# 5 EIA ON DECOMMISSIONING OF THE REMAINING PARTS (EX-GFS BUILDING AND RADAR STATION) OF THE FORMER KAI TAK AIRPORT

## 5.1 Introduction

5.1.1 This section presents an environmental impact assessment for the decommissioning of the ex-Government Flying Service (GFS) building and the Radar Station within the former Kai Tak Airport that are classified as Designated Project (DP) under Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (hereafter referred as "the DP3a Project" in this section).

5.1.2 The remaining sites within the former Kai Tak Airport yet to be decommissioned include the ex-GFS building and the Radar Station in the South Apron area, the Hong Kong Aviation Club (HKAC) and the EMSD Headquarters in the North Apron area. The scope of the DP3a Project is limited to the decommissioning of the remaining facilities, structures and buildings of the ex-GFS building and Radar Station within the former Kai Tak Airport which were not covered under the previous EIAs on decommissioning of former Kai Tak Airport registered under the EIAO (namely EIA on Decommissioning of the former Kai Tak Airport other than the North Apron and EIA on Kai Tak Airport North Apron Decommissioning). The scope of the decommissioning of the Hong Kong Aviation Club is limited to disuse its function. It is also identified that no soil remediation works would be necessary (see **Section 10**) and no building demolition is anticipated. The location and the general layout of the DP3a Project is shown in **Figures 5.0.1** and **5.0.2**.

5.1.3 Potential environmental impact associated with the DP3a Project has been identified and summarized in **Table 5.1**. Appropriate mitigation measures are proposed to alleviate any adverse environmental impacts if necessary.

**Table 5.1 Summary of Environmental Impacts**

| | Decommissioning Phase | Operational Phase |
|---|---|---|
| Air | ✓ | × |
| Noise | ✓ | × |
| Water Quality | ✓ | × |
| Waste Management | ✓ | × |
| Land Contamination | ✓ | × |
| Hazard to Life | × | × |
| Cultural Heritage | × | × |
| Landscape and Visual Impact | ✓ | × |
| Ecological Impact | × | × |
| Fisheries Impact | × | × |

## 5.2 Air Quality Impact

**Environmental Legislation, Policies, Plans, Standards and Criteria**

5.2.1 The criteria for evaluating air quality impacts and the guidelines for air quality impact assessment are set out in Annex 4 and Annex 12 of the *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM).

Air Quality Objectives and EIAO-TM

5.2.2 The Air Pollution Control Ordinance (APCO) provides the statutory authority for controlling air pollutants from a variety of sources. The Hong Kong Air Quality Objectives (AQOs), which must be satisfied, stipulate the maximum allowable concentrations over specific periods for typical pollutants. The relevant AQOs are listed in **Table 5.2**.

**Table 5.2 Hong Kong Air Quality Objectives**

| Pollutant | Maximum Concentration (μg $m^{-3}$) (1) | | | |
|---|---|---|---|---|
| | Averaging Time | | | |
| | 1 hour (2) | 8 hour (3) | 24 hour (3) | Annual (4) |
| Total Suspended Particulates (TSP) | - | - | 260 | 80 |
| Respirable Suspended Particulates (RSP) (5) | - | - | 180 | 55 |
| Sulphur Dioxide ($SO_2$) | 800 | - | 350 | 80 |
| Nitrogen Dioxide ($NO_2$) | 300 | - | 150 | 80 |
| Carbon Monoxide (CO) | 30,000 | 10,000 | - | - |
| Photochemical Oxidants (as Ozone, $O_3$) (6) | 240 | - | - | - |

Notes:
(1) Measured at 298 K and 101.325 kPa.
(2) Not to be exceeded more than three times per year.
(3) Not to be exceeded more than once per year.
(4) Arithmetic mean.
(5) Suspended particulates in air with a nominal aerodynamic diameter of 10 μm or smaller.
(6) Photochemical oxidants are determined by measurement of ozone only.

5.2.3 The EIAO-TM stipulates that the hourly TSP level should not exceed 500 $\mu gm^{-3}$ (measured at 25°C and one atmosphere) for construction dust impact assessment. Standard mitigation measures for construction sites are specified in the *Air Pollution Control (Construction Dust) Regulation*.

5.2.4 In accordance with the EIAO-TM, odour level at an air sensitive receiver should meet 5 odour units based on an averaging time of 5 seconds for odour prediction assessment.

Air Pollution Control (Construction Dust) Regulation

5.2.5 Notifiable and regulatory works are under the control of *Air Pollution Control (Construction Dust) Regulation*. Notifiable works are site formation, reclamation, demolition, foundation and superstructure construction for buildings and road construction. Regulatory works are building renovation, road opening and resurfacing slope stabilisation, and other activities including stockpiling, dusty material handling, excavation, concrete works, stockpiling, dusty material handling etc. This DP3a Project is expected to include both notifiable works and regulatory works. Contractors and site agents are required to inform Environmental Protection Department (EPD) on carrying out construction works and to adopt dust reduction measures to reduce dust emission to the acceptable level.

**Description of the Environment**

5.2.6 The DP3a Project is located in the south apron area of the former Kai Tak Airport. There is no air quality monitoring station located in the proximity of the DP3a Project site. EPD's Sham Shui Po and Kwun Tong air quality monitoring stations are the nearest stations to the DP3a Project site. **Table 5.3** summarizes the annual average concentrations of the air pollutants recorded at these two monitoring stations in Year 2006.

**Table 5.3 Annual Average Concentrations of Pollutants in Year 2006 at EPD's Sham Shui Po and Kwun Tong Air Quality Monitoring Stations**

| Pollutant | Annual Average AQO ($\mu g\ m^{-3}$) | Year 2006 Annual Average Concentration ($\mu g\ m^{-3}$) | |
|---|---|---|---|
| | | Sham Shui Po station | Kwun Tong station |
| TSP | 80 | 79 | 75 |
| RSP | 55 | 55 | 55 |
| $NO_2$ | 80 | 67 | 61 |
| $SO_2$ | 80 | 24 | 19 |

**Air Quality Sensitive Receivers**

5.2.7 In accordance with Annex 12 of the EIAO-TM, any domestic premises, hotel, hostel, hospital, clinic, nursery, temporary housing accommodation, school, educational institution, office, factory, shop, shopping centre, place of public worship, library, court of law, sports stadium or performing arts centre are considered to be an air sensitive receiver (ASR). Any other place with which, in terms of duration or number of people affected, has a similar sensitivity to the air pollutants as the aforelisted places are also considered to be an ASR, for example, playground, sitting area of parks / promenade.

5.2.8 In accordance with Section 3.4.5.3 of the EIA Study Brief No. ESB-152/2006, the air quality impact assessment area is defined by a distance of 500m expanded from the boundary of the Kai Tak Development (KTD) Project. The study area of air quality impact assessment for the KTD Project is shown in **Figure 3.1** which also covers the study area of the DP3a Project.

5.2.9 The identified representative ASRs are listed in **Table 5.4** and the corresponding locations are shown in **Figure 3.1**.

**Table 5.4 Summary of Representative Air Sensitive Receivers**

| ASRs | District (1) | Location | Existing / Planned Land Use | Max. Building Height, m (2) | Distance to DP3a Boundary, m |
|---|---|---|---|---|---|
| A7 | KT | CAC Tower | Commercial | 57 | 1044 |
| A8 | KT | Bite Industrial Building | Industrial | 30 | 799 |
| A9 | KT | Wharf T&T Square | Commercial | 45 | 543 |
| A10 | KT | Hoi Bun Road Park | Recreation | 1.5 | 449 |
| A11 | NTK | Kowloon Bay Factory Estate | Industrial | 24 | 242 |
| A12 | NTK | Kowloon Bay Motor Vehicle Exam Centre | Industrial | 6 | 219 |
| A13 | NTK | New Kowloon Bay Motor Vehicle Exam Centre | Industrial | 3 | 166 |
| A14 | NTK | Kai Fok Industrial Centre | Industrial | 24 | 566 |
| A15 | KB | Sing Tao Building | Commercial | 30 | 662 |

Note: (1) KT – Kwun Tong; NTK – Ngau Tau Kok; KB – Kowloon Bay
(2) The maximum height for Planned ASR was made reference to the RODP.

**Assessment Methodology**

5.2.10 The dusty construction activities under the DP3a Project would mainly be civil works associated with the required decommissioning of the buildings and facilities. Extensive excavation works is not expected. The works would be localized and carried out within the respective sites, the potential dust impacts at the ASRs in the vicinity of the work site would be low. All the above activities are not expected to generate significant amount of construction dust. With the implementation of the requirements stipulated in the *Air Pollution Control (Construction Dust) Regulation* during decommissioning phase, adverse dust impact would not be expected and quantitatively assessment is not necessary. The assessment has been conducted in accordance with the procedures below:

- Identify the potentially fugitive dust emission during decommissioning phase; and
- Assess the significance of construction dust emissions from decommissioning activities.

**Identification, Prediction and Evaluation of Environmental Impacts**

*Dust Impact*

5.2.11 Construction activities at the decommissioning sites will involve demolition works. Extensive excavation works is not expected. Given the limited works area for the decommissioning sites, the potential dust impacts at the ASRs in the vicinity of the work site would be low. All the above activities are not expected to generate significant amount of construction dust.

5.2.12 Control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* of Air Pollution Control Ordinance (APCO) should be implemented to ensure that construction impacts are controlled within the relevant standards described above. Environmental monitoring and audit should be performed to verify the effectiveness of the control measures and to ensure proper construction dust control. With proper implementation of dust control measures, significant construction dust impacts at ASRs during the decommissioning phase of the DP3a Project is not anticipated.

5.2.13 Referring to construction programme of the DP3a Project, there would be a number of concurrent projects taking place in the proximity of the DP3a Project. The concurrent projects are:

- Cruise Terminal Development and related advance works
- Infrastructure works at North Apron, Phase 1 - Housing Sites and Government Offices
- Kai Tak Nullah modification works
- Infrastructure works at runway and Metro Park
- Infrastructure works at North Apron, Phase 2
- Trunk Road T2 and infrastructure works at South Apron
- SCL Construction
- CKR Construction
- Anderson Road Project, etc.

5.2.14 The potential cumulative construction dust impacts arising from the above construction activities have been presented in **Section 3.2** of this Report.

*Air Quality Impact from Decommissioning Other than Dust Impact*

5.2.15 Site investigation has been carried out at Radar Station and the ex-GFS building. Some areas of the ex-GFS building were identified with metals or organic contamination while no contamination was found at Radar Station. The volumes of soil contaminated by different types of contaminants at the ex-GFS building are estimated to be (i) 316.8 $m^3$ of heavy metal contaminated soils and (ii) 72 $m^3$ of TPH/SVOCs contamination soils.

5.2.16 As discussed in **Section 5.6** below, biopiling is proposed to treat TPH /SVOCs contaminated soil. Biopile cleanup progress monitoring and closure assessment are proposed for biopiling to ensure a satisfactory cleanup progress and that all the target contaminants have been treated to below the cleanup targets. Solidification / stabilization is suggested to treat the soil contaminated with metals. Toxicity Characteristics Leaching Procedure (TCLP) Test is proposed to be undertaken after solidification / stabilization in order to ensure that the metal contaminants would not leach to the environment.

5.2.17 The above proposed decontamination method is similar to the method proposed in the approved EIA Report for Decommissioning of the Former Kai Tak Airport Other than the North Apron (KTA Decommissioning EIA, EIAO Register No. AEIAR-114/2007). In accordance with the air quality assessment presented in the KTA Decommissioning EIA, negligible amount of VOCs would be emitted from the biopile operation and solidification process and adverse air quality impact at nearby ASRs would not be expected. In addition, exhaust gas generated from the biopile shall be directed through a blower and activated carbon filter system prior to discharge to the atmosphere. The carbon filter will have a removal efficiency of at least 99%. Furthermore, monitoring programme for the exhaust gas from the carbon filter would be monitored during implementation stage to ensure the criteria would meet. Given that the amount of soil requiring treatment under the DP3a Project is much smaller than that for the KTA Decommissioning project, adverse VOC impact from the DP3a Project is also not anticipated.

5.2.18 Besides, petroleum/kerosene like smell might be detected during soil excavation, transporting and unloading processes. However, very minor odour impact is anticipated as the excavation area would be limited and would be backfilled with clean and/or treated soil shortly after excavation, and the excavated soils would be covered with impermeable liner to minimise odour emission.

**Mitigation of Environmental Impacts**

General Decommissioning Activities

5.2.19 In order to ensure compliance with the acceptable criteria at the ASRs at all time, requirements of the *Air Pollution Control (Construction Dust) Regulation* shall be adhered to during the decommissioning period. Misting for any stockpile of materials and provision of windbreaks on three sides are proposed to prevent wind erosion. An environmental audit program shall be implemented to monitor the decommissioning process in order to enforce controls and modify methods of work if dusty conditions are arisen. In addition, the following good site practices are recommended to minimise dust and other air pollutants impacts during soil excavation, transportation, loading and unloading of dusty materials and/or excavated contaminated soils if any:

- The excavation area should be limited to as small in size as possible and backfilled with clean and/or treated soil shortly after excavation work.
- The exposed excavated area should be covered by the tarpaulin during night time.
- The top layer soils should be sprayed with fine misting of water immediately before the excavation.
- Stockpiling site(s) should be lined with impermeable sheeting and bunded. Stockpiles should be fully covered by impermeable sheeting to reduce dust and other air pollutants emission.
- Misting for the dusty material should be carried out before being loaded into the vehicle.
- Any vehicle with an open load carrying area should have properly fitted side and tail boards.
- Material having the potential to create dust should not be loaded from a level higher than the side and tail boards and should be dampened and covered by a clean tarpaulin.

- The tarpaulin should be properly secured and should extent at least 300 mm over the edges of the sides and tailboards. The material should also be dampened if necessary before transportation.
- The vehicles should be restricted to maximum speed of 10 km per hour and confined haulage and delivery vehicle to designated roadways insider the site. On-site unpaved roads should be compacted and kept free of lose materials.
- Vehicle washing facilities should be provided at every vehicle exit point.
- The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores.
- Every main haul road should be scaled with concrete and kept clear of dusty materials or sprayed with water so as to maintain the entire road surface wet.
- Every stock of more than 20 bags of cement should be covered entirely by impervious sheeting placed in an area sheltered on the top and the three sides.
- Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites.

5.2.20 The mitigation measures shall be implemented during the process of solidification and biopiling are described as follows.

Solidification

- The solidification pit/area should be provided with dust suppression measures.
- Handling and mixing of cement shall follow *Air Pollution Control (Construction Dust) Regulation* to limit cement emission.
- The bin should be covered during residence period after mixing process.

Biopiling

- During the course of biopile formation, the stockpiled soils at the biopiles should be covered by tarpaulin or low permeable sheet to avoid fugitive emissions of dust or any air pollutants from the biopiles affecting the surrounding environment and to minimise runoff from the stockpiled soils. Biopile(s) should be covered by impermeable sheeting (such that no longer than 5m of a biopile should be exposed to open air) to avoid fugitive emissions of dust or any pollutants from the biopile(s).
- Upon formation of a biopile, the biopile should be covered by low permeable geotextiles to prevent dust emission and runoff.
- During the operation of biopile, the biopiles should be fully covered to control the extraction of VOCs.
- The vented air from the biopile(s) should be connected to blower and carbon adsorption system with 99% control efficiency for treatment before release to the atmosphere. Exhaust air from the blower and carbon adsorption system should be monitored for TVOC bi-weekly to check the performance of the carbon filter. The frequency of monitoring might be adjusted subject to review on site. The location of the exhaust of the carbon filter should be sited as far away as possible from the nearby ASRs.
- Spent activated carbon of the carbon adsorption system should be replaced at appropriate intervals such that the TVOC emission concentration from the system is acceptable (i.e. the measured TVOC concentration is below 20ppm).

**Residual Environmental Impacts**

5.2.21 With the implementation of dust suppression measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* during decommissioning and the proposed mitigation measures during decontamination works, no adverse residual air quality impact would be expected.

**Environmental Monitoring and Audit**

5.2.22 Air quality monitoring is not required. A regular site audit (weekly audit) will be conducted to ensure compliance of the *Air Pollutant Control (Construction Dust) Regulation*.

5.2.23 With the implementation of the recommended air quality mitigation measures, good site practices, VOCs monitoring (VOCs monitoring at biopiling discharge), and site audit programme, acceptable air quality impact would be expected at the ASRs during the decontamination process. Details of EM&A Programme are provided in the EM&A Manual.

**Summary**

5.2.24 Control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* of Air Pollution Control Ordinance (APCO) should be implemented to ensure that construction dust impacts are controlled within the relevant standards. With proper implementation of dust control measures, significant construction dust impacts at ASRs during the construction phase of the Project is not anticipated.

5.2.25 The contaminated soil would be treated on site by solidification and biopiling. As the volume of soil requiring treatment would be small and that carbon absorber with 99% removal efficiency would be installed at the biopile facilities to treat off-gas prior to discharge, adverse air quality impact from the decontamination works is therefore not anticipated.

5.2.26 Besides, petroleum/kerosene like smell might be detected during soil excavation, transporting and unloading processes. However, very minor odour impact is anticipated as the excavation area would be limited and would be backfilled with clean and/or treated soil shortly after excavation, and the excavated soils would be covered with impermeable liner to minimise odour emission.

## 5.3 Noise Impact

**Environmental Legislation, Policies, Plans, Standards and Criteria**

General

5.3.1 Noise impacts have been assessed in accordance with the criteria and methodology given in the Technical Memoranda (TMs) under the Noise Control Ordinance (NCO), and the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

5.3.2 The NCO and EIAO provide the statutory framework for noise control. Assessment procedures and standards are set out in five TMs listed below:

- TM on Environmental Impact Assessment Process (EIAO-TM)
- TM on Noise from Construction Work other than Percussive Piling (GW-TM)
- TM on Noise from Construction Work in Designated Areas (DA-TM)
- TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM)

Construction Noise – General Construction

5.3.3 The NCO provides the statutory framework for noise control of construction work, other than percussive piling, using powered mechanical equipment (PME) between the hours of 1900 and 0700 hours or at any time on Sundays and general holiday (that is, restricted hours). Noise control on construction activities taking place at other times is subject to the *Criteria for Evaluating Noise Impact* stated in Table 1B of Annex 5 in the EIAO-TM. The noise limit is $L_{eq\ (30\ minutes)}$ 75 dB(A) at the façades of dwellings and 70 dB(A) at the façade of schools (65 dB(A) during examinations).

5.3.4 Between 1900 and 0700 hours and all day on Sundays and public holidays, activities involving the use of PME for the purpose of carrying out construction work is prohibited unless a construction noise permit (CNP) has been obtained. A CNP may be granted provided that the Acceptable Noise Level (ANL) for the NSRs can be complied with. ANLs are assigned depending upon the area sensitive rating (ASR). The corresponding basic noise levels (BNLs) for evening and night time periods are given in **Table 5.5**.

**Table 5.5 Construction Noise Criteria for Activity other than Percussive Piling**

| Time Period | Basic Noise Level (BNLs) | | |
|---|---|---|---|
| | ASR A | ASR B | ASR C |
| Evening (1900 to 2300 hours) (1) | 60 | 65 | 70 |
| Night (2300 to 0700 hours) | 45 | 50 | 55 |

Notes: (1) Includes Sundays and Public Holidays during daytime and evening

5.3.5 Despite any description or assessment made in this EIA on construction noise aspects, there is no guarantee that a Construction Noise Permit (CNP) will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant Technical Memoranda issued under the Noise Control Ordinance. The Noise Control Authority will take into account of contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making his decision in granting a CNP. Nothing in this EIA shall bind the Noise Control Authority in making his decision. If a CNP is to be issued, the Noise Control Authority shall include in it any condition he thinks fit. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution action under the NCO.

**Description of Environment**

5.3.6 The DP3a Project site is located in the south apron of the former Kai Tak Airport. The existing land uses in adjoining areas are mainly industrial in nature. Kwun Tong Bypass and other distributor networks are dominant noise sources in the area.

**Noise Sensitive Receivers**

5.3.7 In order to evaluate the construction noise impacts from the DP3a Project, representative Noise Sensitive Receivers (NSRs) within the Study Area are identified for assessment. Only the first layer of NSRs has been identified for assessment because it would provide acoustic shielding to those receivers at further distance behind. As the centrally air-conditioned buildings do not rely on opened windows for ventilation, the noise standard as stipulated in Table 1 of EIAO-TM would not be applicable, and hence these buildings are not selected for noise impact assessment.

5.3.8 For the decommissioning of ex-GFS building and the Radar Station, the nearest NSR is Buddhist Chi King Primary School which is located at more than 1km from the site boundary of these two sites.

**Identification of Environmental Impacts**

5.3.9 The potential construction impact arising from the DP3a Project includes demolition and excavation works. The above construction activities will involve the use of Powered Mechanical Equipment (PME) including breakers, excavators, lorries, mobile cranes, etc. Given that a large separation distance between NSR and construction sites, construction noise impact due to the DP3a Project is not expected.

**Mitigation of Environmental Impacts**

5.3.10 In order to further ameliorate the construction noise impacts, good site practices listed below should be adopted by all the contractors. Although the noise mitigating effects are not easily quantifiable and the benefits may vary with the site conditions and operating conditions, good site practices are easy to implement and do not impact upon the works schedule.

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program.
- Mobile plant, if any, should be sited as far away from NSRs as possible.
- Machines and plant (such as trucks) that may be in intermittent use should be shut down between works periods or should be throttled down to a minimum.
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs.
- Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.

**Evaluation of Residual Impacts**

5.3.11 As described above, the nearest NSR is the Buddhist Chi King Primary School which is located at more than 1km from the DP3a Project site boundary. Given the large separation distance between the nearest NSR and the construction sites, adverse construction noise impact on NSRs due to the DP3a Project is not expected.

**Environmental Monitoring and Audit**

5.3.12 As no adverse construction noise impact is expected at the NSRs in the vicinity of the work sites due to the large separation distance between the construction sites and the nearby NSRs, construction noise monitoring is therefore not proposed. However, regular site audit is required to ensure proper implementation of good site practices. Details of the programme are provided in the EM&A Manual.

