4. WATER QUALITY MONITORING

Introduction

4.1 In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of water quality impacts during the construction and operation phase of the Project are presented.

Water Quality Parameters

4.2 Dissolved oxygen (DO), turbidity, suspended solids (SS), and ammonia nitrogen levels shall be monitored at designated marine water quality monitoring stations during the construction phase and operation phase. DO and turbidity should be measured in-situ whereas SS should be determined by laboratory. In addition, other relevant parameters including E.coli, temperature, pH, and salinity shall also be measured.

4.3 The water quality impact assessment undertaken in the EIA study concluded that the ambient level of total inorganic nitrogen (TIN) were generally high and close to or even exceeds the limit level of 0.1 mg/L as stipulated by the WQO. The monitoring of the TIN level is therefore considered necessary during at least during the first 12 months after the commissioning of the STW.

4.4 A sample data record sheet is shown in Appendix B for reference.

Monitoring Equipment

Dissolved Oxygen and Temperature Measuring Equipment

4.5 The instrument should be a portable and weatherproof dissolved oxygen (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\(^{-1}\) and 0 - 200% saturation; and
- a temperature of 0 - 45 degree Celsius.

4.6 It should have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary. (For example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

4.7 Should salinity compensation not be built-in to the DO equipment, in-situ salinity should be measured to calibrate the DO equipment prior to each DO measurement.

Turbidity Measurement Instrument

4.8 Turbidity should be measured in situ by the nephelometric method. The instrument should be portable and weatherproof using a DC power source complete with cable, sensor and comprehensive operation manuals. It should have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU (for example, Hach model 2100P or an approved similar instrument). The probe cable should not be less than 25m in length. The meter should be calibrated in order to establish the relationship between NTU units and the levels of suspended solids.
**Sampler**

4.9 A water sampler is required to collect samples for laboratory analysis. 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).

**Water Depth Detector**

4.10 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 workboat, if the same vessel is to be used throughout the monitoring programme.

**Salinity**

4.11 A portable salinometer capable of measuring salinity in the range of 0 - 40 parts per thousand (ppt) should be provided for measuring salinity of the water at each monitoring location.

**Sample Containers and Storage**

4.12 Water samples for SS and TIN determinations 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 HOKLAS accredited laboratory for analysis as soon as possible after collection. Sufficient volume of samples should be collected to achieve the detection limit stated in Table 4.1.

**Monitoring Position Equipment**

4.13 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication or other instrument of similar accuracy, should be provided and used during marine water quality monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

**Calibration of In-Situ Instruments**

4.14 All in situ monitoring instruments should be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring programme. 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.

4.15 For the on site calibration of field equipment, the BS 127:1993, “Guide to Field and on-site test methods for the analysis of waters” should be observed.

4.16 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.

**Laboratory Measurement / Analysis**

4.17 Duplicate samples from each independent sampling event are required by EPD for all parameters. Analysis of suspended solids, TIN, ammonia nitrogen, and E.coli 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 SS, TIN, ammonia nitrogen, and \textit{E.coli} determinations, with detection limits of each parameter shown in Table 4.1. The determination works should start within 24 hours after collection of the water samples. The analyses should follow the standard methods according to Table 4.1 and as described in American Public Health Association (APHA) Standard Methods for the Examination of Water and Wastewater, 19th edition, unless otherwise specified.

**Table 4.1 Analytical Methods to be applied to Marine Water Quality Samples**

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Standard Method</th>
<th>Detection Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended solids (mg L(^{-1}))</td>
<td>APHA 2540 D</td>
<td>0.5 mg L(^{-1})</td>
</tr>
<tr>
<td>Total Inorganic Nitrogen (mg L(^{-1}))</td>
<td>APHA 4500-N(_{org}) or equivalent methods subject to approval of EPD</td>
<td>0.01 mg L(^{-1})</td>
</tr>
<tr>
<td>Ammonia nitrogen (mg L(^{-1}))</td>
<td>ASTM D3590-89 B (F1A)</td>
<td>0.005 mg L(^{-1})</td>
</tr>
<tr>
<td>\textit{E.coli}</td>
<td>In house method, membrane filtration with CHROMagar Liquid \textit{E.coli}-coliform culture</td>
<td>1 cfu/100 mL</td>
</tr>
</tbody>
</table>

4.18 For each of the testing methods details shall be submitted to the EPD for approval prior to commencement of the monitoring programme. The submitted information should include 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. The QA/QC details should be in accordance with the requirements of HOKLAS or international accredited scheme. The QA/QC results should be reported. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis shall 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 be prepared to demonstrate the quality control programme to EPD or his representatives if and when required.

