

7. SHA CHAU ISLAND LANDFILL

7.1 Basic Information

Project Title

- 7.1.1 Sha Chau Island Landfill (SCIL) – marine site M.2.

Nature of Project

- 7.1.2 The Project would form a new marine based waste disposal site in waters located east of Sha Chau and slightly south of the Urmston Road channel (*Figure 7.1*).
- 7.1.3 The SCIL would require the construction of an artificial island of approximately 350ha. 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

- 7.1.4 The SCIL is located off the southern end of Urmston Road; approximately 3km south of CLP Castle Peak Power Station, 3km north of Chek Lap Kok, and <2km east of Sha Chau. The waters around Sha Chau together with Lung Kwu Chau form the Sha Chau and Lung Kwu Chau Marine Park. Part of the proposed site encroaches into the East Sha Chau Contaminated Mud Disposal Area.
- 7.1.5 Seabed levels in the vicinity of the artificial island are 6-7m below Chart Datum. There would be no need for dredging works to develop the site because the site is relatively sheltered and so the seawall would not need to be dredged to achieve the required stability. Approximately 100Mcum of fill material will be required to construct the artificial island, with a final site formation level to around +6mPD. The capacity of the landfill site would be 50Mcum.

History of Site

- 7.1.6 The site is located within open marine waters and is to be entirely formed as part of this project. The western portion of the artificial island site will be in very close proximity to the contaminated mud disposal pits at the east of Sha Chau. There are four mud pits with a total disposal capacity of about 46Mcum. Mud Pits I, II and III have been filled up with contaminated mud and capped with clean sand and mud. A recent CED Study estimated that the still operational Mud Pit IV would be exhausted by late 2007.¹ As an interim measure, before a long-term disposal facility is available to accept contaminated muds from 2010, CED is to conduct a site selection study for a proposed contaminated mud disposal facility within the Airport East / East of Sha Chau area that can accept muds between 2007 and 2010. The East of Sha Chau study area for this CED Study overlaps with the proposed location of the artificial island.
- 7.1.7 The marine waters around Sha Chau, Tree Island and Lung Kwu Chau were designated a SSSI in 1979, and were upgraded to full Marine Park status in November 1996. This designation has resulted in restrictions on fishing activities and on marine vessel speeds in the area due to potential impacts on resident dolphin. There has however been some past works in the area by the Airport Authority that constructed an Aviation Fuel Receiving Facility pier at Sha Chau.

¹ CED (2001). Strategic Assessment and Site Selection for Contaminated Mud Disposal.

Number and Types of Designated Projects Covered

7.1.8 This proposal would qualify as a Designated Project under the five categories listed in Part A, Section 2.1.

7.2 Outline Of Planning and Implementation Programme

7.2.1 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 7.2*. Assuming landfill operations start in 2017, SCIL would be full during the period 2025 to 2030, depending upon the rate of waste arisings and the number of other landfills operating concurrently.

7.2.2 The proposed 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.

7.2.3 The site is located over part of the East Sha Chau Contaminated Mud Disposal Site, which is a gazetted disposal area. Since December 1992, the East Sha Chau area has been used for contained disposal facilities for contaminated mud arising from the SAR's dredging and reclamation projects. Mud is disposed of in a series of purpose-built pits or by the backfilling of exhausted sand borrow areas.

7.2.4 Tuen Mun lies to the north of this site and is covered by the Draft Tuen Mun OZP Plan no. S/TM/16 issued in April 2002. The nearest developments to the site in the southwest area of Tuen Mun New Town include the River Trade Terminal, CLP's Castle Peak Power Station, a cement plant and steel works. A site in Tuen Mun Area 38 has also been reserved for Special Industries and is currently being considered for a Recovery Park for the recycling and reprocessing of waste products.

7.2.5 Chek Lap Kok lies to the south of this site and is covered by the Chek Lap Kok OZP Plan no. S/I-CLK/3. The nearest development to the site in Chek Lap Kok is the northern airport runway of the Hong Kong International Airport. The airport site is protected by a Marine Exclusion Zone.

7.3 Possible Impacts on the Environment

7.3.1 Possible impacts on the environment during the construction, operation and aftercare phases of the SCIL are outlined below. *Figure 7.1* provides details of identified sensitive receivers. The individual assessments are summarised in *Tables 7.1 and 7.2*.

Air Quality

7.3.2 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.

7.3.3 No Air Sensitive Receivers (ASRs) are found within a 500m radius from the boundary of this site. The closest being the Tin Hau Temple at Sha Chau that is over 800m away from the site's western boundary. As such, no significant air quality impacts associated with reclamation, operation and construction of the landfill facility within the site are anticipated.

- 7.3.4 The site is located in open marine waters with no topographic features situated between the site and the nearest ASR at Sha Chau. As such, no accumulation of air pollutants is anticipated.
- 7.3.5 One project with potential dust generating activities is the proposed Recovery Park at Tuen Mun Area 38, located over 2km from the site, for which the first phase is scheduled for 2004. Castle Peak Power Station, which is approximately 3km away from the site, will be the major source of gaseous emissions (SO₂ and NO₂) located closest to the site. Green Island Cement Works and Shiu Wing Steel Mill are approximately 2.4km away from the site. However, as these various facilities are located very far from the site and there are no existing or planned ASRs in the vicinity of the artificial island, cumulative impacts are not anticipated.
- 7.3.6 This is a marine site, and marine vessels will be the mode of transportation for waste delivery to the site. The amount of air pollutants resulting from the territory-wide waste delivery to the site will be less compared to a land based site that relies on road transport. The estimated cumulative distance to be travelled from the existing and planned (South East Kowloon RTS to be commissioned in 2012) marine RTSs to the site is approximately 300km. In view of these, the regional impacts associated with the territory-wide waste delivery are considered to be neutral to minor.

