

4a. WATER QUALITY IMPACT (TTAL SITE)

4a.1 Introduction

- 4a.1.1.1 This section describes the requirements for the monitoring and audit of water quality impact from the Project.
- 4a.1.1.2 The water quality assessment undertaken in the EIA Study concluded that the identified water quality impacts during construction phase of the IWMF would be minimised by implementing the recommended mitigation measures for the construction works. Release of PFA leachate due to the foundation construction would not be likely to accelerate. Marine water quality monitoring was recommended during the foundation piling of the IWMF to confirm the assessment results.
- 4a.1.1.3 Regular site inspections were recommended to be undertaken to inspect the construction activities and works areas and also the status on the implementation of the recommended mitigation measures. In addition, water quality monitoring of the Tsang Kok Stream was recommended during site formation and foundation piling of the IWMF, in order to ensure no adverse water quality impact to the stream.
- 4a.1.1.4 Discharges of drainage water from the construction works areas would be required to comply with the terms and conditions of a discharge licence, issued by EPD, under the Water Pollution Control Ordinance (WPCO). It may be a stipulation of the WPCO licence to require the Contractor to monitor the quality / quantity of the discharge to show compliance with the conditions of the licence. Such monitoring would not form part of the EM&A programme.
- 4a.1.1.5 During the operation phase of the Project, all generated wastewater will be discharged into an on-site wastewater treatment plant. The treated effluent from the wastewater treatment plant will be reused for washdown and landscape irrigation in the IWMF site. A 'net zero discharge' scheme will be adopted during the operation of the IWMF. Saline water would be discharged from the proposed desalination plant in a low discharge rate. The potential impact associated with saline water discharge has been quantitatively assessed to be minor and acceptable. Adverse impacts on water quality due to the operation of the Project would not be expected. Therefore, no monitoring of water quality would be required during the operation phase of the IWMF.

4a.2 Water Quality Parameters

- 4a.2.1.1 Dissolved oxygen (DO), turbidity, suspended solids (SS) level and pH should be monitored at designated water quality monitoring stations in the Tsang Kok Stream.
- 4a.2.1.2 With regard to the potential marine water quality impact from PFA leachate, heavy metals including cadmium, chromium and aluminium, which have the greatest tendency to leach from the lagoon PFA into the seawater, should be monitored.
- 4a.2.1.3 The levels of DO, turbidity and pH should be measured *in situ* whereas SS and heavy metals should be determined by laboratory analysis.

4a.3 Monitoring Locations

- 4a.3.1.1 The proposed water quality monitoring stations are listed in **Table 4a.1** and shown in **Figures 4a.1 and 4a.2**. For the stream water quality monitoring, a monitoring station should be set in the stream course upstream of the works areas which should act as a control station, and two impact monitoring stations should be located in Tsang Kok stream adjacent and downstream of the works areas. In terms of the marine water

quality monitoring conducted during the foundation piling, two control stations namely C2 and C3 should be set in the outer marine water and two impact monitoring stations should be located adjacent to the Middle Ash Lagoon in the Deep Bay WCZ. The status and locations of water sensitive receivers and the marine activities may change after issuing this Manual. If such case exists, the ET Leader shall propose updated monitoring locations and seek approval from the IEC and EPD.

Table 4a.1 Proposed Water Quality Monitoring Stations

Station	Description	Easting	Northing	Parameters
C1	Control station for the Tsang Kok stream water quality monitoring	809963	830960	DO, turbidity, SS, pH
S1	Impact monitoring stations for the Tsang Kok stream	810042	831065	
S2		810301	831190	
C2	Control station for marine water quality monitoring	811225	833018	cadmium; chromium; aluminium
C3		808281	832684	
M1	Marine water adjacent to the Middle Ash Lagoon	809527	831656	
M2		810131	831818	

4a.3.1.2 For the stream water quality monitoring, measurement should be taken at mid-depth layer. For the marine water monitoring stations, sampling shall be taken at three water depths, namely, 1m below water surface, mid-depth and 1m above seabed, except at where the water depth is less than 6m, in which case the mid-depth station may be omitted. Shall the water depth be less than 3m, only the mid-depth station will be monitored.

