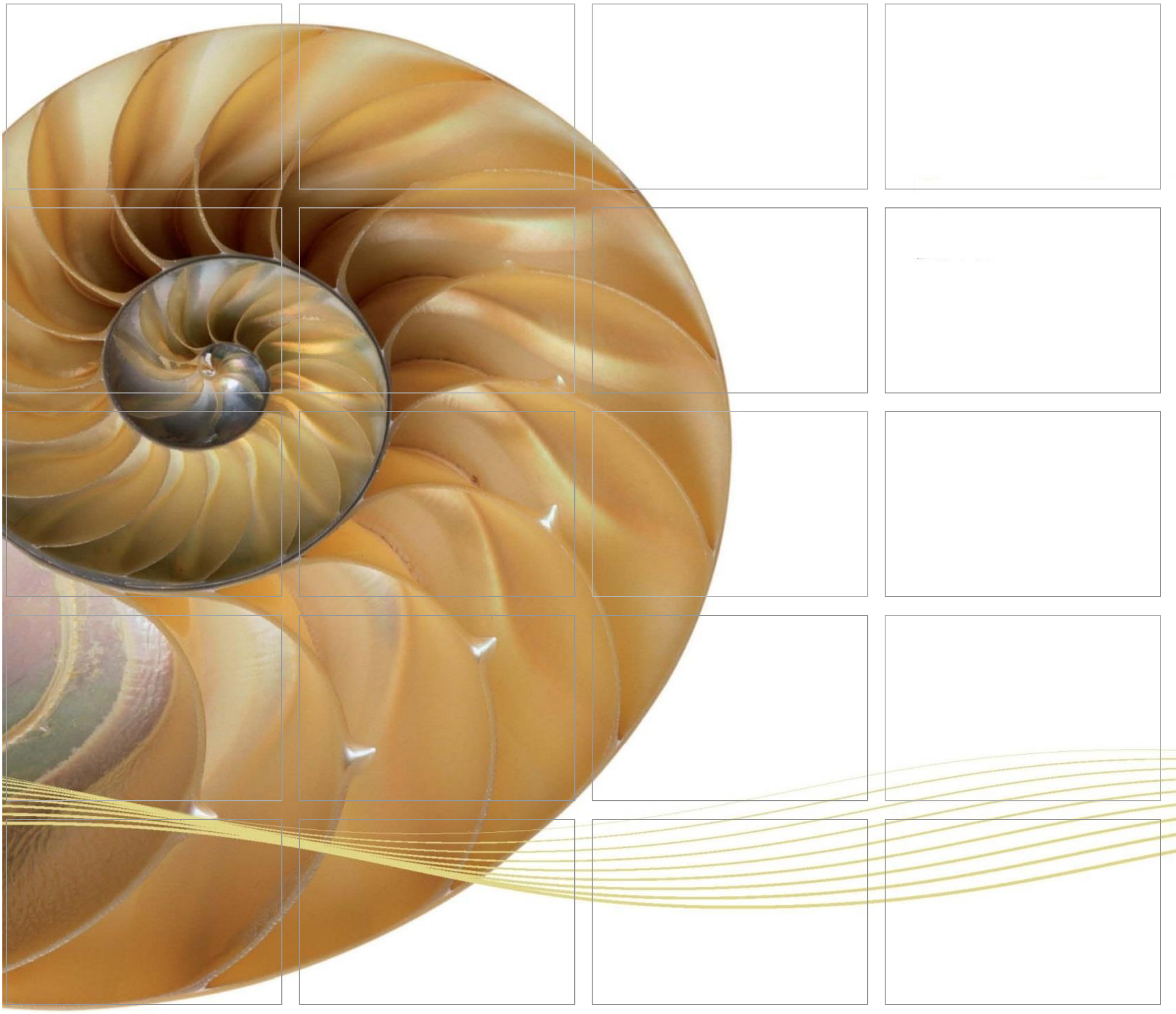
Report



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

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

30 July 2019

Environmental Resources Management
2507, 25/F One Harbourfront
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Ref.: HYDHZMBEEM00_0_7600L.19.docx

01 August 2019

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: Messrs. Andy Westmoreland / Roger Man

Dear Sirs,

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

Reference is made to the Fifth Annual EM&A Report (Nov. 2017 – Oct. 2018) (ET's ref.: "*0212330_5th Annual EM&A_20190730.doc*" dated 30 July 2019) certified by the ET Leader and provided to us via e-mail on 30 July 2019.

Please be informed that we have no further comments on the captioned Report. However, as mentioned in our letters for the First, Second, Third and Fourth Annual EM&A Report (our ref. HYDHZMBEEM00_0_4359L.16, HYDHZMBEEM00_0_5396L.17, HYDHZMBEEM00_0_6338L.18 and HYDHZMBEEM00_0_7021L.18), 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,

F. C. Tsang
Independent Environmental Checker
Tuen Mun – Chek Lap Kok Link

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c.c. HyD – Mr. Stephen Chan (By Fax: 3188 6614)
HyD – Mr. Tony Pang (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, DF, ENPO Site

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

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

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Client: DBJV	Project No: 0212330
Summary: This document presents the Fifth Annual EM&A Report for Tuen Mun – Chek Lap Kok Link Northern Connection Sub-sea Tunnel Section.	Date: 30 July 2019 Approved by: *Mr Craig Reid* *Partner* Certified by: *Dr Jasmine Ng* *ET Leader*

	5th Annual EM&A Report	VAR	JN	CAR	30/07/19
Revision	Description	By	Checked	Approved	Date

Distribution

☐ Internal

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EXECUTIVE SUMMARY

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 by the end of 2019. 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 Fifth Annual EM&A report presenting the EM&A works carried out during the period from 1 November 2017 to 31 October 2018 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

- Box Culvert Extension at Works Area – Portion N-A;
- Construction of North Ventilation Building – Portion N-C;
- Construction of Cross Passage Tympanum – TBM tunnel;
- Cross Passage Lining Installation – TBM Tunnel;
- Cross Passage Construction by Pipe Jacking – TBM Tunnel;
- Excavation of Sub-sea Tunnel – TBM tunnel;
- Corbel & OVHD Construction – TBM Tunnel;
- Parapet wall Installation – TBM Tunnel;
- Phase 2 Surcharge Removal – Portion N-A;
- Bulk Excavation – Portion S-A;
- CSM treatment, Jet Grouting works and D-wall Construction; and
- Ground Freezing Works – Portion S-A

Construction Activities Undertaken
Marine-based Works • Seawall Construction and Filling works – Portion N-A; and • Seawall Enhancement works – Portion N-C

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

24-hour TSP Monitoring	120 sessions
1-hour TSP Monitoring	120 sessions
Water Quality Monitoring	26 sessions
Impact Dolphin Monitoring	24 sessions
Joint Environmental Site Inspection	53 sessions

Implementation of Marine Mammal Exclusion Zone

Daily marine mammal exclusion zone was in effect during the period of dredging, reclamation or marine sheet piling works in open waters under this Contract. Passive Acoustic Monitoring (PAM) was also implemented for the detection of marine mammal when dredging, reclamation or marine sheet piling works were carried out outside the daylight hours under this Contract. 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.

Summary of Breaches of Action/Limit Levels

Breaches of Action and Limit Levels for Air Quality

Twenty-nine (29) Action Level exceedances of 1-hour TSP, two (2) Limit Level exceedances of 1-hour TSP, two (2) Action Level exceedances of 24-hour TSP and three (3) Limit Level exceedances of 24-hour TSP were recorded in the air quality monitoring of this reporting period.

Breaches of Action and Limit Levels for Water Quality

Fourteen (14) Action Level exceedances were recorded from the water quality monitoring in this reporting period.

Dolphin Monitoring

Whilst two (2) Action Level and three (3) Limit Level exceedances were recorded for four (4) sets of quarterly dolphin monitoring data between November 2017 and October 2018, 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 reports were submitted to ENPO and reported in the subsequent EM&A reports.

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*

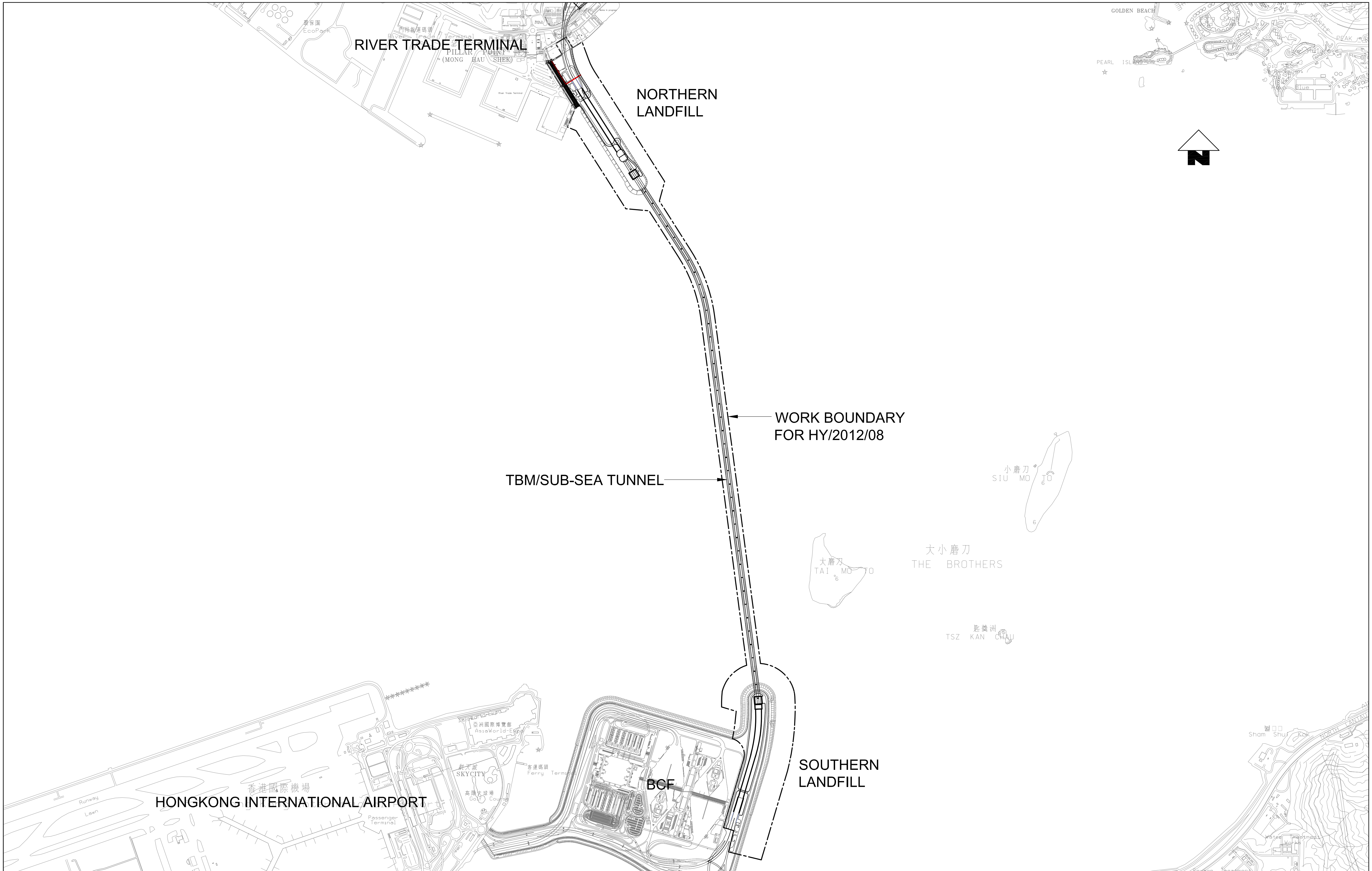
According to the findings of the Northwest New Territories (NWNT) Traffic and Infrastructure Review conducted by the Transport Department, Tuen Mun Road, Ting Kau Bridge, Lantau Link and North Lantau Highway would be operating beyond capacity after 2016. This forecast has been based on the estimated 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 by 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 Hong Kong 香港寶嘉 — A member of the Bouygues Construction group; BOUYGUES TRAVAUX PUBLICS
Dragages - Bouygues Joint Venture 寶嘉 - 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
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Issue Status: DFT (DRAFT)
Revision: A

1.2 *SCOPE OF REPORT*

This is the Fifth 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 2017 to 31 October 2018.

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 22/HZMB	Chow Man Lung, Andrew	2762 4110	2762 4110
SOR (AECOM Asia Company Limited)	Chief Resident Engineer	Roger Man	2293 6388	2293 6300
		Andrew Westmoreland	2293 6360	2293 6300
ENPO / IEC (Ramboll Hong Kong Ltd.)	ENPO Leader	Y.H. Hui	3465 2850	3465 2899
	IEC	Dr. F.C. Tsang	3465 2851	3465 2899
Contractor (Dragages – Bouygues Joint Venture)	Deputy Environmental Manager	Bryan Lee	2293 7323	2293 7499
	Senior Environmental Officer	Ashley Au	52950766	
	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*.

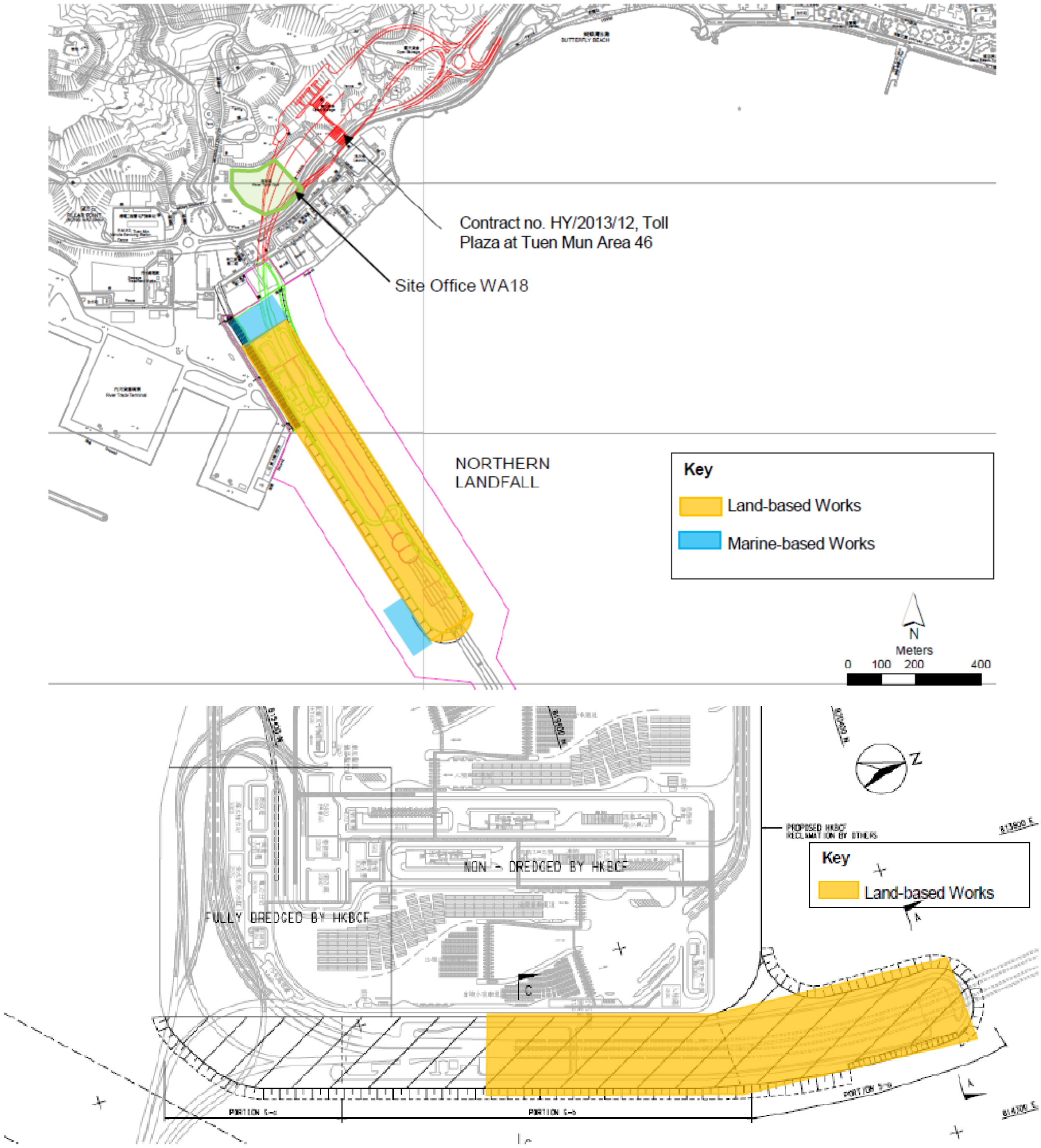
The general layout plan of the site showing the detailed works areas is shown in *Figure 1.2*. The Environmental Sensitive Receivers in the vicinity of the Project are shown in *Figure 1.3*.

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
• Box Culvert Extension at Works Area – Portion N-A; • Construction of North Ventilation Building – Portion N-C; • Construction of Cross Passage Tympanum – TBM tunnel; • Cross Passage Lining Installation – TBM Tunnel; • Cross Passage Construction by Pipe Jacking – TBM Tunnel; • Excavation of Sub-sea Tunnel – TBM tunnel; • Corbel & OVHD Construction – TBM Tunnel; • Parapet wall Installation – TBM Tunnel; • Bulk Excavation – Portion S-A; • CSM treatment, Jet Grouting works and D-wall Construction; and • Ground Freezing Works – Portion S-A
Marine-based Works
• Seawall Construction and Filling works – Portion N-A; and • Seawall Enhancement works – Portion N-C

Figure 1.2 Locations of Construction Activities – November 2017 to October 2018



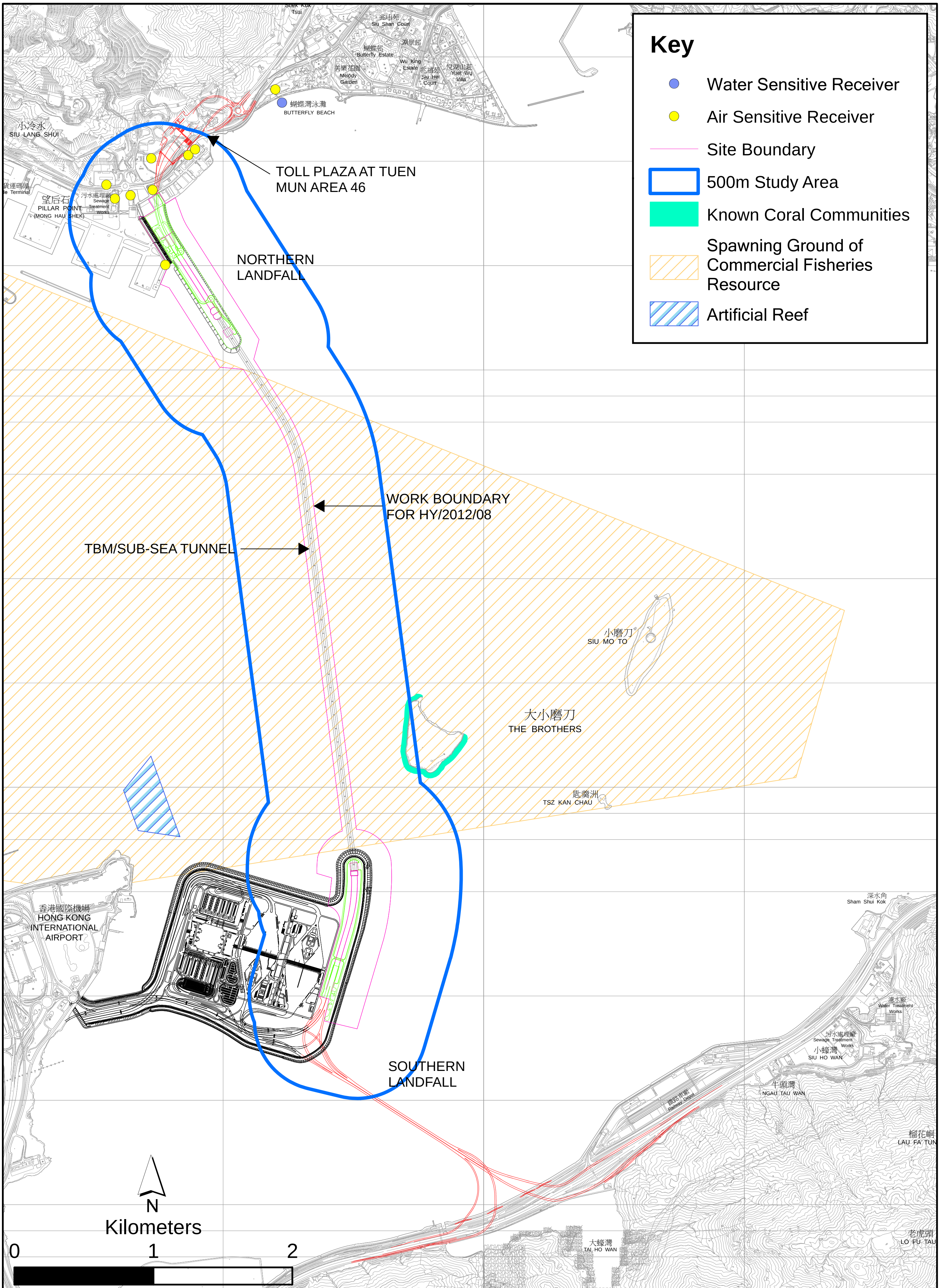


Figure 1.3

Environmental Sensitive Receivers in the vicinity of Contract No. HY/2012/08 Tuen Mun - Chek Lap Kok Link - Northern Connection Sub-Sea Tunnel Section

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Date: 15/4/2014

Environmental Resources Management

ERM

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.

