

7 Waste Management

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 and assessment of waste management implications include:

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

7.1.1.2 Under the Waste Disposal Ordinance, some of the regulations are relevant to EIA, including:

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

7.1.2 Waste Disposal Ordinance (WDO)

7.1.2.1 The Waste Disposal Ordinance (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 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. This ordinance requires Dumping Licenses (to be issued by Civil and Engineering Development Department (CEDD)) to be obtained by individuals or companies, who deliver inert C&D materials to the public filling facilities.

7.1.5.2 Individual licenses and windscreen stickers are issued for each vehicle involved. Public filling areas will accept only inert building debris, soil, rock and broken concrete. The material should, however, be free from marine mud, household refuse, plastic, metal, individual and chemical wastes, animal and vegetable matters and any other materials considered unsuitable by the Filling Supervisor.

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 Construction & Demolition Material Management Plan (C&DMMP)

7.1.7.1 According to the “Project Administrative Handbook Chapter 4, Section 4.1.3”, for Designated Projects, a Construction and Demolition Material Management Plan (C&DMMP) has to be submitted to the Public Fill Committee (PFC) for approval in case of C&D materials disposal exceeding 50,000m³.

7.1.7.2 The C&DMMP was submitted to and approved by the CEDD Vetting Committee on C&D Material Management. The C&DMMP was then subsequently submitted to the PFC for approval on January 2016 and is under their consideration.

7.1.7.3 ETWB TCW No. 19/2005, Environmental Management on Construction Site, sets out the policy, procedures and requirements for contractor to prepare and implement an Environmental Management Plan for on-site sorting and waste reduction of C&D materials.

7.1.8 Other Relevant Guidelines

7.1.8.1 The following documents and guidelines in **Table 7.1** also relate to waste management and disposal:

Table 7.1 Other relevant documents and information

Bureau / Department	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 Project • WBTC No. 12/2000, Fill Management • WBTC No. 19/2001, Metallic Site Hoardings and Signboards • WBTC No. 12/2002, Specification Facilitating the Use of Recycled Aggregates • ETWB TCW No. 34/2002, Management of Dredged / Excavated Sediment • ETWB TCW No. 19/2005, Environmental Management on Construction Site • DEVB TCW No. 06/2010, Trip-ticket System for Disposal of Construction and Demolition Material • 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
CEDD	<ul style="list-style-type: none"> • Project Administrative Handbook for Civil Engineering Works, 2012 Edition
EPD / CEDD	<ul style="list-style-type: none"> • New Disposal Arrangements for Construction Waste (1992)
EPD	<ul style="list-style-type: none"> • Waste Disposal Plan for Hong Kong (December 1989) • Waste Reduction Framework Plan, 1998 to 2007 • A Policy Framework for Management of Municipal Solid Waste (2005 -2014), (December 2005) • Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992) • Practice Guide for Investigation and Remediation of Contaminated Land (2011)

Bureau / Department	Documents / Guidelines / Technical Circulars
	<ul style="list-style-type: none"> Guidance Note for Contaminated Land Assessment and Remediation, (2007) Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management, (2007)
PlanD	<ul style="list-style-type: none"> Hong Kong Planning Standards and Guidelines, Chapter 9 (Section 6 – Waste Management)

7.2 Description of the Environment

7.2.1 Existing Environment

7.2.1.1 As discussed in **Section 1.2** and illustrated in **Figures 1.1** and **1.2**, the Project comprises of the site formation for the C&C facilities at Sandy Ridge and the road widening works at Lin Ma Hang Road. The road widening works at Lin Ma Hang Road is about 1.5 km long and located to the northeast of Man Kam To Road.

7.2.2 Baseline Conditions

7.2.2.1 Within the project boundary, there are a number of landuses including the existing Sandy Ridge Cemetery, natural terrain, MacIntosh Fort at the north of the project boundary, an open storage area near Man Kam To Road and Lin Ma Hang Road to the east of Sandy Ridge.

7.2.2.2 The existing solid wastes arising from the landuses within the project boundary would include general refuse generated from existing cemetery. As the Project is located among the hill terrains, there will be no sediment/mud excavated.

