

VSNL Intra Asia Submarine Cable System – Deep Water Bay

Environmental Monitoring and Audit Manual

6th March 2009

Environmental Resources Management

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1.1 BACKGROUND

Tata Communications (Bermuda) Ltd (formerly Videsh Sanchar Nigam Limited (VSNL)) proposes to install a submarine telecommunications cable, which will run from Deep Water Bay and through southeast Hong Kong offshore waters. The cable landing site will be at the western edge of Deep Water Bay beach at an existing cable landing manhole location. From Deep Water Bay, the cable will extend southwards towards the East Lamma Channel. Near to Round Island, the cable will turn approximately parallel to the East Lamma Channel passing to the south of Po Toi island. The cable will then run eastward close to the boundary of HKSAR waters and then out beyond Hong Kong territorial waters into the South China Sea. At the southeast offshore waters, it will be necessary to install a grout mattress to protect the cable where it crosses Hong Kong Electric Co., Ltd's (HKE) gas pipeline. A map of the proposed cable route is presented in *Figure 1.1*.

In August 2007, a Project Profile (PP) for the Project included an assessment of the potential environmental impacts associated with the installation of the submarine cable circuit was prepared and submitted to the Environmental Protection Department (EPD) under *section 5.(1)(b) and 5.(11) of the Environmental Impact Assessment Ordinance (EIAO)* for application for Permission to apply directly for Environmental Permit (EP). The Environmental Protection Department, subsequently issued an Environmental Permit (EP-294/2007) and Further Environmental Permit (FEP-01/294/2007). Amendments to the permitting requirements were incorporated into Environmental Permit to address potential environmental impacts associated with cable crossings over the HKE's gas pipeline in southeast Hong Kong waters.

The key measures for the Project are summarised as follows:

- The forward speed of the cable laying will be limited to a maximum of 1 km hr⁻¹ so that the amount of seabed sediment disturbed and dispersed during the cable laying process can be kept to a minimum;
- Good house-keeping practises for onshore activities at the cable landing will serve to avoid impacts to water quality;
- Marine works within 200 m of the Deep Water Bay bathing beach will be scheduled to avoid the peak bathing season (April to October);
- A water quality monitoring programme will be conducted to ensure no impacts will occur at the Ocean Park's seawater intakes, the Coastal Protection Areas at Middle Island, Deep Water Bay Beach, the Po Toi Fish Culture Zone and corals sites at the southern coast of Po Toi, Round Island as well as the southern side of Chung Hom Wan;

- A pilot test will be conducted to check the water quality performance of grout mattress installation works associated with the cable crossing at HKE's gas pipeline; and,
- An *ad hoc* water quality monitoring programme will be triggered if accidental incidents result in the release of grout material into the marine environment and remedial actions undertaken.

1.2

PURPOSE OF THE MANUAL

This Environmental Monitoring and Audit (EM&A) Manual ("the Manual") has been prepared by ERM-Hong Kong, Limited (ERM) on behalf of Tata Communications (Bermuda) Ltd. The Manual is a supplementary document of the project entitled *VSNL Intra Asia Submarine Cable System – Deep Water Bay* (Application No. DIR-155/2007) and is required to be submitted to the Director of Environment Protection for approval prior to the application for an environmental permit as listed under *Conditions Imposed under Section 5(12) of the EIA Ordinance for Permission to Apply Directly for Environmental Permit*.

This EM&A Manual has been prepared to:

- monitor the effectiveness of the control measures employed during the cable laying works;
- verify that the project works are not resulting in any impacts to water quality at Ocean Park's seawater intakes, the Coastal Protection Areas at Middle Island, Deep Water Bay Beach, the Po Toi Fish Culture Zone and corals sites at Po Toi, Round Island as well as Chung Hom Wan; and,
- to ensure that any adverse impacts are detected during the cable laying process and that appropriate action is undertaken in the event that impacts are identified to sensitive receivers and are found to be associated with the cable installation works;
- conduct a pilot study to monitor the water quality performance of the grout mattress installation works;
- conduct *ad hoc* water monitoring in the event that any accidental minor or major release of grout material occurs during grout mattress installation works; and
- carry out geophysical surveys and seabed surveys as part of the pipeline cable crossing design works.

A Monitoring Team (MT) shall be appointed to conduct the monitoring and auditing works and to provide specialist advice on the undertaking and implementation of environmental responsibilities.

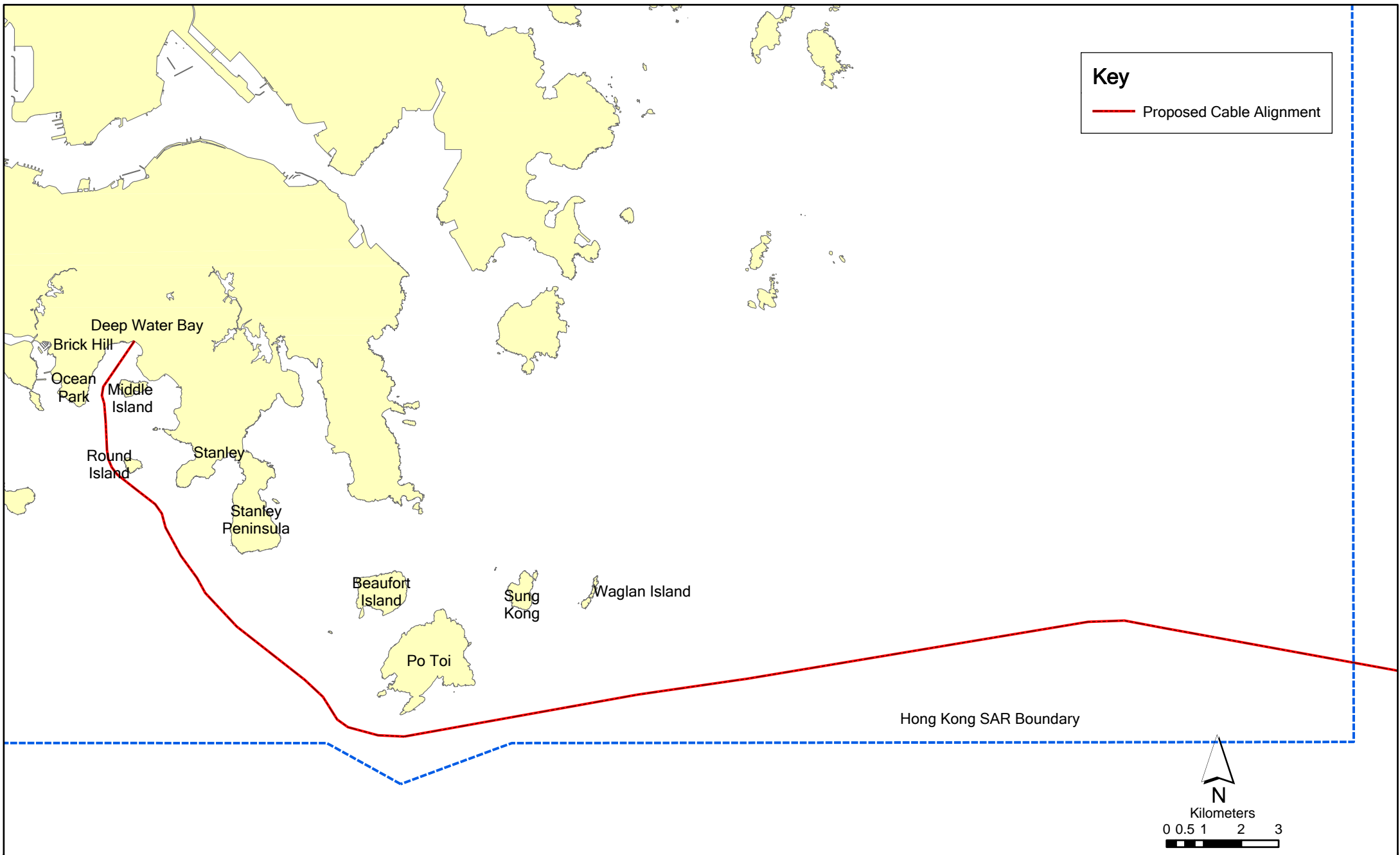


Figure 1.1

The Route of the Proposed Cable System

Potential impacts on water quality associated with the construction of the Project have been identified in the Project Profile. As recommended in the Project Profile, mitigation measures will include limiting the speed of the cable installation barge, avoiding the peak bathing season and a water quality monitoring programme.

The following Section provides details of the water quality monitoring during the installation of the submarine cable.

2.1 SAMPLING METHODOLOGY

2.1.1 Parameters Measured

The parameters to be measured *in situ* are:

- dissolved oxygen (DO) (% saturation and mgL⁻¹)
- temperature
- turbidity (NTU)
- salinity (‰ or ppt)

The only parameter to be measured in the laboratory is:

- suspended solids (SS) (mgL⁻¹)

In addition to the water quality parameters, other relevant data shall also be measured and recorded in field logs, including the location of the sampling stations and cable burial machine at the time of sampling, water depth, time, weather conditions, sea conditions, tidal state, current direction and speed, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results.

2.1.2 Equipment

For water quality monitoring, the following equipment shall be supplied and used by the environmental contractor.

- ***Dissolved Oxygen and Temperature Measuring Equipment*** - The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and shall be operable from a DC power source. It shall be capable of measuring: dissolved oxygen levels in the range of 0 – 20 mgL⁻¹ and 0-200% saturation; and a temperature of 0-45 degrees Celsius.

It shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 35 m in length.

Sufficient stocks of spare electrodes and cable 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).

- ***Turbidity Measurement Equipment*** - Turbidity should be measured from a split water sample from the SS sample. A suitable turbidity test kit should be used to measure the turbidity level.
- ***Salinity Measurement Instrument*** - A portable salinometer capable of measuring salinity in the range of 0-40 ppt shall be provided for measuring salinity of the water at each monitoring location.
- ***Water Depth Gauge*** - No specific equipment is recommended for measuring the water depth. However, water depth gauge affixed to bottom of the water quality monitoring vessel is preferred. The environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- ***Current Velocity and Direction*** – No specific equipment is recommended for measuring the current velocity and direction. However, the environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- ***Positioning Device*** - A Global Positioning System (GPS) shall be used during monitoring to ensure the accurate recording of the position of the monitoring vessel before taking measurements. The use of DGPS is preferred for positioning device, which should be well calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail).
- ***Water Sampling Equipment*** - A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres, which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall 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.

2.1.3 ***Sampling / Testing Protocols***

All *in situ* monitoring instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at-monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use.

For the on-site calibration of field equipment, the BS 1427: 1993, Guide to Field and On-Site Test Methods for the Analysis of Waters shall be observed. Sufficient stocks of spare parts shall be maintained for replacements when

necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when equipment is under maintenance, calibration etc.

Water samples for SS measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4° C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection. At least 2 replicate samples should be collected from each of the monitoring events for *in situ* measurement and lab analysis.

2.1.4 *Laboratory Analysis*

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 mL shall be collected at the monitoring and control stations for carrying out the laboratory determinations. The determination work shall start within the next working day after collection of the water samples. The SS laboratory measurements shall be provided to the client within 2 days of the sampling event (48 hours). The analyses shall follow the standard methods as described in APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition, unless otherwise specified (APHA 2540D for SS).

The submitted information should include pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per-batch etc), detection limits and accuracy. The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

2.2 *MONITORING LOCATIONS*

The monitoring station locations have been established to identify potential impacts to ecological, fisheries and water sensitive receivers.

Prior to, during and after the installation of the cable, water quality sampling will be undertaken at stations situated around the cable laying works at Deep Water Bay, Round Island and Po Toi. The monitoring at those stations is to ensure the construction works of the Project do not affect the sensitive area nearby (shown in *Figure 2.1*).

- S1 and S2 are situated at the two Seawater Intake Points in Deep Water Bay. They are within 500 m west/northwest of the cable alignment at Deep Water Bay for monitoring the effect of cable laying works in the area. The monitoring works will start when the cable installation barge moves inside Zone A;
- S3 is a Sensitive Receiver used to monitor the water quality conditions of the Coastal Protection Areas at Middle Island. The monitoring works will take place when the cable installation barge moves inside Zone A;

- B1 is an Impact Station used to monitor the effect of the construction works on Deep Water Bay Beach when the cable installation barge moves inside Zone A;
- R1 is a Control Station for S1, S2, S3 and B1 at Deep Water Bay which is not supposed to be influenced by the cable laying works due to its remoteness to the construction works;
- C1, C2 and C3 are located approximately 600 m north of the cable alignment at Po Toi for monitoring the effect of cable laying works on coral communities in the area. The monitoring works will be carried out at C1 when the cable installation barge moves inside Zone B. Similarly, the monitoring works will be carried out at C2 and C3 when the cable installation barge moves inside Zones C and D respectively;
- F1 is used to monitor the effect of the cable installation works on the Po Toi Fish Culture Zone (FCZ). It is approximately 1,500 m to the north of the cable alignment, which is not supposed to be influenced by the cable laying works due to its remoteness to the construction works. The water quality of the Po Toi FCZ will be monitored when the cable installation barge moves inside Zones B to D;
- R2 and R3 are Control Stations for C1, C2, C3 and F1 at Po Toi which are not supposed to be influenced by the cable laying works due to their remoteness to the construction works;
- C4 and C5 are Impact Stations used to monitor the effect of cable laying works on the water quality conditions for the coral communities found at Round Island and the southern side of Chung Hom Wan, respectively. The water quality monitoring works will commence when the cable installation barge enters Zone E; and
- R4 is Control Station for C4 and C5 in Zone E. It is not expected to be influenced by the construction works.

The suggested co-ordinates of each zone and the above monitoring stations are listed in *Table 2.1* and *Table 2.2*, respectively.

The monitoring station to be sampled during Baseline Monitoring (prior to landing site preparation, cable laying and landing works), Impact Monitoring (during any works related to the cable installation, ie landing site preparation including excavation, cable laying and landing works) and Post Project Monitoring (after completion of the cable installation).

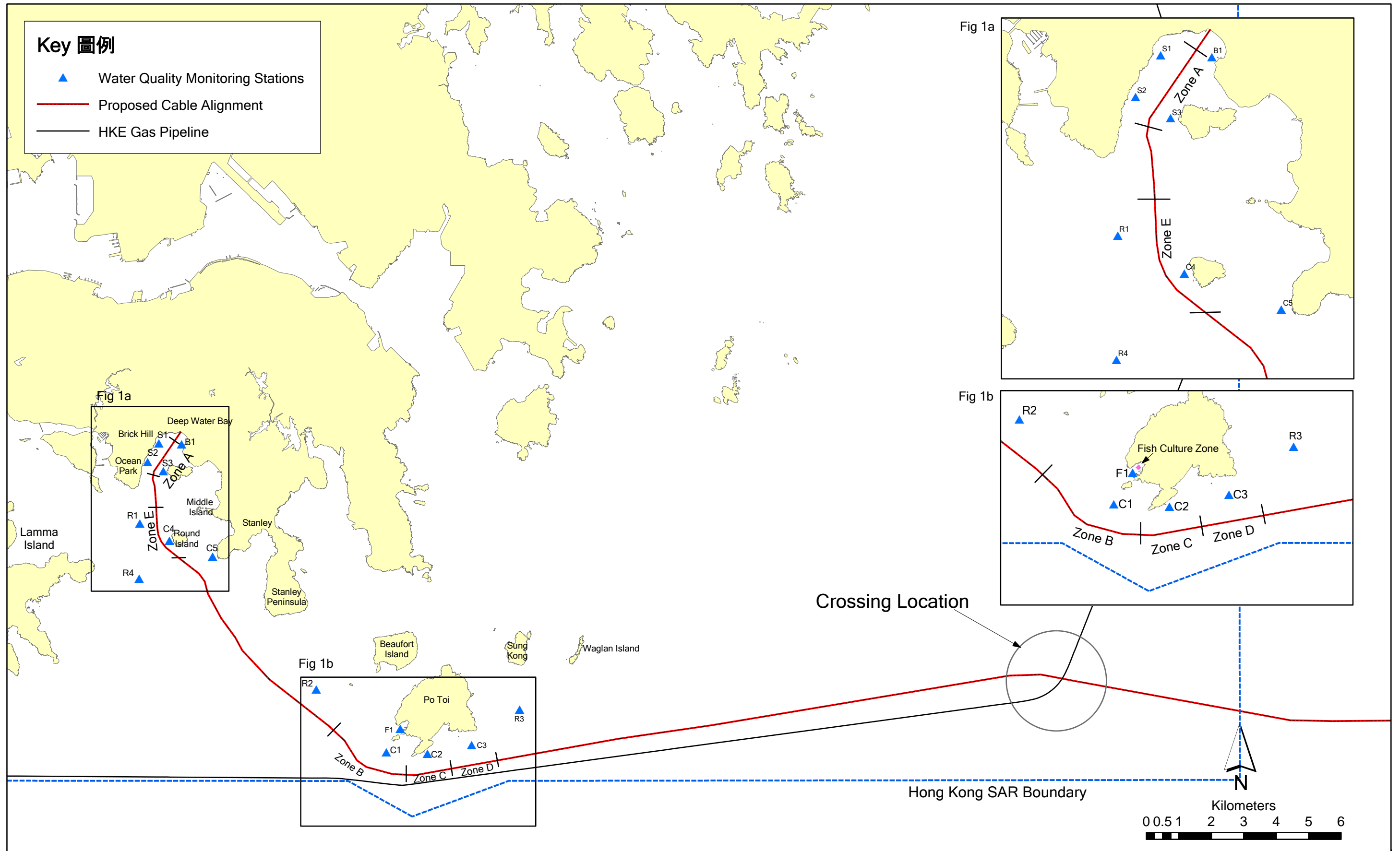


Figure 2.1

Proposed Water Quality Monitoring Stations

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Table 2.1 *Co-ordinates of Starting Points and Ending Points for Zones A to E (HK Grid)*

| Zone | Starting Point | | Ending Point | |
|------|----------------|------------|--------------|------------|
| | Easting | Northing | Easting | Northing |
| A | 837029.763 | 811601.699 | 836367.572 | 810545.975 |
| B | 841917.597 | 802680.115 | 844161.823 | 801308.268 |
| C | 844161.823 | 801308.268 | 845555.155 | 801495.491 |
| D | 845555.155 | 801495.491 | 846970.152 | 801749.210 |
| E | 836457.871 | 809550.593 | 837151.205 | 807996.487 |

