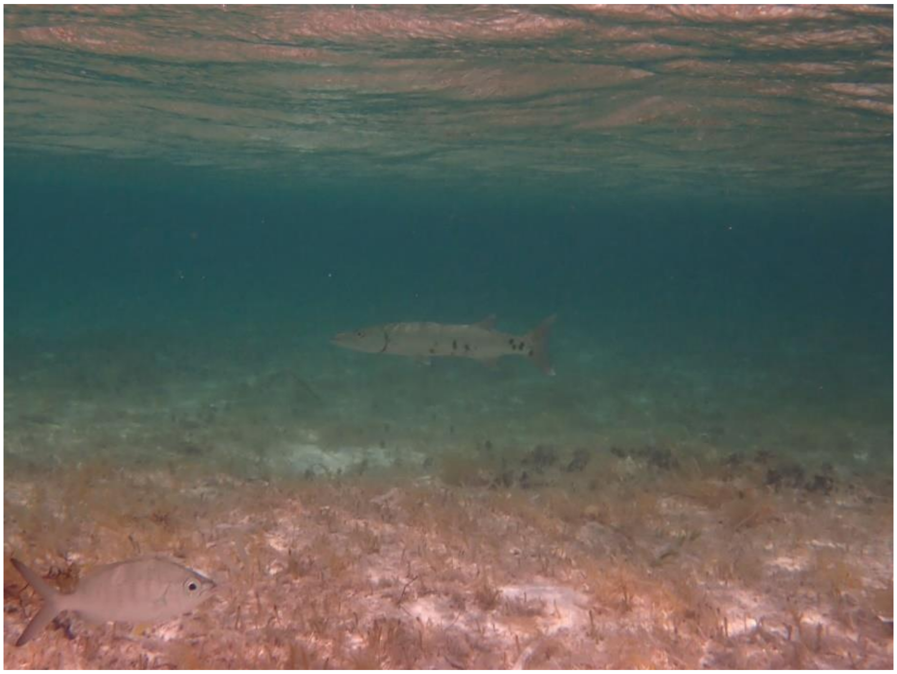


Photo 31: Great Barracuda (Sphyraena barracuda) and a Yellowfin Mojarra (Gerres cinereus)

Photo 32: Cocoa Damselfish, Stegastes variabilis

Coral Species

Divers' observations were made by snorkeling along transects by capturing photographs, video recordings, and spot dives to confirm conditions. Species diversity, general abundance, and overall health were observed. The coral species were observed in the algal hard-bottom areas. There were three (3) species of coral observed. The most dominant were the *Porities spp*. Corals were observed mainly in the ADHB habitat, table 8.

Table 8: Coral Species observed during the assessment.

Common Name	Scientific Name
Mustard Hill	Porites astreoides
Finger Coral	*Porites porites*
Lesser Starlet Coral	*Siderastrea radians*

Photo 33: Siderastrea radians, Lesser Starlet Coral and Porites, Finger Coral

Photo 34: Porites astreoides, Mustard Hill Coral

Fauna and Epifauna Species

The majority of the epifauna species were found either on the sea floor or on rocks that sat on the sea floor and fauna species were found in the surrounding area.

Table 9: Names of Fauna and Epifauna species that were observed during the survey. Sixteen (16) Epifauna and Two (2) Fauna Species.

Table 9: Fauna and Epifauna Species observed during assessment.

Common Name	Scientific Name
Queen Conch	*Aliger gigas*
Sunrise Tellin	*Tellina radiata*
Rock-boring Urchin	*Echinometra lucunter*
White Sea Urchin	*Tripneustes depressus*
Donkey Dung Sea Cucumber	*Holothuroidea mexicana*
Cushion Sea Star	*Oreaster reticulatus*
Stinker Sponge	*Ircinia felix*
Viscous Sponge	*Plakortis angulospulatus*
Green Turtle	*Chelonia mydas*
Loggerhead Sponge	*Spheciospongia vesparium*
Black Ball Sponge	*Ircinia strobilina*
Upsidedown Jellyfish	*Cassiopea frondosa*
Mangrove Upsidedown Jellyfish	*Cassiopea xamachana*
Pink-tipped (Giant) Anemone	*Condylactis gigantea*
Flat Tunicate	*Botrylloides nigrum*
Row-Encrusting Tunicates	*Botrylloides spp.*
Mangrove Tunicate	*Esteinascidia turbinata*
Southern Stingray	*Dansylates americana*

Photo 35: Giant anemone, Condylactis gigantea surrounded by patches of Black Ball Sponge Ircinia strobilina

Photo 36: White Sea Urchin, Tripneustes depressus

Flora – Algae, Seagrass, and Seaweed Species

Flora species were found throughout the survey site.

Table 10: Names of flora species observed during the survey. Eighteen (18) flora species were observed throughout the sites with the algal hardbottom and algal sandy bottom having the highest density.

Flora Species

Table 10: Flora Species observed during assessment.

Common Name	Scientific Name
Manatee Grass	*Syringodium filiforme*
Turtle Grass	*Thalassia testudinum*
Amphiroa Algae	*Amphiroa spp.*
Dictyota sp.	*Dictyota spp.*
Calcareous Red Algae	*Neogoniolithon strictum*
Mermaid's Wineglass	*Acetabularia spp.*
Blade Algae	*Avrainvillea spp.*
Fuzzy Tip Algae	*Neomeris annulata*
Cactus Tree Algae	*Caulerpa serrulata*
Green Feather Algae	*Caulerpa sertularioides*
Palm Tree Algae	*Caulerpa paspaloides*
Green Algae sp.	*Dictyosphaeria cavernosa*
Three Finger Leaf Algae	*Halimeda incrassata*
Green Algae sp.	*Halimeda monile*
Mermaid Shaving Brush	*Penicillus capitatus*
Bristle Brush	*Penicillus dumetosus*
Flat Top Bristle Brush	*Penicillus pyriformis*
Mermaid's Fan	*Udotea spp.*

Photo 37: Cactus Tree alga, Caulerpa cupressoides surrounded by Coralline algae, Order Corallinales

Photo 38: Fuzzy Finger Algae, Neomeris annulata, and Mermaid Shaving Brush, Penicillus capitatus

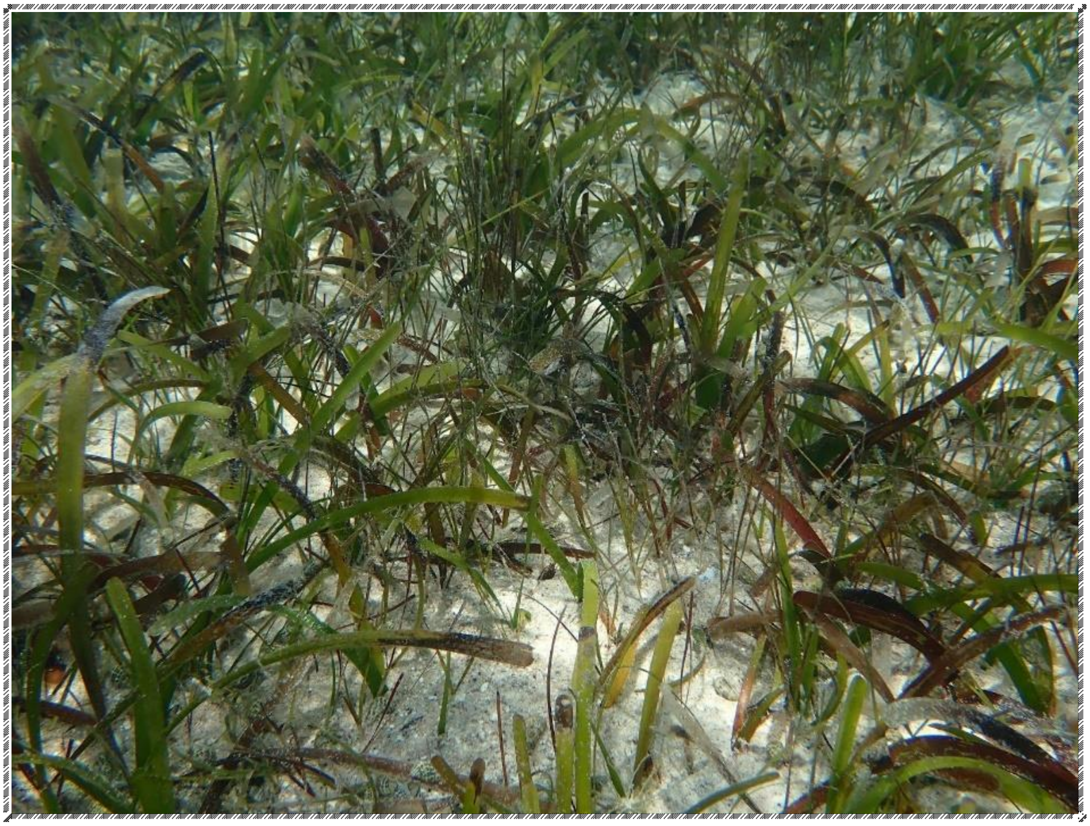


Photo 39: Turtle Grass, Thalassia testudinum and Manatee Grass, Syringodium filiforme

Commercially Important, Endangered, and Invasive Species

There were 20 marine species observed during this assessment that are listed in the Convention on International Trade of Endangered Species (CITES) list (see Table 6). Generally, animals on the CITES list include threatened/endangered species and those that are commercially or economically valuable. The development is adjacent to the Bell Sound Nature Reserve as such the developer is cognizant and concerned about its overall environmental value and as such there will be continued monitoring of the site to minimize the effects of construction and development activities.

Bell Sound Nature Reserve is a shallow lagoon area that is enclosed by the central land mass and peninsula of South Caicos. The reserve covers a total area of 4.4 square miles, and it is surrounded by mangrove ecosystems and tidal flats, which not only act as a sanctuary for local wildlife but support the basis of Turks and Caicos tourism and fisheries industries. Due to the natural resources of Turks and Caicos contributing an estimated economic value of 45.5 million USD per year to the tourism industry (Wolf's Company, 2016), it is important to have protected areas, such as the Bell Sound Nature Reserve, established to safeguard TCI's biodiversity.

In addition to this, the effective management of the Bell Sound Nature Reserve also plays a crucial part in maintaining ecosystem balance and preserving important habitats in Turks and Caicos as the extensive mangroves and fringe reefs found within and around the reserve act as a nursery for fish species as well as protect the surrounding coastline of South Caicos from storm surges in the event of a natural disaster (Pienkowski, n.d.).

Species Diversity

A total number of 56 marine species were recorded during the investigation (see Table 7-11).

Table 11: Marine species observed on Sail Rock, Turks and Caicos.

Scientific Name	Common Name	Conservation Status
Fish Species		
Abudefduf saxatilis	Sergeant Major	LC
Albula vulpes	Bonefish	NT
Chaetodon capristatus	Foureye Butterflyfish	LC
Epinephelus striatus	Nassau Grouper	CE
Gerridae spp.	Mojarra sp.	LC
Haemulon sp.	Grunt sp.	LC
Halichoeres bivittatus	Slippery Dick	LC
Lutjanus apodus	Schoolmaster	LC
Lutjanus spp.	Snapper sp.	LC
Negaprion brevirostris	Lemon Shark	V
Ocyurus Chrysurus	Yellow-tail Snapper	LC
Sphyraena barracuda	Great Barracuda	LC
Stegastes leucostictus	Beaugregory	LC
Coral Species		
Porites astreoides	Mustard Hill Coral	LC

Porites porites	Finger Coral	LC
Siderastrea radians	Lesser Starlet Coral	LC
Non-Coral Invertebrate Species		
Holothuroidea mexicana	Donkey Dung Sea Cucumber	LC
Panulirus argus	Spiny Lobster	DD
Flora Species		
Halodule wrightii	Shoal Grass	LC
Syringodium filiforme	Manatee Grass	LC
Thalassia testudinum	Turtle Grass	LC

TABLE 5 KEY: STATUS

LC = Least Concern (Conservation - IUCN)

CE = Critically Endangered (Conservation- IUCN)

NT = Near-Threatened (Conservation- IUCN)

DD = Data Deficient (Conservation-IUCN)

V = Vulnerable (Conservation- IUCN)

IUCN = International Union for Conservation of Nature

2.3.5 Baseline aesthetics

The proposed development is located on the Sail Rock peninsula of South Caicos Island within the TCI with pristine baseline aesthetics, which includes natural physical features, unique biological environments, and unspoiled social and cultural heritage settings. The area is home to rolling cliffs and ridges, stunning beaches, and crystal-clear waters disturbed only by the low-density Sail Rock boutique hotel and villa development as shown in photo 42.

Photo 40: Existing Baseline aesthetics – Sail Rock Peninsula

Photo 41: Existing Baseline Aesthetics Sail Rock Peninsula

Photo 42: Existing physical aesthetics – Sail Rock boutique hotel and villa development

In addition to the pristine baseline natural environment, there is the manmade physical environment, the historical Cockburn Harbour Settlement which offers a unique example of the island's architectural, social, and cultural heritage that is the main attraction for tourism development. One of the project's main goals is to protect and develop the island's heritage culture for the benefit of the local and tourist populations.

Photo 43: Existing baseline historical Cockburn Town Center

Photo 44: Existing baseline historical Cockburn Town Center

2.4 Coastal Processes and Dynamics, including.

It is vital that a detailed understanding of the operational wave/hydrodynamic climate be established to understand how the implementation of the proposed channel/canal will affect the coastal environment on a day-to-day basis. Numerical models were used to understand the wave and hydrodynamic climate at the site for both the existing and proposed configurations so that the impacts can be evaluated.

This section describes the existing coastal processes at the project site, including the prevailing operational wave climate, hydrodynamics, and the extreme (hurricane) wave climate.

The Turks and Caicos Islands are exposed to two very different wave climates: (1) the operational wave climate defined by day-to-day waves from the north-east Trade Winds and seasonal (winter) swell waves and (2) the extreme wave climate, which is defined as by occasional hurricanes that generate much higher waves.

The operational wave climate describes the day-to-day distribution of wave heights, periods, and directions for a specified location. These wave conditions contribute to sediment movement along the coastline and are responsible for long-term, gradual morphological changes. Typically, when designing coastal structures, the operational wave conditions are used to determine the most appropriate design solution in terms of the types and layout of the structures. In this impact assessment study however, the operational wave conditions will be used to better understand how the area is impacted by waves and to understand how the implementation of the proposed channel will affect the surrounding areas.

The extreme wave climate describes waves associated with tropical storms and hurricanes, to which the Caribbean region is vulnerable each year from June to November. Dramatic and abrupt changes to the coastline can occur because of these storms and, in general, coastal protection structures are designed to withstand wave attacks from these extreme storm events. For example, the selection of an armour stone size that would be required for a coastal structure or the determination of design wave forces that may occur is typically based on these extreme waves. In this study, setback limits and appropriate fill levels can be determined following the analysis of the associated storm surge.

The design wave conditions (operational and extreme) were determined offshore in deep water and then transformed to the nearshore using the MIKE suite of computer models. This model, which was created by the Danish Hydraulic Institute (DHI) couples hydrodynamics (MIKE 21 HD), waves (MIKE 21 SW), particle transport (MIKE 21 TR), and sediment transport

(MIKE 21 ST). MIKE 21 is a professional engineering software package for the simulation of tides, waves, sediments, and ecology in rivers, lakes, estuaries, bays, coastal areas, and seas.

The first step in the modelling process was the creation of a computational mesh (described below) where waves and currents are determined at each simulation time step.

Coastal processes across the entire Turks and Caicos Islands were modelled using coupled hydrodynamic, spectral wave, sand transport, and pollutant transport modules. The models were coupled depending on the type of analysis being conducted.

The MIKE 21 model used to simulate extreme conditions uses various modules to simulate hydrodynamic variances in surface elevation and currents (HD) as well as spectral waves (SW). The coupling of the two modes means that the mutual interaction between waves and currents is properly simulated and results from one module are passed back and forth to the other module to improve the efficiency and accuracy of the simulations. The Spectral Wave (SW) module computes wave conditions throughout the model domain; the Hydrodynamic

(HD) the module computes water levels and current speeds and directions and is coupled with the SW module so that wave-induced currents are included. Water levels and currents affecting waves are also passed back to the SW module to improve the accuracy of the extreme wave conditions.

Flexible Mesh Development

The basic starting point of the model is the creation of a computational mesh where spatial variances can be determined at each simulation time step. MIKE 21 uses a flexible mesh, based on linear triangular elements that represent the seabed and land elevations (bathymetry and topography of the area). The flexible element mesh is particularly well-suited for modelling large complex areas that, at the same time, require a detailed resolution of specific features or areas, Figure 43.

As discussed, all existing bathymetric and topographic data relevant to the area were merged and used as input to the model to define land and seabed elevations. Within the model, interpolation methods are used to interpolate between data gaps to create a smooth surface.

This was then input to the MIKE Zero mesh development file (mdf) which then created the flexible mesh to represent the existing conditions as shown below in Figure 44. As shown, smaller mesh elements were used in the areas closest to the project area. Additionally, smaller elements were used around the areas of significant contour change to adequately resolve wave movements and accurately represent the bathymetry with higher resolution in these areas.

Extraction Points

For all the numerical modelling conducted, results were extracted from nine points distributed along the project site as shown in Figure 45. As shown, the points cover the entire shoreline of the proposed development area and are in various water depths. This is intentionally done to get as great a variation along the project shoreline as possible. A few of the points were selected to ensure that the flushing of pollutants from different points in the proposed channel is recorded.

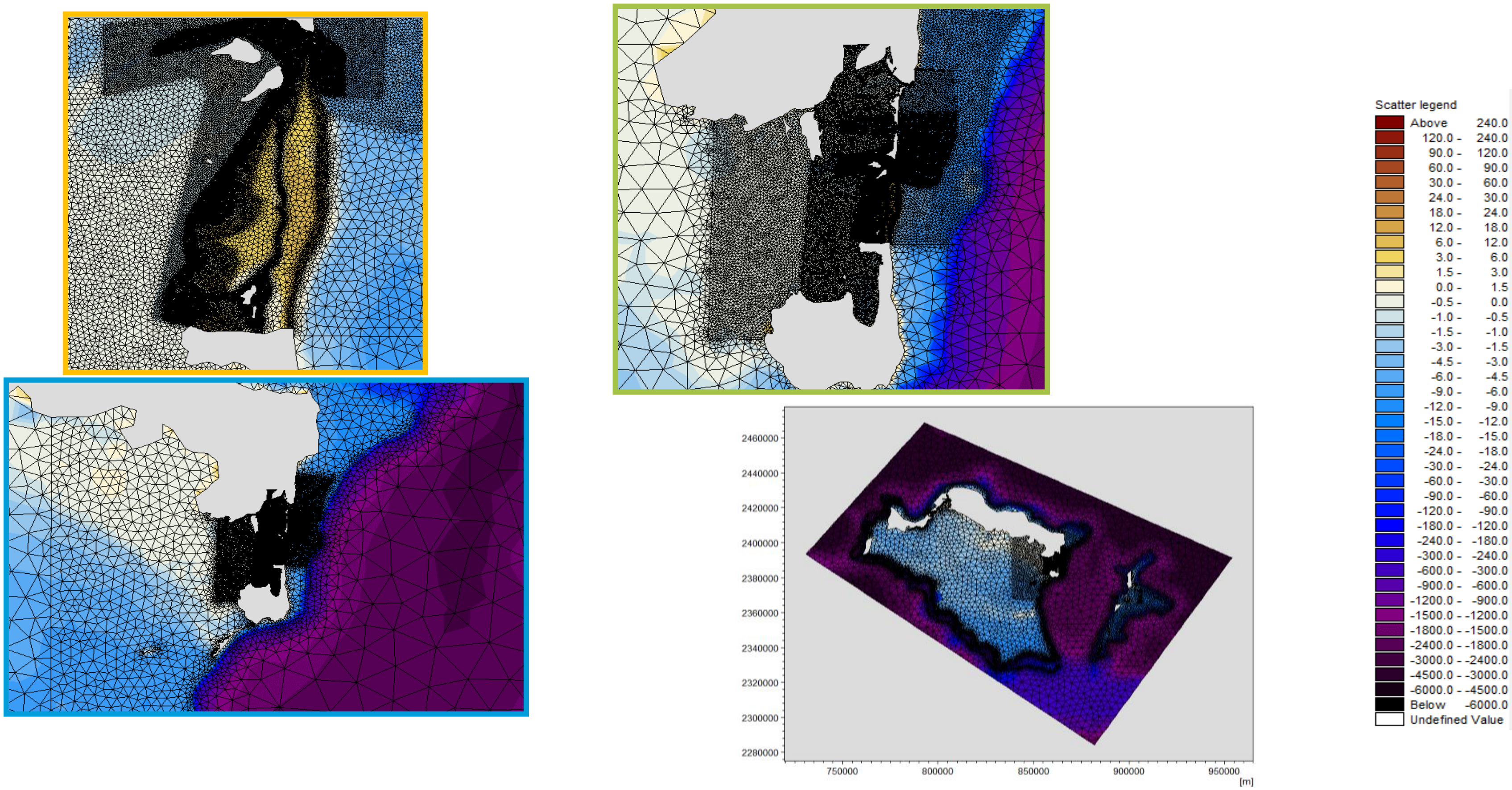


Figure 44: Numerical model mesh used in simulations, varying colours indicate depth ranges, while black lines indicate mesh elements.

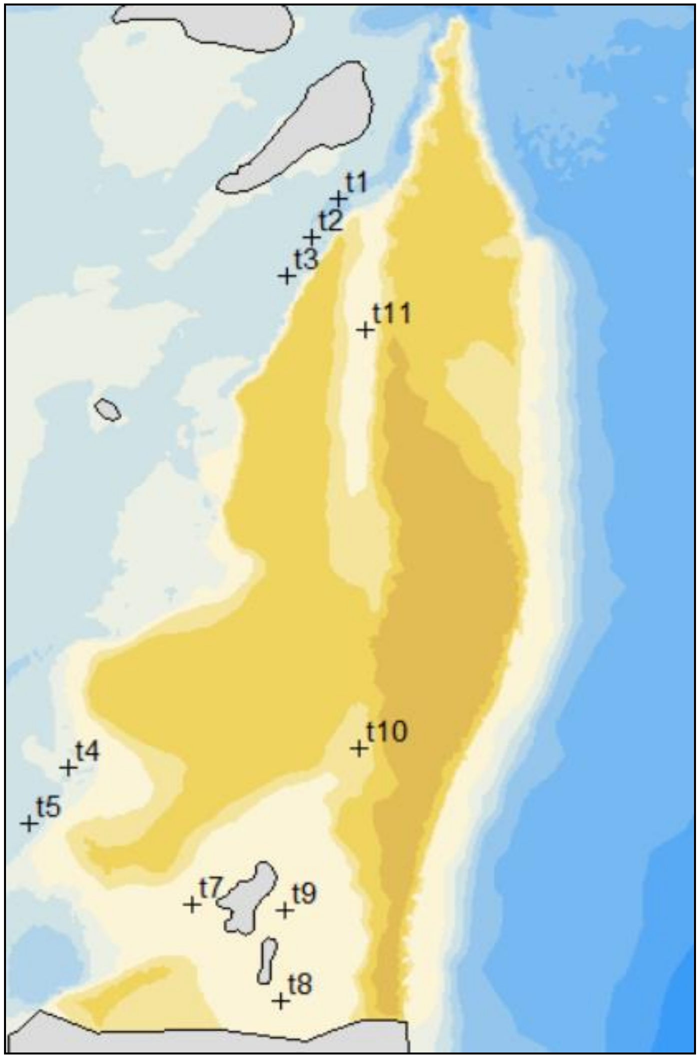

t1
t2
t3
t11
t4
t5
t10
t7
t9
t8

Figure 45: Plot of extraction point locations used in model simulations; the table insert shows the coordinates of extraction points.

The second step was to execute the coastal process modelling to (i) develop a clear picture of the operational/extreme waves and hydrodynamic conditions at the project site and (ii) quantify the impacts on coastal and marine biological processes caused by the proposed works. The analyses of tides, currents, wave climates, and sediment transport are described in this section.

2.4.1 Tides

Global tide models are generally accepted as sufficiently accurate for modelling investigations that simulate tidal currents. Typically, these global tide models are based on harmonic analyses of measured tide gauge data, or from processed satellite observations Figure 46 (top) shows the Denmark Technical University (DTU)[1] model-predicted tides just offshore the project site from January to December 2019. It should be noted that these model-generated tides tend to ignore mesoscale eddies and thermal effects, which can vary the water level through the year in the order of ±0.07m, and a multitude of other smaller factors that can cause "natural variability" in tides; they are, however, sufficient to form a basis for analysis. When looking at extreme water levels, nautical charts using measured tide

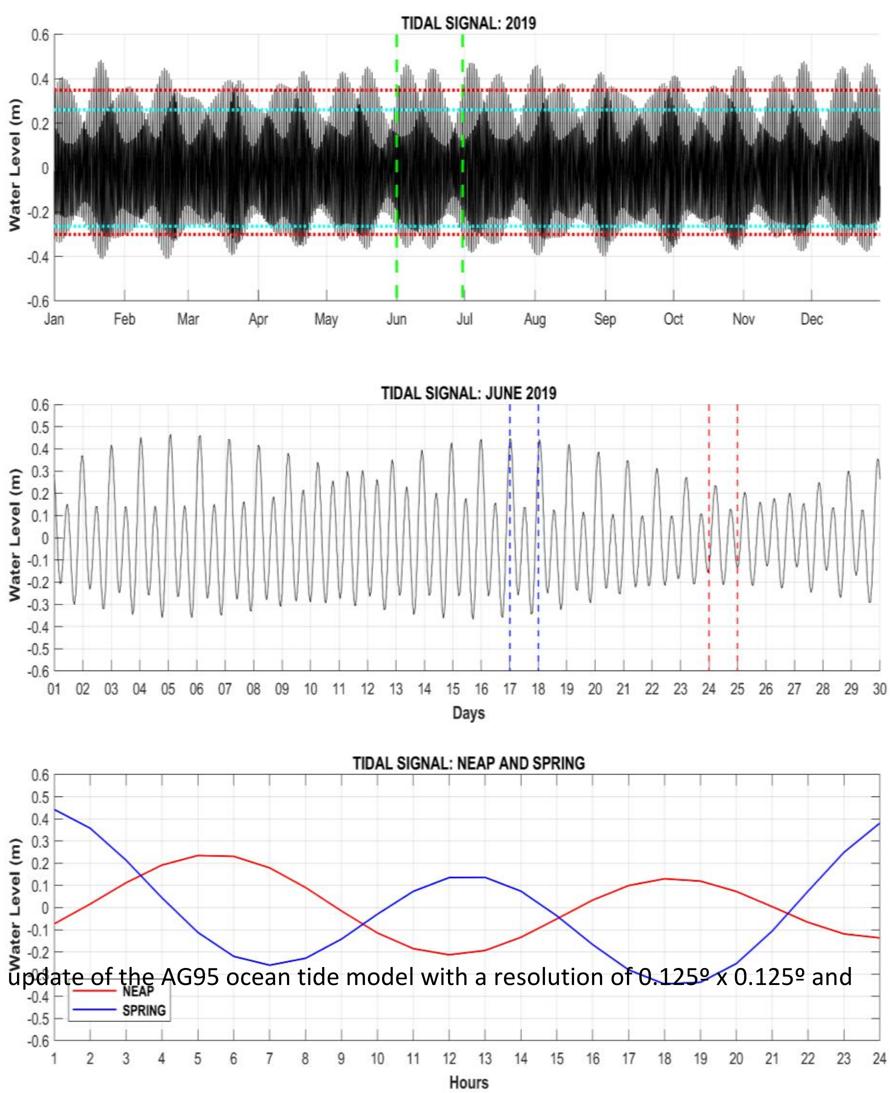


Figure 46: Tidal signal offshore the project site (2019)

[1] The DTU10 global ocean tide model is an update of the AG95 ocean tide model with a resolution of 0.125º x 0.125º and including the 12 major tidal constituents.

levels are a better measure of the tidal range.

Figure 46 indicates the presence of Spring and Neap tides. The red lines show the mean low and high-water marks, while the blue lines indicate the mean high-high and low-low watermarks. The model results indicate a tidal range of approximately 0.52m; a typical high tide of 0.26m and a low tide of -0.26m. The mean high-high water is 0.35m while the highest tide (called the HAT) recorded over the period was 0.51m above MSL. The tide signal also reveals a semi-diurnal signal, meaning that there are two highs and lows per day, often of unequal magnitude. This tidal range was confirmed by the Admiralty Total Tide from the UK Hydrographic Office (*Figure* 46) at Grand Turk, the nearest station located 37 km from South Caicos. The MSL is referenced as 0.45m, therefore making the HAT 0.55m above the MSL which validates the 0.51m obtained from the DTU predicted model.

2529 Grand Turk is a Secondary Harmonic port

The tide type is Semi-Diurnal.

HAT	1.0 m
MHWS	0.8 m
MHWN	0.7 m
MSL	0.45 m
MLWN	0.2 m
MLWS	0.1 m
LAT	0.0 m

Figure 47: Tidal elevations taken from Admiralty Total Tide

2.4.2 Currents

General current flow patterns (flow velocity and flow direction) in the nearshore of the project site were obtained and assessed using drogues. Drogues are simple devices constructed using a hollow tube into which a Global Positioning System (GPS) receiver is placed. This 'mast' is then attached to a tail constructed in the shape of an 'X' as shown below in Figure 48. This 'X' shape of the drogue tail is designed to experience resistance or drag when moving through the water. This drag minimizes the influence of wind on the float meaning that the drogue tracks the water currents only.

Drogue surveys were carried out on 22 April 2022. During this survey, two drogues were used to carry out a total of six surveys at different areas along the South Caicos shoreline. The drogue positions were tracked by the attached GPS, which recorded point coordinates at regular 5-second intervals. The results are shown in Figure 49. From the drogue survey, it could be observed that tidal currents flow east out of the basin during the morning hours up to 13:30 Greenwich mean time (GMT) (i.e., 9:30 am local time). These tidal currents then slow, reverse and flow inwards to the west after 14:00 GMT (i.e.10:00 am local time). The tides then reverse again flowing east out of the basin after 19:00 GMT (i.e., 3:00 pm local time).

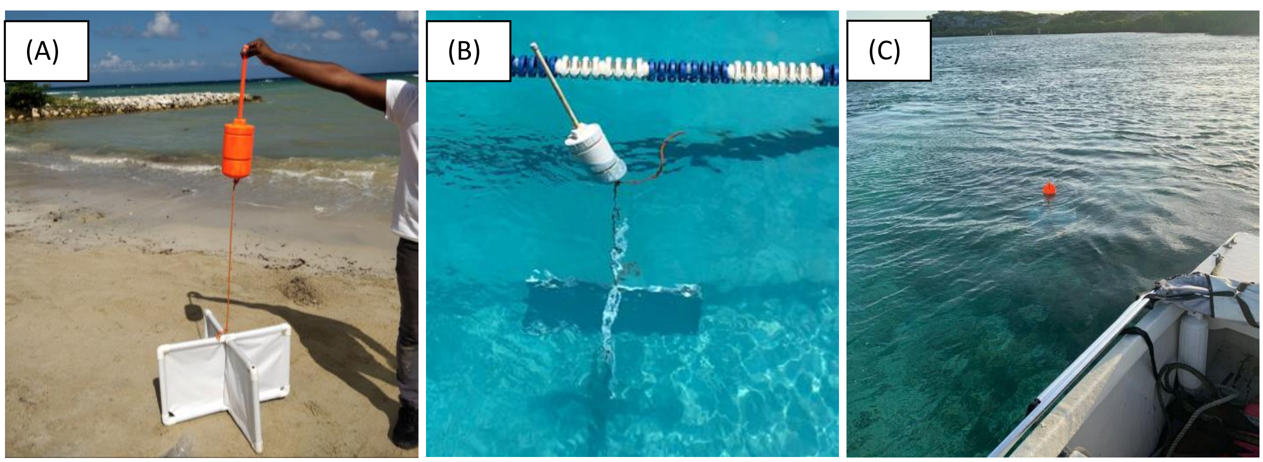


Figure 48: Photographs of drogues showing (a) the configuration of the drogue with mast and tail, (b) the drogue device testing in water, and (c) the drogue deployed in the South Caicos offshore environment.

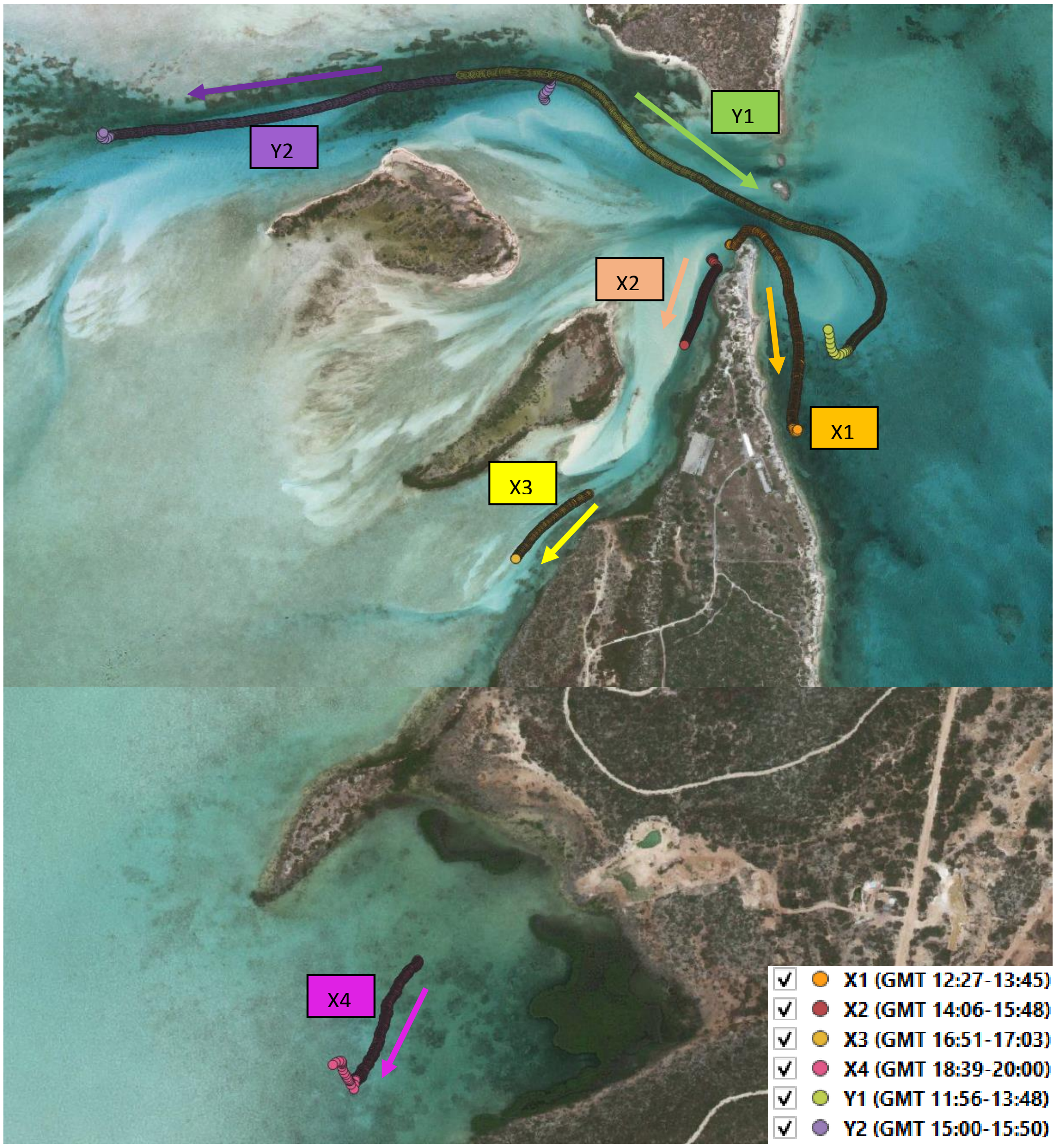


Figure 49: Results of the drogue survey executed on 22 April 2022

As mentioned above, drogues were used to measure the current speed and direction at various locations and times on 22 April 2022. This section describes how the hydrodynamic conditions are replicated using a numerical model to gauge its validity. Once the model is validated, it can be said to be reliable in simulating all other conditions. To simulate the hydrodynamic conditions over the course of 22 April 2022, we used a MIKE 21 HD model with DTU tidal levels at 30-second intervals applied along the East (Green) and West (Yellow) boundaries of the flexible mesh as shown in Figure 50. These differences in water levels across the mesh create a tidal potential that then induces flows or tidal currents. To track the current speeds and direction generated during this day; the above-established HD model was coupled with a MIKE 21 TR (Transport model). This model shows how particles/pollutants move at different points over the course of the simulation.

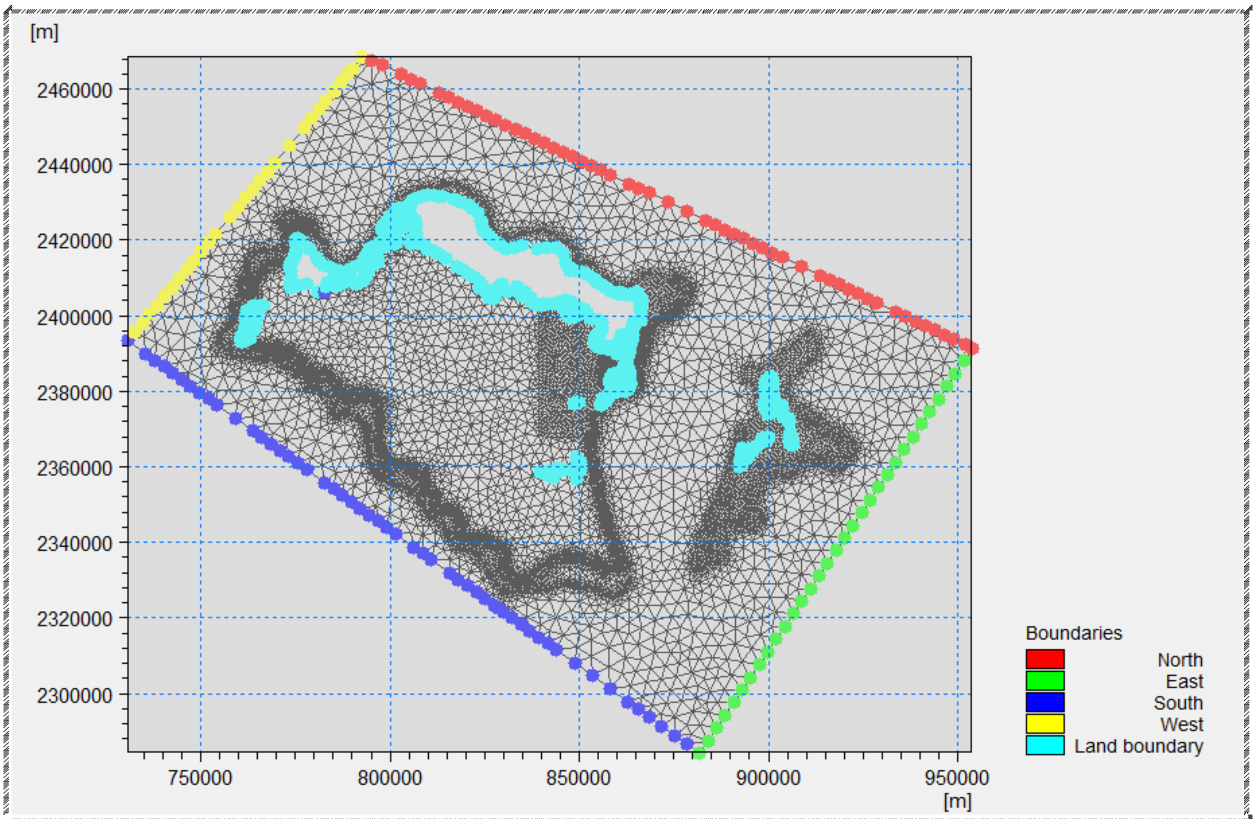


Figure 50: Boundaries and Mesh used in the Numerical model.