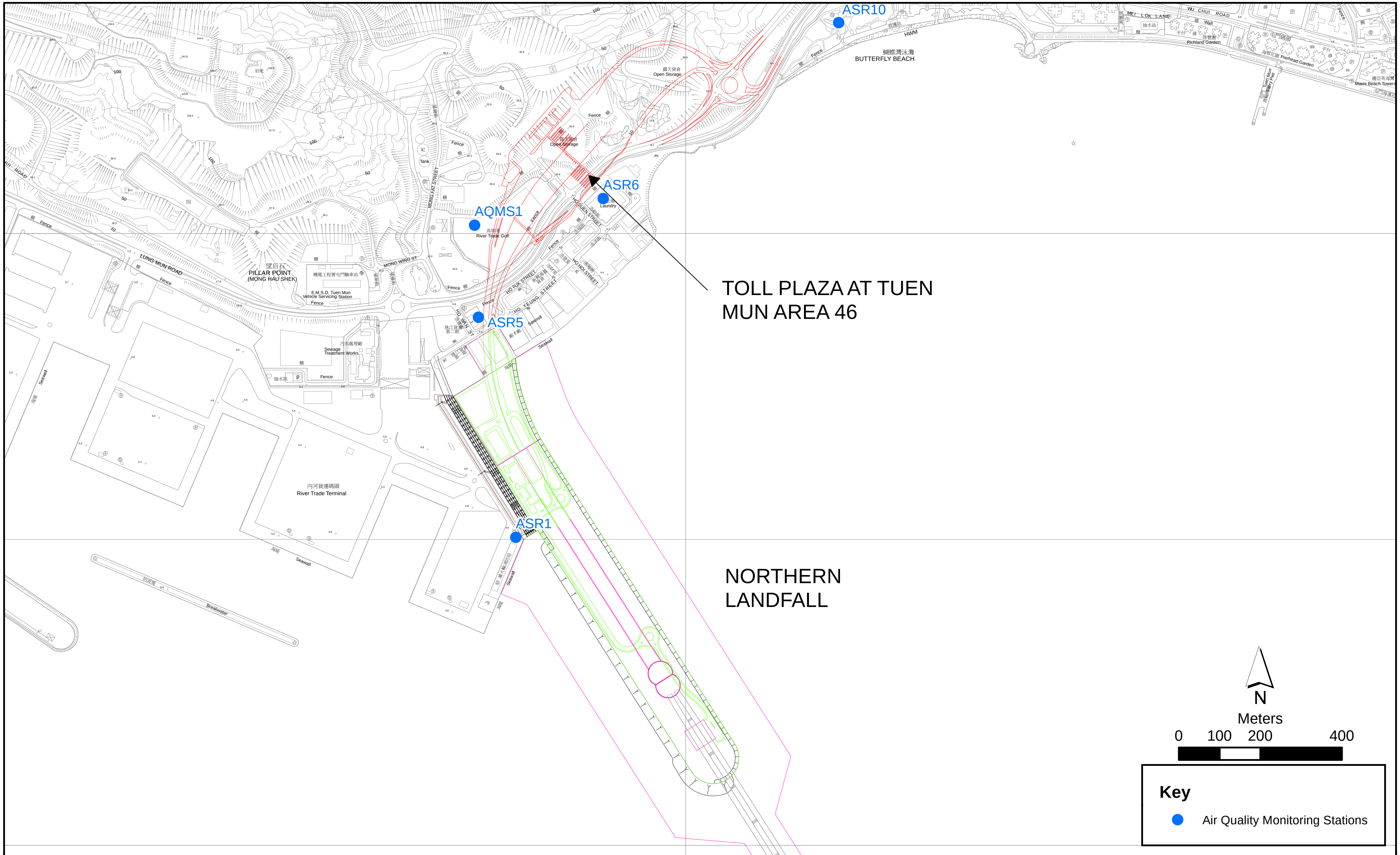

Figure 2.1

Air Quality Monitoring Stations for the Enhanced TSP Monitoring

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Date: 21/2/2014

Environmental Resources Management

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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 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
ASR5	Pillar Point Fire Station	Office	
AQMS1	Previous River Trade Golf	Bare ground	
AQMS2/ASR6	Bare ground at Ho Suen Street /Butterfly Beach Laundry	Bare ground/Office	
ASR10	Butterfly Beach Park	Recreational uses	

*Notes: AQMS2 was relocated and HVS was re-installed at ASR6 (Butterfly Beach Laundry) on 17 January 2014. AQMS2 was then superseded by ASR6 for the impact air quality monitoring. Impact air quality monitoring at ASR6 commenced on 21 January 2014.

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: Weather Wizard III (S/N: WE90911A30) 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 and *Contract No. HY/2013/12* 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 *Thirty-seventh* to *Forty-eighth Monthly EM&A Report*.

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 2017 to October 2018	ASR 1	138	13 - 584	331	500
	ASR 5	167	13 - 455	340	500
	AQMS1	99	14 - 324	335	500
	ASR6	123	13 - 335	338	500
	ASR10	87	13 - 816	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 2017 to October 2018	ASR 1	89	19 - 328	213	260
	ASR 5	100	23 - 279	238	260
	AQMS1	64	16 - 207	213	260
	ASR6	77	18 - 178	238	260
	ASR10	59	17 - 250	214	260

In this reporting period, a total of 120 monitoring events were undertaken. Twenty-nine (29) Action Level exceedances of 1-hour TSP, two (2) Limit Level exceedances of 1-hour TSP, two (2) Action Level exceedances of 24-hour TSP and three (3) Limit Level exceedances of 24-hour TSP were 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 and ASR10 in the reporting period were significantly lower than the average results of baseline monitoring while the average result of ASR6 is slightly lower than the average results of baseline monitoring. The average results of monitoring stations ASR1 and ASR5 in the reporting period were slightly higher than the average results of baseline monitoring (AQMS1: $F_{1,401} = 21.49$, $p < 0.01$, ASR6: $F_{1,401} = 1.74$, $p = 0.19$, ASR1: $F_{1,401} = 0.98$, $p = 0.32$, ASR10: $F_{1,401} = 19.3$, $p < 0.01$ and ASR5: $F_{1,401} = 5.67$ $p = 0.018$). 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: $F_{1,130} = 53.21$, $p < 0.01$, ASR6: $F_{1,130} = 85.79$, $p < 0.01$, ASR1: $F_{1,130} = 7.92$, $p < 0.01$, ASR10: $F_{1,130} = 52.43$, $p < 0.01$ and ASR5: $F_{1,130} = 27.73$, $p < 0.01$). 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	138
ASR1(24-hour TSP)	128	89
ASR5(1-hour TSP)	138	167
ASR5(24-hour TSP)	167	100
AQMS1(1-hour TSP)	131	99
AQMS1(24-hour TSP)	127	64
ASR6(1-hour TSP)	135	123
ASR6(24-hour TSP)	166	77
ASR10(1-hour TSP)	134	87
ASR10(24-hour TSP)	129	59

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	0.051	$F_{1,358} = 19.0$	<0.001	249.5	-0.092
	AQMS2 / ASR6	0.043	$F_{1,358} = 15.9$	<0.001	317.1	-0.119

Parameter	Station	R^2	F-ratio	p-value	Intercept	Coefficient
	ASR1	0.023	$F_{1,358}$ = 8.44	<0.001	339.1	-0.123
	ASR10	0.094	$F_{1,358}$ = 37.2	<0.001	401.1	-0.192
	ASR5	0.034	$F_{1,358}$ = 12.60	<0.001	391.6	-0.137
24-hour TSP	AQMS1	0.191	$F_{1,115}$ = 26.9	<0.001	247.4	-0.112
	AQMS2 /ASR6	0.152	$F_{1,115}$ = 20.51	<0.001	278.9	-0.123
	ASR1	0.218	$F_{1,115}$ = 31.7	<0.001	437.2	-0.212
	ASR10	0.215	$F_{1,115}$ = 31.3	<0.001	289.9	-0.141
	ASR5	0.126	$F_{1,115}$ = 16.42	<0.001	337.3	-0.145

Note:
1. Dependent variable is set as TSP levels (in μg/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.

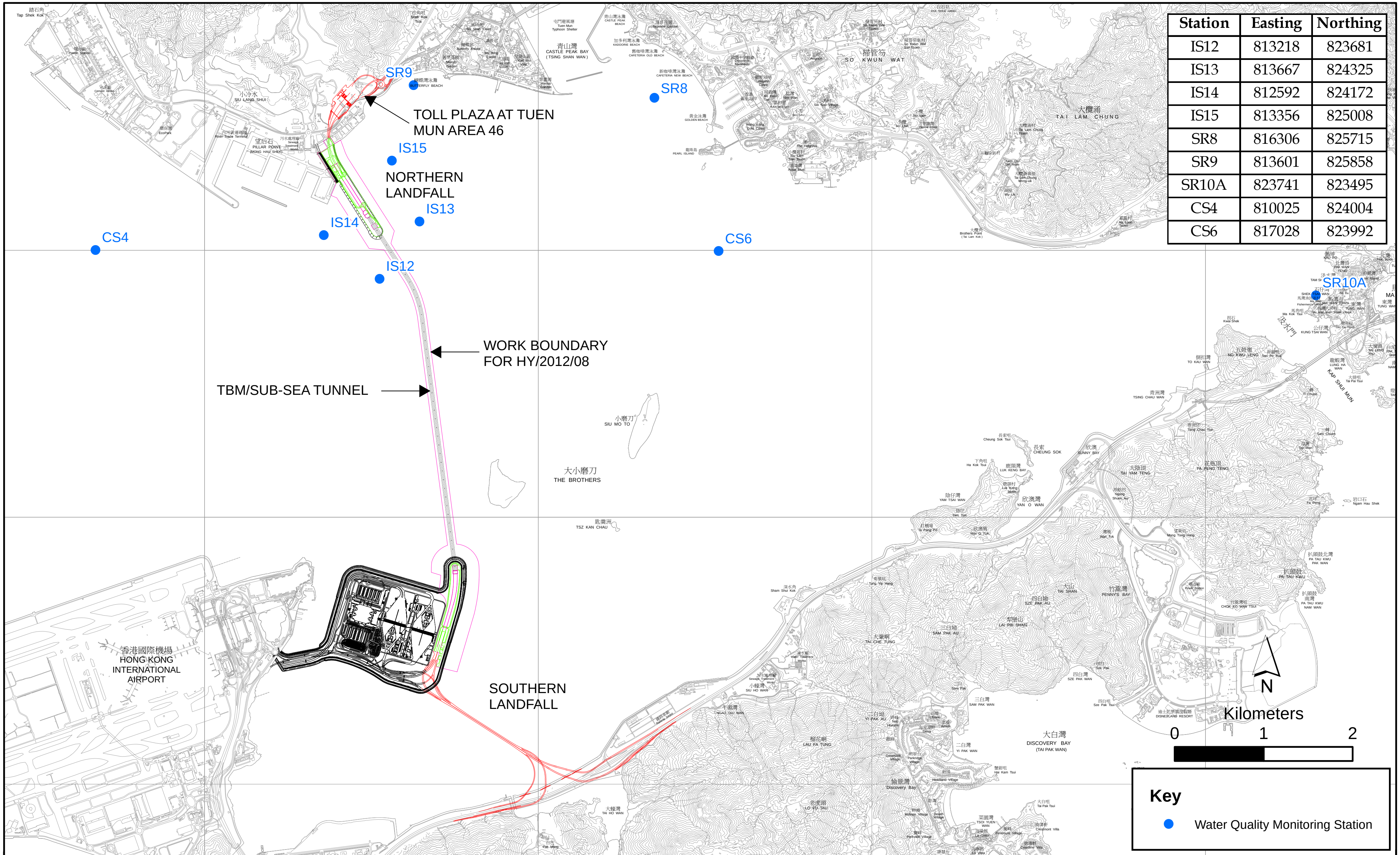
2.2.1 *Monitoring Requirements & Equipment*

In accordance with the Updated EM&A Manual, impact water quality monitoring was carried out three (3) days per week during the construction period at nine (9) water quality monitoring stations (*Figure 2.2*; *Table 2.7*).

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

Station ID	Type	Coordinates		*Parameters, unit	Depth	Frequency
		Easting	Northing			
IS12	Impact Station	813218	823681	• 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.
IS13	Impact Station	813667	824325			
IS14	Impact Station	812592	824172			
IS15	Impact Station	813356	825008			
CS4	Control / Far Field Station	810025	824004			
CS6	Control / Far Field Station	817028	823992			
SR8	Sensitive receiver (Gazettal beaches in Tuen Mun)	816306	825715			
SR9	Sensitive receiver (Butterfly Beach)	813601	825858			

(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.



Station	Easting	Northing
IS12	813218	823681
IS13	813667	824325
IS14	812592	824172
IS15	813356	825008
SR8	816306	825715
SR9	813601	825858
SR10A	823741	823495
CS4	810025	824004
CS6	817028	823992

Figure 2.2

Water Quality Monitoring Station

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Date: 15/11/2013

Environmental Resources Management

ERM

Station ID	Type	Coordinates		*Parameters, unit	Depth	Frequency
SR10A	Sensitive receiver (Ma Wan FCZ)	823741	823495			

*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.

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

Table 2.8 Water Quality Monitoring Equipment

Equipment	Model	Qty.
Water Sampler	Kahlsico Water-Bottle Model 135DW 150	1
Dissolved Oxygen Meter	YSI Pro 2030	1
pH Meter	HANNA HI 9125	1
Turbidity Meter	HACH 2100Q	1
Monitoring Position Equipment	"Magellan" Handheld GPS Model explorist GC	4
	DGPS Koden KGP913MK2 (1)	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 Construction, Filling works and Seawall Enhancement works. Seawall Enhancement Works at Northern Landfall has been completed on 31 December 2017.

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 *forty-ninth* to *Fiftieth Monthly EM&A Report*. Water Quality Monitoring was suspended from 31 December 2017 effectively.

In this reporting period, a total of 26 monitoring events were undertaken in which fourteen (14) Action 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 recorded in the reporting period were significantly lower than the average levels in baseline monitoring, except for IS13 in mid-ebb tide and IS13, IS14, IS15 and SR10A in mid-flood tide in which the turbidity levels recorded during the baseline monitoring period were higher than the corresponding average baseline levels. The SS levels recorded during the reporting period were significantly lower than the results obtained during the baseline monitoring period, except for IS12 and IS13 in mid-ebb tide and IS12, IS13, IS14 and SR9 in mid-flood tide in which the SS levels recorded during the baseline monitoring period were higher than the corresponding average baseline levels. 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	IS12	Surface	6.1	6.5
	IS13	Surface	6.1	6.5
	IS14	Surface	6.1	6.5
	IS15	Surface	6.1	6.5
	SR10A	Surface	6.0	6.4
	SR8	Surface	6.2	6.5
	SR9	Surface	6.0	6.5
Mid-flood	IS12	Surface	6.1	6.6
	IS13	Surface	6.1	6.5
	IS14	Surface	6.1	6.5
	IS15	Surface	6.2	6.5
	SR10A	Surface	6.0	6.5
	SR8	Surface	6.2	6.6
	SR9	Surface	6.0	6.5
Mid-ebb	IS12	Middle	5.9	6.4
	IS13	Middle	6.0	6.4
	IS14	Middle	6.0	6.4
	IS15	Middle	6.0	6.4
	SR10A	Middle	5.9	6.4
Mid-flood	IS12	Middle	5.9	6.5
	IS13	Middle	6.0	6.5
	IS14	Middle	5.9	6.4
	IS15	Middle	6.1	6.5
	SR10A	Middle	5.9	6.5
Mid-ebb	IS12	Bottom	5.9	6.4
	IS13	Bottom	5.9	6.4
	IS14	Bottom	5.9	6.4
	IS15	Bottom	5.9	6.5
	SR10A	Bottom	5.7	6.4
	SR8	Bottom	6.0	6.5
	SR9	Bottom	5.8	6.5
Mid-flood	IS12	Bottom	5.9	6.5
	IS13	Bottom	5.9	6.5
	IS14	Bottom	5.9	6.4
	IS15	Bottom	6.0	6.5
	SR10A	Bottom	5.8	6.5

Tide	Station	Depth	Average DO of baseline monitoring	Average DO of reporting period
	SR8	Bottom	5.8	6.6
	SR9	Bottom	5.9	6.5

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	IS12	10.7	7.6
	IS13	9.2	9.6
	IS14	9.3	8.5
	IS15	9.8	6.0
	SR10A	7.1	5.3
	SR8	11.0	7.2
	SR9	7.2	6.3
Mid-flood	IS12	9.8	8.5
	IS13	9.5	10.3
	IS14	9.4	11.6
	IS15	9.8	11.0
	SR10A	7.0	7.1
	SR8	10.1	7.9
	SR9	8.5	7.5

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	IS12	9.2	10.3
	IS13	10.0	10.3
	IS14	10.4	8.6
	IS15	9.6	7.7
	SR10A	10.3	7.4
	SR8	10.1	8.5
	SR9	8.8	7.8
Mid-flood	IS12	9.5	10.0
	IS13	10.5	12.1
	IS14	9.7	13.7
	IS15	11.0	13.4
	SR10A	10.2	9.8
	SR8	11.3	10.7
	SR9	9.9	10.0

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

Tide	Station	Depth	F ratio	p-value
Mid-ebb	IS12	Surface	$F_{1,37} = 3.69$	0.06
Mid-ebb	IS13	Surface	$F_{1,37} = 3.38$	0.07
Mid-ebb	IS14	Surface	$F_{1,37} = 2.55$	0.12
Mid-ebb	IS15	Surface	$F_{1,37} = 2.51$	0.12

Tide	Station	Depth	F ratio	p-value
Mid-ebb	SR10A	Surface	$F_{1,37} = 3.05$	0.09
Mid-ebb	SR8	Surface	$F_{1,37} = 1.25$	0.27
Mid-ebb	SR9	Surface	$F_{1,37} = 4.47$	0.04
Mid-flood	IS12	Surface	$F_{1,37} = 5.04$	**0.03**
Mid-flood	IS13	Surface	$F_{1,36} = 3.28$	0.08
Mid-flood	IS14	Surface	$F_{1,37} = 2.79$	0.10
Mid-flood	IS15	Surface	$F_{1,37} = 1.58$	0.22
Mid-flood	SR10A	Surface	$F_{1,37} = 6.72$	**0.01**
Mid-flood	SR8	Surface	$F_{1,37} = 3.05$	0.09
Mid-flood	SR9	Surface	$F_{1,37} = 3.93$	0.06
Mid-ebb	IS12	Middle	$F_{1,37} = 4.13$	0.05
Mid-ebb	IS13	Middle	$F_{1,37} = 2.69$	**0.11**
Mid-ebb	IS14	Middle	$F_{1,37} = 3.32$	**0.08**
Mid-ebb	IS15	Middle	$F_{1,37} = 3.13$	**0.09**
Mid-ebb	SR10A	Middle	$F_{1,37} = 5.60$	0.02
Mid-flood	IS12	Middle	$F_{1,37} = 5.98$	0.02
Mid-flood	IS13	Middle	$F_{1,37} = 4.44$	0.04
Mid-flood	IS14	Middle	$F_{1,37} = 4.25$	**0.05**
Mid-flood	IS15	Middle	$F_{1,37} = 2.48$	**0.12**
Mid-flood	SR10A	Middle	$F_{1,37} = 12.1$	**<0.01**
Mid-ebb	IS12	Bottom	$F_{1,37} = 4.42$	0.04
Mid-ebb	IS13	Bottom	$F_{1,37} = 4.36$	0.04
Mid-ebb	IS14	Bottom	$F_{1,37} = 344$	**0.07**
Mid-ebb	IS15	Bottom	$F_{1,37} = 5.96$	0.02
Mid-ebb	SR10A	Bottom	$F_{1,37} = 13.8$	**<0.01**
Mid-ebb	SR8	Bottom	$F_{1,37} = 4.42$	**0.04**
Mid-ebb	SR9	Bottom	$F_{1,37} = 9.29$	**<0.01**
Mid-flood	IS12	Bottom	$F_{1,37} = 7.12$	**0.01**
Mid-flood	IS13	Bottom	$F_{1,37} = 6.27$	**0.02**
Mid-flood	IS14	Bottom	$F_{1,37} = 4.82$	**0.03**
Mid-flood	IS15	Bottom	$F_{1,37} = 4.12$	0.05
Mid-flood	SR10A	Bottom	$F_{1,37} = 12.2$	**<0.01**
Mid-flood	SR8	Bottom	$F_{1,37} = 12.1$	**<0.01**
Mid-flood	SR9	Bottom	$F_{1,37} = 5.1$	**0.03**

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	IS12	$F_{1,37} = 3.68$	0.06
Mid-ebb	IS13	$F_{1,37} = 0.07$	0.80
Mid-ebb	IS14	$F_{1,37} = 0.25$	0.62
Mid-ebb	IS15	$F_{1,37} = 13.3$	**<0.01**
Mid-ebb	SR10A	$F_{1,37} = 3.05$	0.09
Mid-ebb	SR8	$F_{1,37} = 8.88$	**<0.01**
Mid-ebb	SR9	$F_{1,37} = 0.71$	0.41
Mid-flood	IS12	$F_{1,37} = 0.57$	0.45
Mid-flood	IS13	$F_{1,37} = 0.22$	0.64
Mid-flood	IS14	$F_{1,37} = 2.05$	0.16
Mid-flood	IS15	$F_{1,37} = 0.47$	0.50
Mid-flood	SR10A	$F_{1,37} = 0.01$	0.93
Mid-flood	SR8	$F_{1,37} = 2.10$	0.16
Mid-flood	SR9	$F_{1,37} = 0.74$	0.39

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	IS12	$F_{1,37}$ = 0.39	0.53
Mid-ebb	IS13	$F_{1,37}$ = 0.04	0.84
Mid-ebb	IS14	$F_{1,37}$ = 2.17	0.15
Mid-ebb	IS15	$F_{1,37}$ = 3.17	0.08
Mid-ebb	SR10A	$F_{1,37}$ = 7.36	**0.01**
Mid-ebb	SR8	$F_{1,37}$ = 1.42	0.24
Mid-ebb	SR9	$F_{1,37}$ = 1.12	0.30
Mid-flood	IS12	$F_{1,37}$ = 0.08	0.78
Mid-flood	IS13	$F_{1,37}$ = 0.68	0.42
Mid-flood	IS14	$F_{1,37}$ = 4.58	**0.04**
Mid-flood	IS15	$F_{1,37}$ = 1.56	0.22
Mid-flood	SR10A	$F_{1,37}$ = 0.05	0.83
Mid-flood	SR8	$F_{1,37}$ = 0.11	0.75
Mid-flood	SR9	$F_{1,37}$ = 0.01	0.92

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	$F_{1,25}$	p-value	Intercept	Coefficient of days of construction
Mid-ebb Surface DO	IS12	0.41	16.7	0.003	-28.76	0.024
	IS13	0.50	24.2	<0.001	-29.1	0.024
	IS14	0.51	24.7	<0.001	-29.5	0.024
	IS15	0.57	31.2	<0.001	-31.7	0.026
	SR10A	0.76	76.6	<0.001	-28.77	0.024
	SR8	0.56	31.0	<0.001	-30.77	0.025
	SR9	0.50	24.5	<0.001	-29.61	0.024
Parameter	**Station**	**R^2**	**$F_{1,65}$**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-flood surface DO	IS12	0.232	19.4	<0.001	-23.77	0.020
	IS13	0.248	21.2	<0.001	-24.35	0.021
	IS14	0.263	22.8	<0.001	-27.44	0.023
	IS15	0.215	17.5	<0.001	-24.20	0.021
	SR10A	0.235	19.7	<0.001	-25.20	0.021
	SR8	0.208	16.8	<0.001	-26.04	0.022
	SR9	0.157	11.9	<0.001	-28.21	0.023
Parameter	**Station**	**R^2**	**$F_{1,65}$**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-ebb middle DO	IS12	0.260	20.4	0.001	-29.41	0.024
	IS13	0.597	35.5	<0.001	-34.07	0.027

Parameter	Station	R^2	$F_{1,25}$	p-value	Intercept	Coefficient of days of construction
	IS14	0.497	23.7	<0.001	-30.50	0.025
	IS15	0.604	36.5	<0.001	-33.41	0.027
	SR10A	0.760	75.8	<0.001	-29.55	0.024

Parameter	Station	R^2	$F_{1,65}$	p-value	Intercept	Coefficient of days of construction
Mid-flood middle DO	IS12	0.407	16.4	0.004	-25.14	0.021
	IS13	0.387	15.1	0.005	-25.96	0.022
	IS14	0.439	18.7	0.002	-27.45	0.023
	IS15	0.607	14.0	0.007	-25.32	0.021
	SR10A	0.703	56.9	<0.001	-25.2	0.021

Parameter	Station	R^2	$F_{1,65}$	p-value	Intercept	Coefficient of days of construction
Mid-ebb bottom DO	IS12	0.492	23.3	<0.001	-32.47	0.026
	IS13	0.634	41.5	<0.001	-37.88	0.030
	IS14	0.52	25.77	<0.001	-32.75	0.026
	IS15	0.612	37.9	<0.001	-36.25	0.029
	SR10A	0.734	66.1	<0.001	-29.78	0.024
	SR8	0.610	37.5	<0.001	-33.19	0.027
	SR9	0.58	33.3	<0.001	-35.28	0.028

Parameter	Station	R^2	$F_{1,65}$	p-value	Intercept	Coefficient of days of construction
Mid-flood bottom DO	IS12	0.634	16.0	0.004	-25.79	0.022
	IS13	0.412	16.8	0.003	-27.27	0.023
	IS14	0.43	18.3	0.002	-27.48	0.023
	IS15	0.395	15.6	0.004	-26.58	0.022
	SR10A	0.721	61.9	<0.001	-25.24	0.021
	SR8	0.396	15.76	0.003	-28.39	0.023
	SR9	0.485	22.6	<0.001	-30.24	0.025

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 and p-value >0.01 (i.e. showing the regression insignificant) are underlined.
3. By setting α at 0.01, insignificant coefficient is underlined.

