12 WASTE MANAGEMENT IMPLICATIONS

12.1 Introduction

12.1.1.1 This section identifies the types of waste which are likely to be generated during the construction and operation phases of the Project and related activities, and evaluates the potential environmental impacts that may result from the waste generation.

12.1.1.2 Mitigation measures and good site practices, including waste handling, storage and disposal, have been recommended with reference to relevant waste legislation and management guidelines.

12.2 Environmental Legislation, Standards and Criteria

12.2.1.1 The criteria and guidelines for assessing waste management implications are outlined in Annex 7 and Annex 15 of the EIAO-TM, respectively.

12.2.1.2 The following legislation also covers the handling, treatment and disposal of waste in Hong Kong:

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

12.2.2 Waste Disposal Ordinance (Cap. 354)

12.2.2.1 WDO prohibits any unauthorised disposal of waste. Construction waste, defined under Cap. 354N of the WDO, refers to a substance, matter or thing which is generated from construction works. It includes all abandoned materials, whether processed or stockpiled or not, before being abandoned, but does not include sludge, screenings or matter removed or generated from desludging, desilting or dredging works. Under the WDO, waste can be disposed of only at designated waste disposal facilities licensed by EPD.

12.2.3 Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C)

12.2.3.1 Under the WDO, the Chemical Waste (General) Regulation provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical waste. EPD has also issued the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), which details how the chemical waste producers should comply with the regulations on chemical waste.

12.2.4 Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N)

12.2.4.1 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 Facilities (PFRF) for disposal must consist entirely of inert material.
12.2.5 Land (Miscellaneous Provisions) Ordinance (Cap. 28)

12.2.5.1 The inert portion of Construction and Demolition (C&D) materials (including rocks, soil, broken concrete, building debris, etc.) may be taken to public filling facilities including public filling area, public filling barging points and stockpiling areas. These facilities usually form part of land reclamation schemes and are operated by CEDD. The Land (Miscellaneous Provisions) Ordinance requires that individuals or companies who deliver public fill to the public filling facilities are required to obtain Dumping Licences. The licences are issued by CEDD under delegated authority from the Director of Lands.

12.2.6 Public Health and Municipal Services Ordinance (Cap. 132)

12.2.6.1 The Public Cleansing and Prevention of Nuisances Regulation prohibits dumping of litter in public places.

12.2.7 Construction and Demolition (C&D) Material Management

12.2.7.1 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 minimise 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 minimise C&D material generation and encourage proper management of such material; and (ii) providing the contractor with information from the C&DMMP in order to facilitate them in the preparation of the Waste Management Plan (WMP) and to minimise C&D material generation during construction. Projects generating less than 50,000 m$^3$ of C&D material or importing less than 50,000 m$^3$ of fill material are exempt from the C&DMMP. Further, the C&DMMP should be prepared and submitted to Public Fill Committee (PFC) for approval prior to commencement of the detailed design in accordance with the ETWB TCW No. 33/2002. The C&DMMP should be vetted and endorsed by the departmental Vetting Committee before submitting it to PFC for approval. The 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.

12.2.8 Other Relevant Guidelines

12.2.8.1 The following guidelines are also relevant to waste management in Hong Kong:

- Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), EPD;
- Works Branch Technical Circular (WBTC) No. 32/92, The Use of Tropical Hard Wood on Construction Site;
- WBTC No. 2/93, Public Dumps;
- WBTC No. 2/93B, Public Filling Facilities;
- WBTC No. 16/96, Wet Soil in Public Dumps;
- WBTC No. 12/2000, Fill Management;
12.3 Assessment Methodology

12.3.1.1 The methodology for assessing potential waste management impacts during the construction and operation phases of the Project including decommissioning of existing STSTW and temporary explosives magazine and related activities included the following tasks:

- Estimation of types and quantities of the wastes generated;
- Identification of disposal options for each type of waste;
- Assessment of potential impacts from the management of the waste with respect to potential hazards, air and odour emissions, noise, wastewater discharge, ecology and public transport;
- Evaluation of the opportunities for reducing waste generation; and
- Assessment of the impacts caused by handling, collection, transportation and re-use / disposal of wastes.

12.4 Identification of Potential Waste Sources

12.4.1.1 The construction of the Project is tentatively scheduled to commence in early 2018 for completion in 2028. The construction activities to be carried out for the Project include the following:

- Construction of the caverns, portals, tunnels, adits and ventilation shafts and associated facilities for relocated STSTW;
- Construction of sewage and sludge treatment facilities and associated facilities including pipeworks and utilities, odour control and deodorization systems, laboratories, transformer and switchgear houses, workshops, storage, etc.;
- Construction of water reclamation facilities;
- Modifications of the THEES system in relation to effluent discharge from the relocated STSTW;
- WBTC No. 11/2002, Control of Site Crusher;
- WBTC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates;
- DEVB TC(W) No. 2/2011, Encouraging the Use of Recycled and other Green Materials in Public Works Projects;
- DEVB TC(W) No. 9/2011, Enhanced Control Measures for Management of Public Fill; and
- CEDD TC No. 03/2015, Management of C&D Materials.
Construction of ancillary facilities and temporary explosive magazine site;

Rehabilitation, modification and improvement of the existing emergency submarine outfall;

Associated slope stabilization, natural terrain hazard mitigation and geotechnical works;

Landscaping and architectural works and amenity areas; and

Decommissioning and demolition of existing STSTW and temporary explosives magazine.

