CONTENTS

1 INTRODUCTION

1.1 PROPOSED GREASE TRAP WASTE TREATMENT FACILITY

Grease traps are installed at many restaurants and food processing establishments to separate the cooking oils and animal fats from sewage flow. The oil and grease intercepted by grease traps are removed regularly to ensure the proper functioning of the grease traps. For large grease traps, the restaurants and food processing establishments will employ collector registered with the Environmental Protection Department (EPD) to mechanically pump the GTW for disposal. As a result, the GTW consist of high water content (1) and other food debris. *Table 1.1a* presents the typical characteristics of GTW.

Table 1.1a ***Characteristics of GTW***

Quality	Low	Average	High
Dry Matter (%)	2	5	8
% Oil and Grease Content in Dry Matters of GTW	< 50	75	100
COD (g l^{-1})	< 50	125	> 200
Temperature of Raw GTW (^{0}C)	15	25	30
pH	4	5	7

Note:
(a) Based on the average figures obtained from previous studies on the characteristics of GTW undertaken in 2001 and 2004 and the data of the Interim Grease Trap Treatment Facility at WENT Landfill.

Currently, about 380 tonnes per day of GTW are transported to the Interim GTW Treatment Facility at the West New Territories (WENT) Landfill for treatment and disposal. This interim treatment facility is scheduled to decommission in 2007. Policy support was given by the Environment, Transport and Works Bureau (ETWB) to procure a permanent Grease Trap Waste Treatment Facility (GTWTF) at an operating transfer station. EPD plans to develop a permanent GTWTF at the existing West Kowloon Transfer Station (WKTS) (see *Figure 1.1a* for the location of the WKTS). The proposed GTWTF at WKTS will receive GTW delivered by road tankers (hereafter refers as the GTW collection vehicles), recover the oil and grease, and dispose of the wastewater after treatment.

1.2 WEST KOWLOON TRANSFER STATION

The WKTS is located on the West Kowloon Reclamation Area between the Kowloon Expressway and Stonecutter's Island (see *Figure 1.1a*) and occupies an area of about 1.85 ha. It is designed to handle an average throughput of

(1) Assuming the average oil and grease content of the raw GTW is about 50 g l^{-1}.

2,500 tonnes per day (tpd) and a peak handling capacity of up to about 3,750 tpd for the period around the Chinese New Year (CNY). It was commissioned in July 1997 and is currently operated by South China Transfer Limited (SCTL) under a Design, Build and Operate (DBO) Contract with the EPD for an operation period of 15 years. WKTS currently handles approximately 2,100 tpd of privately and publicly collected municipal solid waste (MSW). The MSW delivered by the refuse collection vehicles (RCVs) to the WKTS is compacted into 20 ft ISO containers and then transferred via two marine vessels to the WENT Landfill for disposal.

In addition, the WKTS also provides collection and transfer services to the Drainage Services Department for dewatered sewage sludge generated from the Stonecutter's Island Sewage Treatment Works (SCISTW). Currently, about 400 tpd of dewatered sewage sludge are transferred in ISO tankers through the WKTS. It should be noted that the ISO tankers are delivered directly from the SCISTW to the marine vessels without going through the transfer operations at the Main Transfer Building of the WKTS.

1.3 PURPOSE OF THIS PROJECT PROFILE

Under Schedule 2, Part I, Category G.2 of the *EIAO*, a refuse transfer station is classified as a Designated Project. As the WKTS was commissioned before the implementation of the *EIAO* (ie April 1998), it is classified as an exempted Designated Project. EPD considers that the proposed GTWTF is a material change to the WKTS and this Project Profile describes the scope of project, assess the potential environmental impacts associated with the project and recommend mitigation measures to overcome the identified potential environmental impacts. The purpose of this Project Profile is to satisfy EPD that the impact of the material change to the exempted Designated Project (WKTS) and the mitigation measures described in this Project Profile meet the requirements of the *Technical Memorandum of EIA Process*.

2 BASIC INFORMATION

2.1 PROJECT TITLE

Development of A Grease Trap Waste Treatment Facility at the West Kowloon Transfer Station

2.2 NAME OF PROJECT PROPONENT

Environmental Infrastructure Division of Environmental Protection Department

Figure 1.1a

Location of West Kowloon Transfer Station

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2.3 *NAME AND TELEPHONE NUMBERS OF CONTACT PERSONS*

Mr Andy King, Senior Environmental Protection Officer
Tel: 2872 1802

2.4 *PURPOSE AND NATURE OF THE PROJECT*

After the decommissioning of the existing Interim GTWTF at the WENT Landfill, the proposed GTWTF at WKTS will receive GTW collected from restaurants and food establishments, recover the oil and grease, and dispose of the wastewater after treatment. The proposed GTWTF at WKTS not only offers a convenient disposal outlet to the GTW producers and collectors but also allows the possibility to recover and reuse the oil and grease of the GTW.

2.5 *LOCATION OF PROJECT*

The proposed GTWTF will be located within the existing WKTS and operated by SCTL on behalf of EPD. *Figure 2.5a* shows the location of the proposed GTWTF at the WKTS.

2.6 *PROJECT DESCRIPTION*

This section describes the construction and operational activities associated with the proposed GTWTF at WKTS.

2.6.1 *Introduction*

SCTL will adopt proven GTW treatment technology in the design of the GTWTF to achieve a high efficiency in operation, recover and reuse the oil and grease, meet the permissible effluent discharge standards, and minimise the residues to be disposed of at landfills. SCTL will not only ensure full compliance with legislative and contractual requirements but also take initiative to adopt the 3R principle into the GTWTF operation. SCTL will use every measure to reduce the waste generation, and recycle and reuse the oil and grease as far as practical.

The GTWTF will consist of modular treatment units, which are capable of handling the average and peak loads of 400 m^3 d^{-1} and 572 m^3 d^{-1} of GTW, respectively. *Figures 2.6a* and *2.6b* show the layout plan of the proposed GTWTF at the WKTS. Elevation views of the biological treatment plant are shown in *Figures 2.6c* and *2.6d*. The reception, treatment and disposal of GTW at the WKTS are described below.

2.6.2 *Operation of the GTWTF*

GTW Reception

To be in-line with the operating hours of the WKTS, the GTWTF will be opened to receive GTW from all specified sources between 04:30 hrs and 01:30 hrs (21 hours) on every day of the year (including CNY Day). No operation will be executed outside these hours or outside the stated hours specified in the Waste Disposal Licence of the WKTS without the permission in writing of the EPD. The operation of the GTWTF will continue during typhoon (ie even when typhoon signal nos. 3 to no. 10 are hoisted). However, it is not expected that GTW collectors will deliver the GTW when typhoon signal no. 8 or above is hoisted.

SCTL will make use of the existing waste reception and weighing facilities of the WKTS for reception of GTW collection vehicles. The existing weighbridge system is capable of handling the additional number of GTW collection vehicles (about 58 truck trips per day over a 21-hour period) at all times (including peak hours). The weighbridges will be operated in such a way that incoming RCVs and GTW collection vehicles will not queue outside of the boundary of the WKTS at any time. The design turnaround time of the GTW collection vehicle within the WKTS is 28.6 minutes. SCTL will ensure that the reception of the GTW collection vehicles will not adversely affect the turnaround time of the RCVs.

After weighing, the GTW collection vehicles will be directed to the unloading bays at the tipping hall. The GTW collectors have to declare the locations of the GTW producers upon arrival at the WKTS. The incoming GTW will be randomly sampled and tested (1) at the GTW reception bays of the waste tipping hall (ie 1/F of the Main Transfer Building) to check if they comply with the definition of GTW and the GTW is not contaminated with chemical waste. GTW contaminated with chemical waste will be diverted to the Chemical Waste Treatment Centre. SCTL will provide appropriate personnel protection equipment and safety training to the staff who undertakes the GTW sampling and testing. GTW passing the screening test will be discharged via a flexible hose to the enclosed screens to remove grits and coarse solids. The location of the GTW unloading bays is shown in *Figure 2.6e*. The unloading of GTW will not interfere with the unloading operation of the RCVs at the tipping hall. Three unloading bays (2 on duty and 1 standby) will be provided to allow three GTW collection vehicles to unload simultaneously. Each of the screens will be provided with a conveyor screw system to remove the screenings. The screenings (about 2 to 4 tpd) will be collected for disposal at landfills. The solid waste generated from the GTWTF will not mix with the MSW at the transfer station. The screened GTW will be transferred to the first GTW storage tank by

(1) For example, the sample will be tested for pH. GTW is unlikely to have a pH lower than 4 or higher than 9. The inspector will also check the smell and appearance of the GTW to determine if there is any solvent or other unpermitted waste in the sample.

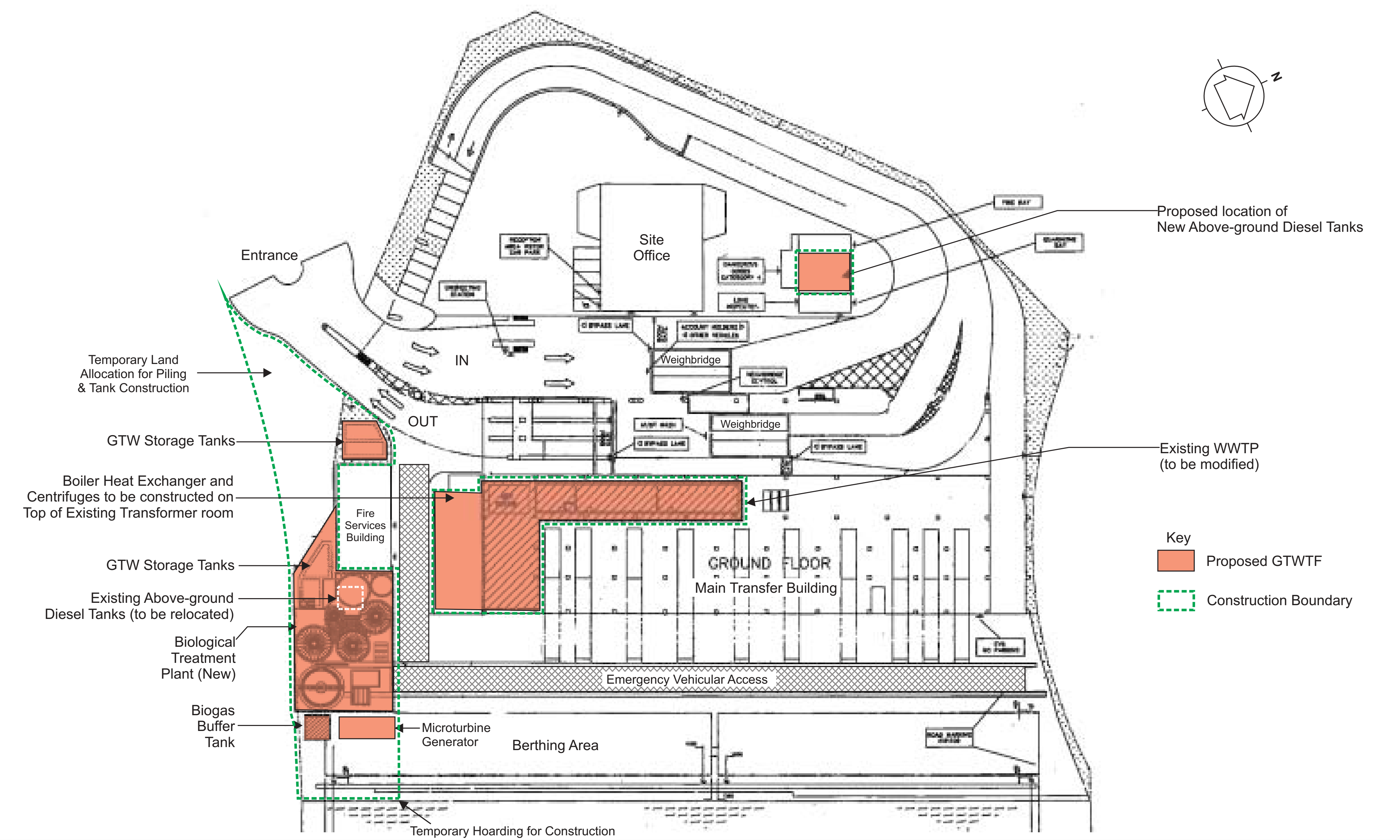

Figure 2.5a

Proposed Location of the GTWTF at WKTS

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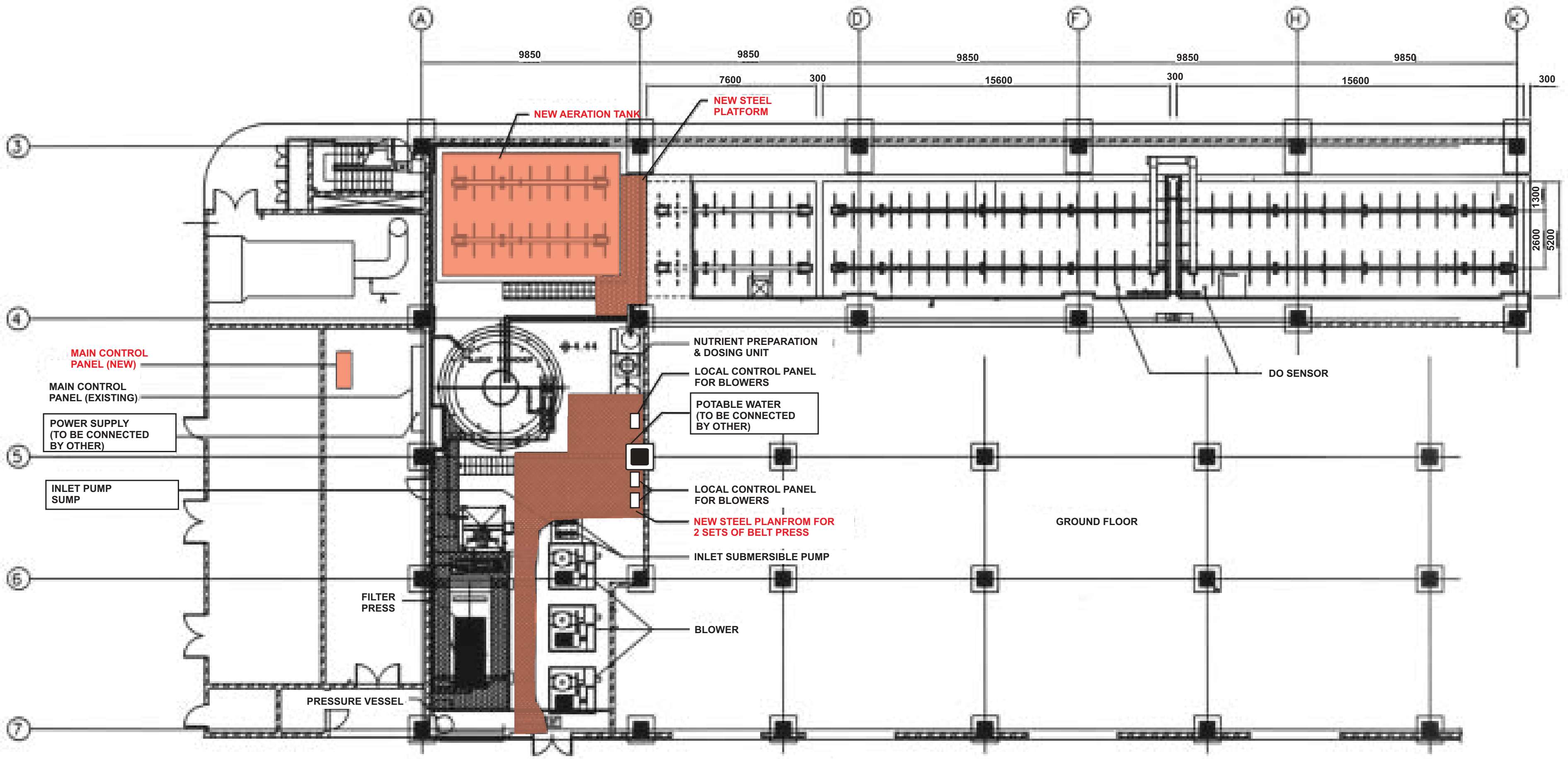

NOTES:

1) ALL DIMENSIONS ARE IN mm
EXCEPT STATED OTHERWISE.

