

## 6. DEEP BAY ISLAND LANDFILL

### 6.1 Basic Information

#### *Project Title*

- 6.1.1 Deep Bay Island Landfill (DBIL) – marine site M.1.

#### *Nature of Project*

- 6.1.2 The Project would form a new marine based waste disposal site in the middle of Deep Bay (Figure 6.1).
- 6.1.3 The Deep Bay waste disposal site would require the construction of an artificial island of approximately 670ha in size. The site would be designated as a public filling area for the receipt of inert C&D material; once the reclamation is completed, the site would be developed as a landfill for subsequent operation for the disposal of waste. Construction works would be as described in Part A; Section 3.2.

#### *Location and Scale of Project*

- 6.1.4 The DBIL site is located approximately 0.8km to the north of the existing WENT Landfill and would cover a site area of some 670ha. Approximately 150Mcum of fill material would be required to construct the artificial island, with a final site formation level to +6 mPD. The capacity of the landfill site would be 110Mcum.
- 6.1.5 Seabed levels in this area vary from 2 to 5m below Chart Datum, with generally shallower waters towards the southern boundary of the site. The shallow water depths may pose some constraints on the selection and operation of marine vessels that would be required to supply materials and equipment to the site. It is understood that there would be no need for dredging works.

#### *History of Site*

- 6.1.6 The DBIL is located within open marine waters and would be entirely formed as part of this project. There has been no previous development activity specifically within the proposed site area.
- 6.1.7 There are proposed works for the Shenzhen Western Corridor (SWC) and Deep Bay Link (DBL) nearby. The gazetted works for SWC will be a bridge linking Shekou (in Shenzhen) and the Northwest New Territories in the HKSAR, and for DBL will be a trunk road linking the proposed SWC from its HKSAR landing point to the existing Yuen Long Highway. The landfall for the SWC on the Shenzhen side will be on an area of reclaimed land (in Dongjiaotou) over 2km north of the DBIL site, and the HKSAR landing point will be at Ngau Hom Shek in Yuen Long.
- 6.1.8 The proposed Waste-to-Energy Facility (WEF) at Ha Pak Nai is located some 1.8km south of the DBIL Site, although this has not yet been confirmed. As the WEF, SWC and DBL are designated under the EIA Ordinance, an EIA Study and other specialised studies are being undertaken for these projects.

#### *Number and Types of Designated Projects covered*

- 6.1.9 The DBIL would qualify as a Designated Project under the five categories listed in Part A; Section 2.1.

## 6.2 Outline of Planning and Implementation Programme

- 6.2.1 An outline for the planning and implementation of this site is summarised in Part A; Section 3.3 and an outline programme is shown in *Figure 6.2*. Assuming landfill operations start in 2016, DBIL would be full during the period 2030 to 2040, depending upon the rate of waste arisings and the number of other landfills operating concurrently.
- 6.2.2 The site is currently not covered by any statutory town plans. As described in Section 3.3, Town Planning Ordinance procedures to cover the proposed site would be required and the reclamation would need to be gazetted under the Foreshore & Sea-bed (Reclamations) Ordinance.
- 6.2.3 The site is outside of the Study Area for the Planning and Development Study on North West New Territories. However, developing a landfill on this site is unlikely to be compatible with the planning intention of this area, especially as Deep Bay is recognised as an area of high ecological significance.
- 6.2.4 The Deep Bay, Mai Po Marshes and its adjacent area (collectively known as the Deep Bay Area) is recognised as a wetland of international importance. It is a habitat for a variety of species of waterbirds, and a stopover point for thousands of migratory birds. The Deep Bay Area comprises natural and man-made wetlands that provide a wide range of habitats to support a high diversity of biota. The Mai Po Marshes, the Inner Deep Bay and the surrounding fishponds have been listed as a “Wetland of International Importance” (the “Ramsar Site”) since 1995. Such designation recognises the ecological importance of the Deep Bay Area as a wetland habitat and landing and resting point for a number of migratory birds.
- 6.2.5 The northern shore line of this part of the North West New Territories to the south of this site is designated as a Coastal Protection Zone and is included under the Sheung Pak Nai & Ha Pak Nai OZP Plan No. S/YL-PN/4.

## 6.3 Possible Impacts on the Environment

- 6.3.1 Possible impacts on the environment during the construction, operation and aftercare phases of the DBIL are outlined below. *Figure 6.1* provides details of identified sensitive receivers. The individual assessments are summarised in *Tables 6.1 and 6.2*.

### *Air Quality*

- 6.3.2 The reclamation and landfill development has the potential to cause the following air quality impacts:
- Dust (TSP / RSP) and exhaust emissions from on-site plant during construction and operation (following reclamation).
  - Gaseous emissions during landfill operation and aftercare arising from non-point source emissions and gas flaring / utilisation (including emissions of methane, carbon dioxide, carbon monoxide, sulphur dioxide, nitrous oxides, etc.).
  - Odours arising during the operation of the landfill from waste decomposition and leachate treatment.
- 6.3.3 No Air Sensitive Receivers (ASRs) exist within a 500m radius from the boundary of this site. The closest ASR is Ha Pak Nai Village that is located some 1.8km south of the site boundary. Thus, no significant air quality impacts associated with reclamation, operation and construction of the landfill facility within the site are anticipated.

- 6.3.4 The SWC running adjacent to the site will be completed in the year 2005/2006. There will likely be vehicular emissions (RSP and NO<sub>2</sub>) arising from future vehicle traffic that may contribute to the operational phase emissions. The WEF at Ha Pak Nai and the Black Point Power Station located over 3km to the southwest of the site will also give rise to gaseous emissions (NO<sub>2</sub> and SO<sub>2</sub>). However, as there are no identified ASRs, no cumulative impacts are anticipated.
- 6.3.5 The DBIL is a marine site and the mode of transportation will likely be by marine vessels. As such, the site will likely be served by those refuse transfer stations with marine / transfer facilities. According to the information provided in the Preliminary Marine Review Report (March 2002), the estimated cumulative distance travelled for waste delivery is approximately 380km, assuming the proposed site will receive waste delivered from the existing network of marine transfer stations (including Island East, Island West, West Kowloon, North Lantau, South East Kowloon and Outlying Islands Transfer Stations). Given the likely distance to be travelled and the benefit of the use of marine transport, the regional impacts from waste transportation are considered to be neutral to minor.
- 6.3.6 The site lies in an open marine area with the prevailing wind direction from the northeast. The site location is not within an airshed and there would not be any accumulation of air pollutants.

#### **Noise**

- 6.3.7 The reclamation and landfill development has the potential to cause the following noise impacts:
- Construction – from dredging, tipping, piling works and general construction activities;
  - Operation – from the use of fixed plant, marine vessels, waste reception area, pumping plant, possible helicopter noise etc.
- 6.3.8 No existing or planned noise sensitive receivers (NSRs) have been identified within 300m of the site.
- 6.3.9 Although not anticipated at this stage, it is possible that activities could continue beyond normal working hours during the construction and operation phases. This would depend upon working arrangements for fill delivery, day-to-day landfill operations and the overall construction programme. However, as this is an offshore site with no NSRs in the vicinity, the more stringent requirements for noise emissions during the evening and night-time periods are not expected to be an issue.
- 6.3.10 Potential operational phase noise impacts would need to be considered in subsequent studies in the event that the island reclamation is used for other land uses (in addition to landfill) or a separate afteruse is developed on top of the landfill following completion of the landfilling operations.
- 6.3.11 The SWC running adjacent to the site will be completed in the year 2005/2006. There will be road traffic noise arising from the future road link that may be cumulative to the operational noise. However, as there are no NSRs identified, no cumulative impacts are anticipated.
- 6.3.12 The DBIL can only be accessed by marine traffic during both operation and construction phase. Noise from land based waste delivery vehicles is not a concern for this site.

