7 Waste Management Implications

7.1 Overview

This section identifies the quality and quantity of waste generated from construction and operational phase of the Project, and evaluates the potential waste management implications that may result from waste generated during these phases. The assessment has covered the entire Lok Ma Chau Loop (Area A) as shown in **Figure 1.1** (hereby refers to LMC Loop) as well as the assessment area including footprint of associated infrastructure, working space and works area for the associated infrastructure in adjacent area in Hong Kong outside the LMC Loop. The locations of the assessment area for the associated infrastructure in adjacent area in Hong Kong outside LMC Loop can be referred to Figure 1.4 of **Appendix 8-3**.

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

The waste management implications have been assessed in accordance with the requirements of Annex 7 and Annex 15 of the TM-EIAO as well as the requirements set out under Clause 3.4.8 of the EIA Study Brief.

7.2 Environmental Legislation, Standards and Guidelines

The relevant legislation and associated guidance notes relate 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), Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO) Annex 7 and Annex 15;
- Dumping at Sea Ordinance (Cap. 466);
- Land (Miscellaneous Provisions) Ordinance (Cap 28); and
- Public Health and Municipal Service Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances Regulation.

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).

7.2.1 Waste Disposal Ordinance (WDO)

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.

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.

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

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.

7.2.3 Waste Disposal (Chemical Waste) (General) Regulation

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.

7.2.4 Dumping at Sea Ordinance

According to this Ordinance, a permit from EPD is required if any waste producer intend to dump materials from vessels to designated marine dumping areas. The Authority will consider a number of factors including sources and nature of materials to be dumped, dumping rates, need for inspection/ testing, water pollution avoidance measures etc. before determining whether such a permit would be granted and, where deemed necessary, any conditions to be complied with.

7.2.5 Land (Miscellaneous Provisions) Ordinance

The inert portion of 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 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.

7.2.6 Public Cleansing and Prevention of Nuisances Regulation

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

7.2.7 Construction & Demolition (C&D) Material Management Plan

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 50,000m^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.

The project C&DMMP had been endorsed by PFC on October 2012 and CEDD Vetting Committee on September 2012. The endorsement letters have been given in **Appendix 7-1**.

7.2.8 Disposal Criteria for Dredged / Excavated Sediment

ETWB TCW No. 34/2002 stipulates the procedures for seeking approval to dredge or excavate marine sediment and the management framework for its disposal of such sediment. Applications for approval of dredging proposal and allocation of marine disposal shall be made to the Secretary of Marine Fill Committee (MFC). Marine Dumping Permits as stipulated under the Dumping at Sea Ordinance are required from EPD for the disposal of dredged sediment. No dredging works is allowed to proceed until all issues on management of dredged sediments have been resolved and all relevant arrangements have been endorsed by the relevant authorities including MFC and EPD. Exact location for marine disposal will be assigned by MFC.

7.2.9 Other Relevant Guidelines

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	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

Bureau / Department	Documents / Guidelines / Technical Circulars
	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 Project Administrative Handbook for Civil Engineering Works, 2010 Edition, Section 4.1.3 of Chapter 4
CEDD	Project Administrative Handbook for Civil Engineering Works, 2010 Edition
EPD / CEDD	New Disposal Arrangements for Construction Waste (1992)
EPD	Waste Disposal Plan for Hong Kong (December 1989) Waste Reduction Framework Plan, 1998 to 2008 A Policy Framework for Management of Municipal Solid Waste (2005 -2014), (December 2005) Code of Practice on the Packaging, Labeling and Storage of Chemical Wastes (1992) Practice Guide for Investigation and Remediation of Contaminated Land (2011) Guidance Note for Contaminated Land Assessment and Remediation, (2007) Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management, (2007)
PlanD	Hong Kong Planning Standards and Guidelines, Chapter 9 (Section 6 – Waste Management)

7.3 Description of the Environment

7.3.1 Waste Handling and Management

LMC Loop is the land area which was formulated in 1997 from the disposal of mud extracted from the training works for the Shenzhen River, some of which were contaminated. The area is a flat land with grasses, shrubs and has been left vacant since its formation.

Adjacent area in Hong Kong outside LMC Loop is intended to provide the infrastructures (e.g. connection roads and service reservoir) supporting the development of the LMC Loop. A large part of these area falls within the Frontier Closed Area (FCA) and is characterized by essentially rural land uses including arable farming and fish ponds.

The area around the San Tin Roundabout has been occupied for uses closely related to the cross-boundary activities. These include open car parks and open storage compounds for the cross-boundary commuters and goods, as well as a public transport interchange for cross-boundary shuttle bus services.

The existing waste arising from the landuse of the Project include domestic waste from traditional village houses, agricultural waste from the existing farming, fisheries, livestock rearing (rare) and horticulture, which are collected and transported to designated waste facilities. Major existing waste facilities serving the Project are shown in **Table 7.2**.

Table 7.2 Summary of existing waste facilities serving the Project

Waste Facilities	Date of Commission	Design Capacity
Strategic Landfills		
NENT	1995	35 Mm^3
Refuse Transfer Stations		
North West New Territories (NWNTRTS) at Shun Tat Street, Tuen Mun (near Lam Tei)	2001	1,100 tpd
Special Waste Facilities		
Sha Ling Livestock Waste Composting Plant and livestock waste collection service	1991	20 tpd
Ngau Tam Mei Animal Waste Composting Plant	2008	20 tpd
Chemical Waste Treatment Centre	1993	100,000 tonnes per year

7.4 Assessment Methodology

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 and the EIA Study Brief.

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.

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 C&D materials to Public Fill Reception Facilities as far as possible.

7.4.1 Analysis of Activities and Waste Generation

The quantity, quality and timing of the waste arising as a result of the construction and operation activities of the LMC Loop Project and 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 public fill/inert C&D materials for other construction works have been considered.

The potential waste management implications associated with the handling, transportation and disposal of waste arising from the construction works have been assessed with reference to the following approach:

- estimation of the types, timing and quantities of the wastes to be generated and fill to be imported; and
- assessment of the potential waste management implications on the capacity of collection, transfer and disposal facilities.

The waste generation rate adopted in the assessment is based on statistical data and previous studies including *Monitoring of Solid Waste in Hong Kong – Waste Statistics for 2010*, and *Reduction of Construction Waste Final Report (Hong Kong Polytechnics, 1993)*.

7.4.2 Proposal for Waste Management

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. Measures which can be taken in the planning and design phases (e.g. by modifying the design approach) and in the construction phase for maximizing waste reduction have been separately considered.

After considering all the opportunities for reducing waste generation and maximizing 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.

The impacts caused by handling (including labelling, packaging and storage), collection, and reuse/disposal of wastes has been addressed and appropriate mitigation measures have been proposed.

7.5 Identification and Evaluation of Waste Management Implications

The Project comprising LMC Loop and the associated infrastructure in adjacent area in Hong Kong outside LMC Loop is shown in **Figure 1.1**. The road alignment of Direct Linkage to MTR LMC Station, Western and Eastern

Connection Roads as well as the location of Flushing Water Service Reservoir are shown in **Figure 2.1a**. The waste implication during construction and operational phase due to the development of LMC Loop and the associated infrastructures in adjacent area in Hong Kong outside LMC Loop including Direct Linkage to MTR LMC Station, Western and Eastern Connection Roads as well as Flushing Water Service Reservoir have been assessed and presented in the following sub-sections. There will not be any other works/development outside the assessment area.

7.5.1 Construction Phase

The waste management implication assessment for construction phase has covered the entire Project as follows:-

- LMC Loop:
  - Ecological Area (Designated Project DP1)
  - Drainage System under Internal Transport Networks (DP4)
  - Sewage Treatment Works (DP5)
  - Other non-DP components (refer to **Section 2**)
- Associated Infrastructures in adjacent area in Hong Kong outside LMC Loop:
  - Western Connection Road (DP2);
  - Direct Link to MTR LMC Station (DP3);
  - Eastern Connection Road (DP6); and
  - Flushing Water Service Reservoir (DP7).

The main activities which would potentially result in the generation of waste include:

- site clearance and site formation;
- construction of connection road works; and
- construction of the proposed buildings and infrastructure.

A variety of type of wastes would be generated during construction phase that can be divided into the following distinct categories based on their compositions:

- site clearance waste;
- excavated materials;
- construction and demolition (C&D) materials;
- contaminated soil;
- sediment;
- chemical wastes;
- general refuse; and
- sewage.

The Project construction will be divided into Advance Works (i.e. DP1 in the period of 2013 to 2017), Phase I (i.e. DP2, DP3, DP4, DP5 and other non-DP components in the period of 2014 to 2020) and Phase II (i.e. DP6 and DP7 in the period of 2021 to 2027). The estimated amount of different type of wastes to be generated during construction phase is summarized in **Tables 7.3a** and **7.3b**.

