AECOM

ATAL-Degremont-China Harbor Joint Venture

Contract No. DC/2013/10
Design, Build and Operate San Wai Sewage Treatment Works

Monthly Operational Phase EM&A Report for July 2021

[08/2021]

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Version:	Rev. 0	Date: 16 August 2021

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ANEWR

Drainage Services Department
Sewage Services Branch
Harbour Area Treatment Scheme
5/F, Western Magistracy
2A Po Fu Lam Road
Hong Kong

Your reference:

Our reference: HKDSD203/50/107472

Date: 16 August 2021

Attention: Mr Albert Wong

BY EMAIL & POST
(email: awong@dsd.gov.hk)

Dear Sirs

Agreement No. HATS 02/2016
Services for Independent Environmental Checker (IEC) for
Contract No. DC/2013/10 – Design, Build and Operate San Wai Sewage Treatment Works – Phase 1
Monthly Operational Phase Environmental Monitoring and Audit Report No.2 (July 2021)

We refer to emails on 9 and 12 August 2021 from AECOM Asia Co. Ltd. attaching the Monthly Operational Phase Environmental Monitoring and Audit Report No. 2 (July 2021).

We have no comments and hereby verify the Monthly Operational Phase Environmental Monitoring and Audit Report No. 2 (July 2021) in accordance with Clause 5.4 of the Environmental Permit no. EP-464/2013.

Should you have any queries, please do not hesitate to contact the undersigned or our Ms Karen Po on 2618 2831.

Yours faithfully
ANEWR CONSULTING LIMITED

James Choi
Independent Environmental Checker

CPSJ/CWKK/PKWK/lsmt

cc AECOM – Mr CY Hung (email: cy.hung@swstw-aecom.com)
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EXECUTIVE SUMMARY

In accordance with the Environmental Monitoring and Audit Manual (EM&A Manual) and the Environmental Permit (EP-464/2013) for the Contract No. DC/2013/10 - Design, Build and Operate San Wai Sewage Treatment Works – Stage 1 (the Project), air quality and water quality monitoring are required during operational phase of the Project. The purpose of operational phase monitoring is to confirm the predictions of mitigation measures advised in the EIA report.

As confirmed by the Contractor, all major construction activities of the Project has been completed in May 2021. The Operational Phase of the Project commenced in March 2021. This Monthly Operational Phase Monitoring Report summarizes monitoring events carried out during period from 1 to 31 July 2021. There were a total of four monitoring events carried out during the reporting month. The exact dates of monitoring carried out in this month are tabulated below:

Monitoring Event	Date
Odour sampling	16 & 17 July 2021
H_2S measurement	16 & 17 July 2021
Odour Patrol	16 July 2021
Marine Water Quality Monitoring	N/A
Effluent Quality Monitoring	N/A
Toxicity Testing	N/A
Landscape and Visual Auditing	29 July 2021

Air Quality Monitoring

No Action and Limit Levels exceedance of odour sampling and H_2S measurement was recorded in the reporting month.

Odour intensity were recorded from 0 to 1 during odour patrolling in the reporting month.

Water Quality Monitoring

No marine water monitoring was conducted in the reporting month.

No effluent monitoring was conducted in the reporting month.

Toxicity Test

No toxicity test was conducted in the reporting month.

Landscape and Visual Auditing

Landscape and visual auditing was conducted in the reporting month.

Environmental complaint, notification of summons and successful prosecution

No environmental complaint, notification of summons and successful prosecution was received in the reporting month.

Reporting Change

There were no reporting changes in the reporting month.

Future Key Issue

The Project has entered the Operation Phase since March 2021 and its normal operation in the reporting month. Mitigation measures as proposed in the approved Environmental Impact Assessment report will be provided and maintained at the Project.

1 INTRODUCTION

1.1 Background

1.1.1. This Monthly Operational Phase Environmental Monitoring and Audit (EM&A) Report is prepared for Contract No. DC/2013/10 - Design, Build and Operate San Wai Sewage Treatment Works – Stage 1 (the Project). The Project was awarded to ATAL-Degremont-China Harbor Joint Venture (ADCJV) by the Drainage Services Department (DSD). AECOM Asia Co. Ltd. was appointed as the Environmental Team (ET) by ADCJV to implement the operational phase EM&A program in compliance with the EP and the EM&A Manuals.

1.1.2. The project involves expansion of the preliminary treatment works at San Wai STW from 164,000 m^3/d to 200,000 m^3/d Average Dry Weather Flow, upgrading the preliminary treatment level to CEPT and adding centralized disinfection. The site layout plan is shown in **Figure1.1**.

1.1.3. According to the Section 25 of the Particular Specification (PS) and the Environmental Permit No. EP-464/2013, an EM&A programme should be implemented in accordance with the procedures and requirements in the Environmental Monitoring & Audit Manual (EM&A Manual) of the approved EIA report (Registration No. AEIAR-072/2003). The EM&A Manual and EP provide guidelines for the Operational Phase Monitoring Reports and for preparation of the Operational Phase Monitoring Reports.

1.1.4. The operational phase of the Project was commenced in March 2021.

1.1.5. As part of the project EM&A program, baseline monitoring was conducted during July 2019 to April 2020 to determine the ambient environmental conditions before the Project commence operation works.

1.1.6. This is the 2nd Monthly Operational Phase Environmental Monitoring and Audit (EM&A) Report for the Project which summaries the audit findings of the EM&A programme during the reporting month from 01 to 31 July 2021.

2 AIR QUALITY MONITORING

2.1 Monitoring Requirement

2.1.1 In accordance with Section 2.5 of the EM&A Manual, odour panel tests and H_2S measurement are required to be conducted for one year after commission of the expanded and upgraded Sai Wai STW.

2.2 Monitoring Parameters

2.2.1 15-min Hydrogen Sulphide (H_2S) concentration (in parts per million) was measured at the site boundary, nearby air sensitive receivers and the exhaust of deodourisation units. Meteorological conditions including temperature, wind speed, wind direction and relative humidity was measured at the time of the monitoring.

2.2.2 Approximately 60 litres of gas sample was collected for a period of 15-mins at the site boundary, nearby air sensitive receivers and the exhaust of deodourisation unit in order to provide sufficient volume for olfactometric analysis. Odour concentration was expressed as OU/m^3.

2.2.3 Apart from odour monitoring, regular oduor patrolling in the vicinity of the STW was also conducted in a monthly interval during the operational phase to ensure that prompt action would be taken whenever any excessive odour emissions area detected.

2.3 Monitoring Frequency

2.3.1 The monitoring frequency of each odour parameters are listed in the **Table 2.1**.

Table 2.1 Parameter and Frequency of Odour monitoring

Monitoring Parameter	Frequency
Odour Panel	Quarterly
H_2S Measurement	
Odour Patrol	Monthly

2.4 Monitoring Method

<u>H_2S Measurement</u>

2.4.1 H_2S concentration were measured by using of two H_2S analyzers, which utilizes a gold film sensor for the detection of H_2S. The H_2S analyzers were controlled by microprocessor and ensuring raid accurate analyses. The H_2S analyzers were fitted with Data logger, Interface cable and interface software, and Data download and graphics service. The calibration certificates of H_2S analysers are presented in **Appendix B**.

2.4.2 Weather condition including wind direction, wind speed, temperature and humidity was recorded during H_2S measurement. The calibration certificate of air velocity meter is presented in **Appendix B**.

<u>Oduour Sampling</u>

2.4.3 The odour concentration was measured by a force-choice dynamic olfactometer in accordance with European Standard Method (EN13725). The Dutch National Standard Method (NVN2820) was superseded by European Standard Method (EN13725). The olfactometer performance check record of olfactometry is presented in **Appendix B**.

2.4.4 Approximately 60 litres of gas sample was collected into a Nalophan sampling bag for testing.

2.4.5 The collected samples was transported to an odour laboratory as soon as possible and analyzed within 24 hours. Testing was performed by at least 5 qualified odour panellists who had been trained and who were complied with the requirement of the n-butanol screening test.

2.4.6 Weather condition including wind direction, wind speed, temperature and humidity will be recorded during the oduour sampling. The calibration certificate of air velocity meter is presented in **Appendix B**.

Odour Patrol

2.4.7 The odour patrol was a simple judgement by an observer patrolling and sniffing around the facilities to detect any odour. This observer should be free from any respiratory disease and not normally working at the facilities.

2.4.8 The observer followed a predeterminded route which should normally be going from non-odours to odours area. The observer would patrol slowly along the route and use his olfactory sense to detect any odours. The locations listed in the predeterminded route are shown **Figure 2.3**.

2.4.9 The observer bought along a logbook to record the findings. The logbook book was kept in the plant office where it could be inspected when necessary. The findings were included the followings:

- Prevailing weather condition
- Wind directions
- Location where odour spotted
- Possible source of odour
- Perceived intensity of the odour
- Duration of odour

2.5 Monitoring Locations for Impact Monitoring

2.5.1 Odour sampling and H_2S measurements were undertaken at the proposed monitoring locations, the proposed monitoring locations were determined by the ET Leader and agreed with ER and EPD as the request of the Section 2.5.1.25 and 2.5.1.26 of the EM&A Manual. The monitoring locations are presented in **Table 2.2** and shown in **Figure 2.1** and **Figure 2.2**.

Table 2.2 Proposed Monitoring Locations for Odour Sampling and H_2S Measurement

Identification of Monitoring Location	Description
ASR1a	晉榮貨櫃服務有限公司
ASR2b	永康貨櫃服務有限公司
Site Boundary, SB1[*1]	Site boundary
OD1[*2]	Downwind of the exhaust point of deodourisation units
OD2[*2]	

*1According to Sections 2.5.1.25 of the EM&A Manual, the odour sampling and H_2S measurement shall be undertaken at the site boundary downwind of the exhaust point of the deodourisation unit and the covered odour source. **Figure 2.2** shown the locations of the site boundary downwind of the exhaust point of the deodourisation unit.

*2According to Sections 2.5.1.26 of the EM&A Manual, both odour sampling and H_2S measurement shall be conducted at the exhaust point of the deodorization unit (OD1&2). Considered the situation of the COVID-19, the ET Leader proposed to conduct only the H_2S measurement at OD1&2. The proposal for this change was approved by the EPD.

2.6 Action and Limit Levels

2.6.1 The Action and Limit Levels established from the baseline monitoring are shown in the **Table 2.3** and **Appendix G**.

Table 2.3 Action and Limit Level for Oduor Monitoring

Location of Monitoring	Parameters	Action Level	Limit Level
SB1	H_2S concentration, ppm	0.0109	0.0109
ASR1		0.0100	0.0100
ASR2		0.0157	0.0157
OD1	H_2S concentration in ppb/ppm, flow rate of exhaust in m^3/s and temperature of exhaust (^oC)	AL = LL/2 = 139 µg/s of H_2S	LL = 277 µg/s of H_2S
OD2			

2.7 Event and Action Plan

2.7.1 The Event and Action Plan for the operational phase odour monitoring was annexed in **Appendix H**.

2.8 Results and Observation

Odour Sampling and H_2S Measurement

2.8.1 The odour and H_2S measurement at the proposed locations was carried out on 16 July 2021 at 10:00 to 17 July 2021 at 09:00. Measurements of odour and H_2S were conducted in parallel (within a 3-hour period) at the sources and receivers. A total of eight sets of data were obtained from samples collected over different periods of a 24-hour cycle day.