Table 2.2 *Co-ordinates of Baseline, Impact & Post Project Sampling Stations (HK Grid)*

| Station | Nature | Corresponding Control Station | Easting | Northing |
|---------|--------------------------|-------------------------------|------------|------------|
| S1 | Seawater Intakes | R1 | 836538.669 | 811528.535 |
| S2 | Seawater Intakes | R1 | 836195.047 | 810956.409 |
| S3 | Coastal Protection Areas | R1 | 836677.103 | 810666.744 |
| B1 | Gazetted Beach | R1 | 837241.114 | 811498.400 |
| C1 | Coral Colonies | R2, R3 | 843547.181 | 802010.004 |
| C2 | Coral Colonies | R2, R3 | 844816.178 | 801952.823 |
| C3 | Coral Colonies | R2, R3 | 846179.538 | 802224.554 |
| C4 | Coral Colonies | R4 | 836863.233 | 808528.950 |
| C5 | Coral Colonies | R4 | 838197.242 | 808036.724 |
| F1 | Fish Culture Zone | R2, R3 | 843977.738 | 802732.580 |
| R1 | Control Station | - | 835951.109 | 809052.535 |
| R2 | Control Station | - | 842074.745 | 803375.183 |
| R3 | Control Station | - | 847656.241 | 803323.252 |
| R4 | Control Station | - | 835934.876 | 807347.391 |

2.3 SAMPLING PROCEDURES

2.3.1 Monitoring Frequency

Baseline Monitoring

Baseline Monitoring of water quality will be undertaken three days per week for the duration of two weeks during mid-ebb and mid-flood tide. The interval between two sets of monitoring shall not be less than 36 hours. The monitoring will be undertaken at all fourteen monitoring stations, as shown in *Figure 2.1* and in *Table 2.2*. Samples will be taken during mid flood and mid ebb tidal state on each sampling occasion. The monitoring frequency and parameters for Baseline Monitoring are summarised in *Table 2.3*.

Table 2.3 *Monitoring Frequency and Parameters for Baseline Monitoring and Post Project Monitoring*

| Zone | Station Type | Monitoring Station | Baseline Monitoring | Post Project Monitoring | Monitoring Parameters |
|------|--------------|--------------------|---|--|--|
| A | Control | R1 | 3 days per week for 2 weeks ; mid ebb and mid flood tides | 3 days in a week ; mid ebb and mid flood tides | Temperature, Turbidity, Salinity, DO, SS |
| | Impact | S1, S2, S3 and B1 | | | |
| B | Control | R2 and R3 | | | |
| | Impact | C1, F1 | | | |
| C | Control | R2 and R3 | | | |
| | Impact | C2, F1 | | | |
| D | Control | R2 and R3 | | | |
| | Impact | C3, F1 | | | |
| E | Control | C4 and C5 | | | |
| | Impact | R4 | | | |

Impact Monitoring

Impact Monitoring at S1, S2, S3, B1 and R1 will commence when the cable installation barge is within 500 m (Zone A) of monitoring stations S1, S2, S3 and B1. The sampling works will cease once the vessel are outside Zone A.

Impact Monitoring at C1, C2, C3, F1, R2 and R3 will commence when the cable installation barge is within Zones B, C or D near Po Toi (coral colonies). The monitoring works will be carried out at C1, F1, R2 and R3 when the cable installation barge moves inside Zone B. The monitoring works will be carried out at C2, F1, R2 and R3 when the cable installation barge enters Zone C. The monitoring works will be carried out at C3, F1, R2 and R3 when the cable installation barge moves inside Zone D. The sampling works will cease once the cable installation barge is outside Zones B, C and D.

Impact Monitoring at C4, C5 and R4 will take place when the cable installation barge enters Zone E. No monitoring works will be performed once the cable installation barge leaves Zone E.

Given that all nearshore and onshore construction works are expected to be undertaken during normal working hours (07:00 - 19:00), impact monitoring will be carried out during the daytime covering both mid-flood and mid-ebb tidal conditions. *In-situ* and SS data of the control and impact stations within the impact zone will be collected during mid-flood and mid-ebb tidal states (Table 2.4). In addition, continuous *in-situ* measurements will be taken at the impact monitoring station(s), ie C1-5, B1, F1 & S1-3, at 30- to 60- minute intervals (subject to the weather conditions and travelling time between stations) within the zone subject to monitoring. The monitoring frequency and parameters for Impact Monitoring are summarised in Table 2.4.

If evening or night-time works are later found to be necessary, water quality impact monitoring may be extended.

Table 2.4 Monitoring Frequency and Parameters for Impact Monitoring

| Zone | Station Type | Monitoring Station | Monitoring Frequency | Monitoring Parameter | |
|------|--------------|--------------------|--|--|--------------------------------------|
| | | | | Mid-ebb Tide / Mid-flood Tide | 30- to 60- Minute Interval |
| A | Control | R1 | Daily when cable installation works undertaken in Zone A | Temperature, Turbidity, Salinity, DO, SS | - |
| | Impact | S1, S2, S3 and B1 | | | Temperature, Turbidity, Salinity, DO |
| B | Control | R2 and R3 | Daily when cable installation works undertaken in Zone B | | - |
| | Impact | C1, F1 | | | Temperature, Turbidity, Salinity, DO |
| C | Control | R2 and R3 | Daily when cable installation works undertaken in Zone C | | - |
| | Impact | C2, F1 | | | Temperature, Turbidity, Salinity, DO |
| D | Control | R2 and R3 | Daily when cable installation works undertaken in Zone D | | - |
| | Impact | C3, F1 | | | Temperature, Turbidity, Salinity, DO |
| E | Control | R4 | Daily when cable installation works undertaken in Zone E | | - |
| | Impact | C4 and C5 | | | Temperature, Turbidity, Salinity, DO |

Post Project Monitoring

Post Project Monitoring will comprise sampling on three occasions (days) within one week after completion of the cable installation works at the same location as the Baseline Monitoring Stations during mid flood and mid ebb tides. The interval between two sets of monitoring shall not be less than 36 hours. The monitoring frequency and parameters for Post Project Monitoring are summarised in *Table 2.3*.

2.3.2 Timing

For Baseline and Post Project Monitoring, water quality sampling will be undertaken within a 3 hour window of 1.5 hours before and 1.5 hours after mid flood and mid-ebb tides.

For Impact Monitoring, *in-situ* and SS data will be collected at both control and impact stations during mid-flood tide and mid-ebb tide in the zone which is under monitoring. Continuous *In-situ* measurements will also be taken at 30- to 60- minute intervals (subject to the weather conditions and travelling time between stations) for each impact station within the zone subject to monitoring.

The environmental contractor will be responsible for liaison with the engineering contractor to ensure installation works are being undertaken during the water quality sampling. Tidal range for flood and ebb tides should not be less than 0.5 m for capturing representative tides.

2.3.3

Depths

Each station will be sampled and measurements will be taken at three depths, 1 m below the sea surface, mid-depth and 1 m above the seabed. For stations that are less than 3 m in depth, only the mid depth sample shall be taken. For stations that are less than 6 m in depth, only the surface and seabed sample shall be taken.

2.4

COMPLIANCE /ACTION EVENT PLAN

Water quality monitoring results will be evaluated against Action and Limit levels shown in *Table 2.5*.

Table 2.5 *Action and Limit Level for Water Quality (based on the result of the Baseline Report)*

| Parameter | Action Level | Limit Level |
|---|---|---|
| SS in mgL ⁻¹ (Depth-averaged) | 95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station | 99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station |
| DO in mgL ⁻¹ | <u>Surface and Middle</u> 5%-ile of baseline data for surface and middle layer <u>Bottom</u> 5%-ile of baseline data for bottom layers | <u>Surface and Middle</u> 4mg/L or 1%-ile of baseline for surface and middle layer <u>Bottom</u> 2mg/L or 1%-ile of baseline data for bottom layer |
| Turbidity (Tby) in NTU (Depth-averaged) | 95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station | 99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station |

Note: "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.

The measures that will be undertaken in the event that the Action or Limit Levels are exceeded are shown in *Table 2.6*.

Table 2.6 *Event Action Plan for Water Quality*

| Event | Contractor |
|-------------------------|---|
| Action Level Exceedance | <p>Step 1 - repeat sampling event.</p> <p>Step 2 – identify source(s) of impact and confirm whether exceedance was due to the construction works;</p> <p>Step 3 – inform EPD, AFCD and LCSD and confirm notification of the non-compliance in writing;</p> <p>Step 4 - discuss with cable installation contractor the most appropriate method of reducing suspended solids during cable installation (e.g. reduce cable laying speed/volume of water used during installation).</p> <p>Step 5 - repeat measurements after implementation of mitigation for confirmation of compliance.</p> <p>Step 6 - if non compliance continues - increase measures in Step 4 and repeat measurements in Step 5. If non compliance occurs a third time, suspend cable laying operations.</p> |
| Limit Level Exceedance | Undertake Steps 1-5 immediately, if further non compliance continues at the Limit Level, suspend cable laying operations until an effective solution is identified. |

2.5

REPORTING

Schedule for baseline and impact monitoring should be submitted to EPD and AFCD at least 2 weeks before commencement of the monitoring works for agreement. A letter report shall be provided to EPD and AFCD that shall include the monitoring results in addition to operating practices of the cable burial machine during sampling (including: position, speed, cable burial depth) and an interpretation of monitoring results. The monitoring data should be provided graphically to show the relationship between the Control and the Impact monitoring stations and compliance or non-compliance with respect to the Action/Limit Levels.