Table 7.3a Estimated amount of different type of wastes to be generated during construction phase (Top soil, Inert soft & hard C&D materials, Non-inert construction waste, Non-inert swamp deposit, Sediment and Contaminated soil)

Phasing	Works area		Activities	Activity period	Quantity of waste to be generated (m^3)						
					Top soil	Inert soft C&D material	Inert hard C&D material Note 1	Non-inert construction waste	Non-inert swamp deposit	Sediment	Contaminated soil
Advance Works	LMC Loop	LMC Loop	Remediation	2013	0	0	0	0	0	0	57,444
		Ecological Area (DP1)	Site clearance & Establishment of Ecological Area	2014 to 2016	47,800	165,000	0	0	165,000	0	0
Phase I	LMC Loop	Drainage System under Internal Transport Networks (DP4)	Site clearance & formation	2017 to 2020	0	22,000	0	0	0	0	0
		Sewage Treatment Works (DP5)	Site clearance & formation	2015 to 2020	0	6,000	0	0	0	0	0
		Other non-DP components (exclude the construction of new buildings)	Site clearance & formation	2014 to 2020	40,000	902,000	0	0	38,000	0	0
		Construction of new buildings	Construction	2016 to 2020	0	0	48,000	12,000	0	0	0

Phasing	Works area		Activities	Activity period	Quantity of waste to be generated (m^3)						
					Top soil	Inert soft C&D material	Inert hard C&D material Note 1	Non-inert construction waste	Non-inert swamp deposit	Sediment	Contaminated soil
Phase I	Adjacent Area in Hong Kong outside LMC Loop	Western Connection Road (DP2)	Site formation & construction	2016 to 2018	200	28,000	1,200	0	0	300 from meander	0
		Direct Link to MTR LMC Station (DP3)	Site formation & construction	2016 to 2018	0	700	0	0	600	0	0
Phase II	LMC Loop	Construction of new buildings	Construction	2024 to 2027	0	0	48,000	12,000	0	0	0
	Adjacent Area in Hong Kong outside LMC Loop	Eastern Connection Road (DP6)	Site formation & construction	2024 to 2027	400	63,800	600	0	43,900	32,700 from fishpond; 31,000 from meander	0 Note 2
		Flushing Water Service Reservoir (DP7)	Site formation & construction	2024 to 2027	200	11,000	0	0	0	0	0

Note: (1) Inert hard C&D materials including broken concrete and granular materials.
(2) No potential contaminated site was identified in the adjacent area in Hong Kong outside LMC Loop. However, re-appraisal would be required to assess the latest situation once the land is handed over to the Project Proponent.

Table 7.3b Estimated amount of different type of wastes to be generated during construction phase (Broken asphalt, Rock, General refuse, Chemical waste and Sewage)

Phasing	Works area		Activities	Activity period	Quantity of waste to be generated (m^3)				
					Broken asphalt	Rock	General refuse	Chemical waste	Sewage
Advance Works	LMC Loop	LMC Loop	Remediation	2013	0	0	900	Few hundred cubic meter per month	$150m^3$/day
		Ecological Area (DP1)	Establishment of Ecological Area	2014 to 2016	0	0			
Phase I	LMC Loop	Drainage System under Internal Transport Networks (DP4)	Site formation	2017 to 2020	0	0			
		Sewage Treatment Works (DP5)	Site formation	2015 to 2020	0	0			
		Other non-DP components (exclude the construction of new buildings)	Site formation	2014 to 2020	0	0			
		Construction of new buildings	Construction	2016 to 2020	0	0			

Phasing	Works area		Activities	Activity period	Quantity of waste to be generated (m^3)				
					Broken asphalt	Rock	General refuse	Chemical waste	Sewage
Phase I	Adjacent Area in Hong Kong outside LMC Loop	Western Connection Road (DP2)	Site formation & construction	2016 to 2018	1,700	0			
	Adjacent Area in Hong Kong outside LMC Loop	Direct Link to MTR LMC Station (DP3)	Site formation & construction	2016 to 2018	0	0			
Phase II	LMC Loop	Construction of new buildings	Construction	2024 to 2027	0	0			
	Adjacent Area in Hong Kong outside LMC Loop	Eastern Connection Road (DP6)	Site formation & construction	2024 to 2027	500	0	700		
	Adjacent Area in Hong Kong outside LMC Loop	Flushing Water Service Reservoir (DP7)	Site formation & construction	2024 to 2027	0	4,800			

7.5.1.1 Site Clearance Waste

The area within the LMC Loop together with the associated infrastructure in adjacent area in Hong Kong outside LMC Loop is within the Project. In the LMC Loop, the proposed development areas will be located on flat land with grasses and shrubs. Some of them are currently covered with patchy vegetation. Site clearance waste of these sites would therefore generally consist of low grade natural vegetation such as scrub, grass and timber as well as top soil. It is estimated that up to approximately 87,800m^3 top soil and a few hundred cubic meter of low grade vegetation will be generated.

In the adjacent area in Hong Kong outside LMC Loop, two connection roads (Eastern Connection Road and Western Connection Road), a Direct Link to MTR LMC Station and the Flushing Water Service Reservoir would be constructed. It is estimated that up to approximately 600m^3 top soil will be cleared from the transport network and 200m^3 from the Flushing Water Service Reservoir.

All top soil generated in the Project would be reused on-site as fill materials and no surplus top soil would be generated.

A portion of non-inert waste will be reused on-site whenever possible and be disposed of at landfills as a last resort. Timber waste will all be collected by recyclers. It is estimated that a few hundred cubic meter of non-inert waste, which is mainly low grade vegetation, will require disposal to landfill.

With the proper implementation of good construction site practice and mitigation measures recommended in **Sections 7.6.1.1** to **7.6.1.4**, the on-site handling and reuse of top soils would not cause adverse environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport).

7.5.1.2 Excavated Materials

The majority of excavated materials will arise during site formation of the new development area and formation of roads along the alignment. Most of the materials would be inert soft C&D material such as soil and inert hard C&D material such as broken concrete and granular material. It is estimated that approximate 1,298,000m^3 of C&D materials, including inert soft C&D materials (1,095,000m^3) and non-inert swamp deposit (203,000m^3) would be generated during site formation in LMC Loop. Taking into consideration the land availability for stockpiling and construction works sequencing, approximately 716,000m^3 inert soft C&D materials and 203,000m^3 non-inert swamp deposit can be reused on-site as backfill material, whilst the remaining 379,000m^3 inert soft C&D materials will required disposal at Public Fill Reception Facilities as the last resort.

Within the adjacent area in Hong Kong outside LMC Loop, it is estimated that approximate 154,600m^3 of excavated materials, including inert soft C&D materials (103,500m^3), inert hard C&D materials (1,800m^3), non-inert swamp deposit (44,500m^3) and rock (4,800m^3), would be generated during the construction of both Eastern and Western Connection Roads, Direct Link to MTR LMC Station and Flushing Water Service Reservoir. The details breakdowns are shown in **Table 7.3**.

Taking into consideration the land availability for stockpiling and construction works sequencing, 72,100m^3 inert soft C&D materials and 1,800m^3 inert hard C&D materials can be reused as backfill material for the Project, whilst 4,800m^3 rock and 31,400m^3 inert soft C&D materials would be disposed to Public Fill Reception Facilities. For non-inert swamp deposit (i.e. 44,500m^3), 14,200m^3 would be reused on-site and 30,300m^3 would be reused in the concurrent projects such as "North East New Territories New Development Areas Planning and Engineering Study – Investigation (NENT NDA)". Agreement from the Project Proponent of NENT NDA has been obtained and is given in **Appendix 7-2**.

With the proper implementation of good construction site practice and mitigation measures recommended in **Sections 7.6.1.1** to **7.6.1.4**, potential impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) associated with on-site handling and transportation to disposal sites are not expected.

7.5.1.3 Construction and Demolition (C&D) Materials

Construction and Demolition (C&D) materials, including concrete, bricks, wood, steel, metal, glass, plastics, packing materials and general refuse, would be generated from the construction of new buildings and structures. The inert portion of the C&D materials is referred to public fill and the non-inert portion is referred to construction waste and would be disposed of at landfill. The buildings and structures to be constructed from the Project are summarized in **Table 7.4**.