## ***Water Quality***

### ***Baseline Conditions at the Site***

- 6.3.13 Deep Bay is a large shallow bay on the east bank of the Pearl Estuary, adjacent to the relatively deep flood channel of Urmston Road. The Bay has a surface area of approximately 112km<sup>2</sup> (11,200ha), with a length of about 15km and an average depth of 3m. The total catchment area of the Bay is about 535km<sup>2</sup>, with 51% of the catchment in Shenzhen and Shekou and the remaining 49% in Hong Kong.<sup>1</sup>
- 6.3.14 Due to its conservation significance and increasing pressures from development within its catchment, in 1990 Deep Bay was designated by the Hong Kong - Guangdong Environmental Protection Liaison Group as the highest priority study area requiring protective conservation action. As a result a study to evaluate the Bay's dispersive and assimilative capacity and develop strategic management options to improve the water quality in the Bay was commissioned in 1995 and completed in 1998.
- 6.3.15 The Deep Bay Water Quality Control Zone can be divided into the inner and outer sub-zones, across which the site extends. Based on data from EPD's routine marine water monitoring programme for the year 2000, the water quality in the inner sub-zone is generally of poorer quality than that in the outer sub-zone; particularly for suspended solids and inorganic nutrients. It is noted however that background levels of suspended solids in Deep Bay are high due to the nature of the Pearl River discharge.
- 6.3.16 The hydrodynamic regime of the Deep Bay area is unidirectional and the current direction reverses during ebb and flood tides. During an ebb tide, currents gradually form at the river mouth in the Deep Bay catchment, then flow from the inner subzone towards the outer subzone with an increasing magnitude, and finally join the southward currents originating from the Pearl River Estuary. During a flood tide, the flow direction reverses with currents flowing from the outer subzone towards the inner subzone. The currents originate from the eastern and southern waters of Hong Kong and are generally stronger in magnitude than the currents during an ebb tide. As the ebb flows leaving Deep Bay are much weaker than the incoming flood flows, pollutants from inner Deep Bay are not well dispersed following discharge at the river mouth.
- 6.3.17 Past studies have previously identified the breakdown of the overall pollution loading to Deep Bay and particularly the significance of the contribution of the rivers discharging into Inner Deep Bay (i.e. the inner sub-zone). The EPD data for year 2000 shows levels of total inorganic nitrogen (TIN) above the WQO at all monitoring stations, with non-compliance for un-ionised ammonia throughout the inner sub-zone.
- 6.3.18 Marine sediment quality tests were performed at the central section of Deep Bay under the Shenzhen Western Corridor site investigation works contract. The results of the test indicate the sediment samples tested consisted of Category L, Category M and Category H sediment. The sediment was deemed suitable for either open sea disposal or disposed at a Confined Marine Disposal Ground. Elutriate tests were also conducted to estimate the potential for contaminant release in the marine waters during dredging for the SWC works and revealed that there was high potential for release of copper, zinc, arsenic and tributyl-tin (TBT) from the sediment.<sup>2</sup>

<sup>1</sup> Hyder Consulting Ltd & CES Ltd (1998). Deep Bay Regional Water Quality Control Strategy Study: Final Report. For EPD, Government of the HKSAR.

<sup>2</sup> Arup (2002). Shenzhen Western Corridor: Draft Final Report on Water Quality Mathematical Modelling Study and Water Quality Impact Assessment. February 2002.

### *Key Issues and Sensitive Receivers*

- 6.3.19 The project has the potential to cause the following water quality impacts:
- Sediment loss to the water column during dredging / reclamation;
  - Runoff with elevated levels of suspended solids from the site during landfill construction (post-reclamation); and
  - Change in the hydrodynamic regime (i.e., change in flushing capacity and sediment deposition / erosion patterns).
- 6.3.20 A number of Water Sensitive Receivers (WSRs) are present in the vicinity of the site. These include:
- Secondary contact recreation subzone at the shoreline from Black Point to Tai Shui Hang and the Yung Lung non-gazetted beach to the southeast; and
  - Cooling water intake for CLP's Black Point Power Station.
- 6.3.21 In addition, there are a range of aquatic and inter-tidal ecological receivers within the site that would be sensitive to any decline or change in the water quality or sediment deposition / erosion patterns. Impacts upon these are discussed within the ecology and fisheries subsections. The sensitive receivers include:
- The Inner Deep Bay Site of Special Scientific Interest (SSSI) to the east;
  - Fu Tian mudflat and mangrove Nature Reserve in Shenzhen to the east;
  - Mai Po Marshes SSSI to the southeast;
  - Tsim Bei Tsui SSSI to the southeast;
  - Pak Nai SSSI and nearby seagrass areas to the south;
  - Horseshoe Crab habitat (sub-tidal and inter-tidal) near Ha Pak Nai
  - Mudflat and mangroves near Ngau Hom Shek;
  - Mariculture subzone at the southern boundary of the site (i.e. oyster/shellfish beds at Lau Fa Shan and generally along the southwest Deep Bay coastline); and
  - Oyster beds at Shekou (Mainland waters).
- 6.3.22 The Study Area coincides with the northern boundary of the Chinese White Dolphin habitat. Dolphin sightings have been recorded in inner and outer Deep Bay during summer and autumn months by the AFCD. The waters of the Lung Kwu Chau and Sha Chau Marine Park to the southwest where dolphin activity is concentrated are also potentially sensitive. The locations and uses of the WSRs are shown in *Figure 6.1*.

### *Reclamation and Site Formation*

- 6.3.23 During reclamation and site formation phase of the artificial island, sediment handling may lead to water quality impacts from increased suspended solids and reduced dissolved oxygen. There is also potential for sediment plumes to form and be dispersed by the prevailing water current. The extent of the sediment plume dispersal will depend on the size and character of the fill material(s) (i.e. dredged sand or muds) and hydrodynamic conditions.
- 6.3.24 The hydrodynamic and water quality modelling predicted significant exceedances above the WQO (30%) during both the wet and dry season for all three construction phases at SI1 (54.68% increase to 191.65% increase) and SG1 (35.15% increase to 126.96% increase) to the west of Sheung Pak Nai in Deep Bay. Elevated SS levels (up to 14.98%) were predicted at OB2, MG, S12, OB1 and CW1 in Deep Bay for both the wet and dry season for all three construction phases and at MA in Inner Deep Bay for the dry season for all three construction phases.