4a.4 Baseline Monitoring

4a.4.1.1 Baseline conditions in the stream course and marine water should be established and agreed with EPD prior to the commencement of construction works. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the proposed monitoring stations. The baseline conditions should normally be established by measuring the water quality parameters specified in **Table 4a.2**.

4a.4.1.2 The baseline monitoring for the stream course should be taken at all designated monitoring stations in the Tsang Kok Stream, three days per week, for at least 4 weeks prior to the commencement of construction works. There should not be any construction activities in the vicinity of the stations during the baseline monitoring. The interval between 2 sets of monitoring should not be less than 36 hours. Duplicate *in-situ* measures should be carried out in each sampling event.

4a.4.1.3 The baseline monitoring for marine water should be taken at all designated monitoring stations, 3 days per week, at mid-flood and mid-ebb tides, for at least 4 weeks prior to the commencement of construction works. There should not be any construction activities in the vicinity of the stations during the baseline monitoring. The interval between 2 sets of monitoring should not be less than 36 hours.

4a.4.1.4 Baseline monitoring schedule should be submitted to EPD at least 4 weeks prior to the commencement of baseline monitoring. EPD should also be notified immediately for any changes in schedule.

4a.4.1.5 The baseline monitoring report should be submitted to EPD at least 4 weeks before the commencement of the construction works for agreement. The baseline monitoring report should be certified by the IEC before submission to EPD.

4a.5 Impact Monitoring

4a.5.1 Stream Water Quality Monitoring

4a.5.1.1 During the course of site formation and foundation piling of the IWMF, impact monitoring should be undertaken three days per week with sampling / measurement at the designated monitoring stations in the Tsang Kok Stream. Upon completion of the above construction works, the monitoring exercise at the designated monitoring locations should be continued for four weeks in the same manner as the impact monitoring. The interval between two sets of monitoring should not be less than 36 hours except where there are exceedances of Action and/or Limit Levels, in which case the monitoring frequency will be increased. **Table 4a.2** shows the proposed monitoring frequency and water quality parameters.

4a.5.1.2 Duplicate *in-situ* measurements should be carried out in each sampling event. The monitoring probes should be retrieved out of water after the first measurement and then redeployed for the second measurement. Where the difference in value between the first and second readings of DO, turbidity or pH is more than 25% of the value of the first reading, the reading should be discarded and further readings should be taken.

4a.5.1.3 The water quality monitoring schedule should be submitted to EPD at least 1 week before the first day of the monitoring month. EPD should be notified immediately of any changes in schedule by fax. If the monitoring data collected at the designated stations indicate that the Action or Limit Levels as shown in **Table 4a.4** are exceeded, appropriate actions should be taken in accordance with the Event and Action Plan in **Table 4a.5**.

4a.5.2 Marine Water Quality Monitoring

4a.5.2.1 During the foundation piling and other construction works of the IWMF, impact monitoring should be undertaken three days per week at mid-flood and mid-ebb tides with sampling / measurement at the designated monitoring stations in the Deep Bay WCZ. Upon completion of the piling or construction works, the monitoring exercise at the designated monitoring locations should be continued for four weeks in the same manner as the impact monitoring. The interval between two sets of monitoring should not be less than 36 hours except where there are exceedances of Action and/or Limit Levels, in which case the monitoring frequency will be increased. **Table 4a.2** shows the proposed monitoring frequency and water quality parameters.

4a.5.2.2 The water quality monitoring schedule should be submitted to EPD at least 1 week before the first day of the monitoring month. EPD should be notified immediately of any changes in schedule by fax. If the monitoring data collected at the designated stations indicate that the Action or Limit Levels as shown in **Table 4a.4** are exceeded, appropriate actions should be taken in accordance with the Event and Action Plan in **Table 4a.5**.