**Summary**

5.3.13 The construction noise impacts associated with the decommissioning activities were identified. Adverse construction noise impact is not expected.

## 5.4 Water Quality Impact

**Water Quality Sensitive Receivers**

5.4.1 No existing water sensitive receiver (WSR) was identified within 300 m from the DP3a Project site boundary. The existing WSD flushing water intakes and cooling water intakes identified closest to the Kai Tak Development (KTD) Project site (which also covers the DP3a Project site) are shown in **Figure 8.2** and all of them are located outside the assessment area (i.e. 300 m from the DP3a Project site boundary) of the DP3a Project.

5.4.2 A new District Cooling System (DCS) will be implemented in the KTD area and the associated seawater intake would be considered as a planned WSR. Based on the RODP, the seawater intake will be located along the waterfront of the former Kai Tak airport runway (**Figure 8.5**).

**Environmental Legislation, Policies, Plans, Standards and Criteria**

5.4.3 The criteria for evaluating water quality impacts in this EIA Study include:

Environmental Impact Assessment Ordinance (EIAO)

5.4.4 The Technical Memorandum on Environmental Impact Assessment Process (Environmental Impact Assessment Ordinance) (EIAO-TM) was issued by EPD under Section 16 of the EIAO. It specifies the assessment method and criteria that are to be followed in this Study. Reference sections in the EIAO-TM provide the details of assessment criteria and guidelines that are relevant to the water quality impact assessment, including:

- Annex 6 – Criteria for Evaluating Water Pollution
- Annex 14 – Guidelines for Assessment of Water Pollution.

Water Quality Objectives

5.4.5 The Water Pollution Control Ordinance (WPCO) provides the major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, Hong Kong waters are divided into ten water control zones (WCZ). Corresponding statements of Water Quality Objectives (WQO) are stipulated for different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) in each of the WCZ based on their beneficial uses. The study area is located within the Victoria Harbour WCZ (refer to **Figure 8.1**) and the corresponding WQOs are listed in **Table 5.6**.

**Table 5.6 Summary of Water Quality Objectives for the Victoria Harbour WCZ**

| Parameters | Objectives | Sub-Zone |
|---|---|---|
| Offensive odour, tints | Not to be present | Whole zone |
| Visible foam, oil scum, litter | Not to be present | Whole zone |
| Dissolved oxygen (DO) within 2m of the seabed | Not less than 2.0mg/l for 90% of samples | Marine waters |
| Depth-averaged DO | Not less than 4.0mg/l for 90% of samples | Marine waters |
| pH | To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2 | Marine waters |
| Salinity | Change due to human activity not to exceed 10% of ambient | Whole zone |
| Temperature | Change due to human activity not to exceed 2 $^{o}$C | Whole zone |
| Suspended solids (SS) | Not to raise the ambient level by 30% caused by human activity | Marine waters |
| Unionised ammonia (UIA) | Annual mean not to exceed 0.021mg/l as unionised form | Whole zone |
| Nutrients | Shall not cause excessive algal growth | Marine waters |
| Total inorganic nitrogen (TIN) | Annual mean depth-averaged inorganic nitrogen not to exceed 0.4mg/l | Marine waters |
| Toxic substances | Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms. | Whole zone |
| | Human activity should not cause a risk to any beneficial use of the aquatic environment. | Whole zone |

Source: Statement of Water Quality Objectives (Victoria Harbour (Phases One, Two and Three) Water Control Zone).

Water Supplies Department (WSD) Water Quality Criteria

5.4.6 Besides the WQOs stipulated under the WPCO, the WSD has specified a set of objectives for water quality at flushing water intakes. The list is shown in **Table 5.7**. The target limit for suspended solids (SS) at these intakes is 10mg/l or less.

**Table 5.7 WSD's Water Quality Criteria for Flushing Water at Sea Water Intakes**

| Parameter (in mg/l unless otherwise stated) | Target Limit |
|---|---|
| Colour (HU) | < 20 |
| Turbidity (NTU) | < 10 |
| Threshold Odour Number (odour unit) | < 100 |
| Ammoniacal Nitrogen | < 1 |
| Suspended Solids | < 10 |
| Dissolved Oxygen | > 2 |
| Biochemical Oxygen Demand | < 10 |
| Synthetic Detergents | < 5 |
| *E. coli* (no. per 100ml) | < 20,000 |

Cooling Water Intake Standards

5.4.7 Based on a questionnaire survey conducted under the approved Comprehensive Feasibility Study for Wan Chai Development Phase II (CFSWDII) EIA [(1)], a SS limit of 40mg/l was adopted as the assessment criterion for Admiralty Centre intake and MTRC South intake. No information on the SS limit is available for other cooling water intakes. These findings have been confirmed by a telephone survey conducted under the recent approved EIA for the Hong Kong Convention and Exhibition Centre (HKCEC) Atrium Link Extension (ALE) and further verified by a questionnaire survey conducted under another recent approved EIA for the Dredging Works for Proposed Cruise Terminal at Kai Tak. The locations of the cooling water intakes are shown in **Figure 8.2**.

Technical Memorandum

5.4.8 Discharges of effluents are subject to control under the WPCO. The Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) gives guidance on the permissible effluent discharges based on the type of receiving waters (foul sewers, storm water drains, inland and coastal waters). The limits control the physical, chemical and microbial quality of effluents. Any effluent from the Project must comply with the standards for effluents discharged into the foul sewers, inshore waters or marine waters of Victoria Harbour WCZ, as given in the TM-DSS.

Practice Note

5.4.9 A Practice Note for Professional Persons (ProPECC) was issued by the EPD to provide guidelines for handling and disposal of construction site discharges. The ProPECC PN 1/94 "Construction Site Drainage" provides good practice guidelines for dealing with ten types of discharge from a construction site. These include surface runoff, groundwater, boring and drilling water, bentonite slurry, water for testing and sterilisation of water retaining structures and water pipes, wastewater from building constructions, acid cleaning, etching and pickling wastewater, and wastewater from site facilities. Practices given in the ProPECC PN 1/94 should be followed as far as possible during decommissioning to minimise the water quality impact due to construction activities.

**Description of the Environment**

***Marine Water Quality***

5.4.10 The EPD water quality monitoring stations, VM2 and VM4, in the Victoria Harbour WCZ is located in the vicinity of the DP3a Project area. A summary of the most recently published monitoring data (in 2006) for these stations is presented in **Table 5.8**. A summary of the published EPD monitoring data (in 2006) collected from the monitoring stations in the Kwun Tong Typhoon Shelter (VT4) and To Kwa Wan Typhoon Shelter (VT11) is presented in **Table 5.9**. Locations of the monitoring stations are shown in **Figure 8.2**. Stations VM2, VM4, VT4 and VT11 are considered to be representative of the water quality in the marine waters of the assessment area.

([1]) Territory Development Department (July 2001). Agreement No. CE 74/98, Wan Chai Development Phase II, Comprehensive Feasibility Study, Environmental Impact Assessment Report, Volume I – Text.

**Table 5.8 Summary Statistics of Marine Water Quality in the Victoria Harbour WCZ in 2006**

| Parameter | | Victoria Harbour East | Victoria Harbour Central | WPCO WQO (in marine waters) |
|---|---|---|---|---|
| | | VM2 | VM4 | |
| Temperature ($^{o}$C) | | 23.5 (17.4 – 27.5) | 23.6 (17.4 – 27.6) | Not more than 2 $^{o}$C in daily temperature range |
| Salinity | | 31.7 (27.8 – 33.0) | 31.6 (27.4 – 33.0) | Not to cause more than 10% change |
| Dissolved Oxygen (DO) (% Saturation) | Depth average | 81 (49 – 97) | 80 (61 – 94) | Not available |
| | Bottom | 81 (36 – 103) | 79 (47 – 98) | Not available |
| Dissolved Oxygen (DO) (mg/l) | Depth average | 5.8 (3.4 – 7.1) | 5.7 (4.1 – 7.3) | Not less than 4 mg/l for 90% of the samples |
| | Bottom | 5.8 (2.5 – 7.4) | 5.6 (3.2 – 7.2) | Not less than 2 mg/l for 90% of the samples |
| pH | | 7.9 (7.7 – 8.1) | 7.9 (7.7 – 8.1) | 6.5 - 8.5 (± 0.2 from natural range) |
| Secchi disc Depth (m) | | 2.0 (1.4 – 3.1) | 2.0 (1.4 – 3.0) | Not available |
| Turbidity (NTU) | | 11.2 (5.4 – 23.4) | 12.1 (5.6 – 23.4) | Not available |
| Suspended Solids (SS) (mg/l) | | 4.2 (1.2 – 12.8) | 4.9 (1.1 – 12.3) | Not more than 30% increase |
| 5-day Biochemical Oxygen Demand ($BOD_5$) (mg/l) | | 0.6 (0.1 – 1.2) | 0.7 (0.1 – 1.4) | Not available |
| Nitrite Nitrogen ($NO_2$-N) (mgN/l) | | 0.024 (0.004 – 0.084) | 0.024 (0.006 – 0.079) | Not available |
| Nitrate Nitrogen ($NO_3$-N) (mgN/l) | | 0.10 (0.03 – 0.25) | 0.11 (0.03 – 0.25) | Not available |
| Ammonia Nitrogen ($NH_3$-N) (mgN/l) | | 0.11 (0.04 – 0.20) | 0.13 (0.05 – 0.23) | Not available |
| Unionised Ammonia (UIA) (mgN/l) | | 0.004 (0.001 – 0.007) | 0.004 (0.002 – 0.007) | Not more than 0.021 mg/l for annual mean |
| Total Inorganic Nitrogen (TIN) (mgN/l) | | 0.23 (0.07 – 0.40) | 0.26 (0.08 – 0.44) | Not more than 0.4 mg/l for annual mean |
| Total Nitrogen (TN) (mgN/l) | | 0.42 (0.20 – 0.64) | 0.47 (0.22 – 0.69) | Not available |
| Orthophosphate Phosphorus ($PO_4$) (mgP/l) | | 0.03 (0.01 – 0.04) | 0.03 (0.01 – 0.04) | Not available |
| Total Phosphorus (TP) (mgP/l) | | 0.05 (0.03 – 0.06) | 0.05 (0.03 – 0.07) | Not available |
| Chlorophyll-*a* (µg/L) | | 3.0 (1.0 – 8.9) | 2.9 (1.0 – 9.2) | Not available |
| *E coli* (cfu/100 ml) | | 1100 (58 – 14000) | 2600 (510 – 12000) | Not available |
| Faecal Coliforms (cfu/100 ml) | | 2600 (130 – 25000) | 6500 (1800 – 40000) | Not available |

Notes:
1. Data source: *EPD's publication: "Marine Water Quality Monitoring in Hong Kong 2006"*
2. Except as specified, data presented are depth-averaged values calculated by taking the means of three depths: Surface, mid-depth, bottom.
3. Data presented are annual arithmetic means of depth-averaged results except for *E. coli and faecal coliforms* that are annual geometric means.
4. Data in brackets indicate the ranges.

**Table 5.9 Summary Statistics of Marine Water Quality in the Kwun Tong and To Kwa Wan Typhoon Shelters in 2006**

| Parameter | | Kwun Tong VT4 | To Kwa Wan VT11 | WPCO WQO (in marine waters) |
|---|---|---|---|---|
| Temperature ($^{o}$C) | | 23.9 (17.5 – 28.8) | 23.5 (17.2 – 28.6) | Not more than 2 $^{o}$C in daily temperature range |
| Salinity (ppt) | | 29.3 (23.2 – 31.4) | 30.5 (21.8 – 32.7) | Not to cause more than 10% change |
| Dissolved Oxygen (DO) (% saturation) | Depth average | 68 (29 – 112) | 83 (56 – 115) | Not available |
| | Bottom | 66 (26 – 110) | 84 (54 – 117) | Not available |
| Dissolved Oxygen (DO) (mg/l) | Depth average | 4.9 (2.0 – 7.6) | 6.0 (3.9 – 7.9) | Not less than 4 mg/L for 90% of the samples |
| | Bottom | 4.7 (1.8 – 7.4) | 6.0 (3.7 – 8.0) | Not less than 2 mg/L for 90% of the samples |
| pH value | | 7.7 (7.4 – 8.1) | 8.0 (7.7 – 8.3) | 6.5 - 8.5 (± 0.2 from natural range) |
| Secchi disc (m) | | 1.4 (1.0 – 2.0) | 1.7 (0.9 – 2.5) | Not available |
| Turbidity (NTU) | | 12.7 (4.1 – 30.1) | 14.8 (9.0 – 22.1) | Not available |
| Suspended Solids (SS) (mg/l) | | 2.6 (1.2 – 3.5) | 6.7 (2.4 – 20.6) | Not more than 30% increase |
| Silica (as $SiO_2$) (mg/l) | | 1.0 (0.4 – 1.8) | 0.7 (0.2 – 1.6) | Not available |
| 5-day Biochemical Oxygen Demand ($BOD_5$) (mg/l) | | 2.2 (1.1 – 3.5) | 1.0 (0.6 – 1.6) | Not available |
| Nitrite Nitrogen ($NO_2$-N) (mg/l) | | 0.157 (0.082 – 0.227) | 0.029 (0.012 – 0.059) | Not available |
| Nitrate Nitrogen ($NO_3$-N) (mg/l) | | 0.34 (0.22 – 0.64) | 0.16 (0.05 – 0.42) | Not available |
| Ammoniacal Nitrogen ($NH_3$-N) (mg/l) | | 0.48 (0.29 – 0.65) | 0.12 (0.06 – 0.21) | Not available |
| Unionised Ammonia (UIA) (mg/l) | | 0.011 (0.005 – 0.016) | 0.004 (0.002 – 0.006) | Not more than 0.021 mg/L for annual mean |
| Total Inorganic Nitrogen (TIN) (mg/l) | | 0.97 (0.71 – 1.42) | 0.31 (0.13 – 0.54) | Not more than 0.4 mg/L for annual mean |
| Total Nitrogen (TN) (mg/l) | | 1.33 (1.02 – 1.82) | 0.53 (0.39 – 0.80) | Not available |
| Ortho-Phosphate ($PO_4$) (mg/l) | | 0.214 (0.153 – 0.295) | 0.028 (0.007 – 0.050) | Not available |
| Total Phosphorus (TP) (mg/l) | | 0.26 (0.20 – 0.36) | 0.05 (0.04 – 0.06) | Not available |
| Chlorophyll-*a* (µg L-1) | | 18.2 (1.0 – 35.0) | 7.9 (1.0 – 20.5) | Not available |
| *E. coli* (cfu per 100 mL) | | 9,200 (2,800 – 29,000) | 1,100 (340 – 4,400) | Not available |
| Faecal Coliforms (cfu per 100 mL) | | 22,000 (4,400 – 78,000) | 2,600 (860 – 8,300) | Not available |

Notes:
1. Data source: *EPD's publication: "Marine Water Quality Monitoring in Hong Kong 2006"*
2. Except as specified, data presented are depth-averaged data.
3. Data presented are annual arithmetic means except for *E.coli and faecal coliforms* that are geometric means.
4. Data enclosed in brackets indicate ranges.

5.4.11 In 2006, marked improvements in the eastern and central Victoria Harbour (VM2 and VM4) since HATS Stage 1 was commissioned were generally sustained. Full compliance with the WQOs for dissolved oxygen, total inorganic nitrogen and unionized ammonia was achieved at these two stations.

5.4.12 In 2006, high levels of *E.coli* were recorded at the Kwun Tong and To Kwa Wan Typhoon Shelters indicating faecal contamination. A high level of total organic nitrogen was also recorded at the Kwun Tong Typhoon Shelter which breached the WQO.

***Kai Tak Approach Channel***

5.4.13 Kai Tak Approach Channel (KTAC) is also one of the surrounding water bodies of the DP3a Project site and its water quality is currently under stressed condition. No long-term water quality data was collected at KTAC by EPD. Two baseline marine water quality surveys were carried out in October 2005 and January 2006 respectively under the Kai Tak Planning Review (KTPR) [(2)]. The survey locations include seven stations within the KTAC, namely AC1 - AC7, as shown in **Figure 8.3**. In each of the two baseline surveys, two monitoring events were carried out for typical spring and neap tides respectively. For each monitoring event, water quality measurements were taken once every three hours for a complete tidal cycle (roughly a 26-hour period).

5.4.14 The field survey results are tabulated in **Table 5.10** and **Table 5.11** for the two monitoring events. The survey results are presented as averaged concentrations (for suspended solids, ammonia nitrogen, total inorganic nitrogen and biochemical oxygen demand) and 10$^{th}$ percentile values (for bottom and depth-averaged dissolved oxygen). The field data showed a gradient of water quality from the inner KTAC to the outer KTAC. The levels of nitrogen nutrients, ammonia and *E.coli* were found to be very high in the KTAC. The DO levels breached the WQO in October 2005 but complied well with the WQO in January 2006. The TIN levels exceeded the WQO in KTAC for both dry and wet seasons.

**Table 5.10 Pollution Levels Measured at KTAC in October 2005**

| | Depth-averaged Suspended Solids | Depth-averaged Ammonia Nitrogen | Depth-averaged *E.coli* | Depth-averaged Total Inorganic Nitrogen | Depth-averaged BOD5 | 10$^{th}$ Percentile Bottom DO | 10$^{th}$ Percentile Depth-averaged DO |
|---|---|---|---|---|---|---|---|
| | Mg/L | mg/L | cfu/100mL | mg/L | mg/L | mg/L | mg/L |
| **WQO:** | **NA** | **NA** | **NA** | **0.4** | **NA** | **2** | **4** |
| AC1 | 25 | 0.9 | 115519 | **3.11** | 11 | **0.99** | **1.48** |
| AC2 | 28 | 1.0 | 17960 | **3.21** | 10 | **0.74** | **1.18** |
| AC3 | 19 | 0.9 | 60517 | **3.53** | 9 | **1.14** | **1.47** |
| AC4 | 20 | 1.2 | 37857 | **3.15** | 10 | **0.93** | **1.33** |
| AC5 | 21 | 1.2 | 28832 | **3.28** | 8 | **1.19** | **1.54** |
| AC6 | 26 | 1.4 | 34375 | **2.76** | 9 | **0.86** | **1.41** |
| AC7 | 27 | 0.8 | 15863 | **2.60** | 7 | 2.06 | **2.20** |

Bolded and shaded – Exceedance of WQO
NA – WQO is not available

(2) Agreement No. CE 4/2004 (TP) South East Kowloon Development Comprehensive Planning and Engineering Review Stage 1: Planning Review (Feasibility Study)

**Table 5.11 Pollution Levels Measured at KTAC in January 2006**

| | Depth-averaged Suspended Solids | Depth-averaged Ammonia Nitrogen | Depth-averaged *E.coli* | Depth-averaged Total Inorganic Nitrogen | Depth-averaged BOD5 | 10th Percentile Bottom DO | 10th Percentile Depth-averaged DO |
|---|---|---|---|---|---|---|---|
| | Mg/L | mg/L | cfu/100mL | mg/L | mg/L | mg/L | mg/L |
| **WQO:** | **NA** | **NA** | **NA** | **0.4** | **NA** | **2** | **4** |
| AC1 | 6 | 1.6 | 126945 | **4.7** | 10 | 3.0 | 5.4 |
| AC2 | 4 | 1.5 | 72689 | **4.1** | 7 | 2.6 | 3.8 |
| AC3 | 20 | 1.6 | 111217 | **4.6** | 11 | 3.1 | 5.1 |
| AC4 | 4 | 1.3 | 81229 | **3.7** | 7 | 3.4 | 5.0 |
| AC5 | 4 | 1.7 | 129380 | **3.9** | 10 | 4.4 | 6.6 |
| AC6 | 4 | 2.2 | 132126 | **3.4** | 9 | 3.8 | 4.7 |
| AC7 | 5 | 0.9 | 11833 | **1.9** | 5 | 6.2 | 5.5 |

Bolded and shaded – Exceedance of WQO
NA – WQO is not available

## Identification of Environmental Impacts

### *Decontamination Process*

5.4.15 In accordance with the land contamination assessment findings presented in **Section 5.6**, localized land contamination is only identified within the ex-GFS building. As identified in the KTA Decommissioning EIA, biopiling is regarded as the most practical way to remediate the organic contaminated soil while solidification/stabilization is best suited for metal contaminated soil based on the (1) technical and cost effectiveness, (2) technology development status, (3) commercial availability, (4) experience and (5) expertise requirement. The DP3a Project will adopt the same decontamination methods as for the KTA Decommissioning project.

5.4.16 Potential water pollution sources would include leachate, contaminated runoff, wastewater generated from the decontamination processes and wheel washing activities. Practical mitigation measures for containing and minimizing water quality impacts as stipulated in the approved KTA Decommissioning EIA should be followed to ensure that any effluent discharge from the DP3a Project will meet the requirements of the TM-DSS.

### *Building Demolition*

5.4.17 The decommissioning works may include demolition of remaining existing structures / building of the former Kai Tak Airport. The key concern from building demolition would be surface runoff and site effluent.

5.4.18 Surface runoff may cause potential water quality impact during the demolition activities. Precipitation that falls on unpaved lands and areas with the topsoil exposed during the demolition would wash away soil particles. Such surface runoff and stormwater overflows with high levels of suspended solids if directly discharged into the water bodies or via the drainage channel could lead to a water quality impact.

5.4.19 Effluent discharge from temporary site facilities shall be controlled to prevent direct discharge to the neighbouring marine waters and storm drains. Such wastewater may include wastewater resulting from wheel washing of site vehicles at site entrances.

### *Sewage from Workforce*

5.4.20 Sewage will arise from the on-site workforce. It is characterized by high level of BOD, $NH_3$-N and *E.coli* counts and may adversely affect the water quality, if not proper controlled.

***Accumulation of Solid Waste and Accidental Spillage***

5.4.21 Accumulation of solid waste (such as debris, rubbish and demolition materials), and spillage of oil, diesel or solvents by vehicles involved with the decommissioning works, if uncontrolled, could also lead to deterioration in water quality.

