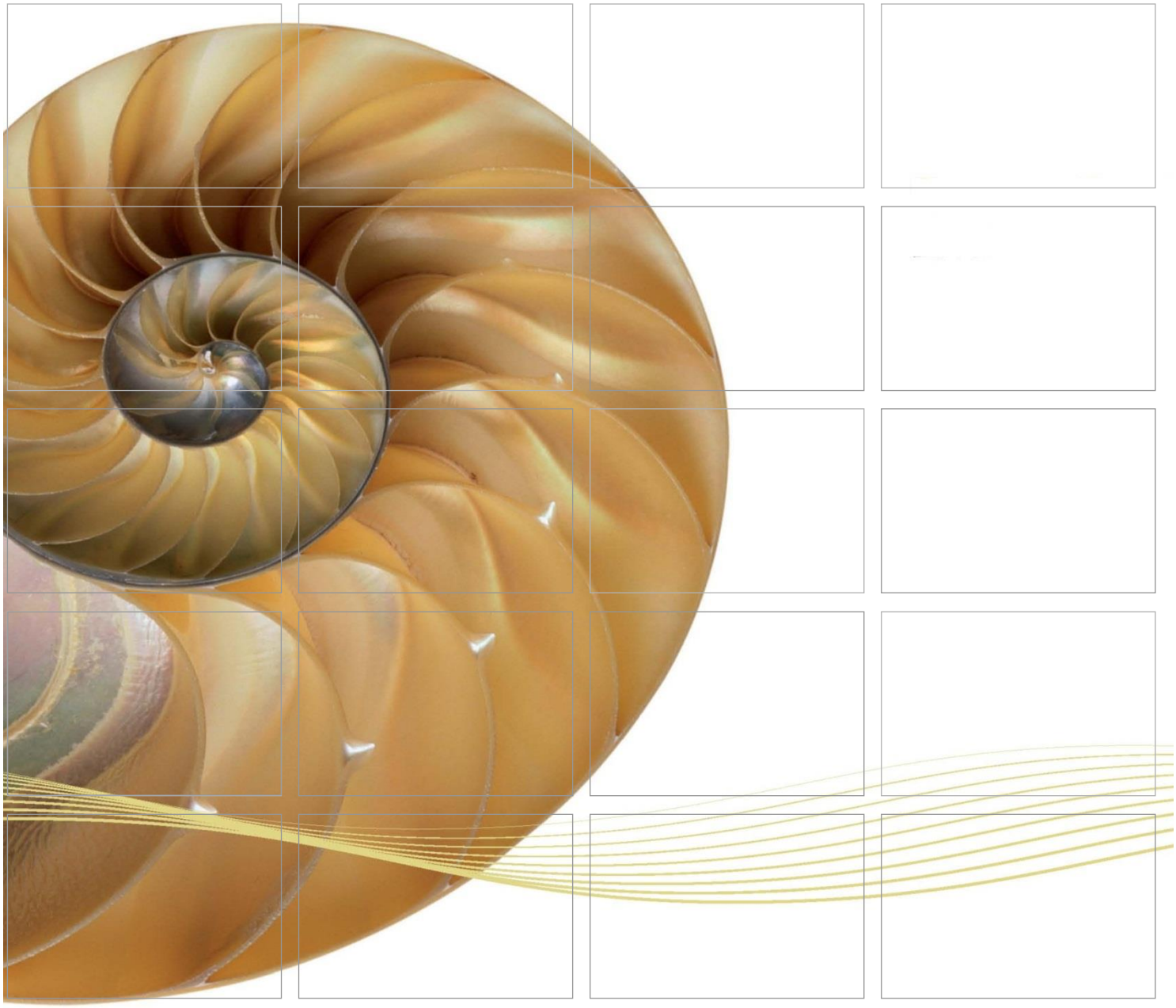
Report



Contract No. HY/2012/08
Tuen Mun – Chek Lap Kok Link – Northern Connection Sub-sea Tunnel Section

Sixth Annual Environmental Monitoring & Audit (EM&A) Report

05 February 2021

Environmental Resources Management
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Contract No. HY/2012/08
Tuen Mun – Chek Lap Kok Link – Northern Connection Sub-sea Tunnel Section

Sixth Annual Environmental Monitoring & Audit (EM&A) Report

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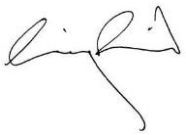
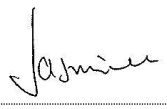
Client: DBJV	Project No: 0212330
Summary: This document presents the Sixth Annual EM&A Report for Tuen Mun – Chek Lap Kok Link Northern Connection Sub-sea Tunnel Section.	Date: 05 February 2021 Approved by:  *Mr Craig Reid* *Partner* Certified by:  *Dr Jasmine Ng* *ET Leader*

Revision	Description	By	Checked	Approved	Date
	6th Annual EM&A Report	VAR	JN	CAR	05/02/21

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Ref.: HYDHZMBEEM00_0_8369L.21.docx

08 February 2021

AECOM
Supervising Officer Representative's Office
No.8 Mong Fat Street, Tuen Mun,
New Territories, Hong Kong

By Fax (2293 6300) and By Post

Attention: Roger Man

Dear Mr. Man,

Re: Agreement No. CE 48/2011 (EP)
Environmental Project Office for the
HZMB Hong Kong Link Road, HZMB Hong Kong Boundary Crossing Facilities, and Tuen Mun-Chek Lap Kok Link – Investigation

Contract No. HY/2012/08 TM-CLKL Northern Connection Sub-sea Tunnel Section
Sixth Annual Environmental Monitoring & Audit (EM&A) Report

Reference is made to the Fifth Annual EM&A Report (Nov. 2018 – Oct. 2019) (ET's ref.: "*0212330_6th Annual EM&A_20210205.doc*" dated 5 February 2021) certified by the ET Leader and provided to us via e-mail on 5 February 2021.

Please be informed that we have no further comments on the captioned Report. However, as mentioned in our letters for the First, Second, Third, Fourth and Fifth Annual EM&A Report (our ref. HYDHZMBEEM00_0_4359L.16, HYDHZMBEEM00_0_5396L.17, HYDHZMBEEM00_0_6338L.18, HYDHZMBEEM00_0_7021L.18 and HYDHZMBEEM00_0_7600L.19), we would like to draw your attention that the ET shall supplement the Report with respect to the following observation:

1. Detailed review, analysis and evaluation of dolphin monitoring data covering annual period as per sections 1.5.1.6 and 12.9.1.1 (vi) of the EM&A Manual for TM-CLKL with level of details not less than the same part in your submitted quarterly EM&A Report and AFCD's annual marine mammal monitoring reports applicable to the dolphin monitoring.

Thank you for your attention. Please do not hesitate to contact the undersigned or the ENPO Leader Mr. Y. H. Hui should you have any queries.

Yours sincerely,

Manson Yeung
Independent Environmental Checker
Tuen Mun – Chek Lap Kok Link

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c.c. HyD – Mr. Patrick Ng (By Fax: 3188 6614)
HyD – Mr. Alan Ip (By Fax: 3188 6614)
AECOM – Mr. Conrad Ng (By Fax: 3922 9797)
ERM – Dr. Jasmine Ng (By Fax: 2723 5660)
Dragages – Bouygues JV - Mr. Bryan Lee (By Fax: 2293 7499)

Internal: DY, YH, ENPO Site

TABLE OF CONTENTS

Under *Contract No. HY/2012/08*, Dragages – Bouygues Joint Venture (DBJV) is commissioned by the Highways Department (HyD) to undertake the design and construction of the Northern Connection Sub-sea Tunnel Section of the Tuen Mun – Chek Lap Kok Link Project (TM-CLK Link Project) while AECOM Asia Company Limited was appointed by HyD as the Supervising Officer. For implementation of the environmental monitoring and audit (EM&A) programme under the Contract, ERM-Hong Kong, Limited (ERM) has been appointed as the Environmental Team (ET) in accordance with *Environmental Permit No. EP-354/2009/A*. Ramboll Hong Kong Limited was employed by HyD as the Independent Environmental Checker (IEC) and Environmental Project Office (ENPO). Subsequent applications for variation of environmental permits (VEP), *EP-354/2009/B*, *EP-354/2009/C* and *EP-354/2009/D*, were granted on 28 January 2014, 10 December 2014 and 13 March 2015, respectively.

The construction phase of the Contract commenced on 1 November 2013 and will tentatively be completed in 2020. The impact monitoring of the EM&A programme, including air quality, water quality, marine ecological monitoring and environmental site inspections, were commenced on 1 November 2013.

This is the Sixth Annual EM&A report presenting the EM&A works carried out during the period from 1 November 2018 to 31 October 2019 for the *Contract No. HY/2012/08 Northern Connection Sub-sea Tunnel Section* (the "Contract ") in accordance with the Updated EM&A Manual of the TM-CLK Link Contract . As informed by the Contractor, the major activities in the reporting year included:

Construction Activities Undertaken
Land-based Works
• Construction of Cross Passage Tympanum – TBM tunnel;
• Cross Passage Lining Installation – TBM Tunnel;
• Cross Passage Construction by Pipe Jacking – TBM Tunnel;
• Corbel & OVHD Construction – TBM Tunnel;
• Parapet Wall and Fireboard Installation – TBM Tunnel;
• Bulk Excavation – Portion N-A;
• D-wall Construction – Portion N-A, S-A & S-C;
• RC Structure – Portion N-A & S-A;
• Construction of Overhead Ventilation Ducts – TBM Tunnel;
• Construction of Thermal Barrier – TBM Tunnel;
• Construction of Walkway Corbel & Cover – TBM Tunnel;
• Demolition of Amenities and Workshop – Portion N-A;
• ELS Construction – Portion S-C;
• ELS Removal – Portion N-A & S-A;
• Seawall Inspection and Remedial Works – Portion N-B;
• Road & Drainage Works – Portion N-A;
• D-wall Removal – Portion S-A;
• E&M Platform Installation – Portion S-A;
• STP Demolition – Portion S-C;
• Backfilling – Portion N-A, S-A & S-C;
• E&M Platform Installation – Portion S-A; and

Construction Activities Undertaken
• Cut & Cover Tunnel RC Structure – Portion S-C
Marine-based Works
• Seawall Modification Works – Portion S-B; and • Jetty Dismantling Works – Portion S-C.

A summary of monitoring and audit activities conducted in the reporting period is listed below:

24-hour TSP Monitoring	119 sessions
1-hour TSP Monitoring	119 sessions
Water Quality Monitoring	93 sessions
Impact Dolphin Monitoring	24 sessions
Joint Environmental Site Inspection	52 sessions

Implementation of Marine Mammal Exclusion Zone

Daily marine mammal exclusion zone was in effect during the period of silt curtain installation in open waters between December 2018 and October 2019. No sighting of the Indo-Pacific humpback dolphin *Sousa chinensis* (i.e. Chinese White Dolphin) was recorded in the reporting period during the exclusion zone monitoring.

No Passive Acoustic Monitoring (PAM) was implemented in the reporting period.

Summary of Breaches of Action/Limit Levels

Breaches of Action and Limit Levels for Air Quality

Twenty-three (23) Action Level exceedances of 1-hour TSP, three (3) Limit Level exceedances of 1-hour TSP and two (2) Action Level exceedances of 24-hour TSP were recorded in the air quality monitoring of this reporting period. No Limit Level exceedances of 24-hour TSP was recorded in the air quality monitoring of this reporting period.

Breaches of Action and Limit Levels for Water Quality

One hundred and forty-seven (147) Action Level exceedances and eighteen (18) Limit Level exceedances were recorded from the water quality monitoring in this reporting period.

Dolphin Monitoring

Whilst four (4) Limit Level exceedances were recorded for four (4) sets of quarterly dolphin monitoring data between November 2018 and October 2019, no unacceptable impact from the construction activities of the TM-CLKL Northern Connection Sub-sea Tunnel Section on Chinese White Dolphins was

noticeable from general observations during dolphin monitoring in this reporting period.

Environmental Complaints, Non-compliance & Summons

No non-compliance with EIA recommendations, EP conditions and other requirements associated with the construction of this Contract was recorded in this reporting period.

One (1) environmental complaint case was received in this reporting period. The investigation report was submitted to ENPO and reported in the subsequent EM&A report.

No environmental summons was received in this reporting period.

Review of EM&A programme

The EM&A requirements have been reviewed and were considered as adequate and effective. No change to the requirements was considered to be necessary. The recommended environmental mitigation measures were also considered to be effective and efficient in reducing the potential environmental impacts associated with the construction of the Contract. No change was thus considered necessary.

Overall, the EM&A results indicated that the Contract has not caused unacceptable environmental impacts. This is in agreement with the assessment presented in the EIA Report.

1 INTRODUCTION

1.1 BACKGROUND

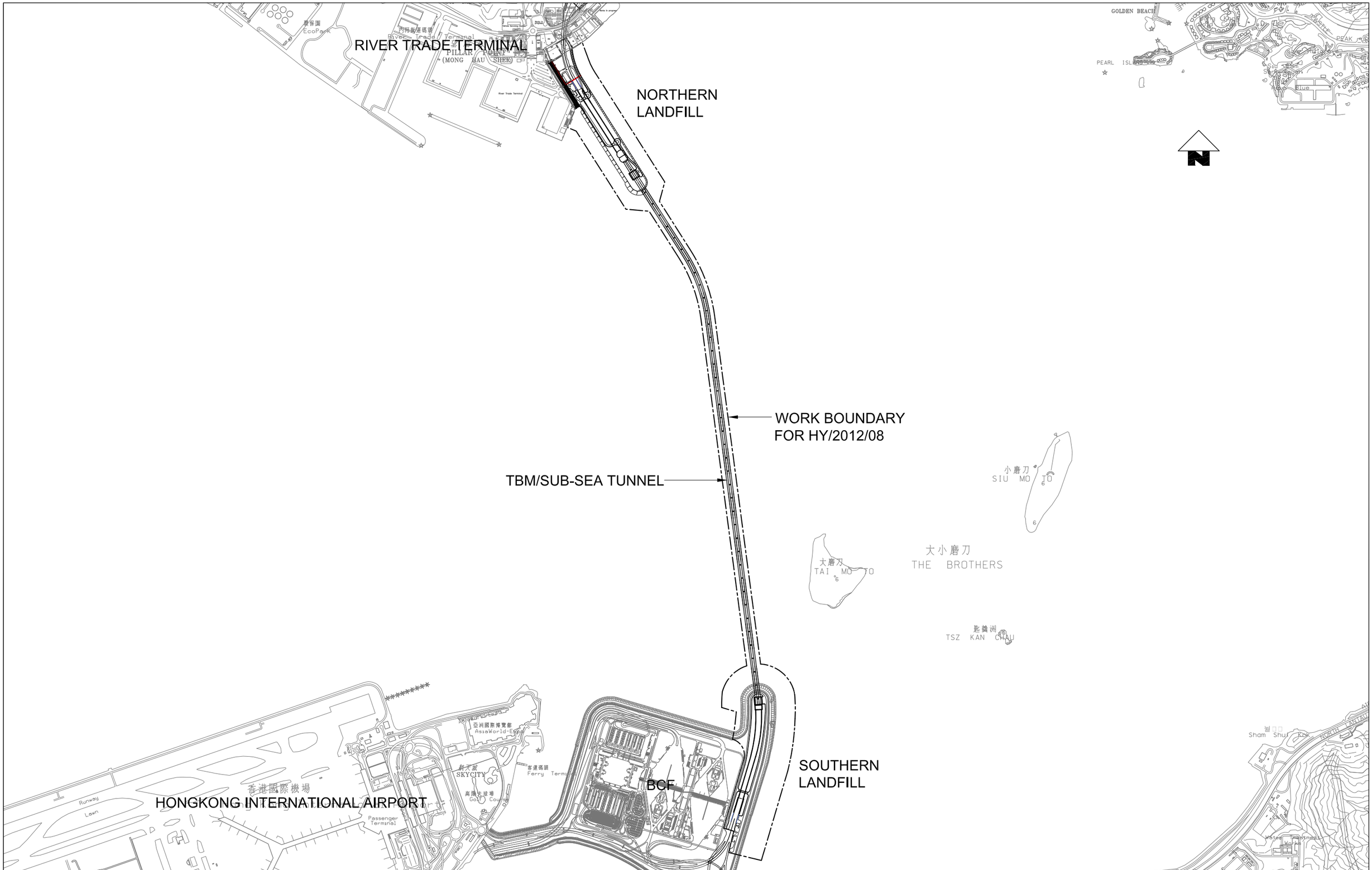
According to the findings of the Northwest New Territories (NWNT) Traffic and Infrastructure Review conducted by the Transport Department, Tuen Mun Road, Ting Kau Bridge, Lantau Link and North Lantau Highway would be operating beyond capacity after 2016. This forecast has been based on the estimated increase in cross boundary traffic, developments in the Northwest New Territories (NWNT), and possible developments in North Lantau, including the Airport developments, the Lantau Logistics Park (LLP) and the Hong Kong – Zhuhai – Macao Bridge (HZMB). In order to cope with the anticipated traffic demand, two new road sections between NWNT and North Lantau – Tuen Mun – Chek Lap Kok Link (TM-CLKL) and Tuen Mun Western Bypass (TMWB) are proposed.

An Environmental Impact Assessment (EIA) of TM-CLKL (the Project) was prepared in accordance with the EIA Study Brief (No. ESB-175/2007) and the *Technical Memorandum of the Environmental Impact Assessment Process* (*EIAO-TM*). The EIA Report was submitted under the Environmental Impact Assessment Ordinance (EIAO) in August 2009. Subsequent to the approval of the EIA Report (EIAO Register Number AEIAR-146/2009), an Environmental Permit (EP-354/2009) for TM-CLKL was granted by the Director of Environmental Protection (DEP) on 4 November 2009, and EP variation (VEP) (EP-354/2009A) was issued on 8 December 2010. Subsequent applications for variation of environmental permits (VEP), *EP-354/2009/B*, *EP-354/2009/C* and *EP-354/2009/D*, were granted on 28 January 2014, 10 December 2014 and 13 March 2015, respectively.

Under *Contract No. HY/2012/08*, Dragages – Bouygues Joint Venture (DBJV) is commissioned by the Highways Department (HyD) to undertake the design and construction of the Northern Connection Sub-sea Tunnel Section of TM-CLKL while AECOM Asia Company Limited was appointed by HyD as the Supervising Officer. For implementation of the environmental monitoring and audit (EM&A) programme under the Contract, ERM-Hong Kong, Limited (ERM) has been appointed as the Environmental Team (ET). Ramboll Hong Kong Limited was employed by HyD as the Independent Environmental Checker (IEC) and Environmental Project Office (ENPO).

Layout of the Contract components is presented in *Figure 1.1*.

The construction phase of the Contract commenced on 1 November 2013 and will tentatively be completed in 2020. The impact monitoring phase of the EM&A programme, including air quality, water quality, marine ecological monitoring and environmental site inspections, were commenced on 1 November 2013.



Rev.	Description	Date	Checked
A	FIRST ISSUE	11SEP13	PKV

Designed By: PKV
Drawn By: DAI
Approved By: SPo PP
Date: 11SEP2013

Main Contractor: Dragages - Bouygues Joint Venture 實嘉 - 布依格聯營

Client: 路政署 HIGHWAYS DEPARTMENT

Contractor's Designer: ARUP Ove Arup & Partners Hong Kong Limited

Project: Contract No. HY/2012/08
Tuen Mun - Chek Lap Kok Link -
Northern Connection Sub-Sea Tunnel Section

Drawing Title: **Figure 1.1**

Drawing no.: TMCLKL8-DBJ-GEN-DWG-00174
Scale: 1:25000 @ A3
CADD Ref.: TMCLKL8-DBJ-GEN-DWG-00174-DFT-A
Issue Status: DFT (DRAFT)
Revision: A

1.2 SCOPE OF REPORT

This is the Sixth Annual EM&A Report under the *Contract No. HY/2012/08 Tuen Mun – Chek Lap Kok Link – Northern Connection Sub-sea Tunnel Section*. This report presents a summary of the environmental monitoring and audit works from 1 November 2018 to 31 October 2019.

1.3 ORGANIZATION STRUCTURE

The organization structure of the Contract is shown in *Appendix A*. The key personnel contact names and contact details are summarized in *Table 1.1* below.

Table 1.1 Contact Information of Key Personnel

Party	Position	Name	Telephone	Fax
Highways Department	Engr 24/SD	Ken T.M. Cheng	2762 4062	3188 6614
SOR (AECOM Asia Company Limited)	Chief Resident Engineer	Roger Man	2293 6388	2293 6300
ENPO / IEC (Ramboll Hong Kong Ltd.)	ENPO Leader	Y.H. Hui	3465 2850	3465 2899
	IEC	Manson Yeung	9700 6767	3465 2899
Contractor (Dragages – Bouygues Joint Venture)	Deputy Environmental Manager	Bryan Lee	2293 7323	2293 7499
	24-hour hotline		2293 7330	
ET (ERM-HK)	ET Leader	Jasmine Ng	2271 3311	2723 5660

1.4 SUMMARY OF CONSTRUCTION WORKS

With reference to DBJV's information, details of major construction works carried out in this reporting period are summarized in *Table 1.2*.

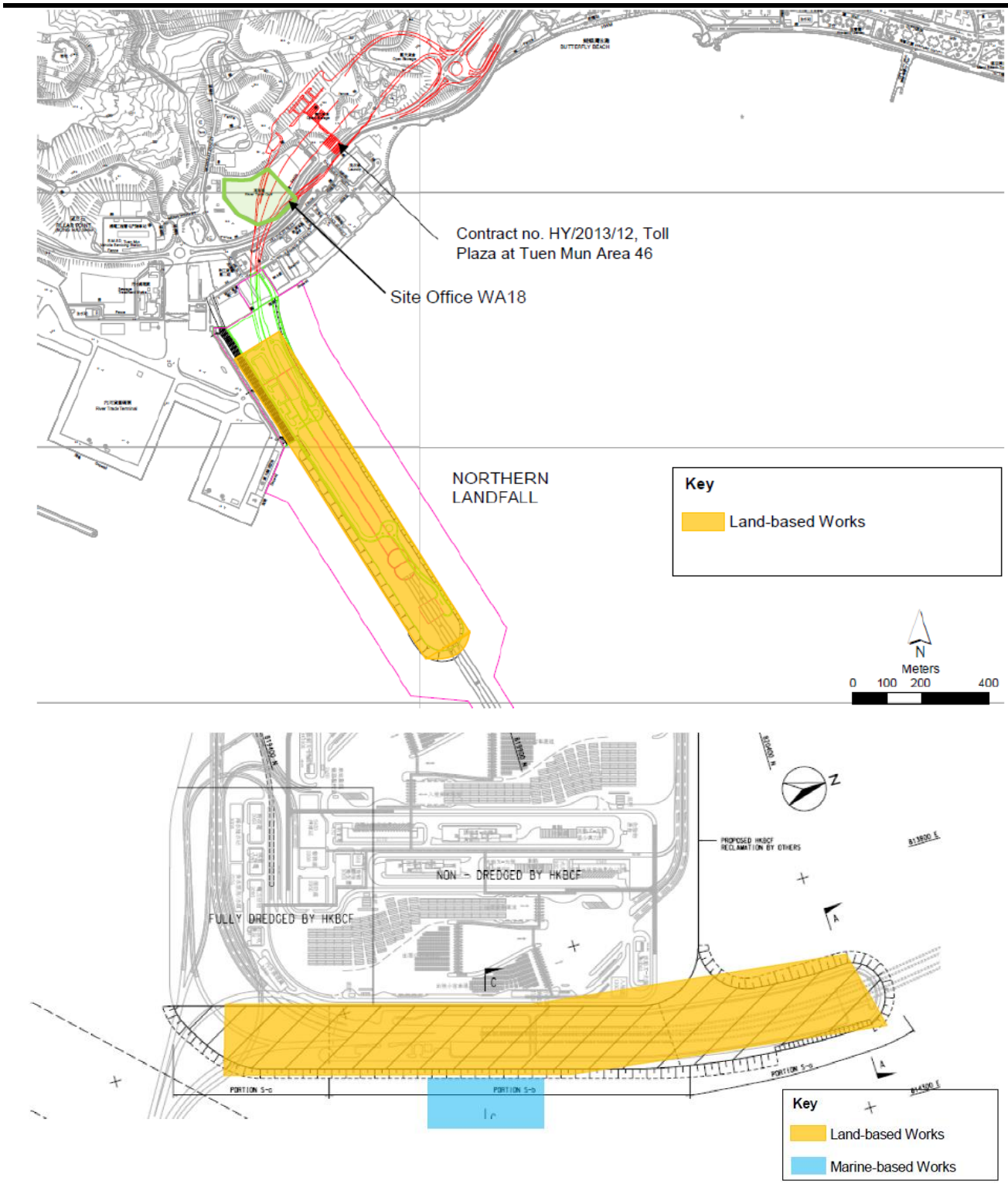
The general layout plan of the site showing the detailed works areas is shown in *Figure 1.2*. The Environmental Sensitive Receivers in the vicinity of the Project are shown in *Figure 1.3*.

The implementation schedule of environmental mitigation measures is presented in *Appendix B*.

Table 1.2 Summary of Construction Activities Undertaken during the Reporting Period

Construction Activities Undertaken
Land-based Works
• Construction of Cross Passage Tympanum – TBM tunnel; • Cross Passage Lining Installation – TBM Tunnel; • Cross Passage Construction by Pipe Jacking – TBM Tunnel; • Corbel & OVHD Construction – TBM Tunnel; • Parapet Wall and Fireboard Installation – TBM Tunnel; • Bulk Excavation – Portion N-A; • D-wall Construction – Portion N-A, S-A & S-C; • RC Structure – Portion N-A & S-A; • Construction of Overhead Ventilation Ducts – TBM Tunnel; • Construction of Thermal Barrier – TBM Tunnel; • Construction of Walkway Corbel & Cover – TBM Tunnel; • Demolition of Amenities and Workshop – Portion N-A; • ELS Construction – Portion S-C; • ELS Removal – Portion N-A & S-A; • Seawall Inspection and Remedial Works – Portion N-B; • Road & Drainage Works – Portion N-A; • D-wall Removal – Portion S-A; • E&M Platform Installation – Portion S-A; • STP Demolition – Portion S-C; • Backfilling – Portion N-A, S-A & S-C; • E&M Platform Installation – Portion S-A; and • Cut & Cover Tunnel RC Structure – Portion S-C
Marine-based Works
• Seawall Modification Works – Portion S-B; and • Jetty Dismantling Works – Portion S-C.

Figure 1.2 Locations of Construction Activities – November 2018 to October 2019



2 EM&A RESULTS

The EM&A programme required environmental monitoring for air quality, water quality and marine ecology as well as environmental site inspections for air quality, noise, water quality, waste management, marine ecology and landscape and visual impacts. The EM&A requirements and related findings for each component are summarized in the following sections

2.1 AIR QUALITY

2.1.1 Monitoring Requirements and Equipment

In accordance with the Updated EM&A Manual and the *Enhanced TSP Monitoring Plan* [1], impact 1-hour TSP monitoring was conducted three (3) times in every six (6) days and impact 24-hour TSP monitoring was carried out once in every six (6) days when the highest dust impact was expected. 1-hr and 24-hr TSP monitoring frequency was increased to three times per day every three days and daily every three days respectively as excavation works for launching shaft commenced on 24 October 2014.

High volume samplers (HVSs) were used to carry out the 1-hour and 24-hour TSP monitoring in the reporting period at the five (5) air quality monitoring stations in accordance with the requirements stipulated in the Updated EM&A Manual (*Figure 2.1*; *Table 2.1*). Wind anemometer was installed at the rooftop of ASR5 for logging wind speed and wind direction. Details of the equipment deployed are provided in *Table 2.2*.

(1) ERM (2013) Enhanced TSP Monitoring Plan. Submitted on 28 October 2013 and subsequently approved by EPD on 1 November 2013.

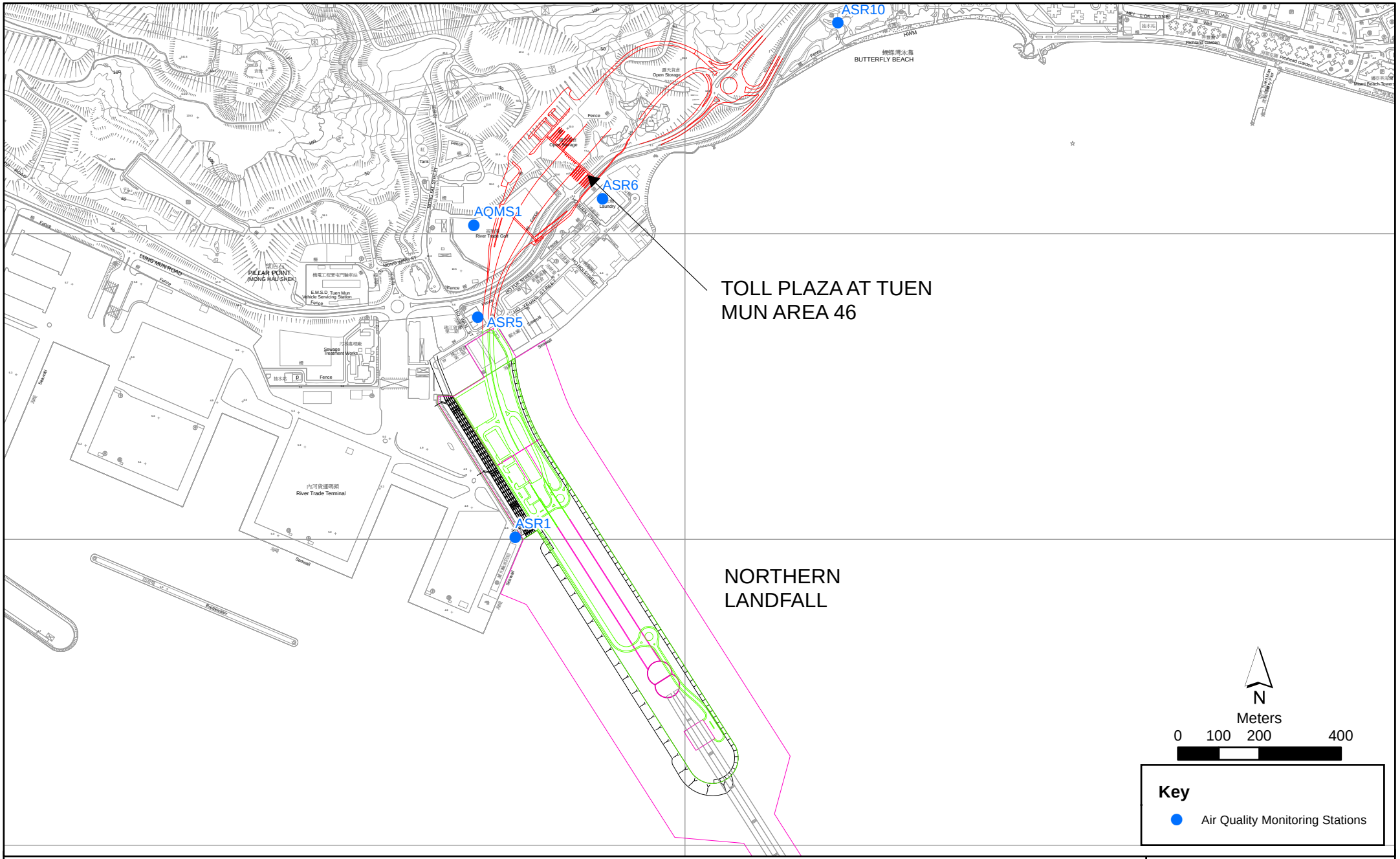


Figure 2.1

Air Quality Monitoring Stations for the Enhanced TSP Monitoring

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Date: 21/2/2014

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Table 2.1 ***Locations of Impact Air Quality Monitoring Stations and Monitoring Dates in this Reporting Period***

Monitoring Station	Location	Description	Parameters & Frequency
ASR1	Tuen Mun Fireboat Station	Office	TSP monitoring • 1-hour Total Suspended Particulates (1-hour TSP, μg/m³), 3 times in every 6 days • 24-hour Total Suspended Particulates (24-hour TSP, μg/m³), daily for 24-hour in every 6 days
ASR5	Pillar Point Fire Station	Office	
AQMS1	Previous River Trade Golf	Bare ground	
ASR6	Butterfly Beach Laundry	Office	
ASR10	Butterfly Beach Park	Recreational uses	Enhanced TSP monitoring (commenced on 24 October 2014) • 1-hour Total Suspended Particulates (1-hour TSP, μg/m³), 3 times in every 3 days • 24-hour Total Suspended Particulates (24-hour TSP, μg/m³), daily for 24-hour in every 3 days

Table 2.2 ***Air Quality Monitoring Equipment***

Equipment	Brand and Model
High Volume Sampler (1-hour TSP and 24-hour TSP)	Tisch Environmental Mass Flow Controlled Total Suspended Particulate (TSP) High Volume Sampler (Model No. TE-5170)
Wind Meter	Davis (Model: Vantage Pro 2 (S/N: AS160104014)
Wind Anemometer for calibration	Lutron (Model No. AM-4201)

2.1.2 Action & Limit Levels

The Action and Limit Levels of the air quality monitoring are provided in *Appendix C*. The Event and Action plan is presented in *Appendix G*.

2.1.3 Results and Observations

Impact air quality monitoring was conducted at all designated monitoring stations in the reporting period under acceptable weather conditions. The major dust sources in the reporting period include construction activities under the Contract as well as nearby traffic emissions.

The monitoring results for 1-hour TSP and 24-hour TSP are summarized in *Tables 2.3* and *2.4*, respectively. Baseline and impact monitoring results are presented graphically in *Appendix D*. The detailed impact air quality monitoring data and meteorological information were reported in the *Sixty-first* to *Seventy-second Monthly EM&A Reports*.

Table 2.3 Summary of 1-hour TSP Monitoring Results in this Reporting Period

Month/Year	Station	Average (μg/m³)	Range (μg/m³)	Action Level (μg/m³)	Limit Level (μg/m³)
November 2018 to October 2019	ASR 1	126	13 - 646	331	500
	ASR 5	151	14 - 425	340	500
	AQMS1	94	14 - 311	335	500
	ASR6	110	14 - 478	338	500
	ASR10	69	14 – 242	337	500

Table 2.4 Summary of 24-hour TSP Monitoring Results in this Reporting Period

Month/Year	Station	Average (μg/m³)	Range (μg/m³)	Action Level (μg/m³)	Limit Level (μg/m³)
November 2018 to October 2019	ASR 1	85	28 - 237	213	260
	ASR 5	91	32 - 196	238	260
	AQMS1	58	19 - 127	213	260
	ASR6	69	25 - 191	238	260
	ASR10	50	18 - 146	214	260

In this reporting period, a total of 119 monitoring events were undertaken. Twenty-three (23) Action Level exceedances of 1-hour TSP, three (3) Limit Level exceedances of 1-hour TSP and two (2) Action Level exceedances of 24-hour TSP were recorded in the air quality monitoring of this reporting period. No Limit Level exceedances of 24-hour TSP was recorded. Summary of exceedances for Air Quality Impact Monitoring in this reporting period is detailed in *Table 2.24*.

As shown in *Table 2.5*, the annual average 1-hour TSP and 24-hour TSP level in the reporting period were generally lower than the corresponding average levels of baseline at most monitoring stations. The annual average 1-hour TSP was higher than the corresponding average levels of baseline at ASR1 and ASR5.

In order to determine any significant air quality impacts caused by construction activities from this Contract, one-way ANOVA (with setting α at 0.05) was conducted to examine whether the observed differences are significant between reporting period and baseline monitoring. For 1-hour TSP, the average results of monitoring stations AQMS1, ASR6 and ASR10 in the reporting period were significantly lower than the average results of baseline monitoring while the average result of ASR1 is slightly lower than the average results of baseline monitoring. The average results of monitoring stations ASR5 in the reporting period were slightly higher than the average results of baseline monitoring (AQMS1: $F_{1, 398} = 24.53$, $p < 0.01$, ASR6: $F_{1, 398} = 7.04$, $p < 0.01$, ASR1: $F_{1, 398} = 0.006$, $p = 0.938$, ASR10: $F_{1, 398} = 106.1$, $p < 0.01$ and ASR5: $F_{1, 398} = 1.30$ $p = 0.254$). For 24-hour TSP, the average results of all monitoring stations in the reporting period were significantly lower than the average results of baseline monitoring (AQMS1: $F_{1, 132} = 114.78$, $p < 0.01$, ASR6: $F_{1, 132} = 128.65$, $p < 0.01$, ASR1: $F_{1, 132} = 14.56$ $p < 0.01$, ASR10: $F_{1, 132} = 114.15$, $p < 0.01$ and ASR5: $F_{1, 132} = 59.76$, $p < 0.01$). In the reporting period, 1-hour and 24-hour TSP were varied across sampling months (see *Appendix D*)

and these variations were however not consistent throughout the reporting period.

Table 2.5 ***Summary of Average Levels of TSP Level of Baseline Monitoring and Reporting Period (in µg/m³)***

Monitoring Station	Average Baseline Monitoring	Average Impact Monitoring
ASR1(1-hour TSP)	125	126
ASR1(24-hour TSP)	128	85
ASR5(1-hour TSP)	138	151
ASR5(24-hour TSP)	167	91
AQMS1(1-hour TSP)	131	94
AQMS1(24-hour TSP)	127	58
ASR6(1-hour TSP)	135	110
ASR6(24-hour TSP)	166	69
ASR10(1-hour TSP)	134	69
ASR10(24-hour TSP)	129	50

Further to the One-way ANOVA, Linear Regression was conducted to examine any relationship between TSP levels and time (i.e. number of days after construction works commencement) during this yearly monitoring period at each monitoring station. Linear regression analysis makes assumptions of equal variance and normal distribution of data. Therefore, the significance level of the test was set at 1 % (i.e. $p = 0.01$) to reduce the chance of committing a Type 1 error. If a significant regression relationship was found between TSP level and time (i.e. $p < 0.01$), r^2 value from the analysis would be further assessed. This value represents the proportion of the total variation in the dependent variable (i.e. TSP level) that is accounted for by the fitted regression line and is referred to as the coefficient of determination. An r^2 value of 1 indicates a perfect relationship (or fit) whereas a value of 0 indicates that there is no relationship (or no fit) between the dependent and independent variables. As there are no specific criteria to indicate how meaningful an r^2 value is, for the purposes of this EM&A programme a value of 0.60 was adopted to indicate a meaningful regression. If $r^2 < 0.60$ then it was considered that there was a weak relationship between TSP level and time or none at all. If the regression analysis indicated $r^2 > 0.60$ then it had been interpreted that there was in fact a strong relationship between the dependent and independent variables (i.e. a strong temporal trend of increasing / decreasing TSP level with time).

As shown in *Table 2.6*, results of the regression analysis indicated that there was no significant ($r^2 < 0.60$) relationship between TSP level and time during this yearly monitoring period. As such, it is considered that there is no apparent trend of increasing / decreasing TSP level during the reporting period.

Table 2.6 ***Linear Regression Result of TSP Monitoring***

Parameter	Station	R^2	F-ratio	p-value	Intercept	Coefficient
1-hour TSP	AQMS1	0.075	$F_{1,355} = 28.6$	<0.001	340.0	-0.122
	ASR6	0.083	$F_{1,365} = 32.1$	<0.001	443.3	-0.166
	ASR1	0.036	$F_{1,355} = 13.3$	<0.001	443.8	-0.158

Parameter	Station	R^2	F-ratio	p-value	Intercept	Coefficient
	ASR10	0.178	$F_{1,355} = 77.0$	<0.001	383.1	-0.156
	ASR5	0.078	$F_{1,355} = 29.9$	<0.001	551.6	-0.199
24-hour TSP	AQMS1	0.070	$F_{1,117} = 8.8$	<0.001	164.9	-0.053
	ASR6	0.125	$F_{1,117} = 16.6$	<0.001	269.4	-0.100
	ASR1	0.018	$F_{1,117} = 2.2$	<0.001	188.5	-0.052
	ASR10	0.163	$F_{1,117} = 22.8$	<0.001	246.9	-0.098
	ASR5	0.173	$F_{1,117} = 24.5$	<0.001	356.9	-0.133

Note:

1. Dependent variable is set as TSP levels (in $\mu g/m^3$) and independent variable is set as number of day of construction works.
2. R^2 <0.6 and p-value >0.01 (i.e. showing the regression insignificant) are underlined.

2.2 *WATER QUALITY MONITORING*

The baseline water quality monitoring undertaken by the Hong Kong – Zhuhai – Macao Bridge Hong Kong Projects (HZMB) between 6 and 31 October 2011 included all monitoring stations for the Project. Thus, the baseline monitoring results and Action/Limit Levels presented in HZMB Baseline Monitoring Report [1] are adopted for this Project.

2.2.1 *Monitoring Requirements & Equipment*

Seawall Enhancement Works at Northern Landfall has been completed on 31 December 2017. Notification of suspension of water quality monitoring has been approved by EPD on 2 March 2018.

In accordance with the approved Environmental Review Report dated 21 March 2018 for the Change in Design of Vertical Seawall to Sloping Seawall on Southern Landfall, Updated Impact water quality monitoring programme and water quality monitoring stations IS17, SR7 and IS(Mf)11 specified under the EM&A Manual for HZMB HKBCF project were adopted.

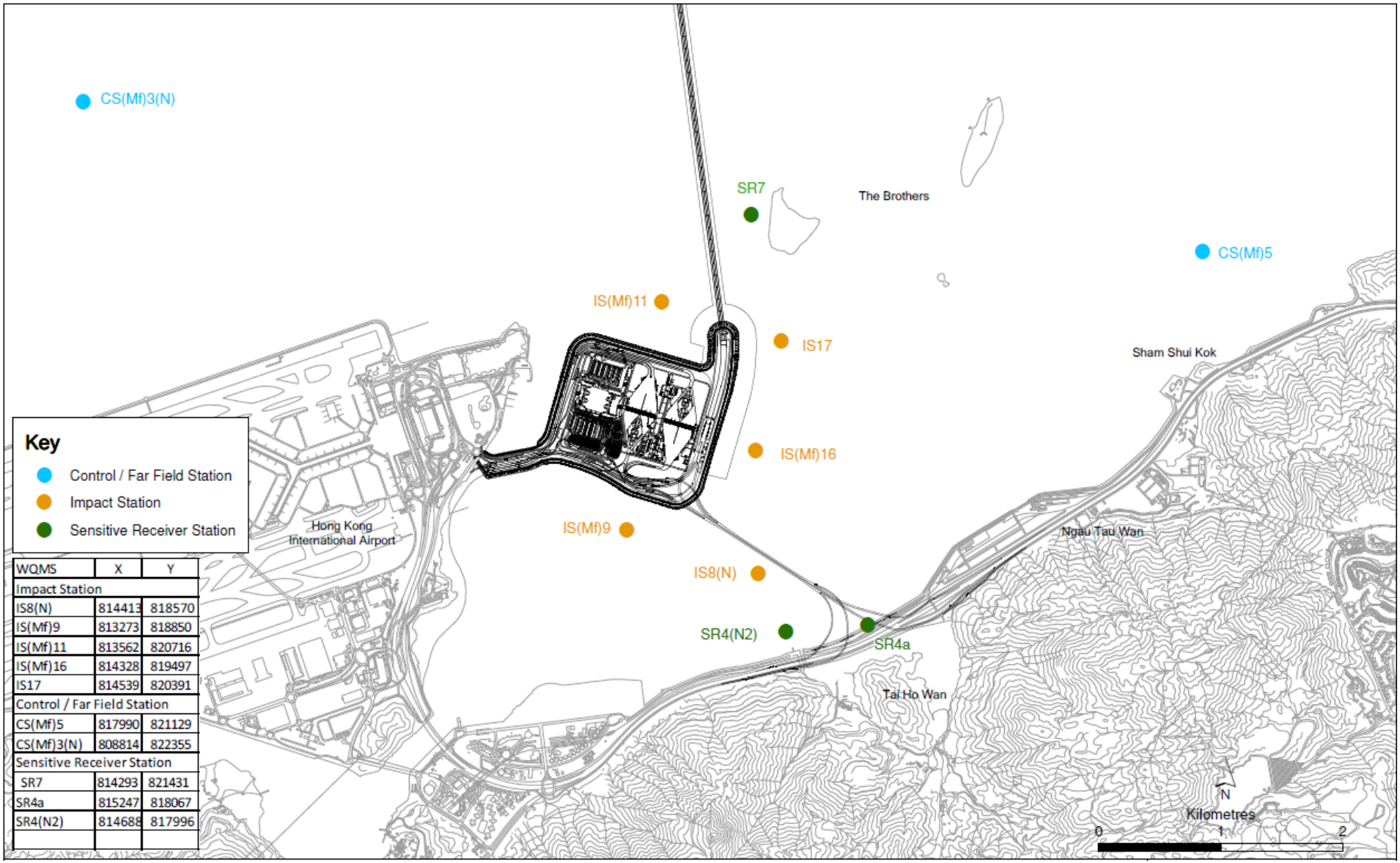
Water Quality Monitoring was resumed between 2 and 30 January 2019, 14 April 2019 and 24 June 2019, and 3 July 2019 and 30 October 2019 during the seawall modification works at Portion S-B.

Results of water quality monitoring were adopted from the published EM&A data of Contract No. HY/2012/07 Tuen Mun-Chek Lap Kok Link – Southern Connection Viaduct Section between January and June 2019.

The Action and Limit Levels of the water quality monitoring were adopted from the EM&A Manual for HZMB HKBCF project.

Impact water quality monitoring was carried out three (3) days per week during the construction period at the water quality monitoring stations in *Figure 2.2* and *Table 2.7*.

[1] *Agreement No. CE 35/2011 (EP) Baseline Environmental Monitoring for Hong Kong - Zhuhai - Macao Bridge Hong Kong Projects - Investigation*. Baseline Environmental Monitoring Report (Version C). Submitted on 8 March 2012 and subsequently approved by EPD.



WQMS	X	Y
Impact Station		
IS8(N)	814413	818570
IS(Mf)9	813273	818850
IS(Mf)11	813562	820716
IS(Mf)16	814328	819497
IS17	814539	820391
Control / Far Field Station		
CS(Mf)5	817990	821129
CS(Mf)3(N)	808814	822355
Sensitive Receiver Station		
SR7	814293	821431
SR4a	815247	818067
SR4(N2)	814688	817996

Figure 2.2

Water Quality Monitoring Stations

Environmental Resources Management

ERM

Table 2.7 Locations of Water Quality Monitoring Stations and the Corresponding Monitoring Requirements

Station ID	Type	Coordinates		*Parameters, unit	Depth	Frequency
		Easting	Northing			
IS(Mf)11	Impact Station (Close to HKBCF construction site) 8	813562	820716	• Temperature(°C) • pH(pH unit) • Turbidity (NTU) • Water depth (m) • Salinity (ppt) • DO (mg/L and % of saturation) • SS (mg/L)	3 water depths: 1m below sea surface, mid-depth and 1m above sea bed. If the water depth is less than 3m, mid-depth sampling only. If water depth less than 6m, mid-depth may be omitted.	Impact monitoring: 3 days per week, at mid-flood and mid-ebb tides during the construction period of the Contract.
IS17	Impact Station (Close to HKBCF construction site)	814539	820391			
SR7	Sensitive receivers (Tai Mo Do)	814293	821431			
IS(Mf)9	Impact Station (Close to HKBCF construction site)	813273	818850			
IS(Mf)16	Impact Station (Close to HKBCF construction site)	814328	819497			
IS8(N)	Impact Station (Close to HKBCF construction site)	814413	818570			
SR4(N2)	Sensitive receiver (Tai Ho Inlet)	814688	817859			
SR4a	Sensitive receiver	815247	818067			
CS(Mf)3(N)	Control Station	808814	822355			
CS(Mf)5	Control Station	817990	821129			

*Notes:

In addition to the parameters presented monitoring location/position, time, water depth, sampling depth, tidal stages, weather conditions and any special phenomena or works underway nearby were also recorded.

Water Quality Monitoring Station CS(Mf)3 was relocated to CS(Mf)3(N) since 2 May 2017.

Water Quality Monitoring Station SR4 was relocated to SR4(N) since 2 March 2018.

Water Quality Monitoring Station SR4(N) was relocated to SR4(N2) since 12 June 2019

Water Quality Monitoring Station IS8 was relocated to IS8(N) since 12 June 2019.

Table 2.8 summarizes the equipment used in the impact water quality monitoring programme.

Table 2.8 Water Quality Monitoring Equipment

Equipment	Model	Qty.
Multi-Parameters	YSI ProDss 18A104824	1
Multi-Parameters	YSI ProDss 15M100005	1

Multi-Parameters	YSI ProDss 0001C6A7	1
Multi-Parameters	YSI ProDss 17H105557	1
Multi-Parameters	YSI ProDss 17E100747	1
Multi-Parameters	YSI ProDss 16H104234	1
Multi-Parameters	YSI ProDss 16H104233	1
Positioning Equipment	Furuno GP-170	1
Water Depth Detector	Lowrance Mark 5x / Garmin Striker 4	1

2.2.2 Action & Limit Levels

The Action and Limit Levels of the water quality monitoring is provided in *Appendix C*. The Event and Action plan is presented in *Appendix G*.

2.2.3 Results and Observations

During this reporting period, major marine works included Seawall Modification Works at Portion S-B and Jetty Dismantling Works at Portion S-A.

Impact water quality monitoring was conducted at all designated monitoring stations in the reporting period under favourable weather conditions. Baseline and impact monitoring results are presented graphically in *Appendix E* and detailed impact water quality monitoring data were reported in the *sixty-third, sixty-sixth* to *seventy-second Monthly EM&A Reports*.

In this reporting period, a total of 93 monitoring events were undertaken in which one hundred and forty-seven (147) Action Level exceedances and eighteen (18) Limit Level exceedances were recorded from the water quality monitoring in this reporting period. Summary of exceedances for Water Quality Impact Monitoring in this reporting period is detailed in *Table 2.25*.

In order to determine any significant water quality impacts caused by construction activities from this Contract, One-way ANOVA (with setting α at 0.05) was conducted to examine whether there was significant difference in DO, turbidity and SS between reporting period and baseline monitoring period. The annual average levels and statistical analysis results are presented in *Tables 2.9 to 2.11* and *Tables 2.12 to 2.14*, respectively. In general, the DO levels recorded during the reporting period were significantly higher than the results obtained during the baseline monitoring period. The annual depth-averaged turbidity and SS levels recorded in the reporting period were significantly lower than the average levels in baseline monitoring. Whilst DO, turbidity and suspended solids levels were varied across sampling months (see *Appendix E*) these variations were, however, not consistent throughout the reporting period.

Table 2.9 Summary of Average DO Level of Baseline Monitoring and the Reporting Period (in mg/L)

Tide	Station	Depth	Average DO of baseline monitoring	Average DO of reporting period
Mid-ebb	IS(Mf)11	Surface	6.5	6.6
	SR7	Surface	6.3	6.5
	IS17	Surface	6.4	6.5

Tide	Station	Depth	Average DO of baseline monitoring	Average DO of reporting period
	IS(Mf)16	Surface	6.3	6.6
	IS(Mf)9	Surface	6.6	6.9
	IS8(N)	Surface	6.4	6.7
	SR4(N2)	Surface	6.1	6.4
	SR4a	Surface	5.5	6.5
Mid-flood	IS(Mf)11	Surface	6.1	6.6
	SR7	Surface	6.0	6.5
	IS17	Surface	6.1	6.7
	IS(Mf)16	Surface	6.3	6.7
	IS(Mf)9	Surface	6.5	6.7
	IS8(N)	Surface	6.4	6.7
	SR4(N2)	Surface	6.3	6.7
	SR4a	Surface	5.5	6.7
Mid-ebb	IS(Mf)11	Middle	6.1	6.1
	IS17	Middle	6.0	6.1
	IS(Mf)16	Middle	6.3	-
	IS(Mf)9	Middle	-	7.1
Mid-flood	IS(Mf)11	Middle	5.9	6.1
	IS17	Middle	5.9	6.3
	IS(Mf)16	Middle	6.1	-
	IS(Mf)9	Middle	6.2	7.2
Mid-ebb	IS(Mf)11	Bottom	5.9	5.8
	SR7	Bottom	6.1	6.3
	IS17	Bottom	5.7	5.9
	IS(Mf)16	Bottom	5.9	6.1
	IS(Mf)9	Bottom	6.6	6.6
	IS8(N)	Bottom	6.2	6.4
	SR4(N2)	Bottom	6.0	6.1
	SR4a	Bottom	5.3	6.0
Mid-flood	IS(Mf)11	Bottom	5.8	5.9
	SR7	Bottom	5.9	6.3
	IS17	Bottom	5.8	6.1
	IS(Mf)16	Bottom	6.0	6.4
	IS(Mf)9	Bottom	6.7	6.5
	IS8(N)	Bottom	6.3	6.6
	SR4(N2)	Bottom	6.2	6.5
	SR4a	Bottom	5.2	6.3

Table 2.10 ***Summary of Average Depth-averaged Turbidity Level of Baseline Monitoring and the Reporting Period (in NTU)***

Tide	Station	Average depth-averaged turbidity of baseline monitoring	Average depth-averaged turbidity of reporting period
Mid-ebb	IS(Mf)11	10.7	5.9
	SR7	8.7	5.5
	IS17	9.8	5.9
	IS(Mf)16	8.9	6.8
	IS(Mf)9	8.2	6.0
	IS8(N)	8.4	7.4
	SR4(N2)	8.9	7.0
	SR4a	8.9	5.8
Mid-flood	IS(Mf)11	12.9	7.9
	SR7	11.7	7.3
	IS17	12.1	5.8
	IS(Mf)16	11.3	7.2
	IS(Mf)9	10.2	7.2

Tide	Station	Average depth-averaged turbidity of baseline monitoring	Average depth-averaged turbidity of reporting period
	IS8(N)	11.9	6.4
	SR4(N2)	10.3	6.0
	SR4a	7.8	5.8

Table 2.11 Summary of Average Depth-averaged SS Level of Baseline Monitoring and the Reporting Period (in mg/L)

Tide	Station	Average depth-averaged SS of baseline monitoring	Average depth-averaged SS of reporting period
Mid-ebb	IS(Mf)11	9.8	6.5
	SR7	11.4	6.2
	IS17	10.7	7.2
	IS(Mf)16	11.3	8.1
	IS(Mf)9	10.9	7.6
	IS8(N)	11.3	8.5
	SR4(N2)	11.1	7.4
	SR4a	9.1	6.9
Mid-flood	IS(Mf)11	10.3	8.1
	SR7	10.4	8.0
	IS17	11.7	7.0
	IS(Mf)16	10.4	8.2
	IS(Mf)9	14.7	8.3
	IS8(N)	13.5	7.7
	SR4(N2)	12.2	7.6
	SR4a	9.8	6.8

Table 2.12 One-way ANOVA Results for DO Comparison between Impact and Baseline Periods

Tide	Station	Depth	F ratio	p-value
Mid-ebb	IS(Mf)11	Surface	$F_{1,103} = 0.17$	0.68
Mid-ebb	SR7	Surface	$F_{1,103} = 0.65$	0.42
Mid-ebb	IS17	Surface	$F_{1,103} = 0.06$	0.80
Mid-ebb	IS(Mf)16	Surface	$F_{1,103} = 0.44$	0.51
Mid-ebb	IS(Mf)9	Surface	$F_{1,87} = 0.36$	0.36
Mid-ebb	IS8(N)	Surface	$F_{1,103} = 0.58$	0.45
Mid-ebb	SR4(N2)	Surface	$F_{1,103} = 0.63$	0.63
Mid-ebb	SR4a	Surface	$F_{1,103} = 9.38$	**<0.01**
Mid-flood	IS(Mf)11	Surface	$F_{1,102} = 0.05$	0.82
Mid-flood	SR7	Surface	$F_{1,102} = 0.24$	0.62
Mid-flood	IS17	Surface	$F_{1,102} = 0.33$	0.57
Mid-flood	IS(Mf)16	Surface	$F_{1,102} = 0.89$	0.35
Mid-flood	IS(Mf)9	Surface	$F_{1,84} = 0.02$	0.90
Mid-flood	IS8(N)	Surface	$F_{1,102} = 0.66$	0.42
Mid-flood	SR4(N2)	Surface	$F_{1,102} = 1.75$	0.19
Mid-flood	SR4a	Surface	$F_{1,102} = 8.49$	**<0.01**
Mid-ebb	IS(Mf)11	Middle	$F_{1,103} = <0.01$	0.95
Mid-ebb	IS17	Middle	$F_{1,103} = 0.17$	0.68
Mid-flood	IS(Mf)11	Middle	$F_{1,102} = 0.33$	0.57
Mid-flood	IS17	Middle	$F_{1,102} = 1.13$	0.29
Mid-flood	IS(Mf)9	Middle	$F_{1,19} = 1.24$	0.28
Mid-ebb	IS(Mf)11	Bottom	$F_{1,103} = 0.22$	0.64
Mid-ebb	SR7	Bottom	$F_{1,103} = 0.93$	0.34
Mid-ebb	IS17	Bottom	$F_{1,103} = 0.20$	0.65

Tide	Station	Depth	F ratio	p-value
Mid-ebb	IS(Mf)16	Bottom	$F_{1,103} = 0.32$	0.57
Mid-ebb	IS(Mf)9	Bottom	$F_{1,87} = 0.02$	0.88
Mid-ebb	IS8(N)	Bottom	$F_{1,103} = 0.13$	0.72
Mid-ebb	SR4(N2)	Bottom	$F_{1,100} = 0.10$	0.75
Mid-ebb	SR4a	Bottom	$F_{1,103} = 4.30$	0.04
Mid-flood	IS(Mf)11	Bottom	$F_{1,100} = 0.02$	0.88
Mid-flood	SR7	Bottom	$F_{1,100} = 0.83$	0.36
Mid-flood	IS17	Bottom	$F_{1,100} = 0.82$	0.37
Mid-flood	IS(Mf)16	Bottom	$F_{1,100} = 1.31$	0.26
Mid-flood	IS(Mf)9	Bottom	$F_{1,81} = 0.12$	0.73
Mid-flood	IS8(N)	Bottom	$F_{1,100} = 0.78$	0.38
Mid-flood	SR4(N2)	Bottom	$F_{1,98} = 0.31$	0.58
Mid-flood	SR4a	Bottom	$F_{1,100} = 8.24$	**<0.01**

Note:
By setting α at 0.05, significant differences (*p*-value < 0.05) are bold.

Table 2.13 One-way ANOVA Results for Depth-averaged Turbidity Comparison between Impact and Baseline Periods

Tide	Station	F ratio	p-value
Mid-ebb	IS(Mf)11	$F_{1,103} = 27.98$	**<0.01**
Mid-ebb	SR7	$F_{1,103} = 10.25$	**<0.01**
Mid-ebb	IS17	$F_{1,103} = 18.92$	**<0.01**
Mid-ebb	IS(Mf)16	$F_{1,103} = 6.06$	**0.02**
Mid-ebb	IS(Mf)9	$F_{1,103} = 6.67$	**0.01**
Mid-ebb	IS8(N)	$F_{1,103} = 1.20$	0.28
Mid-ebb	SR4(N2)	$F_{1,103} = 4.82$	**0.03**
Mid-ebb	SR4a	$F_{1,103} = 11.52$	**<0.01**
Mid-flood	IS(Mf)11	$F_{1,102} = 21.46$	**<0.01**
Mid-flood	SR7	$F_{1,102} = 13.04$	**<0.01**
Mid-flood	IS17	$F_{1,102} = 38.72$	**<0.01**
Mid-flood	IS(Mf)16	$F_{1,102} = 15.11$	**<0.01**
Mid-flood	IS(Mf)9	$F_{1,102} = 6.13$	**0.01**
Mid-flood	IS8(N)	$F_{1,102} = 29.14$	**<0.01**
Mid-flood	SR4(N2)	$F_{1,102} = 23.14$	**<0.01**
Mid-flood	SR4a	$F_{1,102} = 4.69$	**0.03**

Note:
By setting α at 0.05, significant differences (*p*-value < 0.05) are bold.

Table 2.14 One-way ANOVA Results for Depth-averaged SS Comparison between Impact and Baseline Periods

Tide	Station	F ratio	p-value
Mid-ebb	IS(Mf)11	$F_{1,103} = 10.66$	**<0.01**
Mid-ebb	SR7	$F_{1,103} = 21.38$	**<0.01**
Mid-ebb	IS17	$F_{1,103} = 9.05$	**<0.01**
Mid-ebb	IS(Mf)16	$F_{1,102} = 6.40$	**0.01**
Mid-ebb	IS(Mf)9	$F_{1,103} = 6.96$	**<0.01**
Mid-ebb	IS8(N)	$F_{1,103} = 4.47$	**0.04**
Mid-ebb	SR4(N2)	$F_{1,103} = 13.22$	**<0.01**
Mid-ebb	SR4a	$F_{1,103} = 3.32$	0.07
Mid-flood	IS(Mf)11	$F_{1,102} = 2.40$	0.12
Mid-flood	SR7	$F_{1,102} = 2.15$	0.15
Mid-flood	IS17	$F_{1,102} = 14.30$	**<0.01**
Mid-flood	IS(Mf)16	$F_{1,102} = 2.42$	0.12
Mid-flood	IS(Mf)9	$F_{1,102} = 19.62$	<0.01
Mid-flood	IS8(N)	$F_{1,102} = 17.54$	<0.01

Tide	Station	F ratio	p-value
Mid-flood	SR4(N2)	$F_{1,102} = 11.15$	<0.01
Mid-flood	SR4a	$F_{1,102} = 6.13$	0.01

Note:
By setting α at 0.05, significant differences (p-value < 0.05) are bold.

In addition, linear regression was conducted to examine any relationship between DO / Turbidity / SS levels and time (i.e. number of days after construction works commencement) during this yearly monitoring period at each monitoring station. The method of data interpretation followed the same method as indicated in *Section 2.1.3* for TSP monitoring. As shown in *Tables 2.15 to 2.17*, results of the regression analysis indicated that there was no significant ($r^2 < 0.60$) relationship between DO / Turbidity / SS level and time during this yearly monitoring period. As such, it is considered that there is no apparent trend of increasing or decreasing DO / Turbidity / SS level since commencement of constructions works.

Table 2.15 Linear Regression Result of DO

Parameter	Station	R^2	F ratio	p-value	Intercept	Coefficient of days of construction
Mid-ebb Surface DO	IS(Mf)11	0.233	$F_{1,91} = 27.3$	<0.001	17.74	-0.005
	SR7	0.256	$F_{1,91} = 31.0$	<0.001	18.06	-0.006
	IS17	0.287	$F_{1,91} = 36.3$	<0.001	19.17	-0.006
	IS(Mf)16	0.230	$F_{1,91} = 26.8$	<0.001	20.09	-0.007
	IS(Mf)9	0.213	$F_{1,75} = 20.0$	<0.001	21.09	-0.007
	IS8(N)	0.236	$F_{1,91} = 27.8$	<0.001	19.77	-0.006
	SR4(N2)	0.298	$F_{1,91} = 38.3$	<0.001	20.90	-0.007
	SR4a	0.270	$F_{1,91} = 33.3$	<0.001	20.68	-0.007
Parameter	**Station**	**R^2**	**F ratio**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-flood surface DO	IS(Mf)11	0.131	$F_{1,90} = 13.4$	<0.001	16.94	-0.005
	SR7	0.133	$F_{1,90} = 13.6$	<0.001	17.82	-0.005
	IS17	0.086	$F_{1,90} = 8.4$	<0.001	17.49	-0.005
	IS(Mf)16	0.099	$F_{1,90} = 9.8$	<0.001	17.14	-0.005
	IS(Mf)9	0.272	$F_{1,72} = 26.5$	<0.001	21.80	-0.007
	IS8(N)	0.108	$F_{1,90} = 10.8$	<0.001	16.99	-0.005
	SR4(N2)	0.114	$F_{1,90} = 11.4$	<0.001	17.96	-0.005
	SR4a	0.119	$F_{1,90} = 12.0$	<0.001	18.25	-0.006
Parameter	**Station**	**R^2**	**F ratio**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-ebb middle DO	IS(Mf)11	0.385	$F_{1,91} = 56.4$	<0.001	22.69	-0.008
	IS17	0.357	$F_{1,91} = 49.9$	<0.001	21.27	-0.007
	IS(Mf)9	0.112	$F_{1,15} = 0.02$	0.392	8.59	<0.001
Parameter	**Station**	**R^2**	**F ratio**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-flood middle DO	IS(Mf)11	0.246	$F_{1,90} = 29.1$	<0.001	20.66	-0.007
	IS17	0.243	$F_{1,90} = 28.6$	<0.001	19.71	-0.007
	IS(Mf)9	0.009	$F_{1,17} = 0.2$	0.560	4.35	0.001
Parameter	**Station**	**R^2**	**F ratio**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-ebb bottom DO	IS(Mf)11	0.373	$F_{1,91} = 53.5$	<0.001	25.44	-0.009
	SR7	0.385	$F_{1,91} = 56.4$	<0.001	20.11	-0.007
	IS17	0.372	$F_{1,91} = 53.4$	<0.001	23.45	-0.009
	IS(Mf)16	0.399	$F_{1,91} = 59.7$	<0.001	23.76	-0.009
	IS(Mf)9	0.287	$F_{1,75} = 29.8$	<0.001	21.65	-0.007

Parameter	Station	R^2	F ratio	p-value	Intercept	Coefficient of days of construction
	IS8(N)	0.258	$F_{1,91}$ = 31.3	<0.001	21.19	-0.007
	SR4(N2)	0.382	$F_{1,91}$ = 55.6	<0.001	23.34	-0.008
	SR4a	0.451	$F_{1,91}$ = 73.9	<0.001	25.15	-0.009
Parameter	**Station**	**R^2**	**F ratio**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-flood bottom DO	IS(Mf)11	0.241	$F_{1,90}$ = 28.2	<0.001	22.76	-0.008
	SR7	0.254	$F_{1,90}$ = 30.4	<0.001	20.34	-0.007
	IS17	0.354	$F_{1,90}$ = 48.7	<0.001	22.01	-0.008
	IS(Mf)16	0.228	$F_{1,90}$ = 26.3	<0.001	19.58	-0.006
	IS(Mf)9	0.318	$F_{1,72}$ = 33.0	<0.001	21.66	-0.007
	IS8(N)	0.131	$F_{1,90}$ = 13.4	<0.001	17.42	-0.005
	SR4(N2)	0.197	$F_{1,90}$ = 21.9	<0.001	20.46	-0.007
	SR4a	0.290	$F_{1,90}$ = 36.3	<0.001	22.57	-0.008

Note:
1. Dependent variable is set as DO (in mg/L) and independent variable is set as number of day of construction works.
2. R^2 <0.6 values of insignificant regression model are underlined.

Table 2.16 Linear Regression Result of Turbidity

Parameter	Station	R^2	F ratio	p-value	Intercept	Coefficient of days of construction
Mid-ebb depth -average turbidity	IS(Mf)11	0.028	$F_{1,91}$ = 2.6	0.428	-5.85	0.006
	SR7	0.019	$F_{1,91}$ = 1.7	0.541	-4.75	0.005
	IS17	0.107	$F_{1,91}$ = 10.8	0.022	-14.14	0.009
	IS(Mf)16	0.108	$F_{1,91}$ = 10.9	0.024	-15.50	0.011
	IS(Mf)9	0.019	$F_{1,91}$ = 1.7	0.689	-2.66	0.004
	IS8(N)	0.095	$F_{1,91}$ = 9.4	0.043	-14.92	0.011
	SR4(N2)	0.147	$F_{1,91}$ = 15.5	0.005	-19.01	0.013
	SR4a	0.062	$F_{1,91}$ = 6.0	0.146	-8.71	0.007
Parameter	**Station**	**R^2**	**F ratio**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-flood depth -average turbidity	IS(Mf)11	0.088	$F_{1,90}$ = 8.6	0.048	-16.92	0.012
	SR7	0.039	$F_{1,90}$ = 3.5	0.276	-10.22	0.008
	IS17	0.032	$F_{1,90}$ = 2.9	0.343	-7.35	0.006
	IS(Mf)16	0.054	$F_{1,90}$ = 5.1	0.176	-11.16	0.009
	IS(Mf)9	0.095	$F_{1,90}$ = 9.4	0.029	-19.11	0.013
	IS8(N)	0.004	$F_{1,90}$ = 0.4	0.799	1.86	0.002
	SR4(N2)	0.069	$F_{1,90}$ = 6.6	0.112	-10.04	0.008
	SR4a	0.084	$F_{1,90}$ = 8.2	0.052	-12.82	0.009

Note:
1. Dependent variable is set as Turbidity (in mg/L) and independent variable is set as number of day of construction works.
2. R^2 <0.6 values of insignificant regression model are underlined.