The reports to be provided to EPD and AFCD shall include: one Baseline Monitoring Report; one Impact Monitoring Report; and one Post Project Monitoring Report. The Baseline Monitoring Report shall be provided no later than two weeks before the cable laying work and the report should be submitted to EPD for agreement on the Action/Limit Levels. Weekly Impact Monitoring Report will be provided within three days after the relevant monitoring data collected or become available. The Post Project Monitoring Report shall be provided within one week of completion of the Post Project Survey.

GROUT MATTRESS INSTALLATION PILOT TEST WATER QUALITY MONITORING

To ensure that the grout mattress works installation works will not cause any significant impacts to water quality and marine ecological systems, a pilot study will be conducted to confirm the environmental performance of the grouting operations. Given that the nature of the current proposed grout mattress installation works are very similar to those applied for the Proposed Submarine Gas Pipelines from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong (approved EIA project, FEP-01B/167/2003/D), the previous approved pilot test on grouting performance (Appendix C of FEP-01B/167/2003/D) is considered to be relevant and applicable for this study.

The following Section provides details of the pilot study water quality monitoring during the installation of the grout mattress.

3.1 SAMPLING METHODOLOGY

3.1.1 Parameters Measured

The parameters to be measured in situ are:

- turbidity (NTU)
- pH

The only parameter to be measured in the laboratory is:

- suspended solids (SS) (mgL⁻¹)

In addition to the water quality parameters, other relevant data shall also be measured and recorded in field logs, including the location of the sampling stations and cable burial machine at the time of sampling, water depth, time, weather conditions, sea conditions, tidal state, current direction and speed, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results.

3.1.2 Equipment

For water quality monitoring, the following equipment shall be supplied and used by the environmental contractor.

- **Turbidity Measurement Equipment** - Turbidity should be measured from a split water sample from the SS sample. A suitable turbidity test kit should be used to measure the turbidity level.
- **pH Measurement Equipment** - A portable pH meter capable of measuring pH in the range of 2-12 units with an accuracy of ±0.2 units. The cable

shall be not be less than 35 m in length. Sufficient stocks of spare electrodes and cable shall be available for replacement where necessary.

- **Water Depth Gauge** - No specific equipment is recommended for measuring the water depth. However, water depth gauge affixed to bottom of the water quality monitoring vessel is preferred. The environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- **Current Velocity and Direction** – No specific equipment is recommended for measuring the current velocity and direction. However, the environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- **Positioning Device** - A Global Positioning System (GPS) shall be used during monitoring to ensure the accurate recording of the position of the monitoring vessel before taking measurements. The use of DGPS is preferred for positioning device, which should be well calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail).
- **Water Sampling Equipment** - A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres, which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall 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.

3.1.3 *Sampling / Testing Protocols*

All *in situ* monitoring instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at-monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use.

For the on-site calibration of field equipment, the BS 1427: 1993, Guide to Field and On-Site Test Methods for the Analysis of Waters shall be observed. Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when equipment is under maintenance, calibration etc.

Water samples for SS measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4° C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection. At least 2 replicate samples should be collected from each of the monitoring events for *in situ* measurement and lab analysis.

3.1.4 *Laboratory Analysis*

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 mL shall be collected at the monitoring and control stations for carrying out the laboratory determinations. The determination work shall start within the next working day after collection of the water samples. The SS laboratory measurements shall be provided to the client within 2 days of the sampling event (48 hours). The analyses shall follow the standard methods as described in APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition, unless otherwise specified (APHA 2540D for SS).

The submitted information should include pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per-batch etc), detection limits and accuracy. The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

3.2 *MONITORING LOCATIONS*

The monitoring locations have been identified to check the water quality performance of the grout mattress installation. It should be noted there are no water quality/ecological sensitive receivers in the vicinity of the grouting location.

During the grout mattress installation works, water quality sampling will be undertaken at 4 fixed monitoring stations (M1, M2, M3 and M4) located on both sides of the barge (shown in *Figure 3.1*).

- Stations M1 and M4 are located 200 m from the barge.
- Stations M2 and M3 are located 100 m from the barge.

3.3 *SAMPLING PROCEDURES*

3.3.1 *Monitoring Frequency*

To monitor the water quality performance of grouting, monitoring will commence when grouting works on the barge begin. The pilot test monitoring will be only be conducted during the construction phase for 3 days. Baseline and post project monitoring is not required.

3.3.2 *Timing*

Water samples will be taken at each sampling station every 3 hours continuously for a period of 72 hours.

3.3.3 *Depths*

Each station will be sampled and measurements will be taken at three depths, 1 m below the sea surface, mid-depth and 1 m above the seabed.

3.4 *COMPLIANCE /EVENT ACTION PLAN*

Water quality monitoring results will be evaluated against Exceedence Criteria shown in *Table 3.1*.

Table 3.1 *Pilot Study Exceedence Criteria*

| Parameter | Station | Depth | Exceedence Criteria | Other Conditions |
|-----------|----------|-----------|---------------------|---|
| SS | M1 or M4 | Bed Layer | 13 mg/L | For any parameter, if lower level is measured at M2 and M3, the exceedence will not be considered to be caused by the works and it will not be recorded as an exceedence event. |
| Turbidity | M1 or M4 | Bed Layer | 13 NTU | |
| pH | M1 or M4 | Bed layer | 8.5 | |

The following actions shall be taken according to the monitoring results of the pilot test.

- If there is no record of three consecutive exceedence events for any specific parameter during the pilot test, no further water quality monitoring is required except that *ad hoc* water quality impact will be triggered by accidental incidents (see *Section 4*).
- If three consecutive exceedence events for any specific parameter are recorded, the construction method and activities as well as the relevant water quality monitoring results shall be reviewed immediately by the Contractor in conjunction with the MT to determine whether the exceedences are due to the works. If it is determined that the exceedences are due to the works, the grouting operation shall be suspended immediately. Remedial action shall be taken before continuing the remaining grout mattress installation works. The remedial action shall be certified by the MT Leader and approved by EPD and AFCD.

3.5 *REPORTING*

Schedule for the monitoring should be submitted to EPD at least 2 weeks before commencement of the pilot study for agreement.

Turbidity and pH data shall be submitted to EPD and AFCD by email within 24 hours after the measurements are taken in the field. SS data shall be reported to EPD and AFCD within 48 hours, if possible, after the water samples are received by the testing laboratory.

A letter report which includes the monitoring results in addition to grouting operation practices during sampling (including: position) and an

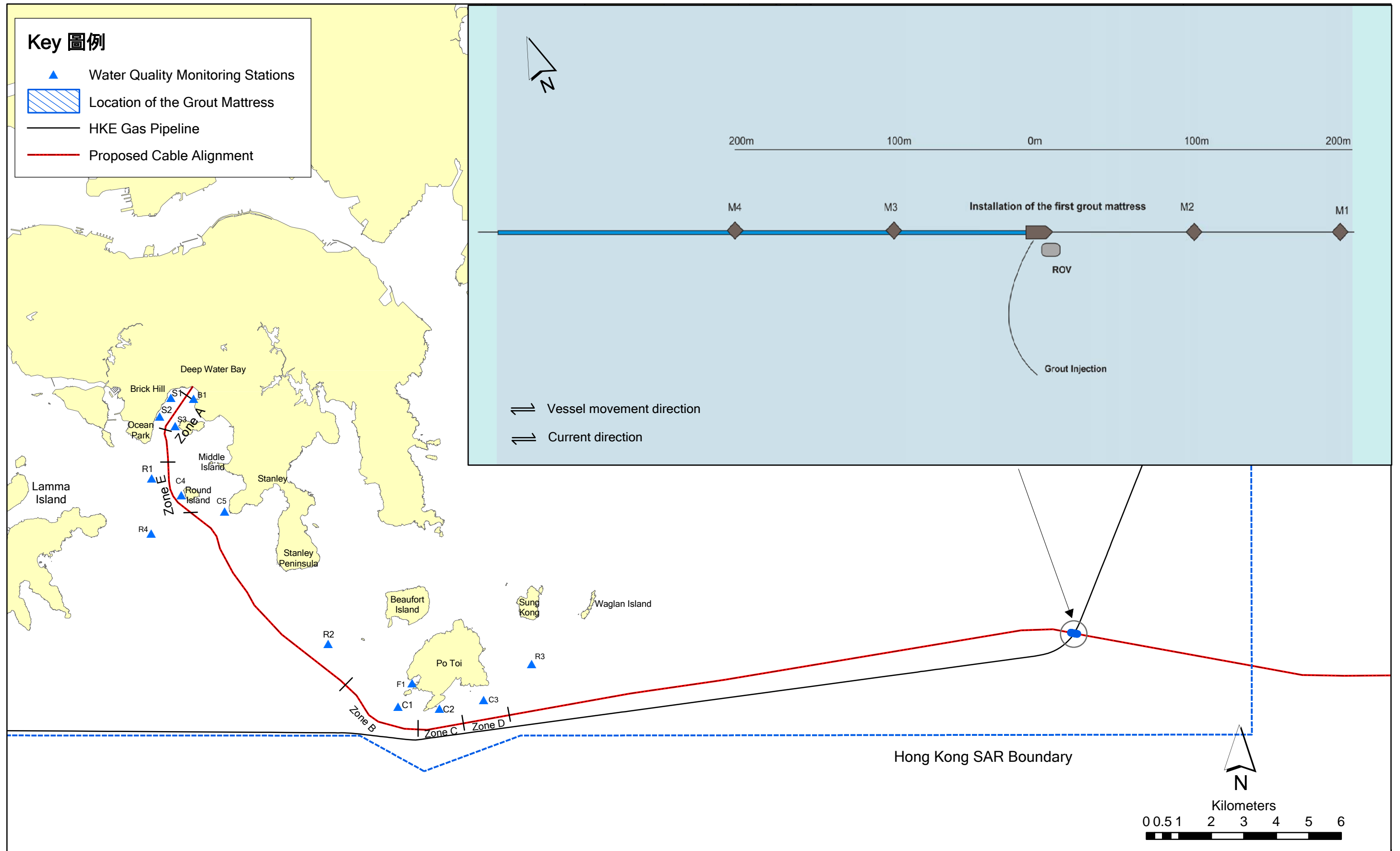


Figure 3.1

Proposed Water Quality Monitoring Stations for Pilot Study Water Quality Monitoring

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Date: 05/02/2009

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interpretation of monitoring results will be submitted to EPD and AFCD. The monitoring data should be provided graphically to show compliance or non-compliance with respect to the Exceedence Levels.