**Assessment Methodology**

5.4.22 The assessment area for the water quality impact assessment covers the Victoria Harbour WCZ and all areas within 300m from the DP3a Project boundary.

5.4.23 The water sensitive receivers that may be affected by the decommissioning activities for the DP3a Project have been identified. Proposed decommissioning activities have been reviewed to assess the land-based water quality impact upon the nearby water bodies. Practical water pollution control measures were subsequently recommended to ensure that effluent discharged from the construction site will comply with the WPCO criteria. Consideration has been given to controlling potentially harmful impacts from site works and to the use of 'best' practice measures to minimise the potential for discharges of pollutants to the nearby waters of the Victoria Harbour.

**Prediction and Evaluation of Potential Environmental Impacts**

5.4.24 Provided that suitable mitigation measures are implemented properly, no unacceptable water quality impacts would be expected.

**Mitigation of Environmental Impacts**

***Decontamination Processes***

Soil Excavation

5.4.25 During excavation, all exposed pits shall be whenever possible backfilled immediately or covered. Where it is unavoidable to transiently pile up soils next to the excavation pit, the transient pile shall be bottom-lined, bunded and covered with impervious membrane during rain event in order to avoid generation of contaminated runoff.

5.4.26 Final surfaces after excavation shall be well compacted and the subsequent permanent work or surface protection shall be carried out as soon as practical after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate intercepting channels and partial shelters shall be provided where necessary to prevent rainwater from collecting within trenches or footing excavations.

Decontaminated Water and Wastewater from Wheel Washing

5.4.27 During excavation, dump trucks or excavators shall be decontaminated before they leave the site to ensure that no contaminated earth, mud or debris is deposited by them on roads. A wheel washing bay shall be provided at every site exit that equipped with an adequately sized centralized wastewater treatment unit. The wastewater treatment unit shall be able to settle out sands / silts with contaminants cohered and remove other contaminants in wheel washes and decontamination water. The polluting parameters in effluent of the wastewater treatment unit shall be in compliance with the discharge standards stipulated in the TM-DSS before the effluent being discharged into the storm drains. Appropriate treatment would include chemical precipitation and activated carbon adsorption. The installation and operation of the wastewater treatment unit shall be licensed and subject to the effluent monitoring as required under the WPCO which is under the ambit of regional office (RO) of EPD. In any case, discharge of wheel wash water shall be minimized and recycled where possible. The haul road between the wheel washing bay and the public road should be paved to reduce vehicle tracking of soil and to prevent surface runoff from entering public road drains.

Operation of Solidification / Stabilization Facility

5.4.28 The solidification/stabilization facility shall be sheltered and the area(s) of soil unloading / loading shall be provided with shed to avoid contaminated runoff. Excessive addition of water shall be avoided during the solidification/stabilization process.

5.4.29 Any pit used for solidification / stabilization area shall be shallower than the water table to minimize the leaching of the contaminated soils. An impermeable membrane / sheet shall be placed at the bottom of any solidification pit during the solidification process.

5.4.30 Any leachate generated from the solidification/stabilization process shall be collected and treated in the centralized wastewater treatment unit before being discharged. The polluting parameters in effluent of the wastewater treatment unit shall be in compliance with the discharge standards stipulated in the TM-DSS before the effluent being discharged. Appropriate treatment would include chemical precipitation and activated carbon adsorption. The installation and operation of the wastewater treatment unit shall be licensed and subject to the effluent monitoring as required under the WPCO.

Operation of Biopiling

5.4.31 As recommended under the land contamination assessment in **Section 5.6** of this report, impermeable liner shall be placed at the bottom of the biopiles and leachate collection sump shall be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil / groundwater. Concrete bund shall be constructed along the perimeter of biopiles to prevent the runoff coming out from the contaminated soil. Biopiles after formation and during rain shall be covered by anchored low permeability geotextiles to prevent contaminated runoff. It is proposed that the exposed biopile section at any time shall not be more than 5 m in length.

5.4.32 All leachate generated from the operation of biopiling shall be collected and recycled to the biopile to avoid effluent discharge.

Groundwater Cleanup

5.4.33 Floating oil / free product (of TPH) has only been found in the ex-GFS apron area. It is proposed that where free product is detected at the groundwater surface at excavated area, only the free product shall be skimmed off. Detailed requirements for removal of free product are given in **Section 5.6** of this report. The skimmed free product shall be drummed properly and collected by a licensed chemical waste collector for disposal.

Groundwater Seepage

5.4.34 With implementation of all the mitigation measures recommended for the decontamination processes, the Project would not induce or pollute any groundwater seeping to the nearby groundwater or surface water system. No further mitigation measure is required.

TPH Removal

5.4.35 Oil/water interceptor should be adopted, where appropriate, as the first tier of treatment to remove TPH contaminant from contaminated runoff and effluent discharge from the decontamination works area.

Failure of Centralized Wastewater Treatment Unit

5.4.36 In the event of wastewater treatment unit failure, all wastewater generating activities should be ceased to avoid emergency discharge.

***Building Demolition***

5.4.37 The site practices outlined in ProPECC PN 1/94 "*Construction Site Drainage*" should be followed as far as practicable in order to minimise surface runoff and the chance of erosion.

5.4.38 There is a need to apply to EPD for a discharge licence under the WPCO for discharging effluent from the construction site. The discharge quality is required to meet the requirements specified in the discharge licence. All the runoff, wastewater or extracted groundwater generated from the works areas should be treated so that it satisfies all the standards listed in the TM-DSS. It is anticipated that the wastewater generated from the works areas would be of small quantity. Monitoring of the treated effluent quality from the works areas should be carried out in accordance with the WPCO license which is under the ambit of regional office (RO) of EPD.

***Sewage from Workforce***

5.4.39 Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor would be responsible for appropriate disposal of waste matter and maintenance of these facilities.

***Accumulation of Solid Waste and Accidental Spillage***

5.4.40 Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering into the adjacent harbour waters. Stockpiles of cement and other construction materials should be kept covered when not being used.

5.4.41 Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to the nearby harbour waters, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

**Summary**

5.4.42 Water quality impacts from the land-based decontamination works, associated with leachate, and contaminated runoff, can be controlled to acceptable levels by implementing the recommended mitigation measures. All the effluents and runoff generated from the works areas shall be treated and their quality be monitored before discharged. No unacceptable water quality impacts would be expected from the land-based decommissioning activities.

5.4.43 Site inspections should be undertaken routinely to inspect the works areas in order to ensure the recommended mitigation measures are properly implemented.

## 5.5 Waste Management Implications

**Environmental Legislation, Policies, Plans, Standards and Criteria**

5.5.1 The criteria and guidelines for assessing waste management implications are set out in Annex 7 and Annex 15 of the Technical Memorandum on Environmental Impact Assessment Ordinance (EIAO-TM), respectively.

5.5.2 The following legislation relates to the handling, treatment and disposal of wastes in the Hong Kong SAR and has been used in assessing potential impacts:

- Waste Disposal Ordinance (Cap. 354)
- Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354)
- Land (Miscellaneous Provisions) Ordinance (Cap. 28)
- Public Health and Municipal Services Ordinance (Cap. 132) - Public Cleansing and Prevention of Nuisances Regulation
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N)

Waste Management

5.5.3 The Waste Disposal Ordinance (WDO) prohibits the unauthorised disposal of wastes. Construction waste is defined as any substance, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. Under the WDO, wastes can be disposed of only at designated waste disposal facilities.

5.5.4 Under the WDO, the Chemical Waste (General) Regulation 1992 provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes. The Environmental Protection Department (EPD) has also issued a guideline document, the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* (1992), which details how the Contractor should comply with the regulations on chemical wastes.

5.5.5 The Public Cleansing and Prevention of Nuisances Regulation provides control on illegal tipping of wastes on unauthorised (unlicensed) sites.

Chemical Waste

5.5.6 Under the Waste Disposal (Chemical Waste) (General) Regulations, all producers of chemical waste must register with EPD and treat their wastes, either utilising on-site plant licensed by EPD, or arranging for a licensed collector to transport the wastes to a licensed facility. The regulation also prescribes the storage facilities to be provided on site, including labelling and warning signs, and requires the preparation of written procedures and training to deal with emergencies such as spillages, leakages or accidents arising from the storage of chemical wastes.

Construction and Demolition (C&D) Materials

5.5.7 The current policy related to the disposal of C&D material is documented in the Works Branch Technical Circular No. 2/93, 'Public Dumps'. Construction and demolition materials that are wholly inert, namely public fill, should not be disposed of to landfill, but taken to public filling areas, which usually form part of reclamation schemes. The Land (Miscellaneous Provisions) Ordinance requires that dumping licences be obtained by individuals or companies who deliver public fill to public filling areas. The Civil Engineering and Development Department (CEDD) issues the licences under delegated powers from the Director of Lands.

5.5.8 Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, enacted in January 2006, construction waste delivered to a landfill for disposal must not contain more than 50% by weight of inert material. Construction waste delivered to a sorting facility for disposal must contain more than 50% by weight of inert material, and construction waste delivered to a public fill reception facility for disposal must consist entirely of inert material. In accordance with the Environment, Transport and Works Bureau (ETWB) TCW No. 31/2004 "Trip Ticket System for Disposal of Construction and Demolition Materials", for all contracts that are expected to generate inert C&D materials (e.g. soil, broken rock, broken concrete and building debris etc.) requiring disposal from the site, the project office shall write to the Public Fill Committee (PFC) through the Secretary of the PFC to request a designated disposal ground for incorporation into the tender documents. For contracts where the estimated amount of non-inert C&D materials requiring disposal at landfill facilities equal or exceed 50$m^3$, the project office shall seek confirmation from the Director of Environmental Protection (DEP) as to whether landfill facilities will be available for disposal of such materials. The DEP will designate landfill facilities, if available, for the contract. Where the estimated amount of non-inert C&D materials to be generated from the contract is less than 50$m^3$, the project office is not required to apply to DEP for designated landfill facilities. However, the project office should still specify in the tender documents appropriate landfill facilities (e.g. Outlying Islands Transfer Facilities managed by the EPD, SENT Landfill at Tseung Kwan O, NENT Landfill at Ta Kwu Ling and WENT Landfill at Nim Wan).

5.5.9 Measures have been introduced under ETWB TCW No. 33/2002, "Management of Construction and Demolition Material Including Rock" to enhance the management of construction and demolition material, and to minimize its generation at source. The enhancement measures include: (i) drawing up a Construction and Demolition Material Management Plan (C&DMMP) at the feasibility study or preliminary design stage to minimize C&D material generation and encourage proper management of such material; (ii) vetting of the C&DMMP prior to upgrading of the project to Category A in the Public Works Programme; and (iii) providing the contractor with information from the C&DMMP in order to facilitate him in the preparation of the Waste Management Plan (WMP) and to minimize C&D material generation during construction. Projects generating C&D material less than 50,000$m^3$ or importing fill material less than 50,000$m^3$ are exempt from the C&DMMP. The new ETWB TCW No. 19/2005 "Environmental Management on Construction Sites" includes procedures on waste management requiring contractors to reduce the C&D material to be disposed of during the course of construction. Under ETWB TCW No. 19/2005, the contractor is required to prepare and implement an Environmental Management Plan (EMP) and the WMP becomes part of the EMP. Besides, ETWB TCW No.31/2004 "Trip Ticket System for Disposal of Construction and Demolition Materials" promulgates the latest trip ticket system for public works contracts including capital works contracts, term contracts and design and build contracts, where C&D materials including waste generated on site require disposal.

**Assessment Methodology**

General

5.5.10 The criteria for assessing waste management implications are outlined in Annex 7 of the EIAO-TM. The methods for assessing potential waste management impacts during the decommissioning phase of the DP3a Project follow those presented in Annex 15 of the EIAO-TM and include the following:

- Estimation of the types and quantities of the wastes generated.
- Assessment of potential impacts from the management of solid waste with respect to potential hazards, air and odour emissions, noise, wastewater discharge and transport.
- Assessment of impacts on the capacity of waste collection, transfer and disposal facilities.

**Identification of Environmental Impacts**

5.5.11 The decommissioning phase activities to be carried out for the DP3a Project would generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate method of disposal. The identified waste types include:

- C&D material
- Chemical waste
- General refuse

5.5.12 Each type of waste arising is described below, together with an evaluation of the potential environmental impacts associated with the generation, handling, storage and transport of the waste.

Construction and Demolition Materials

5.5.13 Construction and demolition (C&D) material arising from the DP3a Project would be included site clearance and site formation. About 43,250m$^3$ of inert materials would be generated in the decommissioning and decontamination of the ex-GFS building and Radar Station and 28,750m$^3$ from the total C&D materials is estimated to be reused. The inert materials are concrete materials which would be re-used on-site or in other projects as far as possible and taken to public filling areas as last resort. The estimated quantity of C&D material generated from demolition activities are summarized in **Table 5.12**.

**Table 5.12 Summary of Estimated C&D Material**

| Projects | Disposal Site (Landfill or Public Fill) | Estimated Quantity |
|---|---|---|
| Decommissioning of the remaining parts (ex-GFS Building and Radar Station) of the former Kai Tak Airport | Landfill / public fill | • 9500 m$^3$ for demolition of ex-GFS Building<br>• 5,000 m$^3$ for demolition of ASDE radar tower<br>• 28,750 m3 for decommissioning and decontamination of the south apron |

Chemical Waste

5.5.14 The maintenance and servicing of construction plant and equipment may generate some chemical wastes such as cleaning fluids, solvents, lubrication oil and fuel. It is difficult to quantify the amount of chemical waste that will arise from the construction activities since it will be dependent on the contractor's maintenance requirements and the amount of plant utilised. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance, would be small and in the order of a few cubic metres per month. The amount of chemical waste to be generated will be quantified in the site Waste Management Plan to be prepared by the contractor.

5.5.15 Chemical wastes arising during the decommissioning phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations. The potential hazards include:

- Toxic effects to workers
- Adverse impacts on water quality from spills
- Fire hazards

5.5.16 Materials classified as chemical wastes will require special handling and storage arrangements before removal for appropriate treatment at the Chemical Waste Treatment Facility (CWTF) or other licensed facility. Wherever possible, opportunities should be taken to reuse and recycle materials. Mitigation and control requirements for chemical wastes are detailed below. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts would not be expected to result.

General Refuse

5.5.17 The construction workforce would generate general refuse comprising food scraps, waste paper, empty containers, etc. As the introduction of these wastes is likely to have detrimental effects on water quality in the area, such refuse should be properly managed so intentional or accidental release to the surrounding environment does not occur. Disposal of refuse at sites other than approved waste transfer or disposal facilities shall be prohibited. Effective collection of site wastes would be required to prevent waste materials being blown around by wind, flushed or leached into the marine environment, or creating an odour nuisance. The waste storage area should be well maintained and cleaned regularly so as to prevent from attracting pests and vermin to the work sites.

5.5.18 With the implementation of waste management practices at the site, adverse environmental impacts on potential hazard, air and odour emissions, noise, wastewater discharge, and public transport would not be expected from the storage, handling and transportation of refuse.

**Mitigation of Environmental Impacts**

Good Site Practices

5.5.19 It is not anticipated that adverse waste management related impacts would arise, provided that good site practices are adhered to. Recommendations for good site practices during the decommissioning activities include:

- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site.
- Training of site personnel in proper waste management and chemical waste handling procedures.
- Provision of sufficient waste disposal points and regular collection for disposal.
- Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers.
- A recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites).

Waste Reduction Measures

5.5.20 Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Sort C&D waste from demolition of the remaining structures to recover recyclable portions such as metals.
- Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
- Encourage collection of aluminium cans, PET bottles and paper by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the work force.
- Any unused chemicals or those with remaining functional capacity shall be recycled.
- Proper storage and site practices to minimise the potential for damage or contamination of construction materials.

Measures for Construction and Demolition Materials

5.5.21 Mitigation measures and good site practices should be incorporated in the contract document to control potential environmental impact from handling and transportation of C&D material. The mitigation measures include:

- Where it is unavoidable to have transient stockpiles of C&D material within the work site pending collection for disposal, the transient stockpiles shall be located away from waterfront or storm drains as far as possible.
- Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric.
- Skip hoist for material transport should be totally enclosed by impervious sheeting.
- Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving a construction site.
- The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores.
- The load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure dust materials do not leak from the vehicle.
- All dusty materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet.
- The height from which excavated materials are dropped should be controlled to a minimum practical height to limit fugitive dust generation from unloading.

5.5.22 When delivering inert C&D material to public fill reception facilities, the material shall consist entirely of inert construction waste and of size less than 250mm or other sizes as agreed with the Secretary of the Public Fill Committee. In order to monitor the disposal of the surplus C&D material at the designed public fill reception facility and to control fly tipping, a trip-ticket system as stipulated in the ETWB TCW No. 31/2004 “Trip Ticket System for Disposal of Construction and Demolition Materials” should be included as one of the contractual requirements and implemented by an Environmental Team undertaking the Environmental Monitoring and Audit work. An Independent Environmental Checker should be responsible for auditing the results of the system.

Measures for Chemical Waste

5.5.23 After use, chemical wastes (for example, cleaning fluids, solvents, lubrication oil and fuel) should be handled according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. Spent chemicals should be collected by a licensed collector for disposal at the CWTF or other licensed facility, in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation*.

Measures for General Refuse

5.5.24 General refuse should be stored in enclosed bins or compaction units separate from C&D material. A licensed waste collector should be employed by the contractor to remove general refuse from the site, separately from C&D material. Effective collection and storage methods (including enclosed and covered area) of site wastes would be required to prevent waste materials from being blown around by wind, wastewater discharge by flushing or leaching into the marine environment, or creating odour nuisance or pest and vermin problem.

**Evaluation of Residual Environmental Impacts**

5.5.25 With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste arisings, no residual impact is expected to arise during the decommissioning phase of the DP3a Project.

**Environmental Monitoring and Audit**

5.5.26 Waste management will be the contractor's responsibility to ensure that all wastes produced during the decommissioning activities are handled and disposed of in accordance with the recommended mitigation measures and EPD's regulations and requirements. The mitigation measures recommended above should form the basis of the site Waste Management Plan to be developed by the contractor during decommissioning phase of the DP3a Project.

**Summary**

5.5.27 The total volume of C&D material generated from the DP3a Project is estimated to be approximately 43,250$m^3$ with about 28,750$m^3$ to be reused. Other wastes generated from the DP3a Project are likely to include chemical waste from the maintenance of construction plant and equipment and general refuse from the construction workforce.

5.5.28 Mitigation measures are recommended to minimise potential environmental impacts associated with handling and disposal of different wastes arising from the DP3a Project. Provided that the recommended mitigation measures are properly followed, adverse environmental impacts would not be expected from the DP3a Project.

## 5.6 Land Contamination Impact

### Introduction

5.6.1 The remaining sites within the former Kai Tak Airport boundaries yet to be decommissioned (Study Area) include the ex-Government Flying Service (GFS) building, the Radar Station, the "Hong Kong Aviation Club (HKAC) and an open area for car parking and exhibition" (HKAC area) and the "Electrical and Mechanical Services Department (EMSD) Headquarters excluding the external heavy vehicle repairing workshop" (EMSD Headquarters). The scope of the DP3a Project is limited to the decommissioning of the remaining facilities, structures and buildings of the ex-GFS building and Radar Station.

5.6.2 This Section 5.6 will adequately address the land contamination impacts associated with the DP3a Project.

### Environmental Legislation, Policies, Plans, Standards and Criteria

5.6.3 The *"Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair /Dismantling Workshop"* (the Guidance Note) issued by the Environmental Protection Department (EPD) shall be referred to for land contamination assessment.

5.6.4 The Practice Note for Professional Persons ProPECC PN3/94 "*Contaminated Land Assessment and Remediation"* issued by the EPD was widely used as the assessment guideline for contaminated sites. The Practice Note makes reference to criteria developed in the Netherlands (the "Dutch ABC Guidelines").

5.6.5 Starting from 15 August 2007, a new guideline, Risk-based Remediation Goals (RBRGs) stipulated in the "*Guidance Note for Contaminated Land Assessment and Remediation*" (the GN) and "*Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management*", dated July 2007 (the GM) were promulgated for use. A transition period of 3 months (from 15 August to 14 November 2007) was granted, during which project proponents were free to choose either the Dutch B levels stipulated in the ProPECC PN3/94 or the RBRGs stipulated in the GN and GM are used as the assessment guidelines for their contaminated sites.

5.6.6 In the context of this EIA Report, CAPs prepared for 1) Radar Station and ii) ex-Government Flying Service (GFS) building have been defined to follow the ProPECC Note No. 3/94 and adopted the Dutch ABC Guidelines as the assessment guidelines for soil and screening levels for groundwater; while the CAP prepared for Hong Kong Aviation Club (HKAC) area has been defined to follow the GN and GM and adopted the RBRGs as the assessment guidelines for soil and groundwater.

5.6.7 Since the Dutch criteria were established based on the assumption that groundwater is used as potable water, it is not so appropriate to be applied directly in Hong Kong where groundwater is not generally for potable use. Hence, the Dutch B levels would be only for screening out the chemicals-of-concern (COCs) for risk assessment and are not for assessing groundwater contamination in Hong Kong.

5.6.8 A risk-based assessment would therefore be carried out for groundwater contaminants with the concentration exceeding the Dutch B level to evaluate the risks posed to the sensitive receptors. The risk-based assessment that has been adopted in U.S. Environmental Protection Agency (USEPA) takes into account concentrations of individual contaminants in groundwater, the anticipated most sensitive human receptor and the potential exposure pathways. It should be noted that risk assessment could only be undertaken for those chemicals that have a recognized oral slope factor or oral reference dose.

5.6.9 Further consideration of contamination issues is provided in Section 3 (Potential Contaminated Land Issues) of Annex 19 "*Guidelines for Assessment of Impact on Sites of Cultural Heritage and Other Impacts*" of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

**Description of Environment**

5.6.10 The scope of the DP3a Project is to decommission the remaining facilities, structures and buildings within the ex-GFS building and Radar Station which were not covered under the previous Environmental Impact Assessments (EIA) on decommissioning of former Kai Tak Airport registered under the EIAO (namely "EIA on Decommissioning of the former Kai Tak Airport other than the North Apron" and "EIA on Kai Tak Airport North Apron Decommissioning").