Table 2.16 ***Linear Regression Result of Turbidity***

Parameter	Station	R^2	$F_{1,65}$	p-value	Intercept	Coefficient of days of construction
Mid-ebb depth -average turbidity	IS12	0.063	1.62	0.184	108.7	-0.068
	IS13	4.84	<0.001	0.912	9.66	<0.001
	IS14	0.232	7.24	0.01	191.16	-0.123
	IS15	0.196	5.83	0.017	98.55	-0.062
	SR10A	0.285	9.56	0.004	148.6	-0.096
	SR8	0.048	1.21	0.228	64.8	-0.039
	SR9	0.182	5.33	0.022	117.0	-0.074

Parameter	Station	R^2	$F_{1,65}$	p-value	Intercept	Coefficient of days of construction
Mid-flood depth -average turbidity	IS12	0.608	1.55	0.188	106.7	-0.066
	IS13	0.155	4.40	0.036	184.9	-0.12
	IS14	0.172	5.00	0.025	175.0	-0.109
	IS15	0.158	4.51	0.034	189.7	-0.12
	SR10A	0.194	5.78	0.020	181.0	-0.12
	SR8	<0.001	0.002	0.863	10.69	-0.002
	SR9	0.191	5.67	0.018	127.8	-0.081

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 and p-value >0.01 (i.e. showing the regression insignificant) are underlined.
3. By setting α at 0.01, insignificant coefficient is underlined.

Table 2.17 ***Linear Regression Result of SS***

Parameter	Station	R^2	$F_{1,65}$	p-value	Intercept	Coefficient of days of construction
Mid-ebb depth -average SS	IS12	0.075	1.96	0.144	140.85	-0.088
	IS13	0.002	0.041	0.760	29.79	-0.013
	IS14	0.058	1.47	0.183	73.48	-0.044
	IS15	<0.001	0.001	0.831	9.19	-0.001
	SR10A	0.15	4.23	0.035	96.25	-0.060
	SR8	0.016	0.38	0.461	48.8	-0.027
	SR9	0.124	3.40	0.049	70.32	-0.042
Parameter	**Station**	**R^2**	**$F_{1,65}$**	**p-value**	**Intercept**	**Coefficient of days of construction**
Mid-flood depth -average SS	IS12	0.098	2.61	0.097	155.2	-0.097
	IS13	0.135	3.73	0.051	205.0	-0.129
	IS14	0.168	4.85	0.028	222.7	-0.140
	IS15	0.147	4.15	0.040	215.3	-0.135
	SR10A	0.059	1.49	0.201	136.5	-0.085
	SR8	0.154	4.38	0.037	207	-0.132
	SR9	0.228	7.08	0.001	181.5	-0.115

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 and p-value >0.01 (i.e. showing the regression insignificant) are underlined.
3. By setting α at 0.01, insignificant coefficient is 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, the on-going 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 are adopted to avoid duplicates of survey effort.

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

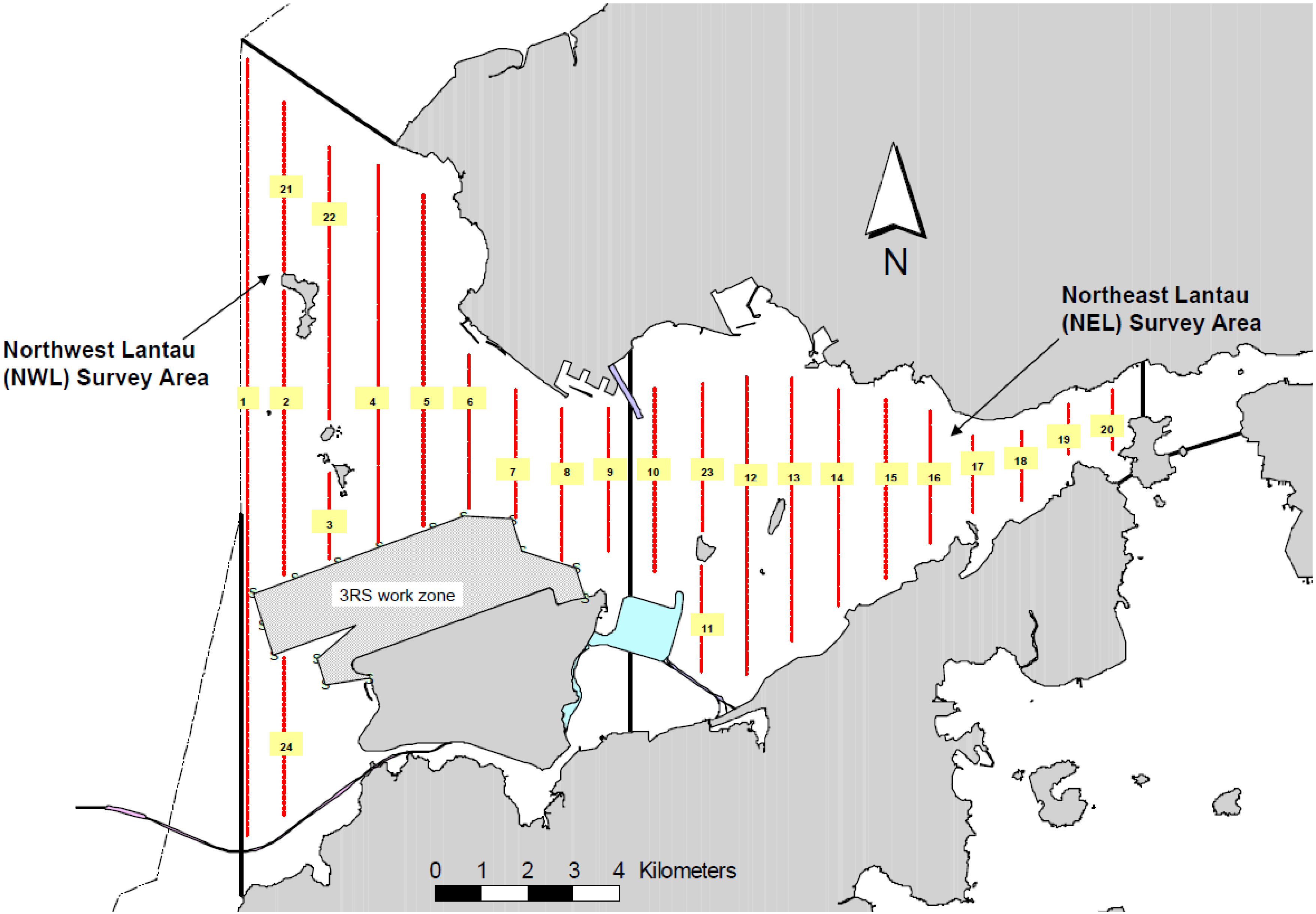

Figure 2.3

Layout of Transect Lines of Dolphin Monitoring in Northwest and Northeast Lantau Areas(Since August 2017)

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Date: 29/11/2013

Environmental Resources Management

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Line No.		Easting	Northing	Line No.		Easting	Northing
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 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 3,152.08 km of survey effort was collected, with 93.6% 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, 1,160.48 km and 1,991.60 km of survey effort were collected from NEL and NWL survey areas, respectively. The total survey effort conducted on primary and secondary lines were 2,300.78 km and 851.30 km, respectively. The survey efforts are summarized in *Appendix F*.

A total of 42 groups of 131 Chinese White Dolphin sightings were recorded during the 24 sets of surveys in this reporting year. All except two (2) sightings were made during on-effort search. Thirty-three (33) on-effort sightings were made on primary lines, while seven (7) 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 2017 to October 2018 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 and fourth years of impact phase (November 2013 to October 2014, November 2014 to October 2015, November 2015 to October 2016 and November 2017 to October 2018 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 (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 and fifth years of impact phase (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 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 twelve (1-12) individuals per group in North Lantau region during November 2017 - October 2018. 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 (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 and fifth years of impact phase (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 2018r espectively), transitional phase (November 2012 – October 2013) and baseline phase monitoring periods (February 2011 – January 2012). (± denotes the standard deviation of the average value)

Whilst two (2) Action Level and three (3) Limit Level exceedances were observed for the quarterly dolphin monitoring data between November 2017 and October 2018. 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 dredging, reclamation or marine sheet piling works in open waters under this Contract. Passive Acoustic Monitoring (PAM) was also implemented for the detection of marine mammal when dredging, reclamation or marine sheet piling works were carried out outside the daylight hours under this Contract. 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.

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-three (53) site inspections were carried out in the reporting period. Key observations were summarized in the *Forty-ninth to Sixtieth 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 2017	3,259	0	345	343,470	3,800	0	5,836
December 2017	3,574	0	121	0	0	0	3942
January 2018	7,165	0	272	241,700	2,800	0	11,357
February 2018	1,762	0	258	257,140	0	0	2,840
March 2018	66,457	62,274	459	229,360	2,000	2,000	0
April 2018	123,942	50,648	281	195,550	8,600	8,600	0
May 2018	127,964	62,822	686	93,010	10,400	0	0
June 2018	102,987	55,385	408	1,060	0	0	0
July 2018	43,768	0	768	770	0	0	0
August 2018	57,809	40,722	749	574,260	0	200	0
September 2018	39,763	11,276	445	0	0	0	7,703
October 2018	108,689	80,347	437	0	0	5,343	9,073
Total	**706,957**	**383,265**	**5,229**	**3,953,742**	**1,508,070**	**16,143**	**40,751**

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 March 2015	Throughout the Contract	HyD	Application for VEP on 3 March 2015 to supersede EP-354/2009/C
Construction Dust Notification	363510	19 August 2013	Throughout the Contract	DBJV	Northern Landfall
Construction Dust Notification	403620	10 June 2016	Throughout the Contract	DBJV	Southern Landfall
Chemical Waste Registration	5213-422-D2516-02	18 January 2017	Throughout the Contract	DBJV	Northern Landfall
Chemical Waste Registration	5213-951-D2591-01	25 May 2016	Throughout the Contract	DBJV	Southern Landfall
Construction Waste Disposal Account	7018108	28 August 2013	Throughout the Contract	DBJV	Waste disposal in Contract No. HY/2012/08
Construction Waste Disposal Account	7021715	17 July 2018	17 October 2018	DBJV	Vessel Disposal
Construction Waste Disposal Account	7021715	18 October 2018	17 January 2019	DBJV	Vessel Disposal
Waste Water Discharge License	WT00017707-2013	18 November 2013	30 November 2018	DBJV	For site WA18
Waste Water Discharge License	WT00019248-2014	5 June 2014	30 June 2019	DBJV	For site Portion N6 and Reclamation Area E
Waste Water Discharge License	WT00025944-2016	15 December 2016	31 December 2021	DBJV	Southern Landfall
Marine Dumping Permit	EP/MD/18-087	21 November 2017	20 December 2017	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/18-118	21 January 2018	20 February 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/18-098	21 December 2017	20 January 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-001	24 April 2018	23 May 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/18-133	22 March 2018	21 April 2018	DBJV	Type 1 (Dedicated site) and Type 2

License/ Permit	License or Permit No.	Date of Issue	Date of Expiry	License/ Permit Holder	Remarks
					(Confined Marine Disposal)
Marine Dumping Permit	EP/MD/18-125	21 February 2018	20 March 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-041	5 October 2018	4 November 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-009	28 June 2018	27 July 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-001	28 May 2018	27 June 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-024	28 August 2018	27 September 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-034	28 September 2018	27 October 2018	DBJV	SVS
Marine Dumping Permit	EP/MD/19-063	19 November 2018	18 May 2019	DBJV	Type 1 (Open Sea Disposal)
Marine Dumping Permit	EP/MD/19-057	5 November 2018	4 December 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/19-015	5 September 2018	4 March 2019	DBJV	Catepillar Area
Construction Noise Permit	GW-RW0538-17	16 April 2018	15 October 2018	DBJV	For Urmston Road in front of Pillar Point
Construction Noise Permit	PP-RS0026-17	3 April 2017	31 July 2018	DBJV	Southern Landfall (Percussive Piling)
Construction Noise Permit	GW-RW0538-17	16 October 2017	15 April 2018	DBJV	For Urmston Road in front of Pillar Point
Construction Noise Permit	GW-RW0641-17	16 December 2017	6 December 2018	DBJV	WA23 @ Tsing Yi
Construction Noise Permit	PP-RS0026-17	1 December 2017	29 March 2018	DBJV	Southern Landfall (Percussive Piling)
Construction Noise Permit	GW-RW0344-18	20 August 2018	19 February 2019	DBJV	WA23 @ Tsing Yi
Construction Noise Permit	GW-RS0878-17	11 October 2017	2 April 2018	DBJV	Southern Landfall
Construction Noise Permit	GW-RW0279-17	13 June 2017	12 December 2017	DBJV	WA23 @ Tsing Yi
Construction Noise Permit	PP-RS0019-17	31 August 2017	30 November 2017	DBJV	Southern Landfall (Percussive Piling)
Construction Noise Permit	GW-RW0060-18	20 February 2018	19 August 2018	DBJV	WA23 @ Tsing Yi
Construction Noise Permit	GW-RS0027-18	22 January 2018	14 July 2018	DBJV	Southern Landfall
Construction Noise Permit	GW-RS0598-18	15 July 2018	14 January 2019	DBJV	Southern Landfall
Construction Noise Permit	GW-RW0406-18	16 October 2018	15 April 2019	DBJV	Urmston Road in front of Pillar Point
Construction Noise Permit	GW-RS0966-18	26 October 2018	14 April 2019	DBJV	Southern Landfall

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 120 air quality monitoring events were undertaken in which Twenty-nine (29) Action Level exceedances of 1-hour TSP, two (2) Limit Level exceedances of 1-hour TSP, two (2) Action Level exceedances of 24-hour TSP and three (3) Limit Level exceedances of 24-hour TSP were 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	13	1
	Limit Level	1	1
ASR5	Action Level	14	0
	Limit Level	0	2
AQMS2/ASR6	Action Level	0	0
	Limit Level	0	0
ASR10	Action Level	2	1
	Limit Level	1	0
Total number of Action level Exceedances:		**29**	**2**
Total number of Limit level Exceedances:		**2**	**3**

For marine water quality impact monitoring, a total of 26 monitoring events were undertaken in which fourteen (14) Action 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)	
		Mid-ebb	Mid-flood	Mid-ebb	Mid-flood	Mid-ebb	Mid-flood	Mid-ebb	Mid-flood
CS4	**AL**	-	-	-	-	-	-	-	-
	LL	-	-	-	-	-	-	-	-
CS6	**AL**	-	-	-	-	-	-	-	-
	LL	-	-	-	-	-	-	-	-
IS12	**AL**	-	-	-	-	-	-	1	1
	LL	-	-	-	-	-	-	-	-
IS13	**AL**	-	-	-	-	-	-	1	1
	LL	-	-	-	-	-	-	-	-
IS14	**AL**	-	-	-	-	-	-	-	2
	LL	-	-	-	-	-	-	-	-
IS15	**AL**	-	-	-	-	-	-	-	3
	LL	-	-	-	-	-	-	-	-
SR8	**AL**	-	-	-	-	-	-	-	2
	LL	-	-	-	-	-	-	-	-
SR9	**AL**	-	-	-	-	-	-	-	1
	LL	-	-	-	-	-	-	-	-
SR10A	**AL**	-	-	-	-	-	-	-	2
	LL	-	-	-	-	-	-	-	-
	Total AL Exceedances:	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**12**
	Total LL Exceedances:	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Notes:
(a) AL = Action Level; LL = Limit Level

There were a total of two (2) Action Level and three (3) 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 Sixteenth to Nineteenth Quarterly EM&A Report*.

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 reports were submitted to ENPO and reported in the subsequent EM&A reports.

No environmental summons was received in this reporting period.

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

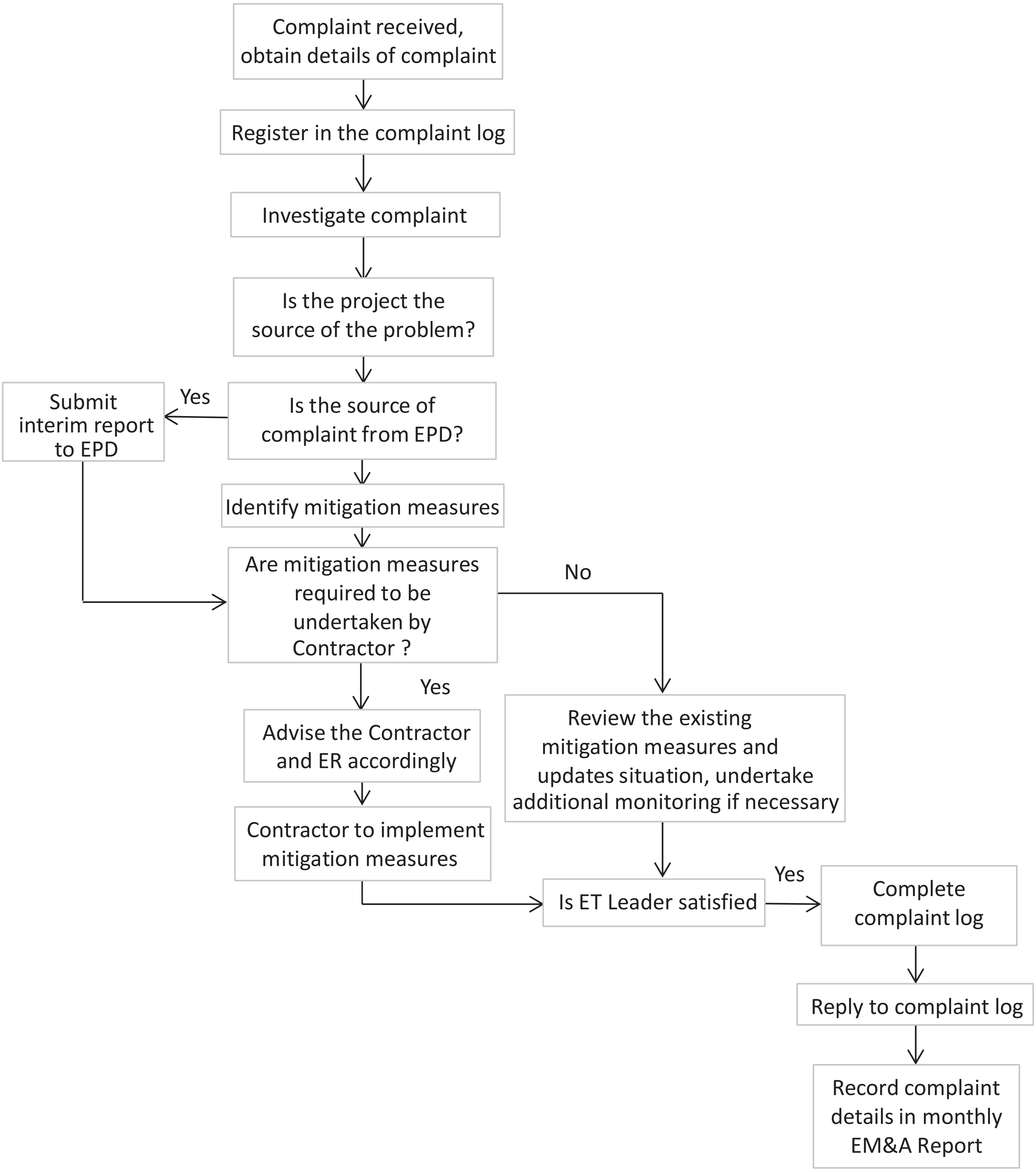

Figure 2.4

Environmental Complaint Handling Procedure

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Environmental Resources Management

ERM

2.10 COMPARISON OF EM&A DATA WITH EIA PREDICTIONS

Findings of the EM&A activities undertaken during the period from 1 November 2017 to 31 October 2018 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	584	138	182	125
ASR1 (24-hour)	148	328	89	173	128
ASR5 (1-hour)	235	455	167	211	138
ASR5 (24-hour)	133	279	100	249	167
AQMS1 (1-hour)	N/A	324	99	196	131
AQMS1 (24-hour)	N/A	207	64	211	127
AQMS2/ASR6 (1-hour)	226	335	123	226	135
AQMS2/ASR6 (24-hour)	153	178	77	221	166
ASR10 (1-hour)	189	816	87	215	134
ASR10 (24-hour)	112	250	59	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). Occasional 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 2017 to October 2018)	
	Mid-ebb	Mid-flood	Mid-ebb	Mid-flood	Mid-ebb	Mid-flood
CS4	10.2	9.0	13.3	11.7	7.8	10.5
CS6	10.9	11.7	14.1	15.2	6.7	8.8
IS12	9.2	9.5	12.0	12.3	10.3	10.0
IS13	10.0	10.5	13.0	13.7	10.3	12.2
IS14	10.4	9.7	13.5	12.6	8.6	13.7
IS15	9.6	11.0	12.5	14.2	7.7	13.4
SR10A	10.3	10.2	13.3	13.3	7.4	9.8
SR8	10.1	11.3	13.1	14.7	8.5	10.7
SR9	8.8	9.9	11.4	12.8	7.8	10.0
Grand Total	**10.0**	**10.3**	**13.0**	**13.4**	**8.3**	**11.0**

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 2017-18, 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-nine (29) Action Level exceedances of 1-hour TSP, two (2) Limit Level exceedances of 1-hour TSP, two (2) Action Level exceedances of 24-hour TSP and three (3) Limit Level exceedances of 24-hour TSP were 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

Fourteen (14) Action Level exceedances were recorded from the water quality monitoring in this reporting period. Marine water quality monitoring was suspended from 31 December 2017 after the completion of Seawall Enhancement Works.

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 dredging, reclamation or marine sheet piling works in open waters under this Contract. Passive Acoustic Monitoring (PAM) was also implemented for the detection of marine mammal when dredging, reclamation or marine sheet piling works were carried out outside the daylight hours under this Contract. 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.

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 Fifth Annual EM&A Report presents the findings of the EM&A activities undertaken during the period from 1 November 2017 to 31 October 2018, 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-nine (29) Action Level exceedances of 1-hour TSP, two (2) Limit Level exceedances of 1-hour TSP, two (2) Action Level exceedances of 24-hour TSP and three (3) Limit Level exceedances of 24-hour TSP were 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.

Fourteen (14) Action Level exceedances were recorded from the water quality monitoring in this reporting period.

A total of 42 groups of 131 Chinese White Dolphin sightings were recorded during the 24 sets of surveys in this reporting year. Whilst two Action Level and three (3) Limit Level exceedances were recorded for four (4) sets of quarterly dolphin monitoring data between November 2017 and October 2018, 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-three (53) 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 reports were submitted to ENPO and reported in the subsequent EM&A reports.