2) ALL LEVELS ARE IN METER

Figure 2.6a

Layout Plan at Existing Wastewater Treatment Plant
(at G/F Room of the Main Transfer Building)

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DATE: 20/06/2005

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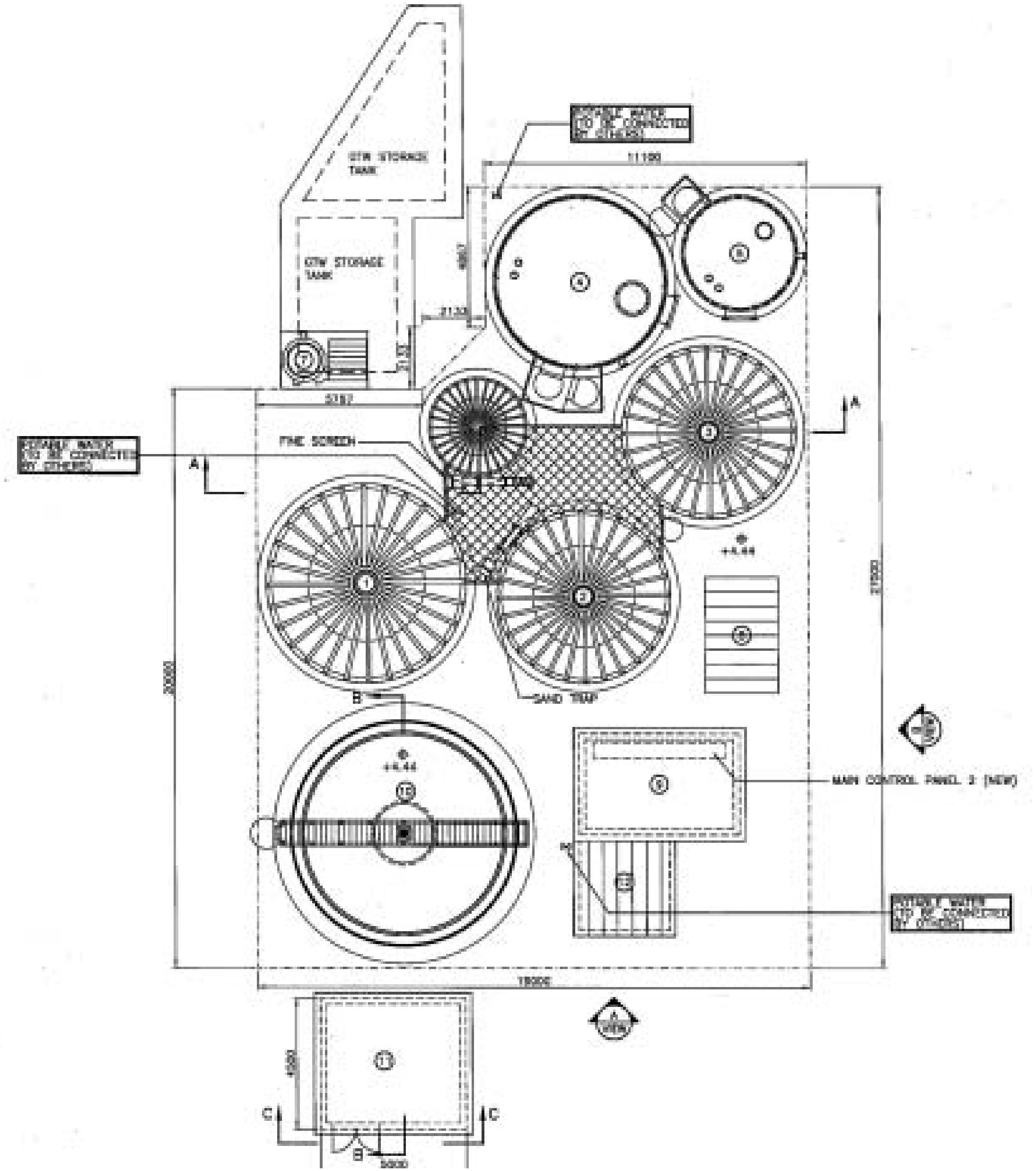

ITEM	PROCESS TANK	DIMENSIONS (m)	LOAD (TON)
1	EQUALIZATION TANK (EQT)	ø8.8 x 8 (H)	220
2	PRIMARY SETTLER (PS)	ø8 x 6.6 (H)	135
3	ACIDIFICATION TANK (AT)	ø6 x 6 (H)	170
4	ANAEROBIC REACTOR (AR)	ø8 x 18 (H)	930
5	RECIRCULATION TANK (RT)	ø4 x 8 (H)	125
6	SLUDGE HOLDING TANK (SHT)	ø3.41 x 6 (H)	60
7	FLARE HOUSE & STACK (FH)	3 x 2 x 3 (H)	5
8	PUMPING STATION	2.5 x 4 x 2 (H)	3
9	CONTROL ROOM	5.5 x 3.5 x 3.2 (H)	TBA
10	FINAL CLARIFIER (FC)	7.8 x 3.5 x 3 (H)	155
11	BIOGAS BUFFER TANK	5 x 4.5 x 3.2 (H)	---
12	CHEMICAL DOSING & STORAGE AREA	3.5 x 3.5 x 1 (H)	8

NOTES :

1) ALL DIMENSIONS ARE IN mm EXCEPT STATED OTHERWISE.
2) ALL LEVELS ARE IN METER.

Figure 2.6b

Proposed Biological Treatment Plant Layout

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DATE: 24/06/2005

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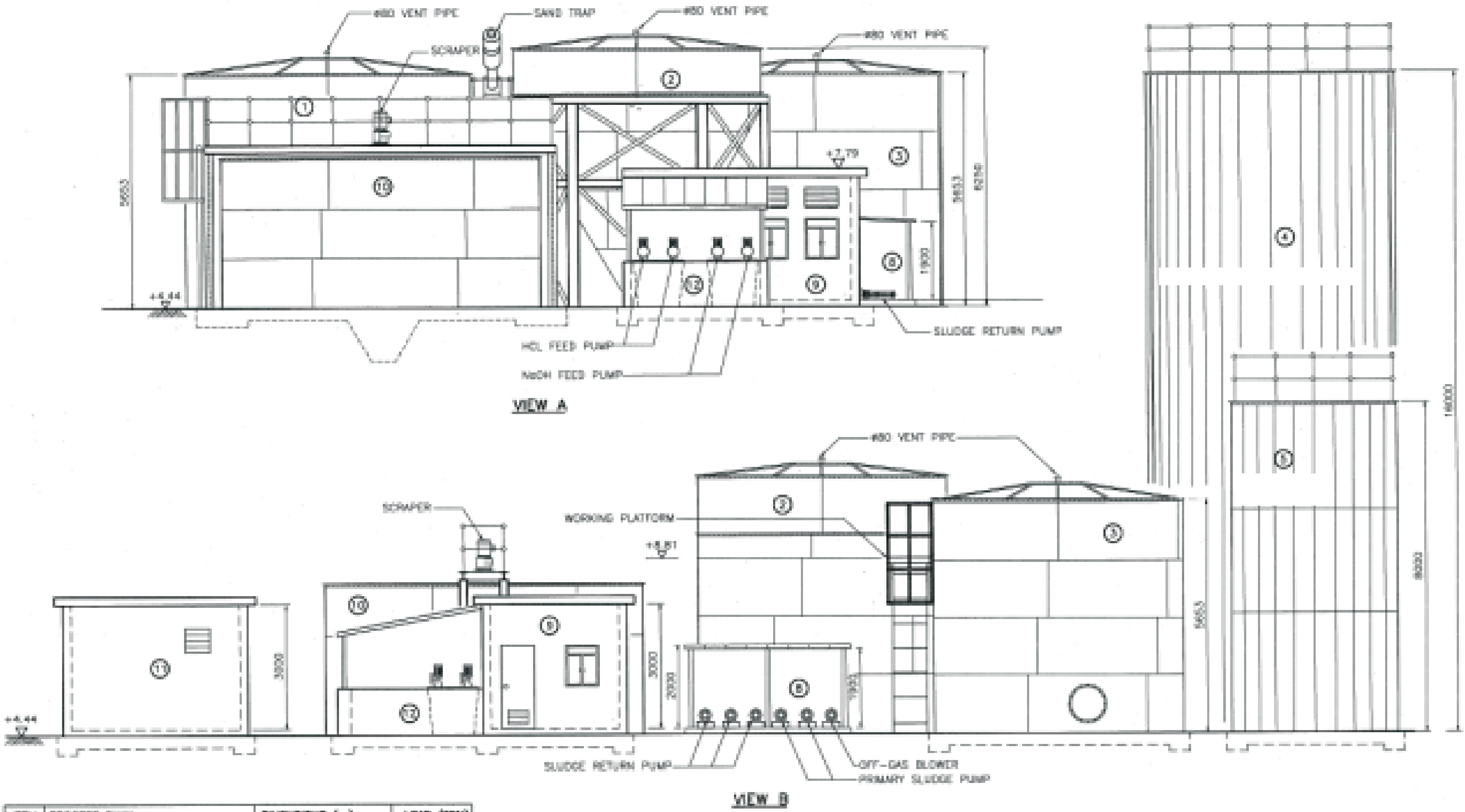

ITEM	PROCESS TANK	DIMENSIONS (m)	LOAD (TON)
1	EQUALIZATION TANK (EQT)	ø5.9 x 6 (H)	220
2	PRIMARY SETTLER (PS)	ø6 x 5.6 (H)	135
3	ACIDIFICATION TANK (AT)	ø6 x 6 (H)	170
4	ANAEROBIC REACTOR (AR)	ø6 x 16 (H)	530
5	RECIRCULATION TANK (RT)	ø4 x 8 (H)	125
6	SLUDGE HOLDING TANK (SHT)	ø3.41 x 6 (H)	60
7	FLARE HOUSE & STACK (FH)	3 x 2 x 3 (H)	5
8	PUMPING STATION	2.5 x 4 x 2 (H)	3
9	CONTROL ROOM	5.5 x 3.5 x 3 (H)	TBA
10	FINAL CLARIFER (FC)	7.6 x 3.5 x 3 (H)	155
11	BIOGAS BUFFER TANK	5 x 4.5 x 3.2 (H)	---
12	CHEMICAL DOSING & STORAGE AREA	3.5 x 3.5 x 1 (H)	8

NOTES :

1) ALL DIMENSIONS ARE IN mm EXCEPT STATED OTHERWISE.
2) ALL LEVELS ARE IN METER.
3) ALL CIVIL AND STRUCTURAL WORK, HOISTING FACILITIES, OPENINGS, FIRE FIGHTING INSTALLATION, MANHOLE COVERS, GRATINGS, CHECKER, PLATES, VENTILATION SYSTEM, LOUVRE DOOR, HANDRAIL, SAFETY CHAIN, CAST-IN-PIPEWORK AND FITTINGS, ACCESS LADDER AND STEP IRON ARE TO BE SUPPLIED AND CONSTRUCTED BY OTHERS.
4) ALL STRUCTURAL COMPONENTS AS SHOWN IN THIS DRAWING ARE FOR REFERENCE ONLY STRUCTURAL DESIGN SHALL BE DONE BY OTHERS

Figure 2.6c

Proposed Biological Treatment Plant Sectional Details (1 of 2)

FILE: 0033519d1
DATE: 17/10/2005

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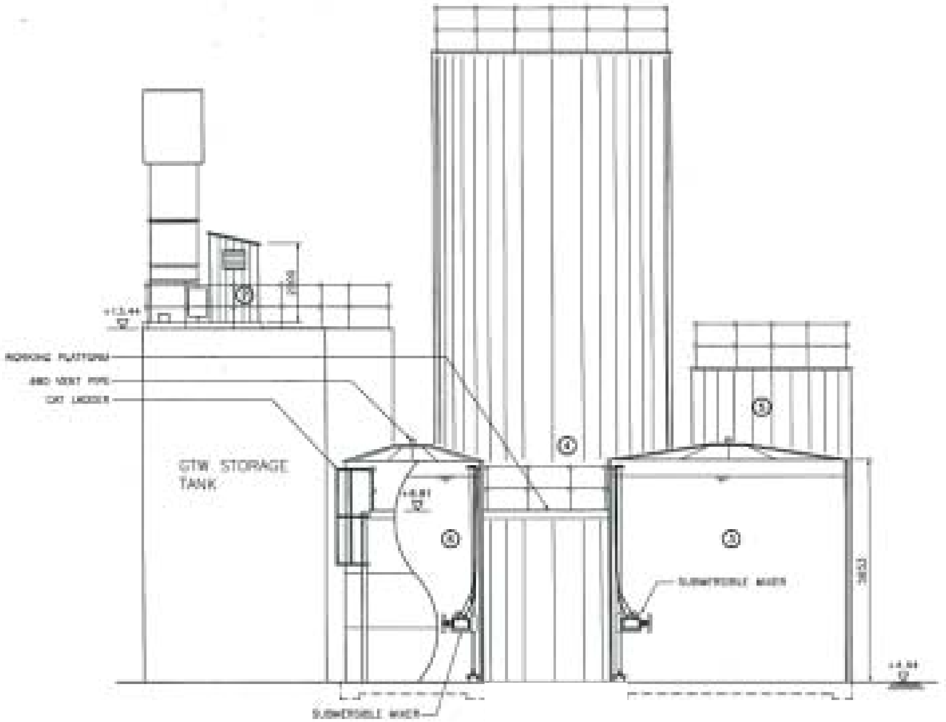
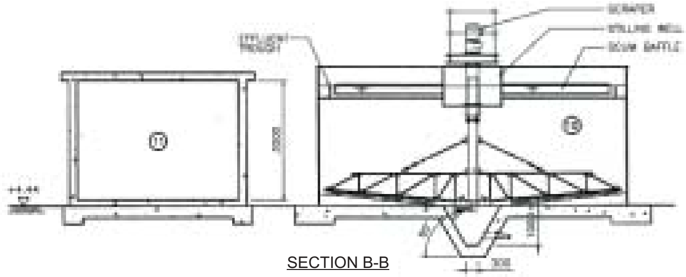
ITEM	PROCESS TANK	DIMENSIONS (m)	LOAD (TON)
1	EQUALIZATION TANK (EQT)	ø6.9 x 6 (H)	220
2	PRIMARY SETTLER (PS)	ø6 x 6.6 (H)	135
3	ACIDIFICATION TANK (AT)	ø6 x 6 (H)	170
4	ANAEROBIC REACTOR (AR)	ø6 x 16 (H)	530
5	RECIRCULATION TANK (RT)	ø4 x 8 (H)	125
6	SLUDGE HOLDING TANK (SHT)	ø3.41 x 6 (H)	80
7	FLARE HOUSE & STACK (FH)	3 x 2 x 3 (H)	5
8	PUMPING STATION	2.5 x 4 x 2 (H)	3
9	CONTROL ROOM	5.5 x 3.5 x 3 (H)	TBA
10	FINAL CLARIFER (FC)	7.8 x 3.5 x 3 (H)	155
11	BIOGAS BUFFER TANK	5 x 4.5 x 3.2 (H)	---
12	CHEMICAL DOSING & STORAGE AREA	3.5 x 3.5 x 1 (H)	8