Table 2.17 Linear Regression Result of SS

Parameter	Station	R^2	F ratio	p-value	Intercept	Coefficient of days of construction
Mid-ebb depth -average SS	IS(Mf)11	0.132	$F_{1,91}$ = 13.6	0.006	-21.55	0.014
	SR7	0.102	$F_{1,91}$ = 10.2	0.017	-19.96	0.013
	IS17	0.094	$F_{1,90}$ = 9.4	0.027	-19.73	0.013
	IS(Mf)16	0.143	$F_{1,90}$ = 14.8	0.004	-26.67	0.017
	IS(Mf)9	0.133	$F_{1,91}$ = 13.8	0.004	-28.03	0.017
	IS8(N)	0.093	$F_{1,91}$ = 9.2	0.032	-21.78	0.015
	SR4(N2)	0.134	$F_{1,91}$ = 13.9	0.008	-19.58	0.013
	SR4a	0.051	$F_{1,91}$ = 4.8	0.193	-10.33	0.008

Parameter	Station	R^2	F ratio	p-value	Intercept	Coefficient of days of construction
Mid-flood depth -average SS	IS(Mf)11	0.090	$F_{1,90} = 8.8$	0.027	-25.51	0.016
	SR7	0.102	$F_{1,90} = 10.1$	0.011	-34.92	0.021
	IS17	0.166	$F_{1,90} = 17.8$	<0.001	-32.21	0.019
	IS(Mf)16	0.194	$F_{1,90} = 21.4$	<0.001	-40.99	0.024
	IS(Mf)9	0.115	$F_{1,90} = 11.6$	0.010	-28.30	0.018
	IS8(N)	0.074	$F_{1,90} = 7.1$	0.061	-19.11	0.013
	SR4(N2)	0.082	$F_{1,90} = 7.9$	0.039	-22.22	0.014
	SR4a	0.156	$F_{1,90} = 16.5$	0.002	-25.10	0.015

Note:
1. Dependent variable is set as Turbidity (in mg/L) and independent variable is set as number of day of construction works.
2. R^2 <0.6 values of insignificant regression model are underlined.

2.3 DOLPHIN MONITORING

2.3.1 Monitoring Requirements

Impact dolphin monitoring is required to be conducted by a qualified dolphin specialist team to evaluate whether there have been any effects on the dolphins. In order to fulfil the EM&A requirements and make good use of available resources, impact line transect dolphin monitoring data collected by HyD's *Contract No. HY/2011/03 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road - Section between Scenic Hill and Hong Kong Boundary Crossing Facilities* on the monthly basis between November 2018 and September 2019 were adopted to avoid duplicates of survey effort.

Contract No. HY/2012/08 has taken over the responsibility for implementation of dolphin monitoring from HZMB HKLR Contract No. HY/2011/03 since October 2019.

2.3.2 Monitoring Equipment

Table 2.18 summarize the equipment used for the impact dolphin monitoring.

Table 2.18 Dolphin Monitoring Equipment

Equipment	Model
Global Positioning System (GPS)	Garmin 18X-PC
	Geo One Phottix
Camera	Nikon D90 300m 2.8D fixed focus
	Nikon D90 20-300m zoom lens
Laser Binoculars	Infinitor LRF 1000
Marine Binocular	Bushell 7 x 50 marine binocular with compass and reticules
Vessel for Monitoring	65 foot single engine motor vessel with viewing platform 4.5m above water level

2.3.3 Monitoring Parameter, Frequencies & Duration

Dolphin monitoring should cover all transect lines in Northeast Lantau (NEL) and the Northwest Lantau (NWL) survey areas twice per month throughout the entire construction period. The monitoring data should be compatible

with, and should be made available for, long-term studies of small cetacean ecology in Hong Kong. In order to provide a suitable long-term dataset for comparison, identical methodology and line transects employed in baseline dolphin monitoring was followed in the impact dolphin monitoring.

2.3.4 *Monitoring Location*

The impact dolphin monitoring was carried out in the NEL and NWL along the line transect as depicted in *Figure 2.3*. The co-ordinates of all transect lines are shown in *Table 2.19* below.

Table 2.19 Impact Dolphin Monitoring Line Transect Co-ordinates

Line No.		Easting	Northing	Line No.		Easting	Northing
1	Start Point	804671	815456	13	Start Point	816506	819480
1	End Point	804671	831404	13	End Point	816506	824859
2	Start Point	805476	820800*	14	Start Point	817537	820220
2	End Point	805476	826654	14	End Point	817537	824613
3	Start Point	806464	821150*	15	Start Point	818568	820735
3	End Point	806464	822911	15	End Point	818568	824433
4	Start Point	807518	821500*	16	Start Point	819532	821420
4	End Point	807518	829230	16	End Point	819532	824209
5	Start Point	808504	821850*	17	Start Point	820451	822125
5	End Point	808504	828602	17	End Point	820451	823671
6	Start Point	809490	822150*	18	Start Point	821504	822371
6	End Point	809490	825352	18	End Point	821504	823761
7	Start Point	810499	822000*	19	Start Point	822513	823268
7	End Point	810499	824613	19	End Point	822513	824321
8	Start Point	811508	821123	20	Start Point	823477	823402
8	End Point	811508	824254	20	End Point	823477	824613
9	Start Point	812516	821303	21	Start Point	805476	827081
9	End Point	812516	824254	21	End Point	805476	830562
10	Start Point	813525	821176	22	Start Point	806464	824033
10	End Point	813525	824657	22	End Point	806464	829598
11	Start Point	814556	818853	23	Start Point	814559	821739
11	End Point	814556	820992	23	End Point	814559	824768
12	Start Point	815542	818807	24*	Start Point	805476*	815900*
12	End Point	815542	824882	24*	End Point	805476*	819100*

Remarks: The coordinates of several starting and ending points have been revised since August 2017 due to the presence of a work zone to the north of the airport platform with intense construction activities in association with the construction of the third runway expansion for

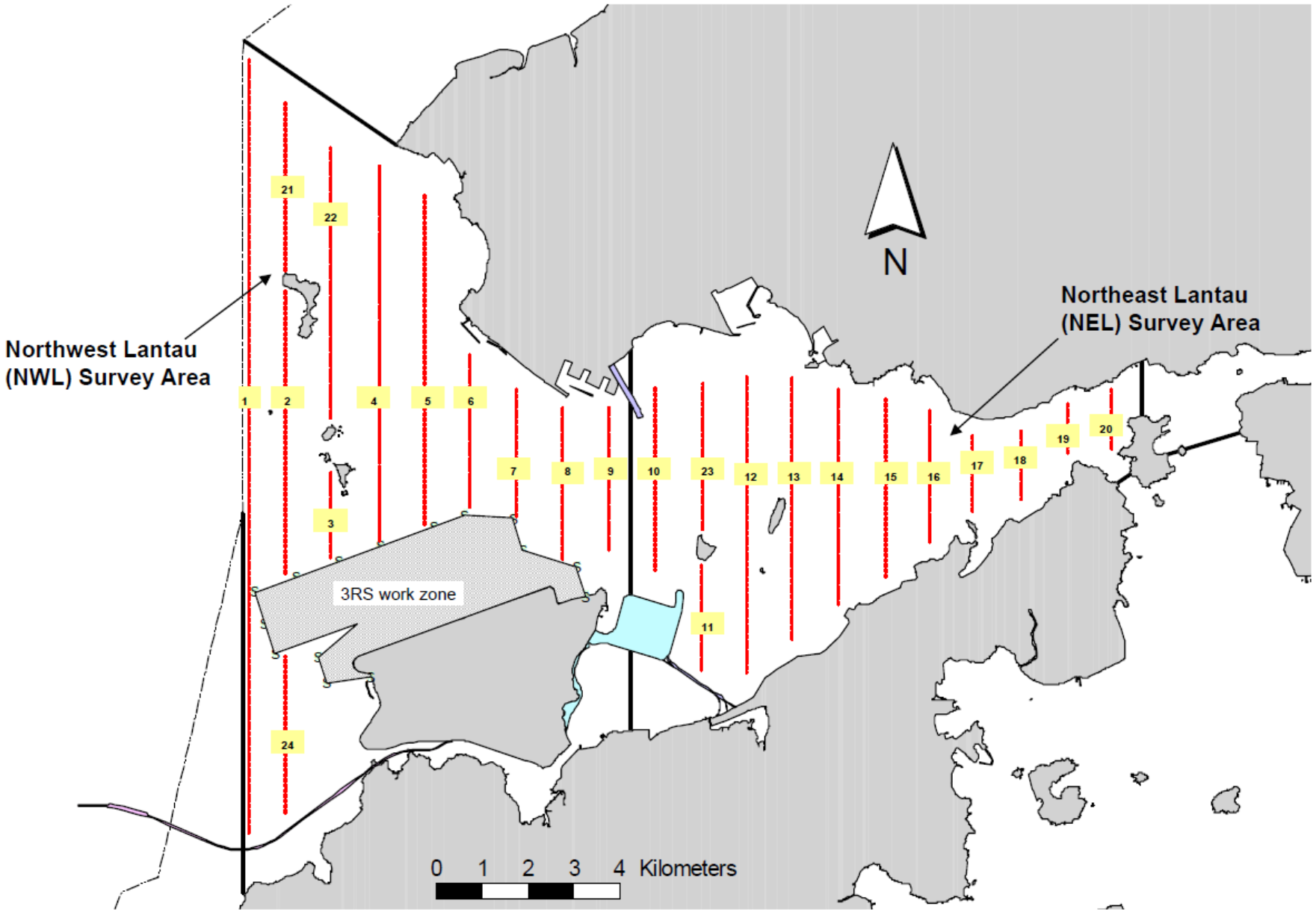


Figure 2.3

Layout of Transect Lines of Dolphin Monitoring in Northwest and Northeast Lantau Areas

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the Hong Kong International Airport. Co-ordinates in red and marked with asterisk are revised co-ordinates of transect line.

2.3.5 Action & Limit Levels

The Action and Limit levels of dolphin impact monitoring are shown in *Appendix C*. The Event and Action plan is presented in *Appendix G*.

2.3.6 Results & Observations

A total of 3,181.16 km of survey effort was collected, with 94.9% of the total survey effort being conducted under favourable weather conditions (ie Beaufort Sea State 3 or below with good visibility) in this reporting year. Amongst the two areas, 1,177.95 km and 2,003.21 km of survey effort were collected from NEL and NWL survey areas, respectively. The total survey effort conducted on primary and secondary lines were 2,304.73 km and 876.43 km, respectively. The survey efforts are summarized in *Appendix F*.

A total of 27 groups of 68 Chinese White Dolphin sightings were recorded during the 24 sets of surveys in this reporting year. All except three (3) sightings were made during on-effort search. Nineteen (19) on-effort sightings were made on primary lines, while five (5) other on-effort sightings were made on secondary lines. During this reporting year, all dolphin groups were sighted in NWL, while none of them were sighted in NEL.

Dolphin sighting distribution of the present impact phase monitoring period (November 2018 to October 2019 was compared to the ones during the baseline phase (February 2011 to January 2012), transitional phase (November 2012 to October 2013) and the first, second, third, fourth and fifth years of impact phase (November 2013 to October 2014, November 2014 to October 2015, November 2015 to October 2016, November 2017 to October 2018 and November 2018 to October 2019 respectively). As TMCLKL construction works commenced in November 2013, a 12-month period between baseline phase and impact phase is defined as transitional phase.

During the present 12-month impact phase monitoring period, the average daily encounter rates of Chinese White Dolphins were deduced in NEL and NWL survey areas, and compared to the ones deduced from the baseline and transitional phases as shown in *Table 2.20*.

Table 2.20 Average Daily Dolphin Encounter Rates

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		**Encounter rate (ANI)** (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	Northeast Lantau	**Northwest Lantau**	**Northeast Lantau**	**Northwest Lantau**
Impact Phase (2018-19)	0.00	1.42 ± 1.80	0.00	3.62 ± 4.93
Impact Phase (2017-18)	0.00	2.68 ± 3.04	0.00	9.02 ± 14.63

Impact Phase (2016-17)	0.00	2.35 ± 2.62	0.00	8.57 ± 11.05
Impact Phase (2015-16)	0.00	2.10 ± 1.83	0.00	8.54 ± 8.53
Impact Phase (2014-15)	0.11 ± 0.54	2.54 ± 2.49	0.11 ± 0.54	11.64 ± 14.04
Impact Phase (2013-14)	0.22 ± 0.74	6.93 ± 4.08	0.76 ± 2.59	26.31 ± 17.56
Transitional Phase (2012-13)	1.70 ± 2.26	7.68 ± 4.36	4.75 ± 7.61	27.51 ± 18.06
Baseline Phase (2011-12)	6.05 ± 5.04	7.75 ± 5.69	19.91 ± 21.30	29.57 ± 26.96

Note: Comparison of average daily dolphin encounter rates from the first, second, third, fourth, fifth and sixth years of impact phase (November 2013 to October 2014, November 2014 to October 2015, November 2015 to October 2016, November 2016 to October 2017, November 2017 to October 2018 and November 2018 to October 2019 respectively), transitional phase (November 2012 – October 2013) and baseline phase monitoring periods (February 2011 – January 2012). ± denotes the standard deviation of the value.

Group size of Chinese White Dolphins ranged from one to seven (1-7) individuals per group in North Lantau region during November 2018 - October 2019. The average dolphin group sizes from the 12-month impact phase monitoring period were compared with the ones deduced from baseline and transitional phases, as shown in *Table 2.21*.

Table 2.21 Comparison of Average Dolphin Group Sizes from Impact Monitoring Period and Baseline Monitoring Period

	Average Dolphin Group Size		
	Overall	**Northeast Lantau**	**Northwest Lantau**
Impact Phase (2018-19)	2.52 ± 1.45 (n = 27)	0.00	2.52 ± 1.45 (n = 27)
Impact Phase (2017-18)	3.12 ± 2.86 (n = 42)	0.00	3.12 ± 2.86 (n = 42)
Impact Phase (2016-17)	3.51 ± 2.68 (n = 43)	0.00	3.51 ± 2.68 (n = 43)
Impact Phase (2015-16)	3.73 ± 3.14 (n = 45)	1.00 (n = 1)	3.80 ± 3.14 (n = 44)
Impact Phase (2014-15)	4.24 ± 3.15 (n = 54)	1.00 (n = 1)	4.30 ± 3.15 (n = 53)
Impact Phase (2013-14)	3.76 ± 2.57 (n = 136)	5.00 ± 2.71 (n = 4)	3.73 ± 2.57 (n = 132)
Transitional Phase (2012-13)	3.37 ± 2.98 (n = 186)	2.64 ± 2.38 (n = 22)	3.47 ± 3.05 (n = 164)
Baseline Phase (2011-12)	3.32 ± 2.86 (n = 288)	2.80 ± 2.35 (n = 79)	3.52 ± 3.01 (n = 209)

Note: Comparison of average dolphin group sizes from the first, second, third, fourth, fifth and sixth years of impact phase (November 2013 to October 2014, November 2014 to October 2015, November 2015 to October 2016, November 2016 to October 2017, November 2017 to October 2018 and November 2018 to October 2018 respectively), transitional phase (November 2012 – October 2013) and baseline phase monitoring periods (February 2011 – January 2012). (± denotes the standard deviation of the average value)

Whilst four (4) Limit Level exceedances were observed for the quarterly dolphin monitoring data between November 2018 and October 2019. In this reporting period, no unacceptable impact from the activities of this Contract on Chinese White Dolphins was noticeable from the general observations. It

is essential to continue monitoring the dolphin usage in North Lantau region for the rest of the impact phase monitoring period.

2.3.7 Implementation of Marine Mammal Exclusion Zone

Daily marine mammal exclusion zone was in effect during the period of silt curtain installation in open waters between December 2018 and October 2019. No sighting of the Indo-Pacific humpback dolphin *Sousa chinensis* (i.e. Chinese White Dolphin) was recorded in the reporting period during the exclusion zone monitoring.

No Passive Acoustic Monitoring (PAM) was implemented in the reporting period.

2.4 EM&A SITE INSPECTION

Site inspections were carried out on a weekly basis to monitor the implementation of proper environmental pollution control and mitigation measures under the Contract. Fifty two (52) site inspections were carried out in the reporting period. Key observations were summarized in the *Sixty-First to Seventy-Second Monthly EM&A Reports*.

2.5 WASTE MANAGEMENT STATUS

The Contractor was registered as chemical waste producer under the Contract. Sufficient numbers of receptacles were available for general refuse collection and sorting.

Wastes generated during this reporting period include mainly construction wastes (inert and non-inert) and recyclable materials. Reference has been made to the waste flow table prepared by the Contractor (*Appendix I*). The quantities of different types of wastes are summarized in *Table 2.22*.

Table 2.22 Quantities of Different Waste Generated in the Reporting Period

Month/Year	Inert Construction Waste [a] (tonnes)	Inert Construction Waste Re-used (tonnes)	Non-inert Construction Waste [b] (tonnes)	Recyclable Materials [c] (kg)	Chemical Wastes (kg)	Marine Sediment (m^3)	
						Category L	Category M
November 2018	155,310	141,730	448	394,690	1,400	0	5,836
December 2018	146,997	137,101	519	213,450	0	0	0
January 2019	299,831	268,846	538	394,550	0	0	1,095
February 2019	133,335	113,728	578	104,340	1,672	0	1,115
March 2019	120,224	71,419	692	88,660	0	15,512	34,501.5
April 2019	130,329	58,956	707	264,790	1,045	12,561	19,851
May 2019	67,355	51,297	798	2,120	0	0	0
June 2019	4,134	0	751	137,410	4,140	0	0
July 2019	3,821	0	730	445,570	0	0	0
August 2019	2,388	0	703	507,510	3,800	0	0
September 2019	4,191	0	737	399,320	8,000	0	0
October 2019	8,366	0	754	524,090	5,800	0	0

Month/Year	Inert Construction Waste [a] (tonnes)	Inert Construction Waste Re-used (tonnes)	Non-inert Construction Waste [b] (tonnes)	Recyclable Materials [c] (kg)	Chemical Wastes (kg)	Marine Sediment (m^3)	
						Category L	Category M
Total	**1,076,281**	**843,077**	**7,955**	**3,476,500**	**25,857**	**28,073**	**62,399**

The Contractor was advised to properly maintain on site C&D materials and waste collection, sorting and recording system, dispose of C&D materials and wastes at designated ground and maximize reuse/ recycle of C&D materials and wastes. The Contractor was also reminded to properly maintain the site tidiness and dispose of the wastes accumulated on site regularly and properly.

For chemical waste containers, the Contractor was reminded to treat properly and store temporarily in designated chemical waste storage area on site in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.

2.6 ENVIRONMENTAL LICENSES AND PERMITS

The status of environmental licensing and permit is summarized in *Table 2.23* below.

Table 2.23 Summary of Environmental Licensing and Permit Status

License/ Permit	License or Permit No.	Date of Issue	Date of Expiry	License/ Permit Holder	Remarks
Environmental Permit	EP-354/2009/D	13-Mar-15	Throughout the Contract	HyD	Application for VEP on 3 March 2015 to supersede EP-354/2009/C
Construction Dust Notification	363510	19-Aug-13	Throughout the Contract	DBJV	Northern Landfall
Construction Dust Notification	403620	10-Jun-16	Throughout the Contract	DBJV	Southern Landfall
Chemical Waste Registration	5213-422-D2516-02	18-Jan-17	Throughout the Contract	DBJV	Northern Landfall
Chemical Waste Registration	5213-951-D2591-01	25-May-16	Throughout the Contract	DBJV	Southern Landfall
Construction Waste Disposal Account	7018108	28-Aug-13	Throughout the Contract	DBJV	Waste disposal in Contract No. HY/2012/08
Construction Waste Disposal Account	7021715	18-Oct-18	17-Jan-19	DBJV	Vessel Disposal
Construction Waste Disposal Account	7021715	04-Oct-19	14-Jan-20	DBJV	Vessel Disposal
Waste Water Discharge License	WT00019248-2014	05-Jun-14	30-Jun-19	DBJV	For site Portion N6 and Reclamation Area E
Waste Water Discharge License	WT00031435-2018	02-Aug-18	31-Aug-23	DBJV	Southern Landfall
Waste Water Discharge License	WT00034060-2019	25-Jul-19	30-Jun-24	DBJV	Northern Landfall (4 Discharge Point)
Marine Dumping Permit	EP/MD/19-063	19-Nov-18	18-May-19	DBJV	Type 1 (Open Sea Disposal)

License/ Permit	License or Permit No.	Date of Issue	Date of Expiry	License/ Permit Holder	Remarks
Marine Dumping Permit	EP/MD/20-013	19-May-19	18-Nov-19	DBJV	Type 1 (Open Sea Disposal)
Marine Dumping Permit	EP/MD/19-015	05-Sep-18	04-Mar-19	DBJV	Catepillar Area
Marine Dumping Permit	EP/MD/19-057	05-Nov-18	04-Dec-18	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-083	05-Jan-19	04-Feb-19	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-097	05-Feb-19	04-Mar-19	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-109	05-Mar-19	04-Apr-19	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-121	05-Apr-19	04-May-19	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/20-001	05-May-19	04-Jun-19	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Construction Noise Permit	GW-RS0598-18	15-Jul-18	14-Jan-19	DBJV	Southern Landfall
Construction Noise Permit	GW-RS0966-18	26-Oct-18	14-Apr-19	DBJV	Southern Landfall
Construction Noise Permit	GW-RS0224-19	25-Mar-19	24-Sep-19	DBJV	Southern Landfall
Construction Noise Permit	GW-RS0766-19	02-Sep-19	25-Feb-20	DBJV	Southern Landfall
Construction Noise Permit	GW-RW0406-18	16-Oct-18	15-Apr-19	DBJV	Urmston Road in front of Pillar Point
Construction Noise Permit	GW-RW0179-19	27-Apr-19	15-Oct-19	DBJV	Urmston Road in front of Pillar Point
Construction Noise Permit	GW-RW0344-18	20-Aug-18	19-Feb-19	DBJV	WA23 @ Tsing Yi

License/ Permit	License or Permit No.	Date of Issue	Date of Expiry	License/ Permit Holder	Remarks
Construction Noise Permit	GW-RW0063-19	20-Feb-19	19-Aug-19	DBJV	WA23 @ Tsing Yi
Construction Noise Permit	GW-RW0374-19	20-Aug-19	19-Feb-20	DBJV	WA23 @ Tsing Yi

Notes:
HyD = Highways Department
DBJV = Dragages – Bouygues Joint Venture
VEP = Variation of Environmental Permit

2.7 IMPLEMENTATION STATUS OF ENVIRONMENTAL MITIGATION MEASURES

In response to the EM&A site audit findings mentioned in *Section 2.4* of this report, the Contractor has carried out the corrective actions.

A summary of the Implementation Schedule of Environmental Mitigation Measures (EMIS) is presented in *Appendix B*. The necessary mitigation measures relevant to this Contract were implemented properly.

2.8 SUMMARY OF EXCEEDANCES OF THE ENVIRONMENTAL QUALITY PERFORMANCE LIMIT

In this reporting period, a total of 119 air quality monitoring events were undertaken in which twenty-three (23) Action Level exceedances and three (3) Limit Level exceedances of 1-hour TSP and two (2) Action Level exceedances of 24-hour TSP were recorded. No Limit Level exceedances of 24-hour TSP was recorded. (*Table 2.24*).

Table 2.24 Summary of Exceedances for Air Quality Impact Monitoring in this Reporting Year

Station	Exceedance Level	Number of Exceedances	
		1-hr TSP	24-hr TSP
AQMS1	Action Level	0	0
	Limit Level	0	0
ASR1	Action Level	12	2
	Limit Level	3	0
ASR5	Action Level	8	0
	Limit Level	0	0
ASR6	Action Level	3	0
	Limit Level	0	0
ASR10	Action Level	0	0
	Limit Level	0	0
Total number of Action level Exceedances:		23	2
Total number of Limit level Exceedances:		3	0

For marine water quality impact monitoring, a total of 93 monitoring events were undertaken in which one hundred and forty-seven (147) Action Level exceedances and eighteen (18) Limit Level exceedances were recorded. (*Table 2.25*).

Table 2.25 Summary of Exceedances for Marine Water Quality Impact Monitoring in this Reporting Period

Station	Exceedance Level [(a)]	DO (Surface and Middle)	DO (Bottom)	Turbidity (depth-averaged)	SS (depth-averaged)
IS(Mf)11	**AL**	14	15	0	0
	LL	0	15	0	0
SR7	**AL**	7	7	0	4
	LL	0	0	0	0
IS17	**AL**	14	24	0	0
	LL	0	0	0	0
IS(Mf)16	**AL**	4	6	0	0
	LL	0	1	0	0
IS(Mf)9	**AL**	3	1	0	1
	LL	0	0	0	0
IS8(N)	**AL**	4	4	0	0
	LL	0	1	0	0
SR4(N2)	**AL**	7	11	0	0
	LL	0	1	0	0
SR4a	**AL**	5	15	0	1
	LL	0	0	0	0
	Total AL Exceedances:	**58**	**83**	**0**	**6**
	Total LL Exceedances:	**0**	**18**	**0**	**0**

There were a total of four (4) Limit Levels exceedances for impact dolphin monitoring in the reporting period. No unacceptable impact from the construction activities of the TM-CLKL Northern Connection Sub-sea Tunnel Section on Chinese White Dolphins was noticeable from general observations during the dolphin monitoring in this reporting period. Detailed investigation findings are presented in *the Twentieth to Twenty-Third Quarterly EM&A Reports*.

Cumulative statistics are provided in *Appendix H.*

2.9 SUMMARY OF COMPLAINTS, NOTIFICATION OF SUMMONS AND SUCCESSFUL PROSECUTIONS

The Environmental Complaint Handling Procedure is provided in *Figure 2.4*.

No non-compliance event was recorded during the reporting period.

One (1) environmental complaint case was received in this reporting period. The investigation report was submitted to ENPO and reported in the subsequent EM&A report.

No environmental summons was received in this reporting period.

Statistics on complaints, notifications of summons and successful prosecutions are summarized in *Appendix H*.

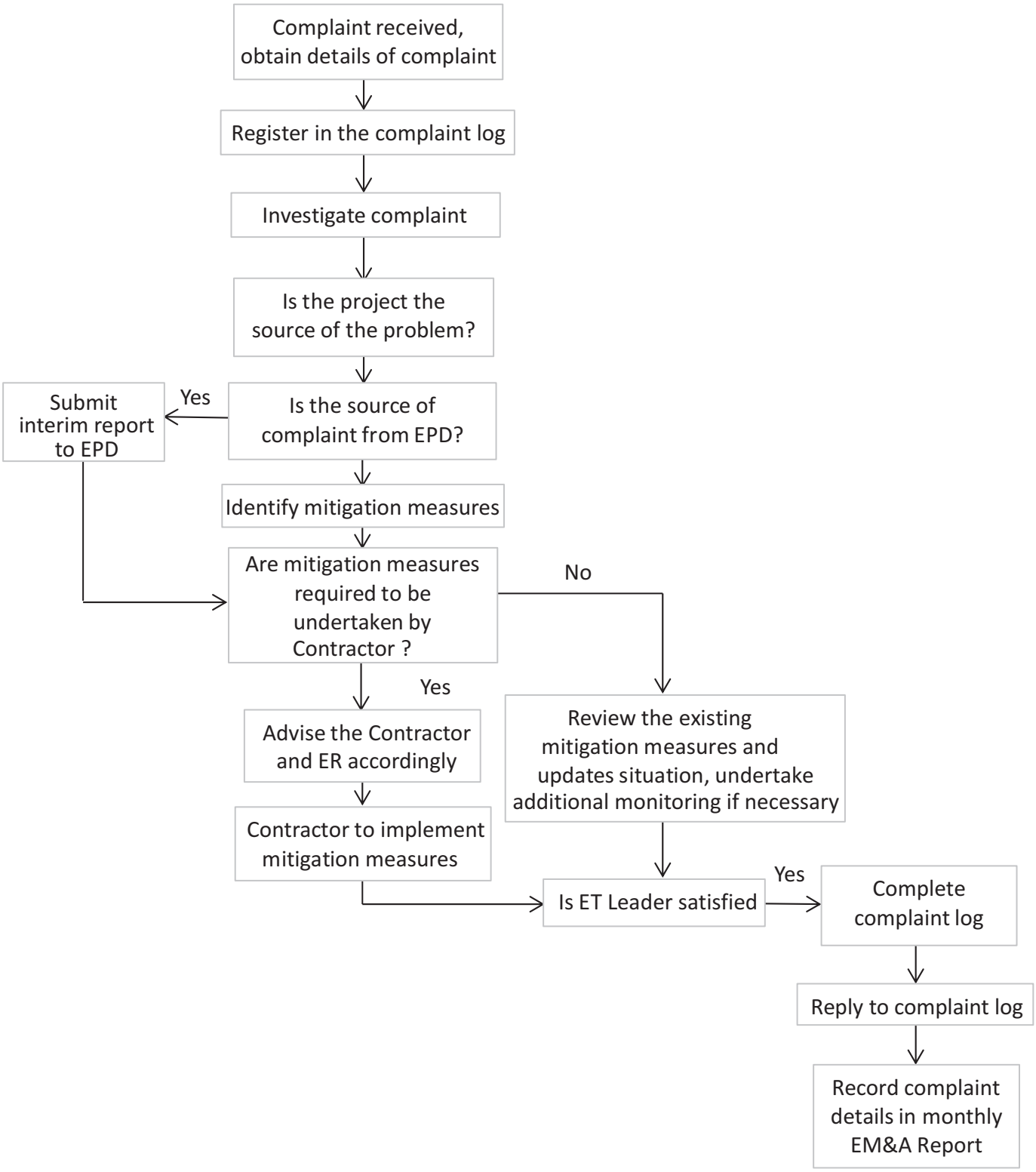

Figure 2.4 Environmental Complaint Handling Procedure

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2.10 COMPARISON OF EM&A DATA WITH EIA PREDICTIONS

Findings of the EM&A activities undertaken during the period from 1 November 2018 to 31 October 2019 were compared with the relevant EIA predictions where appropriate to provide a review of the validity of the EIA predictions and identify potential shortcomings in the EIA recommendations.

2.10.1 *Air Quality*

Based on the findings presented in TM-CLKL EIA study, the major sources of dust nuisance arising from the Northern Connection are related to excavation, wind erosion from reclaimed areas, open sites and stockpiling areas. Therefore, during these construction activities, the TSP monitoring frequency will be increased at all air quality monitoring stations such that any deteriorating air quality can be readily detected and timely action taken to rectify the situation. Comparison of EIA prediction, average baseline monitoring and average impact monitoring results of TSP is presented in *Table 2.26*.

Table 2.26 Comparison of EIA prediction and EM&A Results on Air Quality

Station	EIA Predicted Maximum	Maximum Impact Monitoring	Average Impact Monitoring	Maximum Baseline Monitoring	Average Baseline Monitoring
ASR1 (1-hour)	195	646	126	182	125
ASR1 (24-hour)	148	237	85	173	128
ASR5 (1-hour)	235	425	151	211	138
ASR5 (24-hour)	133	196	91	249	167
AQMS1 (1-hour)	N/A	311	94	196	131
AQMS1 (24-hour)	N/A	127	58	211	127
ASR6 (1-hour)	226	478	110	226	135
ASR6 (24-hour)	153	191	69	221	166
ASR10 (1-hour)	189	242	69	215	134
ASR10 (24-hour)	112	146	50	181	129

As shown in *Table 2.26*, maximum 1-hour TSP at ASR1, ASR5, ASR6 and ASR10 and 24-hour TSP impact monitoring levels at ASR1, ASR5, ASR 6 and ASR10 were higher than their corresponding EIA predicted maximum levels. Occasional exceedances were recorded at these stations during impact monitoring period. However, they were not project-related upon investigation. It also appeared that the construction activities of the Contract did not cause significant impact on air quality with similar average TSP levels between the baseline and impact monitoring. The EIA has concluded that no adverse residual construction dust impacts will occur after implementation of

mitigation measures. Thus, the monitoring results are considered to be in line with the EIA prediction.

2.10.2 Water Quality

As identified in the EIA Report, key water quality issues during construction phase may be caused by dredging and filling works for the reclamation of the Project. Thus, marine water quality monitoring should be carried out during the construction phase to ensure that any unacceptable increase in suspended solids / turbidity or unacceptable decrease in dissolved oxygen due to dredging and filling activities could be readily detected and timely action could be taken to rectify the situation.

According to the EIA prediction, no SS exceedance is anticipated from this Project at the water sensitive receivers in the vicinity of the Contract works area (WSR 12, WSR 13 and WSR 47a). DO and SS exceedances were recorded during impact monitoring period. The annual mean values of depth-averaged SS recorded in this reporting period were compared with the relevant concerned mean values, which were defined as 30% above baseline levels. Results showed that the annual mean values of depth-averaged SS at all monitoring stations except IS14 were well below the concerned mean values (*Table 2.27*), thus the impact monitoring results are considered to in line with the EIA prediction.

DO levels from surface, mid-depth and bottom waters were generally similar amongst Control, Impact stations and Sensitive Receivers, and DO levels were variable throughout the reporting period which represented natural background fluctuation in water quality. Similar to DO levels, turbidity and SS levels were generally comparable amongst Control, Impact stations and Sensitive Receivers and variable throughout the monitoring period. High levels of turbidity and SS were occasionally recorded during both mid-ebb and mid-flood tides. Such fluctuations were also observed during baseline monitoring and are considered to be sporadic events and characteristic of water quality in this area of Hong Kong.

The annual means of DO levels during impact period were higher than the means of DO levels measured during baseline period. The annual means of depth-averaged SS and Turbidity during impact period were lower than the means of depth-averaged SS and Turbidity measured during baseline period. One way Analysis of Variance (ANOVA) was conducted to test for the differences between the baseline and impact monitoring data of Dissolved Oxygen, Turbidity and SS at the designated water quality monitoring locations. The detailed graphical and statistical results, as presented in *Section 2.2.3* and *Appendix E* respectively, show that depth-averaged SS and Turbidity levels were lower during impact period than baseline period whilst DO levels were higher during impact period than baseline period. No deterioration trend on water quality was detected in the reporting period when comparing to baseline data. Thus, the impact monitoring results are considered to in line with the EIA prediction.

Table 2.27 Comparison between Annual Mean and Ambient Mean Values of Depth-averaged Suspended Solids (mg/L)

Station	Baseline Mean		Ambient Mean [(a)]		Annual Mean (November 2018 to October 2019)	
	Mid-ebb	Mid-flood	Mid-ebb	Mid-flood	Mid-ebb	Mid-flood
IS(Mf)11	10.2	10.3	13.3	13.4	6.5	8.1
SR7	10.9	10.4	14.2	13.5	6.2	8.0
IS17	9.2	11.7	12.0	15.2	7.2	7.0
IS(Mf)16	10.0	10.4	13.0	13.5	8.1	8.2
IS(Mf)9	10.4	14.7	13.5	19.1	7.6	8.3
IS8(N)	9.6	13.5	12.5	17.6	8.5	7.7
SR4(N2)	10.3	12.2	13.4	15.9	7.4	7.6
SR4a	10.1	9.8	13.1	12.7	6.9	6.8
Grand Total	**10.1**	**11.6**	**13.1**	**15.1**	**7.3**	**7.7**

Notes:
(a) Ambient mean value is defined as a 30% increase of the baseline mean value

2.10.3 Marine Ecology

Impact monitoring on marine ecology was undertaken during the monitoring period. According to the baseline results in the *Appendix F* of the approved EIA Report, the dolphin groups were largely sighted near Lung Kwu Chau and the waters between Lung Kwu Chau and Black Points and infrequently along the alignment of this Contract. Two-way ANOVAs with repeated measures were conducted to compare results of average encounter rate of sightings (STG) and average encounter rate of dolphins (ANI) between baseline and impact periods. The STG and ANI in impact monitoring period were lower than that before the commencement of this Contract (see *Section 2.3.6*) and the distribution pattern was also different between the impact monitoring period and before the commencement (i.e. transition period in 2012 – 2013) of this Contract. In addition, the habitat use pattern between impact monitoring in this reporting period and before the commencement of this Contract is different. During the present impact phase monitoring period in 2018-19, the most heavily utilized habitats by Chinese White Dolphins were only found on both northwestern end of the North Lantau region, mainly to the north and east of Lung Kwu Chau. Dolphin usage of NWL waters declined during the present and previous phase monitoring periods. The monitoring results in this reporting period are considered to be in line with the EIA predictions, and the review of monitoring data suggested that no unacceptable impacts was noted from the marine dredging and reclamation activities under this Contract. It is essential to monitor the dolphin usage in North Lantau region for the rest of impact monitoring period to keep track on the trend of dolphin ranging pattern.

2.10.4 Waste Management

For wastes generated from the construction activities including C&D materials (inert and non-inert), chemical wastes, recyclable materials and marine sediments (both categories L and M), the types of wastes generated were in line with the EIA predictions. The wastes were disposed of in accordance with the recommendations of the EIA.

2.11 SUMMARY OF MONITORING METHODOLOGY AND EFFECTIVENESS

The EM&A monitoring programme has been reviewed and was considered effective and adequate to cater for the nature of works in progress. No change to the monitoring programme was considered necessary.

The EM&A programme will be evaluated as appropriate in the next reporting period and improvements in the EM&A programme will be recommended if deemed necessary.

2.12 SUMMARY OF MITIGATION MEASURES

The mitigation measures stipulated in the Updated EM&A Manual were undertaken by the Contractor in the reporting period. The mitigation measures were reviewed and considered effective. No addition or change on mitigation measures was considered necessary.

3 REVIEW OF EM&A PROGRAMME

3.1 SITE INSPECTIONS & AUDITS

Weekly joint environmental site inspections have been conducted in the reporting period to assess the effectiveness of the environmental controls established by the Contractor and the implementation of the environmental mitigation measures recommended in the EIA Report. Findings of the site inspections confirmed that the environmental mitigation measures recommended in the EIA Report were properly implemented by the Contractor, and the recommended mitigation measures have been working effectively. There was no non-compliance recorded during the site inspections and environmental performance complied with environmental requirements.

The requirements for site inspections and audits have been reviewed and were considered as adequate. No change to the requirements was considered to be necessary.

The recommended environmental mitigation measures are also considered to be effective and efficient in reducing the potential environmental impacts associated with the construction phase of the Project. No change was thus considered necessary.

3.2 AIR QUALITY MONITORING

Construction phase air quality monitoring was conducted during this reporting period when land-based construction works were undertaken. Twenty-three (23) Action Level exceedances of 1-hour TSP, three (3) Limit Level exceedances of 1-hour TSP and two (2) Action Level exceedances of 24-hour TSP were recorded in the air quality monitoring of this reporting period. No Limit Level exceedances of 24-hour TSP was recorded in the air quality monitoring of this reporting period.

The monitoring programme has been reviewed and was considered to be adequate to cater for the nature of works. No change to the requirements was considered to be necessary.

3.3 MARINE WATER QUALITY MONITORING

One hundred and forty-seven (147) Action Level exceedances and eighteen (18) Limit Level exceedances were recorded from the water quality monitoring in this reporting period.

The monitoring programme has been reviewed and was considered to be adequate to cater for the nature of works. No change to the requirements was considered to be necessary.

3.4 WASTE MANAGEMENT

The waste inspection and audit programme has been implemented during this reporting period. Wastes generated from construction activities have been managed in accordance with the recommendations in the EIA Report, the EM&A Manual, the WMP and other relevant legislative requirements.

The requirements for construction waste management have been reviewed and were considered as adequate. No change to the requirements was considered to be necessary.

3.5 MARINE ECOLOGY MONITORING

Daily marine mammal exclusion zone was in effect during the period of silt curtain installation in open waters between December 2018 and October 2019. No sighting of the Indo-Pacific humpback dolphin *Sousa chinensis* (i.e. Chinese White Dolphin) was recorded in the reporting period during the exclusion zone monitoring.

No Passive Acoustic Monitoring (PAM) was implemented in the reporting period.

3.6 SUMMARY OF RECOMMENDATIONS

Findings of the EM&A programme indicate that the recommended mitigation measures have been properly implemented and working effectively. The EM&A programme has been reviewed and was considered as adequate and effective. No change to the EM&A programme was considered to be necessary.

The EM&A programme will be evaluated as appropriate in the next reporting period and improvements in the EM&A programme will be recommended if deemed necessary.

4 CONCLUSIONS

This Sixth Annual EM&A Report presents the findings of the EM&A activities undertaken during the period from 1 November 2018 to 31 October 2019, in accordance with the Updated EM&A Manual and the requirements of *EP-354/2009/D*.

Air quality (including 1-hour TSP and 24-hour TSP) and dolphin monitoring were carried out in the reporting period. Twenty-three (23) Action Level exceedances of 1-hour TSP, three (3) Limit Level exceedances of 1-hour TSP and two (2) Action Level exceedances of 24-hour TSP were recorded in the air quality monitoring of this reporting period. No Limit Level exceedances of 24-hour TSP was recorded in the air quality monitoring of this reporting period. The Contractor was reminded to ensure that all dust mitigation measures are provided at the construction sites.

One hundred and forty-seven (147) Action Level exceedances and eighteen (18) Limit Level exceedances were recorded from the water quality monitoring in this reporting period.

A total of 27 groups of 68 Chinese White Dolphin sightings were recorded during the 24 sets of surveys in this reporting year. Whilst four (4) Limit Level exceedances were recorded for four (4) sets of quarterly dolphin monitoring data between November 2018 and October 2019, no unacceptable impact from the construction activities of the TM-CLKL Northern Connection Sub-sea Tunnel Section on Chinese White Dolphins was noticeable from general observations during dolphin monitoring in this reporting period. It is essential to monitor the dolphin usage in North Lantau region for the rest of impact monitoring period to keep track on the trend of dolphin ranging pattern.

Fifty two (52) weekly environmental site inspections were carried out in the reporting period. Recommendations on remedial actions provided for the deficiencies identified during the site audits were properly implemented by the Contractor. No non-compliance event was recorded during the reporting period.

One (1) environmental complaint case was received in this reporting period. The investigation report was submitted to ENPO and reported in the subsequent EM&A report.

No environmental summons was received in this reporting period.

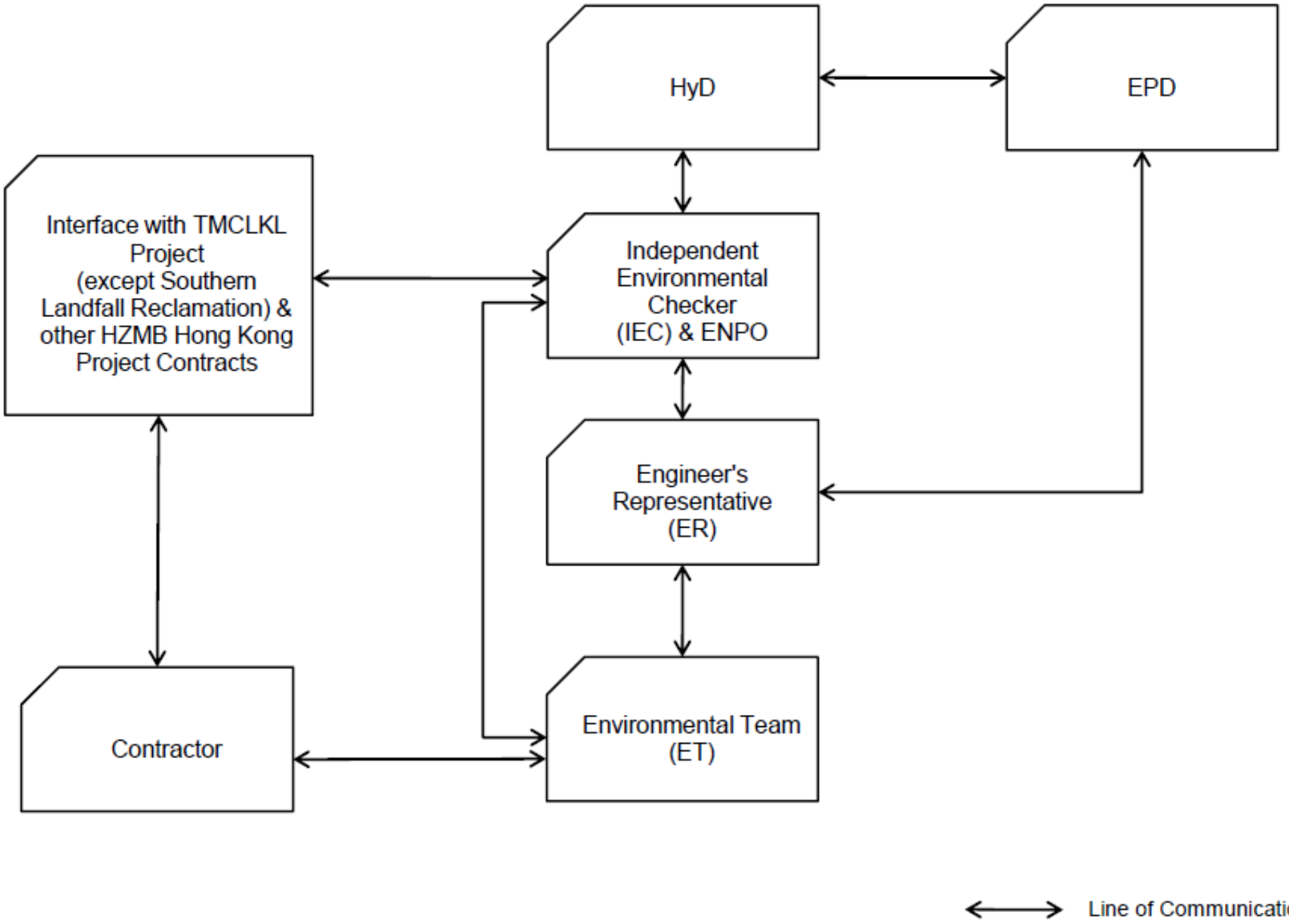
The review of monitoring data suggested that the construction works under this Contract have proceeded in an environmentally acceptable manner in this reporting period.

The monitoring programme has been reviewed and was considered as adequate to cater for the nature of works in progress. Change to the monitoring programme was thus not recommended at this stage. The ET

will keep track on the construction works to confirm compliance of environmental requirements and the proper implementation of all necessary mitigation measures.

Appendix A

Project Organization for Environmental Works



Appendix A1

Contract No. HY/2012/08 Northern Connection Sub-sea Tunnel Section
Project Organization

DATE: 06/03/2013

Environmental Resources Management

ERM

Appendix B

Environmental Mitigation and Enhancement Measure Implementation Schedules

Contract No. HY/2012/08
Tuen Mun – Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Environmental Mitigation and Enhancement Measure Implementation Schedule

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
Air Quality									
4.8.1	3.8	An effective watering programme of twice daily watering with complete coverage, is estimated to reduce by 50%. This is recommended for all areas in order to reduce dust levels to a minimum;	All areas / throughout construction period	Contractor	TMEIA Avoid smoke impacts and disturbance		Y		✓
4.8.1	3.8	Watering of the construction sites in Lantau for 8 times/day and in Tuen Mun for 12 times/day to reduce dust emissions by 87.5% and 91.7% respectively and shall be undertaken.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	The Contractor shall, to the satisfaction of the Engineer, install effective dust suppression measures and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver, dust levels are kept to acceptable levels.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	The Contractor shall not burn debris or other materials on the works areas.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8. 1	3.8	In hot, dry or windy weather, the watering programme shall maintain all exposed road surfaces and dust sources wet.	All unpaved haul roads / throughout construction period in hot, dry or windy weather	Contractor	TMEIA Avoid smoke impacts and disturbance		Y		✓
4.8.1	3.8	Where breaking of oversize rock/concrete is required, watering shall be implemented to control dust. Water spray shall be used during the handling of fill material at the site and at active cuts, excavation and fill sites where dust is likely to be created.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		<>
4.8. 1	3.8	Open dropping heights for excavated materials shall be controlled to a maximum height of 2m to minimise the fugitive dust arising from unloading.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	During transportation by truck, materials shall not be loaded to a level higher than the side and tail boards, and shall be dampened or covered before transport.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		<>
4.8.1	3.8	No earth, mud, debris, dust and the like shall be deposited on public roads. Wheel washing facility shall be usable prior to any earthworks excavation activity on the site.	All site exits / throughout construction period	Contractor	TMEIA Avoid dust		Y		✓
4.8.1	3.8	Areas of exposed soil shall be minimised to areas in which works have been completed shall be restored as soon as is practicable.	All exposed surfaces / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓

Legend: D=Design, C=Construction, O=Operation

Note: Funding Agent for all mitigation measures will be the Highways Department of the Hong Kong SAR Government

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
4.8.1	3.8	All stockpiles of aggregate or spoil shall be enclosed or covered and water applied in dry or windy condition.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		<>
4.11	Section 3	EM&A in the form of 1 hour and 24 hour dust monitoring and site audit.	All representative existing ASRs / throughout construction period	Contractor	EM&A Manual		Y		✓
WATER QUALITY									
Marine Works (Sequence A)									
6.1 Figure 6.2a Appendix D6a	Annex A	Construction of seawalls to be advanced by at least 200m before the main reclamation dredging and filling can commence. The protection by advanced seawall is a dynamic process depending on the progress of the construction activities and the stage when such protection could be realised is illustrated in Figure 6.2a and detailed in Appendix D6a. The part of the works where such measures can be undertaken for the majority of the time includes the following locations: - TM-CLKL northern reclamation;	All areas/ prior to dredging and backfilling works	Contractor	TM-EIAO		Y		✓
6.1	-	a maximum of 50% public fill to be used for all seawall filling below +2.5mPD for TM-CLKL southern and northern landfalls.	TM-CLKL seawall filling	Contractor	TM-EIAO		Y		✓
6.1	-	a maximum of 30% public fill to be used for reclamation filling below +2.5mPD for TM-CLKL southern landfall	TM-CLKL southern landfall reclamation filling	Contractor	TM-EIAO		Y		N/A
6.1	-	a maximum of 100% public fill to be used for reclamation filling below +2.5mPD for TM-CLKL northern landfall	TM-CLKL northern landfall reclamation filling	Contractor	TM-EIAO		Y		✓
6.1	-	Use of cage type silt curtains round allgrab dredgers during the HKBCF, HKLR and TM-CLKL southern reclamation works.	All areas dredging works	Contractor	TM-EIAO		Y		✓
	Figure 1.1 of Annex C	A layer of floating type silt curtain will be applied when dredging and reclamation works are being undertaken at Portion N-a as shown in Figure 1.1 of Annex C of the EM&A Manual.	All areas/ through out marine works	Contractor	TM-EIAO		Y		✓
6.1	-	Trailer suction hopper dredgers shall not allow mud to overflow.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	The use of Lean Material Overboard (LMOB) systems shall be prohibited.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
6.1 Figure 6.2b Appendix D6b	Annex A	For other parts of the reclamation works construction of seawalls to be advanced by at least 200m before the main reclamation dredging and filling can commence. It should be noted that the protection by advanced seawall is a dynamic process depending on the progress of the construction activities and the stage when such protection could be realised is illustrated in Figure 6.2b and detailed in Appendices D6b. The part of the works where such measures can be undertaken for the majority of the time includes the following locations: - TM-CLKL northern reclamation; - Reclamation filling for Portion D of HKBCF; Reclamation filling for FSD berth of HKBCF; and - Reclamation dredging and filling for Portion 1 of HKLR;	TM-CLKL northern landfall, Portion D of HKBCF and HKLR	Contractor	TM-EIAO		Y		✓
6.1	-	The filling material for the other parts of the works are the same as Sequence A;	All other areas/backfilling works	Contractor	TM-EIAO		Y		N/A
6.1	5.7	Cage type silt curtain (with steel enclosure) shall be used for grab dredgers working in the site of HKBCF and TM- CLKL southern reclamation. Cage type silt curtains will be applied round all grab dredgers at other works area.	HKBCF, HKLR and TM-CLKL grab dredging	Contractor	TM-EIAO		Y		✓
6.1	Annex A	A layer of floating type silt curtain will be applied around all works as defined in Appendix D6b.	All areas/ through out marine works	Contractor	TM-EIAO		Y		✓
6.1	-	TM-CLKL northern landfall: - Reclamation filling shall not proceed until at least 200m section of leading seawall at both the east and west sides of the reclamation are formed above +2.5 mPD, except for 100m gaps for marine access;	All areas/ through out marine works	Contractor	TM-EIAO		Y		✓
General Marine Works									
6.1	-	Use of TMB for the construction of the submarine tunnel.	Tunnel works / Construction phase	Contractor	TM-EIAO		Y		N/A
6.1	-	Export dredged spoils from NWWCZ.	All areas as much as possible / dredging activities	Contractor	DASO Permit conditions		Y		✓
6.1	-	Where public fill is proposed for filling below +2.5mPD, the fine content in the public fill will be controlled to 25%	All areas/ backfilling works	Contractor	TM-EIAO		Y		N/A
6.1	-	Where sand fill is proposed for filling below +2.5mPD, the fine content in the sand fill will be controlled to 5%.	All areas/ backfilling works	Contractor	TM-EIAO		Y		N.A

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
6.1	-	Mechanical grabs shall be designed and maintained to avoid spillage and should seal tightly while being lifted.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Barges and hopper dredgers shall have tight fitting seals to their bottom openings to prevent leakage of material.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Any pipe leakages shall be repaired quickly. Plant should not be operated with leaking pipes.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Loading of barges and hoppers shall be controlled to prevent splashing of dredged material to the surrounding water. Barges or hoppers shall not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Excess material shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessel is moved.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Adequate freeboard shall be maintained on barges to reduce the likelihood of decks being washed by wave action;	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		N/A
6.1	-	All vessels shall be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		N/A
6.1	-	The works shall not cause foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the works site.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
6.1	5.2	Silt curtain shall have proved effectiveness from the producer and shall be fully maintained throughout the works by the contractor.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	The daily maximum production rates shall not exceed those assumed in the water quality assessment.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	The dredging and filling works shall be scheduled to spread the works evenly over a working day.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
Land Works									
6.1	-	Wastewater from temporary site facilities should be controlled to prevent direct discharge to surface or marine waters.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		<>
6.1	-	Sewage effluent and discharges from on- site kitchen facilities shall be directed to Government sewer in accordance with the requirements of the WPCO or collected for disposal offsite. The use of soakaways shall be avoided.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		<>
6.1	-	Silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically at the onset of and after each rainstorm.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		<>
6.1	-	Temporary access roads should be surfaced with crushed stone or gravel.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Measures should be taken to prevent the washout of construction materials, soil, silt or debris into any drainage system.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Open stockpiles of construction materials (e.g. aggregates and sand) on site should be covered with tarpaulin or similar fabric during rainstorms.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	5.8	Manholes (including any newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
6.1	-	Discharges of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	All vehicles and plant should be cleaned before they leave the construction site to ensure that no earth, mud or debris is deposited by them on roads. A wheel washing bay should be provided at every site exit.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Wheel wash overflow shall be directed to silt removal facilities before being discharged to the storm drain.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Section of construction road between the wheel washing bay and the public road should be surfaced with crushed stone or coarse gravel.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Wastewater generated from concreting, plastering, internal decoration, cleaning work and other similar activities, shall be screened to remove large objects.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Vehicle and plant servicing areas, vehicle wash bays and lubrication facilities shall be located under roofed areas. The drainage in these covered areas shall be connected to foul sewers via a petrol interceptor in accordance with the requirements of the WPCO or collected for off site disposal.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		N/A
6.1	-	The Contractor shall prepare an oil / chemical cleanup plan and ensure that leakages or spillages are contained and cleaned up immediately.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		<>
6.1	-	Waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance.	All areas/ throughout construction period	Contractor	TM-EIAO Waste Disposal Ordinance		Y		✓
6.1	-	All fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. The storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest tank.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Surface run-off from bunded areas should pass through oil/grease traps prior to discharge to the stormwater system.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Roadside gullies to trap silt and grit shall be provided prior to discharging the stormwater into the marine environment. The sumps will be maintained and cleaned at regular intervals.	Roadside/design and operation	Design Consultant/ Contractor	TM-EIAO	Y		Y	✓
6.1	Section 5	All construction works shall be subject to routine audit to ensure implementation of all EIA recommendations and good working practice.	All areas/ throughout construction period	Contractor	EM&A Manual		Y		✓
Water Quality Monitoring									

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
6.1	Section 5	Water quality monitoring shall be undertaken for suspended solids, turbidity, and dissolved oxygen. Nutrients and metal parameters shall also be measured for Mf sediment operations (only HKBCF and HKLR required handling of Mf sediment) during baseline, backfilling and post construction period. One year operation phase water quality monitoring at designated stations.	Designated monitoring stations as defined in EM&A Manual, Section 5/ Before, through-out marine construction period, post construction and monthly operational phase water quality monitoring for a year.	Contractor	EM&A Manual		Y	Y	✓
ECOLOGY									
8.14	6.3	Specification for and implement pre, during and post construction dolphin abundance monitoring.	All Areas/Detailed Design/ during construction works/post construction	Design Consultant/ Contractor	TMEIA	Y	Y	Y	✓
8.14	6.3,6.5	Specification and implementation of 250m dolphin exclusion zone.	All dredging and reclamation areas/Detailed Design/during all reclamation and dredging works	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.15	6.3, 6.5	Specification and deployment of an artificial reef of an area of 3,600m2 in an area where fishing activities are prohibited.	Area of prohibited fishing activities/Detailed Design/towards end of construction period	TM-CLKL/ HKBCF Design Consultant/TM-CLKL/ HKBCF Contractor	TMEIA	Y		Y	N/A. To be implemented by AFCD.
8.14	6.3, 6.5	Specification and implementation of marine vessel control specifications	All areas/Detailed Design/during construction works	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.14	6.3, 6.5	Design and implementation of acoustic decoupling methods for dredging and reclamation works	All areas/ Detailed Design/during dredging and reclamation works	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.15	6.3, 6.4	Pre-construction phase survey and coral translocation	Detailed Design/Prior to construction	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.15	6.5	Audit coral translocation success	Post translocation	Contractor	TMEIA		Y		✓
7.13	6.5	The loss of habitat shall be supplemented by enhancement planting in accordance with the landscape mitigation schedule.	All areas / As soon as accessible	Contractor	TMEIA		Y		N/A.
7.13	6.5	Spoil heaps shall be covered at all times.	All areas / Throughout construction period	Contractor	TMEIA		Y		✓
7.13	6.5	Avoid damage and disturbance to the remaining and surrounding natural habitat	All areas / Throughout construction period	Contractor	TMEIA		Y		✓
7.13	6.5	Placement of equipment in designated areas within the existing disturbed land	All areas / Throughout construction period	Contractor	TMEIA		Y		✓
7.13	6.5	Disturbed areas to be reinstated immediately after completion of the works.	All areas / Throughout construction period	Contractor	TMEIA		Y		✓
7.13	6.5	Construction activities should be restricted to the proposed works boundary.	All areas / Throughout construction period	Contractor	TMEIA		Y		✓

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
LANDSCAPE AND VISUAL									
10.9	7.6	The colour and shape of the toll control buildings, ventilation building and administration building shall adopt a design which could blend it into the vicinity elements, and the details will be developed in detailed design stage (DM2)	All areas/detailed design	Design Consultant	TMEIA	Y			N/A
10.9	7.6	Aesthetic design of the viaduct, retaining wall and other structures will be developed under ACABAS submission (DM5)	All areas/detailed design	Design Consultant	TMEIA	Y			N/A
10.9	7.6	Screening of construction works by hoardings around works area in visually unobtrusive colours, to screen works (CM5)	All areas/detailed design/ during construction/post construction	Design Consultant/ Contractor	TMEIA	Y	Y		✓
10.9	7.6	Control night-time lighting and glare by hooding all lights (CM6)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		N/A
10.9	7.6	Ensure no run-off into water body adjacent to the Project Area (CM7)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		✓
10.9	7.6	Avoidance of excessive height and bulk of buildings and structures (CM8)	All areas/detailed design/ during construction	Design Consultant/ Contractor	TMEIA	Y	Y		✓
10.9	7.6	Aesthetically pleasing design (visually unobtrusive and non-reflective) as regard to the form, material and finishes shall be incorporated to all buildings, engineering structures and associated infrastructure facilities (OM5)	All areas/detailed design/ during construction / during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	N/A
10.9	7.6	Avoidance of excessive height and bulk of buildings and structures (OM6)	All areas/detailed design/ during construction / during operation	Design Consultant/ Contractor	TMEIA	Y	Y	Y	N/A
WASTE									
12.6		The Contractor shall identify a coordinator for the management of waste.	Contract mobilisation	Contractor	TMEIA		Y		✓
12.6		The Contractor shall prepare and implement a Waste Management Plan which specifies procedures such as a ticketing system, to facilitate tracking of loads and to ensure that illegal disposal of wastes does not occur, and protocols for the maintenance of records of the quantities of wastes generated, recycled and disposed. A recording system for the amount of waste generated, recycled and disposed (locations) should be established.	Contract mobilisation	Contractor	TMEIA, Works Branch Technical Circular No. 5/99 for the Trip-ticket System for Disposal of Construction and Demolition Material		Y		✓
12.6		The Contractor shall apply for and obtain the appropriate licenses for the disposal of public fill, chemical waste and effluent discharges.	Contract mobilisation	Contractor	TMEIA, Land (Miscellaneous Provisions) Ordinance (Cap		Y		✓

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
					28); Waste Disposal Ordinance (Cap 354); Dumping at Sea Ordinance (Cap 466); Water Pollution Control Ordinance.				
12.6	8.1	Training shall be provided to workers about the concepts of site cleanliness and appropriate waste management procedures including waste reduction, reuse and recycling.	Contract Mobilisation	Contractor	TMEIA		Y		✓
12.6	8.1	The extent of cutting operation should be optimised where possible. Earth retaining structures and bored pile walls should be proposed to minimise the extent of cutting.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	The surplus surcharge should be transferred to a fill bank	Reclamation areas / after surcharge works	Contractor	TMEIA		Y		N/A
12.6	8.1	Rock armour from the existing seawall should be reused on the new sloping seawall as far as possible	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	The site and surroundings shall be kept tidy and litter free.	All areas / throughout construction period	Contractor	TMEIA		Y		<>
12.6	8.1	No waste shall be burnt on site.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Provisions to be made in contract documents to allow and promote the use of recycled aggregates where appropriate.	Detailed Design	Design Consultant	TMEIA	Y			✓
12.6	8.1	The Contractor shall be prohibited from disposing of C&D materials at any sensitive locations. The Contractor should propose the final disposal sites in the EMP and WMP for approval before implementation.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Stockpiled material shall be covered by tarpaulin and /or watered as appropriate to prevent windblown dust/ surface run off.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Excavated material in trucks shall be covered by tarpaulins to reduce the potential for spillage and dust generation.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Wheel washing facilities shall be used by all trucks leaving the site to prevent transfer of mud onto public roads.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Dredged marine mud shall be disposed of in a gazetted marine disposal ground under the requirements of the Dumping at Seas Ordinance.	Reclamation areas / throughout dredging works	Contractor	TMEIA		Y		✓

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
12.6	8.1	Standard formwork or pre-fabrication should be used as far as practicable so as to minimise the C&D materials arising. The use of more durable formwork/plastic facing for construction works should be considered. The use of wooden hoardings should be avoided and metal hoarding should be used to facilitate recycling. Purchasing of construction materials should avoid over-ordering and wastage.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	The Contractor should recycle as many C&D materials (this is a waste section) as possible on-site. The public fill and C&D waste should be segregated and stored in separate containers or skips to facilitate the reuse or recycling of materials and proper disposal. Where practicable, the concrete and masonry should be crushed and used as fill materials. Steel reinforcement bar should be collected for use by scrap steel mills. Different areas of the sites should be considered for segregation and storage activities.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	All falsework will be steel instead of wood.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Chemical waste producers should register with the EPD. Chemical waste should be handled in accordance with the Code of Practice on the Packaging, Handling and Storage of Chemical Wastes as follows: - suitable for the substance to be held, - resistant to corrosion, maintained in good conditions and securely closed; - Having a capacity of <450L unless the specifications have been approved by the EPD; and - Displaying a label in English and Chinese according to the instructions prescribed in Schedule 2 of the Regulations. - Clearly labelled and used solely for the storage of chemical wastes; - Enclosed with at least 3 sides; - Impermeable floor and bund with capacity to accommodate 110% of the volume of the largest container or 20% by volume of the chemical waste stored in the area, whichever is greatest; - Adequate ventilation; - Sufficiently covered to prevent rainfall	All areas / throughout construction period	Contractor	TMEIA		Y		<>

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
		entering (water collected within the bund must be tested and disposed of as chemical waste, if necessary); and - Incompatible materials are adequately separated.							
12.6	8.1	Waste oils, chemicals or solvents shall not be disposed of to drain,	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Adequate numbers of portable toilets should be provided for on-site workers. Portable toilets should be maintained in reasonable states, which will not deter the workers from utilising them.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Night soil should be regularly collected by licensed collectors.	All areas / throughout construction period	Contractor	TMEIA		Y		N/A
12.6	8.1	General refuse arising on-site should be stored in enclosed bins or compaction units separately from C&D and chemical wastes. Sufficient dustbins shall be provided for storage of waste as required under the Public Cleansing and Prevention of Nuisances By-laws. In addition, general refuse shall be cleared daily and shall be disposed of to the nearest licensed landfill or refuse transfer station. Burning of refuse on construction sites is prohibited.	All areas / throughout construction period	Contractor	TMEIA		Y		<>
12.6	8.1	All waste containers shall be in a secure area on hardstanding;	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Training shall be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.	All areas / throughout construction period	Contractor	TMEIA		Y		✓
12.6	8.1	Office wastes can be reduced by recycling of paper if such volume is sufficiently large to warrant collection. Participation in a local collection scheme by the Contractor should be advocated. Waste separation facilities for paper, aluminium cans, plastic bottles, etc should be provided on-site.	Site Offices/ throughout construction period	Contractor	TMEIA		Y		✓
12.6	Section 8	EM&A of waste handling, storage, transportation, disposal procedures and documentation through the site audit programme shall be undertaken.	All areas / throughout construction period	Contractor	EM&A Manual		Y		✓
CULTURAL HERITAGE									
11.8	Section 9	EM&A in the form of audit of the mitigation measures	All areas / throughout construction period	Highways Department	EIAO-TM		Y		N/A

*** Remarks:**

✓ Compliance of Mitigation Measures
<> Compliance of Mitigation but need improvement
x Non-compliance of Mitigation Measures

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EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/ Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	

▲	Non-compliance of Mitigation Measures but rectified by Contractor
Δ	Deficiency of Mitigation Measures but rectified by Contractor
N/A	Not Applicable in Reporting Period

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Appendix C

Summary of Action and Limit Levels

Table C1 Action and Limit Levels for 1-hour and 24-hour TSP

Parameters	Action	Limit
24 Hour TSP Level in μg/m³	ASR1 = 213 ASR5 = 238 AQMS1 = 213 ASR6 = 238 ASR10 = 214	260
1 Hour TSP Level in μg /m³	ASR1 = 331 ASR5 = 340 AQMS1 = 335 ASR6 = 338 ASR10 = 337	500

Table C2 Action and Limit Levels for Water Quality

Parameter	Action Level#	Limit Level#
DO in mg/L [(a)]	Surface and Middle **5.0 mg/L** Bottom **4.7 mg/L**	Surface and Middle **4.2 mg/L** Bottom **3.6 mg/L**
Turbidity in NTU (Depth-averaged [(b), (c)])	120% of upstream control station at the same tide of the same day and 95%-ile of baseline data, i.e., **27.5 NTU**	130% of upstream control station at the same tide of the same day and 99%-ile of baseline data, i.e., **47.0 NTU**
SS in mg/L (Depth-averaged [(b), (c)])	120% of upstream control station at the same tide of the same day and 95%-ile of baseline data, i.e., **23.5 mg/L**	130% of upstream control station at the same tide of the same day and 10mg/L for WSD Seawater Intakes at Tuen Mun and 99%-ile of baseline data, i.e., **34.4 mg/L**

Notes:

Baseline data: data from HKZMB Baseline Water Quality Monitoring between 6 and 31 October 2011.

(a) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.

(b) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths

(c) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.

(d) All figures given in the table are used for reference only, and EPD may amend the figures whenever it is considered as necessary

(e) The 1%-ile of baseline data for surface and middle DO is 4.2 mg/L, whilst for bottom DO is 3.6 mg/L.

Table C3 Action and Limit Levels for Impact Dolphin Monitoring

	North Lantau Social Cluster	
	NEL	**NWL**
Action Level	STG < 70% of baseline & ANI < 70% of baseline	STG < 70% of baseline & ANI < 70% of baseline
Limit Level	[STG < 40% of baseline & ANI < 40% of baseline] and STG < 40% of baseline & ANI < 40% of baseline	

Notes:

1. STG means quarterly encounter rate of number of dolphin sightings, which is **6.00 in NEL** and **9.85 in NWL** during the baseline monitoring period
2. ANI means quarterly encounter rate of total number of dolphins, which is **22.19 in NEL** and **44.66 in NWL** during the baseline monitoring period
3. For North Lantau Social Cluster, AL will be trigger if NEL or NWL fall below the criteria; LL will be triggered if both NEL and NWL fall below the criteria.

