

7 Waste Management Implications

7.1 Legislation, Standards and Guidelines

7.1.1 General

7.1.1.1 The relevant legislation and associated guidance notes related to the study for the assessment of waste management implications include:

- Waste Disposal Ordinance (WDO) (Cap. 354) and subsidiary Regulations;
- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499), TM-EIAO Annex 7 and Annex 15;
- Land (Miscellaneous Provisions) Ordinance (Cap. 28); and
- Public Health and Municipal Services Ordinance (Cap. 132) - Public Cleansing and Prevention of Nuisances Regulation.

7.1.1.2 Relevant regulations under the WDO include:

- Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C); and
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N).

7.1.2 Waste Disposal Ordinance

7.1.2.1 The WDO prohibits any unauthorised disposal of wastes. 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.

7.1.2.2 Under the WDO, wastes can only be disposed of at designated waste disposal facilities licensed by Environmental Protection Department (EPD). Breach of this Ordinance can lead to a fine and/or imprisonment. The WDO also stipulates the requirements for issuing licenses for the collection and transportation of wastes.

7.1.3 Waste Disposal (Chemical Waste) (General) Regulation

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

7.1.4 Waste Disposal (Charges for Disposal of Construction Waste) Regulation

7.1.4.1 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 Facilities for disposal must consist entirely of inert material.

7.1.5 Land (Miscellaneous Provisions) Ordinance

7.1.5.1 The inert portion of Construction and Demolition (C&D) materials 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 Civil Engineering and Development Department (CEDD). The ordinance requires Dumping Licenses (to be issued by CEDD) to be obtained by individuals or companies, who deliver inert C&D materials to the public filling facilities.

7.1.6 Public Cleansing and Prevention of Nuisances Regulation

7.1.6.1 This regulation provides control on illegal tipping of wastes on unauthorised (unlicensed) sites.

7.1.7 Other Relevant Guidelines

7.1.7.1 The following documents and guidelines in **Table 7.1** are also related to waste management and disposal during construction:

Table 7.1 Other relevant documents and information

Bureau	Documents / Guidelines / Technical Circulars
Development Bureau	<ul style="list-style-type: none"> • WBTC No. 2/93, Public Dumps • WBTC No. 2/93B, Public Filling Facilities • WBTC No. 16/96, Wet Soil in Public Dumps • WBTC Nos. 4/98 and 4/98A, Use of Public Fill in Reclamation and Earth Filling Projects • WBTC No. 12/2000, Fill Management • WBTC No. 19/2001, Metallic Site Hoardings and Signboards • WBTC No. 12/2002, Specifications Facilitating the Use of Recycled Aggregates • ADV-19, Practice Note for Authorized Persons and Registered Structural Engineers on Construction and Demolition Waste • ADV-21, Practice Note for Authorized Persons and Registered Structural Engineers on Management Framework for Disposal of Dredged/ Excavated Sediment • DEVB TCW No. 06/2010, Trip Ticket System for Disposal of Construction and Demolition Materials • DEVB TCW No. 08/2010, Enhanced Specifications for Site Cleanliness and Tidiness • DEVB TCW No. 09/2011, Enhanced Control Measures for Management of Public Fill
CEDD	<ul style="list-style-type: none"> • Project Administration Handbook (PAH) for Civil Engineering Works, Management of Construction/ Demolition Materials including Rocks
Environment Bureau	<ul style="list-style-type: none"> • A Guide to the Chemical Waste Control Scheme • A Guide to the Registration of Chemical Waste Producers • Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes • Monitoring of Solid Waste in Hong Kong 2016

7.2 Description of the Environment

7.2.1 Previous Environment

7.2.1.1 The Project Site was once part of the Tolo Harbour before 1970s. Since the beginning of 1970s, the Shuen Wan Landfill was then progressively reclaimed at the Project Site. The landfill commenced its operation in Year 1973 and ceased operation in Year 1995. Subsequent to the closure of the landfill site, restoration works were implemented.

7.2.2 Existing Environment

7.2.2.1 The Project Site has been served as a 145-bay golf driving range for public use since Year 1999 after completion of the restoration works at the Shuen Wan Landfill Site. EPD has been operating the management system for landfill gas and leachate systems.

7.2.2.2 There are a number of landuses including industrial (e.g. Tai Po Industrial Estate) and residential developments (e.g. Fortune Garden, Casa Marina, etc.) as well as natural terrain in the vicinity of the Project.

7.3 Construction Phase

7.3.1 Assessment Methodology

7.3.1.1 The assessment of waste management implications from handling, storage, collection, transportation and disposal of solid waste materials generated by the landuse proposals have been undertaken in accordance with Annexes 7 and 15 of the TM-EIAO.

7.3.1.2 The waste management hierarchy, which shows the desirable priority of various waste management methods, has been applied in the assessment and development of mitigation measures for waste:

- Avoidance;
- Minimisation;
- Recycling/reuse;
- Treatment; and
- Disposal.