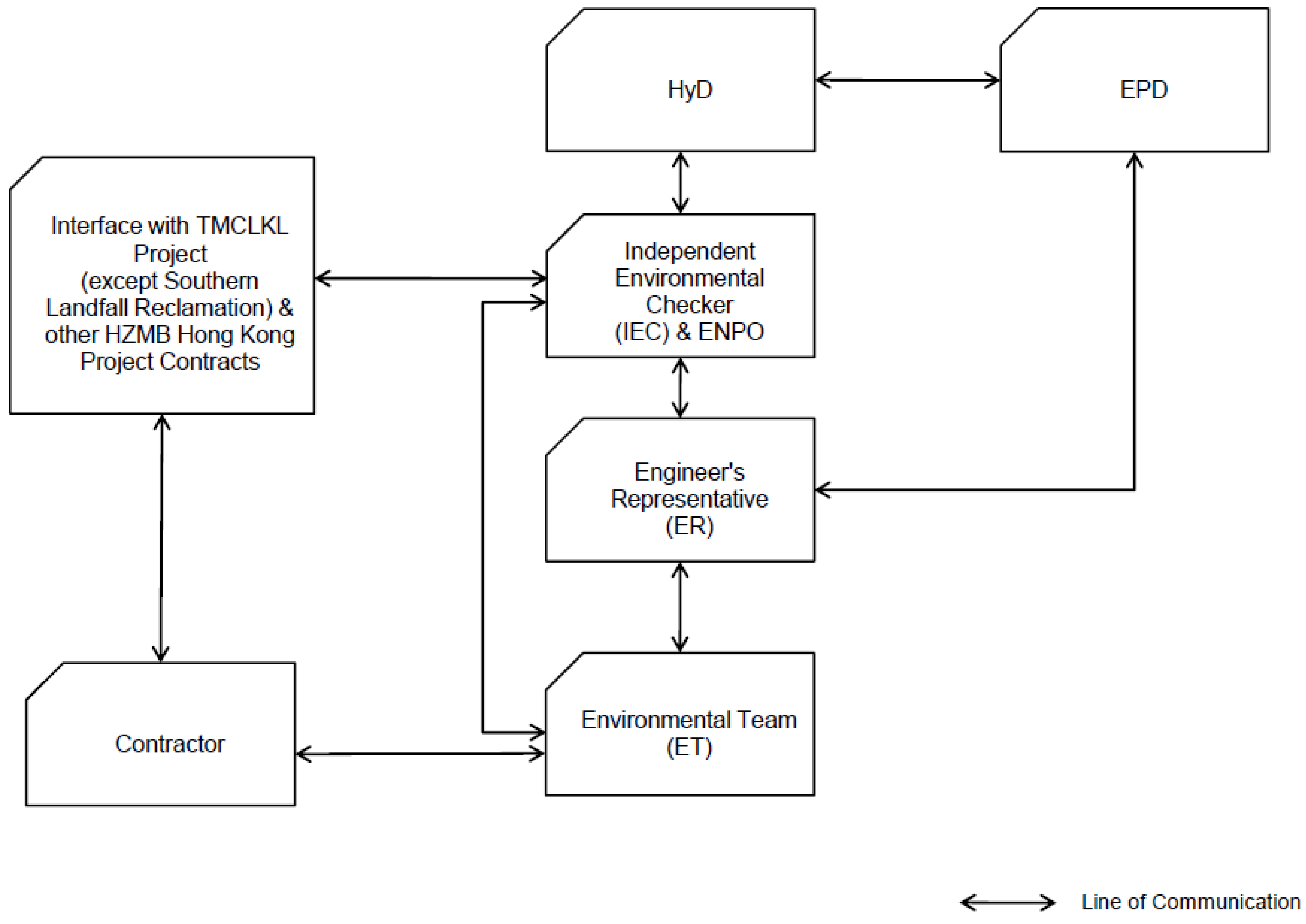
No environmental summons was received in this reporting period.

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

DATE: 06/03/2013

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

Environmental Resources Management

ERM

Appendix B

Environmental Mitigation and Enhancement Measure Implementation Schedules

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		✓

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	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	All exposed surfaces / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
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		✓

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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	-	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		✔
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;	TM-CLKL northern landfall, Portion D of HKBCF and HKLR	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	
		- Reclamation filling for Portion D of HKBCF; Reclamation filling for FSD berth of HKBCF; and - Reclamation dredging and filling for Portion 1 of HKLR;							
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
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		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	
					conditions.				
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		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	
					conditions.				
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		✓
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		<>

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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	-	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		✓
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		✓

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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	-	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									
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.	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	Contractor	EM&A Manual		Y	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	
		One year operation phase water quality monitoring at designated stations.	monitoring for a year.						
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		✓

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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	
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		✔
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									

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	
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 28); Waste Disposal Ordinance (Cap 354); Dumping at Sea Ordinance (Cap 466); Water Pollution Control Ordinance.		Y		✓
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		✓

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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	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		✓
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		✓

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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	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;	All areas / throughout construction period	Contractor	TMEIA		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	
		- Sufficiently covered to prevent rainfall 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		✓

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	
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
▲	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

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

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 HZMB 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

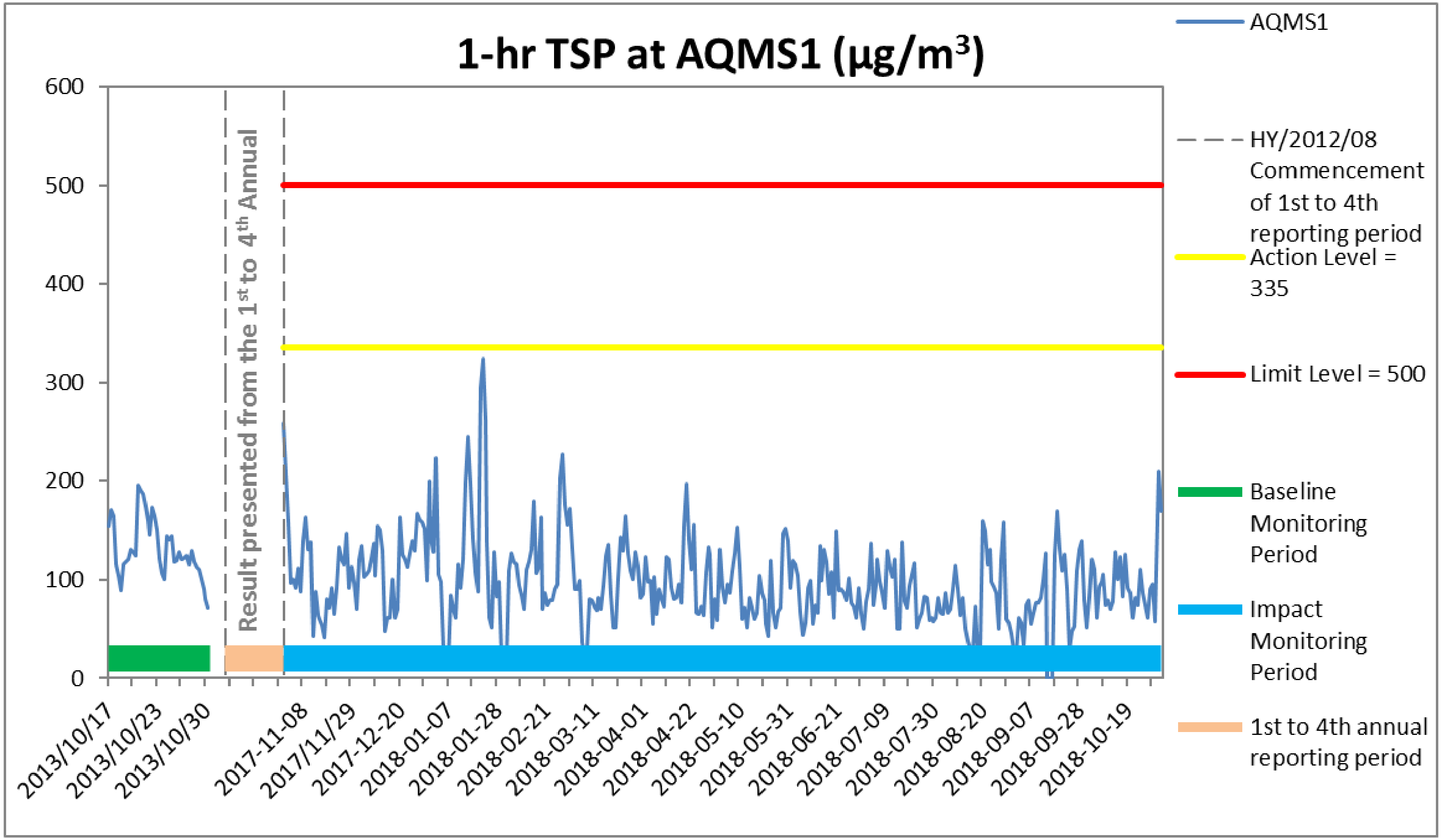

Figure D.1 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at AQMS1 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

ERM

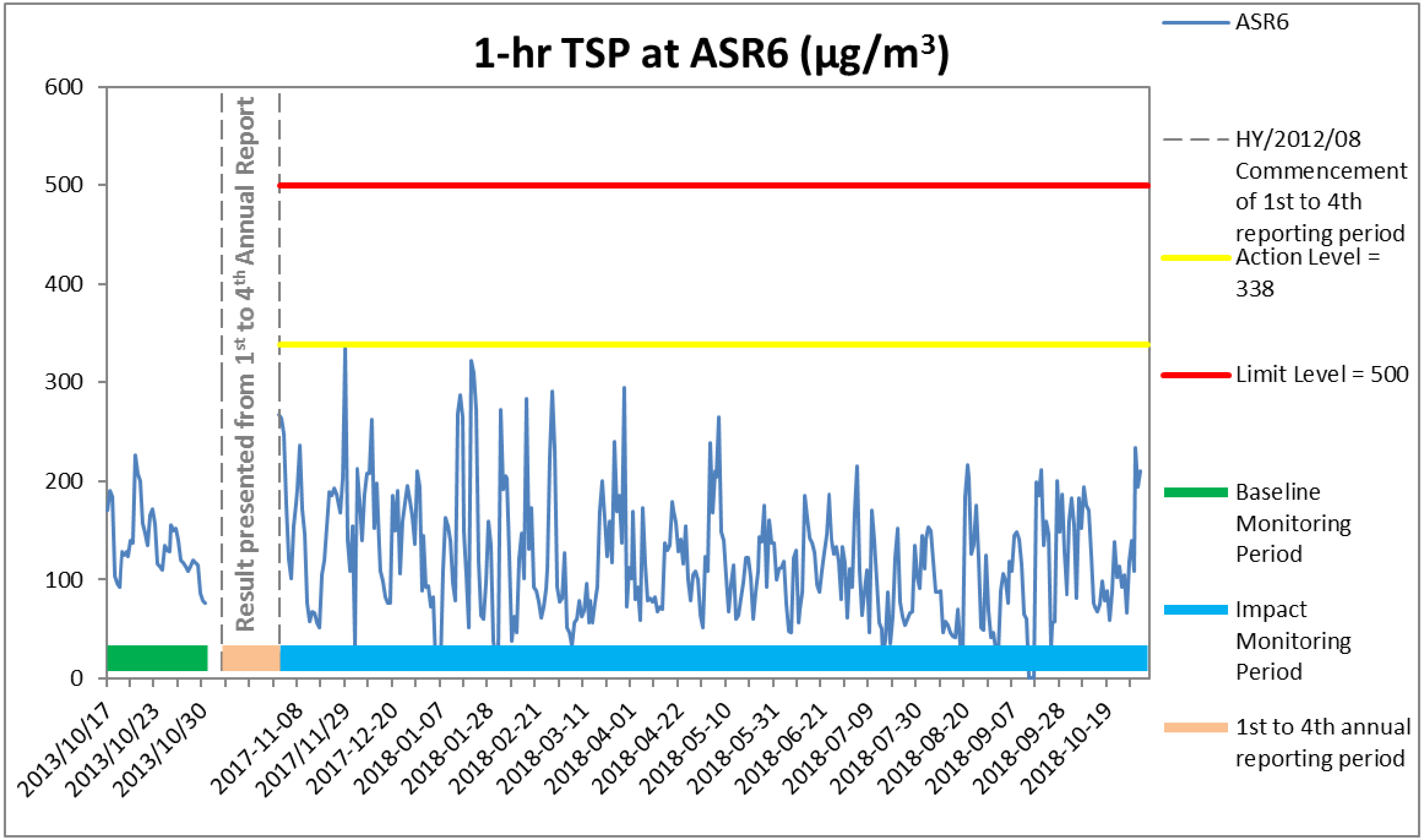

Figure D.2 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (μg/m³) at AQMS2/ASR6 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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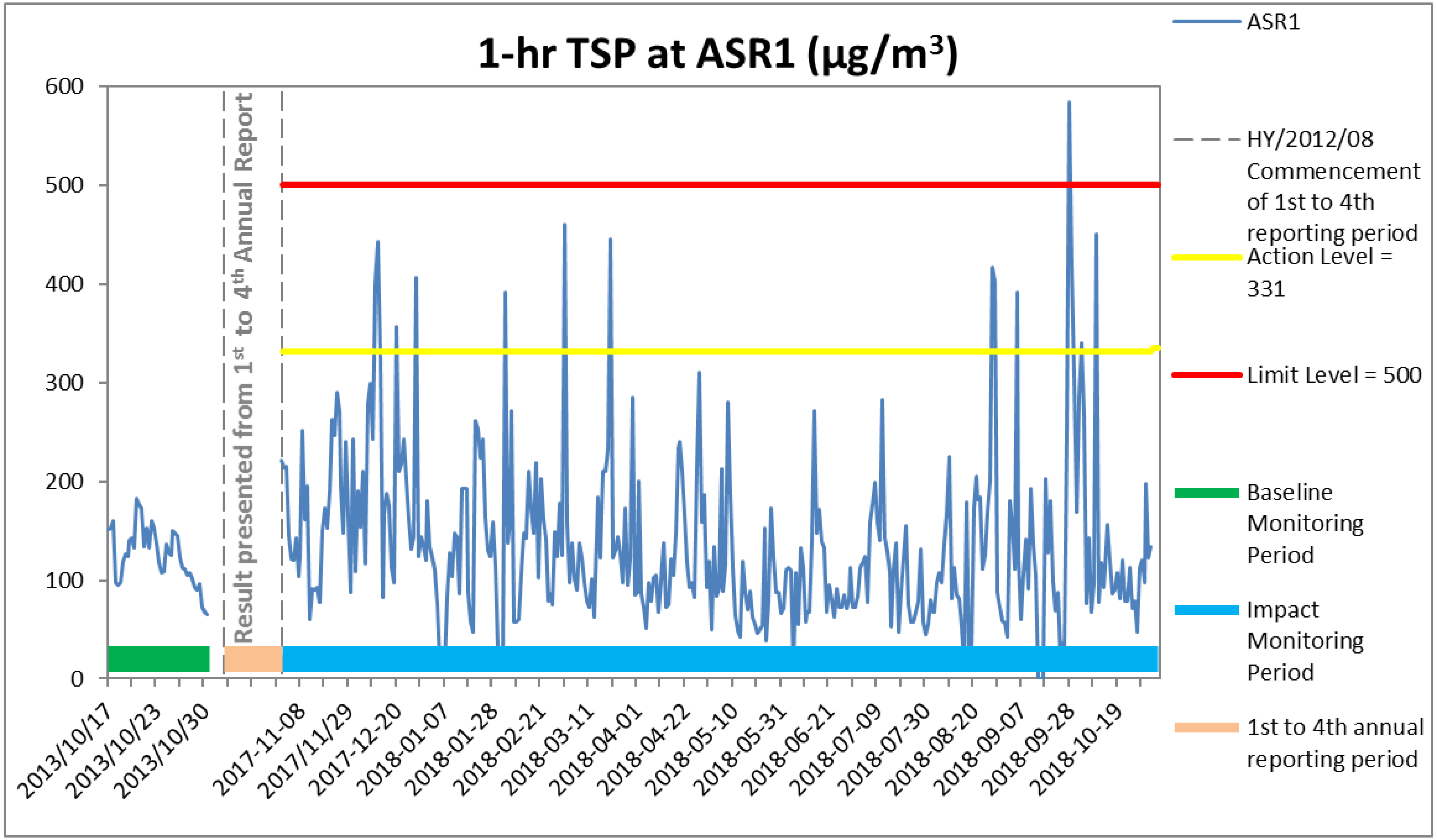

Figure D.3 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at ASR1 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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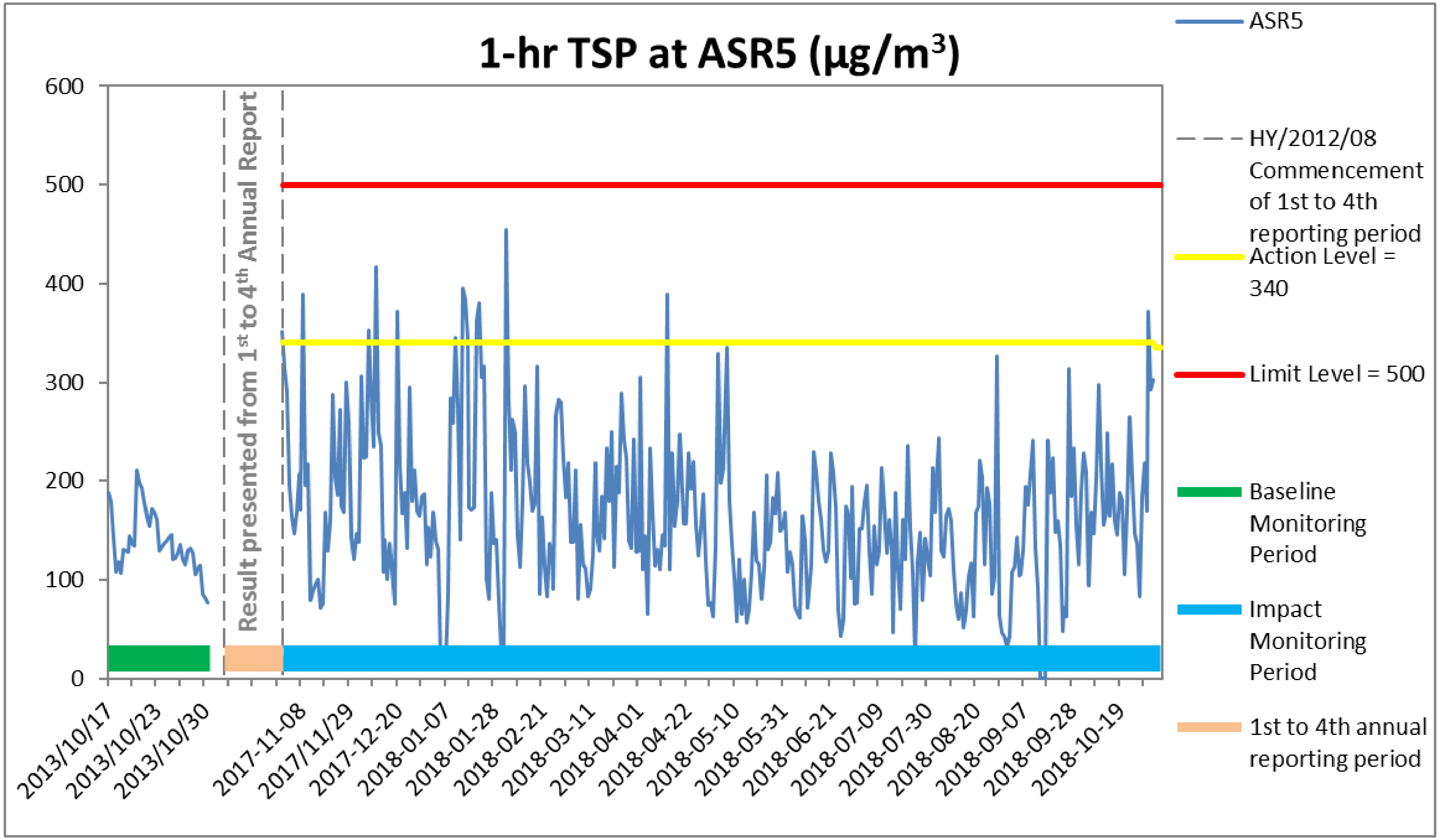

Figure D.4 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at ASR5 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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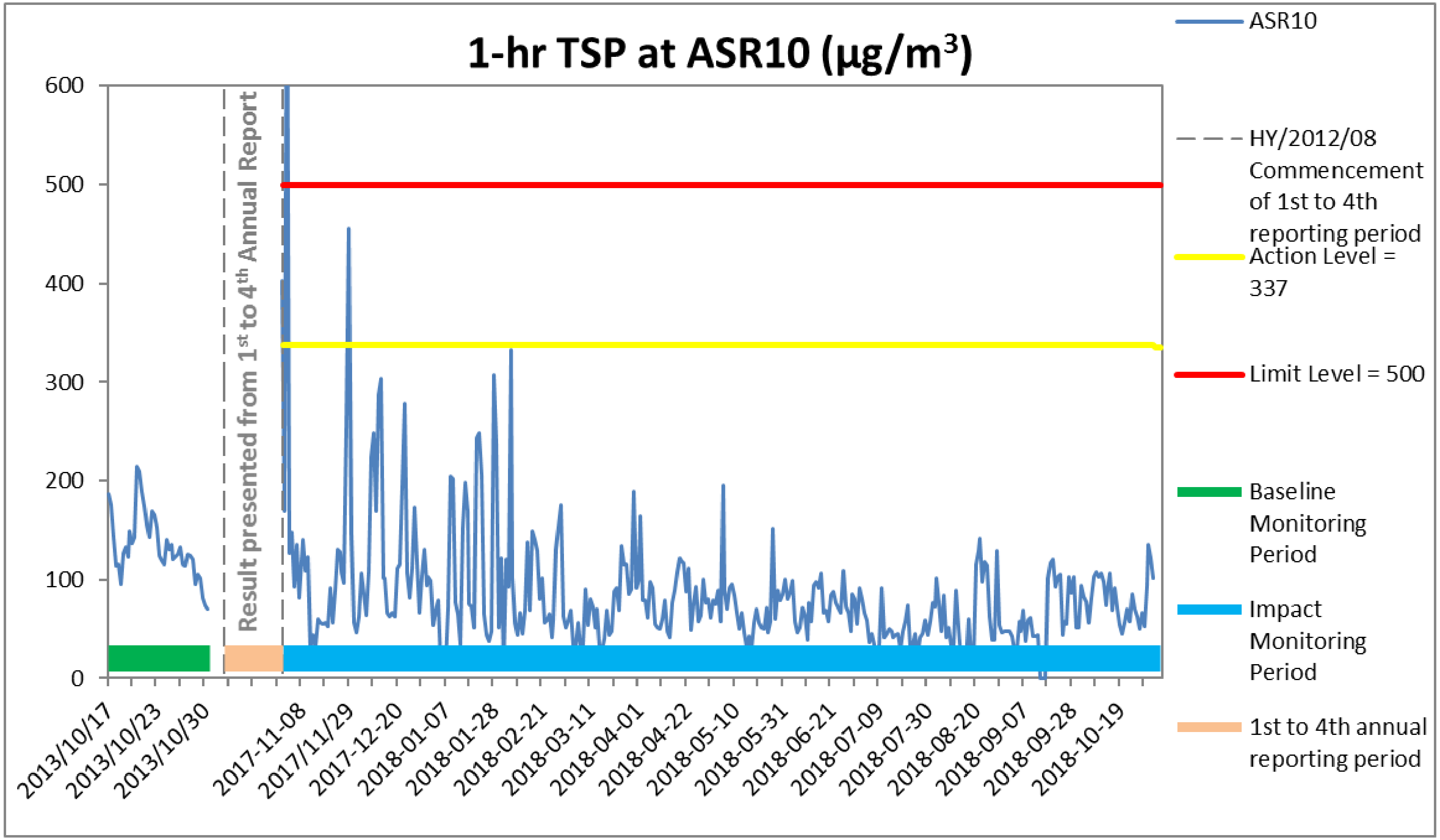

