

## 6 WASTE MANAGEMENT IMPLICATION

### 6.1 Introduction

6.1.1 This section identifies the types of waste which are likely to be generated during the construction and operation phases of the Project, and evaluates the potential environmental impacts that may be resulted from the waste generation. The assessment of the waste management implications arising from construction and operation of the Project was conducted following the criteria and guidelines as stated in Annexes 7 and 15 of the EIAO-TM as well as requirements as given in Clause 3.4.7 and Appendix E of the EIA Study Brief (ESB-323/2019).

### 6.2 Environmental Legislation, Standards and Criteria

6.2.1 The following legislation relates to the handling, treatment and disposal of wastes in the Hong Kong Special Administrative Region (SAR):-

- Waste Disposal Ordinance (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. 132BK) – Public Cleansing and Prevention Nuisances Regulation.

#### Waste Disposal Ordinance (Cap. 354)

6.2.2 The Waste Disposal Ordinance (WDO) prohibits the unauthorised disposal of wastes. Construction waste is defined under Cap. 354N of the WDO as any substance, matter or thing that is generated and abandoned from construction works regardless if it has been processed or stockpiled before being abandoned, excluding sludge, screenings or any matter removed or generated from desludging, desilting or dredging works. Under WDO, waste can be disposed of only at designated waste disposal facilities licensed by the Environmental Protection Department (EPD).

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

6.2.3 Issued under the WDO, the Waste Disposal (Chemical Waste) (General) Regulation controls the possession, storage, collection, transport and disposal of chemical wastes. EPD has also issued three guidelines detailing how the Contractor should comply with the regulations on chemical wastes, namely A Guide to the Chemical Waste Control Scheme (2016), A Guide to the Registration of Chemical Waste Producers (2016) and Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992).

#### Land (Miscellaneous Provisions) Ordinance (Cap. 28)

6.2.4 The inert portion of Construction and Demolition (C&D) materials (including rocks, soil, broken concrete, building debris etc.) may be taken to Public Fill Reception Facilities (PFRFs) operated by the Civil Engineering and Development Department (CEDD). The Land (Miscellaneous Provisions) Ordinance requires that individuals or companies who deliver public fill to the PFRFs are required to obtain Dumping Licences. The licences are issued by CEDD under delegated authority from the Director of Lands.

6.2.5 Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions, public fill reception facilities will only accept soil, sand, rubble, brick, tile,

rock, boulder, concrete, asphalt, masonry or used bentonite. In addition, in accordance with paragraph 12 of the Development Bureau Technical Circular (Works) No.6/2010, Public Fill Committee will advise on the acceptance criteria. The material will, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical wastes, animal and vegetable matter and any other materials considered unsuitable by the public fill reception facility supervisor.

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

- 6.2.6 Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, 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 (PFRF) for disposal must consist entirely of inert material.

Public Health and Municipal Services Ordinance – Public Cleansing and Prevention of Nuisances Regulation (Cap. 132BK)

- 6.2.7 The Public Cleansing and Prevention of Nuisances Regulation provides control on illegal dumping of wastes on unauthorised / unlicensed sites. The illegal dumping of wastes can lead to a fine and/or imprisonment.

- 6.2.8 Other environmental relevant circulars/guidelines applicable to waste management practices for this Project include:-

- Works Branch Technical Circular (WBTC) No. 2/93 Public Dumps;
- WBTC No. 2/93B Public Filling Facilities;
- WBTC No. 12/2000 Fill Management;
- ETWB TCW No. 19/2005 Environmental Management on Construction Sites;
- Development Bureau Technical Circular (Works) (DEVB TCW) No. 06/2010 Trip-ticket System for Disposal of Construction and Demolition Materials;
- DEVB TCW No. 08/2010 Enhanced Specification for Site Cleanliness and Tidiness;
- DEVB TCW No. 09/2011 Enhanced Control Measures for Management of Public Fill;
- Hong Kong Planning Standards and Guidelines, 2021 (PlanD);
- Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (EPD);
- Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste (EPD);
- ProPECC PN 2/97 Handling of Asbestos Containing Materials in Buildings;
- A Guide to the Chemical Waste Control Scheme (EPD); and
- Section 4.1.3 of Chapter 4 of the Project Administration Handbook (PAH) for Civil Engineering Works, Management of Construction/Demolition Materials including Rock.

### 6.3 Description of the Environment

6.3.1 The proposed improvement of Lion Rock Tunnel is located at connecting rims of Kowloon and Shatin districts. It lies across the Lion Rock and spans along the northern part of Waterloo road, Lion Rock Tunnel Road, and to the west part of the Sha Tin Road. Abundant residential uses exist along the rims of two districts while recreational uses exist on the Lion Rock side.

