

## 6 WASTE IMPACT ASSESSMENT

### 6.1 Introduction

A waste management assessment has been undertaken to define the nature and scale of potential environmental impacts associated with the Project specifically in terms of the amount and type of wastes generated during construction and the options to avoid and manage the wastes. Both construction and operational phase impacts have been assessed and mitigation measures have been identified to determine whether any residual impacts can be reduced to acceptable levels.

### 6.2 Legislation, Standards, Guidelines and Criteria

The legislation on handling, treatment and disposal of wastes, which are of relevance to this Project, are described below:

- Waste Disposal Ordinance;
- Environmental Impact Assessment Ordinance;
- Waste Reduction Framework Plan;
- Works Bureau Technical Circular No. 2/93 - Public Dumps;
- Works Bureau Technical Circular No. 25/99 - Incorporation of Information on Construction and Demolition Material Management;
- Environmental, Transport and Works Bureau Technical Circular No. 15/2003 - Waste Management on Construction Sites;
- The Works Bureau Technical Circular No. 12/2002 - Specifications Facilitating the Use of Recycled Aggregates;
- The Works Bureau Technical Circular No. 31/2004 - Trip Ticket System for Disposal of Construction and Demolition Material; and
- Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock.

#### **Waste Disposal Ordinance**

The *Waste Disposal Ordinance (WDO)* enacted in 1980 provides the statutory framework for the management of all wastes from where they arise to the point of final disposal i.e. control on the collection, treatment and disposal of waste. The WDO prohibits any person from using any land or premises for the disposal of wastes unless the person has been authorised by or has obtained a license from the waste disposal authority. The ordinance was amended in early 1995 to enable permit control on import and export of wastes in line with the requirements under the Basel Convention, and was in place in September 1996.

Under the *Waste Disposal (Chemical Waste) (General) Regulation* under the *Waste Disposal Ordinance (Cap 354)*, 'chemical waste' includes any scrap material and unwanted substances specified under Schedule 1 of the Waste Disposal Regulations. These are noted as posing serious environmental, health, and safety hazards if not stored and disposed of

appropriately. Chemical wastes are often produced primarily as a result of construction equipment maintenance activities, and include liquids such as waste oils and cleaning solvents. The Contractor must register as a chemical waste generator with the DEP and arrange for a licensed collector to collect and dispose of the waste. Chemical wastes should be handled, stored, transported and disposed with reference to the Code of Practice on the Package, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme published by the DEP.

### ***Environmental Impact Assessment Ordinance***

*Annex 7 of the Technical Memorandum on Environmental Impact Assessment Process (TMEIA)* under the EIAO specifies the assessment criteria for evaluating waste management implications.

### ***Waste Reduction Framework Plan***

A *Waste Reduction Framework Plan (WRFP)* was launched in November 1998. The WRFP sets out programme to avoid and minimise waste; promote recovery, recycling and reuse of materials; prolong the life of existing landfills and reduce the increasing costs of waste transportation, treatment and disposal. The WRFP also contains suggestions on how different sectors can incorporate various waste reduction measures into their business practices.

### ***Works Bureau Technical Circular No. 2/93 - Public Dumps***

The *Works Bureau Technical Circular No. 2/93 - Public Dumps* outlines the policy relating to dumping of construction and demolition (C&D) waste. The circular states the C&D material suitable for use as fill material should not be disposed of to landfills, but should be reused in public filling area or reclamation and land formation projects. The Public Filling Sub-Committee together with Project Departments are responsible for considering the suitability of a site as a public filling area. In order to dispose of the inert portion of C&D material in a public filling area, a license issued by the Civil Engineering Department is required.

### ***Works Bureau Technical Circular No. 25/99 - Incorporation of Information on Construction and Demolition Material Management***

The *Works Bureau Technical Circular No. 25/99 - Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers*, together with WBTC 25/99A and 25/99C, promulgates the policy and guidelines for incorporating information on the management of construction and demolition material in Publics Works Subcommittee (PWSC) papers.

### ***Environmental, Transport and Works Bureau Technical Circular No. 15/2003 - Waste Management on Construction Sites***

The *Works Bureau Technical Circular No. 15/2003 - Waste Management Plan* introduces the requirement for contractors to prepare and implement a waste management plan (WMP). The requirement shall be included in all PWP contracts (including design and build

contracts but excluding term contracts and contracts administered by Electrical and Mechanical Services Department).

***The Works Bureau Technical Circular No. 12/2002 - Specifications Facilitating the Use of Recycled Aggregates***

*The Works Bureau Technical Circular No. 12/2002 - Specifications Facilitating the Use of Recycled Aggregates* promulgated the particular specifications to facilitate the use of recycled aggregates in construction works.