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 proposal have been undertaken in accordance with Annexes 7 and 15 of the TM-EIAO and the EIA Study Brief No. 271/2014.

7.3.1.2 The waste management hierarchy has been applied in the assessment and development of mitigation measures for waste. The waste management hierarchy is a concept which shows the desirability of various waste management methods and comprises the following in order of preference:

- avoidance;
- minimisation;

- recycling/reuse;
- treatment; and
- disposal.

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

- avoiding or minimising waste generation throughout design, construction and operational phase;
- adopting better management practices to promote segregation materials;
- reuse and recycling on site or other projects; and
- diverting inert 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 minimise the generation of inert C&D materials for the construction works have been considered.

7.3.1.5 The potential waste 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 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.

7.3.1.8 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 of Environmental Impacts

7.3.2.1 The waste management implication during construction phase of the following areas have been assessed and presented in the following sub-sections;

- the site formation and associated infrastructure for C&C facilities at Sandy Ridge Cemetery;
- the road networks including viaduct connecting from the platform to Man Kam To Road; and
- a section of Lin Ma Hang Road widening.

7.3.3 Prediction and Evaluation of Environmental Impacts

7.3.3.1 The main activities which would potentially result in the generation of waste include the site formation, roads construction, infrastructure construction and widening works.

7.3.3.2 A variety of different types of waste would be generated during the construction phase that can be divided into the following distinct categories based on their compositions:

- C&D materials from clearance;
- C&D materials from site formation;
- C&D materials from construction of infrastructure;
- C&D materials from construction of viaduct;
- C&D materials chemical wastes;
- general refuse; and
- sewage.

7.3.3.3 The construction period of the proposed development will tentatively be from mid 2017 to late 2022. The estimated amount of different types of wastes to be generated during the construction phase is summarized in **Table 7.2**.

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 ^[4]							
	Inert C&D Materials			Non-inert C&D Materials		Chemical Waste	General Refuse	Sewage
	Inert soft C&D Material ^[1]	Rock ^[2]	Artificial Hard Materials (AHM) ^[3]	Top Soil	Vegetation			
Site formation	373,100	491,300	700	21,000	600	Few hundred litres/kilograms per month	140 tonne	45m ³ /day
Construction of new road with viaduct	100	-	-	300	-			
Construction of infrastructure along Man Kam To Road	2,100	-	400	-	-			
Road widening of Lin Ma Hang Road	22,000	1,700	2,600	-	100			

Note:

- [1] “Inert soft C&D material” includes, but not limited to excavated soil, etc.
- [2] “Rock” includes all grade rock.
- [3] “AHM” includes, but not limited to, broken concrete, asphalt, bitumen and granular materials, etc.
- [4] Volume of top soil, inert soft C&D materials, rock, AHM and vegetation are in-situ volume. Bulk factor of rock and AHM are 1.25. Bulk factor of top soil, inert soft C&D materials and vegetation are 1.11.
- [5] Top soil and vegetation are generated from site clearance for the corresponding construction activities.

Site Formation

- 7.3.3.4** For the proposed site formation, it is estimated that, approximately 373,100m³ of inert soft C&D materials, 491,300m³ of rock, 700m³ of artificial hard material (AHM), 21,000m³ of top soil and 600m³ of vegetation would be generated. In order to re-use as much as the inert soft C&D materials as possible, 385,700m³ of backfilling material would come from 216,800m³ of inert soft C&D material and 168,200m³ of rock and 700m³ of AHM generated from site formation.
- 7.3.3.5** In order to re-use the inert soft C&D materials as much as possible, the surplus inert soft C&D materials due to site formation works could be reused off-site and for other working areas of this project. In view of this, the required fill materials for the construction of new road with viaduct as mentioned below that could not be absolutely provided from its working area would also be taken into account. 12,590m³ of inert soft C&D materials and 10,710m³ of rock generated in site formation will be reused in road and viaduct construction. The remaining surplus inert C&D materials, i.e. 143,710m³ of inert soft C&D materials and 312,390m³ of rock will be reused in other concurrent projects.
- 7.3.3.6** The material that could be reused will be kept in a temporary stockpile located at the platform level +50mPD (i.e. Middle of C&C facilities) with an approximate area of 9,000m².
- 7.3.3.7** To summarise, there will be total 865,100m³ of inert C&D materials (including 373,100m³ of inert soft C&D materials, 491,300m³ of rock and 700m³ of AHM) generated. 409,000m³ of the inert C&D materials will be reused for site formation and viaduct construction, and the remaining 456,100m³ will be reused in other concurrent projects. A total of 21,000m³ of top soil and 600m³ of vegetation, will be disposed of at North East New Territories (NENT) Landfill. According to the current tentative construction programme (See **Appendix 3.1**), off-site disposal of the both inert and non-inert C&D materials would be required between 3rd quarter 2017 and 4th quarter 2021.
- 7.3.3.8** As discussed in **Section 7.1.7** a C&DMMP shall be submitted to the PFC for approval in the case of C&D materials disposal exceeding 50,000m³. The C&DMMP was submitted to the PFC January 2016 after being approved by the CEDD Vetting Committee. The C&DMMP is currently under the consideration of the PFC.