### 6.4 Assessment Methodology

6.4.1 The assessment of the potential waste management implications during the construction and operation phases of the Project has been conducted in accordance with Annexes 7 and 15 of the EIAO-TM, including the following tasks:-

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

6.4.2 Prior to considering the disposal options for various types of waste, opportunities for reducing waste generation, on-site or off-site reuse and recycling have been evaluated. Measures which can be taken in the planning and design phases (e.g. by modifying the design approach) and in the construction phase for maximizing waste reduction have been separately considered. Practices to promote segregation of waste materials are additionally considered for advancing the waste management efficiency.

6.4.3 After considering the opportunities for reducing waste generation and maximizing reuse, the types and quantities of the waste required to be disposed of have been estimated and the disposal options for each type of waste have been described. The disposal method recommended for each type of waste has been taken into account the result of the assessment. The impacts caused by handling (including stockpiling, labelling, packaging and storage), collection and reuse / disposal of waste have been addressed and appropriate mitigation measures have been proposed.

### 6.5 Identification and Evaluation of Wastes Implications

6.5.1 The construction of the Project is tentatively scheduled to commence in Q1 2025 for completion in 2034. The types of waste generated and their respective sources during the construction and operation phases are tabulated in **Table 6.1**.

**Table 6.1 Identification of Waste Types and Sources in the Construction and Operation Phases of the Project**

Waste Types	Sources of Waste Identified	Examples
<b>Construction Phase</b>		
Construction and Demolition (C&D) Materials	<ul style="list-style-type: none"> <li>Excavated materials from site formation works for tunnelling works including TBM, drill &amp; break tunnel and mechanical excavation</li> <li>Construction of adits, tunnel associated buildings and structures (e.g. ventilation buildings and new administration building etc.)</li> <li>Demolition of existing buildings (e.g. ventilation buildings, administration building, toll plaza etc.)</li> <li>Slope formation works</li> <li>Retaining works</li> <li>Road widening works at Kowloon and Shatin sides and road reconfiguration works</li> </ul>	Inert C&D materials <ul style="list-style-type: none"> <li>Rocks</li> <li>Soft materials (fill, etc.)</li> </ul> Non – inert C&D materials <ul style="list-style-type: none"> <li>Timbers, papers and plastic etc.</li> </ul>
Chemical waste	<ul style="list-style-type: none"> <li>Plant operations and maintenance</li> <li>Maintenance of mechanical equipment</li> <li>Demolition of existing administration building</li> </ul>	Oil and grease; scrap batteries; used paint and cleaners; asbestos waste from building demolition, etc.
General refuse	<ul style="list-style-type: none"> <li>Construction works and site-based staff and workers</li> </ul>	Food waste, containers, cans and waste papers etc.
<b>Operation Phase</b>		
Screening, grits and sludge	<ul style="list-style-type: none"> <li>On-site Sewage Treatment Plant (STP)</li> </ul>	Screening, grits and sludge
Chemical waste	<ul style="list-style-type: none"> <li>Maintenance of facilities and equipment</li> </ul>	Used paint, lubricants and used batteries etc.
General refuse	<ul style="list-style-type: none"> <li>Staff and office activities</li> </ul>	Food waste, containers, cans and waste papers etc.

## 6.6 Predication and Evaluation of Environmental Impacts

### Construction Phase

6.6.1 The types of waste generated during the construction phase include:-

- C&D Materials generated from construction of adits, ventilation buildings and new administration buildings, demolition of existing administration building, excavation and site formation works;
- Chemical Waste; and

- General Refuse.

#### *Construction and Demolition Materials*

6.6.2 The following measures have been taken to minimize quantity of C&D materials:-

##### General Approach

- Constant design reviews in striving to optimise the scheme proposals;
- Proposed use of prefabricated materials where possible;
- Reuse of existing structures in the design where possible;

##### Minimising the generation of inert C&D materials (Design and Construction Method)

- During the design for road widening works, vertical retaining member such as soldier pipe pile wall is adopted at uphill side instead of conventional R.C. L-shaped retaining walls. In the other words, temporary cutting back of slope is avoided as far as possible for the construction of conventional R.C. L-shaped retaining walls. Hence, reducing the generation of the inert C&D materials.

##### Minimising the generation of inert C&D materials (General Layout)

- For instance, a substantial section of the road widening works along LRTR at Shatin side has been modified to be carried out at the downhill areas instead (which are mostly disturbed terrain and man-made slopes). This is to minimize as far as possible the proposed works from encroaching the LRCP and natural hillsides, thus potentially reducing ecological impacts of the Project on the natural surroundings. Carrying most of the widening works downhill also substantially reduce the potential impact to the existing burial sites, and also result in significant reductions to the total amount of excavation spoil generated.
- As the impact assessments and preliminary design under this Assignment progresses, certain works proposed under the CE 30/2015 (HY) Principal Inspection of Lion Rock Tunnel and Associated Studies - Investigation (i.e. which were also reflected in the EIA Study Brief) were deemed no longer required. For instance, the section of road widening works to interface with the Revised Trunk Road T4 project along Sha Tin Road has been omitted. Omitting this section of the road widening works potentially would reduce the total amount of excavation at the upslope natural hillside, and also reduce the potential impacts (e.g. vibrations) to the cultural heritage at Tsang Tai Uk.

