



Environmental Monitoring and Audit for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) – Investigation *Agreement No. CE 23/2012(EP)*

53rd Monthly Progress Report for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau – January 2017

Draft (Revision 0)

February 2017

Environmental Resources Management

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Dredging, Management and Capping of Contaminated Sediment Disposal Facility at Sha Chau and to the South of The Brothers

Environmental Certification Sheet EP-312/2008/A & EP-427/2011/A

Reference Document/Plan

Document/Plan to be Certified/ Verified:

53rd Monthly Progress Report for Contaminated Mud Pits

to the South of The Brothers and at East Sha Chau - January

2017

Date of Report:

7 February 2017

Date prepared by ET:

7 February 2017

Date received by IA:

7 February 2017

Reference EP Condition

Environmental Permit Condition:

Condition 3.4 of EP-312/2008/A and Condition 4.4 of EP-427/2011/A:

4 hard copies and 1 electronic copy of monthly EM&A Report shall be submitted to the Director within 2 weeks after the end of the reporting month. The EM&A Reports shall include a summary of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit Levels). The submissions shall be certified by the ET Leader and verified by the Independent Auditor. Additional copies of the submission shall be provided to the Director upon request by the Director.

ET Certification

I hereby certify that the above referenced document/ $\frac{1}{plan}$ complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A

Craig A. Reid,

Environmental Team Leader:

Date

7/2/2017

IA Verification

I hereby verify that the above referenced document/plan complies with the above referenced condition of EP-312/2008/A and EP-427/2011/A/

Dr Wang Wen Xiong, Independent Auditor: Date:

7/2/2017

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Environmental Resources Management

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Agreement No. CE 23/2012 (EP) Environmental Monitoring and Audit

for Contaminated Mud Pits to the South of The Brothers and at East Sha Chau (2012-2017) - Investigation

53RD MONTHLY PROGRESS REPORT FOR JANUARY 2017

1.1 BACKGROUND

- 1.1.1 Since early 1990s, contaminated sediment (1) arising from various construction works (e.g. dredging and reclamation projects) in Hong Kong has been disposed of at a series of seabed pits at East of Sha Chau (ESC). In late 2008, a review indicated that the existing and planned facilities at ESC would not be able to meet the disposal demand after 2012. In order to meet this demand, the Hong Kong Special Administrative Region Government (HKSARG) decided to implement a new contained aquatic disposal (CAD) (2) facility at the South of The Brothers (SB CMPs) which had been under consideration for a number of years.
- 1.1.2 The environmental acceptability of the construction and operation of the Project had been confirmed by findings of the associated Environmental Impact Assessment (EIA) study completed in 2005 under *Agreement No. CE* 12/2002(EP) ⁽³⁾. The Director of Environmental Protection (DEP) approved this EIA report under the *Environmental Impact Assessment Ordinance* (Cap. 499) (EIAO) in September 2005 (EIA Register No.: AEIAR-089/2005).
- 1.1.3 In accordance with the EIA recommendation, prior to commencement of construction works for the SB CMPs, the Civil Engineering and Development Department (CEDD) undertook a detailed review and update of the EIA findings for the SB site (4). Findings of the EIA review undertaken in 2009/2010 confirmed that the construction and operation of the SB site had been predicted to be environmentally acceptable.

- According to the Management Framework of Dredged / Excavated Sediment of ETWB TC(W) No. 34/2002, contaminated sediment in general shall mean those sediment requiring Type 2 - Confined Marine Disposal as determined according to this TC(W).
- (2) CAD options may involve use of excavated borrow pits, or may involve purpose-built excavated pits. CAD sites are those which involve filling a seabed pit with contaminated mud and capping it with uncontaminated material such that the original seabed level is restored and the contaminated material is isolated from the surrounding marine environment.7
- (3) Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/ East of Sha Chau Area (Agreement No. CE 12/2002(EP))
- (4) Under the CEDD study Contaminated Sediment Disposal Facility to the South of The Brothers (Agreement No. FM 2/2009)

- 1.1.4 Environmental Permits (EPs) (EP-312/2008/A and EP-427/2011/A) were issued by the Environmental Protection Department (EPD) to the CEDD, the Permit Holder, on 28 November 2008 for ESC CMP V and on 23 December 2011 for SB CMPs, respectively. Under the requirements of the EPs, an Environmental Monitoring and Audit (EM&A) programme as set out in the EM&A Manuals (1) (2) is required to be implemented for the CMPs.
- 1.1.5 The present EM&A programme under *Agreement No. CE 23/2012 (EP)* covers the dredging, disposal and capping operations of the SB CMPs as well as ESC CMPs. Detailed works schedule for ESC CMPs and SB CMPs is shown in *Figure 1.1.* In January 2017, the following works were being undertaken:
 - Disposal of contaminated mud at ESC CMP Vd.

Figure 1.1 Works Schedule for ESC CMPs and SB CMPs

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| SB CMP 1 | Backfilling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| SB CMP 2 | Backfilling | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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1.2 REPORTING PERIOD

1.2.1 This 53rd Monthly Progress Report covers the EM&A activities for the reporting month of January 2017.

1.3 DETAILS OF SAMPLING AND LABORATORY TESTING ACTIVITIES

- 1.3.1 The following monitoring activities have been undertaken for ESC CMPs in January 2017:
 - Water Column Profiling of ESC CMP Vd was undertaken on 3 January 2017;
 - *Demersal Trawling* of *ESC CMPs* was undertaken on 4 and 5 January 2017;
 - Routine Water Quality Monitoring of ESC CMPs was undertaken on 5 January 2017; and
 - *Pit Specific Sediment Chemistry of ESC CMP Vd* was undertaken on 12 January 2017.
 - (1) ERM (2012) Environmental Monitoring and Audit (EM&A) Manual. Final First Review. Environmental Monitoring and Audit for Contaminated Mud Pits to the South of the Brothers and at East Sha Chau (2012-2017) – Investigation. Agreement No. CE 23/2012(EP). Submitted to EPD in November 2012.
 - (2) ERM (2010) Environmental Monitoring and Audit (EM&A) Manual. Final Second Review. Environmental Monitoring and Audit for Contaminated Mud Pit at Sha Chau (2009-2013) Investigation. Agreement No. CE 4/2009(EP). Submitted to EPD in November 2010.

- 1.3.2 No monitoring activities were scheduled to be undertaken for SB CMPs in January 2017.
- 1.4 DETAILS OF OUTSTANDING SAMPLING AND/OR ANALYSIS
- 1.4.1 No outstanding sampling remained for January 2017.
- 1.4.2 A summary of field activities conducted are presented in *Annex A*. The following analyses are in progress and will be presented in the corresponding quarterly report:
 - Species identification of the biota samples collected from *Demersal Trawling for ESC CMPs* in January 2017.
- 1.4.3 The following laboratory analyses are in progress during the preparation of this monthly report and will be presented in the next monthly report once the data are available:
 - Laboratory analyses of sediment samples collected for *Pit Specific Sediment Chemistry of ESC CMP Vd* in January 2017.
- 1.5 Brief Discussion of the Monitoring Results for ESC CMPs
- 1.5.1 Brief discussion of the monitoring results of the following activities for ESC CMPs is presented in this 53rd Monthly Progress Report:
 - Water Column Profiling of ESC CMP Vd in January 2017;
 - Routine Water Quality Monitoring of ESC CMPs in January 2017; and
 - Cumulative Impact Sediment Chemistry of ESC CMPs in December 2016.

1.5.2 Water Column Profiling of ESC CMP Vd - January 2017

1.5.3 Water Column Profiling was undertaken at a total of two sampling stations (Upstream and Downstream stations) on 3 January 2017. The monitoring results have been assessed for compliance with the Water Quality Objectives (WQOs) set by Environmental Protection Department (EPD). This consists of a review of the EPD routine water quality monitoring data for the dry season period (November to March) of 2006 - 2015 from stations in the Northwestern Water Control Zone (WCZ), where the ESC CMPs are located (1). For Salinity, the averaged value obtained from the Reference (Upstream) station was used for the basis as the WQO. Levels of Dissolved Oxygen (DO) and Turbidity were also assessed for compliance with the Action and Limit Levels (see Table B1 of Annex B for details).

In-situ Measurements

1.5.4 Analyses of results for January 2017 indicated that levels of DO and pH complied with the WQOs at both Downstream and Upstream stations (*Table B2* of *Annex B*). In addition, DO and Turbidity at all stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).

Laboratory Measurements for Suspended Solids (SS)

- 1.5.5 Analyses of results for January 2017 indicated that the SS levels compiled with the WQO at both Upstream and Downstream stations. In addition, SS levels for both Upstream and Downstream stations complied with the Action and Limit Levels (*Tables B1* and *B2* of *Annex B*).
- 1.5.6 Overall, the monitoring results indicated that the mud disposal operation at ESC CMP Vd did not appear to cause any deterioration in water quality during this reporting period.

1.5.7 Routine Water Quality Monitoring of ESC CMPs - January 2017

1.5.8 Routine Water Quality Monitoring of ESC CMPs was undertaken on 5 January 2017. The monitoring results have been assessed for compliance with the WQOs (see Section 1.5.3 for details). The monitoring results are shown in Tables B3 and B4 of Annex B and Figures 1 - 10 of Annex C. A total of ten (10) monitoring stations were sampled in January 2017 as shown in Figure 1.2.