12.4.1.2 The above construction activities 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 are:

- C&D material;
- Chemical waste; and
- General refuse.

12.4.1.3 Most of the C&D material generated is hard granite, which is a valuable natural resource for construction use. The rock produced under this project would become a local source to support local construction industry.

12.4.1.4 There will be no dredging/excavation of sediment for this Project.

12.4.1.5 During the operation phase of relocated STSTW, the main waste arising would be dewatered sludge which will be transported to the STF in Tuen Mun for treatment and disposal. A limited amount of screenings, grit, chemical waste and general refuse would also be generated.

12.4.1.6 The rejected concentrate from the water reclamation facilities will be collected and diverted to the drain sump in Sludge Transfer Pumping Station. No other waste from the plant during the operational phase of the effluent reuse system is anticipated.

12.4.1.7 During the demolition of the existing STSTW, the public fill (mainly consisting of Artificial Hard Material (AHM)) will be generated from the demolition of the sedimentation tanks, sludge holding tank, sludge storage tank, sludge dewatering house, and foundation and sub-structures of the buildings within the existing STSTW. During the demolition of the temporary explosives magazine, public fill would be generated and they would be disposed of at the PFRF.

12.5 Prediction & Evaluation of Environmental Impacts

12.5.1 Construction Phase and Demolition of the Existing STSTW and Temporary Explosives Magazine

Construction and Demolition (C&D) Material

12.5.1.1 C&D materials will be generated from excavation of rock caverns (at the relocated STSTW site and the potential explosive magazine site), tunnels, adits, ventilation/shafts buildings, site formation works and the demolition of the existing STSTW. These C&D materials will comprise both inert and non-inert components, such as soil, AHM, rocks, wood and metals. Based on the latest layout, the volume of surplus C&D materials is estimated to be approximately 6,000,000 m³ of inert material and 124,000 m³ of non-inert material.
material (i.e. C&D waste). About 3,740,000 m³ of total excavated materials is rock, which would be generated from the cavern constructions at Nui Po Shan. An estimated volume of 595,000 m³ is soft materials while 1,669,000 m³ would be AHM (i.e. concrete).

12.5.1.2 Based on the project specific ground investigation, superficial materials mantled the cavern site are mainly colluviums, corestone and Grade VI residual soil. The hard material in the vicinity of cavern site is predominantly medium grained Granite. Detailed breakdown of inert & non-inert C&D materials generated during construction phase is shown in Table 12.1. The anticipated timing of wastes arising / generation from the construction activities is shown in Table 12.2.

Table 12.1 Summary of Inert and Non-Inert C&D Material Volumes Generated from Work Areas

<table>
<thead>
<tr>
<th>Works Area</th>
<th>Volume of C&amp;D waste (non-inert) (m³)</th>
<th>Volume of Inert C&amp;D Material / Weights of Inert C&amp;D Material (Bulk Volume, m³)</th>
<th>Granite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Inert C&amp;D Materials (soft public fill)</td>
<td>Inert C&amp;D Materials (AHM)</td>
</tr>
<tr>
<td>Main Portal</td>
<td>94,072</td>
<td>204,852</td>
<td>316,406</td>
</tr>
<tr>
<td>Secondary Portal</td>
<td></td>
<td>28,504</td>
<td>35,156</td>
</tr>
<tr>
<td>Access Road</td>
<td></td>
<td>85,305</td>
<td>-</td>
</tr>
<tr>
<td>Caverns</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ventilation Adit &amp; Ventilation Shaft</td>
<td></td>
<td>1,331</td>
<td>-</td>
</tr>
<tr>
<td>Emergency Outfall and Temporary Explosives Magazine</td>
<td>61,700</td>
<td>2,297</td>
<td>-</td>
</tr>
<tr>
<td>Other Works at Existing STSTW</td>
<td></td>
<td>29,958</td>
<td>101,640</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>124,030</strong></td>
<td><strong>595,378</strong></td>
<td><strong>1,668,859</strong></td>
</tr>
</tbody>
</table>

Table 12.2 Anticipated Timing of Wastes Arising / Generation from Construction Activities and Disposal