***The Works Bureau Technical Circular No. 31/2004 - Trip Ticket System for Disposal of Construction and Demolition Material***

*The Works Bureau Technical Circular No. 31/2004 - Trip Ticket System for Disposal of Construction and Demolition Material* promulgates the policy to implement a trip ticket system in Public Works Programme (PWP) contracts for the proper disposal of C&D material at public filling facilities or landfills.

***Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock***

*The Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock* introduces measures to enhance the management of C&D material including rock in public works projects.

***Dumping at Sea Ordinance***

In accordance with the *Dumping at Sea Ordinance* and as ETWBTC(W) No. 34/2002 "Management of Dredged/Excavated Sediment" specified in WBTC No. 22/92, a licence is required by the Contractor for undertaking any dumping at sea. The Contractor will be required to apply for a licence from the DEP.

### **6.3 Assessment Methodology**

Wastes have been calculated based upon drawings and construction methodologies to estimate the volumes and types of wastes to be generated during the project.

### **6.4 Waste Arising**

#### **6.4.1 Construction**

##### **Municipal Waste**

Workers will generate municipal wastes such as food wastes, packaging and wastepaper. For estimating the quantity of municipal wastes, EPD's average value 1.07kg/employee/day has been adopted (*Monitoring of Municipal Solid Waste 1996, EPD (1997)* Hong Kong Government).

The volumes of municipal waste will be minimal compared to other materials generated due to the drainage works. The focus of attention should therefore be on the development of a waste management plan as described below.

### Rock from Tunnelling

Rock spoil will be generated as a result of the tunnelling works. Approximately 282,180m<sup>3</sup> (bulk volume) of mainly granodiorite and tuff rock spoil is expected.

### Waste from Construction of Surface Structures/Site Formation

Waste material such as top soil, vegetation, boulders and construction and demolition material will be generated. The volumes of these wastes are detailed in **Table 6.1** below.

**Table 6.1 Volumes of Waste generated from Construction of Surface Structures/Site Formation**

Structure	Volume of Waste (m <sup>3</sup> )	Bulk Volume*
I-1	4,747	5,839
I-2	1,463	1,800
I-3	2,432	2,991
O-1	39,807	48,962
<b>TOTAL</b>	<b>48,449</b>	<b>59,592</b>

\* Bulk volume – assuming 30% and 70% of the C&D material is rock and soil respectively and bulking factor of 1.3 and 1.2 have been adopted for rock and soil respectively.

### Summary the volumes of Waste generated from the Project Construction

It is estimated that about 341,772m<sup>3</sup> of C&D materials will be generated by the project. Of this approximately 5,959m<sup>3</sup> will be reused for landscaping works on site, approximately 17,878m<sup>3</sup> will be non-inert C&D waste to be disposed of at landfill, and approximately 317,936m<sup>3</sup> will be surplus inert material suitable for public fill or reuse on projects elsewhere. Of the surplus inert material, approximately 74,314m<sup>3</sup> will be soft inert material and approximately 243,622m<sup>3</sup> will be hard inert material. The hard inert C&D materials (i.e. Grade II granodiorite and tuff) generated by the project will vary from cobble to mainly boulder size, and is suitable for recycling. The generation of C&D materials are as follows:

Source	Total Volume	Type and Volume of Excavated Materials
i C&D material from site formation and construction of intake / outfall structures [topsoil, vegetation, boulders and C&D waste (to be sorted)]	59,592m <sup>3</sup>	<ul style="list-style-type: none"> <li>• approx 5,959m<sup>3</sup> (10%) excavated topsoil</li> <li>• approx 17,878m<sup>3</sup> (30%) non-inert material</li> <li>• approx 17,878m<sup>3</sup> (30%) surplus soft inert material</li> <li>• approx 17,878m<sup>3</sup> (30%) surplus hard inert material</li> </ul>

Source		Total Volume	Type and Volume of Excavated Materials
ii	C&D material from tunnelling [mostly Grade II to III granodiorite and tuff rock]	282,180m <sup>3</sup>	<ul style="list-style-type: none"> <li>approx 56,436m<sup>3</sup> (20%) surplus soft inert material</li> <li>approx 225,744m<sup>3</sup> (80%) surplus hard inert material</li> </ul>

#### 6.4.2 Operation

No wastes are anticipated to be generated during operation except for minor quantities of material collected during maintenance inspections.

