5 WASTE MANAGEMENT

5.1 INTRODUCTION

This section identifies the waste arisings from the construction and operation of the Project and provides an assessment of the potential environmental impacts associated with the handling and disposal of these wastes. Issues related to contaminated land are presented in *Section 6*. The options for reuse, minimisation, recycling, treatment, storage, collection, transport and disposal of wastes arising from the Project have been examined. Procedures for waste reduction and management are considered and environmental control measures for avoiding and minimising the potential impacts are recommended.

5.2 ENVIRONMENTAL LEGISLATION AND STANDARDS

The following legislation, documents and guidelines cover or have some bearing upon the handling, treatment and disposal of waste in Hong Kong, and will be used as the basis for the assessment criteria:

- *Waste Disposal Ordinance* (Cap 354);
- *Waste Disposal (Chemical Waste) (General) Regulation* (Cap 354);
- *Crown Land Ordinance* (Cap 28); and
- *Public Health and Municipal Services Ordinance* (Cap 132) - *Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws.*
- *Annex 15* of the EIATM;
- *Waste Disposal Plan for Hong Kong*, Planning, Environment and Lands Branch, Government Secretariat (December 1989);
- *Hong Kong Planning Standards and Guidelines* (HKPSG);
- *New Disposal Arrangements for Construction Waste*, Environmental Protection Department & Civil Engineering Department (1992);
- *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*, Environmental Protection Department (1992);
- *Works Branch Technical Circular No 2/93, Public Dumps;*
- *Works Branch Technical Circular No 16/96, Wet Soil in Public Dumps;* and
- *Practice Note for Professional Persons - Construction Site Drainage* (ProPECC PN 1/94), Professional Persons Consultative Committee (1994).
- *Practice Note for Professional Persons - Contaminated Land Assessment and Remediation* (ProPECC PN 3/94), Professional Persons Consultative Committee (1994).

5.3 CONSTRUCTION PHASE

5.3.1 *Assessment Methodology*

General

The methods for assessing potential waste management impacts during construction follow those presented in *Annexes 7* and *15* of the EIATM and include the following:

- estimation of the types and quantities of the wastes generated;
- assessment of potential impacts from the management of solid waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and transport; and
- impact on the capacity of waste collection, transfer and disposal facilities.

5.3.2 *Potential Sources of Impact*

During the construction phase, solid wastes are likely to be generated as a result of the following activities:

- site clearance, including clearance of vegetation and refuse;
- demolition or decommissioning of existing facilities, including removal of concrete slabs, pipe gantries and temporary structures;
- excavation materials (in some areas the excavated soil which is associated with the preparation of foundations, may be contaminated, this is further discussed in *Section 6*);
- chemical waste associated with the maintenance of construction plant;
- general waste associated with construction activities.

If not properly managed, the handling and disposal of these wastes may cause environmental nuisance and impacts. *Figure 5.3a* shows the potential sources of wastes arising from the construction of the Stage III Extension. The nature of each of these wastes are discussed in the following sections.

Site Clearance Waste

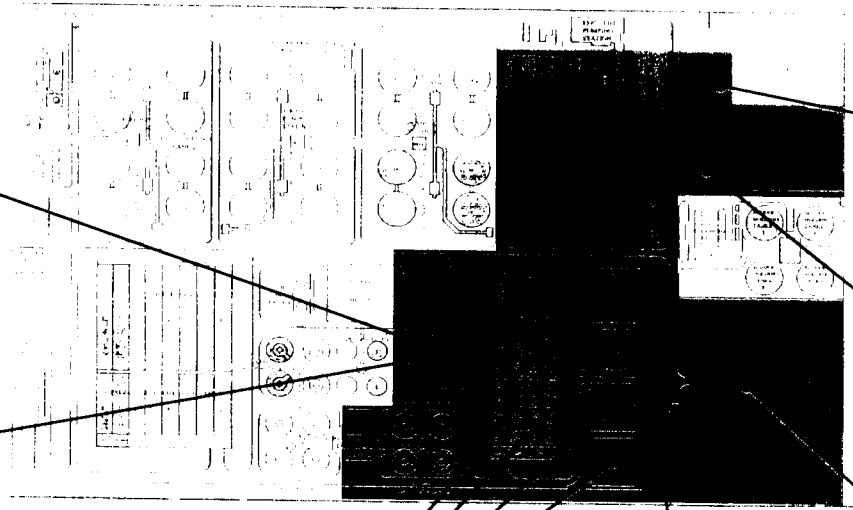
The proposed sites for the development of the Extension are generally unused. Clearance waste generated during the construction works are expected to consist of general refuse and low grade vegetation.

Construction and Demolition Waste

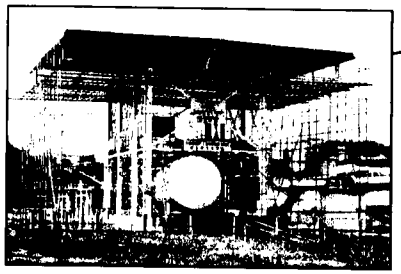
Construction and demolition (C&D) material[30] will mainly arise from the construction of the wastewater treatment facilities. It comprises of unwanted

[30] "C&D material" contains a mixture of inert and non-inert material. The inert portion is the "public fill" and the non-inert portion is the "C&D waste".

