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Report No.: 0041/17/ED/0506B

Monthly EM&A Report November 2019

Client : Drainage Services Department

Project : Contract No. CM 14/2016
Environmental Team for Operational
Environmental Monitoring and Audit for Siu
Ho Wan Sewage Treatment Works

Report No.: : 0041/17/ED/0506B

Prepared by: Andy K. H. Choi

Reviewed by: Cyrus C. Y. Lai

Certified by:

A handwritten signature in black ink, appearing to be "Colin K. L. Yung", written over a horizontal line.

Colin K. L. Yung
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Attn: Mr. LAU Ka Kin, Marcus (E/CM16)

6 January 2020

By Post and E-mail

Dear Sir,

RE: CONTRACT No. CM 13/2016
INDEPENDENT ENVIRONMENTAL CHECKER FOR OPERATIONAL ENVIRONMENTAL MONITORING
AND AUDIT FOR SIU HO WAN SEWAGE TREATMENT WORKS (SHWSTW)
MONTHLY ENVIRONMENTAL MONITORING AND AUDIT (EM&A) REPORT (NOVEMBER 2019)

Reference is made to the submission of Monthly Environmental Monitoring and Audit (EM&A) Report for November 2019 (Report No.:0041/17/ED/0506B) from the Environmental Team (ET), Fugro Technical Services Ltd., received on 4 January 2020 via email.

We would like to inform you that we have no adverse comment on the captioned submission and hereby verify the same in accordance with Condition 4.3 of the Environmental Permit (EP) for the captioned Project (Permit No.: EP-076/2000).

Notwithstanding, please be reminded that the ET shall strictly follow Condition 4.3 of the EP to submit monthly EM&A report within two weeks after the completion of each reporting period and the report shall be certified by the Independent Environmental Checker (IEC) before depositing with the Environmental Protection Department.

Should you have any queries, please feel free to contact the undersigned, or our Mr. Rodney IP at 2815 7028.

Yours faithfully,

For and on behalf of
Allied Environmental Consultants Ltd.

A handwritten signature in black ink, appearing to be 'Grace M. H. Kwok', written in a cursive style.

Grace M. H. KWOK
Independent Environmental Checker

GK/ri/ck/sc

c.c. Fugro Technical Service (ET Leader)
AECOM

Attn: Mr. Colin YUNG
Attn: Ms. Joanne TSOI

(By E-mail)
(By E-mail)

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APPENDICES

- Appendix A Project Organization Chart**
- Appendix B Monitoring Schedule for Present and Next Reporting Period**
- Appendix C Event and Action Plan for Air Quality Monitoring**
- Appendix D Photos of Grab Samplers**
- Appendix E Environmental Complaints Log and Incident Report**
- Appendix F Environmental Mitigation Implementation Schedule (EMIS)**

EXECUTIVE SUMMARY

This Monthly Environmental Monitoring and Audit (EM&A) Report is prepared for Contract No. CM 14/2016 – “Environmental Monitoring and Audit for Operation of Siu Ho Wan Sewage Treatment Works” (hereafter referred to as “the Contract”) for the Drainage Services Department (DSD) of Hong Kong Special Administrative Region. Fugro Technical Services Limited (hereafter referred to as “FTS”) was appointed as the Environmental Team (ET) by DSD, to implement the Environmental Monitoring & Audit (EM&A) programme in accordance with the Operational EM&A Plan of the Contract.

The Contract is part of the “Upgrading of Siu Ho Wan Sewage Treatment Works” (hereinafter referred as “the Project”) which was classified as “Designated Project” under Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap 499) and Environmental Impact Assessment (EIA) Report (Register No. EIAR-124BC) was completed in September 1997. The current Environmental Permit (EP) No. EP-076/2000 was issued in August 2000 to DSD.

In accordance with the EP, an approved operational EM&A Plan was submitted. According to the approved EM&A plan, air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis of H₂S), in addition, water quality monitoring, sediment quality monitoring, benthic survey, Chinese White Dolphin (CWD) monitoring and waste management are the key environmental concern of the Project.

This is the Twenty-eighth Monthly EM&A Report for the Project which summarizes findings of the EM&A works during the reporting period from 1 November 2019 to 30 November 2019 (the “reporting period”).

Breaches of Action and Limit Levels

Air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis), was temporarily suspended and no monitoring was carried out in the reporting period. Action level was triggered as one odour complaint was received during the reporting period.

No water quality monitoring, sediment quality monitoring and benthic survey were carried out in the reporting period as these environmental aspects are monitored bi-monthly. No specific Action/Limit level has to be followed since the purpose of the monitoring is to collect data for future purpose.

Complaint Log

One case from a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal in the reporting period. After investigation, the complaint case was considered as non-project related. Details of the complaint case was recorded in **Appendix E**.

Notifications of Summons and Successful Prosecutions

There were no notifications of summons or prosecutions received during the reporting period.

Summary of the Environmental Mitigations Measures



Mitigation measures specified in the EP and EIA Report such as aeration, chemical dosing system, covering or enclosing the pressing and sludge thickening facilities and ventilating air to a biological treatment unit prior to stack exhaust were implemented during the reporting period.

Future Key Issues

The key issues to be considered in the succeeding reporting month include:

Potential environmental impacts arising from the operations of Siu Ho Wan Sewage Treatment Works (SHWSTW) are mainly associated with air quality, water quality, sediment quality, benthic ecology, waste management and distribution and abundance of Chinese White Dolphins (CWDs).

Due to inadequacy of representative data collected between August 2017 and May 2018, current H₂S measurement and olfactometry analysis were considered as unsuitable methods to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). In order to assess whether SHWSTW is the major H₂S source to ASRs, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASRs are not the appropriate locations for the correlation study as the change of both odour level and H₂S concentrations at ASRs were not sensitive to that at site boundary of SHWSTW. Alternative methods shall be proposed and submitted for EPD's approval.

Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study is approved by EPD. The temporary suspension was approved by EPD's memo dated 14 May 2018.

1. INTRODUCTION

1.1 Background

1.1.1 The Project "Upgrading of Siu Ho Wan Sewage Treatment Works" is to upgrade SHWSTW from the preliminary treatment level to Chemically Enhanced Primary Treatment (CEPT) level with Ultraviolet (UV) disinfection facilities. The Project is required to comply with the Environmental Permit (EP) in respect of the construction and operation phases of the Plant.

1.1.2 Under the EIAO, the Project was classified as "Designated Project". The Environmental Impact Assessment (EIA) study was completed in September 1997 with the EIA Report of Register No. EIA-124BC, Operational Environmental Monitoring and Audit (EM&A) Plan and the EP of No. EP-076/2000 was issued in August 2000 to Drainage Services Department (DSD).

1.1.3 The CEPT part has been completed and was put into operation in March 2005. The UV disinfection works were substantially completed in December 2006. It is considered that the operation of the Project shall be deemed to start when the UV disinfection facilities have been completely installed and tested.

1.2 Project Description

1.2.1 The project proponent was DSD. AECOM was commissioned by DSD as the Engineer for the Project. Allied Environmental Consultants Limited (AEC) was commissioned by DSD as the Independent Environmental Checker (IEC) in the operation phase of the Project. FTS was appointed as the ET by DSD to implement the EM&A programme for the operation phase of the Project including air quality monitoring, water quality monitoring, sediment quality and benthic survey and CWDs monitoring.

1.3 Project Organization

1.3.1 The project organization for environmental works is shown in **Appendix A**. The contact person and telephone numbers of key personnel for the captioned project are shown in **Table 1.1**.

Table 1.1 Contact Persons and Telephone Numbers of Key Personnel

Organization	Role	Contact Person	Telephone No.	Fax No.
DSD	Project Proponent Representative	Mr. Marcus Lau	2594 7218	3104 6426
AECOM	Engineer Representative (ER)	Ms. Joanne Tsoi	3922 9423	3922 9797
AEC	Independent Environmental Checker (IEC)	Ms. Grace Kwok	2815 7028	2815 5399
FTS	ET Leader (ETL)	Mr. Colin Yung	3565 4114	2450 8032

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1.4 Works Undertaken during the Reporting Period

1.4.1 During this reporting period, the principal work activities included:

- Perform comprehensive operation and maintenance services for the electrical, mechanical and electronic systems/equipment at SHWSTW.
- Alleviate as far as practicable the impact that the facilities and sewage systems imposed on the environment of Hong Kong.

2. AIR QUALITY MONITORING

2.1 Methodology of H₂S Concentration Monitoring

2.1.1 15-min H₂S concentration was measured using a Jerome 631-X analyzer. This analyzer is capable of measuring H₂S concentration in the range of 1 ppb to 50 ppm with a resolution of 1 ppb and operates within a temperature range of 0°C to 40°C at an air flow rate of 0.15 L/min. Odour gas samples were drawn by built-in a suction pump of the analyzer and passed through a gold film sensor. The trace level of H₂S of the samples were determined electrochemically on the gold film sensor. Meteorological conditions including temperature, wind speed, wind direction and relative humidity were also measured at the time of the monitoring. Table 2.1 summarizes the equipment used in H₂S monitoring.

Table 2.1 Equipment used for H₂S Concentration Monitoring

Equipment	Manufacturer / Model	Serial Number	Sensor Number
Gold Film Hydrogen Sulphide Analyzer	JEROME X631 0003	2966	14-11-23-R2D

2.2 Methodology of Odour Patrol Monitoring

2.2.1 Odour patrol monitoring was carried out in accordance with the European Standard method: BS EN13725, to ensure the odour sensitivities of all patrol members are within 20-80 ppb/V. Environmental conditions were record as follows:

- i. Prevailing Weather Condition;
- ii. Wind Direction;
- iii. Wind Speed;
- iv. Location where Odour is detected;
- v. Source of Odour detected;
- vi. Perceived intensity of Odour detected;
- viii. Duration of Odour detected; and
- ix. Characteristics of Odour detected

The perceived intensity is classified into 5 categories as shown in **Table 2.2** below.