Table 7.4 Major construction works from the Project

Phasing	Planning Area	Proposed Uses	Descriptions
Advance Works	LMC Loop	Ecological Area (DP1)	- Construction of the ecological area for reed marsh compensation.
Phase I	LMC Loop	Sewage Treatment Works (DP4)	- Construction of new sewage treatment works
		Drainage System under Internal Transport Networks (DP5)	- Construction will include the drainage system within LMC Loop and under the internal transport network.
		Education, High-Tech R&D, Government & commercial, Cultural & Creative Industries	- Construction will include substructure and superstructure of new buildings
	Adjacent Area in Hong Kong outside LMC Loop	Western Connection Road (DP2)	- Improvement works along sections of Lok Ma Chau Road. - Construction of new access road (at grade and viaduct) to the LMC Loop and LMC/Sha Tin Highway.
		Direct Link to MTR LMC Station (DP3)	- Construction of new road (at grade and viaduct) between MTR Lok Ma Chau Station and LMC Loop

Phasing	Planning Area	Proposed Uses	Descriptions
Phase II	LMC Loop	Education, High-Tech R&D, Government & commercial, Cultural & Creative Industries	- Construction will include substructure and superstructure of new buildings
	Adjacent Area in Hong Kong outside LMC Loop	Eastern Connection Road (DP6)	- Construction of new road (at grade and underpass) from the proposed road network of KTN NDA.
		Flushing Water Service Reservoir (DP7)	- Construction works will include earthwork, slope work and concrete works for reservoir structure and maintenance road.

The estimated gross floor area (GFA) of the proposed developments in LMC Loop is approximately 1,200,000m^2. In accordance with the Reduction of Construction Waste Final Report [7-1], a C&D materials generation rate of 0.1m^3 per 1m^2 of GFA is adopted. It is estimated that approximately 120,000m^3 of C&D materials would be generated from construction of the buildings and structures of proposed development.

The construction of new buildings and structures would be implemented in two phases (i.e Phase I building development (Year 2016 to 2020) and Phase II building development (Year 2024 to 2027)) and the associated GFA for both phases is assumed similar (i.e. 600,000m^2). For each phase of building development, it is estimated that approximate 60,000m^3 C&D materials (including 48,000m^3 inert C&D materials and 12,000m^3 non-inert construction waste) [7-2] would be generated. Therefore, a total of 96,000m^3 inert C&D materials and 24,000m^3 non-inert construction waste would be generated from both Phases I and Phase II building development.

For the inert C&D materials, it would be reused on-site. For the non-inert construction waste, it is estimated that the average daily generation rate for Phase I and Phase II building development are 5.6 m^3/day and 8.3 m^3/day respectively, and would be disposed to landfill due to limited outlets.

In the adjacent area in Hong Kong outside LMC Loop, it is estimated that approximate 500m^3 and 1,700m^3 broken asphalt would be generated from the construction of Eastern and Western Connection Road respectively. All broken asphalt would be reused on-site.

C&D materials can be minimized through careful planning during the detailed design stage and with good site practice during construction. This includes the use of non-timber formwork and temporary works and on-site sorting of the C&D materials for reuse and recycling as far as practicable.

With the proper implementation of good construction site practice and mitigation measures recommended in **Section 7.6.1.1** to **7.6.1.4**, potential impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) associated with on-site handling and transportation to disposal sites are not expected.

Disposal Programme for C&D Materials

The estimated disposal programme of surplus C&D materials is shown in **Tables 7.5a** and **7.5b**.

Table 7.5a Summary of annual disposal quantities of surplus C&D materials (Advance Works and Phase I)

Advance Works and Phase I								
Material	**Total (m^3)**	**Annual disposal quantity (m^3)**						
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Inert soft material	399,900 Note 1	0	0	0	160,700	190,000	49,200	0
Rock	0	0	0	0	0	0	0	0
Total (m^3)	**399,900**	**0**	**0**	**0**	**160,700**	**190,000**	**49,200**	**0**

Note: (1) Including 379,000m^3 from other non-DP component (exclude the construction of new building), 20,200m^3 from Western Connection Road (DP2) and 700m^3 from Direct Link to MTR LMC Station (DP3).

Table 7.5b Summary of annual disposal quantities of surplus C&D materials (Phase II)

Phase II								
Material	**Total (m^3)**	**Annual disposal quantity (m^3)**						
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Inert soft material	10,500 Note 1	0	0	0	10,500	0	0	0
Rock	4,800 Note 2	0	0	0	4,800	0	0	0
Total (m^3)	**15,300**	**0**	**0**	**0**	**15,300**	**0**	**0**	**0**

Note: (1) 10,500m3 from Flushing Water Service Reservoir (DP7).
(2) 4,800m3 from Flushing Water Service Reservoir (DP7).

Imported Fill Materials

It is estimated by the Engineer that 1,013,500m^3 (i.e. 957,000m^3 for Advance Works and Phase I; 56,500m^3 for Phase II) of fill materials will need to be imported. The imported fill materials will be used for backfilling during site formation at LMC Loop, construction of the Eastern and Western Connection Roads and the Flushing Water Service Reservoir at the adjacent area in Hong Kong outside LMC Loop. The Project Proponent will review the programme during the detailed design stage and maximize the quantity of on-site reuse of surplus C&D materials. The estimated quantities of imported fill materials are shown in **Tables 7.6a** and **7.6b**.

Table 7.6a Summary of annual quantities of imported fill materials (Advance Works and Phase I)

Advance Works and Phase I								
Material	**Total (m^3)**	**Annual quantity (m^3)**						
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
General fill	767,000	0	430,000	260,000	77,000	0	0	0
Filter material	50,000	0	0	30,000	20,000	0	0	0
Rock fill	140,000	0	0	70,000	70,000	0	0	0

Advance Works and Phase I								
Material	**Total (m^3)**	**Annual quantity (m^3)**						
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Total (m^3)	**957,000**	**0**	**430,000**	**360,000**	**167,000**	**0**	**0**	**0**

Table 7.6b Summary of annual quantities of imported fill materials (Phase II)

Phase II								
Material	**Total (m^3)**	**Annual quantity (m^3)**						
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
General fill	47,000	0	0	0	18,800	9,400	9,400	9,400
Filter material	0	0	0	0	0	0	0	0
Rock fill	9,500	0	0	0	9,500	0	0	0
Total (m^3)	**56,500**	**0**	**0**	**0**	**28,300**	**9,400**	**9,400**	**9,400**

7.5.1.4 Contaminated Soil

Land contamination assessment was carried out at both LMC Loop and the adjacent area in Hong Kong outside LMC Loop to determine the types, level and extent of the contamination, and to quantify the amount of contaminated materials and groundwater to be generated as a result of the proposed development.

The assessment has covered the entire LMC Loop (Area A) as shown in **Figure 1.1** as well as the assessment area including footprint of associated infrastructure, working space and works area for the associated infrastructure in adjacent area in Hong Kong outside the LMC Loop. The locations of the contamination assessment area for the associated infrastructure in adjacent area in Hong Kong outside LMC Loop can be referred to Figure 1.4 in the Contamination Assessment Plan (CAP) for Associated Infrastructure outside Lok Ma Chau Loop given in **Appendix 8-3**.

Under the site investigation (SI) works conducted in LMC Loop, concentrations of Arsenic have been found to have exceeded the relevant RBRGs criteria at 5 locations. Further SI has been conducted to ascertain the extent of these five contaminated zones and the volume of contaminated soil to be generated from these five zones is estimated at $57,444m^3$, and solidification/ stabilisation has been recommended as the remediation method.

The solidified materials would be reused within LMC Loop so that off-site disposal or reuse is not necessary. Mitigation measures are proposed during excavation and remediation of the contaminated soil in order to safeguard the general environment, health and safety on site during construction phase (refer to **Section 7.6.1.5** for details). With the implementation of mitigation measures described in **Section 7.6.1.5**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

Re-appraisal on the LMC Loop will be carried out to ensure any potential contamination activities from land use changes after the approval of this land contamination assessment study, subject to a proper updating review prior to commencement of the construction works. Where re-appraisal or re-assessment is required, the PP would prepare and submit the Supplementary CAP to EPD prior to the commencement of additional SI works, if any. Following on from the submission of Supplementary CAP and completion of additional SI, the PP would prepare Supplementary CAR, RAP and RR and submit to EPD for agreement prior to commencement of the development works.

Identification of potentially contaminated sites within the contamination assessment area for the associated infrastructure in the adjacent area in Hong Kong outside LMC Loop was carried out based on the criteria stipulated in EPD's *Practice Guide for Investigation and Remediation of Contaminated Land*. Information collected from desktop review of available historical records e.g. historical aerial photos and from site survey have been used to assist the identification of potentially contaminated sites

Since the construction works for the associated infrastructure will be confined within the contamination assessment area, and there were no land contamination activities such as motor vehicle maintenance workshops, petrol filling stations etc. observed within the contamination assessment area, based on the above approach, no potentially contaminated site was identified in the contamination assessment area for the associated infrastructure in the adjacent area in Hong Kong outside LMC Loop as shown in the plan of Superimposition of Study Area and Assessment Area i.e. Figure 1.4 of **Appendix 8-3**. It is also confirmed that there will not be any works/development outside the contamination assessment area under the present EIA study.

As the construction of the associated infrastructure would only commence a number of years later, there may be changes in land usage within the entire contamination assessment area. Therefore, re-appraisal on the entire contamination assessment area for the associated infrastructure outside LMC Loop would be required to ensure any potential contamination activities from land use changes after the approval of this land contamination assessment study, subject to a proper updating review prior to commencement of the construction works in order to confirm if there is any change of land use after the approval of the present EIA Study.