Concrete paving blocks to be removed or reused for haul road construction



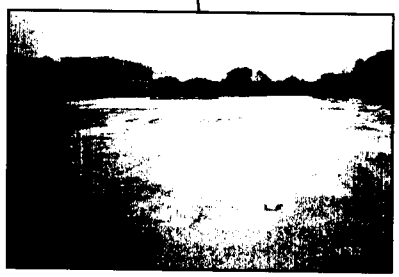
General refuse to be removed



Existing chemical storage tank to be removed or relocated

Unsuitable soil (potentially contaminated with diesel/lubrication oil) to be excavated from existing car park and disposed off-site

Sludge (potentially contaminated material) deposited at lagoons to be excavated and disposed off-site



Concrete/asphalt platform to be demolished

Concrete/asphalt platform to be demolished

KEY

PROPOSED SHA TIN SEWAGE TREATMENT WORKS STAGE 3

FIGURE 5.3a

POTENTIAL SOLID WASTE PRODUCTION DURING THE CONSTRUCTION PHASE OF THE SHA TIN SEWAGE TREATMENT WORKS STAGE III EXTENSION

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materials generated during construction, including rejected structures and materials, and materials which have been used and discarded. C&D waste may include:

- wood from formwork and falsework;
- materials and equipment wrappings;
- unusable/surplus concrete/grouting mixes; and
- damaged/surplus construction materials.

Excavated Materials

Excavations will be required for the foundation works of the proposed facilities. The majority of the excavated materials will comprise of fill materials, as the Sha Tin STW was developed on reclaimed land. These materials are expected to be inert in nature and could be reused on site if they meet necessary engineering requirements.

In the course of reviewing the operational history of the Sha Tin STW, it was identified that from time to time sludge was dried and disposed of on-site in a series of lagoons next to the primary sedimentation tanks. In addition, an area of the existing carpark will form part of the site for the construction of the dewatering house and sludge cake storage area. This area has been identified as having the potential to be potentially contaminated with diesel oil. Excavated material from these two areas may contain elevated levels of heavy metals and organic contaminants which may pose health hazards to construction workers if not adequately managed. This matter is further addressed in *Section 6*.

Chemical Waste

Chemical waste, as defined by the *Waste Disposal (Chemical Waste)(General) Regulation*, includes scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*. A complete list of such substances is provided in the Regulation, however substances likely to be generated by construction activities will, for the most part, arise from the maintenance of the on-site plant and equipment. These may include, but need not be limited to the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oils, hydraulic fluids and waste fuel;
- spent mineral oils/cleaning fluids from mechanical machinery; and
- spent solvents/solutions, some of which may be halogenated, from equipment cleaning activities.

Chemical wastes may pose serious environmental, health and safety hazards and nuisances if not properly managed. These include:

- toxic effects to workers;
- soil and water contamination from spills;
- fire hazards; and

- disruption of sewage treatment works in the event that the waste enters the sewerage system.

General Refuse

General refuse including paper and food waste will be generated from the worksite. The storage of general refuse has the potential to give rise to adverse impacts. These include odour if waste is not collected frequently, windblown litter, water quality impacts if waste enters water bodies, and visual impact. The worksite may also attract pests and vermin if the waste storage area is not well maintained and cleaned regularly. In addition, disposal of waste at sites other than approved waste transfer or disposal facilities, can also lead to similar impacts.

5.3.3 *Evaluation of Impacts*

The amount of waste arising from the construction of the Project and the potential environmental impacts from handling, storage, transport and disposal are discussed in the following sections.

Site Clearance Waste

Site clearance activities will be very limited and will produce a small amount of refuse and low grade natural vegetation. It is considered that the handling and disposal of site clearance waste will not be a key environmental issue and that the potential environmental impacts will be negligible.

Excavated Material

The majority of the excavated materials will be generated during the construction of the foundations for the Stage III Extension, including the primary sedimentation, aeration and final sedimentation tanks, sludge dewatering and storage houses and anaerobic sludge digestion tanks.

With the exception of the sludge digestion tanks, which will require excavations of up to 6 m below existing surface levels, excavations for the Stage III facilities will be limited to foundation works which are quite shallow and will not be more than 2 m below ground. It is estimated that about 600 m^3 of excavated materials will be generated from the construction of the six digestion tanks. The quantity of materials excavated for the foundations of the primary sedimentation tanks, aeration tanks and final settling tanks is estimated to be about 5,700 m^3.

As far as is practicable, the excavated material will be reused on-site for the construction of road embankments and general fill. The Contractor should liaise with the Fill Management Committee (FMC) on matters related to the timing and quantities of excavated materials generated, to ensure that the arisings can be used at the PFAs. Surplus excavated materials can be reused as fill materials in existing Public Filling Areas (PFAs) or tips provided by the Contractor (such as other construction sites where imported fill is required). However, excavated materials that are confirmed to be contaminated shall be disposed of at a landfill approved by EPD.