Table 2.2 Categories of Odour Intensity

Odour Level	Odour Intensity	Classification Criteria
0	Not detected	No odour perceives or an odour so weak that it cannot be readily characterised or described
1	Slight	Identifiable odour, barely noticeable
2	Noticeable	Identifiable odour, noticeable
3	Strong	Identifiable odour, strong
4	Extreme	Severe odour

2.3 Methodology of Odour Sampling and Olfactometry Analysis

- 2.3.1 Odour gas samples were collected in a Nalophan sampling bag placed inside a vacuum air-tight sampler using passive sampling technique. Approximately 60 liter of gas sample was collected at each sampling. All samples collected on the sampling day were returned to laboratory for olfactometry analysis within 24 hours and analyzed within 2 hours upon receiving.
- 2.3.2 ALS Technichem (HK) Pty Ltd. (HOKLAS Reg. No. 066), was the appointed laboratory for olfactometry analysis of the gas sample.
- 2.3.3 The odour concentration of the samples were determined by Forced-choice Dynamic Olfactometer in accordance with the European Standard Method: BS EN13725. Testing were also performed by a panel of six members who have been trained to comply with the requirement of European Standard Method: BS EN13725. All testing were completed within 24 hours upon sampling.

2.4 Monitoring Location

- 2.4.1 H₂S concentration monitoring, odour patrol monitoring and odour sampling were carried out at ASR, Cheung Tung Road near the Bus Depot at the west of the Siu Ho Wan Treatment Plant. The location of ASR is shown in **Figure 1**.

2.5 Monitoring Frequency and Duration

The durations and frequencies of H₂S concentration measurement, odour patrolling and odour sampling are summarized in **Table 2.3** below.



Table 2.3 Durations and Frequencies of Air Quality Monitoring Programme

	Duration	Frequency
H ₂ S concentration monitoring	15 minutes	¹ Weekly basis for 6 months during the initial operation stage
Odour patrol		
Odour sampling for olfactometry analysis	³ 15 minutes	² First week of the odour patrol monitoring

Remark:

- 1) In case excessive odour nuisance was detected during the odour patrol monitoring or the standard of the 5 odour units cannot be complied with during the odour panel monitoring, the odour patrol monitoring and H₂S concentration monitoring shall be extended for a period of three months to cater for the warm-up period of the functioning of the additional mitigation measures.
- 2) In case the relationship between H₂S concentration (ppb) with the odour unit (OU/m³) cannot conclude from the correlation study carried out at the first week of the odour patrol monitoring due to invalid data, additional odour sampling for olfactometry analysis shall be carried out for the correlation study.
- 3) Sufficient air samples (approximate 60L) may be collected in less than 15 minutes during odour sampling.

2.5.1 The monitoring schedule for the present and next reporting period is provided in **Appendix B**.

2.6 Event and Action Plan

2.6.1 Action and limit levels for air quality monitoring are presented in **Table 2.4**.

Table 2.4 Action and Limit Levels for Air Quality Monitoring

Parameter	Action	Limit
Odour	One complaint received for specific odour event	Two or more independent complaints receive for specific odour event

2.6.2 The event and action plan for air quality monitoring is provided in **Appendix C**.

2.7 Quality Assurance and Quality Control

- 2.7.1 A control sample was collected by purging odour-free nitrogen gas from a certified gas cylinder on site at each sampling.
- 2.7.2 Calibration of the analyzer is conducted every year at the laboratory of the manufacturer.
- 2.7.3 In order to ensure the analyzer is functioning properly, manual sensor regeneration and zero adjustment were performed before each set of odour monitoring.

2.8 Monitoring Results and Observations

- 2.8.1 Air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis), was temporary suspended and no monitoring was carried out in the reporting period.
- 2.8.2 According to the approved EM&A plan, a correlation study has to be carried out to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). Due to non-ideal



wind direction or domination of non-target smell during the measurements conducted between August 2017 and May 2018, inadequacy of representative data was result between August 2017 and May 2018. Current H₂S measurement and olfactometry analysis was considered as unlikely way to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). In order to assess whether SHWSTW is the major H₂S source to ASRs, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASRs are not the appropriate locations for the correlation study as the change of both odour level and H₂S concentrations at ASRs were not sensitive to that at site boundary of SHWSTW. Alternative methods shall be proposed and submitted for EPD's approval.

- 2.8.3 Action level was triggered as one odour complaint was received during the reporting period. One case from a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal. After investigation, the complaint case was considered as non-project related. Details of the complaint case was recorded in **Appendix E**.
- 2.8.4 Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study was approved by EPD. The temporary suspension was approved by EPD's memo dated 14 May 2018.
- 2.8.5 Odour mitigation measures such as aeration, chemical dosing system, covering or enclosing the pressing and sludge thickening facilities and ventilating air to a biological treatment unit prior to stack exhaust were implemented during the reporting period.

3. WATER QUALITY MONITORING

3.1 Monitoring Station

3.1.1 In accordance with Section 5 of the EM&A Plan, water quality monitoring should be carried out at eight designated monitoring stations (two impact stations and six control stations) during the first five years of the operational phase of the Project. The monitoring stations shall be the same monitoring stations that were used for the baseline monitoring programme and have been approved by EPD. The coordinates of the monitoring stations are shown in **Table 3.1** and their locations are shown in **Figure 2**.

Table 3.1 Location of Water Quality Monitoring

Sampling Location		Easting	Northing
A	The Brothers, Control Station	816 100	822 500
B	The Brothers, Control Station	816 680	822 440
C	Siu Ho Wan Outfall, Impact Station	816 800	820 180
D	Siu Ho Wan Outfall, Impact Station	817 160	820 360
E	Cheung Sok, Control Station	819 817	821 655
F	Cheung Sok, Control Station	820 158	821 922
G	Tai Ching Chau, Control Station	822 214	822 692
H	Tai Ching Chau, Control Station	822 494	822 939

3.2 Monitoring Parameter

3.2.1 The monitoring parameters for water quality monitoring are summarized in **Table 3.2**.

Table 3.2 Parameters for Water Quality Monitoring

Monitoring Parameters	
In-situ Measurement	Laboratory Analysis
Dissolved oxygen (mg/L)	<i>E. coli</i> (cfu/100ml)
Temperature (degree Celsius)	5-day BOD (mg/l)
pH value	Suspended Solids (mg/l)
Water depth (m)	Ammonia as N (mg/l)
Salinity (ppt)	Nitrate as N (mg/l)
Turbidity (NTU)	Nitrite as N (mg/l)
Current Speed (m/s)	Total inorganic nitrogen (mg/l)
Current Direction (degree magnetic)	Total phosphorus (soluble and particulate) (mg/l)



3.2.2 Apart from the parameters listed in the **Table 3.2**, other relevant supplementary information such as monitoring location, time, weather conditions and any special phenomena will be also recorded.

3.2.3 The tidal data will be obtained from the tide gauge installed in Ma Wan Marine Traffic Station, managed by the Hydrographic Office of Marine Department. Location of the tide gauge is shown in **Figure 3**.

3.3 Monitoring Equipment

3.3.1 A multifunctional meter (YSI 6920 V2/ Aqua TROLL 600) will be used to measure dissolved oxygen (DO), concentration, DO saturation, temperature, salinity, pH and turbidity, simultaneously at the same location and water depth. An Acoustic Doppler Current Profiler (ADCP) integrated with echo sounder function will be used to measure water depth, current velocity (speed and direction). The data measured by ADCP will then be downloaded on site to computer on-board. The water depth data measured by the ADCP shall be electronically logged and available for output. All measurement data from the multiparameter monitoring device and ADCP will be integrated with the GPS data from the DGPS logging device, so that data collected at a specific time and location can be shown. The water sampler will be equipped with a multiparameter monitoring device (with water depth probe to determine the exact sampling depth at which a sample is collected). The equipment employed for the monitoring and sampling and their specifications are presented in **Table 3.3**. **Table 3.4** summarizes the equipment used in water quality monitoring.

Table 3.3 Water Quality Monitoring and Sampling Equipment

Parameter	Equipment	Model	Range	Equipment Accuracy
Temperature, Dissolved Oxygen, salinity, pH, Turbidity, Sampling Depth	Water Quality Monitoring Device	1) YSI 6920V2-2-M Sonde 2) Aqua TROLL 600 Multiparameter Sonde	Temp: -5 to 50°C DO: 0-50mg/L DO%: 0-500% Sal: 0 to 70 ppt pH: 0 to 14 pH units Turb: 0-1000NTU Depth: 0-61 meters	Temp: ±0.15°C DO: ±0.1mg/L or 1% (whichever greater) for 0-20mg/L; ±15% for 20-50mg/L (with correction for salinity and temperature) Sal: ±1% or 0.1ppt (whichever greater) pH: ±0.2 units Turb: ±2% or 0.3NTU (whichever greater) Depth: ±0.12m
Water Depth, Current Speed, Current Direction	Acoustic Doppler Current Profiler	RiverSurveyor M9	Water Depth: 0-80m	Water Depth: 1% Current speed: ±0.25% of measured velocity or ±0.2cm/s Current direction: ±2degree magnetic
Positioning	DGPS	Simrad MX521B Smart Antenna with Simrad MX610 CDU	NA	GPS: ±1m
Water Sampling	Water Sampler	Aquatic Research Transparent PC Vertical Water Sampler 2.2L / 3L / 5L	NA	NA



Table 3.4 Equipment used for Water Quality Monitoring

Equipment	Manufacturer / Model	Serial Number
Water Quality Monitoring Device	Aqua TROLL 600 Multiparameter Sonde	490113
Acoustic Doppler Current Profiler	RiverSurveyor M9	5906

3.3.2 Apart from the equipment mentioned in Section 3.3.1, a Class III commercially licensed vessel will be used as survey vessel. DGPS logging device with accuracy of $\pm 1\text{m}$ at 95% confidence level will be installed on the survey vessel to ascertain that measurement can be made accurately on the specific transects. All GPS data collected during the whole survey will be automatically and electronically logged. Powered winch will be used on-board the Survey Vessel to assist the monitoring. Experienced supervisor will be present all throughout the monitoring activities on-board the survey vessel.