NOTES :

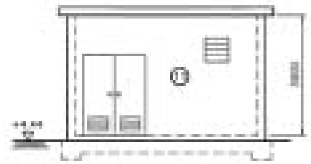
1) ALL DIMENSIONS ARE IN mm EXCEPT STATED OTHERWISE.
2) ALL LEVELS ARE IN METER.
3) ALL CIVIL AND STRUCTURAL WORK, HOISTING FACILITIES, OPENINGS, FIRE FIGHTING INSTALLATION, MANHOLE COVERS, GRATINGS, CHECKER, PLATES, VENTILATION SYSTEM, LOUVRE DOOR, HANDRAIL, SAFETY CHAIN, CAST-IN-PIPEWORK AND FITTINGS, ACCESS LADDER AND STEP IRON ARE TO BE SUPPLIED AND CONSTRUCTED BY OTHERS.
4) ALL STRUCTURAL COMPONENTS AS SHOWN IN THIS DRAWING ARE FOR REFERENCE ONLY STRUCTURAL DESIGN SHALL BE DONE BY OTHERS



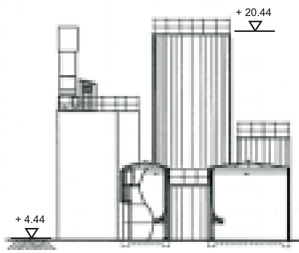
SECTION A-A



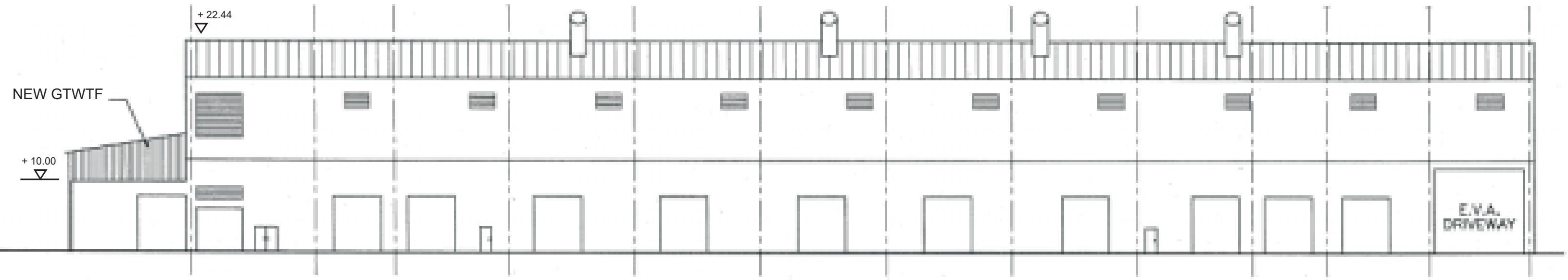
SECTION B-B



SECTION C-C



PROPOSED BIOLOGICAL TREATMENT PLANT



MAIN TRANSFER BUILDING

Figure 2.6d

Proposed Biological Treatment Plant Sectional Details (2 of 2)

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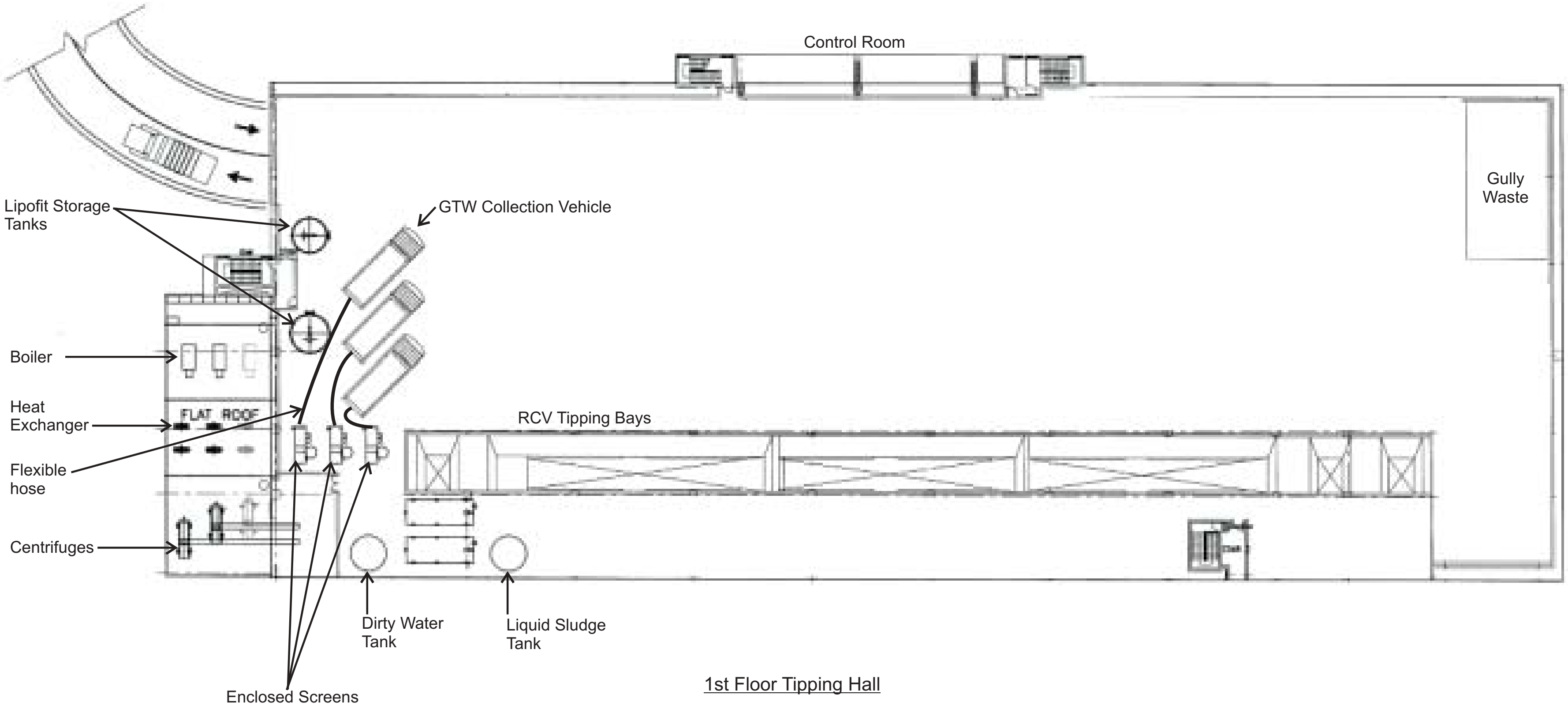

Figure 2.6e

Location of GTW Unloading Bays

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DATE: 18/10/2005

pipelines. The GTW will be treated within 24 hours of receiving at the GTWTF.

GTW Treatment

Figure 2.6f presents the process flow diagram of the proposed GTWTF at WKTS. The treatment processes consist of three major components, namely:

- Lipoval® process (1);
- Wastewater pre-treatment process; and
- Biological treatment process.

Lipoval® Process: The Lipoval® process involves the following key treatment steps:

- to concentrate the oil and grease content of the screened GTW to the target concentration of 150 g l^{-1} (refers as the Lipofit®);
- to pre-heat the concentrated GTW to 90°C prior to centrifugation; and
- to separate the pre-heated GTW into 3 components (ie oil and grease, wastewater and solids) by centrifugation.

Four GTW storage tanks (each with a capacity of 200 m^3) will be installed. One receives the screened GTW; the second one allows the oil and grease to separate from the wastewater by floatation and hence increases the oil and grease content of the GTW; and the third one receives the concentrated GTW and agitates it before pumping to the fourth storage tank. The GTW will be thoroughly mixed in the fourth tank before transfer to the centrifugation system. The wastewater separated (about 267 m^3 d^{-1}) from the second tank will be pumped to the wastewater storage tank for further treatment by the dissolved air floatation (DAF) system. Through these steps, the volume of the raw GTW (an average load of 400 m^3 d^{-1}) will be reduced to about 133 m^3 and the concentration of oil and grease in the GTW will be increased from about 50 to 150 g l^{-1}.

The concentrated GTW will be pre-heated up to 90°C (the melting point of grease) by passing through the heat exchangers in order to turn it into liquid. The pre-heated GTW will be processed in the centrifuges to separate into oil and grease, wastewater and solids.

The oil and grease (Lipofit®) contains about 98% fat with minimal water and mineral contents. It is about 4 to 15% of the concentrated GTW. Lipofit® has

(1) The Lipoval process is a proprietary technology developed by Ecopur in France in 1994. It provides an economic and reliable treatment process for GTW and can recover oil and grease and hence minimise the non-reusable dry matters. It is currently used in 5 facilities in France, Portugal and Israel.

been used as substitute fuel (1) (in replacement of heavy fuel oil) in industrial furnaces for production of cement, glass and clay products. About 7,300 m^3 of Lipofit ® were used in France in 2004. After passing through the continuous filter to eliminate the fine particles, the Lipofit® will be pumped to the Lipofit® Storage Tank (2 nos. of 40 m^3 each). The tanks and pipes handling Lipofit® will be maintained at a temperature above melting point of the grease to avoid blockage and to facilitate pumping. The Lipofit® will be loaded to a road tanker via pipelines and transported to potential users (which may include the power generation companies and other companies that use fuel boilers). With respect to the relatively small quantity of Lipofit ® to be produced (about 14 m^3 d^{-1}), it is likely that all the Lipofit ® produced will be absorbed by the market in Hong Kong. If the market of the lipofit® is not good, the surplus lipofit® will be transported by road tankers to WKTS reception area at WENT Landfill and then transfer to dump trucks for disposal at the tipping face. Lipofit® is in solid form at temperature below 60°C. The physical characteristic and moisture content will conform with WENT Landfill disposal criteria.

The wastewater will be pumped to wastewater storage tank for further treatment by the DAF system.

The solids (about 8 to 10 tpd, with 30 to 40% dry solids content) containing a high organic content will be disposed of at landfills.

Wastewater Pre-treatment Process: The wastewaters collected from the 2nd raw GTW storage tank and the Lipoval® process contain hydrolysed oil and grease and a high level of suspended solids and will be treated by a sealed DAF system at the 1/F of the Main Transfer Building (ie at the tipping hall level). Flocculent will be added to the wastewater to enhance removal of suspended solids and hydrolysed oil and grease from the wastewater. The flocculated particles will be separated from the wastewater by a continuous injection of compressed air into the reactor, which enhances their floatation. The air collected from the DAF tanks (2 nos. of 23.5 m^3 each, 1 standby) will be diverted to the wastewater treatment plant and injected into the aeration tanks. The flocculated particles (sludge) will be removed by a scraper and the pre-treated wastewater will be pumped to the biological treatment plant and wastewater treatment plant (WWTP) (2) for further biological treatment. The raw sludge (about 28 m^3 d^{-1}) generated from the DAF system will be transferred to the Sludge Holding Tank prior to dewatering by filter belts. Flocculents will be added to the sludge to enhance the dewatering process. The dewatered sludge (about 12 to 16 tpd) from the DAF system will have a dry solids content of at least 30%. It will be stored in sealed sludge container and transported to landfills by trucks.

(1) Lipofit ® is non-toxic and non-hazardous. has a high calorific value (about 9,200 kcal kg^{-1} or about 38.5 MJ kg^{-1}) and low ash (about 1.5% by wt) and sulphur (0.2% by wt) contents. Its flashpoint is very high (250°C) and therefore ha s low risks with respect to storage and transfer.

(2) Existing wastewater treatment plant to be modified.

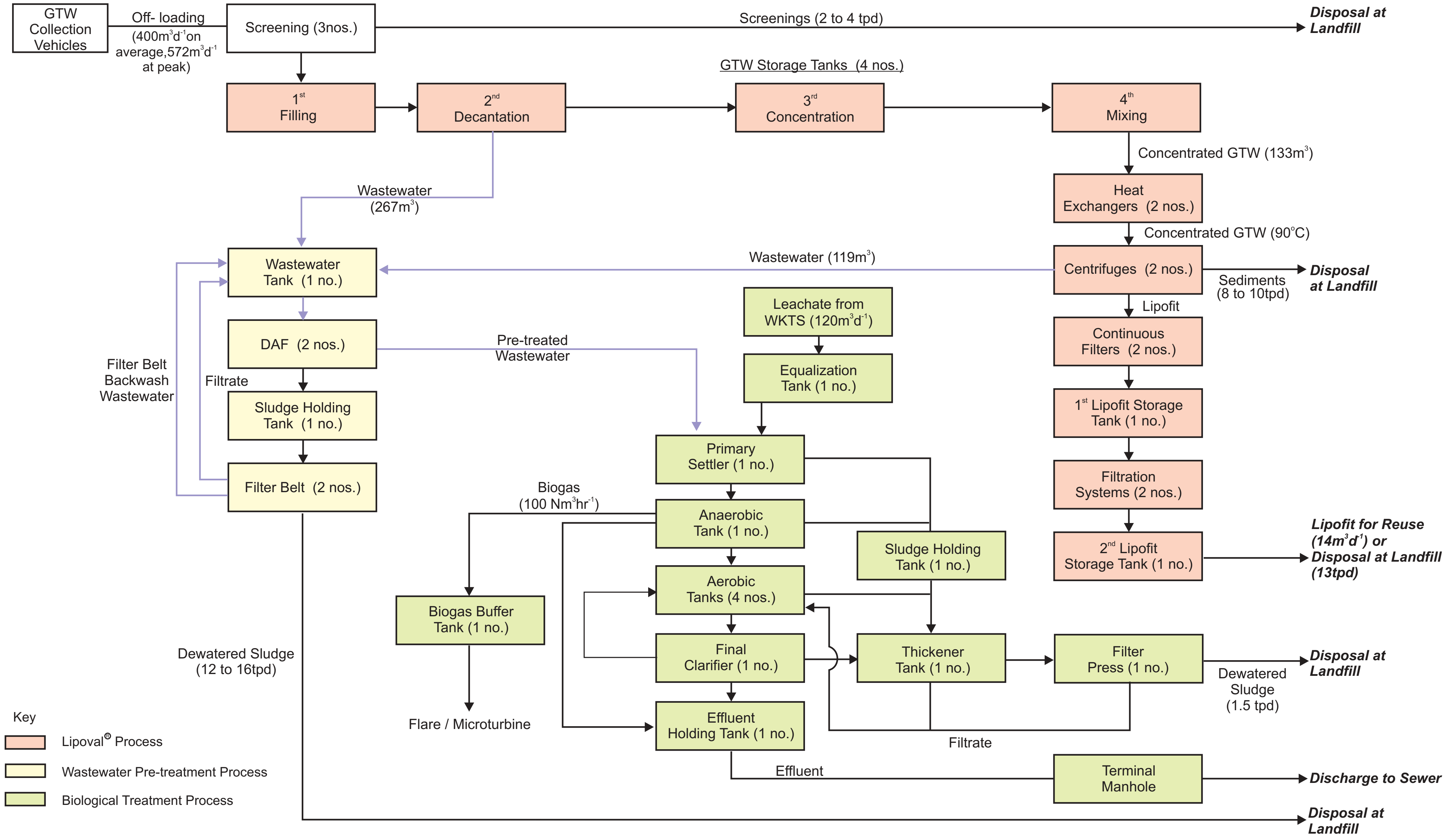

Figure 2.6f

Process Flow Diagram of Proposed Grease Trap Waste Treatment Facility at WKTS

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Biological Treatment Process: After pre-treatment, the wastewater (about 385 m^3 d^{-1} (1)) will be treated together with the wastewater arising from the waste transfer operations (about 120 m^3 d^{-1}) prior to discharge to the sewer. The biological treatment process is a combination of anaerobic and aerobic (2) treatment systems. The existing sequential batch reactor will be converted to a continuous activated sludge system so that its treatment capacity will be increased from 150 to 520 m^3 d^{-1}.