##### Maximise the use of inert C&D materials (Construction Programme)

- Having reviewed the construction programme, the existing Kowloon bound Tunnel enlarged by drill & break method, construction of tunnel portal structure and slope formation at Kowloon Portal are proposed to be carried out in parallel with the proposed roads widening works. Hence, the excavated soils and rocks generated from the enlargement of Kowloon bound tunnel could be used as construction filling materials such as backfilling materials at downhill side for the road widening works.
- The proposed road widening works along Lion Rock Tunnel Road primarily consist of backfilling works at downhill side while slope cutting back works at uphill side. In order to maximise the use of inert C&D materials generated from the slope cutting back works at uphill side for the proposed road widening works, it is envisaged that backfilling works at the downhill side of the proposed road widening works is scheduled to be carried out at the same time in accordance with the construction programme so as to make use of

the excavated soil and rock from the slope cutting back at uphill side for the proposed road widening works.

- 6.6.3 C&D materials would be generated from tunnelling works, site formation works, construction of adits, tunnel associated buildings and structure (e.g. ventilation buildings and new administration building), demolition of existing buildings (e.g. ventilation buildings, administration building, toll plaza etc.), slope formation works, retaining works, as well as road widening/ reconfiguration works. These C&D materials would comprise inert components such as soil, rocks, concrete, and non-inert components such as wood and metals. Based on the latest layout, the volume of C&D materials to be generated is estimated to be approximately 1,338,050 m<sup>3</sup> of inert material and 107,044 m<sup>3</sup> of non-inert materials. About 789,600 m<sup>3</sup> of total excavated materials is rock, which would be generated from tunnel construction mainly. An estimated volume of 442,250 m<sup>3</sup> is soft materials while 106,200 m<sup>3</sup> would be broken concrete. However, it should be noted that these quantities are initial estimates only and would need to be further reviewed and updated as the design progresses.
- 6.6.4 The following non-inert C&D materials would also be generated during the construction phase:-
- Timber and metal from formwork;
  - Vegetation from site formation; and
  - Papers & plastics.
- 6.6.5 About 107,044 m<sup>3</sup> of non-inert C&D materials would be generated, which would be reused and recycled as much as possible before disposal of at landfill site by trucks. In the preliminary design stage, the non-inert C&D materials would be disposed off at Tseung Kwan O South East New Territories (SENT) Landfill. It is the Contractor's responsibility to separate the inert and non-inert C&D materials on site. The maximum number of dump trucks transporting inert and non-inert C&D materials (i.e. generated from TBM Tunnel and 100m mined Tunnel at Kowloon Portal) are estimated to be 182 vehicle trips per day and 33 vehicle trips per day respectively, while inert and non-inert C&D materials (i.e. generated from site formation for tunnelling works, slope formation works at Kowloon Portal) are estimated to be 33 vehicle trips per day and 6 vehicle trips per day respectively.
- 6.6.6 A summary of inert C&D materials generated during the construction phase is shown in **Table 6.2**. The anticipated timing of wastes arising/generated from the construction activities is shown in **Table 6.3**. The location plan of works area is presented in **60604728/R42b/Figure 2.1 to 2.5**.

**Table 6.2 Summary of Inert Construction and Demolition Materials Quantities Generated**

Works Area	Volume of Inert C&D Material/Weights of Inert C&D Material (Bulk Volume, m <sup>3</sup> )		
	Rock (Grade I to III) (m <sup>3</sup> ) *	Inert C&D Material (Broken Concrete) (m <sup>3</sup> )	Inert C&D Materials (Soft Material Fill) (m <sup>3</sup> ) *
Demolition of existing Ventilation Buildings, Administration Building, Security Booth, E&M Buildings, Toll Plaza, Surge Tank and Tunnel associated Buildings	-	4,700	600

Works Area	Volume of Inert C&D Material/Weights of Inert C&D Material (Bulk Volume, m <sup>3</sup> )		
	Rock (Grade I to III) (m <sup>3</sup> ) *	Inert C&D Material (Broken Concrete) (m <sup>3</sup> )	Inert C&D Materials (Soft Material Fill) (m <sup>3</sup> ) *
Construction of New Ventilation Building at Kowloon Portal, and Surge Tank	1,000	300	70,800
Slope formation Works, Retaining Works and Proposed Noise Barriers along LRTR and at Kowloon Side	700	400	98,000
Road Widening Works at Kowloon and Shatin Sides	4,300	55,100	51,100
Site Formation for Tunnelling Works, Toll Plaza Area and Ventilation Building at Shatin Side; and Slope Formation Works at Kowloon and Shatin Portals	90,400	700	205,250
Construction of New Middle Tunnel including Cross Passage Tunnels and Demolition of Internal Partition Wall during Interim Stage	440,700	5,400	10,700
Enlargement of Existing Kowloon bound Tunnel	252,500	39,600	5,800
<b>Total</b>	<b>789,600</b>	<b>106,200</b>	<b>442,250</b>

\* - Bulking Factors of 30% for Soil and 10% for Rock have been considered.

