14.0 MARINE ENVIRONMENT

14.1 INTRODUCTION

This Chapter provides an assessment of the physical and ecological effects of the proposed marine facilities in Rupert's Bay. The proposed works at Rupert's Bay include both the provision of a temporary unloading facility and construction of the permanent wharf and its associated dredging, as shown on Figures 2.1 and 2.14, Volume 3 of the ES. This Chapter should be read in conjunction with Appendix 14.1 which provides more detail regarding the methods and assessment of effects.

The in-shore sea rescue facility to be based in James Bay (described in 2.3.10 of Chapter 2, Volume 2) does not require any physical development and it will not have any significant effects on the marine environment. Therefore, it has been excluded from the assessment.

The potential effects on the seascape and visual amenity of the Rupert's Bay is considered in Appendix 10, Volume 4 and Chapter 10, Volume 2 of the ES.

14.2 METHODS

14.2.1 General Approach to the Assessment

Figure 14.1 shows the location of the three aspects of the marine facilities which could have a physical impact on Rupert's Bay, both in the construction and the operational phases of the works, i.e.:

- **A permanent wharf,** some 300m long, consisting of a 120m long causeway out to the 180m long head of the jetty. Running along the eastern side of the head of the wharf will be a 40m long lighter berth (at the inshore end of the wharf) and, further from the shore, a 120m long main cargo quay. Between these two berths there will be a 15m wide fixed RO-RO ramp,
- **The temporary unloading facility.** There are two potential locations for this: either the permanent wharf in its partially completed form, or a separate facility at the western side of the bay.
- **Dredging** for the cargo quay to give water depths of at least seven metres at all states of the tide.

The assessment of the impacts on Rupert's Bay was carried out in four stages as follows:

1) The definition of the physical characteristics (waves, currents and sediments) of the Bay. The existing conditions for the physical marine environment have been based on both surveys and desk study. Surveys carried out including bathymetry and wave and current data collection. Where these characteristics may be affected, the nature of those impacts are discussed in terms of their importance and significance. The marine ecology, recreation, amenity and commercial interests of the Bay has also been taken into consideration. This has been determined by both desk study and surveys which are described in Appendix 14.1 in Volume 4 of the ES.
2) Assessment of the potential effects which could occur temporarily during construction and permanently during operation.
3) Identification of the mitigation measures which will and have been incorporated into the scheme to reduce any negative impacts

4) Description of the residual effects, i.e. prediction of the effects which are likely to occur assuming the mitigation measures are implemented.

The importance of the existing marine environment and the magnitude of possible impacts and significance of the potential residual effects has been established using the approach described in Section 14.2 of the detailed assessment for the Marine Environment, Appendix 14.1 in Volume 4 of the ES.

14.2.2 Sources of Potential Effects

The three elements of the works identified above could potentially cause impacts to the physical environment in the following ways.

- **Damage to the seabed directly** due to construction activity (e.g. excavation, spillage of construction materials)
- **Damage to the seabed due to coverage** (e.g. the permanent works in the wharf) or removal (in the dredged area)
- **Increase in turbidity resulting from release of fines** (e.g., disturbance of the seabed, spillage, washing out of fines from unprotected fill material)
- **Redistribution of sediments** (erosion and/or deposition) within the bay as a result of the impact of the temporary or permanent works on the wave climate by, e.g., reflections from the new structures, protection of parts of the bay that are currently exposed to wave action.

14.3 EXISTING CONDITIONS

14.3.1 Physical Marine Environment of Rupert's Bay

14.3.1.1 Nature of the Seabed and Coast

Figure 14.1, extracted from the Tritan Report shows the seabed depths and sediments in the bay. The majority of the seabed (shaded olive green on the figure) in the nearshore and offshore areas is shown as sands. Within some 200 to 300 metres of the shore, the bed is predominantly rocky, with the exception that at the southern corner of the bay it remains sandy to the inshore limit of the survey. This sand foreshore fronts the existing small pocket beach to the south west of the root of the proposed wharf. Figure 14.2 - Photographs 14.1 and 14.2 in Volume 3 of this ES show the existing Bay.

14.3.1.2 Tides

Characteristic tidal levels for the area, provided by Atkins, are indicated in Table 14.1.

Table 14.1 Tides

Tidal Level	Elevation (m)
Highest Astronomical Tide (HAT)	1.30
Mean High Water Springs (MHWS)	0.90
Mean Sea Level (MSL)	0.50
Mean Low Water Springs (MLWS)	0.10
Lowest Astronomical Tide (LAT)	-0.2

The Admiralty Pilot states that (off St Helena) The South Sub Tropical Current sets West throughout the year at an average rate of 1/2 knot'. Currents in the area are therefore weak.