Figure D.5 Baseline & Impact Monitoring – 1-hour Total Suspended Particulates (μg/m³) at ASR10 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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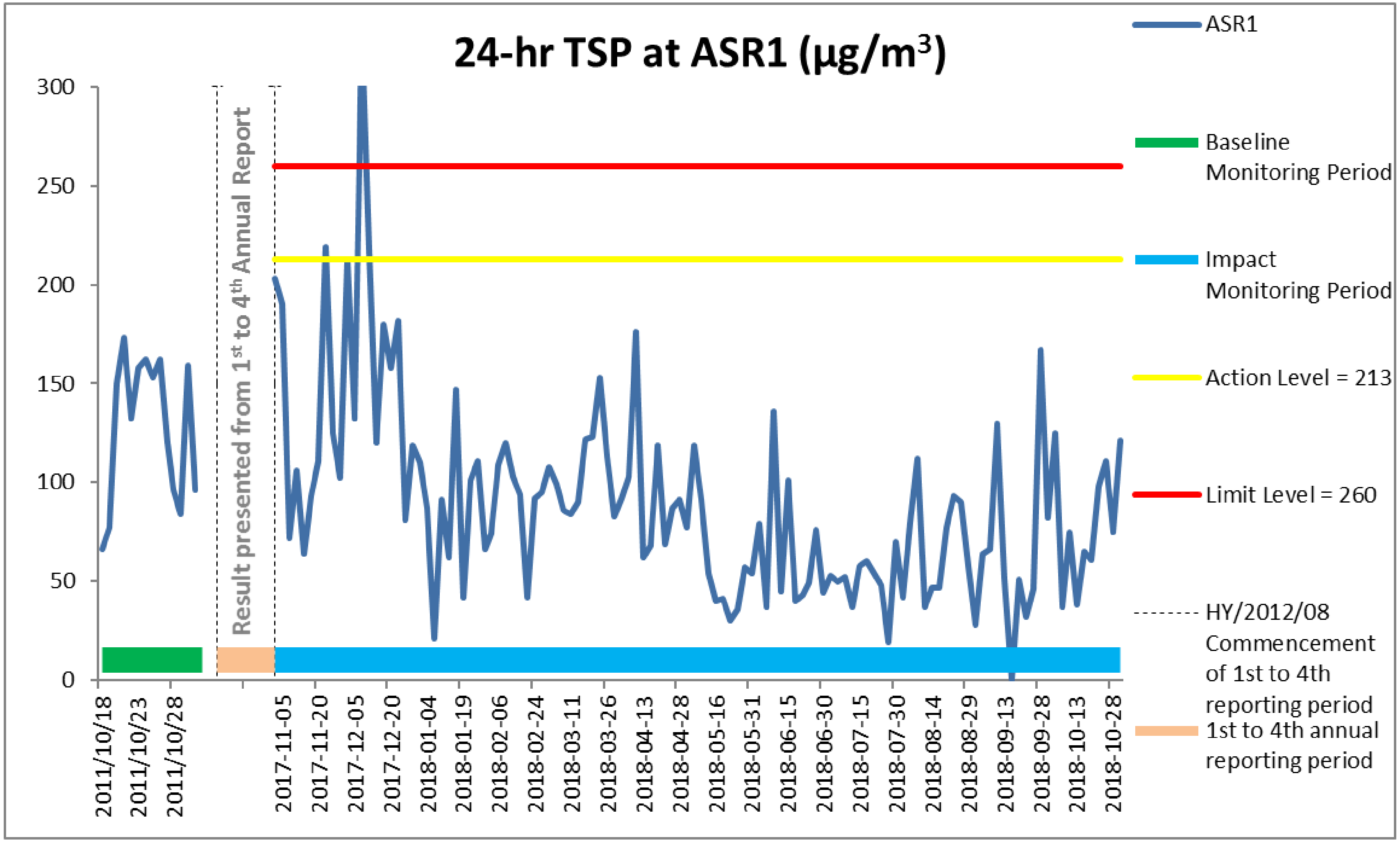

Figure D.6 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (μg/m³) at ASR1 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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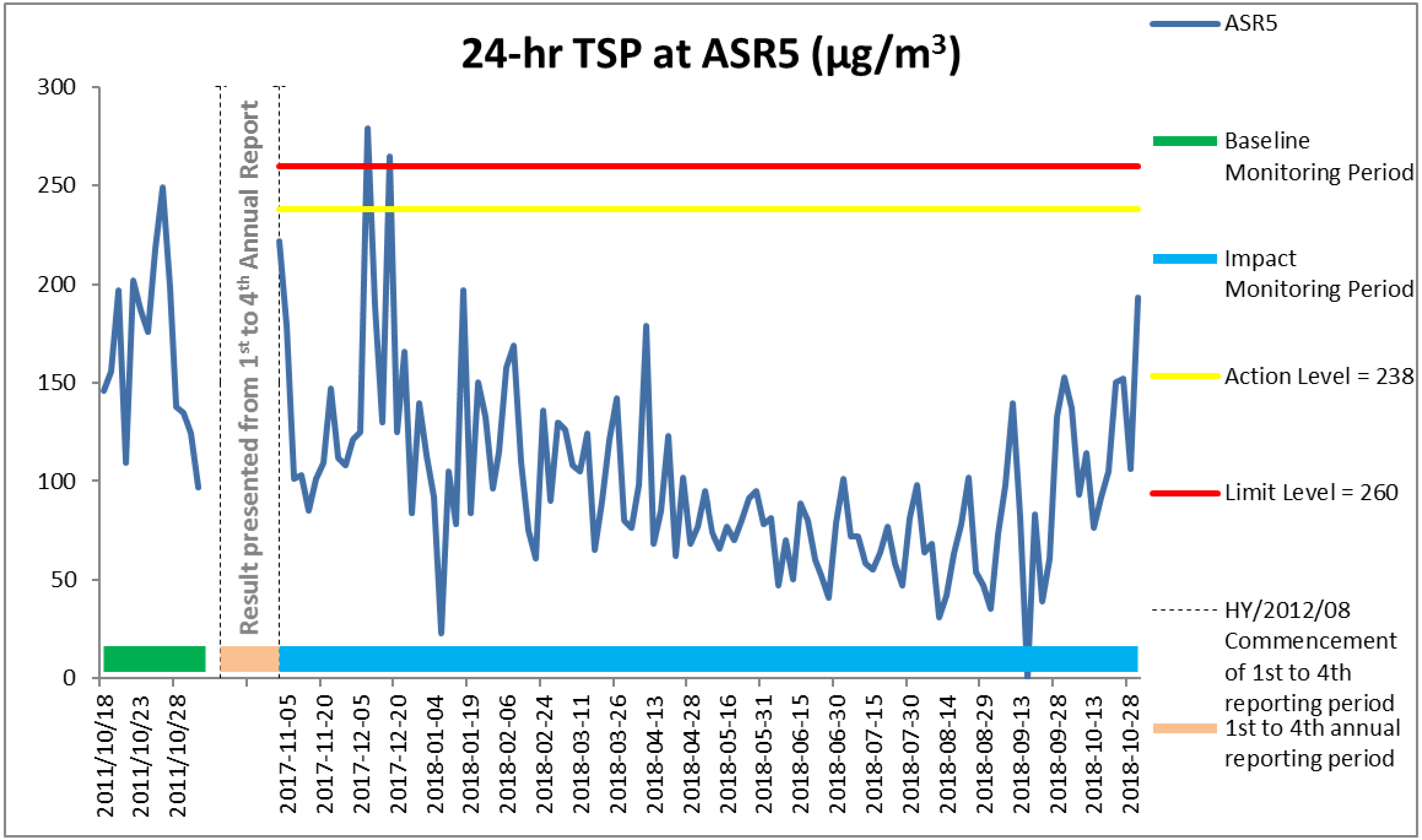

Figure D.7 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (μg/m³) at ASR5 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

ERM

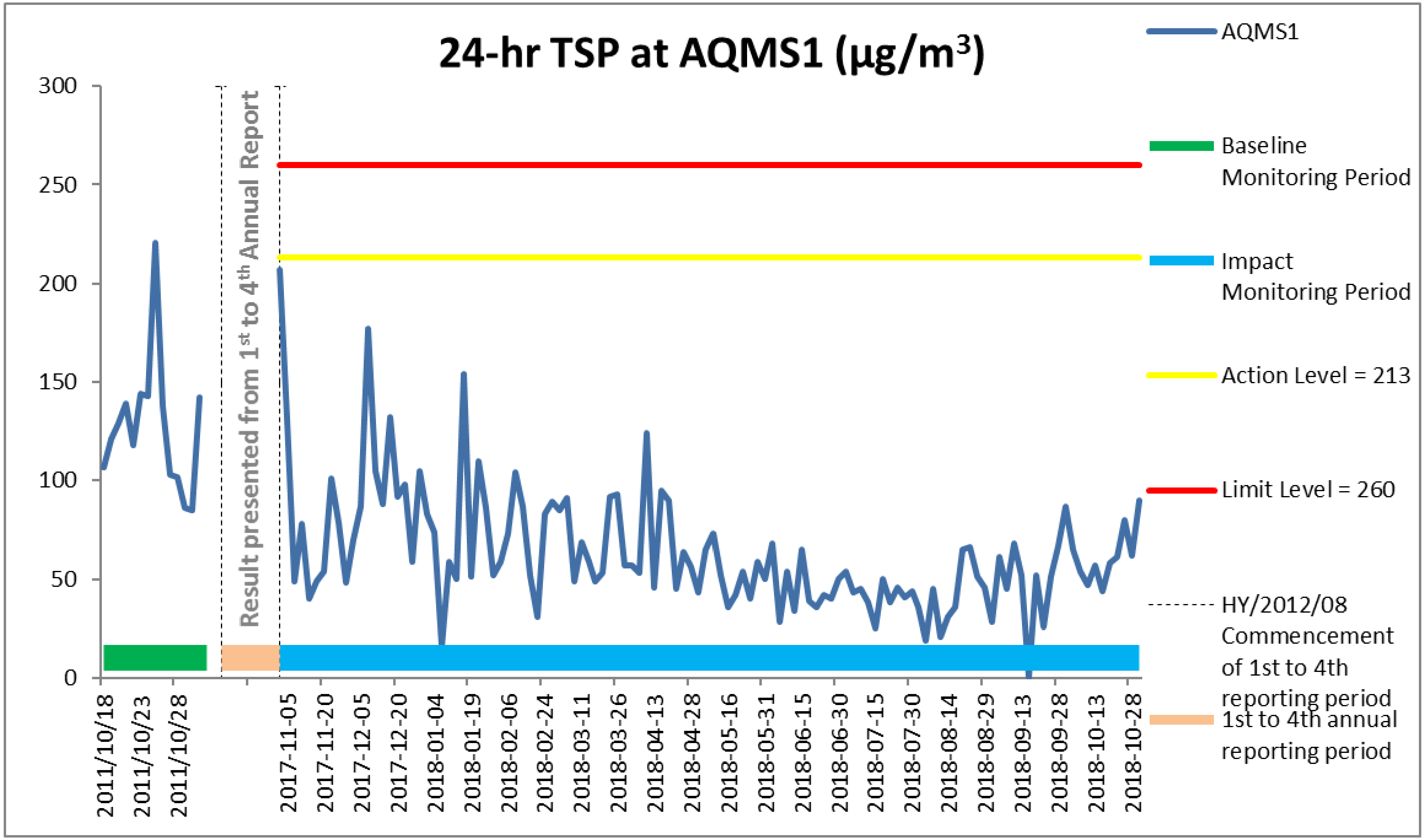

Figure D.8 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at AQMS1 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

ERM

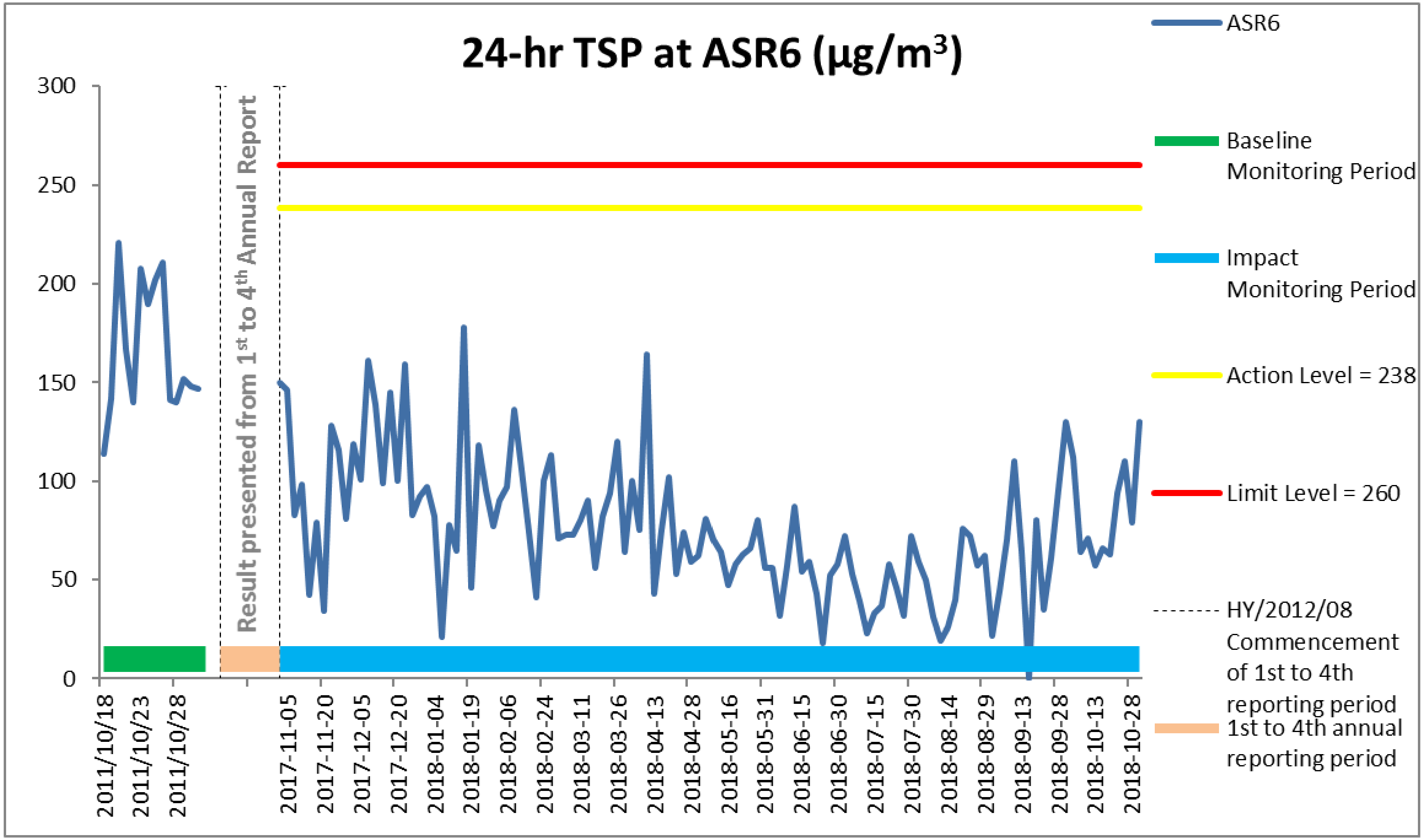

Figure D.9 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at AQMS2/ASR6 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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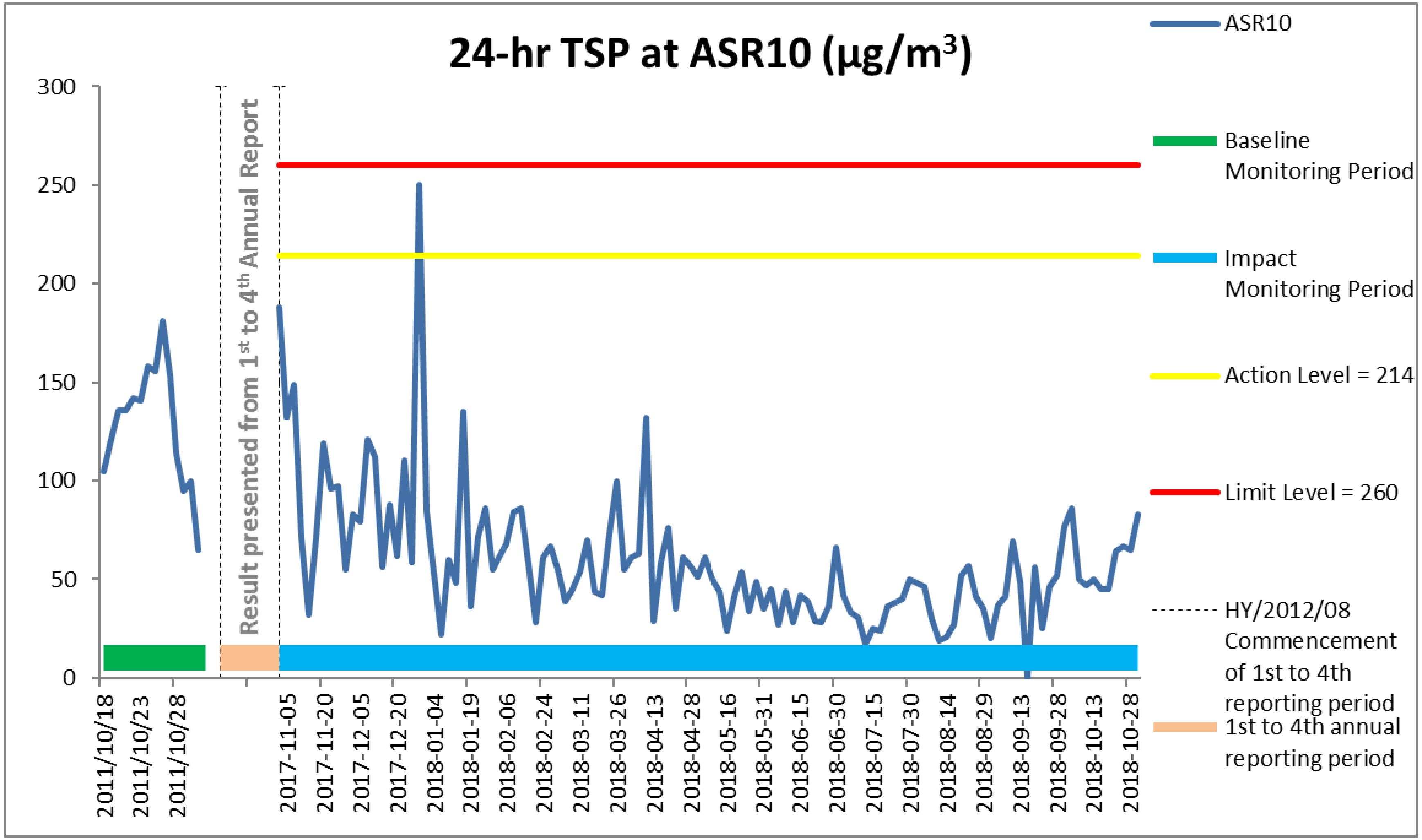

Figure D.10 Baseline & Impact Monitoring – 24-hour Total Suspended Particulates (µg/m³) at ASR10 between 17 October 2013 and 31 October 2018 during Baseline & Impact Monitoring period. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major land-based construction activities included: Construction of Cross Passage Tympanum, Bulk Excavation, CSM Ground Treatment, TBM Tunnel Works & Excavation of sub-sea tunnel. *Ref: 0212330_Impact AQM graphs_5thAnnual_REV a.xlsx*

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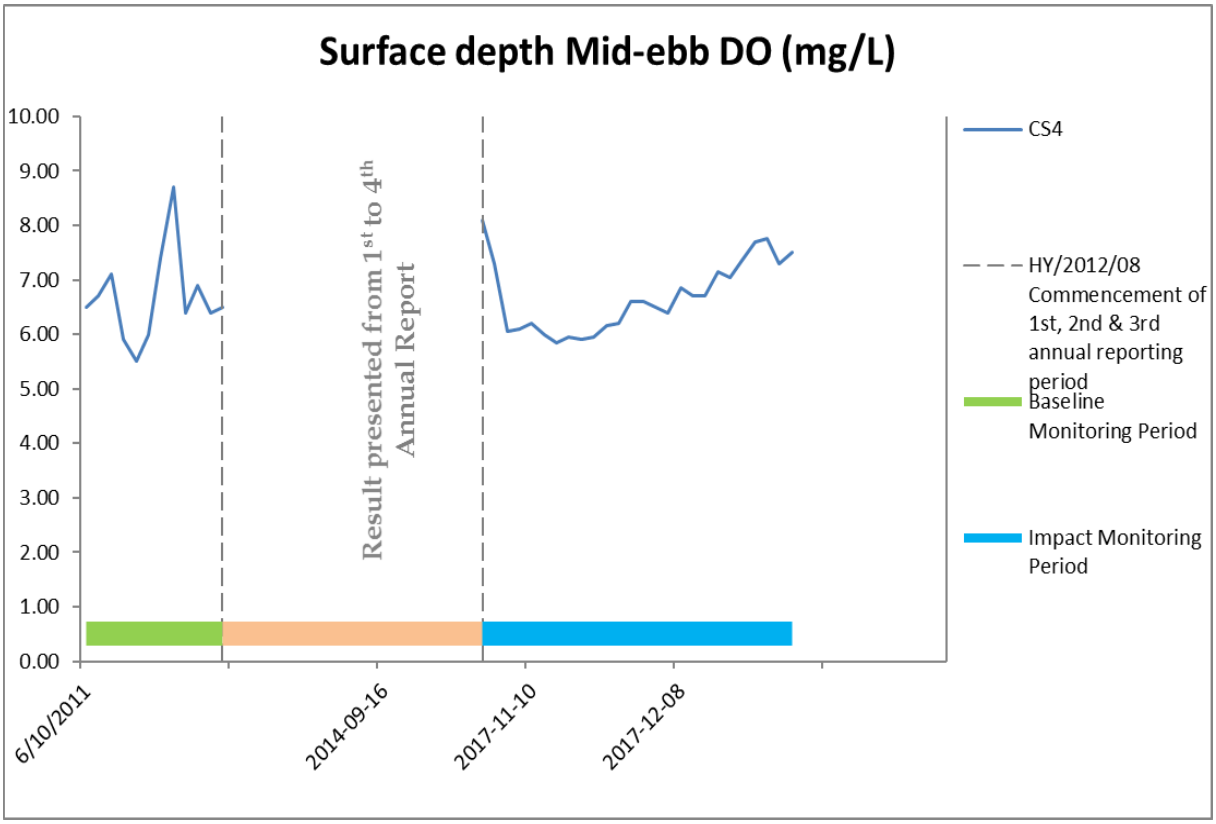
Appendix E