In the Transport module, pollutants were introduced into the model to match the exact geographical coordinates and time periods that each of the six drogues were placed in the water. The results of the actual flow paths versus the simulated flow paths are shown graphically in Figure 51 through Figure 56, while the actual versus simulated flow speeds are recorded in Table 12. The simulations show that the model is in phase with the observed conditions and that the flow paths recorded with the drogues are properly simulated. Except for drogue X4, all other drogues performed satisfactorily. Drogue X4's difference in speed and direction is likely due to the presence of wind-wave currents which were not factored into this simulation. From the results, it can be deduced that the model is able to satisfactorily predict both the current directions and current speeds.

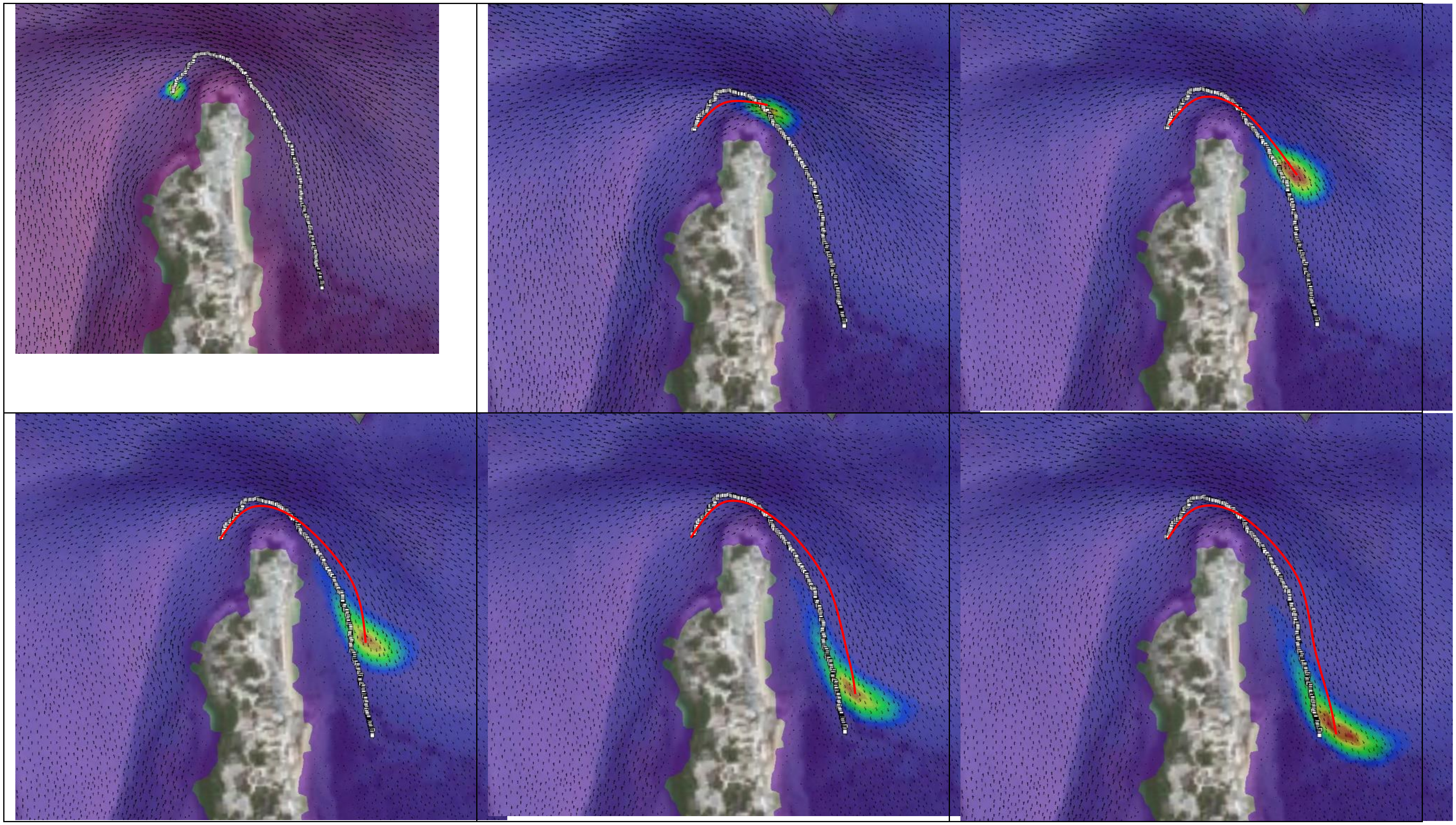


Figure 51: Drogue X1 Modelled (rainbow hue and red line) Vs Actual Drogue (white boxes)

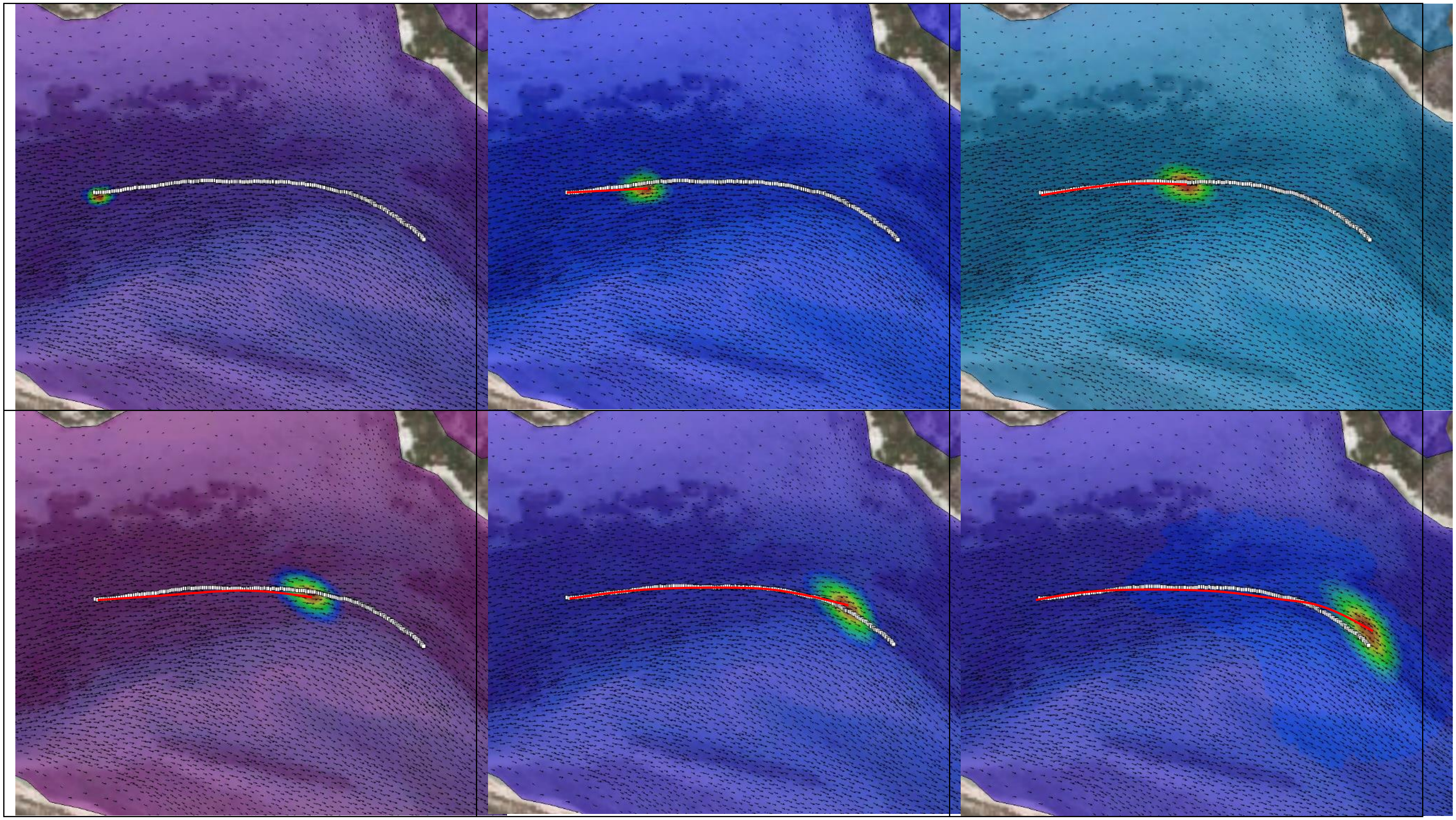


Figure 52: Drogue Y1 Modelled (rainbow hue and red line) Vs Actual Drogue (white boxes)

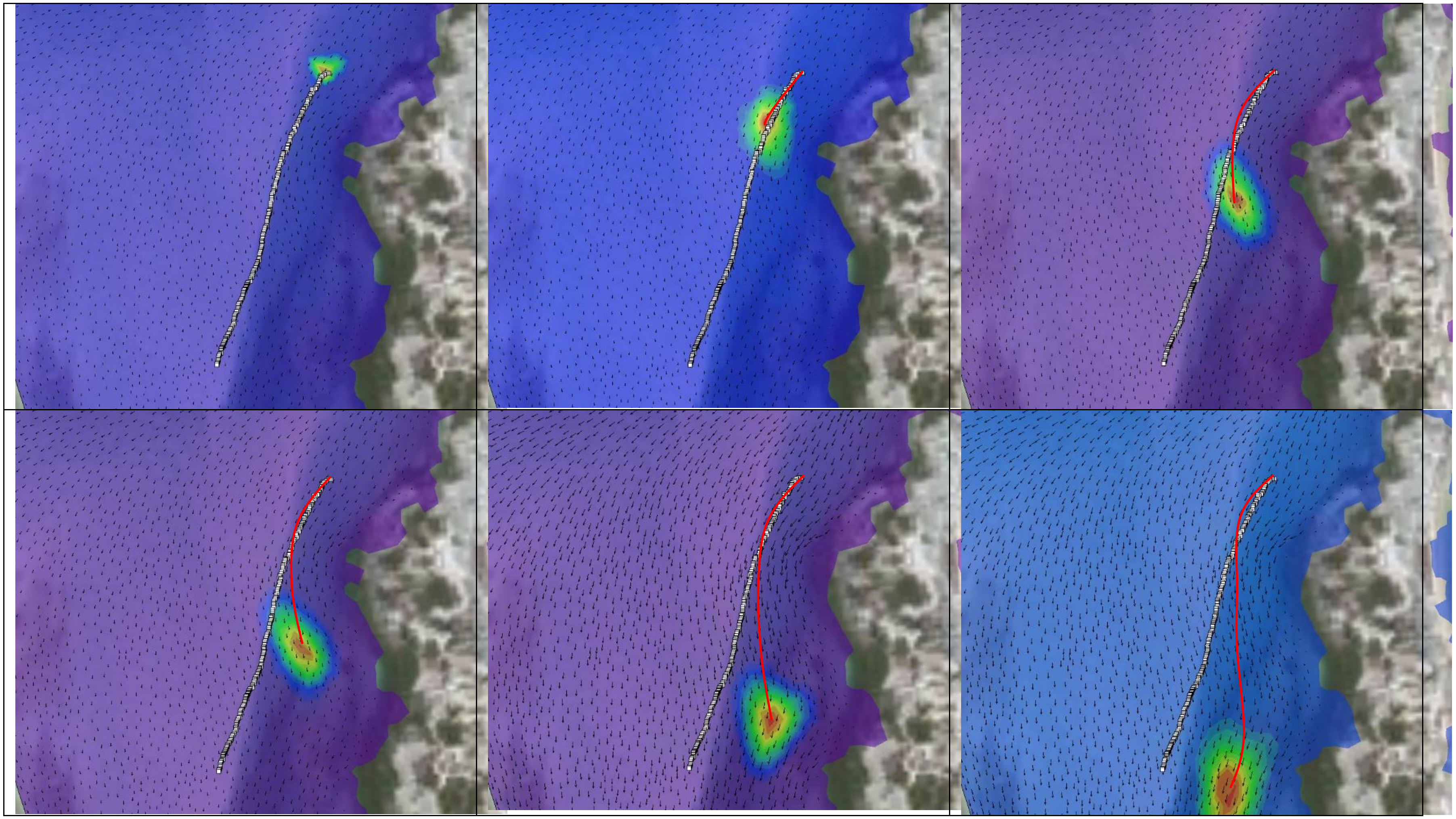


Figure 53: Drogue X2 Modelled (rainbow hue and red line) Vs Actual Drogue (white boxes)

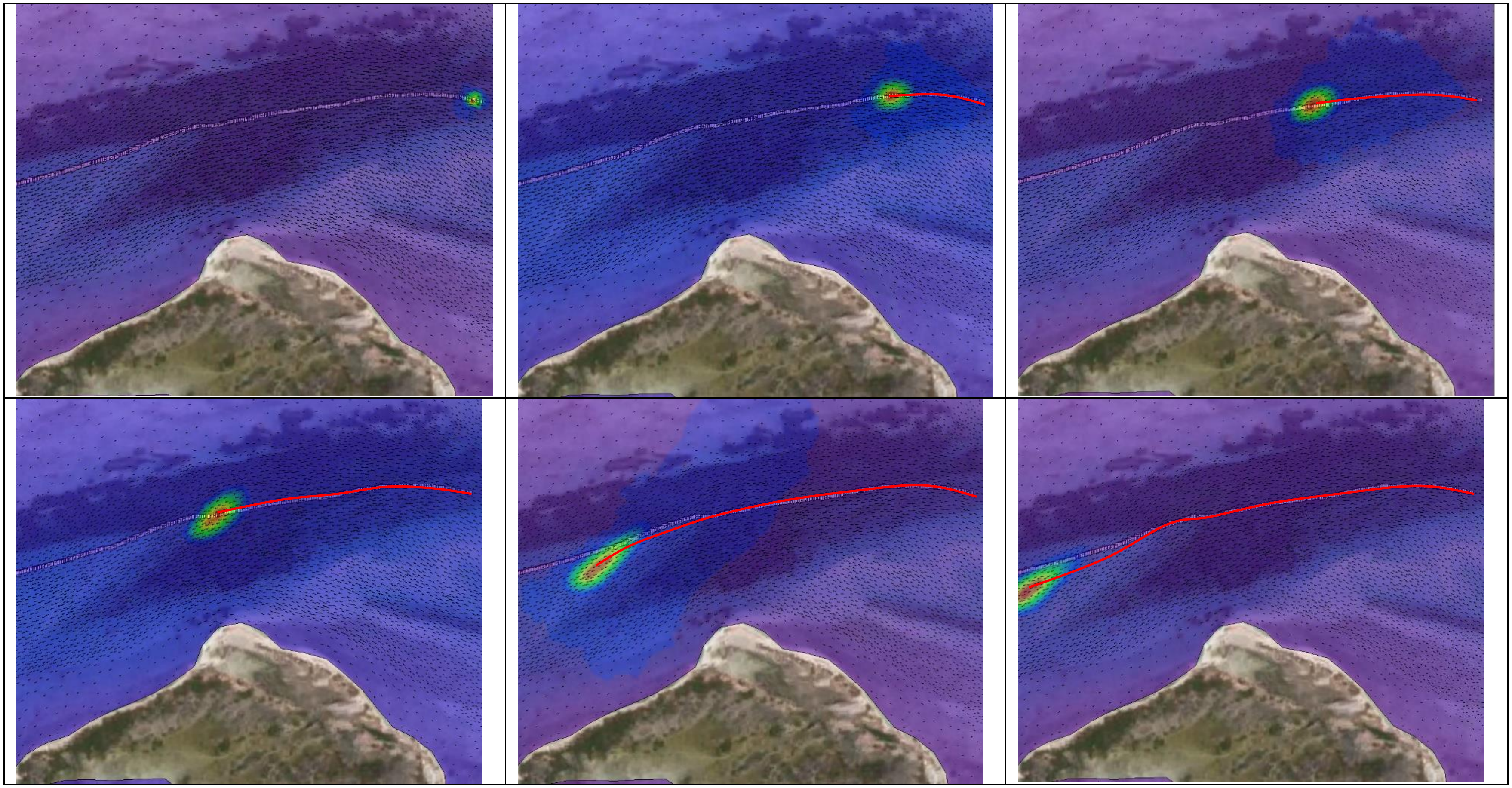


Figure 54: Drogue Y2 Modelled (rainbow hue and red line) vs Actual Drogue (white boxes)

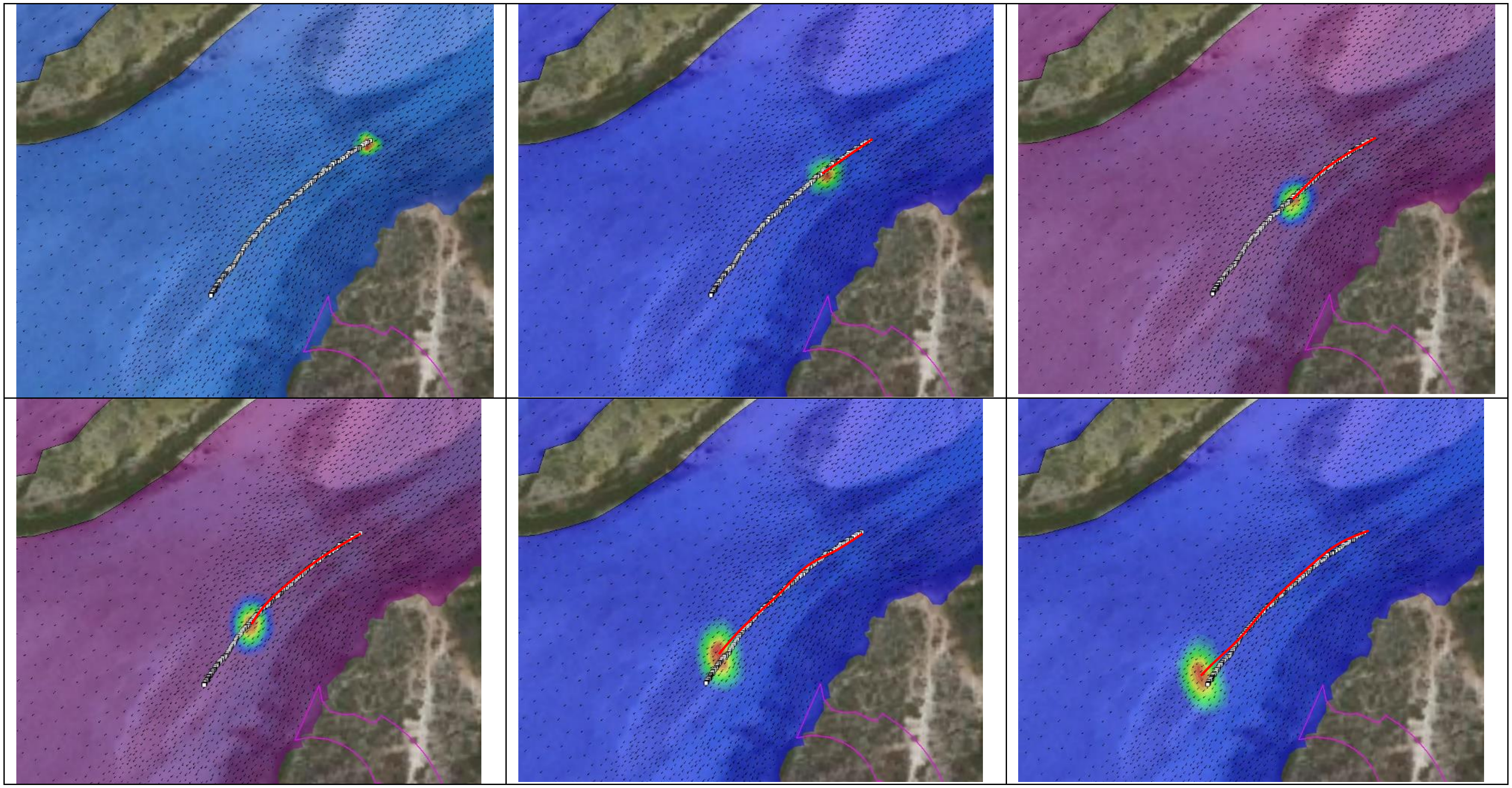


Figure 55: Drogue X3 Modelled (rainbow hue and red line) Vs Actual Drogue (white boxes)

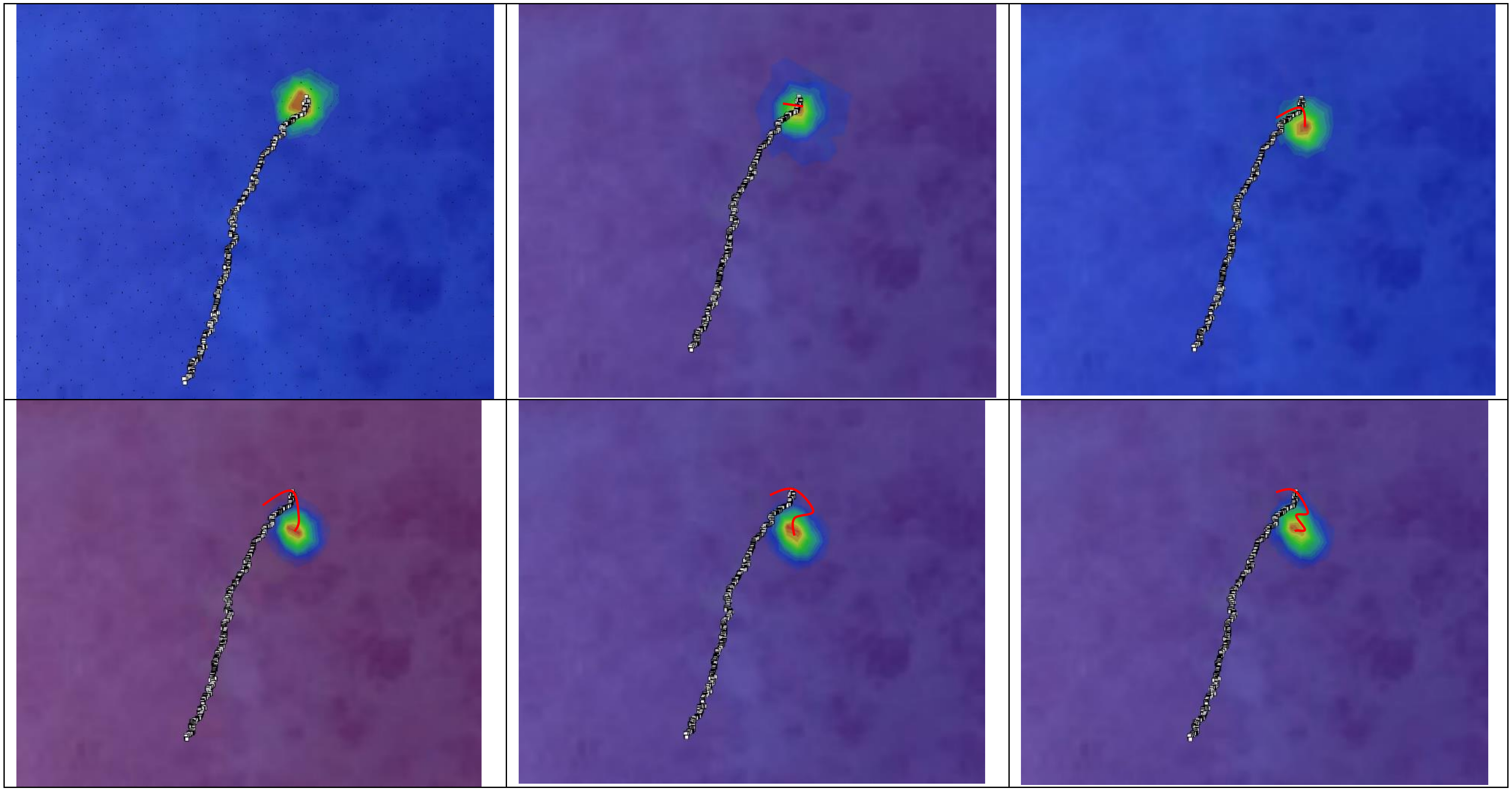


Figure 56: Drogue X4 Modelled (rainbow hue and red lines) Vs Actual Drogue (white boxes)

Table 12: Reliability of model based on deviations.

	Actual Flow Speed (m/s)						Simulated Flow Speed (m/s)						Performance						Reliability	
Instance	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6		
X1	0.29	0.26	0.15	0.11	0.1	0.13	0.2	0.25	0.11	0.12	0.1	0.1	69%	96%	73%	91%	100%	77%	84%	74%
Y1	0.39	0.31	0.39	0.35	0.37	0.39	0.28	0.27	0.26	0.21	0.22	0.25	72%	87%	67%	60%	59%	64%	68%	
X2	0.11	0.12	0.13	1.6	0.17	0.16	0.08	0.1	0.1	0.1	0.15	0.15	73%	83%	77%	6%	88%	94%	70%	
Y2	0.26	0.28	0.25	0.23	0.26	0.24	0.23	0.24	0.17	0.17	0.14	0.15	88%	86%	68%	74%	54%	63%	72%	
X3	0.22	0.17	0.18	0.24	0.22	0.17	0.19	0.16	0.16	0.15	0.15	0.13	86%	94%	89%	63%	68%	76%	79%	
X4	0.03	0.04	0.02	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	67%	50%	100%	50%	50%	100%	69%	

An important design factor in creating an inland channel/canal is to maintain enough circulation so the water quality remains healthy and minimizes algae formation. To ensure continued adequate water exchange and good water quality, the existing conditions were investigated using the validated numerical model. A 24-day neap tide simulation period from 8 May 2021 – 1 June 2021 was selected to assess the baseline hydrodynamic conditions and currents at their lowest levels. Tide levels and current speeds were the parameters examined to assess the baseline hydrodynamics. Tide levels taken from a global tide model (DTU 2010) were input to the model along the boundaries as previously illustrated in Figure 57. The tidal signal applied to the west boundary is shown below in black while the signal applied to the east boundary is shown in blue. The difference in water surface elevation between the two boundaries causes a tidal potential, which generates flows.

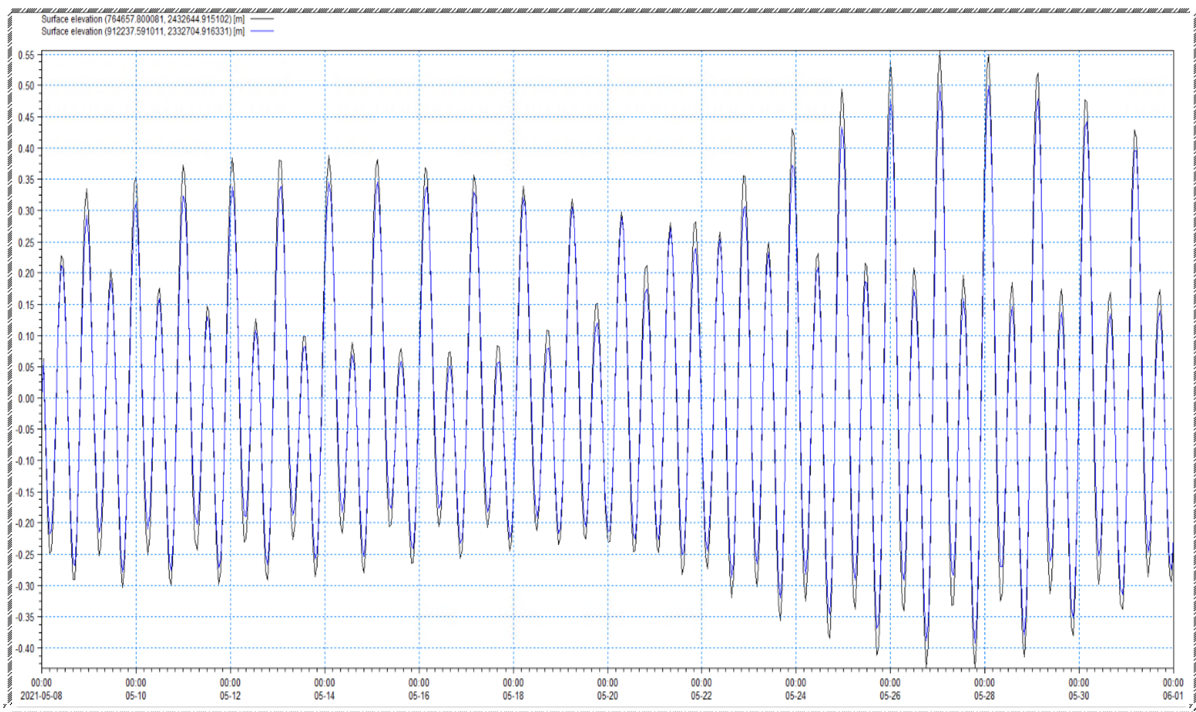


Figure 57: 24-day offshore neap tidal signal from the DTU model used in the analysis

The hydrodynamic model analysed currents over the 24-day simulation period. The 50th percentile plot of the currents (Figure 58) indicates that currents occurring 50% of the time throughout the 24-day simulation range from 0.1m/s to 0.22m/s near the proposed location of the northern channel entrance while ranging from 0.02m/s to 0.07m/s near the proposed location of the southern channel entrance. The resulting rose plots (Figure 59) showing current speed and direction (going to) were plotted over the 24-day period at arbitrary locations along the shoreline. Current roses indicate that currents generally flow parallel to the shoreline back and forth in a unidirectional orientation throughout the modelled period.

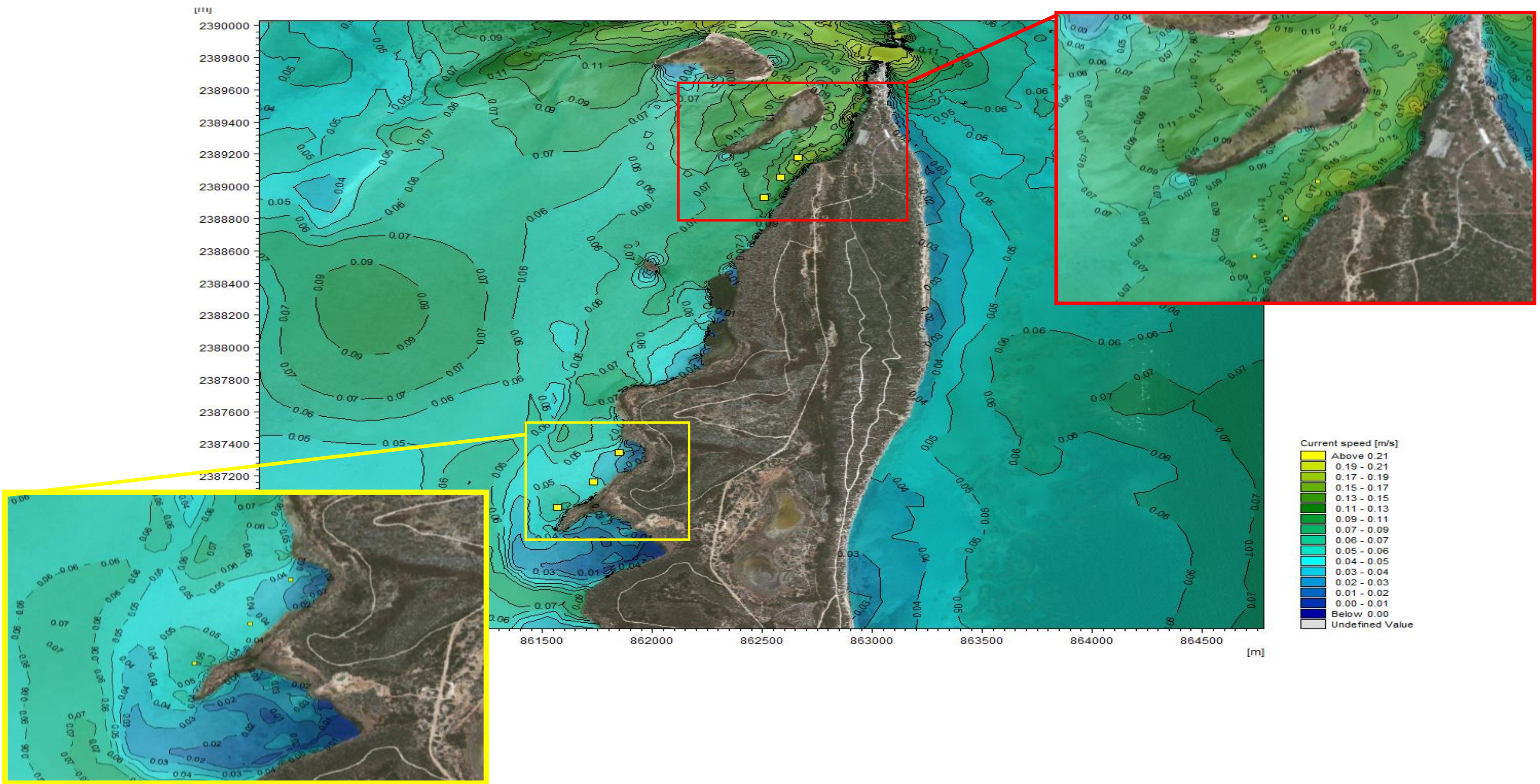


Figure 58: 50th percentile current speeds for simulation period (8 May – 1 June 2021)

Figure 59: Current speeds and directions (going to) over the 24-day period at three different locations in the nearshore of the project site at the location of both the proposed Northern (Top) and Southern (Bottom) channel entrances.

2.4.3 Wave Climate

The operational wave climate at the project site is characterized by (a) day-to-day, relatively calm conditions; and (b) seasonal winter swells (December to May). The day-to-day conditions are primarily generated by the northeast Trade Winds. The swells, however, are generated by north Atlantic cold fronts and these waves approach the site from the northeast to northwest sectors. As such, the north coast of Turks and Caicos is often exposed to these longer period, larger and more aggressive waves. These conditions have a more profound impact on the shoreline of the project site although their occurrence is less frequent.

The data used to assess the operational wave climate of the site was procured from the ERA 5 global reanalysis model. Figure 60 shows a wave rose at node 46 of this model. The European Centre for Medium-range Weather Forecast produced the ERA5 reanalysis which has a detailed record of the global atmosphere, land surface and ocean waves from 1979 to 2021.

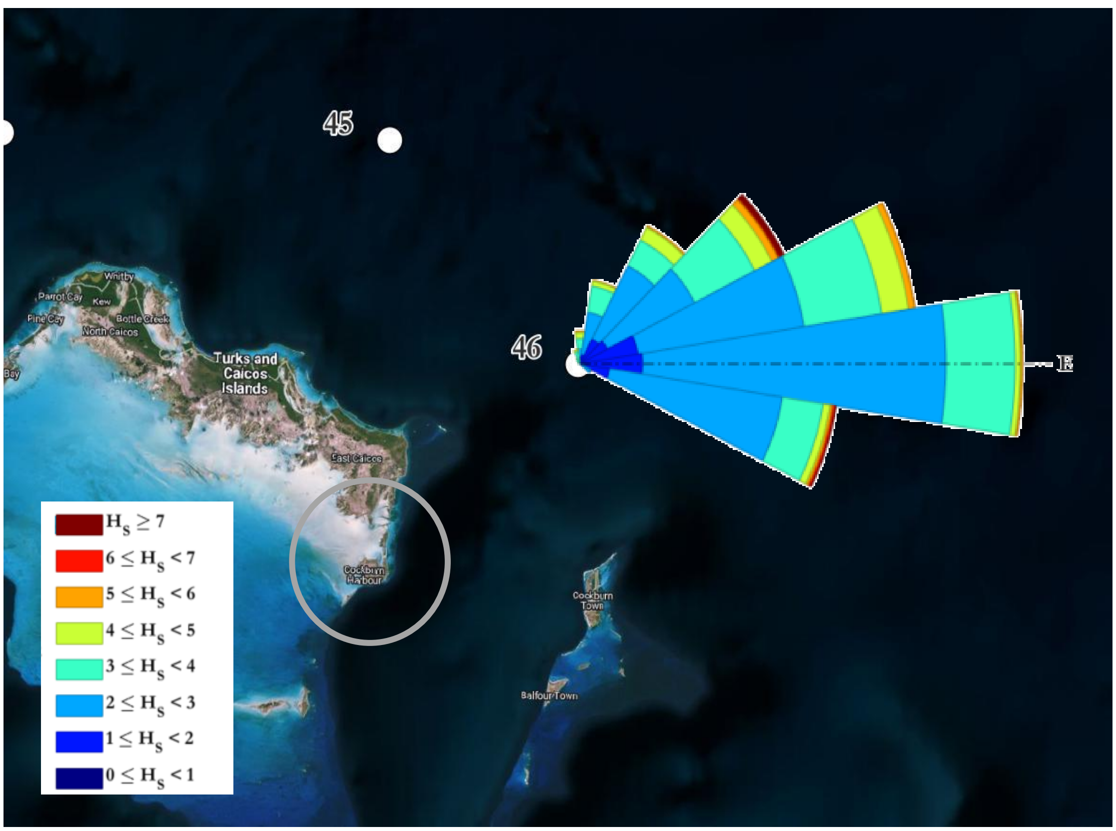


Figure 60: ERA 5 Node 46 used for the Turks and Caicos Islands

The ERA5 is usually applied on spatial scales (grid increments) larger than 10km and outside the surf zone. As a result, the model is not at a sufficiently detailed scale to provide accurate nearshore wave data in the exact area of South Caicos. The project area's nearshore wave climate was therefore developed using a spectral wave model MIKE 21 SW to simulate waves as they approach from the east, north, and west and move over the offshore bathymetry of the island to reach the project site.

The 42 years of wave data (1979-2021) obtained were categorized using a tri-variate frequency analysis of wave height, period, and direction as well as wind speed and direction, also known as "binning". This frequency analysis resulted in 1175 different conditions or "events" representing a combination of wave height (Hs), peak period (Tp) and direction, wind speed (Ws), and direction, each with a specific duration related to the frequency of occurrences in the 42-year period.

The numerical wave model was run in a semi-stationary mode with inputs of the wave heights, periods, and directions along all boundaries of the model domain. The resulting nearshore wave climate data are plotted in Figure 61, having been extracted at various nodes in the nearshore of the project site. This gives a representation of the annual wave climate inclusive of swells.