2.8.2 The odour monitoring results for site boundary/ ASR and dedourisation unit are summarized in **Table 2.4** and **Table 2.5**. Detailed odour monitoring results are presented in **Appendix C**. The

Table 2.4 Summary of Odour Monitoring Results for Site boundary / ASRs

Round	Date	Location	Averaged H_2S Concentration, ppm	Averaged Odour Concentration, OU/m^3	Action Level, ppm	Limit Level, ppm
Round 1 to 8	16 – 17 July 2021	SB1	0.0043	19.0	0.0109	0.0109
		ASR1a	0.0034	17.4	0.0100	0.0100
		ASR1b	0.0035	16.1	0.0157	0.0157

Table 2.5 Summary of Odour Monitoring Results for Exhaust of Deodourisation Unit

Round	Date	Location	Averaged H_2S Concentration, ppm	Expressed as µg/s	Action Level, µg/s	Limit Level, µg/s
Round 1 to 8	16 – 17 July 2021	OD1	0.0079	124.6	139	277
		OD2	0.0082	87.2		

2.8.3 No exceedance of Action and Limit Levels was recorded in the reporting month.

2.8.4 During the sampling period, meteorological data including humidity, wind speed and temperature was recorded, and wind direction was obtained from the Hong Kong Observatory's Lau Fu Shan Weather Station and presented in **Appendix D.**

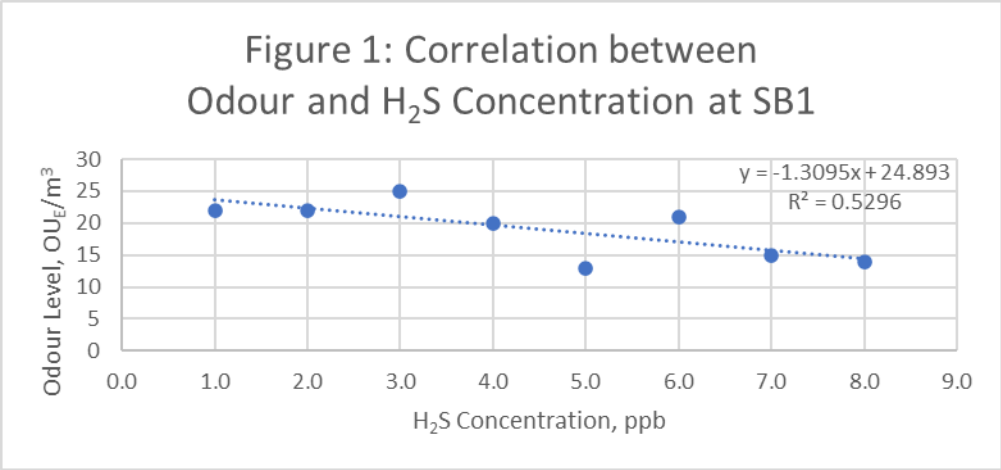
2.9 Correlation between Odour and H_2S

2.9.1 According to the Section 2.5.1.32 of the EM&A Manual, the first set of odour monitoring at monitoring locations mentioned at **Table 2.2** should consist of both odour sampling and H_2S measurement. Sampling at the mentioned locations using olfactometry and H_2S analyzers should be carried out simultaneously using the equipment and methodology described above. The purpose is to establish the correlations between odour level (OU/m^{-3}) and H_2S concentration for each measurement position.

2.9.2 Based on the results obtained from the odour and H_2S measurement, the correlation between odour and H_2S was summarized in below. Noted that all equations presented are measured in OU/m^3 and ppb for odour level and gaseous H_2S concentration respectively.

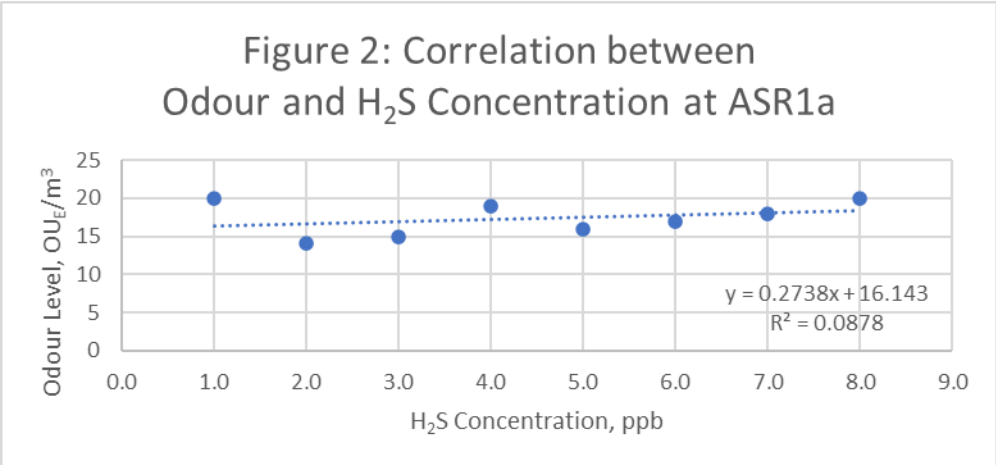
Site boundary (SB1)

2.9.3 Figure 1 show below the odour concentration plotted against H_2S level at the SB1, the plot indicates that the correlation coefficient, R^2, of 0.5296 was obtained weak. There was no direct relationship between the odour and H_2S at the SB1.

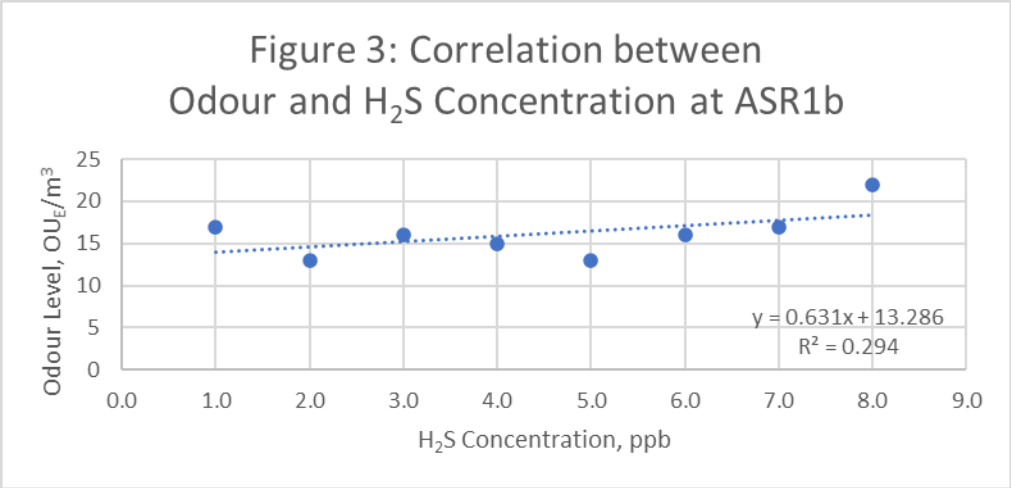


Air Sensitive receivers (ASR1a & ASR1b)

2.9.4 Figure 2 show below the odour concentration plotted against H_2S level at the ASR1a, the plot indicates that the correlation coefficient, R^2, of 0.0878 was obtained weak. There was no direct relationship between the odour and H_2S at the ASR1a.



2.9.5 Figure 3 show below the odour concentration plotted against H_2S level at the ASR1b, the plot indicates that the correlation coefficient, R^2, of 0.294 was obtained weak. There was no direct relationship between the odour and H_2S at the ASR1b.



2.9.6 At the above analysis, the measurement results indicated that there was no direct relation between odour and H_2S at all proposed locations. H_2S levels were generally low at the SB1 and ASRs and it was confirmed that H_2S was not the major contributor to odour, since the H_2S level did not change with the odour level. It was suspected that other sources of odour and H_2S, such as the container yard and vehicle emission etc, also affected the SB1 and ASRs.

Odour Patrol

2.9.7 The odour patrol was carried out on 16 July 2021 during at 11:00 and 17:00. The observer was patrolling and sniffing around the facilities to detect the any odour, as required by the EM&A Manual.

2.9.8 The weather condition, wind speed and results for odour patrol at each monitoring location are provided in **Appendix E.**

2.9.9 During the odour patrol, the odour intensity were recorded from 0(not detectable) to 1(slight). The source and duration of odour recorded during odour patrol can be referred to **Appendix E**.

3 WATER QUALITY MONITORING

Marine Water Quality Monitoring

3.1 Monitoring Requirements

3.1.1 In accordance with Section 4.5.1.12 of the EM&A Manual, operational phase marine water quality monitoring is suggested three months after the commissioning of the expanded and upgraded San Wai STW.

3.1.2 Marine water samples and in situ measurement should be collected from all the sampling stations on 8 occasions at intervals of approximates 3 months during the operational phase of the Project. On each occasion, marine water samples should be collected every 2 hours for a 12-hour duration. When significant change in the marine water quality are detected, the monitoring frequency should be increase as necessary until the cause for the change is identified.

3.2 Monitoring Equipment

3.2.1 Equipment used in the marine water quality monitoring programme is summarized in **Table 3.1**.

Table 3.1 Marine Water Quality Monitoring Equipment

Monitoring Equipment	Equipment Model
Multifunctional Meter (measurement of Dissolved Oxygen, pH, temperature, salinity and turbidity)	YSI 6820 V2
Water Depth	Lowrance x-4
Positioning Equipment	Garmin GPS72H

3.3 Monitoring Parameter, Frequency and Duration

3.3.1 **Table 3.2** summarises the monitoring parameters, frequency and duration of marine water quality monitoring, as request in Section 4.5.1.13 of the EM&A manual.

Table 3.2 Marine Water Quality Monitoring Parameters, Frequency and Duration

Monitoring Stations	Parameters, unit	Frequency	Duration
W1 to W8	**In-situ Measurement:** • Temperature, °C • Salinity, ppt • DO, mg/L • DO Saturation, % • Turbidity, NTU **Laboratory Analysis:** • SS, mg/L • TIN, mg/L • Unionised ammonia, mg/L • BOD_5,mg/L • *E. coli* , cfu/100mL • Cadmium, Copper, Nickel, Lead, Chromium, Mercury and Zinc, µg/L • PCBs, µg/L • PAHs, µg/L	8 occasions at intervals of approximately 3 months during the operation phase of the upgraded and expanded San Wai STW.	On each occasion, marine water samples will be collected every 2 hours for a 12-hour duration.

3.4 Monitoring Locations

3.4.1 Marine water quality monitoring was undertaken at the proposed monitoring stations set out in the Section 4.5.1.6 of EM&A Manual. The proposed marine water quality stations were presented in **Table 3.3** and shown in **Figure 3.1**.

Table 3.3 Proposed Marine Water Quality Monitoring Stations

Station	Easting	Northing
W1	808231	827494
W2	807469	828888
W3	807221	823737
W4	806309	829988
W5	809062	824638
W6	807066	825034
W7	805592	828162
W8	805412	829400

3.5 Monitoring Methodology

3.5.1 Operating/Analytical Procedures

(a) Digital Differential Global Positioning System (DGPS) was used to ensure that the correct location was selected prior to sample collection.
(b) Portable, battery-operated echo sounder was used for the determination of water depth at each designated monitoring station.
(c) All in-situ measurements were taken at 3 water depths, 1 m below water surface, mid-depth and 1 m above seabed, except where the water depth was less than 6 m, in which case the mid-depth station was omitted. Should the water depth be less than 3 m, only the mid-depth station was monitored.
(d) During the marine water quality measurement, a portable multifunctional meter will be used for measurement of pH, dissolved oxygen, water temperature, turbidity and salinity.
(e) Spare parts of equipment will be maintained for necessary replacement.
(f) Water samples were collected using the water sampler at the monitoring stations and the samples were stored in high-density polythene bottles and then packed in cool-boxes (cooled at 4oC without being frozen) for carrying out the laboratory analysis. The analysis will be commenced in a HOKLAS accredited laboratory, WELLAB LIMITED. (HOKLAS Registration No. 083) within 24 hours after collection of the samples.

3.5.2 Maintenance and Calibration

(a) Before each round of monitoring, the dissolved oxygen probe of YSI 6820 V2 was calibrated by the wet bulb method. A zero check in distilled water was performed with the turbidity probe of YSI 6820 V2 once per monitoring day.

(b) The monitoring instruments were checked, calibrated and certified by a laboratory accredited under HOKLAS before use and subsequently re-calibrated at 3-monthly intervals throughout all stages of the water quality monitoring.

3.6 Monitoring Result for Marine Water Quality Monitoring

3.6.1 No marine water quality monitoring was conducted in the reporting month, since the marine water quality monitoring shall be conducted at interval of approximately 3 months during the operational phase of the Project as required in Section 4.5.1.13 of the EM&A manual.

Effluent Quality Monitoring

3.7 Monitoring Requirement

3.7.1 In accordance with Section 4.6.1.1 of the EM&A Manual, in order to ensure the effectiveness of the proposed treatment process, effluent quality monitoring is recommended.

3.8 Monitoring Parameter

3.8.1 As recommended by the EM&A Manual, the effluent quality monitoring was included the follows parameters:

- pH
- BOD (mg/L)
- SS (mg/L)
- TIN (µg/L)
- NH_3-N (mg/L)
- E. coli (cfu/100mL)
- Cadmium (µg/L)
- Copper (µg/L)
- Nickel (µg/L)
- Lead (µg/L)
- Mercury (µg/L)
- Chromium (µg/L)
- PCBs (µg/L)
- PAHs (µg/L)

3.9 Monitoring Location

3.9.1 Effluent quality monitoring was carried out at the effluent outlet of the San Wai STW as shown in **Figure 3.2**.

3.10 Monitoring Result

3.10.1 No effluent monitoring was conducted in the reporting month, since the effluent monitoring shall be conducted at interval of approximately 3 months during the operational phase of the Project.

