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APPENDIX 9.1 CONSTRUCTION PHASE WASTE MANAGEMENT PLAN

Introduction

1.1 In accordance with Clause 3.4.4.2 (iii) of the EIA Study Brief, a Waste Management Plan shall be included in the EIA Report to address the following elements should the construction method(s) adopted lead to the generation of significant amount of wastes material:

(a) measures on how to maximize the waste(s) reduction;

(b) quantity and nature of the waste(s) to be generated;

(c) how, when and where waste(s) will be generated, stored, reused, recycled and disposed on-site/off-site; and

(d) their disposal mean(s), route(s) and final destination(s) inside the HKSAR boundary and outside the HKSAR boundary, which may have potential cumulative impacts to the environment of the HKSAR.

1.2 A review of the construction methods proposed for HATS Stage 2A has identified that the following works items would result in the generation of a significant amount of wastes material:

(a) Construction of a deep sewage conveyance system (SCS) to collect and convey the sewage from the northern and south-western areas of Hong Kong Island to Stonecutters Island Sewage Treatment Works (SCISTW) for centralized treatment;

(b) Construction of a main pumping station at Stonecutters Island Sewage Treatment Works (SCISTW) to extract the flows from the Stage 2A sewage conveyance system, and expansion of the existing SCISTW to provide centralized CEPT and disinfection for all the sewage collected from the entire HATS catchment; and

(c) Upgrading of eight existing preliminary treatment works (PTWs) on Hong Kong Island (i.e. North Point, Wan Chai East, Central, Sandy Bay, Cyberport, Wah Fu, Aberdeen and Ap Lei Chau)

Implementation Programme

1.3 The construction of the SCS is tentatively scheduled to commence in February 2009 for completion by September 2013. The construction period is 56 months.

1.4 The excavation works for the SCISTW expansion would take place in a 27-month period (tentatively scheduled to be commenced from November 2010).

1.5 The excavation works for upgrading of the PTWs would take place in 28 months (tentatively scheduled to be commenced from February 2010 to December 2011 and April 2014 to Sep 2014.)

Constraints to Maximizing Waste Reduction

1.6 The SCS involves the construction of seven sewage conveyance sections of tunnels and/or sewers from North Point and Ap Lei Chau to Sai Ying Pun and from Sai Ying Pun to Stonecutters Island, and includes the shafts construction for mucking out of the spoils and/or the permanent connection shafts forming part of the sewerage system. The majority of the construction works would involve excavation and a very minimal amount of backfilling would be required. Hence, there would be a surplus of waste material generated from the SCS.

1.7 In designing the routing of the SCS, a number of factors have been taken into consideration including:

(a) Geological and hydrogeological conditions;

(b) Hydraulic considerations;

(c) Land constraints;

(d) Construction methods;

(e) Programming constraints;

(f) Environmental considerations; and

(g) Public concerns etc.

1.8 The following two options for tunnel construction have been considered:-

(a) Construction of tunnel by drill and blast (D&B) method; and

(b) Construction of tunnels by tunnel boring machine (TBM).

1.9 The minimum excavated diameter for TBM option would be about 3m which is same as for D&B option to allow for construction space. The volume of construction and demolition (C&D) materials generated from excavation of tunnels by D&B method and TBM are estimated to be 791,600m^3 (bulk volume) and 738,200m^3 (bulk volume) respectively. The difference in volume of C&D materials generated by the two options is approximately 53,400 m^3(bulk volume). As such, the quantity of C&D materials generated would not be sensitive to the choice of tunnel construction method. However, excavated materials generated by TBM could only be used as filling materials while that generated by D&B may be processed for use as aggregates which is of more diversity of reuse and higher commercial value. In the aspect of utilization of C&D materials, D&B method would be a more preferable construction method. The quantity of C&D materials generated is one of the concerns but predominant geological condition would be considered of having a higher priority in choosing the construction method.

Quantity and Nature of Waste Materials

1.10 The majority of the C&D material generated from the construction of the SCS would come from the tunnels excavation, with a relative small quantity coming from the shaft sinking. For both excavation options (D&B and TBM options), the C&D material would comprise mainly rock (approximately 84%) and the majority of the remaining as soil (14%). A summary of the estimated quantities of C&D material is shown in **Table 1**. The breakdown of C&D material generated is attached in **Appendix 9.2**.