It is considered that the handling and disposal of surplus excavated material will not be a key environmental issue and that the potential environmental impacts

will be negligible. However, on-site stockpiling of soils may give rise to dust and siltation problems if not properly maintained and managed.

C&D Waste Arising from Demolition of Existing Concrete Slabs and from the Construction Work

Demolition waste arising from the works will be limited to the removal of the decommissioned structures and concrete slabs from proposed worksites. These include the concrete slabs to be removed for the construction of the following Stage III facilities:

- aeration tanks and primary sedimentation tanks 17 to 22;
- final sedimentation tanks 1 to 20; and
- digestion tanks 5 to 12.

An area of approximately 27,300 m^3 will require removal of existing concrete slabs to accommodate the these tanks. Assuming that the thickness of the concrete slabs is about 0.1m, approximately 2,730 m^3 of demolition material will be generated.

The total construction area estimated for the Project is 41,900 m^2, assuming 0.1 m^3 of construction residual material is generated from 1 m^2 of area to be developed, a total of 4,190 m^3 of construction residual material is estimated to be generated.

It is anticipated that following on-site sorting and segregation, most of the above C&D material could be reused on site as fill material.

Chemical Waste

It is difficult to quantify the exact amount of chemical waste which will arise from the construction activities since it will be highly dependent on the Contractor's on-site maintenance practices and the number of plant and vehicles utilised. However, it is anticipated that the quantity of chemical wastes, such as lubricating oil and solvent, produced from plant maintenance will be relatively small. These types of wastes are accepted at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi.

Storage, handling, transport and disposal of chemical waste will be managed in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Waste* published by the EPD. Provided that this occurs, and the chemical waste is disposed at a licensed chemical waste treatment and disposal facility, the potential environmental impacts arising from the storage, handling and disposal of the chemical waste generated from the construction activities will be negligible.

General Refuse

The quantity of general refuse to be generated from the construction workforce cannot be determined at this stage because information on the size of the workforce is not yet available. If good practice is adhered to with respect to collection, storage and transportation of the refuse, and if the refuse is disposed of to licensed landfills, the potential for adverse environmental impacts is minimal.

5.3.4 *Mitigation of Adverse Impacts*

Introduction

This section presents mitigation measures that could be adopted to avoid or minimise potential adverse impacts associated with waste arising from the construction of the proposed facilities. The Contractor should incorporate these recommendations into a comprehensive on-site waste management plan. Such a management plan should incorporate site specific factors, such as the designation of areas for the segregation and temporary storage of reusable and recyclable materials.

Waste Management Hierarchy

The recommended general waste management hierarchy for the Project is as follows:

- avoidance and minimisation of waste generation;
- reuse of materials as far as practicable;
- recovery and recycling of residual materials where possible; and
- treatment and disposal, according to relevant laws, guidelines and good practices as outlined in *Section 5.2*.

This hierarchy should be used to evaluate waste management options, thus maximising waste reduction and often reducing costs. Waste reduction measures should be introduced at the design stage and carried through the construction activities, wherever possible, by careful purchasing control, reuse of formworks and good site management. By reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing raw materials and waste disposal.

Training and instruction should be given to construction staff to increase awareness and draw attention to waste management issues and, in particular, the need to minimise waste generation. A training programme should be included in the site waste management plan.

Storage, Collection and Transport of Waste

Waste hauliers holding appropriate permits, should be used to collect and transport wastes to the appropriate disposal points. The following measures should be enforced to minimise adverse impacts:

- handle and store wastes in a manner which ensures that they are held securely without loss or leakage, thereby minimising the potential for pollution;
- licensed waste hauliers should only collect wastes prescribed by their permits.
- remove wastes in a timely manner;
- maintain and clean waste storage areas regularly;

- minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;

- obtain the necessary waste disposal permits from the appropriate authorities, if required, in accordance with the *Waste Disposal Ordinance* (Cap 354), *Waste Disposal (Chemical Waste) (General) Regulation* (Cap 354), the *Crown Land Ordinance* (Cap 28);

- dispose of waste at licensed waste disposal facilities;

- develop procedures such as a ticketing system to facilitate tracking of loads, particularly for chemical waste, and to ensure that illegal disposal of wastes does not occur; and

- maintain records of the quantities of wastes generated, recycled and disposed.

Excavated Material

The excavated material may have to be temporarily stockpiled on-site for subsequent re-use. Control measures as described in *Sections 3* and *4* should be taken to prevent the generation of dust and pollution of the stormwater drainage systems.

C&D Waste

In order to minimise waste arisings and to keep environmental impacts to within acceptable levels, the environmental control measures described below should be adopted for the management of C&D waste from the Project.

Careful design, planning and good site management should be adopted to minimise over-ordering and generation of waste materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

Wherever practical, the production of C&D material should be avoided by the careful control of ordering procedures to minimise the amount of surplus materials. The avoidance of over-ordering and the segregation of materials will minimise the quantity of waste requiring landfill disposal. It will also assist in minimising costs should landfill charges be introduced.