3.3.3 Water samples will be collected by water sampler and stored in high density polythene bottles and sterilized glass bottles (for bacterial analysis), packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory on the same day of collection for analysis. All sampling bottles will be pre-rinsed with the same water samples. The sampling bottles will then be taken to a HOKLAS accredited laboratory for analysis of *E. coli*, BOD₅, Suspended Solids, NH₃-N, NO₃-N, NO₂-N, Total inorganic nitrogen, Total phosphorus (soluble and particulate).

3.4 Laboratory Measurement and Analysis

3.4.1 ALS Technichem (HK) Pty Ltd (HOKLAS Reg. No. 066), is the appointed laboratory for analysis of water samples. The methods adopted by the laboratory and the reporting limits are detailed in **Table 3.5**.

Table 3.5 Laboratory Measurement/Analysis Methods and Reporting Limits

Analysis Description	Method	Reporting limits
<i>E. coli</i>	DoE Section 7.8, 7.9.4.2& 7.9.4.4 plus in situ urease test	1 cfu/100mL
5-day Biochemical Oxygen Demand	APHA 5210B	1 mg/L
Total Suspended Solid	APHA 2540D	0.5 mg/L
Ammonia as N	APHA 4500 NH3: G	0.005 mg/L
Nitrate as N	APHA 4500 NO3: I	0.005 mg/L
Nitrite as N	APHA 4500 NO2 B&H	0.005 mg/L
Total Inorganic Nitrogen	By Calculation	0.01 mg/L
Total phosphorus (soluble and particulate)	APHA 4500 P: J	0.01 mg/L

3.5 Monitoring Frequency and Duration

- 3.5.1 The water quality monitoring programme will be carried out once per two months for a period of five years of the operational phase of the Project.
- 3.5.2 Water quality monitoring for two tides at eight designated stations will be carried out for each monitoring event. For each station at each tide, duplicate samples for in-situ parameter and laboratory analysis at three designated water depths (1 m below water surface, mid-depth and 1 m above the seabed) will be taken and analyzed.
- 3.5.3 The monitoring schedule for the present and next reporting period is provided in **Appendix B**.

3.6 Quality Assurance / Quality Control

- 3.6.1 The equipment is in compliance with the requirements set out in the EM&A Plan. All in-situ monitoring instruments were calibrated by a HOKLAS-accredited laboratory or by standard solutions. Calibration of temperature, DO, salinity, pH and turbidity is conducted in three month interval.
- 3.6.2 During the measurements of DO concentration, DO saturation, salinity, turbidity, pH and temperature, duplicate readings will be taken. If the difference between the first and second readings of DO or turbidity is more than 25% of the value of the first reading, the reading was discarded and further readings will be taken.
- 3.6.3 The laboratory incorporates a variety of QA/QC monitoring programme into their testing system. Where applicable or available, the quality of the analysis will be monitored by conducting the following QC analysis:

For each batch of 20 samples:

- A minimal of 1 laboratory method blank will be analyzed;
- A minimal of 1 sample duplicate will be analyzed;
- A minimal of 1 sample matrix spike will be analyzed.

3.7 Event and Action Plan

- 3.7.1 Since the purpose of the water quality monitoring is to collect data for future propose, no specific event and action has to be followed.

3.8 Monitoring Results and Observations

- 3.8.1 Water quality monitoring has been conducted in October 2019. No water quality monitoring is carried out in this reporting period.

4. SEDIMENT QUALITY MONITORING AND BENTHIC SURVEY

4.1 Monitoring Station

4.1.1 In accordance with Section 6 of the EM&A Plan, sediment quality monitoring and benthic survey should be carried out at eight designated monitoring stations (two impact stations and six control stations) during the first five years of the operational phase of the Project. The proposed monitoring stations shall be the same monitoring stations that were used for the baseline monitoring programme and have been approved by EPD. The coordinates of the monitoring stations are shown in **Table 4.1** and their locations are shown in **Figure 2**.

Table 4.1 Location of Sediment Quality Monitoring and Benthic Survey

Sampling Location		Easting	Northing
A	The Brothers, Control Station	816 100	822 500
B	The Brothers, Control Station	816 680	822 440
C	Siu Ho Wan Outfall, Impact Station	816 800	820 180
D	Siu Ho Wan Outfall, Impact Station	817 160	820 360
E	Cheung Sok, Control Station	819 817	821 655
F	Cheung Sok, Control Station	820 158	821 922
G	Tai Ching Chau, Control Station	822 214	822 692
H	Tai Ching Chau, Control Station	822 494	822 939

4.2 Monitoring Parameter

4.2.1 The monitoring parameters for sediment quality monitoring and benthic survey are summarized in **Table 4.2**.

Table 4.2 Parameters for Sediment Quality Monitoring and Benthic Survey

Monitoring Parameters	
Sediment Quality Monitoring	Rinsate Blank for Benthic Survey
Grain size profile* (i.e. Particle Size Distribution) (%)	Cadmium (µg/L)
Total organic carbon* (%)	Chromium (µg/L)
pH value	Copper (µg/L)
Ammonia as N (mg-N/kg)	Lead (µg/L)
Total nitrogen (mg-N/kg)	Mercury ((µg/L)
Total phosphorus (mg-N/kg)	Nickel (µg/L)
Cadmium (mg/kg)	Zinc (µg/L)
Chromium (mg/kg)	Arsenic (µg/L)
Copper (mg/kg)	Silver (µg/L)
Lead (mg/kg)	
Mercury (mg/kg)	
Nickel (mg/kg)	
Zinc (mg/kg)	
Arsenic (mg/kg)	
Silver (mg/kg)	

*Grain size profile and total organic carbon is determined from the sediment sampled collected for benthic survey.

4.2.2 Apart from the parameters listed in the Table 4.2, other relevant supplementary information such as monitoring location, time, weather conditions and any special phenomena will be also recorded.

4.2.3 The tidal data will be obtained from the tide gauge installed in Ma Wan Marine Traffic Station, managed by the Hydrographic Office of Marine Department. Location of the tide gauge is shown in **Figure 3**.

4.3 Sampling Equipment

4.3.1 Ponar grab sampler (capacity of ~ 1 litre) will be used for collection of samples for sediment analysis. The grab will be capable of collecting sufficient amount of surficial (top 5 cm) sediment for the required analysis in a single deployment at each sampling location. The grab will be constructed with non-contaminating material to prevent sample contamination. Photos of ponar grab sampler are shown in **Appendix D**.

4.3.2 A modified Van Veen grab sampler (capacity of ~ 11.3 litres) will be used for collecting sediment samples for benthic survey. The top of the grab will have openings to allow the easy flow of water through the grab as it descends. The openings will be covered with 0.5 mm mesh to prevent the loss of any benthic fauna once sediment samples are taken. In addition the top openings will be sealable by movable flaps which will close when the grab is hauled to surface. Photos of modified Van Veen grab sampler are shown in **Appendix D**.

4.3.3 Class III commercially licensed vessel will be used as survey vessel. DGPS logging device in the ADCP with accuracy of $\pm 1\text{m}$ at 95% confidence level will be installed on the survey vessel to ascertain that measurement can be made accurately on the specific transects. All GPS data collected during the whole survey will be automatically and electronically logged. Powered winch will be used on-board the survey vessel to assist the monitoring. 4 fixed sieve stations will be equipped on survey vessel. Experienced supervisor will be present all throughout the monitoring activity on-board the survey vessel.

4.4 Sampling Procedure

Benthic Survey, Particle Size Distribution and TOC Analysis

4.4.1 A modified Van Veen grab sampler (capacity of ~ 11.3 litres) will be deployed using a winch at each of the benthic survey stations to collect single grab sample at each station. The grab sampler will be lowered through the water column slowly at a constant rate (approximately 30 cm/s) to prevent the formation of a pressure wave that may disturb surficial deposits. The grab will then be retrieved and evaluated on board of the survey vessel. Any sample showing uneven penetration or only partially filled with sediment shall be rejected. Samples will be placed in a plastic box with an identification card. Sub-samples (approximately 1 kg) will be splitted up for analysis of particle size distribution and TOC. The remaining sediment samples will be washed gently to separate the benthic organisms and the sediment using a watering hose with marine seawater supply, by a sieve stack (comprising 1 mm and 0.5 mm meshes). Benthic organisms remaining on the sieve will be removed into pre-labeled ziplock plastic bags. A 10% solution of buffered formalin containing Rose Bengal in seawater will be added to the bag to ensure tissue preservation. Samples will be sealed in plastic containers for transport to the laboratory for sorting and identification of benthic organisms.



Sediment Quality Monitoring (Except Particle Size Distribution and TOC Analysis)

4.4.2 Ponar grab sampler (capacity of ~ 1 litres) will be deployed at each of the benthic survey stations to collect single grab sample at each station. The grab sampler should be lowered through the water column slowly at a constant rate (approximately 30 cm/s) to prevent the formation of a pressure wave that may disturb surficial deposits. The grab will then be retrieved and evaluated on board of the survey vessel. Any sample showing uneven penetration or only partially filled with sediment will be rejected. Samples will be placed in a plastic box with an identification card. Sediment samples will be then transferred into brand new soil jars with QA/QC monitoring for laboratory analysis. Samples will be preserved and stored in accordance with approved SOP of HOKLAS accredited laboratory and the recommendations stipulated in ETWB TC (W) No. 34/2002.

4.4.3 Sediment samples shall be collected and packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory on the same day of collection for analysis.

4.5 Laboratory Measurement and Analysis

4.5.1 ALS Technichem (HK) Pty Ltd (HOKLAS Reg. No. 066), is the appointed laboratory for analysis of sediment samples. The methods adopted by the laboratory and the reporting limits are detailed in **Table 4.3**.