**Monitoring Locations**

4.19 The marine water quality monitoring stations during the construction works are shown in Figure 4.1. These stations were chosen based on the following criteria:

- Close to the sensitive receivers (that is, the gazetted Fish Culture Zone (FCZ) at Picnic Bay and the Secondary Contact Recreation Subzone at Mo Tat Wan) which are directly or likely to be affected;
- For monitoring locations in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance during monitoring;
- Two or more control stations which shall be at locations representative of the project site in its undisturbed condition. Control stations should be located, as far as practicable, both upstream and downstream of the works area.

4.20 The co-ordinates of the proposed monitoring stations are listed in Table 4.2.

**Table 4.2 Proposed Marine Water Quality Monitoring Stations**

<table>
<thead>
<tr>
<th>Station</th>
<th>Description</th>
<th>Easting</th>
<th>Northing</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Secondary recreation contact subzone at Mo Tat Wan</td>
<td>832 968</td>
<td>807 732</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>W2</td>
<td>Fish culture zone at Picnic Bay</td>
<td>832 670</td>
<td>807 985</td>
</tr>
<tr>
<td>W3</td>
<td>Fish culture zone at Picnic Bay</td>
<td>832 045</td>
<td>807 893</td>
</tr>
<tr>
<td>C1 (flood)</td>
<td>Control Station</td>
<td>833 703</td>
<td>808 172</td>
</tr>
<tr>
<td>C2</td>
<td>Control Station</td>
<td>831 467</td>
<td>807 747</td>
</tr>
<tr>
<td>C3 (ebb)</td>
<td>Control Station</td>
<td>832 220</td>
<td>808 862</td>
</tr>
</tbody>
</table>

4.21 Control stations (C1-C3) are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations should be located within the same body of water as the impact monitoring stations but should be outside the area of influence of the works and, as far as practicable, not affected by any other works. The control stations shown in Figure 4.1 are indicative subject to further review before construction phase. The revised station sitings should be submitted 4 weeks before commencement of baseline monitoring for EPD and AFCD approval.

4.22 Three monitoring stations (W1-W3) located at the sensitive receivers (FCZ and secondary contact recreation subzone) are proposed to monitor the impacts from the construction of the submarine outfall as well as the effluent discharge from the proposed STW on water quality.

4.23 Measurements should be taken at 3 water depths, namely, 1 m below water surface, mid-depth and 1 m above sea bed, except where the water depth is less than 6 m, in which case the mid-depth station may be omitted. Should the water depth be less than 3 m, only the mid-depth station would be monitored. The status and locations of water sensitive receivers and the marine activities may change after issuing this Manual. If such cases exist, the ET Leader should propose with justification for changes to monitoring locations or other requirements of the EM&A programme, and seek approval from the IC(E), EPD and AFCD.

**Baseline Monitoring**

4.24 Baseline conditions for marine water quality shall be established and agreed with EPD prior to the commencement of 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 impact and control monitoring stations. The baseline conditions shall be established by measuring the water quality parameters specified in Sections 4.2 - 4.3. The measurements shall be taken at all designated monitoring stations including control stations, at least 2 days per month, at mid-flood and mid-ebb tides during each survey, for at least six months prior to the commencement of marine works. Duplicate in-situ measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database. Table 4.3 summarises the baseline monitoring programme for each water quality parameter.

### Table 4.3  Summary of Baseline Monitoring Programme for Marine Water Quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Stations</th>
<th>Frequency</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO, temperature, turbidity, pH, salinity, SS, Ammonia nitrogen, and E. coli</td>
<td>All</td>
<td>2 days per month, at mid-ebb and mid-flood tides during each survey</td>
<td>Six months (cover dry and wet seasons)</td>
</tr>
<tr>
<td>TIN</td>
<td>All</td>
<td>2 days per month, at mid-ebb and mid-flood tides during each survey</td>
<td>Six months (cover dry and wet seasons)</td>
</tr>
</tbody>
</table>
4.25 Other relevant data shall also be recorded, such as: monitoring location / position, time, water depth, tidal stages, weather conditions and any special phenomena underway near the monitoring station. There shall not be any marine construction activities in the vicinity of the stations during the baseline monitoring.

4.26 In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from the IC(E) and EPD on an appropriate set of data to be used as baseline reference.

4.27 Baseline monitoring schedule shall be faxed to EPD one week prior to the commencement of baseline monitoring. The interval between two sets of monitoring shall not be less than thirty-six hours.

