Agreement No. CE 35/2006(CE)
Kai Tak Development Engineering Study
cum Design and Construction of Advance Works –
Investigation, Design and Construction

DECOMMISSIONING OF THE FORMER KAI TAK AIRPORT OTHER THAN THE NORTH APRON ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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9 MARINE ECOLOGICAL IMPACT

9.1 Introduction

9.1.1 The Project would include decommissioning of the disused fuel dolphin structure and associated abandoned fuel pipelines located near the To Kwa Wan Typhoon Shelter. The disused fuel dolphin structure will be demolished down to 1m below the existing seabed level. The abandoned fuel pipelines will be left in place and, if necessary, grouting it with concrete. No dredging will be required for the removal of the fuel dolphin structure (see **Section 2.4** for more details). Apart from the removal of fuel dolphin structure, all the other activities associated with this Project would be land-based.

9.1.2 This section identifies and evaluates the nature and extent of potential impacts on marine ecological resources in the assessment area resulting from proposed marine works in the Project. Several relevant baseline studies and assessment reports were reviewed and both direct and indirect impacts on marine ecology during construction were included in the assessment.

9.1.3 Where necessary, field surveys were undertaken to check current existing baseline conditions. Ecological importance of habitats and species potentially affected by proposed works was identified and assessed. The scale and significance of possible ecological impacts resulting from the Project was evaluated, and necessary mitigation measures have been recommended. Residual and cumulative ecological impacts were also identified and evaluated, and ecological monitoring and audit requirements were discussed.

9.2 Environmental Legislation, Policies, Plans, Standards and Criteria

9.2.1 This section makes reference to the following HKSAR Government ordinances, regulations, standards, guidelines, and documents when identifying ecological importance of habitats and species, evaluating and assessing potential impacts of the Project on the ecological resources:

- EIAO Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) Annex 8 – provides guidelines for the evaluation of the ecological impact caused by the designated project. A list of criteria is provided for assessing the importance of habitat / species and the ecological impact.
- EIAO-TM Annex 16 – describes the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts.
- EIAO Guidance Note No. 3/2002 - provides guiding principles on the approach to assess the recommended environmental mitigation measures in EIA reports.
- EIAO Guidance Note No. 6/2002 - provides some guidance on conducting ecological assessment.
- EIAO Guidance Note No. 11/2004 - introduces some general methodologies for marine ecological baseline surveys.
- Wild Animals Protection Ordinance (Cap. 170) - designated wild animals are protected from being hunted, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals, including marine cetaceans, are protected under this Ordinance. The Second Schedule of the Ordinance, which lists all the animals protected, was last revised in June 1997.
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) – to give effect to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Ordinance strictly regulates the import, introduction from

the sea, export, re-export and possession or control of certain endangered species of animals and plants and derivatives of those species scheduled in Appendices I, II and III. The Ordinance came into effect on 1 December 2006.

- Town Planning Ordinance (Cap.131) - provides for the designation of coastal protection areas, Sites of Special Scientific Interest (SSSIs), Conservation Area, Country Park, Green Belt or other specified uses that promote conservation or protection of the environment.

- The Marine Parks Ordinance (Cap.476) and Subsidiary Legislation - allows for designation, control and management of marine parks and marine reserves through regulation of activities therein to protect, conserve and enhance the marine environment for the purposes of nature conservation, education, scientific research and recreation. The Ordinance came into effect on 1 June 1995.

- The Protection of the Harbour Ordinance (Cap.531) – bases on a presumption against reclamation, the harbour is to be protected and preserved as a special public asset and a natural heritage of Hong Kong people.

- The Water Pollution Control Ordinance (Cap.358) – aims to control water pollution in waters of Hong Kong. Water control zones are designated with individual water quality objective to promote the conservation and best use of those waters in the public interest. The most updated water quality objectives for the Victoria Harbour Water Control Zone were revised in June 1997.

9.2.2 This section also makes reference to the following international conventions and nearby national regulation:

- International Union for Conservation of Nature and Natural Resources (IUCN) 2006 Red Data Books - provides taxonomic, conservation status and distribution information on threatened species that have been evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction.

- The PRC National Protection Lists of Important Wild Animals and Plants - lists detailed Category I and Category II key protected animal and plant species under Mainland Chinese Legislation. The list was last updated in November 2002.

9.3 Assessment Methodology

9.3.1 As required in the study brief, the assessment areas cover within 300m beyond the Project area and the Victoria Harbour WCZ. The marine environment of the assessment area comprises the Kowloon Bay, Victoria Harbour, Kai Tak Approach Channel (KTAC) and two typhoon shelters at To Kwa Wan (TKWTS) and Kwun Tong (KTTS). **Drawing 9.1** indicates the locations of ecological surveys conducted within the assessment area under previous literatures and also under the present EIA study.

Literature Review

9.3.2 The assessment of ecological impact on marine habitats and species was undertaken with reference to the previous baseline surveys and EIA studies for other proposed projects in the assessment area. These include the following:

- Agreement No. CE 32/99, Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development (SEKDCFS EIA Report)

- Agreement No. CE 42/2001, Environmental and Engineering Feasibility Assessment Studies in Relation to the Way Forward of the Harbour Area Treatment Scheme – Water Quality, Ecological and Fisheries Impact Assessment (HATS EEFS Report)

- Agreement No. CE 87/2001, Further Development of Tseung Kwan O – Feasibility Study (TKOFS EIA)
- Agreement No. 54/2001, Wanchai Development Phase II and Central-Wanchai Bypass Environmental Impact Assessment (WDII & CWB EIA)
- Central Reclamation Phase III Studies - Site Investigation, Design and Construction. Comprehensive Feasibility Study for Minimum Option: Final Key Issues and Initial Environmental Impact Assessment Report (CRIII EIA Report)
- Agreement No. CE 25/2002, Drainage Improvement in Northern Hong Kong Island – Hong Kong West Drainage Tunnel Environmental Impact Assessment Final Report
- Agreement No. CE 52/95, Strategic Sewage Disposal Scheme Environmental Impact Assessment Study (SSDS EIA Study)
- Agreement No. CE 74/98, Wanchai Development Phase II Comprehensive Feasibility Study (WDII EIA Report)
- CityU Professional Services (2002) Consultancy Study on Marine Benthic Communities in Hong Kong. Final Summer Field Survey Report. Submitted to AFCD.
- AFCD (2005) Monitoring of Finless Porpoises (*Neophocaena phocaenoides*) in Hong Kong Waters 2003-2005
- AFCD (2006) Monitoring of Chinese White Dolphins (*Sousa chinensis*) in Hong Kong Waters – Data Collection
- AFCD Port Survey 2001-2002
- EPD Marine Water Quality in Hong Kong 1986-2005