Table 4.3 Laboratory Measurement/Analysis Methods and Reporting Limits

Analysis Description	Method	Reporting limits
Particle Size Distribution	Geospec 3: 2001 Test method 8.1, 8.5 and 8,7 (Wet Sieve and Hydrometer Method)	1%
Total Organic Carbon	APHA 5310B	0.05%
pH value	APHA 4500H: B	0.1 pH unit
Ammonia as N	APHA 4500 NH3: B&G	0.5 mg/kg
Total Nitrogen	APHA 4500 Norg: D & APHA 4500 NO3: I	10 mg/kg
Total Phosphorus	APHA 4500P: B&H	10 mg/kg
Cadmium	USEPA 6020A Digestion method: 3051A	0.1 mg/kg
Chromium		0.5 mg/kg
Copper		0.2 mg/kg
Lead		0.2 mg/kg
Mercury		0.05 mg/kg
Nickel		0.2 mg/kg
Zinc		0.5 mg/kg
Arsenic		0.5 mg/kg
Silver		0.1 mg/kg

4.6 Taxonomic Identification of Benthic Organism

4.6.1 Taxonomic identification of benthic organisms will be performed using stereo dissecting and high-power compound microscopes where it is necessary. Benthic organisms will be counted and identified to lower taxonomic levels as far as practicable with biomass (wet weight, to 0.01gram) of each individual recorded. If breakage of soft-bodied organism occurs, only anterior portions of fragments will be counted, although all fragments will be retained and

weighted for biomass determinations (wet weight, to 0.01gram). Data of species abundance and biomass will be recorded.

- 4.6.2 Data collected during surveys will be presented and summarized in tables and graphics. Species/taxon richness and abundance of marine benthic fauna communities will be analyzed by Shannon-Weiner diversity and Pielou's Evenness.

4.7 Monitoring Frequency and Duration

- 4.7.1 The sediment quality monitoring and benthic survey programmed shall be carried out once per two months for a period of five years of the operational phase of the Project. Since the purpose of the sediment quality monitoring and benthic survey is to collect data for future reference, only a single round of sediment quality monitoring and benthic survey at 8 designated locations will be carried out for each monitoring event. For each location, only a single sample will be taken and analyzed.

4.8 Quality Assurance / Quality Control

- 4.8.1 A rinsate blank will be collected in each monitoring location before each sediment sampling for benthic survey, so as to monitor the effectiveness of field decontamination procedure.
- 4.8.2 The laboratory incorporates a variety of QA/QC monitoring programme into their testing system. Where applicable or available, the quality of the analysis will be monitored by conducting the following QC analysis:

For each batch of 20 samples:

- A minimal of 1 laboratory method blank will be analyzed;
- A minimal of 1 sample duplicate will be analyzed;
- A minimal of 1 sample matrix spike will be analyzed.

4.9 Event and Action Plan

- 4.9.1 Since the purpose of the sediment quality monitoring and benthic survey is to collect data for future purpose, no specific event and action has to be followed.

4.10 Monitoring Results and Observations

- 4.10.1 Sediment quality monitoring and benthic survey have been conducted in October 2019. No sediment quality monitoring and benthic survey is carried in the reporting period.



5. CHINESE WHITE DOLPHIN MONITORING

5.1 Data Interpretation

5.1.1 In accordance with Section 4.1 of the EM&A Plan, relevant information on the distribution and abundance of CWDs in Hong Kong should be obtained from the Agriculture, Fisheries and Conservation Department (AFCD), and be reviewed on a bimonthly basis during the operational phase of the Project for a period of 5 years.

5.1.2 The latest AFCD's report dated 1 August 2019, "*Monitoring of Marine Mammals in Hong Kong Waters (2018-19)*", in terms of the distribution and abundance of CWDs, was reviewed in the Monthly EM&A report in August 2019. According to the advice from AFCD, the data of distribution and abundance of CWDs would only be available in the annual reports for Monitoring of Marine Mammals In Hong Kong Waters which cover monitoring data from 1 April to 31 March (next year). The updated status of the distribution and abundance of CWDs will be provided once the annual report (2019-20) is uploaded to AFCD's webpage.

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6. ADVICE ON IMPLEMENTATION STATUS OF ENVIRONMENTAL MITIGATION MEASURES

6.1 Implementation Status

- 6.1.1 Although no site inspection is prescribed during the operation of the Plant in accordance with the approved EM&A Plan, SHWSTW is reminded to fully and properly implement the mitigation measures specified in the EP and EIA Report. Mitigation measures such as aeration, chemical dosing system, covering or enclosing the pressing and sludge thickening facilities and ventilating air to a biological treatment prior to stack exhaust was implemented in the reporting period. A summary of mitigation measures implementation schedule is provided in **Appendix F**.



7. ADVICE ON THE SOLID AND LIQUID WASTE MANAGEMENT STATUS

7.1.1 SHWSTW is reminded to fully comply with EP conditions. All measures and recommendations in the EP, EIA Report and approved Waste Management Plan (WMP) shall be fully and properly implemented. During the reporting period, following measures in related to solid and liquid waste management were implemented:

- The influent of waste water shall be treated by CEPT with UV disinfection;
- Trip-ticket system shall be implemented for sludge and sediment;
- The acceptance criteria for Landfill disposal should be followed;
- Chemical waste should be properly handled and stored temporarily in designated chemical waste storage area on site in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.

7.1.2 A summary of mitigation measures implementation schedule is provided in **Appendix F**.



8. SUMMARY OF EXCEEDANCE OF THE ENVIRONMENTAL QUALITY PERFORMANCE LIMITS

8.1.1 Air quality monitoring (i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis), was temporary suspended and no monitoring was carried out in the reporting period. Action level was triggered as one odour complaint was received during the reporting period. One case from a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal. After investigation, the complaint case was considered as non-project related. Details of the complaint case was recorded in **Appendix E**.

8.1.2 Water quality monitoring, sediment quality monitoring and benthic survey were carried out on 17 October 2019. No water quality monitoring, sediment quality monitoring and benthic survey were carried out in the reporting period as these environmental aspects are monitored bi-monthly. No specific Action/Limit level has to be followed since the purpose of the monitoring is to collect data for future purpose.



9. SUMMARY OF ENVIRONMENTAL COMPLAINTS

9.1.1 One case from a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal in the reporting period. After investigation, the complaint case was considered as non-project related. Details of the complaint case was recorded in **Appendix E**.

9.1.2 No inspection notice, notification of summons or prosecution was received in relation to environmental impact during the report period. Summaries of complaints, notification of summons and successful prosecutions are presented in **Table 9.1** and **Table 9.2**.

Table 9.1 Cumulative Statistics on Complaints

Environmental Parameters	Cumulative No. Brought Forward	No. of Complaints This Month	Cumulative Project-to-Date
Air	0	1	1
Noise	0	0	0
Water	0	0	0
Waste	0	0	0
Others	0	0	0
Total	0	0	0

Table 9.2 Cumulative Statistics on Notification of Summons and Successful Prosecutions

Environmental Parameters	Cumulative No. Brought Forward	No. of Notification of Summons and Prosecutions This Month	Cumulative Project-to-Date
Air	0	0	0
Noise	0	0	0
Water	0	0	0
Waste	0	0	0
Others	0	0	0
Total	0	0	0



10. FUTURE KEY ISSUES

10.1.1 The key issues to be considered in the coming reporting month include:

- i. Potential environmental impacts arising from the operation of SHWSTW are mainly associated with air quality, water quality, sediment quality, benthic ecology, waste management and distribution and abundance of CWDs.
- ii. Due to inadequacy of representative data collected between August 2017 and May 2018, current H₂S measurement and olfactometry analysis were considered as unsuitable method to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). In order to assess whether SHWSTW is the major H₂S source to ASRs, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASR are not appropriate locations for the correlation study as the change of both odour level and H₂S concentrations at ASRs were not sensitive to that at site boundary of SHWSTW. Alternative methods shall be proposed and submitted for EPD's approval.
- iii. Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study was approved by EPD. The temporary suspension was approved by EPD's memo dated 14 May 2018.

11. CONCLUSION

- 11.1.1 Air quality monitoring i.e. H₂S concentration monitoring, odour patrol monitoring and olfactometry analysis, was temporary suspended and no monitoring was carried out in the reporting period. Action level was triggered as one odour complaint was received during the reporting period.
- 11.1.2 According to the approved EM&A plan, a correlation study has to be carried out to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). Due to non-ideal wind direction or domination of non-target smell during the measurements conducted between August 2017 and May 2018, inadequacy of representative data was result between August 2017 and May 2018. Current H₂S measurement and olfactometry analysis was considered as unlikely way to establish the relationship of H₂S concentration (ppb) with the odour unit (OU/m³). In order to assess whether SHWSTW is the major H₂S source to ASR, three additional air quality monitoring events were conducted on February 2018. The data showed that site boundary of SHWSTW and the location of ASR is not appropriate for the correlation study as the change of both odour level and H₂S concentrations at ASR were not sensitive to that at site boundary of SHWSTW. Alternative methods shall be proposed and submitted for EPD's approval. Since six months air quality monitoring and additional three months air quality monitoring had been conducted according to Section 2.2 of OEM&A Plan without any complaint or non-compliance recorded, air quality monitoring was temporarily suspended until alternative methods of correlation study was approved by EPD. The temporary suspension was approved by EPD's memo dated 14 May 2018.
- 11.1.3 No water quality monitoring, sediment quality monitoring and benthic survey were conducted in the reporting period.
- 11.1.4 The latest AFCD's report dated 1 August 2019, "*Monitoring of Marine Mammals in Hong Kong Waters (2018-19)*" in terms of the distribution and abundance of CWDs was reviewed in the Monthly EM&A report in August 2019. According to the advice from AFCD, the data of distribution and abundance of CWDs would only be available in the annual reports for Monitoring of Marine Mammals In Hong Kong Waters which cover monitoring data from 1 April to 31 March (next year). The updated status of the distribution and abundance of CWDs will be provided once the annual report (2019-20) is uploaded to AFCD's webpage.
- 11.1.5 SHWSTW is reminded to fully *comply with EP conditions*. All *environmental mitigation measures* and recommendations in the EP, EIA Report and approved waste management plan shall be fully and properly implemented.
- 11.1.6 One case from a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal in the reporting period. After investigation, the complaint case was considered as non-project related.
- 11.1.7 No inspection notice, notification of summons or prosecution was received in relation to environmental impact during the report period.