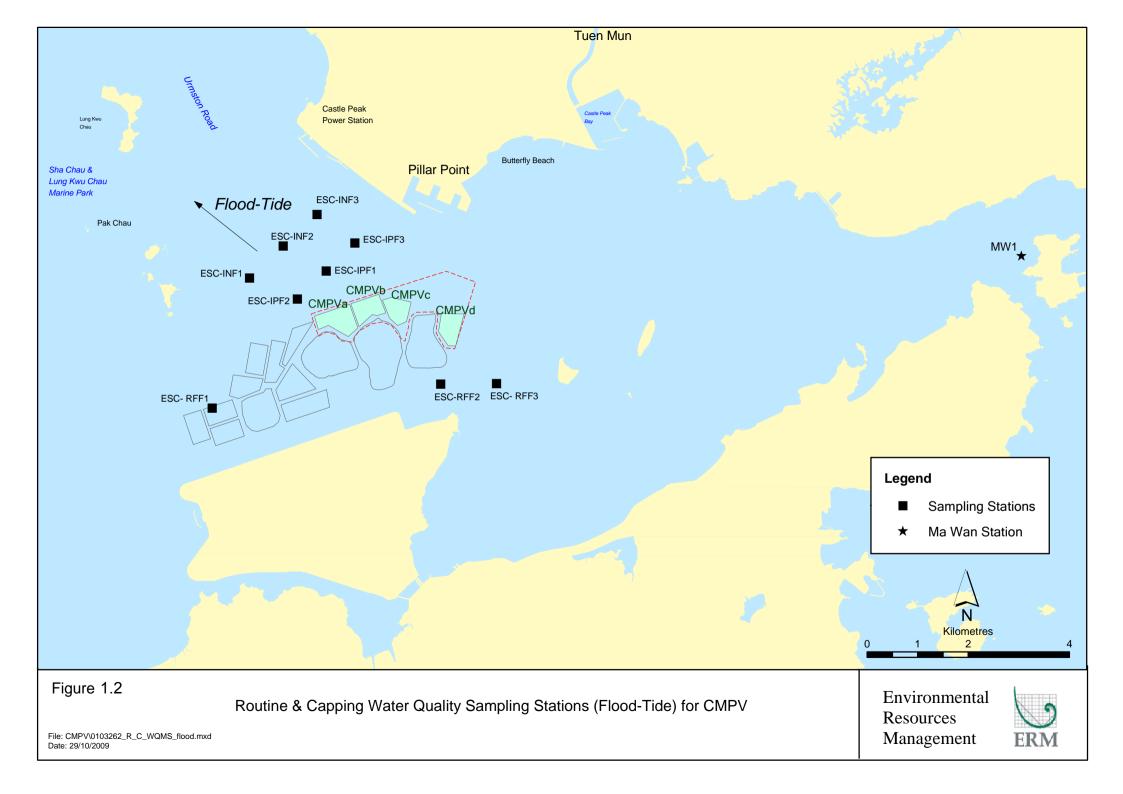
In-situ Measurements

- 1.5.9 Graphical presentation of the monitoring results (Temperature, DO, pH, Salinity and Turbidity) is shown in *Figures 1 6* of *Annex C*. Analyses of results for January 2017 indicated that the levels of pH, Salinity and DO complied with the WQOs at all stations (Impact, Intermediate, Reference and Ma Wan stations) in January 2017 (*Table B3* of *Annex B*; *Figures 1*, 3 and 5 of *Annex C*).
- 1.5.10 The levels of DO and Turbidity complied with the Action and Limit Levels at all stations (*Table B3* of *Annex B*; *Figures 3* and 6 of *Annex C*).
- 1.5.11 Overall, *in-situ* measurement results of the *Routine Water Quality Monitoring* indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable impacts in water quality in January 2017.

Laboratory Measurements

- 1.5.12 Laboratory analysis of January 2017 results indicated that concentrations of Cadmium, Chromium, Lead, Silver and Mercury were below their limit of reporting at all stations. Arsenic, Nickel, Copper and Zinc were detected in January 2017 samples and the concentrations of these metals and metalloids were similar amongst stations (*Table B4* of *Annex B*; *Figure 7* of *Annex C*).
- 1.5.13 For nutrients, concentrations of Total Inorganic Nitrogen (TIN) at Reference and Intermediate stations in January 2017 were higher than the WQO (0.5 mg/L) (*Table B4* of *Annex B*; *Figure 8* of *Annex C*). It should be noted that due to the effect of Pearl River, the North Western WCZ has historically experienced higher levels of TIN (1). Therefore, the exceedances of TIN WQO at these stations are unlikely to be caused by the disposal operation at ESC CMP Vd. Concentrations of Ammonia Nitrogen (NH₃-N) were relatively similar amongst all stations (*Table B4* of *Annex B*; *Figure 8* of *Annex C*). Levels of 5-day Biochemical Oxygen Demand (BOD₅) appear to be higher at Impact stations in January 2017 (*Table B4* of *Annex B*; *Figure 9* of *Annex C*).
- 1.5.14 Analyses of results for January 2017 indicated that the SS levels at Reference stations were higher than the WQO (13.2 mg/L for dry season), however SS levels at all stations complied with the Action and Limit Levels (*Tables B1 and B4* of *Annex B*; *Figure 10* of *Annex C*).

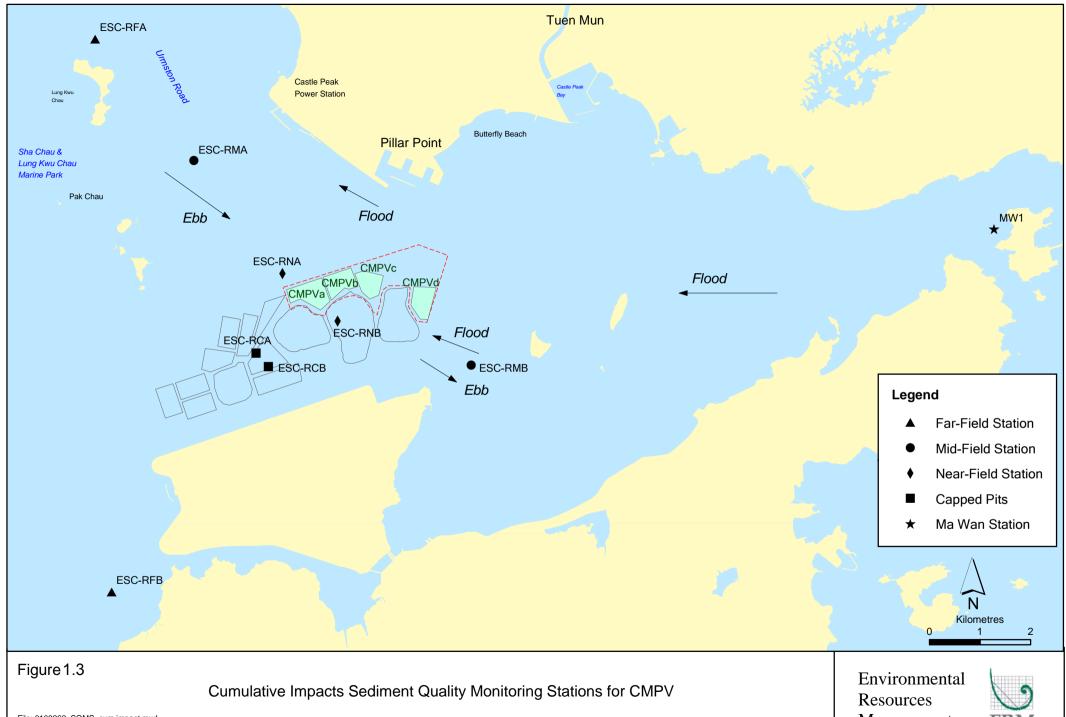
⁽¹⁾ http://www.epd.gov.hk/epd/misc/marine_quality/1986-2005/textonly/eng/index.htm



- 1.5.15 Overall, results of the *Routine Water Quality Monitoring* indicated that the disposal operation at ESC CMP Vd did not appear to cause any unacceptable deterioration in water quality in January 2017. Detailed statistical analysis will be presented in the Quarterly Report to investigate any spatial and temporal trends of potential concern.
- 1.5.16 Cumulative Impact Sediment Chemistry of ESC CMPs December 2016
- 1.5.17 Monitoring locations for *Cumulative Impact Sediment Chemistry for ESC CMPs* are shown in *Figure 1.3*. A total of nine (9) monitoring stations were sampled in December 2016.
- 1.5.18 Analyses of results for the *Cumulative Impact Sediment Chemistry Monitoring* indicated that the concentrations of all inorganic contaminants were below the Lower Chemical Exceedance Level (LCEL) in December 2016 (*Figures 11* and 12 of *Annex C*).
- 1.5.19 For organic contaminants, concentrations of Total Organic Carbon (TOC) were observed to be similar amongst all stations (*Figure 13* of *Annex C*). Concentrations of Tributyltin (TBT) were recorded to be higher at Ma Wan station (*Figure 14* of *Annex C*). Low and High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs), Total Polychlorinated Biphenyls (PCBs), Total dichloro-diphenyl-trichloroethane (DDT) and 4,4'-dichlorodiphenyldichloroethylene (DDE) concentrations were recorded below the limit of reporting at all stations.
- 1.5.20 Overall, there is no evidence indicating any unacceptable environmental impacts to sediment quality as a result of the contaminated mud disposal operations at ESC CMP Vd in December 2016. Statistical analysis will be undertaken and presented in the quarterly report to investigate whether there are any unacceptable impacts in the area caused by the contaminated mud disposal.