<table>
<thead>
<tr>
<th>Works Area</th>
<th>Proposed Works</th>
<th>Anticipated Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Portal</td>
<td>Site formation</td>
<td>Apr 2018 to Mar 2021</td>
</tr>
<tr>
<td>Secondary Portal</td>
<td>Site formation</td>
<td>Apr 2018 to Jul 2020</td>
</tr>
<tr>
<td>Access Road</td>
<td>Site formation</td>
<td>Apr 2018 to Mar 2020</td>
</tr>
<tr>
<td>Main Access Tunnel &amp; Secondary Access Tunnel</td>
<td>Mechanical Excavation, Drill &amp; Blast</td>
<td>Jul 2019 to Dec 2022</td>
</tr>
<tr>
<td>Caverns</td>
<td>Drill &amp; Blast</td>
<td>Feb 2020 to Jan 2023</td>
</tr>
<tr>
<td>Ventilation Adit &amp; Ventilation Shaft</td>
<td>Mechanical Excavation, Drill &amp; Blast</td>
<td>Jun 2020 to Aug 2022</td>
</tr>
</tbody>
</table>
There are four main sources of works which will generate C&D materials. (1) Site formation works for tunnel portals at A Kung Kok Street and Mui Tsz Lam Road; (2) Site formation works for access road to the proposed surface Magazine in A Kung Kok Shan; (3) Tunnel/Cavern construction; and (4) other works at existing STSTW.

Substantial site formation works are required for the construction of Main Access Tunnel Portal at A Kung Kok Street and Secondary Access Tunnel Portal at Mui Tsz Lam Road. Predominantly soft C&D materials will be generated during the works. The inert C&D materials could be sorted and reused as filling material within the portal area and along the construction of access road. The surplus inert C&D material shall be transported to Tuen Mun Area 38 Fill Bank for reuse by other projects.

Site formation works for the access road to the proposed surface magazine is expected to be carried out concurrently. It includes site formation works at the end of A Kung Kok Shan Road, slope cuts, stabilization works and road work towards the hilltop along the alignment. Part of the generated C&D materials is expected to be reused as filling material throughout the construction of the access road. The potential stockpile area will be located within the temporary works area Area 73 shown in Figure No. 60334056/EIA/12.01. The surplus inert C&D materials shall be transported to Tuen Mun Area 38 Fill Bank for reuse by other projects. An alternative disposal site as primary outlet would be Tseung Kwan O Area 137, subject to the availability and handling capacity of Tuen Mun Area 38 Fill Bank.

Excavation of caverns and access tunnels will contribute to the major portion of inert C&D materials generation. Based on the existing Ground Investigation information obtained during the feasibility study stage, approximately 200m of the Main Access Tunnel and 50m of Secondary Access Tunnel will be constructed in soft ground. Inert materials (i.e. soil and fracture rock) are likely to be generated in these portions of tunnels. Excavation for the remained portion of the tunnels and the caverns will likely generate Grade II or better Granite which are suitable to be delivered to Lam Tei Quarry for further processing as concrete aggregate. Other recycling measures include process on site through crushing facilities, recycled as backfilling material, and reuse as drainage layer and disposal to China. There are also some upcoming projects that may need import material. However, it is preliminarily revealed that the peak C&D generation period of STSTW do not meet the tentative construction programme of the upcoming projects. Nevertheless, other potential projects / disposal outlets will continue to be explored throughout the project to maximise the quantity of the recycled C&D materials. Exportation to China will be the last resort should all other alternatives for C&D materials reuse in Hong Kong becomes impractical. Detailed breakdown on disposal and reuse of inert C&D materials generated is shown in Table 12.3.

<table>
<thead>
<tr>
<th>Works Area</th>
<th>Proposed Works</th>
<th>Anticipated Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Outfall and temporary explosives magazine</td>
<td>Demolition &amp; Pipe Jacking</td>
<td>Nov 2022 to Apr 2025</td>
</tr>
<tr>
<td>Other Works at Existing STSTW</td>
<td>Demolition</td>
<td>Jul 2027 to Jan 2029</td>
</tr>
</tbody>
</table>
### Table 12.3 Summary on Disposal and Reuse of Inert C&D Materials Generated

<table>
<thead>
<tr>
<th>Works Area</th>
<th>Off Site Disposal</th>
<th>Reuse</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Soft Material (Fill, etc.)</td>
<td>AHM</td>
</tr>
<tr>
<td>Main Portal &amp; Pilot Adit</td>
<td>204,852</td>
<td>316,406</td>
</tr>
<tr>
<td>Secondary Portal</td>
<td>28,504</td>
<td>35,156</td>
</tr>
<tr>
<td>Access Road</td>
<td>66,090</td>
<td>-</td>
</tr>
<tr>
<td>Main Access Tunnel &amp; Secondary Access Tunnel</td>
<td>112,046</td>
<td>-</td>
</tr>
<tr>
<td>Caverns</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ventilation Adit &amp; Ventilation Shaft</td>
<td>1,331</td>
<td>-</td>
</tr>
<tr>
<td>Emergency Outfall and temporary explosives magazine</td>
<td>32,688</td>
<td>2,297</td>
</tr>
<tr>
<td>Other Works at Existing STSTW</td>
<td>12,100</td>
<td>1,315,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>457,611</td>
<td>1,668,859</td>
</tr>
</tbody>
</table>

12.5.1.7 Non-inert C&D materials generated from the site formation works will be recycled as far as possible before disposed to landfill.