Ecological Surveys

9.3.3 Field surveys are considered necessary, where appropriate, to supplement and check the validity of data collected through the literature review process. The field surveys for this assessment include:

- Ecological surveys on intertidal and subtidal habitats in and within the vicinity of the assessment area was conducted in April 2007. The survey included spot-check reconnaissance dives on selected representative line transects and Rapid Ecological Assessment (REA) at selected transects for more detailed survey. During the spot-check reconnaissance dives, 20 proposed transects (Site 1 – 20) were surveyed by experienced divers and information on GPS location, transect distance, visibility, substrate type, presence of coral colony and other invertebrates, and estimated size, percent cover and condition of coral were recorded. Eight transects with signs of coral colonies observed in the spot-check dives were further surveyed by REA. A 100 m horizontal transect was laid follow the contour of seabed at each eight selected transects and benthic cover, taxon abundance, and ecological attributes within a swathe of 2 m wide, with 1 m of either side of the transects, were recorded following the REA technique as described in DeVantier *et al.* (1998). Locations of transects for spot-check dives and REA surveys are presented in **Drawing 9.2**.

- Benthos survey on seabed within the Kowloon Bay and KTTS was carried out in March 2007 by grab sampling method. Five replicates of grab samples over a 0.1m^2 area seabed substrate were collected using a van Veen grab and samples were sieved through 0.5 mm sieves. Collected organisms were then counted and identified to the lowest practicable taxon as possible. Species diversity H' and evenness J were calculated for pooled data, using the formulae:

$H' = -\sum (Ni / N) \ln (Ni / N)$; and

$J = H' / \ln S$

where S is the total number of species in the sample, N is the total number of individuals, and Ni is the number of individuals of the i^{th} species.

- Intertidal communities surveys on artificial intertidal habitats that would be directly impacted were conducted in both dry and wet seasons using line transects where possible, with one transect deployed on the seawall, starting from the high water mark down to low water mark. Along each transect, standard ecological sampling quadrat was laid at 1 m intervals (or other suitable quadrat dimension and interval distance depend on the field situation). Intertidal fauna and flora were identified and enumerated. Fauna / flora species and relative abundance / coverage were recorded and identified according to Williams (2003).

Impact Assessment Methodology

9.3.4 Evaluation and assessment of potential impact on ecological resources was conducted in accordance with the criteria and guidelines specified in Annex 8 and Annex 16, respectively, of the EIAO-TM.

9.3.5 The significance of impacts was ranked as “low”, “moderate” or “high”. The description of the ranking is as below:

9.3.6 Low - Impacts to species or groups are assessed as “low” if the predicted impact would result in a slight, and/or short-term reduction in the local population numbers or geographic distribution of a species or group, but the species or group is predicted to recover from the perturbation with no-long term adverse impacts. Impacts to habitat are assessed as “low” when the habitat is widely distributed locally and that no rare or restricted species are found in the habitat.

9.3.7 Moderate – Impacts to species or groups are considered “moderate” if the predicted impact probably would result in non-recoverable and/or long-term reduction in population numbers. However, the species in question should be considered widely distributed or common, and abundant on a local, regional or global scale. Impacts to habitat are assessed as ‘moderate” if the habitat is of limited local or regional distribution or declining in extent and that the habitat has a potential of supporting fauna and/or fauna of conservation importance.

9.3.8 High – Impacts to species or groups are judged to be “high” if the predicted impact has an adverse effect on species or groups which are rare, protected or of conservation importance locally, regionally, or globally. Impacts to habitat are considered to be “high” if the habitat in question is of limited local or regional distribution or declining in extent and that it is considered by the scientific community to be of local, regional or global importance to the support of rare or restricted flora and/or fauna species.

9.3.9 If impacts on ecological resources are found to be significant (that is, moderate or high), mitigation measures would be recommended in accordance with the EIAO-TM Annex 16 and EIAO Guidance Note No. 3/2002. Impact mitigation would be sought in the following priority: avoidance, minimisation, on-site compensation, and off-site compensation.

9.3.10 Impact avoidance generally consists of modifications to the preferred development options, but may in some extreme cases require abandonment of the project.

9.3.11 Impact minimisation includes any means of reducing the scope or severity of a given impact, for example, through timing of construction programme, modification in the design or ecological restoration of disturbed areas following the completion of works.

9.3.12 Impact compensation will be recommended if the effect on a given species or habitat is irreversible and attempts will be made to compensate it elsewhere, for example,

enhancement, creation of suitable habitats or recreation of the habitat. Compensation can be on-site or off-site.

9.4 Description of the Environment

9.4.1 The marine environment in the assessment area composed of the marine water of Kowloon Bay and Victoria Harbour, two typhoon shelters at To Kwa Wan (TKWTS) and Kwun Tong (KTTS), as well as Kai Tak Approach Channel (KTAC). Representative photographs of marine environment within the Kai Tak area are presented in **Appendix 9.1**.

Area of Conservation Interest

9.4.2 Literature review reveals that there are no ecological sensitive receivers, such as SSSIs, Marine Parks / Reserves or other areas of ecological importance or conservation interest, in and within the vicinity of the assessment area.

Abiotic

Water

9.4.3 Under the Water Pollution Control Ordinance (Cap. 358), the marine water within the assessment area is within the gazetted Victoria Harbour Water Control Zone. Due to the direct discharge of wastewater after simple screening into the harbour area in the last decades, water quality in the Victoria Harbour was known as poor with high nutrient and sewage bacteria.