Construction of New Road with Viaduct Connecting Man Kam To Road

- 7.3.3.9** An approximately 300m long viaduct will be constructed along a connection road to facilitate access to the proposed Sandy Ridge C&C facilities. The viaduct will extend westward from the eastern section of the Project boundary.
- 7.3.3.10** The construction of the viaduct will generate C&D materials during the foundation works and piling works, which mainly consist of inert soft C&D materials and rock.

- 7.3.3.11** It is estimated that in total, approximately 100m³ of inert soft C&D materials and 300m³ of top soil would be generated from the construction of the proposed new road with viaduct.
- 7.3.3.12** All of the 300m³ of top soil would be disposed of at NENT Landfill.
- 7.3.3.13** In summary, 100m³ of inert soft C&D materials generated from construction of new road with viaduct, 12,590m³ of inert soft C&D materials and 10,710m³ of rock generated from site formation will be reused for construction of new road with viaduct .
- 7.3.3.14** The material that could be reused will be kept in a temporary stockpile located at the platform level +50mPD (i.e. Middle of C&C facilities) with an approximate area of 9,000m².
- 7.3.3.15** According to the current tentative construction programme, off-site disposal of top soil would be required in the period from 3rd quarter 2019 to 4th quarter 2022.

Construction of Infrastructure along Man Kam To Road

- 7.3.3.16** To facilitate the development of C&C facilities, approximately 2,800m long DN350 fresh water main is proposed to be laid along Man Kam To Road to immediate downhill of the Table Hill Fresh Water Service Reservoir at Man Kam To Road.
- 7.3.3.17** It is estimated that, approximately 2,100m³ of inert soft C&D materials and 400m³ of AHM would be generated.
- 7.3.3.18** It is anticipated that 1,700m³ of inert soft C&D material would be reused on-site as backfilling material. The surplus 400m³ of inert soft C&D materials and 400m³ AHM will be reused in other concurrent projects.
- 7.3.3.19** According to the current tentative construction programme, off-site disposal of the inert soft C&D materials and AHM would be from 1st quarter 2020 to 2nd quarter 2022.

Road Widening of Lin Ma Hang Road

- 7.3.3.20** The improvement of about 1.4km long Lin Ma Hang Road involves widening of the existing carriageway width to 7.3m with 2m footpath on both sides as well as the installation of the noise barriers and low noise road surfacing materials along some sections of the road and associated slope works.
- 7.3.3.21** It is estimated that, approximately 22,000m³ of inert soft C&D material, 1,700m³ of rock, 2,600m³ of AHM and 100m³ of vegetation would be generated.
- 7.3.3.22** It is anticipated that 1,300m³ of the inert soft C&D materials and 100m³ of rock will be reused on-site as backfilling material. The remaining inert C&D materials, i.e. 20,700m³ of inert soft C&D materials, 1,600m³ of rock and 2,600m³ of AHM will be reused in other concurrent projects between 3rd quarter 2019 and 2nd quarter 2022.

7.3.3.23 The estimated 100m³ of vegetation will be disposed of at NENT Landfill from 3rd quarter 2019 and 2nd quarter 2022.

Chemical Waste

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

- scrap batteries;
- spent hydraulic oil and waste fuel;
- spent lubrication oil and cleaning fluids from mechanical machinery; and
- spent solvent from equipment cleaning activities.