Where re-appraisal or re-assessment is required, the Project Proponent would prepare and submit a Supplementary CAP to EPD to present the findings of the re-appraisal. Following on from the submission of Supplementary CAP and completion of Site Investigation, if any, the Project Proponent would prepare a Contamination Assessment Report (CAR), a Remediation Action Plan (RAP) and a Remediation Report (RR) and submit to EPD for agreement prior to the commencement of work on the development.

7.5.1.5 Sediment

Sediments from Fishponds

During the construction of Eastern Connection Road, fishpond sediment would be encountered in the adjacent area in Hong Kong outside LMC Loop at the underpass and depressed road section which is designed to minimize the ecological impact to surrounding environment. It is estimated that approximate 32,700m^3 fishpond sediment would be generated during the underpass and depressed road construction. However, on-site reuse of such sediment is not feasible as the road would be constructed at the later stage of the development (i.e.

Year 2024 to 2027) based on the construction programme (the whole construction programme of the Project between Year 2013 and 2027). The detailed construction programme of Eastern Connection Road is shown in **Appendix 2-6,** Item 12 Contract F – Eastern Connection Road. The generated sediment is proposed to be reused as fill materials in the concurrent projects such as "North East New Territories New Development Areas Planning and Engineering Study – Investigation (NENT NDA)". Agreement from the Project Proponent of NENT NDA has been obtained and is given in **Appendix 7-2**.The road alignment of Eastern Connection Road is shown in **Figure 2.12**. The area requiring excavation of sediment along the alignment of Eastern Connection Road is shown in **Figure 7.2**. The generated quantities of sediments from construction works were estimated and is summarized in **Table 7.7**.

Table 7.7 Estimated amount of excavated sediment from the affected fishpond during the construction of Eastern Connection Road

Location	Construction activates	Quantity (m^3)	Recommended outlets
Eastern Connection Road	Underpass and depressed road	32,700	Reused in the concurrent projects such as NENT NDA

As access to the affected fishponds is not granted due to private land ownership, assessment of the sediment quality could not be carried out at this stage. The Project Proponent shall carry out the sediment sampling and testing at these areas in accordance with the ETWB TC(W) No. 34/2002 to determine the sediment quality once the site access is available (i.e. after land resumption). The Project Proponent shall prepare the Sediment Sampling and Testing Plan (SSTP) and submit to EPD for agreement. The testing results shall also be submitted to EPD for agreement prior to the commencement of construction in this area. The sediment would be categorized by the testing results in accordance with the ETWB TC(W) No. 34/2002.

As mentioned above, the sediment is proposed to be reused as fill materials in the concurrent projects such as "North East New Territories New Development Areas Planning and Engineering Study – Investigation (NENT NDA)". Sediment treatment is required prior to reuse. The Project Proponent shall submit the treatment methodology, testing requirements and acceptance criteria to EPD for agreement prior to reuse.

Sediments from Meander

Based on the construction design, excavation of sediments would be required at the meander for the bridge supporting the sections of Western Connection Road and the underpass of Eastern Connection Road. The road alignment of Western and Eastern Connection Roads are shown in **Figure 2.5** and **Figure 2.12** respectively. The areas requiring excavation of sediment along the alignment of both Western and Eastern Connection Road are shown in **Figure 7.1** and **7.2** respectively.

In order to assess the sediment quality of meander, a Sediment Sampling and Testing Plan (SSTP) was prepared in accordance with the guidelines ETWB TC(W) No. 34/2002, to present a sampling and testing proposal as part of this EIA Study. The SSTP was submitted to EPD for agreement on 15 March 2011 and agreed by EPD on 13 April 2011.

A total of 11 sampling locations were proposed and placed along the western (4 sampling locations) and eastern (7 sampling locations) sections of the meander which cover the potential excavation area to cater for the potential design changes. Because of the relatively shallow sediment layer of the meander, grab sampling was adopted for samples collection. The details sampling locations and corresponding methods can be referred to the SSTP in **Appendix 7-3**.

Each collected sample was tested in the HOKLAS accredited laboratory for the parameters which stipulated in the SSTP and is shown below:

- Metal and metalloid including cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb), silver (Ag), zinc (Zn) and arsenic (As);
- Organic compounds including total polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs); and
- Organometallics including tributyltin (TBT) in interstitial water.

After the chemical testing, the laboratory results were compared with the sediment quality criteria listed in SSTP to categorise the sediments. If the result indicated that the sediment was a Category M (sediment with one or more contaminant levels exceeding the Lower Chemical Exceedance Level (LCEL) and none exceeding the Upper Chemical Exceedance Level (UCEL)), Tier III biological screening test was then carried out to determine the appropriate disposal methods in accordance with ETWB TC(W) No. 34/2002. The details are shown below:

(i) A 10-day burrowing amphipod toxicity test;

(ii) A 20-day burrowing polychaete toxicity test;

(iii) A 48-96 hour larvae (bivalve or echinoderm) toxicity test.

In addition, sediment classified as Category H with one or more contaminant levels exceeding 10 times the LCEL was also subject to the above biological screening test but in a diluted manner (dilution test).

Results of Chemical Screening

The sampling works was carried out on 31 August 2011. A total of 7 samples from 7 sampling locations (i.e. Sample ID: GR5 to GR11) at the eastern section of meander had been collected. However, the remaining 4 sampling locations (i.e. Sample ID: GR1 to GR4) at the western section of the meander was not carried out due to the access denial. The objection letter is given in **Appendix 7-4**. All collected samples were then sent to laboratory for analysis. The results indicated that all samples were classified as Category H. However, as none of the results exceeded 10 times LCEL, no samples would require biological screening tests. A summary of the sediment quality analysis and chemical screening results are shown in **Table 7.8** and **7.9** respectively. Detailed laboratory reports are given in **Appendix 7-5**.

Table 7.8 Sediment quality analysis results

Parameters	Sample ID							LCEL	UCEL
	GR5	GR6	GR7	GR8	GR9	GR10	GR11		
Metals (mg/kg)									
Cd	1.1	1.2	0.9	1.0	1.0	1.2	0.9	1.5	4
Cr	52	56	47	51	54	55	42	80	160

Parameters	Sample ID							LCEL	UCEL
	GR5	GR6	GR7	GR8	GR9	GR10	GR11		
Cu	**80**	**76**	62	61	60	64	42	65	110
Hg	0.12	0.11	0.09	0.29	0.11	0.10	0.08	0.5	1
Ni	**43**	**52**	**43**	**48**	**50**	**53**	**41**	40	40
Pb	49	53	45	50	52	52	43	75	110
Ag	0.7	0.8	0.7	0.7	0.8	0.9	0.6	1	2
Zn	**551**	**604**	**455**	**496**	**498**	**549**	**410**	200	270
Metalloid (mg/kg)									
As	**15**	**17**	**17**	**16**	**17**	**18**	**15**	12	42
Organic-PAHs (ug/kg)									
Low M.W. PAHs	<550	<550	<550	<550	<550	<550	<550	5500	3160
High M.W. PAHs	<1700	<1700	<1700	<1700	<1700	<1700	<1700	1700	9600
Organic-non-PAHs (ug/kg)									
Total PCBs	<18	<18	<18	<18	<18	<18	<18	23	180
Organometallics (ug TBT/L)									
Tributyltin	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.15	0.15
Category	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**--**	**--**

Note: (1) Values in **bold** are above the Lower Chemical Exceedance Level (LCEL) but below the Upper Chemical Exceedance Level (UCEL).

(2) Values in **bold and underlined** are above the Upper Chemical Exceedance Level (UCEL).

Table 7.9 Summary of chemical screening results

Location	Sample ID	Category	No. of samples	Remarks
Eastern section of meander	GR5 to GR11	H	7	Exceedance of UCEL in Nickel (Ni) and Zinc (Zn)

Though no samples were collected at the western section, as the eastern sampling location is located upstream of the meander without any branches between the sections, no significant deviations of sediment quality are anticipated. Therefore, Category H classification of the eastern meander samples will be adopted for the sediment quality of the western section.

The Project Proponent shall carry out the sediment sampling and testing at the western sampling locations (i.e. Sample ID: GR1 to GR4) according to the approved SSTP to determine the sediment quality once the site access is granted. The testing results shall be submitted to EPD for agreement prior to the commencement of construction in this area.

Estimated Quantities of Sediment

The generated quantities of sediments from construction works were estimated and is summarized in **Table 7.10**. Based on the construction programme and engineering feasibility, the approximately 300m^3 sediment generated from the Western Connection Road between Year 2016 and 2018 would be reused on-site for backfilling after cement stabilization/solidification treatment.