The Contractor should recycle as much of the C&D material as possible on-site. C&D materials should be sorted before disposal. Different stockpiles should be formed for such segregation and storage. Inert materials should be disposed of at approved PFAs and non-inert or putrescible materials (wood, paper, plastic, etc), should be disposed of at landfills.

The handling and disposal of bentonite slurries should be undertaken in accordance with *Practice Note for Professional Persons - Construction Site Drainage* (ProPECC PN 1/94) on construction site drainage.

Chemical Waste

Chemical waste that is produced, during construction should be handled in accordance with the *Code of Practice on the Packaging, Handling and Storage of Chemical Wastes*. The requirements of the code are summarised below.

Containers used for the storage of chemical wastes should:

- be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed;
- have a capacity of less than 450 litres unless the specifications have been approved by the EPD; and
- display a label in English and Chinese in accordance with instructions prescribed in *Schedule* 2 of the *Regulations*.

The storage area for chemical wastes should:

- be clearly labelled and used solely for the storage of chemical waste;
- be enclosed on at least 3 sides;
- have an impermeable floor and bunding, of capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in that area, whichever is the greatest;
- have adequate ventilation;
- be covered to prevent rainfall entering (water collected within the bund must be tested and disposed as chemical waste if necessary); and
- be arranged so that incompatible materials are adequately separated.

Disposal of chemical waste should:

- be via a licensed waste collector; and
- be to a facility licensed to receive chemical waste, such as the CWTC which also offers a chemical waste collection service and can supply the necessary storage containers; or
- be to a reuser of the waste, under approval from the EPD.

The Centre for Environmental Technology operates a Waste Exchange Scheme which can assist in finding receivers or buyers for the chemical wastes expected to be generated from the Project.

General Refuse

General refuse should be stored in enclosed bins or compaction units separate from C&D and chemical wastes. A licensed waste collection contractor should be employed to remove general refuse from the site, on a daily or every second day basis to minimise any potential odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.

5.4 OPERATIONAL PHASE

5.4.1 *Potential Sources of Impact*

The major waste type that will be produced from the operation of the Stage III Extension will be sludge, which can be divided into the following groups:

- screenings and grit from the inlet works;
- digested sludge from the sewage treatment process.

In addition, the operation of the STW is expected to generate chemical wastes. The nature and the potential impacts of the above materials are discussed in the following sections.

Screenings and Grit

Screenings include all types of organic and inorganic materials large enough to be removed by bar racks and screens. The organic content of these materials depends on the nature of the system and the season of the year. Grit is usually made up of the heavier inorganic solids that settle the relatively high flow velocities. Depending on the operating velocities, grit may also contain significant amounts of organic matter, specifically fats and greases.

Digested Sludge

The nature of sludge generated from a STW will depend on the types of treatment process employed. There are numerous sludge types, including: primary sludge, sludge from chemical precipitation, activated sludge, trickling-filter sludge, aerobically digested sludge and anaerobically digested sludge. Sludges from Sha Tin STW are generated from two main processes (the primary sedimentation and aeration processes) and are blended as a liquid before being anaerobically digested. The digested sludge is then dewatered by centrifugation and sent off-site for disposal at a strategic landfill. The proposed sludge production and treatment processes in Sha Tin STW are presented in *Figure 2.4a*. Digested sludge is usually dark brown to black in colour and does not produce offensive odours if thoroughly digested.

Chemical Waste

Based on the information provided by DSD, a number of chemicals will be used and stored on site during the operational phase. The types of chemicals, their storage locations and quantities are presented in *Table 5.4a*.

Table 5.4a *Chemicals Stored on Site*

Type and Storage Form of Chemicals	Chemical Applied Location	Storage Location	Anticipated Storage Quantities
Soda ash (Na_2CO_3) or sodium bicarbonate ($NaHCO_3$) or NaOH solution (around 50% concentration); soda ash and sodium bicarbonate to be stored in powdered form and packed in plastic woven bags	Bell mouths immediately downstream of the flume channels at inlet works	Underneath the existing flume channels	• Na_2CO_3: 25 tonnes • ($NaHCO_3$): 40 tonnes • NaOH: 30 m^3
Methanol (in liquid form)	Anoxic zone in aeration zone	South-east adjacent to primary settling tanks No. 14	30 m^3
Ferric chloride solution (around 40% concentration)	Sludge digestion	Near to existing thickening house	30 m^3
Ferric chloride solution (around 40% concentration)	Sludge dewatering	Sludge dewatering house	150 m^3
Polymer; stored in powder or liquid form and packed in bags	Sludge dewatering	Sludge dewatering house	3.7 tonnes
Polymer; stored in powder or liquid form and packed in bags	Sludge thickening	Sludge thickening	3 tonnes

Following chemical reactions with the materials in sewage or sludge, these chemicals will be converted to other physical and chemical forms and will become part of the sludge. Potential impacts associated these chemical waste will therefore be related to those associated with sludge management and will not be assessed independently.