12.5.1.8 AHM will mainly be generated from demolition of existing STSTW. In the cavern site, the main contributor of AHM are the demolition of the Evangelical Lutheran Church of Hong Kong, pavement in Area 73 and cycle track, modification works on access road to THEES portal etc.

12.5.1.9 Other works at the existing STSTW are expected to generate AHM (such as concrete and metals) and non-inert material. Onsite sorting shall be carried out to separate the inert and non-inert material and transported to Tuen Mun Area 38 Fill Bank for reuse by other projects and landfill for disposal respectively.

12.5.1.10 The potential environmental impacts arising from the handling and disposal of the C&D material, such as air and odour emissions, noise, wastewater discharge, ecology, potential hazard and public transport, would be negligible. Appropriate measures should be taken to minimise potential adverse impacts from dust during the transportation of C&D material.
Chemical Waste

12.5.1.11 The maintenance and servicing of construction plant, equipment and vehicles involve the use of a variety of chemicals and generate chemical wastes. The possible chemical waste that would be generated during the course of construction works includes:

- Oil and grease associated with plant maintenance;
- Hydraulic fluid from plant machinery;
- Scrap batteries from vehicle maintenance; and
- Used paint, cleaners, solvents used in maintaining mechanical equipment.

12.5.1.12 It is difficult to quantify the amount of chemical waste that would arise from the construction activities since it would depend on the Contractor’s on-site maintenance requirements and the amount of plant utilised. However, it is anticipated that the quantity of chemical waste, such as lubrication oil and solvent produced from plant maintenance, would be small and in the order of a few cubic meters per month. The amount of chemical waste to be generated would be quantified in the WMP to be prepared by the Contractors.

12.5.1.13 Building demolition may possibly generate asbestos waste as the existing building insulation materials likely contain asbestos. Asbestos waste is categorised as chemical waste under the Waste Disposal (Chemical Waste) Regulation. The Project Proponent should conduct an asbestos investigation by a registered asbestos consultant prior to demolition of existing building structure. The investigation should reveal the presence, quantity and location of Asbestos Containing Materials (ACM). Asbestos waste will be handled in accordance with the Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste issued by EPD. Should there be any ACM found in the existing building structure, any demolition works of these building structures should engage Registered Asbestos Contractors and the asbestos waste should be collected and transported by the licensed waste collector to designated landfill site for secure burial in accordance with the “Code of Practice on the Handling, Transport and Disposal of Asbestos Waste” issued by the EPD. The latest designated landfill site is West New Territories (WENT) landfill in Nim Wan, Tuen Mun to receive asbestos waste.

12.5.1.14 Chemical wastes arising during the construction 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 on the workforce;
- Adverse impacts on water quality and aquatic biota from spills; and
- Fire hazards.

12.5.1.15 Materials classified as chemical wastes will require special handling and storage arrangements before removal for appropriate treatment at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. Wherever possible opportunities should be taken to reuse and recycle materials. Mitigation and control requirements for chemical wastes are detailed Section 12.6.7. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements and the Code of Practice on Packaging, Labelling and Storage of Chemical Wastes published by EPD, adverse environmental impacts are not expected to result.
12.5.1.16 Throughout construction, the workforce would generate refuse comprising food scraps, waste paper, empty containers, etc. Escape of such refuse from the site should not be allowed to occur.

12.5.1.17 The number of construction workers to be working on the Project at any one time is estimated to be about 1000. Based on a generation rate of 0.65kg per workers per day, approximately 650 kg of general refuse will be generated daily during the construction period. It is estimated that 1 truck per day would be required to transport the general refuse for disposal.

12.5.1.18 Effective collection and removal of site wastes will be required to prevent waste materials being blown around by wind, flushed or leached into the aquatic environment, and to prevent odour nuisance. The work sites may also attract pests and vermin if the waste storage area is not well maintained and cleaned regularly. Disposal of refuse must be at approved waste transfer or disposal facilities. With the implementation of good waste management practices at the site, adverse environmental impacts would not be expected to arise from the storage, handling and transportation of refuse.

12.5.2 Operation Phase

Screenings and Grits

12.5.2.1 The screenings and grits would be generated at the inlet works of the relocated STSTW. Screening would be compacted first and the compacted screenings and grits will be properly stored in a covered container and disposed of daily to WENT or North East New Territories (NENT) landfills. The estimated volume of screenings and grits to be generated is up to 510 m$^3$ per month and 150 m$^3$ per month, respectively. It is estimated that around 51 and 15 containers per month would be required to transport the screenings and grits separately for disposal. The transportation and disposal of the screenings and grits are managed and controlled by a reputable waste collector employed by the operators to reduce the potential pest, odour and litter impacts.