5.6.11 The Radar Station and the ex-GFS building are located to the southeast of South Apron of the former Kai Tak Airport, at Cheung Yip Street, Kowloon Bay. The locations of the sites are indicated in **Figure 5.1**.

Radar Station and Ex-GFS Building

5.6.12 The Radar Station and the ex-GFS building are located at the southeast of the former Kai Tak Airport. Surrounding environment of the Radar Station and the ex-GFS building are mainly used for industrial and commercial purpose.

**Assessment Methodology**

5.6.13 In this Study, land contamination assessment in the previous EIA studies for the Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development (SEKDCFS EIA) (EIAO Register No: AEIAR-044/2001) was reviewed. Some of the findings, wherever applicable, are summarised and adopted in this assessment.

5.6.14 Additional information was also obtained through desktop review to further update the findings. In addition, site reconnaissance was also carried out to identify and confirm the potential contaminative landuses within the Study Area. **Figure 5.1** summarised the previous findings on land contamination that may pose impacts on the proposed development in this Study, which are to be further elaborated in the following sections.

Review of Previous EIA Study

5.6.15 The SEKDCFS EIA was completed in July 2001 and approved under the EIA Ordinance in September 2001. The reference of the approved report in the EIAO Register is AEIAR-044/2001.

5.6.16 The SEKDCFS EIA reviewed two relevant studies namely Environmental Impact Assessment for the South East Kowloon Development Feasibility Study (SEKDFS EIA) and the Kai Tak Airport North Apron Decommissioning (NAKTA Decommissioning EIA), to provide the background information for assessment of land contamination impact of the EIA study. The SEKDCFS have identified some sites within the former Kai Tak Airport, which were mainly fuel storage tanks, which were not included in the NAKTA Decommissioning EIA and suggested that land contamination assessment on these sites were needed when the sites become accessible. In addition, a preliminary contamination assessment (review of site history) at the ex-GFS building was conducted in the SEKDCFS EIA. A summary table of the site investigation findings reviewed in the SEKDCFS EIA and relevant CAP, CAR/RAP has been provided in **Table 5.13**.

**Table 5.13 Summary of findings in the relevant EIA reviewed**

| EIA reviewed | Site Investigation Findings | Date of Approval |
|---|---|---|
| **SEKDCFS EIA** | | |
| SEKDCFS EIA | • Reviewed SEKDFS EIA and NAKTA Decommissioning EIA.<br>• Suggested land contamination assessment on potential land contaminated sites which were not accessible during the site investigation for the NAKTA Decommissioning EIA.<br>• Identified potential contamination hotspots within former Kai Tak Airport and the vicinity. | September 2001<br>EIAO Register: AEIAR-044/2001 |

**Identification of Sensitive Receivers**

5.6.17 Construction workers are the most likely group to be exposed to any potential contaminated materials during the decommissioning stage. The principle exposure routes for workers include:

- Direct ingestion of contaminated soils through eating or drinking/smoking on site; and
- Dermal contact with contaminated soils.

5.6.18 There would be no sensitive receivers during the operational phase of the DP3a Project provided that remediation actions if necessary are completed.

**Identification of Potential Sources of Environmental Impact**

5.6.19 The previous studies identified a number of hotspots within the Kai Tak Airport. Remediation works was/ would be carried out at the identified locations to decontaminate the land up to the remediation targets.

5.6.20 As revealed from the preliminary appraisal of environmental impact associated with the DP3a Project, past and current landuses including vehicle repairing and maintenance activities, fuel injection facility, dangerous goods storages, waste fuel storage tanks, chemical and chemical waste storage, etc. are suspected to be the major causes of potential land contamination.

5.6.21 The previous findings in relation with the potential land contamination impacts envisaged associated with the decommissioning of the ex-GFS building and the Radar Station covered under the DP3a Project are summarized as follows.

Radar Station

5.6.22 As discussed in the approved CAP provided in **Appendix 5.1a**, the potential sources of land contamination within the Radar Station include oils/paints stored at containers storage area, underground diesel fuel storage tanks, daily diesel fuel tanks, electricity generator, and transformer.

Ex-GFS Building

5.6.23 As discussed in the CAP provided in **Appendix 5.1b**, workshop for electrical, instrument, machine, metal, component, overhaul and engine and battery rooms were identified as potential contaminative areas.

**Site Investigation for Land Contamination Assessment**

5.6.24 In order to define the nature and extent of potential land contamination impacts associated with the DP3a Project, site investigations have been conducted at Radar Station and ex-GFS building. The findings of the site investigations at the captioned sites are summarized in the following sections.

Fieldwork and On-site Measurements

*Radar Station*

5.6.25 The SI works were conducted at the Radar Station from 14 September 2007 to 9 November 2007. A total of 5 boreholes were constructed (including one re-located sampling location). Groundwater sampling was conducted at all the boreholes. The as-built locations of sampling boreholes are shown in **Figure 5.2**. A total of 19 soil samples and 5 groundwater samples were collected and analyzed for TPH, BTEX, PAHs, phenol, chlorinated hydrocarbons and metals. Since the original CAP was submitted on 3 August 2007, the Dutch criteria were referred for the assessment. Due to inaccessibility of some sampling locations, the CAP was revised and approved by EPD on 20 May 2008.

5.6.26 During the SI, no distinctive, characteristic smell of soil and groundwater sample exhibiting signs of contamination was noticeable.

*Ex-GFS Building*

5.6.27 The SI works were conducted at the ex-GFS building from 14 September 2007 to 16 November 2007. A total of 14 borehole and 4 trial pits were constructed. Groundwater sampling was conducted at all sampling locations except the 4 trial pit. The as-built locations of sampling boreholes are shown in **Figure 5.2**. A total of 54 soil samples and 14 groundwater samples were collected and analyzed for TPH, BTEX, PAH, phenol, chlorinated hydrocarbons and metals. Since the original CAP was submitted on 30 August 2007, the Dutch criteria were referred for the assessment. Due to inaccessibility of some sampling locations, the CAP was revised and approved by EPD on 13 June 2008..

5.6.28 During the SI, no distinctive, characteristic smell of soil and groundwater sample exhibiting signs of contamination was noticeable.

Laboratory Results of Soil Samples

5.6.29 Laboratory analytical results of collected soil samples revealed that the major contaminants in the soil samples collected are metals (lead, copper, zinc, cadmium, nickel and cobalt), TPH, Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene. The as-built sampling locations with contaminants exceeding the Dutch B level are shown in **Figure 5.3**. Details of the laboratory analytical results are summarized in the CAR or CAR/RAP provided in **Appendix 5.2a-b.**

*Radar Station*

5.6.30 Among the 19 soil samples collected, no exceedances to the Dutch B levels were recorded.

*Ex-GFS Building*

5.6.31 Among the 54 soil samples collected, TPH, PAHs (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene), metals (copper, lead, zinc, cadmium, nickel and cobalt) were found exceeding the Dutch B/C levels. Details of the exceedances are summarized in **Table 5.14** below.

**Table 5.14 Summary of Soil Samples Exceeding the Dutch B/C Levels**

| Sample I.D. | Depth (m BBC) | Contaminant | Dutch Level (mg/kg) | | Concentration (mg/kg) | Dutch Level Exceeded |
|---|---|---|---|---|---|---|
| | | | B | C | | |
| GFSA-17 | 3.25-3.7 | Lead | 150 | 600 | 200 | >B |
| GFSA-18 | 1 | Phenanthrene | 10 | 100 | 14 | >B |
| | | Benzo(a)pyrene | 1 | 10 | 11 | >C |
| | | Fluoranthene | 10 | 100 | 19 | >B |
| | | Pyrene | 10 | 100 | 17 | >B |
| GFSA-20 | 1 | Zinc | 500 | 3000 | 2000 | >B |
| GFSA-22 | 3.25-3.7 | Copper | 100 | 500 | 150 | >B |
| GFSB-01 | 1.65 | TPH | 1000 | 5000 | 2875 | >B |
| GFSD-03 | 1 | Cadmium | 5 | 20 | 6 | >B |
| | | Lead | 150 | 600 | 480 | >B |
| | | Zinc | 500 | 3000 | 2300 | >B |
| | 3.3-3.75 | Cadmium | 5 | 20 | 510 | >C |
| | | Nickel | 100 | 500 | 410 | >B |
| | | Cobalt | 50 | 300 | 1200 | >C |
| GFSD-04 | 2.2-2.65 | Cadmium | 5 | 20 | 15 | >B |
| | | Lead | 150 | 600 | 430 | >B |
| | 3.2-3.65 | Lead | 150 | 600 | 300 | >B |

Laboratory Results of Groundwater Samples

5.6.32 Laboratory analytical results of the collected groundwater samples within the Radar Station and ex-GFS building revealed some exceedances in the Dutch screening criteria, which are tabulated in **Table 5.15**. The concerned tested parameters include TPH, Phenanthrene and metals (cadmium, copper, lead, zinc, barium, molybdenum, mercury, cobalt and chromium)..

**Table 5.15 Summary of Groundwater Samples Exceeding the Dutch B/C Values**

| Sample I.D. | GW depth (m below ground) | Contaminant | Dutch Level | | Concentration (µg/L) | Dutch Level Exceeded |
|---|---|---|---|---|---|---|
| | | | B | C | | |
| **Radar Station** | | | | | | |
| RSB-01 | 2.24 | Cadmium | 2.5 | 10 | 3.2 | >B |
| | | Copper | 50 | 200 | 76 | >B |
| | | Lead | 50 | 200 | 1600 | >C |
| | | Zinc | 200 | 800 | 700 | >B |
| | | Barium | 100 | 500 | 390 | >B |
| | | TPH | 200 | 600 | 2871 | >C |
| RSB-01A | 2.20 | Cadmium | 2.5 | 10 | 3.8 | >B |
| | | Copper | 50 | 200 | 92 | >B |
| | | Lead | 50 | 200 | 1300 | >C |
| | | Zinc | 200 | 800 | 670 | >B |
| | | Barium | 100 | 500 | 250 | >B |
| | | TPH | 200 | 600 | 259 | >B |
| RSB-02 | 2.18 | Lead | 50 | 200 | 410 | >C |
| | | Zinc | 200 | 800 | 310 | >B |
| | | Barium | 100 | 500 | 170 | >B |
| | | TPH | 200 | 600 | 435 | >B |
| RSB-07 | 2.24 | Lead | 50 | 200 | 210 | >C |
| | | Zinc | 200 | 800 | 210 | >B |
| RSB-08 | 2.28 | Lead | 50 | 200 | 450 | >C |
| | | Zinc | 200 | 800 | 510 | >B |
| | | Barium | 100 | 500 | 640 | >C |
| | | TPH | 200 | 600 | 250 | >B |
| | | Phenanthrene | 2 | 10 | 2.3 | >B |
| **Ex-GFS Building** | | | | | | |
| GFSA-17 | 2.62 | Mercury | 0.5 | 2 | 1.2 | >B |
| | | Molybdenum | 20 | 100 | 31 | >B |
| | | TPH | 200 | 600 | 231 | >B |
| GFSA-18 | 2.58 | Lead | 50 | 200 | 77 | >B |
| | | Zinc | 200 | 800 | 250 | >B |
| | | Molybdenum | 20 | 100 | 21 | >B |
| | | Barium | 100 | 500 | 150 | >B |
| | | TPH | 200 | 600 | 327 | >B |
| GFSA-19 | 2.54 | Lead | 50 | 200 | 72 | >B |
| | | Molybdenum | 20 | 100 | 39 | >B |
| | | Barium | 100 | 500 | 120 | >B |
| GFSA-20 | 2.73 | Barium | 100 | 500 | 110 | >B |
| GFSA-21 | 2.53 | Chromium | 50 | 200 | 64 | >B |
| | | Lead | 50 | 200 | 590 | >C |
| | | Zinc | 200 | 800 | 420 | >B |
| | | Barium | 100 | 500 | 610 | >C |
| GFSA-22 | 2.68 | Chromium | 50 | 200 | 57 | >B |
| | | Lead | 50 | 200 | 130 | >B |
| | | Zinc | 200 | 800 | 250 | >B |
| | | Barium | 100 | 500 | 220 | >B |
| GFSD-01 | 2.69 | Copper | 50 | 200 | 55 | >B |
| | | Lead | 50 | 200 | 550 | >C |
| | | Zinc | 200 | 800 | 480 | >B |
| | | Barium | 100 | 500 | 340 | >B |
| | | TPH | 200 | 600 | 365 | >B |
| GFSD-02 | 2.83 | Cadmium | 2.5 | 10 | 2.7 | >B |
| | | Copper | 50 | 200 | 59 | >B |
| | | Lead | 50 | 200 | 2100 | >C |
| | | Zinc | 200 | 800 | 1000 | >C |
| | | Barium | 100 | 500 | 680 | >C |

| Sample I.D. | GW depth (m below ground) | Contaminant | Dutch Level | | Concentration (µg/L) | Dutch Level Exceeded |
|---|---|---|---|---|---|---|
| | | | B | C | | |
| GFSD-03 | 2.63 | Cadmium | 2.5 | 10 | 27 | >C |
| | | Lead | 50 | 200 | 240 | >C |
| | | Zinc | 200 | 800 | 470 | >B |
| | | Cobalt | 50 | 200 | 200 | >B |
| | | Barium | 100 | 500 | 650 | >C |
| | | TPH | 200 | 600 | 740 | >C |
| GFSD-04 | 2.31 | Cadmium | 2.5 | 10 | 3 | >B |
| | | Lead | 50 | 200 | 320 | >C |
| | | Zinc | 200 | 800 | 290 | >B |
| | | Barium | 100 | 500 | 160 | >B |
| | | TPH | 200 | 600 | 369 | >B |

5.6.33 As discussed earlier, the Dutch values for groundwater would serve to indicate the chemicals-of-concern (COCs) for risk assessment. A risk-based assessment was thus carried out for parameters which exceeded the Dutch B/C levels to evaluate the risks posed to the anticipated most sensitive human receptor.

5.6.34 For a worst-case scenario, the largest contaminant concentrations in the groundwater samples would be taken as the source concentrations for the risk calculation. Exceedance of the risk-based criteria would be qualified in two tiers. For non-carcinogens, firstly, the Total Pathway Hazard Index (TPHI) that is the sum of contaminant hazard quotients exceeds one (i.e. USEPA recommended hazard index). Secondly, the largest contaminant concentration exceeds the corresponding Risk Based Screening Level (RBSL) that is derived from the recognized oral reference dose. For carcinogens, the first is the Total Carcinogenic Risk that is the sum of contaminant carcinogenic risk exceeds 1x10-6 (i.e. USEPA lifetime cancer risk level). The second is the largest carcinogenic contaminant concentration exceeds the corresponding RBSL that is derived from the recognized carcinogenic oral slope factor.

5.6.35 It is shown in **Table 5.16** that the risk due to ingestion of groundwater by construction workers is warranted. It should be noted that the risk due to dermal contact with groundwater by site workers is uncertain. It is because the risk assessment regarding dermal contact cannot be undertaken as the toxicity and / or chemical specific data for the COCs do not exist. As such, it is recommended that personnel protective equipment (PPE) be used by site workers as a mitigation measure.

**Table 5.16 Evaluation of Significance of Risk Due to Groundwater Contamination**

| Receptor | Significance of Risk due to Groundwater Contamination | Rationale |
|---|---|---|
| Construction workers for decommissioning / decontamination works (by ingestion) | Significant | Existence of potential risk. |
| Construction workers for decommissioning / decontamination works (by inhalation) | Insignificant | Decommissioning and decontamination works would be located in the outdoor area. Also, it is recommended that personal protective equipment (PPE) should be used by site workers as a mitigation measures. |
| Construction workers for decommissioning / decontamination works (by dermal contact) | Uncertain | Toxicity and / or chemical specific data do not exist for the COCs for risk assessment to be undertaken. As such, it is recommended that personal protective equipment (PPE) be used by site workers as a mitigation measure. |
| Future land users | Insignificant | As most of the contamination in the site would be removed after the decontamination works, the soil quality would be within Dutch B level and the groundwater contamination would be much reduced. In addition, the site will be covered by filling materials / concrete. Groundwater at the site will not be used as potable water or used for recreation / irrigation purposes. |
| Future construction workers | Insignificant | Contaminated soil is considered as the major contributor for elevated COCs in the groundwater. As most of the contamination in the site would be removed after the decontamination works, the soil quality would be within Dutch B level and the contaminants in groundwater would be much reduced. |

5.6.36 For each parameter, the source concentration chosen for the risk assessment is the maximum concentration of that parameter found in the groundwater samples irrespective of their locations. Chromium was assumed to be Cr(VI) for conservative assessment. The maximum source concentrations (of groundwater samples collected at ex-GFS building and Radar Station) of the COCs (i.e. with concentration above the screening criteria) and their corresponding non-carcinogenic oral reference doses or carcinogenic slope factor are tabulated in **Table 5.17**. It should be noted that for lead, World Health Organisation's (WHO) oral reference dose ($3.6 \times 10^{-3}$ mg/kg-day) was adopted for the risk assessment.

**Table 5.17 Maximum Source Concentrations and Non-carcinogenic Oral Reference Doses / Carcinogenic Oral Slope Factors of Chemicals of Concern**

| Parameter | Source Concentration | Sample I.D. | Noncarcinogenic Oral Reference Dose[a] (RfDo) | Minimum Noncarcinogenic Oral Reference Dose[a] (RfDo) | Carcinogenic Oral Slope Factor[b] (CSFo) |
|---|---|---|---|---|---|
| | [mg/L] | | [mg/kg-day] | [mg/kg-day] | 1/[mg/kg-day] |
| **TPHs** | 2.871 | RSB-01 | 0.03 to 5.00 | 0.03 | Not applicable |
| **Barium** | 0.68 | GFSD-02 | 0.07 | Not applicable | Not applicable |
| **Cadmium** | 0.027 | GFSD-03 | 0.0005 | Not applicable | Not applicable |
| **Chromium*** | 0.064 | GFSA-21 | 0.003 | Not applicable | Not applicable |
| **Cobalt** | 0.2 | GFSD-03 | 0.02 | Not applicable | Not applicable |
| **Copper** | 0.092 | RSB-01A | 0.04 | Not applicable | Not applicable |
| **Lead** | 2.1 | GFSD-02 | 0.0036 | Not applicable | Not applicable |
| **Phenanthrene** | 0.0023 | RSB-08 | 0.04 | Not applicable | Not applicable |
| **Mercury** | 0.0012 | GFSA-17 | 0.0003 | Not applicable | Not applicable |
| **Molybdenum** | 0.039 | GFSA-19 | 0.005 | Not applicable | Not applicable |
| **Xylenes** | 0.03 | All** | 0.2 | Not applicable | Not applicable |
| **Zinc** | 1 | GFSD-02 | 0.3 | Not applicable | Not applicable |

Remarks:
[a] Source for TPHs : *TPH Criteria Working Group, 1999. Total Petroleum Hydrocarbons Criteria Working Group Series Volume 5 – Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach. Massachusetts, U.S.A., Amherst Scientific Publishers.*
Source for Ba, Cd, Cr, Co, Cu, Hg, Mo, Zn, Phenanthrene and Xylene:*USEPA Region IX Risk-based Concentration Table (revised on Oct 04), USEPA Region IX.*
Source for Pb: The value is referenced to the tolerable daily intake (TDI) from t*he National Institute of Public Health and the Environment (RIVM), The Netherlands, 2001.*
[b] Source for TPHs, Ba, Cd, Cr, Co, Cu, Hg, Mo, Zn, Phenanthrene and Xylene: *USEPA Region IX Risk-based Concentration Table (revised on Oct 04), USEPA Region IX.*
** All sampling locations showed the same concentrations for Xylenes (i.e. 30ug/L as the Dutch B level).
* Chromium is assumed to be Cr(VI) as conservative assessment.

5.6.37 The details of risk assessment have been attached in **Appendix 5.3.** Based on the results of the risk assessments, the concentrations of all COCs do not exceed the calculated "allowable" concentrations (i.e. the risk-based criteria for remediation) and thus no remediation has been proposed for groundwater samples collected at ex-GFS building and Radar Station.

**Prediction and Evaluation of Environmental Impacts**

5.6.38 Site investigations findings (including the fieldworks and laboratory analytical results) and the estimation of soil and / or groundwater contamination extent for Radar Station and, ex-GFS building have been summarized in the separate CAR and CAR / RAP as provided in **Appendices 5.2a-b**, respectively.

***Soil Contamination***

5.6.39 Site investigations for the land contamination assessment conducted at the Study Area indicated that some areas in the ex-GFS building area was contaminated with TPH, PAHs (Phenanthrene, Benzo(a)pyrene, Fluoranthene and Pyrene) and metals (copper, lead, zinc, cadmium, nickel and cobalt),

Estimation of Soil Contamination Extent

5.6.40 The estimated quantity of contaminated soil within the ex-GFS building is provided in **Table 5.18** below and illustrated in **Figure 5.4a-5.4b**.