Table C4 Derived Value of Action Level (AL) and Limit Level (LL)

	North Lantau Social Cluster	
	NEL	**NWL**
Action Level	STG < 4.2 & ANI< 15.5	STG < 6.9 & ANI < 31.3
Limit Level	NEL = [STG < 2.4 & ANI <8.9] and NWL = [STG < 3.9 & ANI <17.9]	

Appendix D

Impact Air Quality Monitoring Results

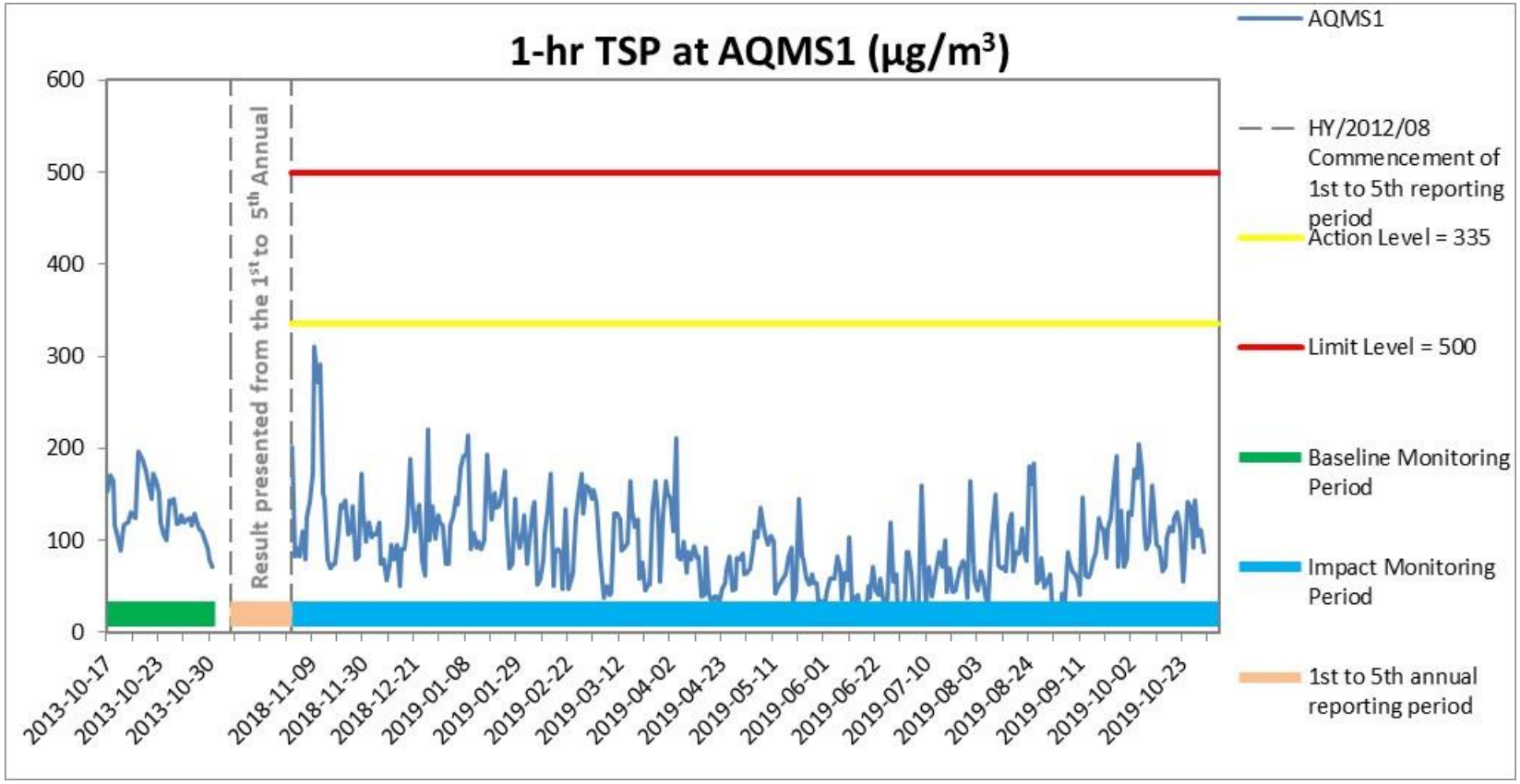

Figure D.1 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at AQMS1 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

Ref: 0212330_Impact AQM graphs_6thAnnual_REV a.xlsx

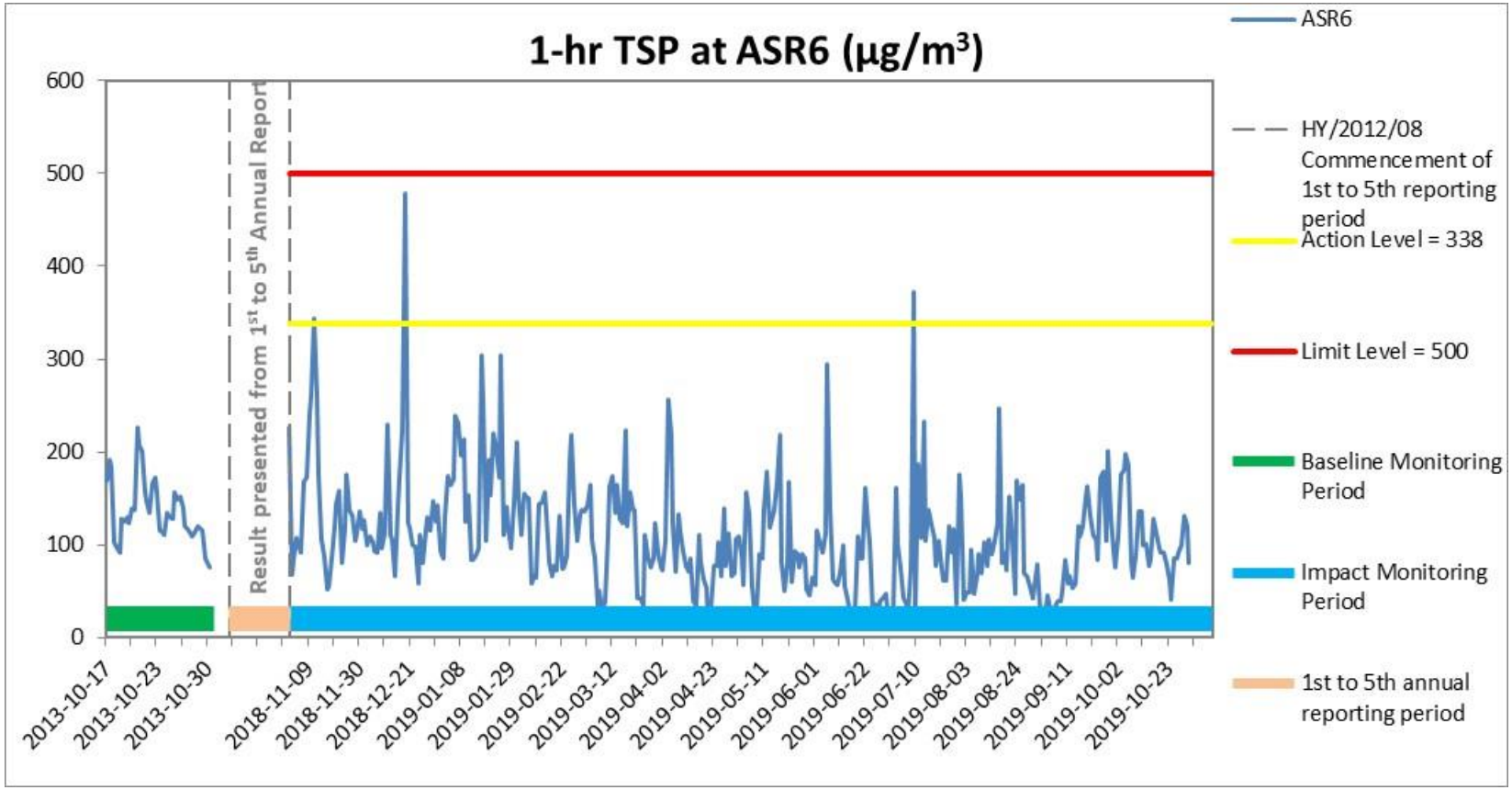

Figure D.2 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at ASR6 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

Ref: 0212330_Impact AQM graphs_6thAnnual_REV a.xlsx

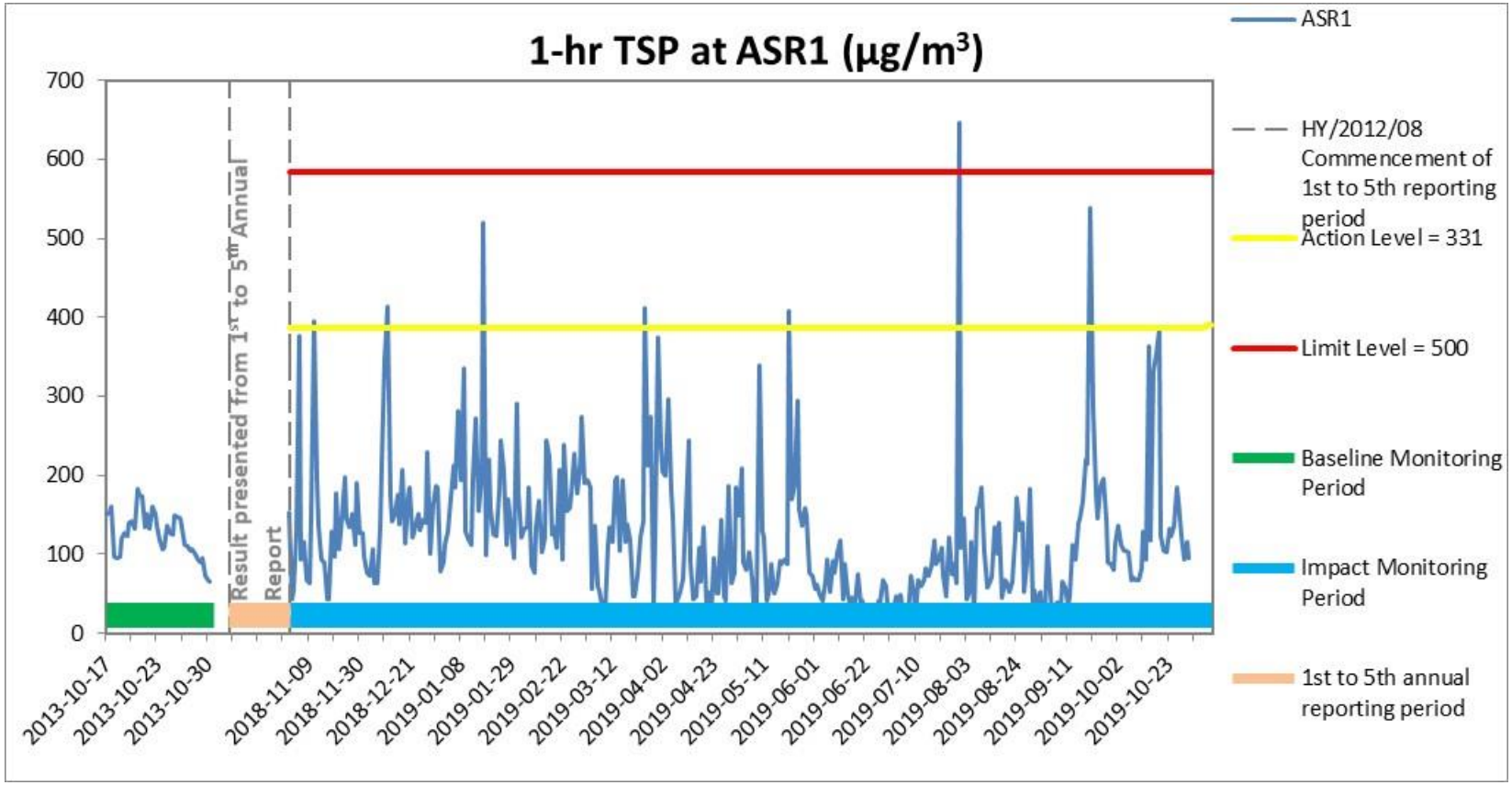

Figure D.3 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at ASR1 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

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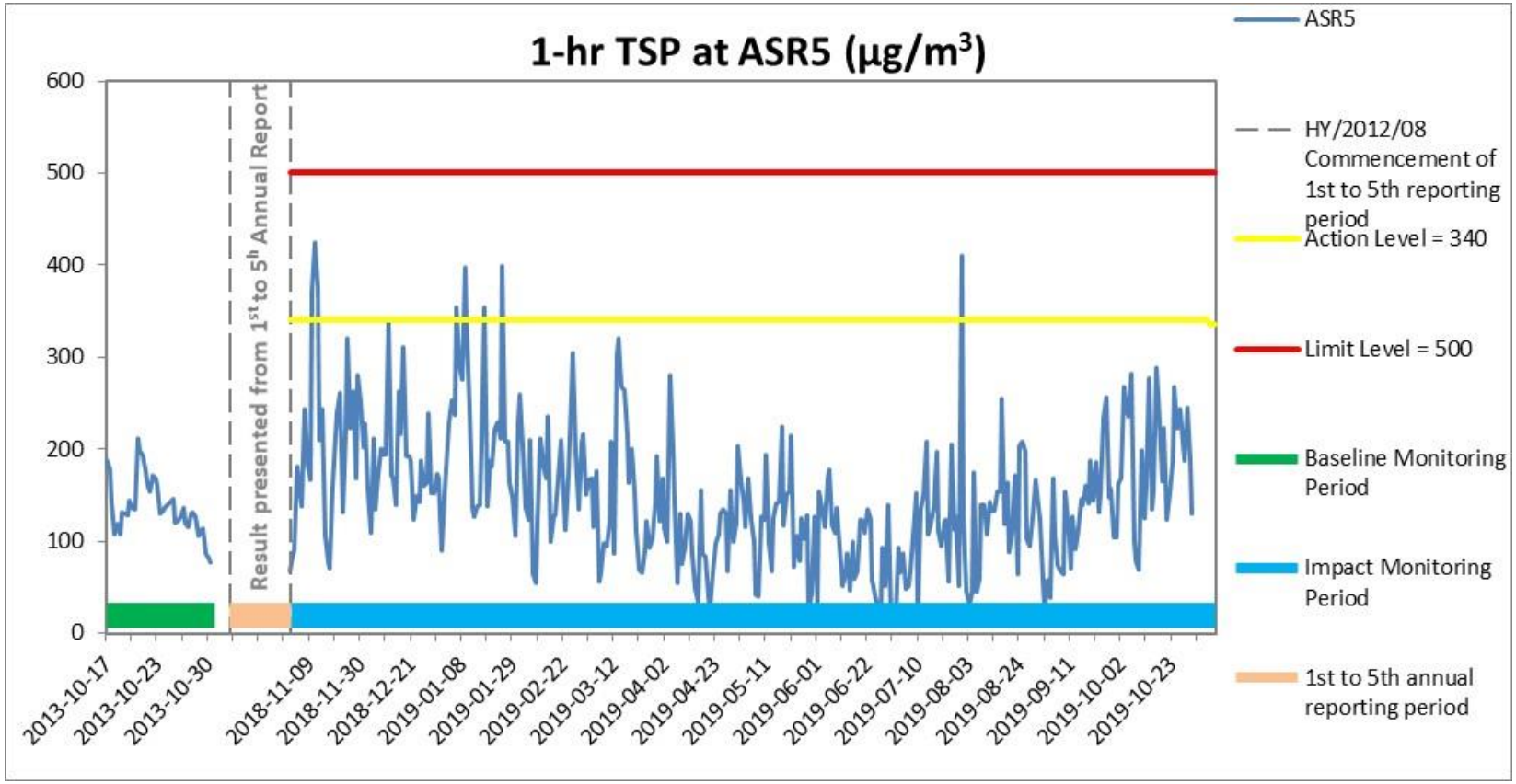

Figure D.4 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at ASR5 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

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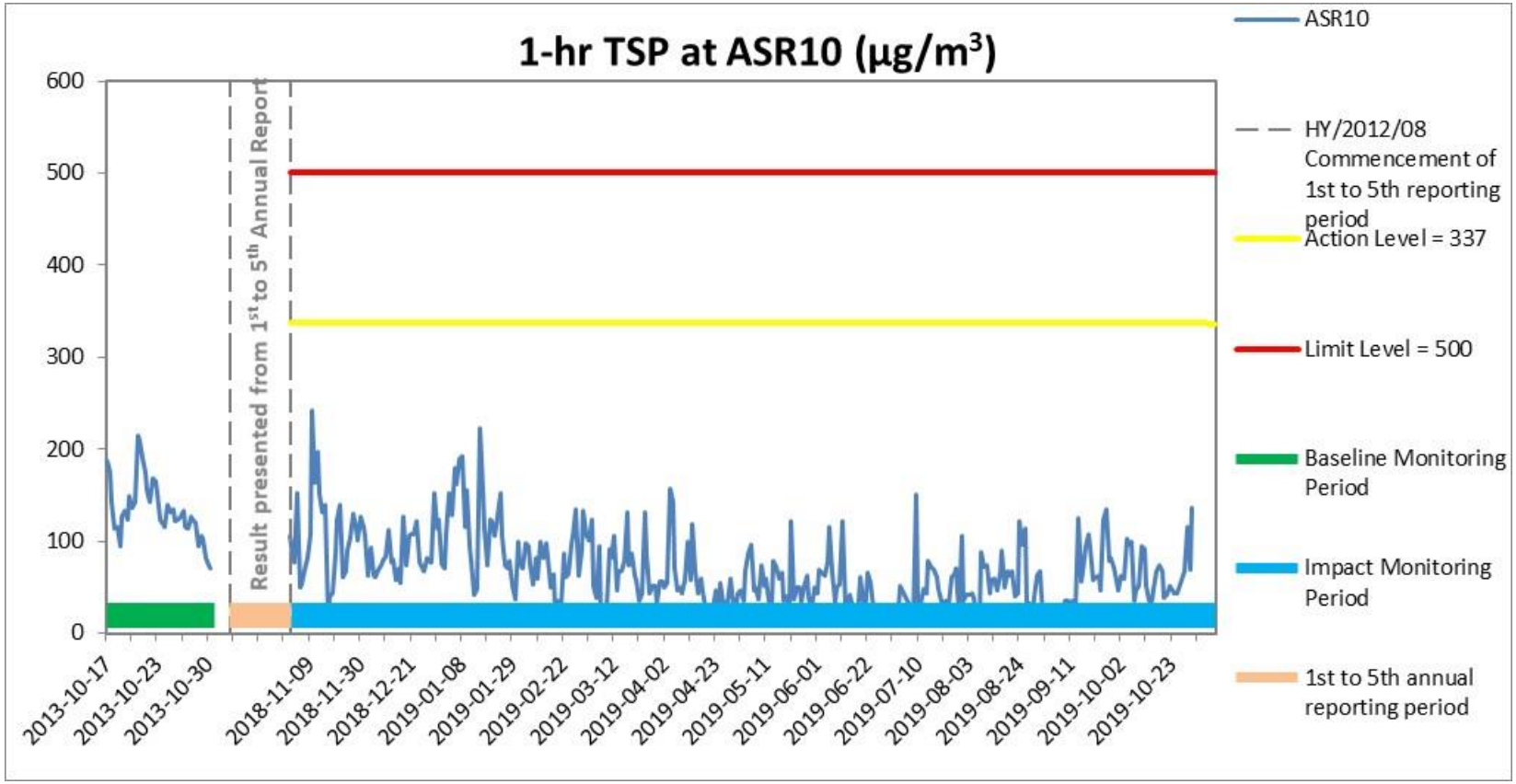

Figure D.5 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at ASR10 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

Ref: 0212330_Impact AQM graphs_6thAnnual_REV a.xlsx

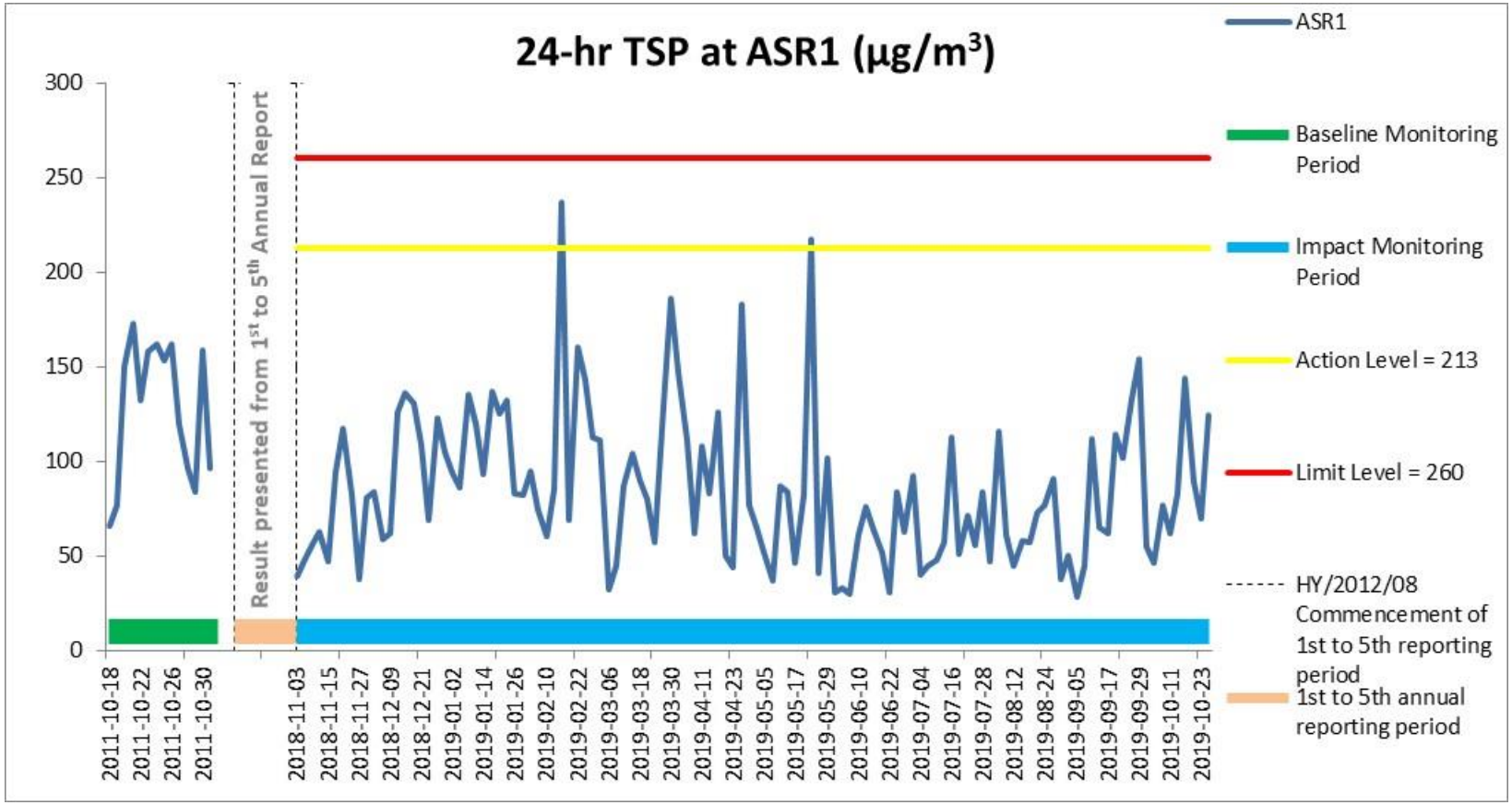

Figure D.6 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at ASR1 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

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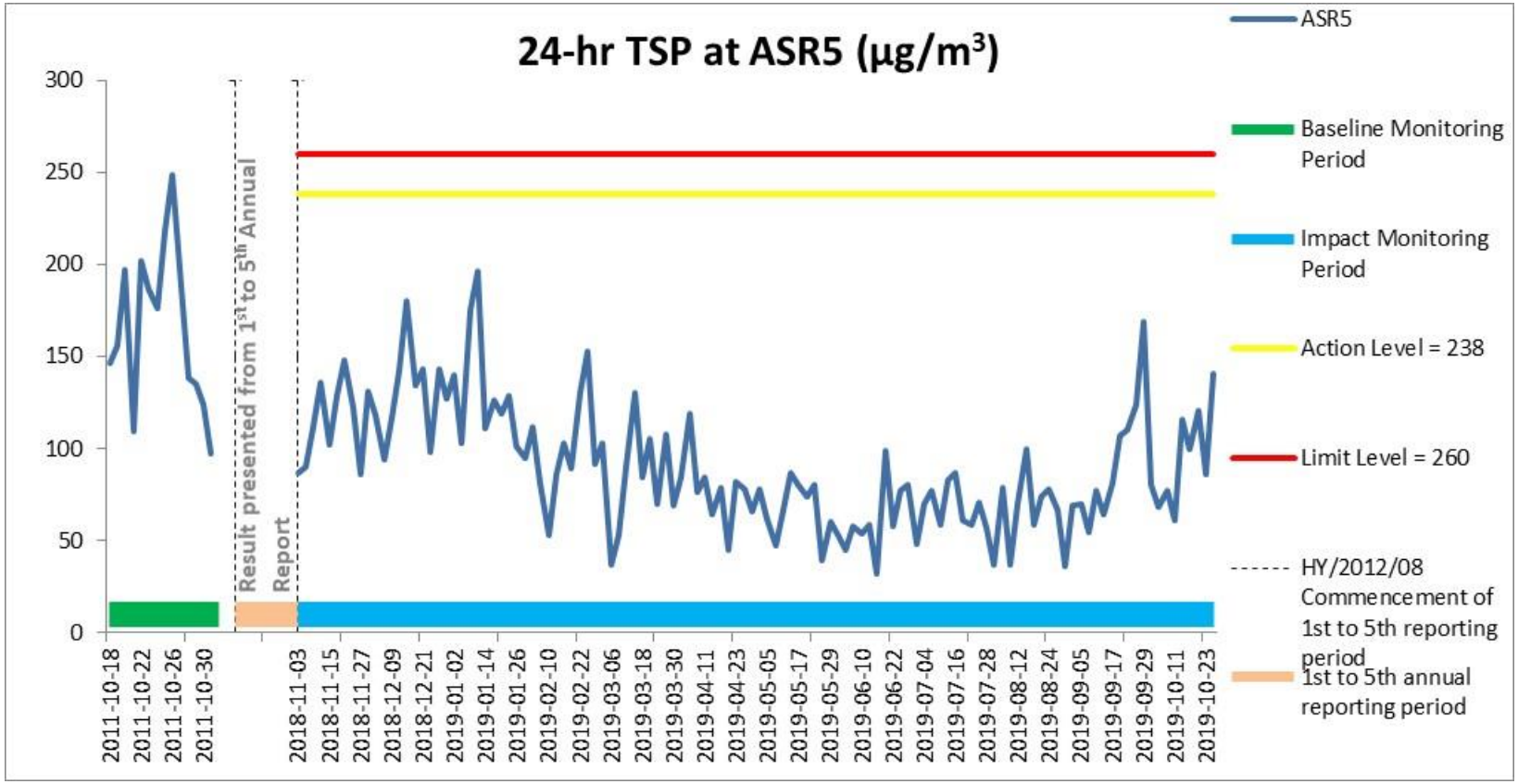

Figure D.7 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at ASR5 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

Ref: 0212330_Impact AQM graphs_6thAnnual_REV a.xlsx

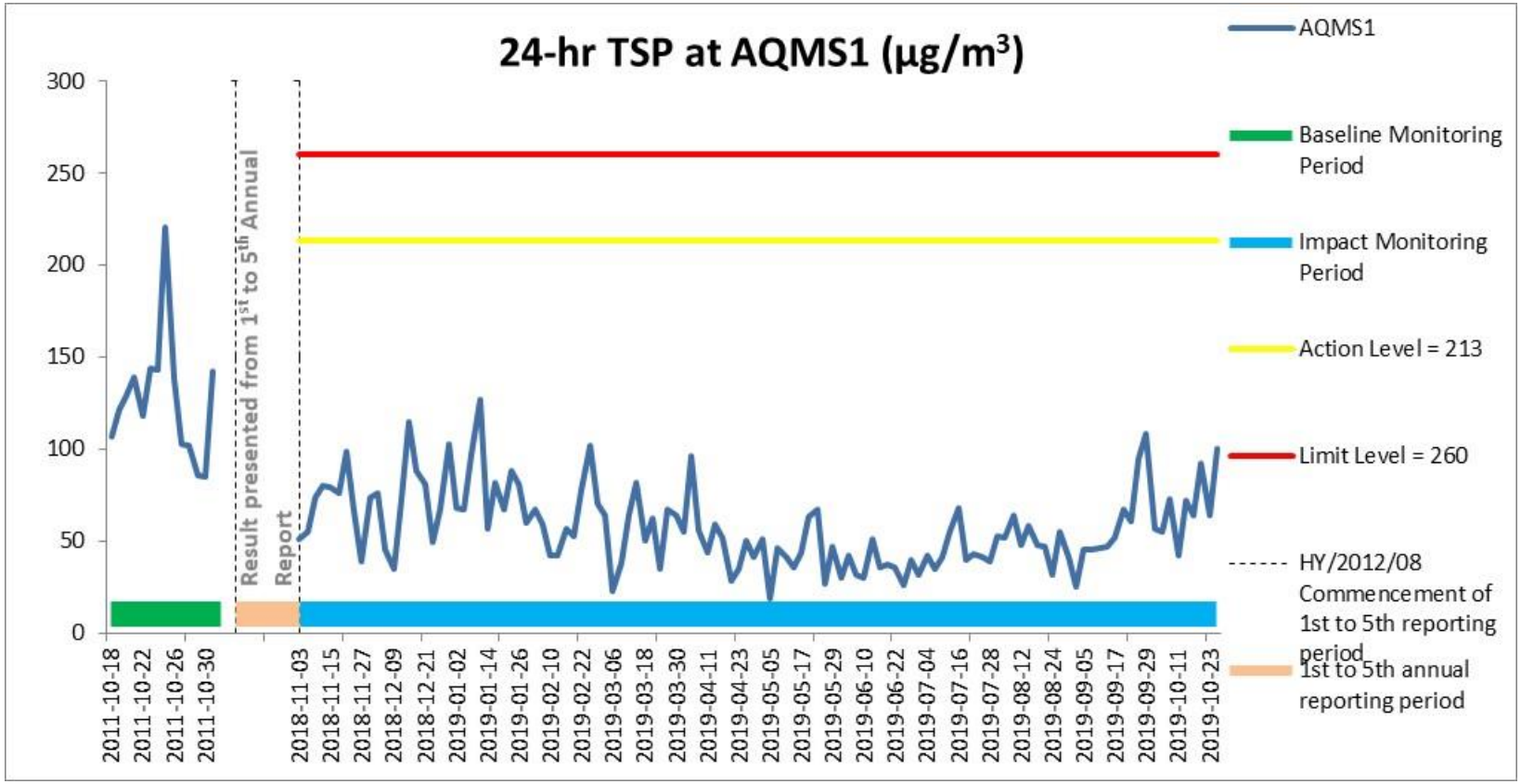

Figure D.8 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at AQMS1 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

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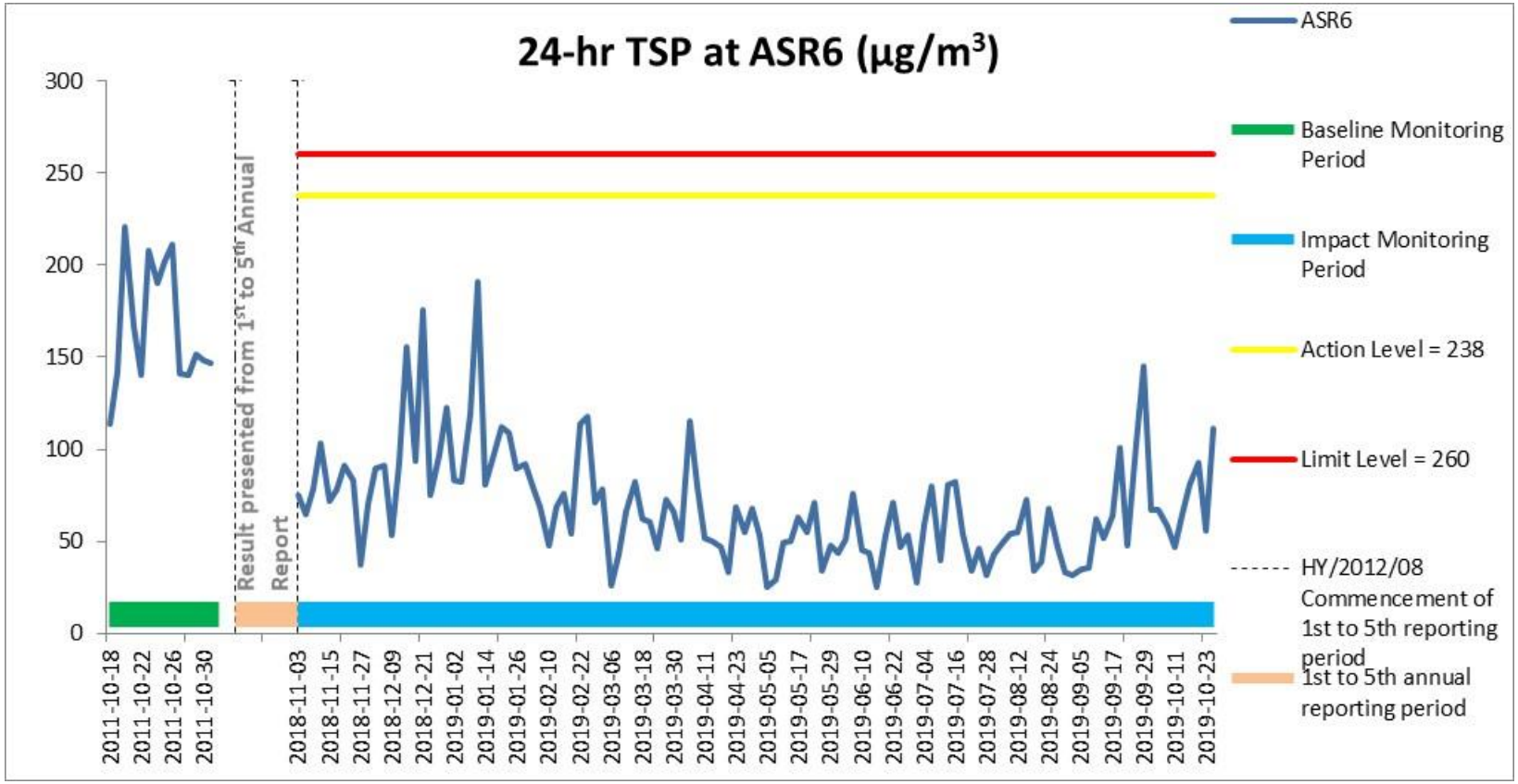


Figure D.9 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at ASR6 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

Ref: 0212330_Impact AQM graphs_6thAnnual_REV a.xlsx

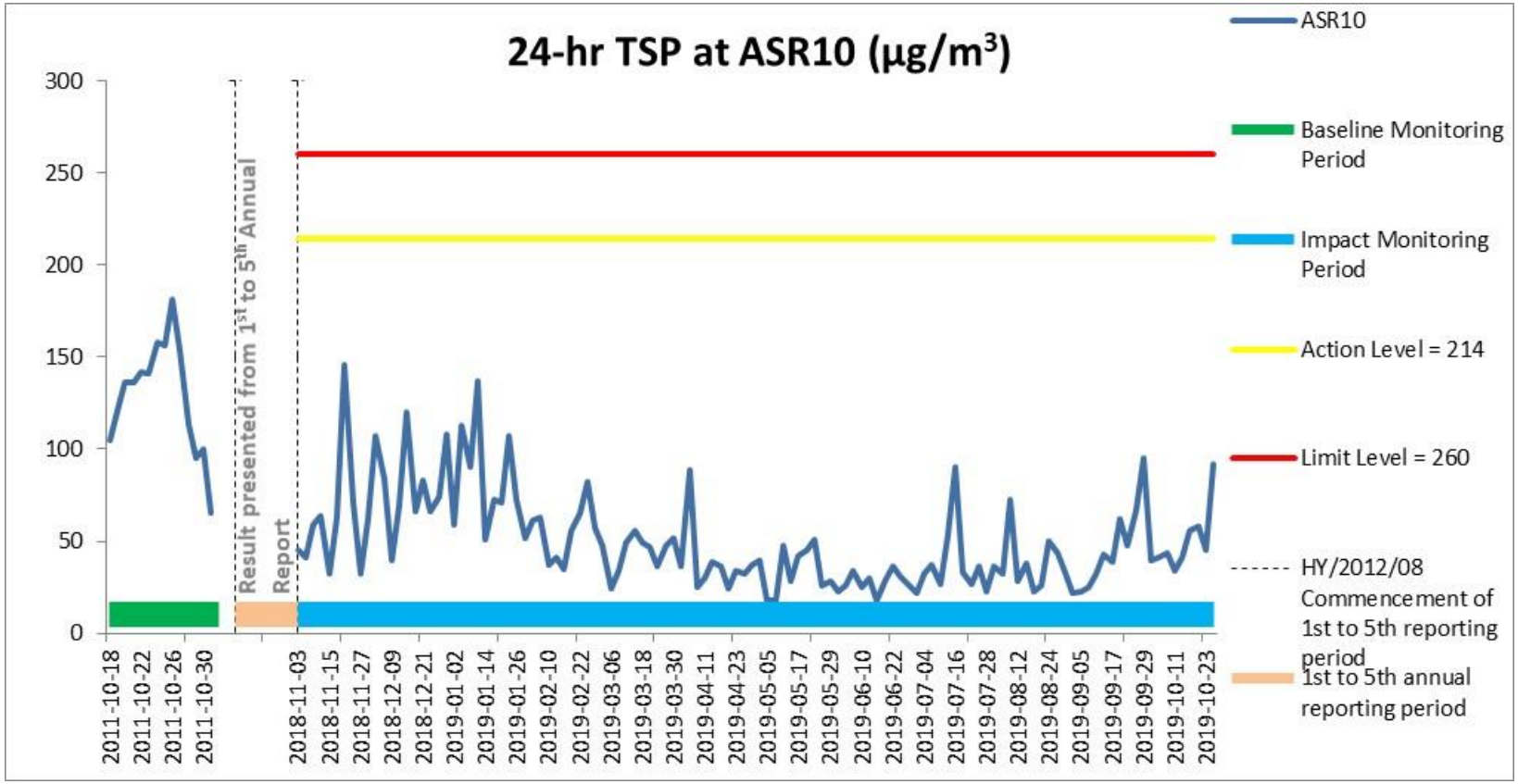
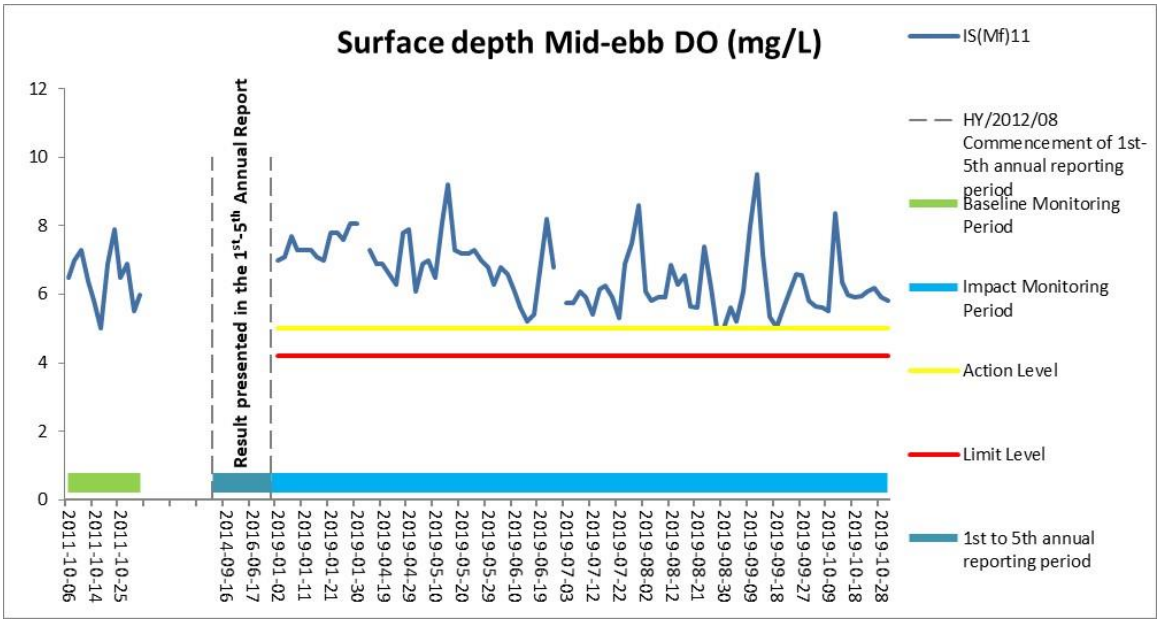


Figure D.10 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at ASR10 between 17 October 2013 and 31 October 2019 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: • Construction of Cross Passage Tympanum – TBM tunnel; Cross Passage Lining Installation – TBM Tunnel; Cross Passage Construction by Pipe Jacking – TBM Tunnel; Corbel & OVHD Construction – TBM Tunnel; Parapet wall and Fireboard Installation – TBM tunnel. Bulk Excavation – Portion N-A; D-wall Construction – Portion N-A, S-A & S-C; RC Structure – Portion N-A & S-A; Construction of Overhead Ventilation Ducts – TBM Tunnel; Construction of Thermal Barrier – TBM Tunnel; Construction of Walkway Corbel & Cover – TBM Tunnel; Demolition of Amenities and Workshop – Portion N-A; ELS construction – Portion S-C;ELS Removal – Portion N-A & S-A; Seawall Inspection and Remedial Works – Portion N-B; Road & Drainage Works – Portion N-A; and Backfilling – Portion S-A & S-C.

Ref: 0212330_Impact AQM graphs_6thAnnual_REV a.xlsx

Appendix E

Impact Water Quality Monitoring Results



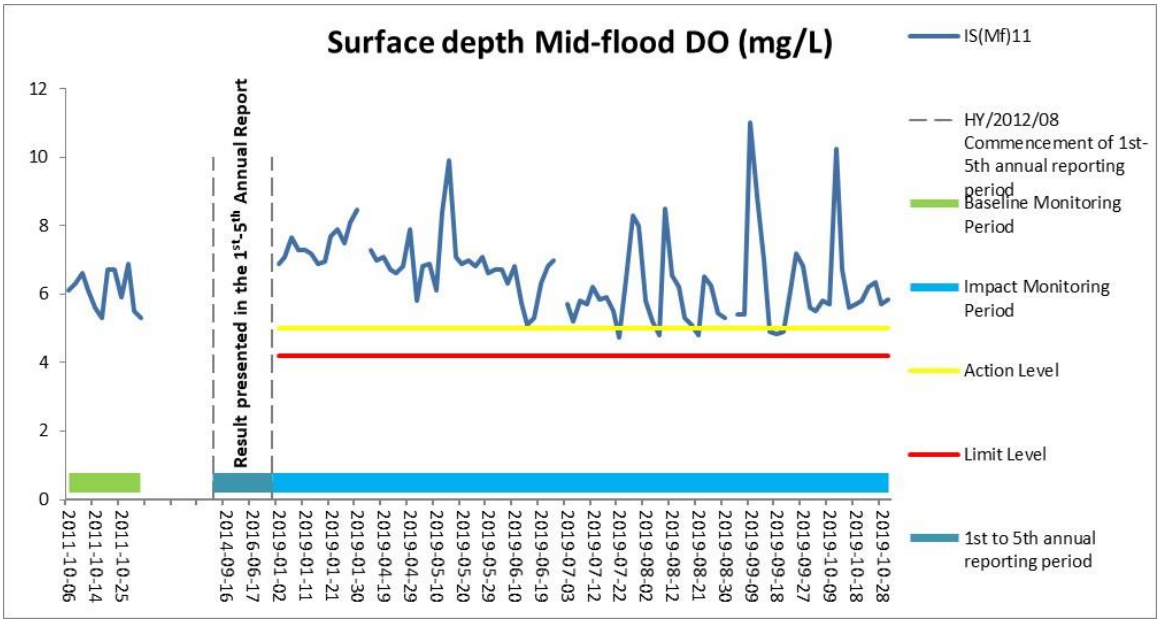
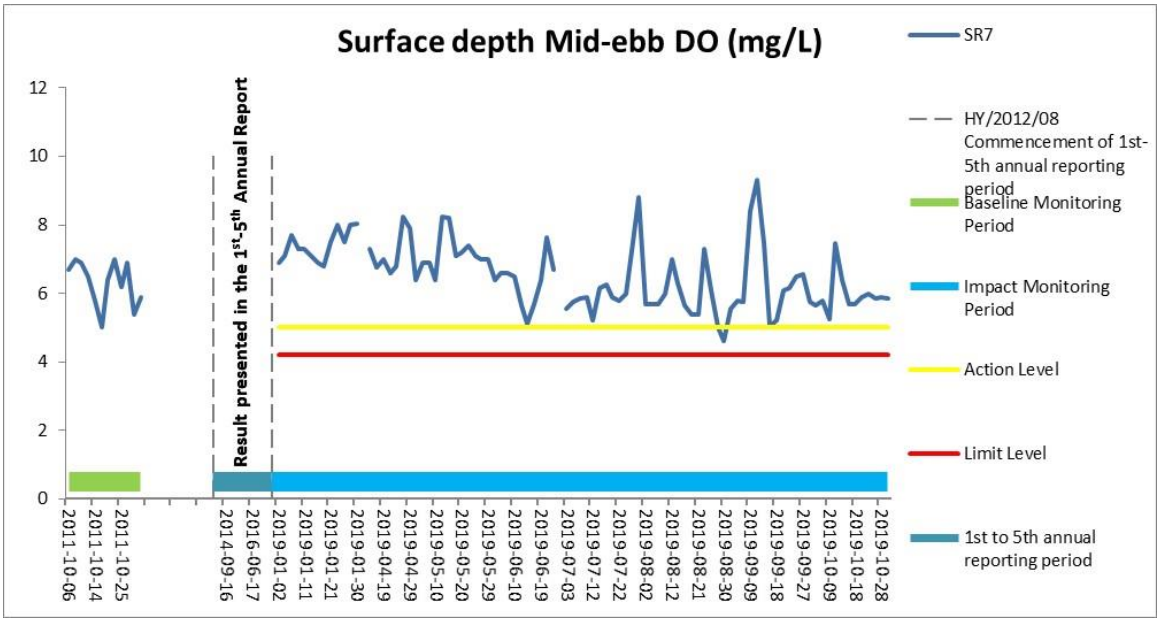


Figure E1 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)11. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



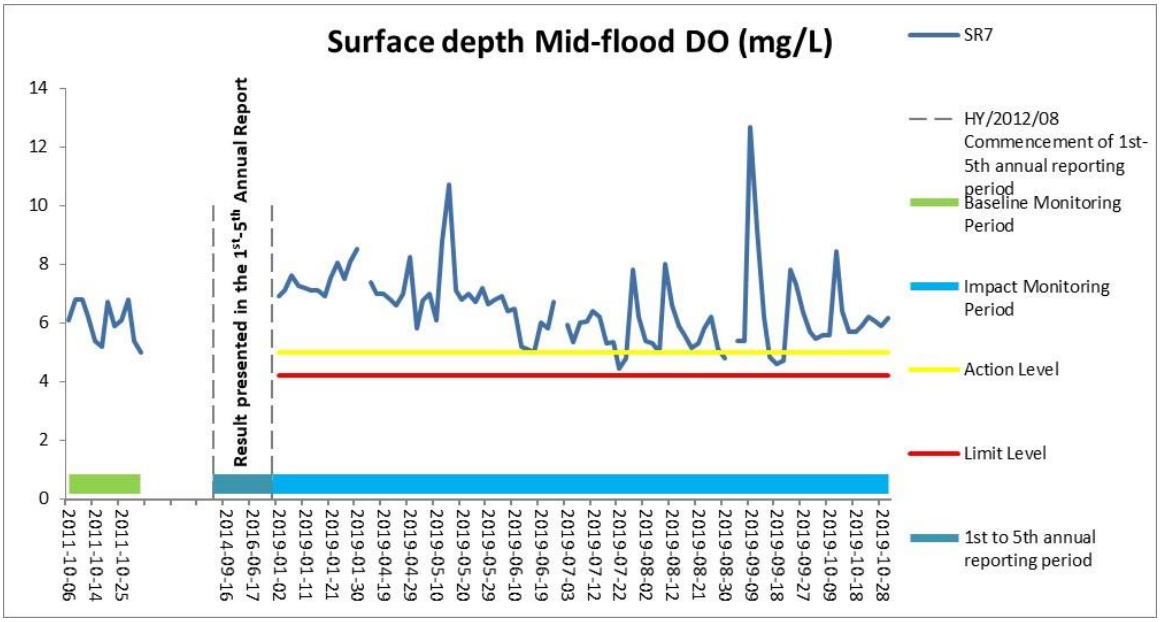
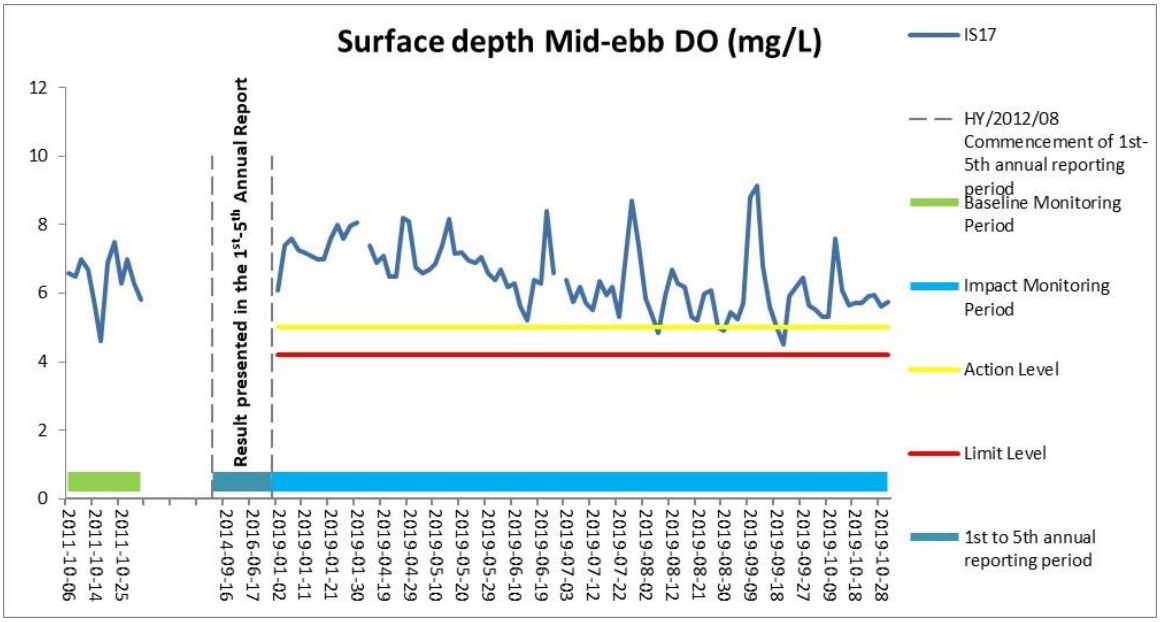


Figure E2 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR7. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



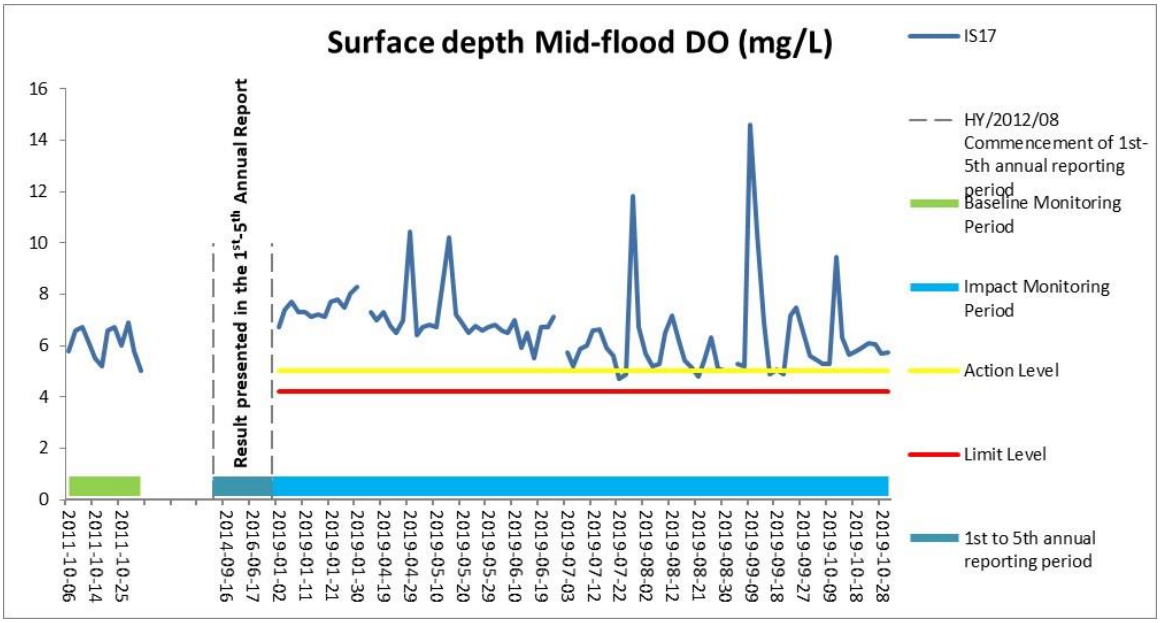
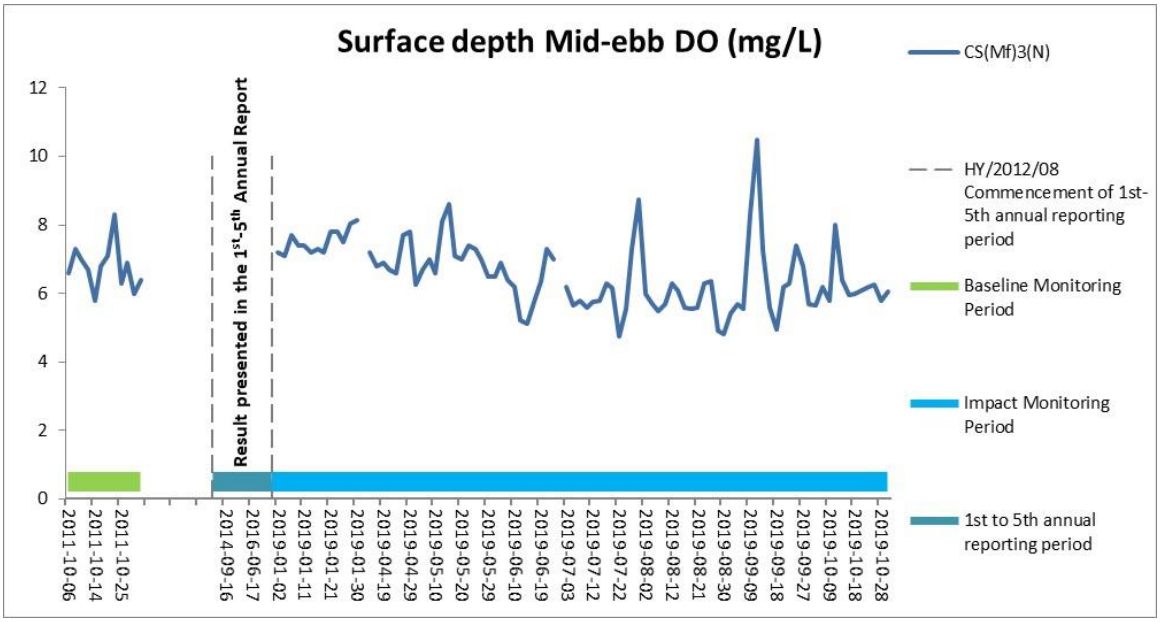


Figure E3 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS17. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



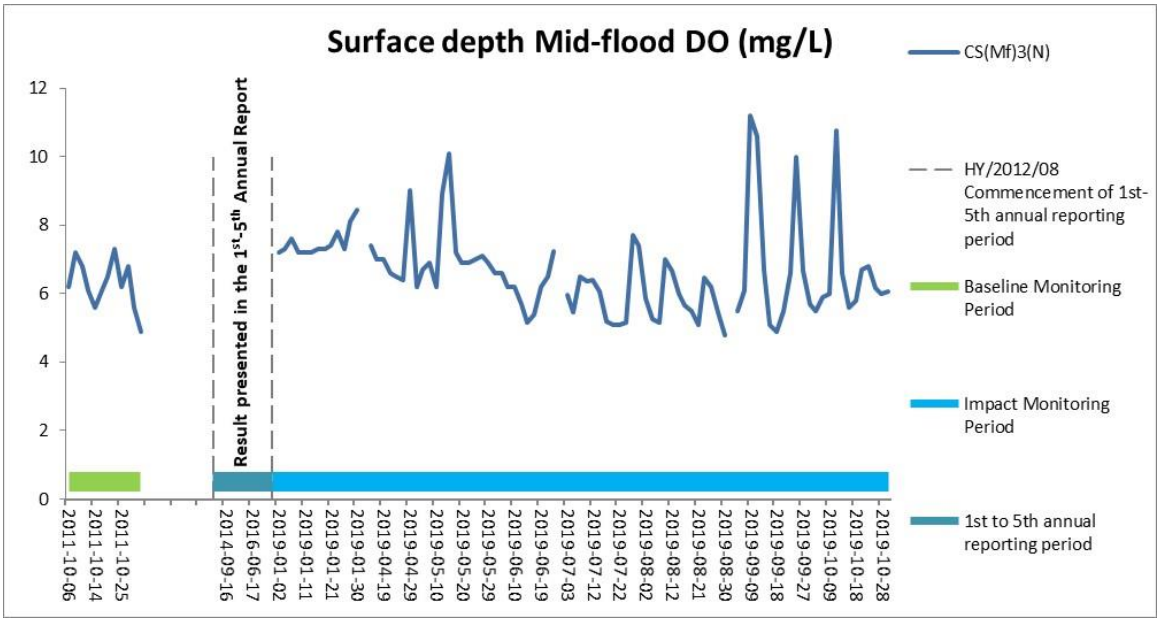
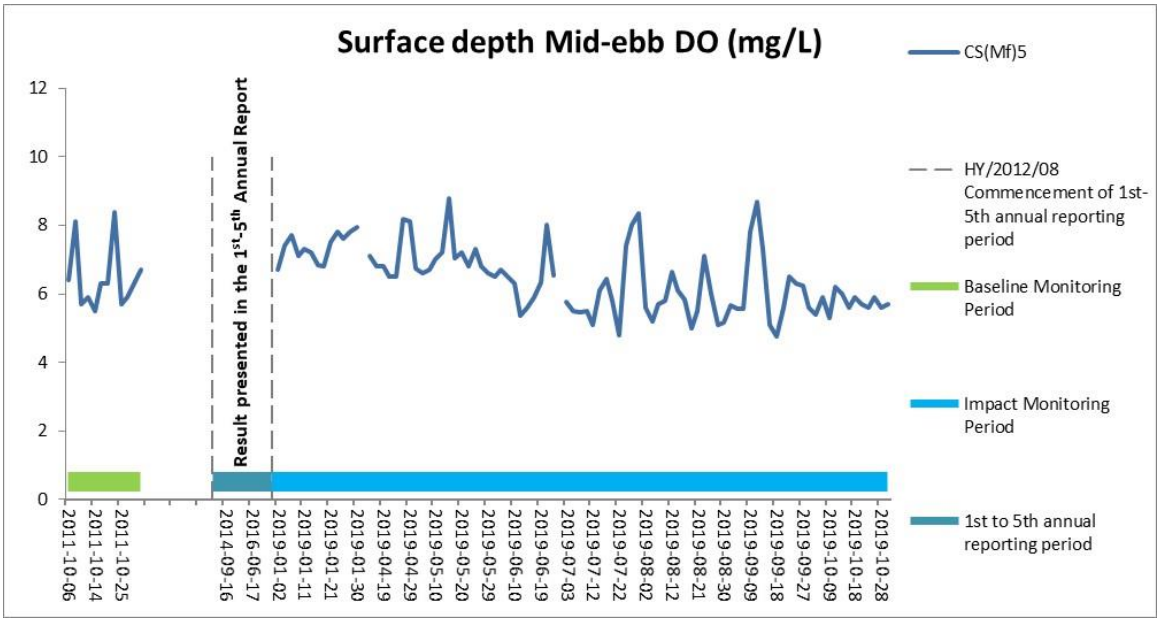


Figure E4 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)3(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



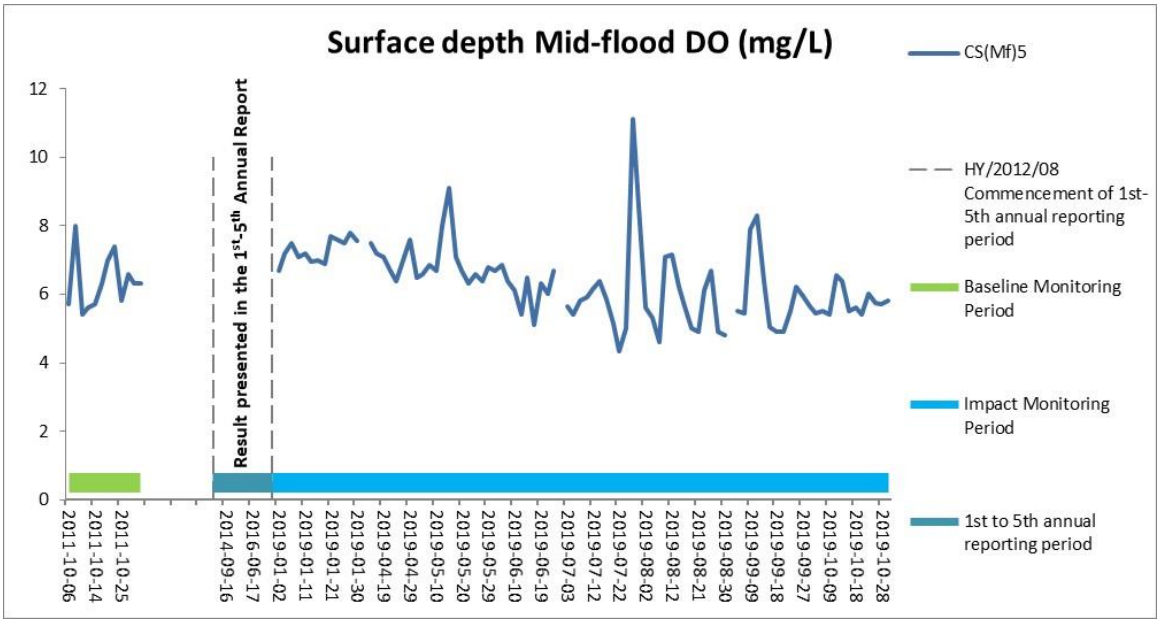
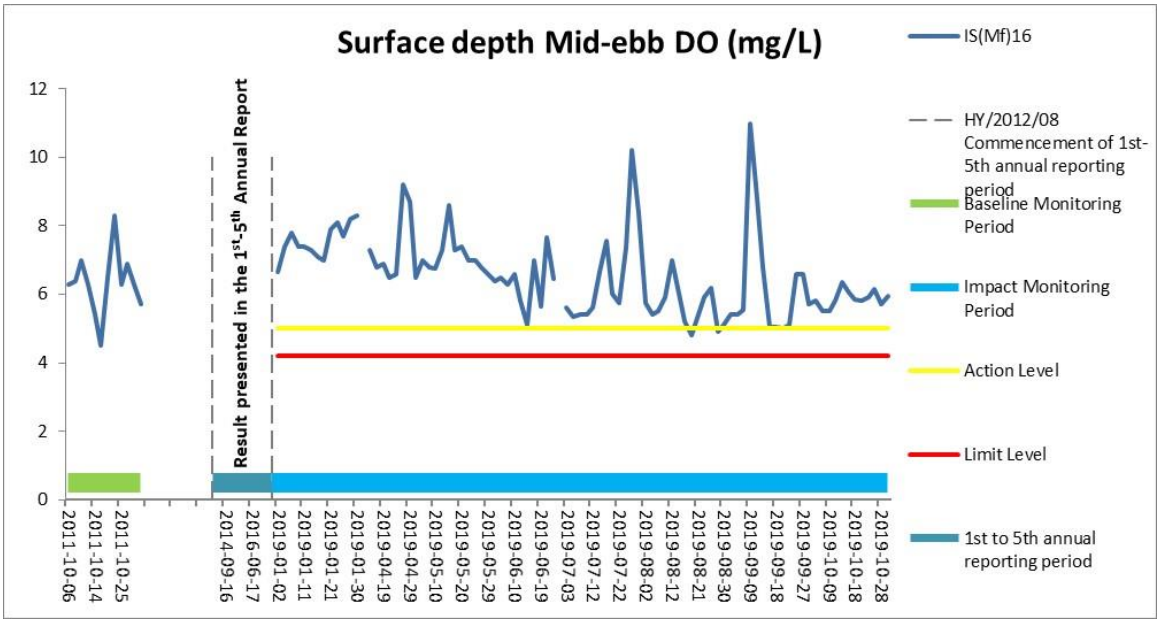


Figure E5 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)5. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



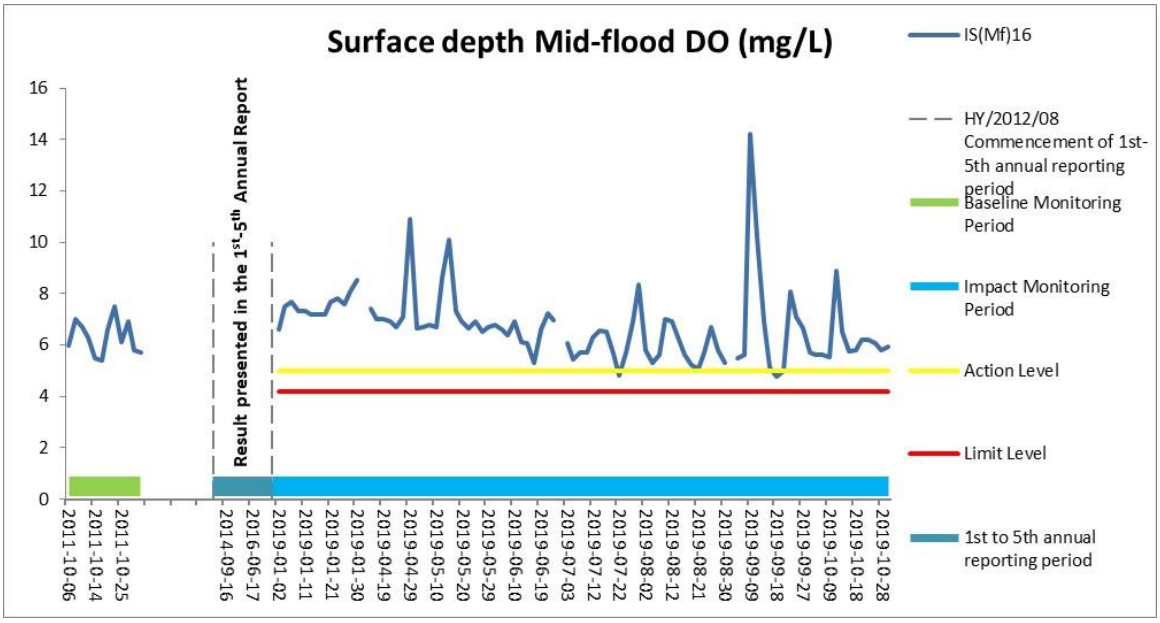
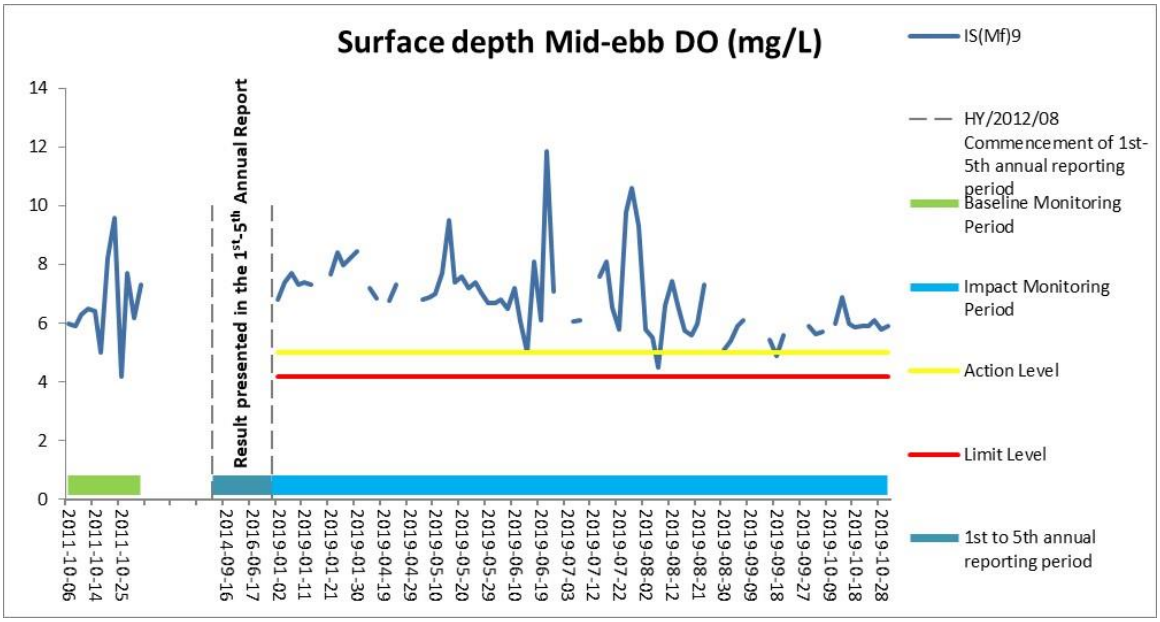


Figure E6 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)16. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