9.4.4 However, after the commissioning of the Stonecutters Island Sewage Treatment Works (SCISTW) in 2002 under Stage 1 of the Harbour Area Treatment Scheme (HATS), water quality has improved significantly, especially in the Eastern Harbour area. According to EPD's water quality monitoring in 2005, marine water in the Project area (Station VM1 and VM2) is now less turbid (suspended solid 0.9-10.8 mg/L), more oxygenated (dissolved oxygen 4.2-6.9 mg/L), and lower in inorganic nutrients (total nitrogen 0.22-0.63 mg/L and total phosphorus 0.02-0.06 mg/L) over the last 20 years (EPD, 2006).

9.4.5 However, the levels of faecal contamination were general high in the Harbour area, though the Eastern Harbour (VM1 & VM2) resulted in the lower level of *E. coli* (88-31000 cfu per 100 mL) and faecal coliforms (300-50000 cfu per 100 mL) compared with the Central and Western Harbour areas (EPD, 2006).

9.4.6 According to the EPD water quality monitoring results, water quality within the To Kwa Wan Typhoon Shelter (TKWTS) (VT11) was similar to the Harbour area in term of water clearance (suspended solid 1.3-7.3 mg/L), oxygenation (dissolved oxygen 3.7-8.0 mg/L), nutrient level (Total nitrogen 0.51-0.58 mg/L and total phosphrous 0.04-0.09 mg/L) and faecal contamination (*E. coli* 150-2800 cfu per 100 ml and faecal coliforms 880-7200 cpu per 100ml).

9.4.7 In contrast, water quality within and Kwun Tong Typhoon Shelter (KTTS) (VT4) was more eutrophic (Total nitrogen 0.84-1.73 mg/L and total phosphorus 0.13-0.37 mg/L) and less oxygenated (dissolved oxygen 2.9-6.7 mg/L), though water turbidity (suspended solid 1.3-3.9 mg/L) and level of faecal contamination (*E. coli* 1500-26000 cfu per 100 ml and faecal coliforms 3200-50000 cpu per 100ml) were more or less the same as the Harbour area (EPD, 2006).

9.4.8 As KTTS is located at the immediate downstream of Kai Tak Approach Channel (KTAC), the poor water quality at KTTS was mainly due to the discharge of secondary treated (un-disinfected) effluent from the Tai Po and Shatin Sewage Treatment Works to Kai Tak Nullah through the Tolo Harbour Effluent Export Scheme (THEES). The Kai Tak Approach Channel (KTAC) and KTTS are therefore subject to the direct influence of pollution discharges from the upstream Kai Tak Nullah.

9.4.9 In general, water quality in the Harbour area has been improved recently but the Victoria Harbour provides a relatively poor marine habitat compared to eastern and southern waters in Hong Kong.

Sediment

9.4.10 The seabed in the Harbour area is mainly composed of soft bottom sediment with coarse particle size. The marine sediment in Victoria Harbour (VS3), according to EPD's sediment monitoring results, is highly anaerobic (electrochemical potential -421mV to -213 mV) due to high organic loading from sewage over the years. The sediment is toxic with high level of total sulphide (200-590 mg/kg). The sediment is classified as Category M or H, as defined in the ETWB Technical Circular (Works) No. 34/2002, as it is also highly contaminated with copper (27-190 mg/kg) and silver (1.0-5.6 mg/kg) which exceed the Lower Chemical Exceedance Level (LCEL) or Upper Chemical Exceedance Level (UCEL) (EPD, 2006).

9.4.11 Numerous sediment toxicity studies have been conducted in the Victoria Harbour and the sediment within the Harbour area was usually determined as polluted in nature by ecotoxicity testing using single species or indicator groups (e.g. barnacles, Chan et al., 1990; Rainbow and Smith, 1992; Blackmore, 1999; fish, Kwan, 1999 and mussel, Nicholson, 1999).

9.4.12 A recent sediment toxicity test was carried out under the HATS EEFS Study and sediments collected from Victoria Harbour (Station XN4 and VM7) were highly toxic to benthic amphipod *Leptocheirus plumulosus*, resulting in very low survivalship of 9-31% only (CDM, 2004).

9.4.13 Sediment contamination within TKWTS, KTTS and KTAC was one of the most serious in Hong Kong marine waters. According to EPD's sediment monitoring results, sediments collected from both typhoon shelters were also highly contaminated with various types of heavy metals and organic pollutants which largely exceeded the UCEL. In addition, chemical analysis of sediments collected from KTAC, undertaken for the SEKDCFS EIA Study, showed that levels of heavy metals and/or organic contaminants were higher than even 10 times of the LCEL (Arup, 2001).

Biotic

9.4.14 The Study area comprises several broad marine habitats including:

- Benthic habitat on soft bottom substratum at Kowloon Bay, Victoria Harbour, TKWTS, KTTS and KTAC
- Intertidal habitats on artificial seawall along ex-airport runway and at the coastlines of TKWTS, KTTS and KTAC
- Subtidal habitat at Kowloon Bay, Victoria Harbour, TKWTS, KTTS and KTAC
- Feeding ground of waterbirds in TKWTS, KTTS and KTAC

Soft Bottom Benthos

9.4.15 There have been numerous studies on benthic fauna assemblage conducted within the Victoria Harbour, showing that the Harbour area was generally of low habitat quality with low species diversity and species abundance recorded in the past years.

9.4.16 Previous SEKDCFS EIA Study has undertaken benthos samplings at the TKWTS, KTTS and KTAC. Only two species of benthic fauna were found at the TKWTS, including the dominant (>99% of all collected specimens) polychaete (*Capitella capitata*) and a juvenile ocypodid carb (*Macrophthalmus* sp.). The species diversity and evenness were very low (both equal to 0.049). No living organism was collected from the sampling locations at the KTAC and KTTS, indicating the very poor habitat quality at these areas (Arup, 2001).

9.4.17 Thompson and Shin (1983) reported that benthic assemblages in the Harbour area were typically of low diversity and abundance, and community structure was largely dictated by organic pollution from sewage discharges in the past. As only a limited number of hypoxia tolerant species can survive the bottom conditions within the study area region, fauna was dominated by opportunists such as bivalves and polychaetes.