*Hydrodynamic and Water Quality Impacts Following Island Formation*

- 6.3.25 The presence of the island will not cause any noticeable changes to momentary or accumulated flow for the East Lamma or West Lamma Channels; however, the accumulated flow across the Tathong Channel is predicted to increase by 14.43% during the wet season and 0.05% during the dry season. The presence of the proposed island would cause a significant increase in current (38.22% on average) in the channel formed to the east, between the artificial island and the New Territories.
- 6.3.26 As the island would be located between the inner and outer Deep Bay cross sections, it was predicted that the site would reduce the fluxes through both inner and outer Deep Bay Channels with a considerably higher relative reduction (ranged from -5.37% to -7.02%) at outer Deep Bay as compared to inner Deep Bay (ranged from +0.06% to -2.08%). It is believed that the proposed island would reduce the flushing capacity of Deep Bay. The pollutant levels within Deep Bay would potentially increase as more pollutant (discharged from the Deep Bay catchments) would tend to accumulate inside the bay due to the reduction in the flushing capacity. This can be further supported by the changes in salinity levels at the stations within inner Deep Bay. The model predicted that the salinity levels would decrease in inner Deep Bay due to the proposed island suggesting that more freshwater (and thus more pollutants) discharged from the rivers flowing into inner Deep Bay would be accumulated inside the bay.
- 6.3.27 The water quality modelling, under the baseline scenario, identified that a significant amount of nutrients from the Pearl River would be washed into Deep Bay. The presence of the island would reduce the tidal flows into Deep Bay and thus block part of the nutrients from entering Deep Bay, however, the island is not a preferred site in terms of water quality impact due to the fact that the proposed island would potentially reduce the self-cleansing capacity of Deep Bay, and there are uncertainties about the future pollution loading discharged into Deep Bay, especially as a portion of the pollutants loadings is from Shenzhen, which is not under the control of HKSAR Government,
- 6.3.28 In the Hydrodynamic and Water Quality Modelling, 7 sensitive receivers that are close to the site were selected for presentation. Of the 7 chosen indicator points, 4 are located in the inner Deep Bay WCZ (MA, SI2, OB1 and SI1), 2 are located in the outer subzone of Deep Bay (SG1 and CW1) and the remaining 1 is located in Mainland waters (OB2).
- 6.3.29 According to the dry season water quality modelling results, the predicted 90%ile DO for depth average and bottom layer ranged from 7.01 to 7.85mg/L and 6.70 to 7.76mg/L respectively which complied with the WQO of  $\geq 4$ mg/L for depth averaged DO and  $\geq 2$  for bottom layer DO. The predicted DO levels at OB2 (ranged from 7.47 to 8.77mg/L) also complied with the Mainland standard of  $>5$ mg/L.
- 6.3.30 The predicted average dry season salinity ranged from 27.27 to 28.29ppt. The differences in salinity levels caused by the presence of the island were minimal (less than 1%) at all the selected indicator points and the differences are well below the WQO of 10%.
- 6.3.31 The predicted dry season SS levels at the indicator points were in the range of 10.66 to 16.97mg/L. The percentage differences caused by the presence of the island were within 3%. Recognising that the WQO requires that any waste discharge should not raise the natural ambient level by more than 30% as well as the Mainland standard that man-made increment should not exceed 100mg/L, the differences in SS at all indicator points are considered to be small.

- 6.3.32 The average *E.coli* levels in the dry season ranged from 20 to 5851count/100ml. Comparing to the WQO of 610cfu/100ml, exceedances were found at MA and SI2 (5851count/100ml and 5781count/100ml respectively). However, the differences caused by the island were minimal (less than 1%) at these 2 stations. The average *E.coli* level at OB2 is 2 which complied with the Mainland standards of 14count/100ml for shellfish culture zone. The predicted *E.coli* levels at all other stations were low and well within the WQO of 610count/100ml.
- 6.3.33 The predicted average dry season UIA (0.00233 – 0.00848mg/L) were very small as compared to the WQO of 0.021mg/L as well as the Mainland standard of 0.02mg/L.
- 6.3.34 The dry season TIN levels ranged from 0.166 to 0.342mg/L. For OB2 in Mainland waters, the predicted dry season TIN level with the presence of the island is 0.166mg/L which complied with the Mainland standard of 0.3mg/L. Since the Hong Kong WQO of TIN is an annual mean value, the predicted mean TIN levels for the dry and wet seasons were averaged to represent the annual mean values. The calculated concentrations (ranged from 0.350 to 0.466mg/L) showed to be below the WQO for TIN of 0.5mg/L and 0.7mg/L for Deep Bay WCZ (outer subzone) and Deep Bay WCZ (inner subzone) respectively.
- 6.3.35 According to the wet season water quality modelling results, for the indicator points in Deep Bay WCZ, the predicted 90%ile DO for depth averaged and bottom layers ranged from 5.05 to 8.54mg/L and the values are above the WQO of 4mg/L and 2mg/L respectively. The predicted DO levels at OB2 (ranged from 6.49 to 7.95mg/L) also complied with the Mainland standard of 5mg/L.
- 6.3.36 The predicted average wet season salinity at the indicator points ranged from 1.91 to 5.05ppt. It is predicted that the presence of the island would reduce the salinity at all of the indicator points in Deep Bay with the largest reduction at SG1 of 3.75%. The predicted differences are considered small as compared to the WQO that requires change due to any waste discharge should not raise the natural ambient level by more than 10%.
- 6.3.37 The predicted wet season SS levels at the indicator points in Deep Bay WCZ were in the range of 15.06 to 38.97mg/L. It is predicted that the island would increase the SS levels at most of the indicator points in Deep Bay WCZ. Recognising the WQO requirement that any waste discharge should not raise the natural ambient level by 30%, the predicted differences are however small (within 5%). OB2 showed an increase in the SS level by 7.67% but the predicted increase complied with the Mainland standard that man-made increment shall not exceed 100mg/L.
- 6.3.38 The predicted wet season *E.coli* levels at the indicator points in Deep Bay ranged from 1 to 2879count/100mL. Exceedances were found at MA and SI2 (2100count/100ml and 2879count/100ml respectively). However, the differences caused by the island were minimal (less than 2%) at these 2 stations. The average *E.coli* level at OB2 was 1 which complied with the Mainland standards of 14count/100ml for shellfish culture zone. The predicted *E.coli* levels at all other stations were low and well within the WQO of 610count/L.
- 6.3.39 The predicted average wet season UIA (0.00581 – 0.00635mg/L) at the indicator points in Deep Bay were low and well below the WQOs of 0.021mg/L. Compared to the baseline water quality results, the percentage differences caused by the presence of the island were small (less than 0.2%).
- 6.3.40 For predicted wet season TIN levels at the indicator points in Deep Bay WCZ, the values were quite high and ranged from 0.206 – 0.679mg/L. Since the Hong Kong WQO of TIN is an annual mean value, the predicted mean TIN levels for the dry and wet seasons were averaged to represent the annual mean values which were discussed in Section 6.3.34. OB2 was identified to have an increase in the TIN level of 4.25%. The wet season mean TIN levels at OB2 for both the baseline and operational scenarios (0.400 and 0.417mg/L respectively) exceeded the Mainland standard of 0.3mg/L.

### *Cumulative Impacts*

- 6.3.41 Outer Deep Bay, which overlaps with the site, is currently gazetted for sand dredging with constraints. From a logistical point of view, the construction of the artificial island is based on the premise that all potential dredging or marine borrowing at the same location will have been completed prior to construction. Thus, it is not anticipated that any borrowing activities will occur concurrently with the construction of the artificial island. As such, no cumulative impact in this regard is expected.
- 6.3.42 The bridge alignment has been gazetted for the SWC project. As such, there will be dredging works required for the bridge piles and coastal reclamation works at the Shekou Peninsula. However, such works would be complete before the start of works for the proposed artificial island site – scheduled for circa. 2011. There is, however, potential for cumulative hydrodynamic effects from the SWC reclamation and the hydrodynamic change induced by any artificial island in Deep Bay. The extent and magnitude of cumulative impacts would need to be considered further under a detailed EIA study.