Table 1 Summary of C&D Material Quantities from HATS Stage 2A Sewage Conveyance System

	Quantity (m^3)(1)	Recycle of backfilling materials from fill bank (m^3)(1)	Surplus C&D Materials (m^3)(1)(2)
Inert C&D Materials			
Soil	108,300	78,000	35,800
Broken concrete	5,500		
Rock			
Tunnel	667,000 (by D&B)	-	667,000 (by D&B)
	613,600 (by TBM)		613,600 (by TBM)
C&D Waste	10,800	-	10,800
Sub-total	791,600 (by D&B) 738,200 (by TBM)	Total:	713,600 (by D&B) 660,200 (by TBM)

Note:
(1) All the figures in this table are in bulk volume.
(2) 366,600 m^3 (bulk volume) of surplus material (Grade I/II granite, by D&B) would be delivered to Lam Tei

Quarry.

1.11 C&D material would also be generated from the upgrading works of the PTWs and demolition of chemical enhanced primary treatment (CEPT) complex next to the Cyberport PTW after commissioning of HATS 2A. An estimated quantity of C&D material generated from the PTW upgrading works are given in **Table 2.** A preliminary estimate is that approximately 5,330 m^3 (bulk volume) of soil could be reused on site for backfilling. The breakdown of the C&D material generated is given in **Appendix 9.3.**

Table 2 Summary of Surplus C&D Material Quantities from HATS Stage 2A PTW Upgrading

PTW Location	Proposed Major Upgrading Works	Estimated Bulk Volume (m^3)(4)				Frequency of Trucks
		Public Fill (waste concrete)	Public Fill (other inert materials)	C&D Waste	Marine Deposit	
North Point	Screening & degritting facilities, Seawater P/S for SCS	8,330	560	2,800	-	3/day
Wan Chai East	Transfer pumping station	130	9,760	130	3,230	3/day
Central	Screening & degritting facilities	2,000	4,510	670	50	2/day
Sandy Bay (1)	Transfer pumping station & connection channel	-	10,130	-	1,220	3/day
	Connection channel only	-	40	-	-	-
Cyberport (1)	Transfer pumping station & connection channel	26,670	13,500	8,930	-	11/day
	Connection channel only	26,670	40	8,930	-	8/day
Aberdeen	Screening & degritting facilities, Seawater P/S for SCS	2,050	4,720	690	-	2/day
Ap Lei Chau	Screening & degritting facilities, Transfer P/S	3,810	3,520	1,270	-	2/day
Wah Fu	Screening & degritting facilities	2,330	1,330	-	-	1/day
Total (m^3)						
Scenario 1 (2)		**45,320**	**34,570**	**14,490**	**4,500**	***23/day***
Scenario 2 (3)		**45,320**	**37,940**	**14,490**	**3,280**	***23/day***

Note:
(1) The transfer pumping station may either be built at Sand Bay PTW or Cyberport PTW
(2) Transfer Pumping Stations built at Wan Chai East PTW & Sandy Bay PTW
(3) Transfer Pumping Stations built at Wan Chai East PTW & Cyberport PTW
(4) All the figures in this table are in bulk volume.

1.12 The estimated quantity of C&D material generated from the SCISTW expansion works is given in **Table 3**. A preliminary estimate is that approximately 23,854m^3 (bulk volume) of soil and 1,641m^3 (bulk volume) of rock could be reused on-site for backfilling. The C&D material would arise from the on-site excavation works in a 27-month period. Breakdown of the C&D material generated is attached in **Appendix 9.4**.

Table 3 Summary of Surplus C&D Material Quantities from HATS Stage 2A SCISTW Expansion

Location	Proposed Major Upgrading Works	Estimated Bulk Volume (m^3)(1)			
		Rock Fill	Public Fill	C&D Waste	Marine Disposal
SCISTW	Pumping station, Treatment units, Effluent tunnels, Sludgy treatment facilities	14,771	214,687	7,337	13,018

Note:
(1) All the figures in this table are in bulk volume.