9.4.18 Dominant polychaetes include *Minuspio cirrifera* and the best-known marine organic enrichment indicator *Capitella capitata*. These polychaetes may be indicators of moderate and severe organic pollution, respectively. The moderately pollution tolerant bivalve *Ruditapes philippinarum* (stated as *Tapes philippinarum*) was also found dominant in the benthic infaunal population in the same study (Thompson and Shin, 1983).

9.4.19 Another field survey of soft bottom benthic organisms at the seabed in the Victoria Harbour near the Central District conducted for CRIII EIA Study (Atkins China Ltd., 1999) was also reviewed in previous assessment. This field survey indicated that the soft bottom marine environment in the Victoria Harbour was polluted and lacked a macroinvertebrate community.

9.4.20 The field survey carried out for the SSDS EIA Study also confirmed a very low species diversity and evenness for benthic assemblages in Victoria Harbour and was indicative of stressful environment for benthos (Binhai, 2000).

9.4.21 A recent study on marine benthic communities in Hong Kong showed that a coarser sediment benthic group was found in Eastern Victoria Harbour (Stations 53 & 54) as compared to eastern and southern waters, with lower species diversity and evenness resulted (CityU, 2002). This study showed that the benthic communities in Victoria Harbour comprised of mainly polychaete (*Cirratulus* sp., *Schistomeringo rudolphi*, *Dodecaceria* sp., *Naineris* sp., *Sigambra hanaoka* and *Prionospio* sp.), oligochaete (*Thalassodrilides gurwitchi*), bivalve (*Ruditapes philippinarum*), and crustacean (amphipod *Cheiriphotis megacheles*) (CityU, 2002). It indicated a distinct benthic composition which is characterized by species strongly adaptable to eutrophic environment.

9.4.22 Other recent survey for HATS EEFS Study on benthic assemblages in Victoria Harbour near North Point (Station VM2 and XM4) also indicated that the benthic assemblage was dominated by polychaeta (*Naineris* sp., *Glycera* sp., *Prionospio* sp.), mollusca (*Ruditapes* sp.) and crustacea (*Corophium* sp.). Bivalve *Ruditapes* sp. is the most abundant (44%) fauna, comprising 95% of the whole benthic assemblage biomass. Although it is a commercial species, the conservation value is not high. It was noted that the benthic community structure has been relatively stable over the years and so quite robust to environmental disturbance (CDM, 2004).

9.4.23 To fill in the information gap, recent benthos survey was carried out at the Kowloon Bay and KTTS in March 2007. Locations of benthos sampling, detailed methodology and survey results are presented in the Benthos Survey Report (**Appendix 9.2**). Totally three sampling locations (Stations A and B at the Kowloon Bay near the southern tip of the former Kai Tak Airport runway as well as Station C at the KTTS) were surveyed by the grab sampling method. Collected benthic fauna was sorted and identified to the lowest practical taxon as possible.

9.4.24 A total of 1,367 specimens were collected in the present survey. Collected taxa included annelids (36 polychaete species and an oligochaete), crustaceans (12 species), mollusks (three species), nemertean (one species) and fish (one species). In term of individual number, 61%, 36%, 3% of specimens were polychaeta, crustacean and other taxa respectively. Polychaeta was the most abundant taxon and *Eunice indica* was the most dominant species, followed by *Mediomastus* sp., *Cirriformia* sp., *Glycinde gurjanovae*, *Glycera chirori* and other species. The other common taxon was crustacea which included mostly the amphipods. Table 3.1 of **Appendix 9.2** showed the twenty most abundant species found in this survey. All the species recorded in present survey are common and widespread in Hong Kong waters.

9.4.25 Recent survey revealed that Kowloon Bay (Stations A and B) was much higher in total number of species, total number of individuals and total biomass as compared to KTTS (Station C) (see Table 3.3 of **Appendix 9.2**). The Kowloon Bay (*H'*: 1.99-2.31; *J*: 0.55-0.64) also showed a higher species diversity and lower species evenness than KTTS (*H'*: 1.05; *J*: 0.96), indicating comparatively higher habitat quality at Kowloon Bay. Nevertheless, owing to the long-term sewage discharge in the Victoria Harbour, the benthic species recorded in present survey was mostly adapted to the organic-enriched sediment and considered as low ecological significance.

Intertidal Communities (Artificial)

9.4.26 The existing artificial coastline in the study area is made of both artificial vertical seawalls at the area of both typhoon shelters and also man-made sloping seawalls and rockfills at the former Kai Tak Airport runway. Though fouling organisms were regarded as common on artificial seawalls (Morton & Morton, 1983), there was no intertidal fauna being observed on vertical seawalls within the study area during the previous SEKDCFS EIA Study (Arup, 2001). On the other hand, only intertidal fauna of low ecological value such as isopod and grapsid crabs were recorded on the rubble-mount seawalls.

9.4.27 A number of literatures indicated that fauna presented in seawalls and rockfills in the other Harbour area were largely restricted to encrusting sessile organisms such as bivalves, molluscs and barnacles (Morton and Morton, 1983; Lee, 1985; Lee and Morton, 1985). Fauna commonly encountered included molluscs such as the common neogastropod (*Thais clavigera*) and the pollution-tolerant bivalve (*Perna viridis*), as well as encrusting crustaceans such as barnacles (*Balanus* spp., *Tetraclita squamosa* and *Capitulum mitella*) and the ubiquitous mobile isopod (*Ligia exotica*) (Morton and Morton, 1983; Lee, 1985; Lee and Morton, 1985). Flora is mostly restricted to algae that are either organic or nutrient enrichment indicators such as *Ulva* spp. and *Cladophora* (Morton and Morton, 1983; Ho, 1987; Moore, 1990).