14.3.1.3 Waves

The wave climate of St Helena is strongly influenced by the southeast trade winds. Rupert's Bay is thus on the lee shore. The following key points have been deduced from Atkins report on wave climate and the recorded data.

- The report states that '**the north western shore receives almost only swell waves**'.
- The offshore wave data confirms clearly that, offshore of St Helena, **waves from the north western sector are significantly lower than from other directions**. As a result, the significant wave height likely to be exceeded once in 100 years is estimated as 2.61m from the sector 240° to 030°, as opposed to 4.49m for all directions.
- **Waves within Rupert's Bay are on average less than 0.35m significant height** (based on long term offshore wave statistics). The recorded data (item e above) suggests the mean wave height in the bay 0.77m, the apparent discrepancy being explained in item f, by the fact that the recorded data was taken during winter.
- **Waves within the bay are predominantly from the north rather than the west** (based on directional figures from item e). This is consistent with the prevailing south easterly swell reaching the bay by diffracting around the north of the island.

14.3.2 Marine Ecology

St Helena's coastline presents a predominance of sheer rocky, sea cliffs, wave-cut rock reefs and shelves with occasional offshore stacks inhabited by nesting seabirds. There are very few beaches and these are largely formed from cobble deposits. The island, particularly on the south and eastern shores is subject to a heavy sea swell from the prevailing winds though there are records of occasional high wave action from the north, considered to result from intense storms in the north Atlantic (Ashmole & Ashmole 2000). The tidal range is a little over one metre between mean water levels for high and low spring tides.

The waters of the neritic zone (i.e. over the relatively narrow inshore shelf around St Helena) are less than 300 metres deep but beyond this the seabed descends sharply to depths well in excess of 4000 metres. The coastal waters of St Helena therefore present an isolated marine habitat similar to the terrestrial habitats and a number of marine animals and plants are similarly found nowhere else or are limited to St Helena and Ascension Islands. Of the 10 species of endemic fish, four are typical of shallow inshore waters and are considered common around the coastal rock and boulder shore habitats of St Helena. These species are the St Helena Gregory, the St Helena damselfish, the St Helena wrasse, or greenfish, all found from the shores down to 35 metres depth, and Springer's blenny often found in rock pools. The remaining endemic species are found in deeper waters of the neritic, below 35 metres and some may now be rare, known from recent historical observations or single specimens.

The seabed of the inshore neritic zone have been surveyed by the Directorate of Fisheries by remote sensing to determine the nature of the habitats present. Habitats range from solid bedrock, to boulder deposits, to sandy substrates with intergrades between and mosaics formed from these substrates. In contrast, there is little survey

information on the inshore fish species around the coastal waters of St Helena though a species list of such fish has been compiled for the waters around James and Rupert's Bay. Commercial fisheries records give an indication of the pelagic species in the open waters. This group will not come under any direct influence from the airport development and are not considered further in this section.

Rupert's Bay in the north of the island provides a sheltered anchorage to the east of James Bay. It has developed as the island's industrial area with a jetty serving a fish factory and a seawall and boom associated with the fuel storage facility for the island. The shore is reinforced by rock-fill breakwaters though a small cobble and pebble beach remains with a very small area of exposed sand which provides one of the few safe locations for swimming in the sea on the island. There has been a rapid colonisation of the shoreline by periwinkles, limpets, crabs, and leafy green algae on the rock-fill breakwater which was completed in June 2004.

Sea-bed habitats below mean low water to around 5 metres depth are composed mainly of boulders in a sandy matrix. In shallower water under the influence of wave action closer to the shore, sands and silts are mobilised into the water column. Beyond, in slightly deeper water are areas of rippled sandy shoals. Rock ledges are locally present by the shore. The permanently submerged rocks and boulders are covered with a turf of fine brown algae, with patches of red coralline algae. A species of leafy green alga occupies the zone around mean water and is exposed at lower tide levels. On the rocks in deeper water, beyond the zone where wave action readily suspends sand particles, are small colonies of an encrusting colonial coral *Favia fragrum*.

Following the results of the initial habitat appraisal at Rupert's Bay, a further survey was undertaken. The SCUBA habitat survey of transects across the bay has shown the dominant habitat type to be sand sediments with the second most abundant substrate type being bare rock often with a fine coating of sand. These habitats showed a very low diversity of marine life. Together these substrates accounted for between 80-90% of the habitat types present along most transects with very few areas of scattered reef with some slight increase in the diversity of benthic organisms.

During one afternoon of the two dedicated to the turtle survey, hawksbill turtles (*Eretmochelys imbricata)* were encountered periodically. Occurrence of hawksbill turtles in Rupert's Bay could be related to offloading of fishing boats, as this is when the turtles are seen most frequently. From this limited sampling period and the results of two years of data from a marine sightings scheme, there appear to be frequent turtle sightings in the Rupert's Bay area.