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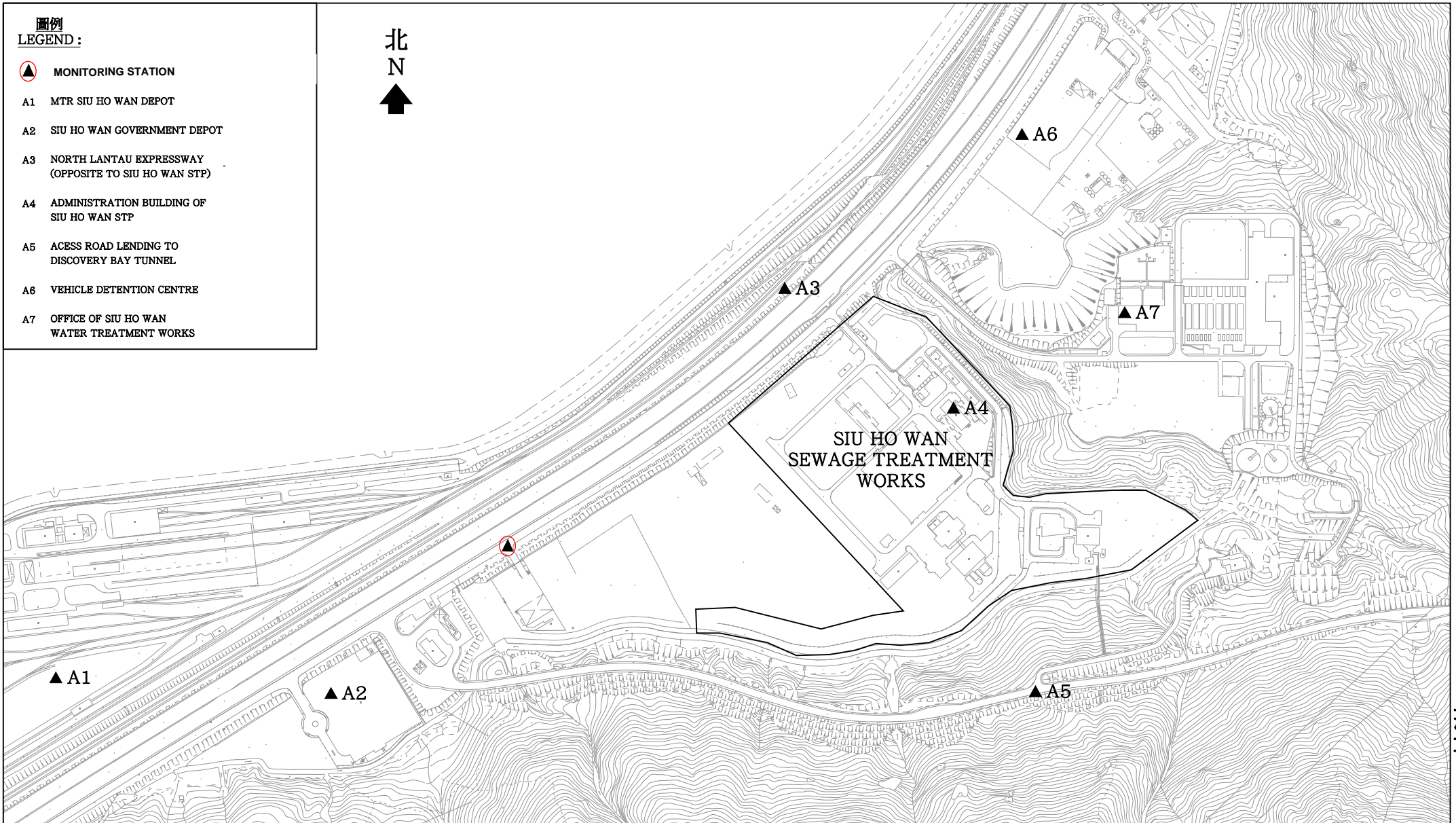
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Figure 1

Monitoring Stations of Air Sensitive Receivers

圖例
LEGEND :

	MONITORING STATION
A1	MTR SIU HO WAN DEPOT
A2	SIU HO WAN GOVERNMENT DEPOT
A3	NORTH LANTAU EXPRESSWAY (OPPOSITE TO SIU HO WAN STP)
A4	ADMINISTRATION BUILDING OF SIU HO WAN STP
A5	ACCESS ROAD LENDING TO DISCOVERY BAY TUNNEL
A6	VEHICLE DETENTION CENTRE
A7	OFFICE OF SIU HO WAN WATER TREATMENT WORKS



圖則名稱 drawing title	繪畫 drawn	C.W. CHAN	日期 date	16-08-2006	圖則編號 drawing no.	DCM/2006/063	比例 scale	N.T.S.
	核對 checked	C.K. LAM	日期 date	16-08-2006	保留版權 COPYRIGHT RESERVED			
批核 approved	S.K. WONG	日期 date	16-08-2006					
UPGRADING OF SIU HO WAN SEWAGE TREATMENT PLANT OPTIONAL ENVIRONMENTAL MONITORING AND AUDIT PLAN ODOUR PATROL MONITORING STATIONS	部門 office	顧問工程管理部 CONSULTANTS MANAGEMENT DIVISION			香港特別行政區政府渠務署 DRAINAGE SERVICES DEPARTMENT GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION			

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Figure 2

Monitoring Stations of Water Quality Monitoring, Sediment Quality Monitoring and Benthic Survey



816000E

818000E

820000E

822000E

822000N

大小灣刀
BROTHERS

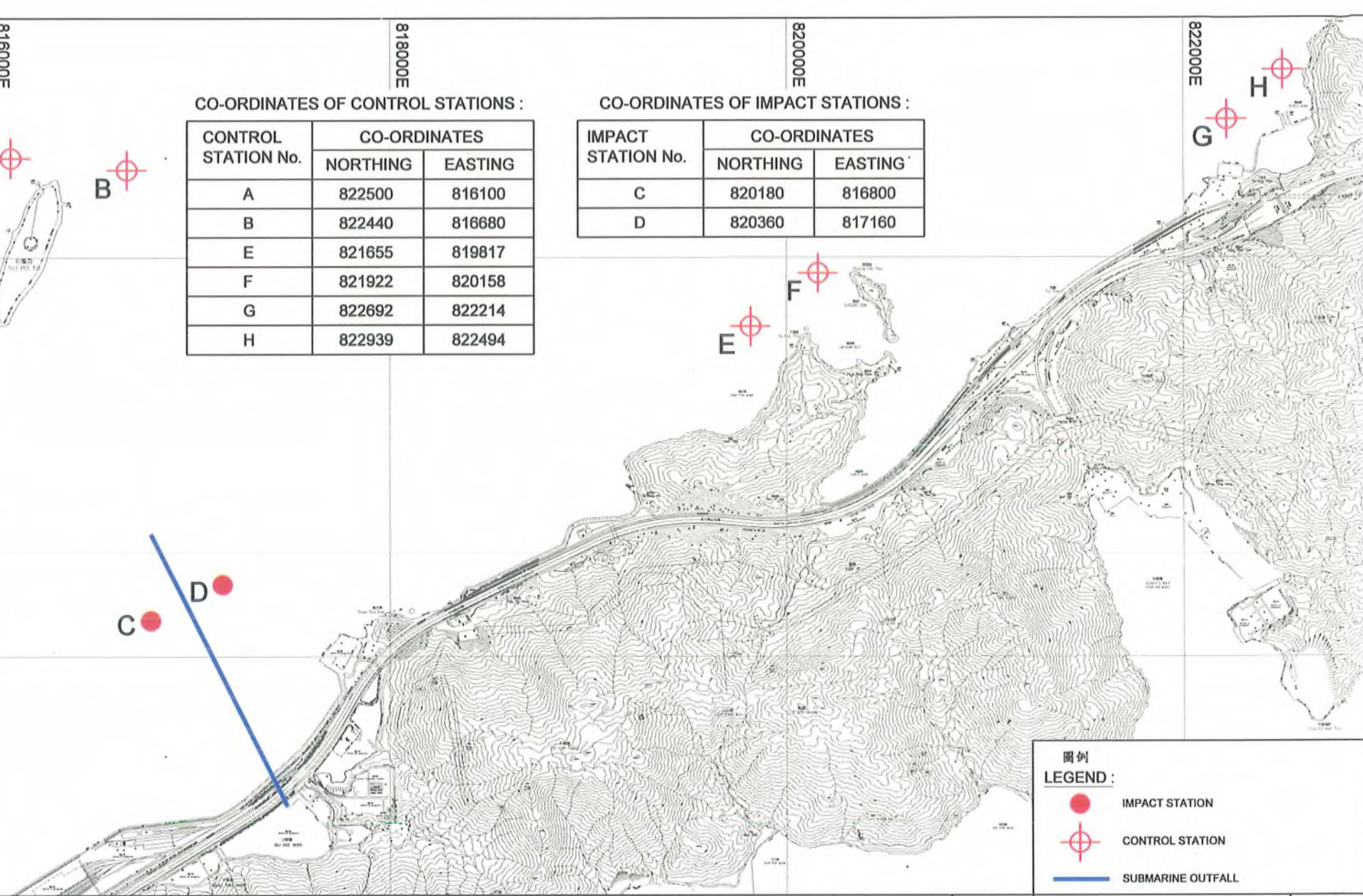
820000N

CO-ORDINATES OF CONTROL STATIONS :

CONTROL STATION No.	CO-ORDINATES	
	NORTHING	EASTING
A	822500	816100
B	822440	816680
E	821655	819817
F	821922	820158
G	822692	822214
H	822939	822494

CO-ORDINATES OF IMPACT STATIONS :

IMPACT STATION No.	CO-ORDINATES	
	NORTHING	EASTING
C	820180	816800
D	820360	817160



圖例
LEGEND :

- IMPACT STATION
- ⊕ CONTROL STATION
- SUBMARINE OUTFALL

圖則名稱 drawing title

**UPGRADING OF SIU HO WAN SEWAGE TREATMENT PLANT
BASELINE MONITORING - LOCATION OF MONITORING STATIONS**

繪畫 drawn	H.K. LAI	日期 date	06-02-2004
核對 checked	C.K. LAM	日期 date	04-03-2004
批核 approved	S.K. WONG	日期 date	04-03-2004
部門 office	顧問工程管理部 CONSULTANTS MANAGEMENT DIVISION		

圖則編號 drawing no. **DCM/2004/002** 比例 scale N.T.S.