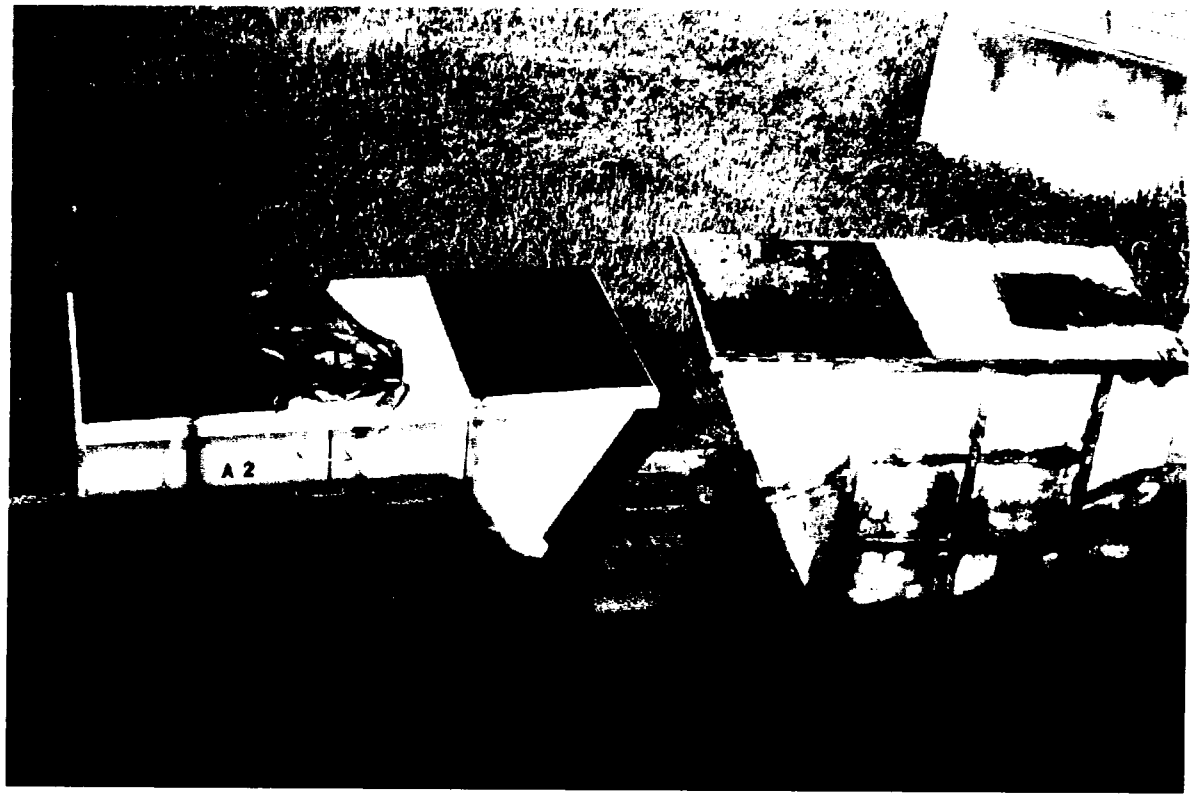
5.4.2 *Evaluation of Impacts*

Screenings and Grit

Currently, seven bar screens are in operation (on a three duty/four standby basis). Space has been allowed for a total of eight bar screens in the existing inlet works. In Stage III Extension, one more set of bar screen will be installed. Screenings are stored in 10 m^3 skips before disposal at the South East New Territories (SENT) landfill at Tseung Kwan O. *Figure 5.4a* shows the skips used for temporary storage. Screened sewage is passed to the spiral flow grit channels in the inlet works, which operate on a two duty one standby basis. Grit is continuously removed by pumps and is separated into inorganic grit and sand and organic solids by a raked classifier. Cleaned grit is discharged into oil drums before disposal to landfill.

The *Sludge Treatment and Disposal Strategy Study*[31] (STDSS) reported that in 1997, the total quantity of screenings and grit produced in Sha Tin STW was 803 m^3 and 218 m^3 respectively. The monthly quantity of screenings varies from 47.5 m^3 to a maximum quantity of 123.5 m^3, which is equivalent to a quantity of 1.6 $m^3\ d^{-1}$ to a maximum quantity of approximately 4.1 $m^3\ d^{-1}$. The monthly quantity of grit

[31] Environmental Resources Management (1999). *Sludge Treatment and Disposal Strategy Study: Draft Final Report.* 5 March 1998.



