

10. SOUTH CHEUNG CHAU ISLAND LANDFILL

10.1 Basic Information

Project Title

10.1.1 South Cheung Chau Island Landfill Site (SCCIL) – marine site M.5.

Nature of Project

10.1.2 The Project would form a new marine based waste disposal site situated on the existing disposal ground for uncontaminated dredged mud situated south of Cheung Chau (see *Figure 10.1*).

10.1.3 The SCCIL would require construction of an artificial island of approximately 850ha. 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.

10.1.4 Construction works would be as described in Part A, Section 3.2. In addition works for SCCIL would include:

- Dredging of 20Mcum of underlying muds for seawall construction.

Location and Scale of Project

10.1.5 The SCCIL is located approximately 5km south of the western end of Lantau and 3km south of Cheung Chau. The island of Shek Kwu Chau lies 2.5km to the north west. The site coincides with the area used for mud disposal. Seabed levels in this area vary from 10 to 20m below Chart Datum. This site is bound by the SAR boundary to the south and a major shipping channel to the north.

10.1.6 The SCCIL would cover an area of 850ha to an elevation of +6 mPD. The artificial island would accommodate a landfill with a capacity of 140Mcum to an elevation of +56mPD. The SCCIL would accommodate approximately 225Mcum of fill material.

History of Site

10.1.7 The original mud disposal ground was gazetted in 1982, with further extensions in 1988 and in the early 1990s (1992-93). No formal EIA was carried out in relation to either of these series of extensions. This area was filled extensively with uncontaminated mud throughout the mid-1990s from the PADS and other projects. It is understood from CED that this Disposal Ground has little, if any, remaining capacity to accept further disposal. It is thus most unlikely that the disposal ground would operate during the construction of the island.

Number and Types of Designated Projects Covered

10.1.8 The SCCIL would qualify as a Designated Project under the five categories listed in Part A; Section 2.1.

10.2 Outline of Planning and Implementation Programme

10.2.1 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 10.2*. Assuming landfill operations start in 2019, SCCIL would be full during the period 2035 to 2045, depending upon the rate of waste arisings and the number of other landfills operating concurrently.

10.2.2 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. There are no future major committed developments on South Cheung Chau or Shek Kwu Chau (according to Layout Plans (L/I-CCE/2 and L/I-CCC/2A).

- 10.2.3 This site falls within the boundary of the study area of the South West New Territories Development Strategic Review (SWNTDSR). The SWNTDSR identified the coastal waters off south west Lantau, Soko Islands and South Lamma as potential Marine Parks. The planning intention of the Marine Park is to protect and conserve the relatively unspoilt marine environment, and provide recreational and educational opportunities to the public in areas, as appropriate.
- 10.2.4 The SCCIL coincides with one of the sites proposed for development under the C&D Materials Study.

10.3 Possible Impacts on the Environment

- 10.3.1 Possible impacts on the environment during the construction, operation and aftercare phases of SCCIL are outlined below. *Figure 10.1* provides details of identified sensitive receivers. The individual assessments are summarised in *Tables 10.1 and 10.2*.

Air Quality

- 10.3.2 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.
- 10.3.3 No air sensitive receivers have been identified within 500m of the site, The nearest ASRs are on Shek Kwu Chau (approximately 3km to the nearest) and on Cheung Chau (approximately 4km). Significant air quality impacts are not anticipated. However, potential operational phase air quality impacts would need to be considered in subsequent studies in the event that the island reclamation is used for other landuses (in addition to landfill) or a separate afteruse is developed on top of the landfill following completion of the landfilling operations. Afteruse issues are not considered further in the SEA.
- 10.3.4 Marine vessel 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 290km. As such, no impacts are anticipated.

Noise

- 10.3.5 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.
- 10.3.6 No noise sensitive receivers have been identified within 300m of the site, The nearest NSRs are on Shek Kwu Chau (approximately 3km to the nearest site boundary) and on Cheung Chau (approximately 4km). Significant noise impacts are not anticipated. However, potential operational phase noise impacts would need to be considered in subsequent studies in the event that the island reclamation is used for other landuses (in addition to landfill) or a separate afteruse is developed on top of the landfill following completion of the landfilling operations.

- 10.3.7 Whilst it is 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 off-shore reclamation site with no noise sensitive receivers 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.
- 10.3.8 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

- 10.3.9 The site is located within the Southern Water Control Zone (WCZ). The current through this area mainly flows in an east/west and west/east direction. Background water quality conditions have been established from EPD routine monitoring stations, the latest available data being that collected in 2000, (EPD 2001¹). The site is situated in the western waters of Hong Kong which are characterised by slightly elevated levels of suspended solids, (compared to Eastern Waters) as a result of the influence of the Pearl River Estuary. Locations of water quality monitoring stations are presented in *Figure 10.1*.
- 10.3.10 The South Cheung Chau Disposal Ground was used by the Airport Authority for the disposal of dredged mud from the airport platform development from 1992 to 1994.
- 10.3.11 The nearest regular EPD sediment monitoring station in this area is SS3, which lies approximately 5km to the east. Sediments at SS3 are considered to be uncontaminated according to the latest published data (EPD 2001). The South Cheung Chau Disposal Ground accepts uncontaminated marine muds. The potential for impacts associated with contaminated muds is considered limited.