**Table 5.18 Location, Depth and Estimated Quantity of Contaminated Soil**

| Zone I.D. | Sample I.D. | Depth (m BBC) | Contaminant | Concentration (mg/kg) | Estimated Contamination Extent | | |
|---|---|---|---|---|---|---|---|
| | | | | | Vertical (m BBC) | Horizontal ($m^2$) | Estimated Volume ($m^3$) |
| ***Exceedances found in the soil samples collected below 0m to 1m BBC*** | | | | | | | |
| A | GFSA-18 | 1 | Phenanthrene | 14 | 0.5-1.5 | 36 | 36 |
| | | | Benzo(a)pyrene | 11 | | | |
| | | | Fluoranthene | 19 | | | |
| | | | Pyrene | 17 | | | |
| B | GFSA-20 | 1 | Zinc | 2000 | 0.5-1.5 | 36 | 36 |
| C | GFSD-03 | 1 | Cadmium | 6 | 0.5-1.5 | 36 | 36 |
| | | | Lead | 480 | | | |
| | | | Zinc | 2300 | | | |
| ***Exceedances found in the soil samples collected below 1m to 6m BBC*** | | | | | | | |
| D | GFSB-01 | 1.65 | TPH | 2875 | 1.15-2.15 | 36* | 36 |
| E | GFSD-04 | 2.2-2.65 | Cadmium | 15 | 1.7-4.15 | 36 | 88.2 |
| | | | Lead | 430 | | | |
| | | 3.2-3.65 | Lead | 300 | | | |
| F | GFSA-17 | 3.25-3.7 | Lead | 200 | 2.75-4.2 | 36 | 52.2 |
| G | GFSA-22 | 3.25-3.7 | Copper | 150 | 2.75-4.2 | 36 | 52.2 |
| H | GFSD-03 | 3.3-3.75 | Cadmium | 510 | 2.8-4.25 | 36 | 52.2 |
| | | | Nickel | 410 | | | |
| | | | Cobalt | 1200 | | | |
| ***Total Volume of Estimated Contaminated Soil=388.8$m^3$*** | | | | | | | |

Remarks:
BBC= Below Base of Existing Concrete Pavement
* Due to space constraint within the D.G. Store, 6m X 6m square centered at GFSB-01 may not be feasible. The frame for excavation would have to be adjusted on site based on the actual site condition.

5.6.41 As summarized in **Table 5.18**, about 388.8$m^3$ of contaminated soils identified within the ex-GFS building would need to be excavated and treated. There are 2 types of contaminated soil being identified based on the nature of contaminants (i.e. metal contaminated soil and organic contaminated soil). The volumes of soil contaminated by different types of contaminants have been estimated as tabulated in **Table 5.19**.

**Table 5.19 Estimated Quantity of Different Type of Contaminated Soil**

| Land | Contaminants | |
|---|---|---|
| | Metals Only | TPH/SVOCs |
| Ex-GFS building | 316.8 $m^3$ | 72 $m^3$ |
| Radar Station | Nil | Nil |
| **Total** | **316.8 $m^3$** | **72 $m^3$** |

Note: The actual volume may be different and is subject to confirmatory sampling and testing to be conducted during the course of proposed remediation processes.

Consideration of Remediation Methods for Contaminated Soil

5.6.42 Soil remediation options applicable to the ex-GFS building site were addressed based on the following criteria:

- Technical and cost effectiveness;
- Technology development status;
- Environmental benefits and dis-benefits;
- Commercial availability;
- Experience; and
- Expertise requirement.

5.6.43 Common *in-situ* and *ex-situ* treatment technologies that were screened for the targeted soil contaminants are presented in **Table 5.20** below. The technologies are classified into biological treatment, physical / chemical treatment and removal, and grouped under *in-situ* and *ex-situ* methods.

**Table 5.20 Treatment Technologies for Contaminated Soil with Metals / TPH /SVOCs**

| **Technology** | ***In-situ* Treatment** | ***Ex-situ* Treatment** |
|---|---|---|
| Biological Treatment | Natural Attenuation<br>Soil Venting | Biopiling<br>Landfarming |
| Physical / Chemical Treatment | Electrokinetic Separation | Solidification/Stabilization<br>Soil washing |
| Removal | NA | Excavation and Landfill disposal |

5.6.44 The applicability / environmental benefits and limitations / environmental dis-benefits of the above remediation techniques for metals / TPH / SVOCs contaminated soil are detailed in **Table 5.21**.

**Table 5.21 List of Soil Remediation Technologies for Metals / TPH / SVOCs Contaminated Soil**

| Remediation Option | Descriptions | Applicability / Environmental Benefits | Limitations / Environmental Dis-benefits |
|---|---|---|---|
| Biopiling | *Ex-situ* bioremediation method where bacteria grow in the piled contaminated soil and degrade the waste into harmless products. | • Effective to TPH and other wide range of organic contaminants with some successful local case studies, e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay, reclamation works at North Tsing Yi Shipyard site.<br>• Most cost-effective for large volumes of contaminated soil<br>• All materials and equipments are commercially available.<br>• Can be designed to be a closed system; vapour emissions can be controlled. | • Labour-intensive; require considerable maintenance<br>• Time-consuming (~1 year required) and not cost-effective for treating small volume of soil.<br>• Space required for biopile construction |
| Soil Venting | *In situ* bioremediation method that uses indigenous bacteria to degrade contaminants. Activity of the bacteria is enhanced by inducing air flow (using extraction or injection wells) and, if necessary, by adding nutrients. | • Very effective to TPH.<br>• Suitable for remediation in built up areas because wells can be placed between or below buildings.<br>• Applicable to large sites with widespread contamination.<br>• Uses readily available equipment; easy to install.<br>• Vapour emissions can be controlled but not to the extent of biopiling due to underground soil in-situ properties. | • Effectiveness is limited by underground soil features e.g. soil moisture content, permeability, etc.<br>• May induce possible air emission to the sensitive receivers<br>• Require large space for the system development |
| Landfarming | *Ex-situ* bioremediation method that mixes the soil with bacteria involving the spread and exposure of contaminated soil to atmosphere. | • Very effective in treating TPH.<br>• Simple to design and implement. | • May induce possible dust and vapour emission to the sensitive receivers (surrounding factories and buildings) and relatively difficult to control<br>• Require large flat space for the system development<br>• Slow bioremediation rate and require long operation period (as long as 2years) which may affect future development schedule |

| Remediation Option | Descriptions | Applicability / Environmental Benefits | Limitations / Environmental Dis-benefits |
|---|---|---|---|
| Solidification /Stabilization | *Ex-situ* immobilization technique treats contaminated soil by mixing soil with binding agents, e.g. cement so that the contaminants become physically bound within stable mass. | • Applicable to clean-up inorganic contaminants such as heavy metals.<br>• Solidification/stabilization has been used on certain contaminated sites in Hong Kong and demonstrated as a successful treatment method for inorganic contaminated soil, e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay, reclamation works at North Tsing Yi Shipyard site and few isolated sites identified in the Deep Bay Link project. | • The effectiveness reduces with the presence of organic contaminants<br>• Large boulders may hinder the mixing process. Soil sorting is necessary before the treatment taken place. |
| Soil Washing | *Ex-situ* soil separation processes mostly based on mineral processing techniques. It is a water-based process for scrubbing soils ex-situ to remove contaminants. | • Applicable to clean inorganic contaminants such as heavy metals from coarse-grained soils. | • The effectiveness of the treatment depends on soil particle size. Fine soil particles may require the addition of a polymer to remove them from the washing fluid.<br>• Complex waste mixtures make formulating washing fluid difficult.<br>• Require further treatment and disposal for residuals. |
| Electrokinetic Separation | *In-situ* remediation uses electrochemical and electrokinetic processes to desorb and remove metals and polar organics from soil. Low intensity direct current is applied to the soil to mobilize the charged species. | • Applicable to treat low permeability soil contaminated with heavy metals. | • The effectiveness depends on moisture content of soil. It decreases with moisture content less than 10%.<br>• Require further treatment to remove the desorbed contaminants and thus increase the cost of remediation.<br>• Presence of anomalies such as large gravels and insulating material in soil can induce variability of electrical conductivity in soil. This may reduce the effectiveness. |
| Excavation and Landfill Disposal | *Ex-situ* method whereby contaminants are removed by excavation of the contaminated soil and direct disposal to landfill. | • Most simple and quickest way to dispose of large volume of contaminated soil.<br>• Contamination is removed definitely.<br>• Higher certainty of success.<br>• Wide experience in Hong Kong.<br>• Applicable to all waste or mixture that meet land disposal restriction treatment standards.<br>• Common practice for shallow, highly-contaminated soils. | • Pre-treatment may be required for contaminated soil to meet landfill disposal criteria<br>• Landfill space limited and valuable.<br>• Indirect costs to the landfill management on monitoring and maintenance.<br>• Potential long-term liabilities to landfill<br>• Need large volume of clean backfill materials<br>• No access to the working site until completion of backfilling<br>• Least desirable management option. |

5.6.45 In assisting the formulation of appropriate remedial measures, the *Guidance Notes* issued by EPD suggest the following factors to be taken into consideration when evaluating different available remediation methods:

- Degree and extent of the contamination;
- Anticipated future use of the site;
- Nature of the contaminants;
- Soil characteristics;
- Time available for remediation; and
- Availability of local expertise and facilities for undertaking the treatment or disposal of the contaminated wastes.

Remediation Methods for Soil Contaminated with Metals

5.6.46 Among the remediation methods listed in **Table 5.21**, solidification / stabilization has been used on certain contaminated sites in Hong Kong and as a successful treatment method for inorganic contaminated soil, e.g. decontamination works at the Cheoy Lee Shipyard at Penny's Bay, reclamation works at North Tsing Yi Shipyard site and few isolated sites identified in the Deep Bay Link project. Based on the above discussion, solidification / stabilization technique is considered as the most practical and cost-effective method to treat the metals contaminated soil on site.

Remediation Methods for Soil Contaminated with TPH / SVOCs

5.6.47 Among the remediation methods listed in **Table 5.21**, biopiling is considered as the most practical and cost-effective method to treat the TPH / SVOCs contaminated soil on site. Since landfill space is very limited and valuable in Hong Kong, landfill disposal shall be considered as the last resort for TPH / SVOCs contaminated soil when other remediation methods are not applicable. Soil venting is not applicable to the contamination which is localized and discrete while landfarming requires longer treatment time and may induce possible dust and vapour emission to the surrounding sensitive receivers. Therefore, biopiling is considered as remediation method for soil contaminated by TPH / SVOCs since this remediation technology is an effective technology to treat organic contaminated soil with several successful local cases such as Cheoy Lee Shipyard and the North Apron of Kai Tak Airport. For example, in the North Apron of Kai Tak Airport, biopiling is capable to treat contaminated soil with TPH concentration as high as 21,728mg/kg. In fact, with reference to "Biopile Design, Operation, and Maintenance Handbook for Treating Hydrocarbon-Contaminated Soils" published by Battelle Press in 1998, biopiling is capable to treat the contaminated soil with TPH concentration less than 50,000mg/kg.

Summary of Proposed Remediation Methods for Soil Contamination

5.6.48 Justifications for the above proposed remediation methods for the contaminated soil identified in this study are summarized in **Table 5.22** below:

**Table 5.22 Summary of Proposed Remediation Methods for Metals / TPH / SVOCs Contaminated Soil**

| Soil Contaminant(s) | Estimated Volume of Contaminated Soil ($m^3$) | Remediation Method | Justification |
|---|---|---|---|
| Metals | 316.8 | Solidification/ Stabilization | • Well developed technology with operation experience in Hong Kong ;<br>• Higher certainty of success;<br>• Simple operation;<br>• Cost effective; and<br>• Treated soil is acceptable to be reused as backfill. |
| TPH/ SVOCs | 72 | Biopiling | |

5.6.49 Since some small parts of the ex-GFS building and Radar Station including the transformer room and the generator room etc. were still under operation during the previous land contamination site investigation (SI), SI at those areas was not possible due to site accessibility and safety issues. For these remaining areas with potential land contamination concerns, a supplementary land contamination SI was recommended to be carried out upon the cessation of the operations and prior to the redevelopment. A supplementary sampling plan providing the sampling and laboratory analysis information for the supplementary SI in these areas has been provided in the respective CAR and CAR/RAP for Radar Station and ex-GFS building respectively.

5.6.50 However, as no exceedances in Dutch B level were found among the soil samples collected in the areas surrounding the inaccessible areas in both Radar Station and ex-GFS building, contamination, if any, within those inaccessible areas are considered localized and surmountable and its impacts on the surrounding environment are considered to be minimal.

**Outline Process and Operation of Remediation**

***Overall Remediation Arrangement***

5.6.51 Contaminated soils will be excavated from the individual contaminated zones (i.e. the excavation zones as shown in **Figure 5.4a-5.4b**) and then transported to a centralized decontamination works area for treatment by biopiling and solidification / stabilization. The overall remediation strategy for soil remediation is illustrated in **Figure 5.5**. Since there has been a decontamination works area located at the northern part of the South Apron set up by the CEDD for decommissioning of the Kai Tak area, the contaminated soil identified in this EIA study could use the same facilities or works area for soil decontamination. According to the KTA Decommissioning EIA, the decontamination works area will be located at the northern part of the South Apron, bounded by the Kai Tak Nullah to the north and Kai Fuk Road to the east as shown in **Figure 5.6**. The proposed decontamination works area will have the following components:

(i) Temporary stockpiling areas;

(ii) Solidification / stabilization unit;

(iii) Biopiling unit; and

(iv) Site management office.

5.6.52 Trucks will carry the excavated contaminated soils using the existing truck route along the eastern shore of the Kai Tak Approach Channel and deliver to the decontamination works area for treatment.

5.6.53 The decontamination works area is expected to operate for about 12 months depending on the progress of treatment.

5.6.54 Impacts regarding air, noise, and water quality generated from the decontamination works area have been addressed in the Sections 5.2, 5.3 and 5.4 of this EIA report.

***Excavation of Contaminated Soil***

5.6.55 Contaminated soil identified within the Study Area shall be excavated from the ground prior to any construction works on site. The excavation plans for the identified contaminated areas at ex-GFS building are shown in **Figure 5.4a-b**. Factors such as excavation areas and depths, engineering properties and stability of the soils shall be considered for safe working conditions. The excavations shall be designed in accordance with the geotechnical properties of the soils and appropriate safety factors as determined by the Engineer. All excavated areas shall be set out by an appropriate qualified and licensed land surveyor based upon the excavation plans shown in **Figure 5.4a-b**.

5.6.56 The excavation sequence would be as follows:

- Excavate the contaminated soil and properly packed until no contaminants are found (confirmed by field and laboratory tests);
- Soils contaminated with different types of contaminants shall not be mixed to avoid the increase the volume of soil that would require treatment by different remediation methods;
- Transport the excavated soil by roll-off trucks for on-site treatment;
- Any free product encountered during excavation will be recovered and drummed properly and collected by licensed chemical waste collector for proper treatment; and
- Finally, backfill the excavation with clean soils.

5.6.57 A site closure assessment to confirm the closure/completion for the excavation of contaminated areas should be undertaken. The excavation work shall be supervised by Land Contamination Specialist. Subsequent construction activities at that particular area could only be carried out after the site closure.

5.6.58 Following excavation and before backfilling, confirmation sampling and testing shall be carried out at limits of excavation to confirm that all the identified contaminated soil has been excavated. Soil samples shall be collected at the limits of excavation for laboratory analysis of contaminants with exceedance of Dutch B level for soil remediation. Samples shall be analysed and if the analytical results are below the relevant Dutch B levels, removal of contaminated soil shall be considered complete. If the analytical samples exceed the relevant action levels, more soil shall be excavated (either with 0.5m increment in vertical or 1m in horizontal direction depending on whether the exceeding confirmation sample is collected from a sidewall or excavation base), and additional confirmation samples shall be collected and analysed until all confirmation samples are below the relevant action levels.

5.6.59 One confirmation sample shall be collected from the pit bottom and one from each sidewall of the excavation pit. The depth of sampling shall be based on the depth of the original SI sample collected during the SI that triggered excavation in that area. If there are any visible indications of impact, extra samples shall be collected from the apparent impact zone(s).

5.6.60 Shall any *in-situ* decommissioned underground fuel tanks and /or any other underground fuel pipelines hinder any necessary excavation works, the following procedures / plans should be followed. Fire Services Department (FSD) and relevant government departments / authorities may be consulted as necessary.

- The soil / fill material from around the tank / pipeline shall be removed adequately, except for the identified contaminated material which shall be separately stockpiled on site for further decontamination treatment to be agreed by the Engineer and the Land Decontamination Specialist;
- Appropriate heavy equipment shall be used for the underground fuel tank / pipeline removal / lifting. Relevant safety precautions should be formulated in the method statement to be prepared by the Contractor;
- The excavated tank should be transferred to a secure area on site. The excavated tank / pipeline should be examined for structural integrity and signs of leakage, if any. Contamination on the exterior surface of excavated tank, if any, should be properly washed and/or treated; and
- The excavated tank / pipeline should then be sent for off-site disposal as general construction and demolition (C&D) waste.

5.6.61 In addition, for proper decommissioning of underground fuel tank / pipelines, the following fire safety advices should be adhered to:

- The gas freeing, abandoning, removing and disposal of all tanks / pipelines should be in accordance with the guidelines contained in Chapter 15 of the "*Guidance for the Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations*", jointly published by the Association for Petroleum and Explosives Administration (APEA) and Energy Institute;
- Precautionary guidelines for hot works (as provided in **Appendix 5.4**) are to be followed at all times throughout the demolition process; and
- A competent person should be assigned in writing to supervise all hot works and method statement should be submitted to FSD for scrutinizing before the commencement of the demolition works.

5.6.62 Spoils generated during excavation shall be placed on heavy-duty and impermeable sheeting adjacent to the excavation. The temporary stockpiles shall be properly covered by impermeable sheeting to avoid leaching out of contaminants during the wet season.

5.6.63 As contamination with TPH within the DP3a Project area have been identified, particular emphasis should be placed on contaminated soil excavation and working in areas that may contain potentially explosive and/or toxic vapours during excavation. The presence of explosive gas in the excavation pits shall be checked by using a Combustible Gas Indicator (CGI) at the excavation zones.

5.6.64 All construction activities related to decontamination works shall be carried out by persons appropriately trained in health and safety and appropriated personal protective equipment shall be used by the persons engaged in decontamination activities. The Occupation Safety and Health Ordinance (OSHO) (Chapter 509) and its subsidiary Regulations shall be followed by all site personnel working on the site at all times:

- Temporary fencing or warning ribbons shall be provided to the boundary of excavation, slope crest and temporarily stockpiled areas. Where necessary, the exposed areas shall be temporarily covered with impermeable sheeting during heavy rainstorm.

- There shall be a clear separation and management of "contaminated" area and "uncontaminated" area for both excavation and stockpiling. There shall also be facilities for decontamination of workers and equipment.
- Workers are required to wear appropriate protective clothing and safety equipment.
- Smoking, eating, drinking and hotworks are strictly prohibited.
- Monitoring for Lower Explosive Limit (LEL) in the work zone, and total VOCs (with a Photo-ionisation Detector (PID)) in the breathing zone shall be undertaken. If the PID reading in the breathing zone is greater than 100ppm, monitoring for benzene in the breathing zone shall also be undertaken.
- Relevant occupational health and safety regulations and guidelines during excavation shall be observed.

***Biopiling***

5.6.65 Biopiling is proposed to treat the contaminated soil with TPH, SVOCs (Phenanthrene, Benzo(a)pyrene, Fluoranthene, Pyrene) for the DP3a Project. In general, biopiling is a commonly accepted bioremediation method for the restoration of site contaminated with TPH and other organic contaminants. By using microorganisms to degrade contaminants in soil, biopile(s) transform hazardous / toxic materials into harmless elements such as water, carbon dioxide, and other innocuous products. The biopiling should be carried out in the proposed decontamination works area is shown in **Figure 5.6**. A schematic layout of a typical biopile is shown in **Figure 5.7** and the essential steps of biopiling are outlined in the following paragraphs:

Biopile Formation

5.6.66 The formation of a biopile should be started from one end and along the longitudinal direction. Uniform starting concentrations will facilitate the control of the bioremediation and ensure a short cleanup time (as decontamination will not be controlled by patches of soil with high initial concentrations). Compaction of the biopile by excavation machinery should be avoided in order to have uniform density of the biopile. Bulking agents are not usually added as they are hard to be compacted during backfilling. The biopile should be covered by impermeable sheeting (such that not longer than 5m of a biopile shall be exposed to open air) to avoid fugitive emissions of dust or any pollutants from the biopile affecting the surrounding environment. Adequate turning should be undertaken during biopile formation (and installation of piping) to maximize sufficient air circulation. Turning of soil may also be undertaken during the operation to enhance air circulation. Nevertheless, this should be confirmed by the cleanup progress monitoring.

5.6.67 Impermeable sheeting shall be placed at the bottom of the biopiles and leachate collection sump shall be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil / groundwater. All leachate generated from the operation of biopiling shall be collected and recycled to the biopile.

5.6.68 The carbon filter system should be designed, constructed, operated and maintained to ensure adequate adsorption efficiency to prevent air pollution impact to the surrounding air sensitive receivers (ASRs). The location of the exhaust of the carbon filter should be sited as far away as possible from the nearby ASRs. The carbon adsorption system should also be monitored regularly to check the performance of the carbon filter.

5.6.69 The first soil samples should be taken once the construction of a biopile is completed to serve as the baseline samples. The baseline conditions should be used as the reference conditions for assessing the cleanup progress of the subsequent biopile operation.

Biopile Operation

5.6.70 The biopile operation involves the induction of air into each biopile resulting from the establishment of a negative pressure field within each biopile. The negative pressure encourages the "evaporation" or volatilization of part of the hydrocarbon contamination that is adsorbed to the soil particles. The inducted air collects the vapour and transports it via the extraction pipes out of the biopile. The inducted air also maintains aerobic conditions in the soil pores which encourage biodegradation of the remaining non-volatile petroleum hydrocarbons.

5.6.71 As a large part of the hydrocarbon contaminant is not expected to be volatilized, cleanup of the non-volatile contaminant will depend on the biodegradation process, which produces $CO_2$. Thus, the gas obtained from the biopile shall comprise a mixture of air, water vapour, $CO_2$, and vaporized hydrocarbons. Exhaust air shall be passed through the activated carbon filters prior to discharging to the atmosphere to remove any contaminants.

5.6.72 Suitable conditions in the biopile should be maintained for the growth of microbes. Moisture would be periodically added to the soil to maintain the moisture content within 10-20%. The optimal oxygen concentration in soil gas is 15% to 20%. The soil pH should be maintained between 5 and 8 for bacteria to survive. Nutrients may be required for microbial activities in small amounts. Regular progress monitoring of the soil conditions should be conducted to ascertain these conditions have been maintained. In addition, TPH and BTEX levels in the soil should also be tested to assess the decontamination performance of the system. Bacterial numbers in soil (CFU heterotrophs or CFU degraders/gram soil) is a good indicator of the health of the biopile. This parameter should be measured too whenever soil samples are collected for TPH analysis during progress monitoring.