**Table 6.3 Anticipated Timing of Wastes Arising/Generation from Construction Activities**

Works Area	Proposed Works	Anticipated Timing
Along LRTR and at Kowloon Side	Road Widening Works, Slope Formation Works and Construction of Noise Barriers	58 months
Tunnelling Works	Tunnelling Works including TBM and drill & break tunnel	27 months for TBM 46 months for drill and break tunnel
Tunnel Portal Areas	Site Formation Work, Construction of Tunnel Associated Buildings and Structures; Road Reconfiguration Works; and Slope Formation at Portal Areas	75 months
Tunnel, Tunnel Portals Areas, along LRTR and at Kowloon Side	Demolition Works of existing Building and Structures	9 months

6.6.7 Since the construction of the new middle third tunnel is round-the-clock and generates significant amount of excavated spoils, the temporary stockpiling area located to the north of the existing toll plaza is proposed accordingly. Conveyor belt systems are also proposed during TBM tunnelling for the transport of tunnel spoil to the stockpiling area for loading of dump trucks. Surplus rock generated from the Project is proposed to be recycled into aggregates and other rock products in the Lam Tei Quarry subject to the operation period of

the Quarry<sup>1</sup>. Surplus soft material is proposed to be delivered to PFRFs operated by CEDD such as Tseung Kwan O Area 137 Fill Bank for later use by other projects. The rock and soft material would all be transported by trucks, there is no barging point to be used. The maximum number of dump trucks transporting inert and non-inert C&D materials (i.e. generated from TBM Tunnel and 100m mined Tunnel at Kowloon Portal) are estimated to be 182 vehicle trips per day and 33 vehicle trips per day respectively, while inert and non-inert C&D materials (i.e. generated from site formation for tunnelling works, slope formation works at Kowloon Portal) are estimated to be 33 vehicle trips per day and 6 vehicle trips per day respectively. A C&DMMP will be prepared and submitted together with EIA Report to PFC for approval. The Project Proponent should be responsible for obtaining confirmation and approval from PFC on the allocation of the disposal site before commencement of the Project works. No construction work is allowed to proceed until all issues on management of C&D materials have been resolved with all relevant authorities including PFC and EPD. Detailed breakdown on on-site and off-site reuse of inert C&D materials generated is shown in **Table 6.4**. In view of site constraint, no crushing and sorting facilities can be provided on-site, only approximately 53,800m<sup>3</sup> of inert C&D materials is anticipated to be reused on-site. Nonetheless, it is envisaged that the reuse/recycling of the excavated rocks generated from the enlargement works of Kowloon bound tunnel as sub-base materials for other projects after reprocessing.

**Table 6.4 Summary on Arrangement of Inert C&D Materials Generated**

Works Area	Off Site Reuse (m <sup>3</sup> )			On-site Reuse (m <sup>3</sup> )		
	Rock	Concrete	Soft Material (Fill, etc)*	Rock	Concrete	Soft Material (Fill, etc)
Demolition of existing Ventilation Buildings, Administration Building, Security Booth, E&M Buildings, Toll Plaza, Surge Tank and Tunnel associated Buildings	-	4,700	600	-	-	-
Construction of New Ventilation Building at Kowloon Portal, and Surge Tank	1,000	300	70,800	-	-	-
Slope formation Works, Retaining Works and Proposed Noise Barriers along LRTR and at Kowloon Side	700	400	98,000	-	-	-
Road Widening Works	4,300	55,100	37,300	-	-	13,800
Site Formation for Tunnelling Works, Toll Plaza Area and Ventilation Building at Shatin Side; and Slope Formation Works at Kowloon and Shatin Portals	90,400	700	165,250	-	-	40,000
Construction of New Middle Tunnel including Cross	440,700	5,400	10,700	-	-	-

<sup>1</sup> Owing to the limited site area and site constraints of the Project, no crushing and sorting facilities is proposed on-site. However, an agreement will be sought with Lam Tei Quarry for processing the surplus rock for reuse in other projects during the detailed design stage.



Works Area	Off Site Reuse (m <sup>3</sup> )			On-site Reuse (m <sup>3</sup> )		
	Rock	Concrete	Soft Material (Fill, etc)*	Rock	Concrete	Soft Material (Fill, etc)
Passage Tunnels and Demolition of Internal Partition Wall during Interim Stage						
Enlargement of Existing Kowloon bound Tunnel	252,500	39,600	5,800	-	-	-
<i>Sub-total</i>	<i>789,600</i>	<i>106,200</i>	<i>388,450</i>	-	-	<i>53,800</i>
<b>Total</b>	<b>1,284,250</b>			<b>53,800</b>		

\* To be delivered to PFRFs for reuse in other projects.