Key Issues and Sensitive Receivers

- 10.3.12 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).
- 10.3.13 Sediment plumes may have some influence on beaches on south Lantau and Cheung Chau. However, these sensitive receivers are not along the main flow path and modelling findings indicate that the impacts will be minor (up to 15.2%) and that the WQO will not be exceeded.
- 10.3.14 The area south of Cheung Chau has no other WSRs within 1,000m, the nearest beach is on eastern side of Cheung Chau – Kwan Yam Wan which is over 4.5km away. Other beaches on Cheung Chau include Tung Wan (4.8km) and Tai Kwai Wan (5.2km). There are also 4 gazetted beaches on south Lantau all of which are at a distance of over 8km and not within the main flow channels.

Reclamation and Site Formation

- 10.3.15 Due to the exposed location of the site, localised dredging is likely to be necessary for the seawalls prior to construction of the reclamation. However, the dredged material can be placed within the existing dumping grounds (within the footprint of the reclamation) reducing transport and spillage losses.

¹ EPD (2001) Marine Water Quality in Hong Kong (in 2000). Environmental Protection Department, Hong Kong Government.

- 10.3.16 Dredging would have to be monitored and controlled through dredging management. This area has been subject to sediment disposal since 1982 and was subject to extremely high disposal rates in the early 1990s (e.g. over 80Mcum in 1992). Thus whilst the levels of suspended solids in this area will rise as a result of the works, they are not anticipated to reach the levels experienced during dumping operations.
- 10.3.17 The hydrodynamic and water quality modelling predicts that the increase in SS level due to construction may exceed the WQO (30%) at NS3 (south-west of Cheung Chau) during both the dry (31.25%) and wet (30.77%) season for Phase 1 construction. Whilst not exceeding WQO, increases were predicted during Phase 1 construction at SC19 (10.78%), MP12 (16.97%) and RD (19.80%) in the vicinity of the Soko Islands and FP7 (15.09%) to the south west of Shek Kwu Chau, during the dry season. Increases were also predicted at these locations (13.28%, 17.22%, 16.28% and 14.83% respectively) during the Phase 2 construction dry season and at NS1 (9.09%) to the south of Cheung Chau during the Phase 2 construction wet season, and at FP7 (14.32%) (in the dry season) and NS1 (11.53%) (in the wet season) during the Phase 3 construction. Furthermore, it is most unlikely that the South Cheung Chau Disposal Ground would operate during the construction of the island, and so cumulative compacts would not arise.

Hydrodynamic and Water Quality Impacts Following Island Formation

- 10.3.18 The presence of the island would cause only slight changes in momentary flow in the major channels. Accumulated flows through the West Lamma Channel were predicted to increase by 7.92% and 7.45% during the dry and wet seasons respectively, whilst an increase of 9.84% was predicted during the wet season for the Tathong Channel. The presence of the artificial island was not predicted to have a significant effect on the current velocity field during either the wet or dry season. It was however predicted that the proposed island would cause significant change to the current velocity with average percentage increases of 16.54% and 19.70% being predicted to the northeast and northwest respectively.
- 10.3.19 In the hydrodynamic and water quality modelling, the relative differences in tidal flux between major channels, including Victoria Harbour, East and West Lamma Channels and Adamasta Channel, were investigated. It is predicted that the presence of the island would cause a small reduction in the accumulated fluxes during the wet season neap ebb and neap flood periods in both Victoria Harbour (-1.44% and -0.91% respectively) and East Lamma Channel (-0.52% and -1.34% respectively) and small increases in the remaining tidal phases. The increment ranged from 0.00% to + 0.41% for Victoria Harbour and from +0.05% to +1.17% for East Lamma Channel.
- 10.3.20 It is also predicted that the island would cause minimal impact on the tidal fluxes during the dry season (changes of 0.00% were predicted by the model) to West Lamma Channel. There would be small increases (ranged from +0.58% to +2.53%) in accumulated fluxes during the wet season for all tidal phases except only for spring flood period where a small reduction (-3.77%) in the accumulated fluxes was predicted by the model.
- 10.3.21 The effect on the Adamasta Channel is predicted to be minimal during the dry season (changes of 0.00% were predicted by the model). The effect however would be quite large during the wet season. There would be a large reduction in the calculated fluxes during the wet season spring ebb and neap ebb periods (-24.40% and -63.64%) respectively. During the wet season spring flood and neap flood periods, the effects were predicted to be relatively smaller (+11.6% and 0.94% respectively).
- 10.3.22 The overall changes in flow discharges through these four channels would however be small. The net reductions would be within 0.1%. This relatively small change in flow indicated that the dispersion capability of harbour west area would not be changed by the presence of the artificial island on this site. However, the flow would be redistributed from the Adamasta Channel to the other channels and the West Lamma Channel would receive the least share of redistribution.