The wastewater generated from waste transfer operation will be collected and stored in the new Equalisation Tank (one tank of 220 m^3). The wastewater will be pumped to the Primary Settler (one tank of 135 m^3) and mixed with the pre-treated wastewater from the DAF system. The combined wastewater will be pumped to an Acidification Tank (one tank of 170 m^3) to adjust the pH and allow the wastewater to hydrolysis before feeding to the anaerobic treatment system.

The anaerobic treatment unit will comprise a Re-circulation Tank (one tank of 100 m^3) and a high-rate anaerobic reactor (one tank of 530 m^3), in which the organic pollutant of wastewater will be degraded via an anaerobic process. It will remove about 70% of COD and 75% of BOD in the wastewater. Biogas (mainly methane gas and carbon dioxide (3), at a rate of about 100 Nm^3 hr^{-1} (4)) generated from the anaerobic process will be collected and transferred to the biogas buffer tank (10 m^3 steel tank with a low working pressure of about 0.3 bar). This tank is not for biogas storage but buffering the biogas produced from the anaerobic reactor up to a minimum level to initiate the combustion by the micro-turbine or flaring. After removal the hydrogen sulphide and the condensate, the biogas will be fed to micro-turbines (5) (one duty and one standby, 30 kW each) to generate electricity for on-site use. Surplus biogas will be combusted by a flare (with a diameter of about 1m and at about 20.9mPD).

To minimise the size of the aerobic treatment system and hence the land take, about 70 to 80% of the effluent from the anaerobic treatment system will be further treated by the aerobic treatment system. The remainder of the effluent will by-pass the aerobic treatment. Effluent from the Aeration Tanks will be discharged by gravity to the Final Clarifier (one tank of 155 m^3). The effluent from the Final Clarifier will be discharged to the effluent holding tank (5.5 m^3) where it will mix with remainder effluent from the Anaerobic Reactor prior to discharge into the sewer through the terminal manhole. The effluent discharged from the terminal manhole will comply with the discharge standards stipulated by under the existing DBO Contract and that specified in the *Water Pollution Control Ordinance* Licence.

(1) Including about 267 m^3 from the 2nd GTW storage tank and about 119 m^3 from the centrifugation system.

(2) The aerobic treatment system is an activated sludge process with a treatment capacity of 520 m^3 d^{-1}.

(3) About 60 - 70% methane and 30- 40% carbon dioxide, about 2% of hydrogen sulphide (estimated and subject to the sulphate contents in the GTW and wastewater from the waste transfer operation).

(4) Normal cubic metre. A normal cubic metre is the volume of dry gas that occupies a volume of $1m^3$ at a temperature of 273 K and an absolute pressure of 101.3 kPa.

(5) Supplied by Capstone C30 or equivalent (H: 1,943 mm x W: 762 mm x D: 1,516 mm). Power - 30 kW net and heat rate of 13,800 kJ/kWh without gas compression option. Exhaust temperature: 276°C. NO_x emission: <9 ppmV @ 15% O_2.

In an unusual circumstance that biological treatment plant is broken down, the pre-treated wastewater will be stored in the GTW holding tanks which have a capacity of up to 2 days of the arisings of the GTW. This will provide sufficient time for emergency repair of the plant and equipment.

Raw sludge (of about 12.4 $m^3 d^{-1}$ collected from the Primary Settler and Anaerobic Reactor Tanks and 21.6 $m^3 d^{-1}$ collected from the Aeration Tanks) will be stored in the Sludge Holding Tank and then pumped into the existing Thickening Tank where ferric chloride, lime and polymer will be added to condition the sludge. The conditioned sludge will be transferred to the filter press for dewatering. Filtrate generated from the dewatering process will be fed back to the aeration tanks for treatment. Dewatered sludge cake (about 1.5 tpd) with a solid content ≥ 30% will be stored in a sludge container and delivered by trucks to landfills for disposal.

All outdoor storage and processing tanks (including the Equalisation Tank, Primary Settler, Acidification Tank, Anaerobic Reactor, Re-circulation Tank, Sludge Holding Tank) will be sealed to avoid potential odour problem. The vent gas from these tanks (except for the Anaerobic Tank) will be diverted to the Aeration Tanks for pre-treatment. Through the biological process, part of the odour components will be removed. As the Aeration Tanks will be located at the existing wastewater treatment plan room of the Main Transfer Building, which is equipped with an air scrubbing system (consisting of wet scrubbers and an ozone system), the exhaust air will be cleaned by the existing air scrubbing system prior to discharge to the atmosphere. A review of the design capacity of the existing air scrubbing system indicates that the existing system is capable of treating the exhaust air to the required air emission standards (including odour emission) specified under the existing DBO Contract (see *Sections 4.1.2* and *4.3.2*).

Table 2.6a summarises the modification works and new installations required for the development of the GTWTF at the WKTS.

Table 2.6a A Summary of the Modification Works and New Installations Associated with the Development of the GTWTF

Improvement/Modification of Existing WTKS Facilities	New Installation
At the G/F of the Main Transfer Building	
• Construction of plinths for blowers • Relocation of existing blowers including E&M works • Modification of existing SBR into activated sludge tank (ie aerobic tanks)	• Installation of an additional aerobic tank (300 m^3). The total tank volume will be increased from 584 m^3 to 884 m^3)
At the 1/F of the Main Transfer Building	
• Modification of the southern portion of the tipping hall (near the entrance from the access ramp) for unloading of GTW from the GTW collection vehicles	• Construction of GTW screens and heating screws at the tipping hall
• E&M works • Utilities and fire services connection	• Installation of Lipofit storage tanks (2 nos. of 40 m^3 each) • Installation of sludge storage tank (1 no. of 45 m^3) • Installation of the DAF units (2 nos. of 23.5 m^3 each, 1 standby) • Installation of wastewater tank (1 no. of 45 m^3)
At the Roof of the Transformer Room	
• Reinforcement work on the roof • E&M works • Utilities and fire services connection	• Construction of plinth for boiler, heat exchangers and centrifuges • Construction of a new floor on the roof • Installation of steel structure • Installation of boilers, heat exchangers and centrifuges
New Treatment Area	
• Relocation of existing above-ground diesel tanks (2 nos., 6.815 m^3 each)	• Pre-drilling for piling • Pilling and foundation construction • Underground utilities construction • Construction of GTW Storage Tanks (4 nos. of 200 m^3 each) • Installation of equalisation tank (1 no. of 220 m^3), primary settler (1no. of 135 m^3), sludge holding tank ((1 no. of 60 m^3), acidification tank (1 no. of 170m^3), final clarifier (1 no. of 155 m^3), anaerobic reactor (1 no. of 530 m^3), and re-circulation tank (1 no. of 100 m^3) • Construction of a pumping station • Construction of biogas buffer tank • Construction of flare and micro-turbines • Construction of control room • Construction of chemical reagent store • E&M works • Utilities and fire services connection
Ground Floor Area Near the Site Office	
	• Reprovision of two above-ground diesel tanks (2 nos., 6.815 m^3 each)

2.6.3 *Construction of the GTWTF*

SCTL will ensure that the construction of the GTWTF will not adversely impact on the transfer operation. Construction works will be carried out at the southern part of the tipping hall (near the entrance of the access ramp), area adjacent to the Fire Services Building at the site boundary, existing diesel tank area, quarantine bay, roof of the transformer building, and the corner at the seawall (see *Figures 2.5a* and *2.6e*). As there is no transfer operation at these areas, it is not expected that the construction activities will affect the transfer operation.

Metal hoarding will be put up around the site area for the new treatment area to separate the construction area from the operational area of the WKTS. 1.8m high fire rated hoarding will be provided at the tipping hall to separate the construction work area from the waste transfer operations. During the construction of the plinths for the screw screens, the construction area will be separated from the transfer activities using temporary barriers.

Piling for the foundations of the new installations at the new treatment area will be carried out by a specialist subcontractor. Pre-bored H piles will be used. Holes will be drilled to the required rock level of grade III/IV or better and the H piles will then be installed into the hole. This piling method will generate least nuisance in term of noise and vibration, keeping disturbance to the existing operation to the minimum. Splicing of the H piles will be carried out using butt welds installed by qualified welders and the weld tested. The hole will be filled using grade 30 cement grout. After all piles are installed, one pile will be selected for loading test. Construction of pile cap and base slab of the tank will commence after the satisfactory testing of the pile.

After completion of the base slab, the installation of the GTW tanks will be carried out. Coated plywood formwork will be used to suit the irregular shape of the tank. A dense and compact concrete is essential to the water-tightness of the tank. Water-stops will be provided at each construction joint to ensure water tightness. After concreting of the tank, epoxy finish will be applied to the internal surface of the tank. Water testing of the tank will be carried out to verify the integrity of the tank.

The construction of the control room, gas storage room and pumping station kiosk will be carried out after completion of the base slab of the tanks.

In the ground floor of the Main Transfer Building, plinths for the blowers will be constructed and the existing blowers will be relocated to the new plinths. After the blowers are relocated, the installation of the plinth for the new aeration tank will be carried out.

SCTL will ensure that the existing wastewater treatment process (including sand removal, screening, equalisation, aerobic treatment (SBR nos.1 and 2) and sludge treatment) will be maintained during the modification works and the effluent quality will comply with the required discharge standards. SCTL will closely monitor the performance of the existing WWTP during the modification works. If it is found that the effluent quality does not comply with the discharge standards, the effluent will be tankered to an off-site facility (SCISTW, Pillar Point Sewage Treatment Works, etc) for treatment and disposal.

The existing cladding of the transfer station will be replaced with fire rated panel. Plinths for the machinery and tanks at the tipping hall will be constructed at the tipping hall. The existing floor slab of the Lipofit ® Storage tank, sludge storage tank and wastewater tank at tipping hall will be strengthened with steel I beams and reinforced concrete slab.

The two existing diesel tanks, each with a capacity of 6.815 m^3, will be relocated to a new location near the site office. The new tanks will be located above-ground with a design similar to that of the existing ones.

Equipment installation will begin on the completion of civil work. Installation work may be carried out on a 24-hour basis and seven days per week.

2.7 PROPOSED PROGRAMME

The key milestones are:

Commencement of the modification of WKTS facilities and installation of new plant and equipment	June 2006
Commissioning of the proposed GTWTF	May 2007
Operation of the GTWTF	June 2007

2.8 PROPOSED ADDITION, MODIFICATION AND ALTERATION

Table 2.6a summarises the modification works and new installations required for the development of the GTWTF at the WKTS.

3 POSSIBLE IMPACTS ON THE ENVIRONMENT

Table 3.1a identifies the potential environmental impacts that may arise from the construction and operation of the proposed GTWTF. The key potential impacts due are odour, air quality, waste management, water quality, and hazard to life associated with the storage of biogas.

However, it is not expected that there will be any adverse environmental impacts due to construction and operation of the proposed GTWTF provided that the proposed environmental pollution control measures are properly implemented. As WKTS is committed to a high standard of environmental and safety performance under contractual administration and monitoring by the EPD, it is considered that the control measures will be effective.

Table 3.1a Potential Sources of Environmental Impacts

Potential Impact	Construction	Operation
• Gaseous Emissions	×	✓
• Dust	✓	×
• Odour	×	✓
• Noise	✓	✓
• Night-time Operations	×	×
• Traffic (Land & Marine)	✓ **(Land only)**	✓ **(Land Only)**
• Liquid Effluents, Discharges or Contaminated Runoff	✓	✓
• Generation of Waste or By-products	✓	✓
• Manufacturing, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods, Hazardous Materials or Wastes	×	✓
• Hazard to Life	×	✓
• Landfill Gas Hazard	×	×
• Disposal of Spoil Material, including potentially Contaminated Materials	×	×
• Disruption of Water Movement or Bottom Sediment	×	×
• Unsightly Visual Appearance	×	×
• Cultural & Heritage	×	×
• Terrestrial Ecology	×	×
• Marine Ecology	×	×
• Cumulative Impacts	×	✓

Note:
✓ = Possible × = Not Expected

4 *AIR QUALITY*

4.1 *EXISTING AND FUTURE ENVIRONMENT*

WKTS is located in an industrial area, adjacent to the container terminals and the SCISTW, and surrounded by the West Kowloon Expressway and the future Route 8. The air quality in the Study Area is mainly affected by vehicle emissions from the surrounding road network and the emissions from the SCISTW.

No air quality monitoring station (AQMS) is operated by the EPD in Cheung Sha Wan. The nearest EPD AQMS is located in Sham Shui Po. The annual average concentrations of air pollutants measured at the Sham Shui Po AQMS are summarised in *Table 4.1a*.

Table 4.1a Background Air Quality

Air Pollutant	Background Concentration (μg m^{-3}) (a)
Nitrogen Dioxide (NO_2)	66
Sulphur Dioxide (SO_2)	21
Carbon Monoxide (CO)	1,544 (b)

Notes:

(a) Reference to Air Quality in Hong Kong 2003, published by Air Services Group of EPD

(b) Since no CO is measured at Sham Shui Po, therefore, the annual average concentration of CO measured at Mongkok AQMS was adopted.