Full details of the survey results are given in the report enclosed in Appendix 14.3: Final Report on Marine Ecology Survey at Rupert's Bay (Bennett, ANRD, 2007).

14.3.3 Commercial, Navigation and Recreation Uses of Rupert's Bay

Rupert's Bay is extensively used by swimmers. It is one of the two coastal areas with access to sea by road which is also safe for swimming. The only other area is Jamestown Wharf which is inaccessible when the RMS St Helena is in the harbour. Other uses include recreational fishing and water sports. The beach is a popular picnic and party spot. Rupert's Bay is therefore of high national importance for the island. The coastal waters of St Helena are also used for leisure diving.

Rupert's Bay is very important for commercial fishing. The Shears landing platform is the point at which all catches are off-loaded for processing at businesses located in the valley. Commercial fishing is discussed in more detail in Chapter 5 and Appendix 5. The Bay is also the point at which fuel is delivered by tanker to the existing bulk fuel stores in the valley. For these reasons the Bay is considered to be of high importance. Rupert's Bay and the coastline nearby are also used for recreational fishing – see Figure 14.2, Photograph 14.3 in Volume 3 of this ES. The footpaths in and around the Bay are discussed in more detail in Chapter 12 and Appendix 12.

The coastline and inland waters of St Helena are also important for the tourism industry. Trips to observe the coastline, sea birds and marine life including dolphins, depart from James Bay frequently.

14.3.4 Summary of Existing Conditions

Rupert's Bay is relatively sheltered. The wave climate is mild and, within the bay, waves approach the shore predominantly (but not exclusively) from a northerly direction. Currents are weak. The movement of sediment is likely therefore to be predominantly wave driven and will be strongest in shallow water where the sea bed is sandy. Wave induced longshore currents are likely to be weak. They would be expected to predominantly southwards on the eastern shore and conversely, eastwards on the southern shore of the bay. It is for this reason that the small beach sits at the southern corner of the bay, facing the incoming waves.

Rupert's Bay is considered to be of very high importance to St Helena for a number of reasons including commercial uses for landing fish and receiving fuel deliveries and the beach is an important resource for recreation. With respect to ecology, the Bay is considered to be of low diversity with a predominance of species-poor sandy substrates.

14.4 POTENTIAL EFFECTS

14.4.1 Potential Construction Effects

The nature of these effects are summarised in Table 14.2 below, based on consideration of the works in the context of the existing physical environment, ecology and use of the bay discussed above in Section 14.3.

Table 14.2 Summary of Potential Adverse Effects on the Physical Marine Environment during Construction

Potential Impacts during Construction
Coverage of the sea bed, temporarily, during the period for which the temporary unloading facility at the western side of the bay is being constructed, in place and being removed.
Damage to the seabed as a result of plant constructing the temporary unloading berth and the permanent wharf with loss of benthic flora and fauna.
Deterioration in water quality in the bay resulting from release of fines due to, e.g., disturbance of the seabed, spillage, dredging and washing out of fines from unprotected fill material. This may adversely affect benthic flora and fauna in areas of re-deposition.
Changes in wave climate and thus sediment transport in the bay as a result of the existence of the temporary unloading berth at the western side of the bay. This is considered unlikely to be significant due to the position of the berth (on a rocky coast) and its alignment (the berth is aligned into the prevailing seas and is unlikely to cause major reflections or interruptions to longshore currents).

Potential Impacts during Construction
Changes in wave climate and thus sediment transport in the bay as a result of the existence of the partially constructed jetty (used as a temporary unloading berth). The likely impact of the jetty along this line is considered below in the section discussing the permanent works.
Possible disruption to people using the Bay for commercial fishing, fuel deliveries and recreation.
Possible temporary closures of Rupert's Beach for safety reasons.

14.4.2 Potential Permanent Operation Effects

These effects, in certain circumstances, could well be more significant, particularly in terms of the impact on sediment transport, by virtue of the fact that it is permanent. As an example, if a temporary structure has an impact on sediment transport, once the structure is removed, the system may well recover rapidly and completely. However, in the case of permanent works, the structure remains and the impact may become progressively more significant with time. The nature of the likely effects of the operational phase is discussed in Table 14.3.

Table 14.3 Potential Adverse Effects on the Physical Environment during Operation

Potential Operation/Permanent Impacts
Permanent removal of the seabed as a result of the berth dredging
Permanent coverage of the seabed beneath the new wharf (quay, causeway and breakwater)
Redistribution of sediments resulting from changes in wave climate and thus sediment transport in the bay as a result of the existence of the new wharf. The likely impact of the wharf along this line is considered below in the section discussing the permanent works.