- 10.3.23 In the Water Quality and Hydrodynamic Modelling, 27 sensitive receivers that are close to the site were selected for presentation. Of the 27 chosen indicator points, 22 are located in the southern WCZ (CW4, GB11-13, HC1, GB3, FP7, FP1-3, 8, MP6, 12, SC19, 20, RD, NS1-4 and NS10-11) and the remaining 5 are all located in Mainland waters (MF5-9). All MFs are classified as Category 2 in the Mainland Sea Water Standard.
- 10.3.24 According to the dry season water quality modelling results, the predicted 90%ile DO for depth average and bottom layer ranged from 6.31 to 7.45mg/L and was above the WQO of ≥ 4 mg/L for depth-average and ≥ 2 mg/L for bottom DO as well as the Mainland Standard of 5mg/L. The predicted average salinity ranged from 33.70 to 34.00ppt. Compared to the baseline water quality results, the percentage differences in salinity and DO levels caused by the presence of the island were insignificant (less than 2%) at the selected indicator points. For salinity, the difference was well below the WQO which states that any change due to any waste discharge should not exceed 10% of natural ambient level.
- 10.3.25 The predicted SS levels for the dry season at the indicator points were in the range of 3.83 to 5.22mg/L. It is predicted that the island would not cause significant impacts to the SS levels in the vicinity. The greatest increase in SS level was observed in NS11 (Fishery Nursery/Spawning Ground South of Lantau Island) with 6.86%. The percentage difference of all of the selected indicator points were below the WQO that states that change due to waste discharge should not raise the natural ambient level by more than 30% as well as the Mainland standard that man-made increment shall not exceed 100mg/L.
- 10.3.26 For *E.coli*, the predicted dry season levels were in the range of 1 to 82count/100mL which were well below the WQO of 610cfu/100mL as well as the Mainland standard of 200count/100mL. The highest deviations from the baseline scenario were observed at indicator point MP12 (Potential Marine Park/Marine Reserve & Fishery Nursery/Spawning Ground near Soko Island) with a 100% or 1count/100mL increase of *E.coli* levels and HC1 (Horseshoe Crab Area near Tong Fuk) with a 48.28% or 14count/100mL reduction of *E.coli* levels. The baseline and operational phase scenarios for the remaining indicator points were similar.
- 10.3.27 The predicted average dry season UIA (0.00067 – 0.00350mg/L) at all indicator points were very small and well below the WQO of 0.021mg/L and the Mainland standard of 0.02mg/L. NS11 (Fishery Nursery/Spawning Ground South of Lantau Island) and GB11 (Gazetted Beaches in Cheung Chau) showed a large reduction in UIA level with differences of 14.75% or 0.00032mg/L and 14.96% or 0.00035mg/L respectively.
- 10.3.28 The predicted dry season TIN levels (0.0862 – 0.0975) at the indicator points in Mainland waters (MF5-9) were very small and well below the Mainland standard of 0.3mg/L. Since the Hong Kong WQO of TIN is an annual mean value, the predicted mean TIN levels at the indicator points in Hong Kong waters for the dry and wet seasons were averaged to represent the annual mean values. All 22 indicator points breached the WQO of 0.1mg/L with calculated annual mean values ranging from 0.1455 to 0.2549mg/L. However, The calculated average baseline concentrations at these stations also exceeded the WQO.
- 10.3.29 According to the wet season water quality modelling results, the predicted 90%ile DO for depth average and bottom layer at the indicator points in Hong Kong waters ranged from 4.64 to 6.73mg/L, with the values were well above the WQOs of ≥ 4 mg/L for depth-averaged and ≥ 2 mg/L for Bottom DO. Meanwhile, for sensitive receivers in Mainland waters, MF5 and MF6 (Fish/Scallop/Rockshore Culture Areas near Zhizhou Islands) breached the WQO of 5mg/L for 90%ile DO for the bottom layer. However, the DO baseline levels at these 2 indicator points also breached the relevant standards.
- 10.3.30 The predicted average salinity in the wet season ranged from 16.50 to 25.10ppt. Compared to the baseline water quality results, the percentage differences in salinity caused by the presence of the island were in the range of 1.00 to 7.30%. The presence of the island would cause reduction in the salinity at all indicator points except MF9 where no notable changes were observed. The percentage difference is below the WQO that states that change due to any waste discharge should not exceed 10% of natural ambient level.

- 10.3.31 The predicted average SS levels in the wet season at the indicator points were in the range of 4.49 to 7.79mg/L. In comparison to the baseline, the predicted percentage differences complied very well with the WQO that states that waste discharge should not to raise the natural ambient level by 30% as well as the Mainland standard that man-made increment should not exceed 10mg/L.
- 10.3.32 The predicted *E.coli* levels in the wet season were in the range from 1 to 9count/100mL which complied very well with the WQO of 610count/100ml and the Mainland standard of 200count/100mL.
- 10.3.33 The predicted average wet season UIA (0.00450 – 0.00553mg/L) at all indicator points were low and were well below the WQO of 0.021mg/L as well as the Mainland standard of 0.020mg/L. NS3 (Fishery Nursery/Spawning Ground Southwest of Cheung Chau) showed the largest reduction in UIA level with 10.83% or 0.00052mg/L.
- 10.3.34 The predicted wet season TIN levels (0.2241 – 0.4111mg/L) at the indicator points in Mainland were quite high. Both MF5 and MF6 (Fish/Scallop/Rockshore Culture Areas near Zhizhou Islands) breached the Mainland standard of 0.3mg/L. However, the predicted TIN levels for the baseline scenario in these 2 stations also exceeded the corresponding Mainland standard. Meanwhile, the predicted TIN levels (0.2737 – 0.4231mg/L) at the indicator points in Hong Kong waters were relatively higher as compared to the dry season data. All stations in Hong Kong waters breached the WQO of 0.1mg/L as discussed in Section 10.3.28 above.