In addition, 2D-plots were generated. Figure 62 shows both the mean annual wave climate (50^{th} percentile) while Figure 63 shows the 99.86^{th} percentile wave climate (right). The 99.86^{th} percentile wave represents the conditions exceeded 0.14% of the time. This is equivalent to 12 hours per year. Conversely, the mean annual wave climate describes the average wave heights and directions each year.

Overall results indicate that the eastern coast of South Caicos mainly experiences 0.3m to 0.45m high waves approaching from the east, which is expected as the bathymetric contours and offshore fringing reef generally runs from north to south; as waves approach the coastline, they attempt to align with their crests parallel to the bathymetric contours. The shallower western coast, however, experiences much smaller waves (2- 5cm in height) that move offshore in a much less uniform direction corresponding to the winds obtained from the ERA5 model. This indicates that the western shoreline is protected from higher offshore waves by the shallow bathymetry in the area. The results also suggest that the dominant waves in this area are fetch limited, meaning they are generated by local wind and are not influenced by offshore wave conditions.

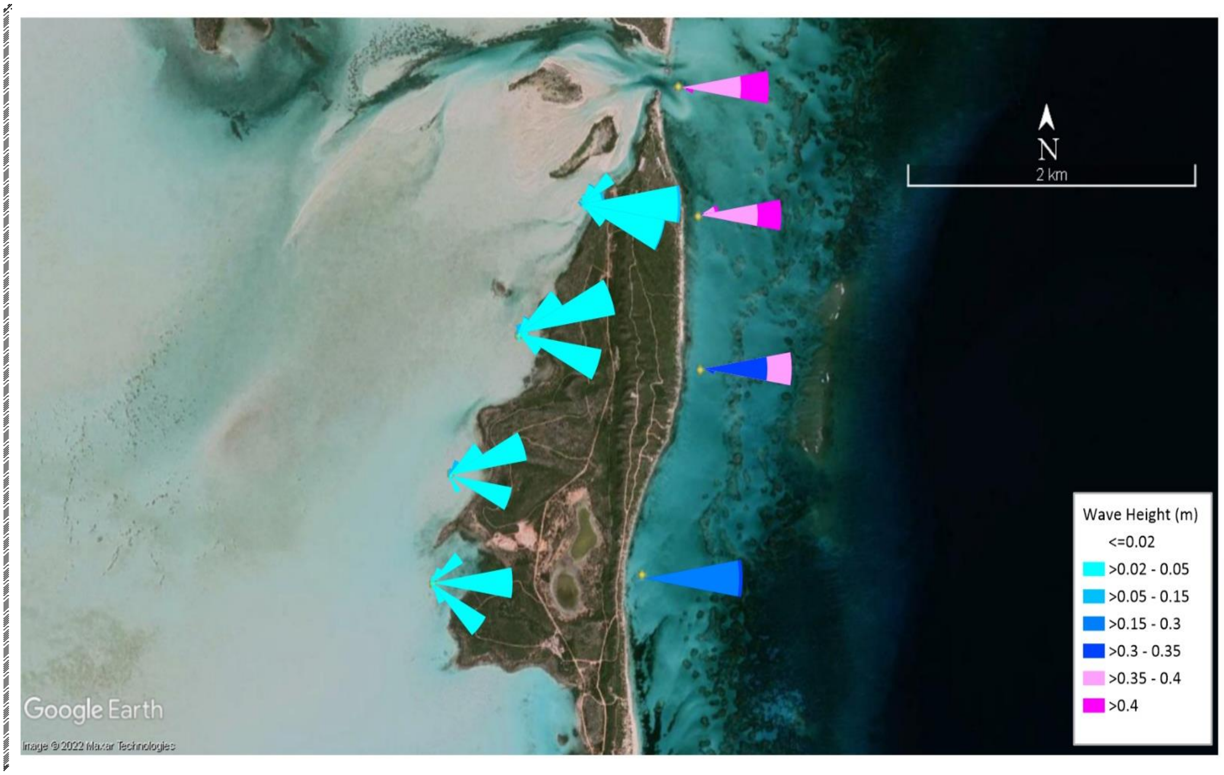


Figure 61: Annual nearshore Wave Climate extracted in the nearshore from the MIKE SW model simulation.

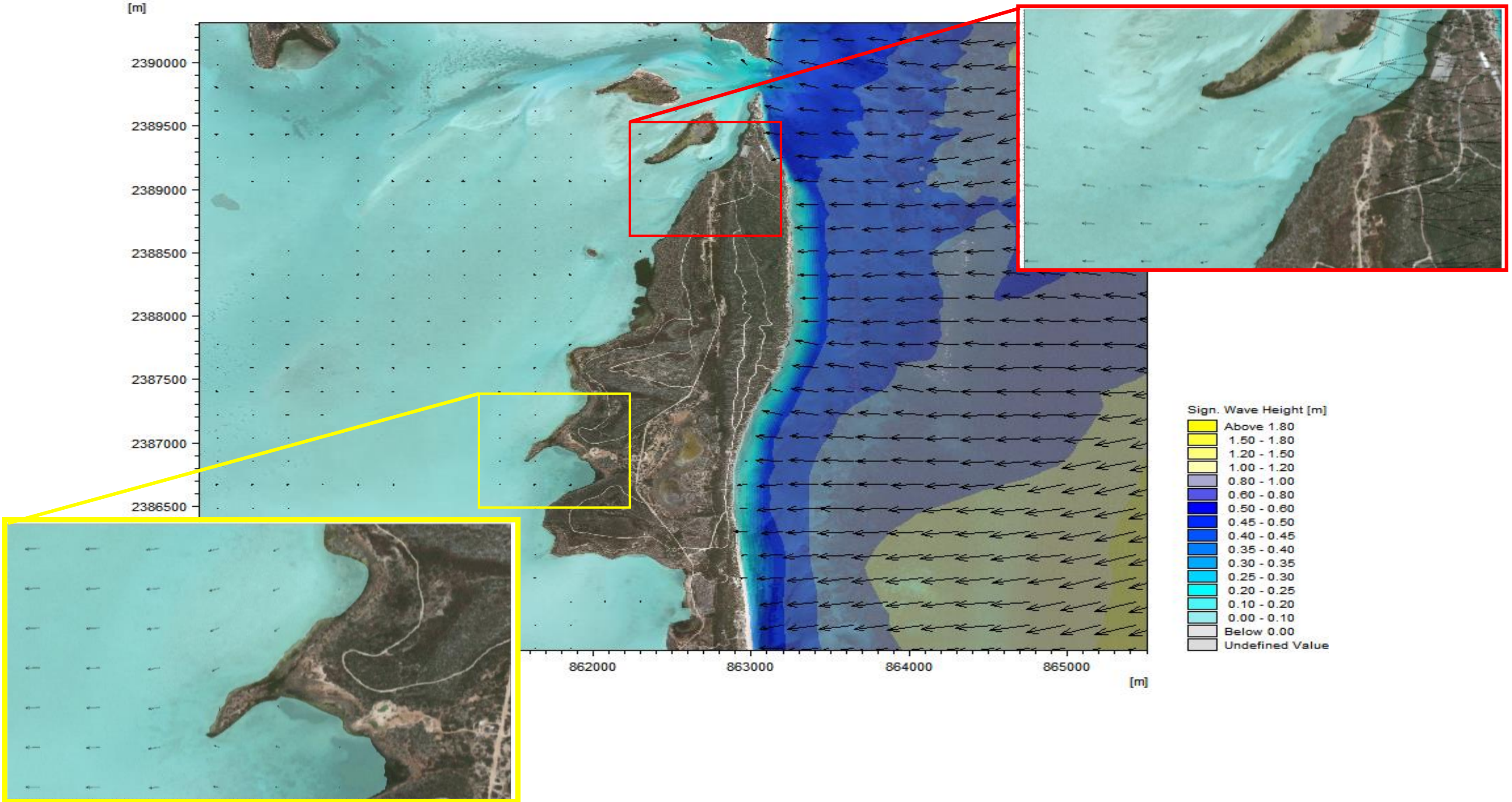


Figure 62: 50th percentile operational wave conditions at the Project Site

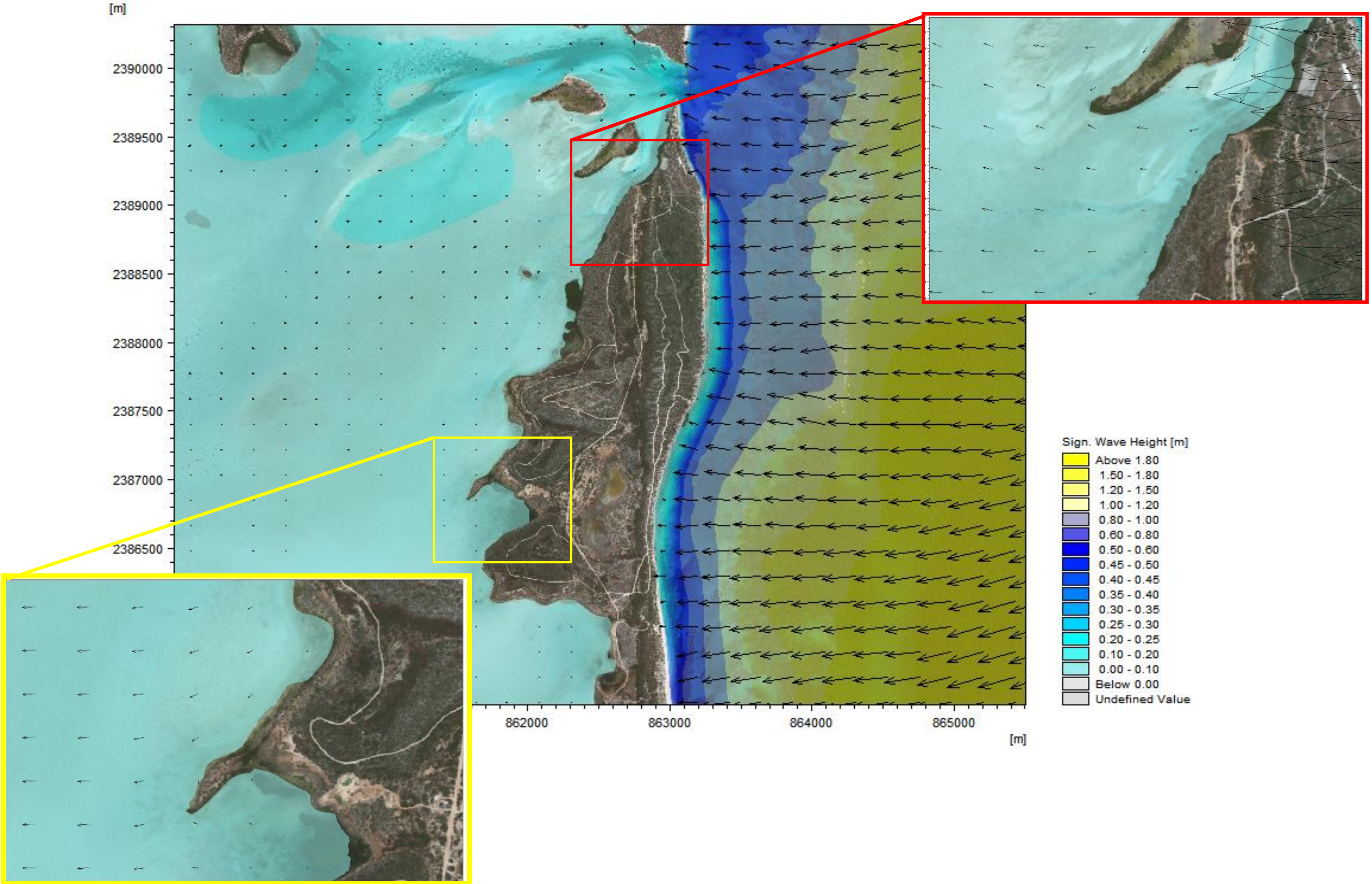


Figure 63: 99.86th percentile operational wave conditions at the Project Site

2.4.4 Sediment transport

Based on the results from the operational wave climate above, it is understood that the sediment transport at the site is forced mainly by currents and not so much the wind driven waves. As such, sediment transport during swell conditions were used in this study. A swell event represents an episode during the operational wave climate when the amount of wave energy reaching the shoreline is significantly increased. Waves form because of wind blowing over the ocean surface during windstorms offshore. Swell waves are usually generated during high windstorms and propagate away from the area of generation and arrive days later at shorelines many miles away from the storm. Typically, swell events are clear sky events meaning that there are no notable wind conditions happening in the vicinity. To assess the effects of the swell wave conditions at the site, it was necessary to evaluate the offshore wave database. This was done by filtering the swell events from the ERA5 wave dataset. A total of 166 swell events lasting more than two days were found in the database. The swell events with the highest maximum wave heights are shown in Table 13.

Table 13: Top deep water swell events within the last 42 years, based on maximum wave heights

Start Date	End Date	Max Sig. Wave Height (m)	Wave Period (s)	Mean Wave Direction (deg)
12/Nov/1985	19/Nov/1985	5.36	11.97	117.28 (SE)
04/Mar/2018	**10/Mar/2018**	**4.48**	**15.74**	**359.44 (N)**
28/Jan/1988	02/Feb/1988	4.43	9.91	79.62 (NE)
26/Jan/2018	30/Jan/2018	4.37	10.16	81.87 (NE)
15/Jan/2000	17/Jan/2000	4.18	11.97	34.90 (NE)

The swell event[2] on 4 March 2018 (Figure) was selected to carry out the swell assessment for the baseline case of wave heights, currents, and sediment transport in the area for the following reasons. This event includes wave heights three times the value of the deep water means wave height. The wave periods were also longer than the mean, and this has implications for sediment transport and flooding. The offshore wave conditions capturing the above swell event were applied to the model over the period of 1-11 March 2018. The resulting sediment transport bed level change is shown in Figure 64.

[2] More information on this swell event is presented by the NOAA at https://www.weather.gov/sju/swell_mar2018.

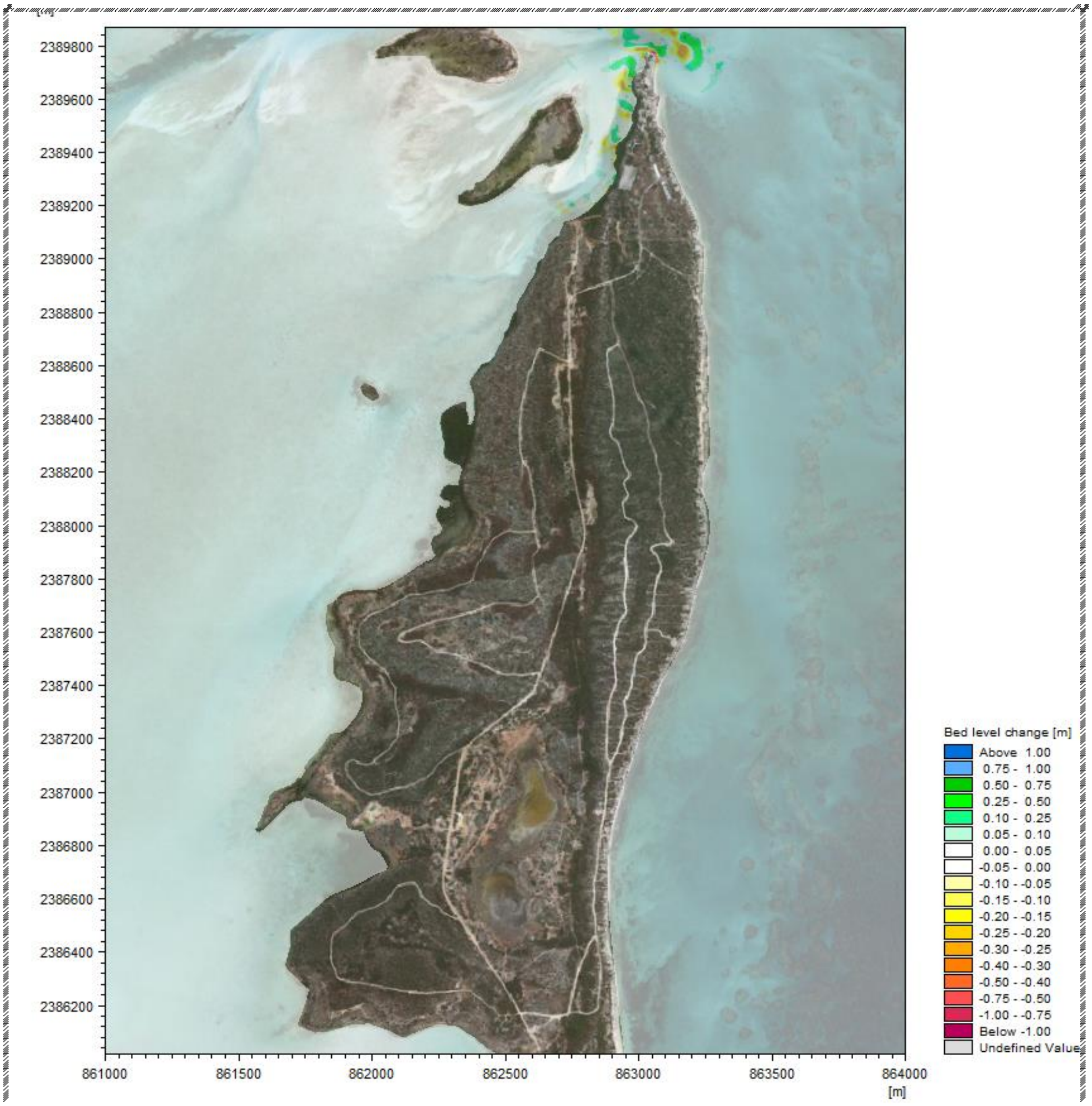


Figure 64: Bed levels at the end of the Swell event

From the above analysis, it can be determined that the site experiences very little sediment movement during swell events. Where there is sediment movement, it is isolated to areas that experience fast-moving currents and large waves such as the gap entrance between the Sail Rock peninsula and Plandon Cay. Areas close to the northern channel entrance experience small changes in bed level, while areas close to the southern channel entrance experience negligible bed level changes. Overall, like the shoreline movement discussed in the historical shoreline analysis of section, the shoreline also remains relatively stable over the course of this swell simulation.

2.5 Coastal Water Quality

Coastal water conditions can be affected by a variety of stressors. Nutrients and pathogens can come from storm water, agricultural runoff, and sewage discharge or overflows. Also, excess nutrients can cause algal blooms that result in low dissolved oxygen levels, which can harm aquatic life.

To establish baseline coastal conditions water quality samples were collected on May 22, 2022, and tested to document the baseline conditions in the project area. Future water quality after the development becomes operational to compare with the baseline parameters to get an idea of the impact of the development on coastal water quality.

Three sampling stations were selected in the coastal area. In accordance with the Terms of Reference the following parameters were analyzed on the water samples:

- Total Suspended Solids
- Nitrate
- Phosphate
- BODS
- Total and Faecal Coliform

The laboratory analyses were performed using the certificated methodology, primarily from the text 'Standard Method for Examining Water, Wastewater, and HACH. Sampling locations and results are shown in Table 14 below.

Table 14: Water Qualities Sampling

Locations	GPS Coordinates	Salinity	Temp	PH	DO	Turbidity
Northwest	21.340206 71.300557	35.80	21.60	7.80	4.80	3.65
Central	21.333921 71.303407	35.70	23.60	7.80	4.70	3.88
Southwest	21.330557 71.305058	35.80	24.40	7.80	3.80	4.52

The subsurface lithology subject to impact from the construction of the inland waterway will render the water quality of the water feature susceptible to elevated turbidity levels. The subsurface earth material is poorly cemented Holocene Sand that will yield an occurrence of crushed earth materials and resultant fines that are easily washed out into the constructed lagoons.

2.6 Conservation/Preservation Zones

Analysis of recent, high-resolution aerial photography suggests that most of the vegetative communities and habitat types that are present within the Assessment Area are also present in significantly larger acreages on other areas of the Sail Rock property.

One area, however, that appears to be seasonally important, and which is composed of a habitat that is either non-existent or minimally existent in other areas of the property is a small seasonal wetland mapped as Palustrine, Nonvascular, Saline/Hypersaline (Figure 65).

This area is referenced in *Birding in Paradise - South Caicos* (Pienkowski et al, 2014) as being a notable area for birds. Observations indicate that during the rainy season, when this area fills with water, it provides important habitat for a variety of migratory and resident waterfowl and wading birds, including, at a minimum, white-cheeked pintails, blue-wing teal, wigeon, and black-necked stilts. As this small pond draws down during the dry season, it appears to concentrate aquatic prey, making it important for migratory waterfowl and nesting passerine birds. Thick-billed vireos, Bahama woodstar hummingbirds, and yellow warblers' nests along the periphery of this area, and ground doves and killdeer were observed in it during the April 2022 assessment. More detailed avian assessments are likely to document that this area is also used by a variety of additional species.

It is also likely that, as this area fills with water during the rainy season, both direct rainfall and seepage from upslope to the east result in it becoming a freshwater or nearly freshwater resource. The lowered salinity is likely to create a habitat for aquatic organisms, which, in the absence of fish (because it dries up seasonally), become prey for other species, which may explain why it attracts various species of waterfowl and wading birds. At this time, if the salinity is low enough, this area could likely also provide an important drinking water source for other wildlife,

including donkeys, which although they are non-native and destructive to native flora, are an important component of South Caicos history and culture.

Because no other area on the Sail Rock property appears to provide this combination of characteristics, it appears to be an important localized biodiversity hotspot. It is recommended that this area, which, together with a surrounding minimum 100-foot buffer area, be set aside as an approximately 4-acre (~1.6 ha) conservation/preservation area. The next section provides a more detailed project description and discusses the potential alternatives to the proposed development.

Figure 65: Recommended Conservation/Preservation Area, including ~100 ft buffer

SECTION III - PROJECT DESCRIPTION AND ALTERNATIVES

3.0 Project Description and Alternatives

Section three gives a detailed description of the development, discusses possible alternatives, and suggests project justifications.

3.1 Project justifications

Sail Rock Development Limited desires to convert the Sail Rock peninsula seasonal pond situated between the coastal ridge to the east and the Caicos Banks coastline to the west into an attractive blue water lagoon basin.

The low-lying seasonal pond is a rich ecological ecosystem, particularly during the rainy season when it comes to life. During the dry season, it is a low-lying dry land, which presents an unsightly view to guests viewing it from the hotel facility located on the ridge above. Hence, the developers desire to transfer it into an attractive blue lagoon basin, with an inland canal system that connects it to the ocean via the northern and southern entrance channels.

The proposed blue water lagoon basin will not only offer an attractive physical environment but will also enhance the economic viability of the development by making the adjacent land more suitable and attractive for development. It also has the potential to enhance the ecosystem by increasing marine life. It can also reduce the risk of flooding by providing a reservoir for rainwater runoff. The project will increase or improve the socio-economic opportunities for the local population.

South Caicos has a history rich in fishing and boating heritage culture, the proposed blue water lagoon basin will build on that heritage culture by providing additional opportunities for boating and other water-based recreational sporting activities and employment opportunities.

In the long term, it is anticipated that the development will have a tremendous impact on the socio-economy development of South Caicos by providing additional employment opportunities in tourism, including water-based recreational employment opportunities.

3.2 Description of the development

The proposed development is Blue Water designed to transform the Sail Rock peninsula seasonal pond into an attractive lagoon Basin. Each component of the development is interrelated and depends on the other to function. Together, they will comprise an elaborate blue-water lagoon ecosystem.

its main components are:

- Blue Water Lagoon Basin
- Inland Peninsula Canal
- Northern and Southern Channel Entrances
- Boat docks
- Rip-Rap Revetment, Roads, culverts, and bridges

3.2.1 Blue Water Lagoon Basin

The purpose of the shallow water lagoon basin is to provide a "blue water" lagoon basin for recreational amenities. The basin will not be used as a marina or for any boat traffic, other than kayaking and paddle boats. The lagoon basin will be flushed via an inland canal and the northern and southern entrances to the ocean, Figure 66.

The geometry of the lagoon base was devised based on local topography and land constraints. The canal network and entrance channels are sized appropriately to aid in tidal exchange. The proposed embayment will have a smooth, rounded shoreline (i.e., no corners or dead ends) that will also promote circulation and flushing.

The embankments of the basin and canal will be treated with a configuration of bedding stone, overlain by a geotextile membrane, and finished with local stone at a grade of 1:2.5 ratio.

Figure 66: Schematic Design of Lagoon Basin

3.2.2 Inland Peninsula Canal

The inland peninsula canal is designed to assist with the flushing of the blue lagoon basin. The canal connects the lagoon basin with the ocean via the northern channel and permits the flushing of the lagoon basin via the southern entrance channel, Figure 67.

Figure 68 shows a typical cross-section of the canal. The shoreline of the canal would be protected from erosion with Rip-Rap lining, Figure 69.

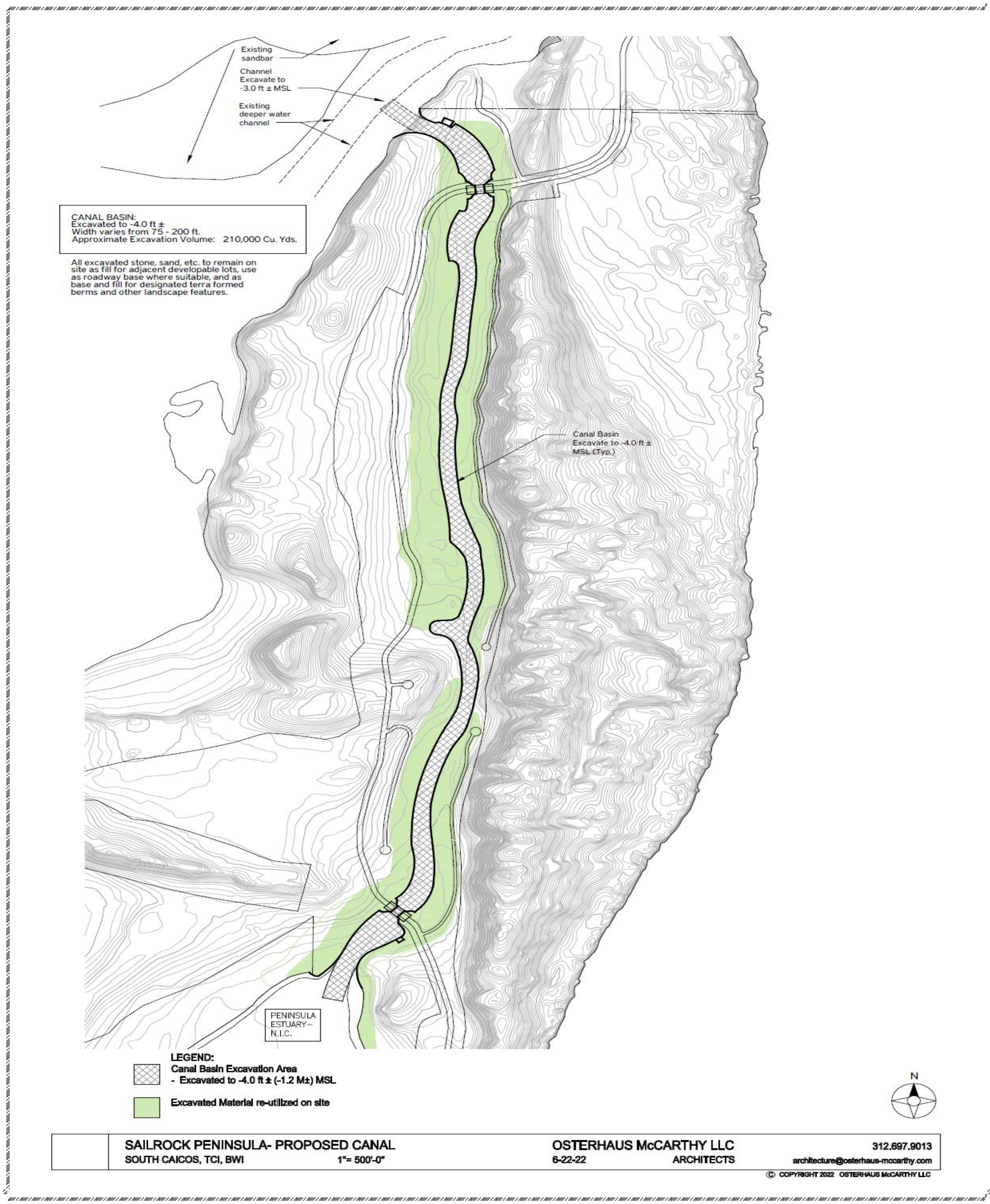


Figure 67: Schematic Design of Inland Canal System

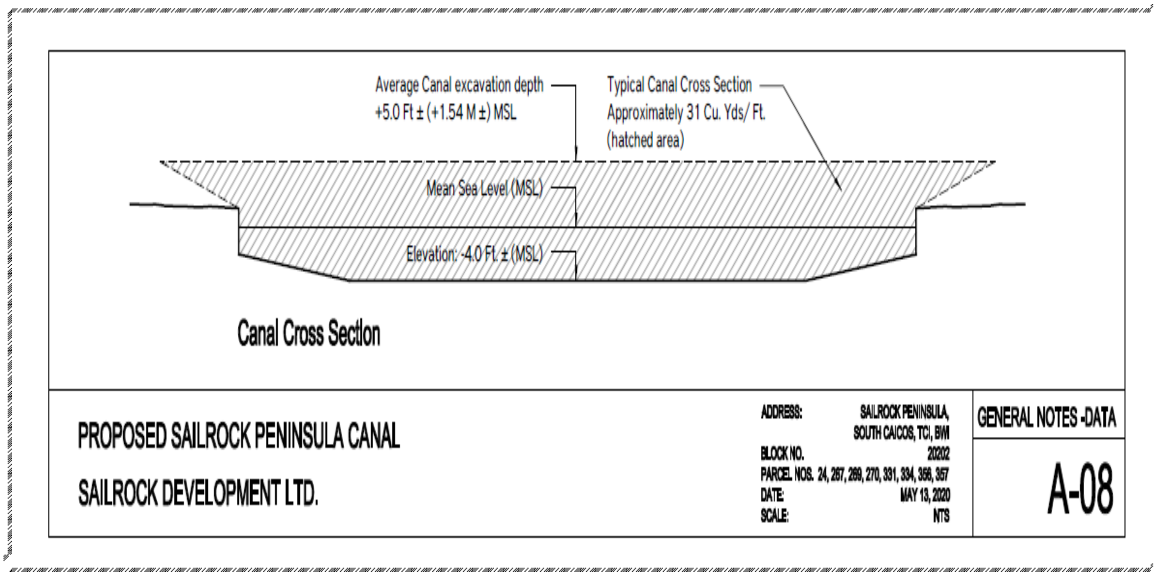


Figure 68: Schematic Canal Cross Section

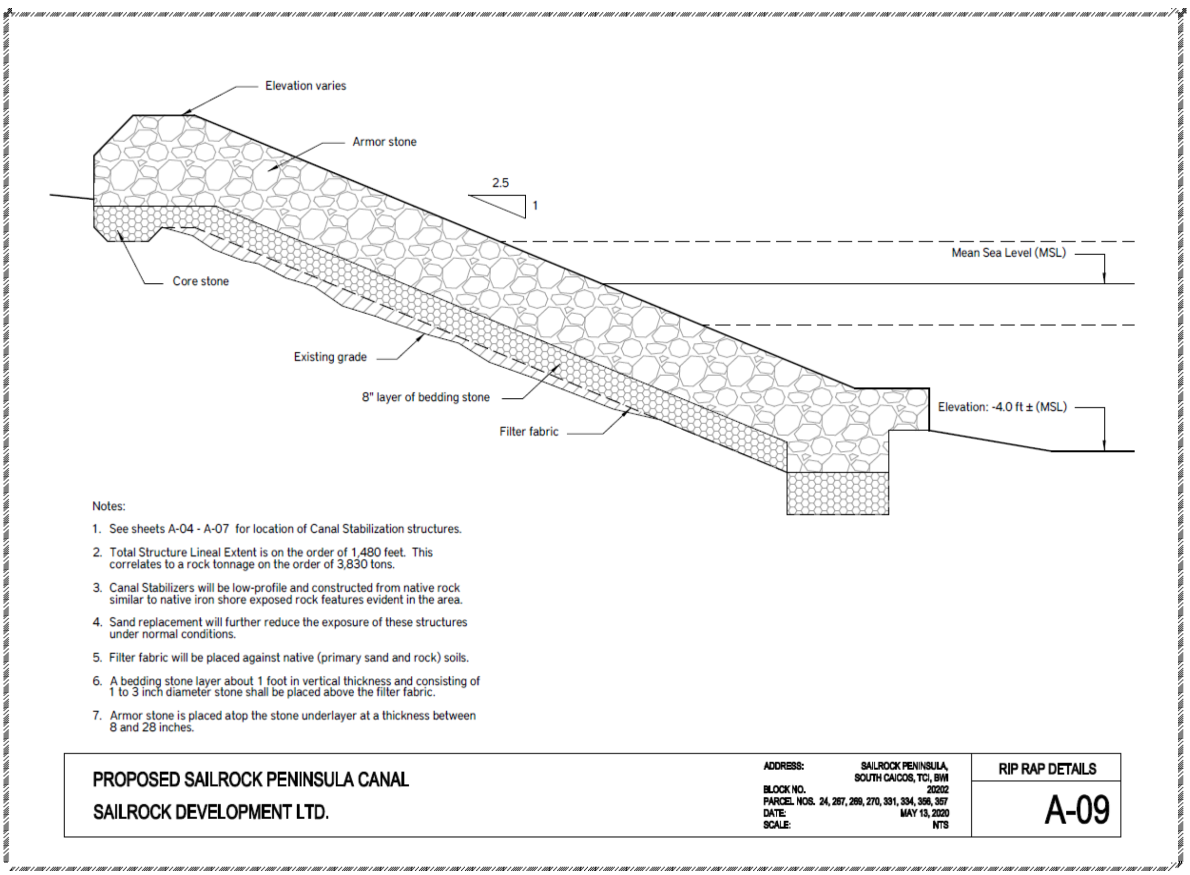


Figure 69: Schematic Design of Rip Rap Detail

3.2.3 Entrance Channel- Northern and Southern

The waters of the lagoon basin will be discharged into the ocean via two entrance channels, the northern and southern entrance channels. The l(Southern) entrance channel will be approximately 110 feet wide and the northern entrance channel approximately 100 feet wide. The depth at each channel is approximately -4 feet +/- (MSL).

The location and alignment of the lagoon basin side (Southern) entrance channel has been adjusted to avoid the lagoon basin flushing directly into the Bell Sound Nature Reserve. The modified alignment of the southern entrance channel exits the lagoon basin to the immediate north of the Bell Sound Nature Reserve.

Figures 70 and 71 below show the approximate location and alignment of the northern and southern entrance channels.

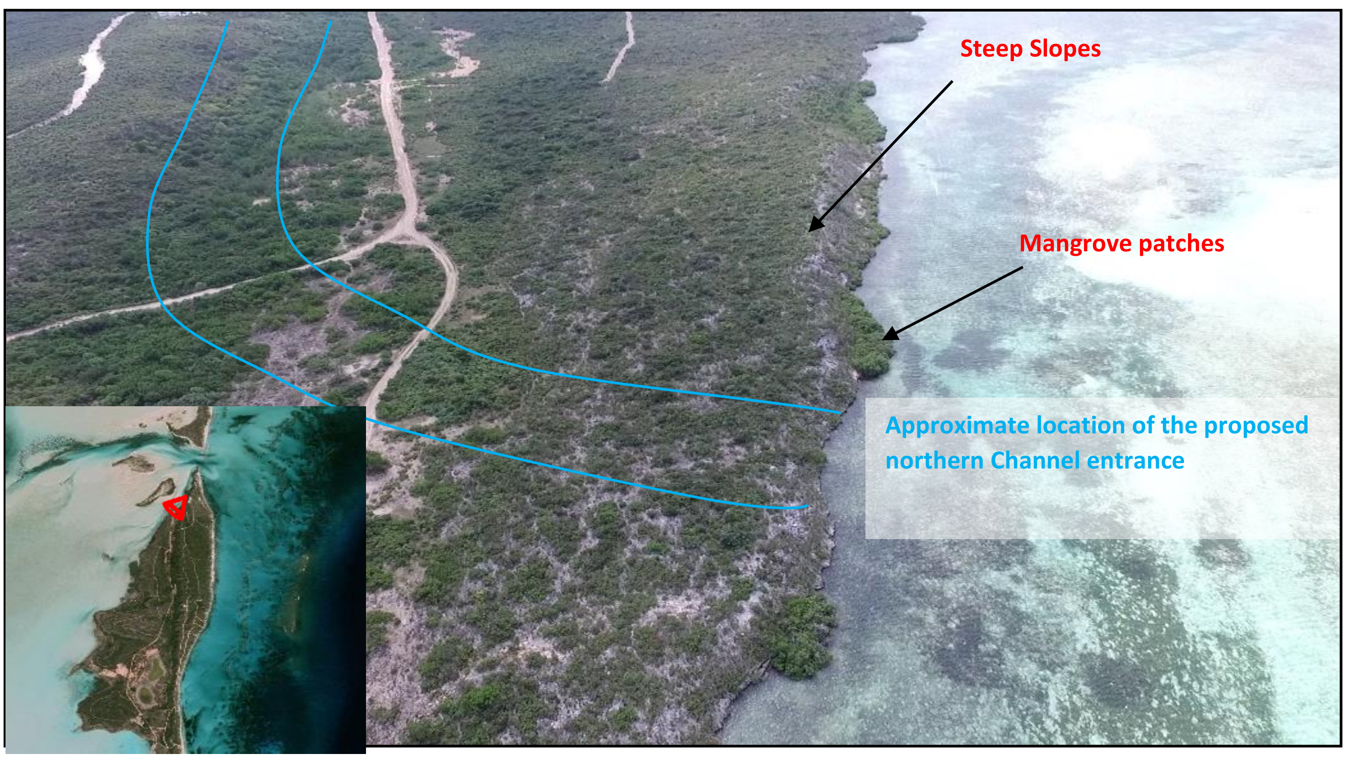


Figure 70: Location and Alignment of Northern Entrance Channel

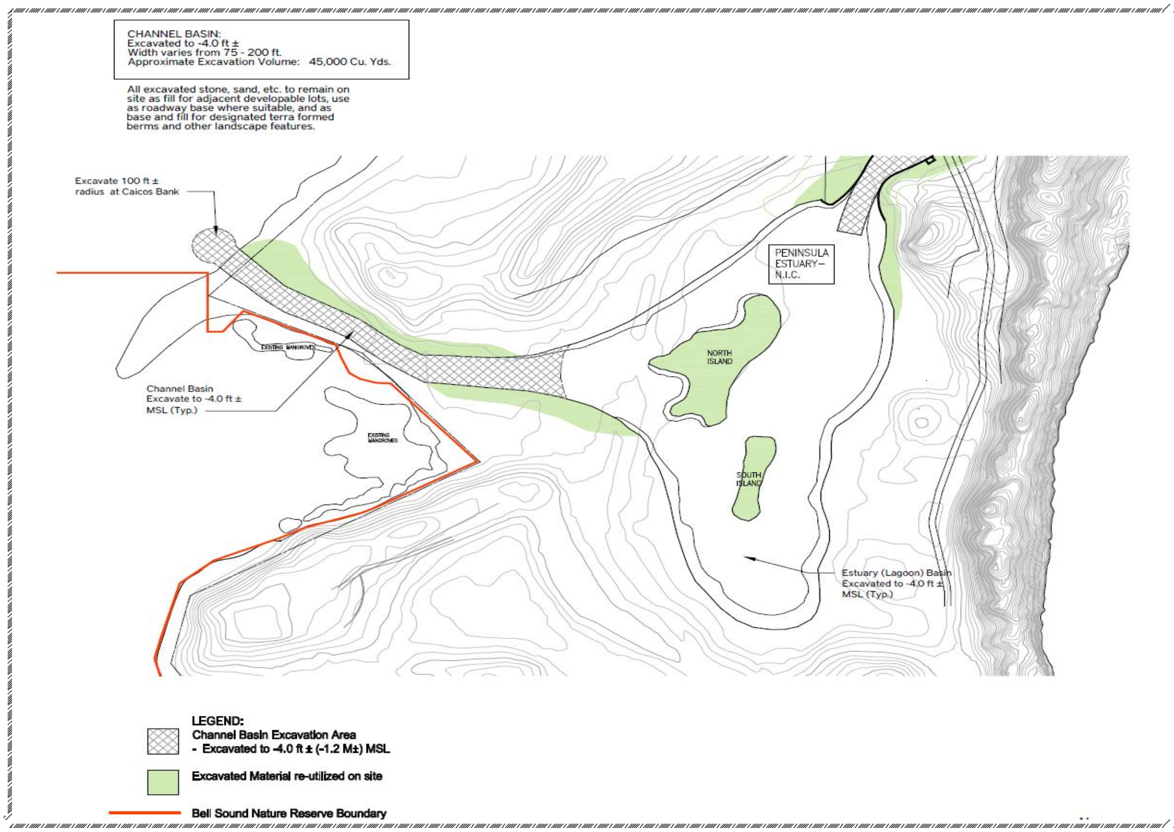


Figure 71: Location and Alignment of the Lagoon Basin Side (Southern) Entrance Channel

3.2.4 Boat Docks

The blue lagoon basin will be complemented with two sets of boat docks to provide boating facilities for development. The boat docks will provide docking facilities for small boats that will be engaged in snorkeling, scuba diving, and sports fishing activities.