4 TOXICITY TEST

4.1 Monitoring Requirement

4.1.1 In accordance with Section 4.6.1.2 of the EM&A Manual, toxicity testing shall be carried out on 8 occasions at intervals of approximately 3 months during the operational phase of the Project for two marine species. One of the two marine species shall be selected from local environment. The representative species that will be chosen for testing and technical details of the testing method should be agreed and approved by the EPD prior to the operation of the sewage treatment works. The testing method for the EPD approval was submitted on 22 April 2021.

4.2 Monitoring methodology

4.2.1 The methodology of the toxicity testing is summarized in the **Table 4.1**.

Table 4.1 Methodology for Toxicity Testing

Types of Respective Species	Diatom (Skeletonema costatum)	Barnacle larvae (Balanus Amphitrite)
Toxicity Testing	Chronic Toxicity	Acute Toxicity
Time requirement	7 days	48 hours
Toxicity testing method	NOEC in 7-day diatom growth inhibition test	LC50 in 48-hr barnacle larvae survival test

4.3 Testing result

4.3.1 No toxicity test was conducted in the reporting month, since toxicity test shall be conducted at interval of approximately 3 months during the operational phase of the Project as required in Section 4.6.1.2 of the EM&A manual.

5 LANDSCAPE AND VISUAL AUDITING

5.1 Monitoring Requirement

5.1.1 In accordance with Section 6.4 of the EM&A Manual, a competent landscape architect should be employed by the Contractor for the implementation of landscape construction works and subsequent maintenance operations during the 12 months establishment period. The establishment works should be undertaken throughout the Contractor's first year maintenance period which will be within the first operational year of the Project.

5.1.2 All measures undertaken by the both Contractor and the Landscape Contractor during the first year of the operational phase should be audited by a Landscape Architect, as a member of the ET, on a regular basis to ensure compliance with the intended aims of the measures. Site inspections should be undertaken at least once every two months during the operational phase.

5.2 Result and Recommendations

5.2.1 Landscape and visual auditing was conducted by a Landscape Architect on 29 July 2021 during the reporting month.

5.2.2 Observations and reminders were summarized in the landscape and visual impact assessment checklists which is annexed in **Appendix F**.

6 ENVIRONMENTAL COMPLAINT, NOTIFICATION OF SUMMONS AND SUCCESSFUL PROSECUTION

6.1 Environmental Complaint, Notification of Summons and Successful Prosecution

6.1.1 No environmental complaint, notification of summons and successful prosecution was received in the reporting month.

7 CONCLUSIONS

7.1 Conclusions

7.1.1 No Action and Limit Levels exceedance of odour sampling and H_2S measurement was recorded in the reporting month.

7.1.2 Odour intensity were recorded from 0 to 1 during odour patrolling in the reporting month.

7.1.3 No marine water monitoring was conducted in the reporting month.

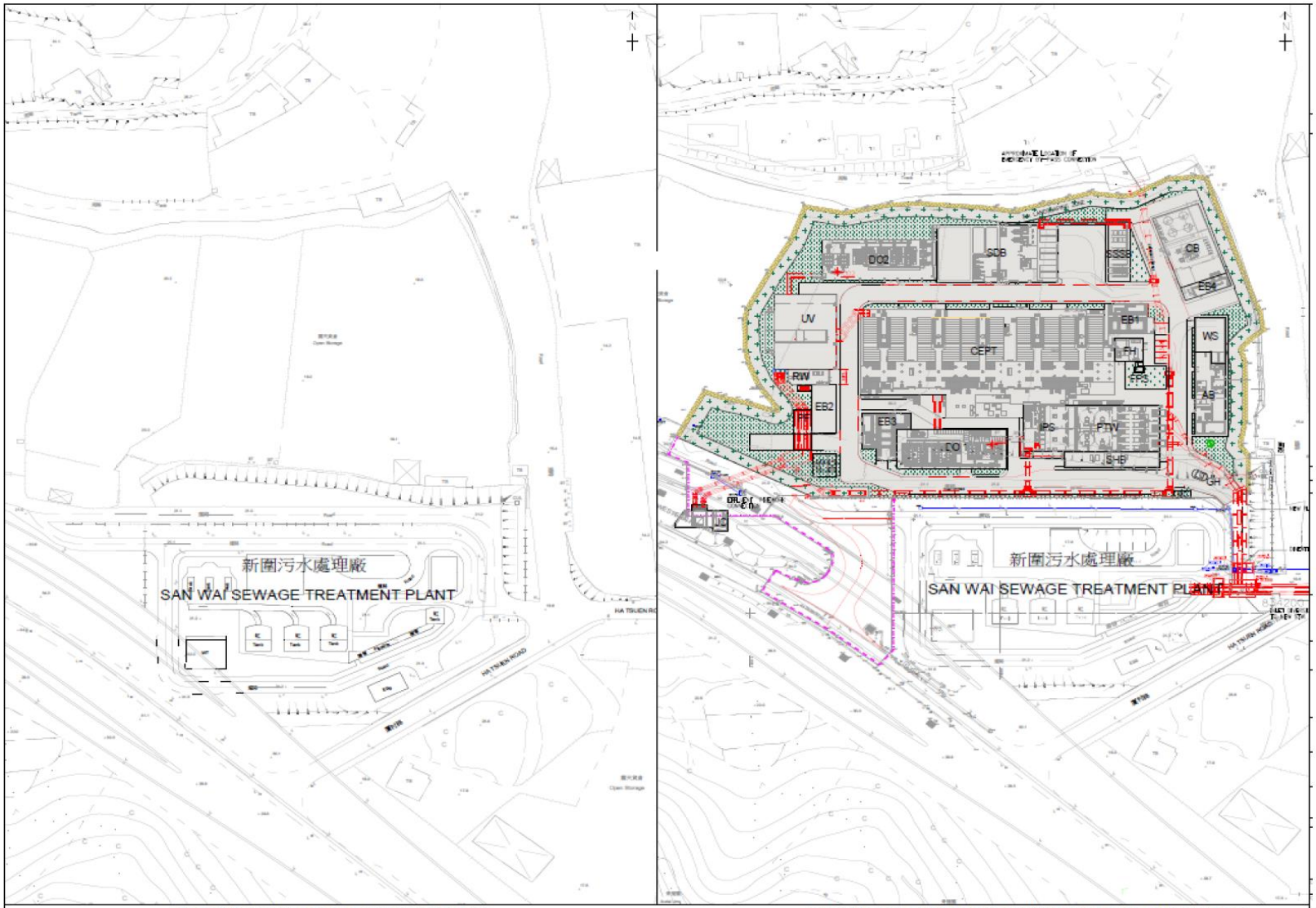
7.1.4 No effluent monitoring was conducted in the reporting month.

7.1.5 No toxicity test was conducted in the reporting month.

7.1.6 Landscape and visual auditing was conducted in the reporting month.

7.1.7 No environmental complaint, notification of summons and successful prosecution was received in the reporting month.

FIGURES



EXISTING SAN WAI SEWAGE TREATMENT WORKS

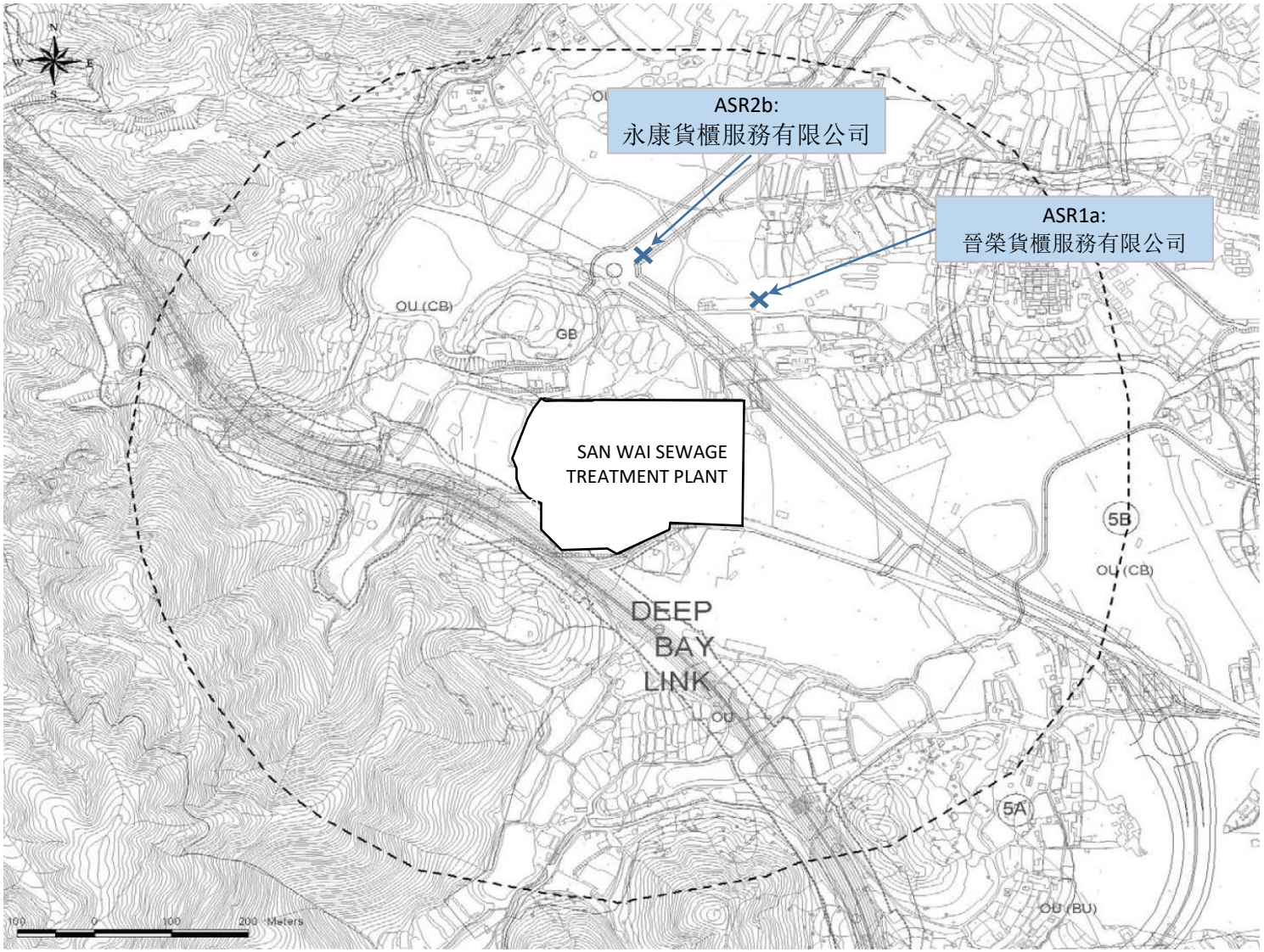
EXPANDED AND UPGRADED SAN WAI SEWAGE TREATMENT WORKS

Contract No. DC/2013/10: Design, Build and Operate
San Wai Sewage Treatment Works –
Operational Phase Monitoring