6.6.8 Non-inert C&D materials will be considered for reuse/recycling as possible before disposal. Surplus non-inert C&D materials is proposed to be disposed to SENT Landfill at Tseung Kwan O.

6.6.9 The potential environmental impacts arising from handling and disposal of the C&D materials, such as air and odour emissions, noise, wastewater discharge, ecology, potential hazard and public transport, would be negligible. Appropriate measures, such as wetting and covering with canvas, should be taken to minimise potential adverse dust impacts during transportation of C&D materials. To avoid illegal dumping and landfilling, the contractor is required to present documentary proof on waste disposal at landfill and/or public fills.

#### *Chemical Waste*

6.6.10 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.

6.6.11 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 utilized. However, it is anticipated that the quantity of chemical waste, such as lubrication oil and solvent produced from plant maintenance, would be small (i.e. in the order of a few cubic metres per month) and as few as 1 ~ 3 trucks per month for transport disposal is envisaged. Nonetheless, the amount of chemical waste to be generated including the frequency of trips for disposal would be specified in the Wastes Management Plan (WMP) to be prepared by the Contractors.

6.6.12 As stipulated in the Waste Disposal (Chemical Waste) (General) Regulations, chemical wastes arisen during the construction phase may pose environmental, health and safety hazards if not stored and disposed of appropriately. These hazards may include:-

- Toxic effects to workers;

- Adverse impacts on water quality from spills; and
  - Fire hazard.
- 6.6.13 The Contractor would be required to register with EPD as a Chemical Waste Producer. Chemical waste will be collected by licensed collectors and disposed of at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi or other licensed facilities. Wherever possible opportunities should be taken to reuse and recycle materials. Mitigation and control requirements for chemical wastes are detailed in **Section 6.7.14**.
- 6.6.14 The handling, storage and disposal of chemical waste will follow the Code of Practice on Packaging, Labelling and Storage of Chemical Wastes published by EPD and the anticipated adverse environmental impacts would be negligible.
- 6.6.15 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. Building structures with asbestos will be demolished in accordance with the Air Pollution Control Ordinance and the asbestos waste will be disposed of as Part A chemical waste in accordance with Waste Disposal (Chemical Waste) (General) 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). 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.

#### *General Reuse*

- 6.6.16 Throughout construction, the workforce would generate refuse comprising food scraps, waste paper, empty containers, etc. The number of construction workers to be working on the Project at any one time is estimated to be about 500. Based on a generation rate of 0.65 kg per worker per day, appropriately 325 kg of general refuse would 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 of at NENT Landfill.
- 6.6.17 Effective collection and removal of site wastes would be required to prevent waste materials being blown around by wind, flushed or leached into the marine environment, and 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 at sites other than approved waste transfer or disposal facilities can also result in similar impacts. 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 workforce wastes.

#### Operation Phase

- 6.6.18 During the operation phase, it is anticipated that the volume of waste generation would be insignificant and the waste to be generated including:-
- Screening, grits and sludge from the on-site Sewage Treatment Plant (STP);
  - Chemical waste; and
  - General refuse.

### *Screening, Grits and Sludge*

- 6.6.19 Screening and grits would be generated at the inlet works of the on-site STP. Considering the design capacity of the on-site STP is 114m<sup>3</sup>/day, insignificant amount of screening and grits is anticipated (e.g. <0.01m<sup>3</sup>/day) and the number of containers required for disposal would be minimal. Nonetheless, the screenings and grits would be compacted and properly stored in a covered container prior being disposed of at NENT Landfill. The transportation and disposal of the screenings and grits would be managed and controlled by a reputable waste collector employed by the operators to reduce the potential pest, odour and litter impacts.
- 6.6.20 The major solid waste types produced from the on-site STP would be the sludge associated with the sewage treatment process. Owing to the small amount of wastewater would be treated by the on-site STP, minimal amount of sludge is envisaged (e.g. ~1m<sup>3</sup>/day). The surplus sludge generated from on-site STP will be trucked away to the designated Drainage Services Department (DSD) sewage treatment works (STW) (e.g. Yuen Long STW) for collaborate treatment. It is estimated that one tanker per 4 - 5 days would be required to transport the sludge for disposal. The sludge would be stored properly in covered containers to avoid odour nuisance prior to disposal. The transportation and disposal of the sludge would be managed and controlled by a reputable licensed waste collector employed by the operators to reduce the potential pest, odour and litter impacts. Provided that the recommended mitigation measures in Section 6.7.18 are properly implemented, adverse environmental impacts from the storage, handling, transport and disposal of sludge would not be anticipated.

### *Chemical Waste*

- 6.6.21 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.
- 6.6.22 Should any chemical waste be generated, the operator should register with EPD as a chemical waste producer. The chemical waste would be readily accepted for disposal of at the CWTC at Tsing Yi or other licensed facilities. This chemical waste should be collected periodically in drum-type containers by licensed chemical waste collectors. The quantities of chemical waste generated from the operation phase is considered as minimal, a few cubic metres per month would be anticipated and as few as 1 ~ 3 trucks per month for transport disposal is envisaged. With proper storage, handling and disposal of this waste, no adverse environmental impact is anticipated.