These boat dock facilities are situated at the entrance channels. Approximately 40 boat dock slips are located at the northern entrance channel, 20 boat slips north of the bridge, and 20 boat slips south of the bridge. Approximately 27 boat slips are to be constructed at the southern entrance channel, Figures 72 and 73 show the location and layout of the boat docks.

Figure 72: Location and Alignment of the Boat Dock Slips at the Southern Entrance Channel

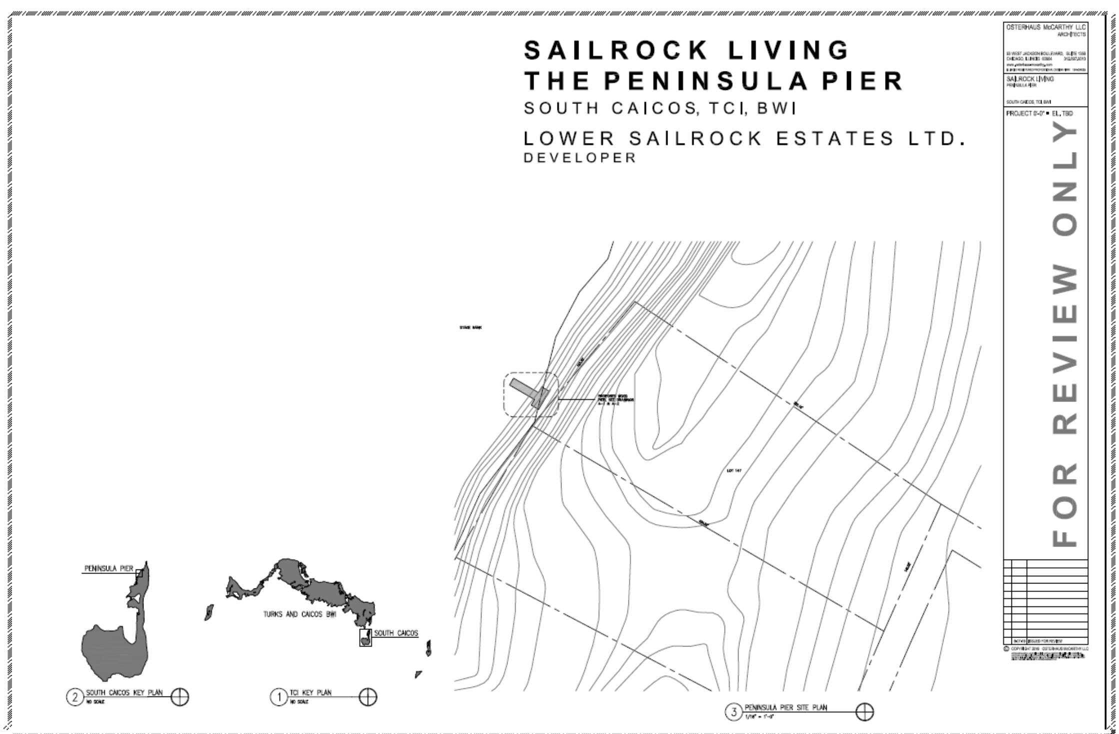


Figure 73: Location of the Boat Dock Slips

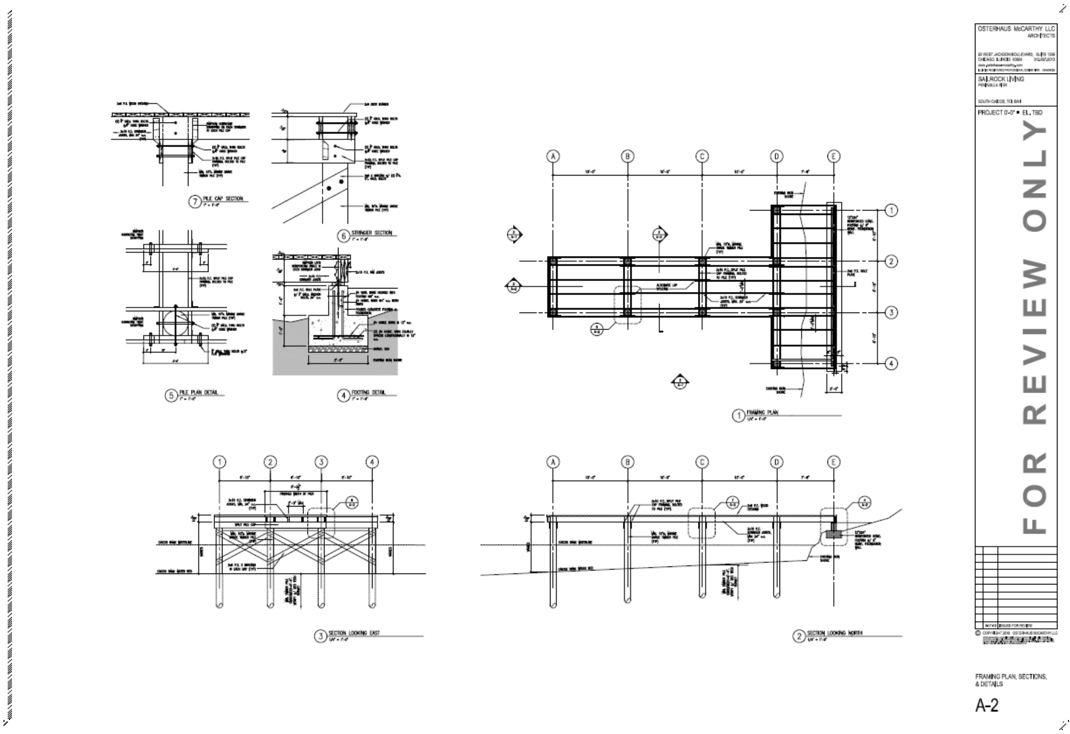


Figure 74: Construction Details of the Boat Dock Slips

3.2.5 Rip-Rap Revetment, Roads, Culverts, and Bridges

Rip-Rap revetment is one of the oldest and most used revetment systems. They are typically made from granite or native limestone. The local native limestone excavated from the dredging operation will be used for this purpose. The limestone riprap will be combined with a geotextile filter fabric to provide a foundation layer. The rip-rap revetment will provide a long-term shoreline protection structure that could resist erosion, attenuate wave activity, and reduce wave reflection.

A network of roads, culverts, and bridges is necessary to provide adequate vehicle access within and around the development. Two reinforced concrete and stone bridges, the northern and southern are proposed to provide vehicle access over the canal system. Natural excavated materials will be used in the road construction. Figures 75 and 76 show the proposed bridge locations.

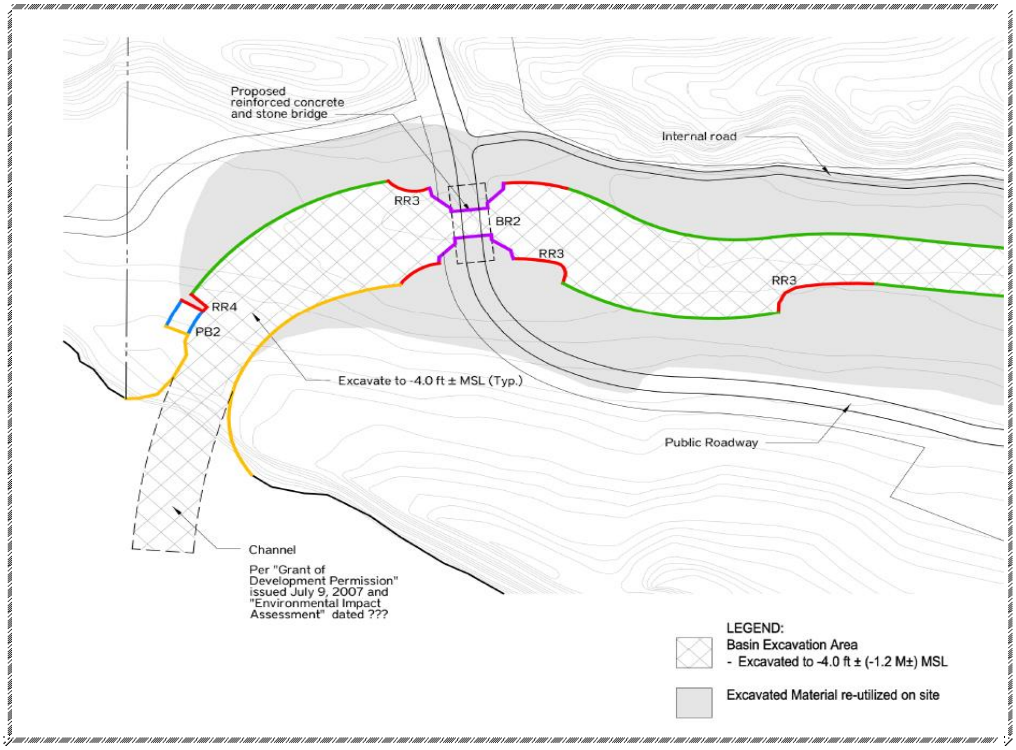


Figure 75: Location of the Northern Bridge

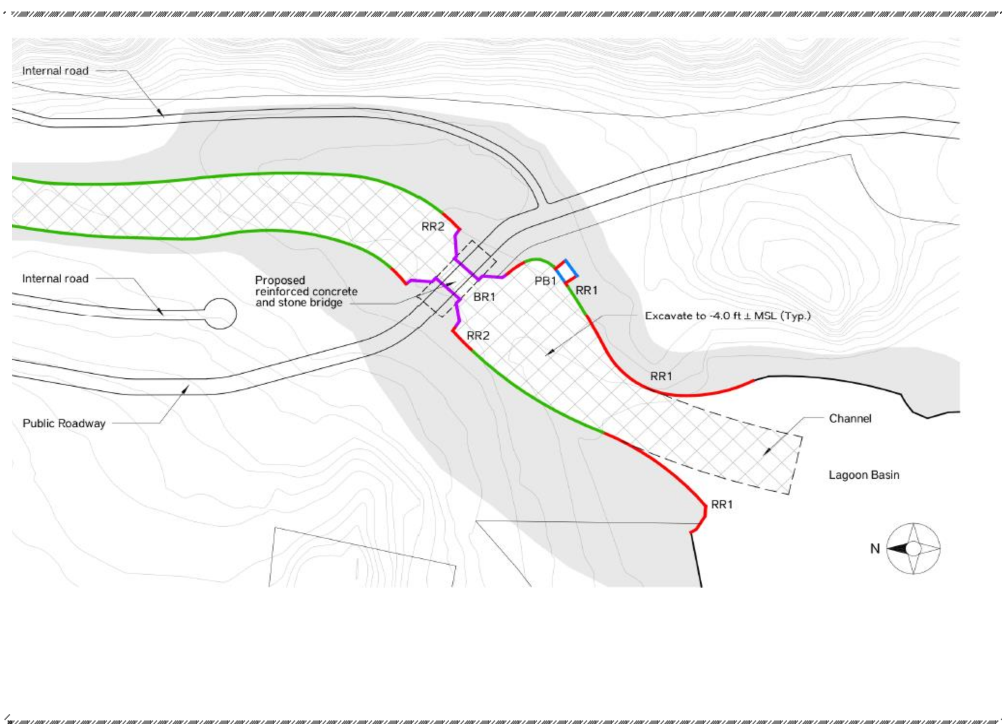


Figure 76: Location of the Southern Bridge

3.3 *Description of the construction phase activities*

According to Marine Insight, the process of dredging involves three independent elements, including excavation, transportation of excavated materials, and then usage or proper disposal of dredged material.

Phase one of the dredging operation involves the excavation of the shallow low-lying area to create a blue water lagoon basin that is to be used for recreational purposes. This dredging process will be a land-based operation. Phase two of the construction activity would include dredging the peninsula canal. The final phase of the dredging operation will include the opening of the northern and southern entrance channels. Each phase of the dredging operation would include the removal of the top vegetation and stocking piling and transportation of dredged materials.

3.3.1 *Construction Methods and Sequencing*

Dredging is the process of removal of earth, sediments, and debris from the bottom of lakes, rivers, harbours, and other water bodies. Dredging of the proposed lagoon basin, peninsula canal, and entrance channel will be carried out in three phases. Phase one will include the dredging of the low-lying area into a blue-water lagoon basin. Phase two includes the dredging of the peninsula canal that will connect the lagoon basin to the ocean, allowing for regular flushing for the basin and phase three will include the opening or connection of the lagoon basin via the northern and southern entrance channels.

Phase three will not occur until phases one and two are fully completed. Transporting, stockpiling, and use of the dredged material will occur during the three phases of the dredging activities.

3.3.2 *Excavation, terraforming, and movement*

Excavation works, including the inland excavation of the low-lying seasonal pond into a shallow blue water lagoon basin to an approximate depth of +/- 4 feet (MSL), excavation of the canal network that will ensure flushing of the lagoon basin, and dredging of the northern and lagoon side (Southern) entrance channels.

Excavated materials, including sand and stone with be moved by dump trucks to stocking areas for future usage. Excavated and dredged materials will be utilized to terraform the surrounding land area to reduce flooding, enhance land elevation, and make it suitable for human habitation.

3.3.3 *Construction materials*

Dredged materials are usually either a natural deposit of sediments and silt or artificial debris such as rock, bottom sediments, construction debris, and plant and animal matter. Due to the large area to be dredged, including the shallow blue water lagoon basin, the canal, and the entrance channel a tremendous volume of construction materials will be generated.

All excavated materials, including topsoil, construction sand, and stone will remain on site and used as fill for adjacent developable lots, use as roadway bases where suitable in road construction, and as the base and fill for designated terraformed berms and other landscape features.

Construction activities will require the management of dredge spoils from channel dredging. Excavated dredge material will be dewatered on the barge or pumped ashore and secure in berms as the excavation proceeds. The channel entrances are to be surrounded by turbidity curtains during excavation to limit sediment plumes. The spoils will be taken directly to the landing site, offloaded, and stockpiled in various locations on-site for future use.

To maintain the existing environmental characteristics of the area, dredged native-like stone will be used in the construction of canal stabilizers. Reinforced concrete will be used in the construction of bridges. Dredged stone will also be used in erosion prevention elements such as ripraps.

3.3.4 *Schedule and working hours.*

The site of the proposed development is in the remote Sail Rock Peninsula of South Caicos, away from any residential or commercial activities. The nearest activity is the Sail Rock Boutique and Villa Hotel Development. The reduce the noise impact of the dredging operation on hotel guests and staff, dredging operations will be scheduled during normal working hours, that is from 7:00 am to 5:00 pm Monday to Saturday of each week.

3.3.5 *Equipment*

According to dredging international, the four broad classifications based on the method of excavation and operation are – Mechanical dredgers, Hydraulic dredgers, Mechanical/hydraulic dredgers (Utilizing both basic elements in some combination) – cutter suction dredgers, and Hydrodynamic dredgers.

Mechanical dredgers use mechanical means for the excavation of material and are like equipment used for dry land excavation. Examples of mechanical dredgers are – grab (or Clamshell), backhoe, dipper, or bucket-ladder.

Hydraulic dredgers on the other hand use hydraulic means both for excavation and transporting material. They use hydraulic centrifugal pumps to provide the excavation force without mechanical cutters and hydraulic transport to carry solid/water slurries from the digging site through a pipeline to the surface and then to the discharge site. In some special cases, hydraulic dredgers pump into barges for subsequent transport to the placement site.

The lagoon basin and peninsula canal will be excavated using conventional earthmoving equipment such as a backhoe or dragline. Where sediment is soft, support of the excavation in the dewatered area can be problematic because the underlying materials may not have the strength to support equipment weight.

3.3.6 *Construction Access and Staging*

Proper construction access to the dredging operation is essential in promoting a safe and secure project site. The remote nature of the project site that offers one vehicular access to the site provides an ideal situation to control both vehicular and pedestrian traffic in and out of the area.

A construction stage area will be established at the entrance of the dredging operation area where a temporary site office will be located, and construction-related equipment and materials are stored.

3.3.7 *Solid Waste Management*

Effective construction waste management is important as it can save the environment from the toxic effects of inorganic and biodegradable elements present in the waste. Mismanagement of waste can cause water contamination, soil erosion, and air contamination. Therefore, it is important that proper waste management systems be established during the construction and operation of the blue-water lagoon basin.

Some of the clean Earth's dredged materials can be processed and used within the development site, including for road construction, retaining walls and embarkments.

3.3.8 *Liquid waste management*

To avoid groundwater or coastal water contamination simple liquid wastewater management techniques such as dewatering, separation and stabilization will be used during the excavation operations.

3.3.9 *Control of runoff*

Runoff and discharge amassed at the juncture of the linear topographic ridge and elevated landmass will be drained via direct percolation to land drains and further disposal into the subsurface via disposal wells or soakaways. The treatment of stormwater will include a filtration network of sand and gravel ahead of drainage into the subsurface wells.

3.3.10 *Control of potential air, land, and water pollutions*

During the early stages of the lagoon basin and canal excavation works brush and landscape clearance and site excavation can create adverse conditions that need to be addressed. These can include soil erosion, silty stormwater runoff, site flooding and pollution of soil. Deforestation and soil erosion are major concerns during dredging and excavation works.

3.3.11 *Control of Noise*

Activities that are associated with the proposed dredging and excavation operation that are most likely to raise the ambient noise levels in the area are the dredging and excavation equipment, pumps and trucks transporting the dredged materials from the site. In the case of the proposed dredging operations short-term temporary increases in noise level will occur in the vicinity of the dredging operations and staging/dewatering activities.

As part of the noise control measures to be implemented to reduce noise level, all dredging and excavation equipment, hauling trucks, pumps and engines used in the dredging operation work will be outfitted with mufflers or noise abatement devices. Other mitigating measures to reduce the impact of noise on the receptors is reducing working hours to normal working hours between 7:00 am to 5:00 pm each day.

3.3.12 *Storage of fuels and other toxic substances*

The Contractor's dredging operation plan does not include the storage of fuel or other toxic substances on site. Dredging equipment and dump trucks will be fueled off-site at the maintenance facility. However, during the operation phase of the development boats using the docks will carry fuel and oil. Therefore, fuel control measures will be put in place to minimize any fuel spills. Oil Spill Kits would be strategically located on the areas where boat docks are to be located that are to be activated in the event of a fuel spill. Staff at the boat dock facility will be trained in operating the oil spill kit.

3.3.13 *Emergency Mitigation Plan*

Emergency mitigation guidelines are outlined below to respond to potential accidents during the construction and operational phases of the proposed development.

3.3.13.1 Health and Safety

The protection of all workers is of critical importance during the construction phase of the proposed development, particularly workers operating heavy equipment and working within the marine environment. To ensure the health and safety of workers. All workers will be given an orientation of the perils associated with operating dredging equipment and working in a dredging environment. For each work Appropriate protective gear will be used by all workers. Gear will include ear plugs, steel-toed boots, hard hats, high visibility vests and gloves. Neighbours and locals will be notified of the works and caution tape will be place along the beach, stockpile area and access path for equipment.

The health of the lagoon basin is also a concern because pollutants can enter the lagoon basin that can have detrimental impacts on living organisms. Therefore, mitigation measures are to be taken to ensure that developable lands surrounding the lagoon basin use proper mechanical sewage treatment package plants.

3.3.13.2 Emergency Response

In the unfortunate event of a worker being injured on site, work along his or her section will be stopped, and emergency response teams called to quickly aid the worker. The cause of the incident will be investigated to prevent further injury on site and safety procedures will be reiterated.

3.3.13.3 Storm Water Runoff

The areas of any stockpile locations onsite will be monitored so that there is always a berm surrounding the stockpile so that there can be no direct runoff to the sea during heavy rainfall. Additionally, the temporary access pad will be at such an elevation that it will provide coastal protection for some sections of the site during large swell and surge events.

3.3.13.4 Spill Prevention

The equipment being used in the dredging operations will be checked daily for any weaknesses of seals and joints that could possibly cause hydraulic oil or diesel leakage into the marine environment. Absorption pads will be stored onsite so that any leakage can be quickly arrested. Any machine that leaks will be removed and repaired and inspected prior to being returned to work in the marine environment.

3.3.13.5 Management and supervision

All work activities will be supervised by trained personnel with an engineer providing oversight and overall management. All workers will participate in an orientation process that details the dangers of working in the marine environment, in addition to the care and diligence that is needed to protect the environment.

3.4 Description of operation phase activities

The Blue Water Lagoon Basin, Peninsula Canal System, North, and South Entrance Channels and the North and South Boat Docks facilities are operated by the management of Sail Rock Development Limited. An Operational Management Plan (OMA) comprising strategies, programs, and operational procedures necessary for the efficient operation of the blue water lagoon and its various components will be developed by Sail Rock Development Limited.

The purpose of the OMA is to provide a framework for ensuring the attainment of the management objectives for the blue lagoon basin and boat docking facility and to guide the day-to-day operation of the facility. The OMA should include, among other strategies, the following:

- The development of boating and safety guidelines, including for kayaks and other paddle boats,
- The provision of adequate directional public signage.
- The provision of adequate public access, particularly in coastal areas.
- The implementation of water quality control measures, including water quality monitoring.
- The implementation of pollution control measures to reduce pollution.
- Enhance and maintain the diversity of flora and fauna species, including the control of invasive species.

- Ensure good water quality to sustain wildlife, and
- Ensure that the Blue Water Lagoon Basin operates in harmony with the surrounding environment, including Bell Sound Nature Reserve.

3.5 *Description of decommissioning phase activities*

The decommissioning phase of a project represents the end of the life span of the project when a Decommission Plan is prepared and executed to address all areas of the development transforming the site near or close to its original conditions.

In the unlike event that development of the scale and nature of Sail Rock development on South Caicos would ever cease to operate, however, if it steps would be taken to decommission or rehabilitate the site.

The aim of the rehabilitation exercise would be to bring back the site to a stabilized condition, as close as possible to pre-construction conditions and to the satisfaction of the landowner. The rehabilitation of the area would entail the following:

- Once the area is clear of all structures and waste, the area disturbed during decommissioning would be re-topsoil (if needed) over the disturbed areas.
- Application of fertilizers will be utilized to improve soil composition.
- Hand seeding of indigenous seed mix will be used to achieve acceptable grass cover.

3.6 *Description of dredging operations*

Dredging is the act of removing sediments and debris from the bottom of water bodies. The construction of the proposed Blue Water Lagoon Basin, Peninsula Canal System and entrance channels require dredging in two different areas, including land-based excavation to create the lagoon basin and flushing canal system and the marine dredging of the north and south entrance channels to provide access to the ocean and to allow flushing of the lagoon basin.

The basic excavation methods of dredging will be used for the dredging of this project. The three main types of dredges are mechanical, hydraulic and lift.

3.7 *Description of shoreline protection and coastal engineering structures*

Shoreline protection contributes to storm damage reduction and coastal erosion mitigation.

3.8 Source of beach sand

Sediment and other quality dredged sand from the lagoon basin and the entrance channel will become a ready source of beach sand to be used where appropriate within the man-made islands and other location along the shoreline of the lagoon basin.

3,9 Restoration and landscaping plan

If approved, excavation of the proposed canal would disturb the soil surface, including areas adjacent to the channel where excavated material would be side-cast, at least temporarily, until the side-slope is dressed. Invasive plant species are well known to colonize disturbed areas, and without maintenance, they become established in areas where surface soils are disturbed. Additionally, undesirable vegetation, whether native or not, is likely to eventually become established on the side slopes.

Because the proposed canal connects directly to waters of high environmental sensitivity at both ends, herbicides, some of which could run off or seep into the canal, should not be used to control unwanted vegetation on the side slopes.

Instead, it is recommended that a variety of native shrubs, vines, and groundcover species be used to stabilize the canal shorelines and provide habitat for aquatic organisms. The species identified on Table 15, all of which currently are present on the Sail Rock property or other areas of South Caicos are recommended:

Table 15: Plant species recommended to be used for landscaping on and adjacent to the proposed Canal

Common Name	Scientific Name	Area to be used	Comments/explanation
Red mangrove	*Rhizophora mangle*	Canal side slopes, intertidal	1. Will stabilize shoreline & provide inter-tidal habitat for marine life. 2. Provides long-term resiliency to fluctuating water levels. 3. May eventually need to be trimmed to maintain views & access
Black mangrove	*Avicennia germinans*	Canal side slopes, inter-tidal	1. Will stabilize shoreline & provide inter-tidal habitat for marine life. 2. Provides long-term resiliency to fluctuating water levels.

			3. May eventually need to be trimmed to maintain views & access
White mangrove	*Laguncularia racemosa*	Side slopes, above MHW	1. Will stabilize shoreline & provide habitat for native fauna. 2. Provides long-term resiliency to fluctuating water levels. 3. May eventually need to be trimmed to maintain views & access
Seashore saltgrass	*Distichlis spicata*	Side slopes, above MHW	1. Will stabilize shoreline & provide habitat for native fauna
Sea purslane	*Sesuvium portulacastrum*	Side slopes, above MHW	1. Provides long-term resiliency to fluctuating water levels. 2. Will stabilize shoreline & provide habitat for native fauna
Seaside Heliotrope	*Heliotropium curassavicum*	Sideslopes, above MHW	1. Salt & drought-tolerant, will provide habitat for native fauna. 2. Will provide habitat for native fauna
Wild Apricot	*Passiflora pectinata*	Upper sideslopes	1. Salt & drought-tolerant vine, will naturally spread over riprap. 2. Will provide habitat for native fauna
Dune sunflower	*Helianthis debilis*	Upper side slopes	1. Salt & drought-tolerant vine, will naturally spread over riprap. 2. Will provide habitat for native fauna
Beach morning-glory	*Ipomoea pes-caprae*	Upper side slopes	1) Salt & drought-tolerant vine, will naturally spread over riprap; 2) Will provide habitat for native fauna
Bay Tansy	*Ambrosia hispida*	Top of slope	1) Salt & drought-tolerant, vine-like, will naturally spread over riprap; 2) Will provide habitat for native fauna

3.10 Financial resources to ensure that once the project commenced, it is completed.

Financial resources for the Environmental Management Plan shall be at the expense of the proponents of the development. Sail Rock Development Limited has the available financial resources to ensure that the development once started is completed in an efficient and timely manner. The developers have assured the environmental consulting team that funding is available to complete the project.

3.11 *Modelling of the flushing capacity and characteristics of the canal*

In enclosed or partially enclosed waters adequate circulation is critical to avoid stagnation and algae build-up. We used a hydrodynamic model to evaluate the worst-case scenario and analyze how well the proposed channel layout (submitted alignment and -4 feet MSL depth) flushes. A pollutant with a concentration of 100% was added uniformly throughout the channel (within the model) and forced under the 24-day neap tide (low tide and current) conditions described in the section above. This neap tide was coupled with the typical recorded winds recorded from METAR archive for South Caicos Airport (MBSC) over the neap tide period.

The properties of the pollutant used had a constant scaled eddy viscosity for horizontal dispersion of one and was also assumed to be non-decaying. The flexible mesh elements inside the channel were refined to a maximum of 50m^2 which results in 7113 triangular elements defining the channel. This provides satisfactory resolution of the concentration changes within the channel. Surface elevation differences at the locations at the northern channel entrance (black) and the southern channel entrance (blue) are shown in Figure 77 below. It can be observed that tidal ranges as low as 0.3m were generated across both entrances. This is a true neap tide simulation and is indicative of the worst-case flushing scenario.

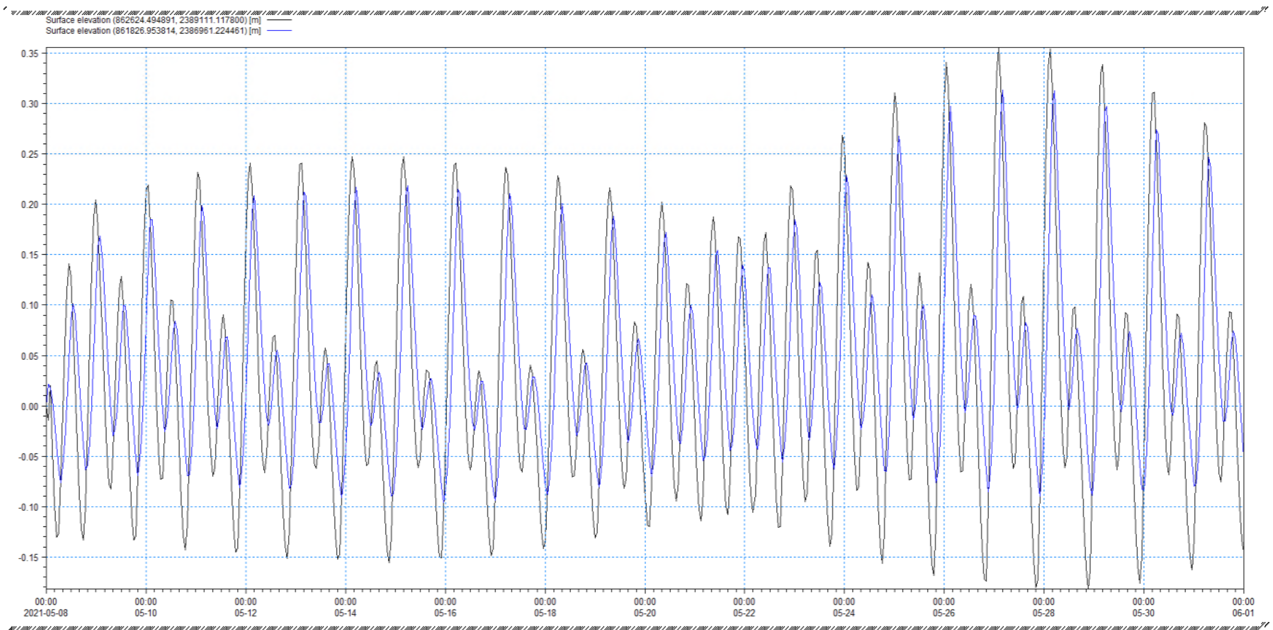


Figure 77: Water surface elevation differences at the locations at the northern channel entrance (black) and the southern channel entrance (blue)

Figure 78 shows the initial condition for the flushing runs, with the basin and channel areas fully dyed. The flushing time is defined as the time it takes to reduce the overall mass in the system to 10% of its original (EPA, 1993[3]).

For marina basins, the U.S. Environmental Protection Agency (USEPA) recommends that to provide reasonable assurance that water quality will not be a concern, flushing times should not exceed four days (USEPA, 1985). However, it should be noted that flushing times more than four days do not necessarily indicate poor water quality or that applicable water quality standards will be violated. Clark (1983) recommends that a maximum time of 2-4 days should be safe as a design criterion while a period of more than 10 days should be considered an unacceptable flushing time.

The generally accepted concentration target for these flushing times is 10% of initial loading (i.e., 90% exchange of water with the ocean). It should be noted that the proposed channel is not a marina basin. As such, longer flushing times do not indicate that there will be poor water-quality, but it does mean that steps should be taken to ensure that sources of pollution

[3] *U.S. Environmental Protection Agency (EPA). 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.More information on METAR data for South Caicos Airport can be found at https://metar-taf.com/MBSC*

are reduced or eliminated. In this analysis, a reduction to 10% within 4 days is considered "good" flushing, 90% exchange within 4 to 10 days will be considered "marginal" flushing, and greater than 10 days will be considered "poor" flushing.

The pollutant concentration distribution during flushing at different timesteps is shown in Figure 79 through Figure 81.