On the other hand, on-site reuse of the sediment from the Eastern Connection Road is not feasible as construction would be at late stage of the development between Year 2024 and 2027. Therefore, the sediment generated from the Eastern

Connection Road (approx. 31,000m³) is proposed to be reused as fill materials in the concurrent projects such as "North East New Territories New Development Areas Planning and Engineering Study – Investigation (NENT NDA)".

Table 7.10 Estimated amount of excavated sediment from meander during the construction of Eastern and Western Connection Roads

Location	Construction activates	Quantity (m^3)	Recommended outlets
Western Connection Road	Bridge structure with intermediate supports	300	Reused on-site after cement stabilization/solidification
Eastern Connection Road	Underpass road	31,000	Reused in the concurrent projects such as NENT NDA

Handling of Sediment

The sediment generated from the both Western and Eastern Connection Roads shall undergo cement stabilization/solidification prior to backfilling or stockpiled for future reuse. The solidified materials shall also carry out the Toxicity Characteristic Leaching Procedure (TCLP) and Unconfined Compressive Strength (UCS) tests to ensure that the contaminant will not leach to the environment after cement stabilization/solidification. The acceptance criteria of TCLP and UCS tests shall follow the EPD's "*Practice Guide for Investigation and Remediation of Contaminated Land"* as are summarized in **Table 7.11**. EPD has no objection to the acceptance criteria of TCLP and UCS tests and the corresponding email is given in **Appendix 7-6**. The solidified materials shall meet both acceptance criteria of TCLP and UCS prior to reuse. If the solidified materials do not meet both acceptance criteria of TCLP and UCS, it shall be crushed and re-treated by cement stabilization/solidification. The re-treated solidified materials shall be tested again for TCLP and UCS tests.

Table 7.11 Acceptance criteria of TCLP and UCS tests

Parameter	Criteria Note 1
TCLP Test	
Copper (Cu)	Note 2
Nickel (Ni)	11mg/L
Zinc (Zn)	4.3mg/L
Arsenic (As)	5mg/L
UCS Test	
UCS	≥1000kPa

Note: (1) Reference to EPD's "Practice Guide for Investigation and Remediation of Contaminated Land".
(2) According to the Table 4.6 of EPD's "Practice Guide for Investigation and Remediation of Contaminated Land". The criteria for Copper must be reduced by at least 90 percent in mobility for metal through cement stabilisation/solidification remedial treatment. The reduction of mobility of metal contaminants (leachable metals contaminants) should be confirmed through TCLP tests (i.e. to carry out TCLP test for the untreated soil and for the soil after treatment and to compare the concentrations of the metals in the leachate).

As the sampling and testing of sediment at the western sampling locations (i.e. Sample ID: GR1 to GR4) would only be carried out once the site access is available, the sediment quality in this area shall be re-categorized based on the future testing results. The Project Proponent shall update the acceptance criteria, if required, and seek agreement of EPD.

To minimize any potential adverse impacts arising from the excavated sediment, the sediment should be excavated, transported and disposed of in a manner that would minimize the loss of contaminants. Mitigation measures to minimize potential environmental impacts are recommended in **Section 7.6.1.6**.

With the proper implementation of good construction site practice and mitigation measures recommended in **Section 7.6.1.6**, potential impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) associated with on-site handling and transportation to other construction sites are not expected.

7.5.1.6 Chemical Waste

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.

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.

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 utilized. 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.

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 **Section 7.6.1.7**. 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.

7.5.1.7 General Refuse

The construction workers would generate refuse comprising food wastes, waste paper, aluminium cans and plastic bottles during construction period.

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 waste at sites other than the approved disposal facilities could also lead to similar adverse impacts at those sites.

The number of work force (clerical and workers) to be employed for the Project is not available at this stage, but is anticipated to be over 1,000 staffs. Based on the generation rate of 0.65kg/person/day, the total refuse generated per day would be about 650kg/day. Therefore, it is estimated that around 900m^3 and 700m^3 general refuse would be generated during the advance work/Phase I and Phase II respectively.

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.

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 7.6.1.8**. 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.

7.5.1.8 Sewage

Sewage will arise from amenity facilities used by the construction workers and site office’s sanitary facilities. The sewage generated should be properly managed to minimize the adverse impact of odour and potential health risks to the workers by attracting pests and other disease vectors.

As the workers are likely to be scattered along the proposed alignment and works area, adequate portable chemical toilets should be provided to ensure all sewage is properly collected. Septic tank is proposed for the resident engineers uses in site office. It is anticipated that no adverse environmental implications would arise if the chemical toilets and septic tank 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.

The number of work force (clerical and workers) to be employed for the Project is not available at this stage, but is anticipated to be over 1,000 staffs including approximate 900 workers and 100 resident engineers. According to Table T-2 of Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, the unit flow is 0.15 m^3/person/day, the total sewage generated per day would be 150 m^3/day.

With the implementation of mitigation measures described in **Section 7.6.1.9**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

7.5.1.9 Construction Waste Summary

A summary of the construction waste arising from the works area (LMC Loop and adjacent area in Hong Kong outside LMC Loop) with recommendation for outlets during construction phase is presented in **Table 7.12**. A Summary of waste arising from the major construction activities in the period of Advance Works, Phase I and Phase II is also presented in **Table 7.13**.

Table 7.12 Summary of waste arising from the works area (LMC Loop and adjacent area in Hong Kong outside LMC Loop)during construction phase

Works area	Activities	Waste type	Total amount generated (m^3)	Total amount reused (m^3)	Total amount disposed (m^3)	Recommended outlets
LMC Loop	Remediation	Contaminated soil	57,444	57,444	0	Reuse within the site after remediation
	Site clearance & formation	Low grade vegetation	Few hundred cubic meter	0	Few hundred cubic meter	Disposal to landfill
		Top soil	87,800	87,800	0	Reuse within the site
		Inert soft C&D materials	1,095,000	716,000	379,000	- Reuse within the site - Disposal to Public Fill Reception Facilities
		Non-inert swamp deposit	203,000	203,000	0	Reuse within the site
	Construction of new buildings	Inert hard C&D materials	96,000	96,000	0	Reuse within the site
		Non-inert construction waste	24,000	0	24,000	Disposal to landfill
Adjacent Area in Hong Kong outside LMC Loop (including Direct Link to MTR LMC Station, Western and Eastern Connection Roads, Flushing	Site formation & construction	Top soil	800	800	0	Reuse within the site
		Inert soft C&D materials	103,500	72,100	31,400	- Reuse within the site - Disposal to Public Fill Reception Facilities
		Inert hard C&D materials	1,800	1,800	0	Reuse within the site
		Sediment	64,000	32,700 from fishpond 31,300 from meander	0	- Reuse within the site after cement stabilization /solidification ($300m^3$ from meander) - Reuse in the concurrent projects such as NENT NDA (32,700 from fishpond; 31,000 from meander)

Works area	Activities	Waste type	Total amount generated (m^3)	Total amount reused (m^3)	Total amount disposed (m^3)	Recommended outlets
Water Service Reservoir)		Non-inert swamp deposit	44,500	44,500	0	- Reuse within the site (14,200m^3) - Reuse in the concurrent projects such as NENT NDA (30,300m^3)
		Broken asphalt	2,200	2,200	0	Reuse within the site
		Rock	4,800	0	4,800	Disposal to Public Fill Reception Facilities
		Contaminated soil	0 Note 1	N/A	N/A	N/A
LMC Loop and Adjacent Area in Hong Kong outside LMC Loop	General construction activities	General refuse	1,600	0	1,600	General refuse: Disposal to landfill
		Paper				Paper, Metals and Plastics: Collected by recycler
		Metals				
		Plastics				
		Chemical waste	Few hundred cubic meter per month	Few hundred cubic meter per month	0	Recycle by licensed facility and/or disposal of at CWTC
		Sewage	150m^3/day	0	150m^3/day	Chemical toilets and septic tanks to be collected and disposed by licensed collector

Note: (1) No potential contaminated site was identified in the adjacent area in Hong Kong outside LMC Loop. However, re-appraisal of these areas would be required to assess the prevailing site situation after the land is handed over to the Project Proponent. Details is described in Section 8 - Land Contaminated Assessment

Table 7.13 Summary of waste arising from the major construction activities in the period of Advance Works, Phase I and Phase II