Site Layout Plan

Date: July 2021

Figure 1.1



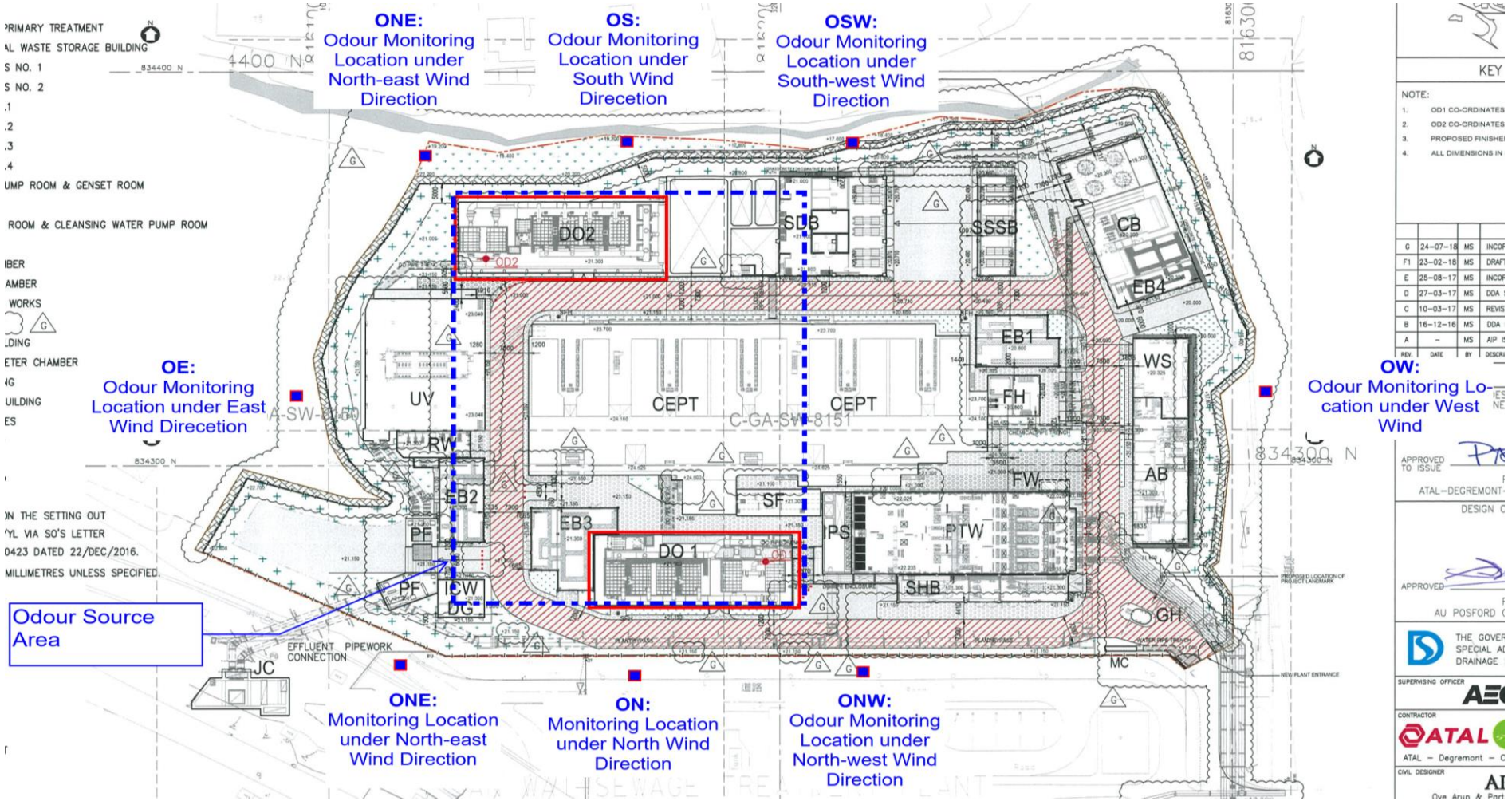
Contract No. DC/2013/10: Design, Build and Operate
San Wai Sewage Treatment Works –
Operational Phase Monitoring

Locations of Air Sensitive Receivers

AECOM

Date: July 2021

Figure 2.1

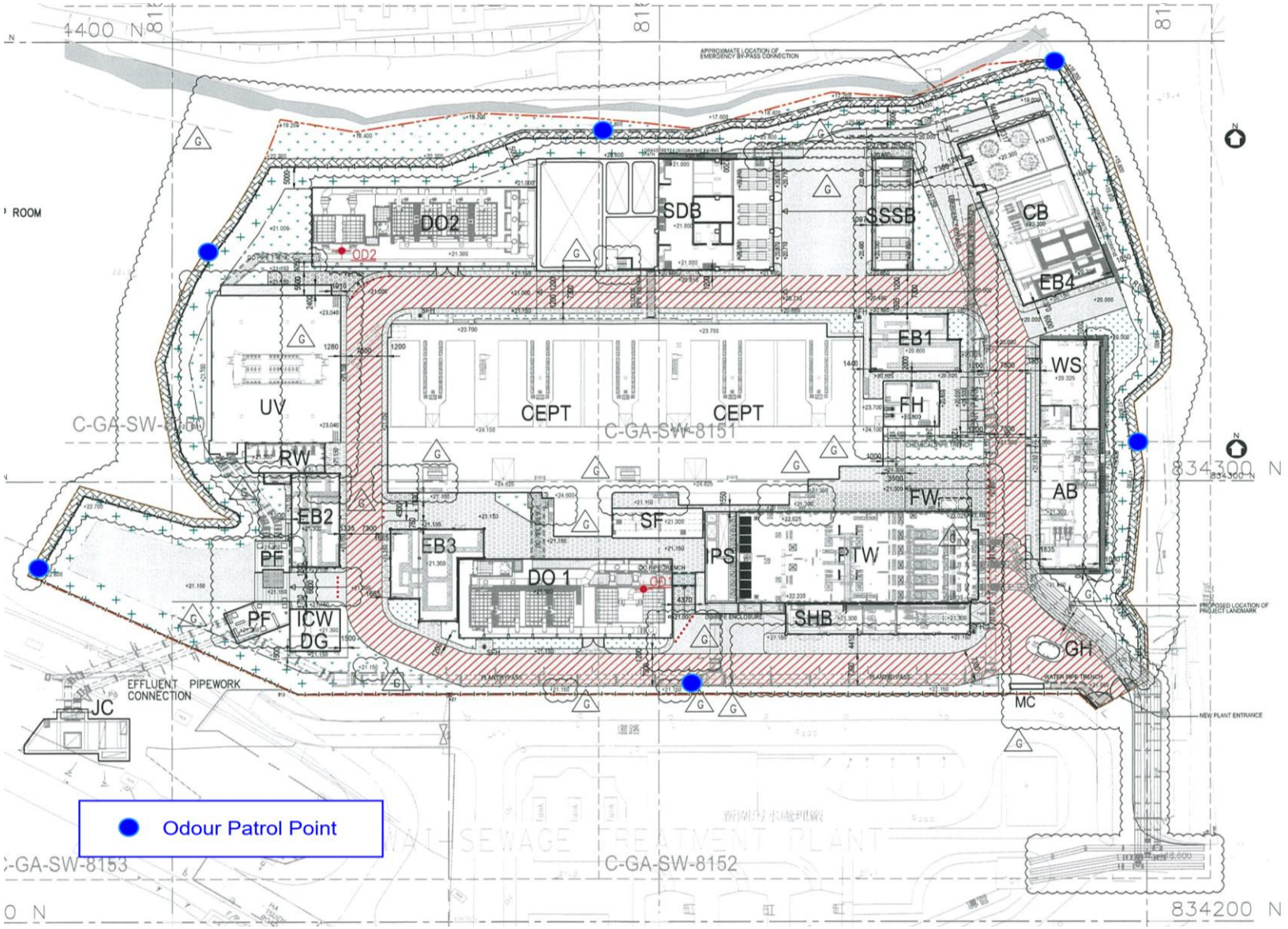


Contract No. DC/2013/10: Design, Build and Operate San Wai Sewage Treatment Works – Operational Phase Monitoring

Site Boundary Downwind Location of Exhaust Point of the Deodourisation Unit

Date: August 2021

Figure 2.2



Contract No. DC/2013/10: Design, Build and Operate
San Wai Sewage Treatment Works –
Operational Phase Monitoring

Locations of Odour Patrol Point

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Date: July 2021

Figure 2.3

Contract No. DC/2013/10: Design, Build and Operate
San Wai Sewage Treatment Works –
Operational Phase Monitoring

Locations of Marine Warer Qaulity Monitoring Stations

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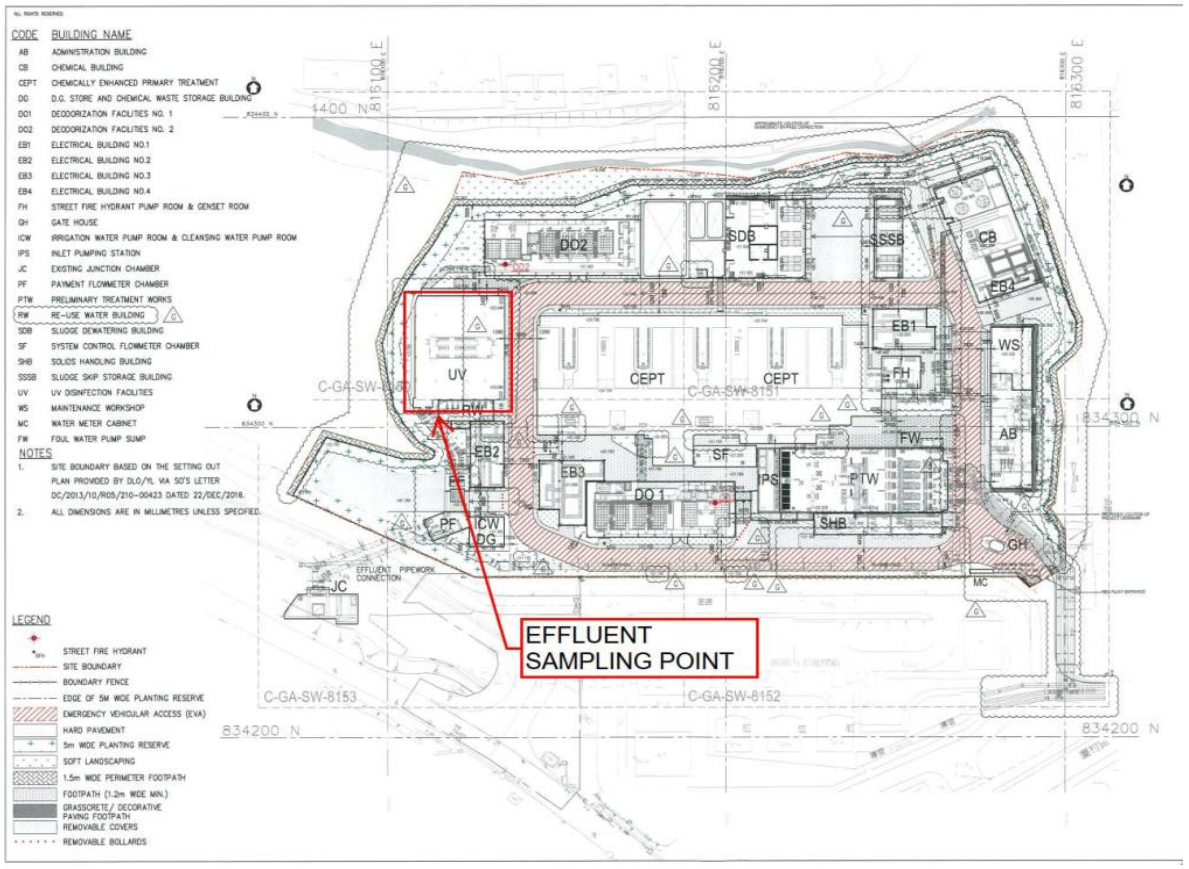
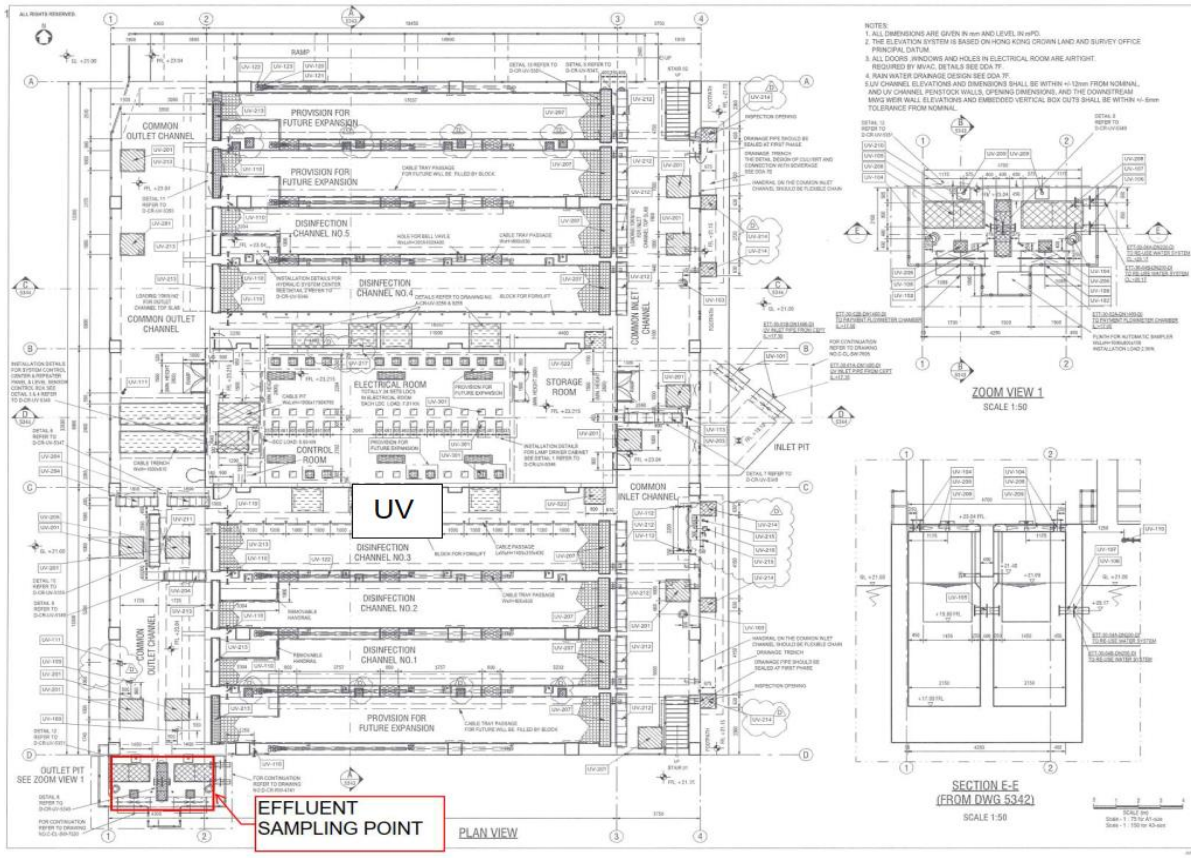
Date: July 2021