7.3.1.3 All opportunities for reducing waste generation have been explored based upon the following factors:

- Avoiding or minimising waste generation throughout design, construction and operational phase (e.g. a balanced cut-and-fill approach would be used as much as practicable to form the terrain so as to aim for no net surplus of fill material to be transported away from the Project Site (see **Sections 2.4.11 and 2.5.10**));
- Adopting better management practices to promote segregation of waste materials;
- Reuse and recycling on-site or other projects; and
- Diverting any C&D materials to public fills as far as possible.

Analysis of Activities and Waste Generation

7.3.1.4 The quantity, quality and timing of the waste arising as a result of the construction activities of the Project and its associated works have been estimated, based on the sequence and duration of these activities. The design, general layout, construction methods and programme to minimize the generation of inert C&D materials for the construction works have been considered.

7.3.1.5 The potential management implications associated with the handling, transportation and disposal of non-inert C&D materials arising from the construction works have been assessed with reference to the following approach:

- Estimation of the types, timing and quantities of the non-inert C&D materials to be generated; and
- Assessment of the potential waste management implications on the capacity of collection, transfer and disposal facilities.

Proposal for Waste Management

7.3.1.6 Prior to considering the disposal options for various types of C&D materials, opportunities for reducing waste generated, on-site or off-site re-use and recycling have been evaluated. Measures which can be taken in the design phase (e.g. by modifying the design approach) and in the construction phase for maximising waste reduction have been separately considered.

7.3.1.7 The inert C&D materials generated by the Project would be reused on-site as fill materials using a balanced cut-and-fill approach as much as practicable so as to aim for no net surplus of fill materials to be transported away from the Project Site.

7.3.1.8 After considering all the opportunities for reducing C&D materials generation and maximising re-use, the types and quantities of the remaining wastes required to be disposed of have been estimated and the disposal options for each type of wastes have been described. The disposal method recommended for each type of wastes has taken into account the result of the assessment.

7.3.1.9 The impacts caused by handling (including labelling, packaging and storage), collection, and reuse/disposal of C&D materials have been addressed and appropriate mitigation measures have been proposed.

7.3.2 Identification and Evaluation of Waste Management Implications

7.3.2.1 The main activities which would potentially result in the generation of waste include site formation, construction of ancillary structures, roadworks and construction of utilities.

7.3.2.2 A variety of different types of waste to be generated during the construction phase can be divided into the following distinct categories based on their source and compositions:

- C&D materials from site clearance, site formation and modification of existing landfill monitoring facilities;
- C&D materials from construction of ancillary structures and pumping stations;
- C&D materials from roadworks and construction of utilities and box culvert; and
- Chemical wastes, general refuse, paper, metals, plastics etc. from general construction activities.

7.3.2.3 The estimated amount of different types of wastes to be generated during the construction phase is summarized in **Table 7.2**. It should however be noted that these quantities are preliminary estimates only and would need to be further reviewed and updated as the design evolves.

7.3.2.4 The estimated quantity of imported fill required for the construction works is about 711,400m³ and is summarised in **Table 7.2a**. Nevertheless, this amount of imported filling materials should be consulted with fill management authority of CEDD.

Table 7.2 Estimated amount of different type of C&D materials and wastes to be generated during construction phase

Activities	Approximate Quantity of C&D Material and Waste to be Generated, m ³					
	Inert C&D Materials ^{[1][5]}		Non-inert C&D Materials ^{[2][5]}		Chemical Waste ^[6]	General Refuse
	Inert Soft C&D Materials ^[3]	Artificial Hard Materials (AHM) ^[4]	Top Soil	Vegetation		
Site Clearance, Site Formation and Modification of Existing Landfill Monitoring Facilities	0	9,700	125,000	7,800	Few hundred litres/kilograms per month	122 tonne
Construction of Ancillary Structures and Pumping Stations	17,900	0	3,200	0		
Roadworks and Construction of Utilities and Box Culvert	6,500	0	2,800	100		
Total	24,400	9,700	131,000	7,900		

Notes:

- [1] “Inert C&D Material”, also known as public fill, includes debris, rubble, earth and concrete which is suitable for land reclamation and site formation.
- [2] Major “Non-inert C&D Material” involved in the Project includes top soil and vegetation. Other “Non-inert C&D Material”, if any, would be generated in insignificant quantities. In contrast to public fill, non-inert waste is not suitable for land reclamation and subject to recovery of reusable/ recyclable items, is disposed of at landfills.
- [3] “Inert Soft C&D Material” mainly refers to excavated soil, etc.
- [4] “AHM” includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.
- [5] Volume of top soil, inert soft C&D materials, AHM and vegetation are in-situ volume. Bulk factor of AHM are 1.25. Bulk factor of top soil, inert soft C&D materials and vegetation are 1.11.
- [6] Chemical waste measured by volume (litres) includes spent hydraulic oil & waste fuel, spent lubrication oil & cleaning fluids, and spent solvent. Scrap batteries are measured by weight (kilograms).