Cumulative Impacts

- 10.3.35 There are no major marine developments currently planned within the area of the proposed SCCIL, however, the possible breakwater in the West Lamma Channel could cause cumulative water quality and hydrodynamic impacts. This issue requires further investigation once the status of the breakwater is ascertained.

Waste Management / Disposal Impacts

- 10.3.36 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.
- 10.3.37 Whilst various options for construction that avoid dredging have been investigated, it is anticipated that muds would need to be excavated to facilitate construction of the outer seawall, prior to public filling. Excavated muds would then be disposed of within the area to be reclaimed with public fill. Following this, the “island” would act as a major recipient of municipal solid waste and other landfilled waste streams.
- 10.3.38 Anticipated volumes of materials are as follows:
- Volume of public fill that could be accepted for island construction: 225Mcum
 - Volume of muds be dredged for outer sea wall: 20Mcum
- 10.3.39 Various potentially polluting materials may be stored, handled and transported to / from the site. Examples may include chemicals for waste water/leachate treatment, waste oils, fuel for plant working on the site, etc. These would be managed as described in Section 5.5.
- 10.3.40 Regarding the GHG emissions, waste delivery to the site will be by marine vessel which will have a lower GHG emission per kg waste handled compared to road transport given the capacity is almost 100 times larger for a marine vessel than a truck. The cumulative distance between marine RTSs and the site is around 290km (Preliminary Marine Review (March 2002)). The GHG impacts are considered to be neutral.

Ecology

Baseline Conditions

- 10.3.41 This SCCIL coincides with the footprint for the South Cheung Chau Disposal Ground. This area has been subject to significant disturbance over a number of years from filling with dredged muds. Over 10m of marine mud has been dumped in this area over the last 17 years.
- 10.3.42 *Figure 10.1* shows the locations of ecologically sensitive areas potentially affected by the project.
- 10.3.43 Several benthic invertebrate surveys have been undertaken at the Disposal Ground (Binnie Consultants Ltd 1994², ERM 1997³, SAIC & Binnie 1994⁴, Binnie Consultants Ltd 1995a⁵ and 1995b⁶). The only surveys conducted prior to gazettal of the site as a dumping ground were during 1976 and 1977 as part of a territory wide study (Shin and Thompson, 1982⁷).
- 10.3.44 The benthic survey data collected in 1976/77 by Shin and Thompson (*Ibid*) indicates that prior to dumping, the sea bed showed a diverse community of polychaetes supported by a physical habitat characterised by a southeast-northwest gradient of sand/silt content. During dumping, grab surveys indicated that polychaetes still dominate the area, however, along with a change in physical habitat, the polychaete community became more dominated by opportunistic species such as the spionids which are often found in disturbed areas. ROV and dive surveys conducted since dumping began, indicate that within the dumping ground, consolidated mud sites support the highest abundance and diversity of epi-benthic invertebrate and fish communities. Whip corals were among those able to colonise the consolidated shell/mud/debris areas.
- 10.3.45 The survey data collected prior and since dumping has been carried out indicates that within the disposal ground, the polychaete community is less diverse than prior to dumping (and compared to reference sites), and is dominated by more opportunistic species. Above the mud, significant communities exist particularly where the mud has had sufficient time and opportunity to consolidate to form a reasonable habitat base. Records of hard corals on exposed rock pieces shows the potential of the area should hard substrate become available.

² Binnie Consultants Limited (1994) South Cheung Chau and Sulphur Channel, Seabed Ecology Pilot Survey by Grab Sample, Draft Report. Report to Civil Engineering Department, Geotechnical Engineering Office.

³ ERM-Hong Kong Ltd (1997) Seabed Ecology Studies: Composite Report. Report to Geotechnical Engineering Office, Civil Engineering Department.

⁴ SAIC & Binnie (1994) REMOTS Survey of Soft-bottom Environments in Coastal Waters of Hong Kong: Demonstration of Rapid Bottom Mapping Technique. Report to Geotechnical Engineering Office, Hong Kong Government.

⁵ Binnie Consultants Limited (1995a) Working Paper on Benthic Recolonization in Relation to Dredging and Disposal Activities in Hong Kong Coastal Waters. Report to Civil Engineering Department, Geotechnical Engineering Office.

⁶ Binnie Consultants Limited (1995b) Underwater Dive Surveys of Hong Kong Waters. Report to Civil Engineering Department, Geotechnical Engineering Office.

⁷ Shin PKS and Thompson GB (1982) Spatial Distribution of the Infaunal Benthos of Hong Kong. *Mar Ecol Prog Ser* 10: 37-47.