Phasing	Works area		Activities	Waste type	Total amount generated (m^3)	Total amount reused (m^3)	Total amount disposed (m^3)	Recommended outlets
Advance Works	LMC Loop	LMC Loop	Remediation	Contaminated soil	57,444	57,444	0	Reuse within the site after remediation
		Ecological Area (DP1)	Site clearance & Establishment of Ecological Area	Top soil	47,800	47,800	0	Reuse within the site
				Inert soft C&D material	165,000	165,000	0	Reuse within the site
				Non-inert swamp deposit	165,000	165,000	0	Reuse within the site
Phase I	LMC Loop	Drainage System under Internal Transport Networks (DP4)	Site clearance & formation	Top soil	0	0	0	
				Inert soft C&D material	22,000	22,000	0	Reuse within the site
				Non-inert swamp deposit	0	0	0	
		Sewage Treatment Works (DP5)	Site clearance & formation	Top soil	0	0	0	
				Inert soft C&D material	6,000	6,000	0	Reuse within the site
				Non-inert swamp deposit	0	0	0	
		Other non-DP components (exclude the construction of new buildings)	Site clearance & formation	Top soil	40,000	40,000	0	Reuse within the site
				Inert soft C&D material	902,000	523,000	379,000	- Reuse within the site - Disposal to Public Fill Reception Facilities
				Non-inert swamp deposit	38,000	38,000	0	Reuse within the site
		Construction of new buildings	Construction	Inert hard C&D material	48,000	48,000	0	Reuse within the site

Phasing	Works area		Activities	Waste type	Total amount generated (m^3)	Total amount reused (m^3)	Total amount disposed (m^3)	Recommended outlets
				Non-inert construction waste	12,000	0	12,.000	Disposal to landfill
Phase I	Adjacent Area in Hong Kong outside LMC Loop	Western Connection Road (DP2)	Site formation & construction	Top soil	200	200	0	Reuse within the site
				Inert soft C&D material	28,000	7,800	20,200	- Reuse within the site - Disposal to Public Fill Reception Facilities
				Inert hard C&D material	1,200	1,200	0	Reuse within the site
				Sediment	300 from meander	300	0	Reuse within the site after cement stabilization/ solidification
		Direct Link to MTR LMC Station (DP3)	Site formation & construction	Inert soft C&D material	700	0	700	Disposal to Public Fill Reception Facilities
				Non-inert swamp deposit	600	600	0	Reuse in the concurrent projects such as NENT NDA
	LMC Loop and Adjacent Area in Hong Kong outside LMC Loop	All works area	General construction activities	General refuse	900	0	900	Disposal to landfill
				Chemical waste	Few hundred cubic meter per month	Few hundred cubic meter per month	0	Recycled by licensed facility and/or disposed of at CWTC
				Sewage	$150m^3$/day	0	$150m^3$/day	Chemical toilet and septic tank to be collected and disposed by licensed collector
Phase II	LMC Loop	Construction of new buildings	Construction	Inert hard C&D material	48,000	48,000	0	Reuse within the site

Phasing	Works area		Activities	Waste type	Total amount generated (m^3)	Total amount reused (m^3)	Total amount disposed (m^3)	Recommended outlets
				Non-inert construction waste	12,000	0	12,000	Disposal to landfill
Phase II	Adjacent Area in Hong Kong outside LMC Loop	Eastern Connection Road (DP6)	Site formation & construction	Top soil	400	400	0	Reuse within the site
				Inert soft C&D material	63,800	63,800	0	Reuse within the site
				Inert hard C&D material	600	600	0	Reuse within the site
				Non-inert swamp deposit	43,900	43,900	0	- Reuse within the site (14,200m^3) - Reuse in the concurrent projects such as NENT NDA (29,700m^3)
				Sediment	32,700 from fishpond; 31,000 from meander	63,700	0	Reuse in the concurrent projects such as NENT NDA
				Broken asphalt	500	500	0	Reuse within the site
				Contaminated soil	0 Note 1	N/A	N/A	N/A
		Flushing Water Service Reservoir (DP7)	Site formation & construction	Top soil	200	200	0	Reuse within the site
				Inert soft C&D material	11,000	500	10,500	- Reuse within the site - Disposal to Public Fill Reception Facilities
				Rock	4,800	0	4,800	Disposal to Public Fill Reception Facilities

Phasing	Works area		Activities	Waste type	Total amount generated (m^3)	Total amount reused (m^3)	Total amount disposed (m^3)	Recommended outlets
Phase II	LMC Loop and Adjacent Area in Hong Kong outside LMC Loop	All works area	General construction activities	General refuse	700	0	700	Disposal to landfill
				Chemical waste	Few hundred cubic meter per month	Few hundred cubic meter per month	0	Recycled by licensed facility and/or disposed of at CWTC
				Sewage	150m^3/day	0	150m^3/day	Chemical toilet and septic tank to be collected and disposed by licensed collector

Note: (1) No potential contaminated site was identified in the adjacent area in Hong Kong outside LMC Loop. However, re-appraisal of these areas would be required to assess the prevailing site situation after the land is handed over to the Project Proponent. Details is described in Section 8 - Land Contaminated Assessment.

7.5.2 Operational Phase

The operational phase of the proposed developments in both LMC Loop and its associated infrastructure in the adjacent area in Hong Kong outside LMC Loop would generate the following categories of wastes based on their compositions:

LMC Loop

- municipal solid waste;
- chemical waste;
- food waste; and
- sewage sludge.

Adjacent Area in Hong Kong outside LMC Loop

- general refuse.

The nature and quantity of each of these waste types arising from the operation of the proposed developments are described in the sub-sections below.

7.5.2.1 Municipal Solid Waste

With reference to the data from Monitoring of Solid Waste in Hong Kong 2010 by EPD which is the latest information available. The MSW generation rate was 1.29kg/person/day. The estimated MSW arising in LMC Loop is summarized in **Table 7.14** based on planned populations, showing about 68.4tpd of MSW would be generated during fully operational phase. This estimate assumed no waste reduction measure to reduce the demand for valuable landfill space. Based on information from EPD, the major components of MSW in Hong Kong included glass, metals, paper, plastics and putrescibles. Most of these materials are recyclable which could considerably reduce the amount for final disposal.

Table 7.14 Estimated quantities of municipal waste from LMC Loop

Phase	Planned Population	Estimated MSW Arising
Phase I	26,500	34.2tpd (12,477tpa)
Phase II	53,000	68.4tpd (24,955tpa)

1) Waste Collection and Disposal

An effective and efficient waste handling system is essential in order to minimize potential adverse environmental impacts during waste storage, collection and transport, such impacts may include odour if waste is not collected frequently; water quality if waste enters storm water drains; aesthetics and vermin problems if the waste storage area is not well maintained and cleaned regularly. The waste handling system may also facilitate materials recovery and recycling.

A refuse collection room could be installed in each building at the ground floor for localized refuse collection and the waste would be transported to a Central Refuse Collection Chamber (CRCC) using electrical vehicles subject to future developers' consideration during the detailed design. The waste could be sorted to recover materials (such as paper and cardboards, plastics, metals and fluorescent lamps etc.) as far as possible, before to be compacted into containers at the CRCC. Different containers should be provided for the storage of different recyclable materials. To avoid potential odour nuisance to the students and residents during transport of waste, enclosed waste collection containers should be used and the collection route and time should be properly planned. The CRCC should contain mobile compactor and related equipments to provide adequate waste handling services. At least daily collection should be arranged by the waste collector.

2) Waste Recycling

In order to facilitate recycling, a 4-bin recycling system for paper, metals, plastics and fluorescent lamps should be adopted together with a general refuse bin. They should be placed in prominent places to promote waste separation at source. Additional recycling bins for toner cartridges and rechargeable battery should be provided in the offices. In addition, locations should be assigned for the collection of scrap electrical and electronic appliances. All recyclable materials should be transported to the CRCC and collected by recyclers. Moreover, the following measures should also be implemented to promote materials recovery and recycling:

- banner should be erected at the recycling bins area;
- operator should make arrangements with the recycler to collect and recycle used toner cartridges as well as the scrap electronic equipments, such as computers to avoid disposal of at landfills as far as practicable;
- staff awareness training should be provided on waste management procedures, including waste reduction and recycling;
- operator should set up waste reduction and recycled targets; and
- operator should participate in the Wastewi$e Label Scheme to facilitate waste reduction.

Based on the data from Monitoring of Solid Waste in Hong Kong 2010 by EPD, the main component of MSW was putrescible waste (36%) within which food waste contributed 88%, followed by papers (22%) and plastics (21%). These three materials accounted for over 83% of the total waste arising. The MSW recovery rate in 2010 was 52%. **Table 7.15** shows the estimated composition of MSW and the estimated quantities of recyclable materials that could potentially be recovered in LMC Loop in different phases of development. The estimated recovery rate of recyclable materials is around 58% assuming that 70% of food wastes would be composted.

As shown in **Table 7.15**, LMC Loop at full operation would recycle 14,396tpa out of 24,954tpa of MSW, leaving 10,558tpa (28.8tpd) of MSW that would need disposal to landfill. The North West New Territories Refuse Transfer Station (NWNTRTS) with a design capacity of 1,100tpd or NENT landfill should have sufficient capacity to cater for such waste load. Assuming 7~8tons loading capacity per truck, it is estimated that 5~6 trucks per day would deliver the waste for disposal at full operation.