### *Waste Management / Disposal Impacts*

- 6.3.43 For construction of the “island” on which the landfill would be located, inert C&D material would be brought in exclusively by marine vessels, from a network of barging points in the SAR. The location of barging points would vary during the filling process, according to the source of materials at any given time.
- 6.3.44 Various options for construction have been explored for this site and it is anticipated that muds would not need to be excavated to facilitate construction of the outer seawall, prior to public filling. Upon completion of construction, the “island” would act as a major recipient of municipal solid waste and other landfilled waste streams.
- 6.3.45 Anticipated volume of materials are as follows:
- Volume of public fill that could be accepted for island construction: 150Mcum.
- 6.3.46 Various potentially polluting materials may be stored, handled and transported to / from the site. Examples include chemicals for wastewater / leachate treatment, waste oils, fuel for plant working on the site, etc. These would be managed as described in Section 5.5.
- 6.3.47 Waste delivery, to DBIL will be by marine vessel, which will have a lower GHG emission rate (in term of per kg waste handled) compared to delivery by road transport, given the amount of waste that can be carried by a marine vessel is 100 times more than a truck. The cumulative distance between marine RTSs and the site is around 380km (as stated in the Preliminary Marine Review (March 2002)) and therefore the potential GHG emissions from waste delivery to this site is considered to be neutral to minor.

### *Ecology*

#### *Baseline Conditions*

- 6.3.48 The ecological value of the broader Deep Bay area has been documented by a number of academic and Government-commissioned studies. The Inner Deep Bay area in particular is the most studied ecosystem (in fact, series of ecosystems) in the HKSAR by virtue of its habitat diversity and relative isolation. Much of the land and coastal area in Inner Deep Bay is protected within the Mai Po Marshes Nature Reserve (MPMNR) that was designated a ‘Restricted Area’ and SSSI in the mid-1970s. As defined under the Wild Animals Protection Ordinance (Cap. 170, Schedule 6), the Restricted Area includes “Mai Po Marshes, all the mangrove swamps adjoining the Marshes, and the intertidal mud flats and shallow waters of Inner Deep Bay”.



- 6.3.49 The estuarine waters of Inner Deep Bay were designated as a SSSI in 1986, and in recognition of the area's diverse range of wetland habitats and its special conservation value for migratory birds, the Mai Po & Inner Deep Bay Ramsar Site was established in September 1995.
- 6.3.50 Due to its cross-boundary situation, there have also been a number of ecological studies of Inner Deep Bay solely or jointly undertaken by Mainland authorities and organisations. In contrast, there has been relatively little study into the habitat and community types outside Inner Deep Bay due to relative habitat homogeneity and the lack of inter-tidal expanses that otherwise provide habitat for a range of communities (e.g. mangrove, mudflat and brackish marsh).
- 6.3.51 The hydrodynamics in Deep Bay influences a range of sub-tidal and inter-tidal ecologically sensitive receivers in Inner Deep Bay (subsection 6.3.21 and *Figure 6.1* refer). The ecological significance of these receivers is summarised in *Table 6.1* below.

**Table 6.1: Significance of ecologically sensitive receivers in the Study Area**

| Name of Receiver                     | Significance  |
|--------------------------------------|---|
| Inner Deep Bay SSSI                  | The largest and most important mangrove habitat in the HKSAR, and the mudflats – that are of high conservation value in their own right due to endemic infauna species - are also a vital feeding ground for tens of thousands of resident and migratory birds. |
| Fu Tian Nature Reserve               | Only remaining area of mudflat and mangrove habitat in Shenzhen.  |
| Mai Po Marshes SSSI                  | Largest area of dwarf mangrove habitat in the HKSAR and has high scientific and educational value due to the number of waterbirds it supports in its ponds.   |
| Tsim Bei Tsui SSSI                   | A mature mangrove community including a good assemblage of uncommon mangrove species.   |
| Pak Nai SSSI                         | Important roosting site for gulls and herons. Locally and regionally rare seagrass / Horseshoe Crabs nearby.  |
| Ha Pak Nai / Ngau Hom Shek coastline | Seagrass and Horseshoe Crab nursery / breeding habitat.   |
| Chinese White Dolphins               | High profile protected species that inhabits the Pearl River Estuary waters.  |

**Sources:** Consultants / Aspinwall Clouston & Wetland Intl (1997)<sup>3</sup>.

- 6.3.52 There is a range of species of high conservation importance in the Inner Deep Bay area, as well as beyond the Inner Bay closer to the site. Species of particular note in Inner Deep Bay wetland bird community are the Dalmatian Pelican, Chinese Egret, Oriental Stork and Saunders' Gull that are listed on Appendix I of the Bonn Convention. Globally threatened bird species include Nordmann's Greenshank and the Spoon-billed Sandpiper.
- 6.3.53 Other species of conservation importance in the area include the seagrass, *Haolphila baccarii*, and two of Southeast Asia's three species of Horseshoe Crab (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) have been identified near Ha Pak Nai. Mammals, including the Chinese otter and Crab-eating mongoose that have been observed at Mai Po and Tsim Bei Tsui, may include other areas along the Ha Pak Nai coastline within their ranges.
- 6.3.54 Accordingly, any deterioration in water quality or change in hydrodynamics brought about by the proposed disposal facility may potentially adversely affect these ecological resources.

<sup>3</sup> Aspinwall Clouston & Wetland Intl (1997). Development of a Comprehensive Conservation Strategy and Management Plan for the Mai Po & Inner Deep Bay Ramsar Site: Final TP4.

### *Direct Habitat Loss*

- 6.3.55 The site footprint covers a surface area of 670ha. The existing site area is entirely sub-tidal, thus generally providing no feeding opportunities for water birds or other terrestrial species, and is comprised of soft muds. Specific details on the benthic assemblages at the site are not known, although it is known that two species of Horseshoe Crab inhabit the general area (with sightings along the Ha Pak Nai coast). As Horseshoe Crabs feed mainly on molluscs and polychaetes it is likely that these prey taxa are well represented in the sub-tidal waters, just as they are in the inter-tidal waters of Inner Deep Bay. There is also likely to be a variety of crustaceans in the area. Adult Horseshoe Crabs will also form an important component of the sub-tidal marine environment of the site; and site formation activities could potentially lead to adverse impacts on what may be important spawning and nursery grounds for these species.
- 6.3.56 During construction works for the DBIL there is potential for sediment plume formation and dispersal, affecting sensitive ecological receivers. The final results of the water quality and hydrodynamic modelling exercise reveal that suspended solids levels at Pak Nai SSSI and at the seagrass / Horseshoe Crab habitat at Ha Pak Nai would be greatly increased during all island formation phases, with suspended solids levels at Pak Nai SSSI reaching 40mg/L (183% above baseline levels at Pak Nai SSSI (S11)). The dry season concentrations at the seagrass habitat that is particularly sensitive to sedimentation effects are predicted to be in the order of 127%.

### *Water Quality / Hydrodynamics*

- 6.3.57 Locating DBIL across the middle of Deep Bay would further restrict the flow of water in an area of already limited dispersive capacity. The decreased flushing capacity may decrease the assimilative capacity of the Inner Bay, meaning that inorganic and organic pollutants in riverine discharges would be retained longer in Inner Bay and would thus be more readily available for biological uptake. The resulting decline in water quality could have significant effects for the benthic community on the inter-tidal mudflats of Inner Deep Bay. The mudflat area is the principal feeding ground for tens of thousands of migratory birds (including several globally endangered and internationally protected species) that rely on feeding opportunities provided by the diverse and abundant benthic community.
- 6.3.58 The island may induce change in sediment deposition and erosion patterns, with potentially significant adverse impacts on some areas of mudflat in Inner Deep Bay where sedimentation provides an opportunity for mangrove and grass encroachment, thus reducing the area of valuable mudflat habitat as a feeding ground by birds (i.e. potentially reducing the carrying capacity of the mudflat). Any increase in suspended solids or sedimentation would have an adverse effect on the seagrass habitat located due south of the site. There may also be increased scouring of inter-tidal habitats with the result that areas of mudflat and mangrove habitat are eroded and undermined. This would also further increase suspended sediment levels in the water column with effects on water quality.
- 6.3.59 Despite these potential hydrodynamic effects, the model output does not indicate that site would lead to any significant change in water quality from baseline conditions. The most significant result is a predicted increase in E.coli levels at Pak Nai SSSI of 15 counts / 100ml (22% above baseline). Whilst this increase is not significant in terms of WQOs, there could conceivably be some effect on the ecological function of the coastal habitat, such as a change in benthic community composition affecting bird feeding opportunities.