4.2 *AIR SENSITIVE RECEIVERS*

The existing uses within the Study Area are mainly industrial. According to the *Stonecutters Island Outline Zoning Plan* (OZP) (S/SC/8), there are no air sensitive uses planned in the vicinity of the WKTS. The closest residential development, Hoi Lai Estate, is located at about 800 m from the WKTS.

Representative Air Sensitive Receivers (ASRs) in the vicinity of the WKTS are identified and shown in *Figure 4.2a*. The horizontal distance between the WKTS and ASRs and the building height of the ASRs are presented in *Table 4.2a*.

Table 4.2a Identified Representative Air Sensitive Receivers

ASR	Location	Distance between WKTS and ASR (m)	Approximate Height of Building (m above ground)
A1	WSD Water Selling Kiosk	120	3
A2	Office of Ocean Ship Building & Engineering Ltd	60	20
A3	Office of CKS Shipyard Co Ltd	150	15
A4	Wang Tak Building	180	25
A5	Office of Shun Tak China Travel	265	25
A6	Office of New World First Ferry Depot	470	8
A7	Administration Building of SCISTW	60	10
A8	Office of KMB Depot	30	20
A9	Office in Marine Department's Dockyard	295	12
A10	COSCO HIT Building	295	38
A11	Hoi Lai Estate	800	100

4.3 GASEOUS EMISSIONS

4.3.1 Construction Phase

With respect to the small scale of the construction work, the number of construction plant and truck movements will be small. It is not anticipated that the emissions from the operation of the plant and vehicles will cause adverse air quality impacts.

4.3.2 Operation Phase

Potential Sources of Impacts

Gaseous emissions will be generated from the GTW collection vehicles, micro-turbines, biogas flare and the fuel boiler during the operation of the GTWTF.

Gaseous Emissions from GTW Collection Vehicles: The operation of GTWTF will increase the traffic flow (an additional 58 truck trips per day on a normal working day, about 10% of the anticipated RCV traffic) within the WKTS resulting in an increase in vehicular emissions. The *Detailed Environmental Impact Assessment of the WKTS (DEIA)* (1) indicated that in order to maintain the air quality of 55 mg m^{-3} for carbon monoxide (CO) and 5 mg m^{-3} for nitrogen dioxide (NO_2) in tipping hall, ventilation rates of 38,700 m^3 hr^{-1} and 103,700 m^3 hr^{-1} are required to be achieved, respectively based on a maximum peak RCV arrival rate of 111 vehicles per hour. As shown in *Table 7.1a* the estimated number of truck trips visiting the WKTS in 2006 (including the GTW collection vehicles) is about 70, which is well within the designed peak traffic flow. In accordance with EM&A programme of the WKTS, SCTL will undertake the flow rate measurement in tipping hall at half yearly intervals. The air flow rates through each wet scrubber (a total of 4 nos.) measured in 2004 ranges from 21.8 to 24.5 m^3 sec^{-1} (with a total air flow rate of about 333,700 m^3 hr^{-1}) which is well above the designed flow rate of 18.6 m^3 sec^{-1} (or a total of 267,800 m^3 hr^{-1}). SCTL undertakes routine maintenance of the air scrubbing system to maintain good ventilation and air quality inside the transfer building. It is considered that the existing ventilation system will be able to maintain the CO and NO_2 concentrations at the tipping hall well within the required air quality standards even with the unloading operation of the GTW at the tipping hall.

During the 2004 annual environmental audit of WKTS, the CO, NO_2 and methane (CH_4) levels at the tipping hall (Station GM4) were measured and the results showed that CO and NO_2 levels in the tipping hall were extremely low. Levels of CH_4 were found to be non-existent between January and May 2003, and when detected, ranged between 0% Lower Explosion Limit (LEL) to 2% LEL.

(1) Final Report (Revised) Contract No EP/SP/21/94, West Kowloon Transfer Station - Detailed Environmental Impact Assessment, Volume I. South China WMI Transfer Limited, 2 March 1998.

Figure 4.2a

Air Sensitive Receivers

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It is therefore considered that the unloading operation of the GTW will not cause adverse air quality impact at the tipping hall.

Gaseous Emissions from the Micro-turbines, Biogas Flare and Boiler: The proposed anaerobic treatment system will produce biogas (about 100 $m^3 h^{-1}$, with about 60-70% of CH_4 and 30-40% of (carbon dioxide) CO_2 [(1)]) (see *Figure 4.3a*). After removal of hydrogen sulphide (H_2S) and condensate [(2)], the biogas will be fed to micro-turbines (Capstone C30 micro-turbine generator or equivalent, one duty and one standby) to generate electricity for on-site use. The micro-turbine will consume 433,000 Btu or about 457 MJ hr^{-1} of biogas per hour (about 12.5 $Nm^3 hr^{-1}$ of biogas assuming a typical calorific value of 36.44 MJ Nm^{-3}) and will generate approximately 30kW of electricity.

The flue gas will be emitted to the atmosphere at a flow rate of 0.25 $m^3 s^{-1}$ through a vent pipe (with an internal diameter of 0.127m) located on the rooftop of the enclosure. The height of pipe is 3 m above ground. The exit temperature of the flue gas is about 276°C. The system achieves ultra-low NO_x performance with a NO_x emission limit of 9 ppmV @ 15% O_2. Emissions of CO and hydrocarbons are 40 ppmv and 9 ppmv, respectively. It is expected that the flue gas will comprise mainly CO_2 and H_2O with a trace amount of NO_2 and CO.

The surplus biogas will be combusted by a flare. The flare will be located on top of the GTW Storage Tank, with a stack height of 16.5 m above ground and a diameter of 1 m. The maximum capacity of the flare is 150 $Nm^3 hr^{-1}$ and the biogas will be combusted at about 800°C. The flue gas will comprise mainly CO_2 and SO_2 (sulphur dioxide) (emission standard of 300 mg m^{-3}) and water vapour with trace amount of NO_2 and CO to be emitted to atmosphere at a flow rate of 0.5 $m^3 s^{-1}$.

To prevent blockage and to facilitate pumping and phase separation, the GTW will be heated to about 90°C by a diesel-fired boiler. The daily fuel consumption is about 650 litres. Air emissions from the boiler will mainly comprise NO_2 and SO_2 with a trace amount of Respirable Suspended Particulate (RSP) and CO. The flue gas will be emitted through a stack located at 18.5 m above ground with a stack diameter of 0.3 m. The flue gas flow rate and temperature are 0.22 $m^3 s^{-1}$and 195°C.

Impact Assessment

The cumulative air quality impact of the above operational gaseous emissions was assessed below. It should be noted that as the impact of emissions from GTW collection vehicles was identified as minimal, therefore, it was not included in the following assessment.

(1) As GTW is generated from restaurants and food processing establishment s, it does not contain hazardous chemicals or compounds (ie solvents, paints that may be found in municipal solid waste, etc). The biogas generated from the anaerobic digester will therefore unlikely to contain significant amount of volatile organic compounds.

(2) The condensate will be collected and treated in the biological treatment system.

Assessment Criteria: The principal legislation for the management of air quality in Hong Kong is the *Air Pollution Control Ordinance* (APCO) (Cap 311). Under the *APCO*, the Hong Kong Air Quality Objectives (AQOs) (see *Table 4.3a*) stipulate the statutory limits for air pollutants and the maximum allowable number of excceedances over specific periods.

Table 4.3a ***Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$) [a]***

Air Pollutant	Averaging Time			
	1 Hour [b]	**24 Hour [c]**	**3 Months [d]**	**1 Year [d]**
Nitrogen Dioxide (NO_2)	300	150	-	80
Sulphur Dioxide (SO_2)	800	350	-	80
Carbon Monoxide (CO)	30,000	-	-	-
Total Suspended Particulates (TSP)	-	260	-	80
Respirable Suspended Particulates (RSP) [e]	-	180	-	55
Photochemical Oxidants (as ozone (O_3)) [f]	240	-	-	-
Lead (Pb)	-	-	1.5	-

Notes:

(a) Measured at 298K (25°C) and 101.325 kPa (one atmosphere)
(b) Not to be exceeded more than three times per year
(c) Not to be exceeded more than once per year
(d) Arithmetic means
(e) Suspended airborne particulates with a nominal aerodynamic diameter of 10 micrometres or smaller
(f) Photochemical oxidants are determined by measurement of ozone only

Assessment Methodology: The 1-hour and 24-hour NO_2, SO_2 and CO concentrations at the ASRs were predicted using an air dispersion model, Industrial Source Complex Short Term (ISCST3). The emission rates of air pollutants from micro-turbine and flare were estimated based on the emission standard and flue gas flow rate provided by the equipment suppliers. The detailed calculation was summarised in *Annex A*. The emission rate of air pollutants of boiler was estimated by using the fuel consumption rate of 650 liter per day and the emission factors recommended in the *Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, USEPA*. The detailed calculation is summarized in *Annex A*. It should be noted that the worst-case scenario, assuming that both the micro-turbine and flare will be operated at the same time and both plants are operating at their maximum capacity, was modelled in the assessment.

Representative hourly meteorological data (including hourly wind speed, wind direction, stability class and mixing height information) from *Hong Kong Observ*atory (HKO) stations located at Cheung Sha Wan were used to simulate the worst case air quality impact. Since Cheung Sha Wan data do not include air temperatures, the air temperatures measured at the HKO station in Tsimshatsui were used.

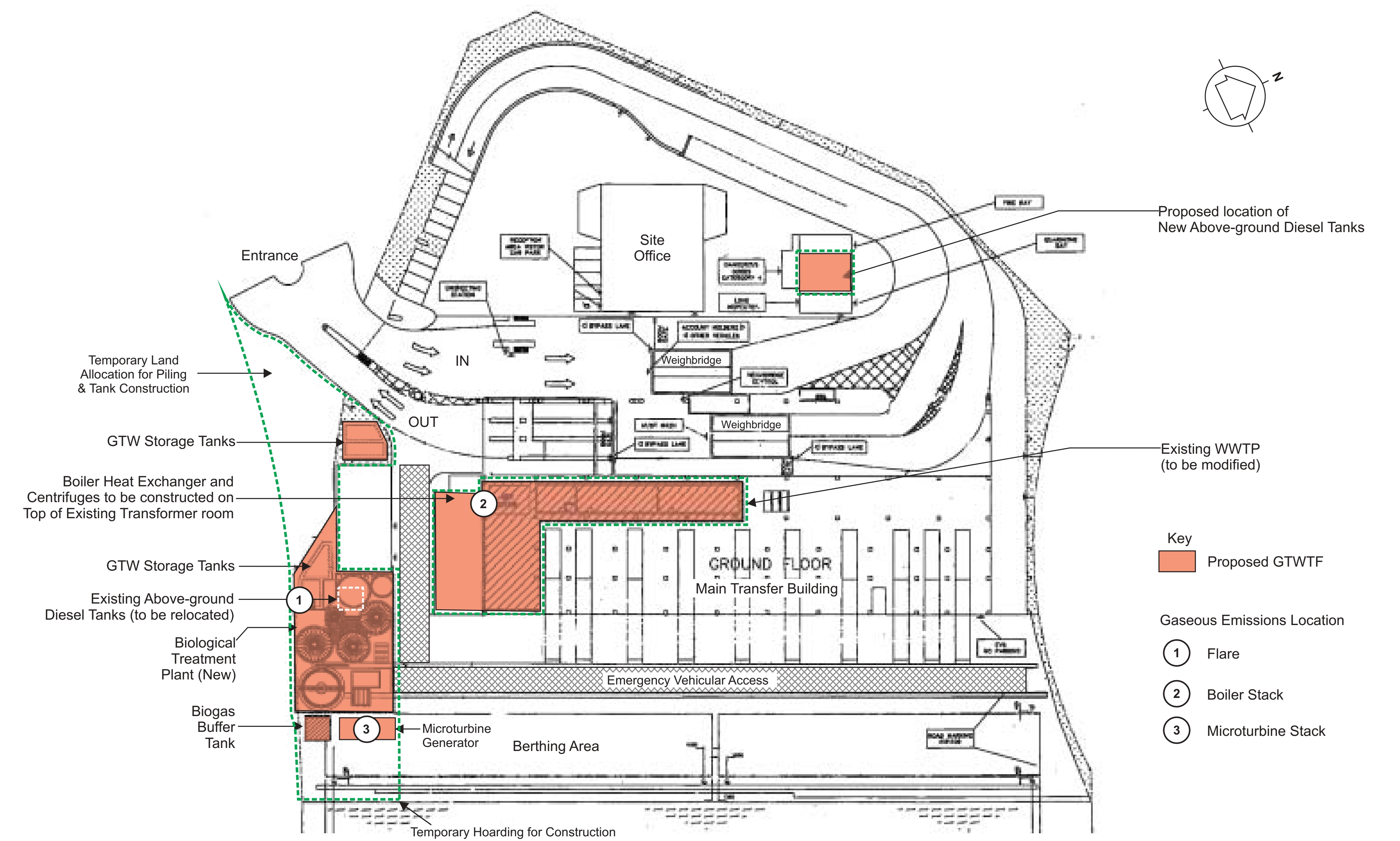

Figure 4.3a

Gaseous Emissions Location

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As the site area is classified as "urban" in accordance with the EPD's *Guidelines on Choice of Models and Model Parameter*, the "urban" dispersion mode was used in the model run. All the model input parameters including stack height, exit temperature and exit velocity are summarised in *Annex A*.

The maximum 1-hour and 24-hour air pollutant concentrations were predicted at various heights from 1.5 m to 60 m above ground of each ASR, taking into account of background concentrations.

Modelling Results: The maximum 1-hour NO_2, SO_2 and CO concentrations and 24-hour NO_2 and SO_2 concentrations were predicted at various heights of all ASRs and the predicted concentrations are shown in *Tables 4.3b* and *4.3c*, respectively. Background air pollutant concentrations were included in the predicted concentrations.