9.4.28 A recent intertidal fauna survey on artificial seawalls and rockfills in central Harbour area at Wan Chai, conducted under WDII & CWB EIA Study, reported that artificial seawalls along the coastline were found to be generally inhabited densely by few species of sessile encrusting fauna, including chiton (*Acanthopleura japonica*), barnacle (*Tetraclita squamosa*) and bivalve (*Saccostrea cucullata*). The only mobile species found on the artificial seawalls were the common Sea Slater (*Ligia exotica*) and topshell (*Monodonta labio*). Encrusting algae (*Pseudulvella applanata* and *Hildenbrandia* sp.) were recorded on the surface of artificial vertical seawalls but no erect algae or higher flowering plant was found during the survey. All of the fauna and flora are common local intertidal species with low conservation interest. Compared with the homogenous nature of the concrete seawalls, artificial rockfills provided a more diverse and abundant intertidal community (Maunsell, on-going).

9.4.29 Recent intertidal surveys within the Kai Tak area were carried out in March and May 2007 to confirm the validity of the literature results. A total of five locations were surveyed on the intertidal assemblages, including two sites (Sites 1 & 2) at KTAC and three sites (Sites 3, 4 & 5) on the runway along the coast of the Kowloon Bay (see **Drawing 9.1**). The intertidal habitats within the Kai Tak area are all man-made in nature but include different types of artificial seawalls (vertical seawall and sloping boulder-mounted seawall) as well as rockfills of big boulders. Representative photographs of intertidal habitats at each survey locations are presented in **Appendix 9.3**.

9.4.30 Compared to other relevant findings within the Victoria Harbour, similar biotic assemblages on artificial intertidal habitats in the Kai Tak area were found in present survey and the intertidal composition in the Assessment Area was generally consistent with the past recorded results. The list of intertidal fauna recorded in present survey is summarised in **Appendix 9.4**.

9.4.31 There was no intertidal fauna recorded for all quadrats at survey locations along the KTAC (Sites 1 and 2) in both dry and wet seasons, only algae *Hincksia mitchelliae* was recorded.

The habitat quality is considered as very poor due to the poor water quality there and has very limited ecological value.

9.4.32 On the other hand, artificial seawalls along the former Kai Tak Airport runway (Sites 3, 4 & 5) were found to be generally inhabited densely by several species of sessile encrusting fauna, such as periwinkle (*Echinolittorina radiate*) topshell (*Monodonta labio*), limpet (*Cellana grata*, *C. toreuma* and *Patelloida saccharina*), bivalve (*Saccostrea cucullata*) and barnacle (*Balanus Amphitrite*, *Tetraclita japonica* and *T. squamosa*). The mobile species found on the artificial seawalls included the common Sea Slater (*Ligia exotica*) and crab.

9.4.33 Encrusting algae (*Pseudulvella applanata* and *Hildenbrandia rubra*) were commonly recorded on the surface of artificial seawalls at Sites 3, 4 & 5 while erect algae (*Hincksia mitchelliae*) was also found during the recent survey. In general, the artificial intertidal habitats within the Kai Tak area were very common in Hong Kong and all of the recorded fauna and flora were common local intertidal species with low conservation interest.

Subtidal Fauna

Coral

9.4.34 In Hong Kong, the richest coral communities are found in the eastern part where water is free from the influence of estuarine water from the Pearl River. As water in Victoria Harbour was generally turbid with high level of suspended solids, it was unsuitable for coral to survive and colonise there. Based on the review on a number of previous literatures, there was no significant record of coral reported within the Harbour area in the past decade.

9.4.35 However, recent dive surveys in the central Victoria Harbour carried out under WDII & CWB EIA (Maunsell, on-going) reported a very low coverage (< 1%) of one species of hard coral (*Oulastrea crispata*) and one species of octocoral (gorgonian *Echinomuricea* sp.) at the central Harbour area (2 km and 4 km west from the Project area). All the colonies found were in fair health condition but in small size (hard coral 3-8 cm in diameter). Neither soft coral nor black coral was identified during this survey.

9.4.36 The EIA Study for Tseung Kwan O Further Development also identified the presence of small colonies of hard corals with sparse cover of soft corals and gorgonians found in Chiu Keng Wan located at the northwestern Junk Bay, which is about 6 km southeast from the Project area (Maunsell, 2005).

9.4.37 Recent dive survey for HASTS EEFS Study also indicated that the shallow water of Joss House Bay and north-west Tung Lung Chau (8 km southeast of the Project area) supported reasonably diverse but low cover hard coral communities. However, the same study showed that there were no hard corals or soft corals observed in the North Point areas (CDM, 2004).

9.4.38 Literature review also indicated far-field soft corals and gorgonians presented at Green Island and Little Green Island over 10 km west from the proposed dredging area. A low coverage of black coral of *Anthipathes* sp. was also found in Green Island (TDD, 1998). In general, soft coral and gorgonians are more resistant to turbid waters than hard coral as they do not contain symbiotic algae zooxanthallae and do not require light penetration for photosynthesis. Therefore, they are more widely distributed in Hong Kong and are also found in areas of higher turbidity.

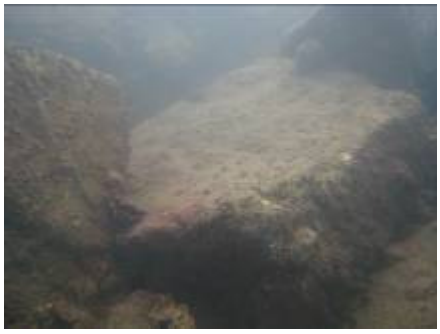
9.4.39 In order to provide sufficient and updated baseline information on marine ecology in and within the assessment area, recent dive surveys included spot-check reconnaissance dives and Rapid Ecological Assessment (REA) were carried out in April 2007. Spot-check reconnaissance dives were first conducted to identify the extent of hard substrate with an emphasis on gaining an overview of coral occurrence within the Project area. Areas with signs of coral colonies observed in spot-check dives were then further surveyed using REA technique along 100 m transect. **Drawing 9.2** indicates the locations of transects covered by the spot-check dives and the locations where the REA transects deployed.