With the implementation of mitigation measures described in **Section 7.6.2.1**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

Table 7.15 Estimation of MSW composition and quantities of recyclable materials in LMC Loop based on MSW composition and recycling data in 2010

	MSW in HK 2010		Development LMC Loop					
			Phase I (population: 26,500)			Phase II (population: 53,000)		
	Waste Arising	**Recovered Rate**	**Waste Arising tpd (tpa)**	**Estimated Quantity of Recyclable Materials tpd (tpa)**	**Quantity of Waste Disposal tpd (tpa)**	**Waste Arising tpd (tpa)**	**Estimated Quantity of Recyclable Materials tpd (tpa)**	**Quantity of Waste Disposal tpd (tpa)**
Food Waste	36%	70%	12.3 (4,493)	8.6 (3,145)	3.7 (1,348)	24.6 (8,986)	17.2 (6,290)	7.4 (2,696)
Paper	22%	62%	7.5 (2,738)	4.7 (1,698)	2.8 (1,040)	15 (5,476)	9.4 (3,396)	5.6 (2,080)
Plastics	21%	69%	7.2 (2,621)	5.0 (1,808)	2.2 (813)	14.4 (5,242)	10.0 (3,616)	4.4 (1,626)
Metals	2%	92%	0.7 (250)	0.644 (230)	0.056 (20)	1.4 (500)	1.288 (460)	0.112 (40)
Glass	4%	4%	1.4 (500)	0.056 (20)	1.344 (480)	2.8 (1,000)	0.112 (40)	2.688 (960)
Wood	3%	14%	1.0 (374)	0.14 (52)	0.86 (322)	2.0 (748)	0.28 (104)	1.72 (644)
Putrescible Waste (exclude food waste) Note 1	5%	0%	1.7 (624)	0 (0)	1.7 (624)	3.4 (1,248)	0 (0)	3.4 (1,248)
Others Note 2	7%	28%	2.4 (874)	0.7 (245)	1.7 (629)	4.8 (1,748)	1.4 (490)	3.4 (1,258)
Total Waste Arising	100%	--	34.2 (12,477)	--	--	68.4 (24,954)	--	--
Total Quantity of Recyclable Materials	--	--	--	19.8 (7,198)	--	--	39.6 (14,396)	--
Total Quantity of Waste Disposal	--	--	--	--	14.4 (5,276)	--	--	28.8 (10,558)

Note: (1) Putrescible waste includes yard waste and other organic waste.
(2) Other waste includes textile, bulky items, electrical & electronic equipment and other miscellaneous materials.
(3) Figure may not add up to total due to rounding off.

7.5.2.2 Chemical Waste

During the operational phase three sources of chemical wastes are expected.

- from the laboratories in academic buildings;
- from machinery maintenance and servicing in academic buildings; and
- from the Sewage Treatment Work (STW).

Among the above sources, laboratory would be the major source compared to the other two. The estimated quantity of major types of chemical wastes from laboratory are summarized in **Table 7.16** based on information provided by local university.

Table 7.16 Estimated quantities of major chemical waste generated from laboratory

Source [Note 1]	Type of Chemical Waste	Estimated Quantity (L/mth)
Laboratory	Alkali	600
	Acid (Organic and Inorganic)	150
	Halogenated Solvent	400
	Non- Halogenated Solvent	810
	Metal Solution	150
	Rags with Solvent Oils	400
	Lube Oil	100
	Total	**2,610**

Note: (1) Information provided by local university.

To minimize potential environmental hazard due to waste handling, localized chemical waste storage areas should be located close to the source of waste generation for temporary storage. Drum-type containers with proper labelling should be used to collect chemical wastes for storage at the designated areas. As various chemical wastes would be generated from different laboratories in academic buildings, a Central Chemical Waste Storage room (CCWS) is also recommended in order to manage the chemical waste effectively and efficiency subject to future developers' consideration during the detailed design. All chemical waste should be transferred to the CCWS regularly.

CCWS should be located in an enclosed area with impermeable floor or surface and adequate ventilation. There should not be any connection to any surface water drains or foul sewers. Bund to retain potential leakage of the capacity of the largest container or 20% of the storage capacity whichever is the greater should be provided. Incompatible chemical wastes should be stored in different areas with impervious wall / partition. CCWS should be properly secured / locked to prevent unauthorized access by others. Further provisions of storage area should follow the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes under the provisions of the Waste Disposal (Chemical Waste)(General) Regulation.

Registration as chemical waste producers with EPD should be made by the above chemical waste generators prior to operation. All chemical wastes generated should be dealt with according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes under the provisions of the Waste Disposal (Chemical Waste) (General) Regulation.

Where possible, it is recommended that waste lubricants are recycled at an appropriate facility e.g. at an oil re-refinery. Remaining chemical wastes that cannot be recycled should be disposed at an appropriate waste disposal facility, such as the CWTC in Tsing Yi. A licensed contractor should be employed for the chemical wastes collection.

Collection receipts issued by the licensed collector showing the quantities and types of chemical waste taken off-site and details of the treatment facility should be kept for record. With the implementation of proper preventive and mitigation measures for handling, transport and disposal, no waste management implications are anticipated.

With the implementation of mitigation measures described in **Section 7.6.2.2**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

7.5.2.3 Food Waste

Most of the food waste would be generated from the canteen and restaurants of the education institutions during the operational phase. Such waste requires proper careful handling and treatment to prevent causing nuisance to the environment.

With reference to the data from Monitoring of Solid Waste in Hong Kong 2010, about 36% of the MSW is food waste. It is estimated that about 24.6tpd of food waste would be generated from LMC Loop at full operation (i.e. population: 53,000).

Food waste contains a high amount of organic matter that is a suitable raw material for composting. Apart from disposal at landfill, on-site treatment is an alternative to handle food waste, which not only reduces the disposal amount to landfill but also produces organic fertilizer or soil conditioner for landscaping. Therefore, a composting unit is recommended for treating the food waste in LMC Loop subject to future developers' consideration. Since there is no sufficient information at present, the future developers shall also observe the EIAO requirements when the green initiative of "on-site composting" or any other relevant proposal(s) is/are considered by the future developers.

Localized composting unit would be recommended to be used in the buildings where pure food waste can be collected easily, such as canteens and restaurants of the education institutions, subject to future developer's consideration. Depending on the specific design, the composting unit could reduce 95% and 80% of the volume and weight of food waste in 24 hours respectively, and the compost could be recovered for use after 30 to 45 days subject to the process condition.

A small amount of leachate would be generated during composting, which could be sprayed back to composting unit. In addition, the composting unit is recommended to be located in an enclosed area.

With the implementation of mitigation measures described in **Section 7.6.2.3**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

7.5.2.4 Sewage Sludge

The proposed on-site STW is designed to mainly handle the sewage arising from LMC Loop. It will be a biological treatment plant with a design capacity of 18,000m^3/day. The major solid waste types produced from the STW would be grit and screenings from the inlet works and the digested sludge associated with the sewage treatment process.

Aerobic digestion is suggested for sludge thickening to reduce volume. The biogas may be collected and reuse during sludge digestion process subject to detailed design. Centrifugation is also suggested for digested sludge dewatering. It is estimated that 7.1 wet tonnes/day of sewage sludge would be generated after sludge dewatering by centrifugation at full operation.

There are several sludge management technologies to treat the sludge before final disposal. Incineration and heat drying method are commonly applied for bulk volume reduction before disposal at landfills. The operation cost of incineration is lower than heat drying. Besides, the energy from the incineration process could be used and the volume of end product after incineration is considerably lower than that after heat drying. Incineration would be the preferred option for sludge management. However, owing to the high capital and operation cost of the incinerator, it is not cost effective to adopt incineration for on-site sludge treatment. Therefore, sewage sludge generated from STW is suggested to be treated at the proposed Sludge Treatment Facility (STF) at Nim Wan, which is planned to be in operation by the end of 2012 with 2,000 wet tonnes/day treatment capacity.

The sewage sludge would be delivered by road transport in water tight containers or skips to avoid odour emission during transportation to STF. It is estimated that 1~2 truck(s) per day would deliver the sewage sludge to the STF at full operation.

With the implementation of mitigation measures described in **Section 7.6.2.4**, potential environmental impacts (including potential hazard, air and odour emissions, noise, wastewater discharge and public transport) are not expected.

7.5.2.5 Operational Phase Waste Summary

A summary of the waste arising from the operational phase is presented in **Table 7.17**.