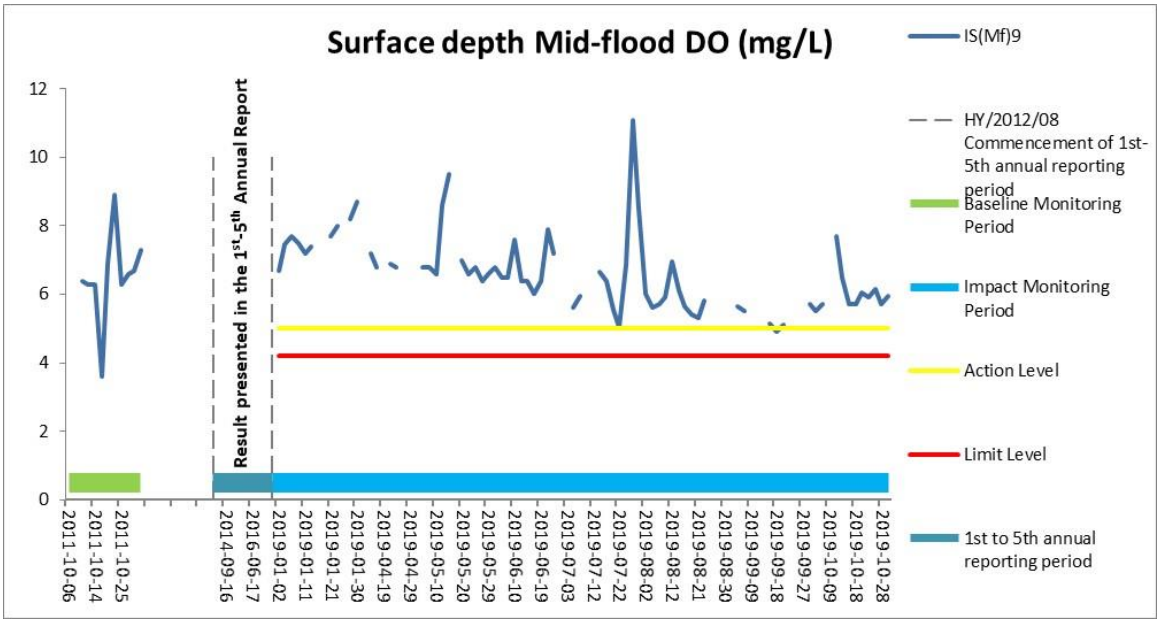
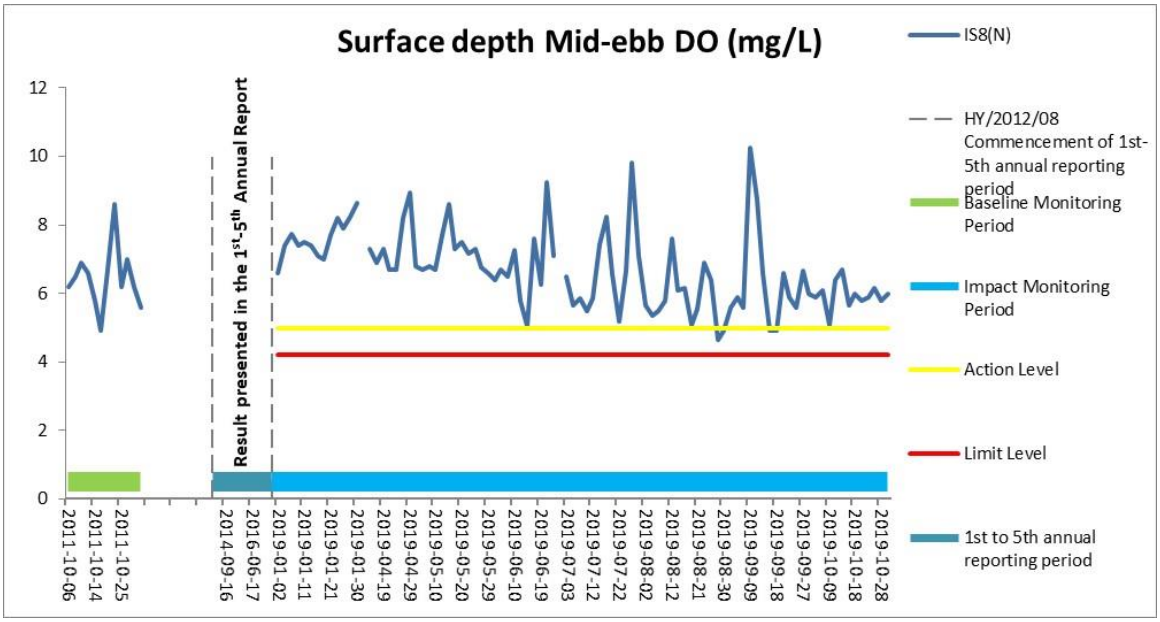


Figure E7 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



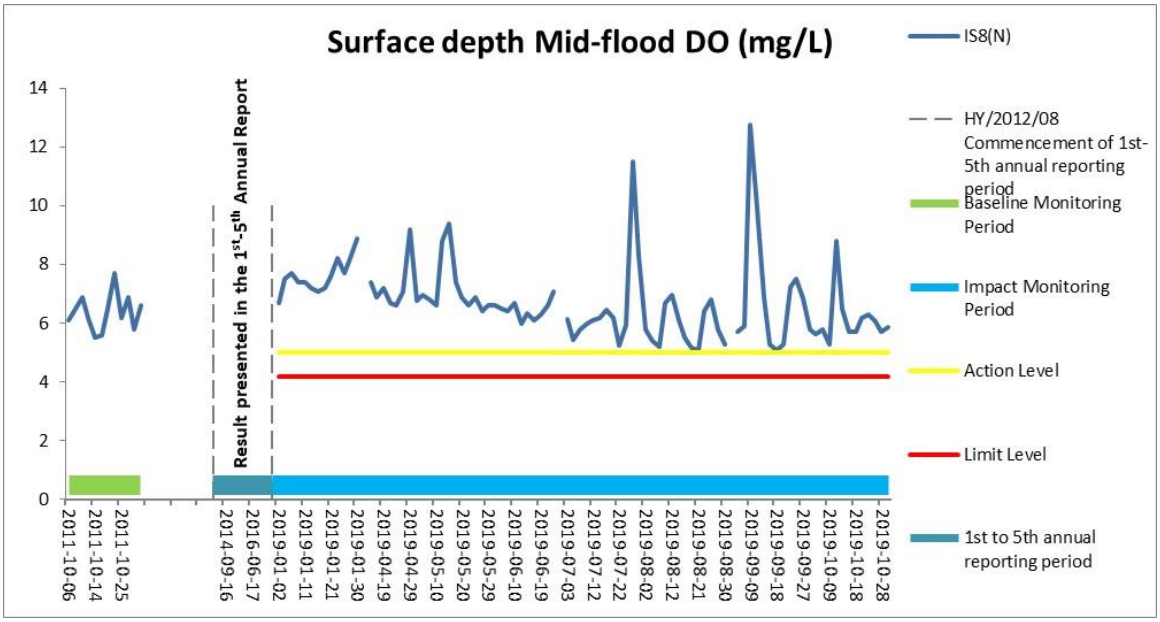
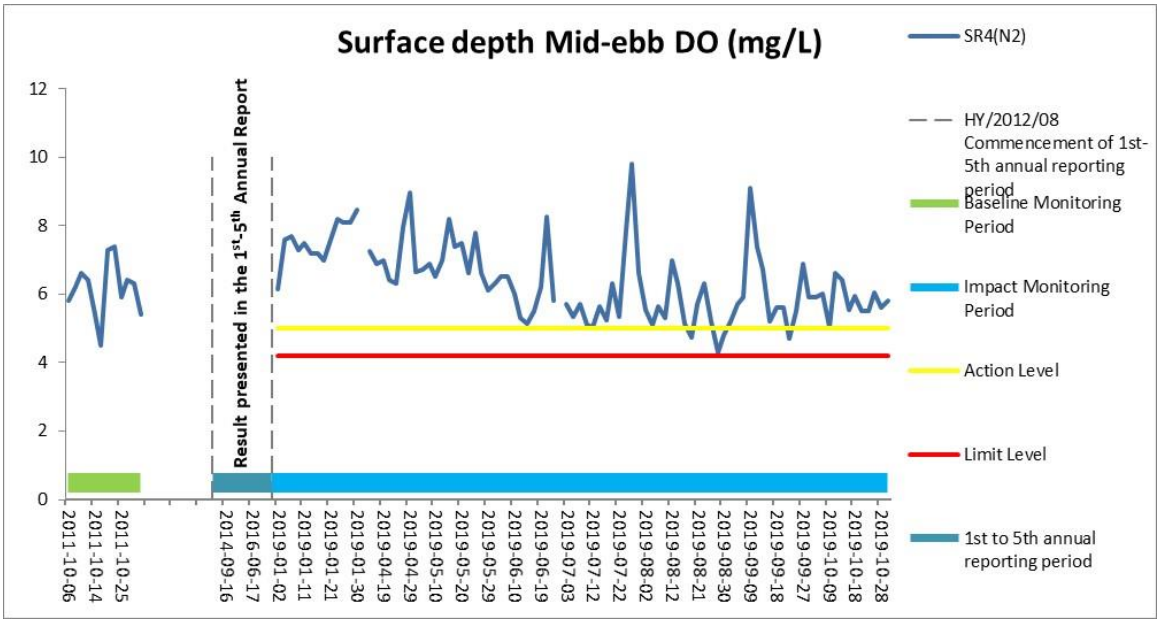


Figure E8 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS8(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



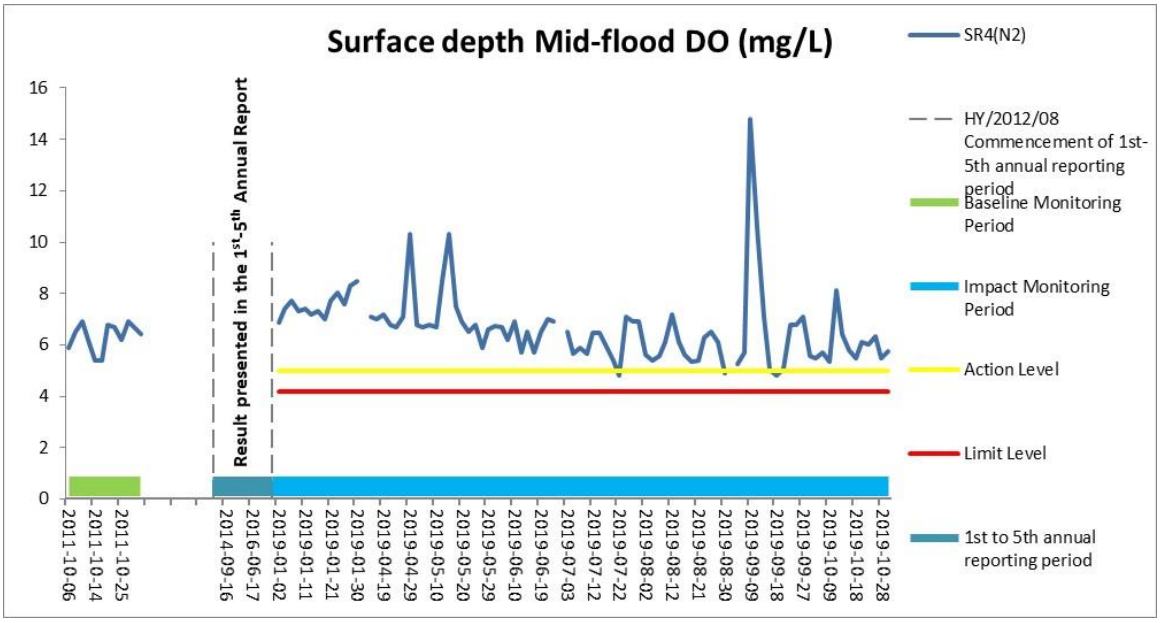
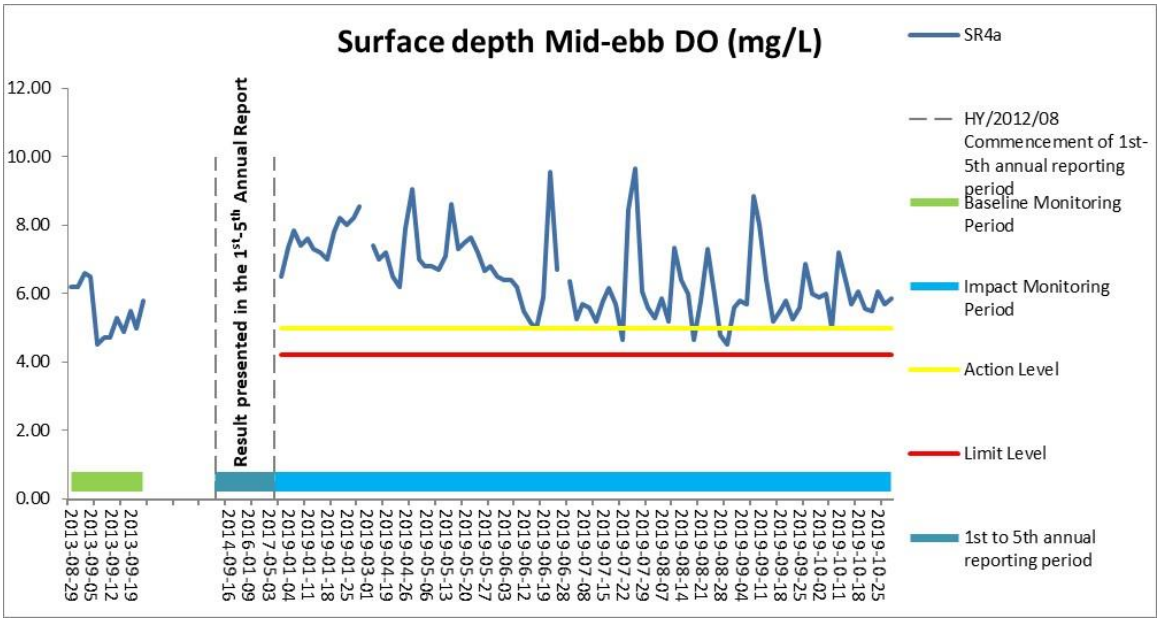


Figure E9 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4(N2). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



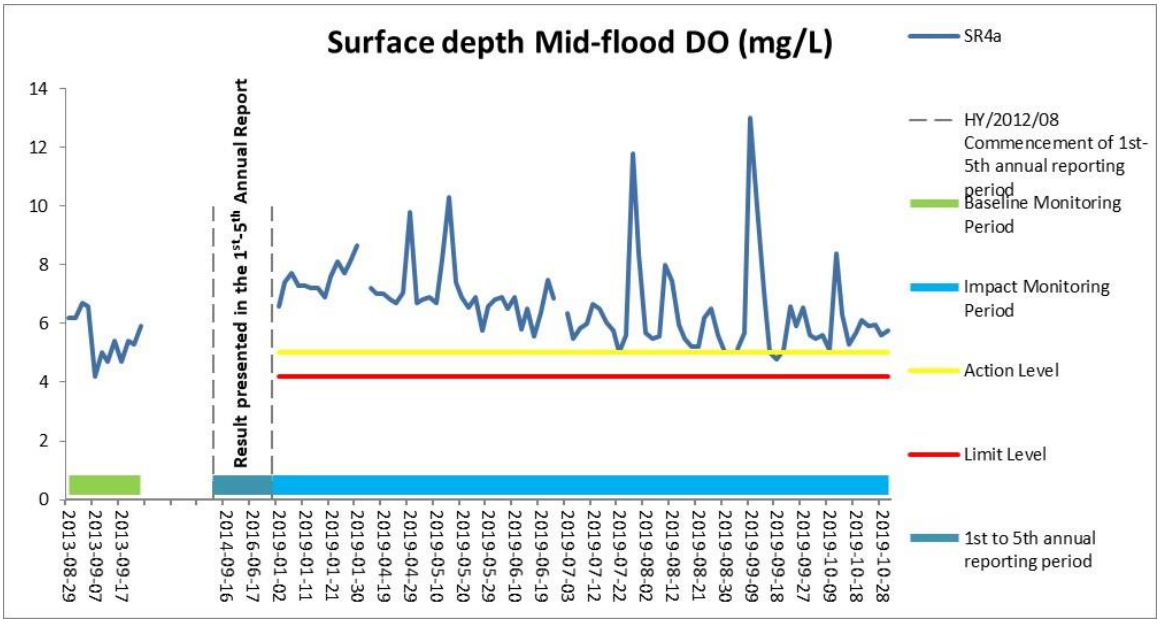


Figure E10 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4a. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

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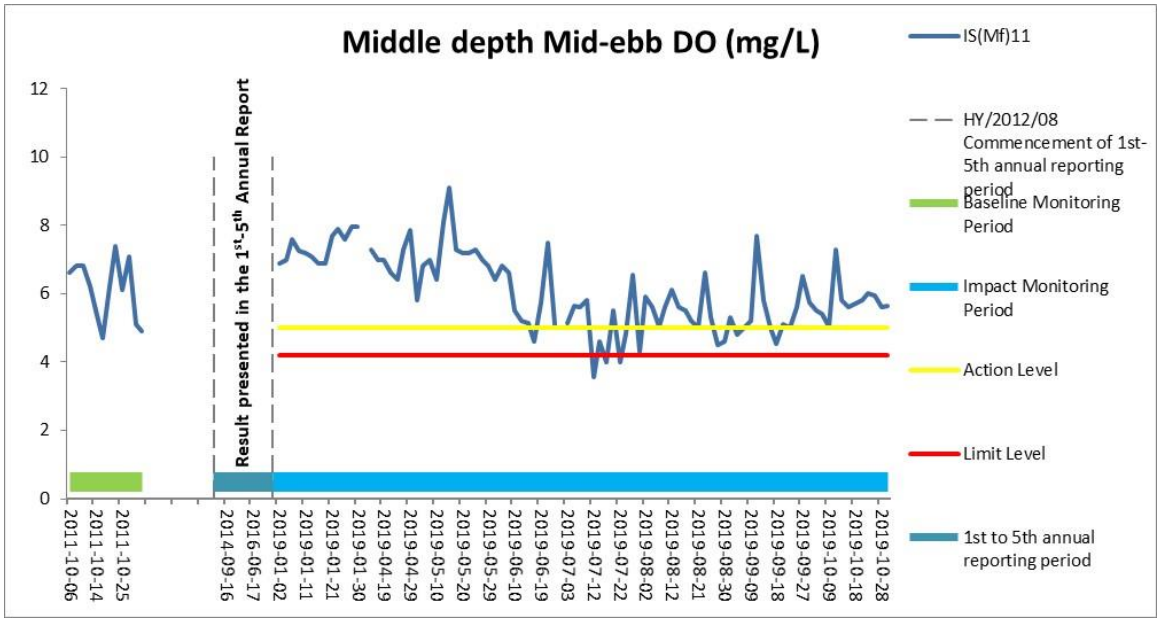

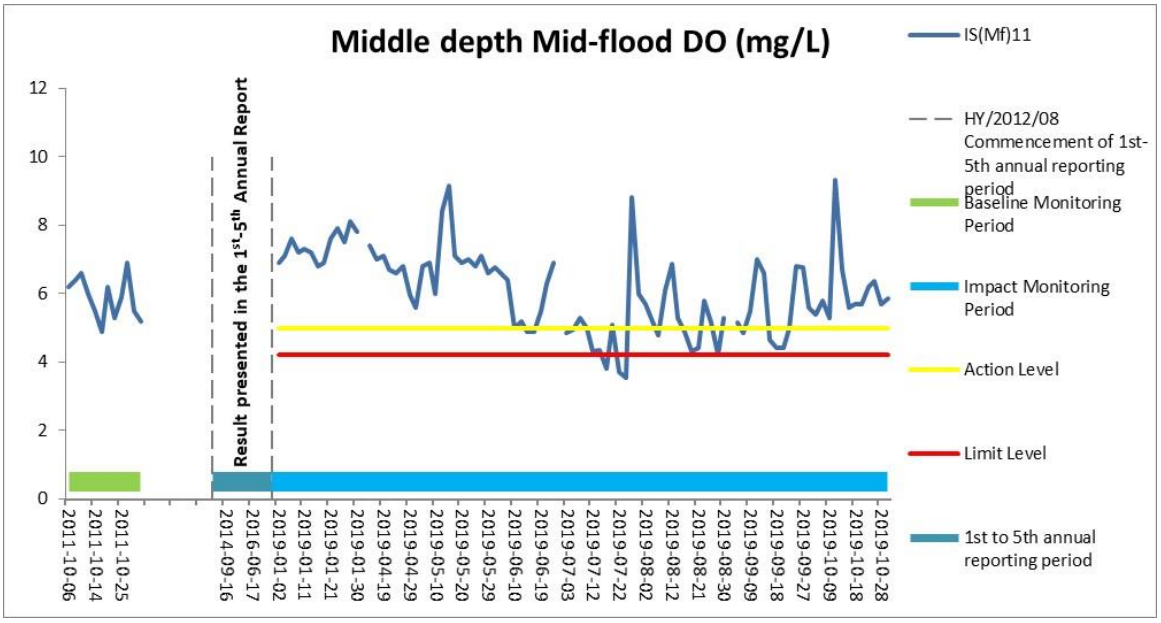

*No data for Stations SR7, IS8(N), SR4(N2) and SR4a due to shallow water depth (< 6m).

Figure E11 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)11. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

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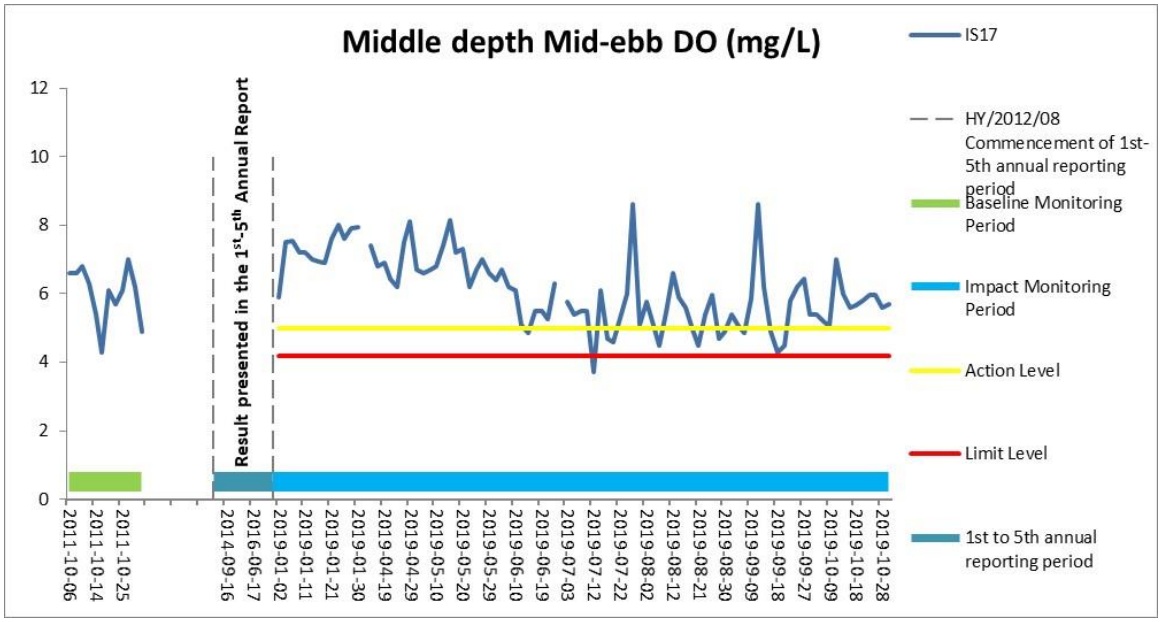
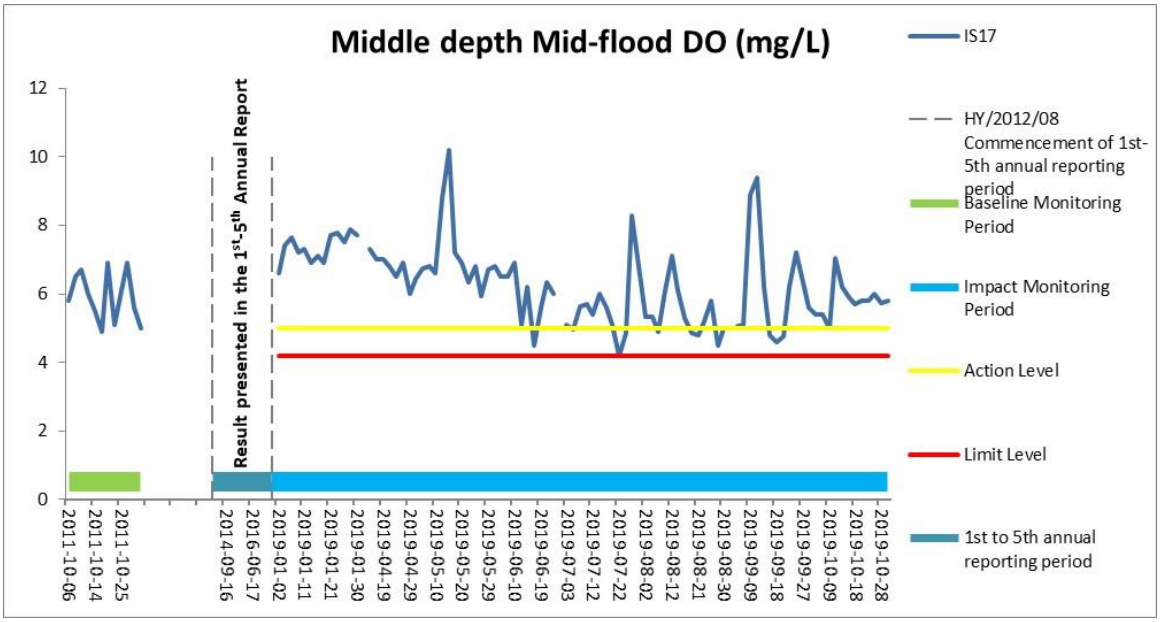
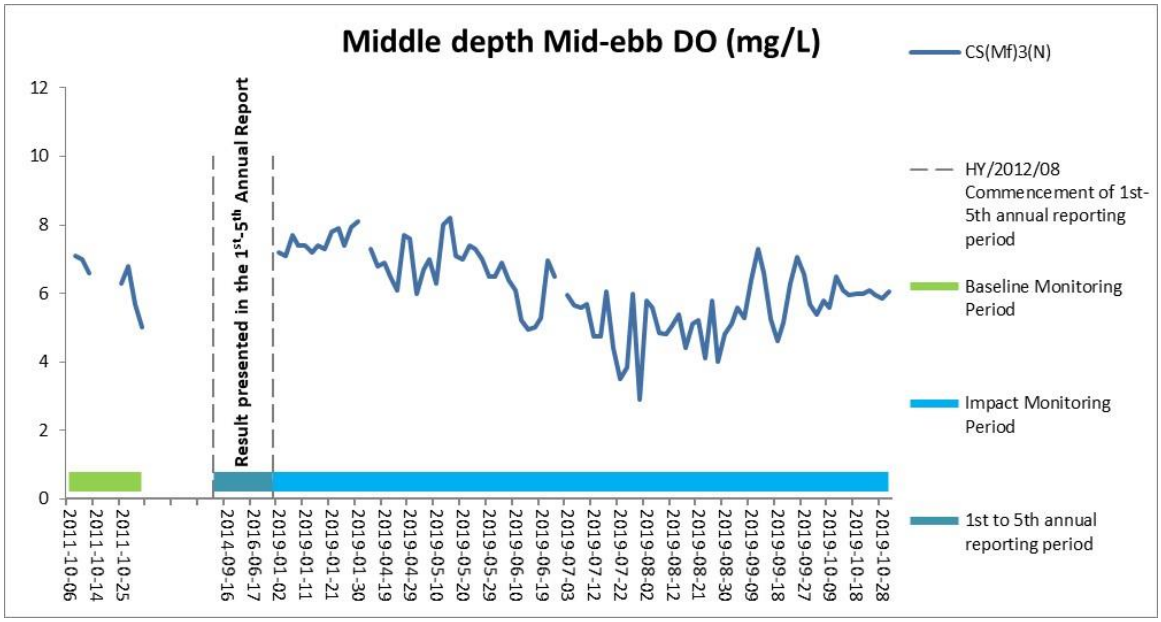
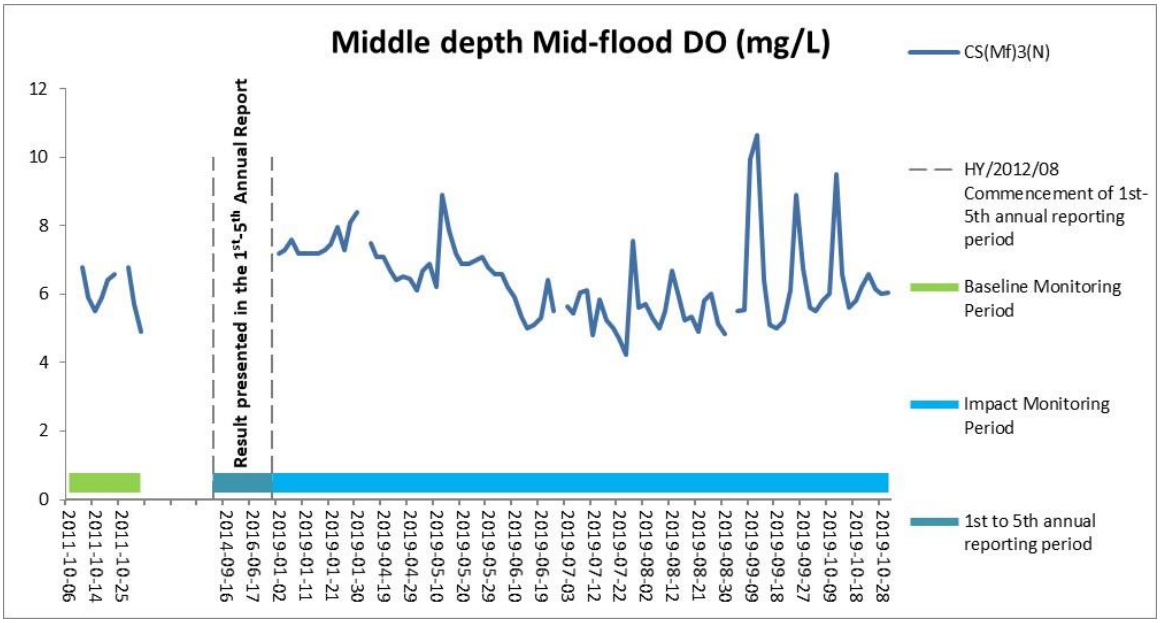




*No data for Stations SR7, IS8(N), SR4(N2) and SR4a due to shallow water depth (< 6m).

Figure E12 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS17. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

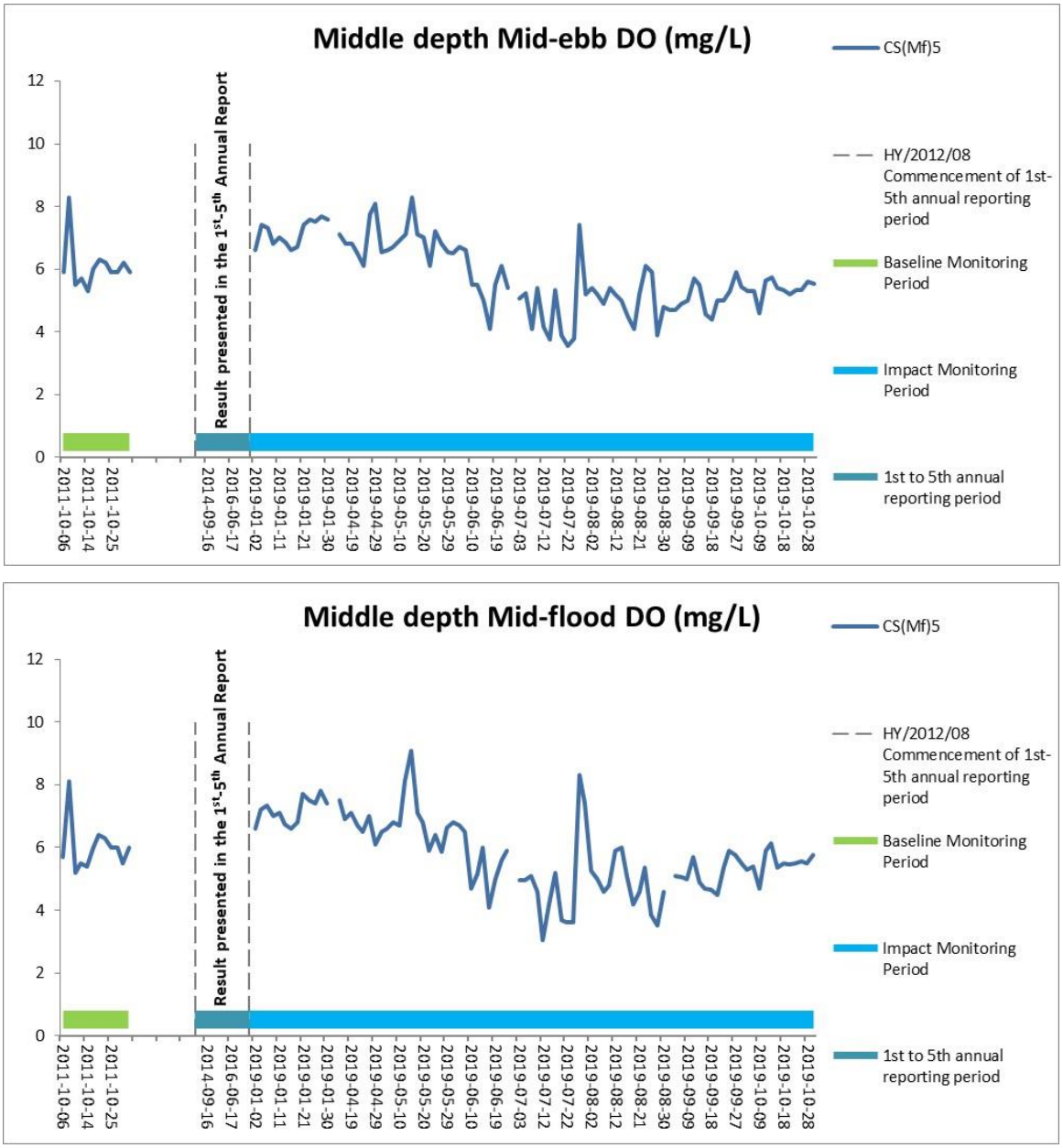




*No data for Stations SR7, IS8(N), SR4(N2) and SR4a due to shallow water depth (< 6m).

Figure E13 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)3(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

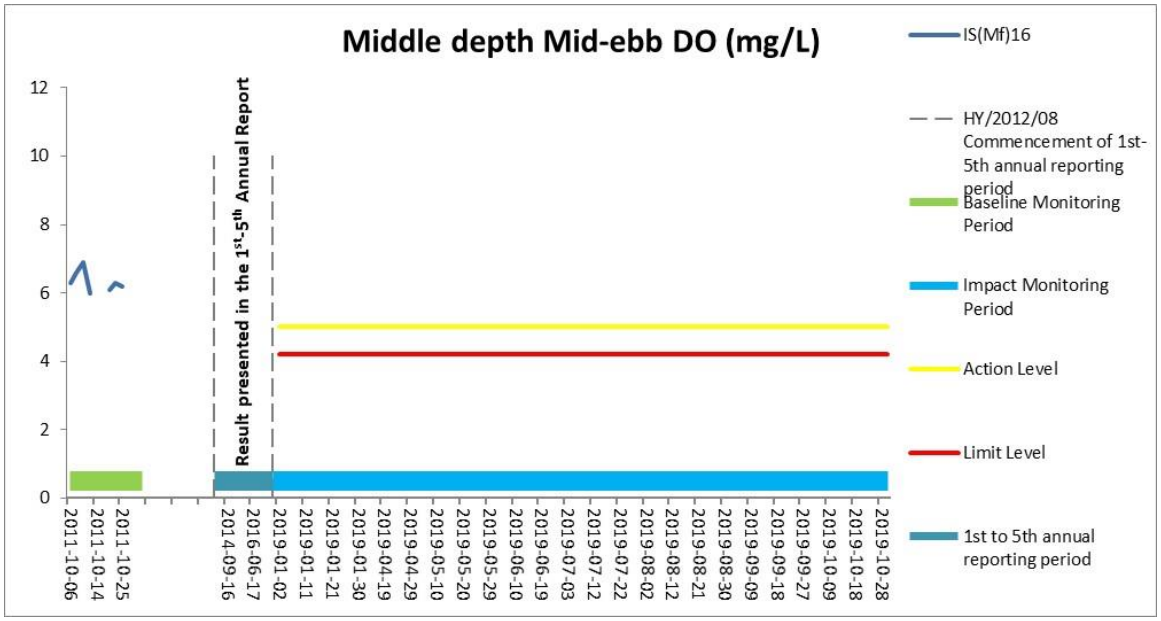
Ref: 0212330_Impact-WQM_6th annual.xlsx

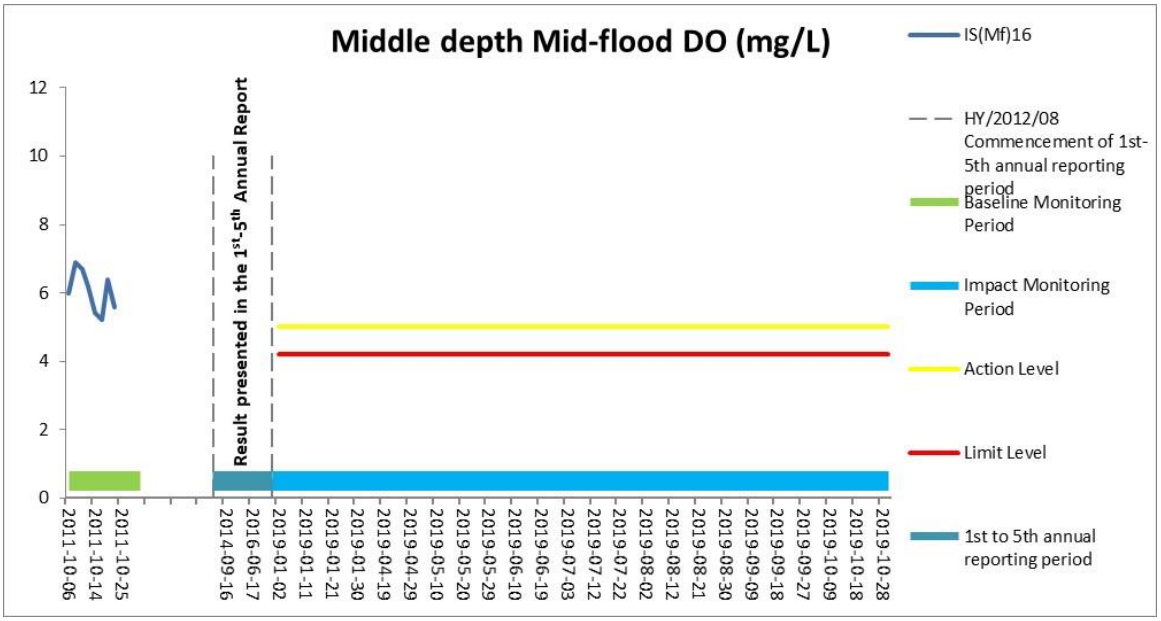


*No data for Stations SR7, IS8(N), SR4(N2) and SR4a due to shallow water depth (< 6m).

Figure E14 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)5. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx

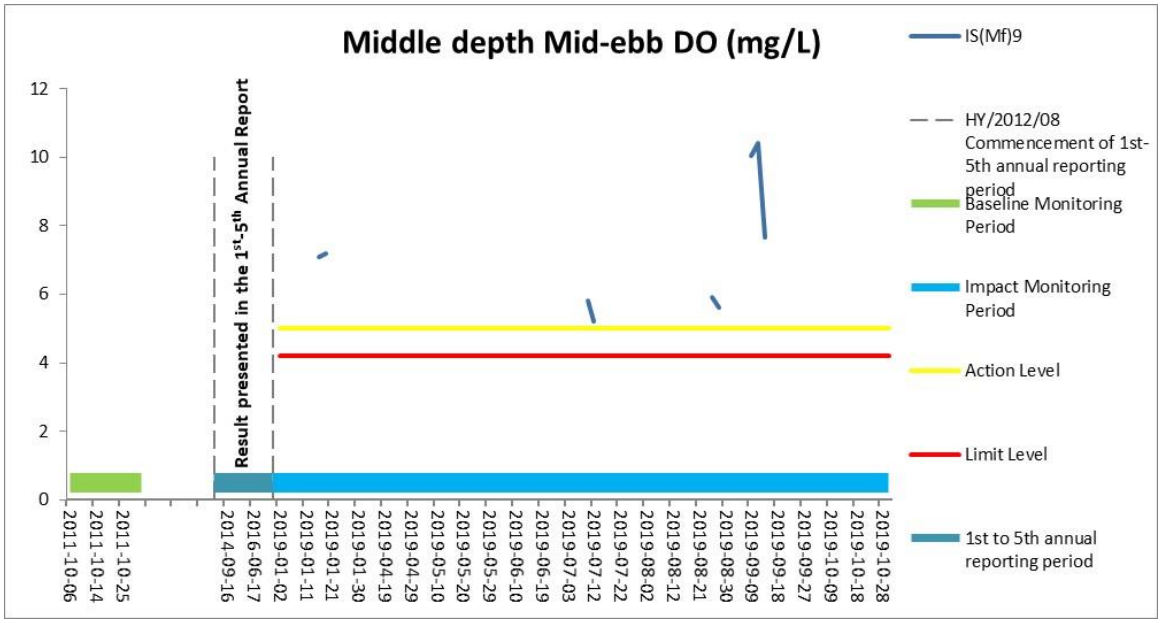


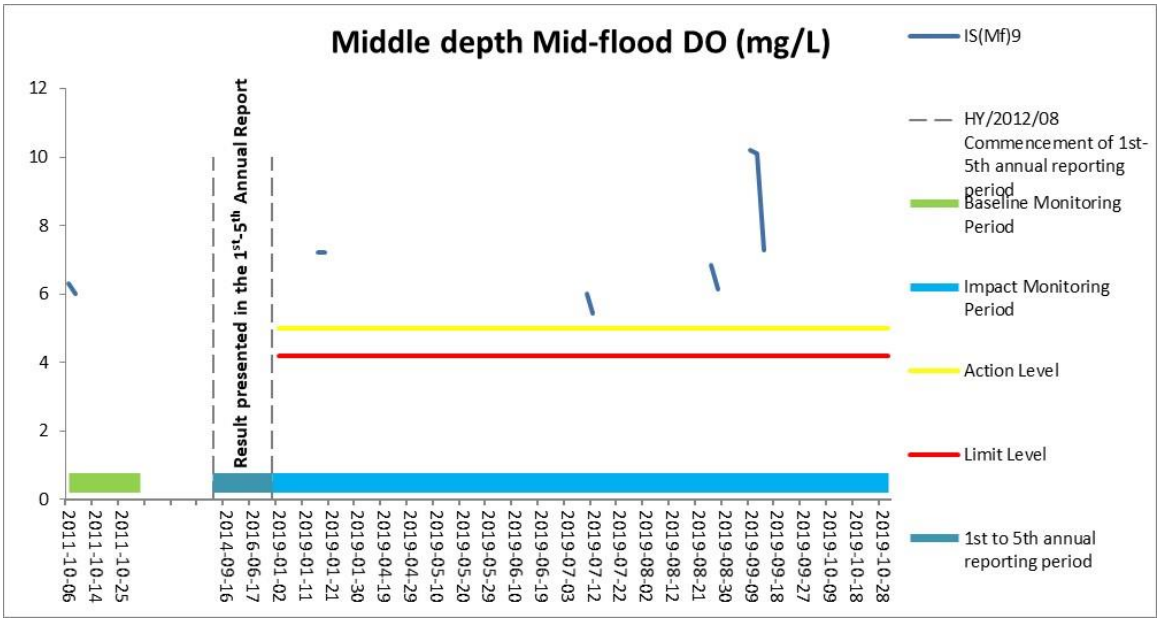


*No data for Stations SR7, IS8(N), SR4(N2) and SR4a due to shallow water depth (< 6m).

Figure E15 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)16. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx

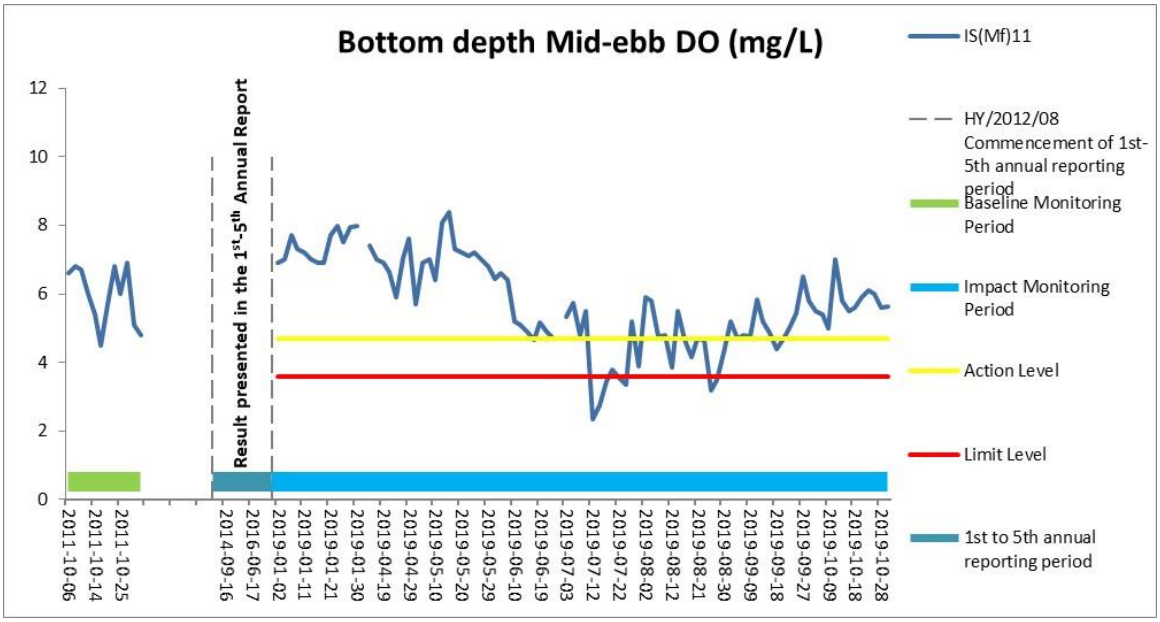




*No data for Stations SR7, IS8(N), SR4(N2) and SR4a due to shallow water depth (< 6m).

Figure E16 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



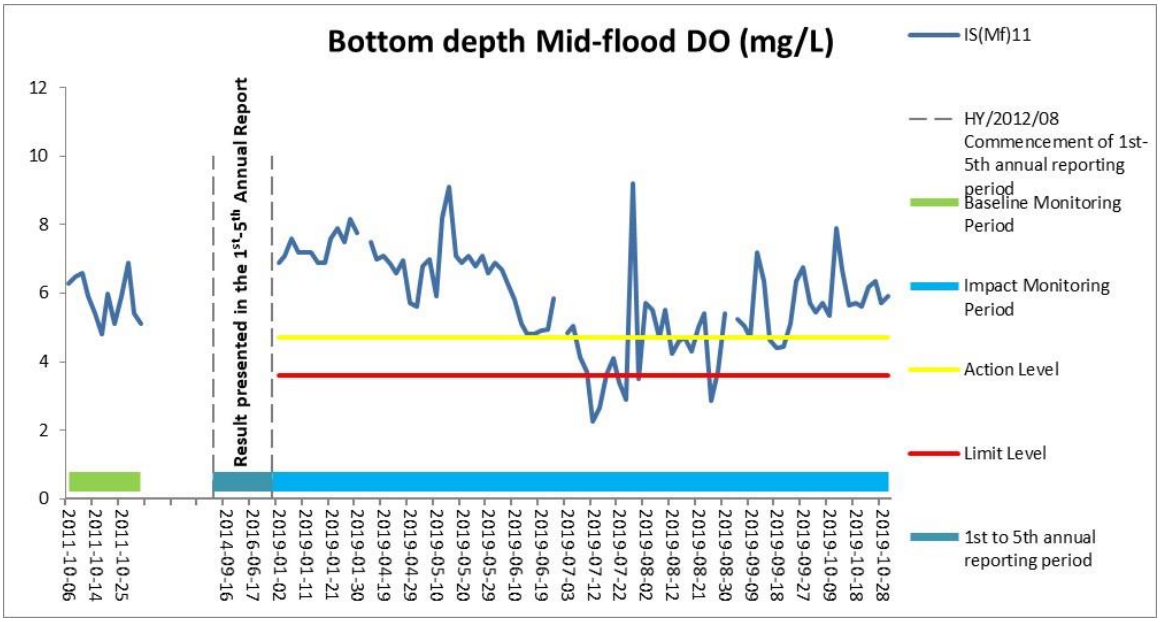
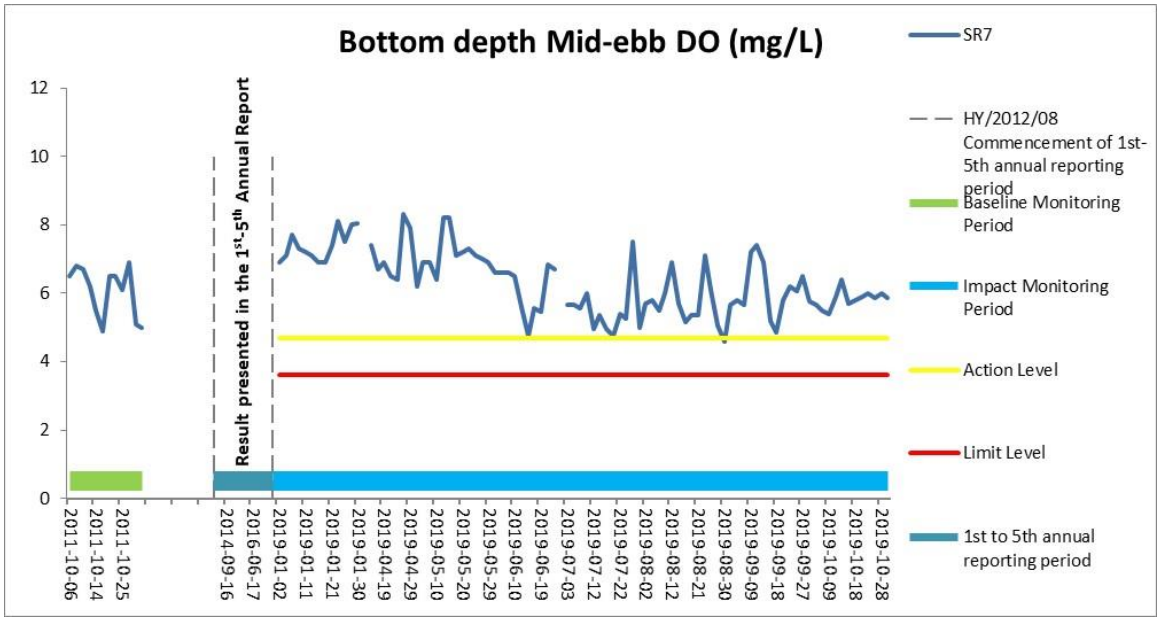


Figure E17 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)11. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



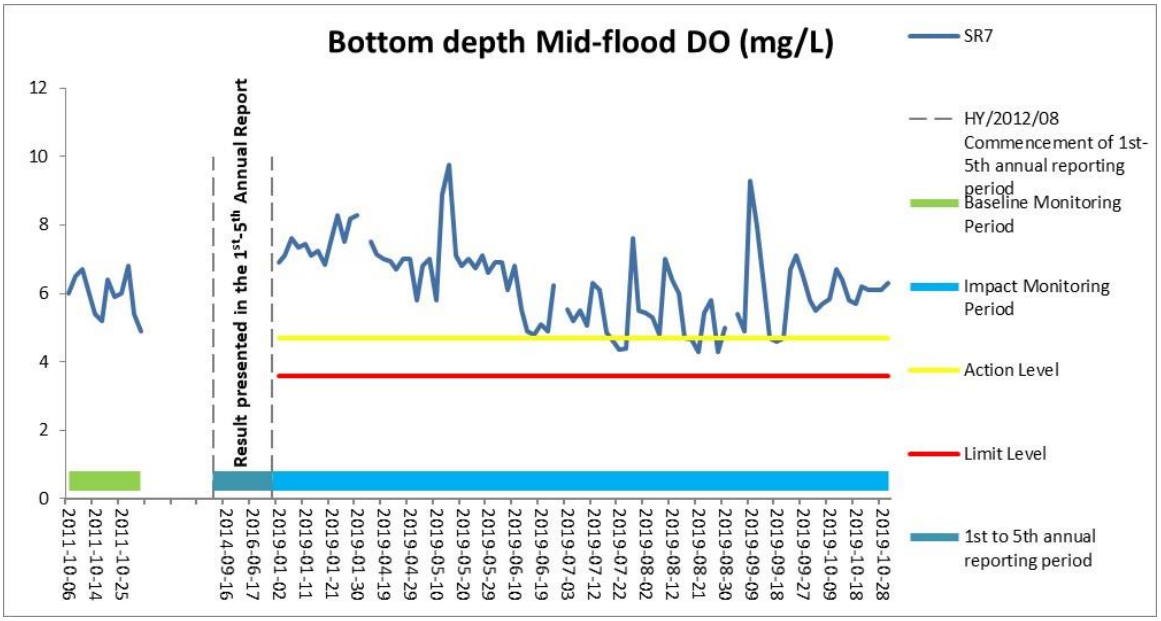
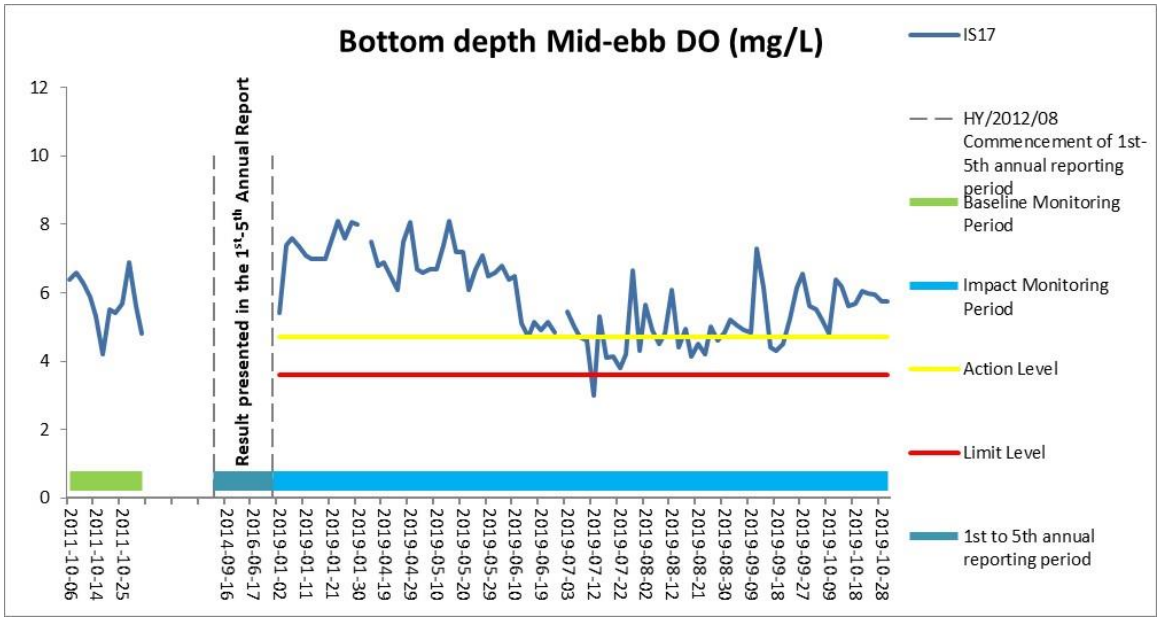


Figure E18 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR7. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



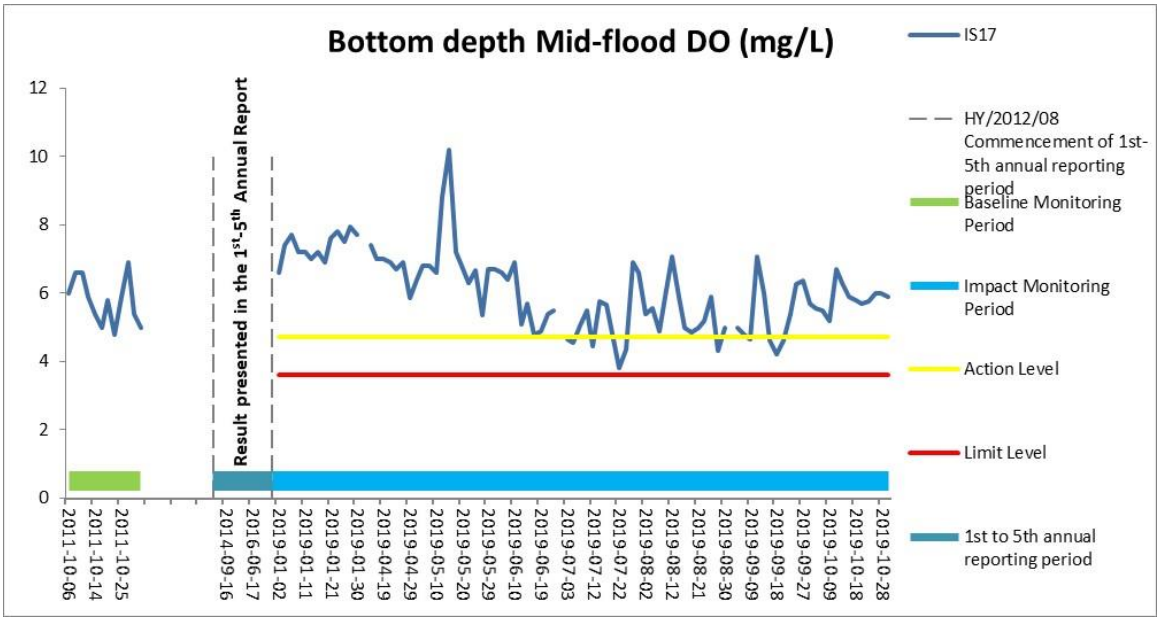
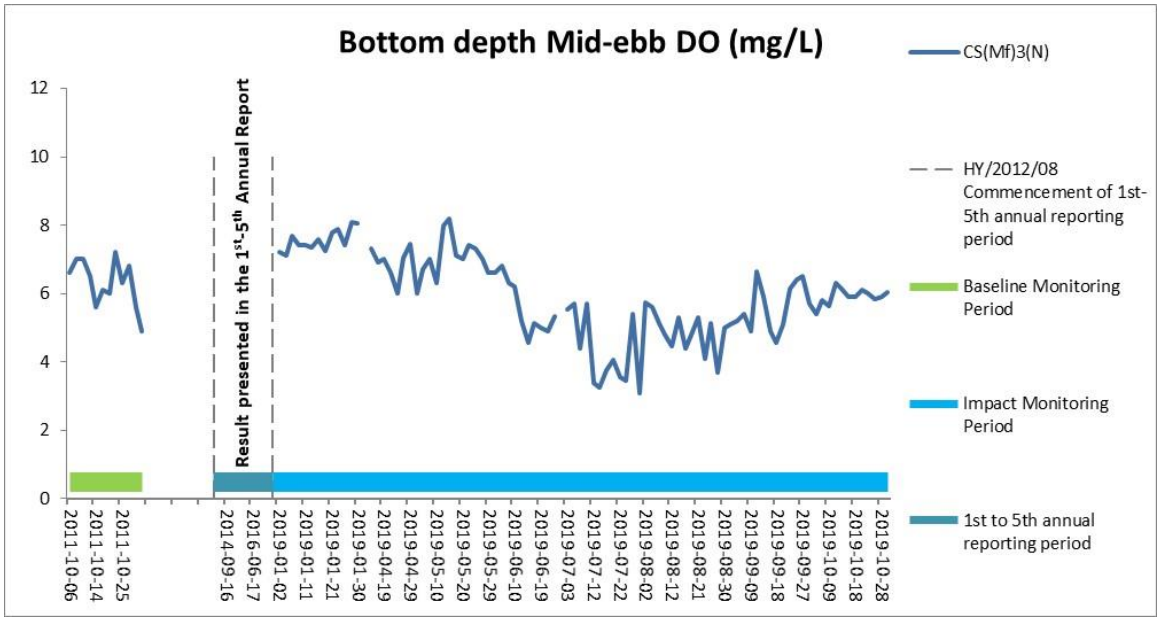


Figure E19 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS17. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



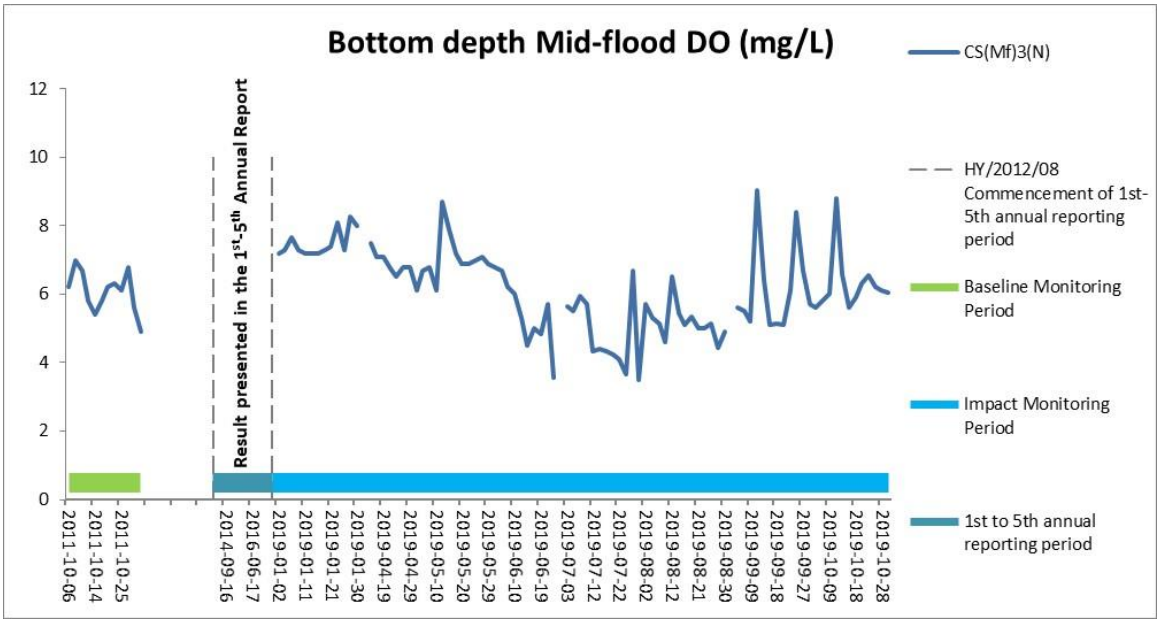
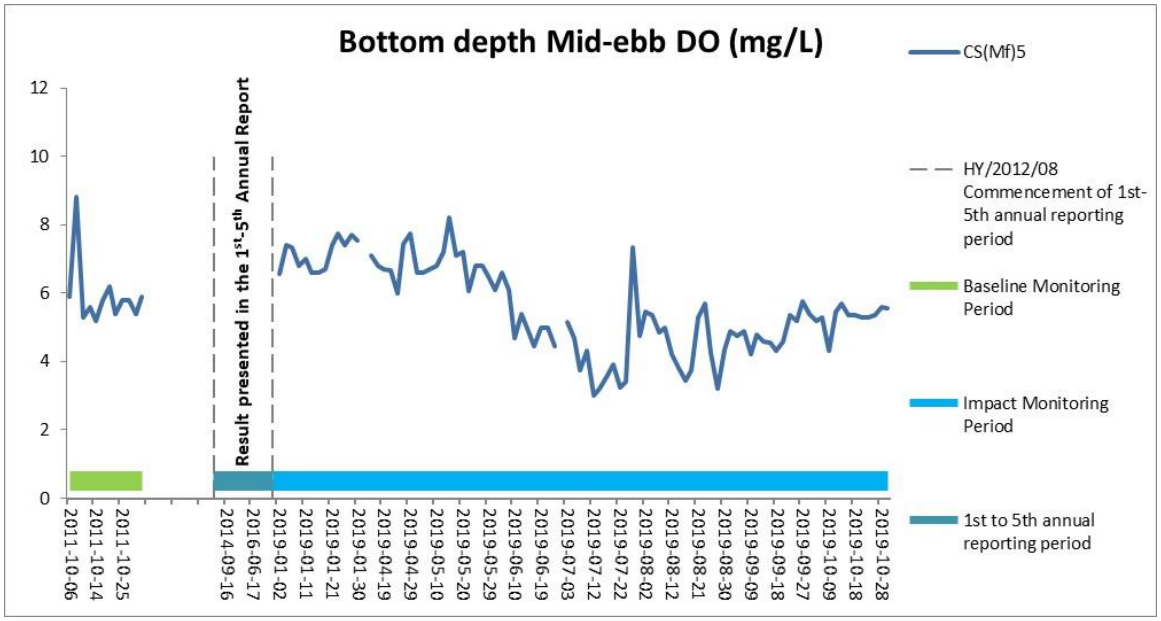


Figure E20 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)3(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



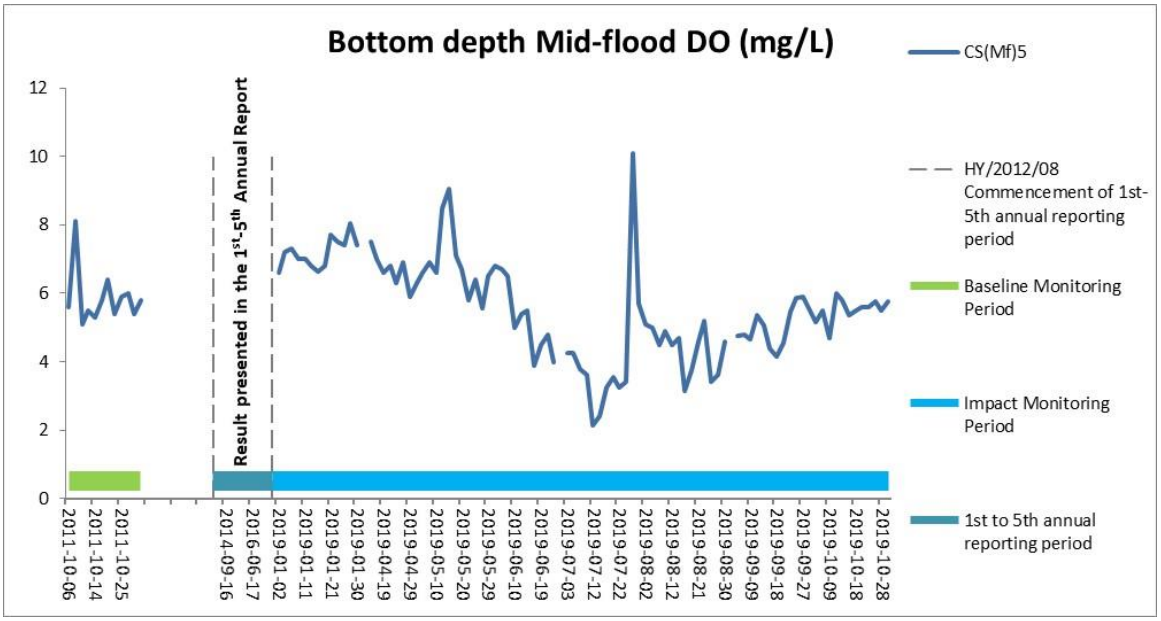
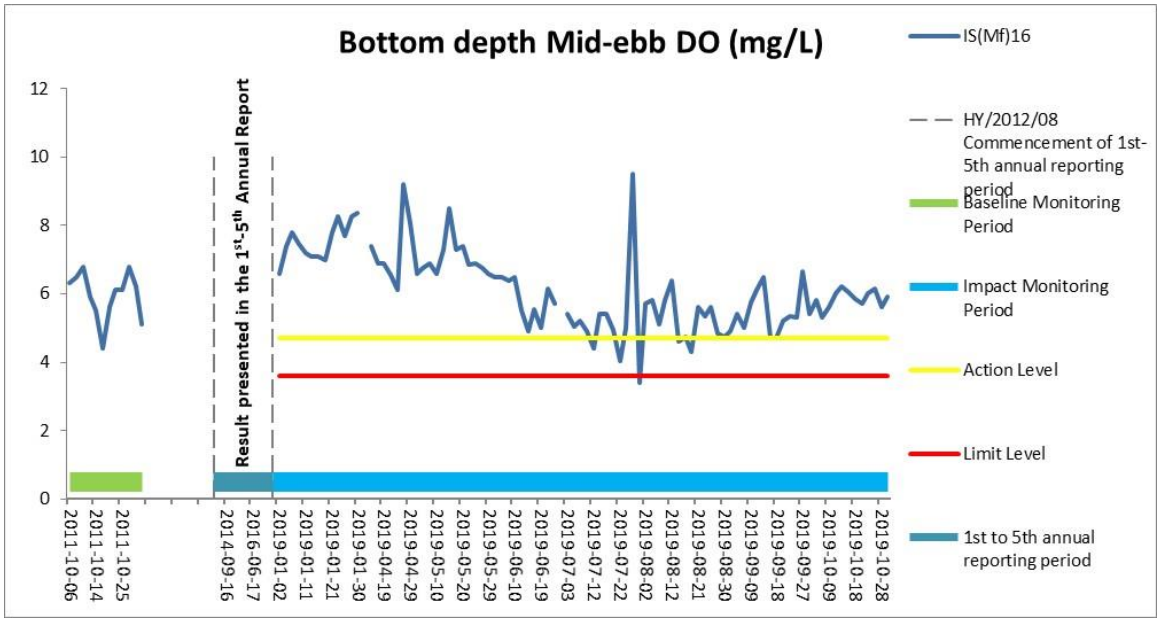