Noise

- 7.3.7 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.
- 7.3.8 No existing or planned noise sensitive receivers (NSRs) have been identified within 300m of the site.
- 7.3.9 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 for this site.
- 7.3.10 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 land filling operations.
- 7.3.11 There will possibly be an interim contaminated mud disposal pit operating between 2007 and 2010. However, given the nature of the activities (controlled sediment disposal) the associated operational noise levels are not expected to be significant. Moreover, no NSRs are identified in the vicinity of the site and thus, no cumulative noise impacts are anticipated.
- 7.3.12 The site 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

- 7.3.13 EPD conducts routine marine water and sediment quality monitoring in the Study Area. The three closest water quality monitoring stations to SCIL are: NM3 to the east, NM5 to the north and NM6 to the south, with sediment quality monitoring stations at the same locations: NS3 to the east, NS4 to the north and NS6 to the south.

7.3.14 Marine water in the area is strongly influenced by nitrogen and phosphorus discharges from the Pearl River and by HKSAR-derived sewage discharges (after preliminary treatment) from three marine outfalls. Despite these influences, there was full compliance with the Water Quality Objectives for dissolved oxygen and un-ionised ammonia for the year 2000. EPD data also shows marine sediment quality to be generally good in the area, with only levels of the metalloid arsenic exceeding the Lower Chemical Exceedance Level.²

Key Issues and Sensitive Receivers

7.3.15 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).

7.3.16 A number of Water Sensitive Receivers (WSRs) are present in the vicinity of the proposed site. These include:

- Cooling water intake for Castle Peak Power Station;
- Cooling water intake for Black Point Power Station;
- Cooling water intake for Hong Kong International Airport;
- WSD cooling and flushing water intakes at Tuen Mun; and
- Gazetted Beaches in Tuen Mun District.

7.3.17 In addition, this area is of significance as a fisheries resource and as part of the core area for the Chinese White Dolphin, *Sousa chinensis*. Due to the conservation value of the dolphin, the marine waters around the Sha Chau and Lung Kwu Chau were designated as a Marine Park in November 1996. Impacts upon ecological and fisheries resources are assessed separately.

7.3.18 The locations of sensitive receivers are shown in *Figure 7.1*.

Reclamation and Site Formation

7.3.19 During the 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 current. The extent of the sediment plume dispersal will depend on the size and character of the fill material(s) and specific hydrodynamic conditions.

7.3.20 Given the strength and direction of the prevailing current along Urmston Road (the section immediately to the north of the proposed site), coupled with a background of elevated suspended solids, reclamation and site formation works may potentially generate impacts on water quality sensitive receivers. The WQ sensitive receiver that may be most exposed to potential impacts during the ebb tide is the cooling water intake for the Hong Kong International Airport at Chek Lap Kok. The gazetted bathing area at Butterfly Beach and the WSD seawater abstraction points at Tuen Mun to the east are also close to SCIL. However, generalised current details for the area indicate that these receivers at Tuen Mun are in sufficiently sheltered waters not to be adversely affected (*ibid.*).

7.3.21 The hydrodynamic and water quality monitoring did not predict any exceedances of SS level with respect to WQO during construction. Elevated SS levels, up to a maximum of 17.40% (Phase 3 construction, dry season period) were identified in the vicinity of the northern end of the Hong Kong International Airport.

² EPD (2001). Marine Water Quality in Hong Kong in 2000. EPD, Government of the HKSAR – 2001.