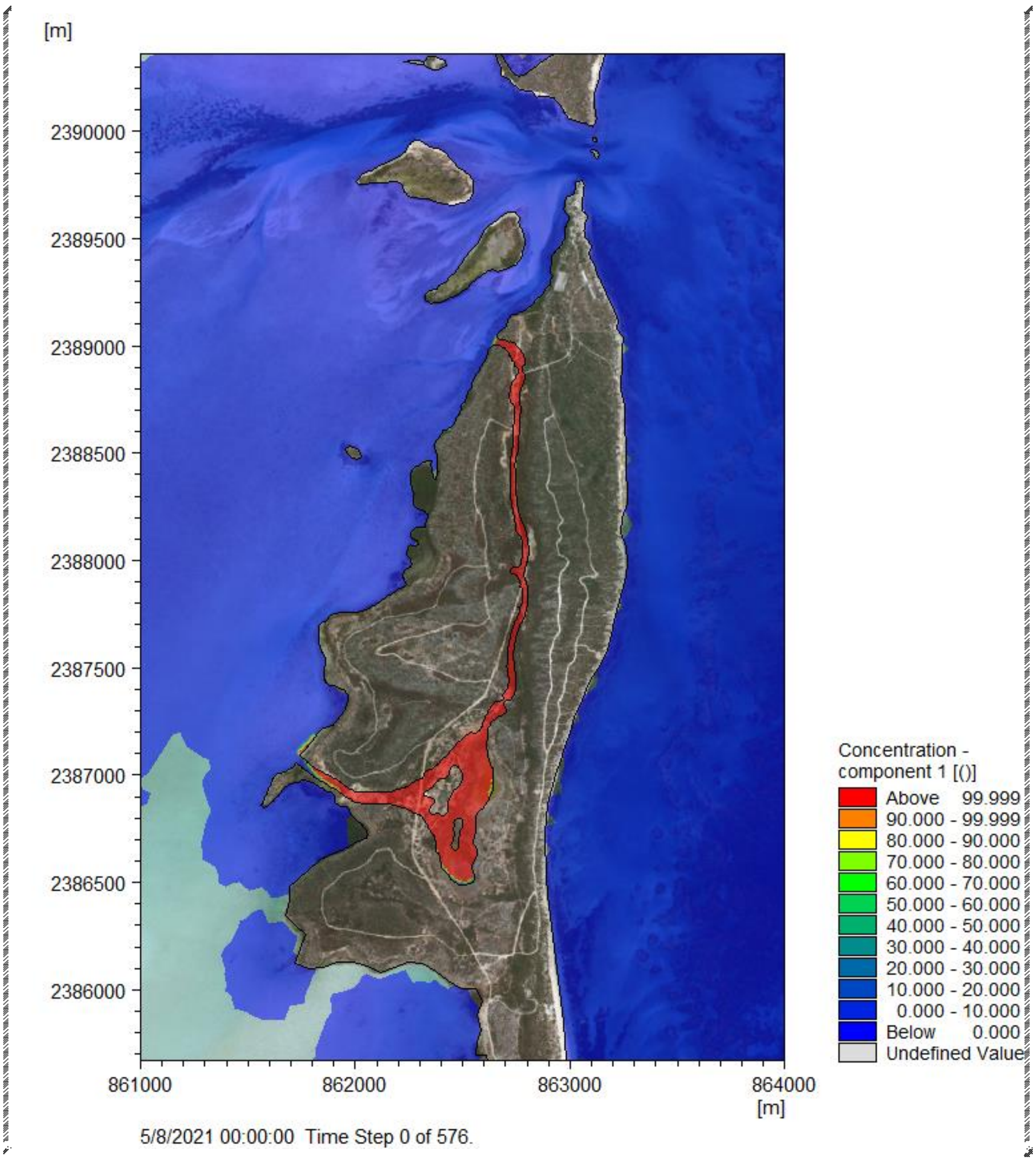


Figure 78: Initial condition for the flushing run with 100% concentration in the Channel

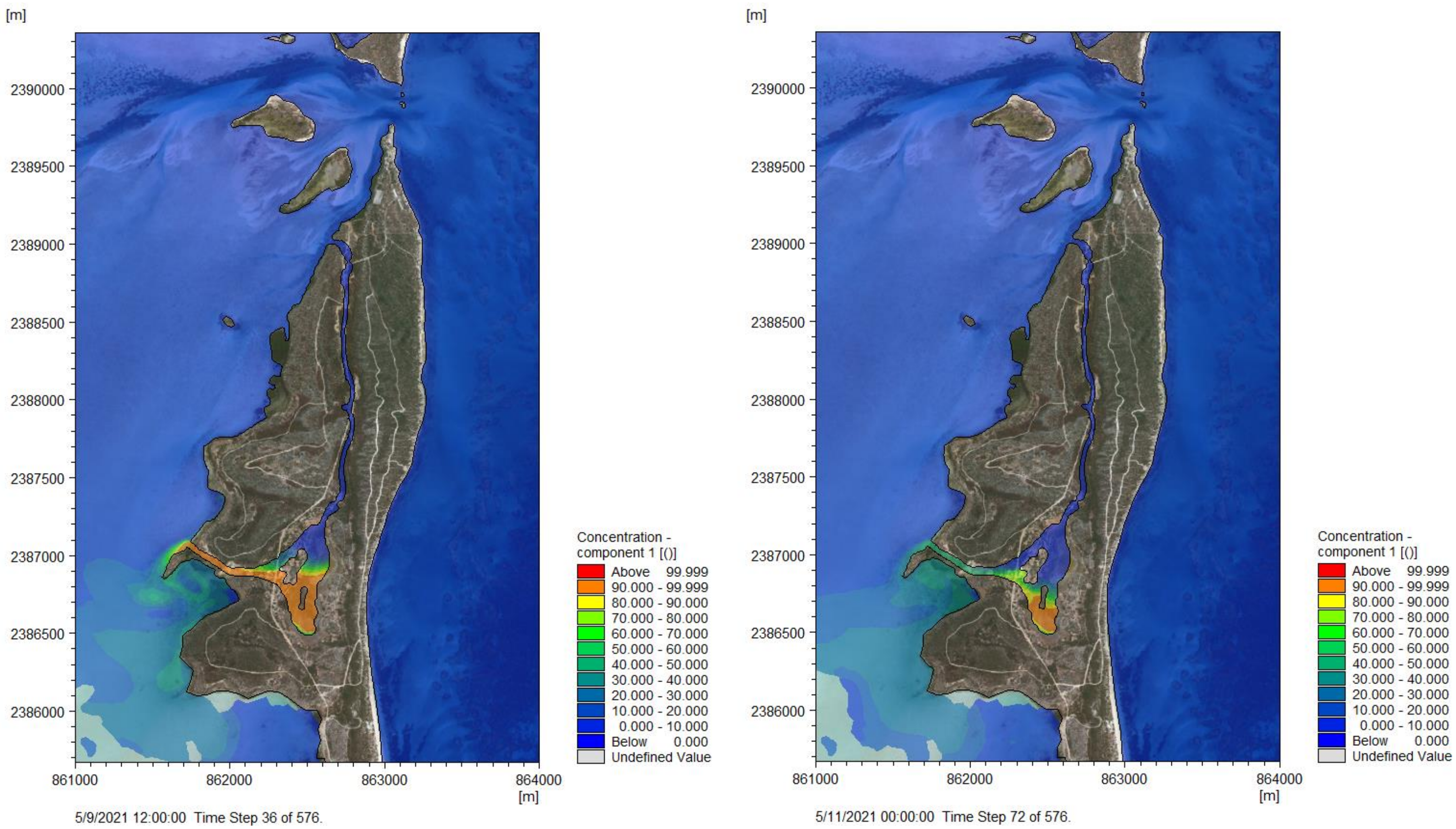


Figure 79: Pollutant concentration at 36 hrs (left) and 72 hrs (right)

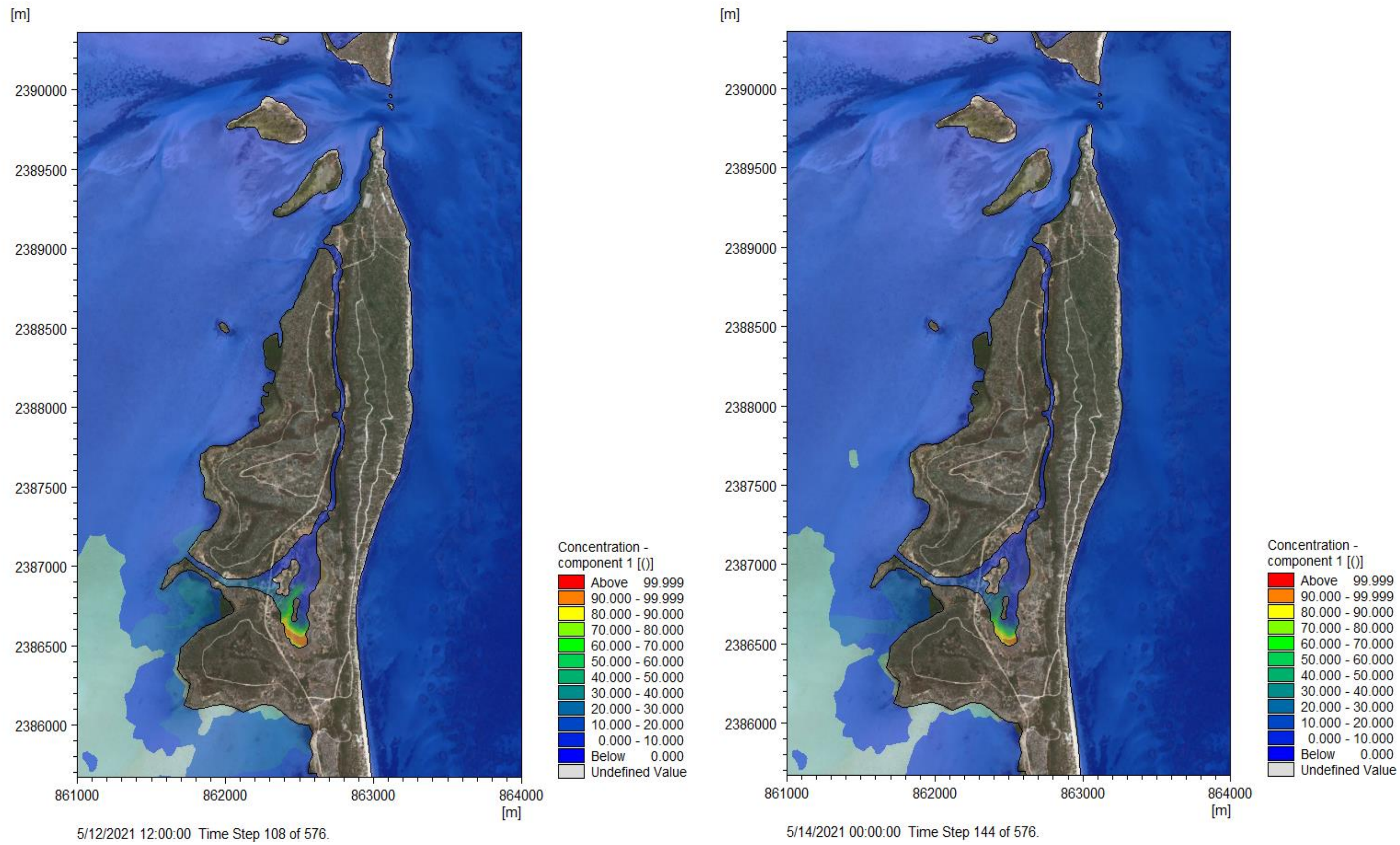


Figure 80: Pollutant concentration at 108 hrs days (left) and 144 hrs (right)

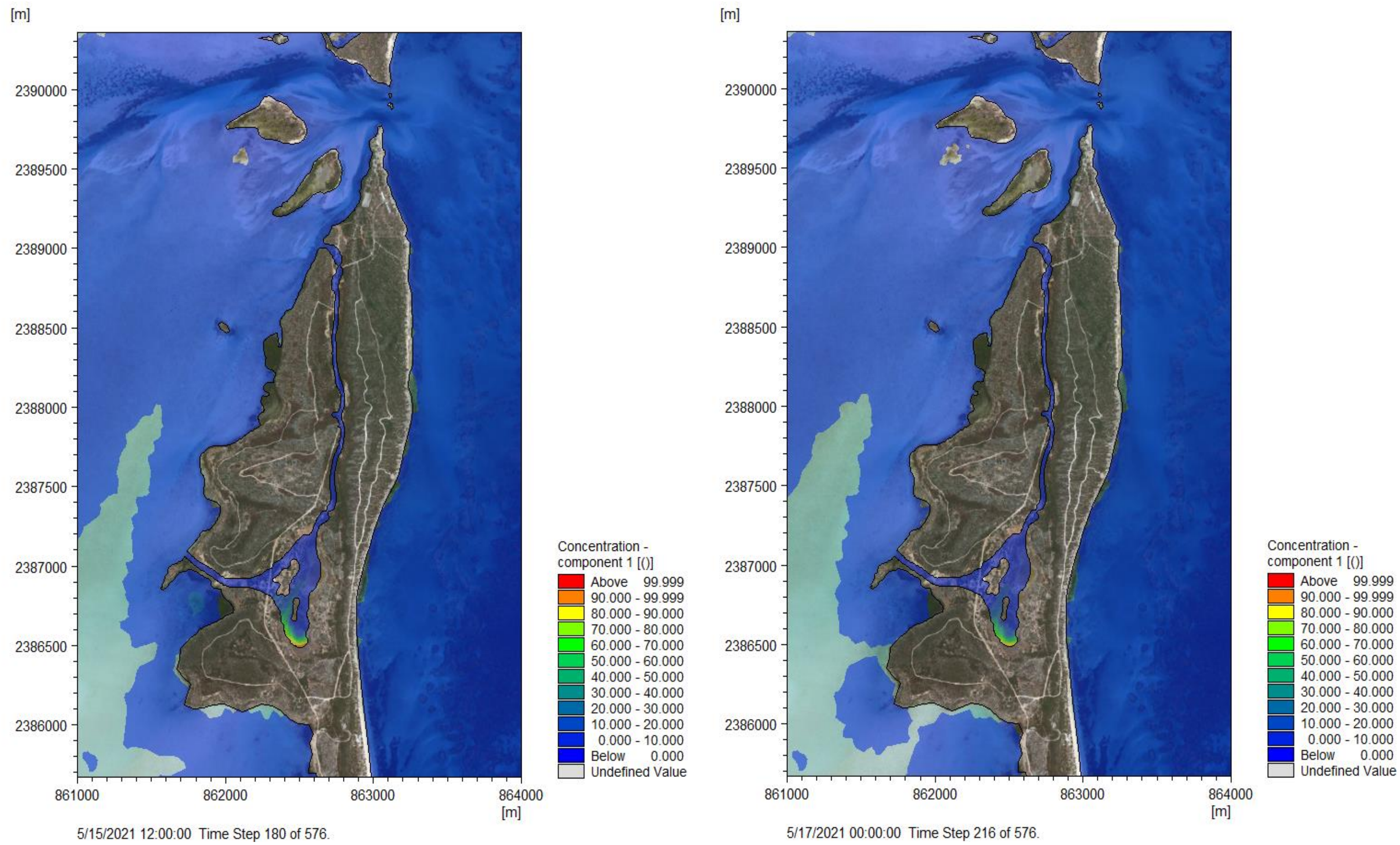


Figure 81: Pollutant concentration at 180 hrs (left) and 216 hrs (right)

Concentrations of the pollutant mass remaining in the channel system were extracted to determine the overall flushing time of the canal i.e., the time it takes for the pollutant mass remaining to reduce to 10%. The resulting graph is shown below in Figure 82. From this result it can be deduced that the system requires 144 hours (6 days) to be flushed during neap tide conditions. This indicates that the system experiences marginal flushing during neap tide conditions. As such, it is recommended that all runoff and sewage are directed away from the channel and that water quality be monitored regularly for health and safety reasons.

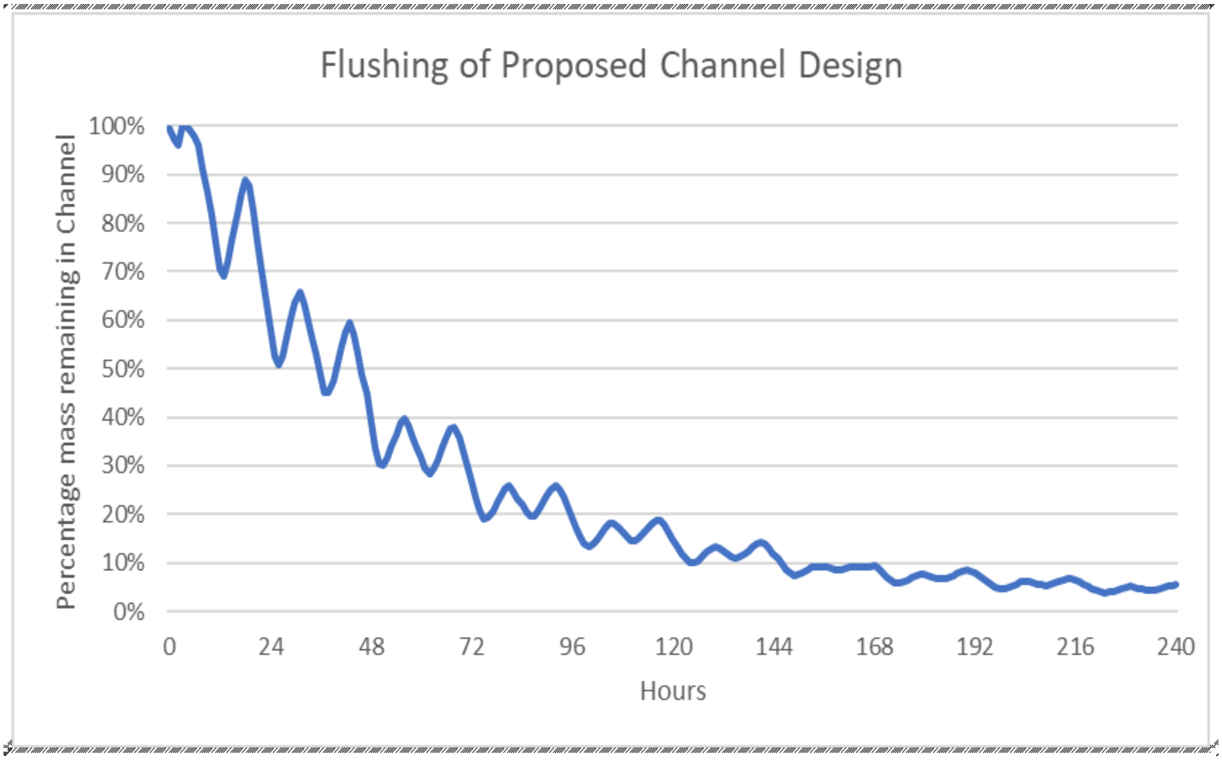


Figure 82: Percentage mass remaining in Channel over time.

To identify points susceptible to stagnation and to further understand the concentration distribution throughout the channel, concentration levels were extracted at five locations inside the channel as shown in Figure 83, yielding results as shown in Figure 83. From the results it can be discerned that pollutant point 2 has the longest flushing time of 10 days, followed by pollutant point 3 with 9 days, then pollutant point 1 with 7 days then by pollutant point 4 with 2 days, then finally followed by pollutant point 1 with 1 day. It should be noted that most of these pollutant concentrations fall below 10% long before the above-mentioned flushing times, however, due to tidal fluctuations the pollutant is pushed back and forth resulting in the sinusoidal concentration graphs observed in Figure 84.

The flushing time stated above is the time after which the concentration never rises above 10%. Based on the results of the two-dimensional plots and the extracted point data, it can be deduced that most areas of the channel flush quite rapidly, however the pollutant tends to pool in the area surrounding P2. This is likely due to the large cross-sectional area in the southernmost section of the lagoon, which slows down currents and retards circulation. The cross-sectional area of this section can be reduced either by decreasing the depth in the area or reducing the distance between the bank of the canal and the southern island. This alternative option and its impacts on flushing time are further discussed in the section above.

Figure 83: Pollutant concentration extraction points

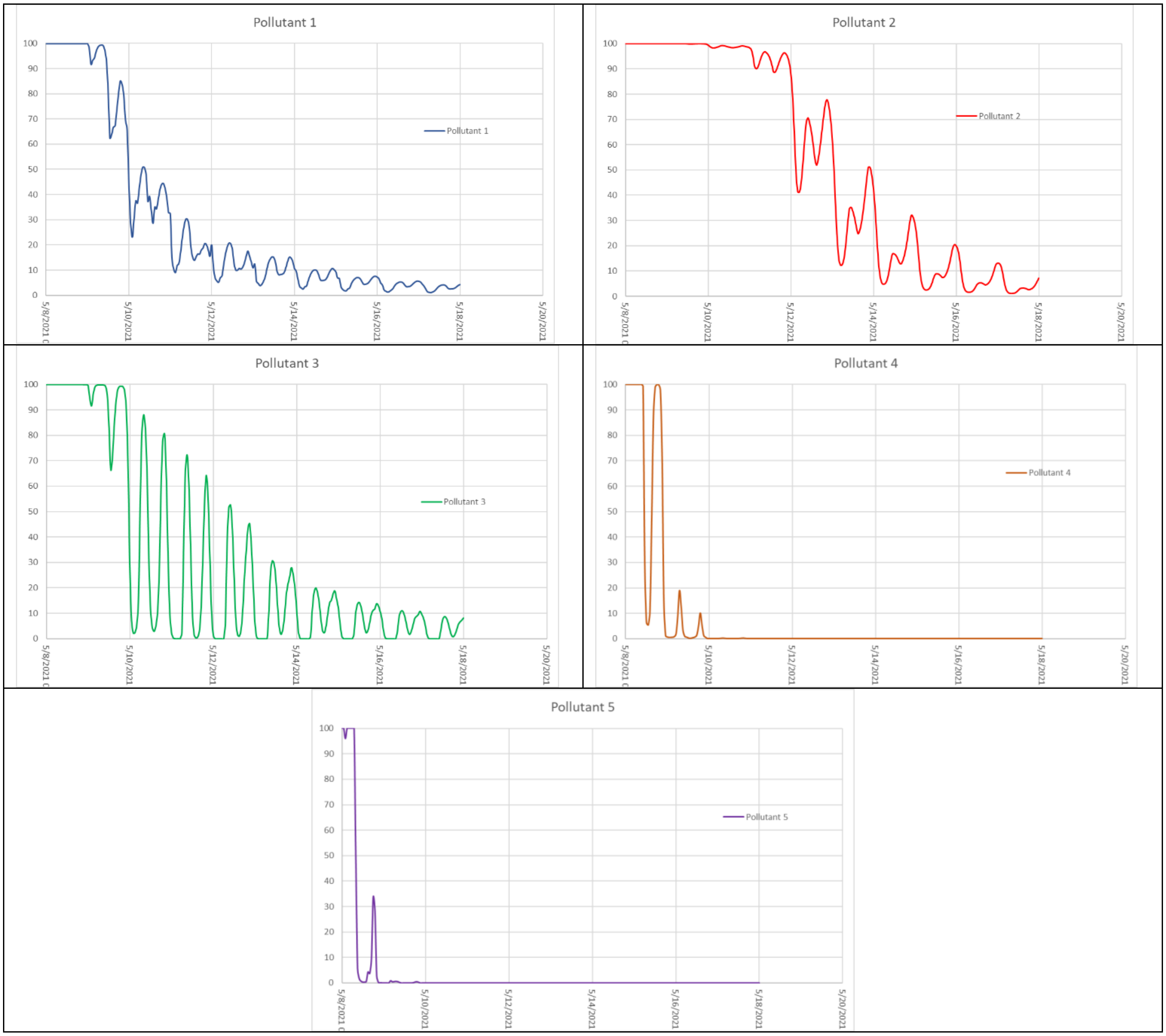


Figure 84: Pollutant concentration levels at each extraction point throughout the simulation.

3.12 Modelling of runoff and drainage from the developed site

Runoff and drainage will be immediately directed to build structures as percolation coefficients will be poor. These areas will be drained with road gullies, deck drains, and channel drains and transported in a closed pipe system to a combination of soak ways, swales, or wells. The stand of the linear topographic ridge immediately east of the proposed development will act as a water divide and direct runoff westward toward the proposed development. Backfilling and elevation of landmass along the eastern embankment of the inland canal and marina basin will act to prevent direct runoff of overland flows into the inland waterway. Runoff and discharge amassed at the juncture of the linear topographic ridge and elevated landmass will be drained via direct percolation to land drains and further disposal into the subsurface via disposal wells or soakaways. The treatment of stormwater will include a filtration network of sand and gravel ahead of drainage into the subsurface wells.

3.13 Consideration of Alternatives

According to Stephen Kirkpatrick, the concept of alternatives can be defined as a possible course of action, in place of another, that would meet the same purpose and need. Environmental Impact Assessment requires an objective and rigorous analysis of alternative causes of action. The concept for the blue water lagoon basin has evolved other the years, from a single channel entrance that only permitted a minimum level of flushing to multi-entrance channels that allows an acceptable level of flushing.

As work on the project was in progress during field assessment work for this study, the environmental team had limited scope in terms of making mean full recommendations for alternative causes of action. If fact, with the commencement of work on the lagoon basin, even the "No-go" alternative was outside the scope of recommendations.

3.13.1 "No-go' Alternatives

The "No-Go" alternative assumed that the environment would be retained in its natural setting. Whilst this may be the most ecologically sound alternative, from a developmental perspective and an economic one, this may not be the most feasible approach. Hence, there is a need for a more balanced alternative, that would consider both ecologically sensitive and economic logical factors.

3.13.2 Design alternatives

Design alternatives were given major consideration during the planning and design process. In fact, the project design evolved over the years, to identify the most functional design. The design concept evolved from a single-entrance channel to multi-entrance channels. The adopted design concept links the blue water lagoon basin with the ocean via an inland canal system with two entrance channels that offer a more satisfactory amount of flushing. Even the depth of the lagoon basin and entrance channels were tested.

To test the impact of a reduction of channel depth on the flushing characteristics, depths close to the southern area of the lagoon were modified within the model. The modified area was raised by 1 foot to -0.91m msl as depicted by the yellow color in Figure 85. This resulted in a reduction of flushing time during the neap tide conditions from 144 hours (6 days) to 98 hours (4 days) as seen in Figure 86. This means that the suggested alternative can be considered to have good flushing.

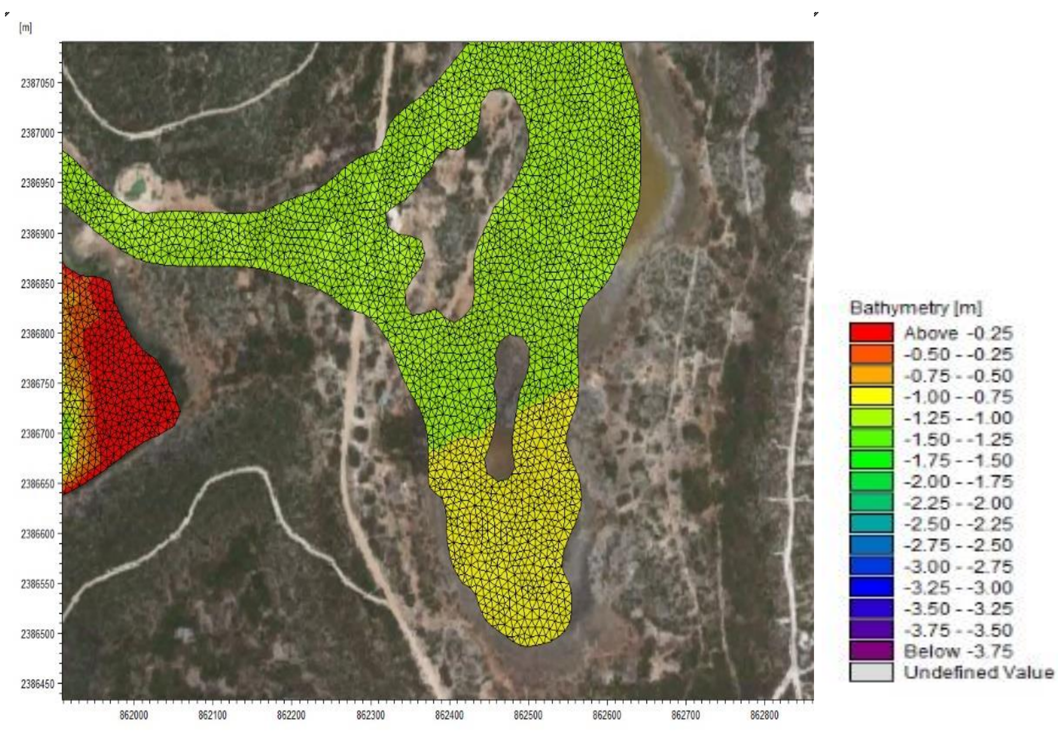
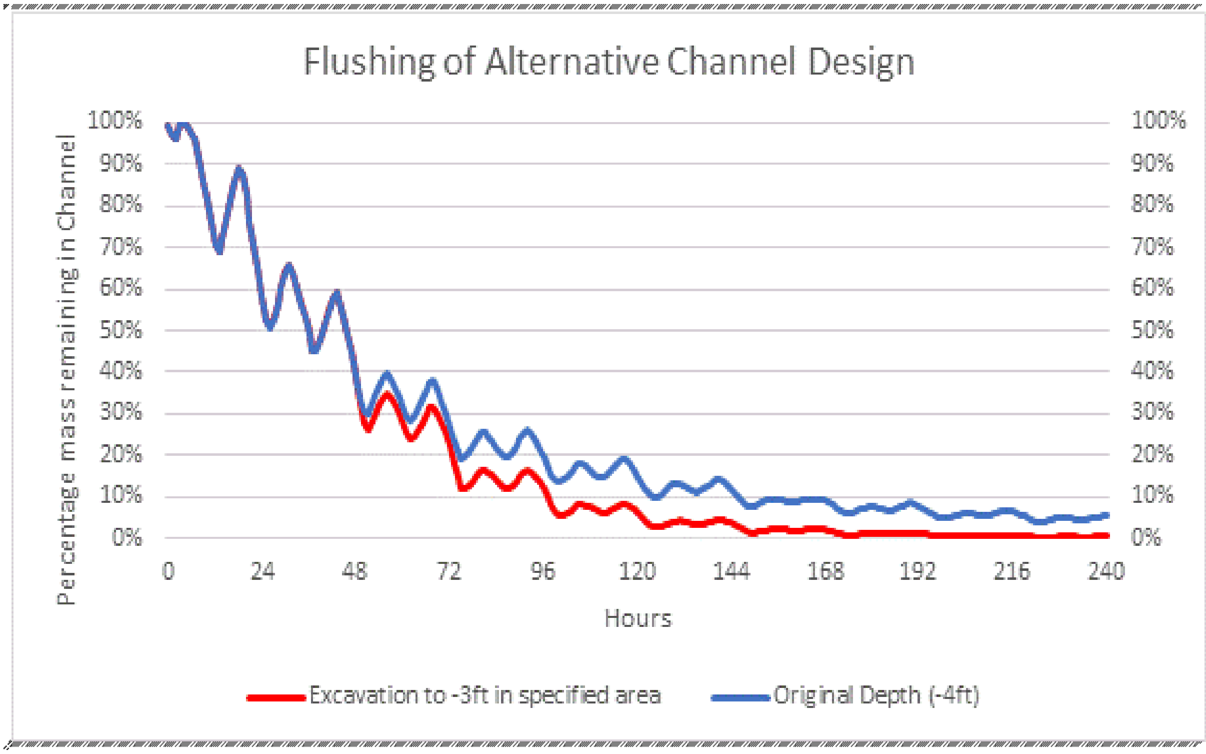


Figure 85: Modified bathymetry in channel lagoon



` *Figure 86: Percentage mass remaining in the channel over time.*

3.13.3 *Activity alternatives*

Best practices and construction activity alternatives need to be adopted to ensure minimum pollution and contamination of the environment. The sequence of dredging activities needs to ensure that land-side dredging operations are fully completed before moving on to the dredging of the entrance channels.

3.13.4 *Site layout alternatives*

As previously mentioned, the design of the lagoon basin evolved over the years. The initial site layout alternative of one entrance channel and the creation of multi-man-made islands in the lagoon basin. The layout of the design was enhanced with a 2-entrance channel alternative with the addition of the inland peninsula canal.

3.13.5 *Technology alternatives*

When selecting the most cost-effective dredging methods, the development considered the use of different dredging technology. Mechanical, hydraulic, and airlift technical methods were considered. Mechanical dredging technique uses grab buckets, cutter heads or scoops, whilst hydraulic focuses on pumping dredged materials from the excavated site to a processing site where the materials are sifted and sorted.

3.13.6 *Summary of Alternatives*

During the fieldwork assessment for this study, the CEIA team observed that work on the creation of the lagoon basin had commenced. Therefore, the consideration of alternatives was carried out whilst work was in progress. Consideration of the "No-go" or the design alternatives was given limited consideration. However, some minor recommendations were made on the design alternative regarding the southern entrance channel not flushing directly into the Bell Sound Nature Reserve. The re-alignment of the southern entrance channel was highly recommended.

Recommendations were made regarding the activity, site layout, and technology alternatives that would improve project implementation. Potential alternative options or alternative approaches to the proposed development can be determined by the appropriate legislation and regulations that governor physical development in the TCI, the next section discusses relevant policies and laws under which the proposed development is to be constructed and operated.

SECTION IV - LEGISLATIVE AND REGULATIVE CONTEXT

4.0 *Legislative and Regulative Context*

This section of the report examines relevant laws and regulations that are applicable to the regulation and management of the proposed lagoon basin, peninsula channel, and boat dock development. Major legislations that can significantly influence the impact of the proposed development on the physical, social, and heritage culture environments examined.

4.1 *TCI Development Plan/Master Plan*

The National Physical Development Plan (2020) for the Turks and Caicos Islands is a plan that looks to the future, it will serve as a guide for land use development in the islands for the next ten years, building upon five guiding principles:

- Equity
- Resilience, sustainability, and multi-functionality
- Island Linkages
- Nature as beauty, and
- TCI culture

The National Physical Development for the Turks and Caicos Islands (The Plan 2020) outlines an Island Development Framework Plan for each inhabited island within the Turks and Caicos archipelago, including South Caicos. The Plan (2020) noted that South Caicos is known for its historic ties to the fishing and boating industries and that these unique features should be utilized to encourage rehabilitation and infill civic infrastructure and waterfront developments.

Some of the main development strategies detailed in the South Caicos Island Framework Plan (2020) are:

- The habitation and upgrade of the fishing industry infrastructure to a level that is competitive and economically viable and sustainable.
- Revitalization and rehabilitation of the historic public and private buildings.

- Aquaculture and hydroponics are new markets that South Caicos could capitalize on within a short time frame.
- The Area Action Concept Plan suggested that a marina would be an ideal pairing with upgraded harbour infrastructure to attract large boats and create a marina village at the heart of Cockburn Harbour.
- Generate nature-based tourism opportunities such as Fish Camps and water-based excursions at key locations.
- Evaluate salina development for recreation tourism and aquaculture.

Noting the importance of maria development to tourism, the Plan suggested that upland geography just inland of the coastline can lend itself to marina development, with some alteration to the natural environment. That Salinas, shallow ponds; and other low-lying areas along the coastline are all examples of potential locales for marina development and have been used for such in other island nations. The Plan cautioned that detailed studies beyond the scope of the National Physical Development Plan (NPDP) are recommended to assess site-specific solutions to minimize sedimentation rates, stabilize inlets, and/or find alternative locations.

The Sail Rock Peninsula low-lying area that has been identified for the blue-water lagoon basin, peninsula canal system, and boat dock facilities fits the description of the low-lying area referenced in the NPDP and should be used as a supportive argument for the land use in question.

4.2 TCI Physical Planning Ordinance

Dredging and excavation of the scale and nature required to execute the proposed lagoon basin and peninsula channel development fall under Section 2 (1) of the Physical Planning Ordinance (2014).

Section 75 (1) of the Physical Planning Ordinance (2014), is particularly relevant to the proposed lagoon basin, peninsula channel, and boat docks because it deals with commercial or industrial development in conservation areas, which requires that a person proposing to submit an application for the grant of development permission for commercial or industrial development in respect of land situated in a conservation area shall, prior to submission of such application, have prepared at his own expense an environmental impact statement on the proposed development and its likely effects on the conservation area concerned.

Furthermore, the proposed development is located just outside of Bell Sound Nature Reserve. The south entrance was initially designed to drain into the Bell Sound Nature Reserve. But this CEIA study recommended that the alignment of the southern entrance of the channel be rerouted to not drain within the Bell Sound Nature Reserve but to the north of it.

4.3 TCI Development Manual

The TCI Development Manual (2014) is the "Go-to" document for developers, architects, planners, and other persons carrying out development in the TCI. It specifies planning and development standards for development in the TCI, including guidelines for the construction of private docks.

The proposed lagoon basin, peninsula channel, and boat docks were designed and will be constructed in accordance with the Development Manuel policy.

4.4 TCI Building Code

The Building Code of the TCI (2014) is a building standard document with the primary purpose of providing minimum requirements for quality, durability, and safety of the building and operational works. Operational works specify applies to dredging, excavation, and the construction of boat docks. These types of operation bring with them significant work-related hazards that needs specific health and safety measures to ensure the safety of workers. The Building Code helps to promote:

- *Public Safety*: reducing exposure and vulnerability to natural hazards (hurricanes, seismic activity); also, to fire, and construction hazards.

- *Public Health*: ensuring that appropriate provision of utilities and services, and appropriate disposal of waste products; and

- *Environmental Issues*: promoting environmental sustainability by improving buildings and dredging operations to mitigate environmental risks both globally (climate change) and locally (resource/pollution).

The design and construction details of the proposed lagoon basin, peninsula channel, and boat dock project meet the requirements of the latest edition of the TCI Building Code in terms of construction methodology, standards, and safety procedures. The Code sets out the requirements for the use of materials and construction methods to conform to the minimum standard provided by the Code.

4.5 TCI National Parks Ordinance

South Caicos has a large area of terrestrial and marine parks that are part of the National Parks System of the Turks and Caicos Islands, including Admiral Cockburn Land and Sea National Park, and the Bell Sound Nature Reserve. The national parks system is under constant threat from development and needs to the protected by appropriate legislation, hence, the National Parks ordinance that offers a certain degree of protection to these areas.

One of the major challenges to the proponents of the proposed blue-water lagoon basin, peninsula channel, and boat dock development, and to government officials, particularly the Department of Environment and Coastal Resources and the Planning Department is the fact that it is located within proximity to Bell Sound Nature Reserve. The developers want to enhance its anchored development project by creating attractive recreational amenities like the blue water lagoon basin and peninsula channel. On the other hand, the technocrats, who are entrusted with safeguarding and protecting the environment, want to ensure that the development takes place in an environmentally friendly manner.

Whereas the TCI National Parks Ordinance (2014) makes provisions for certain types of developments to be permitted within the boundaries of a National Park for the enjoyment of the public if it is carried out in an environmentally sound manner. The Planning Department and the Department of Environmental and Coastal Resources are responsible to ensure that the requirements of the respective ordinances and regulations are adhered to.

4.6 Minerals (Exploration & Exploitation) Ordinance

The Minerals (Exploration and Exploitation) Ordinance 2014 of the Turks and Caicos defined “mineral”, as any substance, whether in solid, liquid, or gaseous form, occurring naturally in or on the earth or in or under the seabed, and formed by or subject to geological process, but does not include water.

The construction of the proposed blue water lagoon basin, peninsula channel, and boat docks involves a substantial amount of dredging and excavation works, that will generate large volumes of dredged or excavated materials that can be classified as minerals. The purpose of the dredging or excavation works is not to exploit the physical environment for financial grains, but rather for the development and enhancement of surrounding lands. All materials dredged or excavated from the site will be used in the redevelopment of the site, whether it be the creation of man-made islands within the lagoon basin or the construction of roads within the development.

The Ordinance requires that royalties be paid to the government in the case where dredged materials are used commercially. As the developers will not sell any of the dredged or excavated materials involved, if any dredged or excavated materials are sold, all royalties due to the government will be paid.

4.7 Ordinance and Subsidiary Legislation (In relation to the protected area of Bell Sound Nature Reserve)

Subsidiary Legislations are laws, rules, or regulations made under the principal Ordinance. Bell Sound Nature Reserve is governed under the National Parks Ordinance.

Whilst the blue water lagoon basin will not operate as a marina, the boat dock slips component of the development will require some level of regulations under appropriate subsidiary maritime legislation. Small boats operating at the facility would need to be licensed under the maritime requirements and would require routine inspections to ensure that maritime safety standards and operational procedures are met.

4.8 TCI Coastal Protection Ordinance

Coastal areas are transitional areas, between the land and sea, characterized by very high biodiversity and they include some of the richest and most fragile ecosystems on earth, like mangroves and coral reefs. At the same time, coastal areas are under extreme population pressures due to rapid urbanization processes. More than half of today's world population lives in coastal areas (within 60 km of the sea) and this number is on the rise (World Tourism Organization). For this recent, countries have developed and implemented coastal protection ordinances to regulate and control physical developments within coastal areas.

The Turks and Caicos Islands Coastal Protection Ordinance (Revised Edition 1998) is a good example of such an ordinance that is designed to provide for the protection of the coastal environs. The proposed development directly impacts the coastal area of South Caicos islands, in two flushing channels connecting the blue lagoon basin and peninsula channel with the ocean to the west, which allows flushing of the shallow blue water body.

4.9 TCI Marine Pollution Ordinance

International laws defined Pollution, as any substance which, if introduced into the sea, is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or interfere with other legitimate uses of the sea, and includes sewage, and any substance control by the International Convention for the Prevention of Pollution from ships (MARPOL).

To safeguard against marine pollution in Turks and Caicos waters, the Marine Pollution Ordinance (2010) was enacted to protect the marine environment by minimizing intentional and negligent discharges of pollutants into the marine environment. According to the Ordinance, the Marine environment consists of the coastal environment, the territorial water, and the Exclusive Economic Zone of the islands, including all marinas, ports, and canals. Therefore, in accordance with this ordinance the blue water lagoon basin and canal system form part of the marine environment and are, therefore, governed thereunder.

Even though the proposed blue water lagoon basin, peninsula canal system, and boat docks will not be classified in accordance with international standards as a marina or operate as such, there will be a certain level of boat operation for scuba-diving and snorkeling purposes, also the lagoon basin will be used small scale kayaking recreational activities, which cumulatively have to potential to generate a small level of marine pollutions. Such activities will fall under the direct orbit of the marine pollution ordinance.

During the project's operational phase, the relevant marine pollution policies and legislation would be adhered to.

4.10 Fisheries Protection Ordinance

Fisheries and aquaculture make a significant contribution to the food security and the livelihoods of millions of people along the world's seashores and waterways (Food and Agriculture Organization of the United Nations). However, destructive fishing practices, such as the use of explosives, toxic substances, electricity, suction, and trawling devices for fishing are detrimental to fisheries and the marine ecosystem and are prohibited under the Fisheries Protection Ordinance.

The Fisheries Protection Ordinance of the Turks and Caicos Islands is an Ordinance for the protection and management of fisheries in the islands. It also gives the Governor, the power to make regulations to regulate fisheries in the islands.

The proposed blue water lagoon basin, peninsula channel system, and boat docks development would not be engaged directly in the processing of fisheries in the islands however, the boat dock facility would be used to facilitate sport fishing and other water-based activities.

Appropriate boat operating licenses, short fishing licenses, scuba-diving, and snorkeling licenses required under the Fisheries Protection Ordinances and Subsidiary Legislation would need to be attained and maintained throughout the operation of the facility.

4.11 Other relevant laws and regulations

The Ports Authority Ordinance (2014), International Treaties, and Conventions were reviewed and examined for applicability to the proposed development.

The Ports Authority Ordinance (2014) is an Ordinance to establish the Ports Authority of the Turks and Caicos Islands, for the management of maritime affairs and related matters. In the Ordinance "berth" includes an anchorage, mooring, dock, jetty, wharf, and every place within the territorial waters where a vessel may be brought to rest and secured. Whilst the proposed boat dock facilities will not operate as a port or for that matter, a port of entry, the Ports Authority Ordinance is relevant because the proposed boat dock facilities will facility the operation and mooring of small boats, the installation of moorings and the operation of boats within the marine environment. Therefore, protocols under the Ports Authority Ordinance and Subsidiary Legislation would be followed by the developers during the construction and operational phases of the project.