### 6.5 Management/ Mitigation of Impacts

#### 6.5.1 During Construction

##### Vegetation Removed from Site Clearance

Wastes generated from site clearance shall be sorted and excavated topsoil segregated from roots for re-use in landscaping works, thus eliminating the need for off-site disposal.

##### Construction and Demolition Materials

Wherever possible the Contractor should reuse any C&D material on-site. C&D material should be segregated and stored in different containers to other wastes to encourage the re-use or recycling of materials and their proper disposal. The use of wooden hoardings shall not be allowed. An alternative material, which can be reused or recycled, for example, metal (aluminium, alloy, etc) shall be used.

Some 317,936m<sup>3</sup> of inert surplus material is generated by the project. This inert surplus material is suitable for public fill and the hard inert C&D material is suitable for recycling as aggregate. Current options for the reuse of surplus inert C&D material generated from the project include:

- Reuse as public fill on other projects managed by DSD.
- Reuse as public fill in reclamation projects in Mainland China.
- Transport to a public fill reception facility.

At present DSD has no committed project in year 2008 that could facilitate the reuse of the large quantity of C&D materials generated by the Tsuen Wan Drainage Tunnel Project. Continuous liaison with DSD for any new project that could reuse the C&D materials generated by this project will be undertaken.

Hong Kong Government is actively discussing with the State Oceanic Administration of the PRC the implementation details of beneficial reuse of public fill from Hong Kong in Mainland reclamation projects. These discussions are presently ongoing.

The public fill reception facility at Tuen Mun Area 38 provides a suitable facility for the reuse of surplus inert C&D material generated from the project as it is convenient for the transport of material from outfall O-1.

Under the contract, the contractor will be required to minimise the generation of C&D material and reuse it on site through the following: -

- a) to plan in the design and construction, methods to minimise the generation of C&D material;
- b) to submit a Waste Management Plan (WMP) in accordance with Environment Transport and Works Bureau Technical Circular (ETWBTC) No. 15/2003 or any superseding circular(s);
- c) to reuse recycled aggregates in accordance with ETWBTC No. 12/2002 or any superseding circular(s);
- d) to observe the requirements of the Trip Ticket System, stipulated in ETWBTC No. 31/2004 or any superseding circular(s), for disposal of C&D material; and
- e) to incorporate a Waste Management System into the WMP for effective management and control of C&D materials to avoid/reduce/minimise the generation of C&D material during construction.

For C&D waste, the contractor will be required to properly sort into inert C&D materials, metals, timber and other non-inert C&D waste in the workplace to prevent cross-contamination. To meet the proposed Construction Waste Disposal Charging Scheme (to be implemented by mid 2005), each load of construction waste delivered to landfill for disposal must not contain more than 50% by weight of inert construction waste and each load of construction waste delivered to a public fill reception facility for disposal must consist entirely of inert construction waste.

In addition, DSD will conduct site inspection to monitor the contractors' performance in the implementation of the WMP and other relevant specified requirements.

### **Excavated Materials**

Wherever practicable, excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public filling areas and avoiding the need for disposal at landfill.

### **Municipal Waste**

Temporary refuse collection facilities should be set-up by the contractor and wastes should be stored in appropriate containers prior to collection and disposal.

Domestic effluent generated by the workforce will be directed to foul sewer or chemical toilets if public facilities are not available.

## Waste Management Plan

A Waste Management Plan (WMP) for the construction of the Project should be prepared as part of the contractors submission. It will provide recommendations for appropriate recycling or disposal route and should include method statement for stockpiling and transportation of the excavated material and other construction wastes should also be included in the WMP and approved before the commencement of construction. All mitigation measures arising from the approved WMP shall be fully implemented.

For the purpose of enhancing the management of C&D material including rock, and to minimize its generation at source, a C&D Material Management Plan (C&DMMP) has been prepared for this project and would be processed in accordance with the Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock.

### 6.5.2 During Operation

No management of wastes is required during operation.

## 6.6 Environmental Monitoring and Audit

It is recommended that auditing of each waste stream should be carried out periodically to determine if wastes are being managed in accordance with approved procedures and the site waste management plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal. An appropriate audit programme would be to undertake a first audit at the commencement of the construction works, and then to audit monthly thereafter.

## 6.7 Conclusions and Recommendations

The potential environmental impacts with the handling and disposal of waste arising from the construction the Tsuen Wan Drainage Tunnel have been assessed. Operational impacts on the proposed route are not expected to be a key concern and no detailed assessment will be required. Key issues include the need for effective waste management planning during the construction phase. The assessment has concluded that the potential environmental impacts associated with the handling, storage, treatment and disposal of waste arising for the construction of the Tsuen Wan Drainage Tunnel meet the requirements of the EIAO-TM.