Table 7.2a Estimated amount of imported fill required during construction phase

Activities	Approximate Quantity of Imported Fill Required, m ³
Site Clearance, Site Formation and Modification of Existing Landfill Monitoring Facilities	690,500
Construction of Ancillary Structures and Pumping Stations	0
Roadworks and Construction of Utilities and Box Culvert	20,900
Total	711,400

Site Clearance, Site Formation and Modification of Existing Landfill Monitoring Facilities

7.3.2.5 Site clearance and site formation will generate AHM from demolition of existing concrete roads within the Project Site. Non-inert excavated C&D materials which mostly consist of top soil and vegetation will also be generated. Modification of existing landfill monitoring facilities including modification of landfill gas and leachate extraction wells, relocation of leachate pumphouse and associated pipeworks as well as landfill gas passive vents and groundwater monitoring wells will generate minimal amount of non-inert excavated C&D materials which mostly consist of top soil. The C&D materials generated can be referred in **Table 7.3** below.

Table 7.3 Summary of C&D materials to be generated during site formation

Inert Soft C&D Materials (m ³) [1]	AHM (m ³) [2]	Top Soil (m ³)	Vegetation (m ³)
0	9,700	125,000	7,800

Notes:

[1] "Inert Soft C&D Material" mainly refers to excavated soil, etc.

[2] "AHM" includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.

7.3.2.6 Filling will be the major activity for the proposed site formation works. The C&D materials required for filling is about 690,500 m³.

7.3.2.7 In general, excavation works of not more than 300mm from the existing ground level will be carried out to facilitate the future filling works. Special care to the cutting works shall be taken and excavation materials shall be handled with care. Prior to the commencement of the excavation works, method statement shall be submitted to EPD for approval.

Construction of Ancillary Structures and Pumping Stations

7.3.2.8 The construction of pumping stations for drainage, sewerage and leachate and ancillary structures including the main building which contains various facilities such as car park, office, shops, staff quarters, catering facilities, maintenance areas and golf driving ranges etc. will generate C&D materials during the foundation works which mostly consist of inert soft C&D materials and top soil.

7.3.2.9 The C&D materials generated can be referred in **Table 7.4** below. The inert soft C&D materials generated will be kept in a temporary storage area located at the central portion of the works area at each construction stage.

Table 7.4 Summary of C&D materials to be generated during construction of ancillary structures

Inert Soft C&D Materials (m³) [1]	AHM (m³) [2]	Top Soil (m³)	Vegetation (m³)
17,900	0	3,200	0

Notes:

[1] “Inert Soft C&D Material” mainly refers to excavated soil, etc.

[2] “AHM” includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.

Roadworks and Construction of Utilities and Box Culvert

7.3.2.10 The proposed roadworks include construction of access road connecting Ting Kok Road to the north of the Project Site with the ancillary facilities at the southeast of the Project Site. Utilities including drainage system will be constructed along the road networks. A box culvert receiving the stormwater will also be constructed underneath the access road.

7.3.2.11 The roadworks and construction of utilities and box culvert will generate C&D materials which mostly consist of inert soft C&D materials, top soil and vegetation. The C&D materials generated can be referred in **Table 7.5** below.

Table 7.5 Summary of C&D materials to be generated during roadworks and construction of utilities

Inert Soft C&D Materials (m³) [1]	AHM (m³) [2]	Top Soil (m³)	Vegetation (m³)
6,500	0	2,800	100

Notes:

[1] “Inert Soft C&D Material” mainly refers to excavated soil, etc.

[2] “AHM” includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.

7.3.2.12 Since the access road is proposed to be located above the existing ground, filling will be required to form the proposed profile of the access road, and the C&D materials required for filling is about 20,900 m³.

Chemical Waste

7.3.2.13 Materials classified as chemical waste are listed in the Waste Disposal (Chemical Waste) (General) Regulation. The main chemical waste types arising from the construction sites may include the following:

- Scrap batteries;
- Spent hydraulic oils and waste fuel;
- Spent lubrication oils and cleaning fluids from mechanical machinery; and
- Spent solvent from equipment cleaning activities.

7.3.2.14 Chemical waste may pose the following environmental, health and safety hazards if not stored and disposed of appropriately:

- Toxic effects to workers;
- Adverse effects on water and land from spills; and
- Fire hazards.

7.3.2.15 It is difficult to quantify the amount of chemical waste as it will be highly dependent on the Contractor's on-site maintenance practice and the quantities of plant and vehicles utilized. Nevertheless, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance, will be small and in the order of few hundred litres per month.

7.3.2.16 Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste published by the EPD. Chemical waste should be collected by a licensed chemical waste collector and to be disposed of at a licensed chemical waste treatment and disposal facility. Wherever possible, opportunities for the reuse and recycling of materials will be taken. Mitigation measures for chemical wastes are detailed in **Section 7.3.3**. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected.

7.3.2.17 The estimated amount of chemical waste to be generated during construction phase is summarized in **Table 7.6**.

Table 7.6 Summary of chemical waste during construction phase

Waste Type	Total Amount Generated
Scrap Batteries	A few hundred kilograms per month
Spent Hydraulic Oil and Waste Fuel	A few hundred litres per month
Spent Lubrication Oil and Cleaning Fluids	
Spent Solvent	

General Refuse

7.3.2.18 The construction workers generate refuse comprising of food waste, waste paper, aluminium cans and plastic bottles during the construction period.

7.3.2.19 The storage of general refuse may give rise to adverse environmental impacts. These could include water quality, odour and visual impact in the form of windblown litter. The construction site may also attract pests and vermin if the storage areas are not well maintained and cleaned regularly. In addition, disposal of waste at sites other than the approved disposal facilities could also lead to similar adverse impacts at those sites.