### *General Reuse*

- 6.6.23 During the operation phase, general refuse would be generated by staff and office activities. The waste includes food waste, paper, wood, plastic, office wastes, etc. As a worst case scenario, assuming the staff of all shifts are present at site, the total number of personnel to be working is estimated to be not more than 150. Based on a generation rate of 0.65 kg per worker per day, appropriately 97.5 kg of general refuse would be generated daily during the operation period. 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 contracted collectors and no more than 1 truck per day would be required for disposal of at NENT Landfill.
- 6.6.24 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 6.7** are strictly followed.

## 6.7 Mitigation of Adverse Environmental Impacts

### Construction Phase

#### *Waste Management Hierarchy*

6.7.1 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.

6.7.2 Based on the waste management hierarchy, waste reduction measures are recommended as follow 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 minimization of waste generation in the hierarchy. Environmental Management Plan (EMP) and trip-ticket system are recommended for monitoring management of waste. Specific measures targeting the mitigation of impacts in works areas and the transportation of spoil off-site would be provided to minimize the potential impacts to the surrounding environment together with recommendations on sediments management.

#### *Good Site Practices*

6.7.3 Adverse impacts related to waste management are not expected to arise, provided that good site practices are strictly followed. Recommendations for good site practices during the construction phase 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 site cleanliness, proper waste management and chemical handling procedures;
- Provision of sufficient waste disposal points and regular collection of waste;
- Appropriate measures to minimize windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers; and
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.

#### *Waste Reduction Measures*

6.7.4 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:-

- Use of steel formwork instead of timber formwork to reduce the generation of timber waste;

- 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 wastepaper, plastic bottles and aluminium cans by providing separate labelled bins to enable this waste to be segregated from other general refuse generated by the workforce;
  - Any used chemicals or those with remaining functional capacity shall be recycled.
  - Proper storage and site practices to minimize the potential for damage or contamination of construction materials; and
  - Plan and stock construction materials carefully to minimize amount of waste generated and avoid unnecessary generation of waste.
- 6.7.5 The Contractor shall prepare and implement a WMP as part of the 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 the 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 the waste management practices in the EMP throughout the construction stage of the Project. The EMP should be reviewed regularly and updated by the Contractor.

*Storage, Collection and Transportation of Waste*

- 6.7.6 Storage of materials on site may induce adverse environmental impacts if not properly managed. The recommendations to minimize the impacts include:-
- Waste should be handled and stored well to ensure secure containment, thus minimizing the potential of pollution;
  - Maintain and clean storage areas routinely;
  - Stockpiling area<sup>2</sup> should be provided with covers and water spraying system to prevent materials from wind-blown or being washed away;
  - Conveyor belt systems should be fully enclosed and equipped with water spray to suppress dust generation; and
  - Different locations should be designated to stockpile each material to enhance reuse.
- 6.7.7 Waste haulier with appropriate permits should be employed by the Contractor for the collection and transportation of waste from works areas to respective disposal outlets. The following suggestions 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;

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<sup>2</sup> The proposed temporary stockpiling area is located to the north of the existing toll plaza as illustrated in **Appendix 6.1**.

- Obtain relevant waste disposal permits from the appropriate authorities, in accordance with the Waste Disposal Ordinance (Cap. 354), Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N) 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.

6.7.8 Land transport would be used for transportation of excavated and stockpile materials. It is expected there would be a maximum of 254 vehicle trips per day for transporting waste during construction phase. The tentative transportation routings for the disposal of various types of wastes are shown in **Table 6.5**. No barging points would be established for the Project. The transportation routings may change subject to the actual traffic conditions of the roads. Nevertheless, with the implementation of appropriate mitigation measures (e.g. using water-tight containers and covered trucks), no adverse environmental impacts would be expected due to transportation of waste.

**Table 6.5 Tentative Transportation Routings for Different Types of Waste**

Treatment Facility/ Disposal Site	Type of Waste	Tentative Transportation Routing
Lam Tei Quarry*	Surplus inert C&D materials (i.e. Rock)	Via New Territories Circular Road and Tuen Mun Road
Tseung Kwan O Area 137 Fill Bank	Surplus inert C&D materials (i.e. soft material and concrete)	Via Wan Po Road
South East New Territories (SENT) Landfill	Non-inert C&D materials	Via Wan Po Road
CWTC	Chemical Waste	Via Tsing Long Highway
West New Territories (WENT) Landfill	Asbestos	Via New Territories Circular Road and Nim Wan Road
North East New Territories (NENT) Landfill	General Refuse	Via Heung Yuen Wai Highway

\*An agreement will be sought with Lam Tei Quarry for processing the surplus rock for reuse in other projects during the detailed design stage.