- 6.3.60 There is high potential for cumulative ecological impacts induced by hydrodynamic and water quality changes during the operation stage of the site, from the committed SWC that will involve coastal reclamation works at Shekou, Shenzhen and at Ngau Hom Shek, Hong Kong if the bridge option is selected. The extent and magnitude of cumulative impacts would be considered further at the detailed EIA stage of the project, when further information regarding the implementation programme is known.

#### *Marine Vessel Disturbance*

- 6.3.61 Sightings of the Chinese White Dolphin *Sousa chinensis* have been made in the area between June and August, with observations all year round at the mouth of Deep Bay and along Urmston Road. Marine transportation of fill and construction material, and operational marine traffic all give rise for potential collision and noise disturbance with these mammals. This may be a particular concern given the shallow water depth and hence the limited water column available for impact avoidance.

#### *Fisheries*

##### *Marine Fisheries*

- 6.3.62 The Study Area is not a key fishing area due to shallow water depths that constrain vessel navigation and the abundance of cargo vessels (mainly marine vessels) that ply these waters between the Shenzhen River and the Pearl River.
- 6.3.63 A consultancy study investigating fishing resources and operations in the HKSAR was commissioned by the AFCD in the mid-1990s. A series of sampling techniques were used to determine fisheries yield. It was originally envisaged (prior to field survey) that a gillnetting exercise off Ha Pak Nai would produce a low fish yield, however a high yield was recorded. Purse seining was conducted at the location of the proposed artificial island where the fisheries yield was considered "low".<sup>4</sup>

##### *Oyster Fisheries*

- 6.3.64 According to AFCD sources, oyster culture has been practised along the inter-tidal mudflat of Deep Bay for some 200 years. The current culturing practice involves fattening of young oysters imported from the Mainland typically for between six to twelve months before marketing. For operation convenience and faster growth, fattening is carried out mostly by raft culture. Oyster production in 2000 was some 76 tonnes with a value of \$3 million.<sup>5</sup>
- 6.3.65 It is understood from AFCD that there are oyster raft culture activities *within* the site boundary of the DBIL. Whilst there are no specific details of these activities, the DBIL would lead at best to displacement of these activities to other inshore waters, and at worst to a cessation of the operation altogether. The potential for water quality impacts associated with the DBIL works would possibly make recommencement of the oyster farming in nearby waters unfeasible.
- 6.3.66 There are also oyster-farming activities in Mainland waters near Shekou. The water quality for oyster farming zones in Hong Kong and Mainland waters of Deep Bay has been predicted using the numerical water quality / hydrodynamic model. The output for the Hong Kong oyster zone (OB1) shows a peak increase in suspended solids levels during the island formation works of around 2mg/L to (a 15% increase above baseline). The increase at Shekou (OB2) is negligible (< 1mg/L). These increases would not be expected to be significant as they fall within the baseline range. The model does not predict any significant change in hydrodynamics / water quality as a result of the development of this site.

4 Environmental Resources Management (1998). Fisheries Resources and Fishing Operations in Hong Kong Waters. Report to the Agriculture and Fisheries Department, Hong Kong Government.

5 AFCD (2001). "Aquaculture Fisheries" [AFCD Website: [www.afcd.gov.hk/web/english/fisheries/fish/aquac.htm](http://www.afcd.gov.hk/web/english/fisheries/fish/aquac.htm)].

6.3.67 In the short-term, the planned SWC project will involve engineering works in the vicinity of the oyster production area along the Deep Bay coastline. It is understood that as the SWC will require inter-tidal and sub-tidal construction works, compensation is to be provided to oyster farm operators for loss of income. As the SWC Study is ongoing, precise details of impacts and the future of oyster production in this area are unavailable. However, given the economic climate of oyster farming in the Deep Bay area, the DBIL and / or the planned SWC would lead to adverse impacts upon this industry.

### ***Cultural Heritage***

6.3.68 There is no immediate evidence of archaeological remains in this area. However a number of land based archaeological sites lie along the coastline of Deep Bay and provide evidence that the coastal area of Tuen Mun and Yuen Long was occupied by early human settlement, and also frequently used by seafaring people for several thousand years.

6.3.69 From west to east, these archaeological sites include:

- Tsang Tsui Archaeological Site (to the west of the WENT Landfill);
- Ha Pak Nai Archaeological Site (to the east of the WENT Landfill);
- Tsuen Ng Ka Yuen Archaeological Site;
- Long Jok Tsuen Archaeological Site;
- Pak Nai Archaeological Site;
- Fu Tei Au & Ngau Hom Shen Archaeological Site;
- Sha Kong Archaeological Site;
- Tseung Kong Wai So Kwun Tsai Archaeological Site;
- Hang Hau Tsuen Archaeological Site;
- Tung Tau Tsuen Archaeological Site; and
- Lau Fau Shan Archaeological Site.

6.3.70 Recognising the likelihood of archaeological remains in this area and the lack of archaeological data currently available for this site a detailed marine archaeological investigation should be carried out in any future studies.

### ***Landscape and Visual***

6.3.71 *Landscape Planning Designations* - while this area of landscape is not covered by any planning designations reflecting landscape values, the close proximity of the site to the existing coast line will conflict with the intention of the adjacent Coastal Protection Area identified in the Outline Zoning Plans for Sheung Pak Nai and Ha Tsuen. The relationship between coast and sea will be fundamentally changed although the coast itself will not actually be affected and resulting impacts will be slight.

6.3.72 *Landscape Resources* - as the site lies in a marine area, so that the only landscape resource affected will be an area of offshore water. Given the low sensitivity of this resource, there will be no significant impacts on landscape resources.

6.3.73 *Landscape Character* - the site falls within the Deep Bay LCA (*Figures 6.3 and 6.4*). This is a shallow and contained coastal bay between the western New Territories and Shenzhen. The bay is low-lying and exposed and contains numerous mud flats that are exposed at low tide. The bay generally has a remote and undisturbed character save for the proximity of high-rise building in Shenzhen. The Castle Peak uplands form a dramatic natural coastline on the southern side of the bay, although the coast is somewhat degraded by power station development.

- 6.3.74 There exists potential for high impacts on landscape character resulting from construction/operation works, which will introduce new artificial elements that are incompatible with the existing open and natural characteristics of the bay and coastal landscape. Upon restoration of the landfill, these impacts are likely to be reduced somewhat. The somewhat artificial character of the island, however, will contrast with the generally natural characteristics of the existing coastline. As a consequence of this, impact on landscape character will be substantial to moderate during the construction/operation phase, whilst during the afteruse phase; the residual impact will reduce to moderate.
- 6.3.75 VSRs - VSRs affected by the proposals are identified in *Tables 6.4 and 6.5*. The extent of the project visual envelope is shown in *Figure 6.5*.
- 6.3.76 Located on the eastern edge of Deep Bay, the site is largely screened from high-density residential areas in Hong Kong by the Castle Peak Range. However, VSRs in taller buildings in Tin Shui Wai and Shenzhen will have distant views of the site. Key residential VSRs in the area are found at the villages of Ha Pak Nai, Sheung Pak Nai, Ngau Hom Sha, Lau Fau Shan and Sha Tu Tsuen as well as the two larger settlements mentioned above (*Figure 6.6*). The distance of these settlements from the source varies from 800m to 5km. Occupational VSRs include those working at the WENT Landfill and Black Point Power Station. Other VSRs include vessels using Deep Bay, road traffic along Nim Wan Road as well recreational users along Castle Peak Trail. Future potential VSRs of the island fill are the travellers on the proposed Shenzhen Western Corridor (SWC). If the SWC is completed, it will become an important "gateway" into Hong Kong and the location of the island landfill will have a substantial detrimental impact on these future VSRs.
- 6.3.77 The VSRs will experience works on the landfill (shipping, marine vessels, construction of the bridge and partially constructed island) as relatively close artificial elements contrasting with the natural qualities of the existing landscape. The coastal villages will be most noticeably affected by the construction / operation of the landfill, resulting in the loss of open and expansive views across Deep Bay, and for these villages the impact will continue through the afteruse phase. However the magnitude of this is offset to a small degree by the area's sparse population levels. The aggregate visual impacts will therefore be substantial during the construction/operation phase. After the restoration of the landfill, the aggregate visual impact of the island will be reduced from substantial to moderate.
- 6.3.78 *Mitigation Measures* - Landscape and visual mitigation measures are outlined in Section A of the Report and are illustrated in *Figure 6.8*.