7.3.2.20 The exact number of work force (clerical and workers) to be employed for the Project is not available at this stage, but is anticipated not to be over 200 staff. Based on the generation rate of 0.65 kg/person/day, the total refuse generated per day would be less than 130 kg/day. Therefore, it is estimated that 122 tons general refuse would be generated during construction phase. The detailed breakdown of estimated amount of general refuse to be generated during construction phase is summarised in **Table 7.7**.

Table 7.7 Summary of general refuse during construction phase

Size of Work Force	Waste Generation Rate (kg/person/day)	Daily Waste Generation (kg/day)	Duration (months) ^[1]	Total Amount Generated (tonne)
200	0.65	130	36	122

Notes:

[1] Assume 26 working days per month.

7.3.2.21 In order to minimize the final disposal quantities of general refuse, provisions of recycle bins for different types of recyclable waste should be provided together with a general refuse bin. Arrangements should be made with the recycling companies to collect the recycle waste as required. The Contractor should implement an education programme for workers relating to avoiding, reducing, reusing and recycling

general waste. Participation in a local collection scheme should be considered by the Contractor to facilitate waste reduction.

7.3.2.22 Provided that the mitigation measures are adopted, the potential environmental impacts caused by the storage, handling transport and disposal of general refuse are expected to be minimal. It is recommended that general refuse should be collected on a daily basis for disposal. Mitigation measures to minimize potential environmental impacts are recommended in **Section 7.3.3**.

Transportation Arrangement for Waste Disposal and Import of Fill Materials

7.3.2.23 Land transportation should be used to deliver and dispose of the waste generated to the designated disposal outlets. It is anticipated that there will be a maximum of 120 vehicles per day for waste transportation during the construction phase (for period between Q2 2021 and Q3 2023). The tentative transportation routings for the disposal of various types of wastes generated during the construction phase are shown in **Table 7.8**. No barging points and associated conveyor systems will be established and used at the Project Site. The transportation routings may change subject to the actual traffic conditions of the roads. Nevertheless, no adverse environmental impacts are anticipated due to the transportation of waste with the implementation of appropriate mitigation measures (e.g. using water-tight containers and dump trucks equipped with mechanical cover).

Table 7.8 Tentative transportation routings for waste disposal during construction phase

Disposal Outlet	Type of Waste	Tentative Transportation Routing
NENT Landfill	Non-inert C&D Materials and General Refuse	Via Ting Kok Road, Fanling Highway, Jockey Club Road, Man Kam To Road, Wo Keng Shan Road
Chemical Waste Treatment Centre (CWTC)	Chemical Waste	Via Ting Kok Road, Tolo Highway, Tai Po Road (Sha Tin), Tsing Sha Highway, Tsing Yi Road

7.3.2.24 The inert C&D materials generated by the Project would be reused on-site as fill materials using a balanced cut-and-fill approach as much as practicable so as to aim for no net surplus of fill materials to be transported away from the Project Site. On the other hand, import of inert C&D materials would be required. Land transportation should be used to deliver the materials from Tuen Mun Area 38 Fill Bank to the Project Site. The tentative transportation routing for the import of inert C&D materials is shown in **Table 7.9**.

Table 7.9 Tentative transportation routing for the import of inert C&D materials during construction phase

Fill Material Source	Type of Waste	Tentative Transportation Routing
Tuen Mun Area 38 Fill Bank	Inert C&D Materials	Via Lung Mun Road, Lung Fu Road, Wong Chu Road, Tuen Mun Road, Yuen Long Highway, San Tin Highway, Fanling Highway, Ting Kok Road

7.3.2.25 A summary of construction waste arising from the works area with recommendation for outlets as well as construction programme for each activity is presented in **Table 7.10**. The total quantities of each type of construction waste to be generated, reused and disposed of are presented in **Table 7.11**.

Table 7.10 Summary of waste arising with recommendation for outlets during construction phase

Activities (Duration)	Waste Type		Total Amount Generated, m ³	Total Amount Reused, m ³		Total Amount Disposed, m ³	Recommended Outlets
				On-site	Off-site		
Site clearance, site formation and modification of existing landfill monitoring facilities (Q1 2021 – Q3 2023)	Inert C&D Materials ^{[1][5]}	Inert Soft C&D Materials ^[3]	0	0	0	0	-
		Artificial Hard Materials ^[4]	9,700	9,700	0	0	To be Reused on-site for site formation & roadworks
	Non-inert C&D Materials ^{[2][5]}	Top Soil	125,000	87,500	0	37,500	To be reused on-site for site formation & roadworks; Remaining to be disposed to NENT Landfill
		Vegetation	7,800	230 ^[7]	0	7,570	Disposal to NENT Landfill
Construction of ancillary structures and pumping stations (Q1 2021 – Q4 2023)	Inert C&D Materials ^{[1][5]}	Inert Soft C&D Materials ^[3]	17,900	17,900	0	0	Reused on-site for site formation & roadworks
		Artificial Hard Materials ^[4]	0	0	0	0	-
	Non-inert C&D Materials ^{[2][5]}	Top Soil	3,200	2,200	0	1,000	To be reused on-site for site formation & roadworks; Remaining to be disposed to NENT Landfill
		Vegetation	0	0	0	0	-
Roadworks and construction of utilities and box culvert (Q1 2021 – Q2 2023)	Inert C&D Materials ^{[1][5]}	Inert Soft C&D Materials ^[3]	6,500	6,500	0	0	Reused on-site for site formation & roadworks
		Artificial Hard Materials ^[4]	0	0	0	0	-
	Non-inert C&D Materials ^{[2][5]}	Top Soil	2,800	1,900	0	900	To be reused on-site for site formation & roadworks; Remaining to be disposed to NENT Landfill
		Vegetation	100	5 ^[7]	0	95	Disposal to NENT Landfill