With respect to the adherence to international treaties and conventions, the Sail Rock blue water lagoon basin, peninsula canal system and boat dock facilities would not operate as a marina and would not be a Port of Entry. Therefore, international vessels would not call at the boat dock facilities. It would however operate as a domestic boating facility, therefore, during the operational phase the facility management would ensure that all maritime laws of the Turks and Caicos Islands are adhered. Measures would be adopted to ensure maritime safety and prevent marine pollution. The previous sections of this report describe the proposed development and the environment in which it is to occur. The next section identifies the potential impacts of the development.

SECTION V - ENVIRONMENTAL IMPACT ASSESSMENT

5.0 *Environmental Impact Assessment*

This section of the report describes the potential environmental impacts, both negative and positive, that are likely to result from the proposed development – blue water lagoon basin, peninsula canal system, entrance channel, and boat docks.

According to the US-based Environmental Protection Agency (EPA), Environmental Impact Assessment (EIA) is the process of examining the anticipated environmental effects of a proposed project, from consideration of environmental effects at the design stage, through consultation and preparation of an Environmental Impact Assessment Report.

The team has benefited from earlier studies carried out by other consultants that were previously engaged by Sail Rock Development Limited. One such study is the Strategic Environmental Impact Assessment (SEIA) by Global Green and Applied Technology and Management in 2015.

Additionally, the EIA team for this study met with government agencies, including the District Commission for South Caicos, the Department of Environmental and Coastal Resources and Planning Department to ensure that all concerns were considered in evaluating the potential impacts of the development on the environment, including work that were observed during the field work.

5.1 The biotic environment

Potential impacts on the biotic environment, including all terrestrial, coastal, and marine habitats within the specified area of study.

5.1.1 The biotic environment – Terrestrial

Overlaying the proposed canal, lagoon, and docks onto the results of the landside vegetative community mapping reveals the extent to which a project will have direct impacts on landside vegetative communities and intertidal communities. In this instance, the proposed canal, lagoon, and dock areas will consume more than 80% of the assessment area. This assumes that there will be an area of no more than 20 feet of impact area extending outward from the top-of-slope of the canal on each side.

Therefore, from the perspective of landside ecological impacts, the remainder of this EIA assumes that canal excavation and top-of-slope areas of disturbance will impact the canal and lagoon areas and 20 feet on both sides. Overlaying the proposed canal and boat-docks plan on existing aerial photography indicates that areas outside the proposed project footprint have been cleared. For the purposes of calculating acreages, it is assumed that some of the material that has been excavated (and continues to be excavated) will be used to bring up the surrounding areas suitable for use in potential future phases of the project, although it is recognized that Environmental Impact Analyses will need to be performed prior to moving forward with these future phases.

Based on this assumption, the extent of the direct impacts of the project on the mapped landside communities is shown in Figures 36 to 39 and Table 16.

Table 16: Direct Impacts on Landside Communities

Community	Acres in Assessment Area	Acres proposed to be impacted
Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous	7.1	7.1
Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous, and Drought Deciduous, Upland	52.7	52.7
Forest, Broadleaf Evergreen Estuarine (Tidal)	1.7	1.7
Shrubland, Broadleaf Evergreen, Estuarine (Tidal)	4.6	4.6
Dwarf Shrubland, Broadleaf Evergreen and Broadleaf Mixed Evergreen Drought Deciduous, Coastal	6.0	6.0
Forest, Palustrine Broadleaf Evergreen	1.4	1.4
Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb	4.0	4.0
Palustrine – Nonvascular, Saline/Hypersaline	12.1	12.1
Sparse, Clear-Cut Land	18.3	18.3
Sparse – Created Open Water Areas	16.4	16.4

In general terms, impacts are likely to affect home-range territories most significantly for numerous species of resident species, including reptiles and birds, Year-round breeding bird species, include thick-billed vireos, Bahama mockingbirds, gray kingbirds, bananaquits, black-faced grassquits, blue-gray gnatcatchers, Bahama woodstar hummingbirds, Wilson's plovers, yellow-warblers, white-winged doves, and common ground-doves. Based on published scientific papers, the sizes of home-range territories for each of these species can vary significantly. In general, smaller species with small home range territories (e.g., yellow warblers (0.4-2 acres,) and thick-billed vireos (~3.7 acres)) will be affected differently than larger species with larger territories (e.g., kestrels (>100 acres).

Habitat modifications are likely to have less significant effects on migratory species, particularly individuals of species that solely pass through the area during long-distance migrations (e.g., Baltimore orioles).

Descriptions and explanations of the results of these direct impacts and potential secondary impacts on each community type follow.

Direct, Indirect, and Secondary Impacts on the Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous

Except for a narrow, variable-width strip along the east and west sides of the proposed canal, all this habitat that is present within the Assessment Area will be converted to another pen-water canal, canal side-slope, or maintenance area at the top-of-slope.

Based on observations of the species of fauna that inhabit this community, impacts are likely to affect home-range territories most significantly for numerous species of year-round breeding bird species, including thick-billed vireos, Bahama mockingbirds, gray kingbirds, bananaquits, black-faced grassquits, blue-gray gnatcatchers, Bahama woodstar hummingbirds, yellow-warblers, white-winged doves, and common ground-doves.

Because the home range territories of the bird species that were heard (or observed) in the plots in this habitat certainly extend into adjoining areas also, it is difficult to reliably estimate, the magnitude of the impact of the proposed project on resident species. However, in general, it is expected that there will be small declines in the numbers of these upland-dependent species when their habitat is converted to open-water and canal side-slopes.

Habitat modifications are likely to have less significant effects on migratory species. Secondary/indirect impacts to this community will occur as the result of habitat fragmentation and loss of foraging, roosting, and nest sites for birds and other wildlife.

Direct, Indirect, and Secondary Impacts to Shrubland, Broadleaf Mixed Evergreen/Drought Deciduous and Drought Deciduous, Upland

Except for a variable-width narrow strip along the east and west sides of the proposed canal, all this habitat that is present within the Assessment Area will be converted to the open-water canal, canal side-slope, or maintenance area at the top-of-slope.

Unless plants designated as Endangered, Threatened, and/or Endemic are salvaged, relocated, and/or protected in situ, they will be lost. Fortuitously, this is the most abundant vegetated community on the Sail Rock property, and there is no reason to believe that the floral and faunal species that are present within this community in the proposed canal area are not also present in larger abundances in adjoining areas that will not be impacted by the proposed project.

Based on observations of the species of fauna that inhabit this community, impacts are likely to affect home-range territories for many bird species. The most significant effect is likely to be on resident nesting species, including thick-billed vireos, Bahama mockingbirds, gray kingbirds, woodstar hummingbirds, ground doves, and white-winged doves. The extent of impacts on these species will vary based on the size of the home-range territories of each individual species.

Secondary/indirect impacts to this community will occur as the result of habitat fragmentation and loss of foraging, roosting, and nest sites for birds and other wildlife.

Direct, Indirect, and Secondary Impacts on Forest, Broadleaf Evergreen Estuarine (Tidal)

This small area is in the southwestern part of the Assessment Area, where the width of the mangrove fringe is less than 100 feet.

The south end of the canal is proposed to join with Bell Sound at a location north of the north boundary of the Bell Sound Nature Reserve. Where inter-tidal mangroves will be replaced by the southwest opening of the canal to Bell Sound, there will be a loss of inter-tidal habitat for juvenile fish and other marine organisms and a reduction in the amount of foraging habitat for wading birds. This reduction could be offset by the increase in littoral habitat that will result from the creation of the side slopes of the proposed canal and lagoon, particularly if mangroves are planted to stabilize the shoreline and provided habitat for native flora and fauna.

Indirect and/or secondary impacts could occur to this habitat and adjoining marine areas if controls are not put in place to ensure that sedimentation does not occur because of sands being deposited by tidal currents.

Direct, Indirect, and Secondary Impacts on Shrubland, Broadleaf Evergreen, Estuarine (Tidal)

Impacts to the Shrubland, Broadleaf Evergreen, Estuarine (Tidal) will occur in the southwestern part of the site. Existing mangroves in this area are stunted/dwarf due to a lack of soil overlaying the rock substrate. No bird nesting was observed in this area, but this is the type of habitat in which yellow warblers may nest. The foraging habitat for wading birds may also be lost but will likely be offset through the increase in littoral zones that will be created along the side slopes of the proposed canal and lagoon.

This was the only location within the Assessment Area where the endemic Turks and Caicos Heather was observed. It is recommended that individuals of this species be relocated to other areas of suitable habitat on the Sail Rock property.

Indirect and secondary impacts that are likely to result from the loss of this habitat include the reduction (or temporary loss) of habitat for insects and insectivores, including migratory birds that may use existing vegetation for foraging and/or roosting during their annual migrations.

Direct, Indirect, and Secondary Impacts to Dwarf Shrubland, Broadleaf Evergreen, and Broadleaf Evergreen Mixed Deciduous, Coastal Impacts to this community type would occur at the northwestern boundary of the site, where landside and marine communities meet at the location where the proposed canal would join the tidal currents between Bell Sound and the cays to the north.

Due to harsh environmental conditions, this habitat was found to provide comparatively little habitat for landside or marine species and is clearly preferable to locating the canal opening in a portion of the shoreline where mangroves are present. Plants designated as Endangered, Threatened or Endemic should be salvaged/relocated, if possible.

Indirect and secondary impacts that are likely to result from the loss of this habitat include the reduction (or temporary loss) of habitat for insects and insectivores, including migratory birds that may use existing vegetation for foraging and/or roosting during their annual migrations.

It is recommended that the precise location of the mouth of the canal be micro-sited to avoid impacts to shoreline mangroves, even if doing so impacts a larger amount of the Dwarf Shrubland community.

Direct, Indirect, and Secondary Impacts on the Forest, Palustrine, Broadleaf Evergreen Community.

Impacts on this community could be avoided if the recommended Preservation/Conservation Area is adopted.

Direct, Indirect, and Secondary Impacts on Herbaceous, Palustrine, Perennial Mixed Graminoid/Forb community

It is proposed to be transformed into a part of the open-water lagoon. The nesting habitat for Wilson's plovers will be lost. No other areas on the property appear to be suitable for nesting by this species, so a minimum of one pair of this species will need to find other, off-site areas for nesting. Additional impacts will be the loss of foraging habitat for wading birds and waterfowl during periods when water levels are high, however, the creation of new shoreline littoral habitat and side slopes and/or habitat improvements in the Salinas may enhance or create new habitat for these species.

Direct, Indirect, and Secondary Impacts on the Palustrine - Nonvascular, Saline/Hypersaline community.

Except for the small area that is recommended as a Conservation/Preservation Area, the remainder of this community is proposed to become open water of the lagoon. As marine life becomes established in this area after it is dredged, there is the likelihood that there will be a net positive benefit in marine productivity and aesthetic appeal in this area. Impacts to habitat for some waterbird species (e.g., blue-winged teal and other ducks), however, are still likely to occur.

Direct, Indirect, and Secondary Impacts on the Sparse, Clear-Cut Land.

If canal construction proceeds as proposed, there will be a temporary increase in the amount of clear-cut land. However, as these lands become re-vegetated, primary productivity will increase and habitat for native flora and fauna will be improved.

Direct, Indirect, and Secondary Impacts on the Sparsely Created Open Water Areas Community.

If canal construction is approved, there will be a net increase around open waters on the site. As marine life colonizes these newly created waters, there will be a net conversion from a terrestrial ecosystem to a marine/aquatic ecosystem.

Construction of the proposed lagoon basin, canal, and the installation of the docks would impact approximately 80 acres (~ 32 ha) of existing terrain, which will result in the conversion of existing native plant and animal communities into a shallow lagoon basin and canal. When side-slopes at a 2.5 (H): 1 (V) slope above existing natural ground elevations and adjacent areas that will be impacted are added, the total anticipated direct impact is calculated to be approximately 120 acres (~43 ha). Therefore, the landside assessment, together with the results of a marine assessment allows environmental impacts to be understood and appropriate minimization and mitigation procedures to be developed to address and minimize impacts to local flora and fauna and to offer suggestions to mitigate unavoidable impacts.

5.1.2 *The biotic environment – Coastal*

Erosion and sediment impacts associated with the overall development are largely dependent on adherence to BMPs. Construction activities will require the management of dredge spoils,

channel dredging and land-based pollutants. Dredging is limited to the two entrances of the inland channel. The development introduces impervious surfaces, which exacerbate the volume and speed of runoff flow, particularly during storm events with periods of heavy downpours. Runoff is a vehicle for the introduction of land-based pollutants into the natural environment. When practical drainage is captured and reused for irrigation purposes; retention ponds may also capture stormwater in certain areas.

Dredge Materials

Construction activities will require the management of dredge spoils from channel dredging. Excavated dredge material will be dewatered on the barge or pumped ashore and secure in berms as the excavation proceeds. The channel entrances are to be surrounded by turbidity curtains during excavation to limit sediment plumes. The spoils will be directly taken to the landing site, offloaded, and stockpiled in various locations on-site for future use.

5.1.3 The biotic environment - Marine

The marine environment at the dredge locations consists of primarily algal hardbottom and sand substrate in dwarf mangrove habitat. The dredging of the northern and southern entrance channels will impact the immediate surrounding areas.

The northern entrance was previously relocated and will impact a lower quantity of *Porities porities*. Coral meeting relocation criteria, including six (greater than 10 centimeters), overall coral health (disease/bleaching less than 50%), and the likelihood of survival should be relocated prior to entrance channel dredging.

5.2 The physical environment

To evaluate the impact of waves inside the proposed channel, as well as to examine any possible impacts (negative, positive) to the shoreline and downdrift to the neighbouring properties, computer-simulated modelling was carried out using various wave conditions. Impacts resulting from operational (seas and swell) waves, hydrodynamics, and sediment transport were evaluated using the two-dimensional MIKE 21 numerical model for both the existing conditions ("do nothing" scenario) and the implementation of the proposed channel described above. The modelling results were used to predict what would happen in the short and long term once the proposed channel has been built.

Long-term Impacts on Operational Waves

The offshore operational waves described in sections of this report were used to establish the dominant wave processes in the area, how they are driven, and if/how they would change because of the proposed works. Documents provided by the client (shown in Figure XIII) indicate a proposed channel depth of -4 feet (-1.21m) MSL, with both channel entrances being dredged to -3 feet (-0.91m) MSL. As such, this channel depth along with the alignment provided has been used in subsequent modelling.

The objective of the proposed channel is to provide a low wave height, a calm area for patrons to wade and conduct water sports, while simultaneously maintaining a constant flushing of fresh water at the site by allowing sufficient wave and tidal energy into the lagoon.

Figure 87 shows a side-by-side comparison of wave heights exceeding 12 hours per year over a 42-year period with the comparison between existing conditions (Top) and the installed channel conditions (Bottom). Results indicate that the waves inside the channel are wind-driven with an average wave height of 0.02m, reaching a maximum of 0.06m. As expected, both Figure 87 and Figure 88 reveal that the implementation of the channel has no impact on the waves surrounding the project area.

Overall, results suggest that the impacts on wave heights are negligible and are expected to have minimal impacts on the neighboring areas. In addition, it is expected that the protected nature of the channel will provide ideal wave heights for water sports and snorkeling.

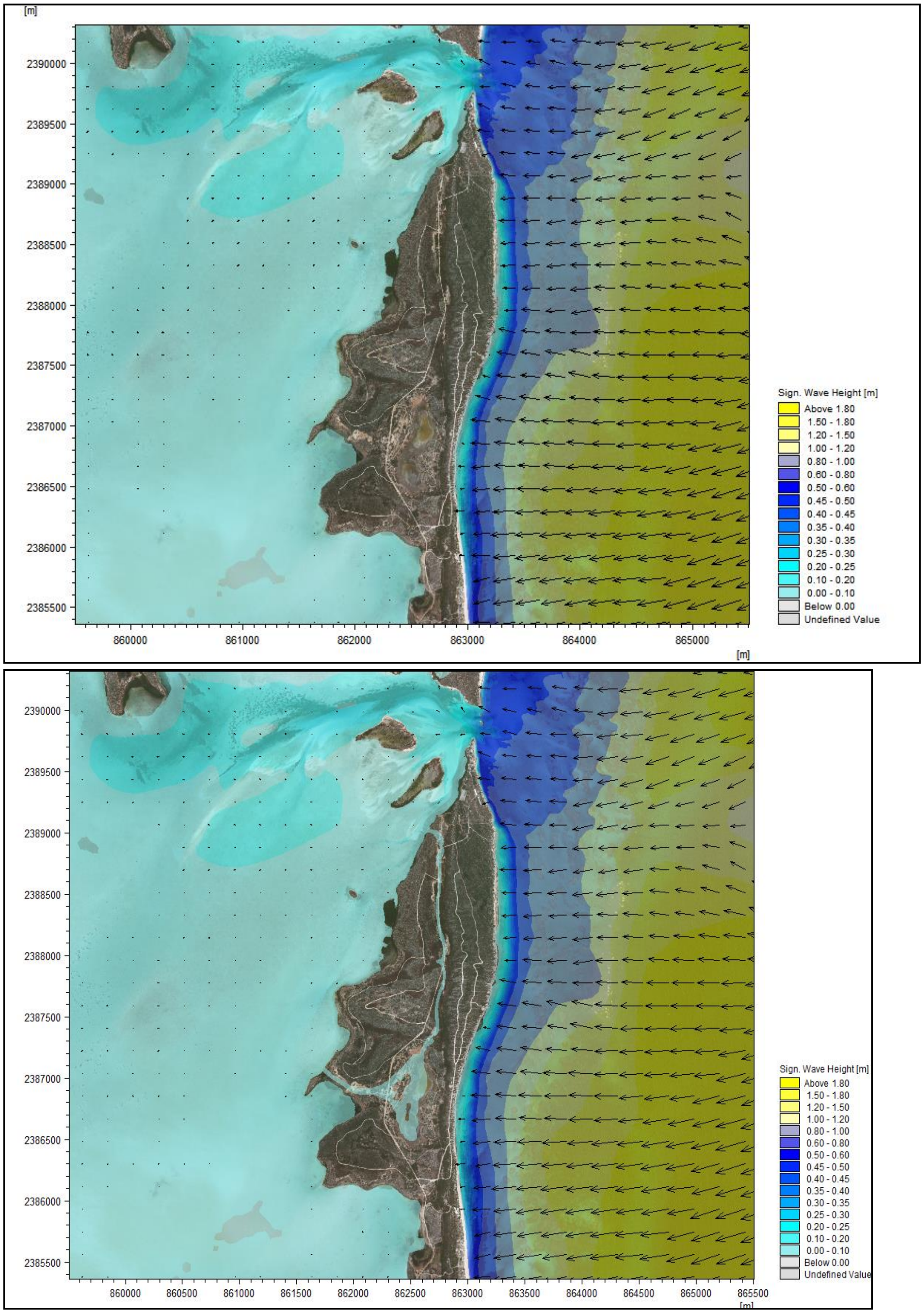


Figure 87: Resulting wave height with existing configuration (Top) and proposed concept (Bottom) for waves exceeding 12 hours per year.

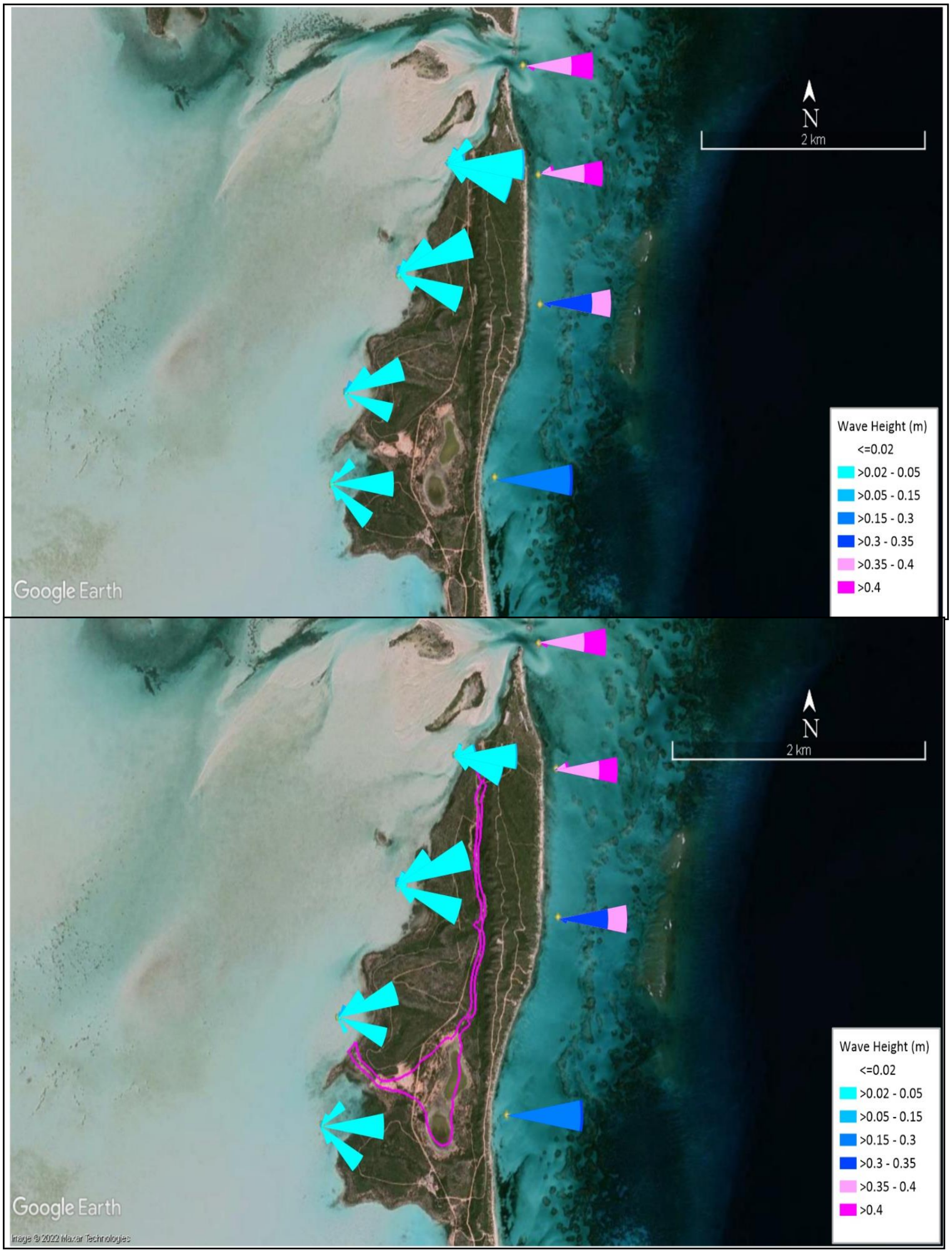


Figure 88: Resulting wave height rose with the existing configuration (Top) and proposed concept (Bottom)

Hydrodynamic Condition (Longshore Impacts)

Maintaining adequate circulation while simultaneously reducing impacts along the shoreline is an important factor in the design of this channel. This is to ensure that the sensitive organisms of the Bell Sound Nature Reserve and neighbouring properties are not negatively affected while promoting healthy water quality and minimizing algae formation inside the channel. The baseline hydrodynamic conditions presented previously were used to establish lower-limit current patterns in the area and understand how they are driven.

This section investigates the predicted changes in the current speeds and directions that may result from the implementation of the proposed channel. The magnitude of the impacts of the proposed channel was established using a 24-day simulation period of neap tide conditions, which results in minimal currents.

To better understand the impact of the proposed channel on areas further along the shoreline, comparisons were done in two ways:

i. Figure 89 shows the current speed and direction over the 24-day simulation period at arbitrary locations along the shoreline with a side-by-side comparison between the existing condition and the proposed channel. Current roses indicate that in general, current speeds and directions are unchanged a few meters away from the channel entrances but have slight differences in directions at the locations immediately where the channel enters open waters. This difference is expected as water flowing into or out of these entrances would affect the existing current directions. This difference is small scale and, as shown, does not result in any longshore current impacts outside the immediate area.

ii. Two-dimensional plots of the resulting mean current speed over the 24-day simulation period were also plotted (Figure 90). The plot allows for easy comparison between existing current conditions versus current conditions with the proposed channel in place. Results indicate that the presence of the channel has very small-scale impacts on longshore ambient current conditions at both the northern and southern channel entrances. The results also indicate that currents along the northern neck of the channel were relatively fast, reaching speeds of up to 0.2 m/s at the bottlenecks where the bridge abutments are proposed. However, the locations south of the two islands in the channel lagoon generally experience relatively low current speeds, especially during low wind speed conditions. This could pose a problem for flushing during neap tide conditions. This flushing performance is explored further in the following subsection

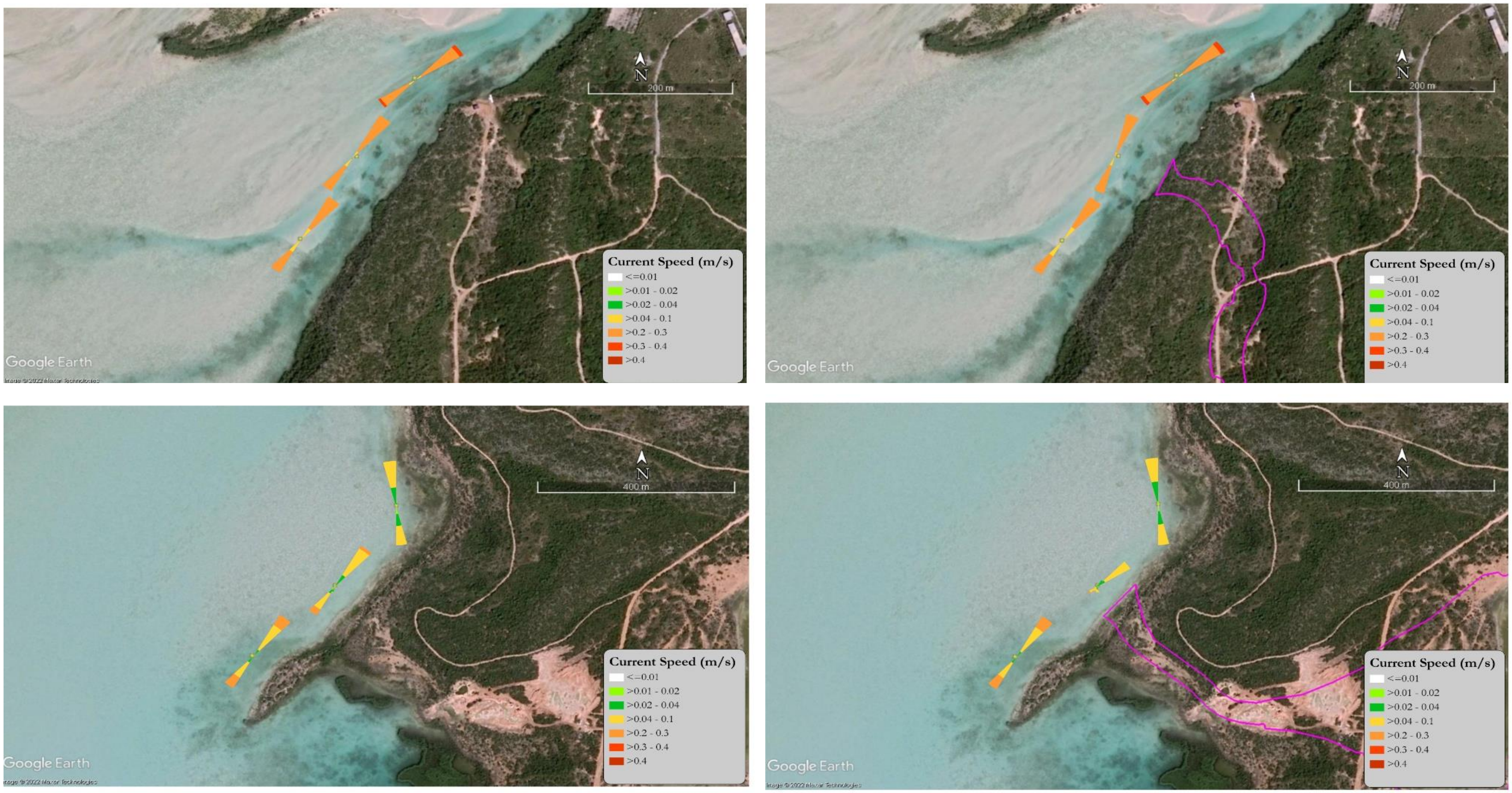


Figure 89: Current speeds and directions (going to) over the 24-day period under existing conditions (Left) and proposed conditions (Right) near the Northern (Top) and Southern (Bottom) channel entrances.

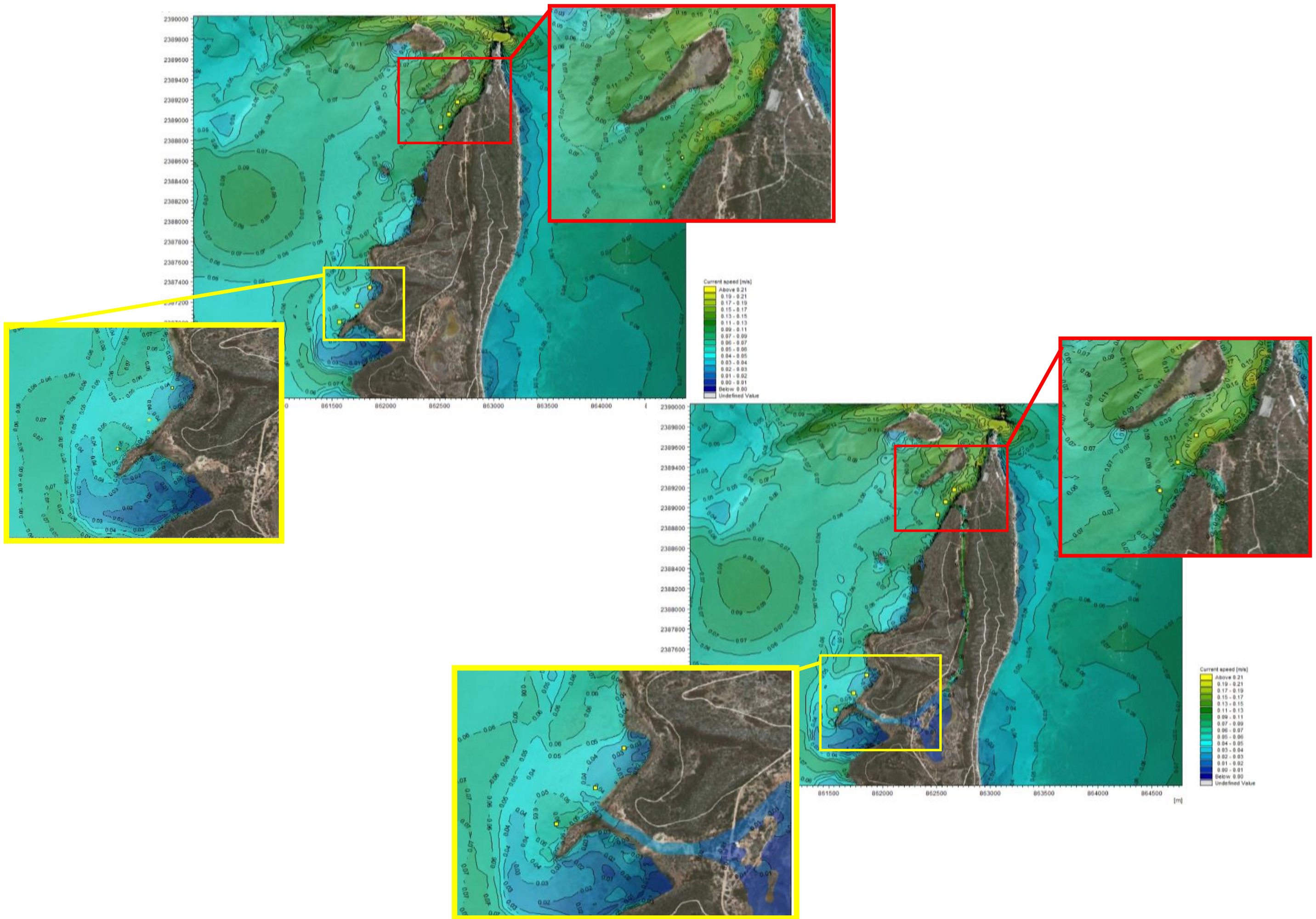


Figure 90: 50th percentile neap current speeds (8 May – 1 June 2021) under existing conditions (top left) and proposed conditions (bottom right)

The swell event[4] on 4 March 2018 mentioned previously was selected to carry out the swell assessment for the baseline case of wave heights, currents, and sediment transport in the area. This event was selected because it includes wave heights three times the value of the deep water means wave height. The wave periods were also longer than the mean, and this has implications for sediment transport and flooding.

The numerical model domain that was developed, validated, and described previously was used to simulate the swell wave event described in this section. The MIKE21 spectral wave (SW), hydrodynamic (HD), and sediment transport (ST) models were run, and the results are described below.

- The swell assessment shows that under swell conditions there are very small waves (<0.1m) approaching the channel entrances and that, like the extreme wave climate explored in the extreme wave analysis, the waves west of the proposed Sail Rock development are wind-driven fetch-limited waves. This is expected as most of the offshore generated swell waves are filtered out by Middle Creek Cay and Plandon Cay.
- The bed level changes induced by the swell runs in the proposed condition are like those shown previously in the existing condition. The figure shows that, aside from the gaps between the Sail Rock mainland and Plandon Cay, there is very little accretion or erosion (represented by green and red colours) near the project site. The minimal bed level changes that do occur are far from the channel entrances and there are no bed level changes within the channel/lagoon. As such, it is not expected that regular maintenance will be needed after similar swell events.
- Based on the current speeds plot, it is noted that at the peak of this swell event, currents of up to 0.5 m/s are observed at the bridge abutments where currents are forced through a small area (pinch points). Maximum current speeds of 0.25m/s were observed along the slender channels. However, current speeds remain below 0.1m/s in the lagoon throughout the swell duration.
- Overall, the results indicate that changes in waves, current and sediment transport between the existing conditions and proposed development are negligible and no noticeable downdrift impacts were noted at either of the channel entrances. From a

[4] More information on this swell event is presented by the NOAA at https://www.weather.gov/sju/swell_mar2018.

stability standpoint, the results show that even after high-energy, long-lasting events such as this 10-day swell event, maintenance dredging within the channel and near the channel entrances are not required to maintain functionality.

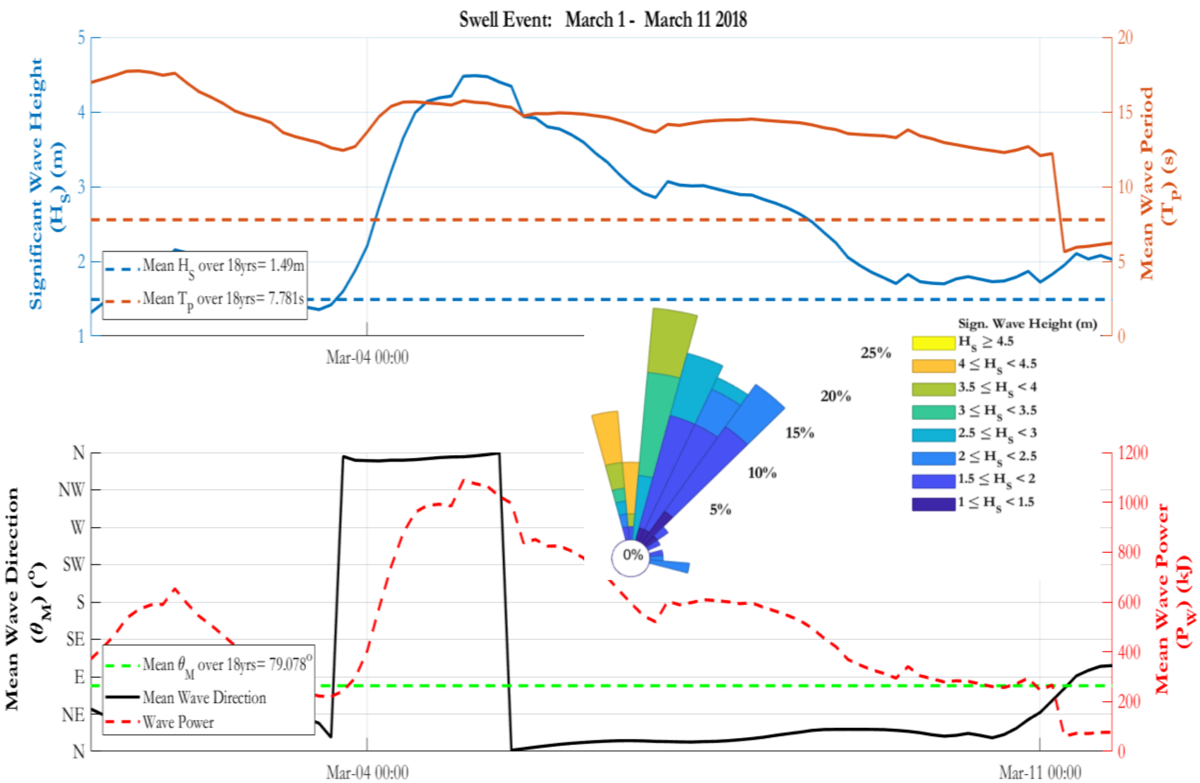


Figure 91: Timeseries and wave rose from the selected swell.