1.6 ACTIVITIES SCHEDULED FOR THE NEXT MONTH

- 1.6.1 The following monitoring activities will be conducted in the next monthly period of February 2017 for ESC CMPs:
 - Water Column Profiling of ESC CMP Vd;
 - Routine Water Quality Monitoring of ESC CMPs;
 - Cumulative Impact Sediment Chemistry of ESC CMPs;
 - Pit Specific Sediment Chemistry of ESC CMP Vd;
 - Sediment Toxicity Test of ESC CMPs; and
 - *Demersal Trawling of ESC CMPs.*



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- 1.6.2 No monitoring activities are scheduled in the next monthly period of February 2017 for SB CMPs.
- 1.6.3 The sampling schedule is presented in *Annex A*.
- 1.7 STUDY PROGRAMME
- 1.7.1 A summary of the Study programme is presented in *Annex D*.

Annex A

Sampling Schedule

| Annex A1 - Environmental Monitor | ing unu Auuit su | mpun | | ie Jor | East of S | Snu Cnuu | i (Septer | | | uurg 2017) | | | | | | 204 | | | | | | | | | | | | | | | | | 204.6 | | | | |
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| | ESC-TSB | | | | * | | | | * | | | | | | | | | | | | | | | | | | | | _ | | | | | * | | | |
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| Annex A1 - Environmental Monitorin | g and Audit Sampling Schedul | e for East of Sha Chau (Se | eptember 2012 - February 2017) |
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| Semigricul provinting of the p | Annex A1 - Environmental Monito | oring ana Auait S | sampun | | | or East | of Sha (| Chau (S | septen | | 2 - Febri | uary 20 | 17) | | | | | 201 | 1 | | | | | | | 20 | 04 F | | | | | | | 2016 | - | | | | 2015 |
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| 148 | Upstream/Reference Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 18 | Downstream/Impact Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Figure F | Reference Station | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Figure F | | ESC-RFE1 | | | | | | | | | | | * | | * | | | * | * | | | * | | * | | * | * | | | * | * | | | | | | | | |
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| Impact Station SC-IPT | | MW1 | | | | | | | | | | | * | | * | | | * | * | | | * | | * | | * | * | | | * | * | | | | | | | | |
| FSC-IPF1 | Flood Tide | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FSC-IPF1 | Impact Station | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ESC-IPF3 | • | FSC-IPF1 | | | | 1 | | | | | | | * | | * | | | * | * | | | * | | * | | * | * | | | * | * | | | | | | | | |
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Annex A1 - Environmental Monitoring and Audit Sampling Schedule for East of Sha Chau (September 2012 - February 2017)

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| | ESC-IPE4 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | 1 |
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| Reference Station | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 1 1 | 1 1 | | | | | | ٦ |
| | ESC-RFE1 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | ٦ |
| | ESC-RFE2 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | 1 | * * | | * | * | * | * | * * | ٦ |
| | ESC-RFE3 | | * * | | * * | | * | * | * | * | | | | | | | | | | 1 | | | | | | | | | | * * | 1 1 | * | * | * | * | * * | ٦ |
| | ESC-RFE4 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | ٦ |
| | ESC-RFE5 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | ٦ |
| Ma Wan Station | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ٦ |
| | MW1 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | |
| Flood Tide | | | | • | | | | | | | | | <u>'</u> | | | | <u> </u> | | | <u>'</u> | | | <u>'</u> | <u> </u> | <u> </u> | <u>'</u> | <u> </u> | <u> </u> | | | <u> </u> | | | | | | |
| Impact Station | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ESC-IPF1 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | ٦ |
| | ESC-IPF2 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | ٦ |
| | ESC-IPF3 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | |
| Intermediate Station | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | † † | | | | | | 1 |
| | ESC-INF1 | | * * | | * * | | * | * | * | * | | 1 1 | | | | | | | | | | | | | | | | | | * * | 1 1 | * | * | * | * | * * | ٦ |
| | ESC-INF2 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | 1 | | | | 1 | | | | * * | † † | * | * | * | * | * * | 1 |
| | ESC-INF3 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | |
| Reference Station | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ESC-RFF1 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | |
| | ESC-RFF2 | | * * | | * * | | * | * | * | * | | | | | | | | | | | | | | | | | | | | * * | 1 1 | * | * | * | * | * * | 1 |
| | ESC-RFF3 | | * * | | * * | | * | * | * | * | | 1 1 | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | 7 |
| Ma Wan Station | | | | | | | | | | | | 1 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MW1 | | * * | | * * | | * | * | * | * | | 1 1 | | | | | | | | | | | | | | | | | | * * | | * | * | * | * | * * | 7 |
| | | | | 1 | | - | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | _ |

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

| | | | | 2012 | | | | | | | 2013 | | | | | | | | | 203 | 14 | | | | | | | | | 2015 | | | | | | | | | | 20 | 016 | | | | | |
|---------------------------------------|-------------|---------------------------------------|----------|--------|-----|--|-------------|---|----------------|---|----------|----|--|------|----------|------------------------------------|---------------|----------|------|-----|------|----------|------------------------------|--------|--|------|--------------|--------|---|--------------|----------------|----------|--------------|--|----|--------------|---------------|--------------|---------------|---------------|--|-------------|------------------------------|---------------|---------------|----------|
| Baseline Monitoring Prior to Dredging | Code | Frequency | I A | S 0 | | D | J F | M | Α | | | | S | 0 1 | N D | J | F | M A | M | | | A | $\mathbf{S} \mid \mathbf{O}$ | O N | D | J | FIN | и А | M | | A | S | 0 | N | D | Ţ | FIN | Л А | M | | 010 J | A | $\mathbf{s} \mid \mathbf{o}$ | N | D | |
| ar Field Stations | 2000 | | , , | | | | - | | | | , , | | | | | | | | | , | , | | | | | , - | | | | , . | | | | | | , | | | | + | + | — | + | +- | + | 一 |
| | SB-WFA | 3 days per week for 4 weeks | * * | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | + | \vdash | \neg | + | + | + | 十 |
| | SB-WFB | 3 days per week for 4 weeks | * * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | \top | + | \vdash | - | \top | + | | 十 |
| Mid Field Stations | | T T T T T T T T T T T T T T T T T T T | | | | | | | | | | | t | | | | | | | | | | | | | | | | 1 1 | | | 1 | | | | | | | + | + | + | - | + | + | + | 十 |
| | SB-WMA | 3 days per week for 4 weeks | * * | | | | | | | | | | | | | | | | | | | | | | | | | | 1 1 | | | 1 | | | | | | | + | + | + | - | + | + | + | 十 |
| | SB-WMB | 3 days per week for 4 weeks | * * | + + | | | | + | | | + | | t | | | | | | | | | | | | | | _ | | | | | + | | | | | _ | | + | + | + | - | $\overline{}$ | + | + | 十 |
| Near Field Stations | OD WIND | 5 days per week for 1 weeks | | + + | + | | | 1 | \vdash | | + | | + | | + | | -+ | - | + | | | - | + | + | + | | - | | | | | ╁ | 1 | \vdash | | | - | - | + | +- | + | - | + | + | + | 十 |
| vear rela stations | SR_W/NI A A | 3 days per week for 4 weeks | * * | + + | | | | | | | + | | \vdash | | \dashv | | -+ | - | + | | | - | + | | | | + | | 1 1 | - | | ╁ | <u> </u> | \vdash | | | + | - | + | +- | + | -+ | + | + | + | + |
| | | | * * | + + - | | | | | | | - | | \vdash | | | | - | | | | | | | | | | + | | | | | 1 | | | | | + | - | + | +- | +-+ | -+ | $\overline{}$ | + | + | + |
| | SB-WNBA | 3 days per week for 4 weeks | * * | | | | | | \vdash | | - | | + | | + | | - | | + | | | | - | + | + | | | | | | | + | <u> </u> | \vdash | | | | - | + | + | + | -+ | + | + | + | + |
| | | 3 days per week for 4 weeks | * * | | + | \vdash | | | | | - | | \vdash | | | - | - | | | | | - | _ | + | + | | - | | | | | - | | \vdash | | | - | - | + | + | + | - | + | + | + | + |
| Reference Stations | 3D-WINDD | 3 days per week for 4 weeks | \vdash | + | + | | | | | | - | | \vdash | | | - | - | | | | | - | _ | + | + | | - | | | | | + | | \vdash | | | - | - | + | + | + | -+ | + | + | + | + |
| Reference Stations | NM1 | 2 dans man areal, for 4 areals | * * | | - | | | | | | - | | | | | - | - | | | | | | - | | 1 | | - | | | | | 1 | | | | | | | + | +- | + | -+ | + | $+\!\!-$ | + | + |
| | | 3 days per week for 4 weeks | | | _ | \vdash | | | \vdash | | _ | | \vdash | | | - | | | - | | | _ | _ | | + | | _ | | + | | | 1 | | | _ | | _ | | + | + | + | - | + | + | + | + |
| | NM2 | 3 days per week for 4 weeks | * * | | | | | | | | _ | | \vdash | | | | | | | | | _ | | - | - | | _ | | 1 | | | <u> </u> | | | | | _ | | + | — | + | - | + | $+\!\!-$ | — | + |
| | NM3 | 3 days per week for 4 weeks | * * | | | | | | | | | | | | | | | | | | | | | _ | | | | | 1 1 | | | | | | | | | | — | | + | $-\!\!\!+$ | + | | | _ |
| | NM5 | 3 days per week for 4 weeks | * * | | | | | | | | | | \sqcup | | | | | | | | | | | | | | _ | | | | | <u> </u> | | | | | _ | | | ┷ | \bot | | | — | | 4 |
| | NM6 | 3 days per week for 4 weeks | * * | \bot | 1 | igspace | | 1 | \sqcup | | | | \sqcup | | | $\downarrow \downarrow \downarrow$ | | | 1 | | | | | | $oxed{igspace}$ | | \perp | | + | | | <u> </u> | 1 | | | | \perp | | 4 | — | + | | \bot | | 4 | |
| Sensitive Receiver Stations | | | | | | | | | $oxed{oxed}$ | | | | \sqcup | | | | | | | | | | | | | | | | | | | | | igsqcut | | | | | | \bot | \sqcup | \bot | \perp | Д_ | | |
| | MW1 | 3 days per week for 4 weeks | * * | | | | | | $\coprod J$ | | | | ШĬ | | | | | | | | | | | | $oldsymbol{ol}}}}}}}}}}}}}}}}$ | | | | | | | | | ШĬ | | | | | | | $oxed{oxed}$ | | | | | |
| | THB1 | 3 days per week for 4 weeks | * * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | THB2 | 3 days per week for 4 weeks | * * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | T | | | | | | П |
| | WSR45C | 3 days per week for 4 weeks | * * | | | | | | | | | | \sqcap | | | | | | | | | | | | | | | | | | | | | | | | | | \top | | \Box | \top | \top | \top | T | \top |
| | WSR46 | 3 days per week for 4 weeks | * * | | | | | 1 | | | \neg | | 1 1 | | | 1 1 | | | 1 | | | \neg | | \neg | 1 1 | | \neg | | 1 1 | | i | 1 | 1 | | | | \neg | \neg | \top | T | \Box | \neg | \top | \top | 1 | \top |
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| mpact Monitoring for Dredging | | | JA | SO | N | D | J F | M | A | M | JI | Α | S | 0 | N D | J | F 1 | M A | M | J | J | A S | $\mathbf{S} \mid \mathbf{C}$ | O N | D | JI | FIN | И А | M | J | A | S | О | N | D | J | FIN | Л А | M | [] | I | A | $S \mid O$ | N | D | |
| Jpstream Stations | | | | | | | | | | | , , | | | | | | | | | | , | | | _ | | , | _ | | | , | | | | | | , | _ | | $\overline{}$ | + | | - | $\overline{}$ | $\overline{}$ | $\overline{}$ | 干 |
| 5 post-cum c unito 110 | US1 | 3 days per week | | | * | * | * * | * | * | * | * * | * | * | * | * * | * | * | * * | * | * | * | * : | * * | * * | | | - | | 1 1 | | | 1 | | | | | - | | + | + | + | - | + | + | + | 十 |
| | US2 | 3 days per week | | + + | * | | | * | | * | * * | * | * | * | * * | * | * | * * | * | * | * | * : | * * | * * | + + | | + | | + + | | | + | | \vdash | | | - | - | + | + | + | -+ | + | + | + | 十 |
| Downstream Stations | 032 | 3 days per week | \vdash | + + | + | \vdash | | + | \vdash | | - | | + | | - | | - | | + | | | - | - | - | + | | + | | + | | | + | | \vdash | - | - | + | - | + | +- | + | - | + | + | + | + |
| Jownstream Stations | DC1 | 2 dans an an anal. | \vdash | | * | * | * * | * | * | * | * * | * | * | * | * * | * | * | * * | * | * | * | * ; | * * | * * | - | | | | + | | | 1 | | | | _ | | | + | +- | + | -+ | + | +- | + | + |
| | DS1 | 3 days per week | \vdash | + + | | | | | | | | | * | | * * | * | | * * | | * | * | | | 4 4 | 1 | | - | | 1 1 | | | - | | \vdash | | | _ | _ | + | +- | + | -+ | - | + | + | + |
| | DS2 | 3 days per week | | + | * | | * * | | | | | * | | | * * | * | | | | | | * ' | * * | * * | | | | | 1 1 | | | | | | | | | | | | + | $-\!\!\!+$ | + | — | | _ |
| | DS3 | 3 days per week | | | * | | * * | | | | | * | * | | * * | * | | | * | | * | * ; | * * | * * | | | | | | | | | | | | | | | | | \bot | | | | | |
| | DS4 | 3 days per week | | | * | * | | | | | | | * | * | * * | * | * | | | | * | * : | * * | * * | | | | | | | | | | | | | | | | Ш_ | \perp | | | | | Ш. |
| | DS5 | 3 days per week | | | * | * | * * | * | * | * | * * | * | * | * | * * | * | * | * * | * | * | * | * : | * * | * * | | | | | | | | | | | | | | | | | | | | | | |
| Sensitive Receiver Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MW1 | 3 days per week | | | * | * | * * | * | * | * | * * | * | * | * | * * | * | * | * * | * | * | * | * : | * * | * * | | | | | | | | | | | | | | | | 1 | | | | T | | |
| | THB1 | 3 days per week | | | * | * | * * | * | * | * | * * | * | * | * | * * | * | * | * * | * | * | * | * : | * * | * * | | | | | | | | | | | | | | | \top | \top | 1 | | | \top | \top | 十 |
| | THB2 | 3 days per week | | | * | * | * * | * | * | * | * * | * | * | * | * * | * | * | | | | | | | * * | | | | | | | | | | | | | | | \top | | \vdash | \neg | \top | \top | _ | \top |
| | WSR45C | 3 days per week | | † † | | * | | | | | | | * | | | * | | | * | | | * : | | * * | | | | | 1 1 | | | | | | | | | | + | + | + | - | + | + | + | 十 |
| | WSR46 | 3 days per week | | | | | * * | | | | | * | * | * | * * | * | * | | * | | * | * : | * * | * * | | | + | | | | | | | | | | | | + | + | + | - | + | + | + | + |
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Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

| | | | | | 012 | | | | | 2013 | | | | | | | | 2014 | | | | | | 2015 | | | | | 201 | 6 | | | 2 |
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| Cumulative Impact Sediment Chen | nistry | | J | A S | | N D | J | F | M A | M J J | AS | 0 | N D | J | F | M A | M | | A | S O N D | J F | MA | M | | | S O | N I | D J F M A | | | S |) N | |
| Near-field Stations | · | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RNA | 4 times per year | | | | | | | | | 12 | | 12 | 2 | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | 2 12 | | | | | |
| | SB-RNB | 4 times per year | | | | | | | | | 12 | | 12 | | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | 2 12 | | | | | |
| Mid-field Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RMA | 4 times per year | | | | | | | | | 12 | | 12 | | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | | | | | | |
| | SB-RMB | 4 times per year | | | | | | | | | 12 | | 12 | 2 | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | 2 12 | | | | | |
| Far-Field Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFA | 4 times per year | | | | | | | | | 12 | | 12 | | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | | | | | | |
| | SB-RFB | 4 times per year | | | | | | | | | 12 | | 12 | 2 | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | 2 12 | | | | | |
| Capped Pit Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RCA | 4 times per year | | | | | | | | | 12 | | 12 | | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | | 2 12 | | | | | |
| | SB-RCB | 4 times per year | | | | | | | | | 12 | | 12 | 2 | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | 2 12 | | | | | |
| Sensitive Receiver Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MW1 | 4 times per year | | | | | | | | | 12 | | 12 | | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | | | | | | |
| | THB1 | 4 times per year | | | | | | | | | 12 | | 12 | | 12 | | _ | 12 | 12 | 12 | 12 | | _ | 12 | 12 | | 1 | | | | | | |
| | THB2 | 4 times per year | | | | | | | | | 12 | | 12 | - | 12 | | | 12 | 12 | 12 | 12 | | | 12 | 12 | | 1 | 2 12 | | | | | |
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| Reference South Demersal Trawling | TNA TNB TSA TSB | 2 times per year 2 times per year 2 times per year 2 times per year 5 4 times per year | J | A S | 0 | N D | D J | F | M A | M J J | 5 | 5 O | N D | J 5 | * * * * * * * * * * * * * * * * * * * | M A | M | J J | * | | * * | M A | M M | | * * * * * 5 5 5 | S O | N | * | M J | J A | S | D N | D J |
| Reference South Demersal Trawling Impact | TNA TNB TSA TSB | 2 times per year 2 times per year 2 times per year 2 times per year | J | A S | 0 | N D |) J | F | M A | M J J | | 5 O | N D | J 5 | * * * * * * * * * * * * * * * * * * * | M A | M | J J 5 5 5 | * | | * * * J F | M A | M | | * * * * * | S O | N 1 | * * * * * * * * * * * * * * * * * * * | M J | J A | S | D N | D J |
| Reference South Demersal Trawling Impact | TNA TNB TSA TSB SB-INA 1-5 | 2 times per year 2 times per year 2 times per year 2 times per year 4 times per year 4 times per year | J | A S | 0 | N D | | F | M A | M J J | 5 5 | 6 O | N D | 5 5 | * * * * * * * * * * * * * * * * * * * | M A | M | J J 5 5 | * | | * * * * * 5 5 5 5 | M A | M | 5 | * * * * * 5 5 5 5 | S O | N | * * * * * * * * * * * * * * * * * * * | M J | J A | S | D N | D J |
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Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