Sludge

12.5.2.2 The raw sludge collected at the sewage treatment processes of the relocated STSTW will be dewatered at the relocated STSTW to dry solid content of 30% before disposal to EPD’s STF at Tuen Mun. The density of sewage sludge is subject to sludge characteristics, which may vary due to sewage characteristic variation. Based on the typical density of primary sludge and biological sludge, as well as the assumed primary to biological sludge ratio of 2:1, the estimated combined sludge density is 1,100 kg/m$^3$ at 30% dry solid content. Unlike the existing STSTW, the sludge of the relocated STSTW will not undergo anaerobic digestions before disposal of as the Fire Services Department has expressed that housing of biogas production facilities inside caverns is not acceptable. In case of extreme weather condition (e.g. typhoons), dewatered sludge will be temporary stored in cavern.

12.5.2.3 The estimated quantities of sewage sludge to be produced by the relocated STSTW at ultimate stage is around 340 tonnes per day based on the sludge production rate of one tonne per 1,000 m$^3$ of treated sewage and dry solid content of 30%. The estimation of sludge production is shown in Appendix 12.01. The dewatered sludge will be discharged into a retractable loading chute which is coupled to a totally enclosed container to minimise odour emission. The sludge container will be hauled away by truck when filled up and delivered to the STF for disposal. It is estimated that around 25 containers per day would be required to transport the dewatered sludge for disposal.

12.5.2.4 Mitigation and control requirements to minimise potential H$_2$S / odour and water quality impacts from sludge handling are detailed in Section 12.6.6. Provided that these
mitigation measures are properly implemented, adverse environmental impacts are not expected.

Chemical Waste

12.5.2.5 Chemical wastes such as paints, lubricants and used batteries may be generated during maintenance activities. This waste may pose environmental, health and safety hazards. Measures as stipulated in the Waste Disposal (Chemical Waste) (General) Regulation and the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes would be strictly followed for the handling and disposal of chemical waste.

12.5.2.6 Should any chemical waste be generated, the operator must register with EPD as a chemical waste producer. The chemical waste would be readily accepted for disposal at the CWTC at Tsing Yi. This chemical waste should be collected periodically in drum-type containers by licensed chemical waste collectors. With proper storage, handling and disposal of this waste, no adverse environmental impact is anticipated.

General Refuse

12.5.2.7 During the operation phase, general refuse would be generated by staff and office activities. This waste includes food waste, paper, wood, plastic, office wastes etc. Plastics, papers and other recyclable wastes should be separated from general refuse and recycled as far as possible. The remaining refuse would be collected by licensed collectors and disposed of at landfills.

12.5.2.8 The anticipated potential environmental impacts arisen from the handling, storage and disposal of waste in operation phase would be insignificant provided that the mitigation measures stated in Section 12.6.8 are strictly followed. Therefore, it is estimated that 1 truck per day would be required to transport the general refuse for disposal.

12.6 Mitigation of Adverse Environmental Impacts

12.6.1 Waste Management Hierarchy

12.6.1.1 The waste management hierarchy has been applied in the assessment and development of mitigation measures for waste which aims at evaluating the desirability of waste management methods and includes the followings in descending preference:

- Avoidance and reduction of waste generation;
- Reuse of materials as far as practicable;
- Recovery and recycling of residual materials where possible; and
- Treatment and disposal according to relevant laws, guidelines and good practices.

12.6.1.2 Based on the waste management hierarchy, waste reduction measures are recommended as follows to reduce impacts and costs arisen from the Project. Recommendations of good site practices and waste reduction measures would be stated in order to achieve avoidance and minimisation of waste generation in the hierarchy. EMP and trip-ticket system are recommended for monitoring management of waste.

12.6.1.3 Different options for the relocated STSTW have been considered and evaluated in Section 2. The options that generate less disposal materials are considered more desirable for minimising the potential environment impacts from waste handling and disposal.
12.6.2 Good Site Practices

12.6.2.1 Appropriate waste handling, transportation and disposal methods for all waste arising generated during the construction works for the Project should be implemented to ensure that construction wastes do not enter the nearby streams or drainage channel.

12.6.2.2 It is anticipated that adverse impacts would not arise on the construction site, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include:

- Nomination of approved personnel, such as a site manager, to be responsible for good site practices, and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility;
- Training of site personnel in proper waste management and chemical waste handling procedures;
- Provision of sufficient waste reception/ disposal points, of a suitable vermin-proof design that minimises windblown litter;
- Arrangement for regular collection of waste for transport off-site and final disposal;
- Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors;
- A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed; and
- A WMP should be prepared and should be submitted to the Engineer for approval. One may make reference to ETWB TCW No. 19/2005 for details.

12.6.2.3 In order to monitor the disposal of C&D material at landfills and public filling areas, as appropriate, and to control fly tipping, a trip-ticket system should be included as one of the contractual requirements to be implemented by an Environmental Team undertaking the EM&A work. One may make reference to DEVB TCW No.6/2010 for details.