Activities (Duration)	Waste Type	Total Amount Generated, m ³	Total Amount Reused, m ³		Total Amount Disposed, m ³	Recommended Outlets
			On-site	Off-site		
General Construction Activities (Q1 2021 – Q4 2023)	Chemical Waste ^[6]	A few hundred kilograms / litres per month	0	0	A few hundred kilograms / litres per month	To be collected by a licensed chemical waste collector and disposed of at a licensed chemical waste treatment and disposal facility
	General Refuse	122 tons	0	0	117 tons	To be disposed to NENT Landfill
	Paper, Metals, Plastics etc.		0	5 tons	0	To be collected by recycler

Notes:

- [1] “Inert C&D Material”, also known as public fill, includes debris, rubble, earth and concrete which is suitable for land reclamation and site formation.
- [2] Major “Non-inert C&D Material” involved in the Project includes top soil and vegetation. Other “Non-inert C&D Material”, if any, would be generated in insignificant quantities. In contrast to public fill, non-inert waste is not suitable for land reclamation and subject to recovery of reusable/ recyclable items, is disposed of at landfills.
- [3] “Inert Soft C&D Material” mainly refers to excavated soil, etc.
- [4] “AHM” includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.
- [5] Volume of top soil, inert soft C&D materials, AHM and vegetation are in-situ volume. Bulk factor of AHM are 1.25. Bulk factor of top soil, inert soft C&D materials and vegetation are 1.11.
- [6] Chemical waste measured by volume (litres) includes spent hydraulic oil & waste fuel, spent lubrication oil & cleaning fluids, and spent solvent. Scrap batteries are measured by weight (kilograms).
- [7] Felled trees, twigs and branches would be reused as mulch on-site as far as possible.

Table 7.11 Total quantities for each type of waste to be generated, reused and disposed of during the construction phase

Waste Type		Total Amount Generated, m ³ [5]	Total Amount Reused, m ³		Total Amount Disposed, m ³	Recommended Outlets
			On-site	Off-site		
Inert C&D Materials [1]	Inert Soft C&D Materials [3][5]	24,400	24,400	0	0	To be reused on-site for site formation & roadworks
	Artificial Hard Material [4][5]	9,700	9,700	0	0	To be reused on-site for site formation & roadworks
Non-inert C&D Materials [2]	Top Soil [5]	131,000	91,600	0	39,400	To be reused on-site for site formation & roadworks; Remaining to be disposed to NENT Landfill
	Vegetation [5]	7,900	235 [7]	0	7,665	To be disposed to NENT Landfill
Chemical Waste [6]		A few hundred kilograms / litres per month	0	0	A few hundred kilograms / litres per month	To be collected by a licensed chemical waste collector and disposed of at a licensed chemical waste treatment and disposal facility
General Refuse		122 tons	0	0	117 tons	To be disposed to NENT Landfill
Paper, Metals, Plastics etc.			0	5 tons	0	To be collected by recycler

Notes:

- [1] “Inert C&D Material”, also known as public fill, includes debris, rubble, earth and concrete which is suitable for land reclamation and site formation.
- [2] Major “Non-inert C&D Material” involved in the Project includes top soil and vegetation. Other “Non-inert C&D Material”, if any, would be generated in insignificant quantities. In contrast to public fill, non-inert waste is not suitable for land reclamation and subject to recovery of reusable/ recyclable items, is disposed of at landfills.
- [3] “Inert Soft C&D Material” mainly refers to excavated soil, etc.
- [4] “AHM” includes, but not limited to, broken concrete, asphalt, bitumen, granular materials, debris, and rubble, etc.
- [5] Volume of top soil, inert soft C&D materials, AHM and vegetation are in-situ volume. Bulk factor of AHM are 1.25. Bulk factor of top soil, inert soft C&D materials and vegetation are 1.11.
- [6] Chemical waste measured by volume (litres) includes spent hydraulic oil & waste fuel, spent lubrication oil & cleaning fluids, and spent solvent. Scrap batteries are measured by weight (kilograms).
- [7] Felled trees, twigs and branches would be reused as mulch on-site as far as possible.

7.3.3 Mitigation Measures

7.3.3.1 The mitigation measures for construction phase are recommended based on the waste management hierarchy principles. Recommendations of good site practices, waste reduction measures as well as the waste transportation, storage and collection are described in following sub-sections.