| | | | | | 2012 | | | | | 20 | 013 | | | | | | | | 2014 | | | | | | | | 2015 | 5 | | | | | | | | 2 | 2016 | | | | | 2017 |
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| | SB-IPE3 | 8 times per year | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 8 | | 8 | 8 | 8 | 8 | 3 8 | _ | 8 8 | | 8 8 | ; | 8 | 8 | | 8 | | \top | + | + | | \top | + | \neg | + |
| | SB-IPE4 | 8 times per year | | | | | | | | | | 8 | 8 | 8 | 8 | 8 | 8 | 8 8 | | 8 | 8 | 8 | 8 | 3 8 | | 8 8 | | 8 8 | ; | 8 | | | 8 | | \top | + | + | | \neg | + | \neg | + |
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| | SB-RFF3 | 8 times per year | | | + | | | | | | | 8 | 8 | | 8 | | | 8 8 | | 8 | 8 | 8 | | 3 8 | | 8 8 | + | 8 8 | - | 8 | | | 8 | | + | + | + | \vdash | - | + | 一十 | + |
| Sensitive Receiver Stations | 22 1410 | o mines per year | | \vdash | | | | + | \vdash | - | 1 1 | | + + + | | | | + | | + | + + | | | ——— | | + + | | \vdash | | + | | | + | + | + | + | + | + | \vdash | + | + | + | + |
| Sending Checker Change | MW1 | 8 times per year | | \vdash | | | | + | | - | | 8 | 8 | 8 | 8 | 8 | 9 | 8 8 | 8 | 8 | 8 | 8 | | 8 8 | + + | 8 8 | | 8 8 | + | 8 | 8 | R | 8 | + | + | + | + | + | + | + | + | + |
| | THB1 | 8 times per year | | \vdash | | | | + | \vdash | - | | 8 | 8 | | 8 | | | 8 8 | | 8 | _ | 8 | | 8 8 | | 8 8 | | 8 8 | | 8 | | | 8 | + | + | + | + | \vdash | + | + | + | + |
| | THB2 | 8 times per year | | \vdash | | | | + | \vdash | - | 1 1 | 8 | | | 8 | | | 8 8 | | 8 | | 8 | | 8 8 | | 8 8 | | 8 8 | | 8 | | | 8 | ++ | + | + | + | \vdash | + | + | + | + |
| | WSR45C | 8 times per year | | | \dashv | | | | | _ | | 8 | 8 | 8 | 8 | | | 8 8 | | 8 | 8 | 8 | | 8 8 | | 8 8 | | 8 8 | | 8 | | | 8 | + | + | + | + | \vdash | + | + | + | + |
| | WSR46 | 8 times per year | | \vdash | | | | + | \vdash | - | \dagger | 8 | _ | 8 | 8 | _ | | 8 8 | | 8 | 8 | 8 | | 8 8 | | 8 8 | \vdash | 8 8 | | 8 | | | 8 | + | + | + | + | \vdash | + | + | + | + |
| | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | o mines per year | | | <u> </u> | | | | | 1 | | Ŭ | 1 0 1 | Ü | Ü | Ŭ | | | | l ~ l | - 1 | Ü | | | 1 1 | | <u> </u> | J (| <u> </u> | U | Ü | | | | | | ш | | | | | — |
| Water Column Profiling | | | Ţ | Α | $S \mid O \mid$ | N D | I F | Е М | Α | M J | I | AS | 0 | N D |) I I | F | M | A M | I I I | Α | s o | N | D | I F | M | A M | Ţ | T I A | S | 0 | N | DI | F | M | AIN | л I | I | A | $S \mid C$ | O N | D | |
| Plume Stations | WCP1 | Monthly | , | | | | | -7- | | - | , | | | | | | | 4 4 | - | | | | | | | | | | | | | | | | — | | + | | 1 | + | 一 | 一 |
| | WCP2 | Monthly | | \vdash | | | | + | | - | 1 1 | 4 4 | | | | | | 4 4 | | 4 | | | | | | 4 4 | | _ | | 4 | | | 4 | | + | + | + | + | + | + | + | + |
| | 11012 | 1/10111111 | | | | | | | | | | . 1 | 1 | | | • | | | - 1 · | - 1 | - I | 1 * | - | · ' | | | | * ' | | 1 | • | | | للثلا | | | لسل | للسلا | | | | |

Annex A2 - Environmental Monitoring and Audit Sampling Schedule for South of The Brothers (July 2012 - February 2017)