#### ***Landfill Gas***

- 6.3.79 There are no sensitive receivers (targets) or pathways within 500m of the site and therefore no potential off-site landfill gas hazard. Landfill gas would have safety implications for those working on the site. In the event that the reclamation on which the landfill would be constructed is also developed for other afteruses, the potential operational phase landfill gas hazards would need to be considered for those developments.
- 6.3.80 Given the remote location of the site and the lack of any sizeable population nearby, the direct off-site use of LFG as an energy source in surrounding communities, is not considered practical. However, it will be used as an on-site energy source.

### **6.4 Environmental Protection Measures to be Incorporated into Design and Further Environmental Implications**

- 6.4.1 Environmental design measures have been identified in Part A (Section 3.8) and generic approaches to mitigating impacts on different environmental parameters are outlined in Part A (Section 5). Whilst the specific requirement for environmental mitigation would be dependent upon the findings of an EIA, the following environmental protection measures are site-specific to the Deep Bay artificial island site.

### ***Air Quality***

- 6.4.2 No specific air quality mitigation measures are recommended at this stage, other than good site practice as described in Part A (Section 5).

### ***Noise***

- 6.4.3 No specific noise mitigation measures are recommended at this stage, other than good site practice as described in Part A (Section 5).

### ***Water Quality***

- 6.4.4 Mitigation is likely to be required to prevent impacts during dredging and filling for the reclamation of the island. Construction procedures, defining the rates and method of dredging and filling taking into account the hydrodynamics of the surrounding waters and tidal effects (ebb and flood) should be defined in the EIA. If significant impacts are predicted, a silt curtain may be installed around the immediate works area to prevent dispersion of sediments, although the effectiveness of silt curtains in mitigating high suspended solids impacts would need to be addressed.

### ***Waste Management***

- 6.4.5 No specific waste management mitigation measures are recommended at this stage, other than good site practice as described in Part A (Section 5).

### ***Ecology***

- 6.4.6 At Ha Pak Nai and Ngau Hom Shek there are Seagrass colonies that require a relatively clear water column for photosynthetic activity. Whilst important in its own right, this habitat is of broader conservation significance for the shelter it provides the populations of Horseshoe Crab that occupy the shallow sub-tidal and inter-tidal environment. These habitats and species are all vulnerable to adverse impacts from sediment mobilisation and potential transportation over the broader area during reclamation works. The application of silt curtains around this Seagrass habitat should be investigated.

### ***Fisheries***

- 6.4.7 As with aquatic ecology, the transport of suspended sediment to the oyster aquaculture area and an overall decline in water quality from reduced flushing capacity in the area is a key concern. Any decline in the ability of these waters to disperse and assimilate water quality parameters such as heavy metals and faecal coliforms will increase the potential for absorption by shellfish and benthic invertebrates that form the basis of the food-chain. Whilst certain localised measures can be taken to control sediment levels, there would be no direct mitigation against a general decline in water quality.

### ***Cultural Heritage***

- 6.4.8 No specific measures are recommended at this stage for the protection of cultural heritage resources.

### ***Landscape and Visual***

- 6.4.9 *Mitigation Measures* - Landscape and visual mitigation measures are outlined in Section A of the Report and are illustrated in *Figure 6.8*.

## 6.5 Summary

6.5.1 A summary of the SEA for the DBIL is provided in *Tables 6.1 and 6.2*:

**Table 6.2: Summary of Deep Bay Island Landfill SEA**

|                               | Impacts   | Score | Commentary   |
|-------------------------------|---|-------|--|
| <b>Air Quality Assessment</b> |   |       |  |
| 1                             | Distance to areas of air sensitive land use   | ○     | There are no air sensitive receivers (ASRs) within 500m of the proposed artificial island site.  |
| 2                             | Presence of topographic features which could decrease or exacerbate impacts   | ○     | The site does not lie within any airshed and generally experiences wind. It is unlikely that dust or odours would accumulate around the site.  |
| 3                             | Occurrence of meteorological conditions which could exacerbate impacts  | ○     | Wind blows both towards and away from ASRs. No prevailing wind direction has been identified.  |
| 4                             | Cumulative Impacts of relevant emissions (TSP (construction), NO <sub>x</sub> , CO, SO <sub>2</sub> – LFG Flare) taking into account ambient conditions | -     | The proposed Shenzhen Western Corridor may be operational in year 2005/2006. There will likely be vehicular emissions (RSP and NO <sub>2</sub> ) arising from the future road traffic.   |
| 5                             | Total emission of air pollutants from territory-wide waste transportation from RTSs to the landfill site  | ○ / - | Access to the site would likely be by marine vessel only, with the cumulative distance to be travelled estimated to be 380km.  |
| 6                             | Overall Air Quality Impact  | ○ / - | Overall air quality impacts is considered to be <b>'Neutral / Negative – Low'</b> . This is because local impacts are not anticipated due to the absence of ASRs within 500m from the site but there are potential for regional impacts (from waste delivery). |
| <b>Noise Assessment</b>       |   |       |  |
| 1                             | Distance to areas of noise sensitive land use   | ○     | There are no noise sensitive receivers (NSRs) within 300m of the site.   |
| 2                             | Topographic Features<br>(only applicable if there are NSRs within 300m)   | ○     | The site is located within open marine waters with no NSRs located within 300m from the site boundary. Therefore, this criterion is not applicable.  |
| 3                             | Cumulative Impacts of developments within 300m  | -     | The proposed Shenzhen Western Corridor running adjacent to the site will be completed in the year 2005/2006. There will be road traffic noise arising from the future road link that may be cumulative to the operational noise.                               |
| 4                             | Overall Noise Impact  | ○     | <b>'Neutral'</b> – due to no NSRs are found within the assessment area.  |