Good Site Practice

7.3.3.2 Adverse waste management implications are not expected, provided that good site practices are strictly implemented. The following good site practices are recommended throughout the construction activities:

- Nomination of an approved personnel, such as a site manager, to be responsible for the implementation of 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, appropriate waste management procedures and concepts of waste reduction, reuse and recycling;
- Provision of sufficient waste disposal points and regular collection for disposal;
- Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers;
- Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors; and
- The Contractor should prepare a Waste Management Plan (WMP) in accordance with the ADV-19 Practice Note for Authorized Persons and Registered Structural Engineers on Construction and Demolition Waste. The WMP should be submitted to the Engineer for approval. Mitigation measures proposed in the EIA Report and the EM&A Manual should be adopted.

Waste Reduction Measures

7.3.3.3 Amount of waste generation can be significantly reduced through good management and control. Waste reduction is best achieved at the planning and design phase, as well as by ensuring the implementation of good site practices. The following recommendations are proposed to achieve reduction:

- Segregate and store different types of waste in different containers, skip or stockpiles to enhance reuse or recycling of materials and their proper disposal;

- Proper storage and site practices to minimise the potential for damage and contamination of construction materials;
- Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste;
- Sort out demolition debris and excavated materials from demolition works to recover reusable/recyclable portions (i.e. soil, broken concrete, metal etc.); and
- Provide training to workers on the importance of appropriate waste management procedures, including waste reduction, reuse and recycling.

7.3.3.4 In addition to the above measures, specific mitigation measures are recommended for the specific waste types so as to minimise environmental impacts during handling, transportation and disposal of waste.

Storage, Collection and Transportation of Waste

7.3.3.5 Storage of waste on site may induce adverse environmental implications if not properly managed. The following recommendation should be implemented to minimise the impacts:

- Non-inert C&D materials such as top soil should be handled and stored well to ensure secure containment of the materials;
- Stockpiling area should be provided with covers 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.

7.3.3.6 The collection and transportation of waste from works area to respective disposal sites as well as imported fill materials from concurrent project sites to works area may also induce adverse environmental impacts if not properly managed. The following recommendation should be implemented to minimise the impacts:

- Remove waste in timely manner;
- Employ the trucks with cover or enclosed containers for waste transportation;
- Obtain relevant waste disposal permits from the appropriate authorities;
- Disposal of waste should be done at licensed waste disposal facilities; and

- All dumping trucks engaged on site be equipped with GPS or equivalent system for tracking and monitoring of their travel routings and parking locations by Environmental Team (ET) and Independent Environmental Checker (IEC) to prohibit illegal dumping and landfilling of materials; and
- Keep record and analysis of data collected by GPS or equivalent system relating to travel routings and parking locations of dump trucks engaged on site.

7.3.3.7 In addition to the above measures, other specific mitigation measures on handling the C&D materials and chemical waste generated from construction phase are recommended in the following subsections.

C&D Materials

7.3.3.8 Wherever practicable, C&D materials should be segregated from other wastes to avoid contamination and ensure acceptability at Public Fill Reception Facilities areas or reclamation sites. The following mitigation measures should be implemented in handling the C&D materials:

- Maintain temporary stockpiles and reuse excavated fill material for backfilling;
- Carry out on-site sorting;
- Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate; and
- Implement a trip-ticket system for each works contract to ensure that the disposal of C&D materials are properly documented and verified.

7.3.3.9 Details of the recommended on-site sorting and reuse of C&D materials are given below:

On-site Sorting of C&D Materials

7.3.3.10 Storage areas will be located within the site during construction phase for temporary storage of inert C&D materials. The total storage area for all the construction stages is about 57,650m² and the approximate height of the pile would be about 2m.

7.3.3.11 All C&D materials arising from the construction would be sorted on-site to recover the inert C&D materials and reusable and recyclable materials prior to disposal off-site. Non-inert portion of C&D materials should also be reused whenever possible and be disposed of at landfills as a last resort.

7.3.3.12 The Contractor would be responsible for devising a system to work for on-site sorting of C&D materials and promptly remove all sorted and processed material arising from the construction activities to minimise temporary stocking on-site. It is recommended that the system should include the identification of the source of generation, estimated quantity, arrangement for on-site sorting and/ or collection, temporary storage areas, and frequency of collection by recycling contractors or frequency of removal off-site.

Reuse of C&D Materials

7.3.3.13 The inert C&D materials generated by the Project would be reused on-site as fill materials using a balanced cut-and-fill approach as much as practicable. It is estimated that no surplus inert C&D materials would be generated through the whole construction stage. On the other hand, import of inert C&D materials would be required.

Specification of Inert C&D Materials to be Disposed off-site

7.3.3.14 In case there are surplus inert C&D materials generated in the Project and are required to be disposed of at the public fill reception facilities, the inert C&D materials should fulfil the following requirements:

- Reclaimed asphalt pavement will not be mixed with other materials when delivered to the public fill reception facilities;
- Moisture content of inert C&D materials will be lowered to 25% max. when delivered to the public fill reception facilities;
- Inert C&D materials delivered to the public fill reception facilities should be of a size less than 250mm; and
- Inert construction waste shall not be in liquid form such that it can be contained and delivered by dump truck instead of tanker truck. Inert C&D materials in liquid form shall be solidified before delivering to the public fill reception facilities.