| | | | | 201 | 2 | | | | 2013 | 3 | | | | | | | 201 | 14 | | | | | | | 2015 | | | | | | | 2016 | } | | | | 2017 |
|-----------------------------------|---|--------------------------------------|------------------|--|----------------|--|-------|------------------|------|-----|-------------------------|----------------|-----|-----|----------|--------------|------------------------------------|----|---------|---|-------|-----|-------|---------|------|------------------|-------|--|-------|---------|--------------------|------|-------|--|--------|----|---|
| Capping Water Quality Monitoring | | | ΤΔ | | | DI | F M | А М | | | S | 0 N | ı D | I F | М | | | | A S (| | D I | F | M A | М | | Δ | s o | N | D 1 | I F M | | | | S |) N | D | |
| Ebb Tide | | | J | 1 3 | O N | D J | I IVI | A WI | J . | JA | 5 | O I | | J I | 141 | A | J | J | A 5 (| | D J | T | IVI A | 141 | J J | Α | 3 0 | 14 | | 1 141 | A W | J | JA | 3 (| J N | | J 1 |
| Impact Stations Downcurrent | | | | + + | | | | | | | | | | | | | | | + + | + + | | | | | | | | | | ++- | ++- | | | | | | |
| 1 | SB-IPE1 | 4 times per year | | | | | | | | | | | | | | | | | | 1 1 | 3 | 3 | | | 3 | 3 | | 1 1 | 3 | 3 | | 3 | 3 | | | 3 | \neg |
| | SB-IPE2 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | + | 3 | 3 | | | 3 | |
| | SB-IPE3 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | + | 3 | 3 | | | 3 | |
| | SB-IPE4 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | 1 1 | 3 | 3 | + | 3 | 3 | | | 3 | |
| | SB-IPE5 | 4 times per year | | 1 1 | _ | | + + + | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | 1 1 | 3 | 3 | 1 | 3 | 3 | | | 3 | |
| Intermediate Stations Downcurrent | | F <i>y</i> | | | | | | | | | 1 | | | | 1 1 | | 1 1 | | | | | | | | | + + | | | | | ++ | + + | | | | | |
| | SB-INE1 | 4 times per year | | | | | | | | | 1 | | | | 1 1 | | 1 1 | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | ++ | 3 | 3 | | | 3 | - |
| | SB-INE2 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | 1 | 3 | 3 | | 1 1 | 3 | 3 | ++ | 3 | 3 | | | 3 | \rightarrow |
| | SB-INE3 | 4 times per year | | + | - | + + | + + + | | | | | | + + | | + | | + | | | ++++ | 3 | 3 | | + | 3 | 3 | | | 3 | 3 | ++ | 3 | 3 | | | 3 | - |
| | SB-INE4 | 4 times per year | | +++ | | | + + + | | | | + + | | + + | | | | + + | | | | 3 | 3 | | | 3 | 3 | | + + | 3 | 3 | ++- | 3 | 3 | | | 3 | $\overline{}$ |
| | SB-INE5 | | | - | | + | + + + | | | | + + | | - | | | | + + | | | | 2 | 2 | | - | 2 | 3 | | + + | 2 | 3 | + | 3 | 2 | | | 2 | - |
| Defended Claffer Historian | SD-IIVES | 4 times per year | | - | | | + + + | | | | + + | | | | | | + + | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | +-+ | 3 | 3 | | | 3 | -+- |
| Reference Stations Upcurrent | CD DEE4 | 4 | | + | _ | + | | | | | + | | _ | | | | + | | | | 2 | - 2 | | | 2 | + | | + | _ | | ++ | 1 2 | | - | - | | - |
| | SB-RFE1 | 4 times per year | | + | | | | | | | + | | | | + | | + | | + | \dashv | 3 | 3 | | | 3 | 3 | | + | 3 | 3 | ++ | 3 | 3 | | _ | 3 | \longrightarrow |
| | SB-RFE2 | 4 times per year | | \dashv | | | + | | | | \downarrow | | + | | \perp | $oxed{oxed}$ | $\downarrow \downarrow \downarrow$ | | + | \dashv | 3 | 3 | | \perp | 3 | 3 | | \bot | 3 | 3 | + | 3 | 3 | $oxed{oxed}$ | | 3 | \longrightarrow |
| | SB-RFE3 | 4 times per year | | \perp | | | | | | | | | | | | | | | \bot | \rightarrow | 3 | 3 | | | 3 | 3 | | | 3 | 3 | \bot | 3 | 3 | | \bot | 3 | \longrightarrow |
| | SB-RFE4 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| | SB-RFE5 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| Sensitive Receiver Stations | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | MW1 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| | THB1 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| | THB2 | 4 times per year | | 1 1 | | | 1 1 | | | | 1 1 | | | | | | 1 1 | | | 1 1 | 3 | 3 | | 1 1 | 3 | 3 | | 1 1 | 3 | 3 | + | 3 | 3 | | | 3 | |
| | WSR45C | 4 times per year | | | | | 1 1 1 | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | ++- | 3 | 3 | | | 3 | |
| | WSR46 | 4 times per year | | + + | - | | + + + | | - | | + + | | + + | | | | + + | | | + + | 3 | 3 | | 1 | 3 | 3 | | + + | 3 | 3 | ++ | 3 | 3 | | | 3 | |
| Flood Tide | *************************************** | r tillies per year | | + + | - | | + + + | | | | + + | | | | | | | | | | | | | | | | | + + | | | + | | | | | | |
| Impact Stations Downcurrent | | | | + | - | + | + + + | _ | | | + + | | + + | | + | | + | _ | | ++++ | - | + | | + + | - | + | | + + | - | | ++ | + | | \vdash | - | | |
| impact stations Downcurrent | CD IDE1 | 4.6 | | - - | | | + + + | | | | + + | | | | | | + + | | | | _ | - | | | 2 | + - + | | | 2 | 3 | +-+ | 3 | | | | 2 | ' |
| | SB-IPF1 | 4 times per year | | + | _ | | | | | | + | | _ | | | | + + | | | | 3 | 3 | | | 3 | 3 | | + | 3 | 3 | ++ | 3 | 3 | | - | 3 | ' |
| | SB-IPF2 | 4 times per year | | | | + + | | | | | + | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | + | 3 | 3 | | | 3 | |
| | SB-IPF3 | 4 times per year | | | | | | | | | + | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | ++ | 3 | 3 | | | 3 | |
| Intermediate Stations Downcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | \perp | | | _ | | \bot | | | | | | |
| | SB-INF1 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | \perp | 3 | 3 | | | 3 | |
| | SB-INF2 | 1 3 | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| | SB-INF3 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| Reference Stations Upcurrent | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SB-RFF1 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| | SB-RFF2 | 4 times per year | | | | | | | | | | | | | | | | | | | 3 | 3 | | | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | |
| | SB-RFF3 | 4 times per year | | | \neg | | | | | | 1 1 | | | | | | 1 1 | | 1 1 | \neg | 3 | 3 | | 1 1 | 3 | 3 | | | 3 | 3 | | 3 | 3 | | | 3 | \neg |
| Sensitive Receiver Stations | | • • | | 1 1 | 1 | | | 1 | | | 1 1 | | | | | | | | 1 | 1 1 | | | | | | | | | | | + | | | | | | \neg |
| | MW1 | 4 times per year | | + + | 1 | + + | + + + | | | | 1 1 | | + + | | + | | \dagger | | ++ | + + | 3 | 3 | | + + | 3 | 3 | | 1 1 | 3 | 3 | ++ | 3 | 3 | | 1 | 3 | |
| | THB1 | 4 times per year | | + + | | | + + + | - | | | + + | | + + | | | | + | | ++ | ++ | 3 | 3 | | + + | 3 | 3 | | 1 1 | 3 | 3 | ++ | 3 | 3 | | 1 | 3 | $\overline{}$ |
| | THB2 | 4 times per year | | ++ | \dashv | + + | + + + | _ | | _ | + + | + | + + | | + + | | + + | | ++ | ++ | 3 | 3 | | + + | 3 | 3 | _ | + | 3 | 3 | ++ | 3 | 3 | | + | 3 | + |
| | WSR45C | 4 times per year 4 times per year | | + | -+ | + + | + + + | | | _ | + + | -+ | + + | | + - | \vdash | + | | + | + | 3 | 3 | | + + | 3 | 2 | _ | + | 3 | 3 | + | 3 | 2 | | - | 3 | + |
| | WSR46 | | | + | \dashv | + | + + + | | | | + | + | + + | | + | \vdash | + | | + | + | 3 | 2 | | + | 3 | 3 | - | + $+$ | 3 | 3 | + | 3 | 2 | \vdash | + | 3 | + |
| | VV 31\40 | 4 times per year | | | | | | | | | | | | | | | | | | | J | J | | | J | J | | | J | 3 | | 3 | 3 | | | J | |
| Benthic Recolonisation Studies | | | I T I A | 1 E I | O L N | DI | EIM | A I M | T I | тІл | c | | I D | I E | M | A 1 3 / | т | Ţ | 1 C L (| O NT I | ד ת | Е | M | M | тІт | Ι Δ | e I o | NT. | י 1 ח | I E I M | A DA | т | T I A | |) I M | D | I E |
| | | | J P | 1 3 | UN | D J | F M | A W | J . | j A | 3 | UN | עיי | J F | IVI | A IV | J | J | A S (| J N | υJ | ľ | IVI A | IVI | JJ | A | 3 0 | IN | J | F M | AM | J | JA | 3 (| JN | D | JF |
| Capped Contaminated Mud Pits | CD CD : | 2.11 | | + | | | | | | _ | + | | | | + | | + | | + | \rightarrow | | | | | | 1.3 | | | | | ++ | + | | | - | 1 | $-\!$ |
| | SB-CPA | 2 times per year | | + | | | 1 1 | | | | $\downarrow \downarrow$ | | + | | \vdash | | 4 | | + | \dashv | | | | | | 12 | | | 12 | | + | | 12 | | | 12 | \longrightarrow |
| | SB-CPB | 2 times per year | | \perp | | | | | | | | | | | igspace | | \bot | | | \rightarrow | | | | | | 12 | | | 12 | | + | | 12 | | | 12 | |
| | | | | \perp | | | | | | | | | | | | | | | \bot | \rightarrow | | | | | | | | | | | \bot | | | | | | |
| Reference Stations | | | | $oldsymbol{ol}}}}}}}}}}}}}}}}}}$ | | | | | | | | | | | | | | | | $oldsymbol{oldsymbol{oldsymbol{\sqcup}}}$ | | | | | | | | | | | <u> </u> | | | | | | |
| | RBA | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | 12 | | | 12 | | | | 12 | | | 12 | |
| | RBB | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | 12 | | 1 | 12 | | | | 12 | | | 12 | |
| | RBC | 2 times per year | | | | | | | | | | | | | | | | | | | | | | | | 12 | | 1 | 12 | | | | 12 | | | 12 | |
| | | | | - | | - | • | • | • | | | - | - | • | | | _ | | | | - | - | • | - | • | | _ | | | | | | | | | | |

Notes:

[&]quot;*" = Number of replicates depends on parameters

Naming of stations are tentative only and will be subjected to changes

Annex B

Water Quality Monitoring Results

Table B1 Action and Limit Levels of Water Quality for Dredging, Backfilling and Capping Activities at ESC CMPs

| Parameter | Action Level | Limit Level |
|---|--|--|
| Dissolved Oxygen (DO) (1) | Surface and Mid-depth (2) | Surface and Mid-depth (2) |
| | 5%-ile of baseline data for surface and | 1%-ile of baseline data for surface and |
| | middle layer = 3.76 mg L-1 | middle layer = 3.11 mg L^{-1} (3) |
| | and | and |
| | Significantly less than the reference | Significantly less than the reference |
| | stations mean DO (at the same tide of | stations mean DO (at the same tide of |
| | the same day) | the same day) |
| | Bottom | Bottom |
| | 5%-ile of baseline data for bottom | The average of the impact station |
| | layers = 2.96 mg L-1 | readings are <2 mg/L-1 |
| | and | and |
| | Significantly less than the reference | Significantly less than the reference |
| | stations mean DO (at the same tide of the same day) | stations mean DO (at the same tide of the same day) |
| Depth-averaged Suspended | 95%-ile of baseline data for depth | 99%-ile of baseline data for depth |
| Solids (SS) (4) (5) | average = 37.88 mg L-1 | average = 61.92 mg L-1 |
| | and | |
| | | and |
| | 120% of control station's SS at the same | 130% of control station's SS at the same |
| | tide of the same day | tide of the same day |
| Depth-averaged Turbidity (Tby) (4) (5) | 95%-ile of baseline data = 28.14 NTU | 99%-ile of baseline data = 38.32 NTU |
| | and | and |
| | 120% of control station's Tby at the same tide of the same day | 130% of control station's Tby at the same tide of the same day |