- 10.3.46 As a result of previous activities, the site is considered relatively ecologically poor when compared to areas of undisturbed seabed. In addition, the waters have consistently contained higher levels of suspended solids than other areas not subject to similar influences and elevated levels of suspended solids are likely to be “normal” for this site and the associated marine resources.
- 10.3.47 The key sensitive receivers during construction phase are ecological habitats near Soko Islands. Since there is some distance between the proposed site and Soko Islands, the sediment plume impact is likely to be moderate.
- 10.3.48 Cetacean surveys in Hong Kong waters, between 1995 and 2000, (Jefferson 1998⁸ and 2000⁹) during the period of mud dumping indicate that there is no significant presence of Chinese White Dolphin or Finless Porpoise within the site area. (see *Figure 10.1*).
- 10.3.49 The nearest protected areas are the proposed Soko Islands and South Lantau Marine Parks (which are 7.2km and 10.3km distant respectively) to the west. In addition, the proposed South Lamma Marine Park is 9km to the east.
- 10.3.50 Additional field surveys have been proposed for this site under C&D Materials Study (Agreement CE 46/2000), and should be taken in to account should this site be investigated further as part of an EIA.

Direct Habitat Loss

- 10.3.51 The SCCIL covers an area of 850ha, and coincides with the disposal ground. Whilst some recolonisation of the seabed has occurred, the site is comparatively ecological poor, and direct impacts are likely to be moderate.

Water Quality / Hydrodynamics

- 10.3.52 As described in the Section on Water Quality, the waters have consistently contained higher levels of suspended solids than other areas not subject to similar influences and elevated levels of suspended solids are likely to be “normal” for this site and the associated marine resources. Protected areas at Soko Islands, South Lantau and Lamma are relatively remote from this area and impacts are likely to be mitigable. There are no major marine developments currently planned in the vicinity of the site, however the possible breakwater in the West Lamma Channel could cause cumulative ecological impacts. This issue requires further investigation once the status of the breakwater is ascertained.

Marine Vessel Disturbance

- 10.3.53 Current levels of mud dumping may discourage the presence of cetaceans within the disposal ground area. Further disturbance as a result of reclamation to form an artificial island for subsequent landfill development, is unlikely to exacerbate the situation.

⁸ Jefferson TA (1998) Population Biology of the Indo-Pacific Hump-Backed Dolphin (*Sousa chinensis* Osbeck, 1765) in Hong Kong Waters: Final Report. Final Report to Agriculture and Fisheries Department, HKSAR.

⁹ Jefferson TA (2000) Conservation Biology of the Finless Porpoise (*Neophocaena phocaenoides*) in Hong Kong Waters: Final Report. Final Report to the Agriculture, Fisheries and Conservation Department, HKSAR.

Fisheries

- 10.3.54 Baseline data on fisheries is available from Port Survey Data and data from the Consultancy Study, Fisheries Resources and Fishing Operations in Hong Kong waters (Fisheries Resources Survey, ERM 1998¹⁰). Due to the historical mud dumping activities, neither of these studies examined the fisheries resources directly within the area of the proposed site. A baseline survey of the disposal ground has been commissioned under the C&D Materials Study.
- 10.3.55 The SCCIL site lies within two fishing areas; Cheung Chau (Area 30) and Shek Kwu Chau (Area 31). Port Survey Data from 1996/97 (AFD 1998) shows the total production per hectare of Area 30 is reasonable, whilst Area 31 is low. Of a total 210 fishing areas in Hong Kong, Area 30 and Area 31 ranked 36 and 118 respectively in terms of production per hectare.
- 10.3.56 The Areas support significant fishing effort, with up to 34% of Hong Kong's larger fishing vessel fleet (>15m) using these waters and up to 11% of Hong Kong's smaller vessels fishing in the area, (Scott Wilson (2002) C&D Materials Study, *Conceptual Layout Study Report*).
- 10.3.57 A trawl survey conducted under the Fisheries Resources Survey reported the highest mean catch weight per month was recorded from sites in southern waters, particularly South Cheung Chau, South Lantau, and South Lamma. As noted in the C&D Materials Study, (*Conceptual Layout Study Report, March 2002*), whilst the data collected under the Fisheries Resources Survey was from a single survey, the findings run contrary to the relative production estimates from the fisher and port surveys. This indicates that the area is potentially richer in resources than its current exploitation rate would imply.
- 10.3.58 Evidence for a nursery zone within Area 30 was also found from trawl survey, regular survey, interviews and site observations that appeared to show that there was a high abundance of juveniles in the area. The site footprint covers an area of 850ha, and coincides with that of the disposal ground. Whilst evidence exists for potential spawning grounds with fishing Area 30 as a whole, dumping activities at the site, suggest that spawning grounds are unlikely to be directly affected. It should be noted that there is a slight increase of suspended solids at NS3, but this is not significant (< 2mg/L above baseline).
- 10.3.59 The nearest fish culture zones are some distance away, on eastern Lamma (12km distant) and southern Lantau (7.5km distant). These would not be affected. Impacts on the nearby Fish Culture Areas in Mainland waters (i.e. MF7, MF8 and MF9) will be insignificant due to the dispersion effect.
- 10.3.60 The results from models show that there are no significant operational changes in water quality and hydrodynamics. Hence, the overall impacts on fisheries resources will not be significantly affected relative to the current situation.

Cultural Heritage

- 10.3.61 There is no immediate evidence of any significant archaeological remains in this area. However on nearby Cheung Chau there is a rock carving that has been designated as a declared monument (the Cheung Chau Rock Carving). It is believed that the carving was carried out about three thousand years ago by early seafarers inhabiting the area and was intended as a magical symbol of the appeasement of the powers of the sea, or to invoke their protection. This suggests that seafaring people used the natural harbour of Cheung Chau for a considerable period.
- 10.3.62 Recognising the extent of mud disposal activities in this area over the past 20 years, archaeological impacts are not anticipated to be significant. However, given the lack of archaeological data currently available for this site a detailed marine archaeological investigation should be carried out in any future studies.