5.6.73 Upon achieving the relevant cleanup targets, soil from the biopile should be reused on-site as filling material as far as practical.

Biopile Cleanup Progress Monitoring

5.6.74 The objective of the operation progress monitoring is twofold: i) to maintain the progress of contaminant cleanup, and ii) to ensure suitable conditions of the soil to support microbial growth. Progress monitoring would involve periodic soil gas monitoring, soil sampling, and physical parameter monitoring.

5.6.75 Soil gas monitoring points are installed within the biopiles. Sampling of oxygen, carbon dioxide, methane and VOC concentrations in the soil gas should be conducted once every month. Soil gas samples are taken by pulling a gas sample from the monitoring points through a vacuum pump. *In-situ* measurement of soil moisture should be included for monitoring. Soil gas sampling after placing the system in operation can establish the effectiveness of the aeration system.

5.6.76 It is proposed to undertake soil sampling monthly for the analysis of pH, nutrients, and bacterial number. Analyses for TPH and BTEX for soil samples shall be conducted at least once every 3 months. Monitoring should continue until the cleanup targets are achieved. Once the cleanup targets for a location have been achieved, soil sampling at that particular location may discontinue.

Biopile Closure Assessment

5.6.77 Biopile closure assessment should be conducted to ensure that the soil contaminant levels in the biopile are meeting the cleanup target for TPH and SVOCs.

5.6.78 The sampling frequency of one sample per 100 $m^3$ for biopile closure assessment is referenced to the CAR & RAP of previous projects in Hong Kong. The biopile shall be divided into lots for sampling and testing for contaminants.

5.6.79 Access to the sampling locations should be through opening of heat bonded cover panels. These openings shall be closed after each access. Extraction of soil samples shall be accomplished by using a hand auger or other methods approved by the Engineer.

5.6.80 All soil samples shall be analyzed for TPH/ SVOCs. The laboratory results are considered satisfactory when the levels of TPH/ SVOCs meet the cleanup target (i.e. Dutch B level). Individual soil lot which has demonstrated meeting the cleanup target could be removed from the biopile provided that the lot would not affect the operation of the biopile or would not be affected by adjacent soil lots which are still under treatment.

***Solidification / Stabilization***

5.6.81 A treatment area for carrying out the cement solidification / stabilization (CS/S) mixing and temporary soil stockpile should be located in the proposed decontamination works area as shown in **Figure 5.6**. Prior to solidification / stabilization, metals contaminated soils should be screened to segregate soil from debris, rock fragments and other materials and to break soil clumps into sizes allow effective mixing with solidifying agents.

5.6.82 During the solidification / stabilization process, portland cement (or other equivalent), water and/or other additive(s) (such as fly ash, lime, soluble silicates and clays) should be added to the contaminated soils to form a solid matrix. Uniform mixing of contaminated soils, cement, water and other additives(s) should be taken by using a skip (or other equivalent) at the designated treatment area to minimise the potential for leaching during the solidification process.

5.6.83 The mixture should be placed in moulds made from wooden formwork to set for approximately one week. The blocks formed should be of a suitable size to allow handling and transporting and larger blocks should be broken down into smaller sizes for transportation.

5.6.84 The soil mixture in the concrete blocks would be solidified within about 1 week. After setting, the samples of the blocks should be collected for testing to confirm if the contaminated materials meet the (i) Toxicity Characteristic Leaching Procedure (TCLP) and (ii) unconfined compressive strength (UCS) tests i.e. achievement of the stabilization targets.

Toxicity Characteristics Leaching Procedure Test

5.6.85 The sampling frequency for the TCLP test should be 1 TCLP sample per 50$m^3$ of broken up hardened mixture after CS/S treatment. Each TCLP sample should be a composite sample collected at 5 locations throughout the 50$m^3$ broken up hardened mixture. Same volume of sample should be collected at each of the 5 locations in order to ensure unbiased composite sample to be collected.

5.6.86 Any hardened samples to be submitted to laboratory for TCLP analysis should be broken up to small pieces with maximum diameter of 10cm. The sample preparation method of USEPA Method 1311 will be followed for the TCLP analysis. It is specified in USEPA Method 1311 that the maximum grain size of samples to be analyzed is 1cm. As such, the samples should be further broken up in the laboratory prior to TCLP analysis.

5.6.87 TCLP tests should be conducted in accordance with USEPA Method 1311 and USEPA Method 6020 for the concerned metals in this Study. “Universal Treatment Standards” (UTS) could be used for interpretation of the TCLP test results (these standards were derived from the performance of the Best Demonstrated Available Technologies (BDAT) for treating most prohibited hazardous wastes and were adopted in previous land contamination studies e.g. decontamination works at the Cheoy Lee Shipyard at Penny’s Bay and reclamation works at North Tsing Yi Shipyard site). The UTS for the concerned heavy metals are summarised in **Table 5.23**.

**Table 5.23 Universal Treatment Standards (UTS) for the Concerned Heavy Metals**

| Parameter | Universal Treatment Standard* |
|---|---|
| Lead | 0.75 mg/L as TCLP |
| Copper | 7.8** mg/L as TCLP |
| Zinc | 4.3 mg/L as TCLP |
| Cadmium | 0.11 mg/L as TCLP |
| Nickel | 11 mg/L as TCLP |
| Cobalt | Not Available** |

Remarks:
* Reference to Universal Treatment Standards (UTS) of U.S. Resource Conservation and Recovery Act (RCRA) in Title 40 of the Code of Federal Regulations (CFR) Parts 268.
**It should be noted that the UTS standard for copper and cobalt are unavailable. To determine the UTS for copper, a comparison has been made between Drinking Water Standards for the USEPA and the USEPA Federal Register. It was found that the 2 sets of standards differ by a factor of ~6 (for Chromium) to ~2950 (for Cyanide). Using a more conservative approach, the factor of 6 is taken. Therefore, the UTS for copper is taken to be the Drinking Water Standard value of 1.3mg/L times a factor of 6, giving a value of 7.8mg/L. For cobalt, it should be noted that there is no UTS or USEPA Drinking Water Standard for Cobalt. Therefore, a cleanup standard is not established for Cobalt. However, it is expected that the solidification process will likely isolate the Cobalt in the same manner as the other COC present.

5.6.88 Any pile of broken up solidified mixture that meets the concerned UTS should be stockpiled on site for future reuses on-site due to their stable and inert properties.

5.6.89 Any pile of broken up solidified mixture that does not meet the concerned UTS should be crushed and re-treated by solidification / stabilization. The re-treated pile should be tested again for TCLP to confirm if it can be reused on site.

Unconfined Compressive Strength (UCS)

5.6.90 The treated material should be allowed to set to achieve the unconfined compressive strength (UCS) of not less than 1mPa with reference to the USEPA guidelines (1986) – Handbook of Stabilization/ Solidification of Hazardous Wastes, EPA/540/2-86-00. The testing procedure of UCS test should be based on British Standard (BS) 1377.

5.6.91 The solidified materials should then be broken into mass with maximum size of 250mm for backfilling or reuse on-site. Whenever the treated soil is to be reused as filling materials, it should be put below 1m of clean fill.

5.6.92 It is recommended that compliance check on soil / groundwater samples by a third party (independent laboratory accredited under the Hong Kong Laboratory Accreditation Scheme (HOKLAS)) should be carried out during the decontamination works.

Remediation Report

5.6.93 A Remediation Report shall be prepared by the Land Contamination Specialist and submitted to EPD to report on the remediation process and demonstrate that contaminated soils and groundwater are all treated to meet the relevant standards or properly handled. All relevant information, including details of closure assessment, sampling results, photographs and certification of independent checker, the quantities of treated soil and recovered free product, final backfill site of treated soil and disposal site of free product shall be included in the remediation report.

**Mitigation Measures**

5.6.94 For contamination identified within ex-GFS building, the following environmental mitigation measures are proposed during the course of the site remediation in order to minimise the potential adverse environmental impacts arising from the handling of potentially contaminated materials:

***Excavation and Transportation***

- Excavation profiles must be properly designed and executed.
- Stockpiling site(s) should be lined with impermeable sheeting and bunded. Stockpiles should be fully covered by impermeable sheeting to reduce dust emission. If this is not practicable due to frequent usage, regular watering should be applied. However, watering should be avoided on stockpiles of contaminated soil to minimise contaminated runoff.
- Stockpiles of contaminated soil should be properly covered by impermeable sheeting to minimize contaminated runoff from the stockpiles.
- Excavation and stockpiling should be carried out during dry season as far as possible to minimise contaminated runoff from contaminated soils.
- Supply of suitable clean backfill material is needed after excavation.
- Vehicles containing any excavated materials should be suitably covered to limit potential dust emissions or contaminated wastewater run-off, and truck bodies and tailgates should be sealed to prevent any discharge during transport or during wet conditions.
- Speed control for the trucks carrying contaminated materials should be enforced.
- Vehicle wheel and body washing facilities at the site's exist points should be established and used.

***Biopiling***

- To avoid fugitive emissions of dust or any air pollutants from the biopile(s) and to minimise runoff from the stockpiled soils, the stockpiled soils at the biopiles should be covered by impermeable sheeting such that not longer than 5m of the biopile is exposed to open air.
- Upon formation of a biopile, the biopile should be fully covered by impermeable sheeting to prevent dust emission and runoff.
- Impermeable sheeting should be placed at the bottom of the biopiles and leachate collection sump should be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil/groundwater. The collected leachate should be discharged following the requirements of Water Pollution Control Ordinance (WPCO).
- The vented air from the biopile(s) should be connected to blower and carbon adsorption system with 99% control efficiency for treatment before release to the atmosphere. Exhaust air from the blower and carbon adsorption system should be monitored for TVOC biweekly to check the performance of the carbon filter. The frequency of monitoring might be adjusted subject to review on site.
- The biopiles should be fully covered by impermeable sheeting to control the extraction of TVOC.

- Spent activated carbon of the carbon adsorption system should be replaced at appropriate intervals such that the VOC emission concentration from the system is acceptable. (i.e. the measured TVOC concentration is below 20 ppm).

- Silencers should be installed at the biopile blowers to minimise noise impact.

- Contaminated runoff from biopile(s) should be prevented by constructing concrete bunds along the perimeter of the biopiles.

***Solidification / Stabilization***

- The loading, unloading, handling, transferring and storage of cement should be carried out in an enclosed system.

- Mixing process and other associated material handling activities should be properly scheduled to minimise potential noise impact.

- Mixing of contaminated soils and cement / water / other additive(s) should be undertaken at a solidification plant to minimise the potential for leaching.

- Runoff from the solidification / stabilization area should be prevented by constructing concrete bunds along the perimeter.

5.6.95 In addition, the following basic health and safety measures should be implemented as far as possible to minimise the potentially adverse effects on health and safety of construction workers during the course of site remediation:

- Set up a list of safety measures for site workers;

- Provide written information and training on safety for site workers;

- Keep a log-book and plan showing the contaminated zones and clean zones;

- Maintain a hygienic working environment;

- Avoid dust generation;

- Provide face and respiratory protection gear to site workers;

- Provide personal protective clothing (e.g. chemical resistant jackboot, liquid tight gloves) to site workers; and

- Provide first aid training and materials to site workers.

5.6.96 For any excavation works / future development works at Radar Station and ex-GFS building, as the risk due to dermal contact with groundwater by site workers is uncertain, it is recommended that appropriate personnel protective equipment (PPE) be used by site workers as a mitigation measure.

5.6.97 Since part of the ex-GFS building and Radar Station were still under operation during the previous site investigation, a supplementary land contamination assessment was recommended to be carried out upon the cessation of the operations and prior to the redevelopment. If contamination is identified in the supplementary SI, remediation shall be performed according to the supplementary CAR/RAP upon EPD's approval.

**Evaluation of Residual Environmental Impacts**

5.6.98 In terms of soil contamination, the proposed remediation methods would remove contaminated soils from the site through excavation followed by degradation of the contaminants to non-toxic substances by biopiling or immobilizing the contaminants by solidification / stabilization. After completion of soil remediation, no residual impact in respect of land contamination on the future users is anticipated.

5.6.99 For groundwater contamination, since the concentrations of all COCs at Radar Station and ex-GFS building do not exceed the calculated "allowable" concentrations (i.e. the risk-based criteria for remediation) in the risk assessment and the groundwater at the Study Area will not be used as potable water or used for recreation / irrigation purposes, the residual impacts in respect of groundwater contamination on future landusers / future construction workers should therefore be insignificant.

**Environmental Monitoring and Audit Requirements**

5.6.100 Details of the environmental monitoring and audit requirements are provided in the EM&A Manual.

**Summary**

5.6.101 The scope of the DP3a Project is limited to the decommissioning of the remaining facilities, structures and buildings of the ex-GFS building, and Radar Station.

5.6.102 This land contamination assessment has adequately addressed the land contamination impacts associated with the DP3a Project. Site investigations have been carried out at Radar Station and ex-GFS building. Some areas of the ex-GFS building were identified with metals or organic contamination while no contamination was found at Radar Station. Results of the groundwater risk assessment for groundwater samples collected at Radar Station and ex-GFS building indicated that the concentrations of the COCs in the groundwater do not exceed the risk-based criteria for remediation..

5.6.103 Based on the site investigations findings, the estimated contaminated soil volumes identified at the ex-GFS building site by different soil contaminant types are (1) metals only: ~ 316.8$m^3$; (2) TPH / SVOC only: ~72$m^3$.

5.6.104 After the review of various remediation methods, biopiling is proposed to treat TPH /SVOCs contaminated soil. Biopile cleanup progress monitoring and closure assessment are proposed for biopiling to ensure a satisfactory cleanup progress and that all the target contaminants are treated to below the cleanup targets. Solidification / stabilization is suggested to treat the soil contaminated with metals. Toxicity Characteristics Leaching Procedure (TCLP) Test is proposed to be undertaken after solidification / stabilization in order to ensure that the metal contaminants would not leach to the environment.

5.6.105 The soil treated by biopiling should be reused on-site as fill material as far as practical. For soil treated by solidification / stabilization, the treated soil should be backfilled on-site and then covered by 1m of clean fill.

5.6.106 Since part of the ex-GFS building and Radar Station were still under operation during the previous site investigation, a supplementary land contamination assessment was recommended to be carried out upon the cessation of the operations and prior to the redevelopment. If contamination is identified in the supplementary SI, remediation shall be performed according to the supplementary CAR/RAP upon EPD's approval.

## 5.7 Landscape and Visual Impact

### Environmental Legislation, Policies, Plans, Standards and Criteria

5.7.1 The following legislation, standards and guidelines are applicable to the evaluation of landscape and visual impacts associated with the construction and operation of the DP3a Project:

- Environmental Impact Assessment Ordinance (Cap.499.S.16) and the Technical Memorandum on EIA Process (EIAO-TM), particularly Annexes 10 and 18;
- Town Planning Ordinance (Cap 131);
- EIAO Guidance Note 8/2002;
- ETWB TCW No. 2/2004 - Maintenance of Vegetation and Hard Landscape Features, and Tree Preservation;
- ETWB TCW No. 3/2006 - Tree Preservation;
- ETWB TCW No. 36/2004 - Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS);
- Hong Kong Planning Standards and Guidelines;
- Land Administration Office Instruction (LAOI) Section D-12 - Tree Preservation;
- Study on Landscape Value Mapping of Hong Kong;
- WBTC No. 25/92 - Allocation of Space for Urban Street Trees; and
- WBTC No. 7/2002 - Tree Planting in Public Works.

5.7.2 Reference has also been made to the following studies:

- Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development; and
- Kai Tak Planning Review.

5.7.3 In addition, reference has been made to the following OZP:

- Approved Kai Tak (KPA22) Outline Zoning Plan no. S/K22/2 (6.11.2007);
- Approved Ngau Tau Kok and Kowloon Bay (KPA 13 & 17) Outline Zoning Plan No.S/K13/25 (12. 9.2006);
- Draft Kwun Tong (South) (KPA 14 Pt.) Outline Zoning Plan No. S/K14S/15 (5.10.2007).

### Assessment Methodology

5.7.4 Landscape and visual impacts have been assessed separately for the construction and operation phases.

5.7.5 The assessment of landscape impacts has involved the following procedure.

- ***Identification of the baseline landscape resources (physical and cultural) and landscape characters found within the study area.*** This is achieved by site visit and desktop study of topographical maps, information databases and photographs.

- ***Assessment of the degree of sensitivity to change of the landscape resources.*** This is influenced by a number of factors including whether the resource/character is common or rare, whether it is considered to be of local, regional, national or global importance, whether there are any statutory or regulatory limitations/ requirements relating to the resource, the quality of the resource/character, the maturity of the resource, and the ability of the resource/character to accommodate change.

The sensitivity of each landscape feature and character area is classified as follows:

**High:** Important landscape or landscape resource of particularly distinctive character or high importance, sensitive to relatively small changes.

**Medium:** Landscape or landscape resource of moderately valued landscape characteristics reasonably tolerant to change.

**Low:** Landscape or landscape resource, the nature of which is largely tolerant to change.

- ***Identification of potential sources of landscape impacts.*** These are the various elements of the construction works and operation procedures that would generate landscape impacts.

- ***Identification of the magnitude of landscape impacts.*** The magnitude of the impact (or magnitude of change) depends on a number of factors including the physical extent of the impact, the landscape and visual context of the impact, the compatibility of the project with the surrounding landscape; and the time-scale of the impact - i.e. whether it is temporary (short, medium or long term), permanent but potentially reversible, or permanent and irreversible. Landscape impacts have been quantified wherever possible.

5.7.6 The magnitude of landscape impacts is classified as follows:

**Large:** The landscape or landscape resource would suffer a major change.

**Intermediate:** The landscape or landscape resource would suffer a moderate change.

**Small:** The landscape or landscape resource would suffer slight or barely perceptible changes.

**Negligible:** The landscape or landscape resource would suffer no discernible change.

- ***Identification of potential landscape mitigation measures.*** These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimize adverse impacts; remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long term impacts. A programme for the mitigation measures is provided. The agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are identified.

- ***Prediction of the significance of landscape impacts before and after the implementation of the mitigation measures.*** By synthesizing the magnitude of the various impacts and the sensitivity of the various landscape resources it is possible to categories impacts in a logical, well-reasoned and consistent fashion. **Table 5.24** shows the rationale for dividing the degree of significance into four thresholds, namely insubstantial, slight, moderate, and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of impact and a low-medium-high degree of sensitivity of landscape resource/character.
- ***Prediction of Acceptability of Impacts*.** An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the EIAO-TM.

**Table 5.24 Relationship between Receptor Sensitivity and Impact Magnitude in Defining Impact Significance**

| | | | | |
|---|---|---|---|---|
| **Magnitude of Impact (Both adverse and beneficial impact are assessed.)** | **Large** | Slight / Moderate | Moderate / Substantial | Substantial |
| | **Intermediate** | Slight / Moderate | Moderate | Moderate / Substantial |
| | **Small** | Insubstantial / Slight | Slight / Moderate | Slight / Moderate |
| | **Negligible** | Insubstantial | Insubstantial | Insubstantial |
| | | **Low** | **Medium** | **High** |
| | | **Receptor Sensitivity (of Landscape Resource, Landscape Character Area or VSRs)** | | |

Note: All impacts are Adverse unless otherwise noted with Beneficial.

5.7.7 The assessment of visual impacts has involved the following procedures.

- ***Identification of the Zones of Visual Influence during the construction and operation phases of the project.*** This is achieved by site visit and desktop study of topographic maps and photographs, and preparation of cross-sections to determine visibility of the project from various locations.
- ***Identification of the Visually Sensitive Receivers (VSRs) within the ZVIs at construction and operation phases.*** These are the people who would reside within, work within, play within, or travel through, the ZVIs.
- ***Assessment of the degree of sensitivity to change of the VSRs.*** Factors considered include:
  - o the type of VSRs, which is classified according to whether the person is at home, at work, at play, or travelling. Those who view the impact from their homes are considered to be highly sensitive as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life. Those who view the impact from their workplace are considered to be only moderately sensitive as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies depends on whether the workplace is industrial, retail or commercial. Those who view the impact whilst taking part in an outdoor leisure activity may display varying sensitivity depending on the type of leisure activity. Those who view the impact whilst travelling on a public thoroughfare will also display varying sensitivity depending on the speed of travel.

- other factors which are considered (as required by EIAO GN 8/2002) include the value and quality of existing views, the availability and amenity of alternative views, the duration or frequency of view, and the degree of visibility.

The sensitivity of VSRs is classified as follows:

| | |
|---|---|
| **High:** | The VSR is highly sensitive to any change in their viewing experience. |
| **Medium:** | The VSR is moderately sensitive to any change in their viewing experience. |
| **Low:** | The VSR is only slightly sensitive to any change in their viewing experience. |

- ***Identification of relative numbers of VSRs.*** This is expressed in term of whether there are many, medium, few VSRs in any one category of VSR.
- ***Identification of potential sources of visual impacts.*** These are the various elements of the construction works and operation procedures that would generate visual impacts.
- ***Assessment of the potential magnitude of visual impacts***. Factors considered include
  - the compatibility with the surrounding landscape,
  - the duration of the impact,
  - the reversibility of the impact,
  - the scale of the impact and distance of the source of impact from the viewer, and
  - the degree of visibility of the impact, and the degree of which the impact dominates the field of vision of the viewer.

The magnitude of visual impacts is classified as follows:

| | |
|---|---|
| **Large:** | The VSRs would suffer a major change in their viewing experience. |
| **Intermediate:** | The VSRs would suffer a moderate change in their viewing experience. |
| **Small:** | The VSRs would suffer a small change in their viewing experience. |
| **Negligible:** | The VSRs would suffer no discernible change in their viewing experience. |

- ***Identification of potential visual mitigation measures.*** These may take the form of adopting alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimize adverse impacts; remedial measures such as colour and textural treatment of building features; and tree planting to screen the roads and associated bridge structures. A programme for the mitigation measures is provided. The agencies responsible for the implementation, management and maintenance of the mitigation measures are identified.
- ***Prediction of the significance of visual impacts before and after the implementation of the mitigation measures.*** By synthesizing the magnitude of the various visual impacts and the sensitivity of the VSRs, and the numbers of VSRs that are affected, it is possible to categories the degree of significance of the impacts in a logical, well-reasoned and consistent fashion. **Table 5.24** shows the rationale for dividing the degree of significance into four thresholds, namely, insubstantial, slight, moderate and substantial, depending on the combination of a negligible-small-intermediate-large magnitude of impact and a low-medium-high degree of sensitivity of VSRs. Consideration is also given to the relative numbers of affected VSRs in predicting the final impact significance - exceptionally low or high numbers of VSRs may change the result that might otherwise be concluded from **Table 5.24**.