Table 7.17 Summary of waste arising from the operational phase

Area	Major activities	Waste type	Total amount generated Note 1	Handling procedures	Recommended disposal outlets
LMC Loop	General activities within site area	General refuse	43.8tpd	Provide on-site refuse collection points with recycle bins	Disposal to landfill Note 2
		Paper			Recycler
		Metals			
		Plastics			
		Fluorescent lamp			

Area	Major activities	Waste type	Total amount generated Note 1	Handling procedures	Recommended disposal outlets
	Canteen & restaurant	Food waste	24.6tpd	Provide on-site food waste collection points	on-site compost; End product – soil conditioner would be reused on-site as far as possible for landscaping
	Laboratory from education institutes	Chemical waste	2,610L/mth	Store on-site in designated area before being collected and disposed of by licensed collector	Recycle by licensed facility and/or disposal to CWTC
	Academic building & Sewage treatment work	Chemical waste	Few hundred litres per month		
	Sewage treatment work	Sewage sludge	7.1 wet tonnes/day	Provide on-site sludge collection point	Disposal to STF at Nim Wan
Adjacent Area in Hong Kong outside LMC Loop	Routine road cleaning activities	General refuse	Insignificant	Collect by routine cleaning activities	Disposal to landfill
	Operation of the Flushing Water Service Reservoir				

Note: (1) Total amount to be generated during full operation.
(2) The quantity of municipal solid waste disposal is shown in **Table 7.15**.

7.6 Mitigation Measures

7.6.1 Construction Phase

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 subsections.

7.6.1.1 Good Site Practice

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

7.6.1.2 Waste Reduction Measures

Amount of waste generation can be significant 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 minimize the potential for damage and contamination of construction materials;
- plan and stock construction materials carefully to minimize 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.);

- provide training to workers on the importance of appropriate waste management procedures, including waste reduction, reuse and recycling.

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

7.6.1.3 Storage, Collection and Transportation of Waste

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

- waste 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;
- different locations should be designated to stockpile each material to enhance reuse;

The collection and transportation of waste from works area to respective disposal sites may also induce adverse environmental impacts if not properly managed. The following recommendation should be implemented to minimize 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.

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

7.6.1.4 Excavated and C&D Materials

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.

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

On-site Sorting of C&D Materials

All C&D materials arising from the construction of the Project 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.

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

Based on the construction programme, C&D surplus materials would be generated throughout the whole development stage (Year 2014 to 2027). However, fill materials would be used for backfilling during site formation. With the programme mismatch of excavation and backfilling, scheduling of construction programme to minimize C&D materials is therefore not feasible, and surplus materials are required to be disposed of off-site. The construction programme would be reviewed during the detailed design stage to maximize the quantity of on-site reuse of surplus C&D materials whenever opportunity arises.

Use of Standard Formwork and Planning of Construction Materials Purchasing

Standard formwork should also be used as far as practicable in order to minimise the arising of C&D waste. 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

Wheel wash facilities have to be provided at the site entrance before the trucks leaving the works area. Dust disturbance due to the trucks transportation to the public road network could be minimized by such arrangement.

7.6.1.5 Contaminated Soil

It is considered unlikely that contaminated land issues would be a concern during either the construction or the operational of the proposed development as remediation on contaminated area would be carried out prior to construction. However, as a precaution, it is recommended that standard good site practice should be implemented during the construction phase to minimize any potential exposure to contaminated soils or groundwater. The details of mitigation measures to minimize the potential environmental implications arising from the handling of contaminated materials are described in Land Contamination Impacts section.

7.6.1.6 Sediment

In order to minimize the potential environmental impacts arising from the handling of sediment, the following mitigation measures are recommended during transportation and stockpiling:

- stockpiling area(s) must be properly designed and close to the excavation locations as far as possible;
- stockpiling area(s) should be lined with impermeable sheeting and bunded;
- stockpiles should be properly covered by impermeable sheeting;
- vehicles delivering the sediment should be covered, and truck bodies and tailgates should be sealed to prevent any discharge during transportation;
- bulk earth moving equipments should be utilized as much as possible to minimize workers' handling and contact of the dredged materials; and
- personal protective clothing should be provided to site workers.

7.6.1.7 Chemical Waste

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.

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 Chemical Waste Treatment Centre, or another licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

7.6.1.8 General Refuse

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 minimize potential environmental impacts.

7.6.1.9 Sewage

The WMP should document the locations and number of portable chemical toilets depending on the number of workers, land availability, site condition and activities. Regularly collection by licensed collectors should be arranged to minimize potential environmental impacts.

7.6.2 Operational Phase

The management offices of new developments in LMC Loop should minimize the amount of waste to be disposal of at landfill and maximize the recovery of materials from the waste stream. The management offices are recommended to implement a waste prevention and recycling programme.

As only connection roads and Flushing Water Service Reservoir would be developed in the adjacent area in Hong Kong outside LMC Loop, it is not expected that large quantities of waste would be generated during operational phase. General refuse would be the main waste type which would be generated from routine cleaning.

7.6.2.1 Municipal Solid Waste

Implementation of a waste prevention programme as well as materials recovery and recycling programme are recommended in order to minimize the production of waste. The programmes should consist of the following components:

- electronic communication and double-sided copying should be used as far as practical to reduce the quantities of paper;
- green products purchasing as far as possible;
- using durable tableware;
- recycling bins such as paper, metals, plastics, fluorescent lamps etc. should be placed at prominent locations to encourage recycling;
- banner should be erected at the recycling bins area;
- operator should make arrangements with the recycler to collect and recycle used toner cartridges as well as the scrap electronic equipments, such as computer to avoid disposal at landfills as far as practicable;
- staff awareness training should be provided on waste management procedures, including waste reduction and recycling;
- operator should set up waste reduction and recycled target ; and
- operator should participate in the Wastewi$e Label scheme to facilitate waste reduction.

General refuse from buildings should be collected with lidded bins and delivered to a central collection point and stored in enclosed containers to prevent windblown, vermin, water pollution and visual impact. At least daily collection should be arranged by the waste collector. Odour removal installations are also recommended to be installed at the Central Refuse Collection Chamber to treat the exhaust air. Wastewater generated should be diverted to the proposed STW through sewerage connections for treatment prior to discharge. Such arrangements would minimize potential environmental impacts. Furthermore, the low emission truck, such as EURO V or later model is recommended to be used for waste transportation to minimize traffic emission and the potential air quality impacts. The above recommendations are proposed as technical guidelines for future developers' consideration and will be subject to detailed design.

7.6.2.2 Chemical Waste

Chemical wastes generated from the laboratories, machinery maintenance as well as STW during operation would mainly include acid, alkali, solvent and lubricant oil. To prevent health hazards to operators, all such chemical wastes should be collected and handled carefully.

Plant / equipment maintenance schedule as well as laboratory testing should be designed to optimise effectiveness and to minimize the generation of chemical waste. The operators should register with EPD as chemical waste producers. Chemical wastes should be stored in appropriate containers and collected by a licensed chemical waste contractor All chemical wastes generated from laboratories as well as from machinery maintenance and servicing should be dealt with according to the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes under the provisions of the Waste Disposal (Chemical Waste)(General) Regulation.

7.6.2.3 Food Waste

Food waste would be generated during operation. The waste should be collected separately with using enclosed containers and treated by on-site composting in an enclosed area. The above recommendations are proposed as technical guidelines for future developers' consideration and will be subject to detailed design. Since there is no sufficient information at present, the future developers shall also observe the EIAO requirements when the green initiative of "on-site composting" or any other relevant proposal(s) is/are considered by the future developers.

7.6.2.4 Sewage Sludge

Sewage sludge generated from STW is suggested to be treated at the proposed STF at Nim Wan and transported by road in water tight containers or skips. Unloading process would be operated in the designated room inside STW which should be enclosed and served by negative pressure by extracting odorous gas to deodorizing unit. The low emission trucks such as EURO V or later model is recommended to be used for transportation to minimize traffic emission and the potential air quality impacts. The above recommendations are proposed as technical guidelines for future developers' consideration and will be subject to detailed design.

7.7 Residual Waste Management Implications

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 both the construction and operational phases.

7.8 Conclusion

7.8.1 Construction Phase

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 excavated fill 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. The disposal quantities for C&D materials and their disposal methods have also been assessed.

It is estimated that total 1,391,900m^3 of inert materials would be generated from the Project. 976,700m^3 of the generated inert materials would be reused on-site and the remaining would be disposed of in Public Fill Reception Facilities.

On the other hand, total 271,500m^3 non-inert materials would also be generated. 247,500m^3 of the generated non-inert material (i.e. non-inert swamp deposit) would be reused on-site and in the concurrent projects such as NENT NDA, and the remaining would be disposed of in landfill.

Besides, total 64,000m^3 of sediment would be generated during the construction of Eastern and Western connection roads. All sediment would be reused on-site and in the concurrent projects such as NENT NDA.

7.8.2 Operational Phase

The types of waste that would be generated during the operational phase have been assessed. Recommendations have been made to ensure proper treatment and disposal of these wastes. It is estimated that LMC Loop at full operation stage would recycle 14,396 tonnes per annum (tpa) out of 24,954tpa of municipal solid waste (MSW), leaving 10,558tpa of MSW that would need disposal to landfill.

7.9 Reference

[7-1] Hong Kong Polytechnics (March 1993) Reduction of construction Waste Final Report

[7-2] Approximate ratio for (inert waste): (non-inert waste) is 8:2 (Monitoring of Solid Waste in Hong Kong 1997)