Figure 3.1





Contract No. DC/2013/10: Design, Build and Operate
San Wai Sewage Treatment Works –
Operational Phase Monitoring

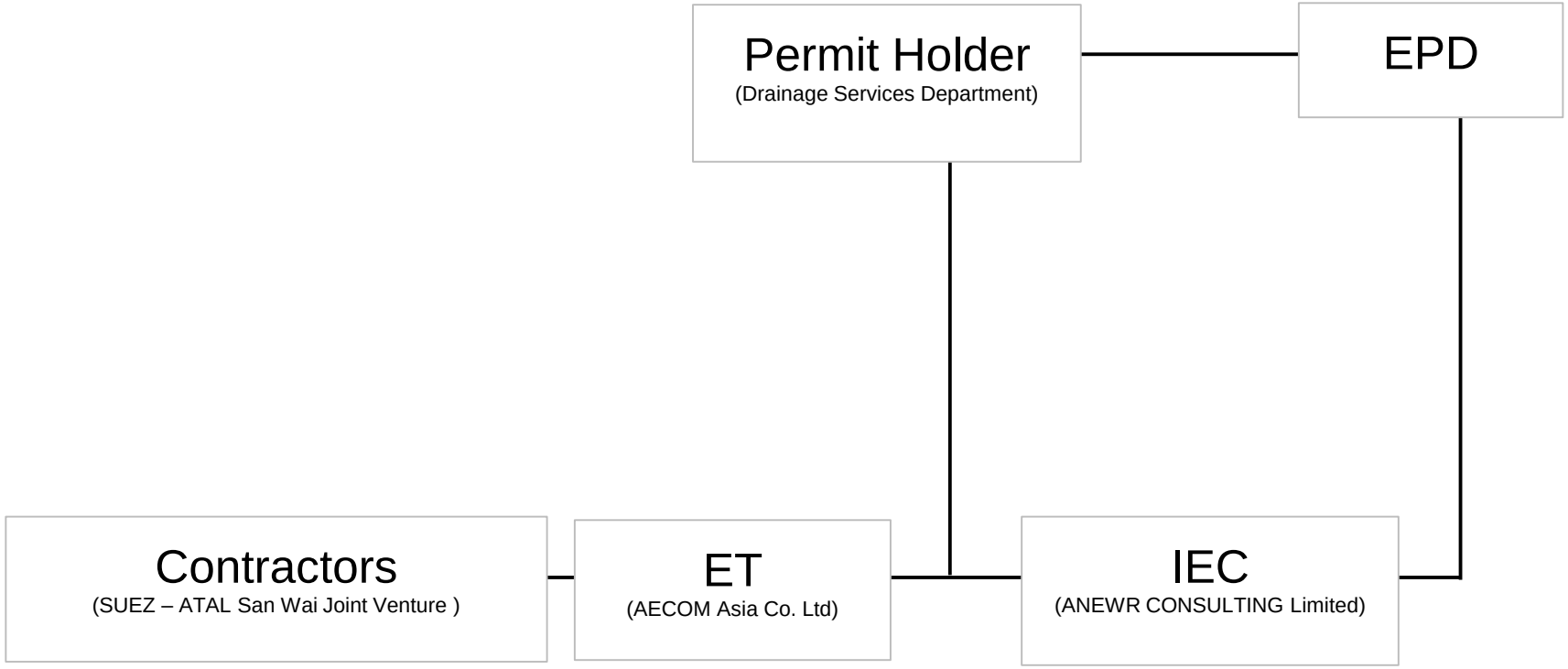
Locations of Effluent Monitoring Stations

AECOM

Date: July 2021

Figure 3.2

APPENDIX A
PROJECT ORGANIZATION STRUCTURE



Project Organization Structure

Contract No. DC/2013/10
Design, Build and Operate San Wai Sewage Treatment Works

Date: July 2021

Appendix A

APPENDIX B
CALIBRATION CERTIFICATES OF MONITORING EQUIPMENT

CALIBRATION

ACCREDITED
Certifiate #3815.01

Calibration Certificate

Certificate No.: CC0082010

1. Description

Calibration item :	a) Hydrogen Sulfide (H_2S)
Equipment description :	Gold Film Hydrogen Sulfide Analyzer
Manufacturer :	ARIZONA INSTRUMENT LLC
Type / Model No. :	Jerome® 631X
Serial No. :	1914
Assigned equipment no. :	N/A
Adjustment :	N/A
Remark :	Received with good condition

2. Customer information

Customer :	AECOM Asia Company Limited
Address :	8/F, Tower 2, Grand Central Plaza, 138 Shatin Rural Committee Road, Shatin, N.T. HK
Date of receipt :	7 October 2020

3. Date of performance of the calibration

Date of calibration :	14 October 2020

Approved Signatory
WM Ling

Company Chop:

Cal Lab Limited 校正實驗室有限公司

Certificate issue date: 16 October 2020

1. The certificate shall not be reproduced except in full, without written approval of CAL LAB LTD
2. The certificate is issued subject to the latest Terms and Conditions, available at our web site

Cal Lab Limited
Address: Room 2103, Technology Plaza, 29-35 Sha Tsui Road, Tsuen Wan, NT, Hong Kong
Tel : (852)25680106 Fax(852)30116194 Email: info@callab.com.hk Website:callab.com.hk

CALIBRATION

4. Result of Calibration

a) Hydrogen Sulfide (H_2S)

Reference Setting ; ppm	Measured reading ; ppm	Error of indication ; % FS
0.0	0.000	0.0
0.5	0.57	0.7
1.0	1.20	2.0
5.0	6.0	3.0
10.0	14	8.0

Estimated expanded uncertainty: 12 %

Technical Requirement: ± 5 ppm

Hydrogen Sulfide (H_2S) - Repeatability

Reference reading ; ppm	RSD ; %
10.0	1.0

Technical Requirement: ± 2 %

Hydrogen Sulfide (H_2S) – Response Time

Reference reading ; ppm	Response time ; second
10.0	13

Technical Requirement:

≤ 30 seconds (Pump)

Note: The technical requirement is refer to JJG 695-2003

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Tel : (852)25680106 Fax(852)30116194 Email: info@callab.com.hk Website:callab.com.hk

CALIBRATION

5. Reference method for calibration

Hydrogen Sulfide	JJG 695-2003

6. Environment condition of calibration

Temperature ; °C	24.5 °C
Relative humidity ; %RH	57 %RH

7. Reference equipment used in the calibration

Item	Model	Serial No.	Expiry date	Traceable to
Hydrogen sulfide	PGM-6208	M01C022401	12 Oct 2021	BJIM

Note1: The estimated expanded uncertainties have been calculated in "Evaluation and expression of uncertainty in measurement" and give an internal estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Note2: The standard (s) and instrument used in the calibration are traceable to national or international recognized standard and are calibrated on a schedule to maintain the accuracy and good condition.

Note3: The result reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long term stability of the instrument.

Note4: The result shows in this calibration certificate relate only to the item calibrated, and the result only applies to the calibration item as received.

Calibrated by: Date: 14 October 2020

Checked by: Date: 14 October 2020

*** End of Certificate ***

CT-END-02

Cal Lab Limited
Address: Room 2103, Technology Plaza, 29-35 Sha Tsui Road, Tsuen Wan, NT, Hong Kong
Tel : (852)25680106 Fax(852)30116194 Email: info@callab.com.hk Website:callab.com.hk

CALIBRATION

ACCREDITED
Certifiate #3815.01

Calibration Certificate

Certificate No.: CC0072010

1. Description

Calibration item :	a) Hydrogen Sulfide (H_2S)
Equipment description :	Gold Film Hydrogen Sulfide Analyzer
Manufacturer :	ARIZONA INSTRUMENT LLC
Type / Model No. :	Jerome® 631X
Serial No. :	1911
Assigned equipment no. :	N/A
Adjustment :	N/A
Remark :	Received with good condition

2. Customer information

Customer :	AECOM Asia Company Limited
Address :	8/F, Tower 2, Grand Central Plaza, 138 Shatin Rural Committee Road, Shatin, N.T. HK
Date of receipt :	7 October 2020

3. Date of performance of the calibration

Date of calibration :	14 October 2020

Approved Signatory
WM Ling

Company Chop:

Certificate issue date: 16 October 2020

Cal Lab Limited
Address: Room 2103, Technology Plaza, 29-35 Sha Tsui Road, Tsuen Wan, NT, Hong Kong
Tel : (852)25680106 Fax(852)30116194 Email: info@callab.com.hk Website:callab.com.hk

CALIBRATION

4. Result of Calibration

a) Hydrogen Sulfide (H_2S)

Reference Setting ; ppm	Measured reading ; ppm	Error of indication ; % FS
0.0	0.000	0.0
0.5	0.49	-0.1
1.0	0.98	-0.1
5.0	4.8	-0.4
10.0	9.8	-0.4

Estimated expanded uncertainty: 12 %

Technical Requirement: ± 5 ppm

Hydrogen Sulfide (H_2S) - Repeatability

Reference reading ; ppm	RSD ; %
10.0	0.6

Technical Requirement: ± 2 %

Hydrogen Sulfide (H_2S) – Response Time

Reference reading ; ppm	Response time ; second
10.0	13

Technical Requirement:

≤ 30 seconds (Pump)

Note: The technical requirement is refer to JJG 695-2003

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Address: Room 2103, Technology Plaza, 29-35 Sha Tsui Road, Tsuen Wan, NT, Hong Kong
Tel : (852)25680106 Fax(852)30116194 Email: info@callab.com.hk Website:callab.com.hk

CALIBRATION

5. Reference method for calibration

Hydrogen Sulfide	JJG 695-2003

6. Environment condition of calibration

Temperature ; °C	24.5 °C
Relative humidity ; %RH	57 %RH

7. Reference equipment used in the calibration

Item	Model	Serial No.	Expiry date	Traceable to
Hydrogen sulfide	PGM-6208	M01C022401	12 Oct 2021	BJIM

Note1: The estimated expanded uncertainties have been calculated in "Evaluation and expression of uncertainty in measurement" and give an internal estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Note2: The standard (s) and instrument used in the calibration are traceable to national or international recognized standard and are calibrated on a schedule to maintain the accuracy and good condition.

Note3: The result reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long term stability of the instrument.

Note4: The result shows in this calibration certificate relate only to the item calibrated, and the result only applies to the calibration item as received.