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Figure 3

Location of the Tide Gauge

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Location of the Tide Gauge

Source: Google Maps

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Appendix A Project Organization Chart

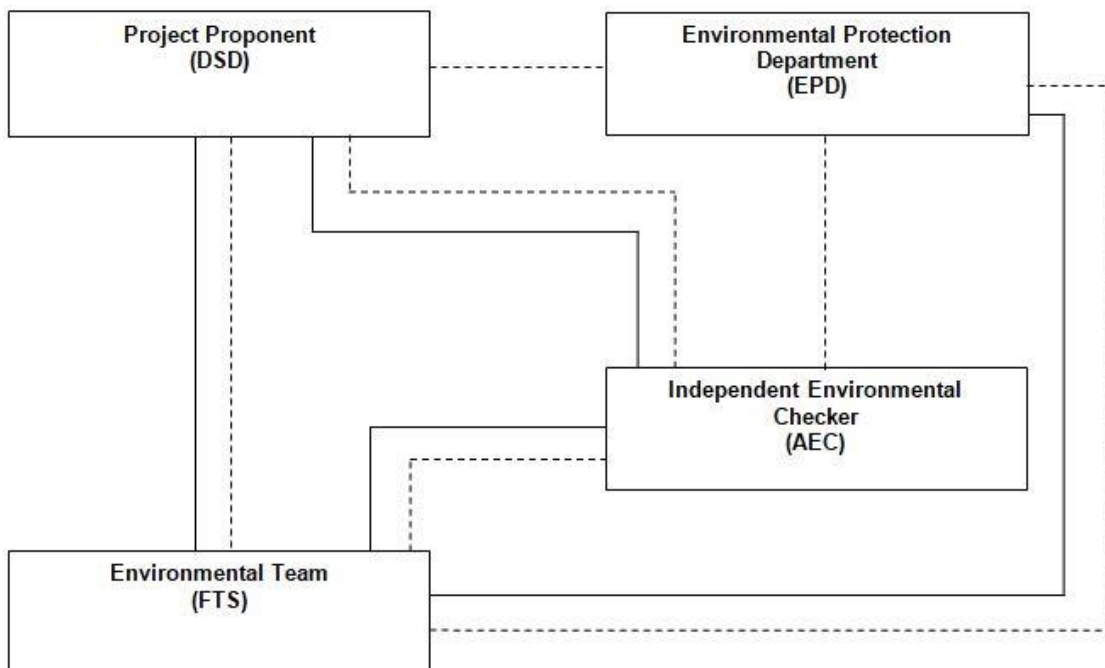
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Legend:
— Line of Reporting
- - - Line of Communication

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Appendix B

Monitoring Schedule for Present and Next Reporting Period

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Monitoring Schedule for the Present Reporting Period

Sun	Mon	Tue	Wed	Thur	Fri	Sat
					1 November	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Remarks

1. Actual monitoring will be subjected to change due to any safety concern or adverse weather condition.

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Monitoring Schedule for the Next Reporting Period

Sun	Mon	Tue	Wed	Thur	Fri	Sat
1 December	2	3	4	5	6	7
8	9	10 Water Quality Monitoring and Sediment Quality Monitoring and Benthic Survey Mid-Ebb (11:09) Mid-Flood (16:50)	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Remarks

- Actual monitoring will be subjected to change due to any safety concern or adverse weather condition.

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Appendix C

Event and Action Plan for Air Quality Monitoring

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EVENT	ACTION		
	ET	IEC	*Operator
Action Level			
One complaint received for specific odour event	<ol style="list-style-type: none"> 1. Check Operator's working methods; 2. Discuss with Operator on required remedial actions 	<ol style="list-style-type: none"> 1. Discuss with ET and Operator on the possible remedial actions; 2. Advise the Operator on the effectiveness of the proposed remedial measures; 3 Supervise implementation of remedial measures 	<ol style="list-style-type: none"> 1. Identify/ confirm source with ET; 2. Discuss with ET for remedial actions required; 3. Ensure remedial actions properly implemented 4. Rectify any unacceptable practice; 5. Amend operation methods if appropriate
Limit Level			
More than one complaint	<ol style="list-style-type: none"> 1. Investigated the causes of complaint; 2. Check Operator's working methods; 3. Carry out analysis of Operator's working procedures to determine possible mitigation to be implemented; 4. Arrange meeting with ET and EPD to discuss the remedial actions to be taken; 5. Discuss with EPD and the Operator on the required remedial actions; 6. Submit proposals for remedial actions within 3 working days of notification; 7. Assess effectiveness of Operator's remedial actions and keep EPD informed of the results; 8. Amend proposal if appropriate; 9. Resubmit proposal if problem still not under control 	<ol style="list-style-type: none"> 1. Discuss amongst ET and the Operator on the potential remedial actions; 2. Review the proposed remedial actions whenever necessary to assure their effectiveness and advise the Operator accordingly; 3. Supervise implementation of remedial measures 	<ol style="list-style-type: none"> 1. Indentify/ confirm source with ET; 2. Confirm receipt of notification of failure in writing; 3. Inform ET, IEC and EPD; 4. Discuss with EPD and ET on the required remedial actions; 5. Ensure remedial actions properly implemented; 6. Take immediate action to avoid further exceedance; 7. Implement the agreed proposals

* The operator who is the constructor responsible for the operation during the maintenance period.

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Appendix D

Photos of Grab Samplers

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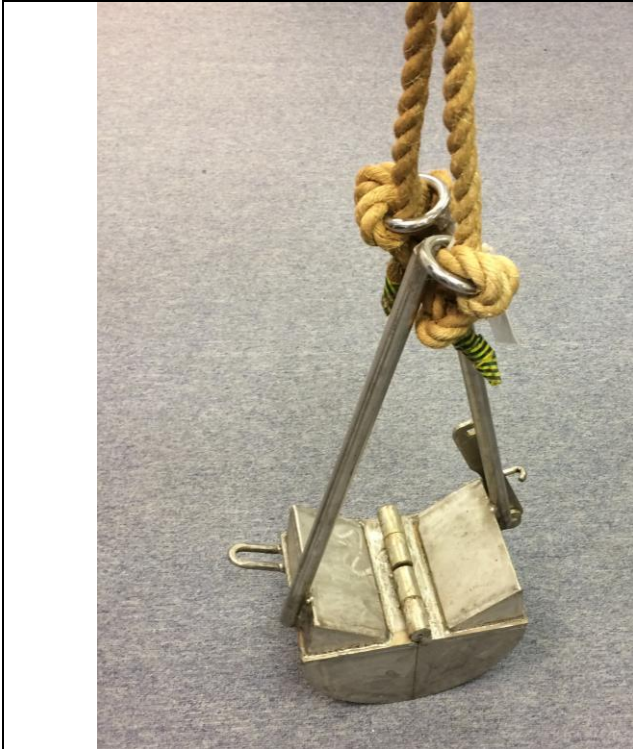


Photo 1. A ponar grab sampler



Photo 2. Grab dimension 1

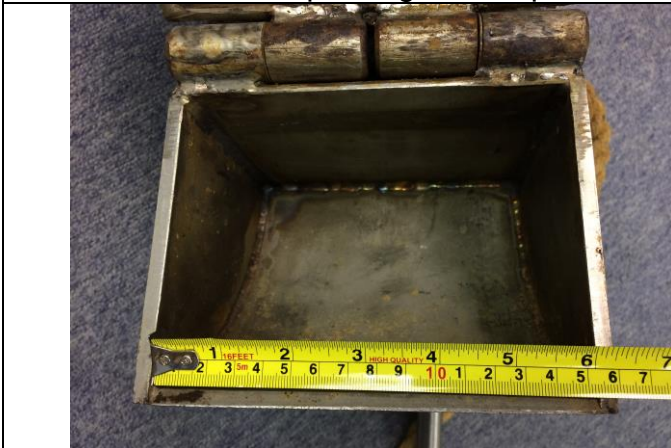


Photo 3. Grab dimension 2



Photo 4. Grab dimension 3

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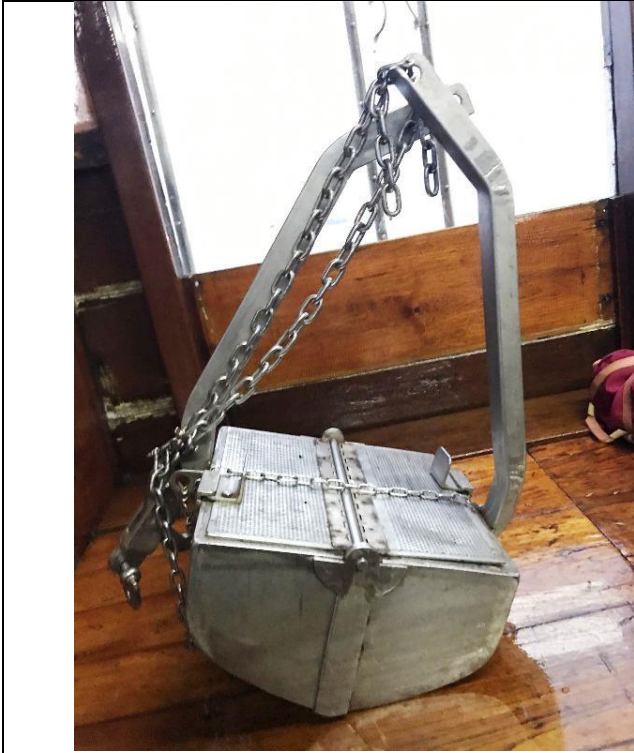


Photo 1. A modified Van Veen grab sampler



Photo 2. Grab dimension 1



Photo3. Grab dimension 2



Photo4. Grab dimension 3

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Appendix E

Environmental Complaints Log and Incident Report

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Report No.: 0041/17/ED/0506B

Environmental Complaints Log

Complaint Log No.	Date of Complaint	Received From and Received By	Nature of Complaint	Investigation
1	28 November 2019	EPD	According to EPD, a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal.	As advised by DSD, the operation of Siu Ho Wan Sewage Treatment Works was properly functioned and there was no special activity on 28 th November 2019. Due to the possibility of having unpleasant gases or odours emitted from these non-DSD premises cannot be precluded, the complaint is considered as non-project related.