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

- toxic effects to workers;
- adverse impacts on water quality from spills and associated adverse impacts on fresh water biota); and
- fire hazards.

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

7.3.3.27 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 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 **Sections 7.3.4**. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

7.3.3.28 The estimated amount of chemical waste to be generated during construction phase is summarised in **Table 7.3**.

Table 7.3: Summary of chemical waste during construction phase

Waste Type	Total Amount Generated
Scrap batteries	A few hundred kilograms per month

Waste Type	Total Amount Generated
Spent hydraulic oil and waste fuel	A few hundred litres per month
Spent lubrication oil and cleaning fluids	
Spent solvent	

General Refuse

- 7.3.3.29** The construction workers would generate refuse comprising food wastes, waste paper, aluminium cans and plastic bottles during the construction period.
- 7.3.3.30** The storage of general refuse may give rise to adverse environmental impacts. These could include water quality, odour and visual impact; and 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 non-inert C&D materials at sites other than the approved disposal facilities could also lead to similar adverse impacts at those sites.
- 7.3.3.31** There will be a work force of approximately 190 people comprising of 150 construction workers and 40 site staff. Based on the generation rate of 0.65 kg/person/day, the total refuse generated per day would be about 124 kg/day. The estimated amount of general refuse generated during construction phase is summarised in **Table 7.4**.

Table 7.4: Summary of general refuse during construction phase

No. of Work Force	Waste Generation Rate, kg/person/day	Daily Waste Generation, kg/day	Duration, month	Total Amount Generated, tonne ^[1]
190	0.65	124	42	140

Note:

[1] Assume 26 working days per month, rounded to the nearest 10 tonne.

[2] Construction period: 3rd quarter 2017 – 4th quarter 2022.

- 7.3.3.32** In order to minimise 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. It is estimated that about 15 tonne of paper, metals, plastics, etc would be reused (assumed about 10% of the general refuse would be reused). 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.
- 7.3.3.33** 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 minimise potential environmental impacts are recommended in **Section 7.3.4**. With the proper implementation of the

recommended mitigation measures, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

Sewage

- 7.3.3.34** The sewage generated by the construction workers should be properly managed to minimise the adverse impact of odour and potential health risks to the workers by attracting pests and other disease vectors.
- 7.3.3.35** Adequate portable chemical toilets should be provided to ensure all sewage is properly collected. It is anticipated that there would be no adverse environmental implications if the chemical toilets are properly maintained and licensed collectors are employed for the collection and disposal of sewage on a regular basis. Advanced notification and approval should be made to authorities prior to connection.
- 7.3.3.36** There will be a work force of 190 people comprising of 150 construction workers and 40 site staff. Site staff would be office based and use septic tanks whilst portable chemical toilets would be used on site by construction workers. According to Table T-2 of Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, the unit flow is 0.23 m³/person/day, the total sewage generated per day would be 45m³/day.
- 7.3.3.37** With the implementation of mitigation measures described in **Section 7.3.4**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

Construction Phase Waste Summary

- 7.3.3.38** A summary of the construction waste arising from the works area with recommendation for outlets as well as the construction programme for each activity is presented in **Table 7.5**. The total quantities of each type of non-inert C&D materials to be generated, reused and disposed of are presented in **Table 7.6**.

Table 7.5: 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 formation (Q3 2017 to Q4 2021)	Inert C&D Materials	373,100	216,800	-	0	Reused on-site (site formation)		
			-	12,590		Reused on-site (construction of new road with viaduct)		
			-	143,710		Reused off-site in other concurrent projects		
	Rock ^[2]	491,300	168,200	-	0	Reused on-site (site formation)		
			-	10,710		Reused on-site (construction of new road with viaduct)		
			-	312,390		Reused off-site in other concurrent projects		
	Artificial Hard Material ^[3]	700	700	0	0	Reused on-site (site formation)		
			Non-inert C&D Materials	0		0	21,000	Disposal to NENT Landfill
			Vegetation	0		0	600	Disposal to NENT Landfill
Construction of new road with viaduct (Q3 2019 to Q4 2022)	Inert C&D Materials	100	100	0	0	Reused on-site (construction of new road with viaduct)		
			Non-inert C&D Materials	0		0	300	Disposal to NENT Landfill
Construction of infrastructure along Man Kam To Road (Q1 2020 to Q2 2022)	Inert C&D Materials	2,100	1,700	0	0	Reused on-site (Infrastructure along Man Kam To Road)		
			0	400		Reused off-site in other concurrent projects		
			0	400		Reused off-site in other concurrent projects		
Road widening of Lin Ma Hang Road	Inert C&D Materials	22,000	1,300	0	0	Reused on-site (road widening of Lin Ma Hang Road)		
			0	20,700		Reused off-site in other concurrent projects		