Calibrated by: Date: 14 October 2020

Checked by: Date: 14 October 2020

*** End of Certificate ***

CT-END-02

Cal Lab Limited
Address: Room 2103, Technology Plaza, 29-35 Sha Tsui Road, Tsuen Wan, NT, Hong Kong
Tel : (852)25680106 Fax(852)30116194 Email: info@callab.com.hk Website:callab.com.hk

Olfactometer Performance Check Record

(ALS ID : HK1231)

Calibration Period	18-May-2021 to 15-July-2021
Next Calbiration Date	18-May-2022

Prepared By	Edwin Wong	Checked By	Allen Poon
Date	20-July-2021	Date	22-July-2021

Summary of the Performance Check

Equipment:	SCENTROID SS600	Equipment ID:	HK1231
CO Analyzer:	Horiba PG-350	Equipment ID:	HK1506

Standard Gas	Standard Gas ID	Expiry Date
1% CO	062920JG-5	01-Jul-24
99.9% CO	SGC11005	10-Feb-22

Part A **Instability and Accuracy**

Setting Dilution	Real Dilution	Average of Instabiltiy (%)	Acceptance Criteria (≤5%)	Accuracy of the Dilution Setting	Acceptance Criteria (≤0.20)
4	4.45	0.3	PASS	0.105	PASS
8	9.01	0.5	PASS	0.117	PASS
16	17.28	0.3	PASS	0.077	PASS
32	33.70	0.3	PASS	0.052	PASS
64	56.14	0.2	PASS	0.142	PASS
128	123.39	0.3	PASS	0.059	PASS
256	253.62	3.2	PASS	0.030	PASS
512	456.22	0.2	PASS	0.127	PASS
1024	921.79	0.9	PASS	0.123	PASS
2048	1809.0	0.6	PASS	0.155	PASS
4096	3639.0	1.4	PASS	0.149	PASS
8192	9395.8	1.6	PASS	0.153	PASS
16384	20059	1.7	PASS	0.188	PASS
32768	35002	2.4	PASS	0.118	PASS
65536	61026	3.8	PASS	0.139	PASS

Part B **Air Flow of Port**

Station	FlowRate ≥20 L/min	Air Velocity ≥0.2 m/s	Deviation between Cups ≤ 10 %	Comment
1	YES	YES	YES	PASS
2	YES	YES	YES	PASS
3	YES	YES	YES	PASS
4	YES	YES	YES	PASS
5	YES	YES	YES	PASS
6	YES	YES	YES	PASS

Part C **Uniform Distribution of Port Opening**

Location	Deviation (%)	Acceptance Criteria (≤10%)
1	0.0	PASS
2	0.0	PASS
3	-0.2	PASS
4	0.2	PASS
5	0.0	PASS

Comment: **The olfactometer pass the performance check.**

AIRFLOW INSTRUMENTS — CERTIFICATE OF CALIBRATION AND TESTING

TSI Instruments Ltd, Stirling Road, Cressex Business Park
High Wycombe Bucks HP12 3ST England
Tel: (Int +44) (UK 0) 1494 459200 Fax: (Int +44) (UK 0) 1494 459700
http://www.airflowinstruments.co.uk

Environment Conditions		
Temperature	20.5	°C
Relative Humidity	51.91	%RH
Barometric Pressure	997.6	hPa

Model	TA410
Serial Number	TA4102035007

☒ As Left ☐ As Found

☒ In Tolerance ☐ Out of Tolerance

– Calibration Verification Results –

Temperature Verification — System T-200 — *Unit: °C*

#	Standard	Measured	Allowable Range	#	Standard	Measured	Allowable Range
1	0.0	0.1	−0.3~0.3	2	60.0	60.0	59.7~60.3

Velocity Verification — System V-352 — *Unit: m/s*

#	Standard	Measured	Allowable Range	#	Standard	Measured	Allowable Range
1	0.00	0.00	−0.03~0.03	7	3.57	3.58	3.39~3.74
2	0.15	0.15	0.13~0.18	8	6.12	6.13	5.81~6.42
3	0.31	0.31	0.28~0.33	9	9.64	9.56	9.15~10.12
4	0.51	0.51	0.48~0.53	10	13.57	13.66	12.89~14.25
5	1.02	1.00	0.97~1.07	11	19.20	19.32	18.24~20.16
6	2.05	2.05	1.95~2.16				

TSI does hereby certify that the above described instrument conforms to the original manufacturer's specification (not applicable to As Found data) and has been calibrated using standards whose accuracies are traceable to members of the European co-operation for Accreditation (EA) (for example: UKAS, SWEDAC, DAkkS) or has been verified with respect to instrumentation whose accuracy is traceable to some member of EA, or is derived from accepted values of physical constants. TSI's calibration system is registered to ISO-9001:2015.

Measurement Variable	System ID	Last Cal.	Cal. Due	Measurement Variable	System ID	Last Cal.	Cal. Due
Temperature	E006020	26-02-20	26-02-21	Temperature	E006019	26-02-20	26-02-21
Pressure	E006001	28-02-20	28-02-21	Pressure	E006038	28-02-20	28-02-21
DC Voltage	E006010	28-02-20	28-02-21	Temp	E006183	26-02-20	26-02-21
Pressure	E006059	28-02-20	28-02-21	Velocity	E006017	06-03-20	06-03-23

P. McBAIN
Calibrated

18 SEP 2020
Date

APPENDIX C
MONITORING RESULT FOR
H_2S MEASUREMENT AND OROUR SAMPLING

Appendix B - Odour Monitoring Results for Site boundary and ASRs

Round	Location	Date	Time Period	Measurement Time	Temperature, °C	Wind Speed, m/s	Wind Direction	Relative Humidity, %	H_2S Concentration								Odour Concentration, OU_E/m^3	Averaged Odour Concentration, OU_E/m^3
									Measruement, ppm							in ppb		
									1st	2nd	3rd	4th	5th	Average	Overall Average			
1	SB1	16-Jul-21	09:00 to 12:00	10:55	36.0	1.81	W	58.1	0.004	0.004	0.004	0.003	0.004	0.004	0.0043	3.8	22	19.0
2		16-Jul-21	12:00 to 15:00	13:45	33.8	0.52	N	59.8	0.004	0.004	0.004	0.004	0.004	0.004		4.0	22	
3		16-Jul-21	15:00 to 18:00	16:40	30.9	0.17	SE	70.1	0.006	0.006	0.005	0.006	0.005	0.006		5.6	25	
4		16-Jul-21	18:00 to 21:00	19:45	30.5	0.31	E	71.3	0.005	0.005	0.005	0.005	0.006	0.005		5.2	20	
5		16-Jul-21	21:00 to 00:00	22:40	29.7	0.24	E	70.2	0.004	0.005	0.004	0.004	0.004	0.004		4.2	13	
6		17-Jul-21	00:00 to 03:00	01:40	28.6	0.33	N	74.7	0.004	0.004	0.004	0.004	0.003	0.004		3.8	21	
7		17-Jul-21	03:00 to 06:00	04:40	29.6	0.19	SE	72.9	0.003	0.004	0.004	0.004	0.005	0.004		4.0	15	
8		17-Jul-21	06:00 to 09:00	07:40	30.3	0.27	SE	72.7	0.004	0.004	0.003	0.003	0.004	0.004		3.6	14	
1	ASR1a	16-Jul-21	09:00 to 12:00	10:35	34.6	0.22	SE	60.5	0.003	0.003	0.004	0.003	0.003	0.003	0.0034	3.2	20	17.4
2		16-Jul-21	12:00 to 15:00	13:25	33.3	0.69	N	58.8	0.004	0.004	0.003	0.003	0.004	0.004		3.6	14	
3		16-Jul-21	15:00 to 18:00	16:20	30.3	0.31	SE	70.3	0.004	0.003	0.004	0.004	0.004	0.004		3.8	15	
4		16-Jul-21	18:00 to 21:00	19:25	30.8	0.88	E	71.6	0.003	0.003	0.003	0.003	0.003	0.003		3.0	19	
5		16-Jul-21	21:00 to 00:00	22:20	30.6	0.66	E	68.1	0.003	0.004	0.003	0.003	0.003	0.003		3.2	16	
6		17-Jul-21	00:00 to 03:00	00:20	28.6	0.21	N	81.3	0.004	0.003	0.003	0.003	0.003	0.003		3.2	17	
7		17-Jul-21	03:00 to 06:00	04:20	29.2	0.16	SE	71.1	0.004	0.004	0.004	0.004	0.003	0.004		3.8	18	
8		17-Jul-21	06:00 to 09:00	07:20	30.4	0.14	SE	73.0	0.003	0.004	0.004	0.003	0.004	0.004		3.6	20	
1	ASR1b	16-Jul-21	09:00 to 12:00	10:10	34.6	0.33	SE	65.3	0.003	0.004	0.004	0.004	0.004	0.004	0.0035	3.8	17	16.1
2		16-Jul-21	12:00 to 15:00	10:05	31.2	0.33	N	57.3	0.004	0.003	0.004	0.004	0.004	0.004		3.8	13	
3		16-Jul-21	15:00 to 18:00	16:00	28.6	0.11	SE	63.0	0.003	0.004	0.003	0.003	0.004	0.003		3.4	16	
4		16-Jul-21	18:00 to 21:00	19:05	30.1	0.22	E	64.4	0.003	0.004	0.004	0.003	0.003	0.003		3.4	15	
5		16-Jul-21	21:00 to 00:00	22:00	31.3	0.17	E	63.6	0.004	0.004	0.004	0.004	0.003	0.004		3.8	13	
6		17-Jul-21	00:00 to 03:00	01:00	28.4	0.23	N	76.4	0.003	0.002	0.003	0.003	0.004	0.003		3.0	16	
7		17-Jul-21	03:00 to 06:00	04:00	28.9	0.75	SE	75.3	0.003	0.003	0.003	0.003	0.003	0.003		3.0	17	
8		17-Jul-21	06:00 to 09:00	07:00	29.2	0.34	SE	72.6	0.003	0.003	0.004	0.004	0.004	0.004		3.6	22	

Appendix B - Odour Monitoring Results for Exhaust of Deodourisation Unit

Round	Location	Date	Time Period	MeasurementTime	Temperature, °C	Average Temperature, °C	Wind Speed, m/s	Average of Wind Speed, m/s	Wind Direction	Relative Humidity, %	H_2S Concentration							
											Measruement, ppm							Expressed as µg/s
											1st	2nd	3rd	4th	5th	Average	Overall Average	
1	OD1	16-Jul-21	09:00 to 12:00	11:40	32.8	30.8	13.01	16.51	W	81.3	0.007	0.007	0.007	0.008	0.007	0.007	0.0079	124.6
2		16-Jul-21	12:00 to 15:00	14:00	32.2		16.40		N	67.9	0.008	0.008	0.008	0.008	0.007	0.008		
3		16-Jul-21	15:00 to 18:00	17:00	31.3		15.70		SE	87.2	0.011	0.011	0.010	0.010	0.010	0.010		
4		16-Jul-21	18:00 to 21:00	20:05	31.7		17.20		E	75.3	0.008	0.009	0.008	0.008	0.008	0.008		
5		16-Jul-21	21:00 to 00:00	23:00	29.4		17.40		E	91.2	0.009	0.008	0.001	0.007	0.007	0.006		
6		17-Jul-21	00:00 to 03:00	02:00	29.6		17.10		N	95.9	0.008	0.008	0.008	0.008	0.007	0.008		
7		17-Jul-21	03:00 to 06:00	05:05	29.6		17.30		SE	94.7	0.008	0.007	0.008	0.007	0.007	0.007		
8		17-Jul-21	06:00 to 09:00	08:00	30.1		18.00		SE	95.1	0.008	0.008	0.008	0.008	0.007	0.008		
1	OD2	16-Jul-21	09:00 to 12:00	12:00	32.3	29.9	11.12	11.03	W	79.3	0.008	0.007	0.007	0.007	0.008	0.007	0.0082	87.2
2		16-Jul-21	12:00 to 15:00	14:20	31.4		10.23		N	86.3	0.010	0.010	0.010	0.010	0.009	0.010		
3		16-Jul-21	15:00 to 18:00	17:20	30.1		10.77		SE	77.6	0.011	0.011	0.011	0.011	0.010	0.011		
4		16-Jul-21	18:00 to 21:00	20:25	29.4		11.69		E	93.8	0.010	0.010	0.010	0.009	0.009	0.010		
5		16-Jul-21	21:00 to 00:00	23:20	29.0		10.88		E	94.4	0.010	0.010	0.009	0.009	0.010	0.010		
6		17-Jul-21	00:00 to 03:00	02:20	28.7		11.02		N	95.8	0.006	0.006	0.006	0.006	0.006	0.006		
7		17-Jul-21	03:00 to 06:00	05:25	28.9		11.11		SE	92.2	0.006	0.006	0.007	0.007	0.007	0.007		
8		17-Jul-21	06:00 to 09:00	08:25	29.5		11.45		SE	72.8	0.006	0.006	0.006	0.006	0.006	0.006		

ALS Technichem (HK) Pty Ltd
11/F, Chung Shun Knitting Centre
1-3 Wing Yip Street
Kwai Chung, N.T., Hong Kong
T: +852 2610 1044
F: +852 2610 2021
www.alsglobal.com

HOKLAS 066
TEST

CERTIFICATE OF ANALYSIS

CLIENT:	AECOM AISA CO. LTD	WORK ORDER:	HK2129521
CONTACT:	MS LEMON LAM	SUB-BATCH:	0
ADDRESS:	13/F, GRAND CENTRAL PLAZA, TOWER 2, 138 SHATIN RURAL COMMITTEE ROAD, SHATIN, N.T.	LABORATORY:	HONG KONG
		DATE RECEIVED:	16 & 17 JULY, 2021
		COMPLETION DATE OF ANALYSIS:	17 JULY, 2021
PROJECT:	OLFACTOMETRY ANALYSIS	DATE OF ISSUE:	27 JULY, 2021
SITE:	SAN WAI SEWAGE TREATMENT PLANT	SAMPLE TYPE:	AIR
PO:	---	NO. OF SAMPLES:	24

COMMENTS

Twenty-Four (24) sample(s) were delivered to ALS Technichem (HK) laboratory for olfactory analysis by AECOM staff on 16th and 17th JULY 2021. All the air samples were sampled by the client.