9.4.40 Twenty transects (Site 1 – 20) within the Project area were surveyed during the spot-check

surveys and information on GPS location, transect distance, visibility, substrate type, presence of coral colony and other invertebrates, and estimated size, percent cover and condition of coral were recorded. Eight transects with signs of coral colonies observed in the spot-check dives and were further surveyed by REA. A 100 m horizontal transect was laid follow the contour of seabed at each eight selected transects and benthic cover, taxon abundance, and ecological attributes within a swathe of 2 m wide, with 1 m of either side of the transects, were recorded following the REA technique as described in DeVantier *et al.* (1998). Photographs of seabed condition and representative coral colonies in the each surveyed sites were taken using an underwater digital camera. Information concerning the physical nature of the surveyed sites such as the degree of wave exposure of the sites, the nature of the substrate type and the topographic profile of the sites was recorded during the REA survey. More detailed information on the methodology, surveyed area, results, and discussion are provided in the Coral Survey Report (**Appendix 9.5**).

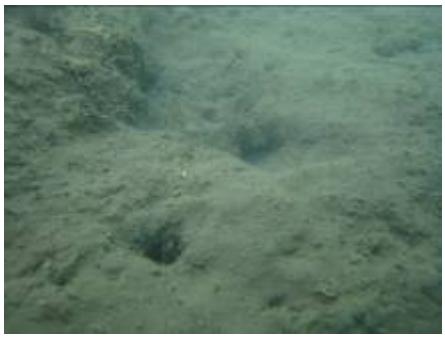
9.4.41 As illustrated in Table 2 of **Appendix 9.5**, 20 representative line transects of totally 6430 m were surveyed in spot-check dives. The underwater visibility at all surveyed sites were generally poor (< 2 m). The maximum water depth in all the surveyed sites ranged from 3 m to 22 m. Bottom substrata were mainly big boulders and rocks in shallow water but sand and mud in deeper water **(Photo 1)**.

Photo 1 Bottom Substrata of Kai Tak area



Boulders

Rocks



Muddy substrata

Sandy substrata

9.4.42 In all of the surveyed sites, only isolated colonies of a hard coral species (*Oulastrea crispata*) were found at Sites 9, 11, 12, 13, 14, 16, 19 and 20, with very low coverage of less than 1% at each survey site. Neither soft coral nor black coral was identified during the current spot-check dives. No coral colony was found at the hard subtidal substrata of the disused fuel dolphin (Site 7).

9.4.43 More detailed REA surveys were then carried out at Sites 9, 11, 12, 13, 14, 16, 19 and 20. Substrata at Sites 9, 11, 12, 13, 14 and 16, were mainly medium-sized boulders and rocks while Sites 19 and 20 comprised big boulders with fewer rocks. In general, Victoria Harbour area is mainly of muddy sea bottom. The marine sediment, according to EPD's sediment

monitoring results, is highly anaerobic and toxic with high level of total sulphide. Due to the low habitat quality, these survey sites support low species diversity and species abundance.

9.4.44 Very limited marine life was observed within all REA surveyed sites. Only sparse coverage (1-5%) of single hard coral species (*Oulastrea crispata*) was recorded during the REA survey. Most of the isolated colonies were attached on the surface of the boulders and rocks. All the colonies found were in fair health condition and ranged from less than 1 cm to 30 cm in diameter. In general, most of the colonies found were in small size (~3 cm to 8 cm) and some at Sites 11, 12 and 13 were even less than 1 cm in diameter with only one single polyp **(Photo 2)**. Most of the coral colonies were found to be covered by layer of sediment **(Photo 3)**.

Photo 2 Colonies of *Oulastrea crispata* with single or few polyps.

Photo 3 Layer of sediment covering on colonies of *Oulastrea crispata*

9.4.45 In general, the coral colonies found in the Project area is characterised by low species diversity and species abundance, and is sparsely covered only by scattered colonies of single coral species (*Oulastrea crispata*) and this species has a wide range of adaptations to different environmental conditions (including those unfavourable to corals) as well as geographic locations, which is a result of its stress-tolerant ability (Chen, *et al.* 2003). With an opportunistic life history trait, a wide range of reproductive strategies and surface-orientation independent growth, *O. crispata* is able to colonise a variety of substrata and to flourish as a pioneer coloniser of newly immersed structures (Lam, 2000a & 2000b). It is common and widespread in Hong Kong marine waters, especially those more turbid and harsh environment in the western waters (Chan, *et al.* 2005).

Marine Mammals

9.4.46 Literature review has shown that there were no sighting or significant record of marine

mammals within the assessment area. One of the most important marine mammals in Hong Kong waters is the Chinese White Dolphin (*Sousa chinensis*) which was only seen in the western estuarine waters in Hong Kong including outer Deep Bay, north, south, east Lantau and west Lamma (Hung, 2006). The other common marine mammal Finless porpoise (*Neophocaena phocaenoides*) was also never reported in the Victoria Harbour and only occurs in the eastern and southern waters of Hong Kong (Jefferson, 2001). There is no significant record of such marine mammals with high conservation interest in and within the vicinity of the assessment area.

Feeding Ground of Waterbirds

9.4.47 Avifaunal surveys conducted under previous SEKDCFS EIA Study (Arup, 2001) identified a number of waterbird species, including some of conservation interest roosting and foraging on the artificial coastline and coastal structures (e.g. breakwater) in KTAC and KTTS. Little Egret (*Egretta garzetta*) was the most abundant species while other ardeids such as Great Egret (*Ardea alba*), Intermediate Egret (*Egretta intermedia*), Cattle Egret (*Bubulcus ibis*), Grey Heron (*Ardea cinerea*) and Chinese Pond Heron (*Ardeola bacchus*) were also found in these areas. All wild birds (including nest) are protected under the Wild Animals Protection Ordinance (Cap. 170) and the ecological significance of the recorded species of conservation interest is discussed below.

9.4.48 Little Egret is a common ardeid which is widely distributed in the coastal waters throughout Hong Kong, it is considered to be a species of conservation interest regionally due to its restricted site of breeding and roosting (Fellowes et al., 2002).

9.4.49 Great Egret is a common resident and winter visitor in Hong Kong, but this species is considered to be of conservation interest regionally due to its restricted breeding and roosting area (Fellowes *et al.*, 2002).