The Pilot Study Monitoring Report will be provided within one week of completing all the pilot study monitoring surveys.

MATTRESS INSTALLATION ACCIDENTAL INCIDENT AD HOC WATER QUALITY MONITORING

Impacts to water quality associated with the installation of the grout mattress have the potential to occur in the event of an accidental release of grout material into the marine environment. Preventative and pollution control measures and remedial actions have been identified to address incidents involving accidental releases of grout materials and presented in *Annex A*.

Ad hoc water quality impact monitoring shall be triggered when an accidental incident which may cause pollution to the marine environment occurs during the grout mattress installation works. In the event of a “Major” or “Minor” accidental incident, the Contractor shall notify EPD, AFCD and the MT within 3 hours after the accidental incident occurs. Different levels of monitoring will be conducted depending on whether it is a “Major” or “Minor” accidental incident as detailed in *Annex A*.

The following Section provides details of the ad hoc water quality monitoring following accidental incidents during the installation of the grout mattress.

4.1 SAMPLING METHODOLOGY

4.1.1 Parameters Measured

The parameters to be measured *in situ* are:

- turbidity (NTU)
- pH

The only parameter to be measured in the laboratory is:

- suspended solids (SS) (mgL⁻¹)

In addition to the water quality parameters, other relevant data shall also be measured and recorded in field logs, including the location of the sampling stations and barge at the time of sampling, water depth, time, weather conditions, sea conditions, tidal state, current direction and speed, special phenomena and work activities undertaken around the monitoring and works area that may influence the monitoring results.

4.1.2 Equipment

For water quality monitoring, the following equipment shall be supplied and used by the environmental contractor.

- ***Turbidity Measurement Equipment*** - Turbidity should be measured from a split water sample from the SS sample. A suitable turbidity test kit should be used to measure the turbidity level.

- ***pH Measurement Equipment*** - A portable pH meter capable of measuring pH in the range of 2-12 units with an accuracy of ± 0.2 units. The cable shall be not be less than 35 m in length. Sufficient stocks of spare electrodes and cable shall be available for replacement where necessary.
- ***Water Depth Gauge*** - No specific equipment is recommended for measuring the water depth. However, water depth gauge affixed to bottom of the water quality monitoring vessel is preferred. The environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- ***Current Velocity and Direction*** – No specific equipment is recommended for measuring the current velocity and direction. However, the environmental contractor shall seek approval of their proposed equipment with the client prior to deployment.
- ***Positioning Device*** - A Global Positioning System (GPS) shall be used during monitoring to ensure the accurate recording of the position of the monitoring vessel before taking measurements. The use of DGPS is preferred for positioning device, which should be well calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail).
- ***Water Sampling Equipment*** - A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres, which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall 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.

4.1.3 ***Sampling /Testing Protocols***

All *in situ* monitoring instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at-monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use.

For the on-site calibration of field equipment, the BS 1427: 1993, Guide to Field and On-Site Test Methods for the Analysis of Waters shall be observed. Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when equipment is under maintenance, calibration etc.

Water samples for SS measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4° C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection.

Two replicate samples should be collected from each of the monitoring events for *in situ* measurement and lab analysis.

4.1.4 *Laboratory Analysis*

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 mL shall be collected at the monitoring and control stations for carrying out the laboratory determinations. The determination work shall start within the next working day after collection of the water samples. The SS laboratory measurements shall be provided to the client within 2 days of the sampling event (48 hours). The analyses shall follow the standard methods as described in APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition, unless otherwise specified (APHA 2540D for SS).

The submitted information should include pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per-batch etc), detection limits and accuracy. The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

4.2 *MONITORING LOCATIONS*

Monitoring locations will be the same as described in *Section 3.2*. During the grout mattress installation works, any *ad hoc* water quality sampling will be undertaken at 4 fixed monitoring stations (M1, M2, M3 and M4) located on both sides of the barge (shown in *Figure 3.1*).

- Stations M1 and M4 are located 200 m from the barge.
- Stations M2 and M3 are located 100 m from the barge.

4.3 *SAMPLING PROCEDURES*

4.3.1 *Monitoring Frequency*

The duration of the *ad hoc* water quality monitoring will dependent on whether the accidental incident is “major” or “minor” (for details see *Annex A*)

Table 4.1 Ad hoc Water Quality Monitoring Frequency Requirement

| Accidental Incident Type | Monitoring Frequency |
|---------------------------------|---|
| “Minor” accidental incident | 1 day with monitoring to be completed within 24 hours on notification of the accidental incident. |
| “Major” accidental incident | 3 days with first day of monitoring to be completed within 24 hours on notification of the accidental incident. |

4.3.2 *Timing*

Water samples will be taken once during the mid-flood and mid-ebb tides on each monitoring day.

4.3.3 *Depths*

Each station will be sampled and measurements will be taken at three depths, 1 m below the sea surface, mid-depth and 1 m above the seabed.

4.4 *COMPLIANCE / EVENT ACTION PLAN*

Water quality monitoring results will be evaluated against Exceedence Criteria shown in *Table 4.2*.

Table 4.2 Exceedence Criteria

| Parameter | Station | Depth | Exceedence Criteria | Other Conditions |
|-----------|----------|-----------|---------------------|---|
| SS | M1 or M4 | Bed Layer | 13 mg/L | For any parameter, if lower level is measured at M2 and M3, the exceedence will not be considered to be caused by the works and it will not be recorded as an exceedence event. |
| Turbidity | M1 or M4 | Bed Layer | 13 NTU | |
| pH | M1 or M4 | Bed layer | 8.5 | |

The following actions shall be taken according to the monitoring results of the ad hoc water quality monitoring results.

Table 4.3 Event Action Plan for Ad hoc Water Quality Monitoring

| Event | Contractor |
|-----------------------------------|--|
| Accidental Grout Release Incident | <p>Step 1 – conduct ad hoc water monitoring as stipulated in <i>Table 4.1</i>.</p> <p>Step 2 – inform EPD and AFCD and confirm notification of any exceedence of exceedence criteria;</p> <p>Step 3 - if exceedences are measured (see <i>Table 4.2</i>), discuss with grout mattress installation contractor the most appropriate method of reducing grout release;</p> <p>Step 4 - repeat measurements after implementation of mitigation for confirmation of compliance;</p> <p>Step 5 - if exceedence continues, increase mitigation measures in Step 3 and repeat measurements in Step 4. If exceedence occurs a third time, suspend mattress installation operations until an effective solution is identified.</p> |

4.5 *REPORTING*

The monitoring results shall be submitted to EPD and AFCD in the following schedule:

- Turbidity and pH data – within 24 hours after the monitoring results are recorded in the field.

- SS data – within 48 hours after the water samples are received by the testing laboratory

A letter report shall be provided to EPD and AFCD that shall include the monitoring results in addition to grouting operation practices during sampling (including: position) and an interpretation of monitoring results. The monitoring data should be provided graphically to show compliance or non-compliance with respect to the Exceedence Levels.

The reports to be provided shall include: an *Ad hoc* Monitoring Report for each accidental release incident. The Monitoring Report will be provided within one week of completing all the monitoring surveys

5.1.1 *Pre Installation Geophysical Survey*

The cable route was surveyed in August 2007 during which all existing pipelines and cables were identified using side-scan sonar, sub bottom profiler, magnetometer and/or multi beam bathymetry. The proposed crossing positions were subsequently charted and recorded. The survey was conducted using precise DGPS positioning to a reported accuracy of +/- 2m.

The survey methodology used to obtain the bathymetric data, which has an absolute bathymetric accuracy in the order of 0.15m, with the ability to detect the pipeline position (shallow depression above the pipeline due to the burial) provided through the use of a digital terrain model which is described in the document:

HONG KONG ELECTRIC_Bathymetric processing

The bathymetric data is provided in an x,y,z file which has soundings at 1m grid intervals as per HKE's previous request:
HK180_1219_1x1_int50_smooth_Mean

A full copy of the Hong Kong SAR survey report and charts will also be provided as part of the environmental monitoring and audit works, this includes a list of Side Scan Sonar targets (debris) identified during the survey work.

The survey methodologies and pre-works survey reports will be submitted to EPD and AFCD for review and the works will not commence until the approval of these submissions is confirmed.

The same digital terrain modelling is proposed for the post installation survey, along with side scan sonar to demonstrate that there is no debris remaining after the work is completed. To gauge the impact of the mattresses on other seabed users, it is not the absolute depth over the highest point of the mattress that needs to be measured, but the relative height of the mattress over that of the surrounding seabed.