Impact Water Quality Monitoring Results



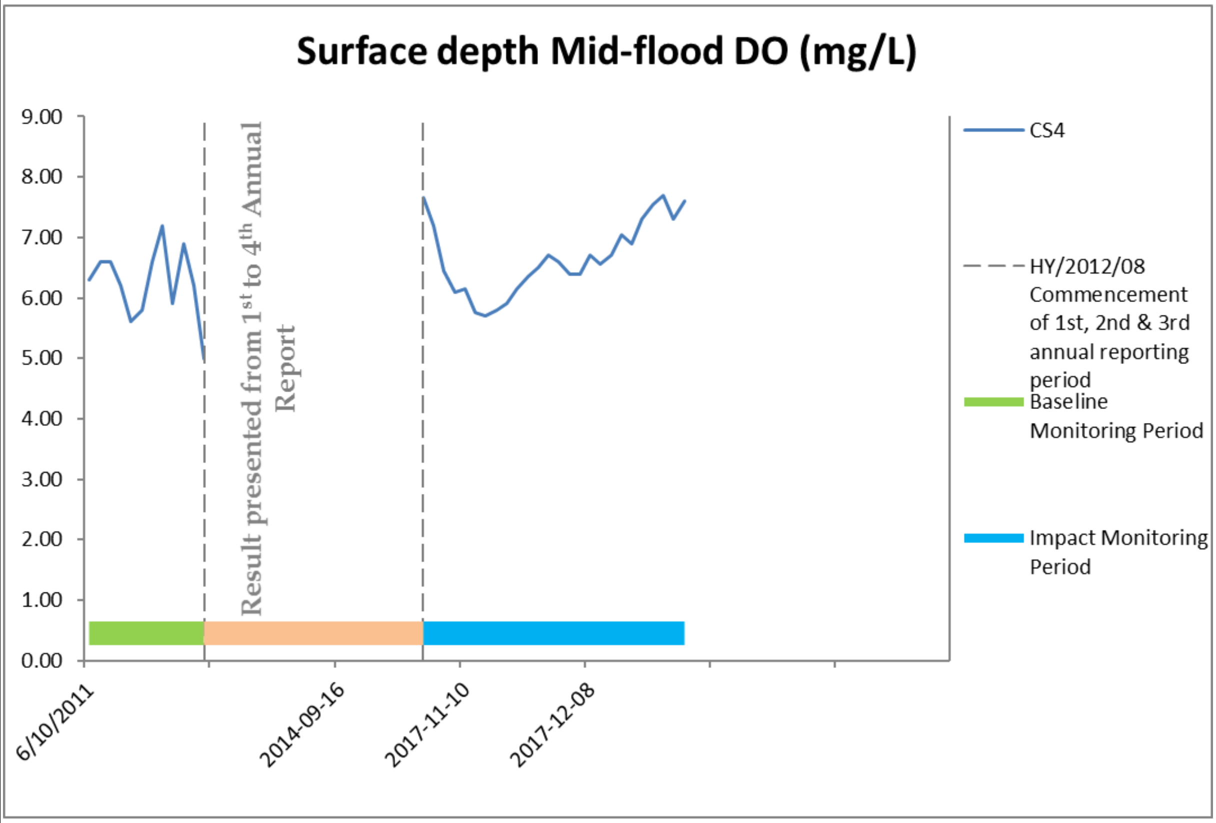
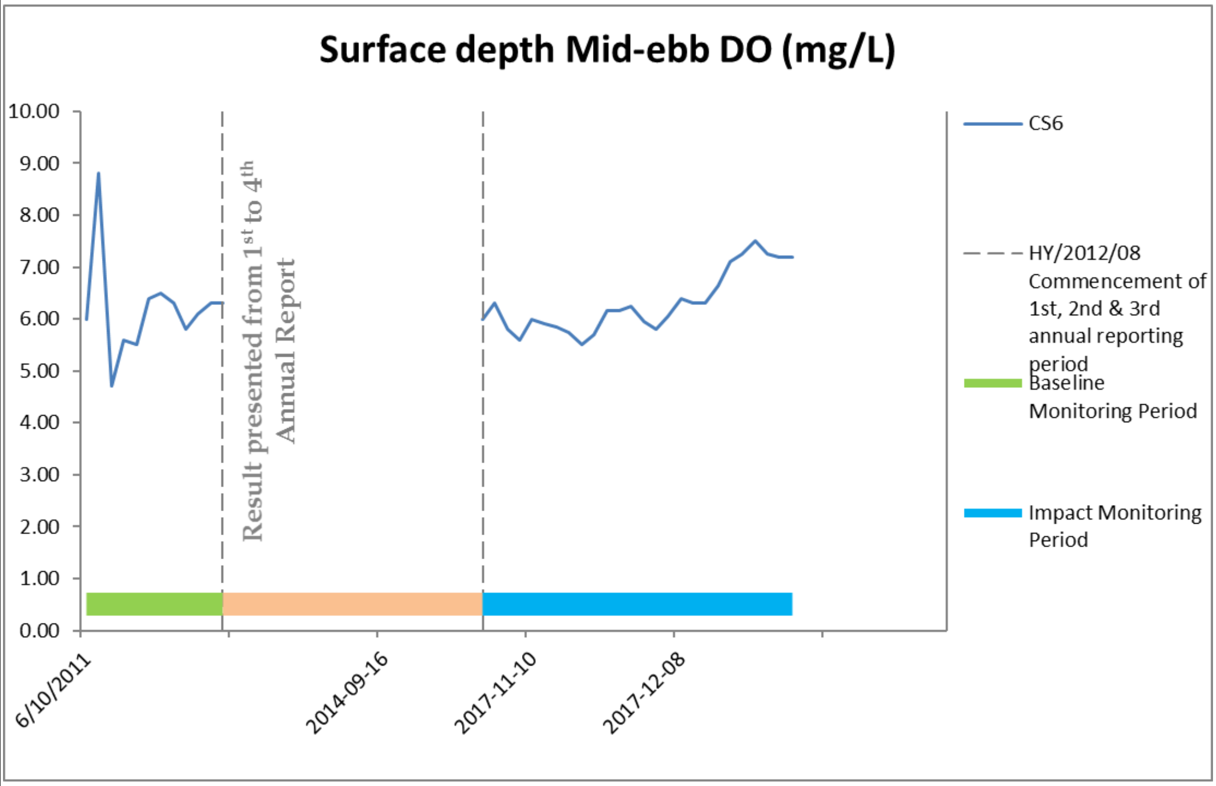


Figure E1 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS4. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



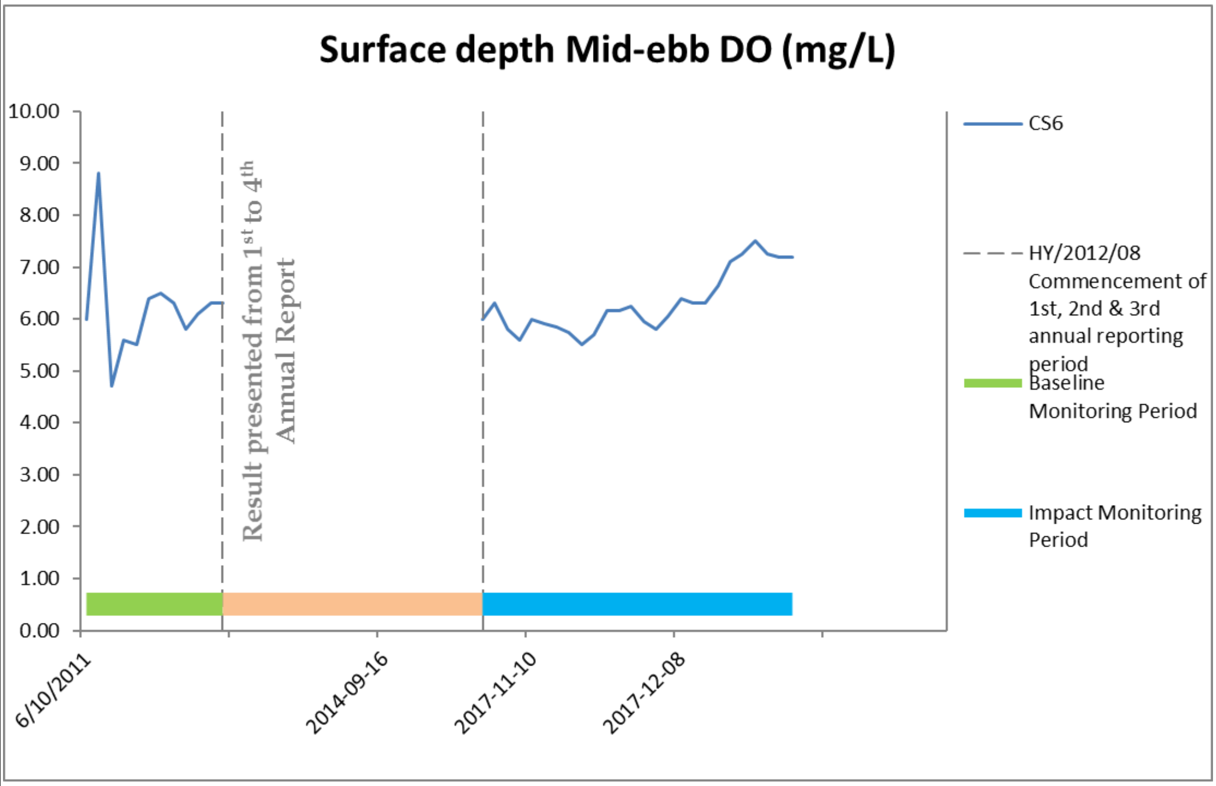
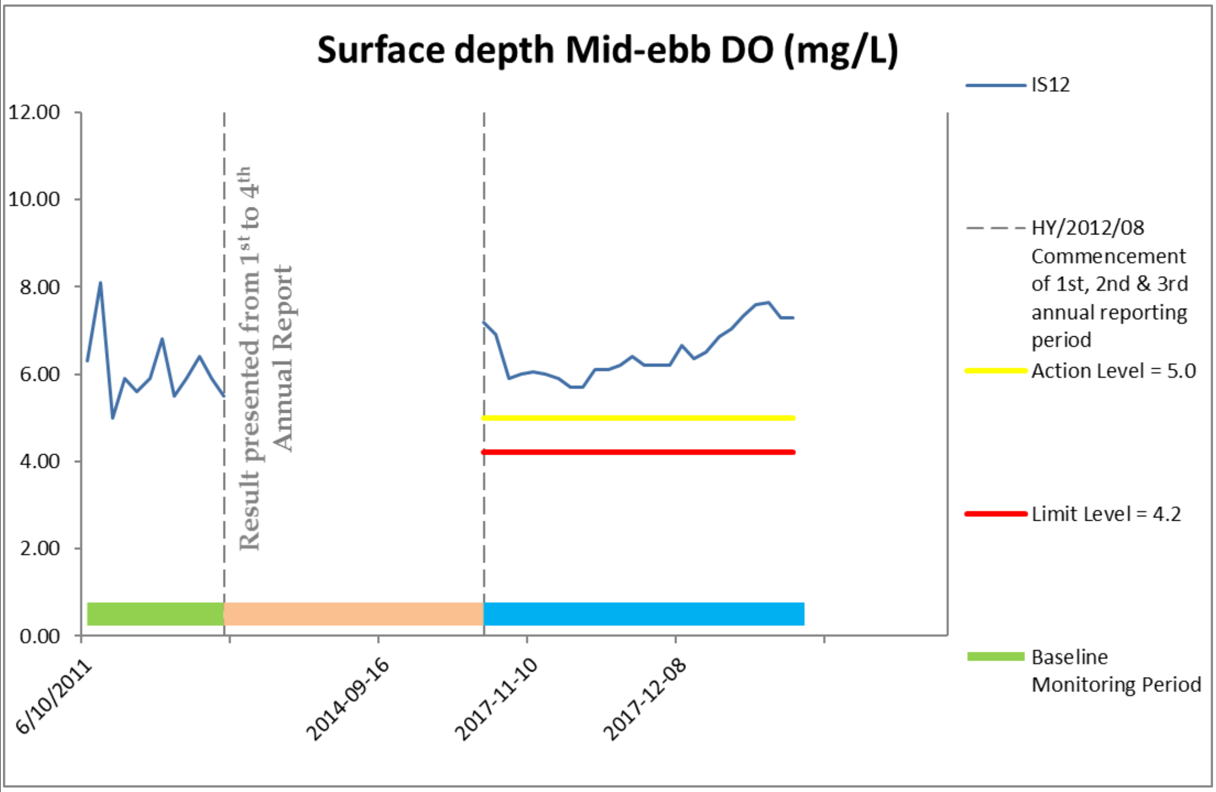


Figure E2 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS6. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



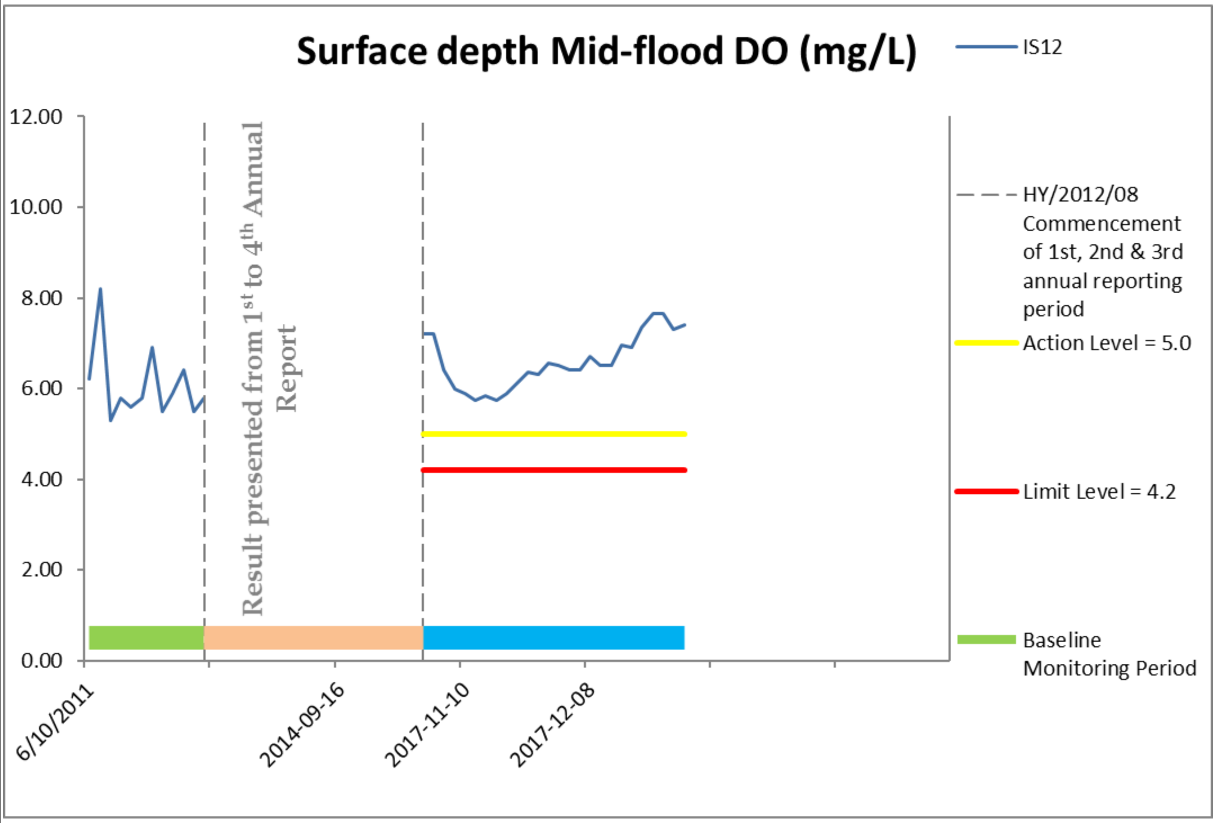
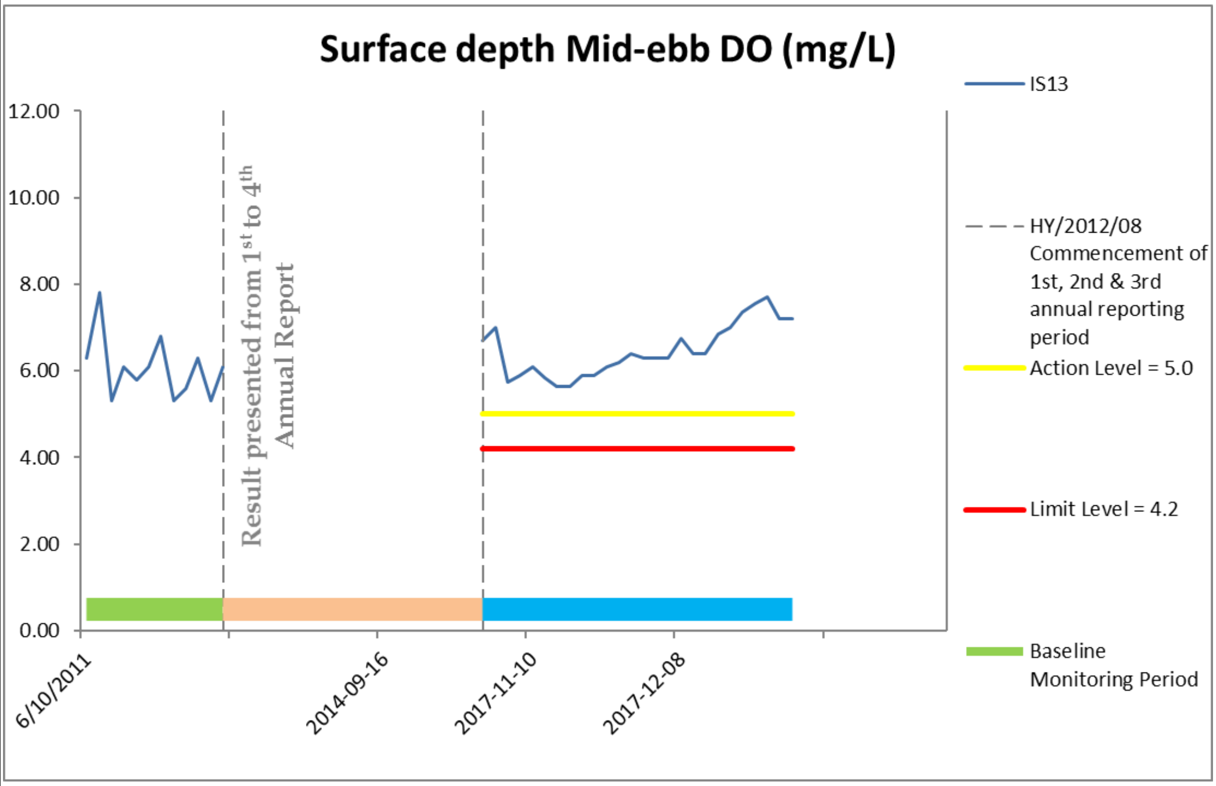


Figure E3 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS12. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



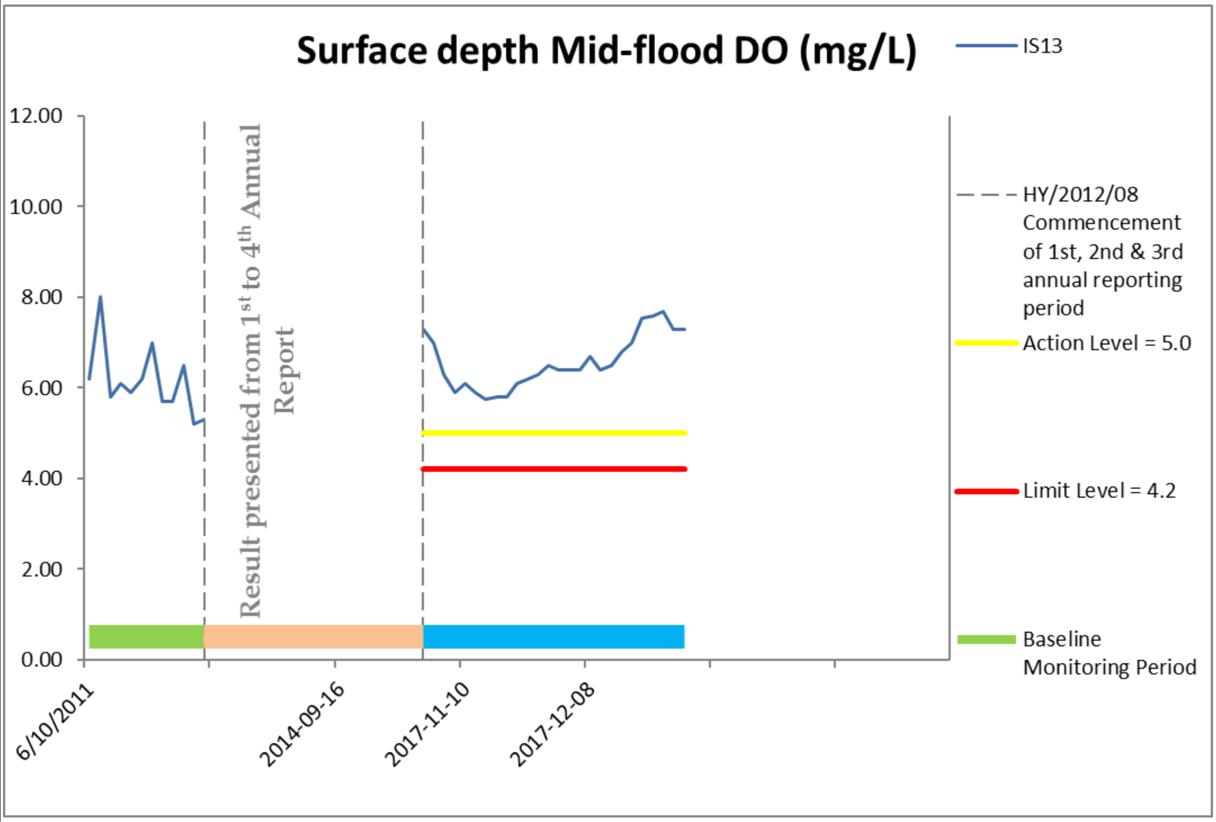
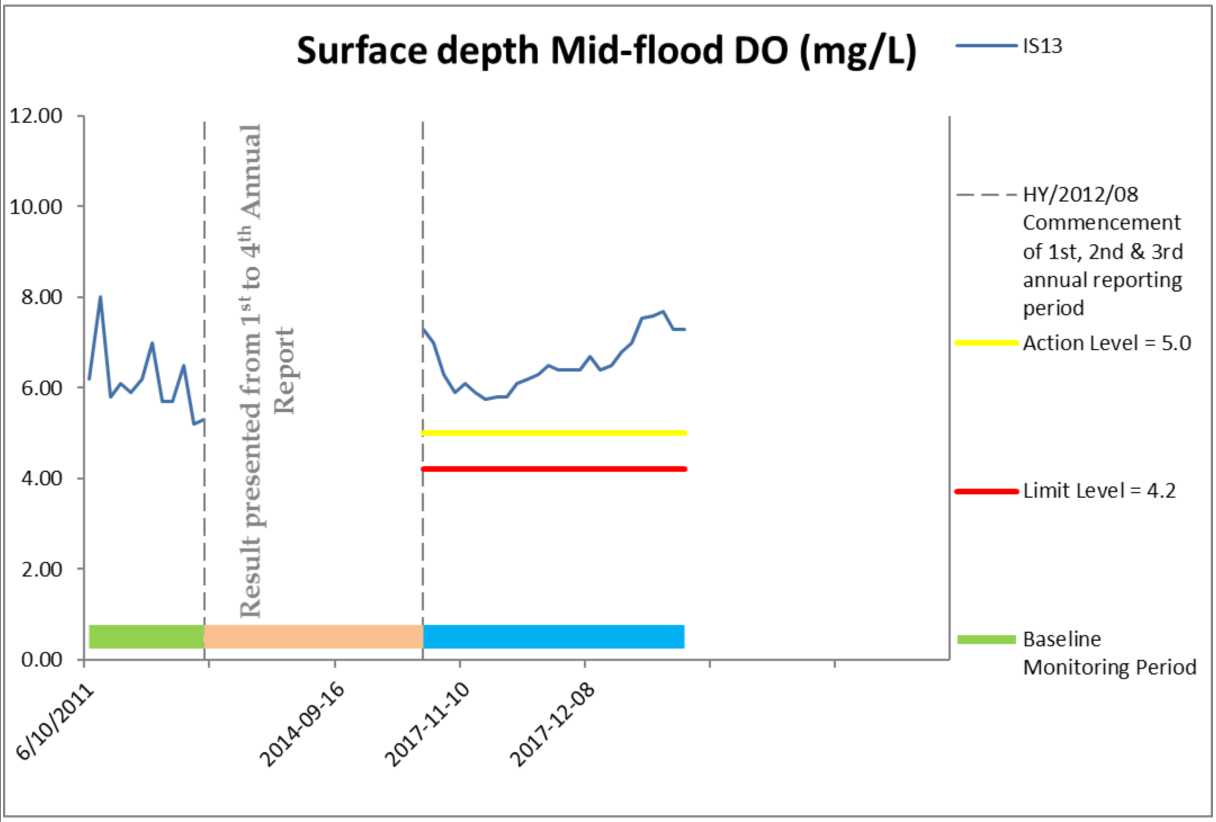


Figure E4 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS13. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