Figure E21 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)5. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



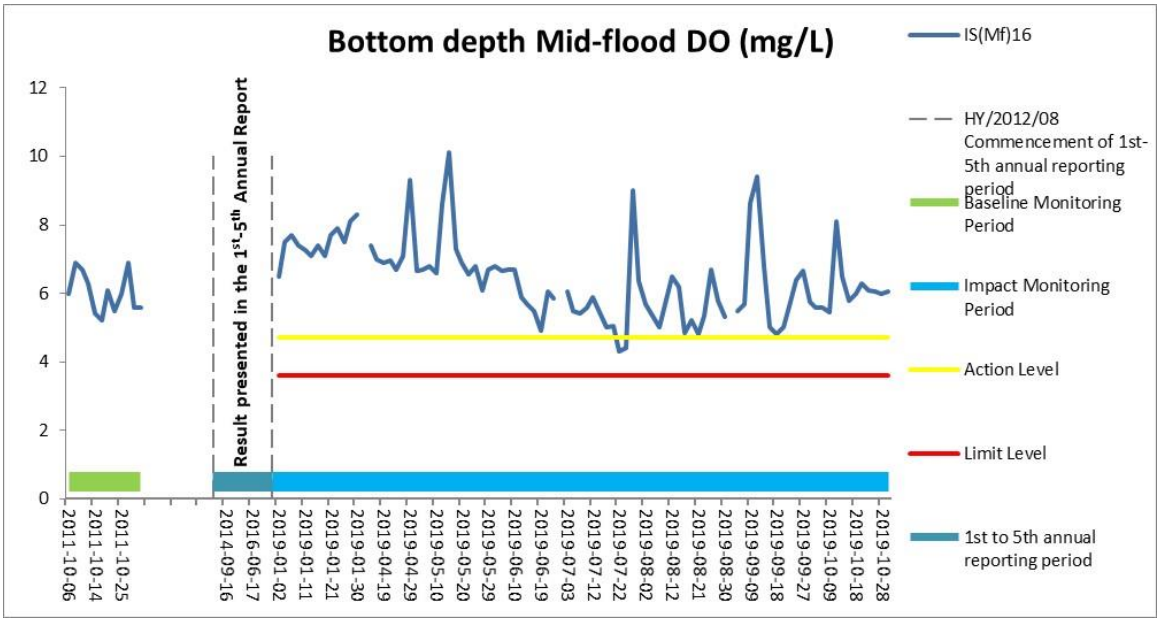
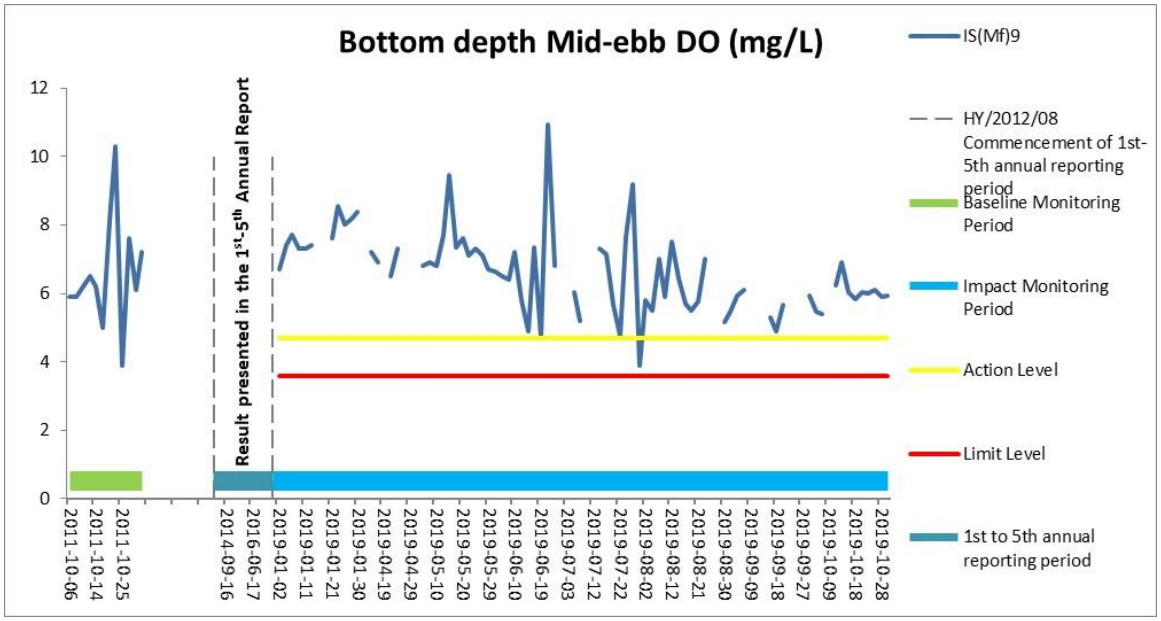


Figure E22 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)16. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



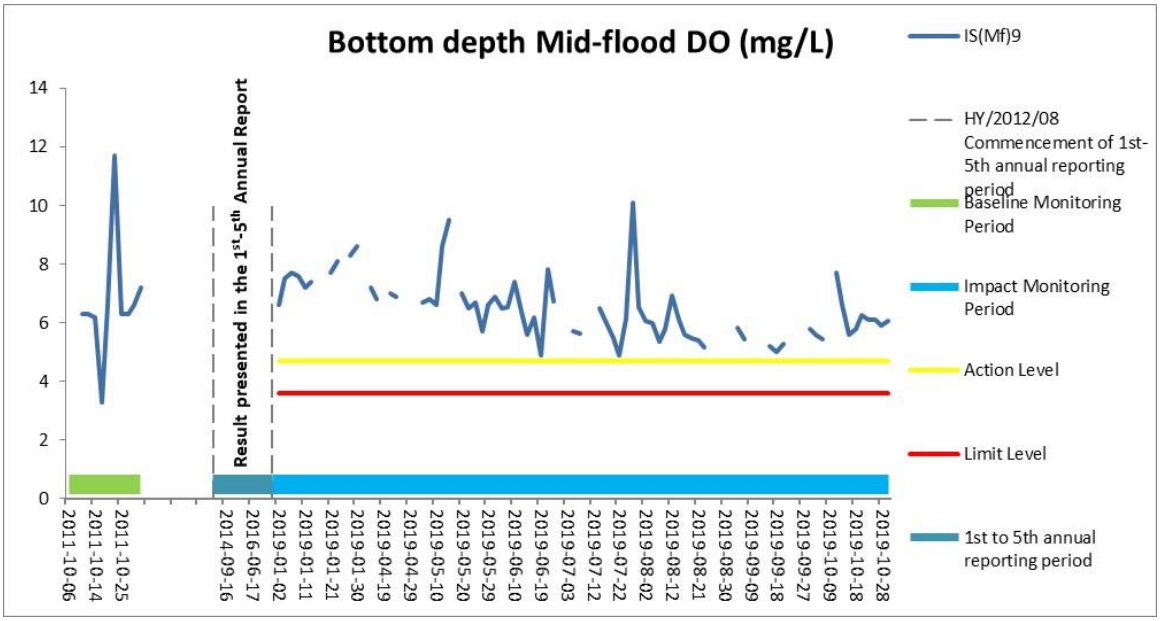
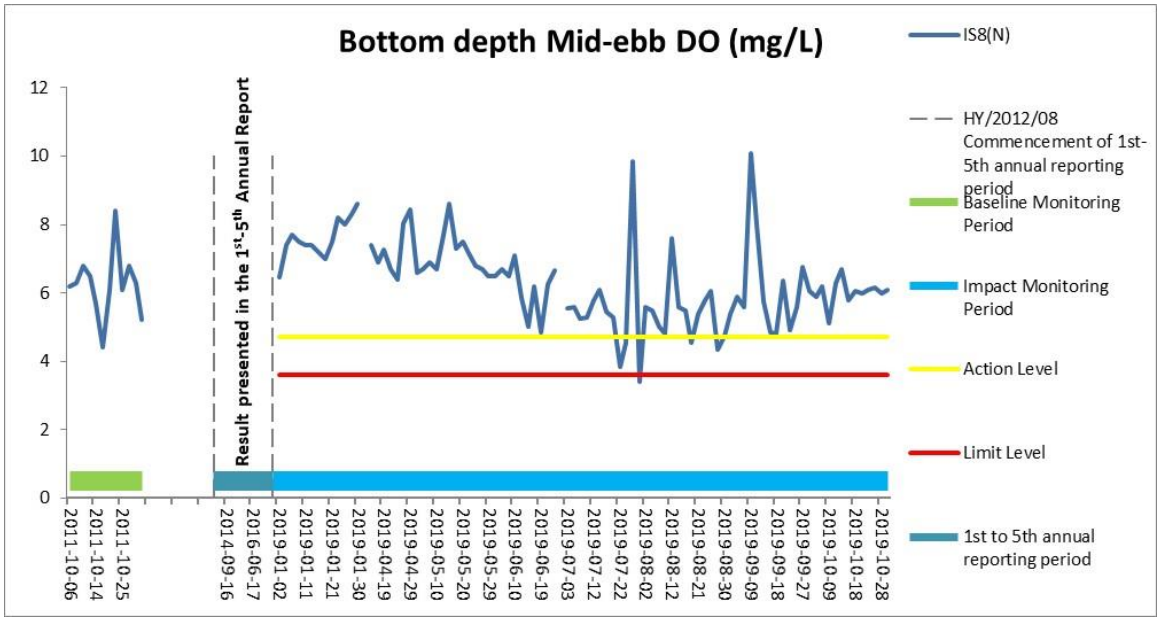


Figure E23 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



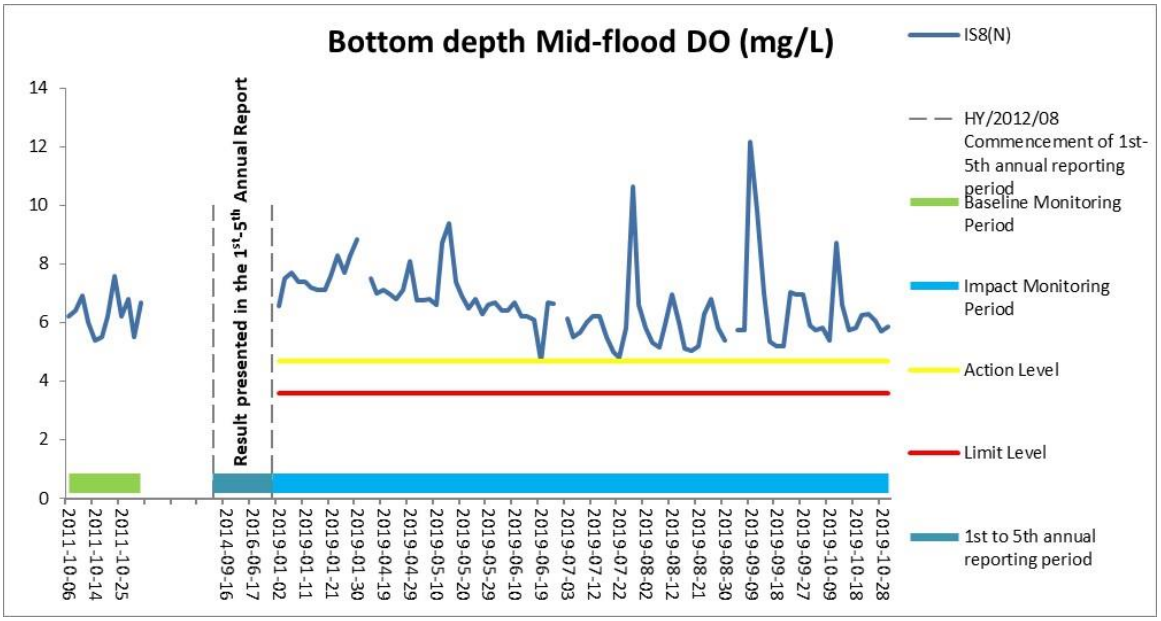
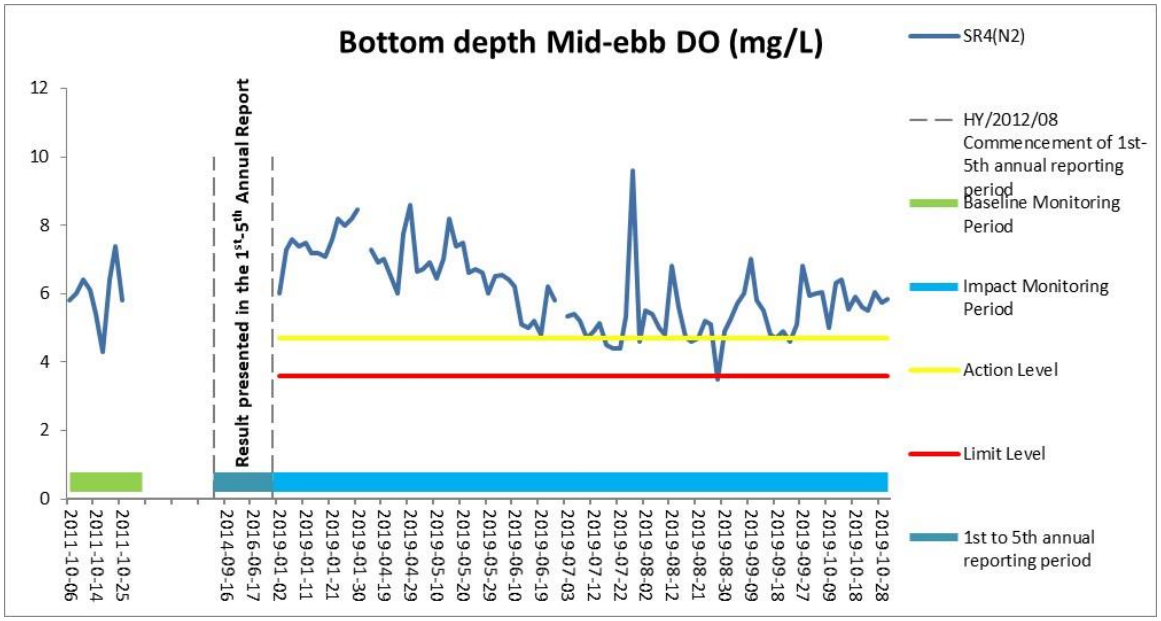


Figure E24 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS8(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



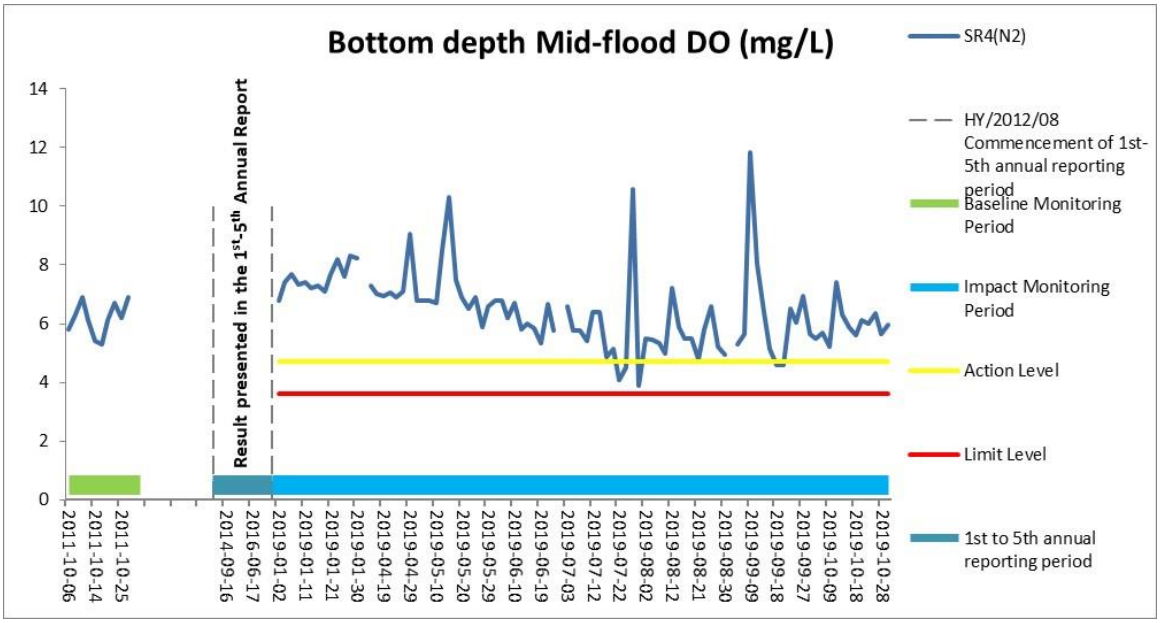
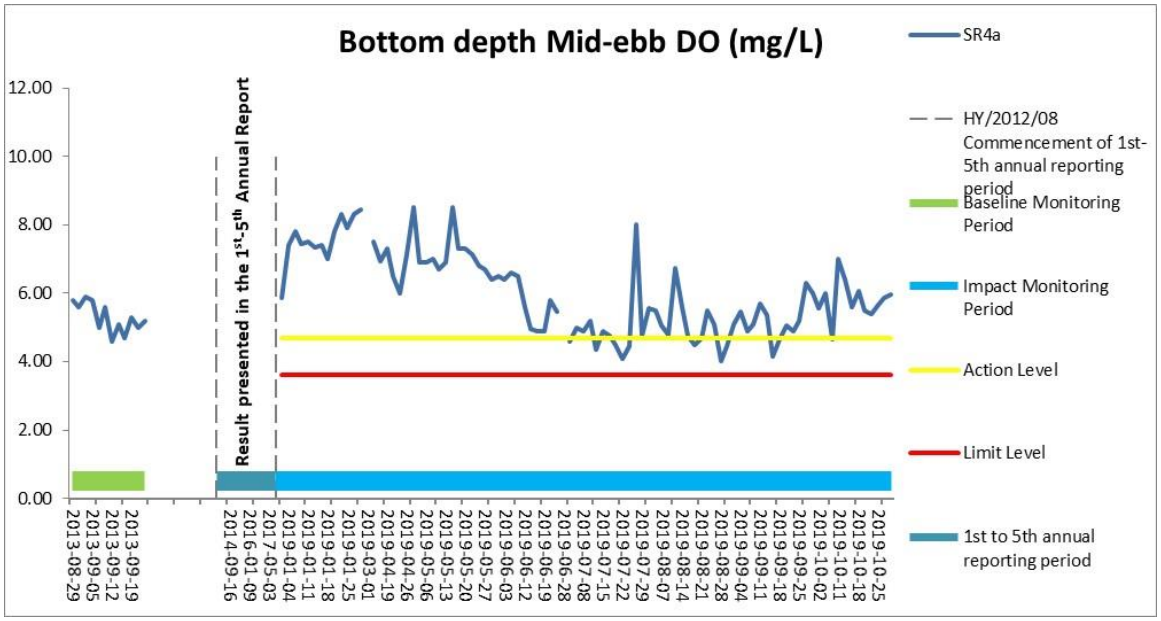


Figure E25 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4(N2). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



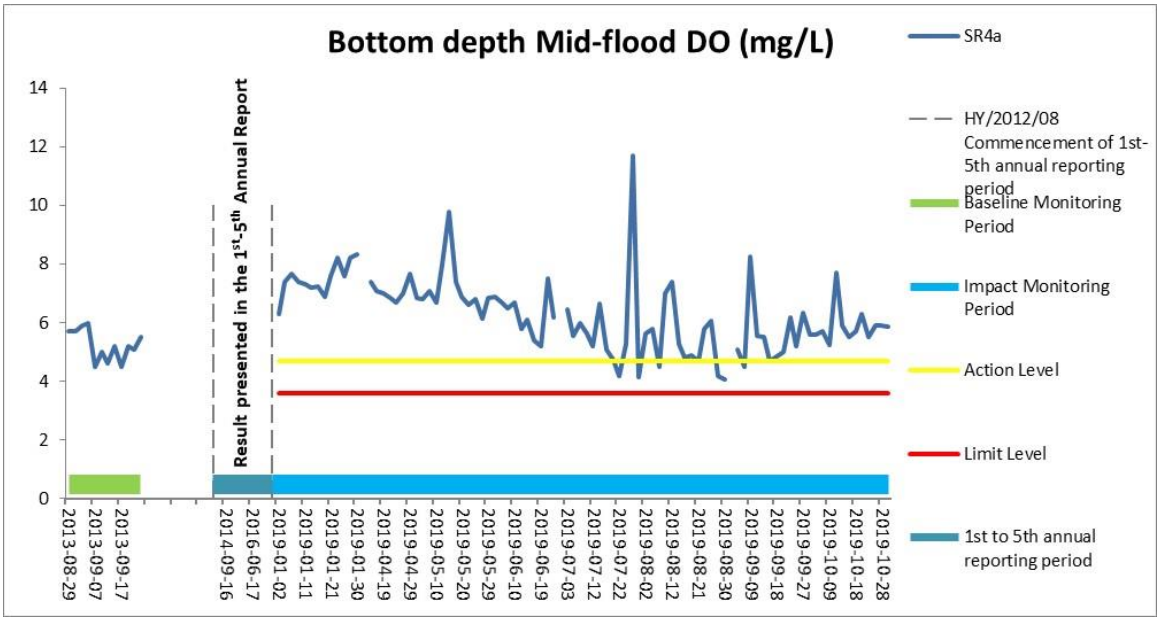
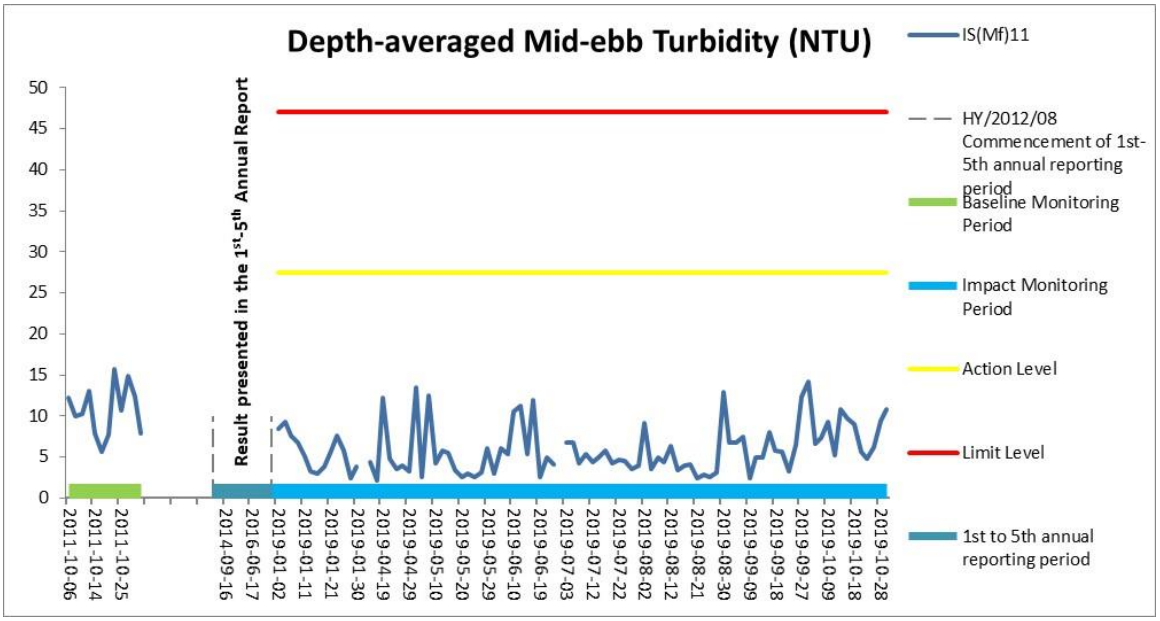


Figure E26 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4a. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



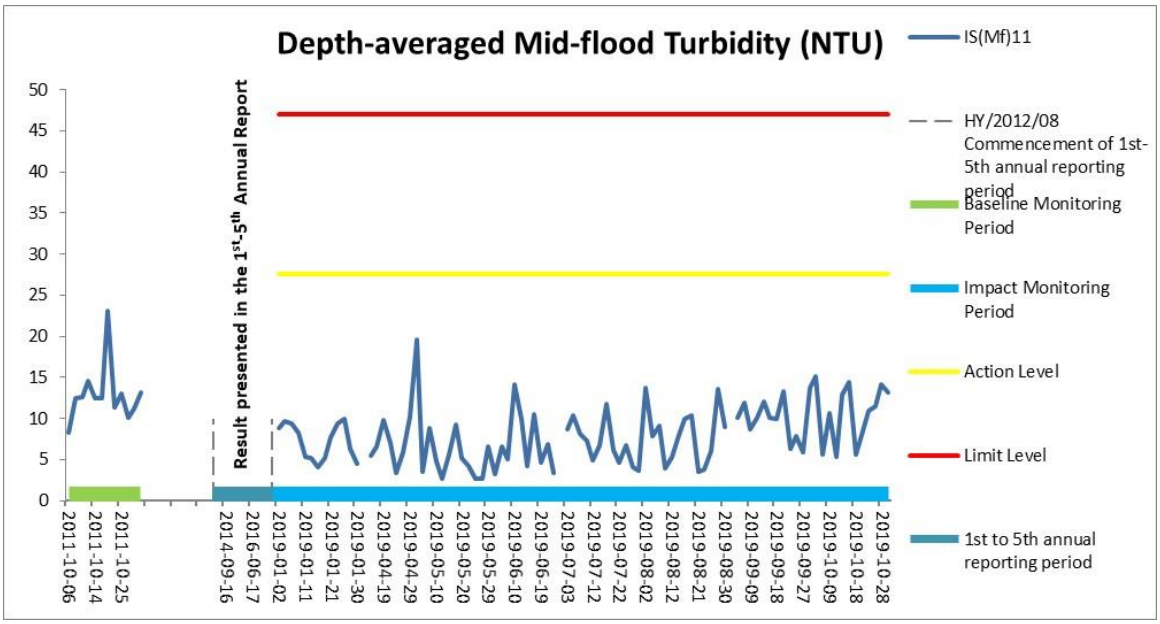
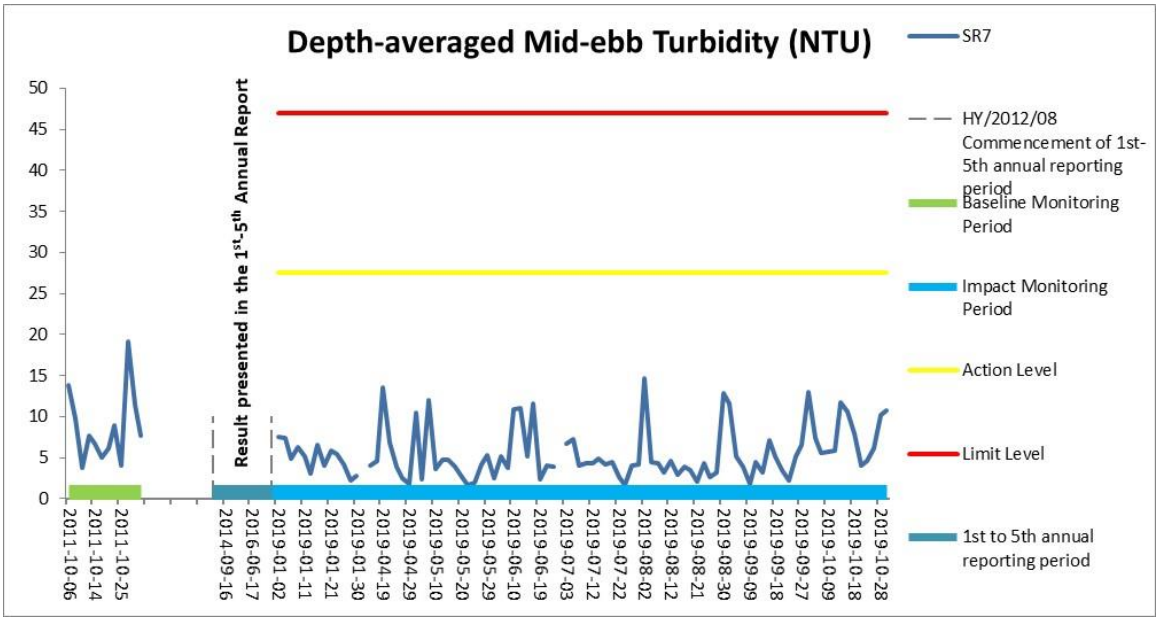


Figure E27 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)11. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



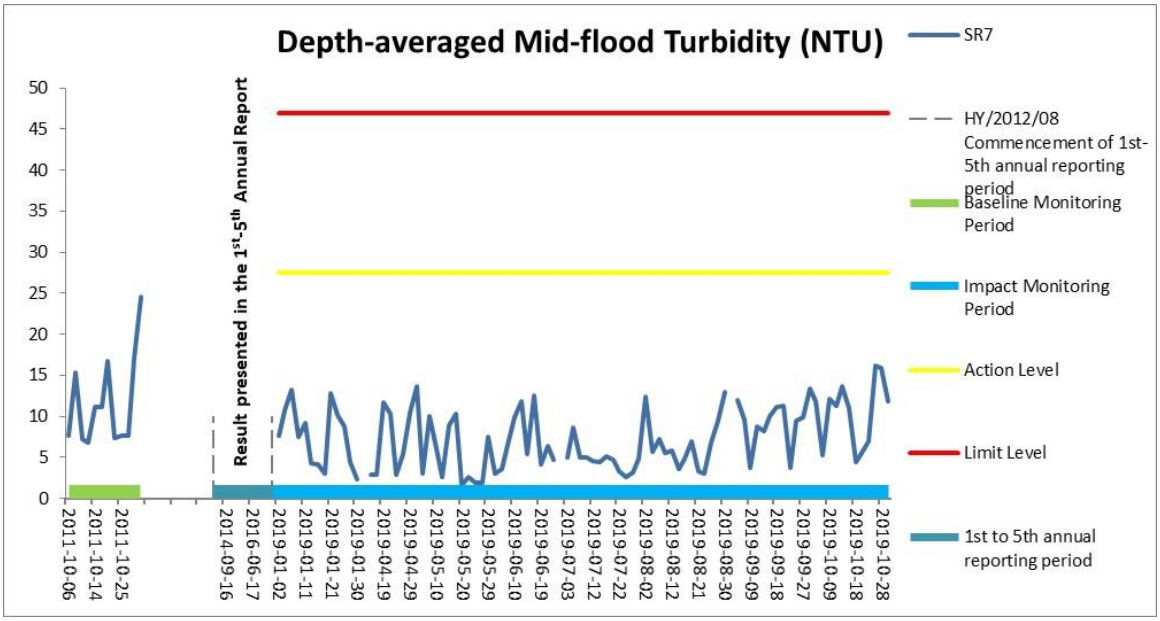
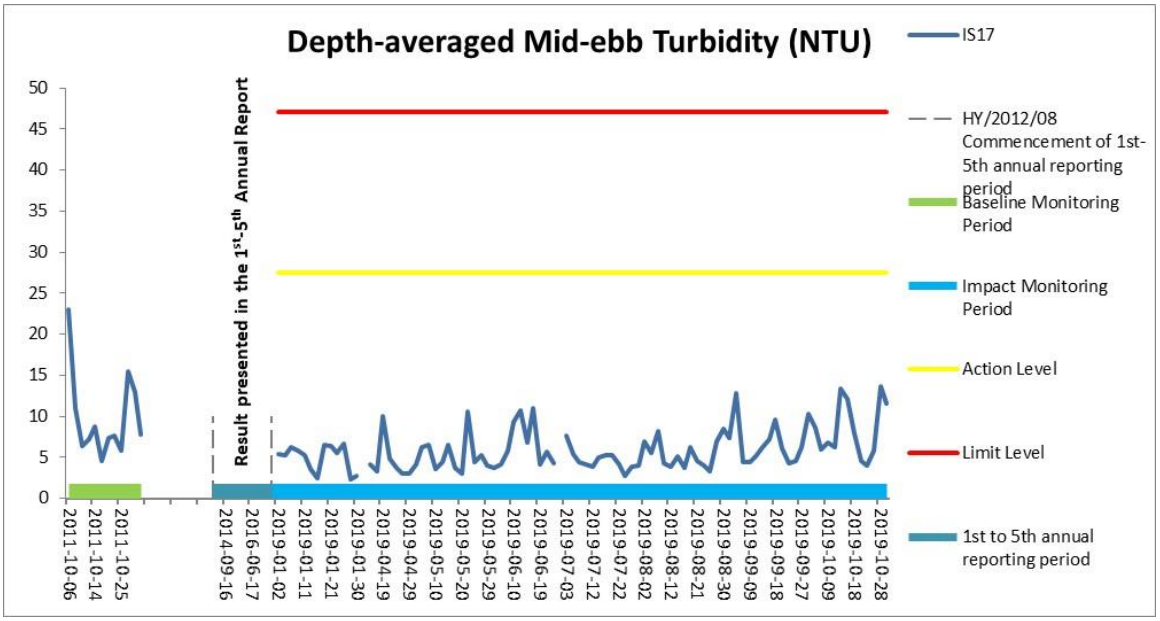


Figure E28 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR7. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



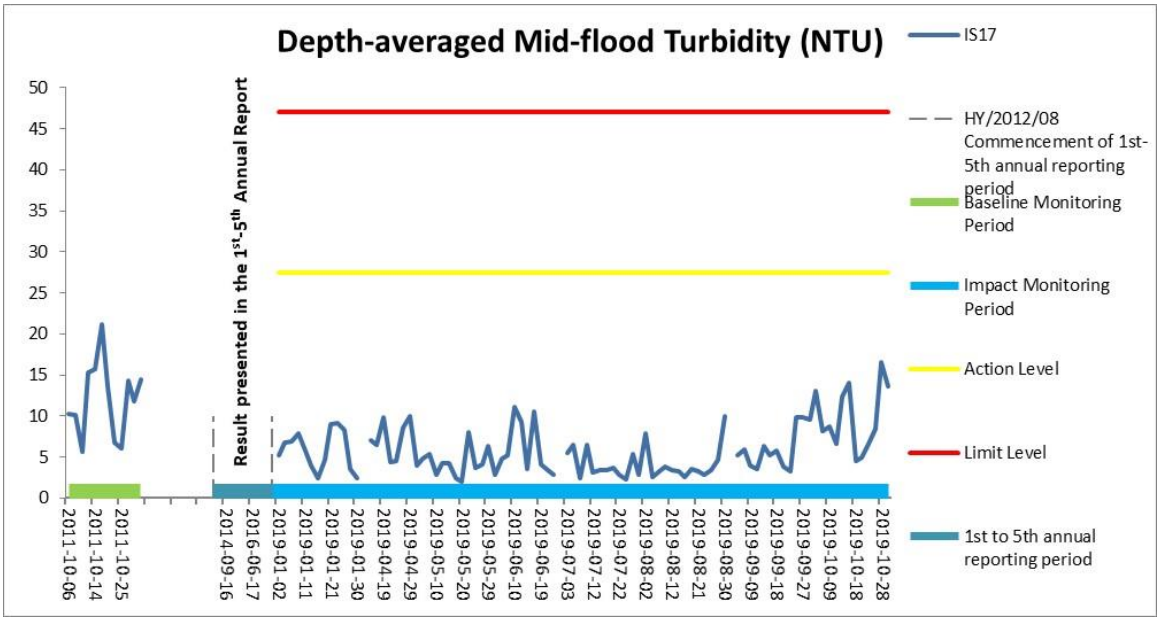
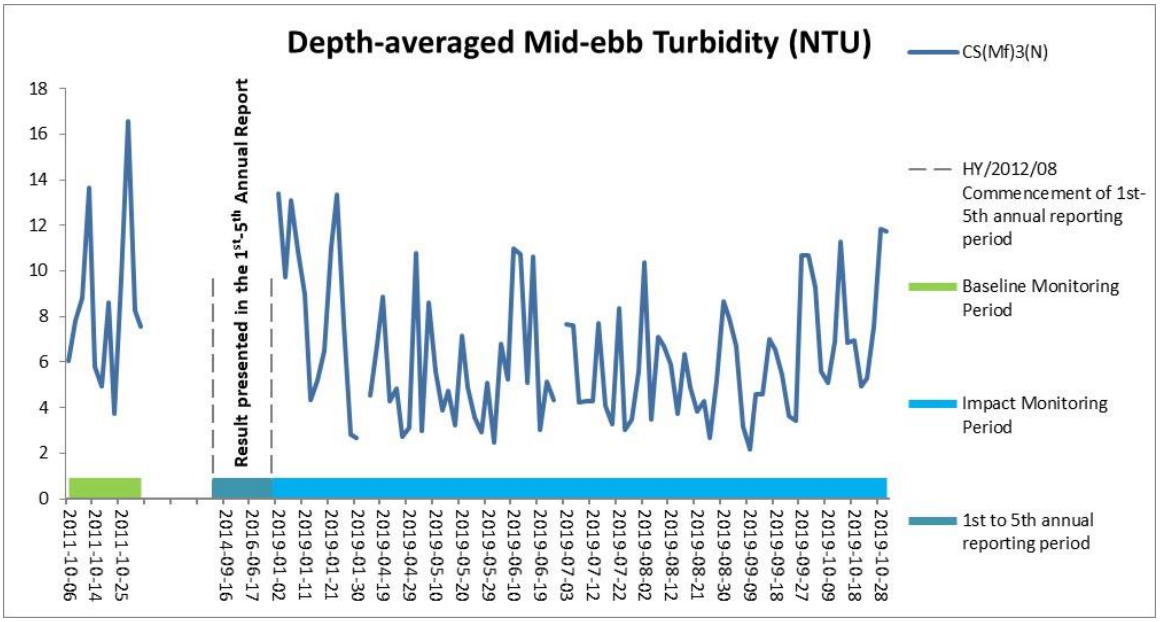


Figure E29 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS17. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



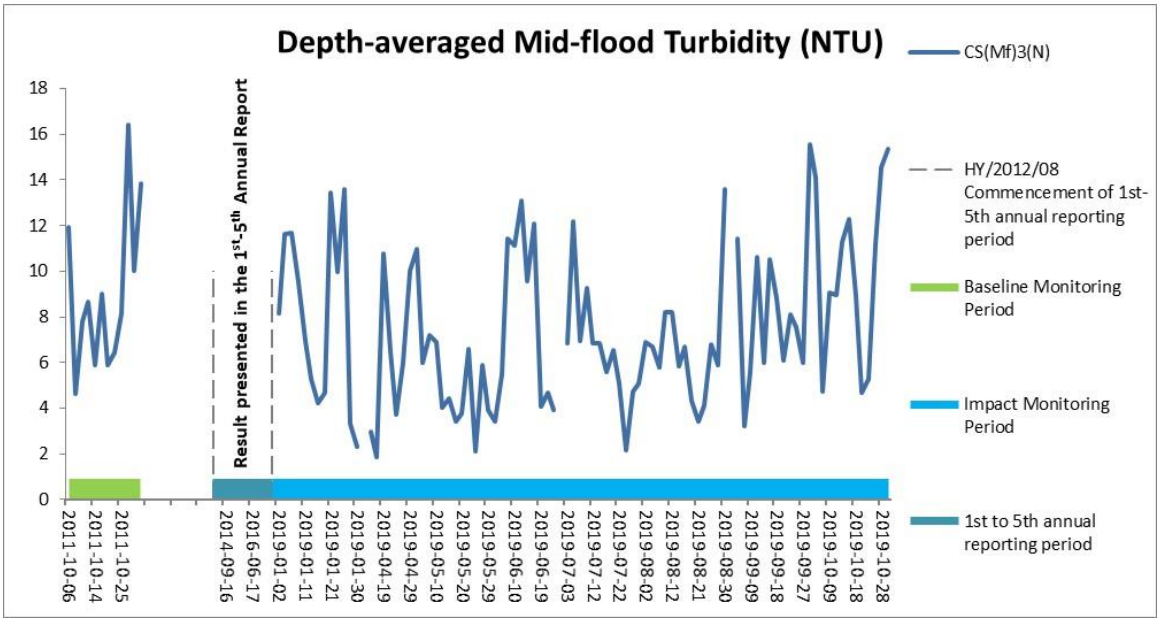
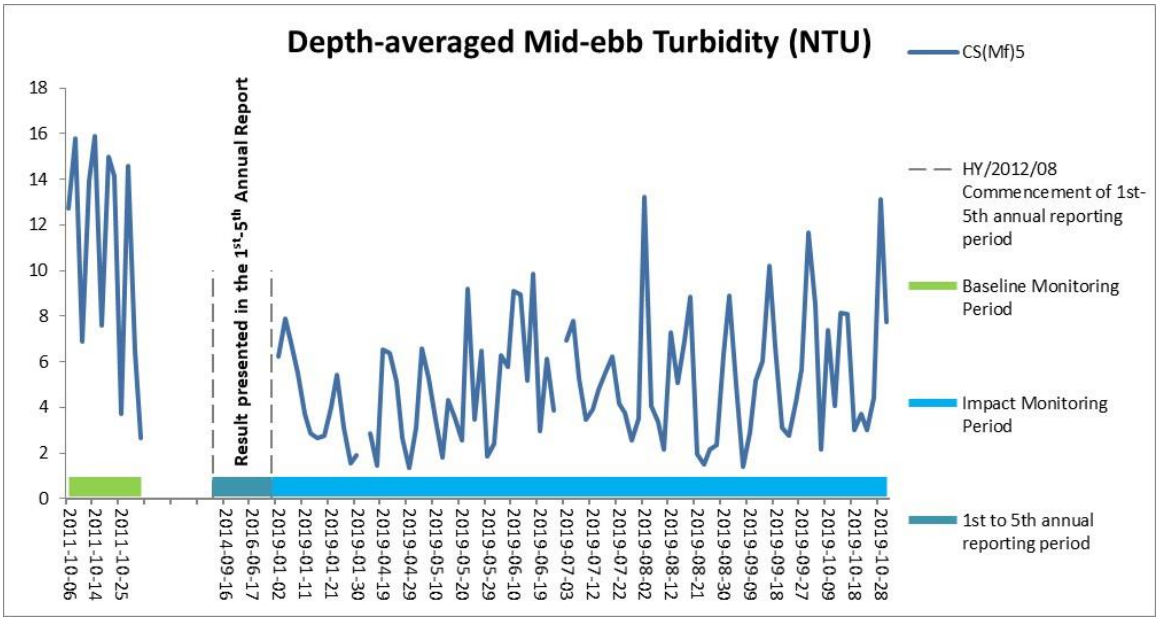


Figure E30 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)3(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



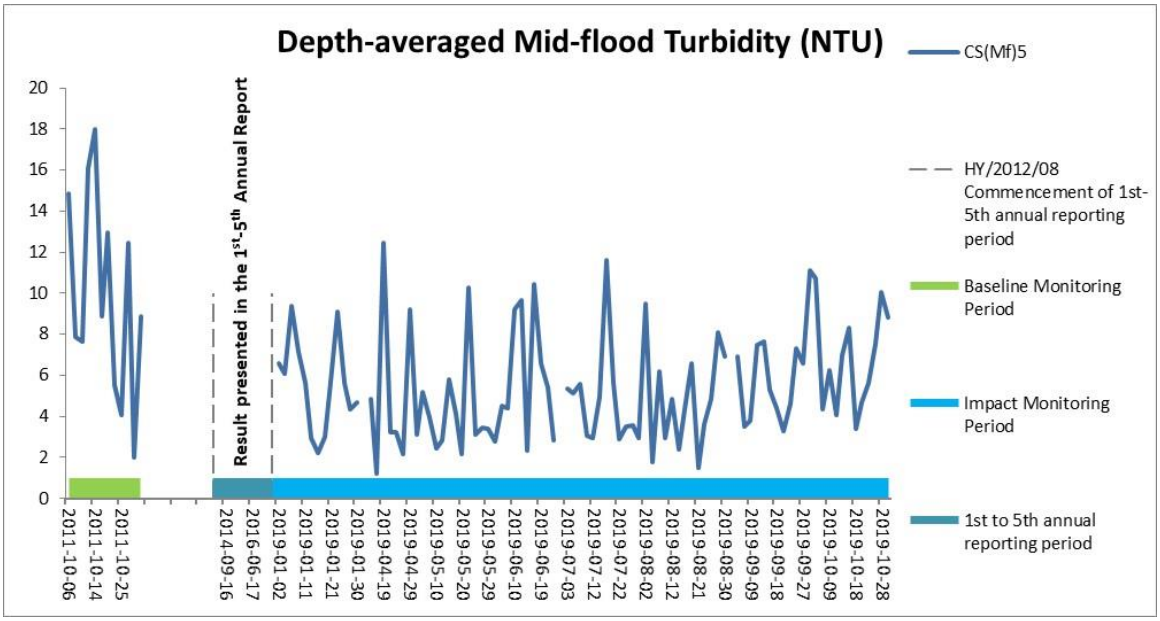
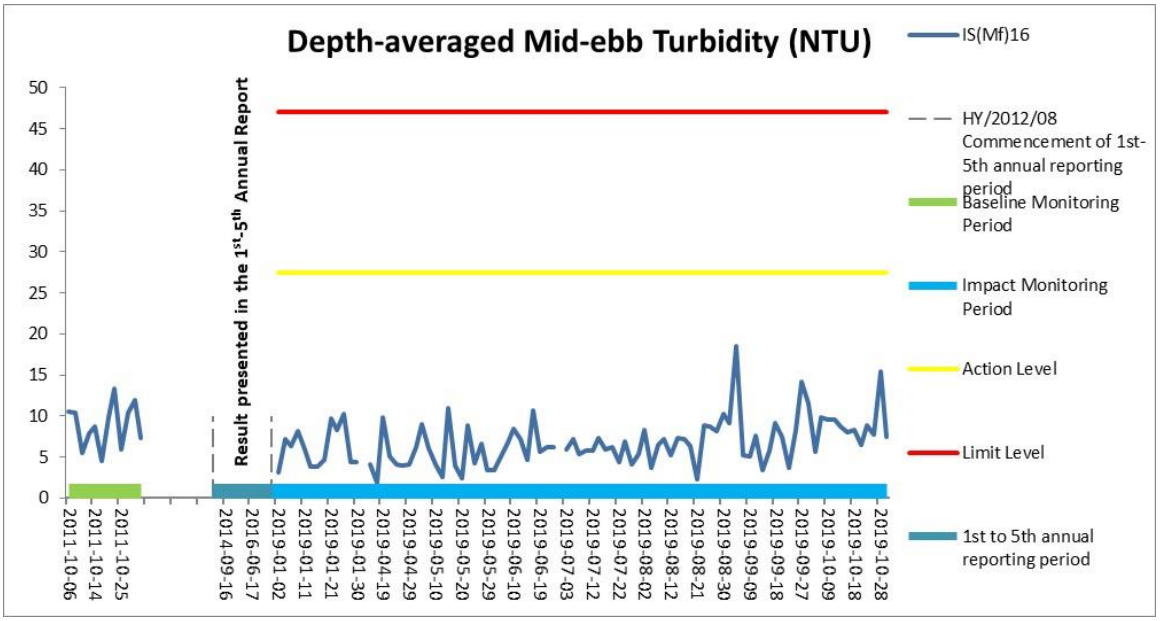


Figure E31 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)5. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



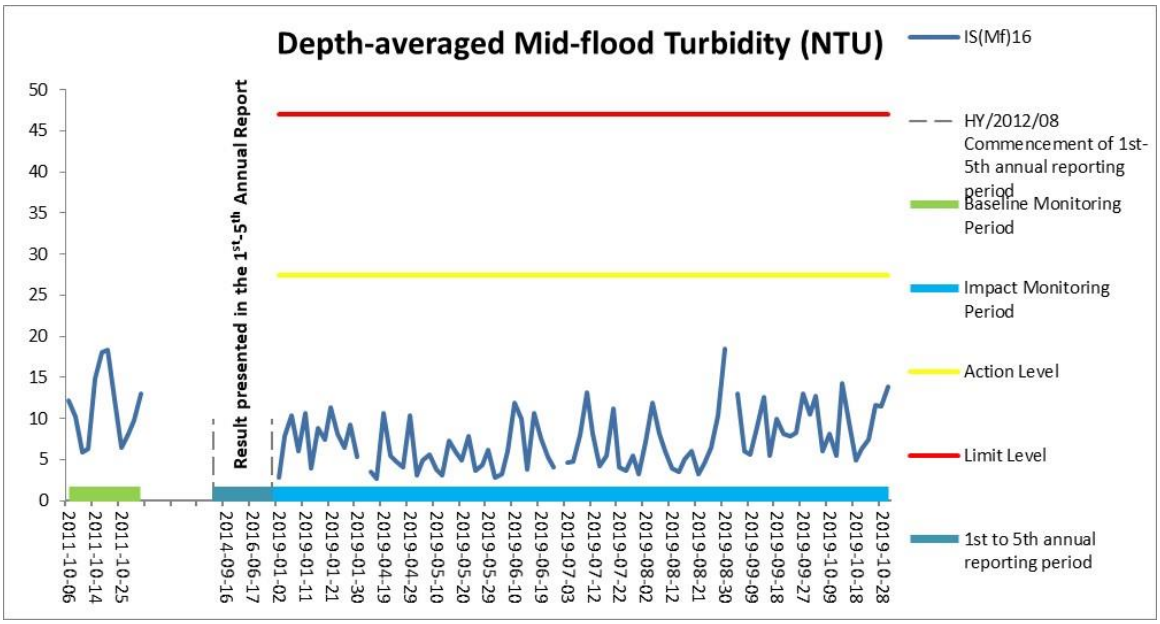
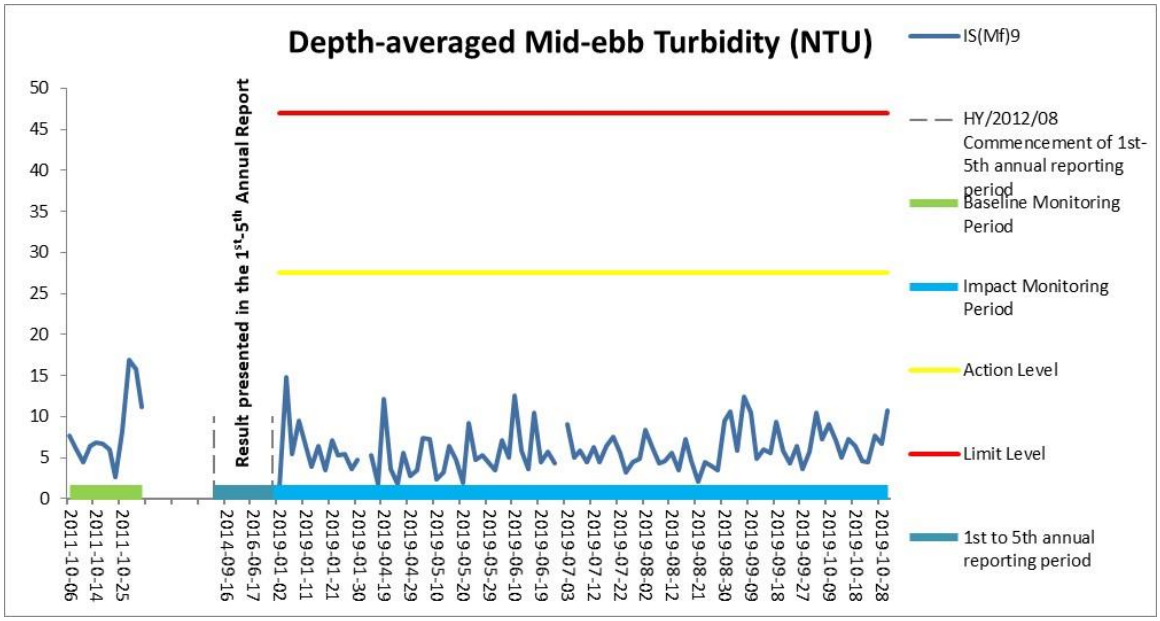


Figure E32 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)16. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



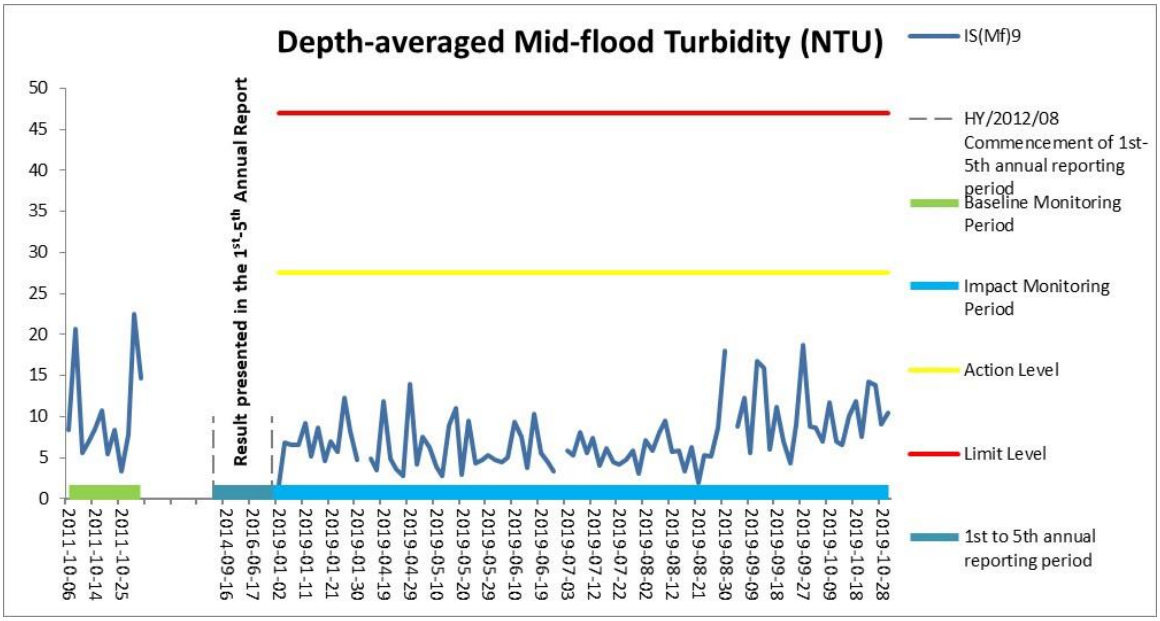
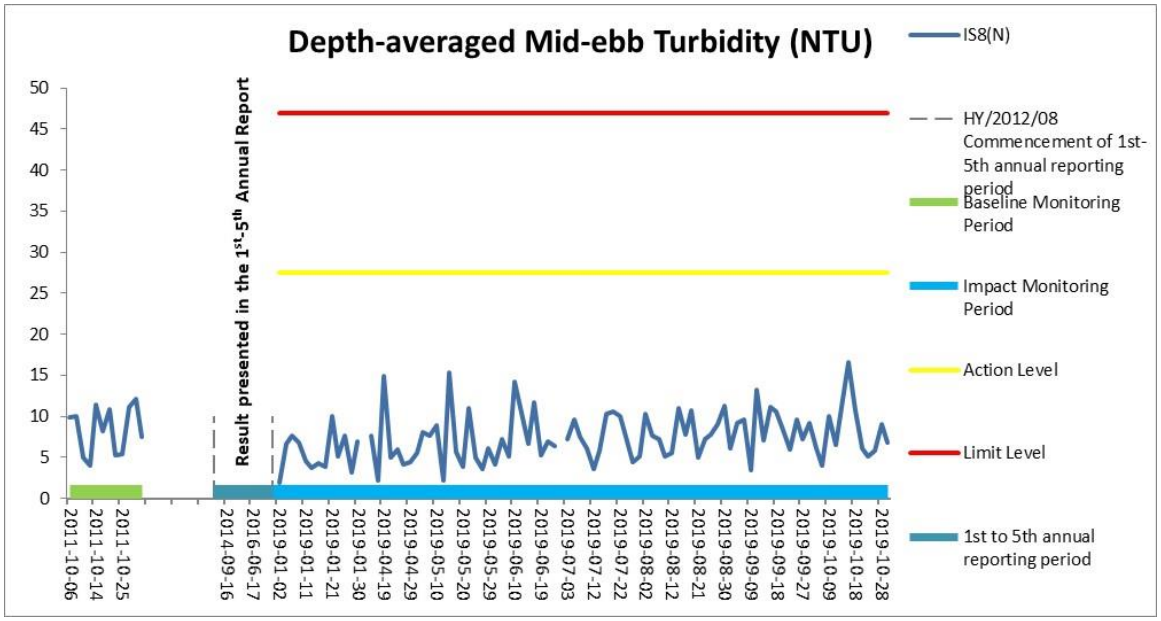


Figure E33 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



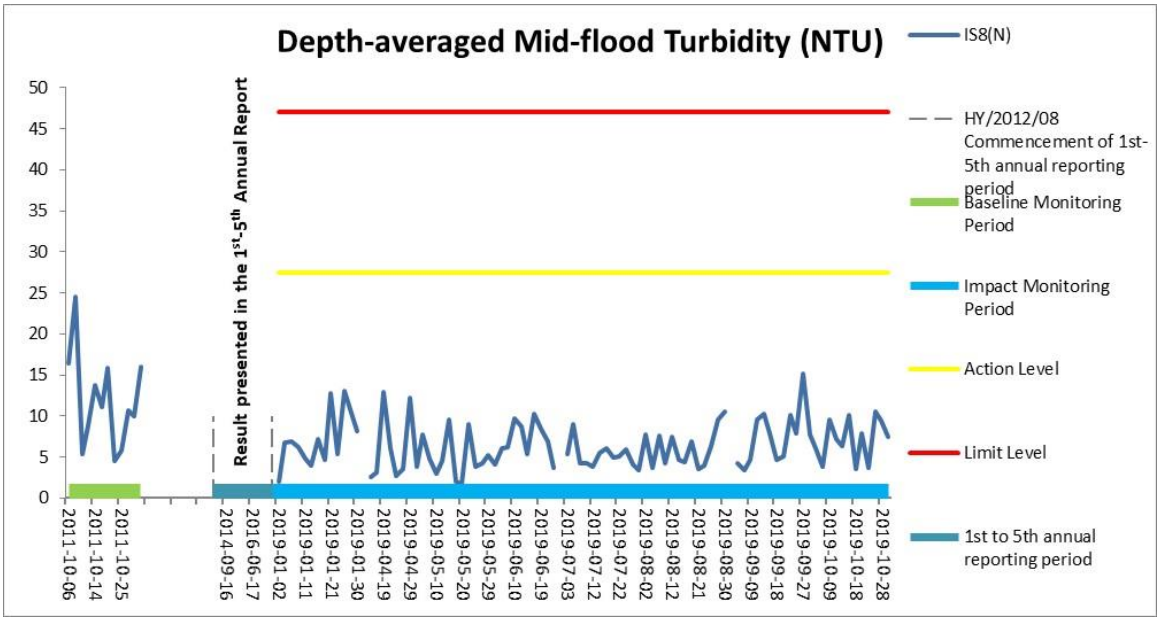
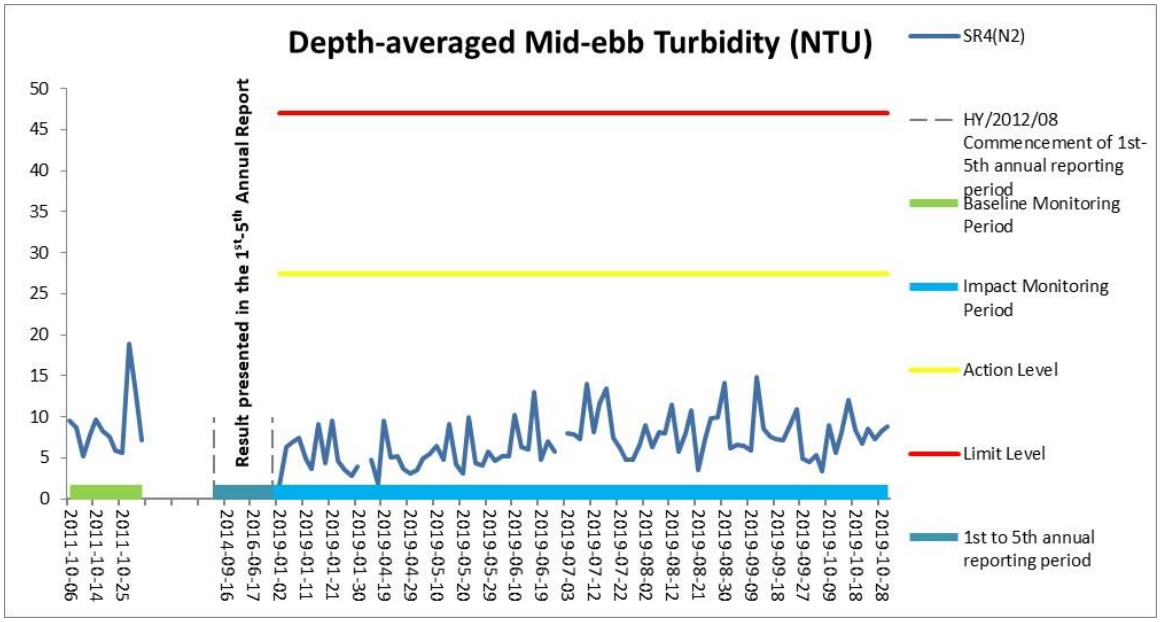


Figure E34 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS8(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



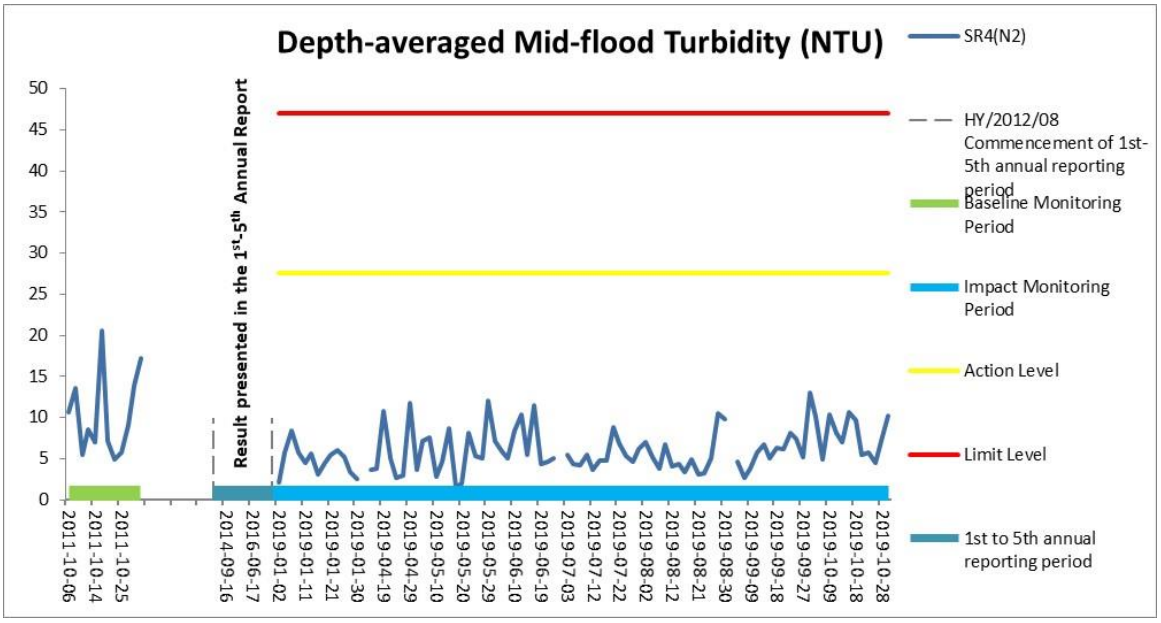
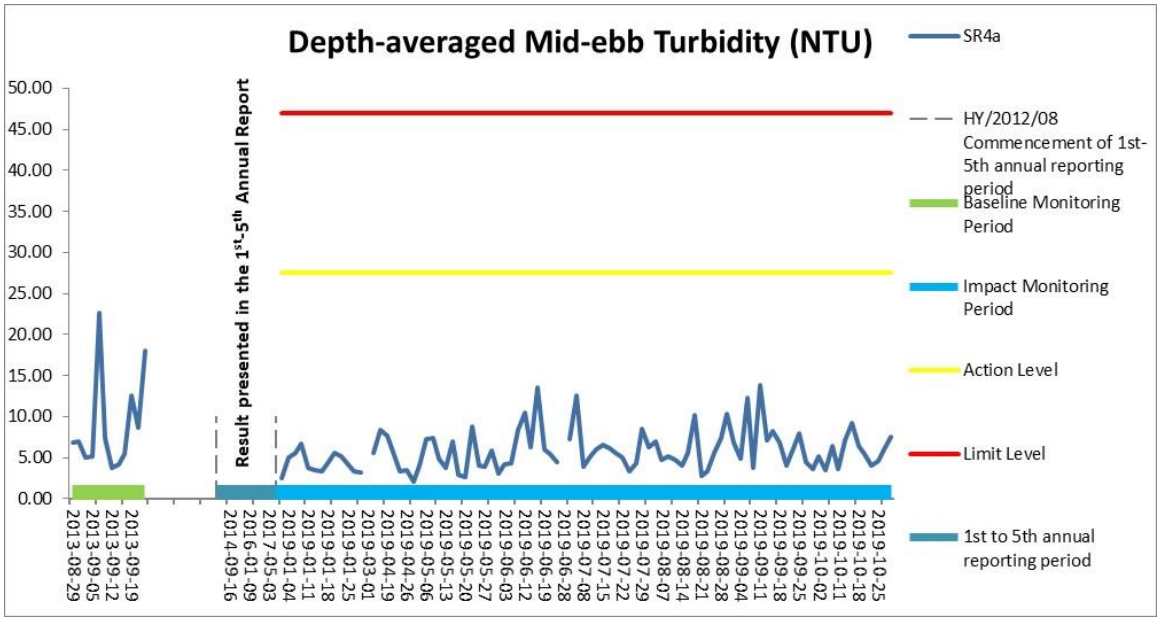


Figure E35 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4(N2). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



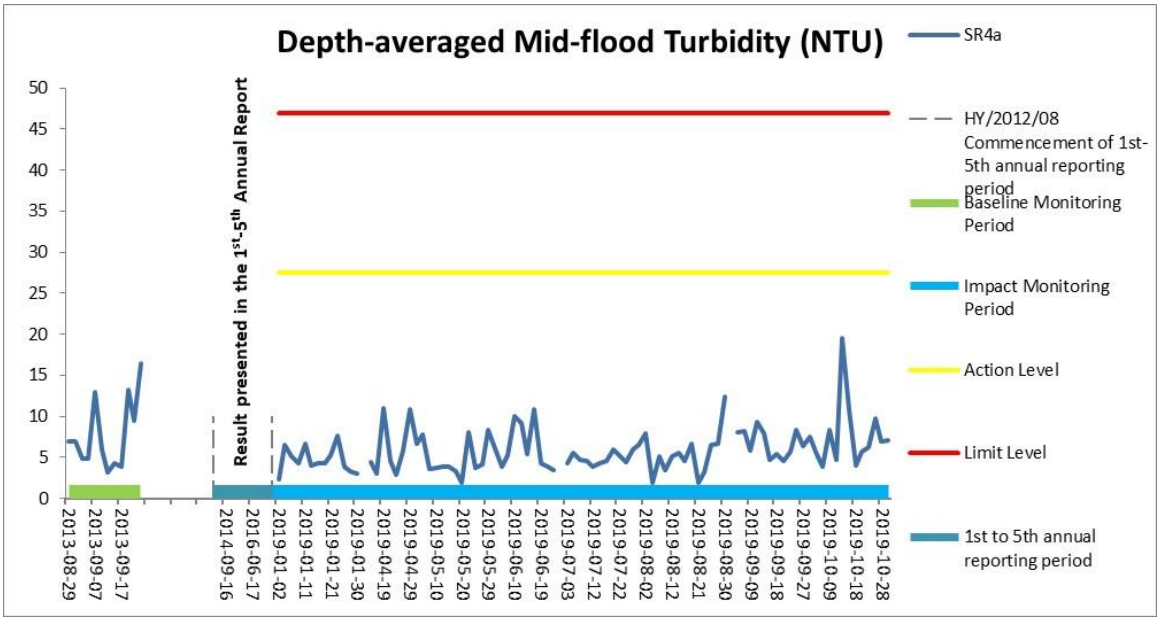
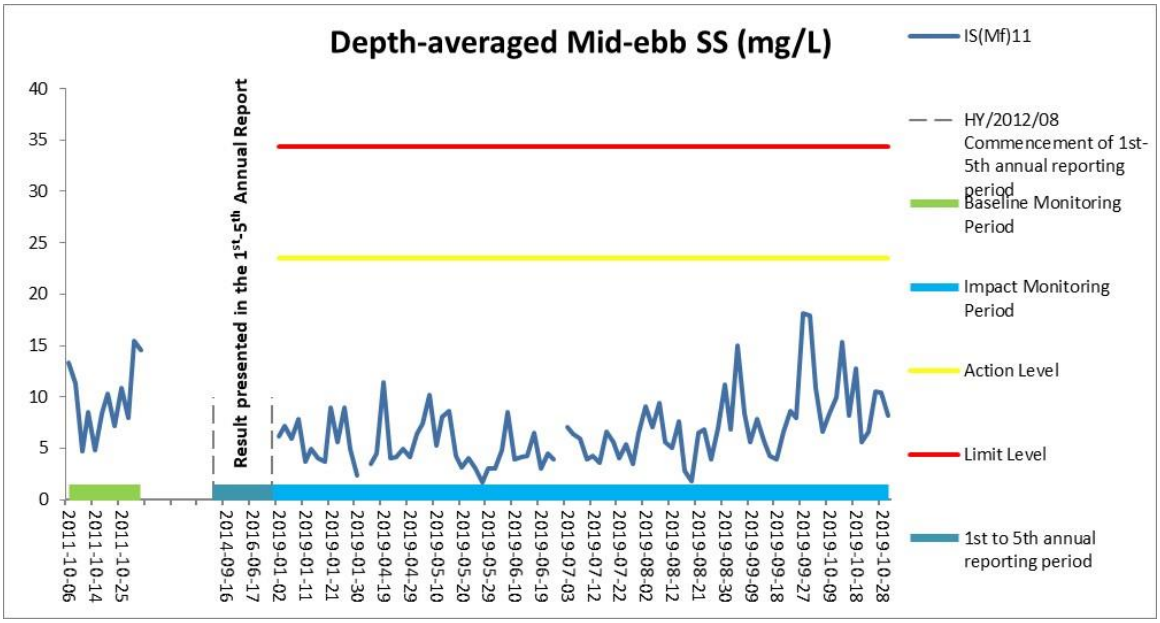