Option selection has identified a tunnel alignment which generates the least volume of C&D material. It is estimated that about 341,772m<sup>3</sup> of C&D materials will be generated by the project as follows: -

Summary of Generated C&D Materials				
Type	Total generated (m <sup>3</sup> )	Reuse on site	Dispose to landfill	Dispose at public fill outlet facility
Topsoil	5,959m <sup>3</sup>	5,959m <sup>3</sup>	-	-
non-inert material	17,878m <sup>3</sup>	-	17,878m <sup>3</sup>	-
soft inert material	74,314m <sup>3</sup>	-	-	74,314m <sup>3</sup>
hard inert material	243,622m <sup>3</sup>	-	-	243,622m <sup>3</sup>
<b>Totals (m<sup>3</sup>)</b>	<b>341,772 m<sup>3</sup></b>	<b>5,959m<sup>3</sup></b>	<b>17,878m<sup>3</sup></b>	<b>317,936m<sup>3</sup></b>

The disposal programme of each type of surplus C&D materials is estimated as follows: -

- |     |                             |   |
|-----|-----------------------------|---|
| i   | topsoil                     | • 851m <sup>3</sup> per month between July 2007 and Jan. 2008   |
| ii  | non-inert material          | • 397m <sup>3</sup> per month between July 2007 and March 2011  |
| iii | surplus soft inert material | • 732m <sup>3</sup> per month between Dec. 2007 and July 2008<br>• 2,722m <sup>3</sup> per month between Aug. 2008 and June 2010<br>• 651m <sup>3</sup> per month between July 2010 and March 2011  |
| iv  | surplus hard inert material | • 732m <sup>3</sup> per month between Dec. 2007 and July 2008<br>• 10,083m <sup>3</sup> per month between Aug. 2008 and June 2010<br>• 651m <sup>3</sup> per month between July 2010 and March 2011 |

It is recommended that the inert surplus C&D material be disposed at the nearest public fill reception facility at Tuen Mun Area 38. However, this is considered the last resort and continuous liaison with Public Fill Committee before tender is recommended to seek any opportunity for the beneficial use of the C&D material generated.

In accordance with requirements stipulated in the ETWBTC (Works) No. 33/2002, it is recommended that the Project office monitor the implementation of this C&DMMP and prepare a half-yearly status report and submit to Public Fill Committee (PFC). The requirements of the status report are detailed in the Technical Circular.

It is recommended that this C&DMMP should be reviewed regularly by both the Project office and the contractor(s) of the Project, and any necessary amendment and updates should be recorded properly.

As part of the WMP, the contractor shall establish a mechanism to record the quantities of C&D materials generated each month and report the quantities to the Project office. In addition, the contractor shall provide estimated quantities of C&D materials that will be generated each year from the site. The contractor is also required to set up a disposal recording system as part of the WMP by adopting the trip ticket system as stipulated in ETWBTCW No. 31/2004, in order to ensure proper disposal of C&D materials at designated outlets.

## 6.8 References

*Waste Disposal Ordinance (Cap. 354) and relevant regulations.*

*Environmental Impact Assessment Ordinance (Cap. 499).*

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

*Waste Reduction Framework Plan.*

*Works Bureau Technical Circular No. 2/93 - Public Dumps.*

*Works Bureau Technical Circular No. 2/93B - Public Filling Facilities.*



*Works Bureau Technical Circular No. 16/96 - Wet Soil in Public Dumps.*

*Works Bureau Technical Circular No. 5/98 - On Site Sorting of Construction Waste on Demolition Sites.*

*Works Bureau Technical Circular No. 25/99 - Incorporation of Information on Construction and Demolition Material Management.*

*Works Bureau Technical Circular No. 12/2000 - Fill Management.*

*Works Bureau Technical Circular No. 29/2000 - Waste Management Plan.*

*The Works Bureau Technical Circular No. 12/2002 - Specifications Facilitating the Use of Recycled Aggregates.*

*The Works Bureau Technical Circular No. 31/2004 - Trip Ticket System for Disposal of Construction and Demolition Material.*

*Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock.*

*Works Bureau Technical Circular No. 25/99A – Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers*

*Works Bureau Technical Circulars No. 25/99C – Incorporation of Information on Construction and Demolition Material Management in Public Works Subcommittee Papers.*

*Environmental, Transport and Works Bureau Technical Circular (Works) No. 15/2003 – Waste Management on Construction Sites.*