The quality of the data from a Multi Beam Echo Sounder is a complicated function of its components. However, the digital terrain model, with the effects of the various factors influencing the measured depth mitigated through accurate positioning, timing, the use of motion and sound velocity compensation does provide a method where by the texture, structure and seabed type can be clearly visualised and objects such as pipelines, rock berms, trenches and in this case, the mattresses on the seabed at the pipeline crossing can be accurately identified. This, when sun illuminated, as per the pipeline in the pre-survey data set provided, will allow better view of the finished installation relative to the surrounding seabed.

5.1.2 *Post Installation Geophysical Survey*

After the mattress installation work is complete, a survey will be carried out to the same standard as the Pre Installation Geophysical Survey as described in *Section 5.1.1*. The new digital terrain model may be compared with the data gathered during the original survey and the height above the surrounding seabed level derived. The survey will include a side scan sonar survey so that any debris or other physical changes to the surface of the seabed may be identified.

5.2 *REPORTING*

A full copy of the Hong Kong SAR survey report and charts shall be provided to EPD and AFCD that shall include a list of Side Scan Sonar targets (debris) identified during the survey work. The survey methodologies and pre-works survey reports shall be submitted to EPD and AFCD for agreement before the commencement of the mattress installation works.

A Post Installation Geophysical Survey Report shall be submitted to EPD and AFCD after the completion of the mattress installation works.

PRE, DURING AND POST SEABED SURVEYS FOR MATTRESS PROTECTION INSTALLATION

It is a requirement that the general area, within which the mattress protection is to be installed, be surveyed and videoed to demonstrate:

- The condition of the local environment prior to the installation of the mattress protection; and
- The condition of the local environment after the installation of the mattress protection.

During/after the installation of the mattresses protection, an inspection shall be made and video recorded that demonstrates that the following requirements have been met:

- The tapered edges of the mattresses form a smooth transition with the seabed;
- The tapered edges are below the level of the adjacent sea bed where burial of the edge of the mattress has been feasible; and
- The top of the mattress is not higher than 350mm above the existing seabed level (This requirement shall be demonstrated by a post installation bathymetric survey and the creation of a new digital terrain model).

These requirements will be followed by adopting the procedures outlined below.

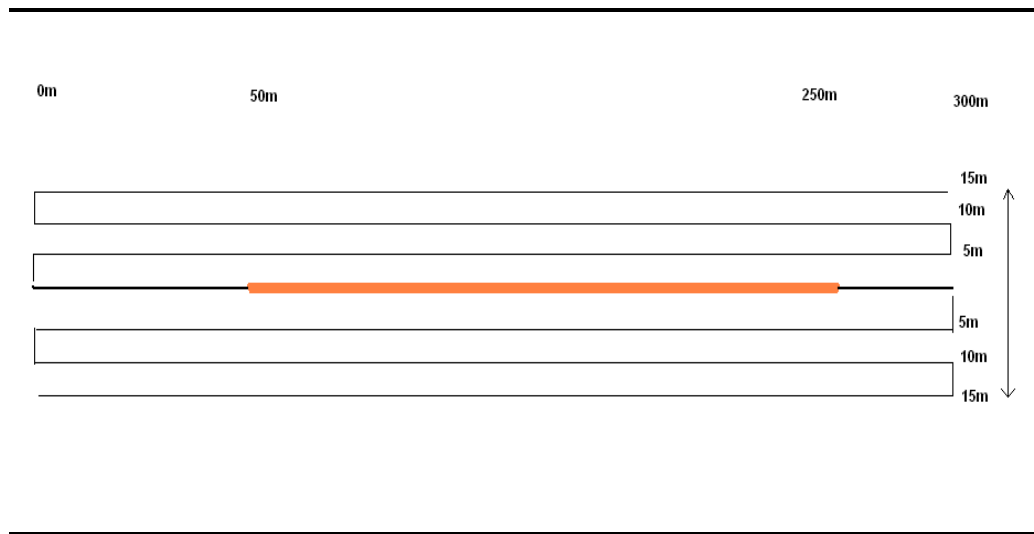
6.1.1 Pre Operation Seabed Video Survey

The grout bag installation work will be carried out by an ROV which will also undertake the Pre Operations Seabed Video Survey. The ROV will be equipped with a number of selectable lights and cameras providing the most appropriate platform from which to obtain high quality video images for all surveys.

Prior to starting the installation the ROV all make an inspection run commencing 50m prior to the Uraduct start point, along the cable, the 100m of Uraduct clad cable and a further 50m of cable. The ROV will then complete inspection runs between start and end points offset to either side and parallel at 5m, 10m & 15m intervals. The ROV will run the offset lines and follow track as planned and displayed on the ROV Operator's navigation screen. The spacing of the offset lines will be adjusted based on visibility to ensure good coverage of the seabed is obtained.

The purpose of the inspection runs shall be obtain the best possible video images of the seabed and any benthic flora/fauna that may exist. The line plan for the survey is shown in *Figure 6.1*.

Figure 6.1 *The Proposed Line Plan for Pre Operation Seabed Video Survey*



The pre operation survey will:

- note and survey any significant scars on the seafloor within the area covered by the line plan;
- collect video imagery of seafloor features, (drag scars, mounding, or depressions);
- take footage of any industry-related items in the immediate vicinity (eg lost anchors, discarded pipe, debris etc); and
- provide a benchmark for the existing benthic flora and fauna against which impact of the installation and installation work may be gauged.

6.1.2 *During Operation Seabed Video Survey*

To ensure the best possible chance of having visibility, the inspection aspect of the work will not be left till the end of the mattresses operation (to be completed as a single operation).

Should the opportunity present itself, after one third of the mattresses have been installed, during a period of good visibility, a post installation survey shall be undertaken of the completed mattresses installed up to that point in time. This shall be repeated after approximately two thirds of the mattresses have been installed. This approach is based on the expectation that visibility may be poor.

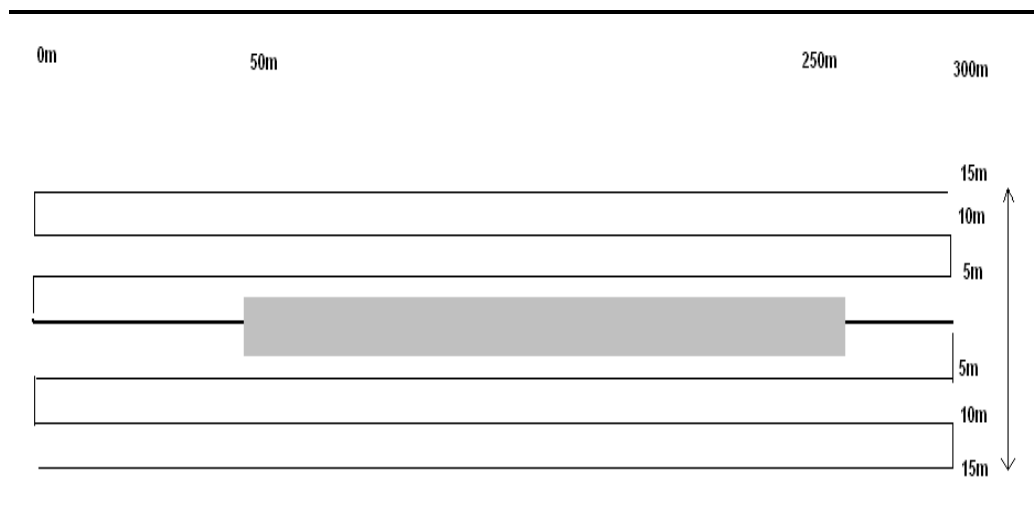
6.1.3

Post Operation Seabed Survey

On completion of the mattresses work, the ROV shall again make the parallel inspection runs at 5m, 10m & 15m intervals with the centre run being over the middle of the bag/mattress installation. The purpose of the inspection runs shall be to again obtain the best possible video images of the seabed.

A plot shall be produced for each of the above video inspections & labelled with any pertinent information from the inspection. Continuous video shall be recorded during the inspections of the surrounding seabed. The line plan for the post operation survey is illustrated in *Figure 6.2*.

Figure 6.2 *The proposed line plan for Post Operation Seabed Video Survey*



The ROV shall video the perimeter of the installed mattress protection after the filling operations have been completed (the short edge at each end of the installed protection and both long edges shall be videoed).

The height of the ROV and camera above the edge of the mattress shall be adjusted along with the lighting and any zoom facility on the camera, to provide an image that provides as true a picture as possible of the installation.

All video inspection work shall include a voice over commentary.

The video footage shall be identified clearly and collated such that they create a presentation that is easy to follow with the position of the mattress being viewed clearly identifiable (the 200m of mattresses will be installed as a number of discreet lengths, the exact number has yet to be decided but in the order of perhaps 20 x 10m long mattresses).

6.2

REPORTING

The reports to be provided to EPD and AFCD shall include: one Pre Operation Seabed Video Survey Report, one During Operation Seabed Video Survey Report and one Post Operation Seabed Video Survey Report.

7.1 SITE INSPECTIONS

Site inspections provide a direct means to assess and ensure the Contractor(s)'s environmental protection and pollution control measures are in compliance with the contract specifications. The site inspection will be undertaken at the landing point (ie Deep Water Bay Beach) to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented in accordance with the Project Profile (PP-324/2007). In addition, the MT will be responsible for defining the scope of the inspections (*Annex B*), detailing any deficiencies that are identified, and reporting any necessary action or additional mitigation measures that were implemented as a result of the inspection.