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		
(Q3 2019 to Q2 2022)	Rock ^[2]	1,700	100	0	0	Reused on-site (road widening of Lin Ma Hang Road)
			0	1,600		
	Artificial Hard Material ^[3]	2,600	0	2,600	0	Reused off-site in other concurrent projects
General construction activities (Q3 2017 to Q4 2022)	Non-inert C&D Materials	100	0	0	100	Disposal to NENT Landfill
	General refuse Paper, metals, plastics etc.	140 tonne	15 tonne		125 tonne	Disposal to NENT Landfill Collected by recycler
	Chemical waste ^[5]	Few hundred litres / kilograms per month	Few hundred litres / kilograms per month			
Sewage		45m ³ /day	0		45m ³ /day	Chemical toilets to be collected and disposed by licensed collector

Note:

- [1] “Inert soft C&D material” includes, but not limited to, excavated soil.
- [2] “Rock” includes all grade rock.
- [3] “Artificial hard material” includes, but not limited to, broken concrete, asphalt, bitumen and granular materials, etc.
- [4] Volume of top soil, inert soft C&D material, rock, AHM and vegetation are in-situ volume. Bulk factor of rock and AHM are 1.25. Bulk factor of top soil, inert soft C&D material and vegetation are 1.11.
- [5] 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 7.6: 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	Total Amount Reused, m ³		Total Amount Disposed, m ³	Recommended Outlets
		On-site (In C&C project)	Off-site (In other concurrent projects)		
Inert C&D Materials	Inert soft C&D materials ^[1]	232,490	164,810	0	Reused on-site in C&C project; and Reused off-site in other concurrent projects.
	Rock ^[2]	179,010	313,990	0	Reused on-site in C&C project; and Reused off-site in other concurrent projects.
	Artificial Hard Material ^[3]	700	3,000	0	Reused on-site in C&C project; and Reused off-site in other concurrent projects.
Non-inert C&D Materials	Top Soil	0	0	21,300	Disposal to NENT Landfill
	Vegetation	700	0	700	Disposal to NENT Landfill
General refuse	140 tonne	15 tonne		125 tonne	Disposal to NENT Landfill
Paper, metals, plastics etc.					Collected by recycler
Chemical waste ^[5]	Few hundred litres / kilograms per month	Few hundred litres / kilograms per month			Recycled by licensed facility as far as possible. Remainder disposed of at CWTC
Sewage	45m ³ / day	0		45m ³ / day	Chemical toilets to be collected and disposed by licensed collector

Note:

- [1] "Inert soft C&D materials" includes, but not limited to, excavated soil.
 [2] "Rock" includes all grade rock.
 [3] "AHM" includes, but not limited to, broken concrete, asphalt, bitumen and granular materials, etc.
 [4] Volume of top soil, inert soft C&D materials, rock, AHM and vegetation are in-situ volume. Bulk factor of rock and AHM are 1.25. Bulk factor of top soil, inert soft C&D materials and vegetation are 1.1.
 [5] 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).

7.3.4 Mitigation Measures

7.3.4.1 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

7.3.4.2 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
- a Waste Management Plan (WMP) should be prepared by the contractor and submitted to the Engineer for approval.

Waste Reduction Measures

7.3.4.3 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.

7.3.4.4 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

7.3.4.5 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 soil should be handled and stored well to ensure secure containment;
- 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.

7.3.4.6 The collection and transportation of non-inert C&D materials from works area to respective disposal sites 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; and
- disposal of waste should be done at licensed waste disposal facilities.