Hydrodynamic Water Quality Impacts Following Island Formation

- 7.3.22 Hydrodynamic modelling for the study area predicted significant increases in accumulated flows in the East Lamma (up to 12.63%) and Tathong Channel (up to 35.48%) and significant reductions in the West Lamma Channel (up to 19.46%). The presence of the island is predicted to cause small increases in average current velocities (1.12% to 3.00%) in the vicinity of the proposed island.
- 7.3.23 The modelling results also indicated that the presence of the island would result in small reduction (<3%) in the calculated fluxes across Tai Lam Channel during the dry season: at spring ebb and neap flood periods; and the wet season: at spring flood, neap flood and neap ebb periods. During all the remaining tidal phases, there would be minimal increases in the tidal fluxes across the channel (<0.2%). This implied that the presence of the island would have a general minor reduction of flow through the harbour west area, and consequently, the pollution dispersion capacity of the harbour west area would be slightly reduced.
- 7.3.24 In the hydrodynamic and water quality and hydrodynamic modelling, 10 sensitive receivers that are close to the site were selected for presentation. Of the 10 chosen indicator points, 6 are located in the North Western WCZ (WD1, WI1, GB1, CW2, CW7, MP3), 1 in the North Western Supplementary WCZ (WD3), 2 in Western Buffer WCZ (FC1, GB2) and 1 in Deep Bay WCZ Outer Subzone (CW1).
- 7.3.25 According to the dry season water quality modelling results, the predicted 90%ile DO for depth average and bottom layer ranged from 6.28 to 7.17mg/L which is above the WQO of 4mg/L and 2mg/L respectively. The percentage differences caused by the presence of the island were insignificant (less than 3%).
- 7.3.26 The predicted average dry season salinity ranged from 28.21 to 33.14ppt. The differences in salinity levels caused by the presence of the island were minimal (less than 1%) at all of the selected indicator points as compared to the WQO requirements that change due to any waste discharge should not exceed 10% of natural ambient level.
- 7.3.27 The predicted dry season SS levels at the indicator points were in the range of 5.54 to 10.73mg/L. The percentage increases in the SS levels caused by the island were less than 3%. Comparing to the WQO requirement that any waste discharge should not raise the natural ambient level by 30%, the differences are considered small.
- 7.3.28 The predicted *E.coli* in the dry season levels ranged from 1 to 215count/100ml and are below the WQO of 610cfu/ 100ml. Only GB1 showed an increase in the *E coli* levels of 6.09% while CW7 showed a reduction in the *E coli* levels of 2.78%. No notable changes were observed at any of the remaining stations.
- 7.3.29 The predicted average dry season UIA (0.00263 – 0.00433mg/L) at all indicator points were very small as compared to the WQO of 0.021mg/L.
- 7.3.30 The dry season TIN levels ranged from 0.161 to 0.251mg/L. Since the WQO of TIN is an annual mean value, the predicted mean TIN levels for both the dry and wet seasons were averaged to represent the annual mean values. The calculated annual mean values ranged from 0.272 - 0.281mg/L for FC1, GB2 (Western Buffer WCZ), 0.345 to 0.448mg/L for WD1, WI1, GB1, CW2, CW7, MP3 (North Western WCZ) and 0.463mg/L for CW1 (Deep Bay WCZ Outer Subzone). The annual mean WQO for TIN is 0.4mg/L for Western Buffer WCZ and 0.5mg/L for both North Western WCZ and Deep Bay WCZ Outer Subzone. Therefore, the calculated annual mean TIN values at all the selected indicator points complied with their respective WQO.

- 7.3.31 According to the wet season water quality modelling results, the predicted 90%ile DO for depth average and bottom layers ranged from 4.78 to 5.07mg/L and is above the WQO of 4mg/L and 2mg/L respectively. It is predicted that the presence of the island would reduce both the 90%ile depth-averaged DO and 90%ile bottom DO at most of the indicator points. Compared to the baseline water quality results, the percentage differences for both 90%ile depth-averaged DO and 90%ile bottom DO were minimal of less than 1.5% at all indicator points.
- 7.3.32 The predicted average wet season salinity ranged from 4.50 to 18.17ppt. It is predicted that the island would change the salinity at CW1, WD1, CW7 and CW2 by -11.07%, -9.71%, -8.42% and +10.71% respectively. Compared to the WQO requirement that change due to any waste discharge should not exceed 10% of natural ambient level, the differences at these 3 stations are considered quite significant. The differences at all the remaining stations were less than 4%.
- 7.3.33 The predicted SS levels in the wet season at the indicator points were in the range of 6.97 to 15.69mg/L. It is predicted that the island would increase the SS levels at most of the sensitive receivers with the largest differences of 13.11% predicted at Station CW7. Compared to the WQO requirement that any waste discharge should not raise the natural ambient level by 30%, the predicted differences are considered small.
- 7.3.34 The predicted wet season *E.coli* levels in the wet season ranged from 1 to 174count/mL and are well below the WQO of 610cfu/100mL.
- 7.3.35 The predicted average wet season UIA (0.00553 – 0.00674mg/L) at all indicator points were low and well below the WQOs of 0.021mg/L.
- 7.3.36 The predicted wet season TIN levels were quite high and ranged from 0.382 – 0.688mg/L. Since the WQO of TIN is an annual mean value, the predicted mean TIN levels for both the dry and wet seasons were averaged to represent the annual mean values. The calculated annual mean values ranged from 0.272 - 0.281mg/L for FC1, GB2 (Western Buffer WCZ), 0.345 to 0.448mg/L for WD1, WI1, GB1, CW2, CW7, MP3 (North Western WCZ) and 0.463mg/L for CW1 (Deep Bay WCZ Outer Subzone). The annual mean WQO for TIN is 0.4mg/L for Western Buffer WCZ and 0.5mg/L for both North Western WCZ and Deep Bay WCZ Outer Subzone. Therefore, the calculated annual mean TIN values at all the selected indicator points complied with their respective WQO.
- 7.3.37 The water quality modelling results indicated that the water quality impacts due to the proposed island on the Sea Water intake would be minimal. The pollutant levels at WI1 (WSD Sea Water Intake at Tuen Mun) complied with the WQO of Sea Water for Flushing Supply.

Cumulative Impacts

- 7.3.38 Site formation and construction works with the potential for cumulative water quality impacts are reclamation works at Yam O and further development work at Tung Chung. Generalised information on prevailing water currents in the area indicates that works at Tung Chung are unlikely to contribute to cumulative impacts due to weak currents in Tung Chung Bay / south of Chek Lap Kok area, which have limited potential for sediment transport. It is also expected that works at Yam O would be completed some time before the start of development activities for the proposed Sha Chau island site: presently scheduled for around 2010.