¹⁰ ERM-Hong Kong Ltd (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters, Agriculture & Fisheries Department, Hong Kong Government.

Landscape and Visual

- 10.3.63 *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.
- 10.3.64 *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.
- 10.3.65 *Landscape Character* – the proposed landfill lies in the Southern Coastal Waters LCA (*Figure 10.4*). The landscape of this part of Hong Kong is characterised by a generally expansive and open extent of water with numerous distant islands on the horizon, including Lantau, Cheung Chau and Lamma as well as islands in PRC territorial waters (*Figure 10.3*). These islands appear natural and unspoilt and provide a coherent, varied and relatively complex landscape. Shipping introduces movement and artificial elements into what is otherwise a predominantly natural landscape.
- 10.3.66 There exists potential for substantial impacts on landscape character resulting from construction works which will introduce new artificial elements which are incompatible with the existing landscape. During the afteruse phase of the island landfill, these impacts are likely to be reduced somewhat, as the completed island is restored. However, somewhat artificial character of the proposed island will be inconsistent with the natural character of the landscape. As a consequence of this, the long-term impact on landscape character will be reduced from moderate to substantial.
- 10.3.67 *VSRs* – *VSRs* affected by the proposals are identified in *Tables 10.3 and 10.4*. The extent of the project visual envelopes is shown in *Figure 10.5*. Because of the location of the proposed site, there are no large areas of population close to the site. Other *VSRs* (such as those on vessels) are often transient. Generally, *VSRs* will experience works on the landfill (shipping, marine vessels and partially constructed island) as distant artificial elements, contrasting with the coherent qualities of existing landscape views (*Figure 10.6*). Generally, visual impacts will be moderate during construction/operation. After the restoration of the landfill island, the visual impact of the island will be reduced to slight to insubstantial for most *VSRs* given the remote location of the island. The exception to this is the *VSR* group at Cheung Chau where the visual impact will be moderate.
- 10.3.68 *Mitigation Measures* - Landscape and visual mitigation measures are outlined in Section A of the Report and are illustrated in *Figure 10.8*.

Landfill Gas

- 10.3.69 There are no sensitive receivers (targets) or pathways within 500m of the site. Therefore, there are no potential off-site landfill gas hazards. 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.
- 10.3.70 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.

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

- 10.4.1 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 South Cheung Chau.

Air Quality

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

Noise

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

Water Quality

- 10.4.4 Although no WQO exceedances were predicted during either the operation or the construction phase, there were WQO exceedances in TIN in all baseline, construction and operation phases. In addition, mitigation could still be required to prevent impacts during dredging and filling for the artificial island reclamation subject to the confirmation of the filling and dredging rate. 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 any EIA. If significant impacts are predicted, a silt curtain may be installed around the immediate works area to prevent dispersion of sediments. In addition, specific protection may be required to protect the cooling water intake at the Lamma Power Station.

Solid Waste

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

Ecology

- 10.4.6 No specific measures to protect areas of ecological value are deemed necessary at this stage; the application of measures to prevent unacceptable impacts on water quality will also apply to ecological resources. It is envisaged that given adequate edge protection design, assemblages typical of those adapted to hard substrates would colonise the rubble mound sea wall of the artificial island.

Fisheries

- 10.4.7 Mitigation applied for the protection of ecological resources would apply equally to the protection of fisheries resources.

Cultural Heritage

- 10.4.8 No specific measures for the protection of cultural heritage are deemed necessary at this stage. This should be re-evaluated in the event that a marine archaeological assessment is carried out as part of an EIA if this site is investigated further.

Landscape & Visual

- 10.4.9 *Mitigation Measures* - Landscape and visual mitigation measures are outlined in Section A of the Report and are illustrated in *Figure 10.8*.

10.5 Summary

10.5.1 A summary of the SEA for the SCCIL is provided in *Tables 10.1 and 10.2*:

Table 10.1: South Cheung Chau Island Landfill SEA

	Impacts	Score	Commentary
<i>Air Quality Assessment</i>			
1	Distance to areas of air sensitive land use	○	There are no ASRs within 500m of the site.
2	Presence of topographic features which could decrease or exacerbate impacts	○	There are no features which would affect air dispersal. In addition as there are no ASRs within 3km, this criterion is not applicable.
3	Occurrence of meteorological conditions which could exacerbate impacts	○ / -	The predominant wind direction is towards ASRs. However the remoteness of ASRs is such that this criterion is not applicable.
4	Cumulative Impacts of relevant emissions (TSP (construction), NO _x , CO, SO ₂ – LFG Flare) taking into account ambient conditions	○	Review of all known planning information (OZPs and the SWNT Development Strategy Review) indicate there are no other confirmed or planned developments within 5km of this marine site, which could contribute to cumulative air quality impacts.
5	Total Emissions of Air Pollutants from the territory-wide waste transportation between the RTSs and the site	○	Waste will be delivered to the site by marine vessel and the cumulative distance to be travelled is estimated to be 290km.
6	Overall Impact	○	'Neutral' . Negligible air quality impacts due to its remote siting.
<i>Noise Assessment</i>			
1	Distance to areas of noise sensitive land use	○	There are no NSRs within 300m of the site.
2	Topographic Features (only applicable if there are NSRs within 300m)	○	The area between the proposed landfill site and Cheung Chau is marine (flat). Notwithstanding, as there are no NSRs within 3km this criterion is not directly applicable.
3	Cumulative Impacts of developments within 300m	○	No developments that could cause cumulative impacts.
4	Overall Impact	○	'Neutral' . Negligible noise impacts on surrounding NSRs due to its remote siting.