|                                    | Impacts  | Score | Commentary  |
|------------------------------------|--|-------|---|
| <b>Water Quality Assessment</b>    |  |       |   |
| 1                                  | Water Course Diversion   | O     | Artificial island. Not relevant.  |
| 2                                  | Potential for sediment contaminant release   | -     | Sediment testing undertaken in Inner Deep Bay and close to the site has identified the presence of contaminated material. Disturbance of bottom sediment during reclamation may disturb and mobilise contaminants.  |
| 3                                  | Potential impacts on WSRs (including increase or exceedance of WQO)                          | --    | <p>WQO exceedance for SS is predicted to be exceeded during the construction of the island.</p> <p>It is predicted that the <i>E. Coli</i> and TIN in the operational phase will exceed their respective standards. Nevertheless, these were also exceeded in the baseline scenario.</p> <p>However the reduced flushing capability of Deep Bay due to the presence of the island in the operational phase may make the dispersion of pollutants from Deep Bay less efficient. Therefore, the presence of the island would cause significant impact to the water quality.</p> |
| 4                                  | Potential Impacts on Groundwater   | O     | Artificial island. Not relevant.  |
| 5                                  | Potential Cumulative Impacts   | -     | The proposed Shenzhen Western Corridor may induce cumulative impacts on the hydrodynamic regime and sedimentation. Discharges to Inner Deep Bay from the Pearl River and Shenzhen River may also compound changes in water quality and hydrodynamics brought about by the project.  |
| 6                                  | Overall Impact   | --    | Due to the significant exceedance of the SS WQO during the construction of the artificial island to the west of Sheung Pak Nai in Deep Bay and, nevertheless, the self-cleansing capability of Deep Bay would be suffered and, consequently more vulnerable to suffer impaired water quality; in particularly the pollution from Deep Bay catchment is uncertain. Therefore, the overall water quality impact is assessed as ' <b>Negative – High</b> '.  |
| <b>Waste Management Assessment</b> |  |       |   |
| 1                                  | Balance of Materials (surplus/deficit of public fill needed for landfill development)        | +     | The site could accommodate significant amounts of public fill (150Mcum), thus negating the need to import filling material for site formation. This site will not require the dredging of any muds.   |
| 2                                  | GHG emissions from mode of transport for delivery of waste to the site from RTSS to the site | O / - | Waste will be delivered to the site via marine vessel. The distance travelled from marine RTSS to the site has been estimated to be 380km.  |
| 3                                  | Overall Waste Impact   | O     | 'Neutral'   |



|                              | Impacts  | Score  | Commentary  |
|------------------------------|--|--------|---|
| <b>Ecological Assessment</b> |  |        |   |
| 1                            | Potential for secondary environmental impacts on "Areas of Absolute Exclusion"               | --     | The Works would affect the Pak Nai SSSI through water quality decline and sediment deposition / erosion.  |
| 2                            | Affects an important habitat   | --     | Seagrass / Horseshoe Crab habitat at Ha Pak Nai would be affected.  |
| 3                            | Affects a species of conservation importance   | --     | The Horseshoe Crab population and Seagrass on the south Deep Bay coastline are of high conservation value. .  |
| 4                            | Potential for Cumulative Ecological impacts on sites of recognised value                     | -      | Hydrodynamic changes from the SWC may affect water quality and sediment dynamics in the area, including Inner Deep Bay. Riverine discharges to Inner Deep Bay may also lead to cumulative water quality / hydrodynamic impacts with direct primary and secondary ecological impacts.  |
| 5                            | Overall Ecological Impact  | --     | The overall impact potential is rated as ' <b>Negative – High</b> ' due to the sensitivity of the shallow Deep Bay ecosystem to change in hydrodynamics and water quality. The cumulative hydrodynamic / water quality effect of the SWC reclamation would exacerbate the potential for adverse ecological impacts in the Bay.  |
| <b>Fisheries Assessment</b>  |  |        |   |
| 1                            | Potential for secondary environmental impacts on "Areas of Absolute Exclusion"               | --     | The oyster mariculture zone at Lau Fau Shan and along the northwest NT coast is an "Area of Absolute Exclusion" but may be affected by the Works from an increase in suspended solids.  |
| 2                            | Affects an important mariculture / fisheries resources (including spawning / nursery ground) | --     | As above, DBIL would be located approximately 1km from the oyster (mariculture) zone and but water quality impacts may be of local significance.  |
| 3                            | Potential for Cumulative Fisheries Impacts on sites of recognised value                      | -      | There is potential for a cumulative hydrodynamic effect on water quality from the proposed SWC reclamation.   |
| 4                            | Overall Impact   | - / -- | ' <b>Negative – Low / High</b> '. Overall, whilst the medium-term economic viability of oyster farming in the area is not good, the site has been included in the evaluation for the time being. The impact of the proposed island development on mariculture activities may be significant, whilst the cumulative effect on hydrodynamics of the SWC reclamation and island site would deteriorate water quality for oyster farming. |

|                                     | Impacts  | Score | Commentary  |
|-------------------------------------|--|-------|---|
| <b>Cultural Heritage Assessment</b> |  |       |   |
| 1                                   | Important cultural (Declared, Deemed or Graded sites) / archaeological sites | 0     | There are no known sites of cultural heritage significance.   |
| 2                                   | Potential for archaeological value   | -     | There is evidence of land based archaeological finds along the Deep Bay Coastline, suggesting that the coastal area was occupied by early human settlement, and frequented by seafaring people for several thousand years. Recognising the lack of archaeological data currently available for the site, it is considered that the likelihood of archaeological remains in this area is reasonable. A detailed marine archaeological investigation should be carried out in any future studies. |
| 3                                   | Potential for Cumulative Heritage Impacts on sites of recognised value       | 0 / - | The adjacent land based archaeological sites are coastal in nature. Given their proximity to the site, a reduction in flow along this area, could result in sedimentation and burial of any offshore / intertidal archaeological deposits.  |
| 4                                   | Overall Cultural Heritage Impact   | -     | The potential impacts on cultural heritage are considered to be ' <b>Negative – Low</b> '. Whilst there is no direct evidence of cultural heritage remains in the location of the site, the occurrence of remains along the adjacent coastline increases the potential for marine archaeological finds.   |

|   | Impacts  | Score | Commentary   |
|---|--|-------|--|
| <b>Landscape and Visual Impact Assessment</b> |  |       |  |
| 1   | Implications for Landscape Planning and Designations             | -     | While this area of landscape is not directly covered by any planning designations reflecting landscape values, the landfill will conflict with the intention of the Coastal Protection Area on the adjacent coast. Overall impacts will therefore be Negative – Low.   |
| 2   | Impacts on Landscape Resources                                   | ○     | As the site lies in a marine area, there will be no significant impacts on landscape resources. Overall impacts on landscape resources will therefore be Neutral.  |
| 3   | Impacts on Landscape Character                                   | --    | The landfill will have substantial impacts open and natural character of the landscape. The somewhat artificial character of the restored landfill, however, will contrast with the generally natural characteristics of the existing coastline. Overall impacts on landscape character will be Negative – High.   |
| 4   | Visual Impacts   | --    | The site will have a substantial impact on the visual amenity of VSRs in villages located along the Sheung Pak Nai coastline, due to the loss of open and expansive views of Deep Bay, as well as upon distant residential VSRs in Shenzhen and in Tin Shui Wai. Overall visual impacts will be Negative – High.   |
| 4   | Overall Landscape & Visual Impact                                | --    | Overall, landscape and visual impacts will be <b>'Negative – High'</b> for the following reasons: <ul style="list-style-type: none"> <li>• There will be indirect impacts on the designated Coastal Protection Area.</li> <li>• The site is a marine one and so no significant landscape resources are affected;</li> <li>• The open and natural landscape character of the coastline to the north of Ha Pak Nai will be lost. The artificial characteristics of the island will contrast unfavourably with the natural characteristics of the coastline.</li> <li>• A small number of residential VSRs in villages will have their entire view of Deep Bay removed, whilst large numbers of distant residential VSRs in Tin Shui Wai and Shenzhen will also be affected.</li> </ul> |
| <b>Landfill Gas Assessment</b>                |  |       |  |
| 1   | Distance between the new / extended landfill and SRs             | ○     | Tnearest sensitive receivers are >250m from the site.  |
| 2   | Number of Receivers within 250m (i.e. the LFG Consultation Zone) | ○     | There are no sensitive receivers within 250m of the site.  |
| 3   | Man Made/Natural Pathways for LFG Migration                      | ○     | None.  |
| 4   | Additional Utilisation of LFG to Reduce Greenhouse Gas Emissions | ○     | There are no potential users of LFG (other than on-site use)   |
| 5   | Overall Landfill Gas Impact                                      | ○     | <b>'Neutral'</b>   |