Figure E36 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4a. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



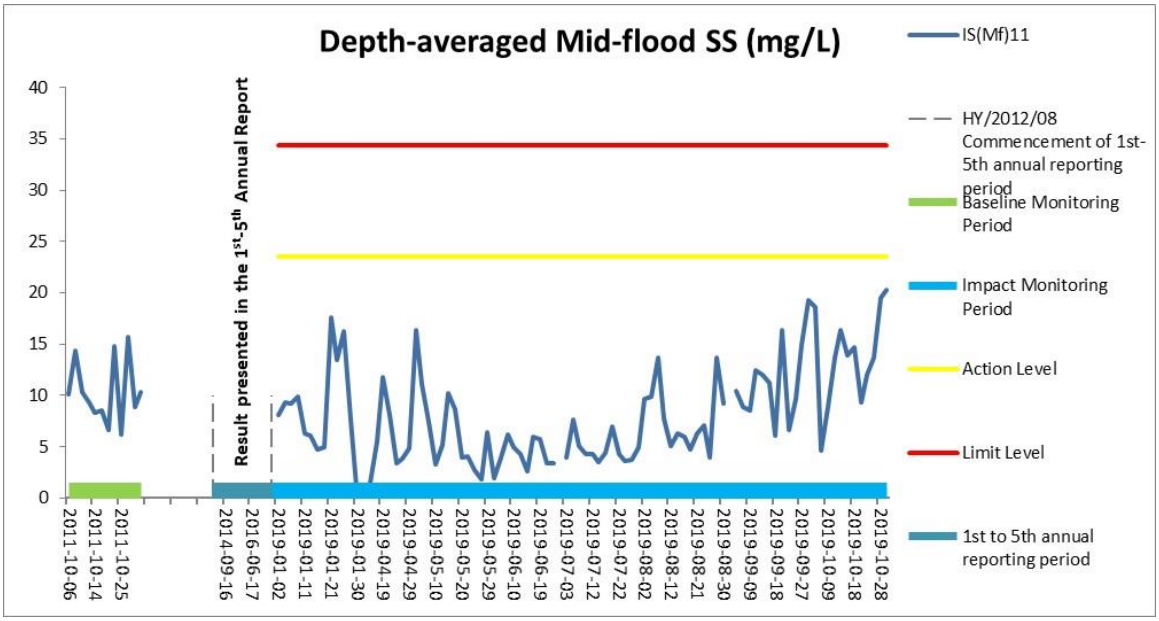
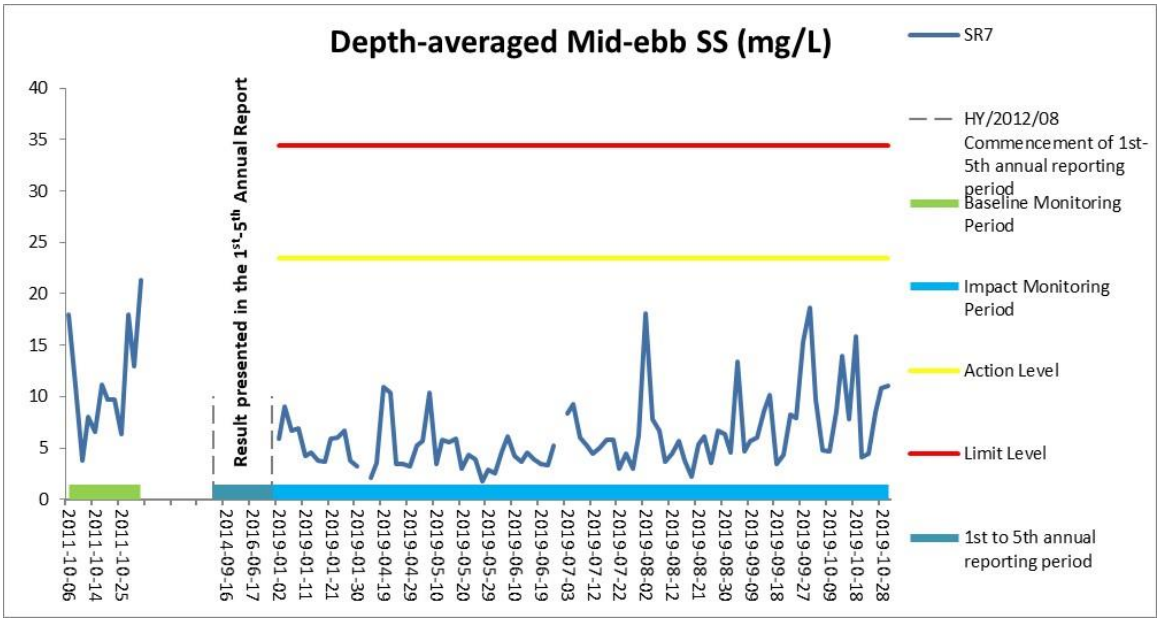


Figure E37 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)11. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



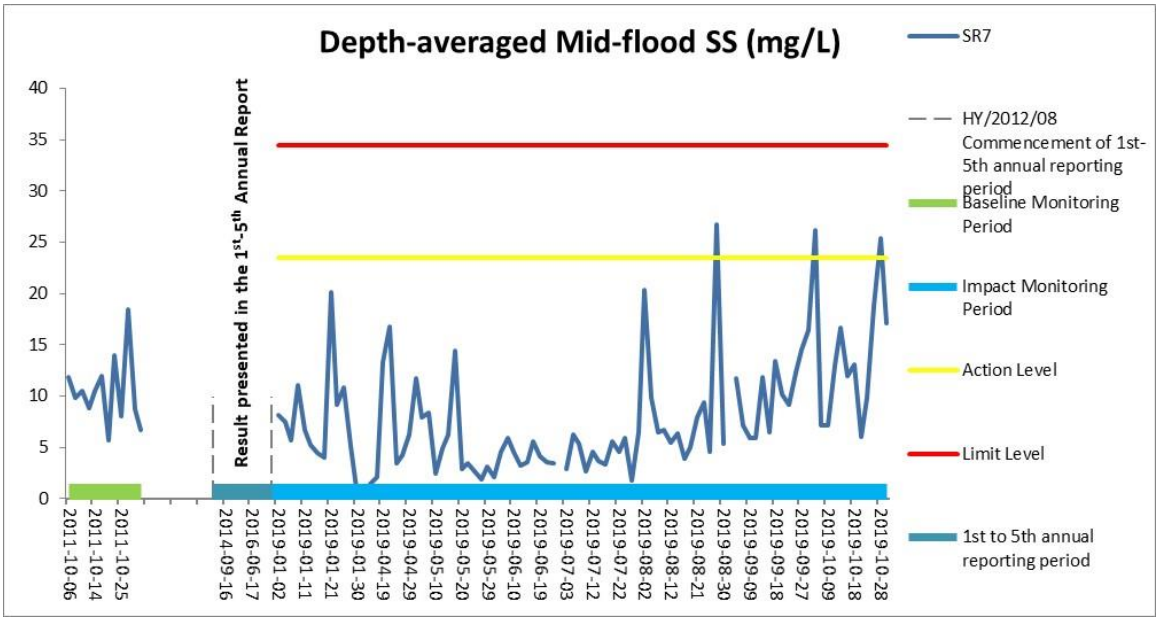
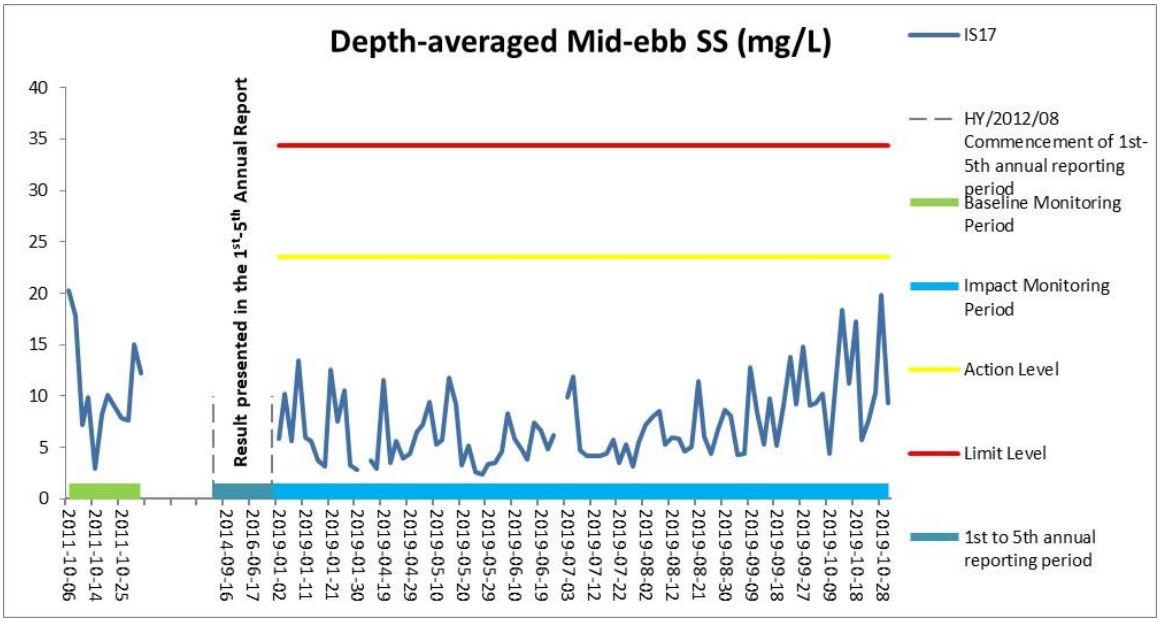


Figure E38 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR7. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



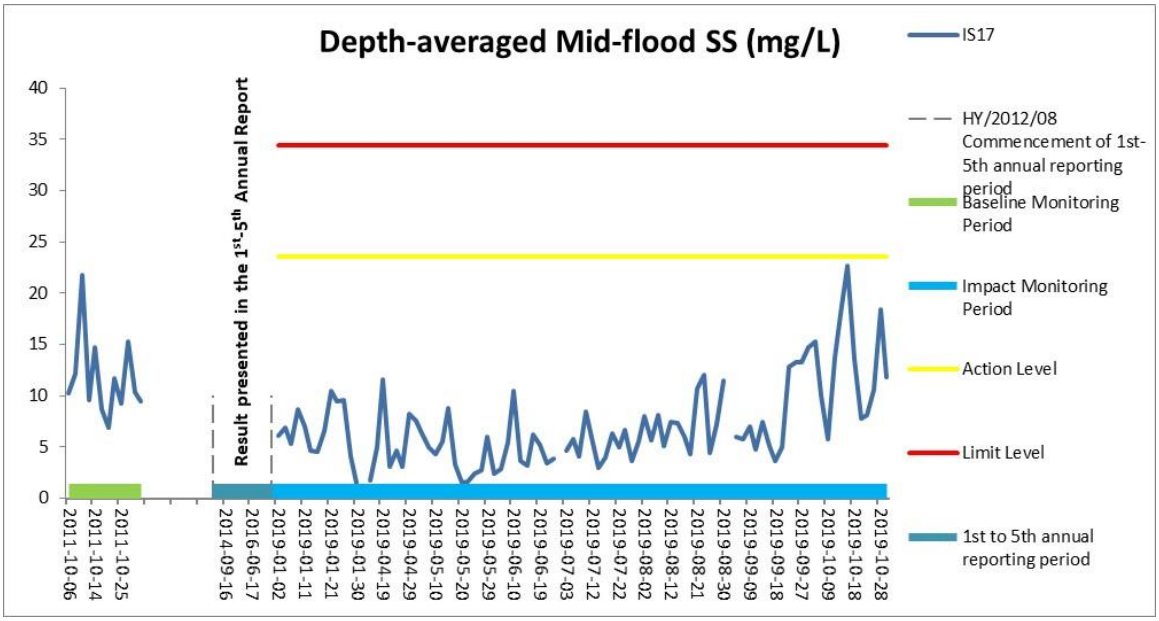
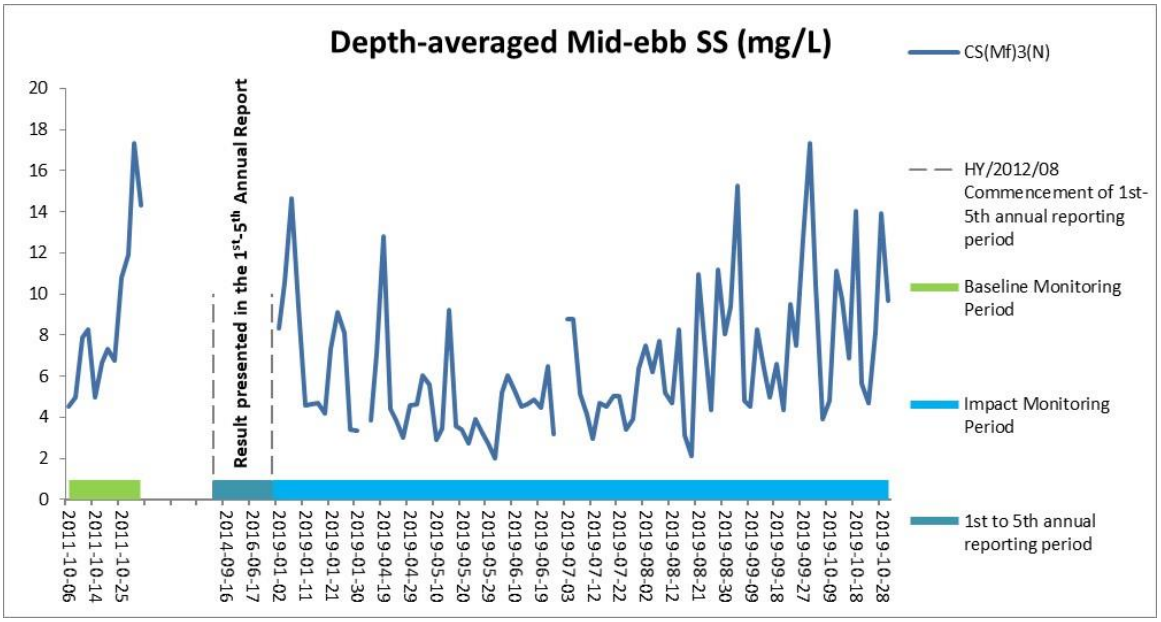


Figure E39 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS17. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



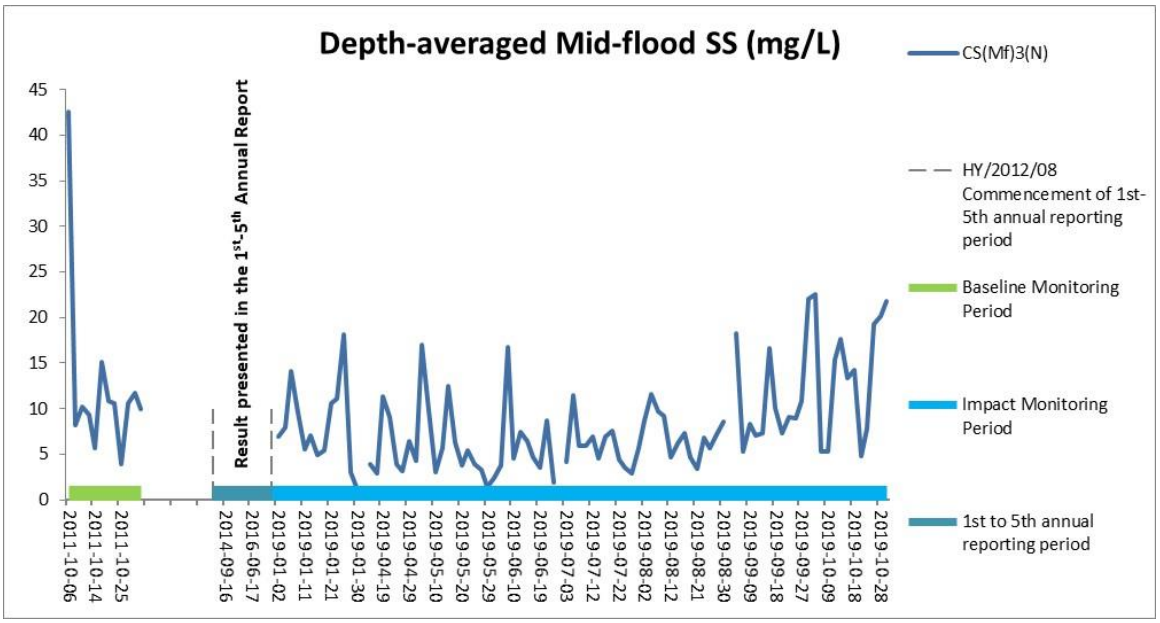
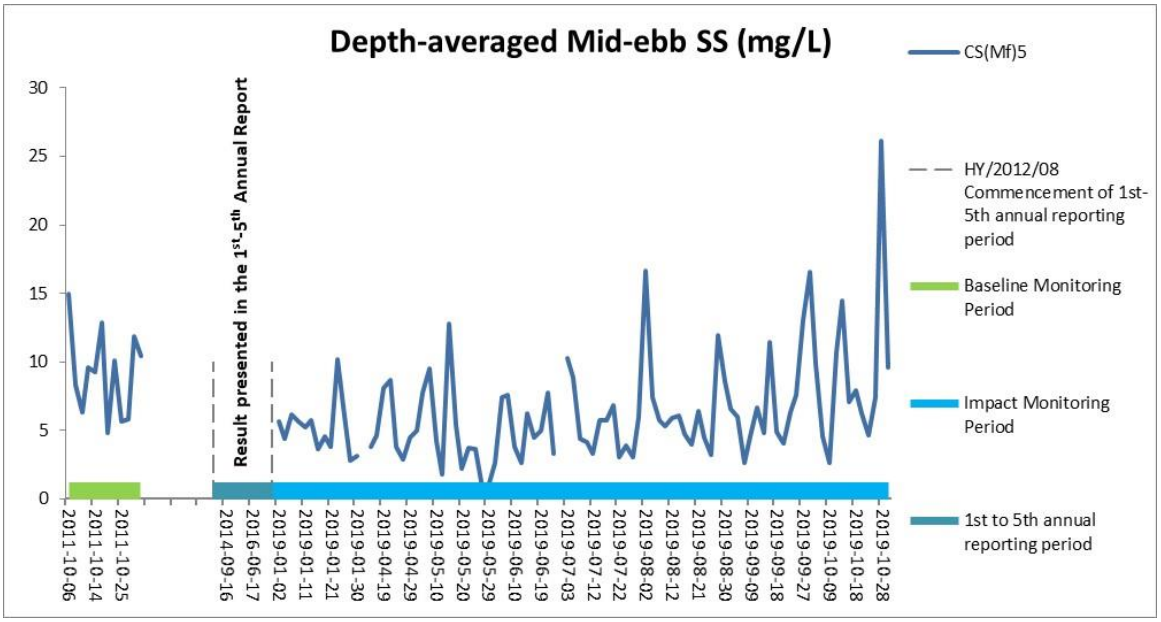


Figure E40 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)3(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



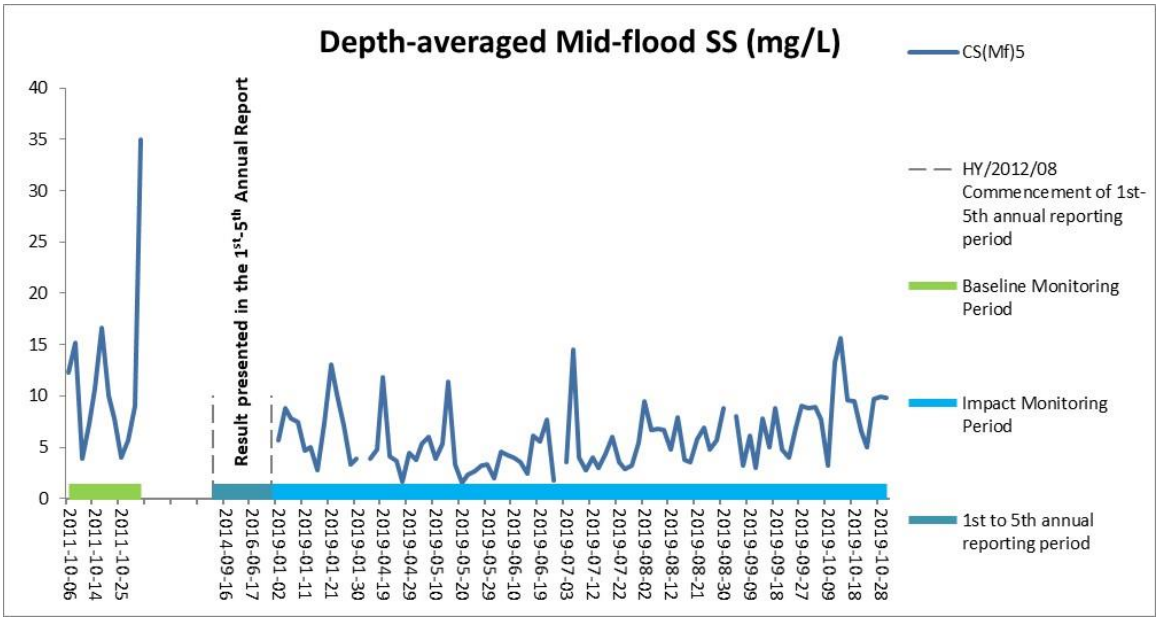
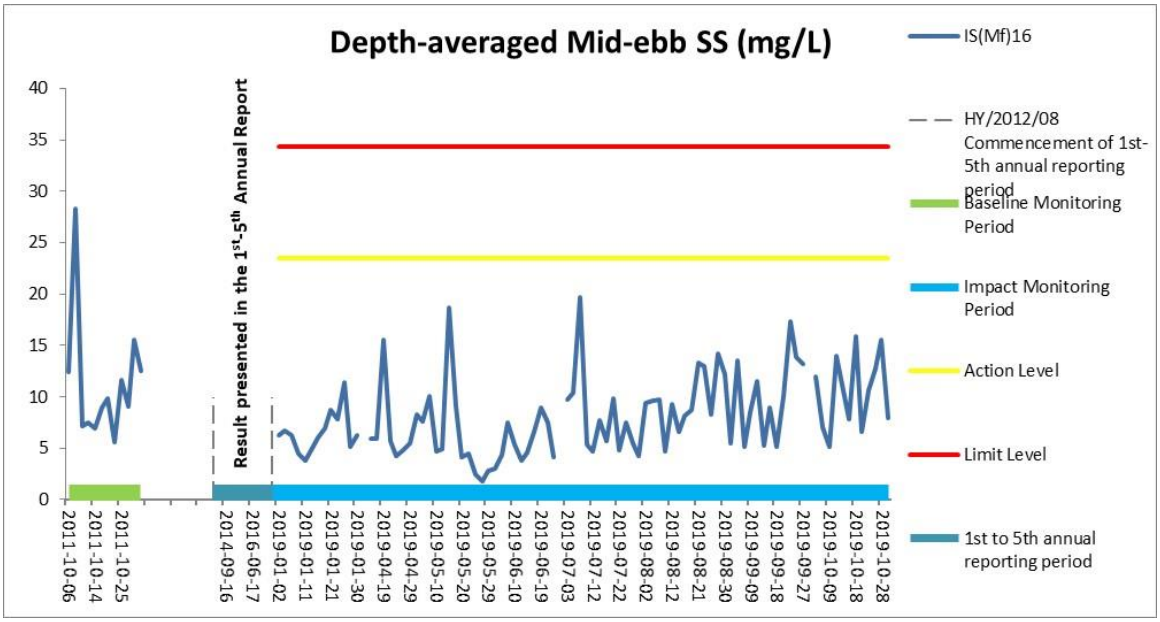


Figure E41 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at CS(Mf)5. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



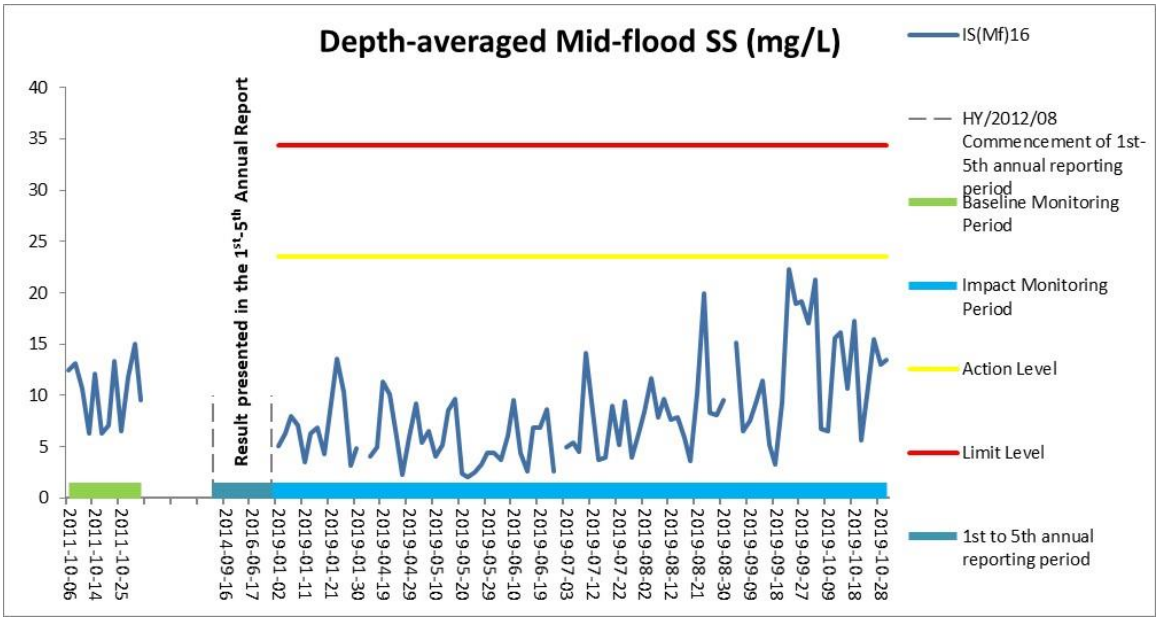
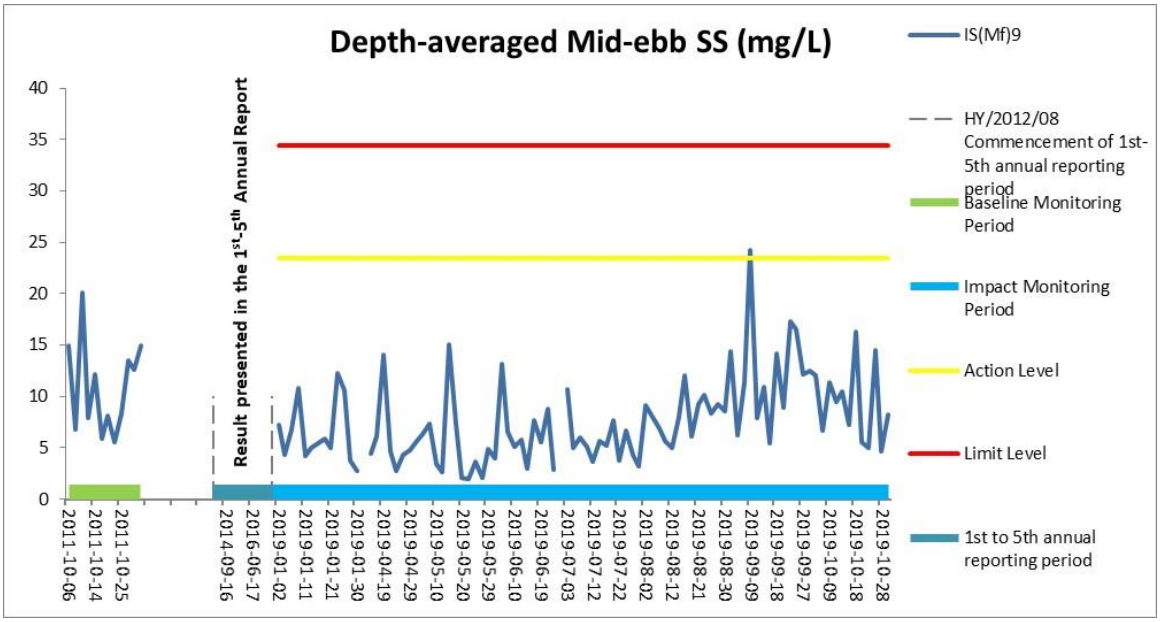


Figure E42 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)16. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



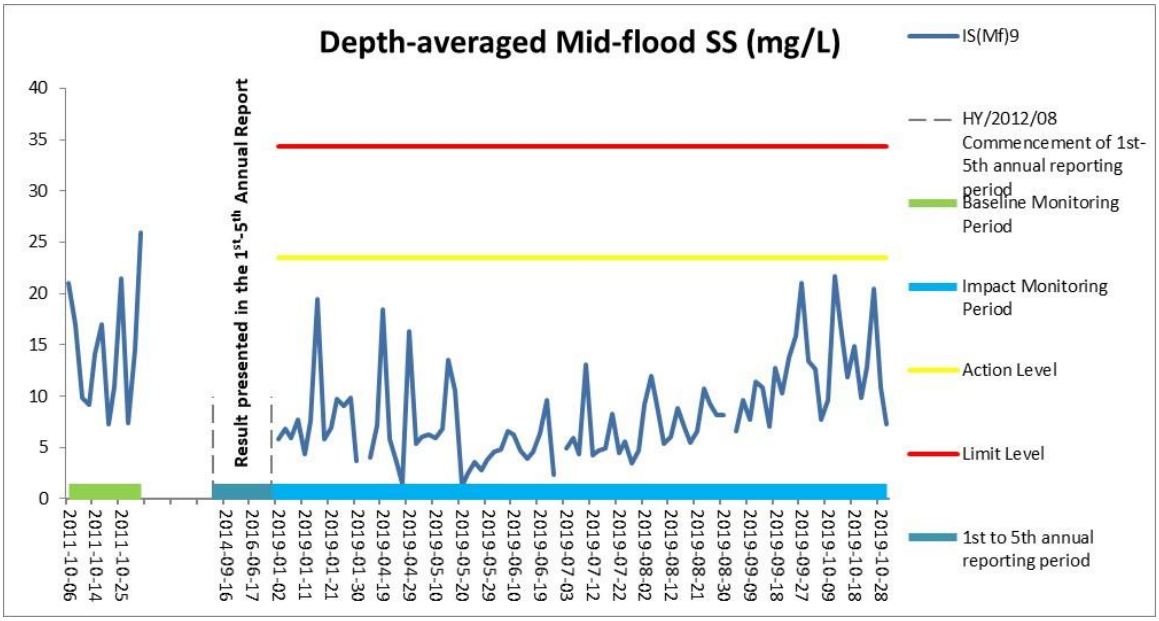
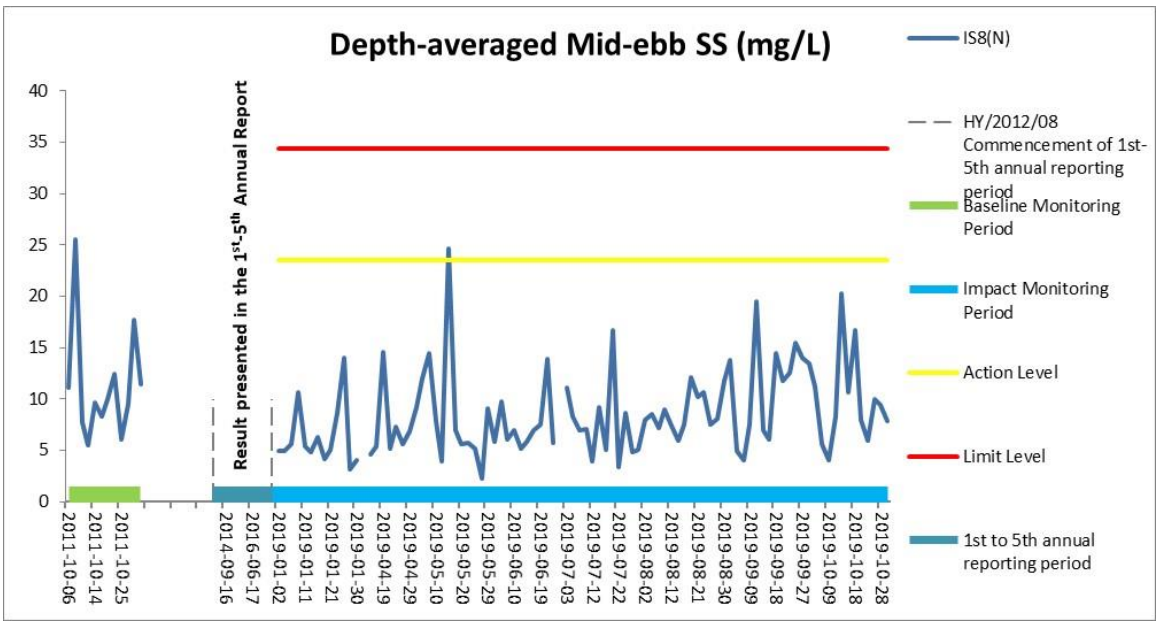


Figure E43 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS(Mf)9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



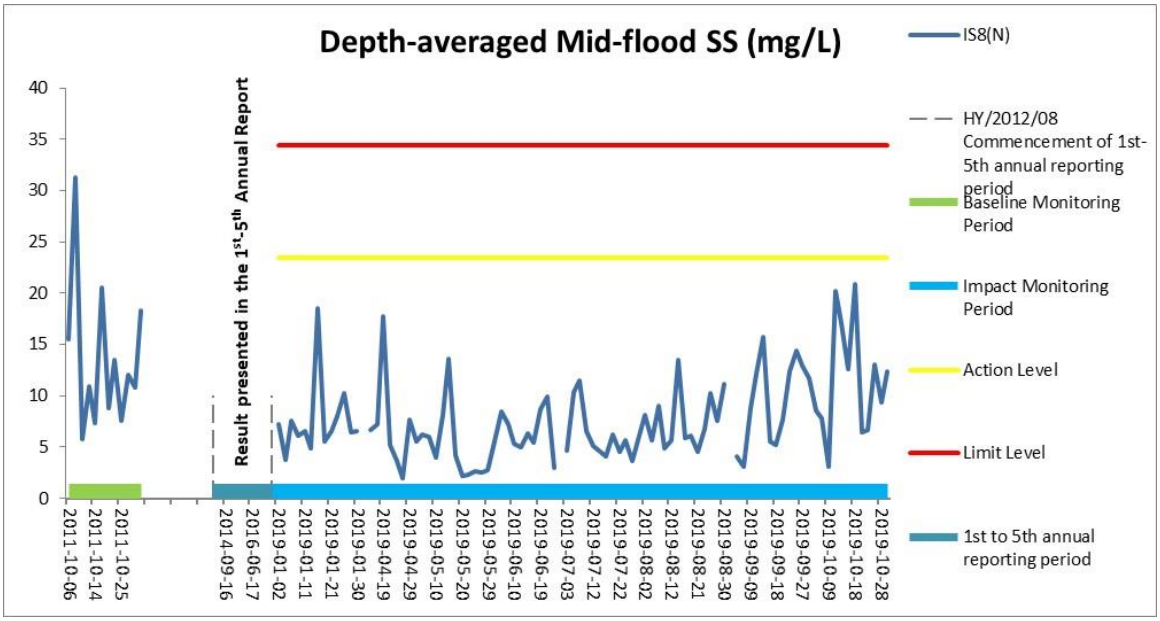
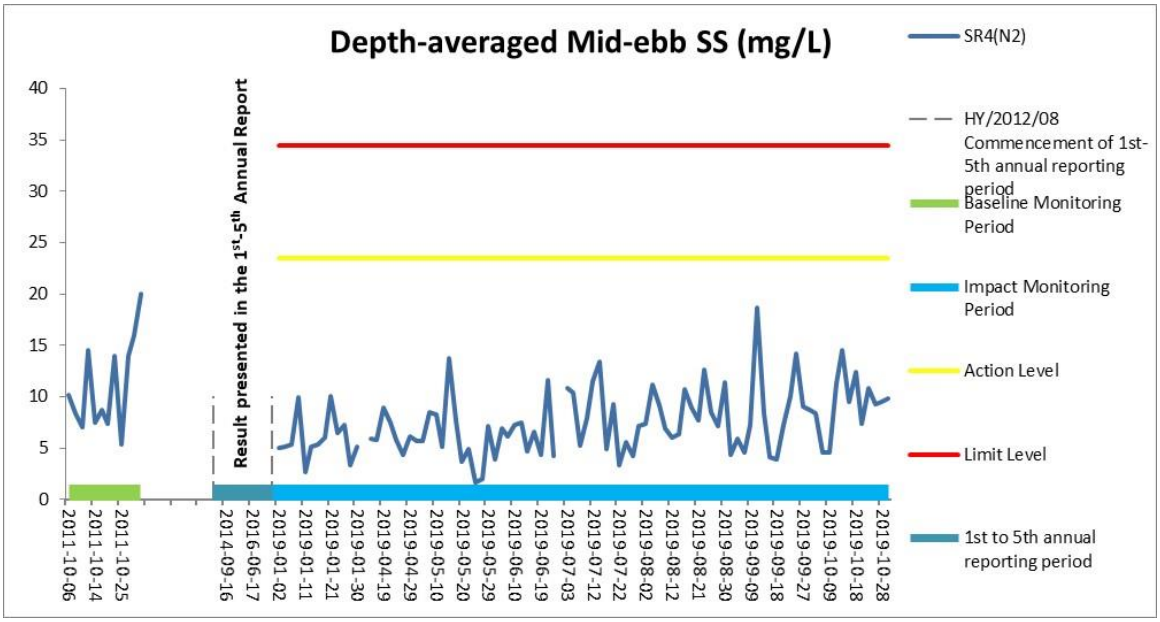


Figure E44 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at IS8(N). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



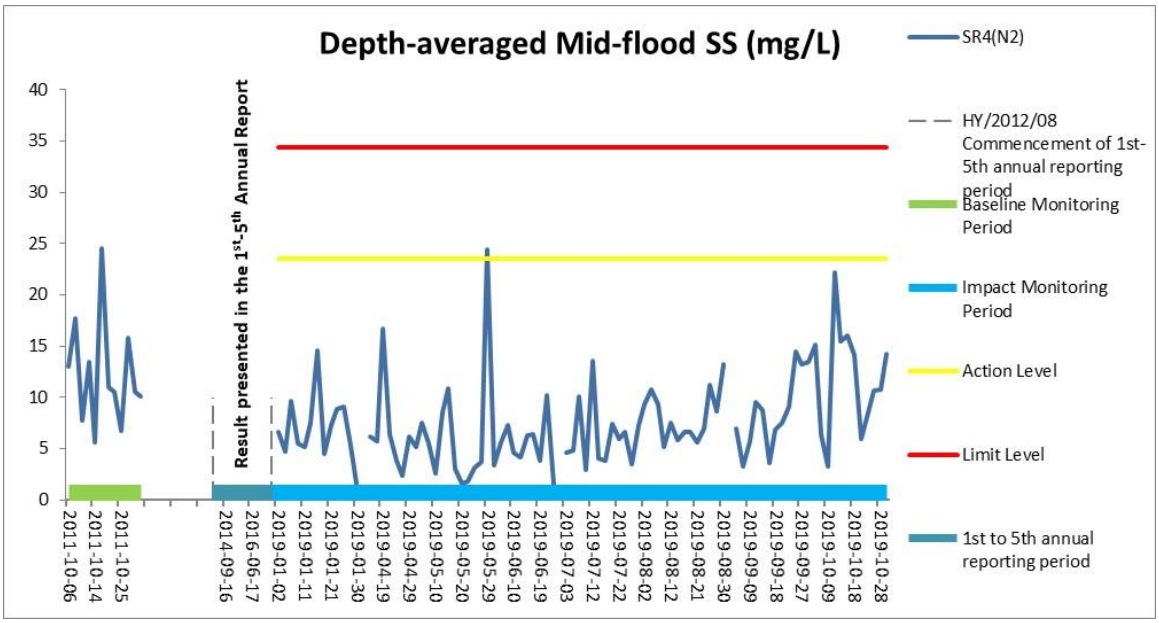
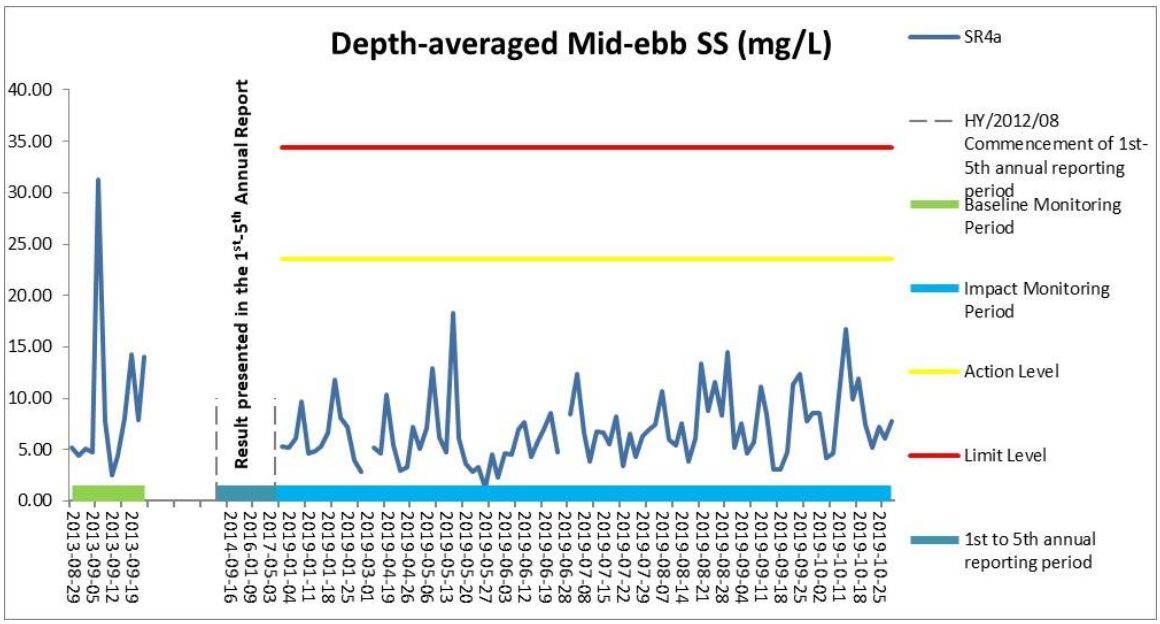


Figure E45 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4(N2). Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx



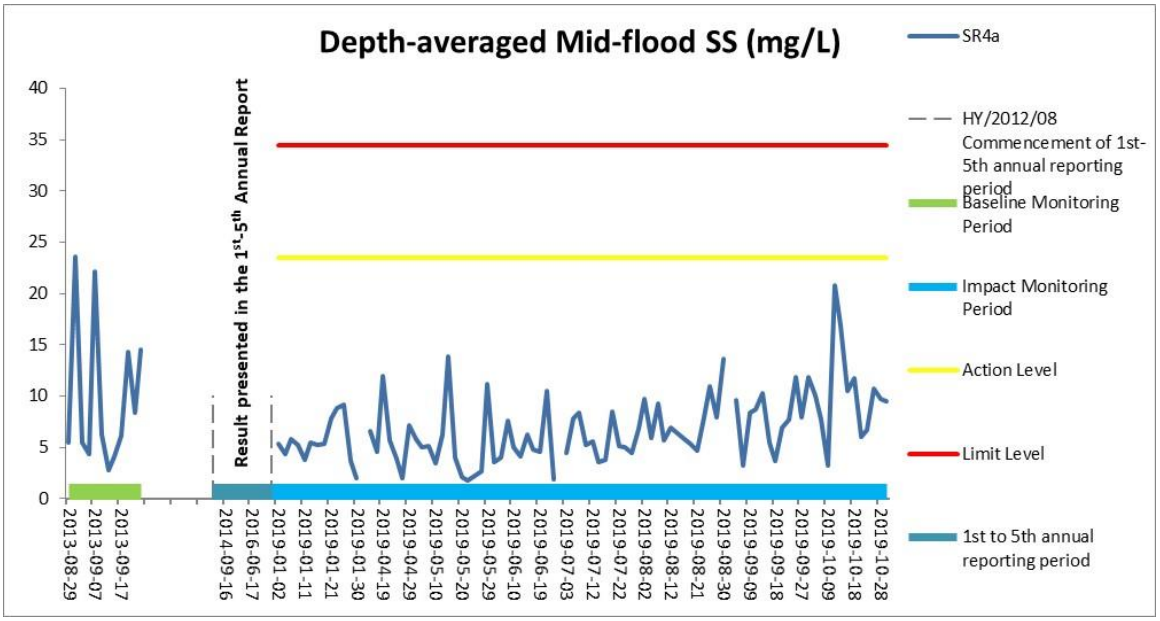


Figure E46 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period and Impact monitoring period (1/11/2018 to 31/12/2019) at SR4a. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Modification Works at Portion S-B

Ref: 0212330_Impact-WQM_6th annual.xlsx

Appendix F

Impact Dolphin Monitoring Survey

CONTRACT NO. HY/2012/08
Hong Kong-Zhuhai-Macao Bridge Tuen Mun – Chek Lap Kok Link (Northern Connection Sub-sea Tunnel Section) Chinese White Dolphin Monitoring

Sixth Annual Progress Report (November 2018 - October 2019)
submitted to Dragages – Bouygues Joint Venture & ERM Hong Kong Ltd.

Submitted by
Samuel K.Y. Hung, Ph.D., Hong Kong Cetacean Research Project

22 January 2021

1. Introduction

1.1. As part of the Hong Kong-Zhuhai-Macao Bridge, the Tuen Mun-Chek Lap Kok Link (TM-CLKL) Northern Connection Sub-sea Tunnel Section (Contract no. HY/2012/08) comprises the sub-sea TBM tunnels (two tubes with cross passages) across the Urmston Road to connect Tuen Area 40 and Hong Kong Boundary Crossing Facilities (HKBCF) of approximately 4 km in length with dual 2-lane carriageway, the tunnels at both the southern landfall and the northern landfall for construction of approach roads to the sub-sea TBM tunnels of approximately 1.5 km in length, as well as the northern landfall reclamation of approximately 16.5 hectares and about 20.km long seawalls. Dragages – Bouygues Joint Venture (hereinafter called the "Contractor") was awarded as the main contractor for the Northern Connection Sub-sea Tunnel Section, and ERM Hong Kong Limited would serve as the Environmental Team to implement the Environmental Monitoring and Audit (EM&A) programme.

1.2. According to the updated EM&A Manual (for TM-CLKL), monthly line-transect vessel surveys for Chinese White Dolphin should be conducted to cover the Northwest (NWL) and Northeast Lantau (NEL) survey areas as in AFCD annual marine mammal monitoring programme. However, as such surveys have been undertaken by the HKLR03 and HKBCF projects in the same areas (i.e. NWL and NEL), a combined monitoring approach is recommended by the Highways Department, that the TM-CLKL EM&A project can utilize the monitoring data collected by HKLR03 or HKBCF project to avoid any redundancy in monitoring effort. Such exemption for the dolphin monitoring will end upon the completion of the dolphin monitoring carried out by HKLR03 contract.

1.3. In November 2013, the Director of Hong Kong Cetacean Research Project (HKCRP), Dr. Samuel Hung, has been appointed by ERM Hong Kong Limited as the dolphin specialist for the TM-CLKL Northern Connection Sub-sea Tunnel Section EM&A project. He is responsible for the dolphin monitoring study, including the data collection on Chinese

White Dolphins during the construction phase (i.e. impact period) of the TMCLKL08 project in Northwest Lantau (NWL) and Northeast Lantau (NEL) survey areas.

1.4. During the construction period of HKLR03/TMCLKL08 projects, the dolphin specialist would be in charge of reviewing and collating data and information collected by HKLR03/ TMCLKL08 dolphin monitoring programme to examine any potential impacts of TMCLKL08 construction works on the dolphins. From the monitoring results, any changes in dolphin occurrence within the study area will be examined for possible causes, and appropriate actions and additional mitigation measures will be recommended as necessary.

1.5. This report is the sixth annual progress report under the TMCLKL08 construction phase dolphin monitoring programme submitted to the Contractor, summarizing the results of the surveys findings during the period of November 2018 to October 2019, utilizing the survey data collected by HKLR03/TMCLKL08 project.

2. Monitoring Methodology

2.1. Vessel-based Line-transect Survey

2.1.1. According to the requirement of the updated EM&A manual, dolphin monitoring programme should cover all transect lines in NEL and NWL survey areas (see Figure 1) twice per month throughout the entire construction period of HZMB. The co-ordinates of all transect lines conducted during the HKLR03/TMCLKL08 dolphin monitoring surveys are shown in Table 1.

Table 1 Co-ordinates of transect lines conducted by HKLR03/TMCLKL08 survey teams

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	804671	815456		13	Start Point	816506	819480
1	End Point	804671	831404		13	End Point	816506	824859
2	Start Point	805476	820800		14	Start Point	817537	820220
2	End Point	805476	826654		14	End Point	817537	824613
3	Start Point	806464	821150		15	Start Point	818568	820735
3	End Point	806464	822911		15	End Point	818568	824433
4	Start Point	807518	821500		16	Start Point	819532	821420
4	End Point	807518	829230		16	End Point	819532	824209
5	Start Point	808504	821850		17	Start Point	820451	822125
5	End Point	808504	828602		17	End Point	820451	823671

6	Start Point	809490	822150		18	Start Point	821504	822371
6	End Point	809490	825352		18	End Point	821504	823761
7	Start Point	810499	822000		19	Start Point	822513	823268
7	End Point	810499	824613		19	End Point	822513	824321
8	Start Point	811508	821123		20	Start Point	823477	823402
8	End Point	811508	824254		20	End Point	823477	824613
9	Start Point	812516	821303		21	Start Point	805476	827081
9	End Point	812516	824254		21	End Point	805476	830562
10	Start Point	813525	821176		22	Start Point	806464	824033
10	End Point	813525	824657		22	End Point	806464	829598
11	Start Point	814556	818853		23	Start Point	814559	821739
11	End Point	814556	820992		23	End Point	814559	824768
12	Start Point	815542	818807		24	Start Point	805476	815900
12	End Point	815542	824882		24	End Point	805476	819100

2.1.2. The HKLR03/TMCLKL08 survey teams used standard line-transect methods (Buckland et al. 2001) to conduct the systematic vessel surveys, and followed the same technique of data collection that has been adopted over the last 20 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2018). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

2.1.3. Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously through 7 x 50 *Fujinon* marine binoculars.

2.1.4. Both observers searched the sea ahead of the vessel, between 270^{o} and 90^{o} (in relation to the bow, which is defined as 0^{o}). One to two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species.

2.1.5. During on-effort survey periods, the survey team recorded effort data including time, positions (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS.

2.1.6. Data including time, position and vessel speed were also automatically and continuously logged by handheld GPS throughout the entire survey for subsequent review.

2.1.7. When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel was diverted from its course to approach the animals for species identification, group size estimation, assessment of group composition, and behavioural observations. The perpendicular distance (PSD) of the dolphin group to the transect line was later calculated from the initial sighting distance and angle.

2.1.8. Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines (as indicated in Figure 1) was labeled as "primary" survey effort, while the survey effort conducted along the connecting lines between parallel lines was labeled as "secondary" survey effort. According to HKCRP long-term dolphin monitoring data, encounter rates of Chinese White Dolphins deduced from effort and sighting data collected along primary and secondary lines were similar in NEL and NWL survey areas. Therefore, both primary and secondary survey effort were presented as on-effort survey effort in this report.

2.2. Photo-identification Work

2.2.1. When a group of Chinese White Dolphins were sighted during the line-transect survey, the HKLR03/TMCLKL08 survey teams would end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides may not be symmetrical.

2.2.2. A professional digital camera (*Canon* EOS 7D model), equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

2.2.3. All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs would then be examined in greater detail, and were carefully compared to the existing Chinese White Dolphin photo-identification catalogue maintained by HKCRP since 1995.

2.2.4. Chinese White Dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000).

2.2.5. All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

2.3. Data Analysis

2.3.1. The following analyses were performed utilizing the HKLR03/TMCLKL08 dolphin monitoring data collected under the present impact phase (the sixth year of TMCLKL construction; i.e. November 2018 to October 2019). In addition, these analyses were also conducted for the one-year baseline phase (one year before any HZMB construction works have commenced; i.e. February 2011 to January 2012); the one-year transitional phase (one year after the HZMB construction works (HKBCF and HKLR works) have commenced, but before the commencement of TMCLKL construction works; i.e. November 2012 to October 2013); and the first to fifth years of TMCLKL construction (i.e. November 2013 to October 2014, November 2014 to October 2015, November 2015 to October 2016; November 2016 to October 2017; and November 2017 to October 2018).

2.3.2. Along with the analyzed results from the baseline and transitional as well as the first five years of impact phase, results from the sixth year of impact phase can then be interpreted from the examination of any temporal changes before and during the construction activities of TMCLKL on dolphin usage in North Lantau waters. For the baseline phase, both baseline monitoring data collected under HZMB contract as well as the AFCD long-term dolphin monitoring data were included to increase the sample size in order to match the similar amount of survey effort in transitional and impact phases.

Distribution analysis

2.3.3. The line-transect survey data was integrated with the Geographic Information System (GIS) in order to visualize and interpret different spatial and temporal patterns of dolphin distribution using sighting positions. Location data of dolphin groups were plotted on map layers of Hong Kong using a desktop GIS (ArcView© 3.1) to examine their distribution patterns in details. The dataset was also stratified into different subsets to examine distribution patterns of dolphin groups with different categories of group sizes, young calves and activities.

Encounter rate analysis

2.3.4. Encounter rate analysis – Encounter rates of Chinese White Dolphins (number of on-effort sightings per 100 km of survey effort, and total number of dolphins sighted on-effort per 100 km of survey effort) were calculated in NEL and NWL survey areas in relation to the amount of survey effort conducted during each month of monitoring survey. Only data collected under Beaufort 3 or below condition would be used for the encounter rate analyses. Dolphin encounter rates during the impact phase were calculated in two ways for comparisons with the HZMB baseline and transitional period monitoring results as well as to the AFCD long-term marine mammal monitoring results.

2.3.5. Firstly, for the comparison with the HZMB monitoring results, the encounter rates were calculated using primary survey effort alone. The average encounter rate of sightings (STG) and average encounter rate of dolphins (ANI) were deduced based on the encounter rates from the 24 events during the present 12-month study period (i.e. 24 sets of line-transect surveys in North Lantau), which was also compared with the ones deduced from the events during the first five years of impact period as well as the

transitional period and baseline period.

2.3.6. Secondly, the encounter rates were also calculated using both primary and secondary survey effort as in AFCD long-term monitoring study. The encounter rate of sightings and dolphins were deduced by diving the total number of on-effort sightings (STG) and total number of dolphins (ANI) by the amount of survey effort for the present 12-month study period.

Quantitative grid analysis on habitat use

2.3.7. To conduct quantitative grid analysis of habitat use, positions of on-effort sightings of Chinese White Dolphins collected during the 12-month impact phase monitoring period were plotted onto 1-km^2 grids among NWL and NEL survey areas on GIS. Sighting densities (number of on-effort sightings per km^2) and dolphin densities (total number of dolphins from on-effort sightings per km^2) were then calculated for each 1 km by 1 km grid with the aid of GIS.

2.3.8. Sighting density grids and dolphin density grids were then further normalized with the amount of survey effort conducted within each grid. The total amount of survey effort spent on each grid was calculated by examining the survey coverage on each line-transect survey to determine how many times the grid was surveyed during the study period. For example, when the survey boat traversed through a specific grid 50 times, 50 units of survey effort were counted for that grid. With the amount of survey effort calculated for each grid, the sighting density and dolphin density of each grid were then normalized (i.e. divided by the unit of survey effort).

2.3.9. The newly-derived unit for sighting density was termed SPSE, representing the number of on-effort **s**ightings **p**er 100 units of **s**urvey **e**ffort. In addition, the derived unit for actual dolphin density was termed DPSE, representing the number of **d**olphins **p**er 100 units of **s**urvey **e**ffort. Among the 1-km^2 grids that were partially covered by land, the percentage of sea area was calculated using GIS tools, and their SPSE and DPSE values were adjusted accordingly. The following formulae were used to estimate SPSE and DPSE in each 1-km^2 grid within the study area:

$$SPSE = ((S / E) \times 100) / SA\%$$
$$DPSE = ((D / E) \times 100) / SA\%$$

where S = total number of on-effort sightings
D = total number of dolphins from on-effort sightings
E = total number of units of survey effort
SA% = percentage of sea area

Behavioural analysis

2.3.10. When dolphins were sighted during vessel surveys, their behaviour was observed. Different activities were categorized (i.e. feeding, socializing, traveling, and milling/resting) and recorded on sighting datasheets. This data was then input into a separate database with sighting information, which can be used to determine the distribution of behavioural data with a desktop GIS. Sighting distribution of dolphins engaged in different activities and behaviours would then be plotted on GIS and carefully

examined to identify important areas for different activities of the dolphins.

Ranging pattern analysis

2.3.11. Location data of individual dolphins that occurred during the present 12-month impact phase monitoring period were obtained from the dolphin sighting database and photo-identification catalogue. To deduce home ranges for individual dolphins using the fixed kernel methods, the program Animal Movement Analyst Extension, was loaded as an extension with ArcView© 3.1 along with another extension Spatial Analyst 2.0. Using the fixed kernel method, the program calculated kernel density estimates based on all sighting positions, and provided an active interface to display kernel density plots. The kernel estimator then calculated and displayed the overall ranging area at 95% UD level.

3. Monitoring Results

3.1. Summary of survey effort and dolphin sightings

3.1.1. During the sixth year of TMCLKL impact phase monitoring (i.e. November 2018 to October 2019), a total of 24 sets of systematic line-transect vessel surveys were conducted from the HKLR03/TMCLKL08 monitoring works to cover all transect lines in NWL and NEL survey areas twice per month.

3.1.2. From these surveys, a total of 3,181.16 km of survey effort was collected, with 94.9% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility). Among the two areas, 1,177.95 km and 2,003.21 km of survey effort were conducted in NEL and NWL survey areas respectively.

3.1.3. The total survey effort conducted on primary lines was 2,304.73 km, while the effort on secondary lines was 876.43 km. The survey effort conducted on primary and secondary lines were both considered as on-effort survey data. Summary table of the survey effort is shown in Appendix I.

3.1.4. From the 24 sets of HKLR03/TMCLKL08 monitoring surveys conducted between November 2018 and October 2019, a total of 27 groups of 68 Chinese White Dolphins were sighted. All except three dolphin groups were sighted during on-effort search. Among the 24 on-effort sightings, 19 of them were made on primary lines, while the other five dolphin sightings were made on secondary lines.

3.1.5. During this 12-month period, all dolphin sightings were made in NWL, and while none of them were made in NEL. A summary table of the dolphin sightings is shown in Appendix II.

3.2. Distribution

3.2.1. Distribution of dolphin sightings made during the HKLR03/TMCLKL08 monitoring surveys in November 2018 to October 2019 is shown in Figure 1.

3.2.2. The majority of dolphin sightings made during the sixth year of impact phase were

concentrated at the northwestern portion of the North Lantau region, with slightly higher concentration at the northern potion of the Sha Chau and Lung Kwu Chau Marine Park (Figure 1). Some sightings were also made near Black Point, at the Urmston Road section between Lung Kwu Tan and Lung Kwu Chau, as well as at the southwestern corner of the NWL survey area (or adjacent to the HKLR09 alignment) (Figure 1).

3.2.3. Notably, none of the dolphin groups were sighted in the vicinity of the entire alignment of TMCLKL as well as the reclamation sites of HKLR03 and HKBCF (Figure 1). On the contrary, four sightings were made adjacent to the HKLR09 alignment to the west of Shum Wat (Figure 1). In general, dolphins appeared to have mostly avoided the construction areas of HZMB works during the present impact phase monitoring period, which was consistent with the dolphin distribution during the first five years of the TMCLKL construction works.

3.2.4. Dolphin sighting distribution of the present impact phase monitoring period (November 2018 to October 2019) was compared with the ones during the baseline phase (February 2011 to January 2012), the transitional phase (November 2012 to October 2013) and the first five years of impact phase (November 2013 to October 2018) (Figure 2).

3.2.5. During the present impact phase period in 2018-19, dolphin distribution was quite similar to the previous four impact phase periods in 2014-15, 2015-16, 2016-17 and 2017-18, with dolphins being largely vacated from the eastern and central portions of the North Lantau region (Figure 2). This was in stark contrast to their very frequent occurrence around the Brothers Islands, Shum Shui Kok, the waters between Pillar Point and airport platform, and the vicinity of HZMB-associated work sites during the baseline period (Figure 2). Even in the transitional phase, dolphins still utilized these waters in a moderate extent, but such usage has progressively diminished during the six periods of impact phase of TMCLKL construction (Figure 2).

3.2.6. The only area where dolphin occurrence was consistently high across the eight periods was around the Lung Kwu Chau area, but even so, such occurrence has been progressively diminishing in past six monitoring periods. This was even more evident in 2018-19 with much lower occurrence in this area (Figure 2).

3.3. Encounter rate

3.3.1. During the present 12-month impact phase monitoring period, the average daily encounter rates of Chinese White Dolphins were deduced in NEL and NWL survey areas, and compared to the ones deduced from the baseline, transitional and first five years of impact phases (Table 2).

3.3.2. To facilitate the comparison with the AFCD long-term monitoring results, the encounter rates were also calculated for the same 12-month study period using both primary and secondary survey effort. The encounter rates of sightings (STG) and dolphins (ANI) in NWL were 1.28 sightings and 3.32 dolphins per 100 km of survey effort respectively, while the encounter rates of sightings (STG) and dolphins (ANI) in NEL were both nil with no on-effort sighting being made there in 2018-19.

Table 2. Comparison of average daily dolphin encounter rates from the first six years of impact phase, transitional phase and baseline phase monitoring periods (Note: encounter rates deduced from the six periods were calculated based on survey and on-effort sighting data made along the primary transect lines under favourable conditions; ± denotes the standard deviation of the average encounter rates).

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		**Encounter rate (ANI)** (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	Northeast Lantau	**Northwest Lantau**	**Northeast Lantau**	**Northwest Lantau**
Impact Phase (2018-19)	0.00	1.42 ± 1.80	0.00	3.62 ± 4.93
Impact Phase (2017-18)	0.00	2.68 ± 3.04	0.00	9.02 ± 14.63
Impact Phase (2016-17)	0.00	2.35 ± 2.62	0.00	8.57 ± 11.05
Impact Phase (2015-16)	0.00	2.10 ± 1.83	0.00	8.54 ± 8.53
Impact Phase (2014-15)	0.11 ± 0.54	2.54 ± 2.49	0.11 ± 0.54	11.64 ± 14.04
Impact Phase (2013-14)	0.22 ± 0.74	6.93 ± 4.08	0.76 ± 2.59	26.31 ± 17.56
Transitional Phase (2012-13)	1.70 ± 2.26	7.68 ± 4.36	4.75 ± 7.61	27.51 ± 18.06
Baseline Phase (2011-12)	6.05 ± 5.04	7.75 ± 5.69	19.91 ± 21.30	29.57 ± 26.96

3.3.3. In NEL, the dolphin encounter rates (both STG and ANI) during the sixth year of TMCLKL impact monitoring period were nil as in the previous three 12-month periods in 2015-16, 2016-17 and 2017-18, which was in stark contrast to the averages during the baseline phase and transitional phase (Table 2). Such progressive decline has actually existed in this area since the transitional phase in 2012-13 (i.e. well before the TMCLKL construction works commenced), with the averages in the transitional phase being much lower than the ones in the baseline phase (reductions of 71.9% for STG and 76.1% respectively). Since then, dolphin occurrence has further diminished to an extremely low level during the first and second impact phase periods of TMCLKL construction works, and then to complete absences in the subsequent periods.

3.3.4. In NWL, the average dolphin encounter rates (STG and ANI) during the present impact phase monitoring period were much lower (reductions of 81.7% and 87.8% respectively) than the ones recorded in the baseline period, indicating a dramatic decline in dolphin usage of this survey area during the sixth year of TMCLKL impact phase monitoring period (Table 2). Moreover, those encounter rates consistently remained at low levels in the five consecutive 12-month monitoring periods between 2014-19.

3.3.5. Notably, the encounter rates in NWL during the first year of impact phase (2013-14) were only slightly lower than the baseline period, but such decline has quickly escalated during the subsequent monitoring periods during the impact phase. This signaled a further widespread of declining usage by the dolphins throughout the entire North Lantau region with no sign of recovery, even though most marine works associated with the HZMB

construction has been completed.

3.3.6. A two-way ANOVA with repeated measures of variance and unequal sample size was conducted to examine whether there were any significant differences in the average encounter rates between the baseline, transitional and the six impact phase periods. The two variables that were examined included the different periods and the two locations (i.e. NEL and NWL).

3.3.7. For the comparison between the different monitoring periods, the p-value for the differences in average dolphin encounter rates of STG and ANI were both 0.000000 and 0.00000 respectively. Even if the alpha value is set at 0.00001, significant differences were detected among the different periods in both dolphin encounter rates of STG and ANI.

3.4. Group size

3.4.1. Group size of Chinese White Dolphins ranged from singletons to seven individuals per group in North Lantau region during November 2018 – October 2019. The average dolphin group sizes from the 12-month impact phase monitoring period were compared with the ones deduced from baseline, transitional and first five years of impact phases, as shown in Table 3.

Table 3. Comparison of average dolphin group sizes from the first six years of impact phase, transitional phase and baseline phase monitoring periods (± denotes the standard deviation of the average encounter rates)

	Average Dolphin Group Size		
	Overall	**Northeast Lantau**	**Northwest Lantau**
Impact Phase (2018-19)	2.52 ± 1.45 (n = 27)	0.00	2.52 ± 1.45 (n = 27)
Impact Phase (2017-18)	3.12 ± 2.86 (n = 42)	0.00	3.12 ± 2.86 (n = 42)
Impact Phase (2016-17)	3.51 ± 2.68 (n = 43)	0.00	3.51 ± 2.68 (n = 43)
Impact Phase (2015-16)	3.73 ± 3.14 (n = 45)	1.00 (n = 1)	3.80 ± 3.14 (n = 44)
Impact Phase (2014-15)	4.24 ± 3.15 (n = 54)	1.00 (n = 1)	4.30 ± 3.15 (n = 53)
Impact Phase (2013-14)	3.76 ± 2.57 (n = 136)	5.00 ± 2.71 (n = 4)	3.73 ± 2.57 (n = 132)
Transitional Phase (2012-13)	3.37 ± 2.98 (n = 186)	2.64 ± 2.38 (n = 22)	3.47 ± 3.05 (n = 164)
Baseline Phase (2011-12)	3.32 ± 2.86 (n = 288)	2.80 ± 2.35 (n = 79)	3.52 ± 3.01 (n = 209)

3.4.2. The average dolphin group sizes in NWL waters (and also the entire North Lantau region) during the present impact phase monitoring period were the lowest among all six impact

phase monitoring periods as well as the baseline and transitional phases (Table 3).

3.4.3. Among the 27 dolphin groups sighted during the impact phase, 24 of them were composed of 1-4 individuals only, while there were three groups with more than 5 animals, including two groups with five animals each and one group of seven animals (Appendix II).

3.4.4. Distribution of dolphins with larger group sizes (i.e. five individuals or more per group) during the present impact phase is shown in Figure 3, with comparison to the ones in the first five years of impact phase, transitional phase and baseline phase. During the impact phase in 2018-19, distribution of the three larger dolphin groups were scattered in the northwestern portion of the NWL survey area with no particular concentration (Figure 3).

3.4.5. Throughout the six impact phases, distribution of these larger groups has been consistently confined to the northwestern portion of North Lantau region. Such limited distribution was drastically different from the baseline phase, when the larger dolphin groups were distributed more evenly in NWL waters with many of them also sighted in NEL waters (Figure 3).