Minimization of Quantity of Waste Materials

1.13 The production shafts will be designed by the Contractor. The number of shafts should be minimized.

1.14 The existing capacities of some facilities at Wan Chai East PTW, Central PTW and Aberdeen PTW are inadequate to handle the projected flow under the ultimate development scenario. In order to minimize C&D material, the existing facilities may be replaced by new E&M equipment in addition to some minor civil modification works such that scale of the demolition and re-construction works could be minimized.

1.15 A more compact treatment technology, e.g. vortex-type grit trap could be adopted instead of traditional detritor for grit removal. Due to smaller size of the grit trap, the volume of excavation could be reduced.

1.16 Choosing of a straighter tunnel alignment and thus shortening the tunnel length could reduce the quantity of excavated spoil. The possibility was evaluated with the project engineers but considered practically infeasible taking into some more constraints including geological and hydrogeological conditions, hydraulic considerations, land and programming constraints, public concerns, construction methods, etc. Two major alternatives for the SCS alignment (**Figure 2.11** refers) have been considered:

(a) Option 1, the initial scheme presented in the EIAO Study Brief, was developed based on the schematic design produced under the Environmental and Engineering Feasibility Assessment Studies in relation to the Way Forward of the HATS (EEFS) commissioned by EPD in 2001.

(b) Option 2, an updated alignment developed for the SCS under Agreement No. CE 34/2005(DS), Harbour Area Treatment Scheme Stage 2A Sewage Conveyance System – Investigation, Design, and Construction

The alternative scheme under Option 2 shows more curvature over the entire alignment and thus may result in more C&D materials generated. However, taking into account different environmental considerations, Option 2 is preferred from an environmental perspective. For example, the curved alignment option under Option 2 minimises encroachment on private lots and thereby eliminates interfaces with private properties. This would be resulting in reduction of programming risk and hence duration of environmental impacts to the public. Besides, the curved alignment also avoid passing through the People Liberation Army's Barrack to the SCISTW (Tunnel L section) and this minimises vibration impacts imposed on the built heritage resources on Stonecutters Island. Since the tunnel alignment under Option 2 is only 0.5km longer than the alternative alignment of Option 1, overall increase of waste generation would not be a significant concern.

Maximization of Use of Waste Materials On-site

1.17 The excavation diameter for both D&B and TBM is similar and therefore, both methods would generate similar quantity of C&D materials. However, excavated materials generated by TBM could only be used as filling materials while that generated by D&B may be processed for use as

aggregates which is of higher commercial value and more diversity of reuse. D&B would be a more preferable construction method in the aspect of utilization of C&D materials.

1.18 In view of the nature of the SCS, surplus excavated material would be generated as discussed above. The only anticipated ground level works for the SCS construction would be the connection channels and the drop and riser shafts. There would not be a need for bulk filling works for the SCS. It is anticipated that the only filling works required would be the backfilling of the production shafts. Although the production shafts will be designed by the Contractor, the on-site use of the excavated material for backfilling of the production shafts has been considered as far as possible. A preliminary estimate is that approximately 78,000 m^3 (bulk volume) of backfilling materials could be reused for backfilling of the production shafts. Nevertheless, there is insufficient working space to temporarily stockpile the excavated material since the backfilling of the production shafts can only be carried out at a very late stage of the construction contract. To maximize reuse of C&D materials, aggregates and backfilling materials should be recycled from fill banks operated by CEDD when backfilling is needed.

1.19 Based on the latest reference design for the SCISTW expansion, the opportunity for on-site reuse of C&D material generated from the expansion works is anticipated to be limited to backfilling of the excavated area. A preliminary estimate is that approximately 25,500 m^3 (bulk volume) of soil and rock could be reused on-site for backfilling.

1.20 Based on the preliminary design for the PTW upgrading works, the opportunity for on-site reuse of C&D material is anticipated to be limited. A preliminary estimate is that approximately 5,330 m^3 (bulk volume) of excavated spoil could be reused for on-site for backfilling of trenches.