Table 4a.2 Proposed Marine Water Quality Monitoring Frequency and Parameters

Activities	Monitoring Frequency	Key Parameters	Monitoring Station
During the 4-week baseline monitoring period	Three days per week	Suspended Solids (SS), Turbidity and Dissolved Oxygen (DO), pH	C1, S1, S2
		cadmium, chromium and aluminium	C2, C3, M1, M2
During the course of site formation and foundation piling of the IWMF	Three days per week	Suspended Solids (SS), Turbidity and Dissolved Oxygen (DO), pH	C1, S1, S2

Activities	Monitoring Frequency	Key Parameters	Monitoring Station
During the foundation piling work	Three days per week	cadmium, chromium and aluminium	C2, C3, M1, M2
During a 4-week period after completion of construction works	Three days per week	Suspended Solids (SS), Turbidity and Dissolved Oxygen (DO), pH	C1, S1, S2
During a 4-week period after completion of foundation piling work	Three days per week	cadmium, chromium and aluminium	C2, C3, M1, M2

Notes: 1. DO, turbidity and pH should be measured *in situ* whereas SS and metals should be determined by laboratory.

4a.6 Site Audits

4a.6.1.1 Implementation of regular site audits is to ensure that the recommended mitigation measures are to be properly undertaken during proposed construction works. It can also provide an effective control of any malpractices and therefore achieve continual improvement of environmental performance on site.

4a.6.1.2 Site audits shall be carried out by the ET and shall be based on the mitigation measures for water pollution control recommended in the implementation schedule as presented in **Appendix 12.1**. In the event that the recommended mitigation measures are not fully or properly implemented, deficiency shall be recorded and reported to the site management. Suitable actions are to be carried out to:

- investigate the problems and the causes;
- issue action notes to the Contractor who is responsible for the works;
- implement remedial and corrective actions immediately;
- re-inspect the site conditions upon completion of the remedial and corrective actions; and
- record the event and discuss with the Contractor for preventive actions.

4a.7 Field Log

4a.7.1.1 Other relevant data should also be recorded, including monitoring location / position, time, water depth, sampling depth, pH, salinity, DO saturation, water temperature, tidal stages, weather conditions and any special phenomena or work underway nearby.

4a.7.1.2 A sample data record sheet is shown in **Appendix 4a.1** for reference.

4a.8 Monitoring Equipment

4a.8.1 Dissolved Oxygen and Temperature Measuring Equipment

4a.8.1.1 The instrument should be a portable and weatherproof DO measuring instrument complete with cable and sensor, and use a DC power source. The equipment should be capable of measuring:

- a DO level in the range of 0 - 20 mg/L and 0 - 200% saturation; and

- a temperature of 0 - 45 degree Celsius.

4a.8.2 Turbidity Measurement Instrument

4a.8.2.1 The instrument should be a portable and weatherproof turbidity-measuring instrument using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU (for example, Hach model 2100P or an approved similar instrument).

4a.8.3 pH Measurement Instrument

4a.8.3.1 The instrument should consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It should be readable to 0.1pH in a range of 0 to 14. Standard buffer solutions of at least pH 7 and pH 10 should be used for calibration of the instrument before and after use.

4a.8.4 Sampler

4a.8.4.1 A water sampler is required. It should comprise a transparent PVC cylinder, with a capacity of not less than 2 litres, which can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (for example, Kahlsico Water Sampler or an approved similar instrument).

4a.8.5 Water Depth Detector

4a.8.5.1 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. This unit can either be hand held or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

4a.8.6 Sample Containers and Storage

4a.8.6.1 Water samples for SS and three heavy metals measurements should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen) and delivered to the laboratory and analysed as soon as possible after collection. Sufficient volume of samples should be collected to achieve the detection limit stated in **Section 4a.9**.

4a.8.7 Monitoring Position Equipment

4a.8.7.1 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication and Radio Technical Commission for maritime (RTCM) Type 16 error message 'screen pop-up' facilities (for real-time auto-display of error messages and DGPS corrections from the Hong Kong Hydrographic Office), or other equipment instruments of similar accuracy, should be provided and used to ensure that the water sampling locations are correct during the water quality monitoring work.