Notes:

- (1) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (2) The Action and Limit Levels for DO for Surface & Middle layers were calculated from the combined pool of baseline surface layer data and baseline middle layer data.
- (3) Given the Action Level for DO for Surface & Middle layers has already been lower than 4 mg L-1, it is proposed to set the Limit Level at 3.11 mg L-1 which is the first percentile of the baseline data.
- (4) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- (5) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

Table B2 Water Column Profiling Results for ESC CMP Vd in January 2017

| Stations | Temp | Salinity | Turbidity | | olved ygen | pН | Suspended Solids | |
|-----------------------|-------|-------------------|-----------|--------|---------------|----------|---------------------|--|
| | (°C) | (ppt) | (NTU) | (%) | (mg L-1) | (mg L-1) | (mg L-1) | |
| WCP 1 | | | | | | | _ | |
| (Downstream) WCP 2 | 19.99 | 29.32 | 8.28 | 108.03 | 8.26 | 8.18 | 6.63 | |
| (Upstream) | 20.04 | 29.45 | 6.30 | 109.19 | 8.34 | 8.17 | 6.95 | |
| WQO (Dry season) | N/A | 26.51 - 32.40# | N/A | N/A | >4 | 6.5-8.5 | 13.2 | |

Note:

*Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Cell shaded grey indicate value exceeding the WQO.

Table B3 In-situ Monitoring Results for Routine Water Quality Monitoring of ESC CMPs in January 2017

| Sampling | Stations | Temp | Salinity | Turbidity | Dissolve | pН | |
|----------|--------------------|-------|--------------------------|-----------|----------|----------|----------|
| Period | Stations | (°C) | (ppt) | (NTU) | (%) | (mg L-1) | (mg L-1) |
| January | RFF (Reference) | 20.28 | 28.32 | 8.45 | 106.66 | 8.16 | 8.15 |
| 2017 | IPF (Impact) | 20.32 | 28.38 | 5.16 | 107.08 | 8.19 | 8.12 |
| | INF (Intermediate) | 20.35 | 27.85 | 3.97 | 107.58 | 8.25 | 8.01 |
| | Ma Wan | 20.24 | 29.22 | 3.27 | 103.66 | 7.89 | 8.12 |
| | WQO | N/A | 25.49 – 31.15# | N/A | N/A | >4 | 6.5-8.5 |

Notes:

Cell shaded yellow / red indicate value exceeding the $\mbox{\it Action/Limit}$ levels.

Cell shaded grey indicate value exceeding the WQO.

Table B4 Laboratory Results for Routine Water Quality Monitoring of ESC CMPs in January 2017

| Sampling | Stations | As | Cd | Cr | Cu | Pb | Hg | Ni | Ag | Zn | NH ₃ | TIN | BOD ₅ | SS |
|----------|----------|--------|--|--|--|--|--|--|---|--------|-----------------|--------|------------------|--------|
| Period | | (μg/L) | (μg/L) | (μg/L) | (μg/L) | (μg/L) | (μg/L) | (μg/L) | (μg/L) | (μg/L) | (mg/L) | (mg/L) | (mg/L) | (mg/L) |
| January | RFF | 2.21 | <lor< td=""><td><lor< td=""><td>0.87</td><td><lor< td=""><td><lor< td=""><td>0.67</td><td><lor< td=""><td>8.68</td><td>0.14</td><td>0.53</td><td>1.53</td><td>14.97</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td>0.87</td><td><lor< td=""><td><lor< td=""><td>0.67</td><td><lor< td=""><td>8.68</td><td>0.14</td><td>0.53</td><td>1.53</td><td>14.97</td></lor<></td></lor<></td></lor<></td></lor<> | 0.87 | <lor< td=""><td><lor< td=""><td>0.67</td><td><lor< td=""><td>8.68</td><td>0.14</td><td>0.53</td><td>1.53</td><td>14.97</td></lor<></td></lor<></td></lor<> | <lor< td=""><td>0.67</td><td><lor< td=""><td>8.68</td><td>0.14</td><td>0.53</td><td>1.53</td><td>14.97</td></lor<></td></lor<> | 0.67 | <lor< td=""><td>8.68</td><td>0.14</td><td>0.53</td><td>1.53</td><td>14.97</td></lor<> | 8.68 | 0.14 | 0.53 | 1.53 | 14.97 |
| 2017 | IPF | 1.85 | <lor< td=""><td><lor< td=""><td>0.88</td><td><lor< td=""><td><lor< td=""><td>0.99</td><td><lor< td=""><td>9.76</td><td>0.12</td><td>0.50</td><td>3.26</td><td>8.65</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td>0.88</td><td><lor< td=""><td><lor< td=""><td>0.99</td><td><lor< td=""><td>9.76</td><td>0.12</td><td>0.50</td><td>3.26</td><td>8.65</td></lor<></td></lor<></td></lor<></td></lor<> | 0.88 | <lor< td=""><td><lor< td=""><td>0.99</td><td><lor< td=""><td>9.76</td><td>0.12</td><td>0.50</td><td>3.26</td><td>8.65</td></lor<></td></lor<></td></lor<> | <lor< td=""><td>0.99</td><td><lor< td=""><td>9.76</td><td>0.12</td><td>0.50</td><td>3.26</td><td>8.65</td></lor<></td></lor<> | 0.99 | <lor< td=""><td>9.76</td><td>0.12</td><td>0.50</td><td>3.26</td><td>8.65</td></lor<> | 9.76 | 0.12 | 0.50 | 3.26 | 8.65 |
| | INF | 2.56 | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<></td></lor<> | <lor< td=""><td>7.80</td><td>0.14</td><td>0.59</td><td>2.00</td><td>8.78</td></lor<> | 7.80 | 0.14 | 0.59 | 2.00 | 8.78 |
| | Ma Wan | 2.49 | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<></td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<></td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td><lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<></td></lor<></td></lor<> | <lor< td=""><td><lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<></td></lor<> | <lor< td=""><td>6.79</td><td>0.13</td><td>0.40</td><td>2.49</td><td>5.33</td></lor<> | 6.79 | 0.13 | 0.40 | 2.49 | 5.33 |

WQO of TIN: 0.5 mg/L

Dry Season WQO of SS: 13.2 mg/L

Notes:

Cell shaded yellow / red indicate value exceeding the Action/Limit levels.

Cell shaded grey indicate value exceeding the WQO.

 $^{{}^{\}sharp}$ Not exceeding 10% of natural ambient level which is the result obtained from the Reference Station.

Annex C

Graphical Presentations

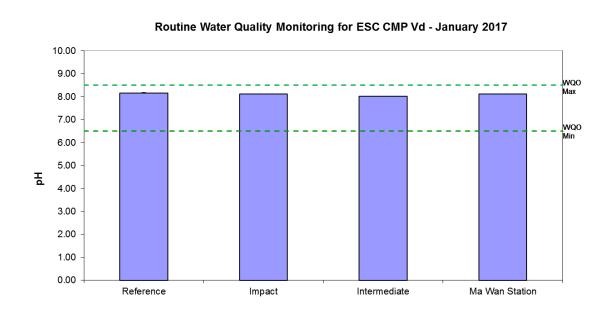


Figure 1: Level of pH recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

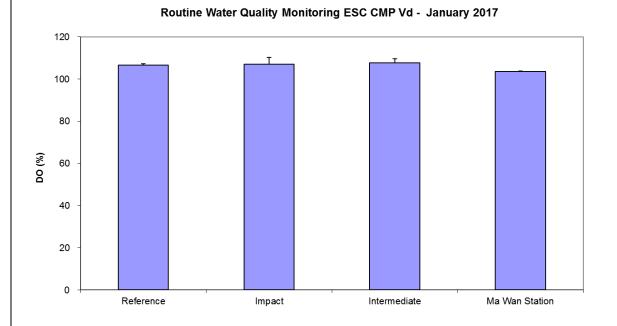


Figure 2: Level of Dissolved Oxygen (DO) (% saturation; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

Date: February 2017



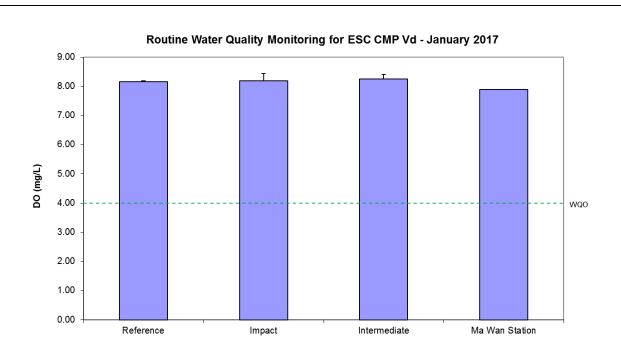


Figure 3: Concentration of Dissolved Oxygen (DO) (mg/L; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