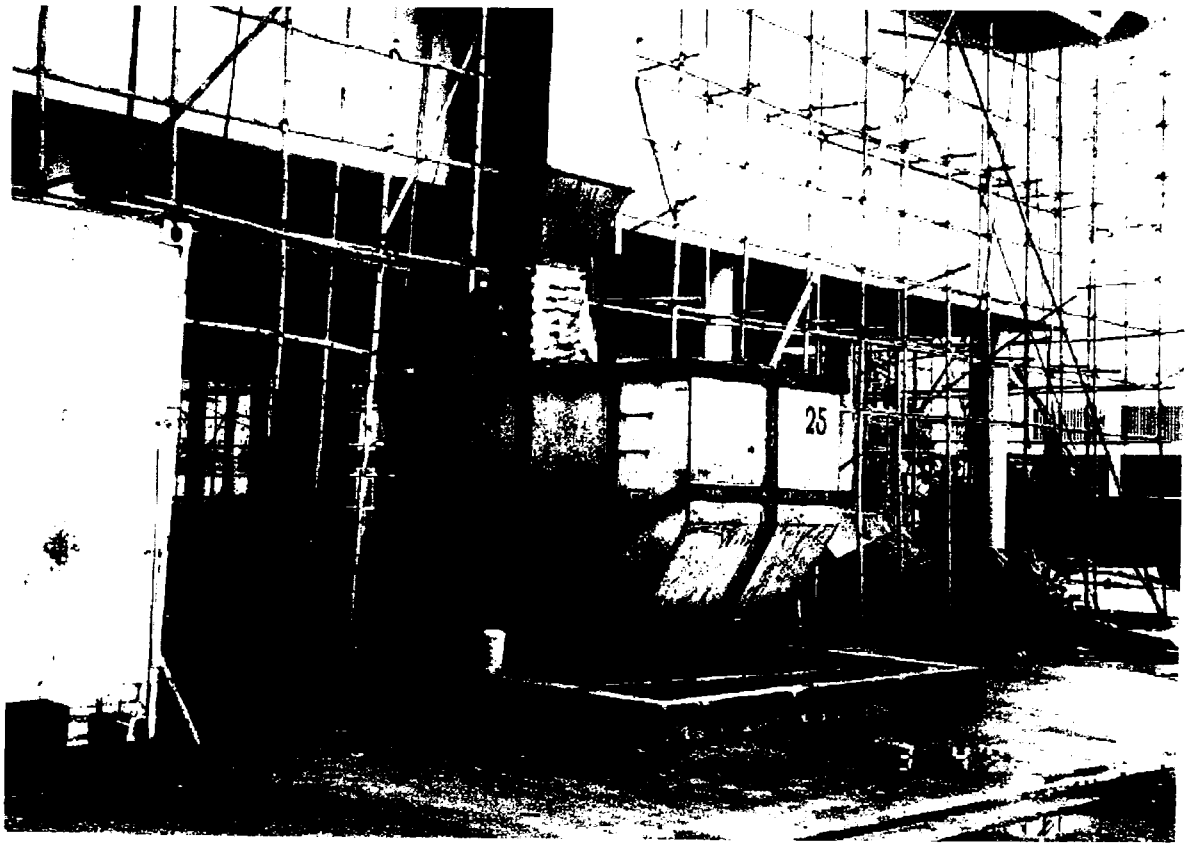


FIGURE 5.4a $10m^3$ SKIPS FOR TEMPORARY STORAGE OF SCREENINGS

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varies from 8.5 m^3 to a maximum of 27 m^3, which is equivalent to a quantity of 0.3 $m^3 d^{-1}$ to a maximum quantity of 0.9 $m^3 d^{-1}$.

The total quantity of the screenings and grit generated from the operation of Stages I, II and III of the STW is expected to be increased by 50%[32]. Under the worst case scenario, the flow in 2011 is estimated to be increased by 75%, equivalent to a flow of 350,000 $m^3 d^{-1}$. The rates of production of screenings and grit are therefore projected to increase to a maximum of 7.2 $m^3 d^{-1}$ and 1.6 $m^3 d^{-1}$ of screenings and grit respectively. As the existing transportation and disposal of these materials is well managed and controlled, it is not envisaged that the additional quantity will cause any significant impacts.

Digested Sludge

Digested sludge currently generated at the Sha Tin STW is stored in two sludge holding tanks. Sludge is then co-dewatered with sludge from the Sha Tin Water Treatment Works (WTW) before disposal at the SENT strategic landfill. The waterworks sludge is transported to Sha Tin STW via a pipeline and is stored in two sludge holding tanks. Currently, sludge dewatering is performed using centrifuges provided by a term contractor. Dewatered sludge is diverted to 10 m^3 skips by conveyor belts. When filled with dewatered sludge, the skips are towed to a temporary storage area. All dewatered sludges are disposed of to the SENT Landfill on a daily basis by a licenced waste contractor. *Figure 5.4b* shows the current sludge dewatering arrangements at the Sha Tin STW.

The characteristics for the blended Sha Tin STW and Sha Tin WTW sludge are presented in *Table 5.4a*. The results are based on the latest data from the *Sludge Treatment and Disposal Strategy Study*[33].