The significance of visual impacts is categorized as follows:

| | |
|---|---|
| **Substantial:** | Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing visual quality. |
| **Moderate:** | Adverse / beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing visual quality. |
| **Slight:** | Adverse / beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in existing visual quality. |
| **Insubstantial:** | No discernible change in the existing visual quality. |

- ***Prediction of Acceptability of Impacts.*** An overall assessment of the acceptability, or otherwise, of the impacts according to the five criteria set out in Annex 10 of the EIAO-TM.

5.7.8 Mitigation measures for DP3a is not required.

**Scope and Content of the Study**

5.7.9 Scope and content of the DP3a Project refer to **Section 5.1**. As required by the EIA Study Brief, the area for the landscape impact assessment shall include all area within 500 metres from the boundary of the scope of the DP3a Project whilst the area for visual impact assessment shall be defined by the visual envelope from the Project and associated works. Due to the life cycle of the project, only construction phase exists and its landscape and visual impacts are assessed.

**Baseline Study**

5.7.10 Baseline Study on Landscape Resources during the Construction is shown in **Figure 5.11**. Key Existing and Planned Landscape Resources identified within the Study Areas are described below. Due to the nature of the project, construction phase is the only phase of the project and there is no operation phase.

***Physical Landscape Resources***

*Topography*

5.7.11 The landform in the landscape study area which is the former Kai Tak Airport comprises flat reclaimed land with no features of topographical interest or value.

*Ridgeline*

5.7.12 The Ridgeline of the Kowloon Hills to the north of the southern areas of Kowloon provides a dramatic natural backdrop to the high-rise urban areas of Kowloon. The ridgeline is a physical landscape resource as well as a key visual resource in South East Kowloon. The ridgeline is partially breached by the existing high-rise developments particularly in Lam Tin, Sau Mau Ping and Ngau Tau Kok. Views to the natural ridgeline shall be preserved as far as possible particular from the strategic vantage points at Quarry Bay Park, Hong Kong Convention and Exhibition Centre New Wing, and Sun Yat Sen Memorial Park viewing from Hong Kong Island.

*Victoria Harbour*

5.7.13 Victoria Harbour is a unique public asset and natural heritage of Hong Kong, its preservation is for the benefit of the current generation as well as the future ones. This is considered to be of high value and sensitivity. Since the proposed development will not involve any reclamation, there will not be any impact on Victoria Harbour.

*Open Spaces*

5.7.14 The study area is a densely urbanized area with limited open space which has significant amenity value. There is one. public open space with a total area of 1.2ha identified, It is the Hoi Bun Road Park. In general, within a densely urbanized area, public open space is considered to be of high value and sensitivity due to their importance as landscape resources within the city.

*Existing Trees*

5.7.15 Broad brush tree survey has been carried out within the study area as show in **Figure 13.2A**. Within the study area, there are more than 350 no. of trees. Tree species include *Acacia confusa*, *Aleurites moluccana*, *Bauhinia variegata*, *Caryota ochlandra*, *Casuarina equisetifolia*, *Celtis sinensis*, *Chrysalidocarpus lutescens*, *Delonix regia*, *Eucalyptus citriodora*, *Ficus benjamina*, *Ficus microcarpa*, *Hibiscus tiliaceus*, *Livistona chinensis*, *Macaranga tanarius and Melaleuca quinquenervia*. Many of the trees are found within LCSD open spaces. They are in general of low to medium amenity value and sensitivity to change. Trees found within the former airport site are in low to medium amenity value and small in size. None of these trees are OVT nor Champion Trees.

***Human Landscape Resources***

5.7.16 The baseline landscape resources (primarily existing open space and trees) which will be potentially affected by the development, together with their sensitivity to change and ability to accommodate changes are described in **Table 5.25**. The locations of baseline landscape resources are mapped in **Figure 5.11**. Photo views illustrating the landscape resources within the study area are illustrated in **Figure 13.2.1** to **13.2.8** inclusive.

***Landscape Character Areas***

5.7.17 Landscape character zones have been identified within the Study Area in accordance with the Study on Landscape Value Mapping of Hong Kong. These are described in **Table 5.25** and illustrated in **Figure 5.12**. Photo views illustrating the landscape character areas within the study area are illustrated in **Figure 13.3.1** to **13.3.3** inclusive.

**Table 5.25 Landscape Resources / Landscape Character Areas and Their Sensitivity to Change**

| ID. No. | Landscape Resources / Landscape Characters | Sensitivity to Change (Low, Medium, High) |
|---|---|---|
| **Baseline Landscape Resources** | | |
| **LR07** | **Trees in the Amenity Areas near Kai Fuk Road**<br>There are approximately 150 trees found in the Amenity Areas near Kwun Tong Road with height around 4-5 m, spread 2 m, trunk diameter 100-180 mm. The amenity value of these trees is considered as medium. Predominant species consist of *Acacia confusa*, *Celtis sinensis*, *Casuarina equisetifolia*, *Ficus microcarpa*, *Hibiscus tiliaceus*, *Macaranga tanarius* and *Melaleuca quinquenervia*. | Medium |

| ID. No. | Landscape Resources / Landscape Characters | Sensitivity to Change (Low, Medium, High) |
|---|---|---|
| **LR21** | **Existing trees along the runway**<br>There are more than 80 trees along runway. All the trees are immature mostly with height around 2-7 m, spread 1-4 m, trunk diameter 100-250 mm.. The amenity value of these trees is considered as low. Species include *Casuarina equisetifolia*, *Chrysalidocarpus lutescens*, *Eucalyptus citriodora*, *Ficus benjamina*, *Ficus microcarpa*, *Hibiscus tiliaceus* and *Macaranga tanarius*. | Low |
| **LR29** | **Hoi Bun Road Park**<br>This is an open space (~ 1.2ha) in the context of the surrounding industrial areas. Tree and shrub planting and sitting out area are provided. There are around 120 trees of common species with height around 3-11 m, spread 2-7 m, trunk diameter 200-350 mm. Predominant species include *Acacia confusa*, *Aleurites moluccana*, *Bauhinia variegata*, *Caryota ochlandra*, *Delonix regia*, *Ficus microcarpa*, *Livistona chinensis* and *Melaleuca quinquenervia*. A few of the trees are mature but most are of small to medium size. | High |
| **LR31B** | **Victoria Harbour**<br>It is a recognised and distinctive feature of Hong Kong worldwide, both as a tourist attraction and working port. The Harbour forms a centrepiece of the Hong Kong setting, with the airport runway forming a unique coastline to it. | High |
| **Baseline Landscape Character Areas** | | |
| **LCA01** | **Former Kai Tak Airport Landscape Character Area**<br>This comprises the former Kai Tak Airport where the future development is to be located. This area is flat, open, primarily hard standing with a few existing buildings that relate to the use of the former airport at the north. The area is currently occupied by various parties for different temporary uses. This LCA can be further sub-divided to the north apron area which consists of a large concrete surface, the linear runway portion and the south apron corner including the Kwun Tong Waterfront with direct interfacing with adjacent Kowloon Bay and Kwun Tong area. | Low |
| **LCA03** | **Kowloon Bay Late 20C / Early 21C Commercial / Residential Complex Landscape**<br>This is an area of primarily mixed residential / commercial use. This comprises a mix of low to high buildings for residential, commercial uses. The streetscape is utilitarian with no soft or little landscape treatment. | Medium |
| **LCA05** | **Kwun Tong Industrial Urban Landscape**<br>This is an area of industrial use. This comprises medium to high rise industrial buildings. The streetscape is utilitarian with no soft landscape treatment. | Low |

| ID. No. | Landscape Resources / Landscape Characters | Sensitivity to Change (Low, Medium, High) |
|---|---|---|
| **LCA08** | **Kwun Tong Typhoon Shelter Landscape**<br>This is an area for typhoon shelter use in Kwun Tong. It is substantially enclosed by coast and offshore breakwater. | Low |

***Visual Envelope***

5.7.18 Visual Envelope of the DP3a is bounded by the Victoria Harbour to the south, Kowloon Bay to the north and east, and the runway to the west. The Visual Envelope i.e. the Primary Zone of Visual Influence is the shown in **Figure 5.13.**

***Visually Sensitive Receivers (VSRs)***

5.7.19 Given the small scale and temporary nature of DP3a, only key Visually Sensitive Receivers (VSRs) in close vicinity to DP3a during the construction phase have been identified and shown in **Figure 5.13**. Photo views illustrating the VSRs within the study area are illustrated shown in **Figure 13.4A1** to **13.4A5**. Baseline viewpoints from Key VSRs at local level illustrating the quality of existing views are shown in **Figure 13.4A6** and **13.4A10**. The baseline assessment of VSRs is shown in **Table 5.26**.

5.7.20 Most of the VSRs have direct and full views to the project area of DP3a. As they are mainly institutional, industrial or commercial type VSR, the sensitivity to charge is considered to be low to medium.

**Table 5.26 VSRs and Their Sensitivity to Change**

| VSR Type & ID. | Key VSR | Number of Individuals (Many/ Medium/ Few/) | Quality of Existing View (Good/ Fair/ Poor) | Availability of Alternative Views (Yes/ No) | Average Distance between VSRs and Impact Source (m) | Degree of Visibility (Full/ Partial/ Glimpse) | Duration of View (Long/ Medium/ Short) | Frequency of View (Frequent/ Occasional/ Rare) | Sensitivity to Change (Low, Medium, High) |
|---|---|---|---|---|---|---|---|---|---|
| **VSRs at Local Level** | | | | | | | | | |
| C3 | Sunshine Kowloon Bay Cargo Centre | Few | Poor | Yes | 400m | Glimpse | Medium | Occasional | Low |
| GIC9 | Kowloon Bay Vehicle Inspection Centre, Vehicle Examination Centre, Water Supplies Department Kowloon East Regional Building, Kowloon Bay Transfer Station, Kowloon Bay Government Land Transport Agency Transport Pool | Few | Fair | No | 20m | Full | Medium | Occasional | Medium |
| GIC12 | Kowloon Bay Vehicle Servicing Station, Public Works Central Laboratory Building (planned GIC use and open space under KTD) | Medium | Fair | No | 10m | Full | Medium | Occasional | Medium |
| GIC23 | Kwun Tong Public Pier, Kwun Tong Ferry Pier Square and adjacent bus terminal (same planned use under KTD) | Medium | Fair | No | 500m | Glimpse | Medium | Occasional | Low |
| O14 | Visitors at Hoi Bun Road Park | Medium | Fair | Yes | 700m | Partial | Medium | Occasional | Medium |
| I5 | Industrial/Office Developments and Godowns at Cheung Yip Street (planned commercial use under KTD) | Medium | Fair | Yes | 300m | Full | Medium | Occasional | Medium |
| OU2 | Business and Industrial Developments in Kowloon Bay (planned commercial use) | Many | Fair | No | 20m | Full | Long | Occasional | Medium |
| OU5 | Business and Industrial Developments in Kwun Tong (planned commercial use) | Many | Fair | No | 500m | Full | Long | Occasional | Medium |
| T3 | Motorists on Kwun Tong Bypass | Many | Fair | Yes | 20m | Full | Short | Occasional | Low |
| T4 | Travelers of Harbour Traffic | Many | Fair | Yes | 200m | Full | Medium | Occasional | Medium |

* C = Commercial, CDA = Comprehensive Development Area, GIC = Government/Institution/Community, I = Industrial, O = Open space, OU = Other use, T = Transport related.

**Landscape Impacts Assessment**

***Potential Sources of Impacts***

5.7.21 The nature and scope of works are described in detail in **Section 5.1**. Sources of impacts in the construction phase would include:

Direct Impacts include visual intrusion due to the following activities:

- Decommissioning of the remaining parts (Ex-GFS Building and Radar Station) of the former Kai Tak Airport (the DP3a Project);

Indirect Impacts include visual intrusion duet to the following activities:

- construction traffic;
- the laying down of utilities, including water, drainage and power;
- temporary site access areas, site cabins and heavy machinery;
- increased road traffic congestion;
- after dark lighting and welding; and
- dust during dry weather.

5.7.22 There would be no impact during operation stage.

***Degree of compatibility of the Project and associated Works***

5.7.23 DP3a - Decommissioning of the remaining parts of the former Kai Tak Airport (other than the site of the existing EMSD Headquarters) is temporary in nature. Therefore, it will not create long-term incompatibility with the surrounding.

***Nature and Magnitude of Unmitigated Landscape Impacts in Construction Phase***

5.7.24 The magnitude of the impacts, before implementation of mitigation measures, on the landscape resources and landscape character areas that would occur in the construction phase are described below and tabulated in **Table 5.27**. All impacts are adverse unless otherwise stated.

5.7.25 The magnitude of unmitigated landscape impact is negligible as the extent of work is small and localized and the works wil be completed within a short period of time,

5.7.26 The DP3a Project will not affect any trees. There will be no impact on all LR. The unmitigated impact on LCA01 is insubstantial due to the small extent of DP3a works. There will be no impact on other LCA.

**Table 5.27 Significance of Landscape Impacts in Construction Phase**

| ID. No. | Landscape Resources / Landscape Characters | Sensitivity to Change (Low, Medium, High) | | Magnitude of Change (Negligible, Small, Intermediate, Large) | | Impact Significance Threshold BEFORE Mitigation (Insubstantial, Slight, Moderate, Substantial) | | Recommended Mitigation Measures | Residual Impact Significance Threshold AFTER Mitigation (Insubstantial, Slight, Moderate, Substantial) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Construction | Operation | |
| | | Construction | Operation | Construction | Operation | Construction | Operation | | | DAY 1 | YEAR 10 |
| **Existing Landscape Resources During Construction and Operation Phase** | | | | | | | | | | | |
| LR07 | Trees in the Amenity Areas near Kai Fuk Road | Medium | - | Negligible | - | Insubstantial | - | Not required | - | - | - |
| LR21 | Existing trees along the runway | Low | - | Negligible | - | Insubstantial | - | Not required | - | - | -- |
| LR29 | Hoi Bun Road Park | High | - | Negligible | - | Insubstantial | - | Not required | - | - | - |
| LR31B | Victoria Harbour | High | - | Negligible | - | Insubstantial | - | Not required | - | - | - |
| **Landscape Character Areas During Construction and Operation Phase** | | | | | | | | | | | |
| LCA01 | Former Kai Tak Airport Landscape Character Area (KTD in Operation Phase) | Low | - | Negligible | - | Insubstantial | - | Not required | - | - | - |
| LCA03 | Kowloon Bay Late 20C / Early 21C Commercial / Residential Complex Landscape | Medium | - | Negligible | - | Insubstantial | - | Not required | - | - | - |
| LCA05 | Kwun Tong Industrial Urban Landscape | Low | - | Negligible | - | Insubstantial | - | Not required | - | - | - |
| LCA08 | Kwun Tong Typhoon Shelter Landscape | Low | - | Negligible | - | Insubstantial | - | Not required | - | - | - |

**Visual Impacts Assessment**

***Potential Sources of Visual Impacts***

5.7.27 The nature and scope of works are described in detail in **Section 5.1**. During the construction phase, direct impacts including visual incompatibility to the surroundings and degrading of visual quality will be resulted due to the decommissioning works.

Indirect Impacts including degrading of visual quality of existing vies and glare from man-made light source will resulted from the following activities:

- construction traffic,
- temporary site access areas, site cabins and heavy machinery,
- after dark lighting and welding, and
- dust during dry weather

All impacts are temporary in nature.

**Prediction and Evaluation of Visual Impacts**

***Nature and Magnitude of Unmitigated Visual Impacts in Construction***

5.7.28 The magnitude of visual impacts on the VSRs during the construction phase is shown in **Table 5.30**. Since the decommissioning works is localized and temporary in nature, the visual impacts during the construction phase is considered to be insubstantial, except for the VSRs adjoining the project area, which will suffer from slight to moderate visual impacts.

**Table 5.28 Significance of Visual Impacts in the Construction Phase (Note: All impacts are adverse unless otherwise noted with Beneficial)**

| VSR Type & ID. | Key Visually Sensitive Receiver (VSR) | Main Source of Visual Impact | Magnitude of Impact (Negligible, Small, Intermediate, Large) | | Receptor Sensitivity (Low, Medium, High) | | Impact Significance Threshold Before Mitigation (Insubstantial, Slight, Moderate, Substantial) | | Recommended Mitigation Measures | Residual Impact Significance Threshold After Mitigation (Insubstantial, Slight, Moderate, Substantial) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Construction | Operation | |
| | | | Construction | Operation | Construction | Operation | Construction | Operation | | | DAY 1 | YEAR 10 |
| **VSRs at Local Level** | | | | | | | | | | | | |
| C3 | Sunshine Kowloon Bay Cargo Centre | DP3a | Negligible | - | Low | - | Insubstantial | - | Not Required | - | - | - |
| GIC9 | Kowloon Bay Vehicle Inspection Centre, Vehicle Examination Centre, Water Supplies Department Kowloon East Regional Building, Kowloon Bay Transfer Station, Kowloon Bay Government Land Transport Agency Transport Pool | DP3a | Small | - | Medium | - | Slight | - | Not Required | - | - | - |
| GIC12 | Kowloon Bay Vehicle Servicing Station, Public Works Central Laboratory Building (planned GIC use and open space under KTD) | DP3a | Large | - | Medium | - | Moderate | - | Not Required | - | - | - |
| GIC23 | Kwun Tong Public Pier, Kwun Tong Ferry Pier Square and adjacent bus terminal (same planned use under KTD) | DP3a | Negligible | - | Low | - | Insubstantial | - | Not Required | - | - | - |
| O14 | Visitors at Hoi Bun Road Park | DP3a | Negligible | - | Medium | - | Insubstantial | - | Not Required | - | - | - |
| I5 | Industrial/Office Developments and Godowns at Cheung Yip Street (planned commercial use under KTD) | DP3a | Large | - | Medium | - | Slight | - | Not Required | - | - | - |

| VSR Type & ID. | Key Visually Sensitive Receiver (VSR) | Main Source of Visual Impact | Magnitude of Impact (Negligible, Small, Intermediate, Large) | | Receptor Sensitivity (Low, Medium, High) | | Impact Significance Threshold Before Mitigation (Insubstantial, Slight, Moderate, Substantial) | | Recommended Mitigation Measures | Residual Impact Significance Threshold After Mitigation (Insubstantial, Slight, Moderate, Substantial) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Construction | Operation | |
| | | | Construction | Operation | Construction | Operation | Construction | Operation | | | DAY 1 | YEAR 10 |
| OU2 | Business and Industrial Developments in Kowloon Bay (planned commercial use) | DP3a | Negligible | - | Medium | - | Insubstantial | - | Not Required | - | - | - |
| OU5 | Business and Industrial Developments in Kwun Tong (planned commercial use) | DP3a | Negligible | - | Medium | - | Insubstantial | - | Not Required | - | - | - |
| T3 | Motorists on Kwun Tong Bypass | DP3a | Negligible | - | Low | - | Insubstantial | - | Not Required | - | - | - |
| T4 | Travelers of Harbour Traffic | DP3a | Negligible | - | Medium | - | Insubstantial | - | Not Required | - | - | - |

* C = Commercial, GIC = Government/Institution/Community, I = Industrial, O = Open space, OU = Other use, T = Transport related.

**Summary**

5.7.29 Due to the small scale and temporary nature of DP3a, it will result in insubstantial landscape and visual impacts during the construction phase. Therefore, no mitigation measure is required.

## 5.8 Environmental Monitoring and Audit Requirement

5.8.1 This section further elaborates the requirements of EM&A for the DP3a Project, based on the assessment results of various environmental issues.

5.8.2 The objectives of carrying out EM&A for the DP3a Project include the following:

- to provide a database against which any environmental impacts of the DP3a Project can be determined;
- to provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- to monitor the performance of the DP3a Project and the effectiveness of mitigation measures;
- to verify the environmental impacts predicted in this EIA;
- to determine project compliance with regulatory requirements, standards and government policies;
- to take remedial action if unexpected problems or unacceptable impacts arise; and
- to provide data to enable an environmental audit.

5.8.3 The following sections summarise the recommended EM&A requirements. Details of EM&A are provided in a stand-alone EM&A Manual.

**Air Quality Impact**

5.8.4 The decommissioning work will inevitably lead to dust (TSP) emissions, mainly from excavation, filling activities, truck haulage and material handling. No exceedance of hourly and daily TSP criteria are predicted at air sensitive receivers (ASRs) in the vicinity of work sites with eight times daily watering on active work areas. With implementation of the proposed mitigation measures, dust suppression measures stipulated in the *Air Pollution Control (Construction Dust) Regulation*, good site practices and comprehensive dust monitoring and audit, the dust impact would be further diminished.

5.8.5 With the implementation of suggested mitigation measures, no adverse residual air quality impact would be expected. No dust monitoring and audit is proposed.

5.8.6 With the implementation of the recommended air quality mitigation measures, good site practices, VOCs monitoring (VOCs monitoring at biopiling discharge), and site audit programme, acceptable air quality impact would be expected at the ASRs during the decontamination process. Details of EM&A Programme are provided in the EM&A Manual.

**Noise Impact**

5.8.7 As no adverse construction noise impact is expected at the NSRs in the vicinity of the work sites due to the large separation distance between the construction sites and the nearby NSRs, construction noise monitoring is therefore not proposed. However, regular site audit is required to ensure proper implementation of good site practices. Details of the programme are provided in a stand-alone EM&A Manual.

**Water Quality Impact**

5.8.8 With the implementation of recommended mitigation measures, no unacceptable water quality impacts would be expected from the proposed works. Site inspections should be undertaken routinely to inspect the works areas in order to ensure the recommended mitigation measures are properly implemented.