Waste Management / Disposal Impacts

- 7.3.39 For construction of the “island” on which the landfill would be located, inert C&D material would be brought in exclusively by marine vessel, 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.

7.3.40 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 sea wall, 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.

7.3.41 The anticipated volume of materials is as follows:

Volume of public fill that could be accepted for island construction: 100Mcum

7.3.42 Various potentially dangerous 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.

7.3.43 Regarding GHG emissions, waste delivery to the Sha Chau Site will be by marine vessel which will have a lower GHG emission per kg waste handled, compared to road traffic, given the capacity for a marine vessel is almost 100 times higher than a truck. The cumulative distance between marine RTSs and the site is around 300km. As such, according to the assessment ranking scale (as presented in Section 5), the potential impacts associated with the GHG emissions are considered to be neutral to minor.

Ecology

Baseline Conditions

7.3.44 The key significance of the Sha Chau area in ecological terms is its status as part of the core area for activity of the Chinese White Dolphin *Sousa chinensis*. Due to the conservation value of the dolphin, the marine waters around the Sha Chau and Lung Kwu Chau were designated as a Marine Park in November 1996.

7.3.45 The Sha Chau and Lung Kwu Chau Marine Park covers a marine and coastal area of about 1,200ha, excluding the land area of Sha Chau, Lung Kwu Chau and Pak Chau. In HKSAR waters the core dolphin habitat area also encompasses waters to the north through Urmston Road and around the mouth of Deep Bay and east towards The Brothers. Whilst dolphins are observed in the general North Lantau area throughout the year, the periods of greatest abundance are June through November.³

7.3.46 According to an AFCD Study, the proposed artificial island site is located at the centre of an ecologically important spawning habitat for a number of fish species, including a number of commercially valuable species.⁴ Species of note in the Sha Chau and Lung Kwu Chau Marine Park include the fish *Cynoglossus macrolepidotus*, *Solea orata* and *Lateolabrax japonicus*, and a range of shrimp species. There are also records of solitary corals in the area, with the hard coral reported at Sha Chau.⁵

³ AFCD (2001). Marine Conservation: Chinese White Dolphin – Abundance [www.afcd.gov.hk/con_new/homepage.htm]

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 ERM (1995). EIA for Proposed Aviation Fuel Receiving Facility at Sha Chau. For Provisional Airport Authority.

- 7.3.47 The predominant benthic infauna taxa in the area is the polychaetes; with this taxa comprising between 40-70% of the community. Molluscs, crustaceans and echinoderms are also well represented.⁶ The epifauna community in the area was investigated in 1995 and more recently in the May 2001. In both case the survey was by trawling. The 1995 survey reported that crustaceans were most abundant, with 19 species of crab and 13 shrimp / prawns from a total community catch of 69 species. Bivalves and gastropods (snails and sea slugs) were also well represented, with 8 and 10 species respectively.⁷ The community was similarly structured based on the 2001 survey, still being dominated by crabs, but with diversity of shrimps / prawns and gastropods being more similar (23 and 24 species respectively).⁸
- 7.3.48 In May 2002, as part of the mitigation for the temporary aviation fuel line at Sha Chau, the deployment of artificial reefs was completed in the Sha Chau and Lung Kwu Chau Marine Park and the Chek Lap Kok Marine Exclusion Zone. The reefs were designed to enhance fisheries resources and promote marine bio-diversity and feeding opportunities for the Chinese White Dolphins.⁹
- 7.3.49 Due to the disposal of contaminated mud at East of Sha Chau, compliance environmental monitoring has been conducted on behalf of CED since opening of the mud pits and will continue until 2 years after closure of Mud Pit IV to ensure that there are no adverse impacts. Due to the level of seabed disturbance in the East Sha Chau it is anticipated that neither a diverse nor abundant benthic community exists. There are however a number of demersal fish species in the area.

Direct Habitat Loss

- 7.3.50 The site footprint covers a surface area of 350ha. The site area is entirely sub-tidal and its benthic community comprises a range of common species. The immediate waters around the artificial island area do not provide a particularly valuable feeding area for marine species, although as the waters form part of the continuous open water habitat that is heavily used by the Chinese White Dolphin loss of the area may be of some ecological significance.

Water Quality / Hydrodynamics

- 7.3.51 The strong water currents that characterise the area, and particularly the waters of Urmston Road to the immediate north of the artificial island, mean that any decline in water quality brought about as a result of site formation and reclamation activities could affect aquatic species. The Chinese White Dolphin that inhabits the area is native to the Pearl River Delta that is characterised by high levels of suspended sediment. Given that sediment levels are naturally high, and that the dolphins feed by echolocation, any increase in suspended solids from the artificial island works is not anticipated to lead to any significant impacts on this species.
- 7.3.52 Output from the completed numerical modelling exercise predicts a maximum increase in suspended solids levels in the dolphin habitat (WD1) due north (off Castle Peak) to be just 1mg/L to a total concentration of 10.5mg/L (a 12% increase above baseline). Predicted levels above baseline in the Sha Chau & Lung Kwu Chau Marine Park (MP3) are comparable, although there is a greater range of levels due to more exposure to the Pearl River flow.

⁶ Binnie Consultants (1995). REMOTS and Grab Sample Survey to Assess Benthic Recolonisation following Backfilling at East of Sha Chau Marine Borrow Pit. For CED, HKSAR Government.