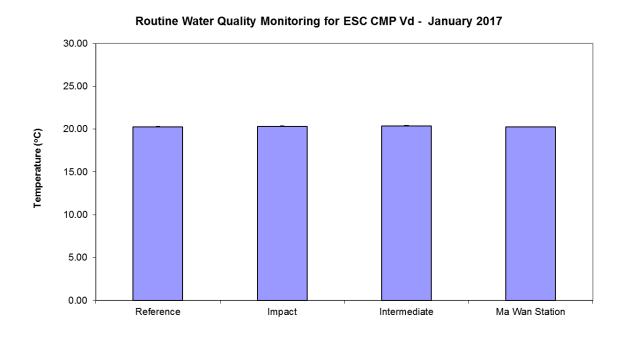


Figure 4: Level of Temperature (°C; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

Date: February 2017



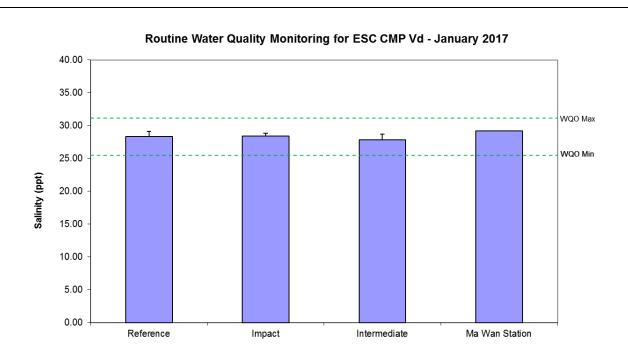


Figure 5: Level of Salinity (ppt; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

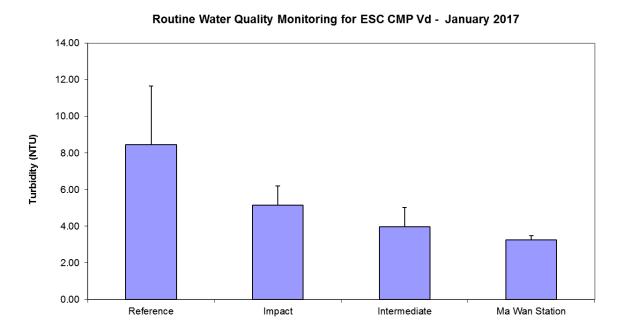


Figure 6: Levels of Turbidity (NTU; mean + SD) recorded during Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

Date: February 2017



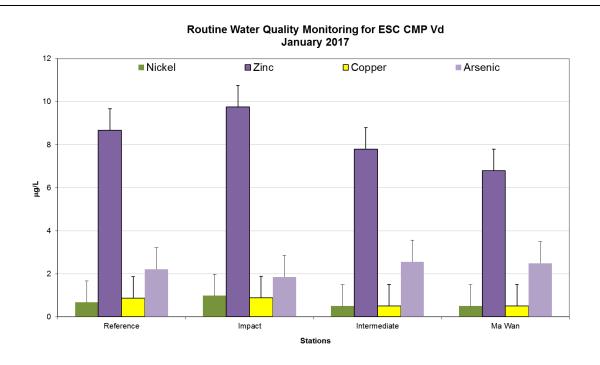


Figure 7: Concentration of Copper, Zinc, Arsenic and Nickel (µg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

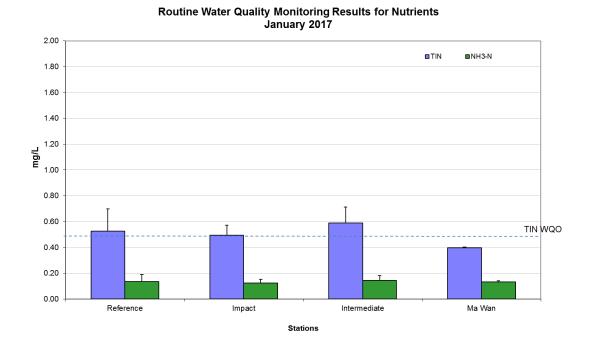


Figure 8: Concentration of Total Inorganic Nitrogen (TIN) and Ammonia Nitrogen (NH3-N) (μ g/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

Date: February 2017



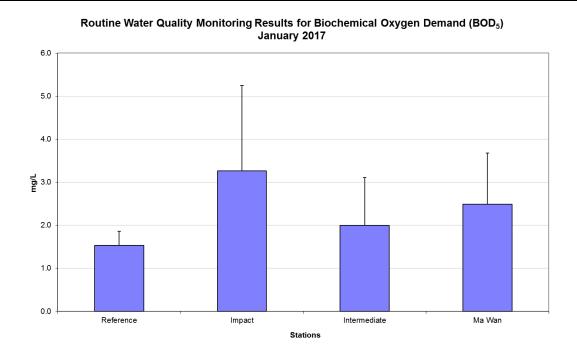


Figure 9: Level of Biochemical Oxygen Demand (BOD5) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

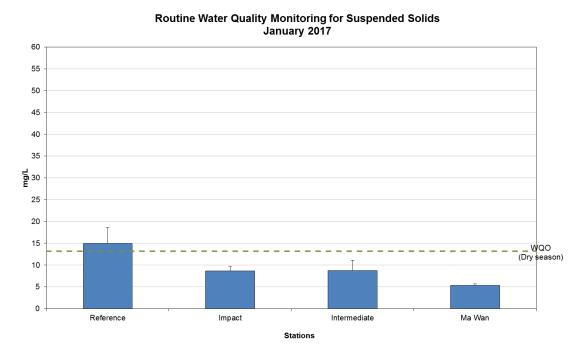


Figure 10: Concentration of Suspended Solids (SS) (mg/L; mean + SD) in water samples collected from Routine Water Quality Monitoring for disposal operations at ESC CMP Vd in January 2017.

February 2017

Date:



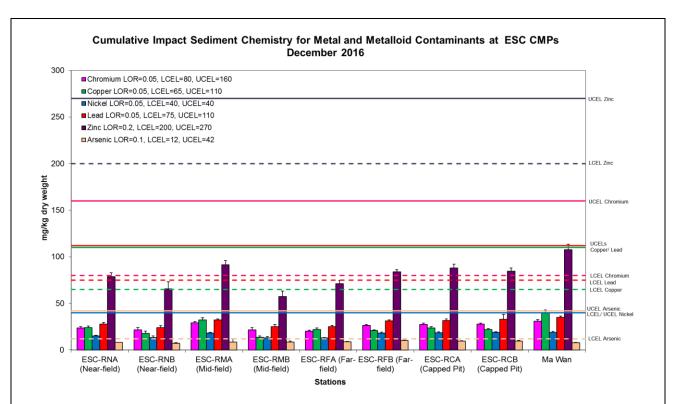


Figure 11: Concentration of Metals and Metalloid (Cr, Cu, Ni, Pb, Zn, As; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2016.

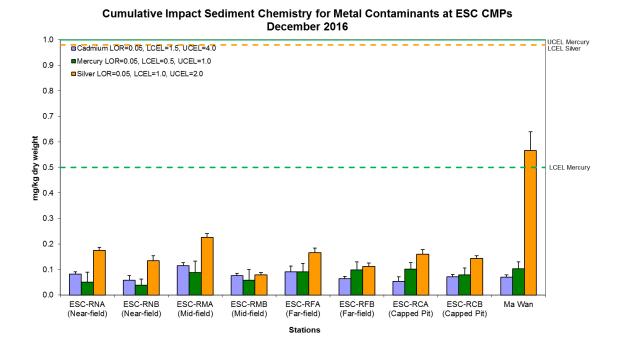


Figure 12: Concentration of Metals (Cd, Hg, Ag; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2016.

Date: February 2017



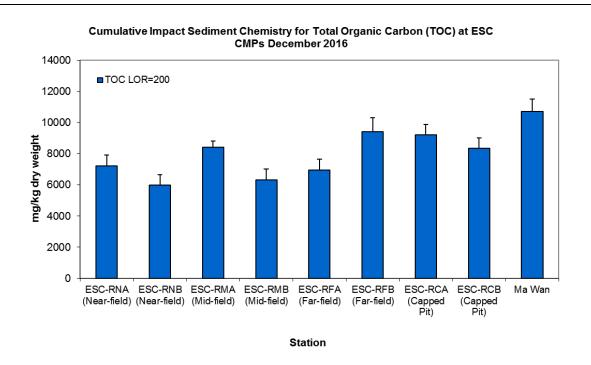


Figure 13: Concentration of Total Organic Carbon (TOC) (mg/kg dry weight; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2016.

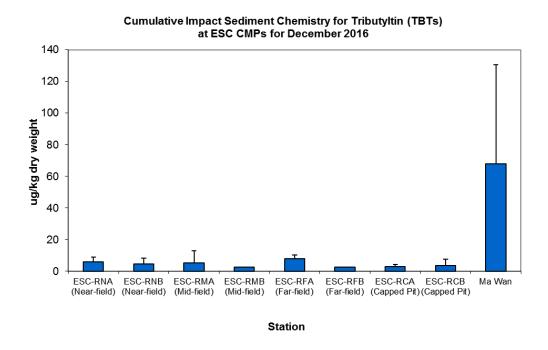


Figure 14: Concentration of Tributyltin (µg TBT/kg; mean +SD) in sediment samples collected from Cumulative Impact Sediment Chemistry Monitoring for ESC CMPs in December 2016.

Date: February 2017



Annex D

Study Programme