7.3.3.15 Nevertheless, the acceptance criteria of inert C&D materials to public fill reception facilities are subject to the fill management authority of CEDD.

Use of Standard Formwork and Planning of Construction Materials Purchasing

7.3.3.16 Standard formwork should also be used as far as practicable in order to minimise the arising of non-inert C&D materials. The use of more durable formwork (e.g. metal hoarding) or plastic facing should be encouraged in order to enhance the possibility of recycling. The purchasing of construction materials should be carefully planned in order to avoid over ordering and wastage.

Provision of Wheel Washing Facilities

7.3.3.17 Wheel washing facilities have to be provided at the site entrance before the trucks leave the works area. Dust disturbance due to the trucks transportation to the public road network could be minimised by such arrangement.

General Refuse

7.3.3.18 General refuse should be stored in enclosed bins separately from construction and chemical wastes. Recycling bins should also be placed to encourage recycling. Preferably enclosed and covered areas should be provided for general refuse collection and routine cleaning for these areas should also be implemented to keep areas clean. A reputable waste collector should be employed to remove general refuse on a daily basis. It is expected that such arrangements would minimise potential environmental impacts.

Chemical Waste

7.3.3.19 For those processes which generated chemical waste, it may be possible to find alternatives to eliminate the use of chemicals, to reduce the generation quantities or to select a chemical type of less impact on environment, health and safety as far as possible.

7.3.3.20 If chemical wastes are produced at the construction site, the contractors should register with EPD as chemical waste producers. Chemical wastes should be stored in appropriate containers and collected by a licensed chemical waste collector. Chemical wastes (e.g. spent lubricant oil) should be recycled at an appropriate facility as far as possible, while the chemical waste that cannot be recycled should be disposed of at either the CWTC, or another licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

Felled Trees, Twigs and Branches

7.3.3.21 Felled trees, twigs and branches can be shredded into smaller particles of appropriate size which can be used as mulch. Mulch is applied to the soil surface modifying the soil environment and enhancing plant growth.

7.3.4 Residual Waste Management Implications

7.3.4.1 With the implementation of recommended mitigation measures for the handling, transportation and disposal of the identified waste, adverse residual waste management implications are not anticipated for the construction phase.

7.4 Operational Phase

7.4.1 Assessment Methodology

7.4.1.1 The assessment of waste management implications have been undertaken in accordance with Annexes 7 and 15 of the EIAO-TM and the EIA Study Brief No. ESB-303/2017. The waste management hierarchy comprising avoidance, minimisation, recycling/ reuse, treatment and disposal has also been adopted for the assessment.

7.4.1.2 Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generated, on-site or off-site reuse and recycling have been evaluated. After considering all the opportunities for reducing waste generation and maximising reuse, the types and quantities of the remaining wastes required to be disposed of have been estimated and the disposal options for each type of wastes have been described. The potential environmental impacts from the management of wastes have been assessed and relevant mitigation measures have been proposed.

7.4.2 Identification and Evaluation of Waste Management Implications

Provision of Option for Staff Quarters and Overnight Accommodations

7.4.2.1 As discussed in **Section 2**, in order to allow for more flexible uses and development of the Project to suit contemporary circumstances and operational requirements, the provision for staff quarters and overnight accommodations have been duly considered. As stated in **Section 2**, the original development scenario with neither staff quarters nor overnight accommodations is categorized as Scenario 1, while the additional development scenario with both staff quarters and overnight accommodations is categorized as Scenario 2. For waste management implications, the worst case of these two development scenarios will be presented. Since additional amount of wastes would be generated from golf course users, staff and visitors staying at the staff quarters or overnight accommodations under Scenario 2 as compared to Scenario 1, Scenario 2 will be presented.

7.4.2.2 The operation of the Project would generate the following categories of wastes based on their composition:

- General refuse from golf course users, visitors and staffs;
- Chemical wastes from turf management;
- Grass clippings from turf management; and
- Food waste from canteens.

General Refuse

- 7.4.2.3** General refuse will be generated from the golf course users, visitors and staffs. General refuse such as food scraps, waste paper, empty containers and packaging are expected to be generated.
- 7.4.2.4** The population intake of the golf course is not available at this stage, but is anticipated not to be over 500. With reference to the latest data from Monitoring of Solid Waste in Hong Kong 2016 by EPD, the Municipal Solid Waste (MSW) disposal rate was 1.41 kg/person/day and the recovery rate for recycling was 34%. These data indicates a generation rate of 2.14 kg/person/day. Based on the generation rate of 2.14kg/person/day, the total refuse generated per day would be less than 1,070kg/day. Therefore, it is estimated that less than 1.07 tons of general refuse would be generated per day during operational phase.
- 7.4.2.5** Provided that the mitigation measures are adopted, the potential environmental impacts caused by the storage, handling transport and disposal of general refuse are expected to be minimal. It is recommended that general refuse should be collected on a daily basis for disposal. Mitigation measures to minimize potential environmental impacts are recommended in **Section 7.4.3**.