Table 4.3b Predicted Maximum 1-hour Air Pollutant Concentrations At ASRs

ASR	**Predicted Maximum 1-hour Air Pollutant Concentration at Different Elevations (μgm^{-3} at m above ground) [(a) (b) (c)]**								
	1.5m	**10m**	**15m**	**20m**	**25m**	**30m**	**40m**	**50m**	**60m**
Nitrogen Dioxide									
A1	69.1	69.1	-	-	-	-	-	-	-
A2	69.6	69.5	69.5	70.2	-	-	-	-	-
A3	68.7	68.7	69.0	-	-	-	-	-	-
A4	68.1	68.4	68.7	69.1	69.4	-	-	-	-
A5	68.0	68.2	68.3	68.4	68.4	-	-	-	-
A6	67.3	67.3	-	-	-	-	-	-	-
A7	70.3	**<u>72.7</u>**	-	-	-	-	-	-	-
A8	70.5	70.7	70.8	71.8	-	-	-	-	-
A9	68.1	68.3	68.5	-	-	-	-	-	-
A10	67.8	68.0	68.2	68.4	68.5	68.6	68.5	-	-
A11	66.9	66.9	66.9	66.9	66.8	66.8	66.7	66.7	66.6
Background	***66***								
AQO	***300***								
Sulphur Dioxide									
A1	37.8	37.7	-	-	-	-	-	-	-
A2	40.6	40.7	40.7	44.9	-	-	-	-	-
A3	36.6	36.4	37.7	-	-	-	-	-	-
A4	33.4	34.7	36.7	39.0	41.2	-	-	-	-
A5	32.7	33.5	34.5	35.3	35.9	-	-	-	-
A6	28.7	28.7	-	-	-	-	-	-	-
A7	41.8	**<u>50.2</u>**	-	-	-	-	-	-	-
A8	45.2	46.3	47.5	52.8	-	-	-	-	-
A9	32.3	33.4	34.7	-	-	-	-	-	-
A10	31.6	32.7	34.1	35.7	37.2	38.4	38.8	-	-
A11	26.5	26.4	26.4	26.3	26.2	26.1	25.7	25.2	24.7
Background	***21***								
AQO	***800***								
Carbon Monoxide									
A1	1,557	1,557	-	-	-	-	-	-	-
A2	1,557	1,557	1,557	1,557	-	-	-	-	-
A3	1,556	1,556	1,556	-	-	-	-	-	-
A4	1,556	1,556	1,556	1,556	1,556	-	-	-	-
A5	1,556	1,556	1,556	1,556	1,556	-	-	-	-
A6	1,555	1,555	-	-	-	-	-	-	-
A7	**<u>1,559</u>**	1,559	-	-	-	-	-	-	-
A8	1,557	1,557	1,558	1,558	-	-	-	-	-
A9	1,556	1,556	1,556	-	-	-	-	-	-
A10	1,556	1,556	1,556	1,556	1,556	1,556	1,555	-	-
A11	1,555	1,555	1,555	1,555	1,555	1,555	1,554	1,554	1,554
Background	***1,554***								
AQO	***30,000***								

Notes:

(a) Background concentrations (NO_2 of 66 $\mu g\ m^{-3}$, SO_2 of 21 $\mu g\ m^{-3}$ and CO of 1,554 $\mu g\ m^{-3}$) have been included.

(b) The bold and underlined figures are the highest predicted pollutant concentrations among all ASRs.

(c) The height of the building should refer to *Table 4.2a*.

The predicted maximum 1-hour NO_2, SO_2 and CO concentrations at various heights of all ASRs are well within the respective AQOs. The NO_2 and CO concentrations increased due to the operation of the GTWTF is minimal. The highest maximum 1-hour NO_2, SO_2 and CO concentrations were predicted to be 24%, 6% and 5% of AQOs, respectively, at ASR A7 (Administration Building of SCISTW). For A11, the height of the residential buildings is about 100 m above ground. The modelling indicates that the concentrations of the concerned pollutants decrease at higher elevations. Therefore, the predicted pollutant concentrations at the top floor units of the ASR A11 will also be well below the respective AQO.

Table 4.3c Predicted 24-hour Averaged Concentrations of Air Pollutants at ASRs

ASR	Predicted 24-hour Air Pollutant Concentration at Different Elevations (μgm^{-3} at m above ground) (a) (b) (c)								
	1.5m	**10m**	**15m**	**20m**	**25m**	**30m**	**40m**	**50m**	**60m**
Nitrogen Dioxide									
A1	66.5	66.7	-	-	-	-	-	-	-
A2	66.4	66.4	66.5	66.8	-	-	-	-	-
A3	66.5	66.7	66.8	-	-	-	-	-	-
A4	66.6	66.7	66.7	66.7	66.8	-	-	-	-
A5	66.6	66.6	66.6	66.6	66.7	-	-	-	-
A6	66.3	66.3	-	-	-	-	-	-	-
A7	68.2	**69.1**	-	-	-	-	-	-	-
A8	67.4	67.6	67.7	67.9	-	-	-	-	-
A9	66.3	66.4	66.4	-	-	-	-	-	-
A10	66.7	66.7	66.7	66.7	66.8	66.7	66.6	-	-
A11	66.3	66.3	66.2	66.2	66.2	66.2	66.2	66.2	66.2
Background					***66***				
AQO					***150***				
Sulphur Dioxide									
A1	23.7	24.6	-	-	-	-	-	-	-
A2	23.0	23.4	23.9	25.1	-	-	-	-	-
A3	24.1	24.8	25.5	-	-	-	-	-	-
A4	24.4	24.8	25.2	25.7	26.0	-	-	-	-
A5	24.4	24.5	24.7	24.9	25.0	-	-	-	-
A6	22.6	22.6	-	-	-	-	-	-	-
A7	27.8	**32.5**	-	-	-	-	-	-	-
A8	28.5	29.2	30.1	31.2	-	-	-	-	-
A9	22.7	22.9	23.0	-	-	-	-	-	-
A10	24.8	25.1	25.4	25.7	26.0	26.1	25.9	-	-
A11	22.6	22.5	22.5	22.5	22.5	22.4	22.3	22.2	22.0
Background					***21***				
AQO					***350***				

Notes:

(a) Background concentrations (NO_2 of 66 $\mu g\ m^{-3}$ and SO_2 of 21 $\mu g\ m^{-3}$) have been included.

(b) The highlighted result is the highest pollutant concentrations predicted among all ASRs.

The predicted 24-hour averaged NO_2 and SO_2 concentrations at various heights of all ASRs are well within the respective AQO. The highest 24-hour NO_2 and SO_2 concentrations were also predicted to be 46% and 9% of the respective AQO standard, respectively, at ASR A7 (Administration Building of SCISTW). Again, the modelling results indicated the pollutant concentrations at the top floor units of the ASR A11 will be much lower than those predicted at 60m level.

The impact assessment indicates that there will be no adverse air quality impact to the identified ASRs due to the gaseous emissions from micro-turbine, biogas flare and boiler during the operational of the GTWTF.

4.4 DUST

4.4.1 Construction Phase

The construction of the GTWTF has the potential to cause adverse dust impact if not properly managed. The major dusty activities will be undertaken during the foundation construction. With respect to the small scale of the foundation works, it is not anticipated to cause adverse dust impact at the identified ASRs if general good construction site practices such as those stated in the *Air Pollution Control (Construction Dust) Regulation* are properly implemented.

4.4.2 Operation Phase

The GTW will be handled in sealed system. No dusty activities during the operation phase and hence no dust impact is anticipated during the operation of the GTWTF.

4.5 ODOUR

4.5.1 Construction Phase

There are no odorous activities during the construction of the GTWTF and hence there is no odour concern during the construction phase.

4.5.2 Operation Phase

Odour impacts may arise during the delivery, unloading and treatment of the GTW.

Odour from GTW Delivery

GTW will be delivered to the WKTS by sealed road tankers (see *Figure 4.5a*). Negligible odour will be emitted from vent pipe of the road tankers. As shown in *Table 7.1a*, the total number of RCV and GTW collection vehicles visiting the WKTS during the peak GTW delivery hour (ie 21 nos., from 15:00 to 16:00 hrs) will be less than the existing peak hour RCV flow (about 64 RCVs from 08:00 to 09:00 hrs) to the WKTS.

During the peak RCV delivery hour (ie from 08:00 to 09:00 hrs), an additional 6 GTW collection vehicles will visit the WKTS (increased by about 10%, with a total of 70 vehicles per hour). It should be noted that WKTS is designed to handle a maximum peak RCV arrival rate of 111 vehicles per hour (1). The Detailed EIA of the WKTS showed that no adverse odour impact would result with this RCV arrival rate. It is therefore anticipated that the additional number of GTW collection vehicles visiting the WKTS during the peak RCV delivery hours will not cause adverse odour impact.

GTW collected from most of the districts (ie Hong Kong Island, Yau Tsim Mong, Kwai Chung, Tsing Yi, Tuen Wan, Tuen Mun, Yuen Long, etc) will be delivered to the GTWTF at WKTS via the West Kowloon Expressway or Lin Cheung Road and then Lai Po Road or Mei Ching Road, and will not go through the local road networks in Sham Shui Po, Lai Chi Kok and Cheung Sha Wan (about 80% of the GTW). The potential odour impacts to local residential developments (ie Mei Foo Sun Tseun, Hoi Lai Estate, etc) due to the delivery of the GTW to WKTS will be minimal.

It is therefore considered that the delivery of GTW by sealed road tankers to the WKTS will not cause adverse odour impact to the identified ASRs.

Odour from Unloading and Treatment of GTW

After weighing, the GTW collection vehicles will be directed to the three designated GTW unloading bays inside the tipping hall (see *Figure 2.6e*) of the enclosed Main Transfer Building (see *Figure 4.5b*). The tipping hall is provided with an air scrubbing system (including 3 sets of ionized wet scrubbers and ozone units which was designed to remove over 99% of the H_2S in the exhaust air in order to meet the compliance odour limit (2 Odour Units) at the site boundary) and maintained with a negative air pressure. GTW will be unloaded from the collection vehicles via flexible hoses into the screens. The screens are enclosed to control odour and the vent gas will be diverted to the aeration system of the Aeration Tank. The odorous gases will be scrubbed by the wastewater and any residue gases will be cleaned via the air scrubbing system prior to discharge to the atmosphere. As the unloading and screening operations will be undertaken in a sealed system, no odour will be emitted to atmosphere. GTW sampling and testing will be undertaken prior to unloading. As only a small volume of GTW sample will be taken, the potential odour emission from this operation will be minimal and will cause negligible additional loading to the existing air scrubbing system. It should be noted that the existing air scrubbing system was designed to treat odour emission from handling of the 384 tonnes of waste per hour (based on the peak hour throughput in the peak day of the year, ie CNY Eve). The annual performance test conducted in early November 2005 demonstrated that the

(1) Due to the actual payload (about 5 tonnes) of each RCV is greater than assumed in the original design (about 2.5 tonnes). It is anticipated that the actual number of RCVs visiting WKTS each day for the design maximum throughput will be much lower than 114.

WKTS could handle 400 tonnes of waste per hour without compromising the environmental performance (including odour). The designed average throughput is 2,500 tpd and the currently waste input is about 2,100 tpd. As the air scrubbing system was designed based on the peak throughput, it has considerable spare capacity (about 70%) during normal working days. Based on the operation records of the WKTS for 2002 to 2005, the peak hour (at 9:00 – 10:00 hrs) throughput during the CNY Eve (peak of the year) ranged from 291 to 379. As discussed in *Table 7.1a*, the peak hour of the RCV arrival does not coincide with the peak hour of the GTW collection vehicles arrival (at 15:00 – 16:00 hrs). To avoid odour emission during the peak hour operation of the RCV on CNY Eve, the GTW sampling can be suspended. It should be noted that GTW collection is generally reduced during the CNY period as most of the collectors will stop their services during this period. It is considered that the spare capacity of the existing air scrubbing system will be able to handle the minimal increase of odour emission due to the random sampling of GTW at the tipping hall.

The screened GTW will be fed into the GTW storage tanks and then enter the treatment system, comprising the Lipoval® process, wastewater pre-treatment (ie the DAF system), and anaerobic treatment systems. It should be noted these systems are sealed to contain emissions from the storage/treatment tanks. The vent gas from the storage/treatment tanks (except for the Anaerobic Reactor) will be vented to the Aeration Tanks for scrubbing. Through the biological process, some of the odorous compounds will be degraded and removed. The aerobic treatment system (modified from the existing SBR to a continuous activated sludge treatment process) is housed within the G/F of the Main Transfer Building, which is provided with a ventilation and air scrubbing system (designed with 20 air changes per hour). As the wastewater to be treated by the aerobic system will be pre-treated by the DAF system and the anaerobic system, the organic loading of the wastewater will be significantly reduced and hence its odour potential. As the nature of the wastewater generated from the Lipoval® Process will be similar to ordinary domestic wastewater, it is assumed that the odour potential of the wastewater will be related to the BOD concentration of the wastewater. *Table 4.3a* compares the organic loads and volume of wastewater stored at the existing wastewater treatment plant and the modified biological wastewater treatment system within the G/F room of the Main Transfer Building.

Figure 4.5a

Typical GTW Collection Vehicle

FILE: 0033519i
DATE: 10/11/2005

Environmental
Resources
Management

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Figure 4.5b

Main Transfer Building

FILE: 0033519j
DATE: 11/11/2005

Environmental Resources Management

ERM

Table 4.3a ***Comparison of Odour Emission Potential of the Existing Wastewater Treatment Plant and the Modified Biological Treatment System***

	Original SBR Design	Existing SBR Plant	Modified Aerobic Treatment Design [h]
Equalisation Tank (m^3)	148	148	[a]
• BOD Concentration (mg l-1)	2,830	6,250	-
• Equalisation Tank BOD Load (kg)	419	926	-
Influent (m^3 d^{-1})	120	120	416
Influent (m^3 hr^{-1})	10 [b]	10 [b]	17 [c]
• BOD Conc (mg l^{-1})	2,830	6,250	1,514 [d]
• Influent BOD Load (kg)	28	63	26
Total Aeration Tank Volume (m^3)	584	584	884 [e]
• BOD Concentration (mg l^{-1})	800 [f]	800 [f]	800 [f]
• Discharge volume (m^3)	10	10	17
• Aeration Tank BOD Load (kg)	459	459	693
Total BOD Load at the Worst Scenario (kg)	***906***	***1,448***	***719***

Notes:

(a) The equalisation tank of the GTWTF will be relocated to the treatment tanks area near the berthing area. The new equalisation tank will be sealed to contain odour emission.

(b) Two 12 hours cycles per day and 60 m^3 per cycle. Filling time of SBR is 6 hours for each cycle.

(c) The existing equalisation tank will be modified into a new aeration tank.

(d) The combined wastewater from the DAF system of the GTWTF and the leachate from the transfer operation will be treated in the Anaerobic Reactor before discharge to the continuous activated sludge system.

(e) Continuous filling.

(f) It is assumed that the BOD concentration (excluding the Mixed Liquor Suspended Solids which is assumed to be similar between the SBR and the continuous activated sludge system) in aeration tank is equal to the maximum allowable discharged standard of 800 mg l^{-1}. It should be noted that the existing BOD concentration of the treated effluent from the SBR system ranges from <2 to 222 mg l^{-1} between January and August 2005. It is therefore is a conservation assumption.

(g) The final clarifier of the modified aerobic treatment system is installed at the new treatment tank area near the berthing area.

(h) The modified aerobic treatment system will replace the existing SBR system although some of the tanks will be maintained and modified.

It can be seen from *Table 4.3a* that the total BOD load of the wastewater being treated at the wastewater treatment plant room (ie G/F room of the Main Transfer Building) for the modified aerobic treatment system (continuous activated sludge system) will be about 20% lower than the original SBR design and is about 50% lower than the existing operating SBR system. It is anticipated that the odour emission potential from the wastewater being treated at the modified aerobic treatment system will be much lower than the existing SBR system. The engineering review therefore concludes that the existing air scrubbing system for the wastewater treatment plant will be able to handle the odour emission to meet the performance requirement.

The regular odour patrols at the site boundary demonstrate that there was no exceedance of the odour performance requirement at the site boundary under the existing WKTS Contract since operation of the station (ie for the last 8 years). It indicates that the existing air scrubbing system can effectively control odour emissions from the transfer operations (including the activities at the tipping hall and the wastewater treatment plant). It is therefore considered that the existing air scrubbing system will be able to handle the odour emissions from the modified aerobic treatment system and no adverse odour impact will be anticipated due to the operation of the wastewater treatment system of the GTWTF.