⁷ ERM (1997). EIA Study for Disposal of Contaminated Mud in the East of Sha Chau Marine Borrow Pit. For CED, HKSAR Government.

⁸ Mouchel (2001a). EM&A for Contaminated Mud IV at East of Sha Chau: Quarterly Report (May – July 2001). For CED.

⁹ AFCD (2001). Fisheries: Artificial Reefs Programme. [<http://www.afcd.gov.hk/fish/ard/webpage/English/index.html>].

- 7.3.53 Impacts on adult pelagic and particularly demersal fish would be more locally significant due to greater sensitivity to increased suspended sediment levels. As the waters are also an important spawning ground for a number of species, there is potential for a greater impact on less mobile and more physiologically sensitive juvenile fishes. There is also potential for water quality impacts upon the artificial reef programme that has been developed, and particularly at the reefs deployed in the Airport Exclusion Zone some 1.5km southeast.
- 7.3.54 Given the water depth, the distance of the artificial island site from coastal areas and the absence of sensitive inter-tidal habitats nearby (i.e. mudflat / mangal), no adverse hydrodynamic impacts are anticipated. This assumption is supported by the results of the modelling exercise, with the greatest change for any of the ecological receivers being a 12% increase in suspended solids at WD1 (from a 9.43mg/L baseline to 10.53mg/L), during Phase 2 construction, Dry Season.

Marine Vessel Disturbance

- 7.3.55 Marine transportation of fill and construction material, and operational marine traffic all give rise for potential collision and noise disturbance with these mammals. There is potential for an increase in incidences of vessel collision with dolphins due to the inevitable increase in marine traffic required for site formation / reclamation activities. Dolphins may feasibly be attracted to the area because of temporary feeding opportunities provided by the works (i.e. disturbance of benthic fish by the works), thus increasing the chances of collision.

Fisheries

- 7.3.56 Fishing activities conducted without a valid permit are prohibited within the Sha Chau & Lung Kwu Chau Marine Park.
- 7.3.57 Due to their importance as a spawning ground for commercial fisheries resources, the marine waters between Sha Chau & Lung Kwu Chau Marine Park and The Brothers (bounded by the Castle Peak and Chek Lap Kok coastlines), have been recommended for protection.⁴ These waters cover part of four main "fishing areas" (from west to east): Lung Kwu Sha Chau; Tap Shek Kok; Mong Hau Shek, and The Brothers.¹⁰
- 7.3.58 Of these four fishing areas, The Brothers is the most productive in terms of adult fish, fish fry and value. Adult fish productivity at the Lung Kwu Sha Chau fishing area is also above average for the HKSAR and as such there is some potential for adverse impacts on fisheries from the development of the potential SCIL in these waters.
- 7.3.59 Commercially valuable fish species in the area include *Leiognathus brevirostris* (pony fish), *Lateolabrax japonicus* (sea bass) and *Clupanodon punctatus* (gizzard shad), with commercially valuable shrimp species such as *Penaeus penicillatus* and *Metapenaeus ensis* also present.¹¹ The Port Survey 96/97 also identified the following species of adult fish that were abundant in the Lung Kwu Sha Chau fishing area: *Caranx kalla* (shrimp cad); *Sardinella jussieu* (sardine); and *Trichiurus haumela* (hairtail).
- 7.3.60 As stated in the ecology sub-section, artificial reefs have been deployed in the Sha Chau & Lung Kwu Chau Marine Park and in the Airport Exclusion Zone to enhance fisheries productivity in the area. Any decline in water quality may thus generate adverse water quality impacts, and particularly at the reef area in the Airport Exclusion Zone.

Cultural Heritage

- 7.3.61 There is no immediate evidence of archaeological remains in this area. However the site lies in one of the most important shipping routes to the Pearl River and has been used by seafarers for several thousand years. Archaeological finds dating to the Neolithic Period have been unearthed on the Archaeological Sites of Sha Chau and Lung Kwu Chau.

¹⁰ AFCD (1998). Port Survey 96/97. Fisheries Management Division, AFCD.

¹¹ AFCD (2001). Marine Parks Database: Sha Chau & Lung Kwu Chau
[<http://parks.afcd.gov.hk/marine/mpark/scmp.htm>]

- 7.3.62 The coastal area of Tuen Mun was developed with early human settlements. During the Tang and Song Dynasties, (960-1279 AD) Guangzhou (Canton) grew into the largest port in China. Tuen Mun has long been of special strategic importance to coastal defence, maritime trade and sea traffic en route to Canton in the historical past. Located on the Pearl River estuary with waterway access to Guangdong Province (and the port of Canton), Tuen Mun Bay was an important harbour for the Persians, the Arabs and the traders from India, Indo-China and East Indies from the 7th century.
- 7.3.63 Merchant ships previously used to anchor and gather at Tuen Mun before entering the Pearl River. There is a possibility, therefore, that significant marine archaeological remains could be lying on the seabed of this site.
- 7.3.64 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