Ecological Importance

9.4.50 Based on the available literature and discussion presented above, the ecological values of marine resources present within the assessment area have been assessed and evaluated. This has been determined in accordance with the EIAO-TM Annex 8 Table 2 criteria and is shown in **Table 9.1**.

Table 9.1 Criteria and Evaluation of Ecological Importance of Marine Habitats in the Assessment Area

Criteria	Soft bottom habitat	Intertidal habitat (artificial)	Subtidal habitat	Feeding ground of waterbirds
Naturalness	Subjected to extensive anthropogenic disturbance	Man-made habitat	Highly disturbed by marine traffic, subjected to extensive water pollution	Disturbed by marine traffic and human activities
Size	Large	Large	Large	Moderate
Diversity	Low, mainly dominant by pollution-tolerant fauna	Low, mainly composed of few intertidal fauna	Low, species confined to those resistant to polluted water	Low
Rarity	No rare species found	No rare species found	No rare species found but only a single species of a common hard coral (*Oulastrea crispata*) was recorded	No rare species recorded but species of conservation interest including Little Egret and Great Egret were recorded

Criteria	Soft bottom habitat	Intertidal habitat (artificial)	Subtidal habitat	Feeding ground of waterbirds
Re-creatability	High	Very High	High	High
Fragmentation	The habitat is fragmented by the ex-airport runway	The habitat is not fragmented	The habitat is fragmented by the ex-airport runway	Feeding grounds in the KTTS and KTAC are physically separated from the TKWTS by the ex-airport runway
Ecological linkage	Not functionally linked to any highly valued habitat in close proximity	Not functionally linked to any highly valued habitat in close proximity	Not functionally linked to any highly valued habitat in close proximity	Not functionally linked to any highly valued habitat in close proximity
Potential value	Very low	Very low	Very Low	Very Low
Nursery ground	No significant record	No significant record	No significant record	No significant record
Age	NA	NA	NA	NA
Abundance / Richness of wildlife	Low for abundance and species richness	Low for abundance and species richness	Low for abundance and species richness	Low for abundance and species richness
Ecological importance	**Very low**	**Very low**	**Low**	**Low**

9.4.51 Soft bottom seabed and artificial intertidal seawall are considered as very low ecological importance based on the considerations of their highly disturbed and man-made nature, commonness of recorded species and low in species diversity and abundance.

9.4.52 Although hard coral (*Oulastrea crispata*) was found in the subtidal habitat, this species is common in Hong Kong waters and tolerant to more turbid and harsh environment (Chan, *et al.* 2005). The species diversity and abundance of this coral found in the Kai Tak area is generally very low when compared with other important coral areas in the eastern and northeastern Hong Kong. Most of the recorded colonies was isolated and in low coverage (<1%) and small size (~3 cm to 8 cm). Therefore, given the low abundance and species diversity as well as the commonness of coral species found there, the subtidal habitat is considered as having low ecological value and not considered as an important habitat or sensitive coral site in this assessment.

9.4.53 Although coastlines along the Kai Tak area, especially areas at TKWTS, KTTS and KTAC were found to serve as the roosting and foraging area for some waterbirds of conservation interest, this habitat is not the sole feeding ground for these waterbirds in the vicinity of the Project area where a number of similar feeding areas such as the Victoria Harbour and the Causeway Bay Typhoon Shelter can be identified. Also, given the poor water quality and high level of human disturbance, this habitat is not considered as an important foraging area for these waterbirds and is therefore ranked as of low ecological significance.

9.5 Identification of Environmental Impacts

Construction Phase

Direct Impact

9.5.1 The removal of the disused fuel dolphin structure would result in loss of only small area of subtidal hard substratum from the fuel dolphin structure. Direct loss of any marine habitat

would not be expected in this Project as no dredging of seabed would be involved.

Indirect Impact

Change of Water Quality

9.5.2 Potential indirect impacts to marine habitats and the associated wildlife would include changes in water quality due to seabed disturbance arising from the proposed marine works and potential site run-off from land-based construction works. Water deterioration may be resulted from elevation of suspended sediment (SS), increase of nutrient and contaminant as well as decrease of dissolved oxygen (DO) during marine works.

9.5.3 Marine fauna, especially sessile filter feeders are susceptible to adverse water deterioration. High SS level in water column would smother and clog their respiratory and feeding apparatus. Similarly, more turbid water may reduce the amount of light reaching beneath the water surface, which may also be detrimental to marine flora and fauna. Deterioration of water quality may indirectly affect avifauna as availability of food sources could become reduced.

9.5.4 In addition, the release of inorganic substances may cause eutrophication and algal bloom. Oxidation of dead algae may use up some of the oxygen in the water. If oxygen levels are depleted to low levels, benthic organisms unable to tolerate such conditions may suffer hypoxia-induced mortality and/or stress including reduced feeding and growth rate. Adverse indirect impact on marine resources may be resulted if average-depth and bottom water DO would be less than 4 mg/L and 2 mg/ L respectively for 90% of the time during the construction phase.

Disturbance Impact

9.5.5 Proposed marine works within the Project area may cause disturbance impacts on the associated waterbird population due to increase of background noise and human activities.

9.6 Prediction and Evaluation of Environmental Impacts

Construction Phase

Direct Impact

9.6.1 Direct impacts to the marine ecological resources would include loss of small area of subtidal hard substratum of the fuel dolphin structure. Loss of marine habitat would not be expected.

9.6.2 Recent dive survey revealed that there were no important marine resources or species of conservation interest such as coral found on the subtidal hard substratum of the fuel dolphin structure. Tube anemone *Cerianthus filiformis* was the dominant fauna found there and it is common and widespread in Hong Kong. No direct loss of important marine resources would be resulted and such impact is considered as very minor in nature.

9.6.3 No permanent loss of benthic habitat in and within the close vicinity of the fuel dolphin structure would occur as no dredging activities on seabed would be employed. However, the proposed marine works would cause minor disturbance on seabed and the associated flora and fauna. Nevertheless, ecological values of the benthic habitat and benthos species in the assessment area are ranked as very low in the previous section based on the disturbed nature of habitat, low species diversity and absence of rare specie found there. No unacceptable ecological impact would be anticipated.