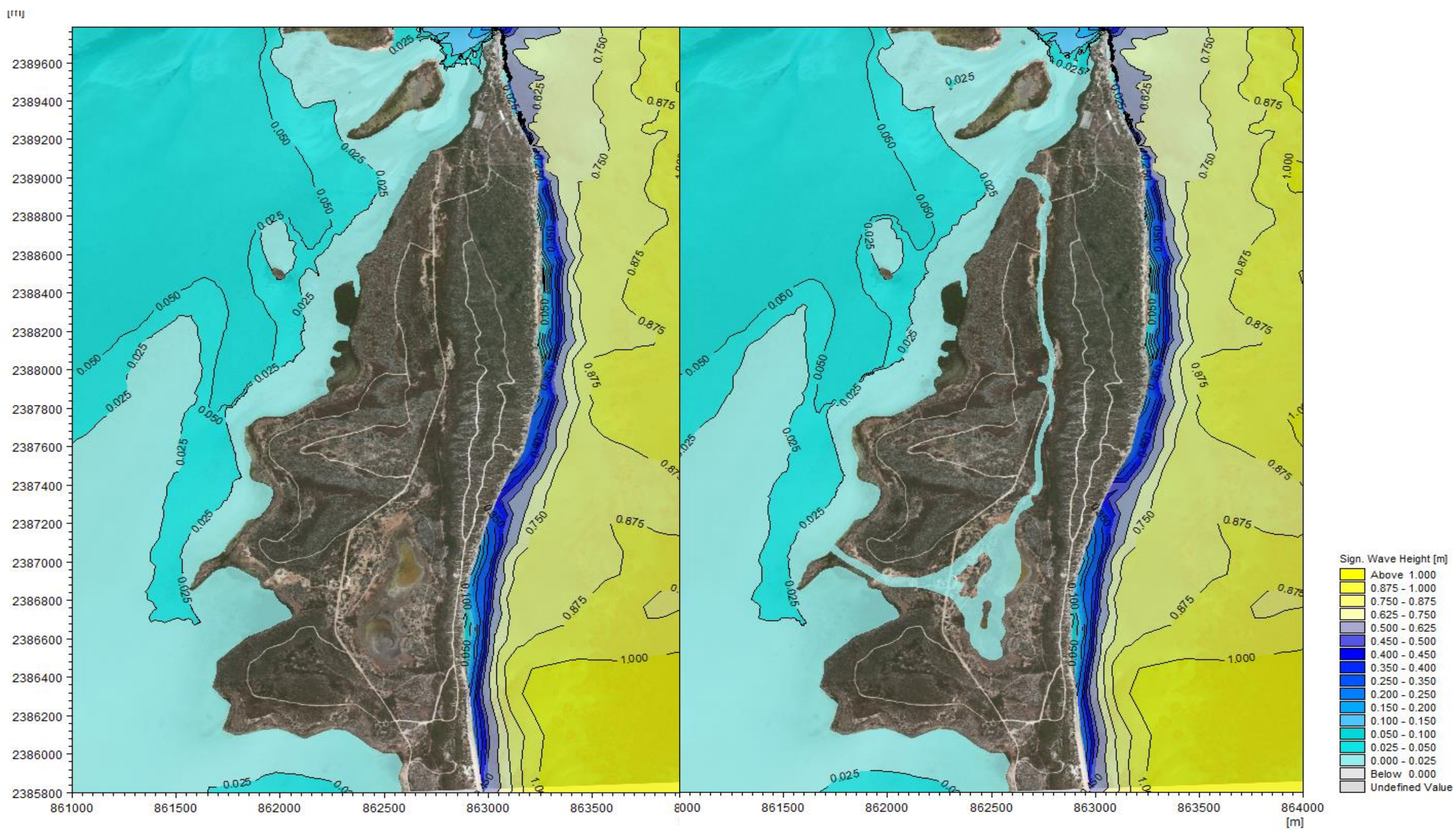


Figure 92: Wave heights at the peak of the swell under the existing layout (left) and with the proposed channel (right)

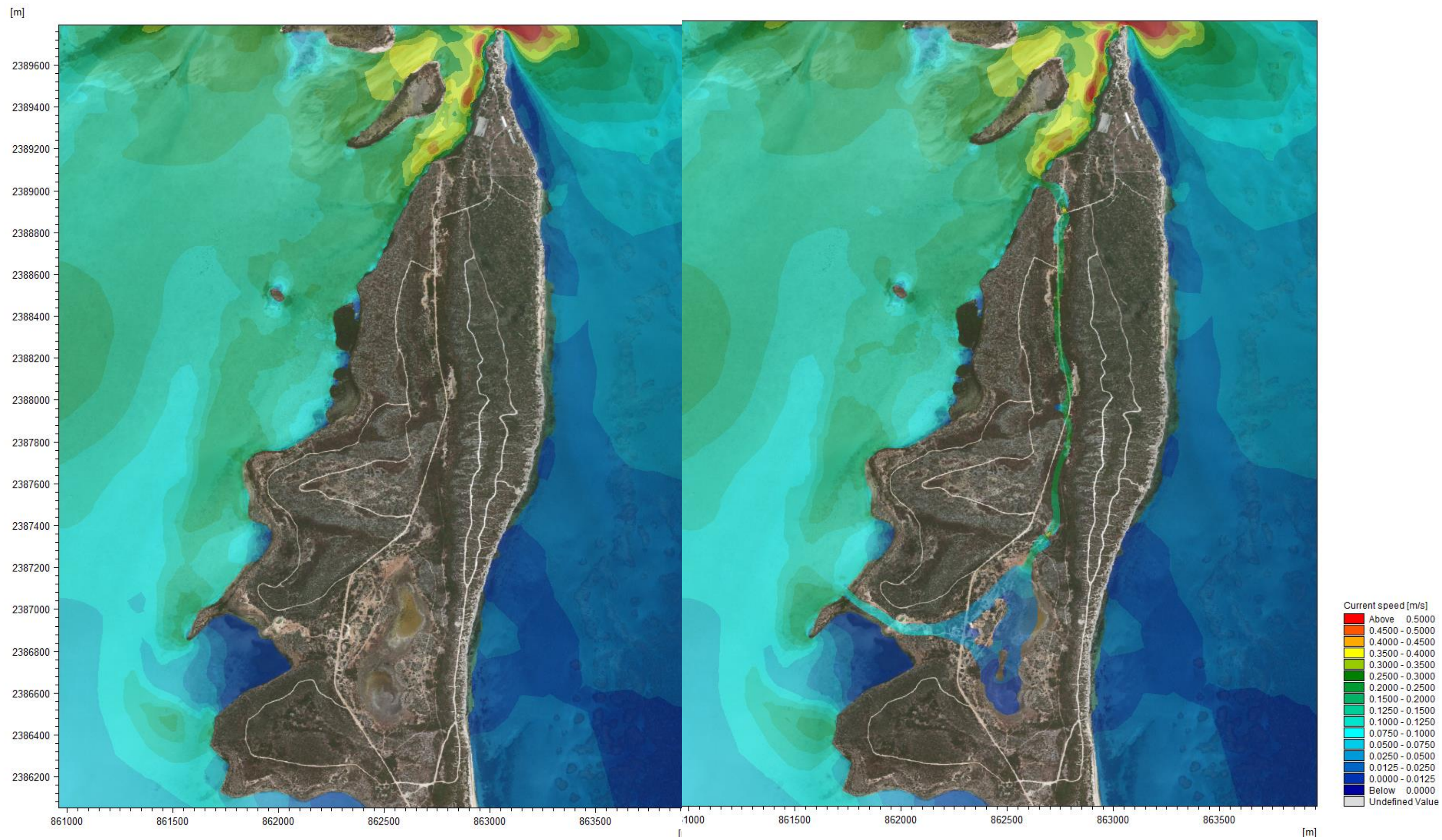


Figure 93: Current speeds at the peak of the swell under the existing layout (left) and with the proposed channel (right)

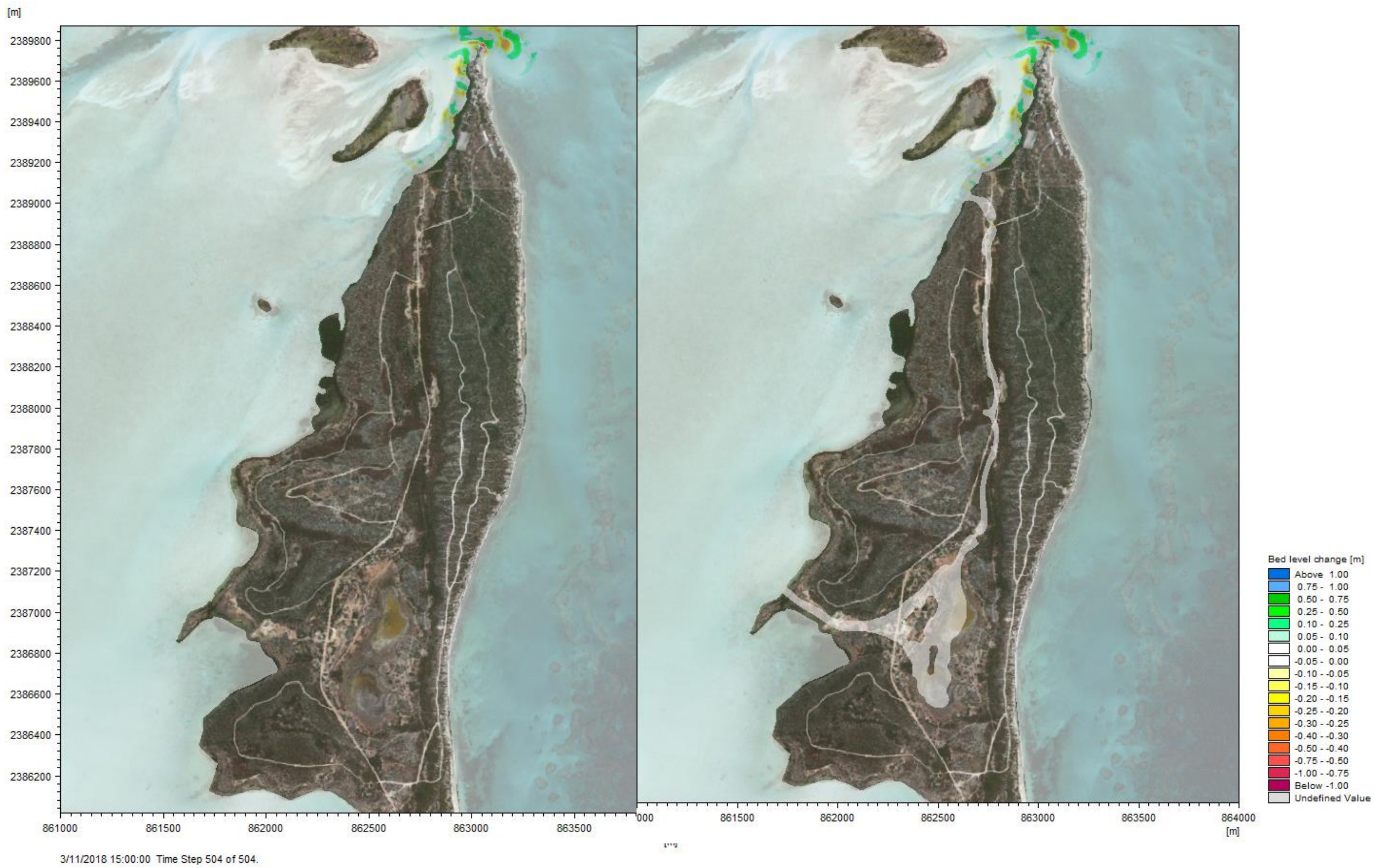


Figure 94: Bed level changes at the end of the swell under the existing layout (left) and with the proposed channel (right)

5.2.1 *The physical environment – Beach profile*

Aerial photography has been a definitive method of capturing data and monitoring shoreline evolution for decades. Traditionally the cost of the aircraft and camera required made the cost prohibitive for applications that were not large-scale. In the last five years, the emergence of over-counter light-weight aerial drones and accompanying cameras has significantly reduced the operating costs associated with aerial photography. One operator and one support technician can map the entire project area in one or two days. Aerial photography generates high-resolution images and point elevations. The elevations are not necessarily ground level and will pick up tree cover and superstructures. The profile data gathered from a licenced surveyor can be used to "calibrate" this point cloud data and produce a large-scale understanding of elevation changes as time progresses. These data sets facilitate the diagnosis of large-scale changes such as shoreline retreat and erosion/deposition within the canal. These methods can be used to gauge the impacts of the canal on the nearshore environment as well as give insight into the timelines required for maintenance works.

5.2.2 *The physical environment – Bathymetry*

Water quality sampling should be conducted to bring attention to any degradation in water quality, which could pose a challenge to the biotic environment or swimmers. Water quality tests can also shed light on the possible sources of pollution entering the canal if any, as well as validating flushing times. Lastly, benthic monitoring should be conducted regularly to map the migration of biological creatures and quantify the populations of species inhabiting the newly formed canal.

5.3 *Coastal water quality*

The perceived potential impacts on water quality would derive from:

- Saltwater encroachment
- Turbidity
- Accidental fuel spills.

These potential impacts will directly relate to activities taking place during the construction and post-construction phases of the proposed development. Each impact can range from low to high, short-term, and reversible using appropriate mitigation measures, Table 17. The areas subjected to water quality impacts are:

- Immediate and surrounding marine environment.
- Constructed inland waterways.

Table 17: Perceived Impact on Water Quality

Project Phase	Impact	Area of Impact	Impact Rating	Mitigation Measure
Pre-Construction	Groundwater	N/A	N/A	N/A
Construction	Groundwater	Immediate	H/ST/R	EMP
	Marine			
	Air		L/ST	EMP
	Noise		L/ST	EMP
Post-Construction	Groundwater	Immediate and surrounding	L/ST/R	EMP
	Marine			

Impact Rating: L - low, H- high, LT- long term, ST- short term, R -reversible

Water quality sampling should be conducted to bring attention to any degradation in water quality, which could pose a challenge to the biotic environment or swimmers. Water quality tests can also shed light on the possible sources of pollution entering the canal if any, as well as validating flushing times. Lastly, benthic monitoring should be conducted regularly to map the migration of biological creatures and quantify the populations of species inhabiting the newly formed canal.

Environmental Management Plan - EMP

These impacts can be effectively mitigated by ensuring that a coastal plug (the waterproof natural barrier between the coastline and the dredging works remains in place during the construction phase of the proposed development. Removal of the plug shall take place only after water quality measurements are consistent with pre-construction levels.

5.4 Sedimentation

To better understand how the implementation of the proposed channel will impact the physical environment after construction, sediment grain size and composition analysis should be done regularly. This analysis can shed light on the direction of sediment movement as grain sizes differ from one area of the project site to another.

5.5 Public Access and recreational use

Public access to any area whether coastal areas, national parks, golf courses, and hotels is a public right guaranteed by law in the Turks and Caicos Islands. Section 4.3.1 of the TCI Development Manual 2014 particularly notes that access to the whole coastline of all the islands is to be free to the public. For these reasons, special areas should be set aside to ensure public access to open space, coastal areas, and lagoon basins.

The Sail Rock blue water lagoon basin, peninsula canal system, entrance channels, and boat docks when completed will comprise a blue water lagoon basin ecological ecosystem diverse in marine life and shallow water environment conducive to a range of recreational activities that will attract local and tourist visitors. Therefore, public access to this man-made ecological wonder should be assured to all.

5.6 Impact on future neighbouring developments and Businesses

Coast lagoon basins are highly productive ecosystems that contribute to the overall productivity of coastal waters by supporting a variety of habitats, including marshes, seagrasses, and mangroves. They also provide essential habitats for fish and shellfish species.

The immediate impact on the only development in the area, the Sail Rock Boutique Hotel and Villa Development would be the enhanced physical environment for hotel guests and visitors to the hotel.

The lagoon basin will provide a reservoir and catchment area for rainwater runoff thereby reducing the flooding potential.

In the long term, man-made changes to the physical environment have the potential to have a negative impact on the area because of storm surges due to climate change. However, it is anticipated that with proper flushing potential flooding due to storm surges can be reduced or eliminated.

It is anticipated that the long-term impact on the area will be positive due to the potential ecological enhancement of the ecosystem by increasing biodiversity and contributing to improved fishing and water-based recreational activities.

5.7 Social and economic impacts

This section will identify any socio-economic, cultural, and heritage impacts (positive or negative; direct or indirect) associated with the proposed blue water lagoon basin, inland peninsula canal, and boat docks development.

5.7.1 Socio-economic setting

South Caicos, with an estimated land area of 8.5 square miles is located to the east of the Caicos chain of islands and approximately 22 miles to the west of the capital islands of Grand Turk. The present population is less than 1,500 people who work mainly in fishing and tourism. South Caicos is known for its historic ties to the fishing and boating industry. At the beginning of the 19th century, the island was home to the most intense economic activity in the archipelago – the salt industry, but today the focus is mostly on small-scale fishing and nature-based tourism.

Most of the population lives within the Cockburn Harbour settlement area or within the suburban area of the town center. In recent years the island has experienced a decline in population due to the outward migration of the younger population to Providenciales in search of employment.

Currently, most of the workforce is either employed in the public service, the fishing industry, or in the tourist industry. There are two major hotels presently operating in South Caicos, East Bay Hotel and Sail Rock Boutique Hotel and Villas.

The proposed blue water lagoon basin and boat dock facilities are intended to complement the anchored boutique hotel and villa development on the island of South Caicos and will likely impact the local economy, provide additional employment opportunities, enhanced the local tourism product, benefit the fishing industry, provide additional water-based recreational activities, and support the boating cultural and heritage.

5.7.2 Economic Impact

It is anticipated that the proposed development will have some positive and negative impacts on the economy and the residents of South Caicos in particular, and the Turks and Caicos Islands in general. As the major developer on the island, Sail Rock Development Limited has invested more than 100 million dollars in South Caicos. The blue water lagoon basin, peninsula canal, and boat dock project will inject over $500, 000.00 into the local economy. The total annual amount paid to the government in fees to date is more than 12.5 million dollars and 20 million dollars directly to the government in land transfer and other fees.

This expenditure alone has had a great economic and social impact on the island of South Caicos.

5.7.3 Employment

The dredging, excavation, and other associated works related to the creation of the blue water lagoon basin, and construction of the inland canal and boat docks are likely to significantly increase the number of short-term and long-term employment opportunities on the island of South Caicos.

The total number of persons presently employed by Sail Rock Development Limited at its boutique hotel and villa facility stood at 78, of which 36 or 46% are Belongers or British Overseas Territory Citizens (BOTC). The total number of jobs that will be generated during the construction phase of the blue water lagoon basin, peninsula canal, and boat dock project is approximately 21. Some 7 -10 full-time jobs will be created during the operational phase of the development. This will have a significant impact on the island's labour force, which is already fully employed (Sail Rock Development Limited). This means that most of the jobs created by the proposed development will have to be sourced from foreign labour pools.

5.7.4 Tourism

The blue water lagoon basin and its surrounding environments will offer an enhanced aesthetic environment to the locals and tourists alike.

It is anticipated that the long-term impact on the area will be positive due to the potential ecological enhancement of the ecosystem by increasing biodiversity and contributing to improved fishing and water-based recreational activities.

The proposed development is likely to have a significant impact on the local tourism product because of the enhanced physical environment and the increased opportunities it brings for eco-tourism such as bird watching in the lagoon basin, water-based recreational activities like kayaking, paddle boating or just relaxing in the blue water lagoon basin. Additionally, it provides the setting and ideal environment for the development of ecotourism facilities like fishing camps, bone fishing excursions, and blue water lagoon excursions.

In the long term, the blue water lagoon will enhance the natural beauty of the area and help in the development of tourism by providing water-based recreational activities.

5.7.5 Fishing and boating activities

South Caicos is the fishing of the Turks and Caicos Islands, where historically fishing was the main source of employment. The enhancement of the low-lying area into a blue water lagoon basin that is connected to the ocean via the peninsula canal network has the potential to transform the area into an ecologically enhanced ecosystem with increased biodiversity that would contribute to the overall productivity of the coastal waters by supporting a variety of habitat, including marshes, seagrasses, and mangroves. It also has the potential to provide essential habitat for many fish and shellfish species and act as a nursery and feeding ground for marine life.

South Caicos' Island Framework Plan (National Physical Development Plan 2020) recognized the need for a major marina on South Caicos to complement the growing tourism sector on the islands. There are approximately 55 commercial fishing and conch boats, and 15 commercial excursion boats registered with the Maritime's office in South Caicos (Maritime Department 2022). The boats either operate from the Conch Ground harbour or from the Sail Rock Peninsula small dock. There is presently no structured marina facility on the islands. The proposed 67 boat dock slips, 40 at the northern entrance channel and 27 at the southern entrance channel will facilitate scuba diving, snorkeling, and sport fishing excursions.

The proposed lagoon basin and boat dock slips will provide a positive impact on the fishing and boating heritage culture of South Caicos.

5.7.6 Cultural Heritage

South Caicos has a rich history of cultural heritage, including its customary annual events and historical buildings. The objective of the proposed development is to continue that historical cultural heritage legacy, particularly in the fishing and boating industries, by providing improved facilities for these activities to continue to develop.

Sail Rock Development Limited is committed to the restoration and preservation of historical buildings in historic Cockburn Harbour. The developers have already invested large sums of money in the preservation of historical buildings and have a plan for the enhancement and redevelopment of historic Cockburn Harbour. Additionally, the developers have been good corporate citizens by investing heavily in the community of South Caicos and have donated generously to social clubs and social causes. Table 18 below is a list of donations made by the South Caicos Heritage Foundation.

Table 18: South Caicos Heritage Foundation Charitable Contributions

Year	Description	Amount $
2017	Lumber, Roofing, and Supplies	175,684.00
2018	Holiday Events	2,127.00
2020	Holiday Events	704.00
2020	Soroptimist International	750.00
2020	History of South Caicos Book	71,647.00
2020	Boys 2 Men Charity	1,500.00
2020	Food for Thought	1,430.00
2021	Holiday Events	3,611.00
2021	TCI Red Cross	500.00
2021	TCSPCA	1,500.00
2021	Soroptimists International	1,500.00
2022	Holiday Events	1,597.00
2022	Majorie Basden High School	500.00
2022	Calvary Christian School	500.00
2022	TCSPCA	2,000.00
2022	Precious Memories Forever	2,499.00
	Total	$268,048.00

It is anticipated that the long-term impact on the area will be positive due to the potential ecological enhancement of the ecosystem by increasing biodiversity and contributing to improved fishing and water-based recreational activities.

5.8 Aesthetics

The main goal of the developers is to transform what is perceived to be an unsightly eyesore into an environmentally pleasing physical environment, thus ensuring greater economic prosperity for all parties involved and enhancing the overall environmental integrity of the area.

5.9 Ecosystem Study and economic analysis

Assessments of the landside ecology indicate that the site where the proposed canal and docks are to be constructed is composed of a mosaic of upland and wetland habitats that have been moderately disturbed by various natural and human-related activities.

Natural-related impacts appear to be primarily related to hurricanes, which intermittently affect the area with varying impacts that depend on the strength of the storm, its direction, the duration of its impacts on the area, the amount of rain it brings, and other climatic factors.

Human-related impacts are both direct (e.g., construction of roads, buildings, utility lines, etc.) and indirect (e.g., the introduction of donkeys several centuries ago and the adverse impacts on floral communities that result from vegetation browsing by a population of these large, free-roaming herbivores.

Despite these impacts, the overall condition of the subject area is good. Naturally occurring shoreline mangrove communities, dry broadleaf evergreen forests (coppice) and shrublands, seasonal wetlands, and other vegetative communities and landforms are mostly intact and provide habitat for a variety of native floral and faunal species. These include dozens of species of birds that include year-round, breeding residents and migratory species, waterfowl, warblers, and other passerines that are present either during the migration or for periods of several months.

Additionally, numerous floral and faunal species that are designated by the Turks and Caicos Islands Government (TCIG) as “Protected” due to their degree of endemism and/or abundance are present on the property, and for the most part, appear to be present in sustainable populations.

Wetlands within the project area appear to presently include a variety of sizes (i.e., from less than 1 acre to over 10 acres) that apparently vary in water depths, salinity, populations of aquatic organisms, and other parameters during annual dry and wet seasons.

Portions of the proposed canal coincide with an existing hard surfaced, but the unpaved road that allows access by Sail Rock residents and other residents and visitors to South Caicos across the property and to the portions of the island that are north of Sail Rock's ownership. Trees and other vegetation on the site provide a variety of ecosystem functions, including soil stabilization, oxygen production, carbon sequestration, foraging, roosting, and/or nesting habitat for birds and other wildlife.

No plant or animal species appear to be present within the Assessment Area that are not also present in other areas of the property. However, one comparatively low-lying area that appears to be a localized biodiversity hot spot is present in the northeastern part of the property and is being recommended to be preserved as a Conservation Area.

Conversion of previously impacted upland areas to the proposed open-water canal and new inter-tidal shoreline areas will change result in a change in vegetative communities. This change will benefit some species (e.g., terrestrial flora will be replaced by aquatic species. This change will have a positive effect on some faunal species (e.g., wading birds) and have an adverse effect on other species (e.g., vireos, bananaquits, and doves). In general, wetlands are considered valuable habitats, and indeed, the scrape-down of uplands to create wetland hydrologic conditions is often accepted as mitigation to offset the impacts of development.

No information has been found that indicates that the landside portions of the subject of the property are presently used for any economic-generating purposes (e.g., silviculture, agriculture, aquaculture, the harvest of medicinal plants, ecotourism, etc.).

While the replacement of a road and impacted terrestrial communities with an open-water canal and littoral zones may not necessarily be seen as a net negative effect (provided species that are designated as threatened, endangered, and/or endemic are salvaged), other roads will need to be created to allow continued access across the property. These roads (and potential future homesites) are mostly in areas that are composed of naturally occurring vegetative communities. It is noted that the Terms of Reference and this Environmental Impact Assessment do not address these future aspects of the long-term build-out of the property.

Marine areas adjacent to the project site, however, do provide direct and indirect economic benefits due to their desirability for non-consumptive ecotourism, including bone fishing.

5.10 Other impacts including flooding or storm surge.

Other possible impacts include possible oil pollution from equipment tanks, solid waste pollution, and surface runoff. The impacts identified in this section with be addressed by monitoring programs outlined in the next section.

SECTION VI - MONITORING

6.0 Monitoring

6.1 Monitoring for - pre, during, and post-construction

Pre-construction - 2 in-situ measurements shall be taken once weekly over a two-week period prior to construction. Surface and mid-depth samples will be taken at a minimum separation of 500 linear feet.

Construction - Daily in-situ measurements will be taken during construction activities: 1 sample at least 1 hour before the start of work, 1 sample during work, and 1 sample no more than 1 hour after work.

Post-construction - 2 in-situ measurements are to be taken once weekly over a four-week period at the competition of construction. Surface ace and mid-depth samples will be taken at a minimum separation of 500 linear feet.

Sample locations will be established at the inlet and outlet areas of the canal system.

Floral Monitoring

As described in the Mitigation section (VII), it is recommended that a plant salvage program be instituted to salvage plants that are designated as “Protected” and which are relocatable with a reasonably high level of success, primarily orchids and *Euphorbia gymnonota*. Monitoring is recommended to track the success (or lack thereof) of transplanting. Epiphytes are generally regarded as having a higher degree of transplanting success than other species, and monitoring of a subset of (e.g., not less than 25%) is recommended to document the degree of survival of the relocated individuals.

GPS coordinates should be recorded of the receiver areas for a minimum of 25% of the transplanting, and follow-up monitoring visits should be conducted 6 months and 1-year post relocation and once during the expected blooming season.

A report should be generated at the end of the one-year period describing the overall number of specimens relocated and the percentage of the monitored population that remains alive at 6 months and one-year post relocation.

Invasive Species Monitoring

Presently no invasive pest plants have been observed within the Assessment Area. The extensive land clearing that is proposed has the potential to create scarified conditions into which invasive species could colonize and become established from seed sources located off the Sail Rock property. It is recommended that field monitoring be conducted at least annually to identify the extent to which invasive species are becoming established and that an invasive species control program be established and implemented if invasive species are identified on the site.

Avian Monitoring

In recognition that the proposed canal and dock construction project is a "next step" toward the implementation of a long-term master plan for the Sail Rock project, it has become apparent that baseline data on avifauna is needed. The long-term presence of dozens of flamingos in the main Salina coupled with the varied habitats and general accessibility throughout most of South Caicos make the island a potential travel destination for bird watchers. To that end, Sail Rock has been a funding partner for *Birding in Paradise - South Caicos - A Guide to Birdwatching and heritage sites*, a 56-page booklet that was published in 2014 jointly by the UK Overseas Territories Conservation Forum and the Turks and Caicos National Museum. The book includes photographs and descriptions of many of the dozens of species of resident and migratory birds that have been observed on the island. A recommended "Birding Tour" in that booklet includes publicly accessible roads on the Sail Rock property.

It appears that, to date, bird surveys on the Sail Rock property and other areas of South Caicos have been primarily associated with data collection for Environmental Impact Assessments and species-specific surveys for notable birds (e.g., piping plovers).

It is recommended that an avian monitoring program be established, perhaps in association with the South Caicos-based School for Field Studies. Monitoring is recommended on a two-prong approach: 1) Surveys to document seasonal variations in species and abundance, and 2) Breeding bird surveys that follow a more rigorous protocol. Both monitoring protocols are described hereafter:

Bird Surveys to Document Seasonal Variations in Species and Abundance.

It is recommended that bird surveys be conducted at least four times per year:

Period	Target Species
May-June	Summer breeding species
Sept-Oct	Fall Migration
Jan-Feb	Winter Residents
March-April	Spring Migration

Surveys should follow a pre-set route and include documentation of both species observed and general abundance. Notation of water levels and salinity should be noted in areas that have surface water, as these parameters are related to avian species' use and abundance.

Breeding Bird Surveys (BBS)

Breeding Bird surveys should follow a more stringent protocol, which is based on surveys in other areas of North America, in which birds encountered (seen and heard) during a pre-designated driving route, with point-count surveys conducted for three-minute periods at locations approximately 0.5 miles apart are recorded.

See https://www.pwrc.usgs.gov/bbs/participate/training/ for details.

Discussions with Heidi Hertler, the Director at the School for Field Studies (SFS), suggest that there may be a willingness to establish a new avian curriculum as part of the school's three-month term for visiting college students. The curriculum could include a variety of pertinent materials, (e.g., basics on bird identification (by sight and by call), an introduction to the Birds of South Caicos, and information regarding migratory patterns, plumage changes, survey techniques, bird diets etc.). Partnering with UKOTCF is recommended.

The goal of these surveys is to establish scientifically collected baseline information on the species diversity and abundances of the avifauna at Sail Rock specifically, or South Caicos on an island-wide basis.

Additionally, field monitoring should also be conducted to avoid impacts on nesting birds during land clearing.

6.2 Post-Construction Monitoring

The purpose of post-construction monitoring is to facilitate the optimal performance of the installed canal throughout its operational period. As such, a plan was developed with a focus on being pre-emptive, cost-effective, and routine.

Post-construction monitoring will follow the pre-construction format on a quarterly basis and include an additional sample station within the constructed marina basin. The plan comprises a range of tasks that fall into two categories:

- Data collection and analysis
- Implementation of additional maintenance works

Each of the topics discussed in this section addresses a specific element of the data recommended for collection. Trends can be recognized through cumulative comparison and analysis of each data set and further correlations may be drawn from comparisons across data sets. Equipped with estimated rates of degradation for the various elements of the design, the management agency can approximate when maintenance works will be necessary and maximize pre-emptive intervention.

Monitoring Schedule

To properly assess the post-construction impacts of the proposed works on the coastal and biotic environment, the following monitoring schedule is suggested, figure 19.

Table 19: Monitoring Schedule

No.	Item	Category	Duration (days)	Time Interval	Resources
1	**Aerial Photography**				
1.1	Aerial Photography: Purchase and set up drone, accessories and software	Procurement	28	One Time Instalment	1 Coastal Engineer, 2 Technicians
1.2	Aerial Photography: Drone Survey	Data Collection	3	Annually (1/year)	1 Surveyor, 1 Technician
1.3	Aerial Photography: Convert data to DEM and Orthomosaic	Analysis and Report	2	Annually (1/year)	1 Surveyor
1.4	Aerial Photography: Analyze imagery and develop Shoreline Evolution Report	Analysis and Report	4	Annually (1/year)	1 GIS Specialist
2	**Beach Profiles**				
2.1	Beach Profiles: Purchase and Setup Traverse Kit	Procurement	28	One Time Instalment	1 Coastal Engineer, 1 Surveyor, 2 Technicians
2.2	Beach Profiles: Beach Topography Survey	Data Collection	12 (6)	Monthly for first year then 2 times per year	1 Surveyor, 1 Technician
2.3	Beach Profiles: Analyze data and develop Beach Evolution Report	Analysis and Report	7	Monthly for first year then 2 times per year	1 Coastal Engineer, 1 Surveyor
3	**Sediment Sampling**				
3.1	Sediment Sampling: Site Visit and Sample Collection	Data Collection	4	6 months	2 Technicians
3.2	Sediment Sampling: Laboratory Wet and Dry Sieve Analysis	Analysis	14	6 months	2 Technicians, 1 Geotechnical Engineer
4	Sediment Sampling: Sediment Quality Assessment	Analysis	14	6 months	2 Technicians, 1 Geotechnical Engineers
4.1	**Water Quality Sampling and Benthic Monitoring**				
4.2	Benthic Survey: Visual Benthic Assessment	Data Collections	12 (4)	Monthly for first year then 2 times per year	2 Technicians, 1 Marine Biologist
4.3	Benthic Survey: Visual Benthic Reports	Analysis	12 (4)	Monthly for first year then 2 times per year	2 Technicians, 1 Marine Biologist
5	Water Quality Sampling: Site Visit and Sample Collection	Data Collection	4	6 months	2 Technicians
5.1	Water Quality Sampling: Water Quality Testing	Lab Analysis	14	6 months	2 Technicians, 1 Marine Biologist
5.2	Water Quality Sampling: Water Quality Report	Analysis	14	6months	2 Technicians, 1 Marine Biologist/Environmentalist

6.2.1 Marine biota - post-construction monitoring

Any debris left on the seabed from the construction activity can become a projectile during severe wave activity, and this may cause damage to sensitive benthic resources or to property on land. It is recommended that a final inspection be carried out to ensure that no construction debris is on the seabed before the completion of the construction/maintenance phase of the project.

6.2.2 Bathymetry - Post-construction

To properly assess and understand the post-construction impact of the proposed development on the bathymetry and coastal environment frequent bathymetry post-construction monitoring is recommended. Immediately following the completion of the proposed development and annually thereafter, for a three-year period.

6.2.3 Water quality within the canal and coastal areas

Background water samples should be taken prior to the commencement of any work on site. Results of the pre-construction water quality sample should be used to establish a pre-construction baseline, as agreed with DECR. Samples should again be taken within 15 days of the completion of major site works. Thereafter, water quality samples should be taken seasonally, four times per year following standard protocols. The duration of testing should be agreed upon between DECR and the developers.

Parameters to be tested include:

- BOD, TSS, Total and faecal Coliform, pH, DO, Salinity, Temperature, Oil, Grease, Copper, Tin, Lead, Zinc, and Mercury
- Ultra-low levels of Ammonia, Nitrate/Nitrite as N, Nitrate as N, Orthophosphate as P, Total Phosphorous as P, and Chlorophyll a,b.

6.3 Field team for monitoring

Monitoring should be performed by experienced environmental professionals, and/or in coordination with suitably trained individuals. To the extent feasible and desirable, it is recommended that Sail Rock work with the School for Field Studies, through whom, the monitoring could be done in a fiscally prudent manner, provided there is long-term oversight to ensure that field monitors are adequately trained, and data are collected consistently.

The entire monitoring program will take place under the management of the lead consultant (Caribbean Environmental Design Associates). Local personnel from

South Caicos will be trained to conduct ongoing monitoring during the post-construction phase.

6.4 Government oversight

The environmental monitoring program shall be approved by TCIG-DECR and subjected to routine reporting. A shared Excel file containing measured results will be created and recipients of the file will include DECR, DoP, and the proponents of the development. The responsibility for oversight of the development lies with government agencies, particularly, the Department of Planning, the Department of Environment and Coastal Resources, and the District Commissioner's Office in South Caicos. The developers should support and facilitate all oversight exercises. In addition to monitoring programs detailed in this section, the next section will include mitigation measures to address the identified impacts.

VII MITIGATION

7.0 Mitigation

The mitigation measures outlined in the Environmental Management Plan included a project specific water quality monitoring program that covers the pre-construction, construction, and post-construction phases of the proposed development. A critical aspect of the proposed mitigation plan involves the establishment of coastal barriers at the inlet and outlet of the canal system. The coastal plugs are to remain in place during the construction phase and will be removed only after satisfactory monitoring measurements are consistent with pre-construction levels.

Potential activities that could be considered to minimize and/or offset ecological impacts could include:

1. Micro-siting the alignment of the canal to the west in the vicinity of the seasonal pond that apparently provides valuable habitat for a variety of resident and migratory waterfowl, shorebirds, hummingbirds, thick-billed vireos, and other species. Re-aligning the canal to the west to avoid the pond and a minimum 100-foot buffer around the pond would protect this feature.

2. In other areas in the vicinity of the proposed canal, naturally occurring vegetative communities have been previously impacted. To the extent practicable, the canal should be re-aligned so that canal excavation occurs primarily in previously impacted areas rather than the mature Forest, Upland Broadleaf Mixed Evergreen/Drought Deciduous community that is present near the western base of the slope from the high coastal ridge.

3. Minimally motile organisms (e.g., *Cerion* and *Hemitrochus* snails) should be salvaged and relocated to suitable off-site receiver locations prior to land clearing.

4. While donkeys are a resource of historical/cultural significance, their presence has had and continues to have an adverse impact on native floral communities. It is recommended that Sail Rock actively become engaged with the TCSPCA in its efforts to limit the expansion of the donkey population.

It is recommended that a portion of the property be fenced, to prevent property-wide grazing of free-roaming donkeys. Working with the School for Field Studies or instituting a Sail Rock-funded programme to monitor the extent to which vegetative communities change over time in areas where donkeys are excluded could provide valuable insight into the potential advantages (and techniques) for expanding this initiative to other areas. This insight could be helpful as future phases of the Sail Rock project are proposed.

5. Field monitoring should be conducted to avoid impacts to nesting birds during land clearing, as follows: Clearing of raw land should be scheduled to avoid the period during which species of birds that are designated as "Protected" by the TCIG would potentially have eggs or hatchlings that are not capable of sustained flight, which is typically annually from April 1 through June 30. Site clearing could take place during this period if: a) It has begun prior to April 1, and has been in continuous operation since its onset, or; b) Field surveys are performed within areas to be cleared and it is determined that no active nests (i.e., nests with eggs or chicks that are not capable of sustained flight) are present in the area to be cleared) and/or c) Temporary protection areas are established around active nests in a size that is large enough that the land-clearing will not result in the mortality/failure of the parent bird, eggs, or nestlings.
6. As described in the Monitoring section above, presently no invasive pest plants were observed within the Assessment Area. The extensive land clearing that is proposed has the potential to create scarified conditions into which invasive species could colonize and become established. It is recommended that field monitoring be conducted at least annually to identify the extent to which invasive species are becoming established and that an invasive species control programmed be established and implemented if invasive species are identified on the site.
7. Educational materials notifying future residents and guests of the presence of species of notable plants and that the collection and transport of endemic, endangered, and/or threatened species is prohibited should be developed.
8. Coordination with the landscape team should take place to ensure that no ornamental species that are on the list of invasive plants are introduced onto the property.
9. The results of bird surveys should be provided to DECR and posted online for access by other researchers and interested members of the public.

10. It is likely that flotsam, jetsam and/or other solid waste or debris will find its way into the canal. Periodic clean-ups should be scheduled and undertaken to remove any of this material that may accumulate in the canal and/or along its shoreline; and
11. Accumulations of drift *Sargassum* has become an increasingly problematic phenomenon in recent years. Sail Rock should engage its engineering team to develop a proactive response plan to ensure that an ecologically sensitive programme can be implemented if *Sargassum* is drawn into the canal to such an extent that it becomes problematic.
12. It is possible that, even with the implementation of these monitoring and mitigation activities, the project will result in unavoidable impacts on birds and the localized ecology. In accordance with recommendations contained in the National Physical Sustainable Development Plan (NPSDP), it is recommended that Sail Rock partner with the TCIG and others rehabilitate the Salina, seek opportunities to create aquaculture and hydroponics facilities, and/or create native plant nurseries.
13. Due to concerns about potential future impacts to environmentally sensitive resources, it is not recommended that Sail Rock participate in constructing the bridge or causeway to the north (which is included in NPSDP).