4a.8.8 Calibration of In-Situ Instruments

4a.8.8.1 The DO meter and turbidimeter should be checked and calibrated before use. DO meter and turbidimeter should be certified by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at three monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet

bulb calibration for a DO meter should be carried out before measurement at each monitoring location.

- 4a.8.8.2 Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment should also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

4a.9 Laboratory Measurement / Analysis

- 4a.9.1.1 Analysis of suspended solids (SS) and heavy metals should be carried out in a HOKLAS or other international accredited laboratory. Sufficient water samples should be collected at the monitoring stations for carrying out the laboratory determinations. The determination work should start within 24 hours after collection of the water samples. The analyses should follow the American Public Health Association (APHA) Standard Methods for the Examination of Water and Wastewater or an equivalent method subject to the approval of EPD. Analytical methods and detection limits for SS and heavy metals are present in **Table 4a.3**.

Table 4a.3 Analytical Methods to be Applied to Water Quality Samples

Parameters	Analytical Method	Detection Limit
Suspended Solids	APHA 2540D *	1 mg/L
Cadmium	APHA 20e 3111B *	0.5 µg/L
Chromium	APHA 20e 3111D *	1 µg/L
Aluminium	APHA 3500-Al-D *	20 µg/L

* APHA American Public Health Association Standard Methods for the Examination of Water and Wastewater

- 4a.9.1.2 The testing of SS and metals should be HOKLAS accredited (or if not, approved by EPD) and comprehensive quality assurance and control procedures in place in order to ensure quality and consistency in results.
- 4a.9.1.3 Detailed testing methods, pre-treatment procedures, instruments use, Quality Assurance / Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limit and accuracy shall be submitted to EPD for approval prior to the commencement of monitoring programme. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. The QA/QC shall be in accordance with the requirements of HOKLAS or international accredited scheme. The QA/QC results shall be reported. The testing methods and related proposal should be checked and certified by IEC before submission to EPD for approval.
- 4a.9.1.4 Additional duplicate samples may be required by EPD for inter-laboratory calibration. Remaining samples after analysis should be kept by the laboratory for 3 months in case repeat analysis is required. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to EPD. In any circumstance, the sample testing should have comprehensive quality assurance and quality control programmes. The laboratory should prepare to demonstrate the programme to DEP or his representatives when requested.

4a.10 Event and Action Plan

- 4a.10.1.1 The water quality criteria, namely action and limit levels, are shown in **Table 4a.4**. These criteria should be applied to ensure that any deterioration of water quality is readily detected and timely action is taken to rectify the situation. Should the monitoring results of the water quality parameters at any designated monitoring station exceed the water

quality criteria, the actions in accordance with the Event and Action Plan summarized in **Table 4a.5** shall be carried out.

- 4a.10.1.2 The ET Leader should assess the potential impacts on the water sensitive receivers based on the monitoring data. The performance of the environmental management system (i.e. of the overall EM&A programme) should be reviewed by the ET Leader on a quarterly basis. The findings of this review should be included in the quarterly EM&A summary reports, together with any recommendations to improve the performance of the EM&A programme.

Table 4a.4 Action and Limit Levels for Water Quality

Parameters	Action	Limit
DO in mg/L	≤ 5 %-ile of baseline data	≤ 4 mg/L
SS in mg/L	≥ 95 %-ile of baseline data or 120% of control station's SS on the same day of measurement	≥ 99 %-ile of baseline or 130% of control station's SS on the same day of measurement
Turbidity in NTU	≥ 95 %-ile of baseline data or 120% of control station's turbidity on the same day of measurement	≥ 99 %-ile of baseline or 130% of control station's turbidity on the same day of measurement
pH	=<5 %-ile or >=95 %-ile of baseline data	pH ≤ 6 or pH ≥ 9
Cadmium	≥ 95 %-ile of baseline data	≥ 99 %-ile of baseline
Chromium	≥ 95 %-ile of baseline data	≥ 99 %-ile of baseline
Aluminium	≥ 95 %-ile of baseline data	≥ 99 %-ile of baseline