**Table 6.3: Summary of Deep Bay Island Landfill SEA**

| <b>Overall Impacts</b>            | <b>Score</b> | <b>Commentary</b>        |
|-----------------------------------|--------------|--------------------------|
| Overall Air Quality Impact        | ○ / -        | Neutral / Negative – Low |
| Overall Noise Impact              | ○            | Neutral                  |
| Overall Water Quality Impact      | --           | Negative – High          |
| Overall Waste Management Impact   | ○            | Neutral                  |
| Overall Ecological Impact         | --           | Negative – High          |
| Overall Fisheries Impact          | - / --       | Negative – Low / High    |
| Overall Cultural Heritage Impact  | -            | Negative – Low           |
| Overall Landscape & Visual Impact | --           | Negative – High          |
| Overall Landfill Gas Impact       | ○            | Neutral                  |

**Table 6.4 Assessment of Significance of Visual Impacts for Deep Bay Island Landfill During Construction / Operation Phase**  
(Note: All Impacts are adverse unless otherwise noted)

| Identity No. of VSR      | Key Visually Sensitive Receiver (VSR)                               | Approx. Minimum Distance Between VSR and Source(s) | No.s of VSRs (order of magnitude only) | Magnitude of Impact During Construction / Operation (Negligible, Small, Intermediate, Large) | VSR Sensitivity (Low, Medium, High) | Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial) | Significance of Residual Impacts (Insubstantial, Slight, Moderate, Substantial) |
|--------------------------|---|--|--|--|-------------------------------------|---|---|
| <i>Residential VSRs</i>  |   |  |  |  |                                     |   |   |
| VR 1                     | Sha Tu Tsuen  | 5km  | Few                                    | Small  | High                                | Moderate  | Moderate  |
| VR 2                     | Tin Shui Wai  | 45km   | Many                                   | Intermediate   | High                                | Moderate to Substantial   | Moderate  |
| VR 3                     | Lau Fau Shan  | 2.5km  | Few                                    | Large  | High                                | Substantial   | Substantial   |
| VR 4                     | Ngau Hom Shek   | 1.4km  | Very Few                               | Large  | High                                | Substantial   | Substantial   |
| VR 5                     | Sheung Pak Nai  | 0.8km  | Very Few                               | Large  | High                                | Substantial   | Substantial   |
| VR 6                     | Ha Pak Nai  | 1.7km  | Very Few                               | Large  | High                                | Substantial   | Substantial   |
| VR 7                     | Shenzhen (Shekou)   | 5km  | Very Many                              | Intermediate   | High                                | Moderate to Substantial   | Moderate  |
| <i>Occupational VSRs</i> |   |  |  |  |                                     |   |   |
| VR 8                     | Workers at WENT Landfill  | 1.7km  | Very Few                               | Intermediate   | Low                                 | Slight to Moderate  | Slight  |
| VR 9                     | Workers in Black Point Power Station                                | 3km  | Very Few                               | Intermediate   | Low                                 | Slight to Moderate  | Slight  |
| <i>Recreational VSRs</i> |   |  |  |  |                                     |   |   |
| VR 10                    | Hikers on Castle Peak Peninsula                                     | 5.5km  | Very Few                               | Small  | Medium                              | Moderate to Slight  | Moderate to Slight  |
| VR 11                    | Area for Boating, Fishing, Diving and other water sports activities | 0.5km - 10km (varies)                              | Very Few                               | Large  | Medium                              | Substantial to Moderate   | Moderate  |
| <i>Travelling VSRs</i>   |   |  |  |  |                                     |   |   |
| VR 12                    | Nim Wan Road Users  | 1km  | Few                                    | Intermediate   | Medium                              | Moderate  | Moderate  |
| VR 13                    | Users of the Proposed Shenzhen Western Corridor                     | 0 - 0.5km  | Moderate                               | Large  | Medium                              | Substantial   | Substantial   |
| VR 14                    | Vessels in Deep Bay   | > 1km  | Very Few                               | Small  | Medium                              | Moderate to slight  | Slight  |

**Table 6.5 Assessment of Significance of Visual Impacts for Deep Bay Island Landfill During Afteruse Phase**  
(Note: All Impacts are adverse unless otherwise noted)

| Identity No. of VSR      | Key Visually Sensitive Receiver (VSR)                               | Approx. Minimum Distance Between VSR and Source(s) | No.s of VSRs (order of magnitude only) | Magnitude of Impact During Afteruse (Negligible, Small, Intermediate, Large) | VSR Sensitivity (Low, Medium, High) | Impact Significance before Mitigation Measures (Insubstantial, Slight, Moderate, Substantial) | Significance of Residual Impacts (Insubstantial, Slight, Moderate, Substantial) |
|--------------------------|---|--|--|--|-------------------------------------|---|---|
| <i>Residential VSRs</i>  |   |  |  |  |                                     |   |   |
| VR 1                     | Sha Tu Tsuen  | 5km  | Few                                    | Small  | High                                | Moderate  | Insubstantial   |
| VR 2                     | Tin Shui Wai  | 4.5km  | Many                                   | Intermediate   | High                                | Moderate to Substantial   | Slight  |
| VR 3                     | Lau Fau Shan  | 2.5km  | Few                                    | Large  | High                                | Substantial   | Substantial to Moderate   |
| VR 4                     | Ngau Hom Shek   | 1.4km  | Very Few                               | Large  | High                                | Substantial   | Substantial to Moderate   |
| VR 5                     | Sheung Pak Nai  | 0.8km  | Very Few                               | Large  | High                                | Substantial   | Substantial to Moderate   |
| VR 6                     | Ha Pak Nai  | 1.7km  | Very Few                               | Large  | High                                | Substantial   | Substantial to Moderate   |
| VR 7                     | Shenzhen (Shekou)   | 5km  | Very Many                              | Intermediate   | High                                | Moderate to Substantial   | Slight to Insubstantial   |
| <i>Occupational VSRs</i> |   |  |  |  |                                     |   |   |
| VR 8                     | Workers at WENT Landfill  | 1.7km  | Very Few                               | Intermediate   | Low                                 | Slight to Moderate  | Insubstantial   |
| VR 9                     | Workers in Black Point Power Station                                | 3km  | Very Few                               | Intermediate   | Low                                 | Slight to Moderate  | Insubstantial   |
| <i>Recreational VSRs</i> |   |  |  |  |                                     |   |   |
| VR 10                    | Hikers on Castle Peak Peninsula                                     | 5.5km  | Very Few                               | Small  | Medium                              | Moderate to Slight  | Slight  |
| VR 11                    | Area for Boating, Fishing, Diving and other water sports activities | 0.5km - 10km (varies)                              | Very Few                               | Large  | Medium                              | Substantial to Moderate   | Moderate  |
| <i>Travelling VSRs</i>   |   |  |  |  |                                     |   |   |
| VR 12                    | Nim Wan Road Users  | 1km  | Few                                    | Intermediate   | Medium                              | Moderate  | Insubstantial   |
| VR 13                    | Users of the Proposed Shenzhen Western Corridor                     | 0 - 0.5km  | Moderate                               | Large  | Medium                              | Substantial   | Moderate  |
| VR 14                    | Vessels in Deep Bay   | > 1km  | Very Few                               | Small  | Medium                              | Moderate to slight  | Insubstantial   |