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Incident Report on Complaint Case

Project	Siu Ho Wan Sewage Treatment Works (SHWSTW)
Date of Complaint Received	28 th November 2019
Nature of Complaint	malodour from SHWSTW
Description of Complaint	According to EPD, a member of public complained that SHWSTW cause a malodour and was smelled as far as the Discovery Bay tunnel portal (see Appendix A).
Investigation Result	<p>SHWSTW is a preliminary sewage treatment works and was designed to provide sewage treatment services for a population of 200,000 in Chek Lap Kok Airport, Tung Chung, Discovery Bay and Disneyland. The current inflow is about 51,000 m³ per day.</p> <p>The daily process of SHWSTW included filtration, chemical injection and mixing, sedimentation, collection and dewatering of scum and sludge and disinfection.</p> <p>Three types of mitigation measures in reducing odour nuisance from the sewage treatment works are implemented at Siu Ho Wan STW. These include -</p> <ul style="list-style-type: none"> • dosing of chemicals, like ferric chloride, into sewage / sludge to control the generation of odour; • covering up of channels, chambers and tanks which are likely to emit odour; and • installing deodourisation units like activated carbon system, chemical scrubbers and biofilters at appropriate locations to clean up the collected foul gases from odour sources in the plants. <p>The provision of odour mitigation measures together with good operational practices have been proven to be very effective in controlling odour nuisance from sewage treatment facilities.</p> <p>As advised by DSD, the operation of Siu Ho Wan Sewage Treatment Works was properly functioned and there was no special activity on 28th November 2019 (see Appendix B).</p> <p>As the possibility of having unpleasant gases or odours emitted from these non-DSD premises cannot be precluded, the complaint is considered as non-project related.</p>
Actions taken/to be taken	<p>SHWSTW is reminded to fully comply with EP conditions. All measures and recommendations in the EP, EIA Report and approved Waste Management Plan (WMP) shall be fully and properly implemented (see Appendix C).</p> <p>As advised by EPD, odour patrol is recommended to conduct for air quality monitoring. It is suggested to conduct the odour patrol monitoring once per week at ASR to monitor the performance of the odour control measures.</p>
Remarks	Figure 1 – Location Plan
Attachment	<p>Appendix A – Notification of Complaint Case</p> <p>Appendix B – Email from DSD for site condition</p> <p>Appendix C – Environmental Mitigation Implementation Schedule on Air Quality</p>

Prepared by:	Name & Designation Andy Choi (Environmental Team)	Signature 	Date 18 th December 2019
Checked by:	Colin Yung (Environmental Team Leader)		18 th December 2019

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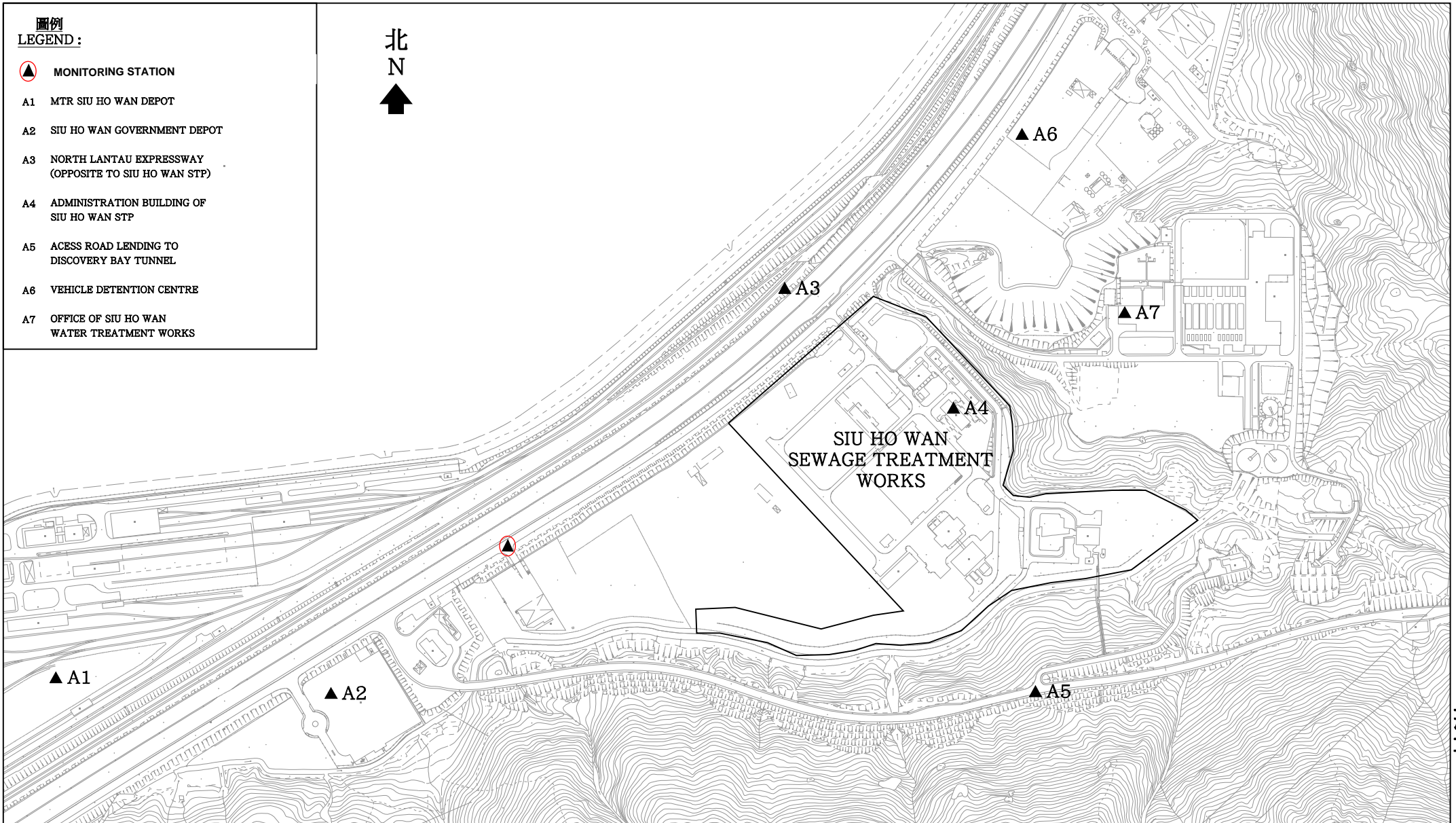
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Figure 1

圖例
LEGEND :

	MONITORING STATION
A1	MTR SIU HO WAN DEPOT
A2	SIU HO WAN GOVERNMENT DEPOT
A3	NORTH LANTAU EXPRESSWAY (OPPOSITE TO SIU HO WAN STP)
A4	ADMINISTRATION BUILDING OF SIU HO WAN STP
A5	ACCESS ROAD LENDING TO DISCOVERY BAY TUNNEL
A6	VEHICLE DETENTION CENTRE
A7	OFFICE OF SIU HO WAN WATER TREATMENT WORKS



圖則名稱 drawing title	繪畫 drawn	C.W. CHAN	日期 date	16-08-2006	圖則編號 drawing no.	DCM/2006/063	比例 scale	N.T.S.
	核對 checked	C.K. LAM	日期 date	16-08-2006	保留版權 COPYRIGHT RESERVED			
UPGRADING OF SIU HO WAN SEWAGE TREATMENT PLANT OPTIONAL ENVIRONMENTAL MONITORING AND AUDIT PLAN ODOUR PATROL MONITORING STATIONS	批核 approved	S.K. WONG	日期 date	16-08-2006	香港特別行政區政府渠務署 DRAINAGE SERVICES DEPARTMENT GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION			
	部門 office	顧問工程管理部 CONSULTANTS MANAGEMENT DIVISION						

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Appendix A

From: tiffanyytchan@epd.gov.hk <tiffanyytchan@epd.gov.hk>
Sent: Friday, December 6, 2019 1:45:33 PM
To: Yung, Colin <c.yung@fugro.com>
Cc: marcuslau@dsd.gov.hk <marcuslau@dsd.gov.hk>; holywsto@epd.gov.hk <holywsto@epd.gov.hk>; "S[RS]5"@epd.gov.hk <"S[RS]5"@epd.gov.hk>
Subject: Complaint of malodour from Siu Ho Wan Sewage Treatment Works

Dear Mr. Yung,

We received a complaint from a member of public on 28.11.2019 regarding malodour from SHWSTW (details refer to the remark below). Please follow-up according to EM&A manual and submit an interim report **on or before 13.12.2019.**

Understand that air quality monitoring was temporarily suspended since May 2018. In view of the current situation, we strongly recommend you to initiate at least part of the monitoring programme first (i.e. odour patrol) and propose alternative air quality measurement methods to our Regional Assessment Group for approval asap. Thanks.

Complaint detail:

投訴小蠔灣污水處理廠發出很濃烈臭味, 遠至愉景灣隧道口到聞到, 情況十分嚴重, 要求跟進及回覆

Best Regards,
Tiffany CHAN
RSG/EPD

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Appendix B

RE: 回覆: 回覆: Complaint of malodour from Siu Ho Wan Sewage Treatment Works

pycheng02@dsd.gov.hk

週二 2019/12/17 下午 09:00

收件者:

Choi, Kam Ho <a.choi@fugro.com>; Cindy Kwok <cindykwok@aechk.com>

副本:

Lai, Chun Yip <c.lai@fugro.com>; Leung, Min Pong Calvin <c.leung@fugro.com>; Yung, Colin <c.yung@fugro.com>; Grace Kwok <gk@aechk.com>; Joanne Ng <jn@aechk.com>; Tsoi, Yeung Kin Joanne <joanne.tsoi@aecom.com>; marcuslau@dsd.gov.hk <marcuslau@dsd.gov.hk>; Chung, Pak Hin <ph.chung@fugro.com>; Rodney Ip <ri@aechk.com>

Dear Andy and Cindy

Kindly find below supplementary information provided from our plant operator of SHWSTW for your reference.