6.7.9 Implementation of trip ticket system with reference to DEVB TC(W) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials, to monitor disposal of waste and to control fly-tipping at PFRFs or landfills. Additionally, all dump trucks should be equipped with GPS or equivalent system for the monitoring of their travel routings and parking locations to prohibit illegal dumping and landfilling of C&D materials. A recording system for the amount of waste generated, recycled and disposed (including disposal sites) as well as travel routings and parking locations should be proposed.

6.7.10 In addition to the above measures, other specific mitigation measures on handling the C&D materials and materials generated from site formation and demolition work are recommended as follow.

*Sorting of C&D Materials*

6.7.11 Concerning the necessity of maximising reuse for the Project, it is paramount for sorting to be performed to recover the inert materials, reusable and recyclable materials before disposal off-site. All surplus C&D materials arising from or in connection with the works shall 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 sorting of C&D materials and promptly

removing all sorted and processed materials arising from the construction activities. The system should be included in the EMP, identifying the source of generation, estimated quantity, arrangement for sorting, collection, temporary storage areas (if any) and frequency of collection by recycling Contractors or frequency of off-site removal. A Construction and Demolition Material Management Plan (C&DMMP) should be prepared and submitted together with EIA Report for PFC's approval as required under Section 4.1.3 of the PAH.

6.7.12 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. The materials could be segregated according to the categories as shown below:-

- Excavated materials suitable for reuse on site;
- Excavated materials for delivery to PFRFs for beneficial reuse in other projects;
- Surplus rock to be recycled into aggregates and other rock products in the Lam Tei Quarry; and
- Non-inert C&D materials for delivery to landfills.

6.7.13 The C&D materials should at least be segregated into inert and non-inert materials, in which the inert portion could be reused and recycled as far as practicable before delivery to PFRFs for beneficial reuse in other projects. While opportunities for reusing the non-inert portion should be investigated before disposal of at designated landfills.

#### *Chemical Wastes*

6.7.14 If chemical wastes are produced at the construction site, the Contractor would 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 either the Chemical Waste Treatment Centre at Tsing Yi, or other licensed facilities, in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation*.

#### *General Refuse*

6.7.15 General refuse should be stored in enclosed bins or compaction units separate from C&D material. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from C&D material. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material. Clearly labelled recycling bins should be provided on site in order to encourage segregation and recycling of aluminium and plastic wastes, and wastepaper in order to reduce general refuse generation. The Contractor should carry out an education programme for workers in avoiding, reducing, reusing and recycling of materials generation. Posters and leaflets advising on the use of the bins should also be provided in the site as reminders. The recyclable waste materials should then be collected by reliable waste recycling agents on a regular basis.

6.7.16 **Table 6.6** provides a summary of the various waste types likely to be generated during the construction activities for the Project, together with the recommended handling and disposal methods.

**Table 6.6 Summary of Estimated Waste Arising and Recommended Arrangement**

Waste Materials Type	Generation from Work Items	Materials Generated	Total Quantity Generated	Handling Methods /Reuse	Destinations
<b>C&amp;D Materials</b>	Excavated materials from site formation works for tunnelling works including TBM and drill & break tunnel and mechanical excavation, construction of adits, tunnel associated buildings and structures (e.g. ventilation buildings and new administration building etc.), demolition of existing buildings (e.g. ventilation buildings, administration building, toll plaza etc.), slope formation works, retaining works and road widening/ reconfiguration works	Inert C&D materials – Rock and Soft Materials etc.	1,338,050 m <sup>3</sup>	<ul style="list-style-type: none"> <li>• Segregation from non-inert C&amp;D materials during stockpiling and transportation</li> <li>• Stockpile area (if required) should be well managed with covers and water spraying system</li> <li>• Covered conveyor belt to transfer tunnel spoil to stockpiling area for loading of dump trucks</li> <li>• 53,800 m<sup>3</sup> of inert C&amp;D material to be reused on-site</li> <li>• Reused in the Project, delivered to PFRFs for beneficial use in other projects or to Lam Tei Quarry for recycle</li> </ul>	<ul style="list-style-type: none"> <li>• Lam Tei Quarry</li> <li>• PFRFs</li> </ul>
		Non-inert C&D materials – Timber, Papers and Plastics etc.	107,044 m <sup>3</sup>	<ul style="list-style-type: none"> <li>• Segregation from inert C&amp;D materials during stockpiling and transportation</li> <li>• Reusable materials should be separated and recycled as far as practicable</li> </ul>	Designated Landfill (i.e. South East New Territories (SENT) Landfill)
<b>Chemical Waste</b>	Maintenance and Operation of Equipment	Oils and grease hydraulic fluids, paints, solvents, cleaners etc.	A few cubic meters per month	<ul style="list-style-type: none"> <li>• Store in compatible containers in designated area on site</li> <li>• To be collected and recycled by licensed collectors</li> </ul>	Chemical Waste Treatment Centre at Tsing Yi or other licensed facilities