As discussed in Section 14.3.4 above, the location of the small beach at the southern corner of the bay is a function of the local wave climate. The construction of the new wharf will mean that the wave climate at the beach will be changed as, in future, only waves from the North West will reach the beach, rather than the predominantly northern waves to which it is currently exposed. As result the beach will tend to realign to face the new dominant wave direction, which would suggest that the beach would tend to migrate towards the new wharf. In addition, the presence of the wharf, including the causeway out to the berth, will prevent the generation of the (weak) longshore currents in that part of the bay. This, together with the more sheltered wave climate, suggests that the beach could be more susceptible to the accumulation of fines and flotsam. The beach is very important to the island as a recreational beach and these adverse impacts are likely to be potentially very significant.

14.4.3 Mitigation

Mitigation has been developed through the design and incorporated into the technical specification which the DBO Contractor must follow. Mitigation measures have also been developed for the construction and operation of the proposed scheme and these are set out in the EMP. In general these require that working practices and techniques will be such that the risks of pollution from the release of fines or other construction materials will be minimised. A description of the mitigation measures is includes in Section 14.4.2 of Appendix 4. Examples of such measures are provided below:

14.4.4 Residual Impacts

Tables 14.4 and 14.5 provide a description of the residual effects which would occur during construction and operation respectively.

Table 14.4 Summary of Residual Construction Effects

Description of Potential Impact	Classification of Potential Impact	Assessment of Significance Without Mitigation	Proposed and Recommended Mitigation Measures	Residual Impact
The mobilisation of sediment laden runoff which could enter local watercourses, drains and the marine environment. Sediment could also be disturbed or enter the marine environment during dredging and wharf construction.	Direct Temporary Short term	Moderate to major adverse	Measures to prevent sediment laden runoff being discharged to local watercourses untreated will be put in place. Measures to reduce the effects of disturbance of fine material during dredging and to control the ingress of fine material during construction of the wharf will be in place as described in the EMP in Volume 5 of the ES.	**Minor adverse**
The mobilisation of sediment laden runoff which could enter local watercourses, drains and the marine environment.	Direct Temporary Short term	Moderate to major adverse	Appropriate mitigation measures to prevent sediment laden runoff being discharged to local watercourses and the marine environment untreated will be in place.	**Minor adverse**
The potential risk of chemical and fuel (oil) spillages entering the marine environment	Direct Temporary Short term	Moderate to major adverse	Appropriate mitigation measures to protect local watercourses from the potential risk of chemical/fuel spillages will be in place, these shall include an emergency procedure to be followed in the event of a spillage or other pollution incident.	**Neutral**
Disruption to navigation, commercial use, tourism and recreation	Temporary Short term	Major adverse	Avoid land take and adverse impacts on Rupert's beach and amenity area as far as possible. Implement measures to minimise the disturbance to businesses and users of the amenity area and beach at Rupert's Bay. Temporary closures of the beach shall be kept to an absolute minimum.	**Minor adverse**

Description of Potential Impact	Classification of Potential Impact	Assessment of Significance Without Mitigation	Proposed and Recommended Mitigation Measures	Residual Impact
Marine and shore habitats at Rupert's Bay are considered to be of low value on an island-wide basis. Possibility for additional loss of benthic habitat at temporary wharf location	Temporary Short term	Low adverse to neutral	Wharf structures likely to provide new substrates for use by epiphytic plants and animals.	**Neutral**

Table 14.5 Summary of the Permanent Residual Effects During Operation

Description of Potential Impact	Classification of Potential Impact	Assessment of Significance Without Mitigation	Proposed and Recommended Mitigation Measures	Residual Impact
Movement of the small recreational beach along the shore of the bay	Permanent Long term	Moderate adverse	Nourishment of the beach with sand arising from the dredging	**Minor adverse**
Accumulation of fines and flotsam on the recreational beach	Permanent Long term	Moderate adverse	Incorporation of culverts into the causeway to allow easy passage of currents through it	**Minor adverse**
Recreation – potential impact on the beach and Bay	Permanent Long term	Major adverse	Although the physical impact on the beach will be mitigated as described above. The placement of the wharf close to the beach will reduce its amenity value of the beach and Bay..	**Moderate adverse**
Navigation and commercial use	Permanent Long term	Major beneficial	The wharf will provide much improved facilities for landing cargo for St Helena.	**Major beneficial**
Marine and shore habitats at Rupert's Bay which are considered to be low value and are island-wide basis.	Possibility for additional loss of benthic habitat to wharf extensions	Impacts may be low adverse to neutral	Wharf structures likely to provide new substrates for use by epiphytic plants and animals. Measures to prevent pollution of the marine environment will be in place including those described in the EMP in Volume 5 of this ES. Surface drainage from the wharf will pass through oil interceptors.	**Neutral**