**Impact Monitoring**

4.28 During the course of marine works, monitoring shall be undertaken three days per week, at mid-flood and mid-ebb tides, with sampling / measurement at the designated monitoring stations. Duplicate in-situ measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database. The interval between two sets of monitoring shall not be less than thirty-six hours except where there are exceedances of Action and / or Limit levels, in which case the monitoring frequency will be increased.

4.29 Two consecutive measures of DO concentration, DO saturation and turbidity will be taken *in situ* at 1 m below the surface, mid-depth and 1 m above the seabed at each location. If the water depth is less than 6 m, the mid-depth measurement may be omitted subject to the approval of the ER. If the depth is less than 3 m, only the mid-depth measurements need to be taken subject to the approval of the ER. The monitoring probes shall 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 or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings shall be taken. Duplicate water samples for SS and TIN shall be collected at the same three depths.

**Post-construction Monitoring**

4.30 Upon completion of all marine based construction activities, a post-construction monitoring exercise on water quality shall be carried out for four weeks in the same manner as the impact monitoring. Duplicate in-situ measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database.

**Event and Action Plan**

4.31 Marine water quality criteria, namely Action and Limit levels, are shown in Table 4.4. These criteria should be applied to ensure that any deteriorating water quality could be readily detected. When the monitoring results of the water quality parameters at any designated monitoring stations exceed the water quality criteria, the actions in accordance with the Event and Action Plan in Table 4.5 shall be carried out.

4.32 It is recommended that if monitoring results indicate that the marine works have caused an adverse impact on water quality at the sensitive receivers, additional mitigation measures should be recommended to rectify the non-compliance or the construction programme should be carefully reviewed to slow down the rate of dredging such that the water quality at the sensitive receivers is in compliance with criteria. The working schedule and the mitigation measures should be reviewed by the Contractor, the IC(E), the ET Leader and the ER, and if necessary,
works should be slowed down or suspended until such impact is reduced to an acceptable level.

4.33 The ET Leader should assess the effectiveness and efficiency of the proposed mitigation measures and/or remedial actions for the on-going construction activities. The performance of the environmental management system (that is, 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 4.4  Action and Limit Levels for Marine Water Quality

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Action</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO in mg L$^{-1}$ (Surface, Middle &amp; Bottom)</td>
<td>Surface and Middle 5 percentile of baseline data for surface and middle layer  Bottom 5 percentile of baseline data for bottom layer</td>
<td>Surface and Middle For non-FCZ stations, the limit level shall be 4 mg L$^{-1}$ or 1 percentile of baseline data for surface and middle layer, whereas for FCZ stations the limit level shall be 5 mg L$^{-1}$ or 1 percentile of baseline data for surface and middle layer  Bottom 2 mg L$^{-1}$ or 1 percentile of baseline data for bottom layer</td>
</tr>
<tr>
<td>SS in mg L$^{-1}$ (depth-averaged)</td>
<td>95 percentile of baseline data or 120% of upstream control station's SS at the same tide of the same day</td>
<td>99 percentile of baseline or 130% of upstream control station's SS at the same tide of the same day</td>
</tr>
<tr>
<td>Unionised Ammonia in mg L$^{-1}$ (depth-averaged)</td>
<td>95 percentile of baseline data or 0.021 mg L$^{-1}$</td>
<td>99 percentile of baseline data or 0.021 mg L$^{-1}$</td>
</tr>
<tr>
<td>E. coli (depth-average)</td>
<td>95 percentile of baseline data</td>
<td>99 percentile of baseline or 610 cfu/100mL as geometric mean</td>
</tr>
<tr>
<td>Turbidity in NTU (depth-averaged)</td>
<td>95 percentile of baseline data or 120% of upstream control station's Turbidity at the same tide of the same day</td>
<td>99 percentile of baseline or 130% of upstream control station's Turbidity at the same tide of the same day</td>
</tr>
<tr>
<td>TIN in mg L$^{-1}$ (depth-averaged)</td>
<td>95 percentile of baseline data</td>
<td>99 percentile of baseline data</td>
</tr>
</tbody>
</table>

Notes:
1. "depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
2. For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
3. For turbidity, SS and TIN, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
4. All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary.
### Table 4.5  Event and Action Plan for Marine Water Quality