- 7.3.65 *Landscape Planning Designations* - this area of landscape is not covered by any planning designations reflecting landscape/landscape values and so there will be no impact on these values.
- 7.3.66 *Landscape Resources* - 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.
- 7.3.67 *Landscape Character* - the SCIL lies adjacent to the existing islands of Sha Chau and Lung Kwu Chau at the mouth of the Chi Shui-Men LCA, lying between Lantau Island to the south and the western New Territories to the north (*Figure 7.3*). It has a relatively contained character with little major shipping passing through it (*Figure 7.4*). Within the character area are the Brothers, two small sedimentary islands located in the middle of it. Formerly natural landforms, the islands were levelled as part of the construction of the Hong Kong International Airport at Chek Lap Kok and now comprises low, level platforms with a simple grass cover.
- 7.3.68 There exists potential for significant impacts on landscape resulting from construction/operation works. The SCIL will be incompatible with the existing open character of the LCA and in particular the relationship of Chi Shui-Men to the Pearl River Estuary. During the afteruse phase, these impacts are likely to be reduced slightly as the island begins to appear more natural. As a consequence of this, the long-term impact on landscape character will be substantial/moderate.
- 7.3.69 *VSRs* - *VSRs* affected by the proposals are identified in *Tables 7.3 and 7.4*. The extent of the project visual envelope is shown in *Figure 7.5*. Key views of visual receivers are illustrated in *Figure 7.6*.
- 7.3.70 The SCIL is located adjacent to heavily populated coastal areas and has a high degree of visibility. It is also adjacent to an important transportation node into the city, namely the Hong Kong International Airport. The key residential *VSRs* are the high-rise, high density developments at Tuen Mun and Tung Chung (still undergoing development) as well as various locations along the coastal edge. The above mentioned *VSRs* are identified as they are the closest to the site and will therefore have the largest degree of impact.
- 7.3.71 Occupational *VSRs* include the industrial activities at Pillar Point, the Hong Kong International Airport and numerous ferries that cross the area. Recreational *VSRs* include Butterfly Beach, Lantau Peak and Castle Peak. Of notable importance are the travelling *VSRs* arriving at Chek Lap Kok, and using the Airport Express and the ferries. For air travellers, although the view is often short in length, it can often be their first of Hong Kong as a new arrival. For this reason, this area has important visual quality as a tourist gateway to the city.

7.3.72 VSRs will experience works on the landfill (shipping, marine vessels, construction of the bridge and partially constructed island) as relatively close artificial elements reducing open views across Chi Shui-Men and the visual impacts will be generally substantial to moderate. After the restoration of the landfill island, its visual impact will be reduced to moderate overall.

Landfill Gas

7.3.73 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.

7.3.74 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.

7.4 Environmental Protection Measures to be Incorporated into Design and Further Environmental Implications

7.4.1 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 Sha Chau site.

Air Quality

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

Noise

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

Water Quality

7.4.4 Mitigation is likely to be required to prevent impacts during dredging and filling for the artificial island reclamation. 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.

Waste Management

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

Ecology

7.4.6 Vessel movements in the area should be reviewed to minimize disturbance of and the potential for collision with the Chinese White Dolphin population.

Fisheries

7.4.7 No special measures are recommended for fisheries mitigation.

Cultural Heritage

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

Landscape & Visual

- 7.4.9 *Mitigation Measures* - Landscape and visual mitigation measures are outlined in Section A of the Report and are illustrated in *Figure 7.8*. Given the proximity of the proposed island landfill to the Hong Kong International Airport flight paths, the orientation of landscape mitigation and choice of appropriate vegetation species should be made with reference to aviation authorities at the full EIA stage.

7.5 Summary

7.5.1 A summary of the SEA for the potential the SCIL is provided in *Tables 7.1 and 7.2*.

Table 7.1: Summary of Sha Chau Island Landfill SEA

	Impacts	Score	Commentary
Air Quality Assessment			
1	Distance to areas of air sensitive land use	O	There are no air sensitive receivers (ASRs) within 500m of the site.
2	Presence of topographic features which could decrease or exacerbate impacts	O	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	O	Wind blows both towards and away from ASRs. No prevailing wind direction has been identified.
4	Cumulative Impacts of relevant emissions (TSP (construction), NO _x , CO, SO ₂ – LFG Flare) taking into account ambient conditions	-	Whilst there may be dust generated from the Recovery Park at Tuen Mun Area 38 and Green Island Cement Works, and gaseous emissions from Castle Peak Power Station and Shiu Wing Steel Mill, these are distant sources. Furthermore, there are no ASRs within 500m of the site. Hence no cumulative impacts are anticipated.
5	Total Emissions of Air Pollutants from the territory-wide waste transportation between the RTSs and the site	O / -	Waste will be delivered to the site by marine vessel and the cumulative distance to be travelled is estimated to be 300km.
6	Overall Impact	O / -	Overall air quality impacts is considered to be 'Neutral / Negative – Low' . 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).
Noise Assessment			
1	Distance to areas of noise sensitive land use	O	There are no noise sensitive receivers (NSRs) within 300m of the site.
2	Topographic Features (Only applicable if there are NSRs within 300m)	O	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	-	Depending on the development programme for the artificial island there may be noisy activities associated with the interim contaminated mud disposal pit. However, there are no NSRs in the works area.
4	Overall Impact	O	'Neutral'