ALS Technichem (HK) Pty Ltd is HOKLAS accredited for the testing provided in according to EN Method 13725.

The results related only the items tested. Sampling information (Project name, Sample ID) is provided by the client and sampling activity involved is not covered by the laboratory HOKLAS accreditation.

NOTES

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Poon Kwong Lun, Allen
Manager
HOKLAS Approved Signatory

This document has been signed by those names that appear on this report and are the authorised signatories.

A. OLFACTORY SAMPLING

Air samples were collected by using passive sampling technique:

Approximately 60 litre of gas sample was collected into a Nalophan sampling bag inside an air-tight vacuum chamber.

Sample information were shown as below:

ALS Sample ID	Client's Location ID	Sampling Date and Period	Analysis Date and Time	Odour Sampled
HK2129521-1	SB1-01	16-Jul-2021 11:00 - 14:00	17-Jul-2021 09:12 - 09:19	Near the sewage treatment plant
HK2129521-2	ASR1a-01	16-Jul-2021 11:00 - 14:00	17-Jul-2021 09:22 - 09:29	Near the sewage treatment plant
HK2129521-3	ASR2b-01	16-Jul-2021 11:00 - 14:00	17-Jul-2021 09:34 - 09:42	Near the sewage treatment plant
HK2129521-4	SB1-02	16-Jul-2021 14:00 - 17:00	17-Jul-2021 09:45 - 09:52	Near the sewage treatment plant
HK2129521-5	ASR1a-02	16-Jul-2021 14:00 - 17:00	17-Jul-2021 09:57 - 10:06	Near the sewage treatment plant
HK2129521-6	ASR2b-02	16-Jul-2021 14:00 - 17:00	17-Jul-2021 10:25 - 10:33	Near the sewage treatment plant
HK2129521-7	SB1-03	16-Jul-2021 17:00 - 20:00	17-Jul-2021 10:38 - 10:45	Near the sewage treatment plant
HK2129521-8	ASR1a-03	16-Jul-2021 17:00 - 20:00	17-Jul-2021 10:48 - 10:54	Near the sewage treatment plant
HK2129521-9	ASR1b-03	16-Jul-2021 17:00 - 20:00	17-Jul-2021 11:15 - 11:23	Near the sewage treatment plant
HK2129521-10	SB1-04	16-Jul-2021 20:00 - 23:00	17-Jul-2021 11:29 - 11:35	Near the sewage treatment plant
HK2129521-11	ASR1a-04	16-Jul-2021 20:00 - 23:00	17-Jul-2021 11:39 - 11:48	Near the sewage treatment plant
HK2129521-12	ASR1b-04	16-Jul-2021 20:00 - 23:00	17-Jul-2021 11:52 - 11:59	Near the sewage treatment plant
HK2129521-13	SB1-05	16-Jul-2021 23:00 - 02:00	17-Jul-2021 13:15 - 13:22	Near the sewage treatment plant
HK2129521-14	ASR1a-05	16-Jul-2021 23:00 - 02:00	17-Jul-2021 13:25 - 13:42	Near the sewage treatment plant
HK2129521-15	ASR1b-05	16-Jul-2021 23:00 - 02:00	17-Jul-2021 13:46 - 13:52	Near the sewage treatment plant
HK2129521-16	SB1-06	17-Jul-2021 02:00 - 05:00	17-Jul-2021 13:55 - 14:02	Near the sewage treatment plant
HK2129521-17	ASR1a-06	17-Jul-2021 02:00 - 05:00	17-Jul-2021 14:20 - 14:27	Near the sewage treatment plant
HK2129521-18	ASR1b-06	17-Jul-2021 02:00 - 05:00	17-Jul-2021 14:32 - 14:39	Near the sewage treatment plant

ALS Sample ID	Client's Location ID	Sampling Date and Period	Analysis Date and Time	Odour Sampled
HK2129521-19	SB1-07	17-Jul-2021 05:00 - 08:00	17-Jul-2021 14:44 - 14:50	Near the sewage treatment plant
HK2129521-20	ASR1a-07	17-Jul-2021 05:00 - 08:00	17-Jul-2021 14:54 - 15:02	Near the sewage treatment plant
HK2129521-21	ASR1b-07	17-Jul-2021 05:00 - 08:00	17-Jul-2021 15:25 - 15:31	Near the sewage treatment plant
HK2129521-22	SB1-08	17-Jul-2021 08:00 - 11:00	17-Jul-2021 15:35 - 15:42	Near the sewage treatment plant
HK2129521-23	ASR1a-08	17-Jul-2021 08:00 - 11:00	17-Jul-2021 15:45 - 15:52	Near the sewage treatment plant
HK2129521-24	ASR1b-08	17-Jul-2021 08:00 - 11:00	17-Jul-2021 15:56 - 16:02	Near the sewage treatment plant

B. OLFACTOMETRY TESTING

Olfactometry testing of the odour concentration in the collected gas sample was determined by a Forced-choice Dynamic Olfactometer: Model No: Scentroid SS6000 in accordance with the European Standard EN13725:2003 E.

The testing was performed by at least five qualified panellists who are complied with the requirement of the n-butanol screening test. At least 8 individual threshold estimates, after retrospective screening, will be used to determine the odour concentration of the sample.

The odour concentration of each sample was determined by the dilution factor of the sample until the odour of the diluted sample reached the detection threshold of the human assessors, ie 1 ou_E/m^3. The odour concentration of the sample was then reported as the dilution factor of the detection.

Customer Reference:

1. Laboratory Temperature — 20.4 – 21.2 °C
2. Laboratory CO_2 — 0.07 – 0.10 %
3. Presentation mode — Forced Choice
4. Olfactometer
   - Equipment ID — HK1231
   - Calibration Due Date — 18-MAY-2022
5. Pre-Dilution Equipment — NA
6. Reference odorant — 50.0 ppm N-butanol
7. Accepted Reference value — 40 ppb
8. Calibration Status

Date	17-Jul-2021
Accuracy, A_{od}	0.063
Repeatability, r	0.179

9. Method — Follow ALS Method Number: EO001 which incorporates BS EN13725 "Air quality – Determination of Odour Concentration by Dynamic Olfactometry".
10. Special Remark — None
11. Deviation from the standard — None

C. ANALYTICAL RESULT

ALS Sample ID	LOR (ou_E/m^3)	Odour Panel Threshold (ou_E/m^3)	Pre-dilution	Odour Concentration (ou_E/m^3)
HK2129521-1	11	22	None	22
HK2129521-2	11	20	None	20
HK2129521-3	11	17	None	17
HK2129521-4	11	22	None	22
HK2129521-5	11	14	None	14
HK2129521-6	11	13	None	13
HK2129521-7	11	25	None	25
HK2129521-8	11	15	None	15
HK2129521-9	11	16	None	16
HK2129521-10	11	20	None	20
HK2129521-11	11	19	None	19
HK2129521-12	11	15	None	15
HK2129521-13	11	13	None	13
HK2129521-14	11	16	None	16
HK2129521-15	11	13	None	13
HK2129521-16	11	21	None	21
HK2129521-17	11	17	None	17
HK2129521-18	11	16	None	16
HK2129521-19	11	15	None	15
HK2129521-20	11	18	None	18
HK2129521-21	11	17	None	17
HK2129521-22	11	14	None	14
HK2129521-23	11	20	None	20
HK2129521-24	11	22	None	22

Remark: LOR denotes limit of reporting.

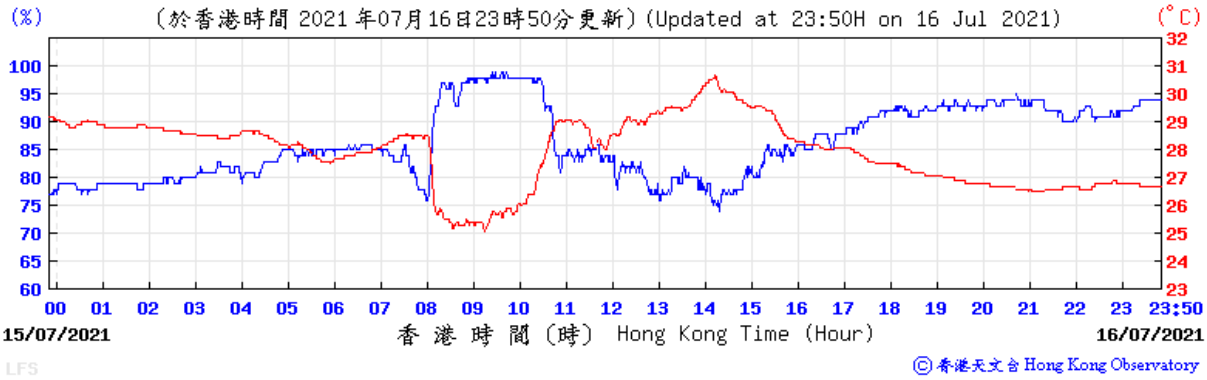
APPENDIX D
WEATHER INFORMATION

Appendix D

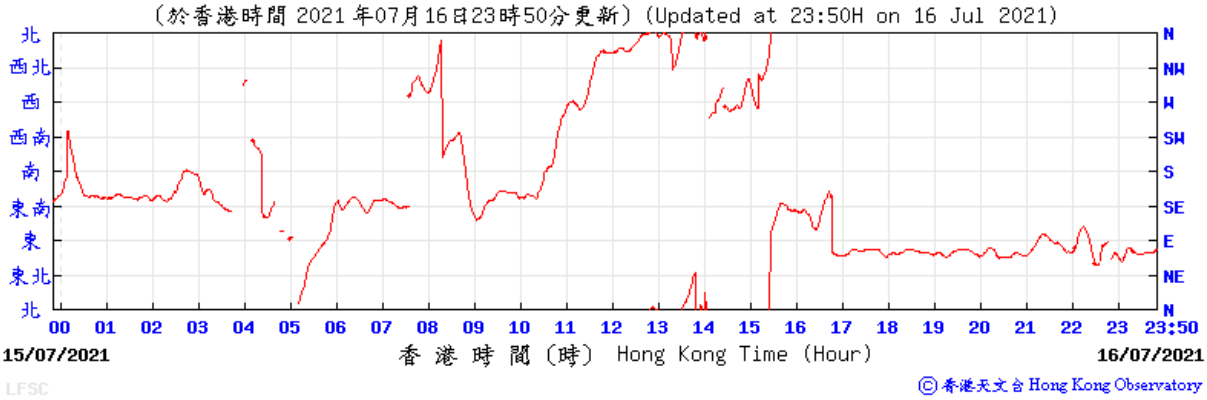
Extracted meteorological data from the Hong Kong Observatory's Lau Fu Shan Weather Station