Floral Diversity

The ecological assessment that was competed as part of the Environmental Impact Assessment process at this site revealed the presence of populations of eighteen species of plants that are notable for their inclusion on the TCIG's lists of Endemic Plants, Lucayan Archipelago Endemics and/or Native Plants of Special Conservation Concern (See Table 3). While it is recognized that individuals of several of these species may not transplant table due to their unique biology, other species can be salvaged and/or relocated with a comparatively high level of success and confidence. Activities that should be considered to further reduce impacts include:

14. Salvaging all individuals of all native orchids prior to undertaking any future land clearing activities.
15. Salvaging all individuals of all native *Tillandsia* air plants prior to undertaking any land clearing activities.

16. Working with landscaping and native plant professionals to assess the individual biology of the other plant species identified in Table 3 to determine the extent to which they can be salvaged and/or transplanted with a high enough expectation of success that a plant salvage undertaking would be practical.

17. Developing and implementing a program to relocate all notable plants, including the identification of a location and procedure for temporary relocation of floral species that could be removed from the site prior to land clearing, and moved into disturbed areas the site.

18. Ensuring that additional ecological mapping of the location of notable plants be performed to prepare for the relocation of individuals of notable plant species prior to continuing land clearing in areas of natural vegetation.

19. Schedule the clearing of vegetation to avoid be performed during the bird nesting season, ensure that no active nests (i.e., nests with eggs or young incapable of sustained flight) will be damaged or destroyed; and

20. A biological monitoring program be developed and implemented such that monitoring for invasive species is completed not less than quarterly, and that protocols are implemented to ensure that invasive pest plants do not become re-established on the site and that the uses of chemicals (e.g., herbicides, pesticides, rodenticides, fertilizers etc.) be prohibited.

Marine Fisheries

Individuals who are knowledgeable about long-term trends in populations of bonefish and other marine resources have expressed concern about declines in the fishery based on human-related activities, which include both legal netting and illegal fish netting. Because the proposed canal construction and dock installation (and future increases in recreational use) are unlikely to have any positive effects on the marine environment, it is recommended that off-site mitigation be performed. Sail Rock should increase their involvement with DECR, the Bonefish and Tarpon Trust, and local bonefish advocates to:

a) regulations,

b) Include scientific monitoring to determine and document if bonefish spawning aggregations occur in waters adjacent to South Caicos, and if they do, implement protocols to protect this fisher during critical times of their life cycle.

c) Provide financial assistance to increase enforcement of laws, rules, and regulations that protect fisheries in the South Caicos area, including the cays to the north; and

d) Implement recommendations that may result from current and/or ongoing marine fisheries studies.

7.1 Proposed actions to mitigate any environmental impacts.

The method for building the proposed channel will likely involve relatively standard practices of construction. For the potential impacts identified, regardless of their nature, appropriate mitigation measures have been proposed. These mitigation measures involve known techniques related to the relocating of resources, the use of silt screens (turbidity barriers), and visual inspections. The proposed construction methodology including recommended mitigation measures is outlined below.

- To minimize possible major impacts on the benthos in the marine environment, a thorough benthic survey will be conducted within the footprint and general proximity of the proposed seafloor dredging. Should there be any coral and/or seagrass found in this area, it will be transplanted if it is believed that it will be directly impacted by the machinery and their construction. Any benthos of significance within the footprint of the proposed works will be identified, mapped, and relocated prior to the execution of the works.
- An acceptable form of turbidity control will be installed and maintained to prevent/control silt entering the water column; these controls will always remain in place during the cutting of the proposed channel near the sea and dredging of the foreshore at the channel entrances. At any point in time when turbidity readings exceed the stipulated NTU values, works should stop until adequate silt screens are implemented, and turbidity plumes are controlled.
- Excavation of the channel within the South Caicos mainland should be completed before the channel entrances are opened to reduce the impact of the tides on construction and to prevent turbid waters from escaping into the nearshore.

- The excavation can be done onsite using mainly conventional land-based equipment such as loaders, excavators, and cranes. The local armour stones/core material for the bank stabilization structures can be stockpiled at locations on land within the project site. The stones should be washed before reaching the stockpile location to minimize the introduction of silt or debris to the marine environment.
- All the equipment being used will be maintained regularly to avoid any mechanical failures and to prevent oil leaks/spillage into the sea due to broken seals and hoses. There will be no fuelling of equipment near the water and absorbent pads will be implemented to deal with oil spills.
- The packing of armour stones in the canal stabilization is recommended to be done such that each boulder is in contact with two or three other boulders. The voids between the boulders can be left as voids and not filled with smaller rocks. It is critical to the structural stability of the structures that the specified range of boulders be used and that they are packed and shaped to the specified design slope of 1:2.5 based on the client-provided drawings.
- Access to the area to be dredged at the north channel entrance can be created using a low-crested temporary construction pad added over the water section; the temporary construction pads will be completely removed once the dredging is completed.
- Specific physical, chemical, and structural laboratory tests will be required for the stone material that will be used in the canal stabilization structures. Once an appropriate quarry is located, the required numbers and sizes of stones can be sourced and stockpiled. It is imperative that the quarries selected for use in boulder supply be inspected to ensure that they are certified to operate and are operating in a reliable and safe manner.

Potential Impacts on Marine Environment

An impact is defined as any change to the existing condition of the environment arising from project implementation. Impacts may arise during two phases of project implementation: (1) construction/short-term maintenance and (2) post-construction (operation). Understanding the nature of the impact can be assisted by categorizing the effect of the potential impact as being either:

- Positive or negative,
- Reversible or irreversible,
- Of short or long duration,
- Of small or large magnitude, and
- Being local or wide in extent.

Where the effect of an impact is negative, consideration should be given to implementing mitigation measures. It is important to design mitigation measures carefully so that potential negative impacts are minimized as much as possible so that any damage to the environment is reduced. Mitigation measures are especially important when the nature of the impact has been identified as being irreversible, being of long duration, or being of large magnitude, or where the expression is likely to be wide in extent.

This environmental impact assessment was designed with the following objectives:

- to assess the impact of construction on the surrounding marine environment, and
- to propose mitigation measures to minimize the impact of the proposed work.
- A summary of the potential negative impacts and the proposed mitigation measures is presented in Table 20.

Table 20: Potential impacts of construction activities

Potential Negative Impact	Duration		Magnitude		Extent	
	Long	Short	Large	Small	Wide	Local
Physical damage: impacts on slow-moving and sedentary intertidal and subtidal flora and fauna within the footprint and nearshore.		X		X		X
Loss of habitat/ biodiversity: death of benthos	X			X		X
Turbidity/ Smothering: sedimentation leads to the smothering of sensitive resources near the work sites.		X		X		X
Oil Pollution: fuel spills from boat engines and dredging equipment		X		X		X
Debris: construction debris becomes a damaging projectile when moved by waves.		X		X		X

The project could have low to moderate environmental effects depending on the results of the benthic survey in the footprint of the proposed dredged area. Works are likely to cause some short-term increases in suspended sediment concentrations, and turbidity barriers will be installed around the area of work to control this. Some species may experience additional risks due to increased turbidity, an increased risk of pollution during work, and habitat damage due to the dredging of the sea floor. With adherence to mitigation measures and monitoring procedures, potentially adverse impacts can be minimized, avoided, or compensated for. The impacts and mitigations are further discussed below.

Smothering: There is potential for *smothering* of benthic resources during the construction period. There is a risk of covering the benthos with material (temporary or permanent) such as dredged material, boulders, or temporary construction pads. Temporary smothering could also occur through the passage of heavy machinery over sensitive areas during the construction process. The nearshore area close to the proposed dredging footprint is at particular risk in this instance. To mitigate these risks, the benthic resources within the footprint of the structure should be relocated prior to construction.

***Turbidity*:** There is a great potential for disturbances as they relate to the *turbidity* of the water column. The direct excavation of the sea floor, the deployment and removal of construction pads, and the natural flushing of the channel during and shortly after construction will all generate turbidity. This turbidity can affect sensitive resources directly by smothering, or indirectly by occluding the water column in the vicinity of the construction. Turbidity management techniques (sandbags, barriers, etc.) must be used during dredging and during the installation of the temporary construction pad. This is necessary to contain the suspended sediments in the nearshore where it is desired and prevent it from moving to adjacent areas where smothering could occur. In addition, a turbidity meter will be used to measure the turbidity outside of the construction area to ensure that the turbidity readings are within the acceptable range as specified in the licenses.

***Oil Pollution*:** There is also the potential for oil pollution stemming from fuel leaks or spills from equipment used for the dredging of the foreshore, canal stabilizing works, and inland excavation during refuelling or operation.

The refuelling of the heavy machinery should be done on land. Appropriate refuelling equipment (such as funnels) and techniques should be always used. There should be appropriate minor spill response equipment (for containment and clean-up) kept on hand.

Loss of habitat/ biodiversity: A direct impact of the works proposed at the site is the loss of the animals and plants living on and in the seabed substrate, as well as the loss of ecological function when the substrate is removed/smothered. The loss of these animals and plants could include a related disruption of the trophic web.

- As a mitigation solution to this problem, where possible, sensitive resources (e.g. corals) will be relocated to appropriate sites. Invertebrates (particularly Echinoderms – sea urchins, starfish, etc.) must be relocated immediately before (morning of) excavation/construction work begins to prevent them from re-occupying the space during construction.

- For those resources that cannot be suitably relocated, an appropriate compensation mechanism will be devised. As a compensation method, the submerged portions of protective structures themselves used in the channel stabilization can serve as an excellent fish and coral habitat for increasing biodiversity in the area. Observations recorded in the field demonstrate how, within just a few years from implementation, submerged boulders can develop in fish abundance, richness, and structure aging characteristics that are comparable to that of natural coral reefs. Fish and invertebrates of all demographic stages have used these submerged boulders as habitat, and coral and other species such as gorgonians and sponges have used them for recruitment. The structures also encourage coral recruitment where the availability of uncovered hard-bottom habitat is a limiting factor, which is typical given the sandy foreshore of western South Caicos. Overall, the presence of the channel will introduce approximately 300,000m^2 of new seafloor for fishes, corals, and other types of marine flora and fauna to shelter, reproduce and inhabit.

7.2 Storm Surge and extreme wave analysis

A tropical cyclone is classified as a hurricane only after it has attained one-minute maximum sustained near-surface (10m above ground level) winds of 33m/s or more. Below this, these cyclones are referred to as tropical storms. The Saffir-Simpson Scale is commonly used to classify hurricanes into five groups (Categories 1 through 5) based on the maximum wind speed attained.

During a hurricane, elevated water levels associated with the inverse barometric rise (IBR) are destructive, causing flooding and damage to coastal infrastructure. Storm surge is commonly defined as the rise in water surface elevation of the sea above its mean level. The static storm surge is made up of five major components, namely:

1. Inverse Barometric Rise (IBR), (caused by low pressure)
2. Highest Astronomical Tide (HAT),
3. Global Sea Level Rise (GSLR),
4. Wind Setup (when winds push water up onto the land), and
5. Wave Setup (caused by wave breaking).

The Turks and Caicos Islands, like most of its Caribbean neighbours, lie directly in 'Hurricane Alley', an area of water in the Atlantic Ocean within which hurricanes typically form because of the warmer sea surface temperatures there. Figure 32 shows the historical paths of hurricanes in the North Atlantic basin, which tend to form between latitudes 5°N and 25°N off the west coast of Africa and then track across the Atlantic Ocean. Those formed at the lower latitudes are usually pushed on a westerly track by the north-east Trade Winds, whereas those of the higher latitudes track more to the north and north-west.

Extreme waves occur infrequently at any given location, and decades or centuries of data must be explored to adequately describe the statistics of these rare events. For the Atlantic Ocean, detailed information on tropical cyclones, including all hurricanes, has been collected by the US National Oceanic and Atmospheric Administration (NOAA), specifically at the National Hurricane Center (NHC). This database of storm tracks and other parameters was the main source of information describing the individual storms. A detailed analysis of the historical storms and associated offshore conditions is presented in the following section.

The occurrence of tropical cyclones is difficult to predict based on short-term analysis, but the accuracy of predictions can be significantly improved by taking into consideration the historical occurrence of tropical cyclones. The method of mathematically recreating past tropical storms and hurricane occurrences to predict the intensities of future ones is called hindcasting. This was a process of hindcasting that was carried out using the HURWave program. Within this context, wave conditions are often described in terms of a return period, a statistical term expressing a low probability of occurrence that represents the average time between successive occurrences of an event being equaled or exceeded.

The severity of the design storm event (i.e., return period) is chosen in view of the acceptable level of risk of damage or failure that the developer is willing to assume. The use of a return period or *design event* such as the 1 in 50-year or 1 in 100-year, for example, essentially defines the kind of design conditions that will, on average, occur or be exceeded once every 50 years or every 100 years respectively. It is important to understand the risks and consider the chance of occurrence of a particular storm condition during the lifetime of the infrastructure so that the associated risks of damage can be understood.

Hindcasting hurricane waves and surge levels

Deep water wave parameters were calculated for each selected tropical cyclone using parametric models (Cooper, 1988; Young and Burchell, 1996). The resulting wave conditions were segmented into directional sectors and fit to a statistical function describing their exceedance probability. The wave parameter values for the 50-year and 100-year return periods were determined from the best-fit statistical distribution. The deep-water wave parameters corresponding to the various return periods were computed for five directional sectors of incidence. Table 21 shows the wave heights, wind speeds, and periods for the directional sectors investigated. The highest waves come from the eastern sector with wave heights of almost 12m for the 50-year storm. Although the hurricane waves coming from the east had the largest wave heights and longest wave periods, the highest winds came from the northeast.

Table 21: Wave Parameters (significant wave height and peak period) and wind conditions used for the 50-year AND 100-year return period simulations

Directional Sector	Parameters	Return Period (-year)	Return Period (-year)
		50	100
SOUTH	Hs	8.12	8.94
	Tp	12.35	13.11
	Vm	33.83	37.71
SOUTH-EAST	Hs	9.11	10.20
	Tp	13.27	14.25
	Vm	36.86	41.78
NORTH	Hs	6.11	6.83
	Tp	10.32	11.08
	Vm	30.17	33.89
NORTH- EAST	Hs	8.08	9.07
	Tp	12.31	13.24
	Vm	37.16	41.19
EAST	Hs	9.37	10.64
	Tp	13.52	14.63
	Vm	37.63	43.32

To compute the total static storm surge level in deep water, global sea level rise (GSLR) for the projected year and the highest astronomical tide were added to the IBR values. The results for the 50-year and 100-year surface level values are listed in Table 22.

Table 22: IBR and design deep water surface level (m) for return periods of 50 and 100 years

Parameter	Return Period (-years)		Notes
	50	100	
IBR (m)	0.41	0.51	Determined through statistical hind-casting analysis
Highest Astronomical Tide (m)	0.55		Determined through historical analysis
Rate of Sea Level Rise (mm/year)	15		Scenario value from IPCC research
Design Life (years)	50	100	The period over which the sea level rise occurs (not related to design storm return period)
Design Deep Water Surface Level (m)	**1.71**	**2.56**	Sum of IBR, Highest Astronomical Tide, and Sea Level for 25 years.

Table 23 below gives the exposure risk (probability) over a project life span for different return periods events. For example, within the next 50 years (project life span), there is an 87% chance that the 1 in the 25-year event will occur, a 64% chance that a 1 in 50-year event will occur and a 39% chance that a 1 in 100-year storm event will occur.

Table 23: Exposure risks (%) over a project life span (blue) for different return periods (green)

Storm Event Return Period (years)	Design Life (years)			
	25	50	100	200
10	93%	99%	100%	100%
25	64%	87%	98%	100%
50	40%	64%	87%	98%
100	22%	39%	63%	87%
200	12%	22%	39%	63%
500	5%	10%	18%	33%

The coupling of hydrodynamics and waves in the numerical model is an important aspect of storm surge computations, particularly in areas such as the Caribbean where wave set-up is a significant component of the total storm surge. As large waves approach shallow water or a reef and break, the water level is increased, causing localized currents. These currents and changing water levels affect the waves by allowing them to travel farther inland. The coupling of the waves and currents in MIKE 21 allow these factors to be properly simulated. Using the conditions for the extreme wave climate as listed above, the model was set to run and the maximum conditions near the shoreline were extracted.

The maximum wave heights and storm surges resulting from the 50-year and 100-year return periods are plotted in Figure 95 and Figure 96. Results indicate that in the 50-year return period hurricane the entire eastern shoreline is vulnerable to large wave heights (up to 1.5m) in the nearshore and is entirely flooded with inundation up to 2.2m (excluding wave run-up). The western shoreline of the project area on the other hand experiences much smaller wave action with waves up to 0.25m in height and inundation levels of up to 2.0m. This storm surge level results in flooding of the lots surrounding the lagoon and those along the northern roadway. It is recommended that these areas are at least raised above +2.5m MSL to mitigate a 50-year return period event.

Like the 50-year return period storm, the 100-year return period storm also sees a variation in extreme conditions from the east coast to the west coast. Under a 100-year return period event, the entire eastern shoreline is vulnerable to large wave heights (up to 2.1m) in the nearshore and is entirely flooded with inundation up to 3.3m (excluding wave run-up). The western shoreline of the project area on the other hand experiences much smaller wave action with waves up to 0.38m in height and inundation levels of up to 2.92m. This storm surge level results in flooding of the lots surrounding the lagoon, the northern roadway, and a few of the lots on the northeast of the proposed development. It is recommended that these areas are raised above +3.6m MSL to mitigate a 100-year return period event. It is also recommended that an armoured retaining structure such as a revetment be installed along areas being breached by storm surge; this structure should be designed to a crest elevation above the storm surge level it is designed to withstand.

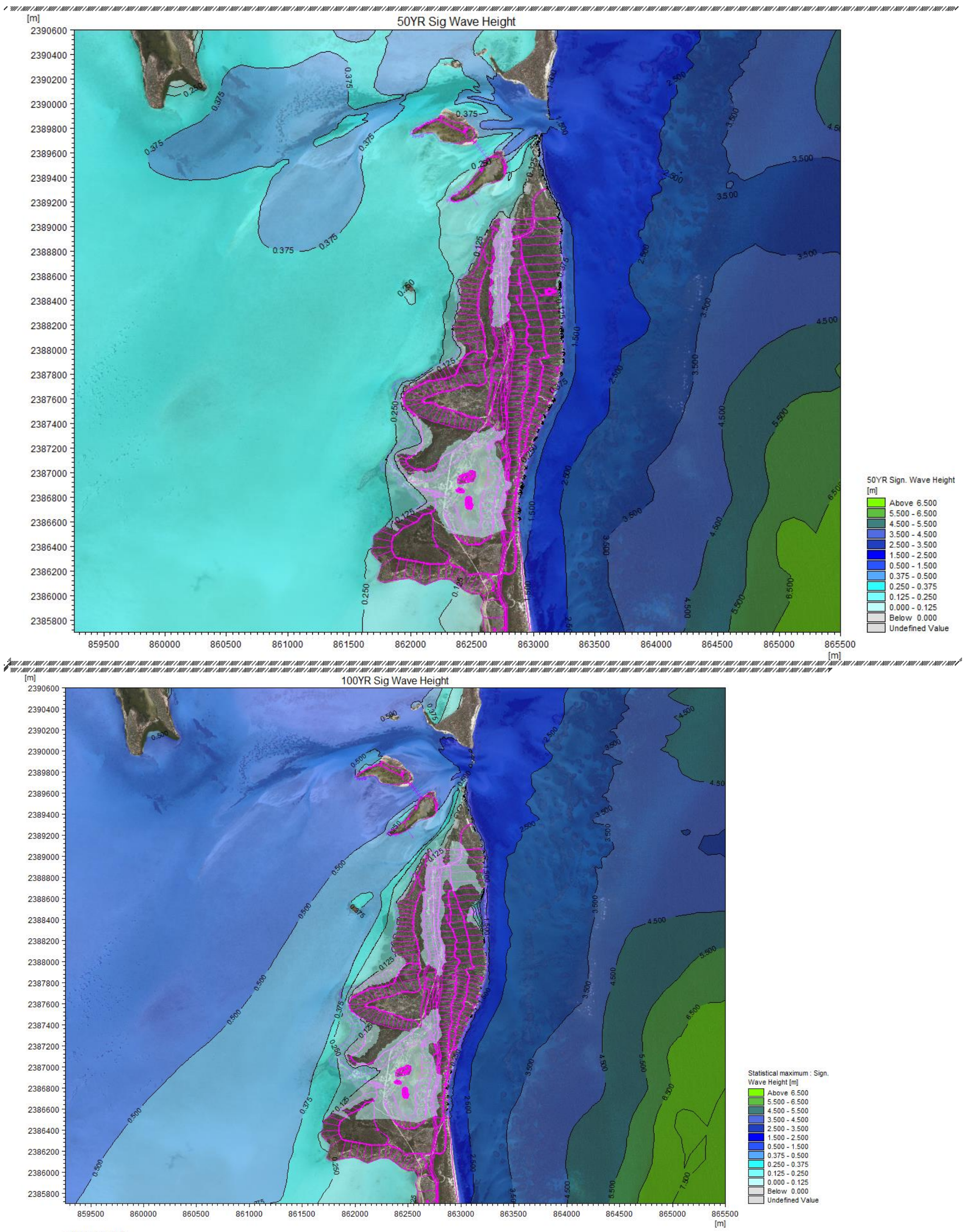


Figure 95: 50-year Significant Wave Height at project shoreline (top plot) and 100-year Significant Wave Height at project shoreline (bottom plot)

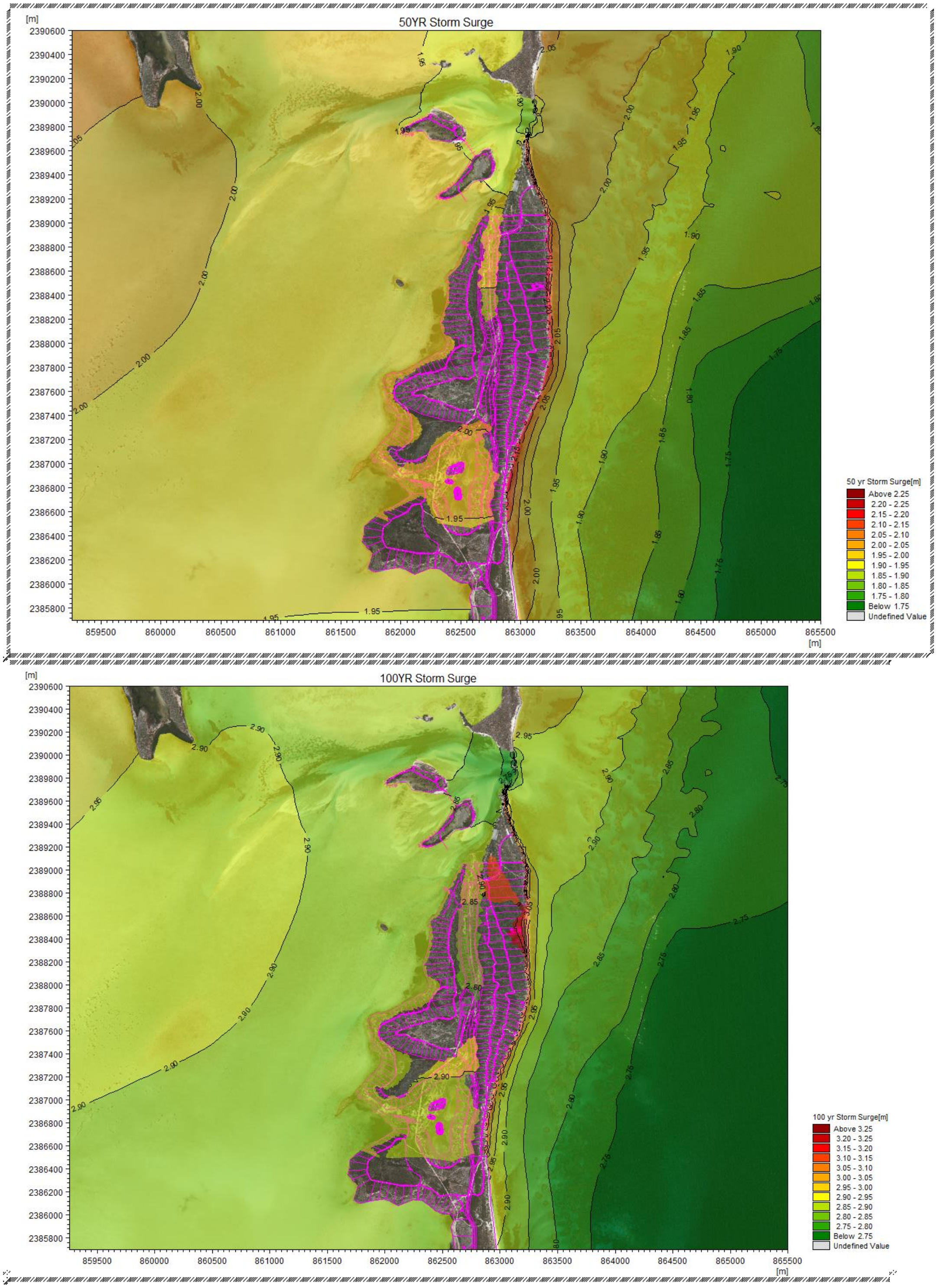


Figure 96: 50-year storm surge inundation at project shoreline (top plot) and 100 year storm surge inundation at project shoreline (bottom plot)

7.3 A summary of financial and economic values for mitigation

Impacts of the proposed dredging operation for the Sail Rock peninsula lagoon basin, canal, entrance channel and boat docks can be divided into project impacts and process impacts. Project impacts are associated with project design and mitigation of project impacts is firmly rooted in the Planning and Environmental Impact Assessment processes. Process impacts are associated with the actual dredging process and the mitigation of these impacts is the effective management of the dredging process.

The coastal marine environment, particularly, coral reef ecosystems in the Turks and Caicos Islands are vulnerable environmental resources that provide significant economic goods and services to the economy. The health of these ecosystems is critical to human well-being; they contribute to the livelihoods, food security and health of local people. The Sail Rock anchor development on South Caicos benefits directly from the marine ecosystem. The entire development concept is based on a low-density eco-system principle and the environment is the magnet that draws guests to the development and the island. Therefore, it is imperative that the developers take due care of the environment during the proposed dredging and excavation operations.

The end results, the blue water lagoon basin will be an added blue water resource on South Caicos that will assist South Caicos and the Turks and Caicos Islands to significantly benefit from the "Blue Economy".

The mitigation measures will be at the full expense of the proponents of the development. The economic cost for the implementation of the proposed mitigation measures will be on the order of approximately $10,000.00 per year. This financial contribution goes a long way to safeguard the integrity of the adjacent Bell Sound Nature Reserve.

Several mitigation measures aimed minimizing the impact of the proposed dredging and excavation on both the marine and terrestrial environs will have financial cost to the developers and economic value to the process, they are:

- The installation of turbidity curtains at the mouth of the entrance channels will contain turbidity and sediment levels which will help reduced the impact on the marine environment.

- Water quality testing is another direct cost on the developers.

- Installation of navigational aids and navigational lights are essential for the safe operation of the area during the dredging of the entrance channels.

- A safeguard issued under the dredging license requirements specified that the Contractor shall obtain (at its own cost) a Performance Bond in the amount of Five Hundred Thousand Dollars (**US$500,000.00**) to cover any environmental damage or remedial works/cost related to non-compliance of the terms and conditions of the Licence.

- The beach-quality sand dredged from the dredging operation will be source of sand for beach creation in other specified areas.

7.4 Risk prevention mechanisms or activities and a schedule and proposed budget to avoid the occurrence of a negative impact and/or control measures.

Environmental Risk Assessments (ERA) is applied to address a particular human or ecological impact identified in the EIA. These impacts could arise because of a particular contaminant or a particular receptor. They are particularly relevant to dredging projects because of the complexity of the effects and the chain reactions that could ensue from the activity. For dredging projects ERA tends to focus on the impacts arising from chemical contaminants found in the dredged material. This could include metals such as Mercury, cadmium, copper, lead, zinc, or Polychlorinated bipheryls (PCBP), pesticides, dioxins and/or furans[1]. These contaminants are prevalent in enclosed areas such as marinas and bays where there is limited flushing and consequentially an accumulation of silt.

As previously noted, benthic floral and faunal resources will not suffer direct impacts from the dredging and excavation works. The primary impact will result from the resuspension of sediment in the water column. However, as previously assessed, these sediments do not contain any of the metals and other contaminants listed above.

As a risk prevention mechanism and to minimize the occurrence of negative impacts, recommendations for best dredging and excavation methodologies must also be strictly followed. Also, the Environmental Monitoring Plan should be adhered to. This entails the implementation of water quality testing during dredging; and pre and post biological and hydrodynamic surveys. If any insignificant changes are observed in data, dredging should be suspended, and an alternative approach devised.

7.5 *Involvement of key stakeholders in a public consultation process. Describe methods and information to be discussed.*

Key stakeholders have been invited to in-person meetings designed to gather feedback and views about the proposed project. Additionally, the public will be invited to an open meeting to voice their support for or position against the proposed development. In general, public and private feedback indicates strong support for the development since it seeks to revitalize the economy of South Caicos.

Discussions took place with local South Caicos residents and others who are knowledgeable about the site, to identify specific natural resources of concern, such that field assessments could be focused on notable floral and faunal species. Individuals who were consulted on landside resources included Perla “Gwen” Pierre (plants), Stanley Jennings (bush medicine), Susan Blehr (local free-roaming donkeys), Dr. Michael Pienkowski (Chairman, UK Overseas Territories Conservation Forum) and his wife/colleague Ann, Marian Jayne and Michael Tibbetts (birds), Heidi Hertler (Director, School for Field Studies), and residents knowledgeable about bonefish, including Captain Bebo Jayne and Brandon Maharaj, and others. The Environmental Management Plan which in accordance with the ToR should form the next section, but it will be submitted separately.

VIII ENVIRONMENTAL MANAGEMENT PLAN

8.0 *An Environmental Management Plan (EMP) must be prepared with the following minimum components.*

The Environmental Management Plan (EMP) in support of the proposed blue lagoon basin, peninsula canal system, entrance channels, and boat docks are prepared, but is submitted separately. According to the ToR the EMP is prepared considering the prescribed minimum components:

- *A summary of the potential impacts of the proposal*
- *Description of the recommended mitigation measures*
- *Statement of their compliance with relevant standards*
- *Allocations of resources and responsibilities for the plan implementation*
- *Schedule of the actions to be taken*
- *Program for surveillance, monitoring, and auditing*
- *Contingency Plan when impacts are greater than expected.*

The recommendations and conclusions are included in the next section.

SECTION IX RECOMMENDATION AND CONCLUSIONS

9.0 *Recommendations and Conclusions*

Numerous Recommendations have been provided in the Monitoring and Mitigation sections for ensuring that unacceptable ecological impacts do not occur. These recommendations include:

1. Micro-site the alignment of the canal to the west in the vicinity of the seasonal pond that apparently provides valuable habitat for a variety of resident and migratory waterfowl, shorebirds, hummingbirds, thick-billed vireos, and other species. Re-aligning the canal to the west to avoid the pond and a minimum 100-foot buffer around the pond would protect this feature.

2. Re-align the canal such that canal excavation occurs primarily in previously impacted areas rather than mature Mixed Evergreen/Drought Deciduous Forest.

3. Salvage and relocate minimally motile organisms (e.g., *Cerion* and *Hemitrochus* snails) to suitable off-site receiver locations prior to land clearing.

4. Become engaged with the TCSPCA in their efforts to limit the expansion of the donkey population.

5. Consider installing fencing and/or "cattle guards" to prevent property-wide grazing of free-roaming donkeys. Working with the School for Field Studies or instituting a Sail Rock-funded program to monitor the extent to which vegetative communities change over time in areas where donkeys are excluded could provide valuable insight into the potential advantages (and techniques) for expanding this initiative to other areas.

6. Conduct field monitoring to avoid impacts to nesting birds during land clearing, as follows: Clearing of raw land should be scheduled to avoid the period during which species of birds that are designated as "Protected" by the TCIG would potentially have eggs or hatchlings that are not capable of sustained flight, which is typically annually from April 1 through June 30. Site clearing could take place during this period if: a) It has begun prior to April 1, and has been in continuous

operation since its onset, or ; b) Field surveys are performed within areas to be cleared and it is determined that no active nests (i.e., nests with eggs or chicks that are not capable of sustained flight) are present in the area to be cleared) and/or c) Temporary protection areas are established around active nests in a size that is large enough that the land-clearing will not result in the mortality/failure of the parent bird, eggs, or nestlings.

7. Conduct field monitoring at least annually to identify the extent to which invasive species are becoming established and ensure that a site-specific invasive species control programmed is established and implemented if invasive species are identified on the site.

8. Develop, distribute, and/or post educational materials notifying future residents and guests of the presence of species of notable plants and that the collection and transport of endemic, endangered, and/or threatened species is prohibited.

9. Coordinate with the landscape team to ensure that no ornamental plant species that are on the TCIG's list of invasive plants are introduced onto the property.

10. Provide the results of bird surveys to DECR and post them online for access by other researchers and interested members of the public.

11. Schedule and undertake periodic clean-ups to remove any flotsam, jetsam, and/or other debris that may accumulate in the canal and/or along its shoreline.

12. Engage the Sali Rock engineering team to develop a proactive response plan to ensure that an ecologically sensitive programme can be implemented if *Sargassum* is drawn into the canal to such an extent that it becomes problematic.

13. It is possible that, even with the implementation of these monitoring and mitigation activities, the project will result in unavoidable impacts on birds and the localized ecology. In accordance with recommendations contained in the National Physical Sustainable Development Plan (NPSDP), it is recommended that Sail Rock partner with the TCIG and others to rehabilitate the Salina, seek opportunities to

create aquaculture and hydroponics facilities, and/or create native plant nurseries.

14. Due to concerns about potential future impacts to environmentally sensitive resources, it is not recommended that Sail Rock participate in constructing the bridge or causeway to the north (which is included in NPSDP).

15. The ecological assessment that was competed as part of the Environmental Impact Assessment process at this site revealed the presence of populations of eighteen species of plants that are notable for their inclusion on the TCIG's lists of Endemic Plants, Lucayan Archipelago Endemics and/or Native Plants of Special Conservation Concern (See Table 5). While it is recognized that individuals of several of these species may not transplantable due to their unique biology, other species can be salvaged and/or relocated with a comparatively high level of success and confidence. Activities that should be considered to further reduce impacts include:

16. Individuals of all native orchids should be salvaged and relocated to suitable receiver areas prior to undertaking any future land clearing activities.

17. Individuals of all native *Tillandsia* air plants should be salvaged and relocated to appropriate receiver sites prior to undertaking any land clearing activities.

18. Sail Rock should work with landscaping and native plant professionals to assess the individual biology of the other plant species identified in Table 3 to determine the extent to which they can be salvaged and/or transplanted with a high enough expectation of success that a plant salvage undertaking would be practical.

19. Sail Rock should develop and implement a programme to relocate all notable plants, including the identification of a location and procedure for temporary relocation of floral species that could be removed from the site prior to land clearing, and moved into disturbed areas the site.

20. Ecological mapping of the location of notable plants should be performed to prepare for relocation of individuals of notable plant species prior to continuing land clearing in areas of natural vegetation.

21. The clearing of vegetation should be scheduled to avoid being performed during the bird nesting season, to ensure that no active nests (i.e., nests with eggs or young incapable of sustained flight) will be damaged or destroyed; and

22. A biological monitoring programme should be developed and implemented such that monitoring for invasive species is completed not less than quarterly, and that protocols are implemented to ensure that invasive pest plants do not become re-established on the site and that the uses of chemicals (e.g., herbicides, pesticides, rodenticides, fertilizers etc.) be prohibited.

Regarding Marine Fisheries

23. Sail Rock should increase their involvement with DECR, the Bonefish and Tarpon Trust, and local bonefish advocates to:

a. Develop and implement science-based refinements of local fishery regulations,
b. Include scientific monitoring to determine and document if bonefish spawning aggregations occur in waters adjacent to South Caicos, and if they do, implement protocols to protect this fisher during critical times of their life cycle.
c. Provide financial assistance to increase enforcement of laws, rules and regulations that protect fisheries in the South Caicos area, including the cays to the north; and
d. Implement recommendations that may result from current and/or on-going marine fisheries studies.

24. Micro-site the north canal connection to tidal waters at a location that avoids or minimizes impacts to tidal mangroves.

25. Micro-site the south canal connection to Bell Sound at a location that minimizes impacts to tidal mangroves.

26. Turbidity curtains to be place across the openings of the inlet and outlet channels to further contain potential turbidity plumes during the removal of the coastal plugs.

27. The frequency of monitoring to be 3 times daily during the coastal plug removal exercise

28. The bottom substrate of the canal system and marina basin to be vacuumed to remove fines created during the construction phase.

29. Overall, the impacts on coastal processes (waves, currents, sediment transport) are post-construction impacts of small magnitude in time and space and localized to the footprint of the channel and dredging area. It is recommended that the dredging and protective structures be built according to the technical specifications issued by a licensed coastal engineer.

30. The storm surge study indicates flooding of the lots surrounding the lagoon and those along the northern roadway under the 50-year return period storm, with the additional flooding of low-lying areas to the northeast of the Sail Rock property under the 100-year return period storm. It is recommended that these areas are at least raised above +2.5m MSL to mitigate a 50-year return period event and above +3.6m MSL to mitigate a 100-year return period event. It is also recommended that an armoured retaining structure such as revetment (with armour stone size determined by an engineer) be installed along areas being breached by storm surge. This structure can be aligned at critical breach points such as the flooded area to the northeast and should have a crest elevation above the storm surge level it is designed to withstand.

31. The identified environmental impacts were found to occur mostly during the construction phase of the project. They were found to be of small magnitude and likely to be expressed only in the vicinity of the proposed channel entrances. It is recommended that the mitigation measures listed above to be followed to reduce smothering, turbidity, and oil pollution both during and after the construction phase of the project.

32. Environmental impacts, including the loss of habitat and biodiversity, were found to be of long duration, particularly if endangered flora and fauna are found occupying areas to be dredged. Additional mitigation is to provide compensation from the newly created seafloor and protective structures lining

the banks of the canal. The proposed channel was found to have minimal impacts on the nearshore waves, currents, and sediment transport. The original channel design is deemed to have moderate circulation and flushing capabilities during worst-case tidal conditions. The alternative design discussed in the section was deemed to have good circulation. As such, it is expected that the proposed channel will promote the proliferation of a diversity of species within its banks, however, it is recommended that runoff and sewage are directed away from the channel and that water quality is monitored regularly for health and safety reasons.

Conclusions

Provided the recommendations identified in the Monitoring, Mitigation and Recommendations are implemented, the creation of the canal and construction and use of the docks can likely be performed without causing unacceptable ecological impacts to the landside and marine environment.

Limestone is the dominant geology of the project site.

The footprint of the inland canal system and shallow marina basin is well situated within a topographic trough.

The potable freshwater lens does not occur within the footprint of the proposed development.

The ingress of seawater inland through the proposed canal system will not adversely impact the existing groundwater configuration.

The Appendices are also submitted separately.

SECTION X - APPENDICES

1.0 Appendices

The appendices which run from I through LIV – Schedule of Protected Flora and Fauna in the Turks and Caicos Islands and References and Literature Cited are submitted separately.