1.21 The possibility of recycling the excavated spoil as aggregates has been considered with the project engineers. The aggregate could be directly used on site for road sub-base construction. Nonetheless, the excavated spoil could not be recycled directly to be reused on-site as the excavated spoil need to be crushed into suitable size by means of crushing plant. With the consideration of limited working space, tight working programme and at close proximity to the nearby sensitive receivers, setting up of this plant is not practical. Besides, the extent of road pavement works is limited. As such, opportunity in recycling the C&D material as aggregate is considered to be limited.

Disposal of Surplus Waste Materials

1.22 The tentative construction period for the SCS is 56 months. The majority of the C&D material would be generated during shaft sinking and tunnel excavation anticipated to take place between month 4 and 37. The estimated timing of the generation of C&D material throughout the SCS construction programme is shown in **Appendix 9.2**.

1.23 The estimated timing and volume of surplus C&D material generated from SCS, PTW upgrading works and SCISTW extension works is shown in **Appendix 9.5**.

1.24 The surplus inert C&D material would require disposal to the designated public fill reception facility (PFRF) to be agreed with Civil Engineering and Development Department (CEDD). CEDD have advised that it is likely that the surplus inert C&D material would require to be delivered to the PFRFs at Chai Wan and Tuen Mun Area 38 by land transport. Apart from PFRF designated by CEDD, Grade I/II granite generated from SCS construction would be delivered to Lam Tei Quarry for crushing into aggregate. The C&D waste would require disposal at the designated landfill site to be agreed with EPD.

1.25 Transportation routings for disposal of C&D materials will be depended on the PFRFs designated by CEDD during the detail design stage as well as planning of the Contractor during the construction stage. The possible land transportation routings are identified as follows:-

Table 4 Possible Disposal Routes to PFRFs

Routing	PFRFs	Description
1	Tuen Mun Area 38	Possible Route 1: Victoria Road, Connaught Road, Western Harbour Crossing, (Stonecutters Island), West Kowloon Expressway, Tsing Kwai Highway, Cheung Tsing Tunnel, Ting Kau Bridge, Tai Lam Tunnel, Route 3, Yuen Long Highway, Tuen Mun Road, Lung Mun Road. Possible Route 2: Island Eastern Corridor, Gloucester Road, Connaught Road, Western Harbour Crossing, (Stonecutters Island), West Kowloon Expressway, Tsing Kwai Highway, Cheung Tsing Tunnel, Ting Kau Bridge, Tai Lam Tunnel, Route 3, Yuen Long Highway, Tuen Mun Road, Lung Mun Road. Possible Route 3: Connaught Road, Gloucester Road/Island Eastern Corridor, Cross Harbour Tunnel, Hong Chong Road, Gascoigne Road, Ferry Street, West Kowloon Corridor, Kwai Chung Road, Tsuen Wan Road, Tuen Mun Road, Lung Mun Road
2	Chai Wan Barging Point	Possible Route 1: Victoria Road, Connaught Road, Victoria Park Road, Island Eastern Corridor. Possible Route 2: Cyberport Road, Shek Pai Wan Road, Aberdeen Praya Road, Wong Chuk Hang Road, Aberdeen Road, Canal Road, Victoria Park Road, Island Eastern Corridor.

1.26 C&D waste may be delivered to the SENT, NENT and WENT Landfills. The transportation routings would depend on planning of the Contractor or waste collector during the construction stage. The possible land transportation routings are identified as follows:-

Table 5 Possible Disposal Routes to Landfills

Routing	Landfills	Description
1	SENT	<u>Hong Kong Island</u> Victoria Road, Gloucester Road, Victoria Park Road, Island Eastern Corridor, Eastern Harbour Crossing, Tseung Kwan O Road, Wan Po Road <u>Stonecutters Island</u> Ching Cheung Road, Lung Cheung Road, Kwun Tong Bypass, Tseung Kwan Road, Wan Po Road
2	NENT	Victoria Road, Connaught Road, Western Harbour Crossing, (Stonecutters Island), Ching Cheung Road, Tai Po Road, Tolo Highway, Fanling Highway, Sha Tau Kok Road, Wo Keng Shan Road