With the designed odour management system, it is not anticipated that the operation of the proposed GTWTF will cause adverse odour impact to the identified ASRs.

Under the existing WKTS contract, daily odour patrolling is performed by a qualified odour panelist from the Hong Kong Polytechnic University (HKPU) at the site boundary of the WKTS at a time randomly scheduled during the operating hours between 08:00 and 21:00 hrs. It is recommended to increase the frequency of the odour patrol to twice daily during the commissioning of the GTWTF (two months) and the first month of the normal operation of the GTWTF to confirm the findings of the assessment. SCTL will take all necessary measures to ensure the compliance of the odour performance requirement at the site boundary. Should the odour limit at the site boundary be exceeded (although it is considered unlikely), the existing air scrubbing system for the wastewater treatment plant room should be improved (eg by adding an activated carbon unit after the existing air scrubbing system).

Odour from Transportation of Lipofit®

The Lipofit® recovered from the GTW will have a mild odour. The pumping and storage of the lipofit ® will be undertaken in a sealed system to avoid odour emission from these activities. The Lipofit® will also be loaded to the road tanker via a flexible hose at the tipping hall. It is not anticipated that the transportation of Lipofit® from WKTS to the potential users (about 1 to 2 tanker trips per day) in a sealed road tankers will cause adverse odour impact to the identified ASRs.

5 NOISE

WKTS is located in an industrial area, adjacent to the container terminals and the SCISTW, and surrounded by the West Kowloon Expressway and the future Route 8. The noise environment in the Study Area is mainly affected by traffic noise from the surrounding road network and the operation of the container terminals. The closest Noise Sensitive Receiver (NSR), Hoi Lai Estate, is located at about 800m from the WKTS. According to the Stonecutters Island Outline Zoning Plan (S/SC/8), there are no noise sensitive uses planned in the vicinity of the WKTS.

Construction. The number of construction equipment to be used during construction is small given the relatively small size of the project and nature of the construction works. There will be minor excavation work at the south corner of the WKTS site and pre-bored H-piles will be used for the tank foundation. This arrangement should generate least nuisance in terms of noise and vibration. This, together with the absence of NSRs within 600m from the proposed site boundary, indicates that no adverse construction noise impact is envisaged.

Operation. Noise from fixed sources will be generated from pumps and the micro-turbine. Since most of these noise sources will be located indoor and the NSRs are far from the site (greater than 600m), the potential noise impact to NSRs will be minimal. Traffic noise impacts associated with the small traffic of GTW collection vehicles (58 truck trips per day) are insignificant compared with the background industrial and traffic noise.

6 NIGHT-TIME OPERATIONS

Construction. Equipment installation works may be carried out on a 24-hour basis and 7 days per week. As these activities will not involve noisy plant and equipment and dusty activities, it is not anticipated that the installation works will cause adverse air and noise impacts at the identified sensitive receivers. The installation works at night-time will involve a few vehicles per hour. As the night-time traffic will be low, it is not anticipated that the night-time traffic associated with the installation works will cause adverse traffic impact to the local road network. Construction work to be carried out within the restricted hours will satisfy the requirements of the *Noise Control Ordinance*.

Operation. Similar to the operating hours of the waste transfer operation, the WKTS will open to receive GTW from 04:30 am to 1:30 am. The treatment system of GTWTF will be operating on a 24 hours basis. As discussed in *Section 4*, the operation of the GTWTF (including the flare, boiler and micro-turbine will not cause adverse air quality impacts at the identified sensitive receivers. As there is no NSR in the vicinity of the WKTS, no noise impacts will result from the operation of the GTWTF at night-time. It is anticipated that the night-time traffic will be less than 7 vehicles per hour. As the night-time traffic will be low, it is not anticipated that the night-time traffic due to delivery of GTW to WKTS will cause adverse traffic impact to the local road network.

7 TRAFFIC

In November 2004, the average truck trip of RCV visiting the WKTS was 454 truck trips per day. In December 2004, the average truck trip of GTW collection vehicles visiting the existing Interim GTWTF at the WENT Landfill was 58 trips per day. It is estimated that about 454 trips per day of RCV and 58 trips per day of GTW collection vehicle will visit the WKTS on a normal working day in 2007. Based on the arrival pattern of the RCV at the WKTS and the GTW collection vehicles at the Interim GTWTF at WENT Landfill, the peak hours for the RCV and GTW collection vehicle using the facilities are different. The peak hour for the RCVs is from 08:00 hrs to 09:00 hrs whilst the peak hour for the GTW collection vehicles is from 15:00 hrs to 16:00 hrs. As the WKTS will be more convenient comparing with the WENT Landfill and the operating hours of the WKTS will be longer, it will expected that the arrival pattern of the GTW collection vehicles at the WKTS will be slightly different from that at the WENT Landfill (ie some vehicles may arrive at the WKTS earlier in the morning or later in the evening). The hourly averaged number of GTW collection vehicles visiting the WKTS is therefore expected to be less than that of the WENT Landfill. For conservative assessment, the arrival pattern of GTW at the WENT Landfill has been used.

The forecast traffic flows to the WKTS with the operation of the proposed GTWTF in 2006 are summarised in *Table 7.1a*.

Table 7.1a ***Forecasted Number of Truck Trips of RCVs and GTW Collection Vehicles to the WKTS in 2007***

Time Period	**RCVs**	**GTW Collection Vehicles**	**Total**
Normal Working Day			
08:00 to 09:00 hrs (RTS peak hour)	64	6	70
15:00 to 16:00 hrs (GTW peak hour)	14	7	21
Daily Average	454	58	512
Lunar New Year's Eve			
Peak Hour of the Year	70 (a)	7 (b)	77
Daily Average	700	58	758

Notes:

(a) Based on the peak factor estimated for peak hour during the CNY's Eve (ie between 10:00 and 11:00 hrs.

(b) Based on the arrival pattern of GTW collection vehicles to the Interim GTWTF at the WENT Landfill (peak hour is between 15:00 and 16:00 hrs). Unlike MSW, it is not anticipated that the collection of GTW during CNY will increase comparing with a normal working day.

The total number of truck trips visiting the WKTS after the commissioning of the GTWTF during the peak hours of the CNY's Eve will be about 77 (comprising 70 RCVs and 7 GTW collection vehicles). It should be noted that this estimate is conservative as the peak hours for RCV and GTW collection vehicles are different. For a conservative analysis, this peak traffic flow was used for the assessment of site operation in terms of vehicle turnaround time for both the RCV and GTW collection vehicles, vehicle queuing space within the site as well as queuing at the weighbridge area.

The estimate turnaround times for RCV and GTW collection vehicles within the WKTS are presented in *Table 7.1b*.

Table 7.1b Estimated Turnaround Times of the RCV and GTW Collection Vehicle

No.	Activity	Time Required (minutes)
GTW Collection Vehicle		
1	Front gate to incoming weighbridge	0.1
2	Waiting at incoming weighbridge	1.6
3	Weighing in	1.0
4	Incoming weighbridge to screen	0.5
5	Waiting to unload	4.7
6	Unload GTW	17.5
7	Screen to outgoing weighbridge	0.5
8	Waiting at outgoing weighbridge	1.6
9	Weighing out	1.0
10	Outgoing weighbridge to exit gate	0.1
Total Turnaround Time for GTW Collection Vehicle		**28.6 minutes**
RCV		
1	Front gate to incoming weighbridge	0.1
2	Waiting at incoming weighbridge	1.6
3	Weighing in	1.0
4	Incoming weighbridge to screen	0.5
5	Waiting to unload	0.0
6	Unload RTS	7.0
7	Screen to outgoing weighbridge	0.5
8	Waiting at outgoing weighbridge	1.6
9	Weighing out	1.0
10	Outgoing weighbridge to exit gate	0.1
Total Turnaround Time for RCV		**13.4 minutes [b]**

Notes:

(a) For the peak hour traffic of a "normal working day".

(b) Well within the required turnaround time for RCV under the existing WKTS contract, ie 25 minutes.

The weighbridge will be operated in such a way that vehicles will not queue outside of the boundary of the WKTS at any day. The average waiting time for each vehicle at the weighbridge is about 1 minute. As there will be about 70 and 77vehicles per hours during the peak hours for the normal working day and on the CNY's Eve, respectively. As there are two in-weighbridges and two out-weighbridges, a total of 120 vehicles per hour can be processed in each direction. It is therefore considered that the existing weighbridges will be able to handle the forecast vehicle flow (ie a maximum of 81 vehicles per hour).

In the event of a weighbridge breakdown, traffic will be re-routed to use one of the other weighbridges. In addition, the following temporary provisions may be implemented, subject to EPD's approval, to improve traffic flows through the WKTS if problems are experienced with vehicle queuing as a result of a weighbridge breakdown.

- the movements of waste collection vehicles, for example GTW collection vehicles of known tare weight, will be monitored and manually recorded in sufficient detail to permit subsequent identification and payload calculations to be made at a later time;

- non-routine deliveries of privately collected waste may be charged at a rate computed from the vehicle type and volume using agreed conversion factors; and

- GTW collection vehicles may be rejected by the WKTS until the weighbridge is operational.

The incremental traffic associated with the operation of the proposed GTWTF is about 58 truck trips per day. This traffic comparing with the background traffic flow of the roundabout outside the WKTS (about 40,000 vehicles per day) is negligible (about 0.15%). It is therefore not anticipated that operation of the proposed GTWTF at the WKTS will cause adverse traffic impact to the local road network.

In addition, there will be about 1 to 2 truck trips for disposal of screening, sediment and sludge generated from the GTW treatment processes. With respect to this small traffic, it will have negligible impact on the overall traffic on local road networks.

No marine traffic will be generated from the operation of the proposed GTWTF.

With respect to the small volume of traffic generated from the construction activities, it is not anticipated that the construction of the GTWTF will cause adverse traffic impacts to the local road networks.

8 WATER QUALITY

There are no major water sensitive receivers such as mariculture zones, commercial fisheries or recreational beaches identified in close proximity of the WKTS. The nearest water sensitive receiver is the Yau Ma Tei Typhoon Shelter, which is over 2.5km to the south-east of the WKTS. The nearest bathing beach, the Approach Beach, is over 7km to the north-west and is well sheltered by Tsing Yi Island. The nearest fish culture zone is over 10km away.

No reclamation or dredging works will be required for the construction and operation of the GTWTF. There is no concern related to disruption of water movement or bottom sediment.

Construction. The major sources of water quality impacts that can potentially arise from the construction of the GTWTF (see *Section 2.6.3*) will be typical of normal land based construction activities, including construction runoff and sewage from construction work force. Since the scale of construction work is small, adverse water quality impact due to construction runoff is not anticipated provided the good construction site practices (see *Section 16*) are implemented. It is anticipated that a maximum of 30 workers will be working at the site during the construction phase. They will use the sanitary facilities of the WKTS. No adverse water quality impact will result from the discharge of the sewage generated from the workers.

Since the existing wastewater treatment process at the WKTS will be maintained during the modification work of the existing wastewater treatment plant, the effluent quality will be maintained and closely monitored for performance compliance under the current *WPCO* Licence.

Operation. Wastewater collected from the 2nd GTW storage tank and the centrifugation system of the Lipoval ® process and will be pre-treated by the DAF system. The pre-treated wastewater, about 400 m^3 d^{-1}, leaving the DAF system will be treated together with the wastewater arising from the waste transfer operations (about 120 m^3 d^{-1}) prior to discharge to the sewer. The existing sequential batch reactor (SBR) will be converted to a continuous activated sludge system so that its aerobic treatment capacity will be increased from 150 to 520 m^3 d^{-1} to accommodate the increased volume of wastewater. The effluent discharged from the biological treatment processes (including anaerobic and aerobic treatment systems) will comply with the discharge standards stipulated under the existing WKTS DBO Contract and that specified in the *WPCO* Licence. The existing *WPCO* Licence of the WKTS allows SCTL to discharge up to 400 m^3 d^{-1} of treated effluent to the foul sewer till October 2006. It is not anticipated that the additional flow (about 100 m^3 d^{-1}) will cause adverse drainage impact to the local sewer from the WKTS to the SCISTW. SCTL will apply for a variation of discharge license. With respect to the small incremental flow due to the operation of the proposed GTWTF, it will have negligible impact to the treatment capacity of the SCISTW.

From the effluent discharge record of the existing wastewater treatment plant, the plant has been discharged about 180 m^3 of effluent in a 4-hour period (ie about 45 m^3 hr^{-1}). The modified aerobic treatment system will discharge continuously at a rate of about 17 m^3 hr^{-1}. This together with the treated effluent from the Anaerobic Reactor (about 4.3 m^3 hr^{-1}), a total of about 21.3 m^3 hr^{-1} of treated effluent will be discharged to the sewer which is much lower than the maximum flow discharged by the existing plant. The operation of the GTWTF will therefore not cause adverse impact on the local drainage system.

With the implementation of the proposed mitigation measures (see *Section 17*), adverse impacts to marine water quality are not anticipated.

9 ECOLOGY

The proposed GTWTF will be constructed within the site boundary of the

WKTS which has no ecological sensitive area. No marine works will be required for the construction and operation of the proposed GTWTF. No ecological impacts, either terrestrial or marine, are anticipated given that the proposed GTWTF is located on reclaimed land and that no Marine Ecological Sensitive Receivers have been identified.

10 CULTURAL HERITAGE

No cultural heritage impacts are expected, as the proposed GTWTF will be constructed on reclaimed land within the existing WKTS site boundary.

11 LANDSCAPE & VISUAL

Some of the new facilities will be located within the Main Transfer Building facilities (ie at the ground floor – the aerobic treatment system, sludge thickness tank, and filter press; at the 1/F - GTW unloading facility, screens, and the DAF system) and they will not be visible from the following visual sensitive receptors (VSRs).

Table 11.1a Identified Representative VSRs and Their Visual Sensitivity

Visual Sensitive Receptors	Approximate Distance From the Proposed GTWTF (m)	Visual Sensitivity	Potential Visual Impact
• Offices of the SCISTW, Water Services Deport, and Shipyards	Immediately adjacent	Low (industrial)	Low
• Users of the West Kowloon Expressway	580 (the view of the users will be blocked by the noise barrier and buildings in between)	Low (transient)	Low
• Distant views from Mei Foo Sun Chuen	800 to 1,050	High (residential)	Low (The maximum height of the outdoor tanks and facilities will be lowered than the adjacent buildings, such as the Main Transfer Building and KMB Bus Depot. The outdoor tanks will be screened by these structures. The flare will be an enclosed flare and the sensitive receptor will not observe any flame. The proposed GTWTF blended in with the existing industries facilities in the Study Area and the GTWTF will not be noticeable)
• Distant views from Hoi Lai Estate	800	High (residential)	Low (same as Mei Foo Sun Chuen)
• Distant views from Aqua Marine	1,000	High (residential)	Low (same as Mei Foo Sun Chuen)
• Distant views from the higher level units of the Banyan Garden, Liberte and The Pacifica	>1,030	High (residential)	Low (same as Mei Foo Sun Chuen)

Two GTW storage tanks will be constructed near the site entrance (see *Figure 2.5a*) and another two GTW storage tanks, the biological treatment plant, biogas buffer tank, micro-turbine generator and the biogas flare will be constructed near the berthing area. With respect to the industrial setting of the area, the existing visual quality of the area is low. The out-door structures will include concrete tanks and buildings. The tallest structure is the flare (see *Figures 2.6c* and *2.6d*, with a diameter of 1m and a height of 6.5m on top of the GTW storage tank (with a height of 14.4m), the highest level is at 20.9 mPD, which is below the roof line of the Main Transfer Building). The proposed GTWTF will be blended in well with the existing structures of the WKTS, SCIWTW (with larger concrete treatment tanks), and the adjacent industry facilities (ie shipyards, container ports, etc). It is therefore considered that the proposed GTWTF will not cause visual intrusion to the identified visual sensitive receptors. As the biogas flare is an enclosed flare, the visual sensitive receptors will not observe any flame.