A weekly site inspection will be carried out at the Deep Water Bay Beach until the completion of construction works at the landing point. The areas of inspection will not be limited to the site area and should also include the environmental conditions outside the site which are likely to be affected, directly or indirectly, by the site activities. The MT will make reference to the following information while conducting the inspections:

- the Project Profile and EM&A recommendations on environmental protection and pollution control mitigation measures;
- ongoing results of the EM&A programme;
- work progress and programme;
- individual works methodology proposals;
- the contract specifications on environmental protection;
- the relevant environmental protection and pollution control laws; and
- previous site inspection results.

The Contractor(s) will update the MT with relevant information on the construction works prior to carrying out the site inspections. The site inspection results will be submitted to Tata Communications and the Contractor(s) within 24 hours. Should actions be necessary, the MT will follow up with recommendations on improvements to the environmental protection and pollution control works and will submit these recommendations in a timely manner to Tata Communications and the Contractor(s). They will also be presented, along with the remedial actions taken, in the EM&A report. The Contractor(s) will follow the procedures and time frame stipulated in the environmental site inspection for the implementation of mitigation proposal and the resolution of deficiencies. An

action reporting system will be formulated and implemented to report on any remedial measures implemented subsequent to the site inspections.

The MT will undertake the following procedures (see *Figure 8.1*) upon receipt of a complaint:

- (i) log complaint and date of receipt into the complaint database;
- (ii) investigate the complaint and discuss with the Contractor(s) and Tata Communications to determine its validity and to assess whether the source of the issue is due to works activities;
- (iii) if a complaint is considered valid due to the works, the MT will identify mitigation measures in consultation with the Contractor(s) and Tata Communications;
- (iv) if mitigation measures are required, the MT will advise the Contractor(s) accordingly;
- (v) review the Contractor(s)'s response on the identified mitigation measures and the updated situation;
- (vi) if the complaint is transferred from EPD, an interim report will be submitted to EPD on the status of the complaint investigation and follow-up action within the time frame assigned by EPD;
- (vii) undertake additional monitoring and audit to verify the situation if necessary and ensure that any valid reason for complaint does not recur;
- (viii) report the investigation results and the subsequent actions on the source of the complaint for responding to complainant. If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD; and
- (ix) record the complaint, investigation, the subsequent actions and the results in the EM&A report.

During the complaint investigation work, the Contractor(s) and Tata Communication will cooperate with the MT in providing the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor(s) will promptly carry out the mitigation measures. Tata Communication will approve the proposed mitigation measures and the MT will check that the measures have been carried out by the Contractor(s).

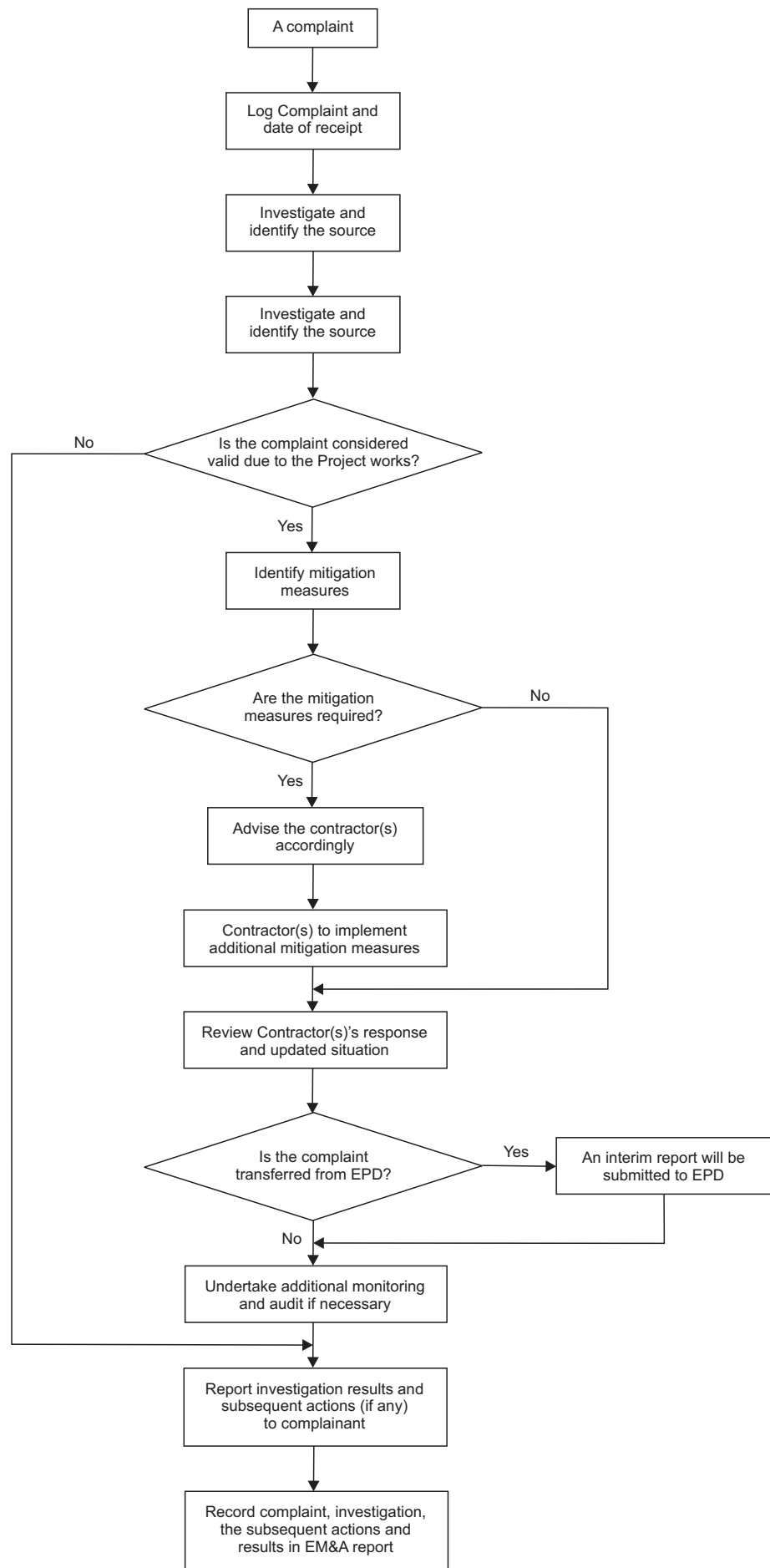


Figure 8.1

Flow Chart for Handling Environmental Complaints

Annex A

Grout Mattress Installation Pollution Prevention and Control Measures

Table A1 Pollution Prevention and Control Measures for Grout Mattress Installation Works

| Accidental incident | Preventive Measure | Remedial Action/Mitigation Measure | Responsible Party |
|--|---|---|--|
| A. General | | | |
| Normal operations | Implement appropriate measures of pollution prevention and control | | |
| Occurrence of any major or minor accidental incidents | | <ol style="list-style-type: none"> 1. Notify EPD and the MT within 3 hours after the accidental incident occurs. 2. Take remedial actions and/or implement mitigation measures. 3. Conduct ad hoc impact monitoring for water quality (see Section 4 for details). 4. If any Action or Limit Level exceedance is recorded, the Event-Action Plans for water quality Monitoring in the EM&A Manual should be followed (see Section 4). | <p>Contractor</p> <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| B. Dry Grout Transportation | | | |
| 1. Spillage of dry grout into the sea. | 1. The grout will be loaded onto the vessel in bulk while alongside a wharf. | <ol style="list-style-type: none"> 1. Likelihood of dry grout spillage into the sea on site or in transit to site is negligible and specific mitigation measure is not considered necessary. 2. If the dry grout is spilled into the sea, <ol style="list-style-type: none"> a. Ad hoc impact monitoring should be conducted. b. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| C. Loading and Mixing | | | |
| 1. While being moved by compressed air from tank to tank, or from tank to mixing bowl, there may be a dry spill. | <ol style="list-style-type: none"> 1. Ensure all hoses and couplings are in good condition. 2. Ensure the hoses are properly fastened to the couplings. 3. Ensure male/female couplings are fully engaged and locked prior to pressurizing the system. | <ol style="list-style-type: none"> 1. If any disconnection occurs: <ol style="list-style-type: none"> a. Stop the transfer immediately. b. Store spilt materials in waste container. c. Remove spilt materials for land disposal or recycling. 2. If dry grout is spilled into the sea, <ol style="list-style-type: none"> a. Ad hoc impact monitoring should be conducted. b. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |

| Accidental incident | Preventive Measure | Remedial Action/Mitigation Measure | Responsible Party |
|---|---|--|--|
| 2. The grout is mixed in purpose built grout mixers (proprietary equipment). There may be spillage into the sea during the mixing operation due to mechanical failure, improper maintenance and operational error. (Minor event) | <ol style="list-style-type: none"> All grout mixing equipment will be set up within a bunded area of a suitable capacity (approximately 7.2m³) to contain the contents of the mixer. The equipment will be operated and frequently checked by experienced operators. Ensure proper maintenance of equipment. | <ol style="list-style-type: none"> If leakage/spillage occurs: <ol style="list-style-type: none"> Stop mixing and check for cause. Deposit spilt material into waste storage tank. Remove for land disposal or recycling. If the mixed grout is spilled into the sea: <ol style="list-style-type: none"> Ad hoc impact monitoring should be conducted. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| D. Grout Injection - Delivery Hose | | | |
| <p>Once mixed the wet grout is pumped by hydraulic pumps from a holding tank through a one-piece hose to the grout mattress. Potential sources of leakage are:</p> <ol style="list-style-type: none"> Leakage from pumping equipment (Minor event) | <ol style="list-style-type: none"> All grout pumping equipment will be set up within a bunded area of a suitable capacity (approximately 7.2m³) to contain the contents of the mixer. Pumping equipment will be operated by experienced operator. Pump operation and the grout flow rate will be monitored for any indications of abnormalities. Ensure proper maintenance of equipment. | <ol style="list-style-type: none"> If the pump operation and flow rate indicate any abnormalities such as the amount of grout pumped per mattress exceeds the specified volume, then the pumping operation should stop immediately for leak checks and repair. If leakage/spillage occurs, all grouting operations should stop and any leaks in the equipment should be repaired before grouting starts again. If any grout is spilled into the sea: <ol style="list-style-type: none"> Ad hoc impact monitoring should be conducted. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| 2. Leakage from delivery hose due to ruptured hose or loose connections (Minor event) | <ol style="list-style-type: none"> The delivery hose will be a single continuous hose to minimize connections. The delivery hose and all connections will be inspected for wear and tear prior to pumping commencing. Protective device will be installed to prevent chafed hose from chafing. Pump operation and the grout flow rate will be monitored for any indications of abnormalities. A Remote Operated Vehicle (ROV) will be on station to observe the underwater pumping operation at all times for any indications of abnormalities. The ROV operator will have radio contact with the Deck. Note: The use of the ROV will allow constant | <ol style="list-style-type: none"> If the pump operation and flow rate indicate any abnormalities such as the amount of grout pumped per mattress exceeds the specified volume, then the pumping operation should stop immediately for leak checks and repair. If the ROV operator observes any abnormalities such as leaks from the delivery hose or the mattress not being filled properly, the pumping operation should be stopped for checks and repairs. If the delivery hose is ruptured, it should be immediately retrieved and replaced by an intact one. If leakage occurs underwater: <ol style="list-style-type: none"> Ad hoc impact monitoring should be conducted. | <p>Contractor</p> <p>Contractor</p> <p>Contractor</p> <p>MT</p> |

| Accidental incident | Preventive Measure | Remedial Action/Mitigation Measure | Responsible Party |
|---|---|--|--|
| | monitoring of all operations in progress using the same video images as the ROV operator. No De-compression diver bottom time in 31m water depth being only 25 minutes. | b. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | Contractor and MT |
| 3. Leakage from delivery valve (connected by the ROV) due to valve malfunction or when connecting and disconnecting the hose with the mattress. (Minor event) | <ol style="list-style-type: none"> The delivery valve at the bottom of the hose will only be opened after it is securely fixed inside the pre-installed grout mattress sleeve. The pumping will stop immediately when there appears to be a loss of grout at the bleed valve. The hose will only be disconnected and removed once the surface and delivery valve has been shut The hose will then be immediately removed from the mattress and the mattress sleeve sealed and securely tied. Pump operation and the grout flow rate will be monitored for any indications of abnormalities. ROV operator (with CCTV and radio) will be on station to observe the underwater pumping operation at all times for any indications of abnormalities. | <ol style="list-style-type: none"> If the ROV Operator observes any abnormalities such as leaks from the delivery valve or that the mattress not being filled properly, the pumping operation should be stopped for checks and repairs. If the pump operation and flow rate indicate any abnormalities such as the amount of grout pumped per mattress exceeds the specified volume, then the pumping operation should stop immediately for leak checks and repair. If leakage from the valve occurs: <ol style="list-style-type: none"> Ad hoc impact monitoring should be conducted. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| E. Grout Injection - Mattress | | | |
| 1. During grouting there may be minor leakage from the mattress due to manufacturing defects, damage from handling or overfilling. (Minor event) | <ol style="list-style-type: none"> All mattresses are in palletized and containerized storage to prevent damage before use. Every mattress will be checked for damage prior to placing it on the seabed. Only trained and experienced operators will be allowed to handle the mattress. The mattress will be frequently inspected while being filled underwater. The grouting operation will stop immediately when there appears to be a loss of grout at the bleed valve. ROV operator (with CCTV and radio) will be on station to observe the underwater pumping operation at all times for any indications of abnormalities. | <ol style="list-style-type: none"> If leakage from the mattress occurs (except normal bleeding) grouting operation should be stopped. Seal leak using Hessian sacking and/or tie wraps. If leakage from the mattress occurs: <ol style="list-style-type: none"> Ad hoc impact monitoring should be conducted. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| 2. During grouting the mattress may rupture due to manufacturing defect or damage from handling. | <ol style="list-style-type: none"> All mattresses are in palletized and containerized storage to prevent damage before use. | <ol style="list-style-type: none"> If the mattress ruptures and the grout released, stop grouting operation until grout material has cured sufficiently to allow close examination. | Contractor |

| Accidental incident | Preventive Measure | Remedial Action/Mitigation Measure | Responsible Party |
|--|---|--|--|
| (Major event) | <ol style="list-style-type: none"> 2. Every mattress will be checked for damage prior to installation. 3. Only trained and experienced operators will be allowed to handle the mattress. 4. ROV operator (with CCTV and radio) will be on station to observe the underwater pumping operation at all times for any indications of abnormalities. | <ol style="list-style-type: none"> 2. The mattress may be removed if necessary and the grouting process repeated with a new mattress. 3. If a grout filled mattress ruptures underwater: <ol style="list-style-type: none"> a. Ad hoc impact monitoring should be conducted. b. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |
| F. Cleaning | | | |
| <ol style="list-style-type: none"> 1. Once the grouting operation is complete the equipment (mixer and pump) must be cleaned. There is a potential for spillage of the washing from the cleaning. (Minor event) | <ol style="list-style-type: none"> 1. All surplus grout will be cleaned out and stored prior to disposal on shore. 2. All grouting equipment (including hoses) will be cleaned within the bunded area. All cleaning water will be collected and pumped to storage tanks for later disposal onshore. | <ol style="list-style-type: none"> 1. If spillage occurs: <ol style="list-style-type: none"> a. Clean up spillage b. Repair any leaks of the bund. 2. If the washing is spilled into the sea: <ol style="list-style-type: none"> a. Ad hoc impact monitoring should be conducted. b. If any Action or Limit Level exceedance is recorded, the Event-Action Plan in the EM&A Manual will be followed. | <p>Contractor</p> <p>MT</p> <p>Contractor and MT</p> |

Annex B

Site Inspection Log Sheets

Site: Inspected By:

Inspection Date: Time:

Weather

Condition Sunny Fine Overcast Drizzle Rain Storm Hazy

Temperature °C **Humidity** High Moderate Low

Wind Calm Light Breeze Strong

A Noise

| | | N/A or not observed | Yes | No | Photo/Remarks |
|----|---|--------------------------|--------------------------|--------------------------|---------------|
| A1 | Are all plant and equipment well maintained and in good operating condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A2 | Is idle equipment turned off or throttled down? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A3 | Are powered mechanical equipment covered or shielded by acoustic materials? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A4 | Are silenced equipment used where practicable? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A5 | Do mobile plants be sited as far away from NSRs as possible? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A6 | Do plants known to emit noise strongly in one direction be oriented away from nearby NSRs? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A7 | Major noise source(s) <input type="checkbox"/> Traffic <input type="checkbox"/> Construction activities outside of site | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| | <input type="checkbox"/> Construction activities inside of site <input type="checkbox"/> Others | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| A8 | Any remedial action undertaken? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |

B Water Quality

| | N/A or not observed | Yes | No | Photo/Remarks |
|--|--------------------------|--------------------------|--------------------------|---------------|
| B1 Is drainage system adequate? Are there temporary ditches for runoff discharge into appropriate | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B2 Watercourse? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B3 With silt retention pond? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B4 Do permanent drainage channels have: sediment basin? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B5 traps and baffles? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B6 Are there sediment tanks for settling runoff prior to disposal? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B7 Are there oil interceptors in drainage system? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B8 Oil and grease removed regularly? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B9 Bypass to prevent flushing during periods of heavy rain? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B10 Is drainage system well maintained? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B11 Is exposed earth stabilized after earthworks have been completed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B12 Are exposed slope surfaces covered (by tarpaulin or other means)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B13 Are open stockpiles of more than 20 m ³ covered during rainstorm? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B14 Are manholes covered and sealed? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Rainy Season | | | | |
| B15 Drainage system adequately designed for storm flow? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B16 Sediment control measures inspected and maintained after rain storms? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B17 Is debris and rubbish on site collected and disposed of properly? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B18 Is wastewater discharge license available for inspection? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B19 Measures to prevent the washing away of sand/silt to drains? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B20 Is there any sediment plume observed existing the marine works area? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| B21 Are there any marine works within 200 m of the Deep Water Bay Beach during the peak bathing season (April to October)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |

C Environmental Complaint

C1 Number of Environmental Complaint Received from _____ to _____. _____

D General / Housekeeping

| | N/A or not observed | Yes | No | Photo/Remarks |
|--|--------------------------|--------------------------|--------------------------|----------------|
| D1 Are potential stagnant pools cleared and mosquito breeding prevented? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ _____ |

Items for Inspection

Notes / Issues Recorded On Site

Corrective Actions

**Signatures:
MT:**

(Name: _____)

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