12.6.3 Waste Reduction Measures

12.6.3.1 Good management and control of construction site activities / processes can minimise the generation 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:

- Segregate and store different types of construction related waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal;
- Provide separate labelled bins to segregate recyclable waste such as aluminum cans from other general refuse generated by the work force, and to encourage collection by individual collectors;
- Any unused chemicals or those with remaining functional capacity shall be recycled;
- Maximising the use of reusable steel formwork to reduce the amount of C&D material;
Prior to disposal of C&D waste, it is recommended that wood, steel and other metals shall be separated for re-use and/or recycling to minimise the quantity of waste to be disposed of to landfill;

On-site crushing and sorting facilities are being considered to reduce the rock size to fulfill the size requirements from relevant waste collection/transfer/disposal facilities;

Adopt proper storage and site practices to minimise the potential for damage to, or contamination of, construction materials;

Plan the delivery and stock of construction materials carefully to minimise the amount of surplus waste generated;

Adopt pre-cast construction method instead of cast-in-situ method for construction of concrete structures as much as possible; and

Minimise over ordering of concrete, mortars and cement grout by doing careful check before ordering.

In addition to the above measures, other specific mitigation measures are recommended below to minimise environmental impacts during handling, transportation and disposal of wastes.

Storage, Collection and Transportation of Waste

Storage of materials on site may induce adverse environmental impacts if not properly managed, recommendations to minimise the impacts include:

- Waste, such as soil, should be handled and stored well to ensure secure containment, thus minimising the potential of pollution;
- Maintain and clean storage areas routinely;
- Stockpiling area should be provided with covers as much as practicable and water spraying system to prevent materials from wind-blown or being washed away; and
- Different locations should be designated to stockpile each material to enhance reuse.

Licensed waste haulers should be employed for the collection and transportation of waste generated. The following measures should be enforced to minimise the potential adverse impacts:

- Remove waste in timely manner;
- Waste collectors should only collect wastes prescribed by their permits;
- Impacts during transportation, such as dust and odour, should be mitigated by the use of covered trucks or in enclosed containers;
- Obtain relevant waste disposal permits from the appropriate authorities, in accordance with the WDO (Cap. 354), Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 345) and the Land (Miscellaneous Provisions) Ordinance (Cap. 28);
- Waste should be disposed of at licensed waste disposal facilities; and
- Maintain records of quantities of waste generated, recycled and disposed.
12.6.4.3 Land transport will be used for transportation of excavated and stockpile materials. It is expected there will be 1260 vehicles per day for transporting waste during peak construction phase. The tentative transportation routings for the disposal of various types of wastes are shown in Table 12.4. The transportation routing may be changed subject to the traffic conditions. Nevertheless, it is anticipated that there is no adverse impact from the waste during transportation with the implementation of appropriated measures (e.g. using water-tight containers and covered trucks).

Table 12.4 Tentative Transportation Routings for Waste Disposal

<table>
<thead>
<tr>
<th>Disposal Outlet</th>
<th>Type of Waste</th>
<th>Tentative Transportation Routing</th>
</tr>
</thead>
<tbody>
<tr>
<td>NENT Landfill</td>
<td>Non-inert C&amp;D Materials, Screenings and Grits and General Refuse</td>
<td>Via Tolo Highway, Fanling Highway, Man Kam To Road and Lin Ma Hang Road</td>
</tr>
<tr>
<td>WENT Landfill</td>
<td>Non-inert C&amp;D Materials, Screenings and Grits and General Refuse</td>
<td>Via Tai Po Road (Sha Tin), Shing Mun Tunnel Road (Shing Mun Tunnel), Tuen Mun Road, Lung Fu Road, Lung Mun Road and Lung Kwu Tan Road</td>
</tr>
<tr>
<td>STF</td>
<td>Sludge</td>
<td></td>
</tr>
<tr>
<td>Lam Tei Rock Quarry</td>
<td>Hard Inert C&amp;D Materials (Grade I &amp; II granitic rock)</td>
<td>Via Tai Po Road (Sha Tin), Shing Mun Tunnel Road (Shing Mun Tunnel) and Tuen Mun Road</td>
</tr>
<tr>
<td>Tuen Mun Area 38 Fill Bank</td>
<td>Surplus Soft Inert C&amp;D Materials, AHM and Hard Inert C&amp;D Materials (Grade III granitic rock)</td>
<td>Via Tai Po Road (Sha Tin), Shing Mun Tunnel Road (Shing Mun Tunnel), Tuen Mun Road, Lung Fu Road and Lung Mun Road</td>
</tr>
<tr>
<td>CWTC</td>
<td>Chemical Waste</td>
<td>Via Tai Po Road (Sha Tin), Tsing Sha Highway (Eagle’s Nest Tunnel and Stonecutters Bridge) and Tsing Yi Road</td>
</tr>
</tbody>
</table>

12.6.4.4 Alternative other than land transport has been explored, i.e. the option of using the conveyor belt and marine transport for transportation of excavated materials. However, this option is deemed not preferable. First of all, the main consideration of using the conveyor belt is to reduce the impact of land transport on road networks, therefore the conveyor belt should be linked directly to the pier/docking area in order to make use of marine transport instead of land transport for the delivery of excavated materials. The nearest pier/docking area which is suitable for loading operation is the pier in the existing STSTW, which is quite far away from the cavern site. The route of the conveyor belt has to span Shing Mun River Channel, which is approximately 200m wide. Extensive structural works across the Shing Mun River Channel would be expected. Moreover, the marine traffic route from the existing STSTW pier to Lam Tei Quarry is long in distance and the barge have to sail across the high wind area near Tseung Kwan O, which is not suitable for marine transport especially during typhoon season.