	Impacts	Score	Commentary
Water Quality Assessment			
1	Water Course Diversion	○	Artificial island. Not relevant.
2	Potential for sediment contaminant release	-	EPD's marine sediment testing reveals that the sediment outside the ESC contaminated mud pits is not contaminated. However, as the site would partially overlap with that of the mud pits, there is some potential for disturbance of contaminated mud therein and thus potential for release of contaminated mud into the water column during reclamation works.
3	Potential impacts on WSRs (including increase or exceedance of WQO)	-	The WQO for salinity is predicted to be exceeded to the north-west of Black Point and in the vicinity of the northern end of Chek Lap Kok airport. Elevated salinity levels are also predicted near Castle Peak Bay and south of Urmston Road.
4	Potential Impacts on Groundwater	○	Artificial island. Not relevant.
5	Potential Cumulative Impacts	○	Whilst there are reclamation works scheduled at Tung Chung and Yam O, the hydrodynamics would not generate a cumulative impact. Furthermore, the activities at Yam O (closest to the site) would be completed before the commencement of any construction activities at the site.
6	Overall Impact	-	Overall the potential for adverse water quality impact is considered as 'Negative - Low' . There is some potential for disturbance and mobilisation to the water column of contaminated muds due to overlap of the site with the ESC contaminated mud pits. There are also water intakes in the area that may be affected by sediment plume formation and transport.
Waste Management Assessment			
1	Balance of Materials (surplus/deficit of public fill needed for landfill development)	+	The site could accommodate a large volume of public fill (100Mcum) 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 Mode of transport for delivery of waste to the site	○ / -	Waste will be delivered to the site via marine vessel. The distance travelled from marine RTS(s) to the site has been estimated to be 300km.
3	Overall Impact	○	'Neutral' . Overall the site is considered to have neutral impact due to the balance between the benefit for being able to accommodate surplus C&D material and the relatively larger amount of GHG emissions for the longer distance travelled.

	Impacts	Score	Commentary
Ecological Assessment			
1	Potential for secondary environmental impacts on "Areas of Absolute Exclusion"	-	Model output shows there is some potential for water quality (suspended sediment) impacts on ecological resources in the Sha Chau & Lung Kwu Chau Marine Park and SSSI – both excluded areas.
2	Affects an important habitat	--	The potential island location is within a fish spawning area of ecological importance, and within part of the core dolphin habitat area. Habitat loss and vessel disturbance may be significant.
3	Affects a species of conservation importance	- / - -	Whilst the Chinese White Dolphin may be able to avoid the works area and frequent other undisturbed waters, the site is located within their core habitat and so there is potential for adverse impacts upon this protected species during site construction and operation.
4	Potential for Cumulative Ecological Impact on sites of recognised value	○	It is considered that there is no potential for cumulative effects from either the proposed development works at Tung Chung or at Yam O due to water current and the timing of these works relative to activities at the potential Sha Chau island site.
5	Overall Impact	- / - -	The site is located within an important habitat for fisheries (of ecological value) and forms part of the core area for the Chinese White Dolphin. These pelagic groups however are adapted to the high background concentrations in suspended solids and also have the ability to avoid areas of disturbance at the proposed site. Overall the impact potential is considered to be ' Negative – Low / High '.

	Impacts	Score	Commentary
Fisheries Assessment			
1	Potential for secondary environmental impacts on "Areas of Absolute Exclusion"	○	There are no "Areas of Absolute Exclusion" in the vicinity of the works area.
2	Affects an important mariculture/ fisheries resources (including spawning / nursery ground)	--	The site is located in an area regarded as economically important for fish spawning, and supports several fish species of commercial value.
3	Potential for Cumulative Fisheries Impacts on sites of recognised value	○	It is considered that there is no potential for cumulative effects from either the proposed development works at Tung Chung or at Yam O due to water current and the timing of these works relative to activities at the potential Sha Chau island site.
4	Overall Fisheries Impact	-	The area is of importance as a spawning ground for several commercially valuable fish species. As the extent of the impact zone from site reclamation activities is not expected to infringe on the core area of the fisheries zone, impacts should be limited, so overall: ' Negative – Low '.
Cultural Heritage Assessment			
1	Important cultural (Declared, Deemed or Graded sites) / archaeological sites	○	There are no known sites of cultural heritage significance.
2	Potential for archaeological value	-	The site is located in a known shipping route, and there is evidence of land based archaeological finds on adjacent islands of Sha Chau and Lung Kwu Chau. Recognising the lack of archaeological data currently available at the site, it is considered that the likelihood of archaeological remains in this area is good. A detailed marine archaeological investigation should be carried out in any future studies.
3	Potential for Cumulative Heritage Impacts on sites of recognised value	○	The adjacent land based archaeological sites are coastal. 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 Impact	-	' Negative – Low '. The nearest sites of cultural heritage value are land based, (on Lung Kwu Chau (3km) and Sha Chau, (1km)). They would not be affected by this development. There are no planned or confirmed projects, which may cause cumulative heritage impacts.