Waste Materials Type	Generation from Work Items	Materials Generated	Total Quantity Generated	Handling Methods /Reuse	Destinations
	Building Demolition	Asbestos	Subject to building to be demolished	<ul style="list-style-type: none"> <li>Handled by registered asbestos contractors</li> <li>Transported by licenced waste collectors</li> </ul>	Designated landfill (i.e. West New Territories (WENT) landfill)
<b>General Refuse</b>	Workforce	Food waste, plastic aluminium cans, waste papers, etc.	325 kg/day	<ul style="list-style-type: none"> <li>Provide on-site collection points together with recycling bins</li> <li>To be collected and recycled by contracted collectors</li> </ul>	Disposed of at North East New Territories (NENT) Landfill

#### Operation Phase

6.7.17 As mentioned in Section **6.6.18 - 6.6.24**, the anticipated volume of waste generation in operation phase is insignificant. Nevertheless, mitigation measures are recommended for the identified waste types in order to minimise the potential impacts to the environment.

#### *Screening, Grits and Sludge*

6.7.18 The below good housekeeping practices should be followed to further ameliorate any odour impact from handling, collection, transportation and disposal of screenings, grits and sludge:

- Screens should be cleaned regularly to remove any accumulated organic debris;
- Screening and grit 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 trucks and containers should be washed thoroughly before leaving the new administration building to avoid any odour nuisance during transportation; and
- The screenings & grits would be collected and disposed of at NENT Landfill by a reputable waste collector, while sludge would be trucked away to the designated DSD STW (e.g. Yuen Long STW) for collaborate treatment by a reputable licensed waste collector. The disposal of screening & grits as well as sludge would be carried out on a regular basis to reduce the potential pest, odour and litter impacts.

#### *Chemical Waste*

6.7.19 The requirements given in the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes* would be followed in handling of chemical waste as in construction phase.

A trip-ticket system would be adopted by the operator to monitor disposal of chemical waste. The Contractor shall register with EPD as a chemical waste producer. The licensed collector shall deliver the waste to the CWTC at Tsing Yi, or other licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

#### *General Refuse*

- 6.7.20 Recycling of wastepaper, 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 waste by providing separated bins for storage to maximize the recyclable volume.
- 6.7.21 A reputable waste collector should be employed to remove general refuse on a daily basis to minimize odour, pest and litter impacts.

### **6.8 Evaluation of Residual Impacts**

- 6.8.1 With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste arising, no residual impact is expected during both construction and operation phases.

### **6.9 Environmental Monitoring and Audit Requirements**

#### Construction Phase

- 6.9.1 During the construction period, it is the Contractor's responsibility to ensure that all the waste produced during the construction of the Project are handled, stored and disposed of in accordance with good waste management practices, relevant legislation and waste management guidelines.
- 6.9.2 Waste materials generated during construction activities, such as C&D materials, are recommended to be audited at regular intervals to ensure that proper storage, transportation and disposal practices are implemented. This measure ensures the proper disposal of waste. The Contractor would be responsible for the implementation of any mitigation measures to minimize waste or mitigate problems arisen from waste materials.
- 6.9.3 A WMP, as 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.

#### Operation Phase

- 6.9.4 It is expected that limited quantities of waste would be generated from the operation of the Project and adverse environmental impacts would not be anticipated with the implementation of good waste management practices. Waste monitoring and audit programme for the operation phase of the Project is not required.

### **6.10 Conclusion**

- 6.10.1 C&D materials (from site formation works for tunnelling works, excavation, construction of adits, tunnel associated buildings and structures (e.g. ventilation buildings and new administration building etc.), demolition of existing buildings, slope formation works, retaining works and road widening/ reconfiguration works), general refuse (from workforce) and chemical waste (from maintenance of equipment and potential asbestos waste from building demolition) would be generated during the construction phase. Provided that these wastes are handled, transported and re-use/disposed of in a proper manner and that the recommended good site practices are strictly followed, adverse environmental impacts in

relation to hazard, air and odour emissions, noise, wastewater discharge and public transport would not be expected.

- 6.10.2 Reduction measures have been recommended to minimise the amount of materials generated in the Project. Approximately 1,338,050 m<sup>3</sup> of inert materials and 107,044 m<sup>3</sup> of non-inert materials would be generated during the construction phase of the Project. 53,800 m<sup>3</sup> of inert material would be reused on site while the remaining 1,284,250 m<sup>3</sup> of surplus C&D inert material would be recycled or transported to PFRFs for beneficial reuse in other projects. Non-inert waste would be recycled as far as possible before disposed to landfill. Opportunities in minimisation of generation and maximisation of reuse would be continually investigated during the detailed design and construction phases. The other materials that cannot be reused or recycled would be disposed to designated outlets.
- 6.10.3 The main waste types generated during the operation of the Project would be screening, grits and sludge (from the operation of on-site STP), general refuse (from staff and office activities) and chemical waste (from maintenance activities). Adverse impacts would not be anticipated if the mitigation measures are strictly followed.