<table>
<thead>
<tr>
<th>Event</th>
<th>ET Leader</th>
<th>IC(E)</th>
<th>ER</th>
<th>Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action level being exceeded by one sampling day</td>
<td>Repeat <em>in situ</em> measurement on next day of exceedance to confirm findings; Identify source(s) of impact; Inform IC(E), contractor and ER; Check monitoring data, all plant, equipment and Contractor’s working methods.</td>
<td>Check monitoring data submitted by ET and Contractor’s working methods.</td>
<td>Confirm receipt of notification of non-compliance in writing; Notify Contractor.</td>
<td>Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Amend working methods if appropriate.</td>
</tr>
<tr>
<td>Action level being exceeded by two or more consecutive sampling days</td>
<td>Repeat measurement on next day of exceedance to confirm findings; Identify source(s) of impact; Inform IC(E), contractor, ER EPD, and AFCD; Check monitoring data, all plant, equipment and Contractor’s working methods; Discuss mitigation measures with IC(E), ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Action level.</td>
<td>Check monitoring data submitted by ET and Contractor’s working method; Discuss with ET and Contractor on possible remedial actions; Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; Supervise the implementation of mitigation measures.</td>
<td>Discuss with IC(E) on the proposed mitigation measures; Ensure mitigation measures are properly implemented; Assess the effectiveness of the implemented mitigation measures.</td>
<td>Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment and consider changes of working methods; Submit proposal of additional mitigation measures to ER within 3 working days of notification and discuss with ET, IC(E) and ER; Implement the agreed mitigation measures.</td>
</tr>
<tr>
<td>Limit level being exceeded by one sampling day</td>
<td>Repeat measurement on next day of exceedance to confirm findings; Identify source(s) of impact; Inform IC(E), contractor, ER EPD, and AFCD; Check monitoring data, all plant, equipment and Contractor’s working methods; Discuss mitigation measures with IC(E), ER and Contractor.</td>
<td>Check monitoring data submitted by ET and Contractor’s working method; Discuss with ET and Contractor on possible remedial actions; Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly.</td>
<td>Confirm receipt of notification of failure in writing; Discuss with IC(E), ET and Contractor on the proposed mitigation measures; Request Contractor to review the working methods.</td>
<td>Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment and consider changes of working methods; Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IC(E) and ER.</td>
</tr>
<tr>
<td>Limit level being exceeded by two or more</td>
<td>Repeat measurement on next day of exceedance to confirm findings; Identify source(s) of</td>
<td>Check monitoring data submitted by ET and Contractor’s working method;</td>
<td>Discuss with IC(E), ET and Contractor on the proposed mitigation</td>
<td>Take immediate action to avoid further exceedance; Submit proposal of</td>
</tr>
<tr>
<td>Event</td>
<td>ET Leader</td>
<td>IC(E)</td>
<td>ER</td>
<td>Contractor</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>consecutive sampling days</td>
<td>impact; Inform IC(E), contractor, ER EPD, AFCD; Check monitoring data,</td>
<td>Discuss with ET and Contractor on possible remedial actions; Review</td>
<td>Request Contractor to critically review the working methods; Make</td>
<td>mitigation measures to ER within 3 working days of notification and discuss with ET, IC(E) and ER;</td>
</tr>
<tr>
<td></td>
<td>all plant, equipment and Contractor’s working methods; Discuss mitigation</td>
<td>the Contractor’s mitigation measures whenever necessary to ensure their</td>
<td>agreement on the mitigation measures to be implemented; Ensure</td>
<td>Implement the agreed mitigation measures; Resubmit proposals of mitigation measures if problem still not under control; As directed by the Engineer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.</td>
</tr>
<tr>
<td></td>
<td>measures with IC(E), ER and Contractor; Ensure mitigation measures are</td>
<td>effectiveness and advise the ER accordingly; Supervise the</td>
<td>mitigation measures are properly implemented; Consider and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>implemented; Increase the monitoring frequency to daily until no</td>
<td>implementation of mitigation measures.</td>
<td>instruct, if necessary, the Contractor to slow down or to stop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>exceedance of Limit level for two consecutive days.</td>
<td></td>
<td>all or part of the construction activities until no exceedance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of Limit level.</td>
<td></td>
</tr>
</tbody>
</table>
Operation Phase Monitoring

4.34 During operation phase (post commissioning of the STW), monitoring locations (W1-W3) and control stations (C1-C3) should be monitored on a monthly basis for the parameters as listed in Sections 4.2 and 4.3. Water quality samples should be collected at 1m below the surface and 1m above the seabed at each location. Monitoring should be undertaken at least 2 days per month during first year (12 months) after the commissioning of the STW at mid-ebb and mid-flood tide during each survey. The post commissioning monitoring will be terminated after the 12-month monitoring as long as the water quality in Sok Kwu Wan do not deteriorate. The post-commissioning monitoring will be funded under the project vote.

Mitigation Measures

Construction Phase

4.35 No-dig method using Horizontal Directional Drilling (HDD) would be used for the installation of outfall pipe of about 480 m from shore to minimize the potential water quality impacts arising from the dredging works required for the submarine outfall construction. For the remaining outfall pipe of about 240m and the diffuser section, open trench dredging would still be required.