Table 5.4a ***Quality of Blended Dewatered Sludge Generated from Sha Tin STW and Sha Tin WTW in 1998***

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average
Dry solids (%)	23.7	25.9	25.1	25.4	26.1	25.2
Volatile solids (%)	53.9	42.3	48.6	51.9	51.4	49.6
As (mg kg^{-1}dwt)	18.9	19.4	19.9	8.9	32.9	20.0
Cd (mg kg^{-1}dwt)	1.39	0.58	1.01	1.23	0.86	1.0
Co (mg kg^{-1}dwt)	8.2	6.3	8.3	8.8	8.4	8.0
Cr (mg kg^{-1}dwt)	27.3	22.4	37.9	39.8	37.0	32.9
Cu (mg kg^{-1}dwt)	197.9	163.9	178.8	284.4	386.3	242.3
Hg (mg kg^{-1}dwt)	2.59	2.73	1.20	6.52	4.67	3.5
Ni (mg kg^{-1}dwt)	45.8	72.0	97.2	98.0	80.0	78.6
Pb (mg kg^{-1}dwt)	41.9	73.0	27.2	65.0	79.9	57.4
Sn (mg kg^{-1}dwt)	84.6	79.5	87.1	87.5	65.8	80.9

According to the recommendations of the *Draft Final Report* of the STDSS , sludge produced at the Sha Tin STW should be incinerated. This recommendation is

[32] This is based on a projected total sewage flow of about 300,000 $m^3 day^{-1}$ compared with an existing sewage flow of about 200,000 $m^3 day^{-1}$.

[33] Environmental Resources Management (1999). *Op. Cit.*

based on the *Sludge Management Strategy* (SMS) which outlines treatment and disposal strategies for all existing and planned STWs in Hong Kong.

In 1997, Sha Tin STW handled approximately 12,509 tds a^{-1} of sludge[34] and 4,226 tds a^{-1} of water treatment works sludge[35]. Estimates from the DSD[36] indicate that in 2011, about 48 tds d^{-1} of sludge will be generated from Stages I, II and III, which is equivalent to 17,520 tds a^{-1} for a flow of 295,000 m^3d^{-1}, whereas under a flow of 350,000 m^3d^{-1}, a sludge quantity of approximately 58 tds d^{-1} will be generated. In addition, there is predicted to be about 15 tds a^{-1} of water treatment works sludge from Sha Tin WTW in 2011, which is equivalent to 5,500 tds a^{-1}. Altogether, the combined quantity of STW and WTW sludge will be equal to 63 tds d^{-1} or 22,995 tds a^{-1} under a flow of 295,000 m^3d^{-1} and 73 tds d^{-1} or 26,645 tds a^{-1} under a flow of 350,000 m^3d^{-1}.

The predicted quantity of sludge to be treated and disposed of to landfill is approximately 210 m^3 d^{-1}[37] for a flow of 295,000 m^3d^{-1}, and 243 m^3 d^{-1}[38] for a flow of 350,000 m^3d^{-1}, which will require 21 and 25[39] skips respectively. *Table 5.4b* compares the sludge quantities in 1997 with the forecasted quantities when the Project is fully operational. The additional quantity is not considered large enough to have any major impacts on traffic flow and will only give rise to a further 5 to 9 vehicle movements a day.

Table 5.4b ***Summary of Existing (1997) and Forecasted Sludge Quantities (2011) Generated from Sha Tin STW***

Quantities of Sludge	Existing (1997)	Upon Completion of Project (2011) for a flow of 295,000 m^3d^{-1}	Upon Completion of Project (2011) for a flow of 350,000 m^3d^{-1}
Sludge generated at Sha Tin STW (tds d^{-1})	34	48	58
Sludge generated at Sha Tin WTW (tds d^{-1})	12	15	15
Total quantity of sludge from Sha Tin STW and Sha Tin WTW (tds d^{-1})	46	63	60
Total volume of sludge from Sha Tin STW and Sha Tin WTW (m^3 d^{-1})	153	210	243
Total no of skips required for Sha Tin STW and Sha Tin WTW (skips day^{-1})	16	21	25

Provided that the containers for the temporary storage and transportation of the sludge are suitably covered and cleaned, and that the dewatered sludge cake is removed from the site on a daily basis, the potential for impacts will be minimal.

[34] Environmental Resources Management (1997) *Sludge Treatment and Disposal Strategy Study: Baseline Report.* 24 November 1997.

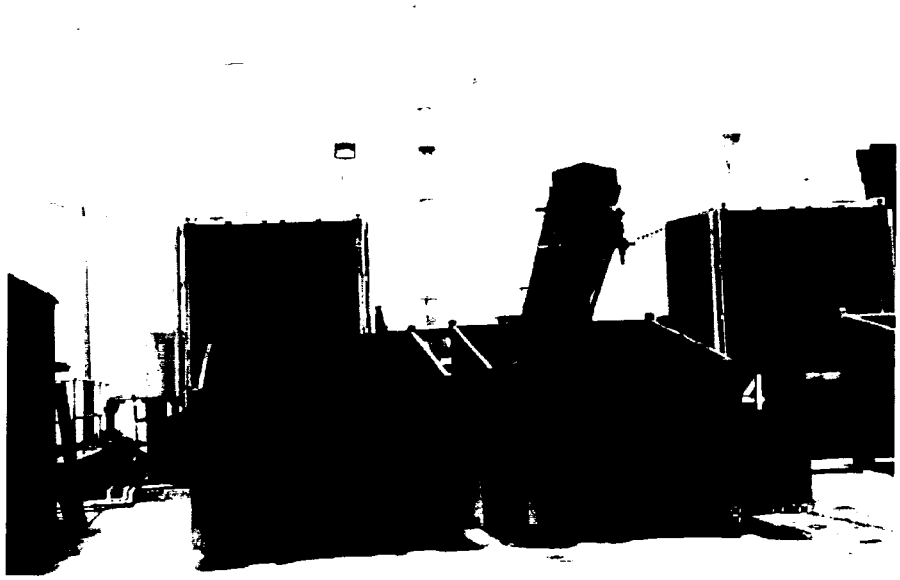
[35] Environmental Resources Management (1997) *Op. Cit.*

[36] Drainage Services Department (1999a) Facsimile to ERM: *Comments on draft EIA Report. Ref. ( ) in SP 8/4276DS/S3/17.* 21 May 1999.