12.6.4.5 In order to monitor the disposal of C&D materials at PFRFs and landfills and to control fly-tipping, a trip-ticket system should be established in accordance with DEVB TCW No. 6/2010. A recording system for the amount of waste generated, recycled and disposed, including the disposal sites, should also be set up. Warning signs should be put up to remind the designated disposal sites. CCTV should be installed at the vehicular entrance and exit of the site as additional measures to prevent fly-tipping.

12.6.4.6 In addition to the above general measures, other specific mitigation measures on handling the C&D materials and materials generated from site formation and demolition work are recommended below, which should form the basis of the WMP to be prepared by the Contractor in construction phase.
12.6.5 Construction and Demolition Material

12.6.5.1 In order to minimise the impact resulting from collection and transportation of C&D materials for off-site disposal, the excavated material arising from site formation and foundation works should be reused on-site as backfilling material and for landscaping works as far as practicable. Other mitigation requirements are listed below:

- A WMP, which becomes part of the EMP, should be prepared in accordance with ETWB TCW No.19/2005;
- A recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be adopted for easy tracking; and
- In order to monitor the disposal of C&D materials at public filling facilities and landfills and to control fly-tipping, a trip-ticket system should be adopted (refer to DEVB TCW 06/2010).

12.6.5.2 It is recommended that specific areas should be provided by the Contractors for sorting and to provide temporary storage areas (if required) for the sorted materials.

12.6.5.3 The Contactor should prepare and implement an EMP in accordance with ETWB TCW No.19/2005, which describes the arrangements for avoidance, reuse, recovery, recycling, storage, collection, treatment and disposal of different categories of waste to be generated from construction activities. Such a management plan should incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials. The EMP should be submitted to the Engineer for approval. The Contractor should implement waste management practices in the EMP throughout the construction stage of the Project. The EMP should be reviewed regularly and updated by the Contractor, preferably on a monthly basis.

12.6.5.4 All surplus C&D materials arising from or in connection with construction works should become the property of the Contractor when it is removed unless otherwise stated. The Contractor would be responsible for devising a system to work for on-site sorting of C&D materials and promptly removing all sorted and process materials arising from the construction activities to minimise temporary stockpiling on-site. The system should be included in the EMP identifying the source of generation, estimated quantity, arrangement for on-site sorting, collection, temporary storage areas and frequency of collection by recycling Contractors or frequency of removal off-site.

12.6.6 Sludge

12.6.6.1 Through relocation of the STSTW to caverns, the odour issue is expected to be largely reduced. Nevertheless, the practices of good housekeeping for the relocated STSTW listed below should be followed to further ameliorate any odour impact from handling, collection, transportation and disposal of sludge:

- Screens should be cleaned regularly to remove any accumulated organic debris;
- Grit and screening transfer systems should be flushed regularly with water to remove organic debris and grit;
- Grit and screened materials should be transferred to closed containers;
- Scum and grease collection wells and troughs should be emptied and flushed regularly to prevent putrefaction of accumulated organics;
- Skim and remove floating solids and grease from primary clarifiers regularly;
• Frequent sludge withdrawal from tanks is necessary to prevent the production of gases;

• Sludge should be transported to the STF by water-tight containers to avoid H₂S/odour emission and ingress of water into the containers which would lower the sludge dryness during transportation;

• Sludge cake should be transferred to closed containers;

• Sludge containers should be flushed with water regularly; and

• Sludge trucks and containers should be washed thoroughly before leaving the STSTW to avoid any odour nuisance during transportation.

12.6.6.2 In addition, all wastewater generated from the sludge dewatering process and all contaminated water from the cleaning operations recommended for odour control will be diverted to the relocated STSTW for proper treatment.

12.6.7 Chemical Waste

12.6.7.1 If chemical wastes are produced at the construction site or during operation, the Contractor during construction or the operator during operation will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes. Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor shall use a licensed collector to transport and dispose of the chemical wastes, to the licensed CWTC, or other licensed facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

12.6.8 General Refuse

12.6.8.1 Recycling of waste paper, aluminum cans and plastic bottles should be encouraged, it is recommended to place clearly labelled recycling bins at designated locations which could be accessed conveniently. Other general refuse should be separated from chemical and industrial waste by providing separated bins for storage to maximise the recyclable volume.

12.6.8.2 A reputable licensed waste collector should be employed to remove general refuse on a daily basis to minimise odour, pest and litter impacts.