	Impacts	Score	Commentary
Water Quality Assessment			
1	Water Course Diversion	○	Artificial island. Not relevant
2	Potential for sediment contaminant release	○	The site is a designated ground for dumping of uncontaminated dredged muds. The potential for impacts associated with contaminated muds is limited.
3	Potential impacts on WSRs	○ / -	<p>Potential impacts considered limited. Nearest beaches (on Cheung Chau – Kwan Yam Wan over 4.5km), are not within the main flow channels. Modelling predicts that SS WQO will be exceeded in both the wet and dry season during construction.</p> <p>It is predicted that both DO and TIN standards in the operational phase would be breached, however, these were both breached in the baseline scenario and the elevations due to the presence of island were not significant, therefore, the island would not be the cause of the exceedances.</p>
4	Potential Impacts on Groundwater	○	Artificial island. Not relevant.
5	Potential Cumulative Impacts (Potential for concurrent projects to exacerbate preceding impacts)	○	No major marine developments currently planned around the site. The possible Lamma breakwater requires further investigation once the status of the breakwater is ascertained.
6	Overall Impact	○ / -	Potential water quality impacts are considered to be ' Neutral / Negative – Low '. The area has been a mud disposal ground for over 17 years and has thus been subject to impacted water quality for many years.
Waste Management Assessment			
1	Balance of Materials (surplus/deficit of public fill needed for landfill development)	+	The site could accommodate major volume of public fill (225Mcum) negating the need to import filling material for site formation. Dredged muds will be incorporated with the fill materials within the island footprint.
2	GHG emissions from mode of transport for delivery of waste to the site from RTSS	○	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 290km.
3	Overall Impact	+	'Positive' .

	Impacts	Score	Commentary
Ecological Assessment			
1	Potential for secondary environmental impacts on "Areas of Absolute Exclusion"	○ / -	Limited impacts anticipated. The nearest protected areas are the proposed Soko Islands and South Lantau Marine Parks (7.2km and 10.3km respectively) to the west. The proposed S Lamma Marine Park is 9km to the east.
2	Affects an important habitat	○ / -	The proposed site is a marine disposal ground and the seabed habitat is of relatively low ecological value (compared to undisturbed sea-bed). Nearest habitat of interest is moderate value corals at Soko's.
3	Affects species of conservation importance	○ / -	This site is likely to disturb an area where Finless Porpoise occur, although the density of sightings in this area is only moderate.
5	Potential for Cumulative Ecological Impacts on sites of recognised value	○	No major marine developments currently planned around the site. The possible Lamma breakwater requires further investigation once the status of the breakwater is ascertained.
6	Overall Impact	○ / -	Ecological impacts are considered to be ' Neutral / Negative – Low '. The site is not a core area for identified marine mammals, and those individuals surveyed have been recorded despite the historical effects of mud dumping. Most ecological receivers of importance are remote from the site and no significant impacts are envisaged.
Fisheries Assessment			
1	Potential for secondary environmental impacts on "Areas of Absolute Exclusion"	○ / -	The site would not impinge on any areas of Absolute Exclusion, (eg. Fish Culture Zones)
2	Affects important mariculture/ fisheries resources (including spawning / nursery ground)	○ / -	This site is within an area of commercially valuable fisheries. However, assuming sediment impacts are not exacerbated significant above existing, impacts are not considered likely to be significant.
3	Potential for Cumulative Fisheries Impacts on sites of recognised value	○	No major developments planned within the area of the site. The status of the Lamma breakwater would require further investigation if this site is pursued
4	Overall Impact	○ / -	The site is within an area generally recognised as having a high fisheries potential. However, the potential fishery impacts are considered to be ' Neutral / Negative – Low ', on the basis of the long history of mud dumping.