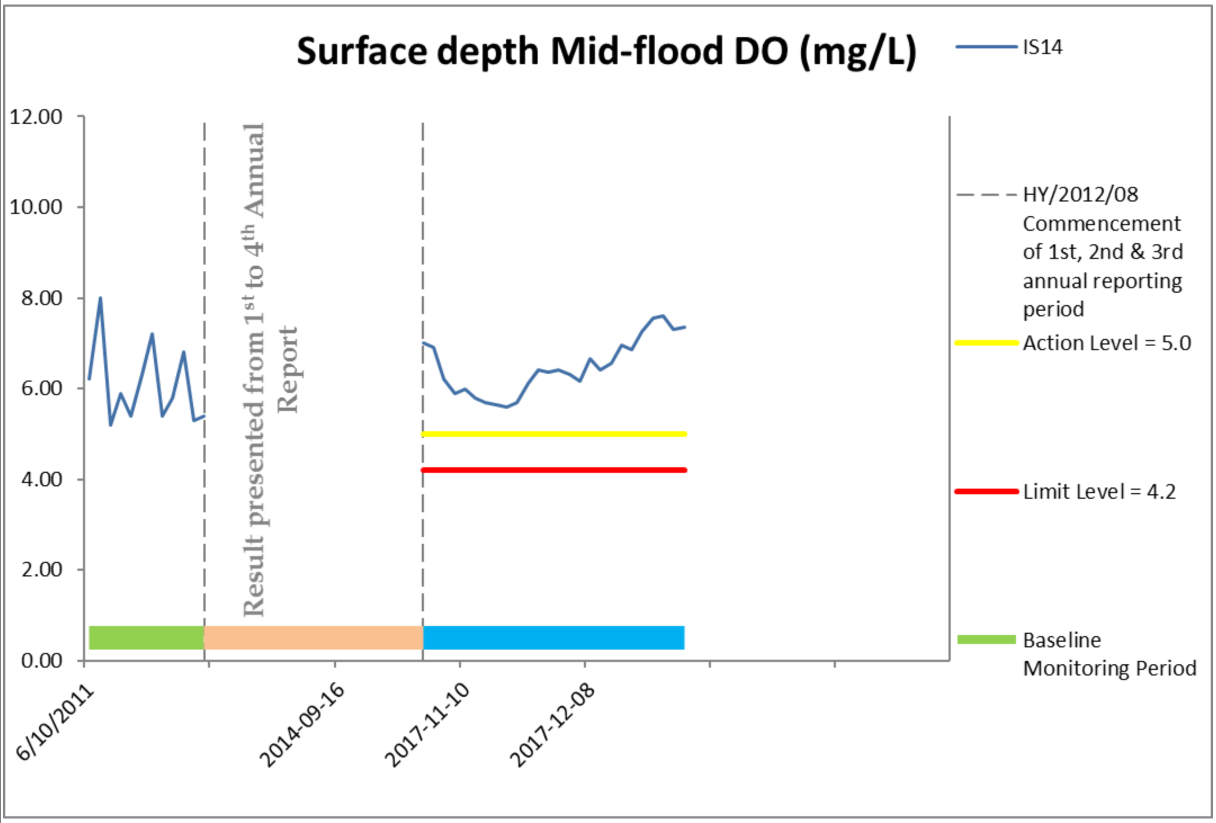
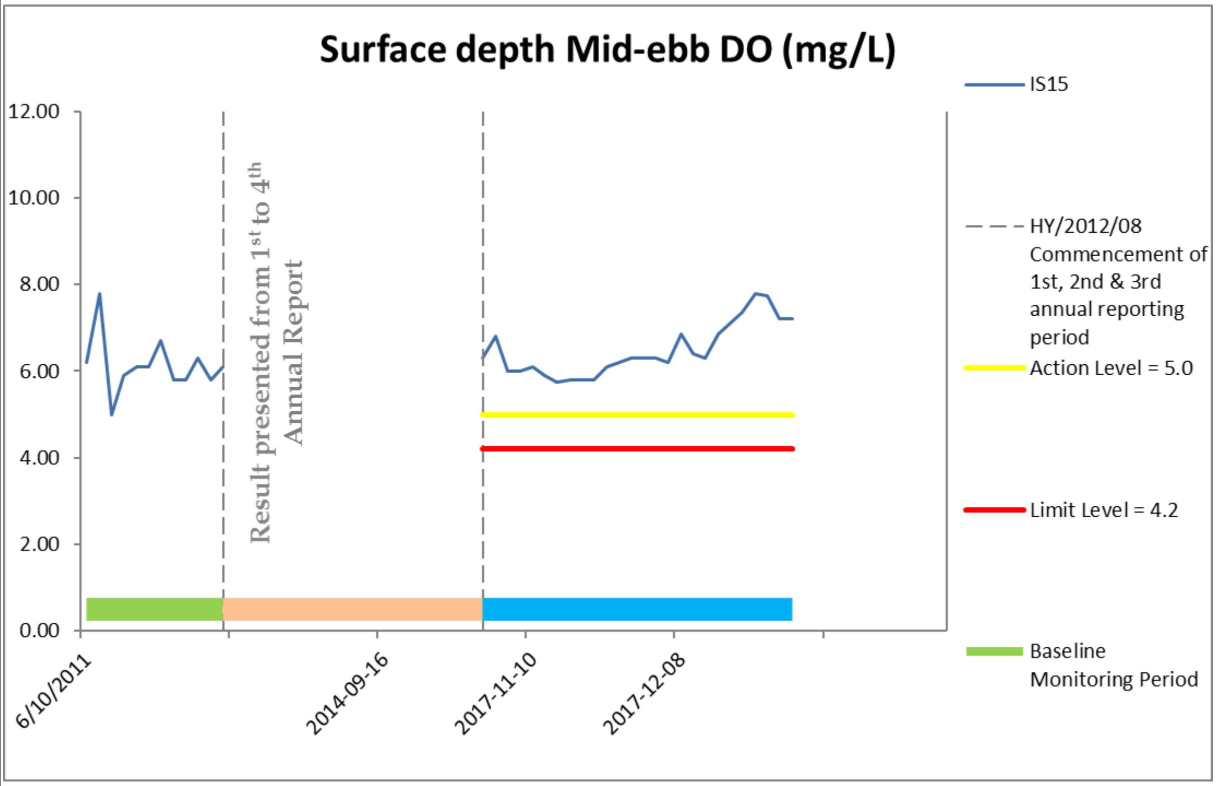


Figure E5 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS14. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



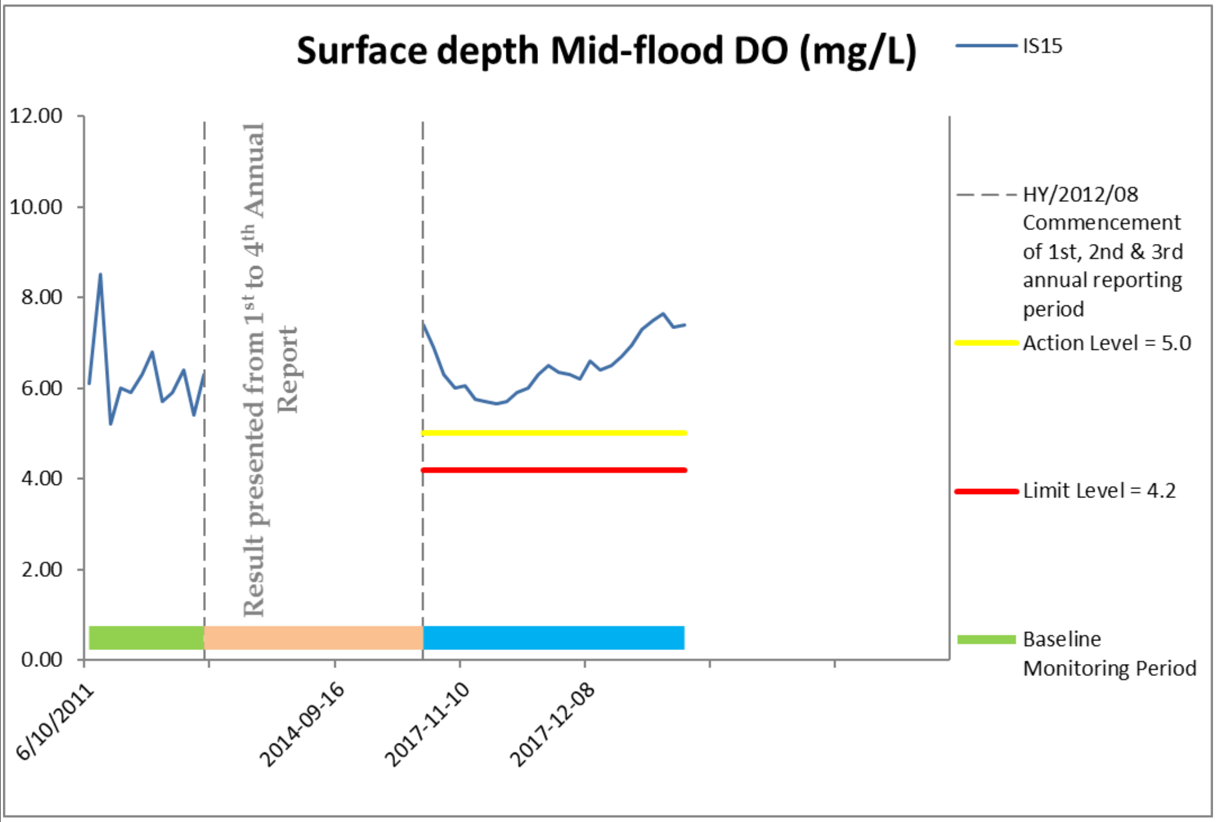
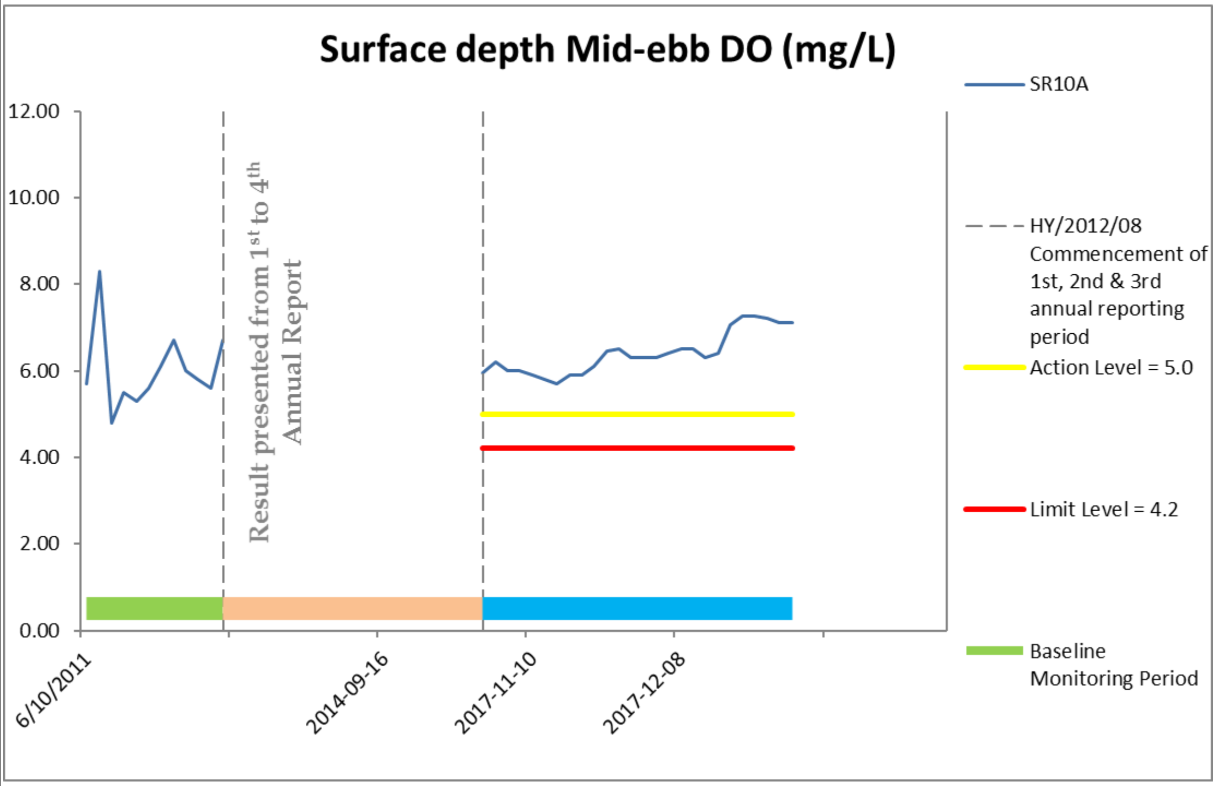


Figure E6 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS15. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



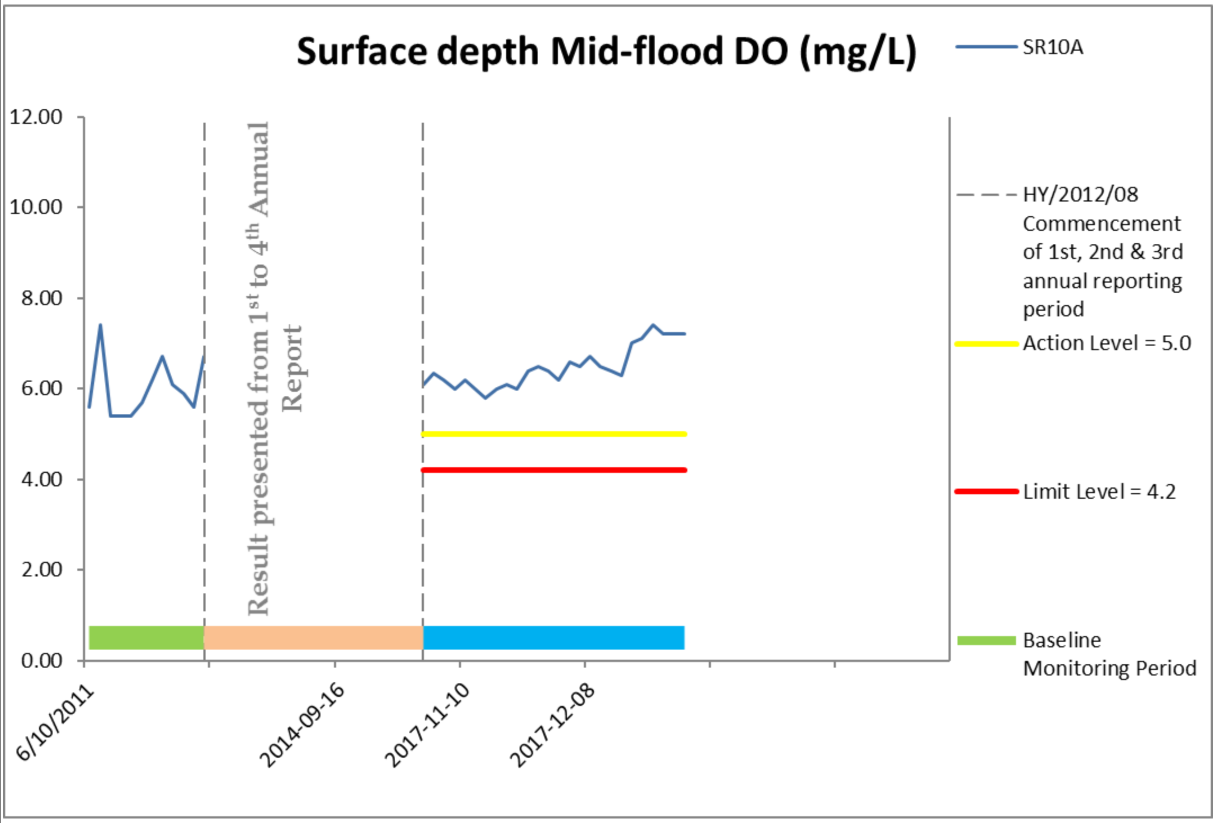
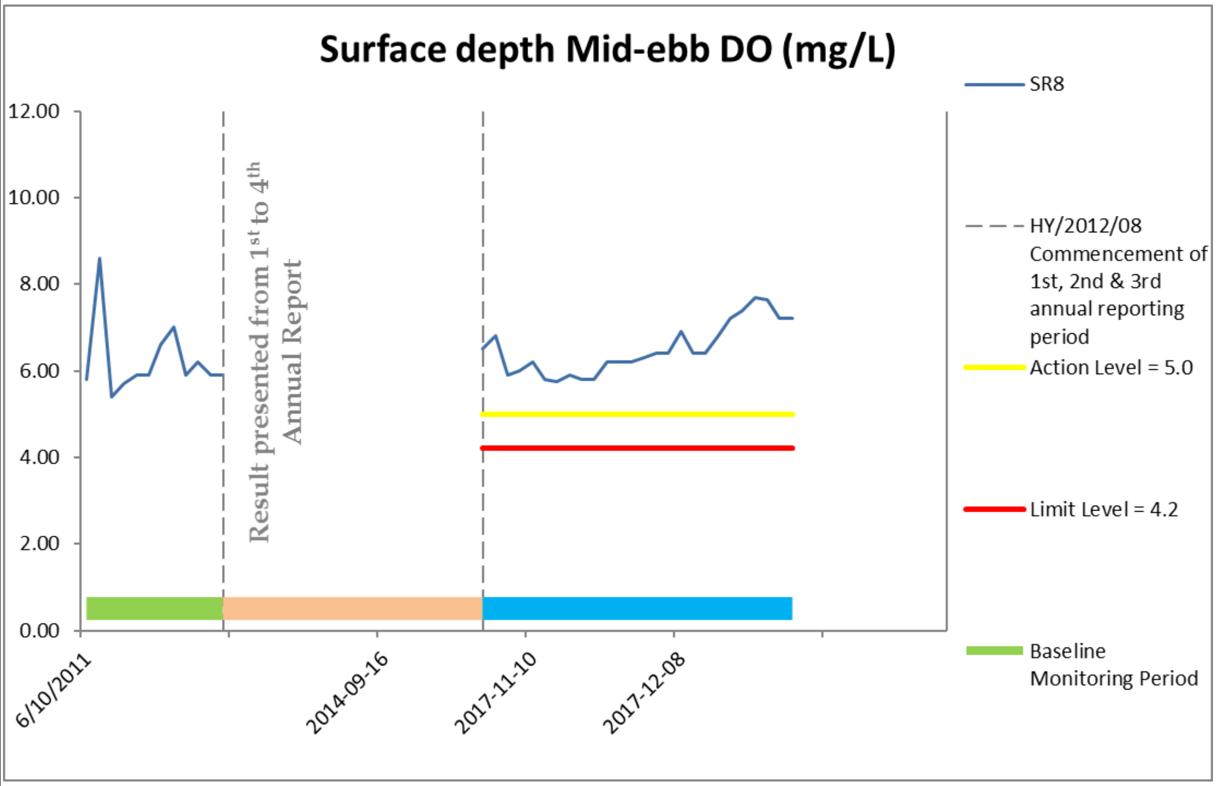


Figure E7 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR10A. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



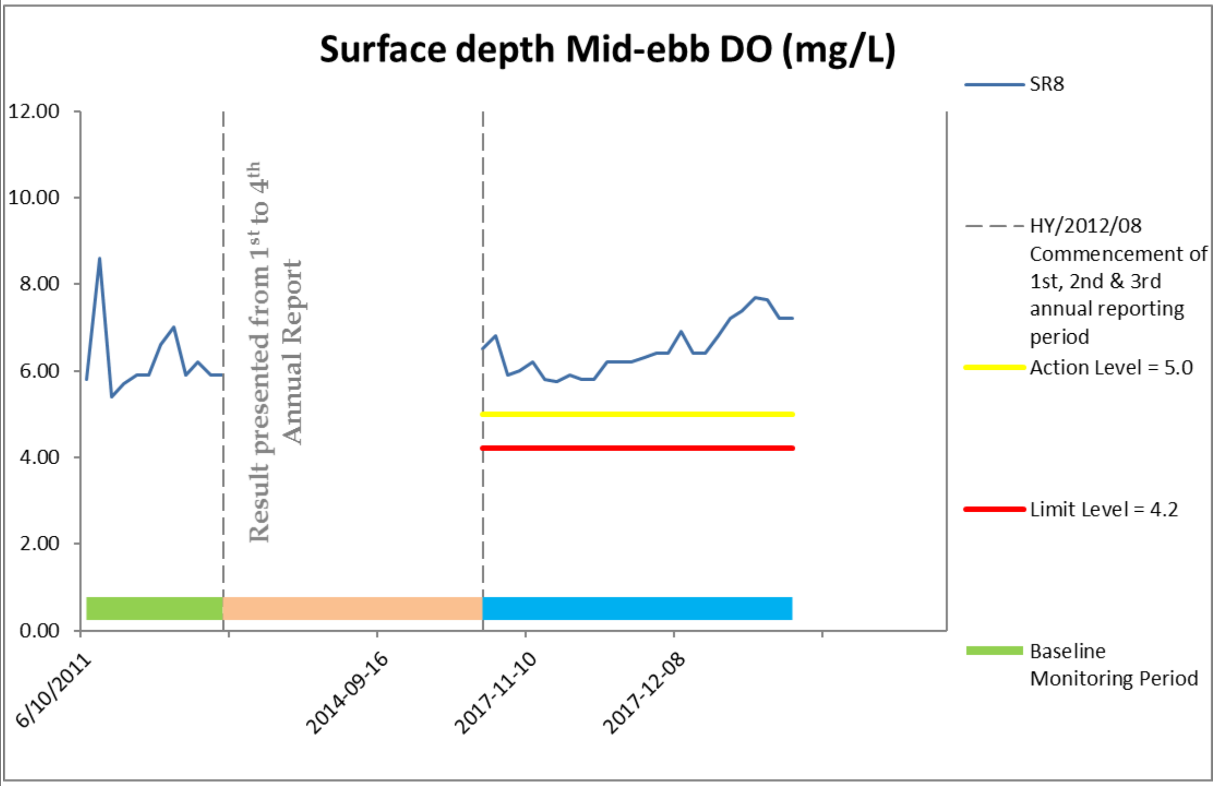
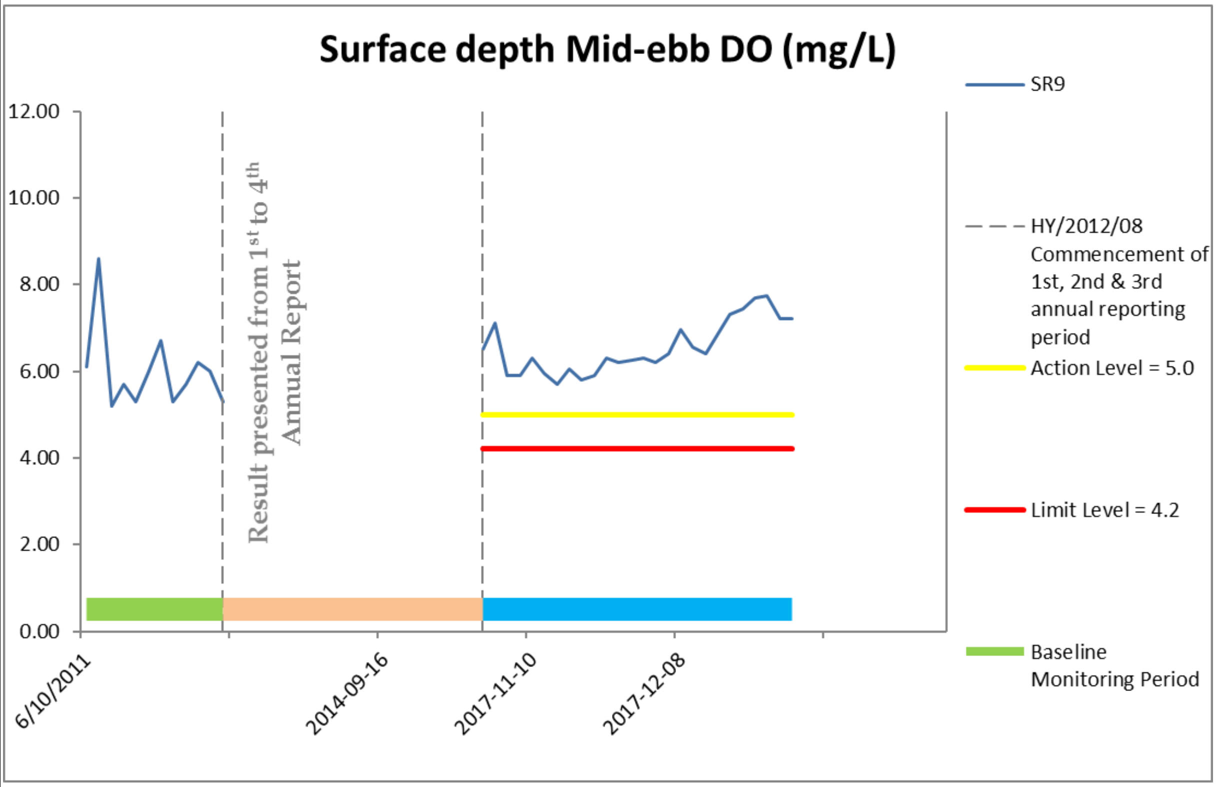