Indirect Impact

Changes in Water Quality

9.6.4 Indirect impacts on the marine ecology would be associated with changes of water quality due to seabed disturbance arising from the proposed marine works as well as site runoff

from land-based construction works. Potential elevation of SS, release of inorganic nutrients and contaminants as well as DO reduction in the water column could occur during the construction phase.

9.6.5 Marine fauna could be susceptible to the effects of water deterioration. Effects could be lethal or sublethal through reduction in survivalship, growth rate and reproductive potential due to stress incurred by high sediment load, release of toxic substance or oxygen deprivation. The nature and extent of this impact depends on several factors, such as species sensitivity, life modes of organisms (sessile or free-swimming), life stage (adult or juvenile) and water movement.

9.6.6 If deterioration of water quality leads to a reduction in the abundance of marine fauna, there would be indirect effects on avifauna as food availability would be reduced. However, as the Kai Tak area potentially affected is relatively small compared to the total area available in the harbour for foraging birds, no significant impact is predicted.

9.6.7 Suspended sediment plume occurs naturally in marine environment by wave action and vertical flux of water current. Subtidal fauna like fish have evolved behavioural adaptations to combat increased turbidity, including clearing their gills by flushing with water or simply avoidance movement to less turbid waters.

9.6.8 As no dredging works would be required for the proposed decommissioning of the disused fuel dolphin, increases in suspended sediment would be minor. The dolphin removal works would be undertaken at inner Kowloon Bay within the semi-enclosure of the breakwaters of To Kwa Wan Typhoon Shelter where the water currents are slow. Therefore, it is expected that suspended solids, if any, released from the decommissioning works would not be transported off site and would be gradually resettle in the vicinity of the work site. In view that the area of the work site would be small, any release of inorganic and organic contaminants and increase in turbidity from the decommissioning works would be localized and transient and therefore no significant indirect impact is anticipated on marine habitat or marine life.

Disturbance Impact

9.6.9 During the construction works, increased marine traffic and noise generated from construction plant could cause disturbance impacts to the associated waterbirds of conservation interest. However, set against the background of intense human activities in the Project area, the associated waterbirds are considered already well adapted to human disturbance. It is expected that displacement to the nearby waters for roosting and feeding area may occur temporarily but adverse impact is not anticipated.

Overall Impact

9.6.10 Based upon the foregoing discussion, the marine ecological impacts associated with the Project are considered to be very minor. A summary of impact evaluation is presented in **Table 9.2**.

Table 9.2 Evaluation of Ecological Impacts on Marine Resources

Criteria	Construction phase		
	Loss of subtidal substratum	**Change in water quality**	**Disturbance impact**
Impacted habitat	Subtidal hard substratum of fuel dolphin structure	Subtidal and intertidal habitats	Feeding ground of waterbirds
Habitat quality	Very low	Very low to low	Low
Species	No rare species recorded	Only a single species of common hard coral would be affected	Waterbirds of conservation interest such as Little Egret and Great Egret would be affected

Size / Abundance	Permanent loss of only very small area of subtidal hard substratum habitat	Small in size , low in abundance	Small in size, low abundance
Duration	Persist permanently	Temporary	Temporary
Reversibility	Would not recover after construction phase, but similar marine life would be established on the nearby subtidal hard substratum.	Would recover after construction phase	Would recover after construction phase
Magnitude	The magnitude of impact is considered as very minor	The magnitude of impact is considered as very minor	The magnitude of impact is considered as very minor
Overall impact	**Very low**	**Very low**	**Very low**

9.7 Mitigation of Adverse Environmental Impacts

9.7.1 As no significant ecological impact on marine habitats and associated wildlife is predicted, no necessary mitigation measure is considered as required in this assessment. The mitigation measures recommended in the water quality impact assessment to control water quality would also serve to protect marine ecological resources from indirect impacts and ensure no adverse impact on marine life would be resulted from the Project.

9.8 Evaluation of Residual Impacts

9.8.1 Residual impact of loss of small area of subtidal hard substratum would be resulted from the Project. Such residue impact is considered as minimal in nature due to the very low ecological importance of the directly affected area/species

9.9 Environmental Monitoring and Audit

9.9.1 As water quality impact assessment suggested that change of water quality within the assessment area would be minor and acceptable during the construction phase and no ecological sensitive receivers was identified within the assessment area, no monitoring programme specific for marine ecology would be required.

9.10 Conclusion

9.10.1 Literature reviews of existing information with supplement findings from recent field surveys indicated that identified marine habitats within the assessment area are of generally very low ecological value. There are no ecological sensitive receivers, such as SSSIs and Marine Parks and / or Reserves and other areas of ecological importance or conservation interest, in and within the immediate vicinity of the assessment area.

9.10.2 Marine habitats within the assessment area include soft bottom seabed, artificial seawalls, subtidal habitats and feeding ground of waterbirds. All the identified habitats are considered to have generally very low of ecological value due to their highly artificial and disturbed nature. Species diversity and abundance in these habitats were low and no rare or restricted species was recorded. The species of conservation interest recorded within the assessment area only include a single species of common hard coral (*Oulastrea crispata*) (but all colonies found are small in size, sparsely distributed and in very low coverage) and few species of waterbirds such as Little Egret and Great Egret. All these species of conservation interest recorded within the assessment area are common and widespread in other Hong Kong waters.

9.10.3 Direct and indirect ecological impacts arising from the Project during construction phase

were identified and evaluated. The Project will result in the permanent loss of small area of subtidal hard substratum of the disused fuel dolphin and no adverse impact is expected. No coral colonies were found at the hard subtidal substrate of the disused fuel dolphin. Potential direct disturbance on benthic habitats and associated marine life would be resulted from the proposed marine works. Considering that the benthic habitats within the assessment area are of very low ecological value, no adverse impact is expected also.

9.10.4 Other indirect impacts arsing from the Project would be temporary and considered as negligible in nature. Overall, no significant and unacceptable ecological impact on marine resource was anticipated in this assessment.

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