Chemical Waste

- 7.4.2.6** Chemical waste such as lawn care products, which may include pesticides and herbicides, will be generated from turf management.
- 7.4.2.7** Chemical waste may pose the following environmental, health and safety hazards if not stored and disposed of appropriately:
- Toxic effects to workers/ visitors;
 - Adverse effects on water and land from spills; and
 - Fire hazards.
- 7.4.2.8** It is difficult to quantify the amount of chemical waste at this stage as it will dependent on the management policy and requirements of the golf course operator. Nevertheless, it is anticipated that insignificant amount of chemical waste such as lawn care products will be generated during the operational phase.
- 7.4.2.9** Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste published by the EPD. Chemical waste should be collected by a licensed chemical waste collector and to be disposed of at a licensed chemical waste treatment and disposal facility. Wherever possible, opportunities for the reuse and recycling of materials will be taken. Mitigation measures for chemical

wastes are detailed in **Section 7.4.3**. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected.

Grass Clippings and Food Waste

7.4.2.10 Grass clippings will be produced in large quantities every day from turf management. They can be used for composting, and the compost produced can be used as fertilizer or soil conditioner in the golf course. Composting can be arranged on-site using the 3-Bin Composting System. The process starts from one bin wherein the pile will be transferred to the next bin when it is full. Turning and mixing the compost pile will add oxygen and accelerate the process of decomposition. Finished compost will eventually be removed from the last bin to the end users.

7.4.2.11 Food waste will be produced from canteens at the golf course. They can also be composted on-site using composting machine.

7.4.2.12 Composting may cause potential environmental impacts including odour emissions if not being carried out appropriately. With the implementation of mitigation measures described in **Section 7.4.3**, potential environmental impacts are not expected.

7.4.3 Mitigation Measures

General Refuse

7.4.3.1 General refuse should be collected on a daily basis and delivered to the refuse transfer station accordingly. A reputable waste collector should be employed to remove general refuse regularly to avoid odour nuisance or pest/vermin problem. Sufficient recycling containers are recommended to be provided at suitable locations to encourage recycling of waste such as aluminium cans, plastics and waste paper.

Chemical Waste

7.4.3.2 If chemical wastes are expected to be produced during the operational phase, the Project Proponent should register with the EPD as a chemical waste producer and follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.

7.4.3.3 Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately.

- 7.4.3.4** Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc.
- 7.4.3.5** Licensed chemical waste collector should be deployed to transport and dispose of the chemical wastes at the approved CWTC or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

Grass Clippings and Food Waste

- 7.4.3.6** It is anticipated that grass clippings will be generated in large quantities every day from turf grass management, and the on-site composting system might not be able to process all the grass clippings all at once. Therefore, grass clippings should be temporarily stored in bays around the golf course before periodic collection for composting.
- 7.4.3.7** Food waste should be collected and stored in enclosed containers at shady, flat and ventilation locations before being composted. Contents of the storage container should be kept dry.

7.4.4 Residual Waste Management Implications

- 7.4.4.1** With the implementation of recommended mitigation measures for the handling, transportation and disposal of the identified waste, adverse residual waste management implications are not anticipated for the operational phase.

7.5 Conclusion

7.5.1 Construction Phase

- 7.5.1.1** Potential waste management implications from the generation of waste during the construction phase have been evaluated. Measures, including the opportunity for on-site sorting, reusing C&D materials etc., are devised in the construction methodology to minimise the surplus materials to be disposed. Recommendations have been made for implementation by the Contractor during the construction period to minimise waste generation and off-site disposal.

7.5.1.2 It is estimated that 24,400m³ of inert soft C&D materials would be generated in which all would be reused on-site. Besides, 9,700m³ of AHM would be generated in which all would be reused on-site. The total inert C&D materials (includes inert soft C&D materials and AHM) to be generated would be 34,100m³ in which all of them would be reused on-site. It is estimated that 131,000m³ of top soil would be generated, in which 91,600m³ would be reused on site and the remaining 39,400m³ would be disposed to NENT Landfill. Furthermore, it is estimated that 7,900m³ of vegetation would be generated. 235m³ of felled trees, twigs and branches would be reused on-site as mulch, while 7,665m³ would be disposed to NENT Landfill.

7.5.1.3 It is estimated that 122 tonne of general refuse, paper, metals, plastics, etc. would be generated, in which 5 tonne would be collected by recycler for offsite reuse and the remaining 117 tonne would be disposed to NENT Landfill. A few hundred litres / kilograms of chemical waste would be generated per month and it would be recycled by licensed facility as far as possible. The remaining chemical waste would be disposed of at CWTC.

7.5.2 Operational Phase

7.5.2.1 It is estimated that 1.07 tonne of general refuse such as food scraps, waste paper, empty containers and packaging would be generated per day. A reputable waste collector will be employed to remove general refuse regularly to avoid odour nuisance or pest/vermin problem.

7.5.2.2 Insignificant amount of chemical waste will be generated and it would be recycled by licensed facility as far as possible. The remaining chemical waste would be disposed of at CWTC.

7.5.2.3 Grass clippings and food waste will be generated from turf management and canteens respectively. They would be composed on-site and used as fertilizer or soil conditioner in the golf course.