Routing	Landfills	Description
3	WENT	By marine route: West Kowloon Refuse Transfer Station (adjacent to SCISTW), WENT prier By land route: *Possible Route 1:* Island Eastern Corridor, Victoria Park Road, Gloucester Road, Connaught Road, Western Harbour Crossing, (Stonecutters Island), West Kowloon Expressway, Tsing Kwai Highway, Cheung Tsing Tunnel, Ting Kau Bridge, Tai Lam Tunnel, Route 3, Yuen Long Highway, Tuen Mun Road, Lung Mun Road, Lung Kwu Tan Road, Nim Wan Road. *Possible Route 2:* Connaught Road, Gloucester Road/Island Eastern Corridor, Cross Harbour Tunnel, Hong Chong Road, Gascoigne Road, Ferry Street, West Kowloon Corridor, Kwai Chung Road, Tsuen Wan Road, Tuen Mun Road, Lung Mun Road, Lung Kwu Tan Road, Nim Wan Road.

1.27 Prior to excavation of soil nearer the ground level, the soil should be collected for laboratory analysis in accordance with the "Guidance Note for Contaminated Land Assessment and Remediation" (refer to as Guidance Note) issued by EPD and the laboratory results should be compared with the Risk-based Remediation Goals (RBRGs) in the Guidance Note for assessing soil contamination. The impacts as a result of the findings should be evaluated and remedial measures shall be formulated if necessary, the treated soil can then be used as public filling materials.

1.28 Prior to excavation of the silt and marine deposit, a proposal for sampling and chemical testing of the materials should be submitted to the Director of Environmental Protection (DEP) in accordance with ETWB(W) 34/2002 to determine the category of the silt and deposit with reference to the Chemical Exceedance Levels (CEL). Upon completion of the sampling and chemical testing, a Preliminary Sediment Quality Report (PSQR) should be submitted to DEP with a copy to the Secretary of the Marine Fill Committee (MFC). MFC will determine the most appropriate open sea or confined marine disposal site on the basis of the chemical and biological test results and formally allocate disposal space. If the silt and marine disposal is classified as Category L with a quantity less than 50,000 m^3 (bulk volume), the allocation of disposal space has been delegated to DEP.

Conclusions

1.29 The majority of the C&D material generated from the construction of the SCS would come from the tunnels excavation, with a relatively small quantity coming from the shaft sinking. Two tunnel excavation options, i.e. Drill & Blast (D&B) and Tunnel Boring Machine (TBM) may be adopted. As the excavation diameter for the two options are similar, the quantity of C&D materials generated would not be sensitive to the choice of the tunnel construction method. A preliminary estimate is that approximately 78,000m^3 (bulk volume) backfill material is required for backfilling of production shafts. The backfill material should be recycled from fill banks whenever possible. The volume of surplus inert C&D material generated from SCS by the D&B and TBM options is estimated to be approximately 791,600m^3 (bulk volume) and 738,200m^3 (bulk volume) respectively. Soil and rock would constitute the majority portion (over 90%) of the C&D material for both excavation options. Approximately 366,600m^3 (bulk volume) of Grade I/II granite would be delivered to Lam Tei Quarry for crushing as aggregate. For both options, about 10,800m^3 (bulk volume) of C&D waste would be generated.

1.30 C&D material would be generated from upgrading works of the PTWs and demolition of CEPT complex at Cyberport after commissioning of HATS 2A. A preliminary estimate is that approximately 5,330 m^3 (bulk volume) of soil could be reused on site for backfilling of trenches. The volume of surplus inert C&D material is estimated to be approximately 93,350 m^3 (bulk volume) while surplus C&D waste and marine deposit would be about 14,490 m^3 (bulk volume) and 4,500 m^3 (bulk volume)

respectively.

1.31 For the SCISTW extension works, approximately 23,854m^3 (bulk volume) of soil and 1,641m^3 (bulk volume) of rock could be reused on-site for backfilling. The volume of surplus inert C&D material is estimated to be approximately 229,458 m^3 (bulk volume) while surplus C&D waste and marine deposit would be about 7,337 m^3 (bulk volume) and 13,018 m^3 (bulk volume) respectively.