3.5. Habitat use

3.5.1. During the present impact phase monitoring period in 2018-19, only 19 grids recorded dolphin densities and all of these grids were with low to moderately low densities (Figures 4a and 4b). Moreover, all grids near the HKLR03 and HKBCF reclamation sites as well as the entire alignment of TMCLKL did not record any presence of dolphins in the present 12-month impact monitoring period in 2018-19 (Figures 4a and 4b).

3.5.2. When compared with the habitat use patterns during the baseline phase, dolphin usage in NEL has progressively diminished during the transitional phase and the subsequent six periods of impact phases (Figure 5). During the baseline period, a number of grids between Siu Mo To and Shum Shui Kok recorded moderately high to high dolphin densities, and most grids in NEL recorded dolphin usage. This was in stark contrast to the complete absence of dolphin in this area during the present and previous three impact phase periods (Figure 5).

3.5.3. Moreover, dolphin usage of NWL waters has also declined dramatically during the recent monitoring periods (including the present one in 2018-19), with only slightly higher densities occurred near Lung Kwu Chau. This is in contrast to a more evenly spread usage in NWL during the baseline phase, transitional phase and the first year of impact phase monitoring (Figure 5). Apparently, there has been a more widespread decline of dolphin usage throughout the North Lantau waters in the past five years of the impact monitoring periods, to the lowest level in 2018-19.

3.6. Mother-calf pairs

3.6.1. During the present 12-month impact phase monitoring period, one unspotted juvenile (UJ) was sighted near the HKLR09 alignment at the southwestern corner of the NWL survey area (Figure 6). Notably, the extremely low occurrence of young calves have been persistent in recent impact phase monitoring periods between 2014-19, ranging from 0%

in 2015-16 and 2017-18 to 1.5% in 2018-19, when compared to the higher percentages during the first impact phase monitoring period of 2013-14 (5.7%), transitional phase (6.7%) and baseline phase (4.5%).

3.6.2. The very rare occurrence of young calves in North Lantau region in the past five 12-month periods was drastically different from the distribution patterns observed during the baseline and transitional phases when the young calves were sighted throughout NWL waters (Figure 6).

3.7. Activities and associations with fishing boats

3.7.1. A total of five dolphin sightings were associated with feeding activities during the 2018-19 impact phase monitoring period. Even though the percentage of sightings associated with feeding activities during the present impact phase period (18.5%) was similar to the impact phase period in 2016-17 (18.6%) and higher than the baseline period (12.8%), transitional period (8.6%) as well as the other impact phase periods (5.9-11.1%), it should be considered that the sample size in 2018-19 was much smaller than all other periods.

3.7.2. Only one dolphin sighting was associated with socializing activities in 2018-19. With the exception of 2016-17 monitoring period (with no sighting associated with socializing activity), the percentage of such sightings in 2018-19 (3.7%), was lower than all other impact monitoring periods (2017-18 (4.8%), 2015-16 (8.9%), 2014-15 (5.5%) and 2013-14 (5.9%)) as well as the transitional period (6.4%) and the baseline period (3.8%). Notably, none of the 27 dolphin groups was engaged in traveling or resting/milling activities in 2018-19.

3.7.3. Distribution of dolphins engaged in feeding and socializing activities during the present impact phase monitoring period is shown in Figure 7. The five groups engaged in feeding activities were scattered near Black Point, to the north of Lung Kwu Chau and third runway expansion construction site, as well as near the HKLR09 alignment (Figure. On the other hand, the only group engaged in socializing activity was found to the north of Lung Kwu Chau at the mouth of Deep Bay.

3.7.4. The comparison in distribution of dolphins engaged in different activities during different monitoring phases revealed that feeding activities were more frequently sighted during the baseline and transitional periods along the Urmston Road, within the Sha Chau and Lung Kwu Chau Marine Park, to the west of the airport platform and around the Brothers Islands, while the socializing activities were more scattered throughout the North Lantau region for these periods (Figure 7). It is apparent that the “hotspots” where dolphins engaged in different activities were considerably different between the baseline, transitional and the six impact phase periods.

3.7.5. Notably, none of the 27 dolphin groups sighted during the impact phase monitoring period in 2018-19 was found to be associated with any operating fishing vessel. The extremely rare events of fishing boat associations by the dolphins during the six 12-month periods of impact phase as well as the transitional phase was quite different from the baseline period with 14 of 288 dolphin groups associated with fishing boats.

3.8. Summary of photo-identification works

3.8.1. During the 12-month impact phase monitoring period in 2018-19, a total of 22 individuals sighted 49 times altogether were identified (see Appendix III). All of these re-sightings were made in NWL.

3.8.2. More than two-thirds of the 22 identified individuals were sighted only once or twice, but there were six individuals that were sighted more frequently during the 12-month period. For example, CH34, NL136, and NL182 were sighted 4-5 times, while NL123 and NL202 were sighted six and seven times respectively in 2018-19. Their relatively more frequent occurrences during the sixth year of impact phase monitoring indicated stronger reliance of NWL waters as part of their home ranges.

3.8.3. Notably, a total of four well-recognized females (i.e. NL33, NL202, WL98, WL145) were accompanied with their calves during their re-sightings, but the calves of NL33 and NL202 (i.e. NL322 and NL286 respectively) are older and already in their juvenile stage.

3.9. Individual range use

3.9.1. Ranging patterns of the 22 individuals identified during the 12-month impact phase monitoring period in 2018-19 were determined by fixed kernel method, and are shown in Appendix IV.

3.9.2. Most identified dolphins sighted within this 12-month period were utilizing their ranges primarily in NWL, but eight individuals (NL293, NL331, WL98, WL145, WL218, WL243, WL273 and WL281) were sighted in NWL waters in 2018-19 but have primarily utilized WL waters in the past (Appendix IV). Moreover, 10 of the 27 individuals have occurred in both North and West Lantau waters based on the HKLR09 monitoring data collected concurrently during the same 12-month period in 2018-19. On the contrary, all identified dolphins have avoided the NEL waters, the area where many of them have utilized as their core areas of activities before the HZMB construction.

3.9.3. Temporal changes in range use of eight individual dolphins that have consistently occurred in baseline phase, transitional phase and all six periods of impact phases were examined in details (Appendix V). It is apparent that six of them have gradually shifted their range use away from their previously important habitat in NEL since 2013-14, and have been completely absent from there in the recent impact phase periods (Appendix V).

3.9.4. Moreover, some individual dolphins have gradually diminished their utilization of NWL waters during the TMCLKL impact phases, and at the same time some of them (e.g. NL33, NL123) have increased their utilization of WL waters (Appendix V).

3.9.5. On the contrary, two individuals (NL202 and NL286) did not record any change in their range use throughout different periods. Moreover, five individuals (e.g. CH34, NL98, NL286) have utilized Lantau waters less in recent years (Appendix V).

3.9.6. The abovementioned temporal changes in individual range use should be continuously monitored for the rest of the TMCLKL construction period, as to determine whether such

range shifts are temporary or permanent, and whether the dolphins would continue the North Lantau waters once the HZMB-related construction works have completed.

4. Conclusion

4.1. During the sixth year of TMCLKL impact phase monitoring of Chinese white dolphins, no adverse impact from the activities of the TMCLKL construction project on the dolphins was noticeable from general observations.

4.2. Although the dolphins infrequently occurred along the alignment of TMCLKL northern connection sub-sea tunnel section in the past and during the baseline monitoring period, it is apparent that dolphin usage has been drastically reduced in the entire North Lantau region, and many individuals have shifted away from the important habitats around the Brothers Islands and the rest of North Lantau waters.

4.3. It is critical to monitor the dolphin usage in North Lantau region for the rest of the impact phase monitoring period, to determine whether the dolphins are continuously affected by the various construction activities in relation to the HZMB-related works, and whether suitable mitigation measure can be applied to revert the situation.

5. References

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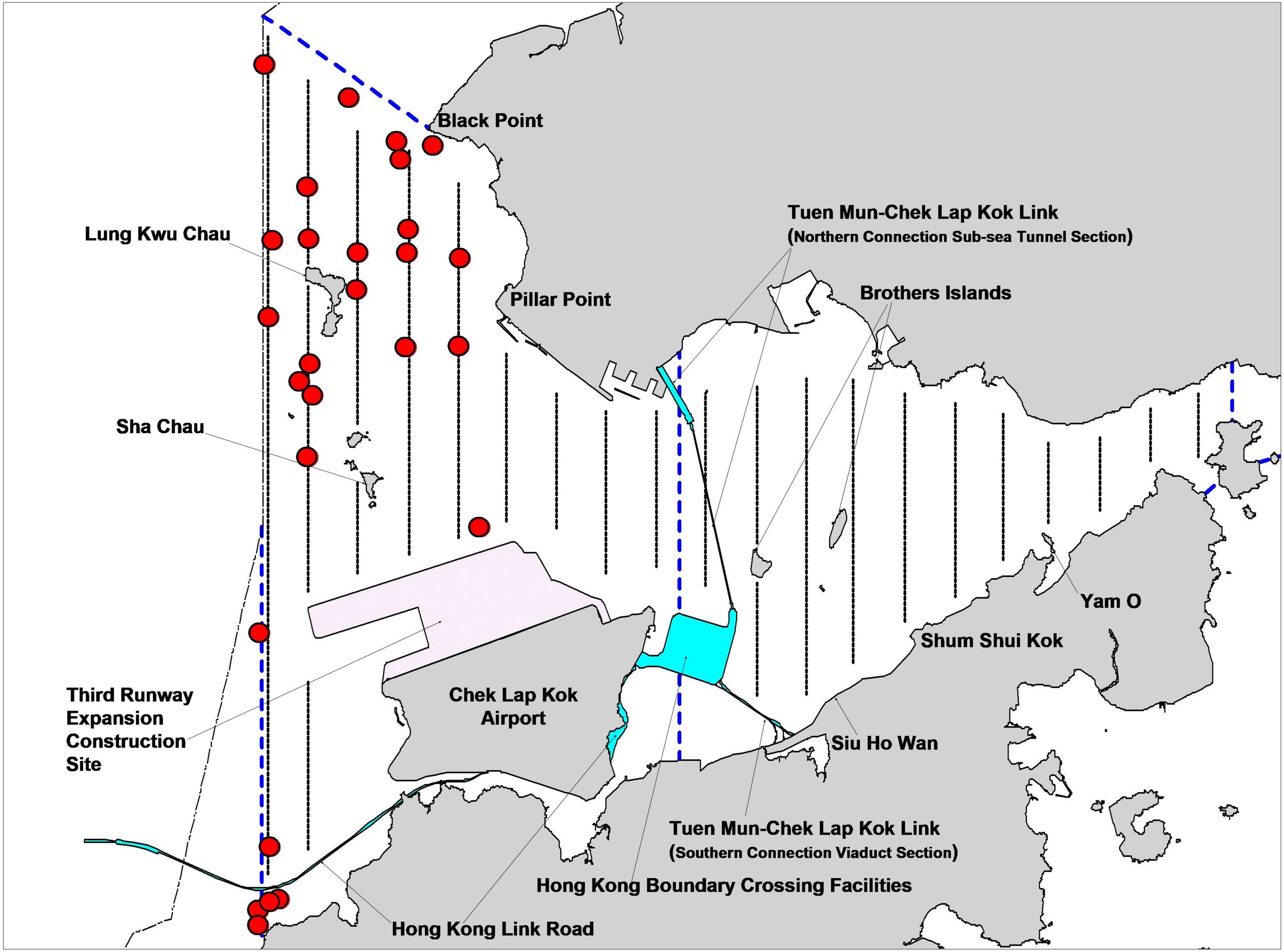


Figure 1. Distribution of Chinese white dolphin sightings in North Lantau region during the sixth year of TMCLKL construction works (November 2018 to October 2019), utilizing the HKLR03/TMCLKL08 monitoring data

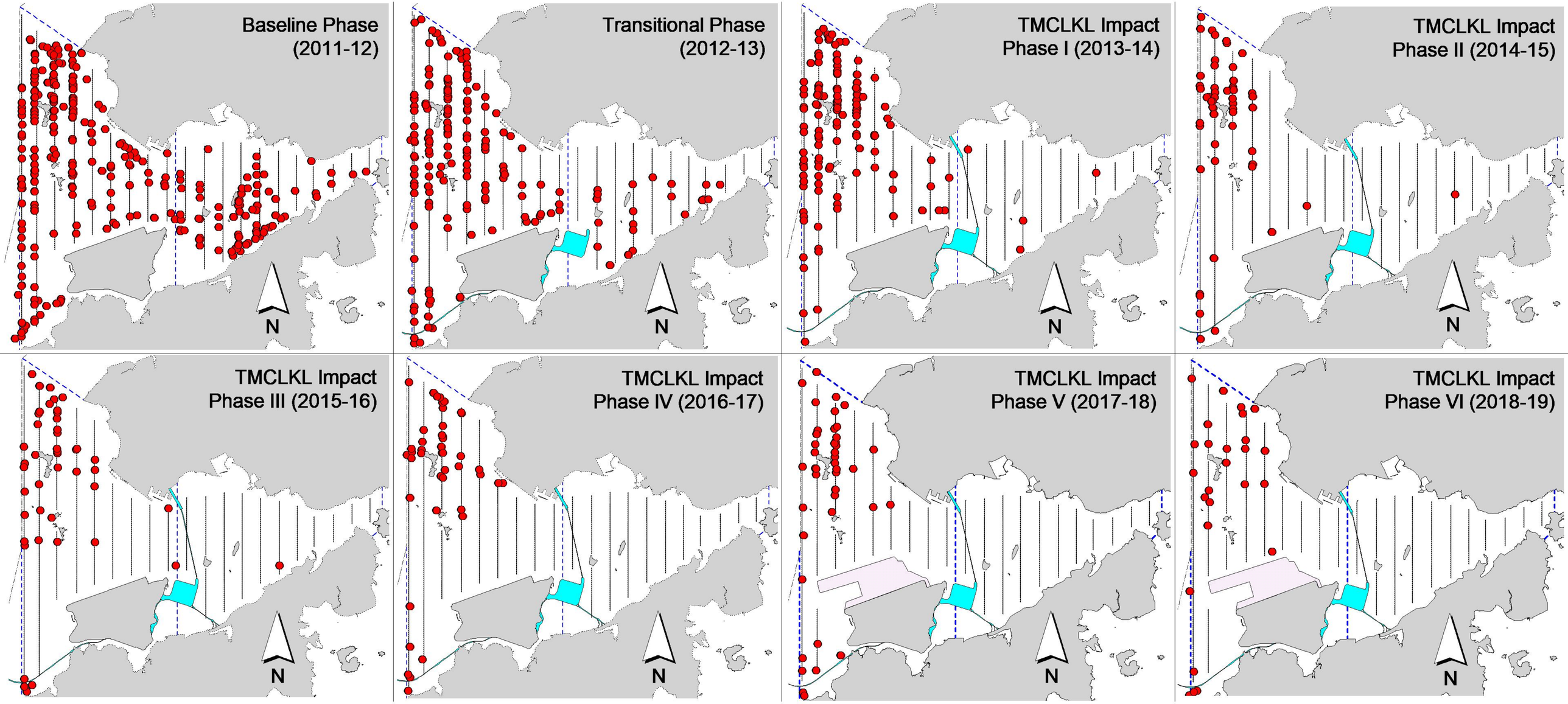


Figure 2. A comparison on distribution of Chinese white dolphin sightings in North Lantau region during the baseline (2011-12), transitional (2012-13) and six impact phases (2013-14, 2014-15, 2015-16, 2016-17, 2017-18 & 2018-19) of TMCLKL construction works

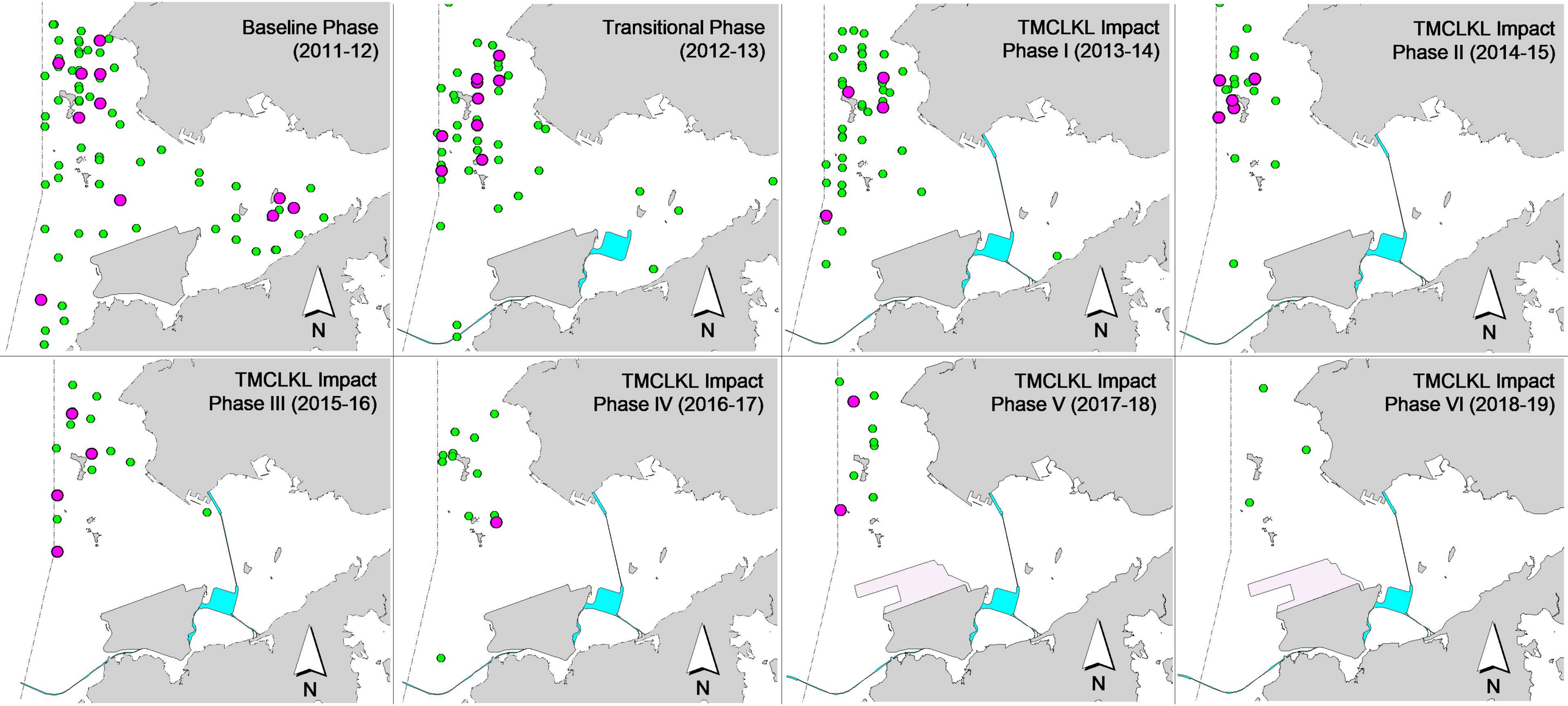


Figure 3. Distribution of dolphins with larger group sizes during different phases of TMCLKL construction works (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more)

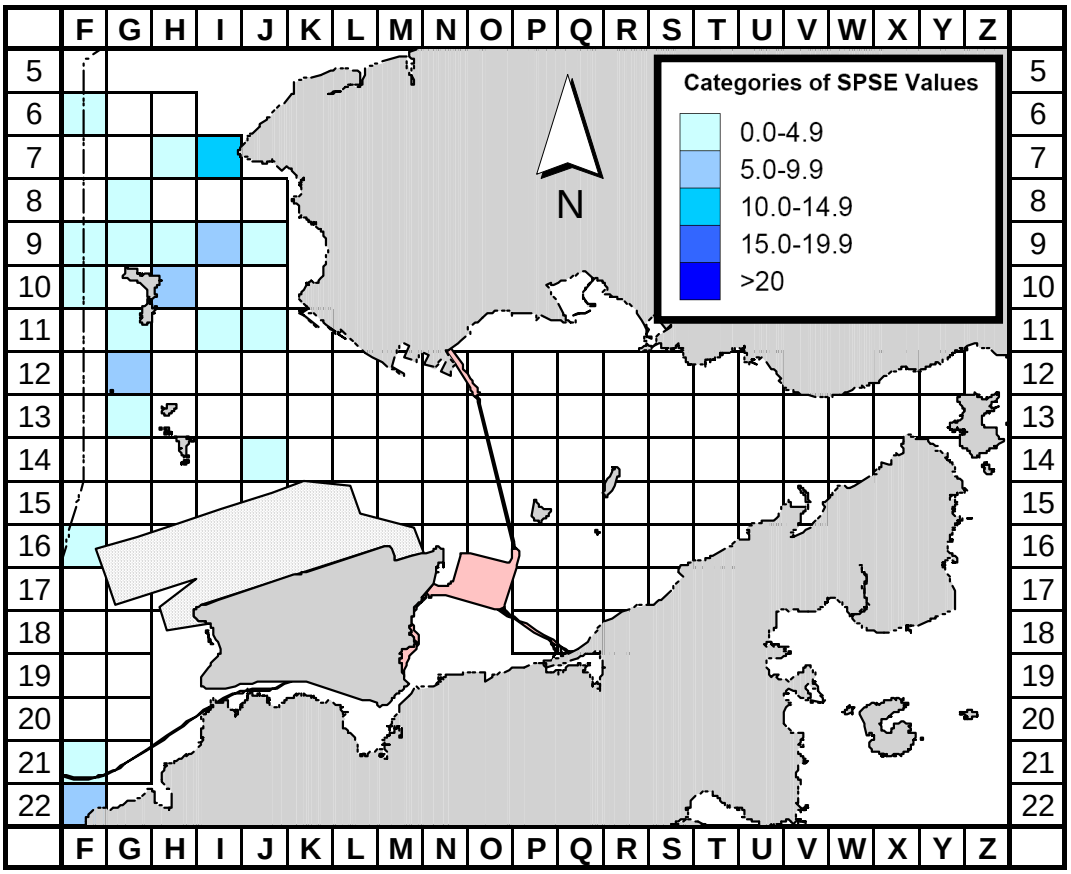


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03/TMCLKL08 impact monitoring period (Nov18 - Oct19) (SPSE = no. of on-effort sightings per 100 units of survey effort)

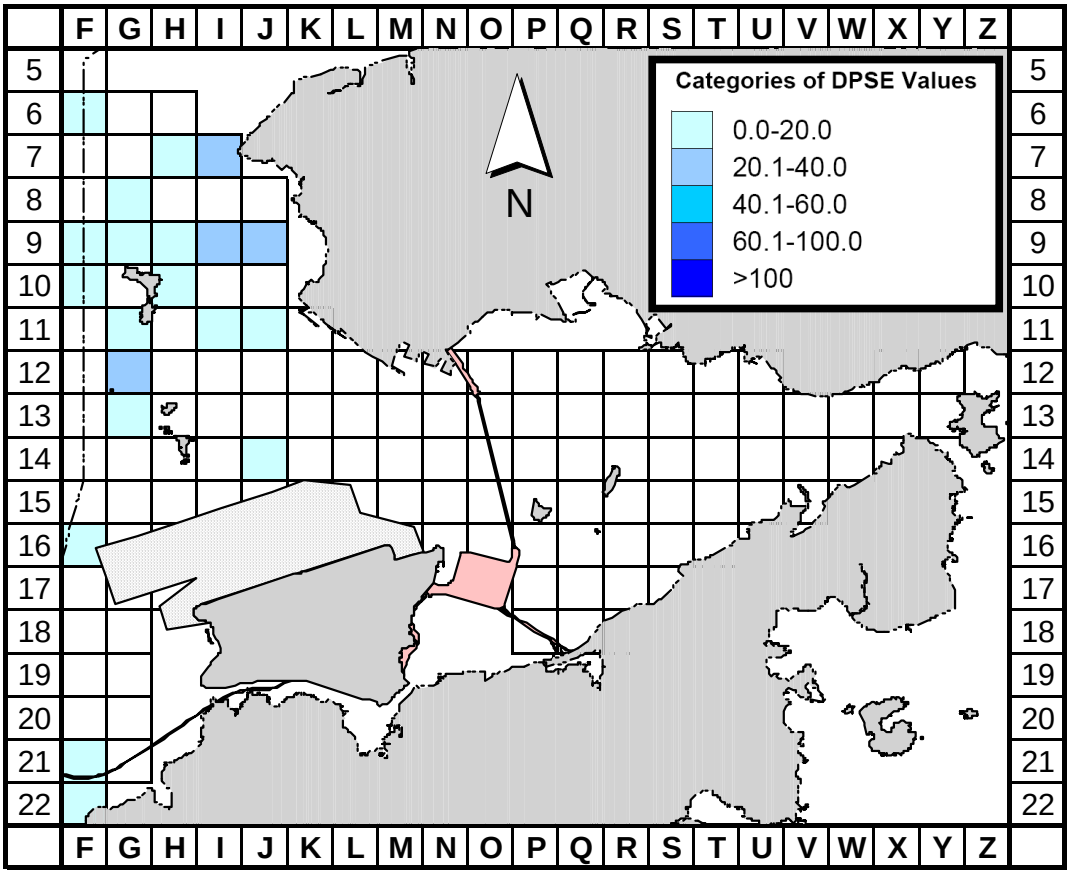


Figure 4b. Density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03/TMCLKL08 impact monitoring period (Nov18 -Oct19) (DPSE = no. of dolphins per 100 units of survey effort)

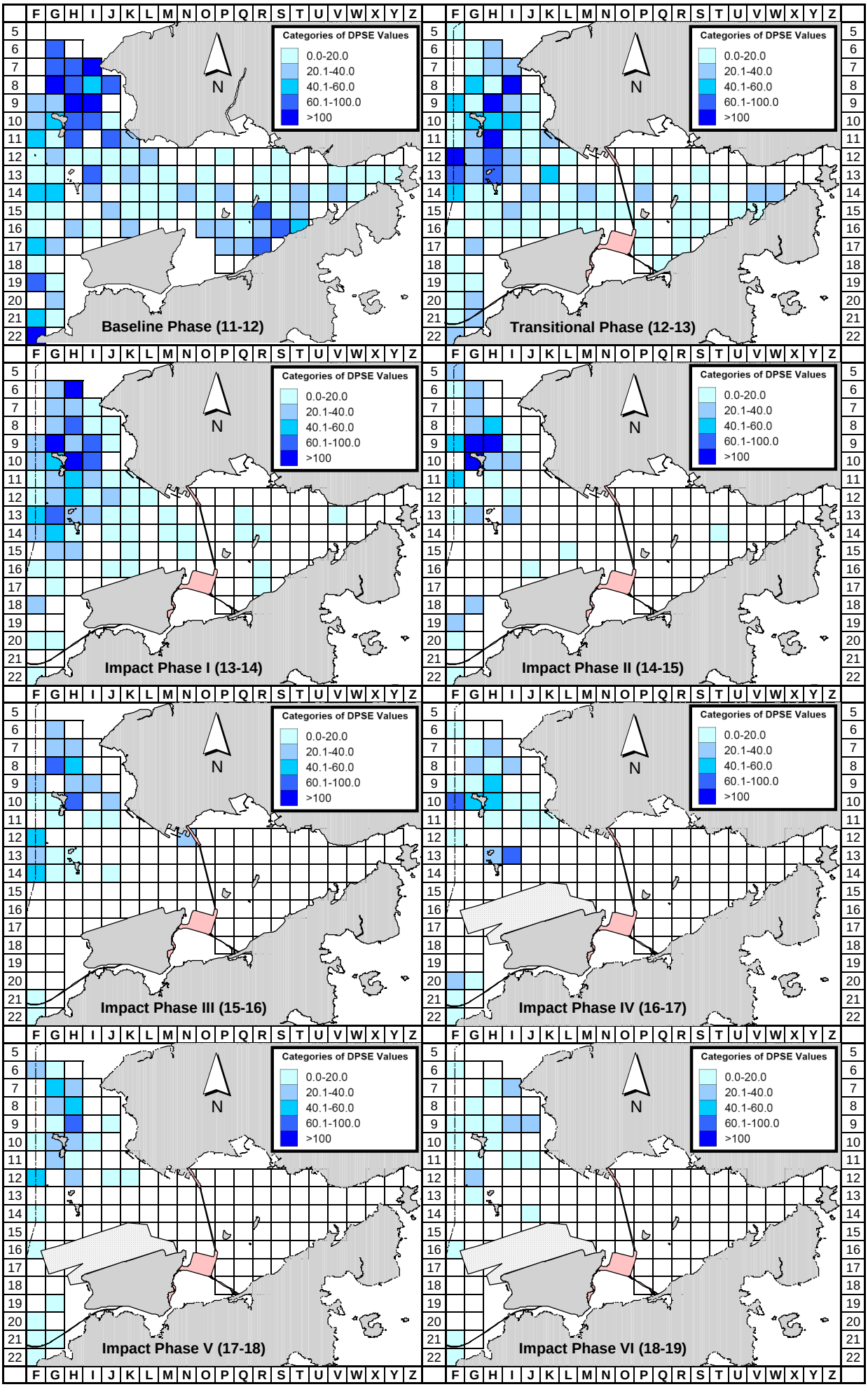


Figure 5. Comparison of density of Chinese white dolphins with corrected survey effort per km^2 in NWL and NEL survey areas between the six impact phases of TMCLKL (2013-14, 2014-15, 2015-16, 2016-17, 2017-18 & 2018-19), transitional phase (2012-13) & baseline phase (Feb11-Jan12) monitoring periods (DPSE = no. of dolphins per 100 units of survey effort)

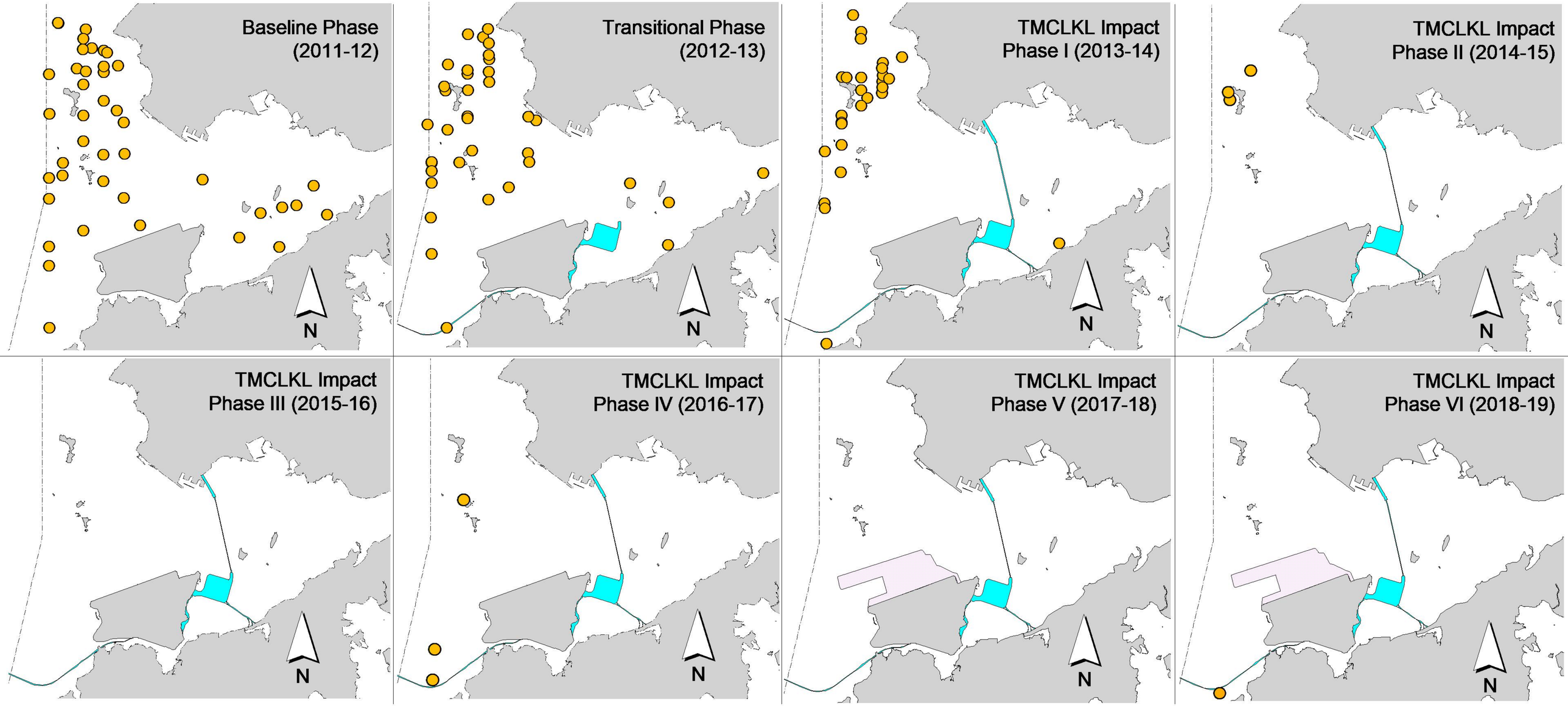


Figure 6. Distribution of young calves of Chinese white dolphins during different phases of TMCLKL construction works

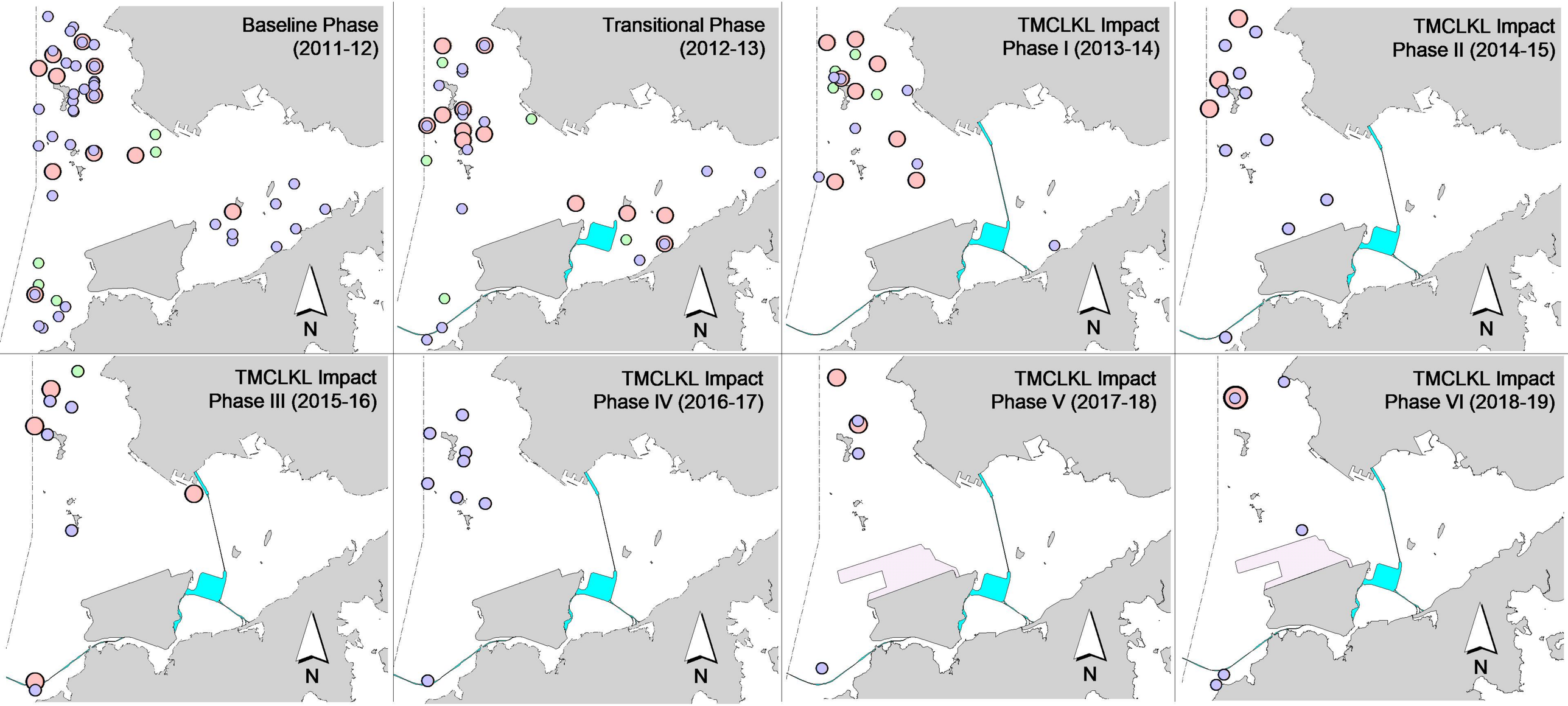


Figure 7. Distribution of dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during different phases of TMCLKL construction works

Appendix I. HKLR03/TMCLKL08 Survey Effort Database (Nov 2018-Oct 2019)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
1-Nov-18	NE LANTAU	2	10.78	AUTUMN	STANDARD36826	HKLR	P
1-Nov-18	NE LANTAU	3	19.78	AUTUMN	STANDARD36826	HKLR	P
1-Nov-18	NE LANTAU	4	6.85	AUTUMN	STANDARD36826	HKLR	P
1-Nov-18	NE LANTAU	2	4.88	AUTUMN	STANDARD36826	HKLR	S
1-Nov-18	NE LANTAU	3	7.41	AUTUMN	STANDARD36826	HKLR	S
6-Nov-18	NW LANTAU	2	32.12	AUTUMN	STANDARD36826	HKLR	P
6-Nov-18	NW LANTAU	3	19.50	AUTUMN	STANDARD36826	HKLR	P
6-Nov-18	NW LANTAU	4	6.80	AUTUMN	STANDARD36826	HKLR	P
6-Nov-18	NW LANTAU	2	17.37	AUTUMN	STANDARD36826	HKLR	S
6-Nov-18	NW LANTAU	3	7.91	AUTUMN	STANDARD36826	HKLR	S
6-Nov-18	NW LANTAU	4	2.70	AUTUMN	STANDARD36826	HKLR	S
8-Nov-18	NW LANTAU	3	9.12	AUTUMN	STANDARD36826	HKLR	P
8-Nov-18	NW LANTAU	4	16.42	AUTUMN	STANDARD36826	HKLR	P
8-Nov-18	NW LANTAU	5	1.50	AUTUMN	STANDARD36826	HKLR	P
8-Nov-18	NW LANTAU	3	5.80	AUTUMN	STANDARD36826	HKLR	S
8-Nov-18	NW LANTAU	4	5.75	AUTUMN	STANDARD36826	HKLR	S
8-Nov-18	NW LANTAU	5	1.40	AUTUMN	STANDARD36826	HKLR	S
8-Nov-18	NE LANTAU	2	21.83	AUTUMN	STANDARD36826	HKLR	P
8-Nov-18	NE LANTAU	3	13.92	AUTUMN	STANDARD36826	HKLR	P
8-Nov-18	NE LANTAU	4	1.30	AUTUMN	STANDARD36826	HKLR	P
8-Nov-18	NE LANTAU	2	7.10	AUTUMN	STANDARD36826	HKLR	S
8-Nov-18	NE LANTAU	3	5.64	AUTUMN	STANDARD36826	HKLR	S
8-Nov-18	NE LANTAU	4	0.81	AUTUMN	STANDARD36826	HKLR	S
13-Nov-18	NW LANTAU	2	18.07	AUTUMN	STANDARD36826	HKLR	P
13-Nov-18	NW LANTAU	3	14.72	AUTUMN	STANDARD36826	HKLR	P
13-Nov-18	NW LANTAU	2	6.80	AUTUMN	STANDARD36826	HKLR	S
13-Nov-18	NW LANTAU	3	1.71	AUTUMN	STANDARD36826	HKLR	S
3-Dec-18	NW LANTAU	2	27.00	WINTER	STANDARD36826	HKLR	P
3-Dec-18	NW LANTAU	3	4.18	WINTER	STANDARD36826	HKLR	P
3-Dec-18	NW LANTAU	2	10.68	WINTER	STANDARD36826	HKLR	S
5-Dec-18	NW LANTAU	3	19.43	WINTER	STANDARD36826	HKLR	P
5-Dec-18	NW LANTAU	4	9.90	WINTER	STANDARD36826	HKLR	P
5-Dec-18	NW LANTAU	3	6.57	WINTER	STANDARD36826	HKLR	S
5-Dec-18	NW LANTAU	4	4.30	WINTER	STANDARD36826	HKLR	S
5-Dec-18	NE LANTAU	2	8.60	WINTER	STANDARD36826	HKLR	P
5-Dec-18	NE LANTAU	3	26.18	WINTER	STANDARD36826	HKLR	P
5-Dec-18	NE LANTAU	4	1.10	WINTER	STANDARD36826	HKLR	P
5-Dec-18	NE LANTAU	2	6.60	WINTER	STANDARD36826	HKLR	S
5-Dec-18	NE LANTAU	3	6.22	WINTER	STANDARD36826	HKLR	S
10-Dec-18	NW LANTAU	2	13.34	WINTER	STANDARD36826	HKLR	P
10-Dec-18	NW LANTAU	3	22.85	WINTER	STANDARD36826	HKLR	P
10-Dec-18	NW LANTAU	2	8.98	WINTER	STANDARD36826	HKLR	S
10-Dec-18	NW LANTAU	3	1.73	WINTER	STANDARD36826	HKLR	S
12-Dec-18	NW LANTAU	2	7.60	WINTER	STANDARD36826	HKLR	P
12-Dec-18	NW LANTAU	3	10.12	WINTER	STANDARD36826	HKLR	P
12-Dec-18	NW LANTAU	4	7.55	WINTER	STANDARD36826	HKLR	P
12-Dec-18	NW LANTAU	2	2.10	WINTER	STANDARD36826	HKLR	S
12-Dec-18	NW LANTAU	3	6.10	WINTER	STANDARD36826	HKLR	S
12-Dec-18	NW LANTAU	4	2.53	WINTER	STANDARD36826	HKLR	S
12-Dec-18	NE LANTAU	2	33.02	WINTER	STANDARD36826	HKLR	P
12-Dec-18	NE LANTAU	3	2.59	WINTER	STANDARD36826	HKLR	P
12-Dec-18	NE LANTAU	2	12.69	WINTER	STANDARD36826	HKLR	S

Appendix I. (cont'd)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
2-Jan-19	NW LANTAU	2	5.20	WINTER	STANDARD36826	HKLR	P
2-Jan-19	NW LANTAU	3	23.70	WINTER	STANDARD36826	HKLR	P
2-Jan-19	NW LANTAU	2	5.40	WINTER	STANDARD36826	HKLR	S
2-Jan-19	NW LANTAU	3	3.96	WINTER	STANDARD36826	HKLR	S
2-Jan-19	NW LANTAU	4	2.14	WINTER	STANDARD36826	HKLR	S
2-Jan-19	NE LANTAU	2	17.54	WINTER	STANDARD36826	HKLR	P
2-Jan-19	NE LANTAU	3	17.80	WINTER	STANDARD36826	HKLR	P
2-Jan-19	NE LANTAU	2	8.76	WINTER	STANDARD36826	HKLR	S
2-Jan-19	NE LANTAU	3	5.80	WINTER	STANDARD36826	HKLR	S
3-Jan-19	NW LANTAU	2	31.36	WINTER	STANDARD36826	HKLR	P
3-Jan-19	NW LANTAU	2	11.88	WINTER	STANDARD36826	HKLR	S
7-Jan-19	NW LANTAU	2	21.80	WINTER	STANDARD36826	HKLR	P
7-Jan-19	NW LANTAU	3	10.90	WINTER	STANDARD36826	HKLR	P
7-Jan-19	NW LANTAU	2	2.20	WINTER	STANDARD36826	HKLR	S
7-Jan-19	NW LANTAU	3	9.60	WINTER	STANDARD36826	HKLR	S
7-Jan-19	NE LANTAU	2	35.83	WINTER	STANDARD36826	HKLR	P
7-Jan-19	NE LANTAU	2	12.07	WINTER	STANDARD36826	HKLR	S
14-Jan-19	NW LANTAU	2	26.88	WINTER	STANDARD36826	HKLR	P
14-Jan-19	NW LANTAU	2	13.92	WINTER	STANDARD36826	HKLR	S
1-Feb-19	NW LANTAU	2	6.59	WINTER	STANDARD36826	HKLR	P
1-Feb-19	NW LANTAU	3	20.70	WINTER	STANDARD36826	HKLR	P
1-Feb-19	NW LANTAU	4	5.70	WINTER	STANDARD36826	HKLR	P
1-Feb-19	NW LANTAU	1	1.06	WINTER	STANDARD36826	HKLR	S
1-Feb-19	NW LANTAU	2	5.60	WINTER	STANDARD36826	HKLR	S
1-Feb-19	NW LANTAU	3	4.30	WINTER	STANDARD36826	HKLR	S
1-Feb-19	NE LANTAU	1	2.60	WINTER	STANDARD36826	HKLR	P
1-Feb-19	NE LANTAU	2	33.86	WINTER	STANDARD36826	HKLR	P
1-Feb-19	NE LANTAU	1	2.30	WINTER	STANDARD36826	HKLR	S
1-Feb-19	NE LANTAU	2	10.14	WINTER	STANDARD36826	HKLR	S
14-Feb-19	NW LANTAU	2	11.58	WINTER	STANDARD36826	HKLR	P
14-Feb-19	NW LANTAU	3	12.95	WINTER	STANDARD36826	HKLR	P
14-Feb-19	NW LANTAU	4	3.30	WINTER	STANDARD36826	HKLR	P
14-Feb-19	NW LANTAU	2	1.76	WINTER	STANDARD36826	HKLR	S
14-Feb-19	NW LANTAU	3	7.76	WINTER	STANDARD36826	HKLR	S
20-Feb-19	NW LANTAU	2	15.35	WINTER	STANDARD36826	HKLR	P
20-Feb-19	NW LANTAU	3	12.38	WINTER	STANDARD36826	HKLR	P
20-Feb-19	NW LANTAU	2	7.25	WINTER	STANDARD36826	HKLR	S
20-Feb-19	NW LANTAU	3	5.06	WINTER	STANDARD36826	HKLR	S
25-Feb-19	NW LANTAU	2	27.52	WINTER	STANDARD36826	HKLR	P
25-Feb-19	NW LANTAU	3	5.53	WINTER	STANDARD36826	HKLR	P
25-Feb-19	NW LANTAU	2	11.35	WINTER	STANDARD36826	HKLR	S
25-Feb-19	NE LANTAU	1	4.41	WINTER	STANDARD36826	HKLR	P
25-Feb-19	NE LANTAU	2	15.20	WINTER	STANDARD36826	HKLR	P
25-Feb-19	NE LANTAU	1	6.35	WINTER	STANDARD36826	HKLR	S
25-Feb-19	NE LANTAU	2	5.24	WINTER	STANDARD36826	HKLR	S
26-Feb-19	NE LANTAU	3	12.70	WINTER	STANDARD36826	HKLR	P
26-Feb-19	NE LANTAU	4	3.51	WINTER	STANDARD36826	HKLR	P
26-Feb-19	NE LANTAU	5	1.64	WINTER	STANDARD36826	HKLR	P
26-Feb-19	NE LANTAU	3	8.80	WINTER	STANDARD36826	HKLR	S
26-Feb-19	NE LANTAU	4	0.55	WINTER	STANDARD36826	HKLR	S
4-Mar-19	NW LANTAU	2	11.18	SPRING	STANDARD36826	HKLR	P
4-Mar-19	NW LANTAU	3	20.02	SPRING	STANDARD36826	HKLR	P
4-Mar-19	NW LANTAU	2	8.70	SPRING	STANDARD36826	HKLR	S
4-Mar-19	NW LANTAU	3	2.90	SPRING	STANDARD36826	HKLR	S

Appendix I. (cont'd)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
4-Mar-19	NE LANTAU	2	4.90	SPRING	STANDARD36826	HKLR	P
4-Mar-19	NE LANTAU	3	19.04	SPRING	STANDARD36826	HKLR	P
4-Mar-19	NE LANTAU	4	9.20	SPRING	STANDARD36826	HKLR	P
4-Mar-19	NE LANTAU	2	2.97	SPRING	STANDARD36826	HKLR	S
4-Mar-19	NE LANTAU	3	6.69	SPRING	STANDARD36826	HKLR	S
4-Mar-19	NE LANTAU	4	2.30	SPRING	STANDARD36826	HKLR	S
11-Mar-19	NW LANTAU	2	26.50	SPRING	STANDARD36826	HKLR	P
11-Mar-19	NW LANTAU	2	14.30	SPRING	STANDARD36826	HKLR	S
13-Mar-19	NW LANTAU	1	2.59	SPRING	STANDARD36826	HKLR	P
13-Mar-19	NW LANTAU	2	21.23	SPRING	STANDARD36826	HKLR	P
13-Mar-19	NW LANTAU	3	7.50	SPRING	STANDARD36826	HKLR	P
13-Mar-19	NW LANTAU	1	3.40	SPRING	STANDARD36826	HKLR	S
13-Mar-19	NW LANTAU	2	4.45	SPRING	STANDARD36826	HKLR	S
13-Mar-19	NW LANTAU	3	4.60	SPRING	STANDARD36826	HKLR	S
13-Mar-19	NE LANTAU	2	17.90	SPRING	STANDARD36826	HKLR	P
13-Mar-19	NE LANTAU	3	18.05	SPRING	STANDARD36826	HKLR	P
13-Mar-19	NE LANTAU	2	10.55	SPRING	STANDARD36826	HKLR	S
13-Mar-19	NE LANTAU	3	1.90	SPRING	STANDARD36826	HKLR	S
18-Mar-19	NW LANTAU	2	19.21	SPRING	STANDARD36826	HKLR	P
18-Mar-19	NW LANTAU	3	8.19	SPRING	STANDARD36826	HKLR	P
18-Mar-19	NW LANTAU	2	9.25	SPRING	STANDARD36826	HKLR	S
18-Mar-19	NW LANTAU	3	1.55	SPRING	STANDARD36826	HKLR	S
10-Apr-19	NE LANTAU	1	4.30	SPRING	STANDARD36826	HKLR	P
10-Apr-19	NE LANTAU	2	32.38	SPRING	STANDARD36826	HKLR	P
10-Apr-19	NE LANTAU	2	13.15	SPRING	STANDARD36826	HKLR	S
10-Apr-19	NE LANTAU	3	0.77	SPRING	STANDARD36826	HKLR	S
10-Apr-19	NW LANTAU	2	4.14	SPRING	STANDARD36826	HKLR	P
10-Apr-19	NW LANTAU	3	21.86	SPRING	STANDARD36826	HKLR	P
10-Apr-19	NW LANTAU	4	1.50	SPRING	STANDARD36826	HKLR	P
10-Apr-19	NW LANTAU	2	3.74	SPRING	STANDARD36826	HKLR	S
10-Apr-19	NW LANTAU	3	8.86	SPRING	STANDARD36826	HKLR	S
15-Apr-19	NW LANTAU	2	2.50	SPRING	STANDARD36826	HKLR	P
15-Apr-19	NW LANTAU	3	17.18	SPRING	STANDARD36826	HKLR	P
15-Apr-19	NW LANTAU	4	13.38	SPRING	STANDARD36826	HKLR	P
15-Apr-19	NW LANTAU	2	3.37	SPRING	STANDARD36826	HKLR	S
15-Apr-19	NW LANTAU	3	5.37	SPRING	STANDARD36826	HKLR	S
15-Apr-19	NW LANTAU	4	2.10	SPRING	STANDARD36826	HKLR	S
23-Apr-19	NW LANTAU	2	20.00	SPRING	STANDARD36826	HKLR	P
23-Apr-19	NW LANTAU	3	8.13	SPRING	STANDARD36826	HKLR	P
23-Apr-19	NW LANTAU	2	8.17	SPRING	STANDARD36826	HKLR	S
23-Apr-19	NW LANTAU	3	2.90	SPRING	STANDARD36826	HKLR	S
23-Apr-19	NE LANTAU	2	34.43	SPRING	STANDARD36826	HKLR	P
23-Apr-19	NE LANTAU	3	2.70	SPRING	STANDARD36826	HKLR	P
23-Apr-19	NE LANTAU	2	13.81	SPRING	STANDARD36826	HKLR	S
25-Apr-19	NW LANTAU	2	20.27	SPRING	STANDARD36826	HKLR	P
25-Apr-19	NW LANTAU	3	12.70	SPRING	STANDARD36826	HKLR	P
25-Apr-19	NW LANTAU	2	13.23	SPRING	STANDARD36826	HKLR	S
2-May-19	NW LANTAU	2	22.59	SPRING	STANDARD36826	HKLR	P
2-May-19	NW LANTAU	3	4.80	SPRING	STANDARD36826	HKLR	P
2-May-19	NW LANTAU	2	9.51	SPRING	STANDARD36826	HKLR	S
2-May-19	NW LANTAU	3	2.80	SPRING	STANDARD36826	HKLR	S
2-May-19	NE LANTAU	2	22.54	SPRING	STANDARD36826	HKLR	P
2-May-19	NE LANTAU	3	13.82	SPRING	STANDARD36826	HKLR	P
2-May-19	NE LANTAU	2	12.74	SPRING	STANDARD36826	HKLR	S

Appendix I. (cont'd)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
7-May-19	NW LANTAU	2	14.50	SPRING	STANDARD36826	HKLR	P
7-May-19	NW LANTAU	3	16.55	SPRING	STANDARD36826	HKLR	P
7-May-19	NW LANTAU	4	0.90	SPRING	STANDARD36826	HKLR	P
7-May-19	NW LANTAU	2	8.25	SPRING	STANDARD36826	HKLR	S
7-May-19	NW LANTAU	3	2.00	SPRING	STANDARD36826	HKLR	S
21-May-19	NE LANTAU	2	27.09	SPRING	STANDARD36826	HKLR	P
21-May-19	NE LANTAU	3	9.40	SPRING	STANDARD36826	HKLR	P
21-May-19	NE LANTAU	2	11.51	SPRING	STANDARD36826	HKLR	S
21-May-19	NE LANTAU	3	1.20	SPRING	STANDARD36826	HKLR	S
21-May-19	NW LANTAU	2	9.44	SPRING	STANDARD36826	HKLR	P
21-May-19	NW LANTAU	3	19.68	SPRING	STANDARD36826	HKLR	P
21-May-19	NW LANTAU	4	1.20	SPRING	STANDARD36826	HKLR	P
21-May-19	NW LANTAU	2	8.58	SPRING	STANDARD36826	HKLR	S
21-May-19	NW LANTAU	3	4.60	SPRING	STANDARD36826	HKLR	S
23-May-19	NW LANTAU	2	18.63	SPRING	STANDARD36826	HKLR	P
23-May-19	NW LANTAU	3	10.25	SPRING	STANDARD36826	HKLR	P
23-May-19	NW LANTAU	2	11.32	SPRING	STANDARD36826	HKLR	S
23-May-19	NW LANTAU	3	1.00	SPRING	STANDARD36826	HKLR	S
3-Jun-19	NW LANTAU	3	25.81	SUMMER	STANDARD36826	HKLR	P
3-Jun-19	NW LANTAU	4	1.66	SUMMER	STANDARD36826	HKLR	P
3-Jun-19	NW LANTAU	3	11.38	SUMMER	STANDARD36826	HKLR	S
3-Jun-19	NW LANTAU	4	0.55	SUMMER	STANDARD36826	HKLR	S
3-Jun-19	NE LANTAU	2	24.60	SUMMER	STANDARD36826	HKLR	P
3-Jun-19	NE LANTAU	3	11.37	SUMMER	STANDARD36826	HKLR	P
3-Jun-19	NE LANTAU	2	11.83	SUMMER	STANDARD36826	HKLR	S
3-Jun-19	NE LANTAU	3	2.10	SUMMER	STANDARD36826	HKLR	S
6-Jun-19	NW LANTAU	2	8.26	SUMMER	STANDARD36826	HKLR	P
6-Jun-19	NW LANTAU	3	19.60	SUMMER	STANDARD36826	HKLR	P
6-Jun-19	NW LANTAU	4	3.70	SUMMER	STANDARD36826	HKLR	P
6-Jun-19	NW LANTAU	2	5.99	SUMMER	STANDARD36826	HKLR	S
6-Jun-19	NW LANTAU	3	4.25	SUMMER	STANDARD36826	HKLR	S
10-Jun-19	NW LANTAU	3	17.00	SUMMER	STANDARD36826	HKLR	P
10-Jun-19	NW LANTAU	4	10.53	SUMMER	STANDARD36826	HKLR	P
10-Jun-19	NW LANTAU	5	0.60	SUMMER	STANDARD36826	HKLR	P
10-Jun-19	NW LANTAU	3	7.07	SUMMER	STANDARD36826	HKLR	S
10-Jun-19	NW LANTAU	4	4.80	SUMMER	STANDARD36826	HKLR	S
10-Jun-19	NE LANTAU	2	19.40	SUMMER	STANDARD36826	HKLR	P
10-Jun-19	NE LANTAU	3	15.46	SUMMER	STANDARD36826	HKLR	P
10-Jun-19	NE LANTAU	2	8.04	SUMMER	STANDARD36826	HKLR	S
10-Jun-19	NE LANTAU	3	5.72	SUMMER	STANDARD36826	HKLR	S
13-Jun-19	NW LANTAU	2	24.25	SUMMER	STANDARD36826	HKLR	P
13-Jun-19	NW LANTAU	3	8.10	SUMMER	STANDARD36826	HKLR	P
13-Jun-19	NW LANTAU	2	10.05	SUMMER	STANDARD36826	HKLR	S
16-Jul-19	NW LANTAU	2	22.62	SUMMER	STANDARD36826	HKLR	P
16-Jul-19	NW LANTAU	3	5.34	SUMMER	STANDARD36826	HKLR	P
16-Jul-19	NW LANTAU	2	9.44	SUMMER	STANDARD36826	HKLR	S
16-Jul-19	NW LANTAU	3	0.80	SUMMER	STANDARD36826	HKLR	S
18-Jul-19	NW LANTAU	0	4.07	SUMMER	STANDARD36826	HKLR	P
18-Jul-19	NW LANTAU	1	3.86	SUMMER	STANDARD36826	HKLR	P
18-Jul-19	NW LANTAU	2	24.87	SUMMER	STANDARD36826	HKLR	P
18-Jul-19	NW LANTAU	1	2.20	SUMMER	STANDARD36826	HKLR	S
18-Jul-19	NW LANTAU	2	8.80	SUMMER	STANDARD36826	HKLR	S
18-Jul-19	NE LANTAU	2	30.03	SUMMER	STANDARD36826	HKLR	P
18-Jul-19	NE LANTAU	3	5.56	SUMMER	STANDARD36826	HKLR	P

Appendix I. (cont'd)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
18-Jul-19	NE LANTAU	2	11.89	SUMMER	STANDARD36826	HKLR	S
22-Jul-19	NW LANTAU	1	7.40	SUMMER	STANDARD36826	HKLR	P
22-Jul-19	NW LANTAU	2	19.85	SUMMER	STANDARD36826	HKLR	P
22-Jul-19	NW LANTAU	1	4.40	SUMMER	STANDARD36826	HKLR	S
22-Jul-19	NW LANTAU	2	7.65	SUMMER	STANDARD36826	HKLR	S
22-Jul-19	NE LANTAU	2	27.91	SUMMER	STANDARD36826	HKLR	P
22-Jul-19	NE LANTAU	3	5.70	SUMMER	STANDARD36826	HKLR	P
22-Jul-19	NE LANTAU	2	10.29	SUMMER	STANDARD36826	HKLR	S
22-Jul-19	NE LANTAU	3	2.80	SUMMER	STANDARD36826	HKLR	S
24-Jul-19	NW LANTAU	2	34.15	SUMMER	STANDARD36826	HKLR	P
24-Jul-19	NW LANTAU	3	9.95	SUMMER	STANDARD36826	HKLR	S
13-Aug-19	NE LANTAU	2	34.82	SUMMER	STANDARD36826	HKLR	P
13-Aug-19	NE LANTAU	3	2.90	SUMMER	STANDARD36826	HKLR	P
13-Aug-19	NE LANTAU	2	9.78	SUMMER	STANDARD36826	HKLR	S
13-Aug-19	NE LANTAU	3	1.90	SUMMER	STANDARD36826	HKLR	S
13-Aug-19	NW LANTAU	2	0.84	SUMMER	STANDARD36826	HKLR	P
13-Aug-19	NW LANTAU	3	24.00	SUMMER	STANDARD36826	HKLR	P
13-Aug-19	NW LANTAU	4	7.90	SUMMER	STANDARD36826	HKLR	P
13-Aug-19	NW LANTAU	2	0.90	SUMMER	STANDARD36826	HKLR	S
13-Aug-19	NW LANTAU	3	8.66	SUMMER	STANDARD36826	HKLR	S
13-Aug-19	NW LANTAU	4	1.40	SUMMER	STANDARD36826	HKLR	S
14-Aug-19	NW LANTAU	2	27.12	SUMMER	STANDARD36826	HKLR	P
14-Aug-19	NW LANTAU	2	14.88	SUMMER	STANDARD36826	HKLR	S
20-Aug-19	NW LANTAU	2	27.37	SUMMER	STANDARD36826	HKLR	P
20-Aug-19	NW LANTAU	3	5.80	SUMMER	STANDARD36826	HKLR	P
20-Aug-19	NW LANTAU	2	11.23	SUMMER	STANDARD36826	HKLR	S
26-Aug-19	NW LANTAU	2	17.21	SUMMER	STANDARD138716	HKLR	P
26-Aug-19	NW LANTAU	3	11.36	SUMMER	STANDARD138716	HKLR	P
26-Aug-19	NW LANTAU	2	6.10	SUMMER	STANDARD138716	HKLR	S
26-Aug-19	NW LANTAU	3	4.13	SUMMER	STANDARD138716	HKLR	S
26-Aug-19	NE LANTAU	1	4.21	SUMMER	STANDARD138716	HKLR	P
26-Aug-19	NE LANTAU	2	26.68	SUMMER	STANDARD138716	HKLR	P
26-Aug-19	NE LANTAU	3	0.27	SUMMER	STANDARD138716	HKLR	P
26-Aug-19	NE LANTAU	1	1.10	SUMMER	STANDARD138716	HKLR	S
26-Aug-19	NE LANTAU	2	4.11	SUMMER	STANDARD138716	HKLR	S
26-Aug-19	NE LANTAU	3	0.97	SUMMER	STANDARD138716	HKLR	S
29-Aug-19	NE LANTAU	2	2.61	SUMMER	STANDARD36826	HKLR	P
29-Aug-19	NE LANTAU	3	2.42	SUMMER	STANDARD36826	HKLR	P
29-Aug-19	NE LANTAU	2	1.90	SUMMER	STANDARD36826	HKLR	S
29-Aug-19	NE LANTAU	3	0.96	SUMMER	STANDARD36826	HKLR	S
4-Sep-19	NW LANTAU	2	21.38	AUTUMN	STANDARD36826	HKLR	P
4-Sep-19	NW LANTAU	3	6.40	AUTUMN	STANDARD36826	HKLR	P
4-Sep-19	NW LANTAU	2	9.12	AUTUMN	STANDARD36826	HKLR	S
4-Sep-19	NW LANTAU	3	2.52	AUTUMN	STANDARD36826	HKLR	S
4-Sep-19	NE LANTAU	2	16.70	AUTUMN	STANDARD36826	HKLR	P
4-Sep-19	NE LANTAU	3	18.83	AUTUMN	STANDARD36826	HKLR	P
4-Sep-19	NE LANTAU	2	7.75	AUTUMN	STANDARD36826	HKLR	S
4-Sep-19	NE LANTAU	3	5.12	AUTUMN	STANDARD36826	HKLR	S
11-Sep-19	NW LANTAU	1	1.60	AUTUMN	STANDARD36826	HKLR	P
11-Sep-19	NW LANTAU	2	29.50	AUTUMN	STANDARD36826	HKLR	P
11-Sep-19	NW LANTAU	3	2.10	AUTUMN	STANDARD36826	HKLR	P
11-Sep-19	NW LANTAU	1	1.40	AUTUMN	STANDARD36826	HKLR	S
11-Sep-19	NW LANTAU	2	8.99	AUTUMN	STANDARD36826	HKLR	S
17-Sep-19	NW LANTAU	2	8.96	AUTUMN	STANDARD36826	HKLR	P

Appendix I. (cont'd)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
17-Sep-19	NW LANTAU	3	22.90	AUTUMN	STANDARD36826	HKLR	P
17-Sep-19	NW LANTAU	4	1.90	AUTUMN	STANDARD36826	HKLR	P
17-Sep-19	NW LANTAU	2	4.54	AUTUMN	STANDARD36826	HKLR	S
17-Sep-19	NW LANTAU	3	4.90	AUTUMN	STANDARD36826	HKLR	S
17-Sep-19	NW LANTAU	4	1.20	AUTUMN	STANDARD36826	HKLR	S
23-Sep-19	NW LANTAU	2	19.22	AUTUMN	STANDARD36826	HKLR	P
23-Sep-19	NW LANTAU	3	7.79	AUTUMN	STANDARD36826	HKLR	P
23-Sep-19	NW LANTAU	2	9.84	AUTUMN	STANDARD36826	HKLR	S
23-Sep-19	NW LANTAU	3	4.25	AUTUMN	STANDARD36826	HKLR	S
23-Sep-19	NE LANTAU	1	11.30	AUTUMN	STANDARD36826	HKLR	P
23-Sep-19	NE LANTAU	2	25.35	AUTUMN	STANDARD36826	HKLR	P
23-Sep-19	NE LANTAU	1	3.61	AUTUMN	STANDARD36826	HKLR	S
23-Sep-19	NE LANTAU	2	10.74	AUTUMN	STANDARD36826	HKLR	S
8-Oct-19	NW LANTAU	1	3.70	AUTUMN	STANDARD36826	TMCLKL	P
8-Oct-19	NW LANTAU	2	23.60	AUTUMN	STANDARD36826	TMCLKL	P
8-Oct-19	NW LANTAU	3	5.20	AUTUMN	STANDARD36826	TMCLKL	P
8-Oct-19	NW LANTAU	2	8.30	AUTUMN	STANDARD36826	TMCLKL	S
8-Oct-19	NW LANTAU	3	2.80	AUTUMN	STANDARD36826	TMCLKL	S
8-Oct-19	NE LANTAU	2	11.50	AUTUMN	STANDARD36826	TMCLKL	P
8-Oct-19	NE LANTAU	3	21.93	AUTUMN	STANDARD36826	TMCLKL	P
8-Oct-19	NE LANTAU	2	5.40	AUTUMN	STANDARD36826	TMCLKL	S
8-Oct-19	NE LANTAU	3	8.87	AUTUMN	STANDARD36826	TMCLKL	S
9-Oct-19	NW LANTAU	2	7.77	AUTUMN	STANDARD36826	TMCLKL	P
9-Oct-19	NW LANTAU	3	19.26	AUTUMN	STANDARD36826	TMCLKL	P
9-Oct-19	NW LANTAU	2	4.33	AUTUMN	STANDARD36826	TMCLKL	S
9-Oct-19	NW LANTAU	3	8.44	AUTUMN	STANDARD36826	TMCLKL	S
14-Oct-19	NW LANTAU	1	3.10	AUTUMN	STANDARD36826	TMCLKL	P
14-Oct-19	NW LANTAU	2	24.38	AUTUMN	STANDARD36826	TMCLKL	P
14-Oct-19	NW LANTAU	1	1.60	AUTUMN	STANDARD36826	TMCLKL	S
14-Oct-19	NW LANTAU	2	11.62	AUTUMN	STANDARD36826	TMCLKL	S
29-Oct-19	NW LANTAU	2	7.60	AUTUMN	STANDARD36826	TMCLKL	P
29-Oct-19	NW LANTAU	3	14.90	AUTUMN	STANDARD36826	TMCLKL	P
29-Oct-19	NW LANTAU	4	10.10	AUTUMN	STANDARD36826	TMCLKL	P
29-Oct-19	NW LANTAU	2	5.10	AUTUMN	STANDARD36826	TMCLKL	S
29-Oct-19	NW LANTAU	3	6.10	AUTUMN	STANDARD36826	TMCLKL	S
29-Oct-19	NE LANTAU	2	31.08	AUTUMN	STANDARD36826	TMCLKL	P
29-Oct-19	NE LANTAU	3	4.40	AUTUMN	STANDARD36826	TMCLKL	P
29-Oct-19	NE LANTAU	2	12.30	AUTUMN	STANDARD36826	TMCLKL	S

Appendix II. HKLR03/TMCLKL08 Chinese White Dolphin Sighting Database (November 2018 - October 2019)

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Lines)