	Impacts	Score	Commentary
Landscape and Visual Impact Assessment			
1	Implications for Landscape Planning and Designations	O	This area of seascape is not covered by any planning designations reflecting landscape / seascape values and so there will be no impact on these values. Overall impacts on landscape designations will therefore be Neutral.
2	Impacts on Landscape Resources	O	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 site will have a substantial impact on landscape character by reducing the open character of Chi Shui-Men and changing its relationship to the Pearl River Estuary. During the afteruse phase the natural character of the island will increase but the open character will still be adversely impacted upon. Overall impacts will be Negative – High.
4	Visual Impact	--	The site is close to two heavily populated residential areas (Tung Chung and Tuen Mun) as well as to the North Lantau Expressway. It will be seen by very significant numbers of VSRs. The landfill will therefore have a significant visual impact and overall impacts will be Negative – High.
5	Overall Impact	--	Overall, landscape and visual impacts will be 'Negative – High' for the following reasons: <ul style="list-style-type: none"> • There are no landscape designations covering the disposal site. • As a marine site, no significant landscape resources are affected. • The open landscape character of Chi Shui-Men and its relationship to the Pearl River will be changed with the construction of an island at the opening to this area. • There are large numbers of residential VSRs surrounding the site that will be adversely impacted upon by the construction and operation of the island landfill. The site is also close to the North Lantau Expressway.

	Impacts	Score	Commentary
Landfill Gas Assessment			
1	Distance between the new / extended landfill and SRs	O	This is a marine site, the nearest sensitive receivers are >500m from the site.
2	Number of Receivers within 250m (i.e. Consultation Zone)	O	There are no sensitive receivers within 250m of the site.
3	Man-Made/Natural pathways for LFG Migration	O	None.
4	Additional Utilisation of LFG to Reduce GHG Emissions	O	There are no potential users of LFG (other than on-site use)
5	Overall Impact	O	'Neutral'

Table 7.2: Summary of Sha Chau Island Landfill SEA

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

Table 7.3 Assessment of Significance of Visual Impacts for Sha Chau Island Landfill During Construction / Operation Phase (Note: All impacts 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 21	Tung Chung	6km	Many	Intermediate	High	Moderate to Substantial	Substantial to Moderate
VR 28	Residential Tower in Tuen Mun	4.5km	Very Many	Large	High	Substantial	Substantial
VR 29	Siu Lam San Tsuen	7km	Few	Small	High	Moderate	Moderate
VR 30	Ma Wan	12km	Few	Intermediate	High	Moderate to Substantial	Moderate
<i>Occupational VSRs</i>							
VR 31	Pillar Point Power Station and Cement Works	1.5km	Very Few	Intermediate	Low	Slight to moderate	Slight
VR 22	Hong Kong International Airport	2.2km	Few	Intermediate	Medium	Moderate	Moderate
VR 23	Shekou, Lantau Island and Tuen Mun Ferries	0.1+km	Very Few	Intermediate	Medium	Moderate	Moderate
<i>Recreational VSRs</i>							
VR 32	Butterfly Beach	3.75km	Few	Intermediate	Medium	Moderate	Moderate
VR 20	Lantau Peak	9km	Very Few	Small	Medium	Moderate to Slight	Insubstantial
VR 11	Area for Boating, Fishing, Diving and other water sports activities	0.5 – 10km (varies)	Very Few	Large	Medium	Substantial to Moderate	Moderate
VR 10	Castle Peak	4.5km	Few	Small	Medium	Moderate to Slight	Insubstantial
<i>Travelling VSRs</i>							
VR 25	Hong Kong International Airport	0-3km	Many	Large	Medium	Substantial to Moderate	Substantial to Moderate
VR 26	Airport Expressway	7.5km	Many	Intermediate	Low	Slight to Moderate	Slight
VR 27	Shekou, Lantau Island and Tuen Mun Ferries	0.5 - 3km	Few	Intermediate	Low	Slight to Moderate	Slight

Table 7.4 Assessment of Significance of Visual Impacts for Sha Chau Island Landfill During Afteruse Phase
(Note: All impacts 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 28	Residential Tower in Tuen Mun	4.5km	Very Many	Large	High	Substantial	Moderate
VR 29	Siu Lam San Tsuen	7km	Few	Intermediate	High	Moderate to Substantial	Slight
VR 30	Ma Wan	12km	Few	Intermediate	High	Moderate to Substantial	Slight
VR 21	Tung Chung	6km	Many	Intermediate	High	Moderate to Substantial	Moderate
<i>Occupational VSRs</i>							
VR 31	Pillar Point Power Station and Cement Works	1.5km	Very Few	Intermediate	Low	Slight to moderate	Insubstantial
VR 22	Hong Kong International Airport	2.2km	Few	Intermediate	Medium	Moderate	Slight
VR 23	Shekou, Lantau Island and Tuen Mun Ferries	0.1+km	Very Few	Intermediate	Medium	Moderate	Slight
<i>Recreational VSRs</i>							
VR 32	Butterfly Beach	3.7km	Few	Intermediate	Medium	Moderate	Slight
VR 20	Lantau Peak	9km	Very Few	Small	Low	Insubstantial to Slight	Insubstantial
VR 11	Area for Boating, Fishing, Diving and other water sports activities	0.5 – 10km (varies)	Very Few	Large	Medium	Substantial to Moderate	Moderate to Slight
VR 10	Castle Peak	4.5km	Few	Small	Low	Insubstantial to Slight	Insubstantial
<i>Travelling VSRs</i>							
VR 25	Hong Kong International Airport	0 - 3km	Many	Large	Medium	Substantial to Moderate	Slight
VR 26	Airport Expressway	7.5km	Many	Intermediate	Low	Slight to Moderate	Insubstantial
VR 27	Shekou, Lantau Island and Tuen Mun Ferries	0.5 - 3km	Few	Intermediate	Low	Slight to Moderate	Slight