**Waste Management Implications**

5.8.9 Waste management will be the contractor's responsibility to ensure that all wastes produced during the decommissioning of the DP3a Project are handled, stored and disposed of in accordance with the recommended good waste management practices and EPD's regulations and requirements. The mitigation measures recommended in Section 5.5 should form the basis of the site Waste Management Plan to be developed by the Contractor at the decommissioning stage.

5.8.10 It is recommended that the waste arisings generated during the decommissioning activities should be audited periodically to determine if wastes are being managed in accordance with approved procedures and the site Waste Management Plan. The audits should look at all aspects of waste management including waste generation, storage, transport and disposal. An appropriate audit programme would be to undertake a first audit near the commencement of the construction works, and then to audit on a weekly basis thereafter. In addition, the routine site inspections should check the implementation of the recommended good site practices and other waste management mitigation measures.

**Land Contamination Impact**

5.8.11 The contaminated soil collected at the ex-GFS Building area should be excavated and treated on-site by biopiling or solidification / stabilization. In order to gauge the effectiveness of the remedial system and minimise the potentially adverse environmental impacts arising from the handling of potentially contaminated materials, the recommended environmental mitigation and safety measures, progress monitoring and/or confirmation sampling / testing recommended during the course of remedial works should be implemented during the decommissioning / decontamination works of the DP3a Project. Detailed requirements are provided in the EM&A Manual.

**Impact on Culture Heritage**

5.8.12 No mitigation and monitoring and audit programme specific for cultural heritage would be required for the proposed decommissioning works.

**Impact on Landscape and Visual Impact**

5.8.13 No mitigation and monitoring and audit programme specific for landscape and visual impact would be required for the proposed decommissioning works.

## 5.9 Implementation Schedule of the Proposed Mitigation Measures

**Table 5.29 Implementation Schedule for Air Quality Measures**

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.2.19 | Implementation of dust suppression measures stipulated in *Air Pollution Control (Construction Dust) Regulation*. The following mitigation measures and good site practices are recommended to minimize cumulative dust impacts.<br>• The excavation area should be limited to as small in size as possible and backfilled with clean and/or treated soil shortly after excavation work.<br>• The exposed excavated area should be covered by the tarpaulin during night time.<br>• The top layer soils should be sprayed with fine misting of water immediately before the excavation.<br>• Stockpiling site(s) should be lined with impermeable sheeting and bunded. Stockpiles should be fully covered by impermeable sheeting to reduce dust and other air pollutants emission.<br>• Misting for the dusty material should be carried out before being loaded into the vehicle.<br>• Any vehicle with an open load carrying area should have properly fitted side and tail boards.<br>• Material having the potential to create dust should not be loaded from a level higher than the side and tail boards and should be dampened and covered by a clean tarpaulin.<br>• The tarpaulin should be properly secured and should extent at least 300 mm over the edges of the sides and tailboards. The material should also be dampened if necessary before transportation. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM & Air Quality Objective |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| | • The vehicles should be restricted to maximum speed of 10 km per hour and confined haulage and delivery vehicle to designated roadways insider the site. On-site unpaved roads should be compacted and kept free of lose materials.<br>• Vehicle washing facilities should be provided at every vehicle exit point.<br>• The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores.<br>• Every main haul road should be scaled with concrete and kept clear of dusty materials or sprayed with water so as to maintain the entire road surface wet.<br>• Every stock of more than 20 bags of cement should be covered entirely by impervious sheeting placed in an area sheltered on the top and the three sides.<br>• Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites. | | | | | | | |
| S5.2.20 | Solidification<br>• The solidification pit/area should be provided with dust suppression measures.<br>• Handling and mixing of cement shall follow Air Pollution Control (Construction Dust) Regulation to limit cement emission.<br>• The bin should be covered during residence period after mixing process. | Work sites / during solidification and biopiling process | Contractor | | | | ✓ | EIAO-TM & Air Quality Objective |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| | Biopiling<br>• During the course of biopile formation, the stockpiled soils at the biopiles should be covered by tarpaulin or low permeable sheet to avoid fugitive emissions of dust or any air pollutants from the biopiles affecting the surrounding environment and to minimise runoff from the stockpiled soils. Biopile(s) should be covered by impermeable sheeting (such that no longer than 5m of a biopile should be exposed to open air) to avoid fugitive emissions of dust or any pollutants from the biopile(s).<br>• Upon formation of a biopile, the biopile should be covered by low permeable geotextiles to prevent dust emission and runoff.<br>• During the operation of biopile, the biopiles should be fully covered to control the extraction of VOCs.<br>• The vented air from the biopile(s) should be connected to blower and carbon adsorption system with 99% control efficiency for treatment before release to the atmosphere. Exhaust air from the blower and carbon adsorption system should be monitored for TVOC bi-weekly to check the performance of the carbon filter. The frequency of monitoring might be adjusted subject to review on site. The location of the exhaust of the carbon filter should be sited as far away as possible from the nearby ASRs.<br>• Spent activated carbon of the carbon adsorption system should be replaced at appropriate intervals such that the TVOC emission concentration from the system is acceptable (i.e. the measured TVOC concentration is below 20ppm). | | | | | | | |

* Des - Design, C - Construction, O – Operation, and Dec - Decommissioning

**Table 5.30 Implementation Schedule for Noise Measures**

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.3.10 | Good Site Practice:<br>• Only well-maintained plant should be operated on-site and plant shall be serviced regularly during the decommissioning program.<br>• Silencers or mufflers on construction equipment should be utilized and shall be properly maintained during the decommissioning program.<br>• Mobile plant, if any, should be sited as far away from NSRs as possible.<br>• Machines and plant (such as trucks) that may be in intermittent use shall be shut down between works periods or should be throttled down to a minimum.<br>• Plant known to emit noise strongly in one direction shall, wherever possible, be orientated so that the noise is directed away from the nearby NSRs.<br>• Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site decommissioning activities. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM, NCO |

* Des - Design, C - Construction, O – Operation, and Dec - Decommissioning

**Table 5.31 Implementation Schedule for Water Quality Measures**

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.4 | Decontamination Processes<br>**Soil Excavation**<br>• During excavation, all exposed pits shall be whenever possible backfilled immediately or covered. Where it is unavoidable to transiently pile up soils next to the excavation pit, the transient pile shall be bottom-lined, bunded and covered with impervious membrane during rain event in order to avoid generation of contaminated runoff.<br>• Final surfaces after excavation shall be well compacted and the subsequent permanent work or surface protection shall be carried out as soon as practical after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate intercepting channels and partial shelters shall be provided where necessary to prevent rainwater from collecting within trenches or footing excavations. | Work site / During excavation | Contractor | | | ✓ | | WPCO, TM-DSS |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.4 | **Decontaminated Water and Wastewater from Wheel Washing**<br>• During excavation, dump trucks or excavators shall be decontaminated before they leave the site to ensure that no contaminated earth, mud or debris is deposited by them on roads. A wheel washing bay shall be provided at every site exit that equipped with an adequately sized centralized wastewater treatment unit. The wastewater treatment unit shall deploy suitable treatment processes to settle out sands/ silts with contaminants cohered and remove other contaminants in wheel washes and decontamination water. The polluting parameters in effluent of the wastewater treatment unit shall be in compliance with the discharge standards stipulated in the TM-DSS before the effluent being discharged into the storm drains. The installation and operation of the wastewater treatment unit shall be licensed and subject to the effluent monitoring as required under the WPCO which is under the ambit of regional office (RO) of EPD. In any case, discharge of wheel wash water shall be minimized and recycled where possible. The selection of construction road between the wheel washing bay and the public road should be paved with backfill to reduce vehicle tracking of soil and to prevent surface runoff from entering public road drains. | Work site / During excavation | Contractor | | | √ | | WPCO, TM-DSS |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.4 | **Operation of Solidification / Stabilization Facility**<br>• The solidification facility shall be sheltered and area of soil unloading / loading shall be provided with shed to avoid contaminated runoff. Excessive addition of water shall be avoided during the solidification process.<br>• Any pit used for solidification area shall be shallower than the water table to minimize the leaching of the contaminated soils. An impermeable membrane / sheet shall be placed at the bottom of any solidification pit during the solidification process.<br>• Any leachate generated from the solidification process shall be collected and treated in the centralized wastewater treatment unit before being discharged. The polluting parameters in effluent of the wastewater treatment unit shall be in compliance with the discharge standards stipulated in the TM-DSS before the effluent being discharged. The installation and operation of the wastewater treatment unit shall be licensed and subject to the effluent monitoring as required under the WPCO. | Decontamination works area / During soil treatment | Contractor | | | | ✓ | WPCO, TM-DSS |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.4 | **Operation of Biopiling**<br>• Iimpermeable liner shall be placed at the bottom of the biopiles and leachate collection sump shall be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil/ groundwater. Concrete bund shall be constructed along the perimeter of biopiles to prevent the runoff coming out from the contaminated soil. Biopiles after formation and during rain shall be covered by anchored low permeability geotextiles to prevent contaminated runoff. It is proposed that the exposed biopile section at any time shall not be more than 5 m in length.<br>• All leachate generated from the operation of biopiling shall be collected and recycled to the biopile to avoid effluent discharge. | Decontamination works area / During soil treatment | Contractor | | | | ✓ | WPCO, TM-DSS |
| S5.4 | **Groundwater Cleanup**<br>• Floating oil/free product (of TPH) has only been found in the apron area of the Ex-GFS site. It is proposed that where free product is detected at the groundwater surface at excavated area, only the free product shall be skimmed off from the water surface. The skimmed free product shall be drummed properly and collected by a licensed chemical waste collector for disposal. | Work site / During excavation | Contractor | | | ✓ | | WPCO, TM-DSS<br>Waste Disposal (Chemical Waste) (General) Regulation |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.4 | **TPH Removal**<br>• Petrol interceptor should be adopted, where appropriate, as the first tier of treatment to removal TPH contaminant from contaminated runoff and effluent discharge from the decontamination works area. | Work site / During the decommissioning, excavation and soil treatment | Contractor | | ✓ | ✓ | ✓ | WPCO, TM-DSS |
| S5.4 | **Failure of Centralized Wastewater Treatment Unit**<br>• In the event of wastewater treatment unit failure, all decontamination activities should be ceased to avoid emergency discharge. | Work site / During the decommissioning, excavation and soil treatment | Contractor | | ✓ | ✓ | ✓ | WPCO, TM-DSS |
| S5.4 | Building Demolition<br>The site practices outlined in ProPECC PN 1/94 "*Construction Site Drainage*" should be followed as far as practicable in order to minimise surface runoff and the chance of erosion. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM, WPCO, ProPECC PN 1/94 |
| S5.4 | There is a need to apply to EPD for a discharge licence under the WPCO for discharging effluent from the construction site. The discharge quality is required to meet the requirements specified in the discharge licence. All the runoff, wastewater or extracted groundwater generated from the works areas should be treated so that it satisfies all the standards listed in the TM-DSS. It is anticipated that the wastewater generated from the works areas would be of small quantity. Monitoring of the treated effluent quality from the works areas should be carried out in accordance with the WPCO license which is under the ambit of regional office (RO) of EPD. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM, WPCO, TM-DSS |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.4 | Sewage from Workforce<br>Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor would be responsible for appropriate disposal of waste matter and maintenance of these facilities. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM, WPCO |
| S5.4 | Solid Waste and Accidental Spillage<br>Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering into the adjacent harbour waters. Stockpiles of cement and other construction materials should be kept covered when not being used. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM, WPCO, WDO |
| S5.4 | Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to the nearby harbour waters, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event. | Work sites / during decommissioning | Contractor | | | | ✓ | EIAO-TM, WPCO, WDO |

* Des - Design, C - Construction, O – Operation, and Dec - Decommissioning

**Table 5.32 Implementation Schedule for Waste Management Measures**

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.5 | Good Site Practices<br>It is not anticipated that adverse waste management related impacts would arise, provided that good site practices are adhered to. Recommendations for good site practices during decommissioning activities include:<br>• Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site<br>• Training of site personnel in proper waste management and chemical waste handling procedures<br>• Provision of sufficient waste disposal points and regular collection for disposal<br>• Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers<br>• A recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites) | Work sites / during decommissioning | Contractor | | | | √ | EIAO-TM |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
|---|---|---|---|---|---|---|---|---|
| | | | | Des | C | O | Dec | |
| S5.5 | Waste Reduction Measures<br>Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:<br>• Sort C&D waste from demolition of the remaining structures to recover recyclable portions such as metals<br>• Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal<br>• Encourage collection of aluminium cans, PET bottles and paper by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the work force<br>• Any unused chemicals or those with remaining functional capacity should be recycled<br>• Proper storage and site practices to minimise the potential for damage or contamination of construction materials | Work sites / during decommissioning | Contractor | | | | √ | EIAO-TM |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
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| S5.5 | Construction and Demolition Material<br>Mitigation measures and good site practices should be incorporated into the contract document to control potential environmental impact from handling and transportation of C&D material. The mitigation measures include:<br>• Where it is unavoidable to have transient stockpiles of C&D material within the work site pending collection for disposal, the transient stockpiles shall be located away from waterfront or storm drains as far as possible<br>• Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric<br>• Skip hoist for material transport should be totally enclosed by impervious sheeting<br>• Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving a construction site<br>• The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores<br>• The load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure dust materials do not leak from the vehicle<br>• All dusty materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet<br>• The height from which excavated materials are dropped should be controlled to a minimum practical height to limit fugitive dust generation from unloading | Work sites / during decommissioning | Contractor | | | | √ | ETWB TCW No. 33/2002, 31/2004, 19/2005 |

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| | When delivering inert C&D material to public fill reception facilities, the material should consist entirely of inert construction waste and of size less than 250mm or other sizes as agreed with the Secretary of the Public Fill Committee. In order to monitor the disposal of the surplus C&D material at the designed public fill reception facility and to control fly tipping, a trip-ticket system as stipulated in the ETWB TCW No. 31/2004 "Trip Ticket System for Disposal of Construction and Demolition Materials" should be included as one of the contractual requirements and implemented by an Environmental Team undertaking the Environmental Monitoring and Audit work. An Independent Environmental Checker should be responsible for auditing the results of the system. | Work site / during decommissioning | Contractor and Independent Environmental Checker | | | | √ | ETWB TCW No. 31/2004 |
| S5.5 | Chemical Waste<br><br>After use, chemical wastes (for example, cleaning fluids, solvents, lubrication oil and fuel) should be handled according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. Spent chemicals should be collected by a licensed collector for disposal at the CWTF or other licensed facility, in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* | Work sites / during decommissioning | Contractor | | | | √ | Waste Disposal (Chemical Waste) (General) Regulation<br><br>Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes |

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| S5.5 | General Refuse<br><br>General refuse should be stored in enclosed bins or compaction units separate from C&D material. A licensed waste collector should be employed by the contractor to remove general refuse from the site, separately from C&D material. Effective collection and storage methods (including enclosed and covered area) of site wastes would be required to prevent waste materials from being blown around by wind, wastewater discharge by flushing or leaching into the marine environment, or creating odour nuisance or pest and vermin problem | Work sites / during decommissioning | Contractor | | | | √ | Waste Disposal Ordinance<br><br>Water Pollution Control Ordinance |

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**Table 5.33 Implementation Schedule for Land Contamination Measures**

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
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| S5.6.96 | For any excavation works conducted at Radar Station and ex-GFS building,<br>• As the risk due to dermal contact with groundwater by site workers is uncertain, it is recommended that personnel protective equipment (PPE) be used by site workers as a mitigation measure. | Radar Station and ex-GFS building | Contractor | | √ | | | |
| S5.6.35, S5.6.51to S5.6.60 | For ex-GFS building, the following environmental mitigation measures are proposed during the course of the site remediation in order to minimise the potential adverse environmental impacts arising from the handling of potentially contaminated materials:<br>**<u>Excavation and decontamination works</u>**<br>• Personal protective equipment (PPE) should be used by site workers during soil excavation. | Excavation zones/ During excavation | Contractor | | | | √ | |
| | • All contaminated soil within the ex-GFS building should be excavated and treated on-site at a centralized decontamination works area located at the northern part of the south apron | Excavation zones/ During excavation | Contractor | √ | | | √ | |
| | • After excavation, confirmation sampling and testing should be conducted to ensure complete excavation of contaminated soils | Excavation zones/ During excavation | Contractor | | | | √ | |
| | • Contaminated soil should be sorted and handled with respect of their contamination | Excavation zones/ During excavation | Contractor | | | | √ | |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
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| | • Health and safety plan for excavation should be followed | Excavation zones/ During excavation | Contractor | √ | | | √ | Occupational Safety & Health Ordinance |
| | • The following remediation processes should be applied for different types of soil contamination<br>- Biopiling for TPH/SVOCs contamination<br>- Solidification / stabilization for metal contamination | Decontamination works area/ During excavation | Contractor | √ | | | √ | |
| S5.6.94 | <u>Excavation and Transportation</u><br>• Excavation profiles must be properly designed and executed.<br>• Stockpiling site(s) should be lined with impermeable sheeting and bunded. Stockpiles should be fully covered by impermeable sheeting to reduce dust emission. If this is not practicable due to frequent usage, regular watering should be applied. However, watering should be avoided on stockpiles of contaminated soil to minimise contaminated runoff.<br>• Stockpiles of contaminated soil should be properly covered by impermeable sheeting to minimise contaminated runoff from the stockpiles.<br>• Excavation and stockpiling should be carried out during dry season as far as possible to minimise contaminated runoff from contaminated soils.<br>• Supply of suitable clean backfill material is needed after excavation. | Excavation zones and decontamination works area/ During excavation and soil treatment | Contractor | √ | | | √ | • Waste Disposal Ordinance<br>• Waste Disposal (Chemical Waste) (General) Regulation<br>• Water Pollution Control Ordinance<br>• Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
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| S.5.6.94 | • Vehicles containing any excavated materials should be suitably covered to limit potential dust emissions or contaminated wastewater run-off, and truck bodies and tailgates should be sealed to prevent any discharge during the transportation or during wet conditions.<br>• Speed control for the trucks carrying contaminated materials should be enforced;<br>• Vehicle wheel and body washing facilities at the site's exist points should be established and used.<br><br><u>Biopiling</u><br>• To avoid fugitive emissions of dust or any air pollutants from the biopile(s) and to minimise runoff from the stockpiled soils, the stockpiled soils at the biopiles should be covered by impermeable sheeting such that not longer than 5m of the biopile is exposed to open air.<br>• Upon formation of a biopile, the biopile should be fully covered by impermeable sheeting to prevent dust emission and runoff.<br>• Impermeable sheeting should be placed at the bottom of the biopiles and leachate collection sump should be constructed along the perimeter of the biopiles to prevent leachate from contaminating the underlying soil/groundwater. The collected leachate should be discharged following the requirements of Water Pollution Control Ordinance (WPCO). | Excavation zones and decontamination works area/ During excavation and soil treatment | Contractor | √ | | | √ | |

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| | • The vented air from the biopile(s) should be connected to blower and carbon adsorption system with at least 99% control efficiency for treatment before release to the atmosphere. Exhaust air from the blower and carbon adsorption system should be monitored for TVOCs biweekly to check the performance of the carbon filter. The frequency of monitoring might be adjusted, subject to review on site.<br>• The biopiles should be fully covered by impermeable sheeting to control the extraction of VOCs.<br>• Spent activated carbon of the carbon adsorption system should be replaced at appropriate intervals such that the TVOC emission concentration from the system is acceptable (i.e. the measured TVOC concentration is below 20 ppm).<br>• Silencers should be installed at the biopile blowers to minimise noise impact.<br>• Contaminated runoff from biopile(s) should be prevented by constructing concrete bunds along the perimeter of the biopiles. | | | | | | | |
| S5.6.94 | <u>Solidification / Stabilization</u><br>• The loading, unloading, handling, transfer and storage of cement should be carried out in an enclosed system.<br>• Mixing process and other associated material handling activities should be properly scheduled to minimise potential noise impact. | Excavation zones and decontamination works area/ During excavation and soil treatment | Contractor | √ | | | √ | |

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| S5.6.95 | • Mixing of contaminated soils with cement / water / other additive(s) should be undertaken at a solidification plant to minimise the potential for leaching.<br>• Runoff from the solidification / stabilization area should be prevented by constructing concrete bunds along the perimeter.<br>In order to minimise the potential adverse effects on health and safety of construction workers during the course of site remediation, the Occupational Safety and Health Ordinance (OSHO) Chapter 509, and its subsidiary Regulations should be followed by all site personnel working on the site at all times. In addition, the following basic health and safety measures should be implemented as far as possible:<br>• Set up a list of safety measures for site workers;<br>• Provide written information and training on safety for site workers;<br>• Keep a log-book and plan showing the contaminated zones and clean zones;<br>• Maintain a hygienic working environment;<br>• Avoid dust generation;<br>• Provide face and respiratory protection gear to site workers; | Excavation zones and decontamination works area/ During excavation and soil treatment | Contractor | √ | | | √ | Occupational Safety and Health Ordinance, Chapter 509 and its subsidiary Regulations. |

| EIA Ref | Environmental Protection Measures / Mitigation Measures | Location / Timing | Implementation Agent | Implementation Stages* | | | | Relevant Legislation and Guidelines |
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| | • Provide personal protective clothing (e.g. chemical resistant jackboot, liquid tight gloves) to site workers; and<br>• Provide first aid training and materials to site workers. | | | | | | | |
| S5.6.97 | For the remaining areas with potential land contamination concerns in ex-GFS building and Radar Station,<br>• A supplementary land contamination assessment shall be carried out upon the cessation of the operations and prior to the redevelopment, following the approved supplementary sampling plan in the respective CAR and/ or RAP of Radar Station and ex-GFS building in the EIA Report.<br>• Supplementary CAR(s) and if necessary RAP(s) shall be prepared. If contamination is identified in the supplementary site investigation, remediation shall be performed according to the supplementary CAR/RAP upon EPD's approval. | Ex-GFS building and Radar Station | CEDD | √ | | | √ | the Practice Note for Professional Persons ProPECC PN3/94<br>"Contaminated Land Assessment and Remediation" and "Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair /Dismantling Workshop" |

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