The construction works will only last for 9 months that coincides with the construction of the Route 8 in the area. The construction GTWTF will not be noticeable to the identified visual sensitive receptors that are far from the site. It is therefore considered that the landscape and visual impact during the construction phase to be insignificant.

12 WASTE MANAGEMENT

Construction

Construction and Demolition Material (C&DM): C&DM will be generated from site preparation work and construction of the GTWTF. As the site has been formed, no major earthworks will be required for the construction of the GTWTF. Pre-bored H-piles will be used for foundation construction. Small amount of excavated material will be generated from remove of the concrete slab at the existing diesel storage tanks area; construction of the pre-bored H-piles and removal of roofing material of the existing transformer room. With respect to the small scale of the construction work, it is anticipated that small amount of C&DM (approximately 500m^3) will be generated within one month. On average, about 21 m^3 d^{-1} of C&DM will be generated.

The construction of the new structures will consume about 700 m^3 of ready mixed concrete. It is assumed that about 10% of which (about 70 m^3) will become C&DM. This C&DM will be generated after the demolition and foundation works and in a 5-month period. The daily generation rate will therefore be minimal.

With respect to the nature of the construction work, majority of the C&DM that cannot be recycled and reused on site and will have to be disposed off-site. The C&DM will be segregated into pubic fill and construction waste (including paper, metals, plastic and wood waste from packaging materials and wooden formworks) on-site and stored separately for disposal at public filling areas and landfill, respectively. Paper waste, metal, and wood waste will be stored in different skips for recycling as far as practicable. It is expected that the amount of construction waste requiring disposal at landfills will be small. The disposal of small quantities of public fill (a total of about 570 m^3) and construction waste (about a few tonnes) to public filling areas and landfills, respectively, will not cause adverse environmental and operational impacts to these facilities.

General Refuse: General refuse will be generated from site operations and personnel. It is estimated that a maximum of about 30 workers will be working at the site for the construction of the GTWTF at any one time. Based on a generation rate of 0.65 kg per worker per day, a total of about 20 kg of general refuse per day (mainly paper, food waste and aluminium cans) will be disposed of via the WKTS to the WENT Landfill.

Chemical Waste: Chemical wastes will be generated from the construction activities. If not properly stored and disposed of, chemical waste may pose serious environmental, health and safety hazards. These hazards may include:

- Toxic effect to workers;
- Adverse effect on air, water and land from spills; and
- Fire hazards.

The chemical waste likely to be generated from the construction of the GTWTF will, for the most part, arise from the maintenance of construction plant and equipment. These may include:

- Scrap batteries or spent acid/alkali from their maintenance;
- Used paint, 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.

The quantity of chemical waste to be generated will be small (expected to be less than one hundred litres). These chemical wastes will be readily accepted at the Chemical Waste Treatment Centre (CWTC) at Tsing Yi.

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

Secondary Environmental Impacts Associated with the Disposal of Waste: A small volume of traffic (expected to be maximum of about 2 truck trips per day) will be generated from the disposal of C&DM to public filling facilities or construction waste at landfills. It is not anticipated that it will cause adverse traffic impact to the local road networks. The anticipated volume of traffic associated with the disposal of public fill off-site (expected to be less than 3 truck trips per day during demolition and foundation works) will also be negligible and will not cause any adverse traffic, noise and air quality impacts. With the implementation of good construction site practices such as those stated in the *Air Pollution Control (Construction Dust) Regulation*, the handling and storage of construction waste and public fill on site will not cause adverse dust impacts. It is not anticipated that there will be any potential hazard associated with the handling and disposal of C&D waste and public fill if general construction safety procedures are properly implemented.

Operation:

The following solid wastes/by-products will be generated from the operation of the GTWTF.

Table 12.1a Solid Waste / By-product To Be Generated During the Operation of the GTWTF

Treatment Process	Quantity / Frequency	Reuse/Disposal
Screenings	About 2 to 4 tpd of screenings	Disposed of at landfills by trucks
Lipoval ® Process		
• Centrifugation System	About 8 to 10 tpd of sediments	Disposed of at landfills
• Filtration	About 14 m^3 d^{-1} of oil and grease (Lipofit) OR About 13 tpd if all the Lipofit has to be disposed of at landfill [(a)].	Reuse at potential users OR Disposed of at landfills
DAF System	About 12 to 16 tpd of dewatered sludge (>30% dry solids contents)	Disposed of at landfills by trucks
Biological Treatment System	About 1.5 tpd of dewatered sludge (>30% dry solids contents)	Disposed of at landfills by trucks
Chemical waste (used lubricant oil, solvents from plant maintenance activities)	About a few litres per month	Disposed of at CWTC
Total	**49.5 to 57.5 tpd of solid wastes to be disposed of at landfill**	

Note:

(a) Assuming the density of oil and grease is about 0.92 tonnes per m^3. The moisture content of the Lipofit is <2% and therefore comply with the landfill disposal criteria with addition of a binder.

It is not anticipated that the disposal of these wastes at landfills and CWTC will have adverse impact on the operation of the landfills.

It should be noted that the proposed GTWTF allows the possibility to reuse the recovered oil and grease, and hence reduces the amount of solid residues to be disposed of at landfills. Currently the Interim GTWTF at the WENT Landfill receives about 380 tpd of GTW. The raw GTW is separated into two streams, ie oil and grease and wastewater at the DAF tank. The oil and grease and sludge from the Sequential Batch Reactor of the wastewater treatment plant are mixed with PFA and then disposed of at the WENT Landfill. Currently, about 125 tpd of residues (after mixing with PFA) generated from the Interim GTWTF are disposed of at the WENT Landfill. With the operation of the GTWTF at

WKTS, the amount of solid waste generated by the GTWTF to be disposed of at landfill may be reduced by about 64% to 71%.

13 LAND CONTAMINATION

Construction. The construction work involves the relocation of the existing diesel tanks. The locations of the existing and the proposed diesel tanks are shown in *Figure 2.5a*. The existing diesel tanks are located above ground and are well contained within an appropriate bund area. There has not been any record of leakage or spillage from the diesel tanks since the commissioning of WKTS in 1997. Therefore, land contamination associated with the relocation of diesel tanks is not expected.

Operation. During the operation of the GTWTF, potential land contamination may arise when there is any spillage of chemicals. The chemicals to be stored on site include diesel, mineral oil and chemical reagents (hydrogen chloride, sodium hydroxide, polymer, iron chloride and sodium chloride). These chemicals will be stored in tanks with appropriate containment bunds or proper containers indoor. As the floor of the WKTS is paved with concrete and with the implementation of the Spill Handling Plan, potential land contamination is not anticipated. The design of the new diesel storage tanks will be similar to that of the existing one, and will comply with the relevant legislative requirements which will include the construction of a containment bund. A separate Dangerous Goods submission will be made to the Fire Services Department for the approval of the installation of the new diesel tanks at the proposed location.

GTW is not a chemical/hazardous waste. Spillage of GTW within the site will not cause land contamination.

14 HAZARD TO LIFE

GTW is not a chemical/hazardous waste. Spillage of GTW within the site will not cause hazard to life of the workers or the general public.

The operation of the biogas buffer tank has the potential to cause hazard to life of the on-site personnel and general public if not properly managed. As discussed in *Section 2.6.2*, the biogas buffer tank will be operated under low pressure (0.3 bar) and the risk of explosion is low. It is considered that the operation of the proposed GTWTF will not cause unacceptable risk to site personnel and general public.

15 LANDFILL GAS HAZARD

The proposed GTWTF is not located close to any landfills. There is no potential hazard associated with landfill gas migration from landfill to the GTWTF.

16 CUMULATIVE IMPACTS

Construction. In the immediate vicinity of the WKTS, the new Stonecutter's Island Bridge is under construction. The Bridge will be commissioned in phases and will be in full operation by June 2008. The construction period of the GTWTF will overlap with the construction of the Stonecutter's Island Bridge. Cumulative dust and noise impact may be generated. However, in view of the minimal dust and noise emission associated with the construction of the GTWTF (see *Sections 4* and *5*), adverse cumulative dust and noise impacts are not anticipated.

Operation. The SCISTW is located adjacent to the WKTS. There may be potential cumulative odour concerns. However, as discussed in *Section 4*, odour from the GTWTF will be treated by the air scrubbing system in the Main Transfer Building of the WKTS and will comply with the compliance odour limit as stipulated under the existing DBO contract. Hence, adverse cumulative odour impact is not anticipated.

17 MITIGATION MEASURES

Sections 4 to *16* indicate that the proposed GTWTF will not result in any adverse environmental impacts, with the implementation of the following good site management practices and mitigation measures.

Construction Phase

- All debris and materials shall be covered or stored in a sheltered debris collection area. Dust control measures such as water spaying on roads and dusty areas, covering of lorries by impervious sheets and controlling of the falling height of fill materials, shall be implemented in accordance with *Air Pollution Control Ordinance.*

- Public fill and general refuse should be segregated and stored separately for disposal. Waste should be properly stored at site and windblown litter and dust should be minimised during transportation by either covering trucks or transporting wastes in enclosed containers. Waste should be disposed of at licensed sites and a disposal permit shall be obtained from appropriate authorities, if required, in accordance with the *Waste Disposal Ordinance*.

- Effluent discharge from construction activities shall conform to relevant *ProPECC Note 1/94 Construction Site Drainage* requirements and comply with the *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* under the *WPCO.*

Operation Phase

Proven technologies and practices will be adopted for the design and operation of the proposed GTWTF. The environmental assessment shows that the operation of the GTWTF will not cause adverse environmental impacts and hence other than the adoption of good site practice and the existing environmental and management plan (including environmental monitoring) of the WKTS, as well as the application of conventional mitigation measures such as air scrubber system and enclosure of treatment facilities, no specific environmental mitigation measures will be required.

It is recommended to review the operation plan of the existing WKTS to incorporate the appropriate operation procedures and control measures for the GTW reception and treatment so that the routine site supervision and audits of the WKTS will cover the operation of the GTWTF.

18 REFERENCE TO PREVIOUSLY APPROVED EIA REPORTS

Title:	West Kowloon Refuse Transfer Station Study: Initial Environmental Impact Assessment, 1993
Reference Number:	EIA-038/BC
Time of Endorsement:	EIA Reports Placed under Section 15(1)(f) of the *EIAO*. Approved prior to 1 April 1998
Endorsed by:	EPD
Environmental Aspects Addressed:	Air quality, noise, water quality and visual impacts

Title:	West Kowloon Refuse Transfer Station Study: Detailed Environmental Impact Assessment, 1998
Environmental Aspects Addressed:	Air quality, noise, water quality and visual impacts

Annex A

Detailed Emission Rate Calculations & Modelling Input Parameters

A1 MICRO-TURBINE

Given Stack Information

Stack height	:	3 m above ground
Stack diameter	:	0.127 m
Exit temperature	:	276 °C
Exit flow rate	:	0.25 $m^3 s^{-1}$
Fuel used	:	Biogas (about 60-70% of methane and 30-40% of carbon dioxide)

Given Emission Data

NO_x = 9 ppm
NO_2 = 20% of NO_x = 9 x 20% = 1.8 ppm
CO = 40 ppm

Emission Rate

NO_2

1.8 ppm = [(x µg m^{-3} / 64) x 22.414] x [(276 + 273) / 273] / (1 x 1000)

x = 1.837 x 10^{-3} g m^{-3}

Emission Rate = 1.837 x 10^{-3} g m^{-3} x 0.25 $m^3 s^{-1}$
= 4.59 x 10^{-4} g s^{-1}

CO

40 ppm = [(x µg m^{-3} / 28) x 22.414] x [(276 + 273) / 273] / (1 x 1000)

x = 0.0248 g m^{-3}

Emission Rate = 0.0248 g m^{-3} x 0.25 $m^3 s^{-1}$
= 6.21 x 10^{-3} g s^{-1}

A2 BIOGAS FLARE

Given Stack Information

Stack height	:	16.5 m above ground
Stack diameter	:	1 m
Exit temperature	:	800 °C
Exit flow rate	:	0.5 m^3 s^{-1}
Fuel used	:	Biogas

Given Emission Data

SO_2 = 90 mg m^{-3}

Emission Rate

Emission Rate = (90 mg m^{-3} x 0.5 m^3 s^{-1}) / 1000
= 0.045 g s^{-1}

Given Stack Information

Stack height : 18.5 m above ground
Stack diameter : 0.3 m
Exit temperature : 195 °C
Exit flow rate : 0.22 $m^3 s^{-1}$
Fuel used : Diesel oil

Given Emission Data

Fuel consumption Rate = 650 litre per day

Emission Rate

Emission factors of NO_2, SO_2 and CO are referenced to *Section 1.3* of the *Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, USEPA*.

NO_2 = 18 lb/10^3 gal = 2.16x10^{-3} kg/l
SO_2 = 142S lb/10^3 gal = 8.52 x 10^{-3} kg/l
where S = sulphur content (0.5% in diesel)
CO = 5 lb/10^3 gal = 6 x 10^{-4} kg/l

NO_2

Emission rate = 2.16 x 10^{-3} kg/l x 650 l/day x 1000 / (24 x 3600)
= 0.01625 g/s

SO_2

Emission rate = 8.52 x 10^{-3} kg/l x 650 l/day x 1000 / (24 x 3600)
= 0.064 g/s

CO

Emission rate = 6 x 10^{-4} kg/l x 650 l/day x 1000 / (24 x 3600)
= 0.00451 g/s

A4 SUMMARY OF EMISSION RATE AND STACK INFORMATION

Parameters	Unit	Micro-turbine	Biogas Flare	Fuel Boiler
Stack height	m above ground	3	16.5	18.5
Stack diameter	m	0.127	1	0.3
Exit flow rate	$m^3 s^{-1}$	0.25	0.5	0.22
Exit velocity	$m s^{-1}$	19.74	0.636	3.1
Exit temperature	°C	276	800	195
NO_2 Emission Rate	g/s	$4.59x10^{-4}$	-	0.01625
SO_2 Emission Rate	g/s	-	0.045	0.0641
CO Emission Rate	g/s	$6.21x10^{-3}$	-	0.00451