Notes:

1. For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
2. For metals, SS and turbidity, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

4a.11 Mitigation Measures

- 4a.11.1.1 Mitigation measures for water quality control have been recommended in the EIA Report and listed in the implementation schedule given in **Appendix 12.1**.
- 4a.11.1.2 In the event of complaints or non-compliance / area of improvement being observed, the ET and the Contractor should review the effectiveness of these mitigation measures, design alternative or additional mitigation measures as appropriate and propose to the IEC for approval and implement these alternative or additional measures.

Table 4a.5 Event and Action Plan for Water Quality

Event	ET Leader	IEC	ER	Contractor
Action level being exceeded by one sampling day	<ul style="list-style-type: none"> Repeat <i>in situ</i> measurement to confirm findings; Identify reasons for non-compliance and source(s) of impact; Inform IEC and Contractor; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IEC and Contractor; Repeat measurement on next day of exceedance. 	<ul style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures; Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Discuss with IEC on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented. Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ET and IEC and propose mitigation measures to IEC and ER; Implement the agreed mitigation measures.
Action level being exceeded by more than one consecutive sampling day	<ul style="list-style-type: none"> Repeat <i>in situ</i> measurement to confirm findings; Identify reasons for non-compliance and source(s) of impact; Inform IEC and Contractor; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IEC and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat measurement on next day of exceedance. 	<ul style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures; Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Discuss with IEC on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ET and IEC and propose mitigation measures to IEC and ER within three working days; Implement the agreed mitigation measures.

Event	ET Leader	IEC	ER	Contractor
Limit level being exceeded by one sampling day	<ul style="list-style-type: none"> • Repeat <i>in situ</i> measurement to confirm findings; • Identify reasons for non-compliance and source(s) of impact; • Inform IEC Contractor and EPD; • Check monitoring data, all plant, equipment and Contractor's working methods; • Discuss mitigation measures with IEC, ER and Contractor; • Ensure mitigation measures are implemented; • Increase the monitoring frequency to daily until no exceedance of Limit level. 	<ul style="list-style-type: none"> • Discuss with ET and Contractor on the mitigation measures; • Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; • Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> • Discuss with IEC, ET and Contractor on the proposed mitigation measures; • Request Contractor to critically review the working methods; • Make agreement on the mitigation measures to be implemented; • Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> • Inform the ER and confirm notification of the non-compliance in writing; • Rectify unacceptable practice; • Check all plant and equipment; • Consider changes of working methods; • Discuss with ET, IEC and ER and propose mitigation measures to IEC and ER within three working days; • Implement the agreed mitigation measures.

Event	ET Leader	IEC	ER	Contractor
Limit level being exceeded by more than one consecutive sampling day	<ul style="list-style-type: none"> • Repeat <i>in situ</i> measurement to confirm findings; • Identify reasons for non-compliance and source(s) of impact; • Inform IEC Contractor and EPD; • Check monitoring data, all plant, equipment and Contractor's working methods; • Discuss mitigation measures with IEC, ER and Contractor; • Ensure mitigation measures are implemented; • Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days. 	<ul style="list-style-type: none"> • Discuss with ET and Contractor on the mitigation measures; • Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; • Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> • Discuss with IEC, ET and Contractor on the proposed mitigation measures; • Request Contractor to critically review the working methods; • Make agreement on the mitigation measures to be implemented; • Assess the effectiveness of the implemented mitigation measures; • Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level. 	<ul style="list-style-type: none"> • Inform the ER and confirm notification of the non-compliance in writing; • Rectify unacceptable practice; • Check all plant and equipment; • Consider changes of working methods; • Discuss with ET, IEC and ER and propose mitigation measures to IEC and ER within three working days; • Implement the agreed mitigation measures; • As directed by the ER, to slow down or to stop all or part of the construction activities.