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

Excavated and C&D Materials

7.3.4.8 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 excavated and 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.

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

On-site Sorting of C&D Materials

7.3.4.10 A stockpile area will be located within the site during construction phase for temporary storage of inert C&D materials. The stockpile area is about 9,000m² at the platform +50mPD at southern portion of C&C facilities, and the approximate height of the stockpile would be about 1m.

7.3.4.11 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.

7.3.4.12 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

7.3.4.13 It is estimated that surplus C&D materials would be generated throughout the whole construction stage. The construction programme would be reviewed at a later stage to maximise the quantity of on-site reuse of surplus C&D materials whenever opportunity arises.

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

7.3.4.14 In case the surplus inert C&D materials generated in the Project is 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.

Use of Standard Formwork and Planning of Construction Materials

Purchasing

7.3.4.15 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 Wash Facilities

7.3.4.16 Wheel wash 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.

Chemical Waste

7.3.4.17 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.

7.3.4.18 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 contractor. 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.

General Refuse

7.3.4.19 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.

Sewage

7.3.4.20 The Waste Management Plan should document the locations and number of portable chemical toilets depending on the number of workers, land availability, site condition and activities. Regular collection by licensed collectors should be arranged to minimise potential environmental impacts.

7.3.5 Residual Environmental Impacts

7.3.5.1 With the implementation of the 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 TM-EIAO and the EIA Study Brief No. 271/2014. 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 re-use and recycling have been evaluated.

7.4.1.3 After considering all the opportunities for reducing waste generation and maximising re-use, the types and quantities of the remaining non-inert C&D materials 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.

7.4.1.4 The details of the assessment methodology could be referred to **Section 7.3.1**.

7.4.2 Identification of Environmental Impacts

7.4.2.1 The waste management implication during operational phase of the following areas have been assessed and presented in the following sub-sections;

- the roads network for the C&C facilities;
- a section of Lin Ma Hang Road widening; and
- Visitor / staff to the columbarium / crematorium

7.4.3 Prediction and Evaluation of Environmental Impacts

7.4.3.1 During operational phase, it is expected that road cleaning activities would be carried out regularly along the road networks for the C&C facilities and Lin Ma Hang Road. General refuse mainly comprising debris, waste paper and plastic bottle etc. generated from the road user would be collected. In addition, a total of 5,000 and 87,000 people (include staff and visitor) will access columbarium and crematorium during weekdays and festivals respectively. However, it is anticipated that the quantity of general refuse is not significant.

7.4.4 Mitigation Measures

7.4.4.1 A reputable waste collector should be employed to remove general refuse during routine road cleaning activities on the roads network for the C&C facilities and Lin Ma Hang Road.

7.4.5 Residual Environmental Impacts

7.4.5.1 With the implementation of the recommended mitigation measures, 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 397,300m³ of inert soft C&D materials would be generated in which 232,490m³ would be reused on-site and the remaining 164,810m³ would be reused off-site in other concurrent projects. A total of 493,000m³ of rock would be generated in which 179,010m³ would be reused on-site and the remaining 313,990m³ would be reused off-site in other concurrent projects. Besides, 3,700m³ of AHM would be generated in which 700m³ would be reused on-site and the remaining 3,000m³ would be reused off-site in other concurrent projects. The total inert C&D materials (includes inert soft C&D materials, rock and AHM) to be generated would be 894,000m³, in which 412,200m³ of them will be reused on-site and the remaining 481,800m³ will be reused in other concurrent projects. It is estimated that 21,300m³ of top soil and 700m³ of vegetation would be generated and all of them will be disposed to NENT Landfill.

7.5.1.3 It is estimated that 140 tonne of general refuse, paper, metals, plastics, etc. would be generated, in which 15 tonne will be reused on-site and the remaining 125 tonne will be collected by recycler and/or disposed to NENT Landfill. A few hundred litres / kilograms of chemical waste will 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. 45m³/day of sewage will be generated and the chemical toilets will be collected and disposed by licensed collector.

7.5.2 Operational Phase

7.5.2.1 It is anticipated that an insignificant amount of general refuse would be generated during the operational phase from the routine road cleaning activities along the roads network for the C&C facilities and Lin Ma Hang Road.