	Impacts	Score	Commentary
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 potential for archaeological finds in this site is considered limited due to previous disturbance. However, given the lack of archaeological data currently available, the need for a detailed marine archaeological investigation should be reviewed in future studies, particularly when preparing the EIA Study Brief.
3	Potential for Cumulative Heritage Impacts on sites of recognised value	○	The nearest sites of cultural heritage value are land based, (on Shek Kwu Chau (2.6km) and on Cheung Chau – over 2.8km away). They will be unaffected by this development. There are no planned or confirmed projects, which may cause cumulative heritage impacts.
4	Overall Impact	○	Cultural heritage impacts are considered to be ' Neutral '. The extensive site disturbance resulting from dredging significantly limits the potential for archaeological finds. Recognising the current uncertainty related to lack of information, this is subject to verification.
Landscape and Visual Impact Assessment			
1	Implications for Landscape Planning and Designations	○	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 resources will therefore be Neutral.
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 open, natural character the Southern Coastal Waters Landscape Character Area will be significantly affected by the proposals. Resulting impacts will be Negative High.
4	Visual Impacts	- / - -	The location of the island is at a considerable distance from most populated areas and as a result will generally only have a moderate or slight impact on their visual amenity. Recreational receivers on Cheung Chau will be most impacted by the proposal. Overall visual impacts will be 'Negative – Low / High'.
5	Overall Impact	- / - -	Overall, landscape and visual impacts will be ' Negative – Low / High ' for the following reasons: <ul style="list-style-type: none"> • There are no landscape designations covering the disposal site. • The site is a marine one and so no significant landscape resources are affected; • There will be significant impacts on the open and natural character of the Southern Coastal Waters LCA. • There are relatively low numbers of visual receivers close to the site.

	Impacts	Score	Commentary
Landfill Gas Assessment			
1	Distance between the new / extended landfill and SRs	○	This is a marine site located over 3km south of Cheung Chau, the nearest sensitive receivers are >250m away
2	Number of Receivers within 250m (i.e. Consultation Zone)	○	There are no SRs within 500m
3	Man-made / Natural Pathways for LFG Migration	○	None
4	Additional Utilisation of LFG to Reduce GHG Emissions	○	LFG would be utilised on-site. There are no potential off-site users of LFG.
5	Overall Impact	○	'Neutral'.

Table 10.2: Summary of South Cheung Chau Island Landfill SEA

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

Table 10.3 Assessment of Significance of Visual Impacts for South Cheung 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>							
VR50	Cheung Chau	3km	Many	Intermediate	High	Moderate to Substantial	Moderate
VR51	Sea Ranch	8km	Very Few	Small	High	Moderate	Moderate
VR52	Yung Shue Wan	10km	Many	Small	High	Slight	Slight
VR53	Pokfulam	15km	Very Few	Negligible	High	Insubstantial	Insubstantial
<i>Occupational VSRs</i>							
VR54	Lamma Power Station	10km	Very Few	Small	Low	Insubstantial to Slight	Insubstantial
VR49	Maritime Vessels	5km	Very Few	Intermediate	Low	Slight to Moderate	Slight
<i>Recreational VSRs</i>							
VR55	Cheung Chau	2.5km	Many	Intermediate	High	Moderate to Substantial	Moderate
VR20	N/S Lantau Country Parks	6.5km	Very Few	Negligible	Medium	Insubstantial	Insubstantial
VR56	Lantau Trail	8km	Very Few	Intermediate	High	Moderate to Substantial	Moderate
VR57	Lamma Lookout Point pavilion at Headland on trail between Hung Shing Yeh Beach and Soh Kwu Wan,	10.5km	Very Few	Small	High	Moderate	Moderate to Slight
VR11	Area for Boating, Fishing and Diving Activities	0 - 10km (varies)	Very Few	Large	High	Substantial	Substantial to Moderate
VR58	Victoria Peak	16km	Many	Negligible	High	Insubstantial	Insubstantial
<i>Travelling VSRs</i>							

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)
VR40	Macau/ Sea Ranch Ferries	5km	Few	Small	Medium	Slight	Insubstantial
VR59	Lamma/ Cheung Chau Ferries	10km	Few	Small	Medium	Slight	Insubstantial

Table 10.4 Assessment of Significance of Visual Impacts for South Cheung 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>							
VR50	Cheung Chau	3km	Many	Intermediate	High	Moderate to Substantial	Moderate
VR51	Sea Ranch	8km	Very Few	Small	High	Moderate	Slight
VR52	Yung Shue Wan	10km	Many	Small	High	Slight	Slight to Insubstantial
VR53	Pokfulam	15km	Very Few	Negligible	High	Insubstantial	Insubstantial
<i>Occupational VSRs</i>							
VR54	Lamma Power Station	10km	Very Few	Small	Low	Insubstantial to Slight	Insubstantial
VR49	Maritime Vessels	5km	Very Few	Intermediate	Low	Slight to Moderate	Slight to Insubstantial
<i>Recreational VSRs</i>							
VR55	Cheung Chau	2.5km	Very Few	Intermediate	High	Moderate to Substantial	Slight to Insubstantial
VR20	N/S Lantau Country Parks	6.5km	Very Few	Negligible	High	Insubstantial	Insubstantial
VR56	Lantau Trail	8km	Very Few	Intermediate	High	Moderate to Substantial	Slight to Insubstantial
VR57	Lamma Island, Lookout Point pavilion at Headland on trail between Hung Shing Yeh Beach and Soh Kwu Wan,	10.5km	Very Few	Small	High	Moderate	Insubstantial
VR11	Area for Boating, Fishing and Diving Activities	0 - 10km (varies)	Very Few	Large	High	Substantial	Moderate to Slight
VR58	Victoria Peak, Hong Kong Island	16km	Many	Negligible	High	Insubstantial	Insubstantial

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>Travelling VSRs</i>							
VR40	Macau/ Sea Ranch Ferries	5km	Few	Small	Medium	Slight	Insubstantial
VR59	Lamma/ Cheung Chau Ferries	10km	Few	Small	Medium	Slight	Insubstantial