4.36 During the dredging works, the Contractor should be responsible for the design and implementation of the following mitigation measures.

- Dredging should be undertaken using closed grab dredgers with a total production rate of 55m³/hr;
- Deployment of 2-layer silt curtains with first layer enclosing the grab and the second layer at around 50, from the dredging area while dredging works are in progress;
- all vessels should be sized such that adequate clearance (i.e. minimum clearance of 0.6m) is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash;
- all pipe leakages should be repaired promptly and plant shall not be operated with leaking pipes;
- excess material should be cleaned from the decks and exposed fittings of barges before the vessel is moved;
- adequate freeboard (i.e. minimum of 200m) should be maintained on barges to ensure that decks are not washed by wave action;
- all barges should be fitted with tight fitting seals to their bottom openings to prevent leakage of material; and
- loading of barges and hoppers should be controlled to prevent splashing of dredged material to the surrounding water, and barges and hoppers should not be filled to a level which would cause the overflow of materials or sediment laden water during loading or transportation; and
- the decks of all vessels should be kept tidy and free of oil or other substances that might be accidentally or otherwise washed overboard.

Construction Run-off and Drainage

4.37 The Contractor should observe and comply with the Water Pollution Control Ordinance and the
subsidiary regulations. The Contractor should follow the practices, and be responsible for the
design, construction, operation and maintenance of all the mitigation measures as specified in
ProPECC PN 1/94 “Construction Site Drainage”. The design of the mitigation measures should
be submitted by the Contractor to the Engineer for approval. These mitigation measures should
include the following practices to minimise site surface runoff and the chance of erosion, and also
to retain and reduce any suspended solids prior to discharge:

- Provision of perimeter channels to intercept storm-runoff from outside the site. These should
  be constructed in advance of site formation works and earthworks.
- Works programmes should be designed to minimize works areas at any one time, thus
  minimising exposed soil areas and reducing the potential for increased siltation and runoff.
- Sand/silt removal facilities such as sand traps, silt traps and sediment basins should be
  provided to remove the sand/silt particles from run-off. These facilities should be properly
  and regularly maintained. These facilities shall be carefully planned to ensure that they
  would be installed at appropriate locations to capture all surface water generated on site.
- Careful programming of the works to minimise soil excavation works during rainy seasons.
- Exposed soil surface should be protected by paving or hydroseeding as soon as possible to
  reduce the potential of soil erosion.
- Trench excavation should be avoided in the wet season, and if necessary, these should be
  excavated and backfilled in short sections.
- Open stockpiles of construction materials on site should be covered with tarpaulin or similar
  fabric.

**General Construction Activities**

4.38 Debris and rubbish generated on-site should be collected, handled and disposed of properly to
avoid entering the nearby coastal waters and stormwater drains. All fuel tanks and storage areas
should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to
110% of the storage capacity of the largest tank. Open drainage channels and culverts near the
works areas should be covered to block the entrance of large debris and refuse.
Wastewater Arising from Workforce

4.39 Portable toilets shall be provided by the Contractors, where necessary, to handle sewage from the workforce. The Contractor shall also be responsible for waste disposal and maintenance practices.

Operation Phase

4.40 The project proponent should be responsible for the following measures:

- Use of standby pump at all pumping stations and the STW in case of pump failure;
- Use of standby generator at all pumping stations in case of interruption of electrical power supply;
- Use of 24-hour temporary storage for all pumping stations in emergency;
- Use of Sequencing Batch Reactor (SBR) units as storage tanks in case STW failure;
- No emergency discharge is allowed at Pumping Station P2 and the STW;
- Automatically shutdown the pumping station at Lo So Shing in case of Pumping Station P1a failure;
- Automatically shutdown the upstream pumping stations (P1a and Lo So Shing pumping station) in case of Pumping Station P1b failure;
- Automatically shutdown the upstream pumping stations (including Pumping Stations P1a and P1b, and Lo So Shing pumping station) in case of Pumping Station P2 failure;
- Automatically shutdown all pumping stations (including Pumping Stations P1a, P1b and P2, Lo So Shing and Mo Tat Wan pumping station) in case of STW failure;
- Implement a telemetry system to ensure prompt action to be undertaken in an emergency occasion.

4.41 A detailed emergency response plan for emergency discharges based on the major components showing in Appendix D should be prepared and approved by EPD/AFCD during the subsequent detailed design stage.

4.42 The project proponent will also be responsible for the implementation of a full secondary level treatment works with denitrification and UV disinfection.

4.43 The implementation for the recommended water quality mitigation measures is presented in Appendix A.