16 July 2021

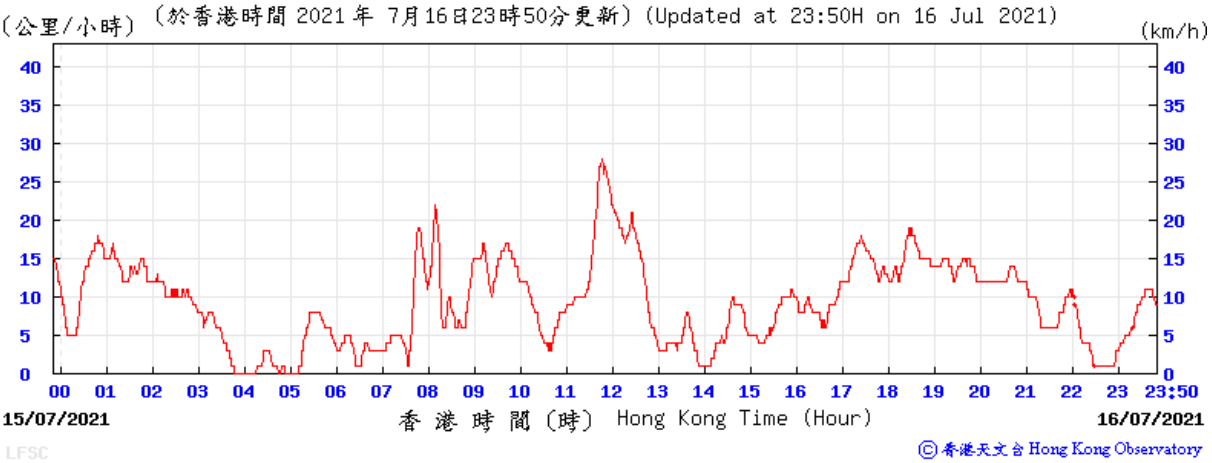
Humidity & Temperature



Wind Direction

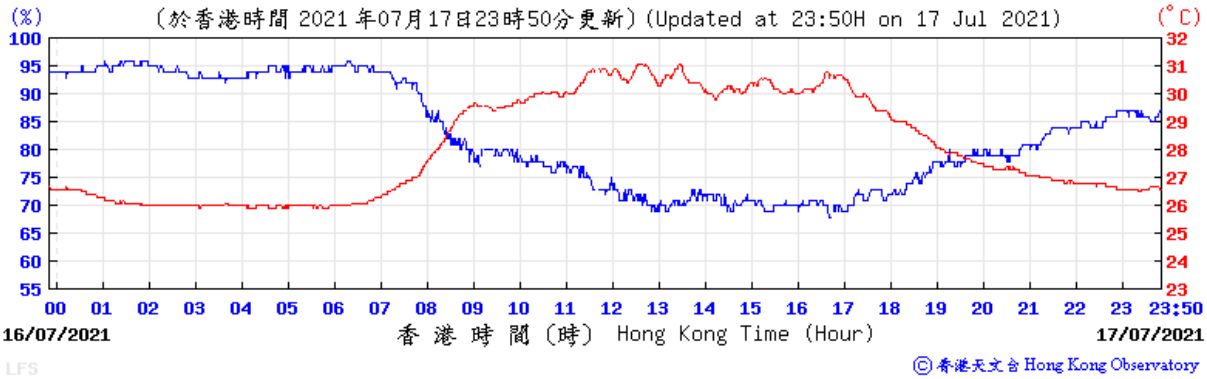


Wind Speed

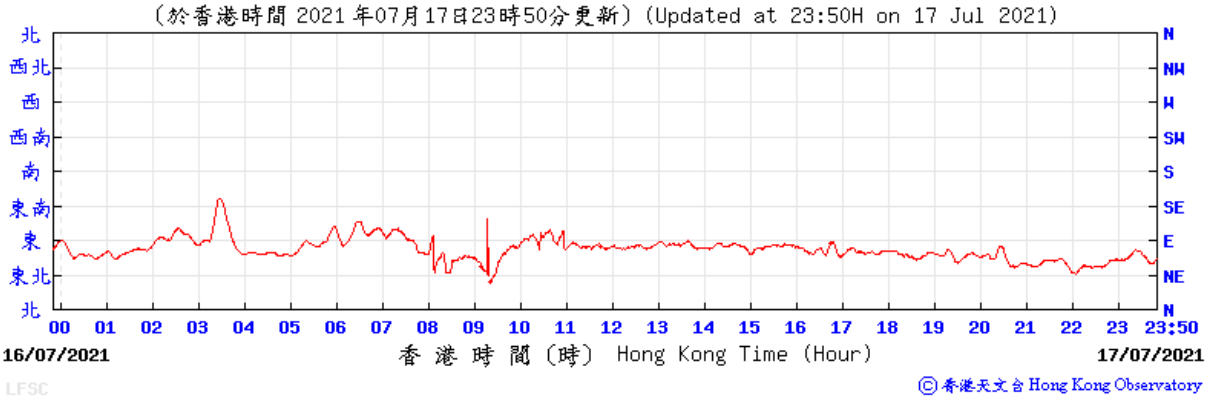


17 July 2021

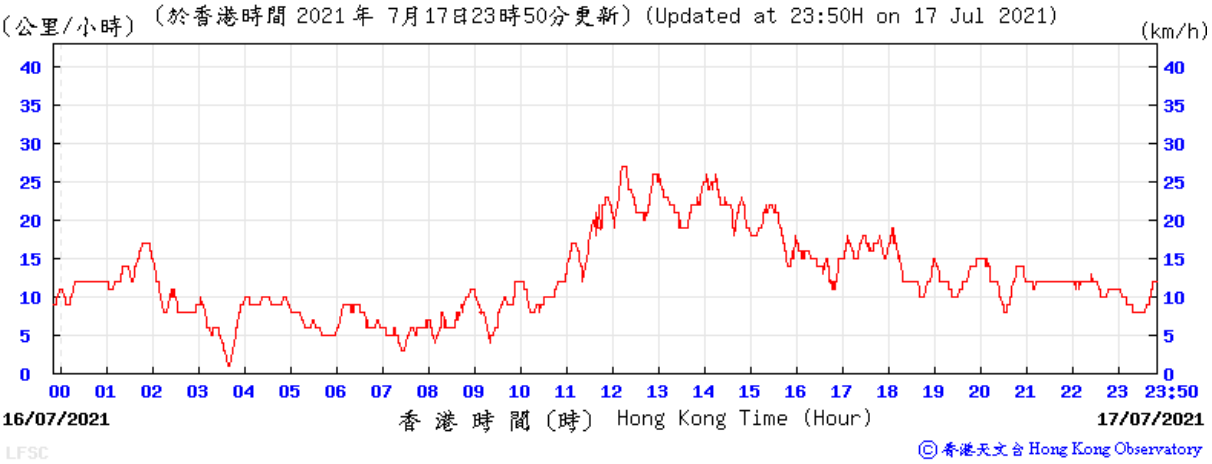
Humidity & Temperature



Wind Direction



Wind Speed



APPENDIX E
LOGSHEET OF ODOUR PATROL

Contract No. DC/2013/10

Design, Build and Operate San Wai Sewage Treatment Works

Monthly Odour Patrol Record Log Sheet (Operational Phase)

Date: 16 July 2021 **Temperature: 32.5°C**

Checkpoint ID	Time	Weather Condition	Wind Direction	Odour Intensity	Odour Characteristics	Possible Odour Source	Direction from Source	Duration of Odour
1	11:15	Sunny	W	0	N/A	N/A	N/A	Intermittent / Continuous
2	11:19	Sunny	W	1	Vehicle exhaust	Traffic Road	Side-wind	Intermittent / ~~Continuous~~
3	11:23	Sunny	W	1	Grassy	Vegetation	Downwind	Intermittent / ~~Continuous~~
4	11:27	Sunny	W	1	Biogas	Ultra-violet (UV) irradiation disinfection system	Downwind	Intermittent / ~~Continuous~~
5	11:31	Sunny	W	1	Vehicle exhaust	Traffic Road	Side-wind	Intermittent / ~~Continuous~~
6	11:35	Sunny	W	1	Vehicle exhaust	Traffic Road	Downwind	Intermittent / ~~Continuous~~

Remark for Odour Intensity:-

0: Not detectable (No odour perceived or an odour so weak that it cannot be easily characterised or described)
1: Slight (Slight identifiable odour)
2: Moderate (Moderate identifiable odour)
3: Strong (Strong identifiable odour)
4: Extreme (Extreme severe odour)

Contract No. DC/2013/10

Design, Build and Operate San Wai Sewage Treatment Works

Monthly Odour Patrol Record Log Sheet (Operational Phase)

Date: 16 July 2021 **Temperature: 31.0°C**

Checkpoint ID	Time	Weather Condition	Wind Direction	Odour Intensity	Odour Characteristics	Possible Odour Source	Direction from Source	Duration of Odour
1	17:40	Sunny	SE	0	N/A	N/A	N/A	Intermittent / Continuous
2	17:44	Sunny	SE	1	Vehicle exhaust	Traffic Road	Side-wind	~~Intermittent~~ / Continuous
3	17:48	Sunny	SE	1	Grassy	Vegetation	Downwind	~~Intermittent~~ / Continuous
4	17:52	Sunny	SE	1	Biogas	Ultra-violet (UV) irradiation disinfection system	Downwind	~~Intermittent~~ / Continuous
5	17:56	Sunny	SE	1	Vehicle exhaust	Traffic Road	Side-wind	~~Intermittent~~ / Continuous
6	18:00	Sunny	SE	1	Vehicle exhaust	Traffic Road	Downwind	~~Intermittent~~ / Continuous

Remark for Odour Intensity:-

0: Not detectable (No odour perceived or an odour so weak that it cannot be easily characterised or described)
1: Slight (Slight identifiable odour)
2: Moderate (Moderate identifiable odour)
3: Strong (Strong identifiable odour)
4: Extreme (Extreme severe odour)

APPENDIX G
ACTION AND LIMIT LEVELS

Appendix G - Action and Limit Levels

Action and Limit Levels for Operational Phase Odour Monitoring

Location of Monitoring	Parameters	Action Level	Limit Level
SB1	H_2S concentration, ppm	0.0109	0.0109
ASR1		0.0100	0.0100
ASR2		0.0157	0.0157
OD1	H_2S concentration in ppb/ppm, flow rate of exhaust in m^3/s and temperature of exhaust (^oC)	AL = LL/2 = 139 µg/s of H_2S	LL = 277 µg/s of H_2S
OD2			

APPENDIX H
EVENT AND ACTION PLAN

Appendix H - Event and Action Plan

Event / Action Plant for the Operational Phase Odour Monitoring

Event	Action			
	ET	IEC	ER	Contractor
Exceedance of Action Level for one sample at site boundary, ASRs or exhaust of deodourisation unit	• Identify source/ reason of exceedance; • Inform IEC and ER; • Repeat measurement to confirm finding.	• Check with Contractor on the operating activities and implementation of odour mitigation measures; • Discuss with ET and Contractor on the possible remedial actions; • Advise the ER on the effectiveness of the proposed remedial measures; • Supervise implementation of remedial measures.	• Confirm receipt of notification of exceedance in writing; • Notify Contractor; • Ensure remedial actions properly implemented.	• Carry out investigation to identify the source/reason of exceedance or complaints. Investigation shall be completed within 1 week; • Rectify any unacceptable practice; • Amend working methods as required; • Inform ET and EPD if the cause of exceedance is considered to be caused by the project; • Implement amended working methods.
Exceedance of Limit Level for one or more samples at site boundary, ASRs or exhaust of deodourisation unit	• Notify IEC, ER, Contractor and EPD; • Identify source of odour; • Increase monitoring frequency; • Carry out analysis of the operating activities and implementation of odour mitigation measures to determine possible mitigation to be implemented • Arrange meeting with IEC and ER to discuss the remedial actions to be taken; • Assess effectiveness of the remedial actions and keep IEC, EPD and ER informed of the results; • Carry out odour measurement using dynamic olfactometry after implementation of remedial measures to confirm their effectiveness.	• Discuss amongst ET, ER and the Contractor on the potential remedial actions; • Review the proposed remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; • Supervise implementation of remedial measures.	• Confirm receipt of notification of exceedance in writing; • Notify Contractor; • In consultation with the ET, agree with the Contractor on the remedial measures to be implemented; • Ensure remedial measures properly implemented; • If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	• Carry out investigation to identify the source/reason of exceedance. Investigation shall be completed within 1 week; • Rectify any unacceptable practice; • Amend working methods as required; • Inform ET and EPD; • Formulate remedial actions; • Ensure amended working methods and remedial actions properly implemented; • If exceedance continues, consider what portion of the work is responsible and stop that portion of work until the exceedance is abated.