[37] Assumes that dewatered sludge has a ds content of 30%, and the density of sludge is about 1 t m^{-3}, thus 60 tds of sludge will be equivalent to 200 m^3 of sludge.

[38] Assumes that dewatered sludge has a ds content of 30%, and the density of sludge is about 1 t m^{-3}, thus 60 tds of sludge will be equivalent to 200 m^3 of sludge.

[39] Drainage Services Department (1999b) *Per. comm. with Mr W C Fong of Sha Tin STW.* The existing skip used for sludge transportation can hold approximately 10 m^3 of dewatered sludge.



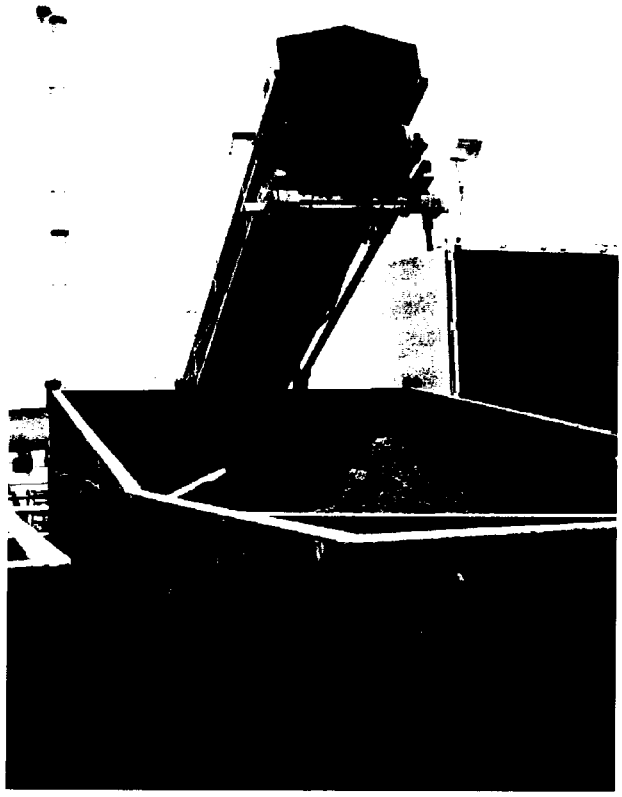


FIGURE 5.4b

SLUDGE DEWATERING AT SHA TIN STW

FILE: C1795/C1795P7
DATE: 03/11/98

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5.4.3 *Mitigation of Adverse Environmental Impacts*

The potential impacts associated with the management of waste generated from the operation of Sha Tin STW are limited to the disposal of the screenings and grit and sludge.

Environmental impacts associated with the transportation of sludges can be reduced by the use of fully enclosed containers similar to those used at the Stonecutters Island STW or by covering the existing skips with tarpaulin covers. Before a container is transported out of the STW, it should be inspected and if necessary, washed to make sure that no sludge is attached to the exterior.

The period for storage on-site should be as low as practicable. Sludge should be transported off-site for disposal on a daily basis.

A responsible site officer with adequate authority and training should be appointed to supervise the waste collection and disposal activities to ensure that wastes are collected and transported in a timely and environmentally acceptable manner. Records of the disposal operations should be on site kept for regular inspection.

5.5 *Environmental Monitoring and Audit Requirement*

The effective management of waste arisings during the construction and operation phase of the Project should be monitored through the site audit programme. The details of the programme relating to waste management will be presented in the *EM&A Manual.*

The objectives of the waste audit are as follows:

- to effectively manage waste arisings from the works in an environmentally acceptable manner;
- to ensure that handling, storage, collection and disposal of waste arising from demolition works comply with relevant requirements under the *Waste Disposal Ordinance* and associated regulations; and
- to encourage the reuse and recycling of materials.

5.6 *Conclusion and Recommendations*

The potential waste management issues resulting from the construction and operation of the Project have been assessed. Key issues include the removal of contaminated materials during the construction phase, as further assessed in *Section 6*, and the need for good practice for the management of sludges during the operational phase.

It is estimated that the operation of Stage III works will generate a further 30% of sludge relative to arisings from the Stage I/II works. This will require an additional vehicle movements a day for off-site disposal. Provided that the mitigation measures proposed for the control of construction wastes and sludge management are adopted, the impacts associated with wastes generated from the construction and operation of the Project should be minimal and considered not

to pose a nuisance. Furthermore, the provision of enhanced anaerobic sludge digestion capacity should ensure that the odour potential of dewatered sludge cake is further reduced.