12.6.8.3 Table 12.5 provides a summary of the various waste types likely to be generated during the construction and operation phase for the Project, together with the recommended handling and disposal methods.
### Table 12.5 Summary of Waste Arising, Waste Handling Procedures and Disposal Routes

<table>
<thead>
<tr>
<th>Waste Material Type</th>
<th>Generated From</th>
<th>Materials Generated</th>
<th>Total Quantity Generated (Approx.)</th>
<th>Disposal</th>
<th>Handling Methods/Reuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&amp;D Materials</td>
<td>Construction Phase Excavation works, demolition works, site formation, road improvement works, etc.</td>
<td>Inert C&amp;D materials – rock, AHM, soft materials</td>
<td>6,000,000 m³</td>
<td>Suitable material to be sorted and reused on site as much as possible. Surplus excavated materials (i.e. Grade I &amp; II granitic rocks) would be transported to Lam Tei Rock Quarry for recycling as useful aggregates. The remaining surplus excavated materials (i.e. Grade III granitic rocks, AHM and soft materials) would be transported to Tuen Mun Area 38 Fill Bank for reuse by other projects.</td>
<td>• Segregation from non-inert C&amp;D materials during stockpiling and transportation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-inert C&amp;D materials – vegetation, timber, papers &amp; plastics</td>
<td>124,000 m³</td>
<td>To be disposed to landfill</td>
<td>• Segregation from inert C&amp;D materials during stockpiling and transportation • Reusable materials should be separated and recycled as far as practicable</td>
</tr>
<tr>
<td>Sludge</td>
<td>Operation Phase Operation of the relocated STSTW</td>
<td>Sludge</td>
<td>340 tonnes / day</td>
<td>To be disposed to STF</td>
<td>• Dewatered sludge discharged into a retractable loading chute which is coupled to a totally enclosed container • Practices of good housekeeping listed in Section 12.6.6</td>
</tr>
<tr>
<td>Screenings and Grits</td>
<td>Operation Phase Operation of the relocated STSTW</td>
<td>Screenings and grits</td>
<td>Screenings: 510 m³ / month Grits: 150 m³ / month</td>
<td>To be disposed to landfill</td>
<td>• Transportation and disposal of the screenings and grits managed and controlled by a reputable waste collector</td>
</tr>
<tr>
<td>Waste Material Type</td>
<td>Generated From</td>
<td>Materials Generated</td>
<td>Total Quantity Generated (Approx.)</td>
<td>Disposal</td>
<td>Handling Methods/Reuse</td>
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</tr>
</tbody>
</table>
| General Refuse      | Construction Phase Workforce | Food waste, plastic, aluminum cans, waste papers etc. | Construction Phase 650 kg / day | Approved waste transfer or disposal facilities and then to landfill | • Provide on-site collection points together with recycling bins  
• To be collected by a licensed collector |
|                     | Operational Phase Workforce | Insignificant | Operational Phase Insignificant | **Chemical Waste** | **Chemical Waste Treatment Centre** | • Store in compatible containers in designated area on site  
• To be collected and recycled by a licensed collector |
|                     | Construction and Operational Phase Excavation machines maintenance | Oils and grease hydraulic fluids, paints, solvents, cleaners etc. | A few cubic meters per month | **Chemical Waste Treatment Centre** |
12.7 Evaluation of Residual Impacts

12.7.1.1 Construction work should not proceed until all issues on management of C&D materials have been resolved and all relevant arrangements have been endorsed by the relevant authorities including PFC and EPD.

12.7.1.2 With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste arising, adverse residual impact is not expected to occur during the construction and operation of the proposed Project and demolition of the existing STSTW.

12.8 Environmental Monitoring and Audit

12.8.1.1 It will be the contractor's responsibility to ensure that any wastes produced during the construction and demolition works are handled, stored and disposed of in accordance with good waste management practices and relevant regulations and other legislative requirements. The recommended mitigation measures should form the basis of the site WMP to be developed by the Contractor in the construction stage.

12.8.1.2 A WMP, as a part of the EMP, should be prepared in accordance with ETWB TC (W) No.19/2005 and submitted to the Engineer for approval. The recommended mitigation measures should form the basis of the WMP. The monitoring and auditing requirement stated in ETWB TC (W) No.19/2005 should be followed with regard to the management of C&D materials.

12.8.1.3 No EM&A requirement is considered necessary during the operational phase.

12.9 Conclusion

12.9.1.1 Waste types generated by the construction activities are likely to include C&D materials (from excavation, demolition of existing structures, and site formation), general refuse from workforce and chemical waste from maintenance of construction plant and equipment. Provided that these wastes are handled, transported and disposed of using approved methods and that the recommended good site practices are strictly followed, adverse environmental impacts are not expected during the construction phase.

12.9.1.2 The main waste types to be generated during the operation phase would be grit and screenings, and sewage sludge. The collection, transportation and disposal practices of the grit and screenings would follow the existing arrangements currently in operation at the existing STSTW. The dewatered sludge would be disposed of to the proposed STF. Provided proper handling procedures and disposal method are adopted, adverse environmental impacts are not expected during the operation phase.