Sewage treatment process

Siu Ho Wan Sewage Treatment Works (Siu Ho Wan STW) is a preliminary sewage treatment works commissioned in 1998. The plant was subsequently upgraded to a chemically enhanced primary treatment works in December 2004. It was designed to provide sewage treatment services for a population of 200,000 in Chek Lap Kok Airport, Tung Chung, Discovery Bay and Disneyland. The design flow of the STW is 180,000 m³ per day and its current inflow is about 51,000 m³ per day.

The large solids (over 6mm), grit and sand are removed from the sewage by fine screens and grit chambers before the sedimentation process.

Chemicals (ferric chloride and polymer) are injected at the inlet to the works and mixed with the sewage inflow in the mixing chambers. The sewage is then distributed into sedimentation tanks. The flocs settle in the sedimentation tanks as sludge and are removed using chain and flight sludge collectors to sludge hoppers. The lighter scum rise to the surface and are skimmed off by scum collectors. The sludge, together with the scum, are pumped to a separate facility for dewatering. The treatment process removes 75% of the suspended solids and 60% Biochemical Oxygen Demand. Before discharge, effluent will pass through a Ultra-Violet disinfection facility to further improve the quality.

Centrifuges are used to dewater the sludge to achieve a minimum dryness of 30%. The dewatered sludge will then be transported using sealed containers

to Sludge Treatment Facility in Tuen Mun. To act proactively in an environmental manner and to provide a better service to nearby residents, an odour management system with deodourizing facilities has been put into operation.

Measures to control odour

Three types of mitigation measures in reducing odour nuisance from the sewage treatment works are implemented at Siu Ho Wan STW. These include -

- dosing of chemicals, like ferric chloride, into sewage / sludge to control the generation of odour;
- covering up of channels, chambers and tanks which are likely to emit odour; and
- installing deodourisation units like activated carbon system, chemical scrubbers and biofilters at appropriate locations to clean up the collected foul gases from odour sources in the plants.

To ensure that all odour control systems are in proper working condition, their performance is closely monitoring and proper maintained, like timely replacement of odour absorption media such as activated carbon in the deodourisers is ensured. The provision of odour mitigation measures together with good operational practices have been proven to be very effective in controlling odour nuisance from sewage treatment facilities.

Sewage treatment works occasionally experience shock odour load arising from the fluctuating composition of incoming sewage. This may result in short term strong odour emission. The source of such shock load is very difficult to trace. If the sources can be identified, appropriate actions to avoid reoccurrence will be taken.

Odour monitoring

DSD adopts hydrogen sulphide measurement for odour monitoring at Siu Ho Wan STW. Hydrogen sulphide levels is regularly measured to monitor the performance of the odour control measures. Operational adjustment, like adding more chemical or increasing the air changing rate of the deodourisers, would be done to tackle any variations in operating environment. In case there are or will be major variations which could not be handled by operational adjustments alone, upgrading works will be considered.

Operation and maintenance

The plant operation and maintenance activities were normal on 28 November 2019 and no irregularities were noted.

Remarks

There are a number of premises such as bus depots, water treatment works, food waste treatment works, refuse transfer station, engineering workshops, MTR depot etc. under the jurisdiction of other organisations or government departments in Siu Ho Wan. These premises are adjacent to Siu Ho Wan STW. The possibility of having unpleasant gases or odours emitted from these non-DSD premises can not be precluded.

Should you need any further information, please let me know.

Regards

Paul Cheng
SE/CM2, DSD
tel 2594 7245

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Appendix C

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Report No.: 0041/17/ED/0506

P Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
Air Quality					
NA	4.5	NA	Odour reduction measures like aeration, chemical dosing system shall be implemented to reduce any odour impacts to an acceptable level.	SHWSTW	Implemented
3.4	4.5	NA	Sewage treatment works including sludge thickening tanks, the sludge pump house and sludge press house shall be completely enclosed.	SHWSTW	Implemented
3.4	4.5	NA	Exhaust air shall be ventilated to an odour scrubber prior to discharge. Ventilating air to a biological treatment unit with 95% odour removal efficiency prior to stack exhaust shall be implemented	SHWSTW	Implemented

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Report No.: 0041/17/ED/0506B

Appendix F

Environmental Mitigation Implementation Schedule (EMIS)

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Report No.: 0041/17/ED/0506B

EP Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
Air Quality					
NA	4.5	NA	Odour reduction measures like aeration, chemical dosing system shall be implemented to reduce any odour impacts to an acceptable level.	SHWSTW	Implemented
3.4	4.5	NA	Sewage treatment works including sludge thickening tanks, the sludge pump house and sludge press house shall be completely enclosed.	SHWSTW	Implemented
3.4	4.5	NA	Exhaust air shall be ventilated to an odour scrubber prior to discharge. Ventilating air to a biological treatment unit with 95% odour removal efficiency prior to stack exhaust shall be implemented	SHWSTW	Implemented
Water Quality					
3.3	NA	4.01	To avoid impacts on the marine ecology due to effluent discharge, the disinfection facility as in Part B of the EP shall be equipped with an UV disinfection system capable of removing at least 99.9% of E.coli from the sewage	SHWSTW	Implemented
Waste Management					
3.6	NA	NA	Transportation of sludge shall be carried out in fully enclosed containers, or be placed in sludge skips with tarpaulin covers	SHWSTW	Implemented
NA	NA	5.02	Trip-ticket system mentioned shall be implemented. Trip-ticket is required for each truckload delivered to the landfills facilities according to WBTC No. 31/2004.	SHWSTW	Implemented
NA	NA	5.02	The acceptance criteria for Landfill disposal should be followed, i.e. solid content of sludge waste should be more than 30%.	SHWSTW	Implemented
NA	NA	5.02	The disposal of grit & debris (if any) generated during primary screening works should follow the requirement set in the WMP Section 4.05.	SHWSTW	Implemented
NA	NA	5.03	The wet sludge should be temporarily stored at the sludge buffer tank. It should then be transported to the centrifuge building for dewatering and discharged to the container for disposal. The whole process should be managed by the automatic electronic electronic system and monitored by the operators during operation.	SHWSTW	Implemented
NA	NA	5.04	The other solid waste material such as sediment and grit, refuse containers or collection bags should be temporarily stored in slips at designated area. Operators should ensure sufficient space is identified and provided for temporary storage of waste materials to facilitate collection. Storage of waste material on site will be kept to a minimum to avoid nuisance to local residents.	SHWSTW	Implemented
NA	NA	5.05	Chemical wastes which likely to be generated by activities arise from the maintenance, shall followed the Waste Disposal (Chemical Waste) (General) Regulation, includes Schedule 1 of the Regulation.	SHWSTW	Implemented
NA	NA	5.06	In case of unlikely occurred chemical spillage, procedures should be followed as according to the WMP Section 5.06.	SHWSTW	Implemented
NA	NA	5.07	Temporary storage areas should be identify and provided for the temporary storage of general	SHWSTW	Implemented

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Report No.: 0041/17/ED/0506B

EP Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
			refuse to facilitate collection		
NA	NA	5.07	Domestics wastes refuse generated on-site will be stored in enclosed bins or compaction units separately	SHWSTW	Implemented
NA	NA	5.07	Sufficient dustbins should be provided for domestic waste if required.	SHWSTW	Implemented
NA	NA	5.07	Domestics wastes should be cleared daily and will be disposed off to the nearest licensed landfill or refuse transfer station.	SHWSTW	Implemented
NA	NA	5.07	Separate labeled bins should be provided to segregate the waste generated by workforce. Waste recycle collector should be employed to collect the segregated waste	SHWSTW	Implemented
NA	NA	5.07	Cardboard and paper packaging (for plant, equipment and materials) should be recovered on site, properly stockpiled in dry condition and covered to prevent cross contamination by other materials.	SHWSTW	Implemented
NA	NA	5.07	Office waste should be minimized through using papers on both sides. Communication by electronic means should be used as far as possible.	SHWSTW	Implemented
NA	NA	5.07	The burning of refuse on-site is prohibited by law and shall not be undertaken	SHWSTW	Implemented
NA	NA	5.07	Toilet wastewater shall be transported to the STW for treatment	SHWSTW	Implemented
NA	NA	5.07	Arrangement for collection of recyclable materials by recycling contractors should be followed as according to the WMP Section 5.07.	SHWSTW	Implemented
NA	NA	5.08	All recycling materials removed by the recycling contractors should be properly recorded before the removal. The natures and quantities of the recycling materials, the date of removal and the name of the recycling contractor should be recorded.	SHWSTW	Implemented
NA	NA	5.09	To maintain the site in a clean and tidy condition during the operation, general measures specified in the WMP should be implemented on site at all times. Regular site inspections shall be undertaken by the management team to ensure the measures are implemented.	SHWSTW	Implemented
NA	NA	5.10	Daily cleaning should be performed daily after work within the plant and the public areas immediately next to the site.	SHWSTW	Implemented
NA	NA	5.11	The work officer in charge of the corresponding area should perform daily inspection on the items mentioned in the WMP Section 5.10. If observations were discovered, the work officer should record the result of the inspection on an inspection checklist with photos taken and submitted to the inspectors or Chief Technical Officer for review on the following day. Any deficiency should be rectified promptly.	SHWSTW	Implemented
NA	NA	5.12	Weekly tidying should be performed weekly within the site.	SHWSTW	Implemented
NA	NA	5.13	The inspector should perform Weekly Inspection on the items mentioned in the WMP Section 5.12. If observations were discovered, the work officer should record the result on an inspection checklist and submitted to the Chief Technical Officer for review on the following day. Any deficiency should be rectified promptly.	SHWSTW	Implemented

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Report No.: 0041/17/ED/0506B

EP Ref.	EIA Ref.	WMP Ref.	Environmental Protection Measures	Location of the measures	Implementation Status
NA	NA	5.14	All wastes generated through the operational phase will be managed in accordance with the protocols set out in the WMP Section 5.14.	SHWSTW	Implemented

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