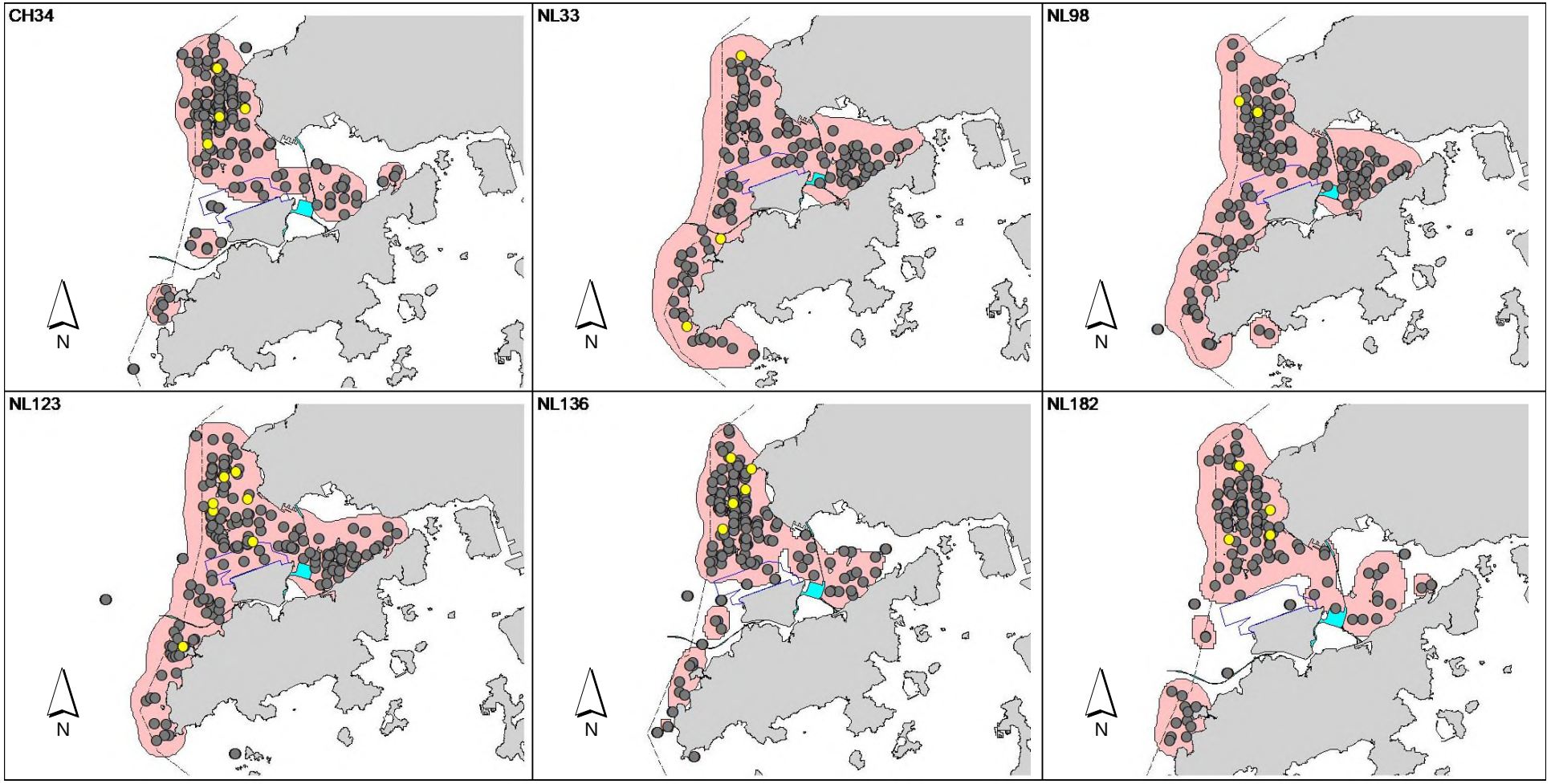
DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
6-Nov-18	1	1107	1	NW LANTAU	2	364	ON	HKLR	825486	807443	AUTUMN	NONE	P
6-Nov-18	2	1119	2	NW LANTAU	2	221	ON	HKLR	827280	807456	AUTUMN	NONE	P
6-Nov-18	3	1202	2	NW LANTAU	2	84	ON	HKLR	828546	805451	AUTUMN	NONE	P
3-Dec-18	1	1046	5	NW LANTAU	2	821	ON	HKLR	827178	808517	WINTER	NONE	P
3-Dec-18	2	1247	1	NW LANTAU	3	962	ON	HKLR	826056	804663	WINTER	NONE	P
3-Jan-19	1	1151	7	NW LANTAU	2	614	ON	HKLR	830239	806267	WINTER	NONE	P
3-Jan-19	2	1234	2	NW LANTAU	2	71	ON	HKLR	827529	804728	WINTER	NONE	P
14-Jan-19	1	1319	2	NW LANTAU	2	ND	OFF	HKLR	814949	804866	WINTER	NONE	
14-Jan-19	2	1336	3	NW LANTAU	2	ND	OFF	HKLR	814739	804443	WINTER	NONE	
1-Feb-19	1	1233	3	NW LANTAU	3	219	ON	HKLR	825495	808493	WINTER	NONE	P
14-Feb-19	1	1024	2	NW LANTAU	3	341	ON	HKLR	820043	804465	WINTER	NONE	S
14-Feb-19	2	1102	1	NW LANTAU	3	197	ON	HKLR	824826	805278	WINTER	NONE	P
14-Feb-19	3	1356	4	NW LANTAU	3	82	ON	HKLR	822050	808930	WINTER	NONE	S
20-Feb-19	1	1220	5	NW LANTAU	3	878	ON	HKLR	824548	805556	WINTER	NONE	P
25-Feb-19	1	1146	3	NW LANTAU	2	147	ON	HKLR	826584	806435	WINTER	NONE	P
13-Mar-19	1	1018	2	NW LANTAU	2	131	ON	HKLR	815946	804673	SPRING	NONE	P
13-Mar-19	2	1131	2	NW LANTAU	1	371	ON	HKLR	830873	804580	SPRING	NONE	P
18-Mar-19	1	1140	2	NW LANTAU	2	853	ON	HKLR	829406	807254	SPRING	NONE	S
23-Apr-19	1	1102	2	NW LANTAU	2	58	ON	HKLR	825168	805485	SPRING	NONE	P
7-May-19	1	1137	3	NW LANTAU	2	254	ON	HKLR	827293	806457	SPRING	NONE	P
3-Jun-19	1	1138	4	NW LANTAU	3	121	ON	HKLR	827734	807488	SUMMER	NONE	P
6-Jun-19	1	1312	1	NW LANTAU	3	77	ON	HKLR	814894	804681	SUMMER	NONE	P
16-Jul-19	1	1152	2	NW LANTAU	2	197	ON	HKLR	829052	807326	SUMMER	NONE	S
24-Jul-19	1	1330	1	NW LANTAU	2	ND	OFF	HKLR	814451	804453	SUMMER	NONE	
4-Sep-19	1	1046	2	NW LANTAU	2	311	ON	HKLR	823375	805440	AUTUMN	NONE	P
11-Sep-19	1	1058	3	NW LANTAU	2	430	ON	HKLR	829316	807975	AUTUMN	NONE	S
9-Oct-19	1	1221	1	NW LANTAU	3	57	ON	TMCLKL	827538	805469	AUTUMN	NONE	P

Appendix III. Individual dolphins identified during HKLR03/TMCLKL08 monitoring surveys conducted in November 2018-October 2019

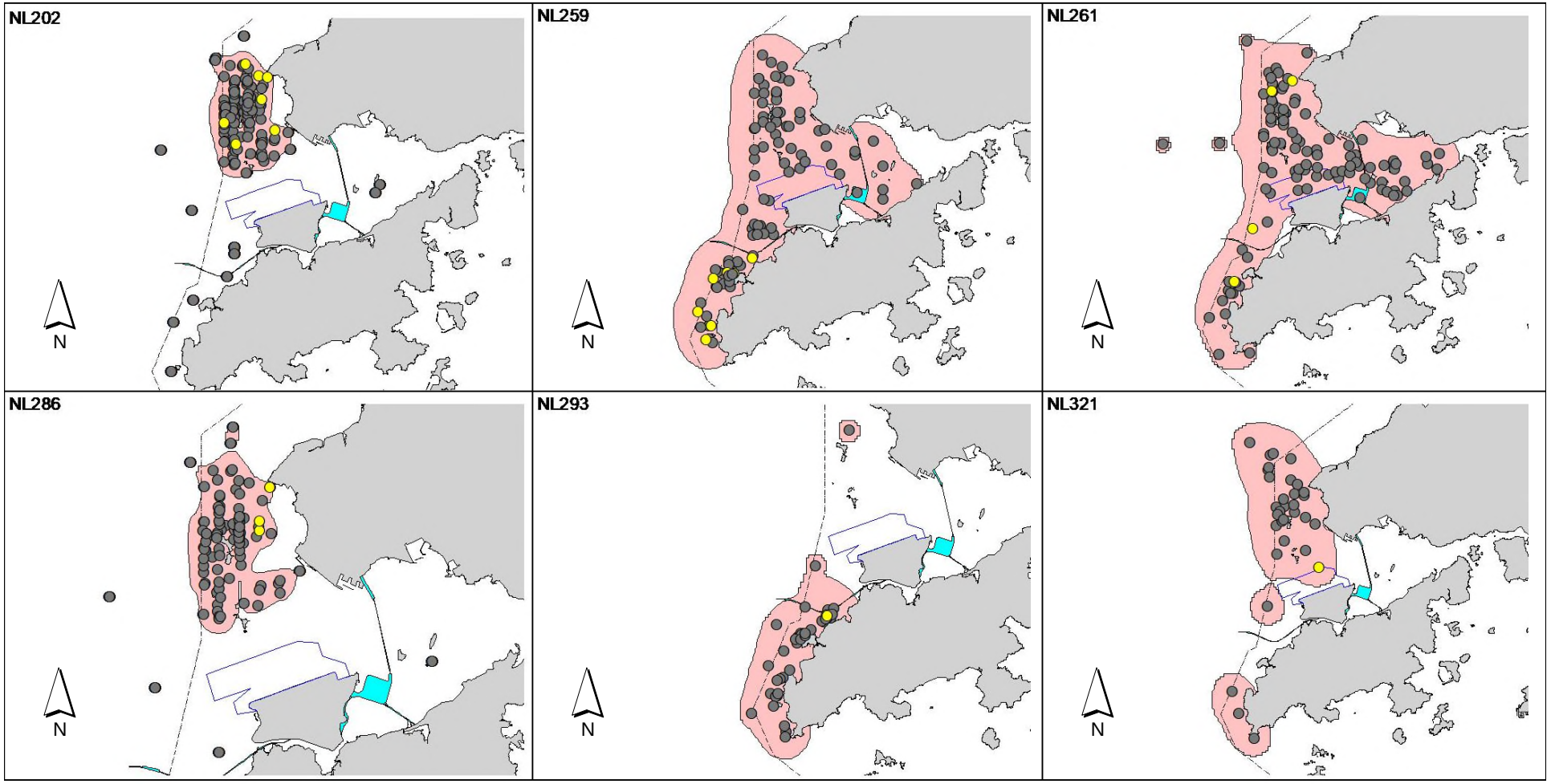
ID#	DATE	STG#	AREA
CH34	03/12/18	1	NW LANTAU
	03/01/19	1	NW LANTAU
	20/02/19	1	NW LANTAU
	25/02/19	1	NW LANTAU
NL33	03/01/19	1	NW LANTAU
	14/01/19	2	NW LANTAU
NL98	03/01/19	2	NW LANTAU
	25/02/19	1	NW LANTAU
NL123	01/02/19	1	NW LANTAU
	14/02/19	3	NW LANTAU
	20/02/19	1	NW LANTAU
	23/04/19	1	NW LANTAU
	07/05/19	1	NW LANTAU
	03/06/19	1	NW LANTAU
NL136	03/01/19	1	NW LANTAU
	20/02/19	1	NW LANTAU
	25/02/19	1	NW LANTAU
	03/06/19	1	NW LANTAU
	11/09/19	1	NW LANTAU
NL182	03/12/18	1	NW LANTAU
	03/01/19	1	NW LANTAU
	01/02/19	1	NW LANTAU
	23/04/19	1	NW LANTAU
NL202	03/12/18	2	NW LANTAU
	03/01/19	1	NW LANTAU
	01/02/19	1	NW LANTAU
	20/02/19	1	NW LANTAU
	18/03/19	1	NW LANTAU
	03/06/19	1	NW LANTAU
	11/09/19	1	NW LANTAU

ID#	DATE	STG#	AREA
NL259	14/01/19	2	NW LANTAU
NL261	06/11/18	3	NW LANTAU
	18/03/19	1	NW LANTAU
NL286	06/11/18	2	NW LANTAU
	03/06/19	1	NW LANTAU
	11/09/19	1	NW LANTAU
NL293	06/06/19	1	NW LANTAU
NL321	14/02/19	3	NW LANTAU
NL322	03/01/19	1	NW LANTAU
	14/01/19	2	NW LANTAU
NL328	06/11/18	3	NW LANTAU
NL331	14/02/19	1	NW LANTAU
WL17	14/02/19	3	NW LANTAU
WL98	14/01/19	1	NW LANTAU
WL145	13/03/19	1	NW LANTAU
WL218	24/07/19	1	NW LANTAU
WL243	14/02/19	1	NW LANTAU
WL273	03/01/19	1	NW LANTAU
WL281	20/02/19	1	NW LANTAU

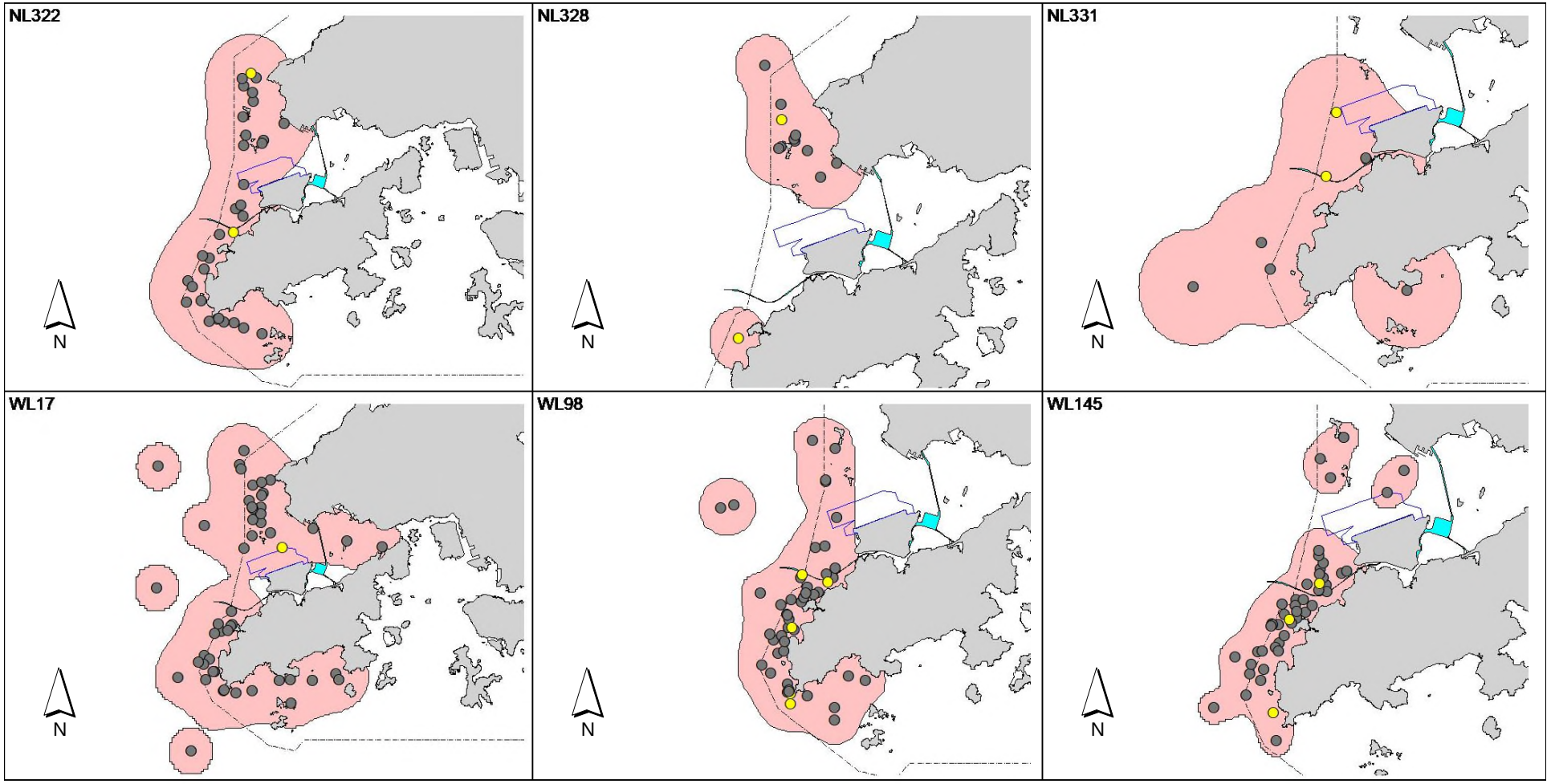
Appendix IV. Ranging patterns (95% kernel ranges) of 22 individual dolphins that were sighted during the sixth year of TMCLKL construction works, utilizing the HKLR03/TMCLKL08 monitoring data with supplement of HKLR09 monitoring data in West Lantau (note: yellow dots indicates sightings made in November 2018 to October 2019)



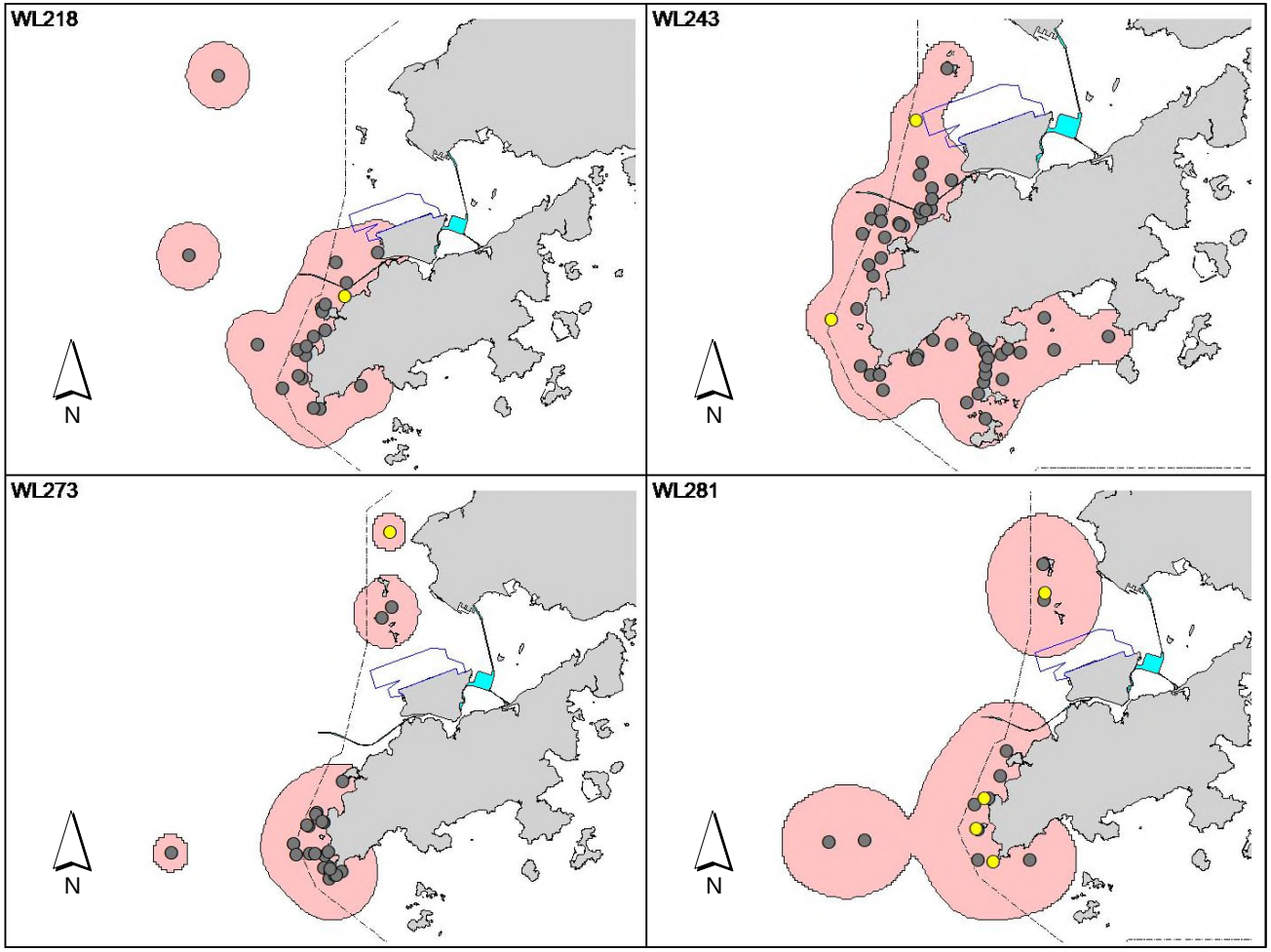
Appendix IV. (cont'd)

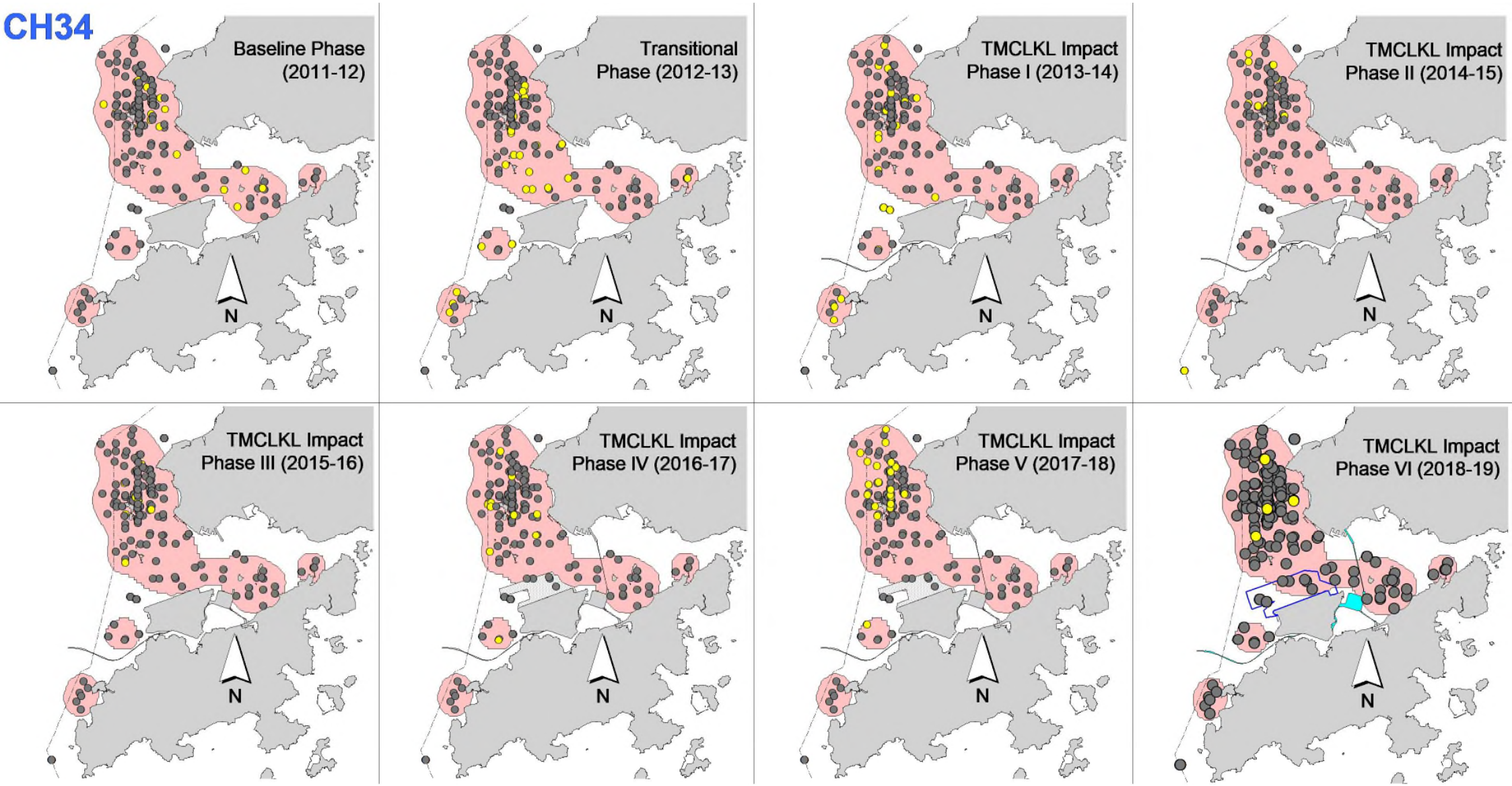


Appendix IV. (cont'd)

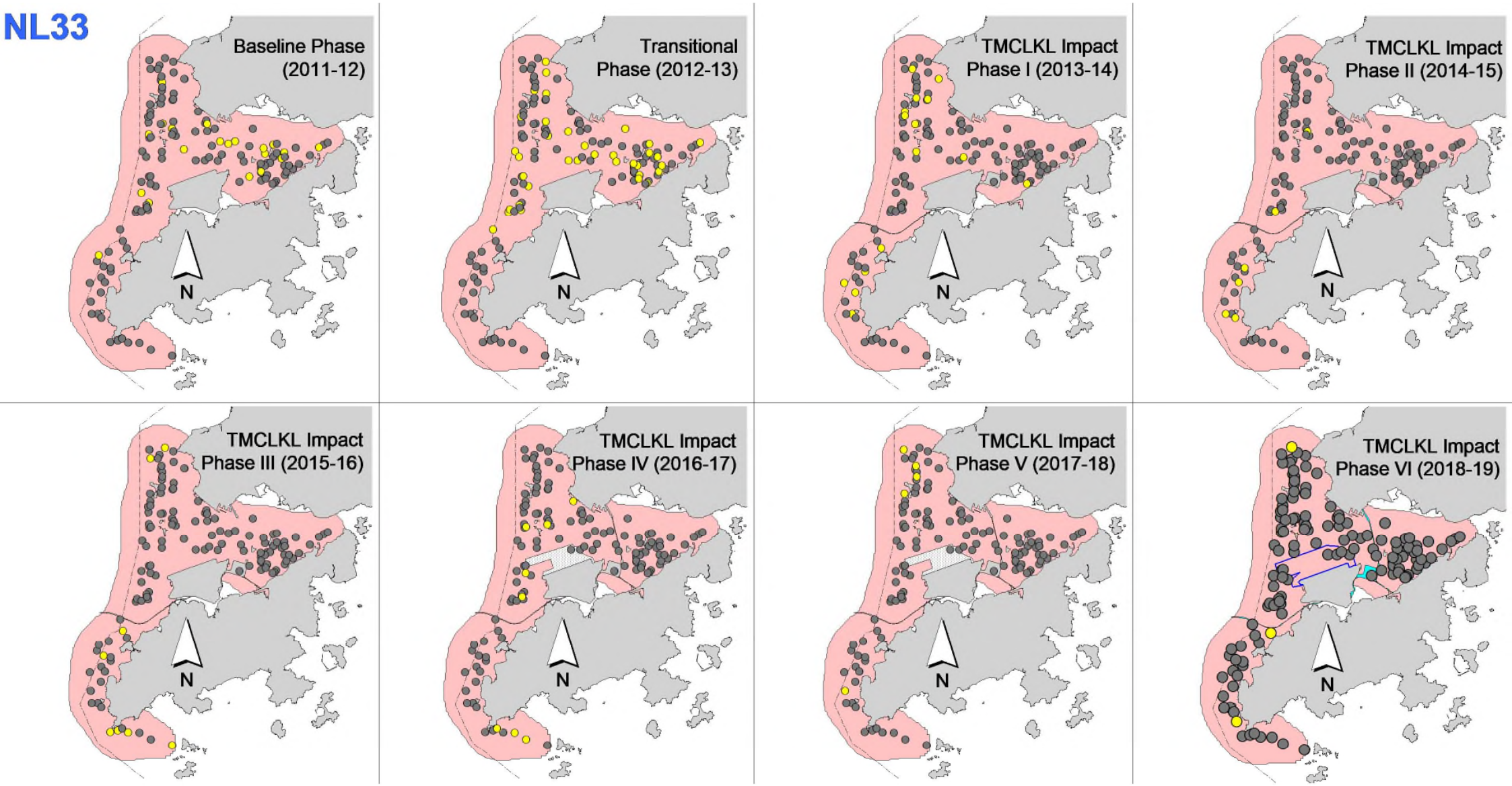


Appendix IV. (cont'd)

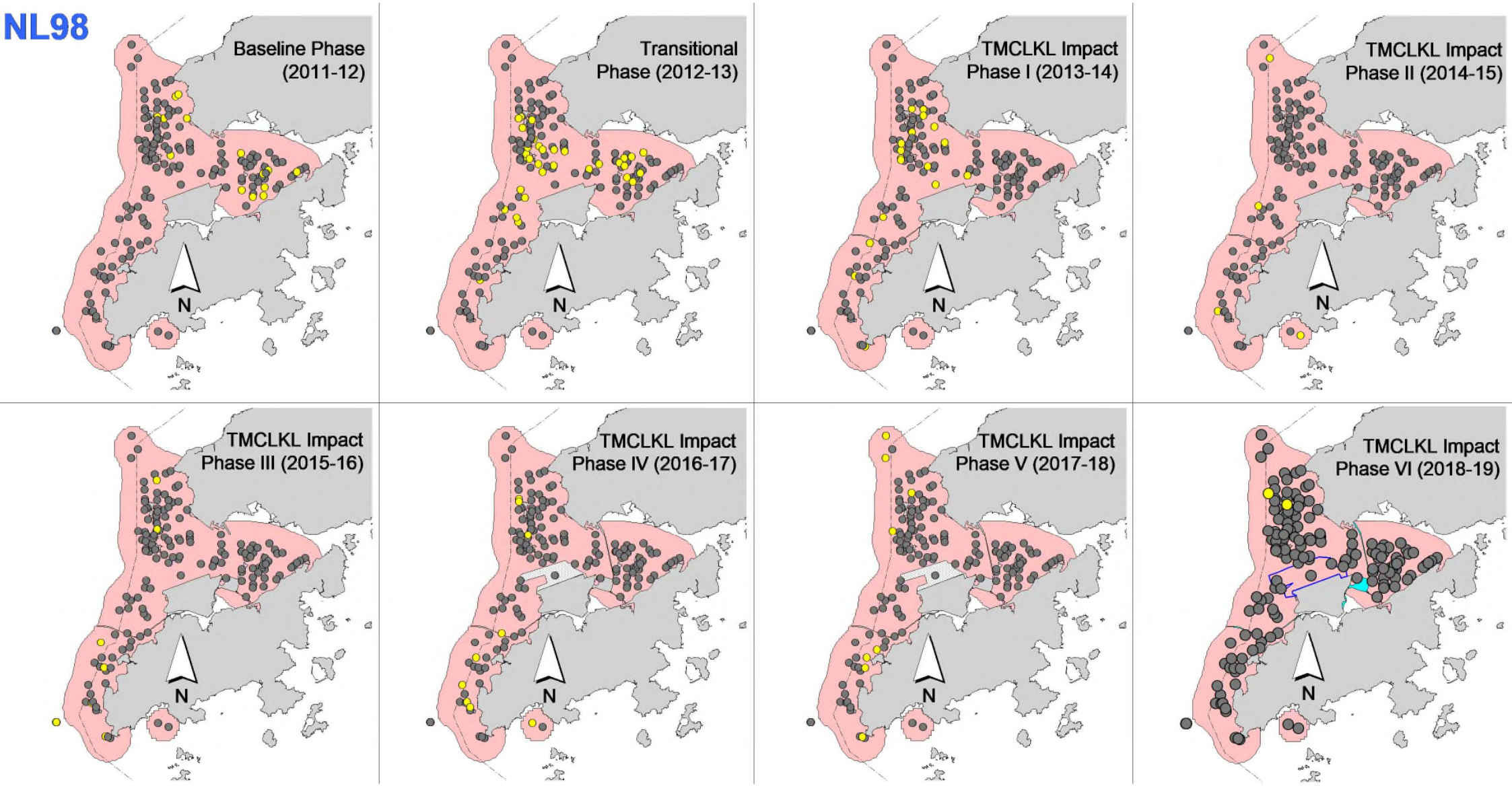




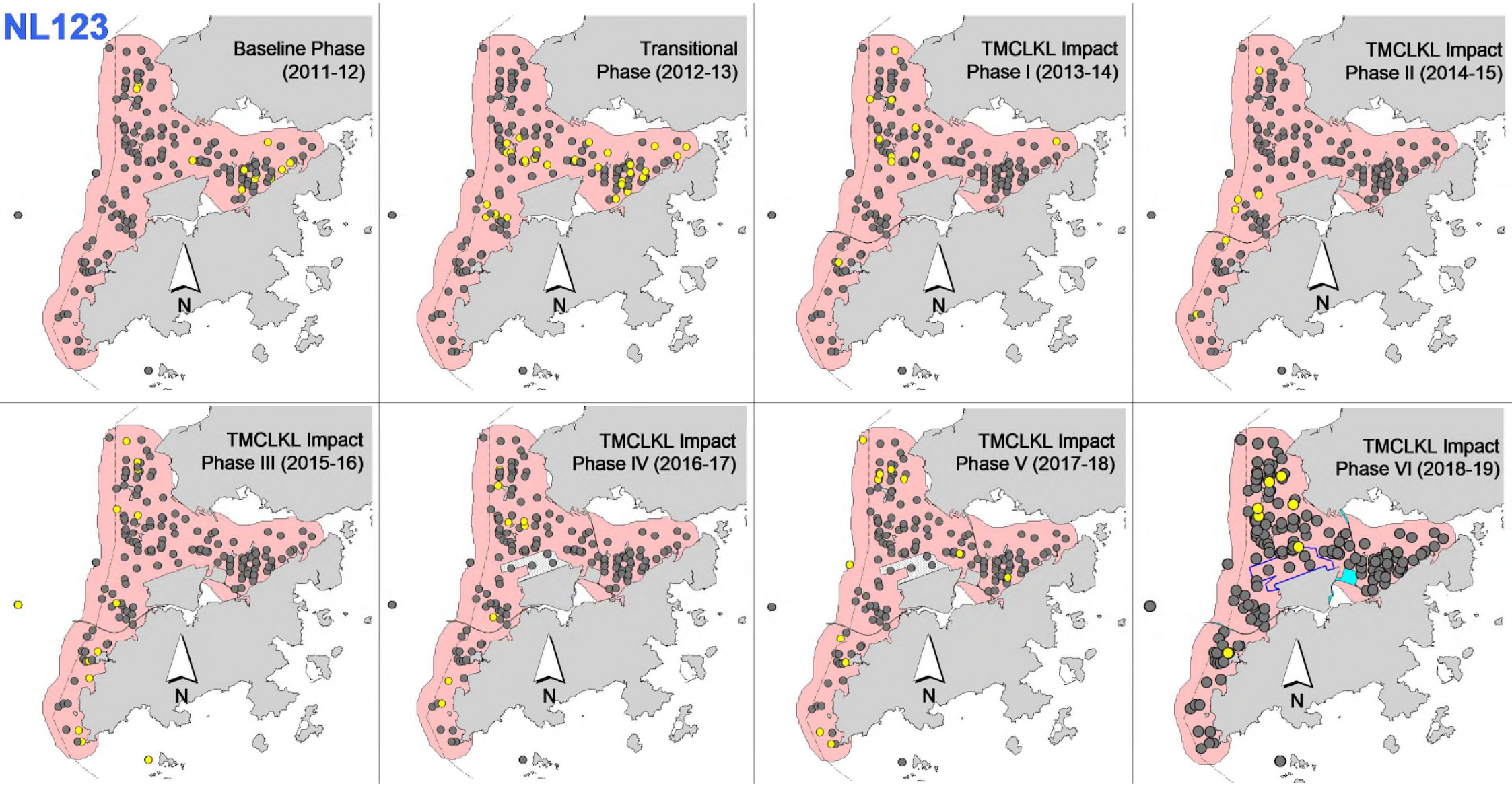
Appendix V. Temporal changes in range use patterns of eight individual dolphins during baseline, transitional & six impact phases of TMCLKL construction (note: yellow dots indicates sightings made in corresponding period)



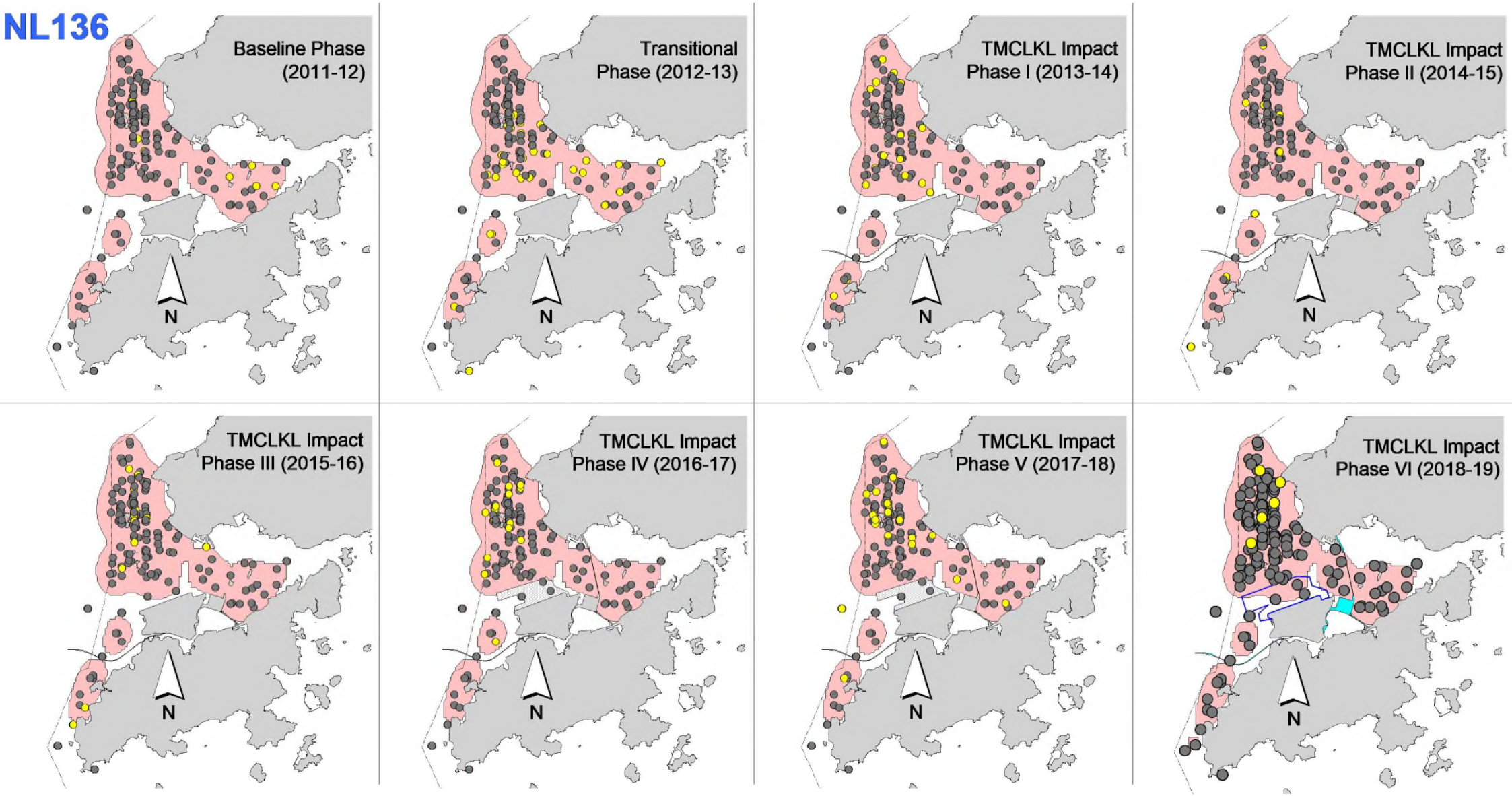
Appendix V. (cont'd)



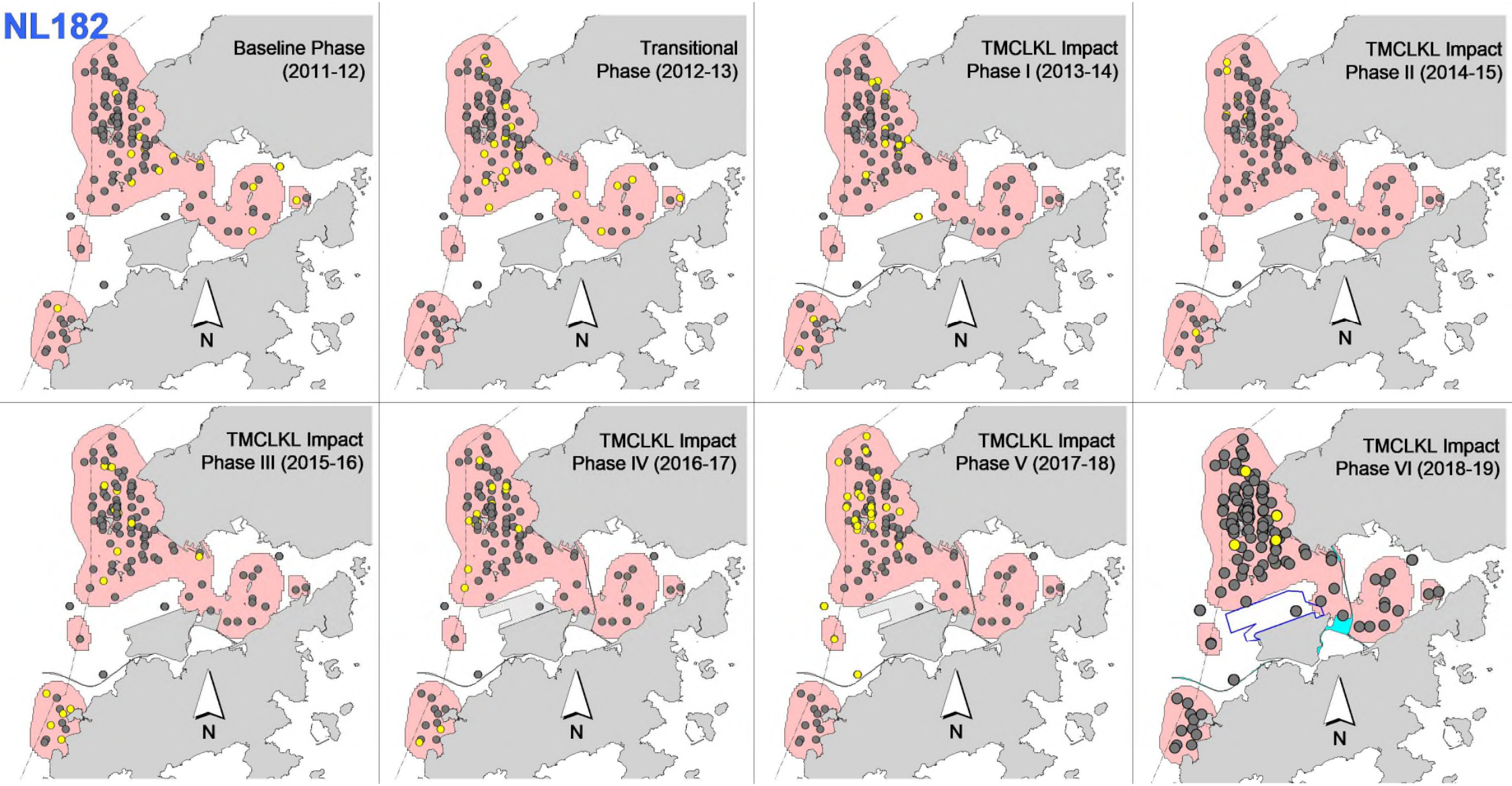
Appendix V. (cont'd)



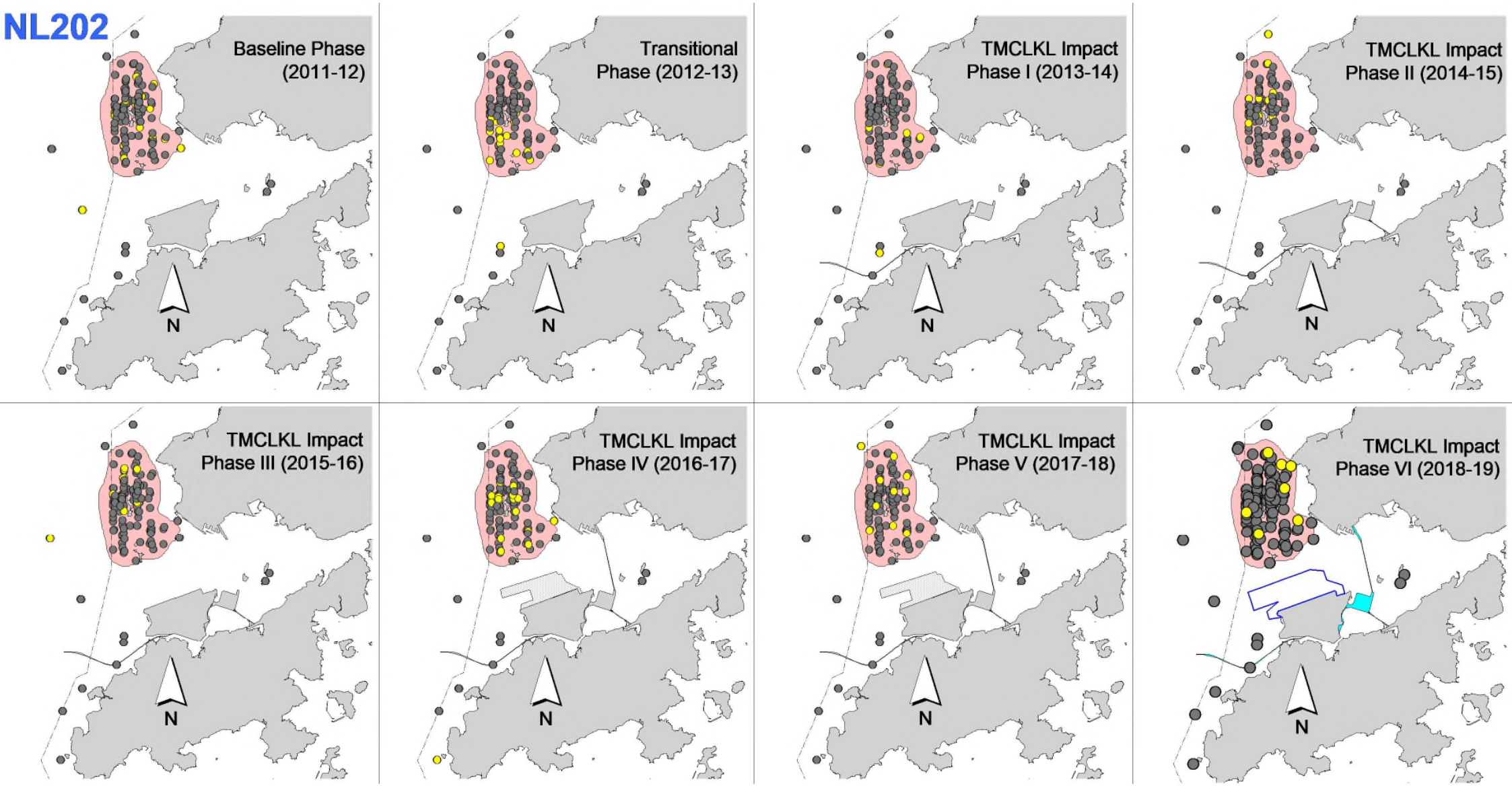
Appendix V. (cont'd)



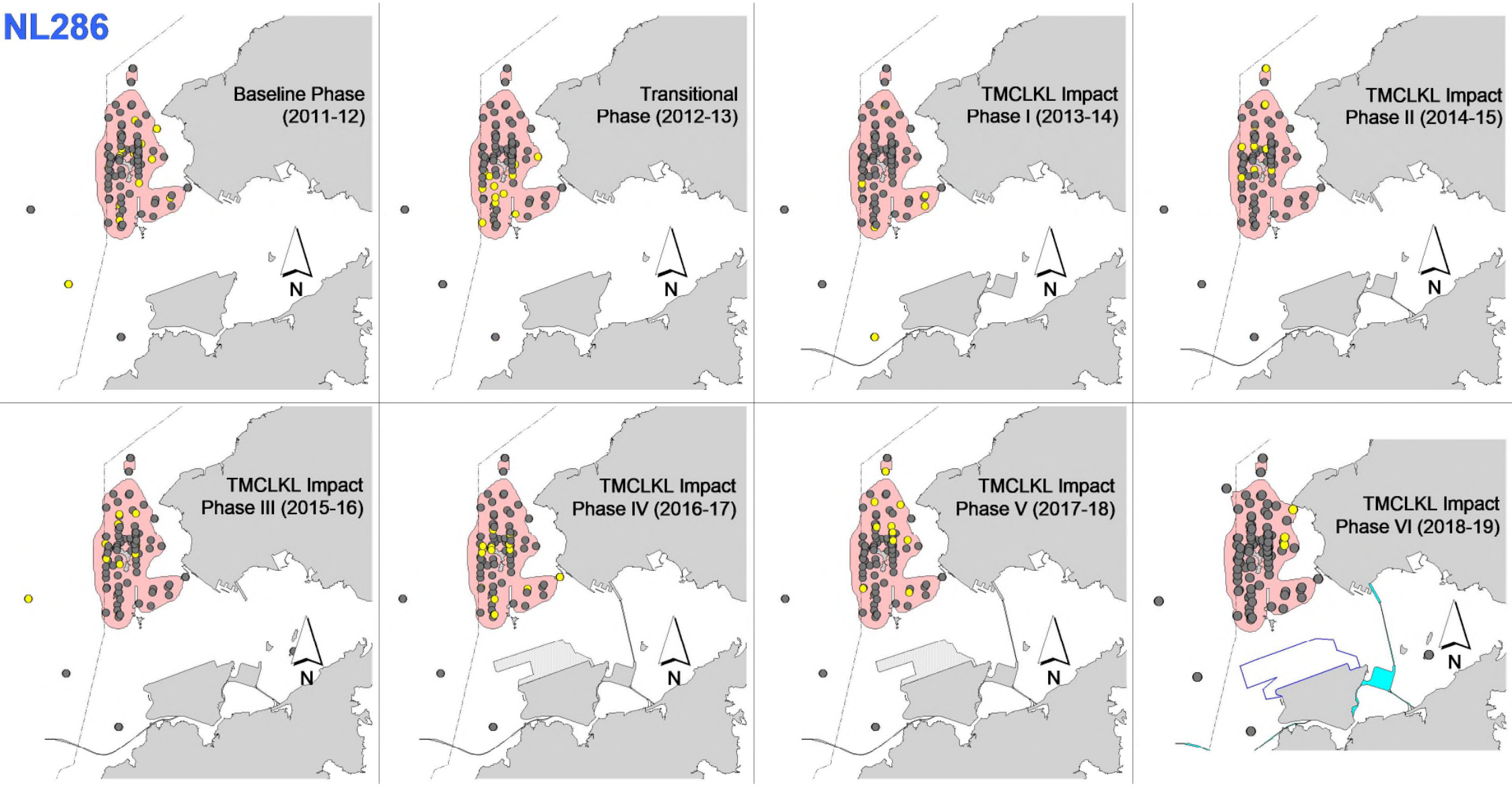
Appendix V. (cont'd)



Appendix V. (cont'd)



Appendix V. (cont'd)



Appendix V. (cont'd)

Appendix G

Event and Action Plan

Event and Action Plan for Impact Air Monitoring

	Action			
	ET [(a)]	**IEC [(a)]**	**SOR [(a)]**	**Contractor(s)**
Action Level Exceedance				
	1. Identify the source. 2. Repeat measurement to confirm finding. If two consecutive measurements exceed Action Level, the exceedance is then confirmed. 3. Inform the IEC and the SOR. 4. Investigate the cause of exceedance and check Contractor's working procedures to determine possible mitigation to be implemented. 5. If the exceedance is confirmed to be Project related after investigation, increase monitoring frequency to daily. 6. Discuss with the IEC and the Contractor on remedial actions required. 7. If exceedance continues, arrange meeting with the IEC and the SOR. 8. If exceedance stops, cease additional monitoring.	1. Check monitoring data submitted by the ET. 2. Check the Contractor's working method. 3. If the exceedance is confirmed to be Project related after investigation, discuss with the ET and the Contractor on possible remedial measures. 4. Advise the SOR on the effectiveness of the proposed remedial measures. 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. Ensure remedial measures properly implemented.	1. Rectify any unacceptable practice 2. Amend working methods if appropriate 3. If the exceedance is confirmed to be Project related, submit proposals for remedial actions to IEC within 3 working days of notification 4. Implement the agreed proposals 5. Amend proposal if appropriate

	Action			
	ET [a]	**IEC [a]**	**SOR [a]**	**Contractor(s)**
Limit Level Exceedance				
	1. Identify the source. 2. Repeat measurement to confirm finding. If two consecutive measurements exceed Limit Level, the exceedance is then confirmed. 3. Inform the IEC, the SOR, the DEP and the Contractor. 4. Investigate the cause of exceedance and check Contractor's working procedures to determine possible mitigation to be implemented. 5. If the exceedance is confirmed to be Project related after investigation, increase monitoring frequency to daily. 6. Carry out analysis of the Contractor's working procedures to determine possible mitigation to be implemented. 7. Arrange meeting with the IEC and the SOR to discuss the remedial actions to be taken. 8. Assess effectiveness of the Contractor's remedial actions and keep the IEC, the DEP and the SOR informed of the results. 9. If exceedance stops, cease additional monitoring.	1. Check monitoring data submitted by the ET. 2. Check Contractor's working method. 3. If the exceedance is confirmed to be Project related after investigation, discuss with the ET and the Contractor on possible remedial measures. 4. Advise the SOR on the effectiveness of the proposed remedial measures. 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of failure in writing. 2. Notify the Contractor. 3. If the exceedance is confirmed to be Project related after investigation, in consultation with the IEC, agree with the Contractor on the remedial measures to be implemented. 4. Ensure remedial measures are properly implemented. 5. If exceedance continues, consider what activity of the work is responsible and instruct the Contractor to stop that activity of work until the exceedance is abated.	1. Take immediate action to avoid further exceedance. 2. If the exceedance is confirmed to be Project related after investigation, submit proposals for remedial actions to IEC within 3 working days of notification. 3. Implement the agreed proposals. 4. Amend proposal if appropriate. 5. Stop the relevant activity of works as determined by the SOR until the exceedance is abated.

Note: (a) ET – Environmental Team; IEC – Independent Environmental Checker; SOR – Supervising Officer's Representative

Event & Action Plan for Impact Water Quality Monitoring

Event	ET Leader	IEC	SOR	Contractor
Action level being exceeded by one sampling day	1. Repeat *in situ* measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor and SOR; 4. Check monitoring data, all plant, equipment and Contractor's working methods.	1. Check monitoring data submitted by ET and Contractor's working methods.	1. Confirm receipt of notification of non-compliance in writing; 2. Notify Contractor.	1. Inform the SOR and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Amend working methods if appropriate.
Action level being exceeded by two or more consecutive sampling days	1. Repeat measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, Contractor, SOR and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, SOR and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Action level;	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the SOR accordingly; 4. Supervise the implementation of mitigation measures.	1. Discuss with IEC on the proposed mitigation measures; 2. Ensure mitigation measures are properly implemented; 3. Assess the effectiveness of the implemented mitigation measures.	1. Inform the Supervising Officer and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Submit proposal of additional mitigation measures to SOR within 3 working days of notification and discuss with ET, IEC and SOR; 5. Implement the agreed mitigation measures.
Limit level being exceeded by one sampling day	1. Repeat measurement on next day of exceedance to confirm findings;	1. Check monitoring data submitted by ET and	1. Confirm receipt of notification of failure in	1. Inform the SOR and confirm notification of the

Event	ET Leader	IEC	SOR	Contractor
	2. Identify source(s) of impact; 3. Inform IEC, Contractor, SOR and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, SOR and Contractor;	Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the proposed mitigation measures submitted by Contractor and advise the SOR accordingly.	writing; 2. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 3. Request Contractor to review the working methods.	non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment and consider changes of working methods; 4. Submit proposal of mitigation measures to SOR within 3 working days of notification and discuss with ET, IEC and SOR.
Limit level being exceeded by two or more consecutive sampling days	1. Repeat measurement on next day of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, SOR and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, SOR and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days;	1. Check monitoring data submitted by ET and Contractor's working method; 2. Discuss with ET and Contractor on possible remedial actions; 3. Review the Contractor's mitigation measures whenever necessary to assure their effectiveness and advise the SOR accordingly; 4. Supervise the implementation of mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Ensure mitigation measures are properly implemented; 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.	1. Take immediate action to avoid further exceedance; 2. Submit proposal of mitigation measures to SOR within 3 working days of notification and discuss with ET, IEC and SOR; 3. Implement the agreed mitigation measures; 4. Resubmit proposals of mitigation measures if problem still not under control; 5. As directed by the Supervising Officer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.

Note: ET – Environmental Team, IEC – Independent Environmental Checker, SOR – Supervising Officer's Representative

Event / Action Plan for Impact Dolphin Monitoring

EVENT	ACTION			
	ET	**IEC**	**SOR**	**Contractor**
Action Level	1. Repeat statistical data analysis to confirm findings; 2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences; 3. Identify source(s) of impact; 4. Inform the IEC, SOR and Contractor; 5. Check monitoring data. 6. Review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary.	1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and finding with the ET and the Contractor.	1. Discuss monitoring with the IEC and any other measures proposed by the ET; 2. If SOR is satisfied with the proposal of any other measures, SOR to signify the agreement in writing on the measures to be implemented.	1. Inform the SOR and confirm notification of the non-compliance in writing; 2. Discuss with the ET and the IEC and propose measures to the IEC and the SOR; 3. Implement the agreed measures.
Limit Level	1. Repeat statistical data analysis to confirm findings; 2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences;	1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and findings with the ET and the Contractor; 3. Attend the meeting to discuss with ET, SOR and	1. Attend the meeting to discuss with ET, IEC and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures. 2. If SOR is satisfied with the	1. Inform the SOR and confirm notification of the non-compliance in writing; 2. Attend the meeting to discuss with ET, IEC and SOR the necessity of additional dolphin monitoring and any other

EVENT	ACTION			
	ET	**IEC**	**SOR**	**Contractor**
	3. Identify source(s) of impact; 4. Inform the IEC, SOR and Contractor of findings; 5. Check monitoring data; 6. Repeat review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary. 7. If ET proves that the source of impact is caused by any of the construction activity by the works contract, ET to arrange a meeting to discuss with IEC, SOR and Contractor the necessity of additional dolphin monitoring and/or any other potential mitigation measures (e.g., consider to modify the perimeter silt curtain or consider to control/temporarily stop relevant construction activity etc.) and submit to IEC a proposal of additional dolphin monitoring and/or mitigation measures where necessary.	Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures. 4. Review proposals for additional monitoring and any other mitigation measures submitted by ET and Contractor and advise SOR of the results and findings accordingly. 5. Supervise / Audit the implementation of additional monitoring and/or any other mitigation measures and advise SOR the results and findings accordingly.	proposals for additional dolphin monitoring and/or any other mitigation measures submitted by ET and Contractor and verified by IEC, SOR to signify the agreement in writing on such proposals and any other mitigation measures. 3. Supervise the implementation of additional monitoring and/or any other mitigation measures.	potential mitigation measures. 3. Jointly submit with ET to IEC a proposal of additional dolphin monitoring and/or any other mitigation measures when necessary. 4. Implement the agreed additional dolphin monitoring and/or any other mitigation measures.

Note: ET – Environmental Team, IEC – Independent Environmental Checker, SOR – Supervising Officer's Representative

Appendix H

Cumulative Statistics on Exceedances, Complaints, Notifications of Summons and Successful Prosecutions

Table H1 *Cumulative Statistics on Exceedances*

Monitoring Parameters	Action/Limit Level	Total No. recorded in this reporting year (Nov 2018 to Oct 2019)	Total No. recorded since Contract commencement
1-Hr TSP	Action	23	96
	Limit	3	8
24-Hr TSP	Action	2	10
	Limit	0	4
Water Quality	Action	147	167
	Limit	18	19
Impact Dolphin	Action	0	11
Monitoring	Limit	4	17

Table H2 *Cumulative Statistics on Complaints, Notifications of Summons and Successful Prosecutions*

Reporting Period	Cumulative Statistics		
	Complaints	Notifications of Summons	Successful Prosecutions
This Reporting Period (Nov 2018 to Oct 2019)	1	0	0
Total No. received since Contract commencement	17	1	0

Appendix I

Waste Flow Table

Appendix D – Monthly Summary Waste Flow Table

Name of Department: HyD **Contract No. / Works Order No.:** HY/2012/08

Monthly Summary Waste Flow Table for December 2018 [to be submitted not later than the 15th day of each month following reporting month]

(All quantities shall be rounded off to 3 decimal places.)

Month	Monthly Break-down of Inert Construction & Demolition Materials (i.e. Public Fill Materials)				
	(a)=(b)+(c)+(d)+(e) Total Quantity Generated	(b) Hard Rock and Large Broken Concrete	(c) Reused in the Contract	(d) Reused in other Projects	(e) Disposed of as Public Fill
	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)
Sub-total, 2013-2017	1221.977	0.000	0.000	0.000	1221.977
Jan-2018	7.165	0.000	0.000	0.000	7.165
Feb-2018	1.762	0.000	0.000	0.000	1.762
Mar-2018	66.457	0.000	0.000	62.274	4.183
Apr-2018	123.942	0.000	0.000	50.648	73.294
May-2018	127.964	0.000	0.000	62.822	65.142
Jun-2018	102.987	0.000	0.000	55.385	47.602
Half Year Sub-total	430.277	0.000	0.000	231.129	199.148
Jul-2018	43.768	0.000	0.000	0.000	43.768
Aug-2018	57.809	0.000	0.000	40.722	17.087
Sep-2018	39.763	0.000	0.000	11.276	28.487
Oct-2018	108.689	0.000	20.471	79.694	28.342
Nov-2018	155.310	0.000	25.702	116.028	13.580
Dec-2018	146.997	0.000	30.581	106.520	9.896
Project Total Quantities	2224.407	0.000	76.754	585.369	1562.284

Month	Actual Quantities of Non-inert Construction Waste Generated Monthly								
	Metals		Paper/ cardboard packaging		Plastics (see Note 3)		Chemical Waste		Others, e.g. General Refuse disposed at Landfill
	(in '000kg)		(in '000kg)		(in '000kg)		(in '000kg)		(in '000ton)
	generated	recycled	generated	recycled	generated	recycled	generated	Disposed	generated
Sub-total, 2013-2017	619.38	619.38	4.15	4.15	6.87	6.87	33.15	33.15	8.259
Jan-2018	241.50	241.50	0.20	0.20	0.00	0.00	2.80	2.80	0.272
Feb-2018	256.94	256.94	0.20	0.20	0.00	0.00	0.00	0.00	0.258
Mar-2018	229.36	229.36	0.00	0.00	0.00	0.00	2.00	2.00	0.459
Apr-2018	195.55	195.55	0.00	0.00	0.00	0.00	8.60	8.60	0.281
May-2018	93.01	93.01	0.30	0.30	0.00	0.00	10.40	10.40	0.686
Jun-2018	0.00	0.00	0.00	0.00	1.06	1.06	0.00	0.00	0.408
Half Year Sub-total	1016.36	1016.36	0.70	0.70	1.06	1.06	23.80	23.80	2.364
Jul-2018	0.00	0.00	0.86	0.86	0.77	0.77	0.00	0.00	0.768
Aug-2018	980.56	980.56	0.00	0.00	0.00	0.00	2.00	2.00	0.749
Sep-2018	838.04	838.04	0.00	0.00	0.00	0.00	0.00	0.00	0.445
Oct-2018	2702.35	2702.35	1.02	1.02	0.00	0.00	0.00	0.00	0.437
Nov-2018	394.69	394.69	0.00	0.00	0.00	0.00	1.40	1.40	0.448
Dec-2018	212.44	212.44	1.01	1.01	0.00	0.00	0.00	0.00	0.519
Project Total Quantities	6763.82	6763.82	7.74	7.74	8.70	8.70	60.35	60.35	13.989

Forecast of Total Quantities of Construction and Demolition Materials to be Generated from the Contract*									
Total Quantity Generated	Hard Rock and Large Broken Concrete	Reused in the Contract	Reused in other Projects	Disposed of as Public Fill	Metals	Paper/ cardboard packaging	Plastics (see Note 3)	Chemical Waste	General Refuse disposed of at Landfill
(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000kg)	(in '000kg)	(in '000kg)	(in '000kg)	(in '000 ton)
2850.000	0.000	50.000	800.000	2000.000	7000.00	10.00	9.50	65.00	15.000

Notes:
(1) The performance targets are given in the **ER Appendix 8J Clause 14** and the EM & A Manual(s).
(2) The waste flow table shall also include C&D materials to be imported for use at the Site.
(3) Plastics refer to plastic bottles/containers, plastic sheets/foam from packaging material.
(4) The Contractor shall also submit the latest forecast of the total amount of C&D materials expected to be generated from the Works, together with a breakdown of the nature where the amount of C&D materials expected to be generated from the Works is equal to or exceeding 50,000 m^3. (**ER Part 8 Clause 8.8.5 (d) (ii)** refers).

Monthly Summary Waste Flow Table

Name of Department: HyD **Contract No. / Works Order No.: HY/2012/08**

Monthly Summary Waste Flow Table for October 2019 [to be submitted not later than the 15th day of each month following reporting month] (All quantities shall be rounded off to 3 decimal places.)

Month	Monthly Break-down of Inert Construction & Demolition Materials (i.e. Public Fill Materials)				
	(a)=(b)+(c)+(d)+(e) Total Quantity Generated	(b) Hard Rock and Large Broken Concrete	(c) Reused in the Contract	(d) Reused in other Projects	(e) Disposed of as Public Fill
	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)
Sub-total	2224.407	0.000	76.754	585.369	1562.284
Jan-2019	299.831	0.000	53.419	215.427	30.985
Feb-2019	133.335	0.000	46.021	67.707	19.607
Mar-2019	120.224	0.000	50.455	20.964	48.805
Apr-2019	130.329	0.000	58.956	0.000	71.373
May-2019	67.355	0.000	51.297	0.000	16.058
Jun-2019	4.134	0.000	0.000	0.000	4.134
Half Year Sub-total	755.208	0.000	260.148	304.098	190.962
Jul-2019	3.821	0.000	0.000	0.000	3.821
Aug-2019	2.388	0.000	0.000	0.000	2.388
Sep-2019	4.191	0.000	0.000	0.000	4.191
Oct-2019	8.366	0.000	0.000	0.000	8.366
Nov-2019					
Dec-2019					
Project Total Quantities	2998.391	0.000	336.902	889.467	1772.012

Month	**Actual Quantities of Non-inert Construction Waste Generated Monthly**								
	Metals		Paper/ cardboard packaging		Plastics (see Note 3)		Chemical Waste		Others, e.g. General Refuse disposed at Landfill
	(in '000kg)		(in '000kg)		(in '000kg)		(in '000kg)		(in '000ton)
	generated	recycled	generated	recycled	generated	recycled	generated	Disposed	generated
Sub-total	6763.82	6763.82	7.74	7.74	8.70	8.70	60.35	60.35	13.989
Jan-2019	394.55	394.55	0.00	0.00	0.00	0.00	0.00	0.00	0.538
Feb-2019	103.72	103.72	0.62	0.62	0.00	0.00	1.672	1.672	0.578
Mar-2019	88.20	88.20	0.46	0.46	0.00	0.00	0.00	0.00	0.692
Apr-2019	260.89	260.89	0.00	0.00	3.90	3.90	1.045	1.045	0.707
May-2019	0.66	0.66	1.46	1.46	0.00	0.00	0.00	0.00	0.798
Jun-2019	136.75	136.75	0.66	0.66	0.00	0.00	4.14	4.14	0.751
Half Year Sub-total	984.77	984.77	3.20	3.20	3.90	3.90	6.857	6.857	4.064
Jul-2019	444.37	444.37	1.20	1.20	0.00	0.00	0.00	0.00	0.730
Aug-2019	505.93	505.93	0.00	0.00	1.58	1.58	3.80	3.80	0.703
Sep-2019	397.10	397.10	0.60	0.60	1.62	1.62	8.00	8.00	0.737
Oct-2019	523.05	523.05	0.00	0.00	1.04	1.04	5.80	5.80	0.754
Nov-2019									
Dec-2019									
Project Total Quantities	9619.04	9619.04	12.74	12.74	16.84	16.84	84.807	84.807	20.977

Forecast of Total Quantities of Construction and Demolition Materials to be Generated from the Contract*				
Total Quantity Generated	Hard Rock and Large Broken Concrete	Reused in the Contract	Reused in other Projects	Disposed of as Public Fill
(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)	(in '000 ton)
3200.000	0.000	350.000	1000.000	2000.000

Forecast of Total Quantities of Construction and Demolition Materials to be Generated from the Contract*				
Metals	Paper/ cardboard packaging	Plastics (see Note 3)	Chemical Waste	General Refuse disposed of at Landfill
(in '000kg)	(in '000kg)	(in '000kg)	(in '000kg)	(in '000 ton)
10500.00	20.00	20.00	100.00	30.000

Notes:
(1) The performance targets are given in the **ER Appendix 8J Clause 14** and the EM & A Manual(s).
(2) The waste flow table shall also include C&D materials to be imported for use at the Site.
(3) Plastics refer to plastic bottles/containers, plastic sheets/foam from packaging material.
(4) The Contractor shall also submit the latest forecast of the total amount of C&D materials expected to be generated from the Works, together with a breakdown of the nature where the amount of C&D materials expected to be generated from the Works is equal to or exceeding 50,000 m^3. (**ER Part 8 Clause 8.8.5 (d) (ii)** refers).