Figure E8 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR8. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



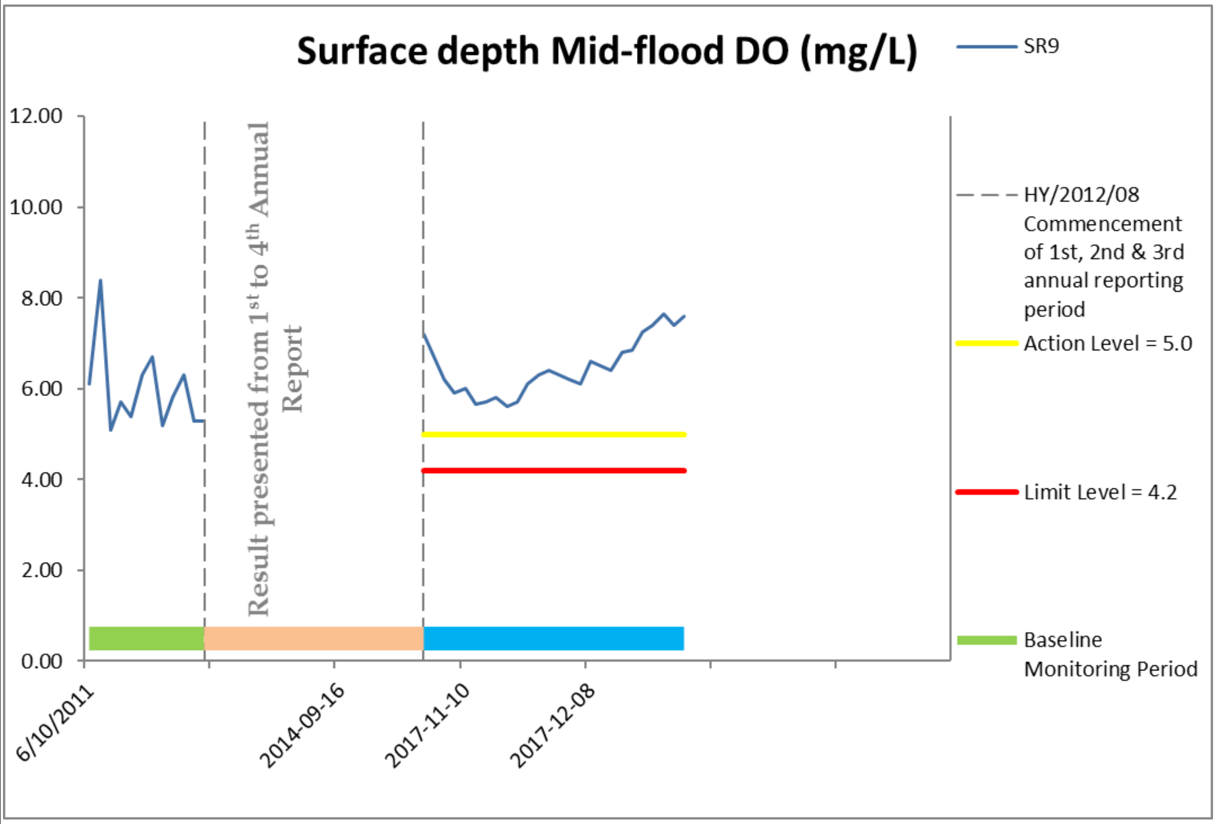
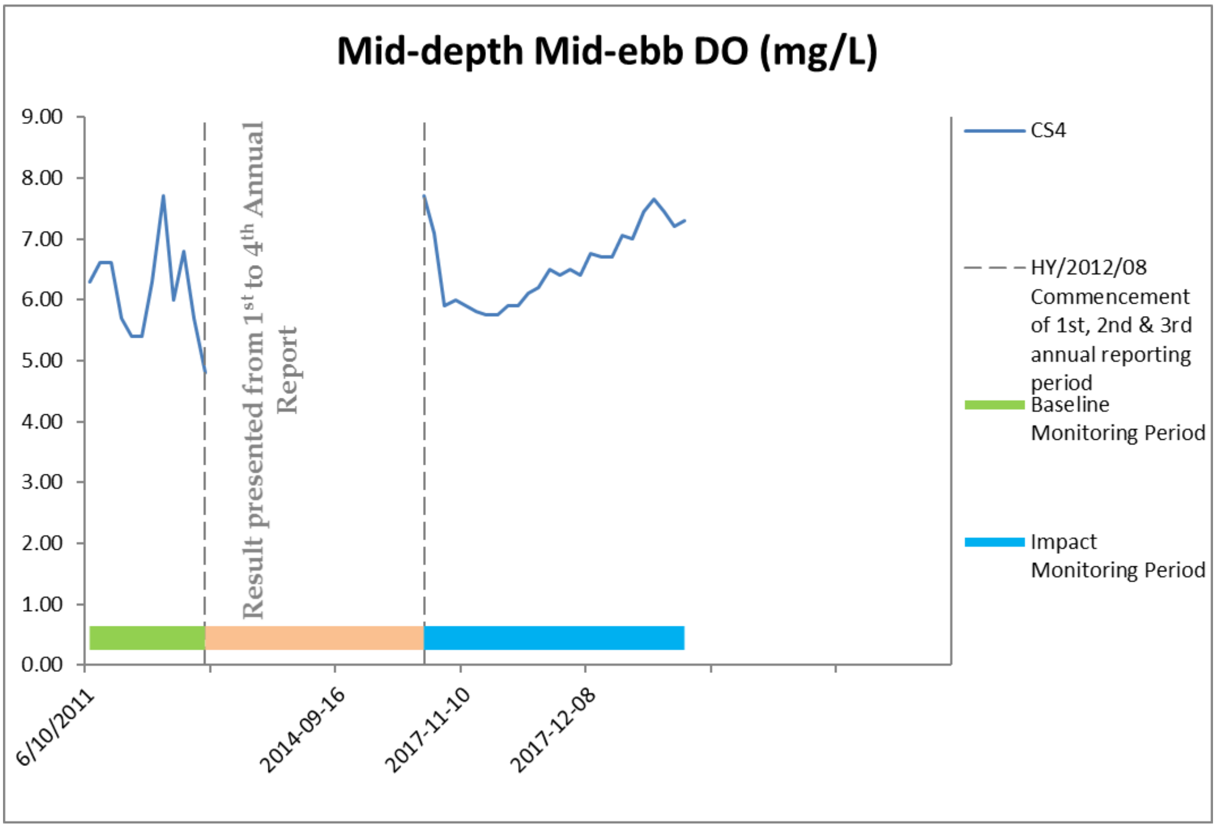
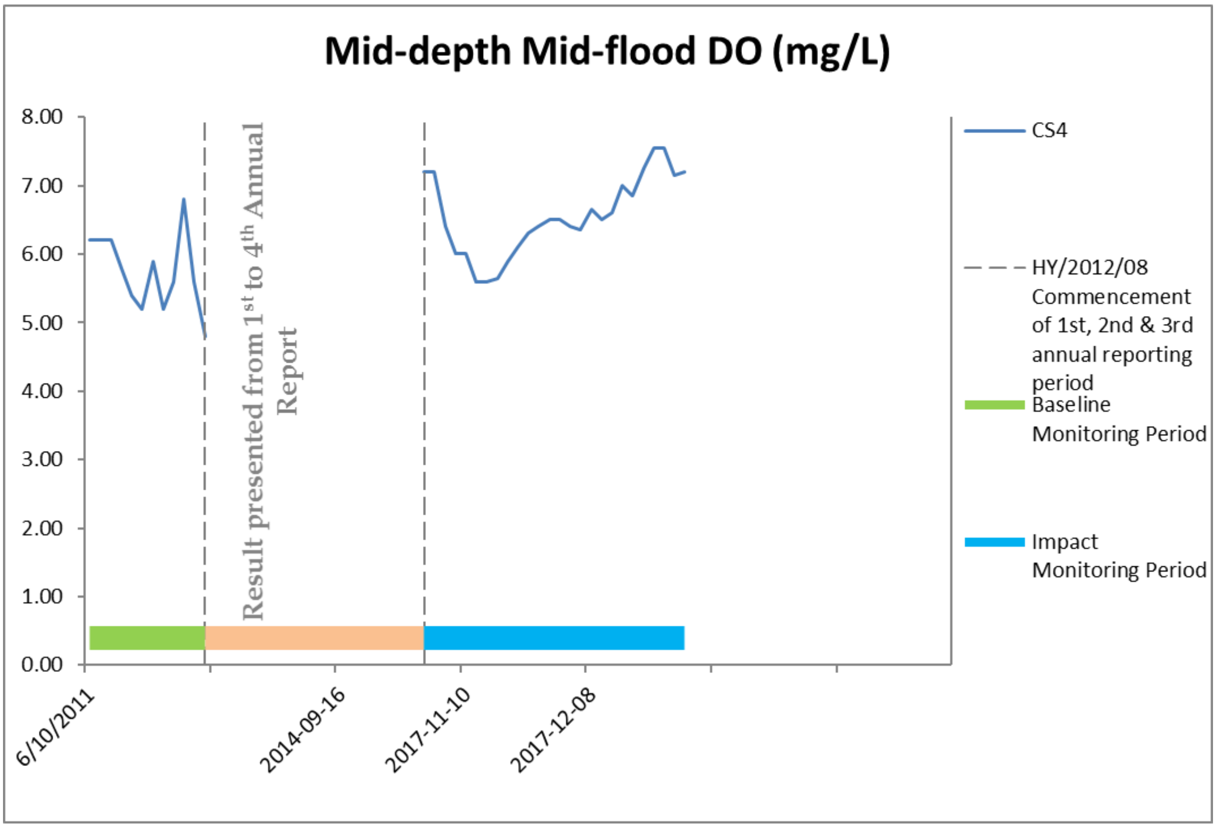


Figure E9 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in surface waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



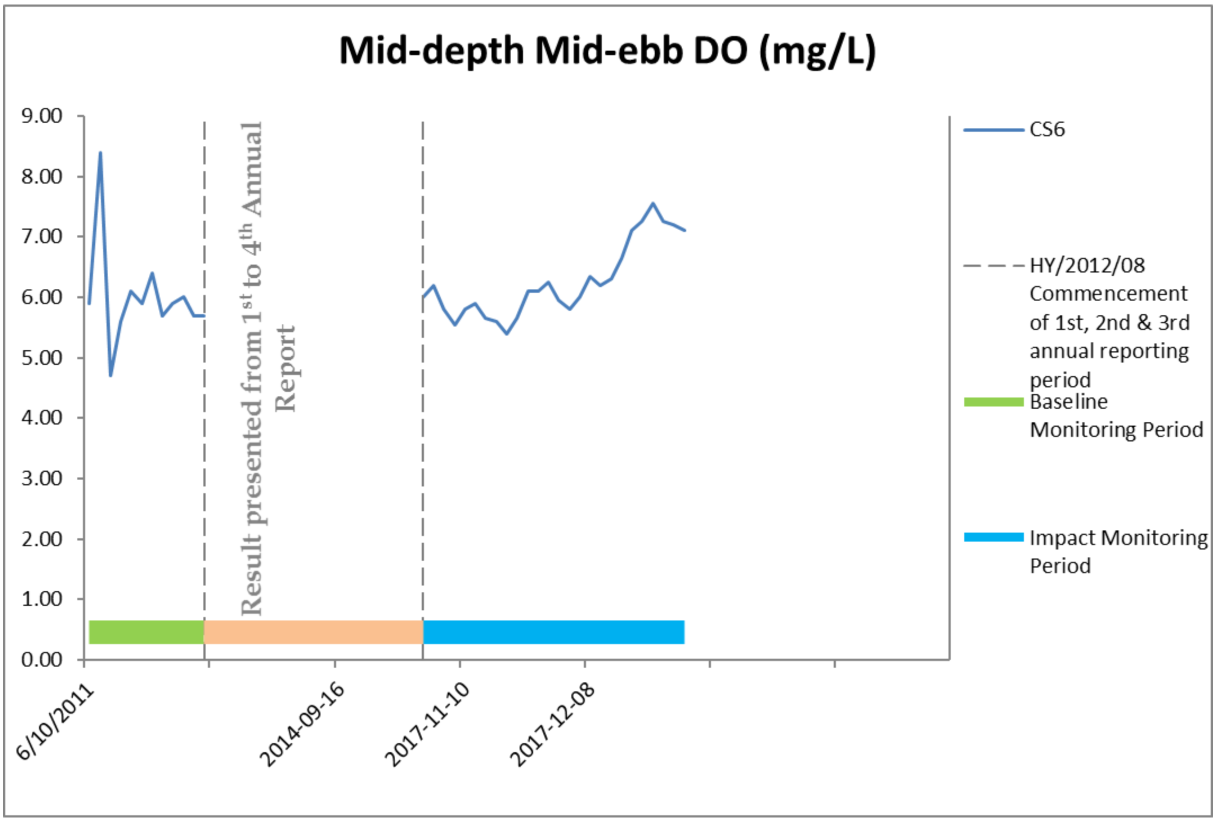


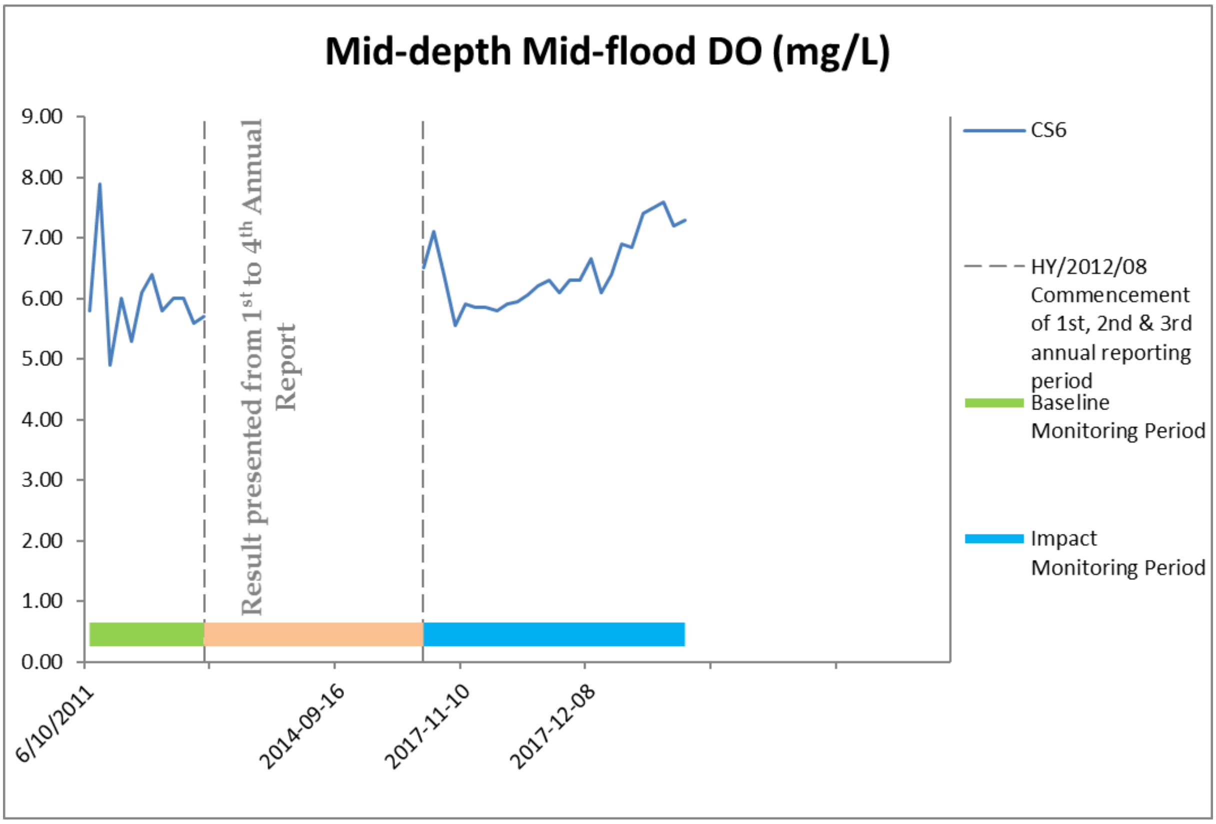
*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E10 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS4. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



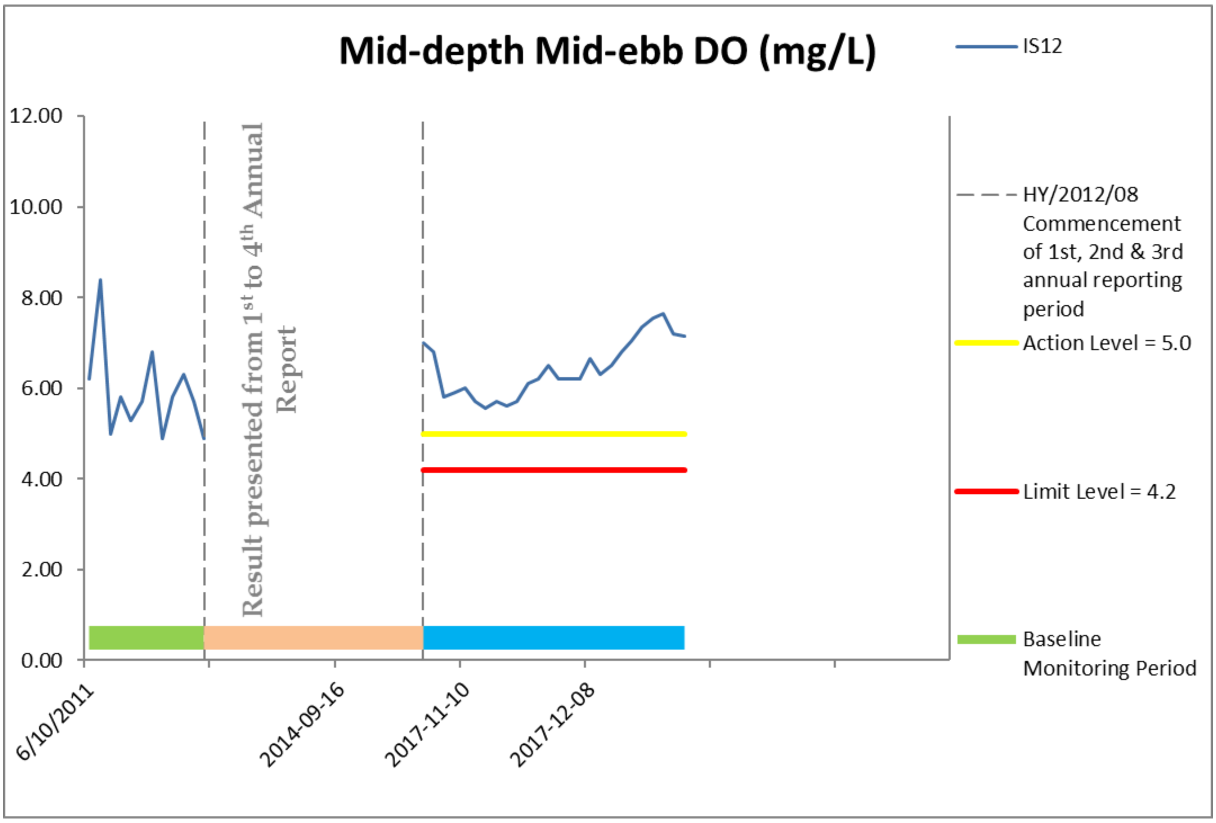


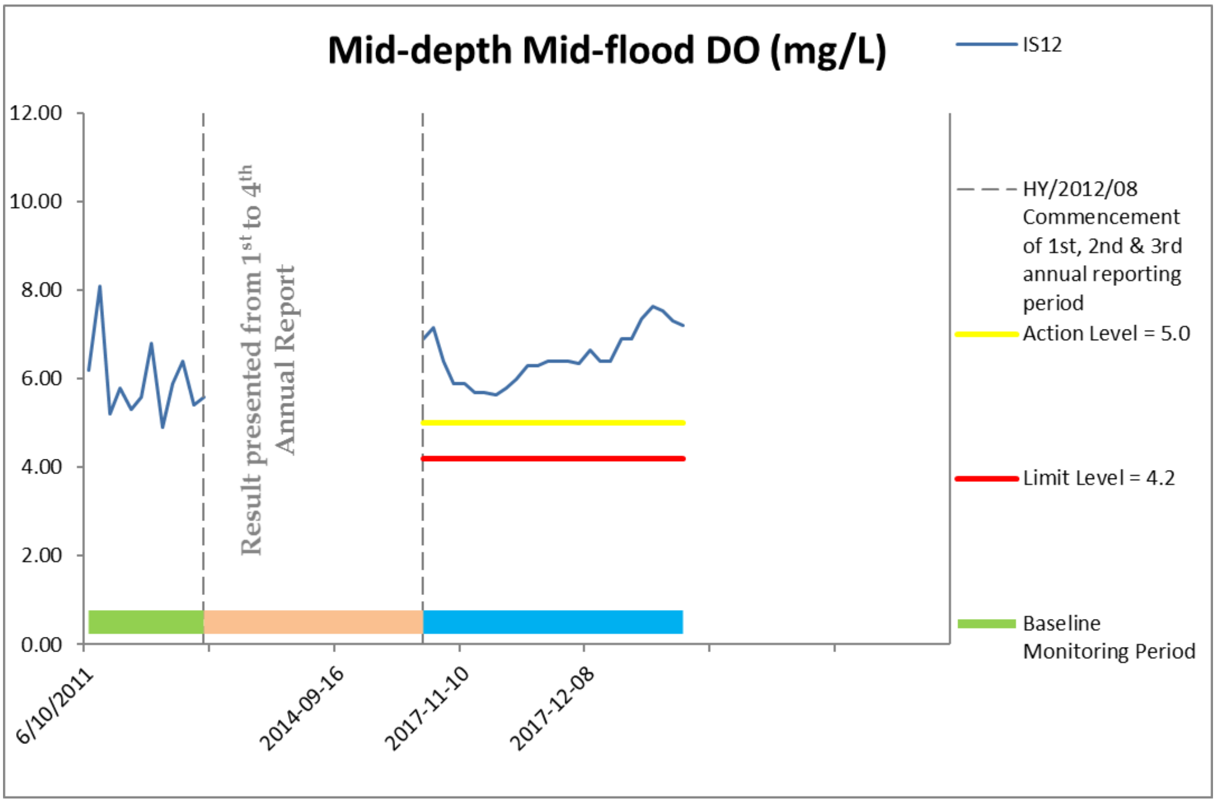
*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E11 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS6. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



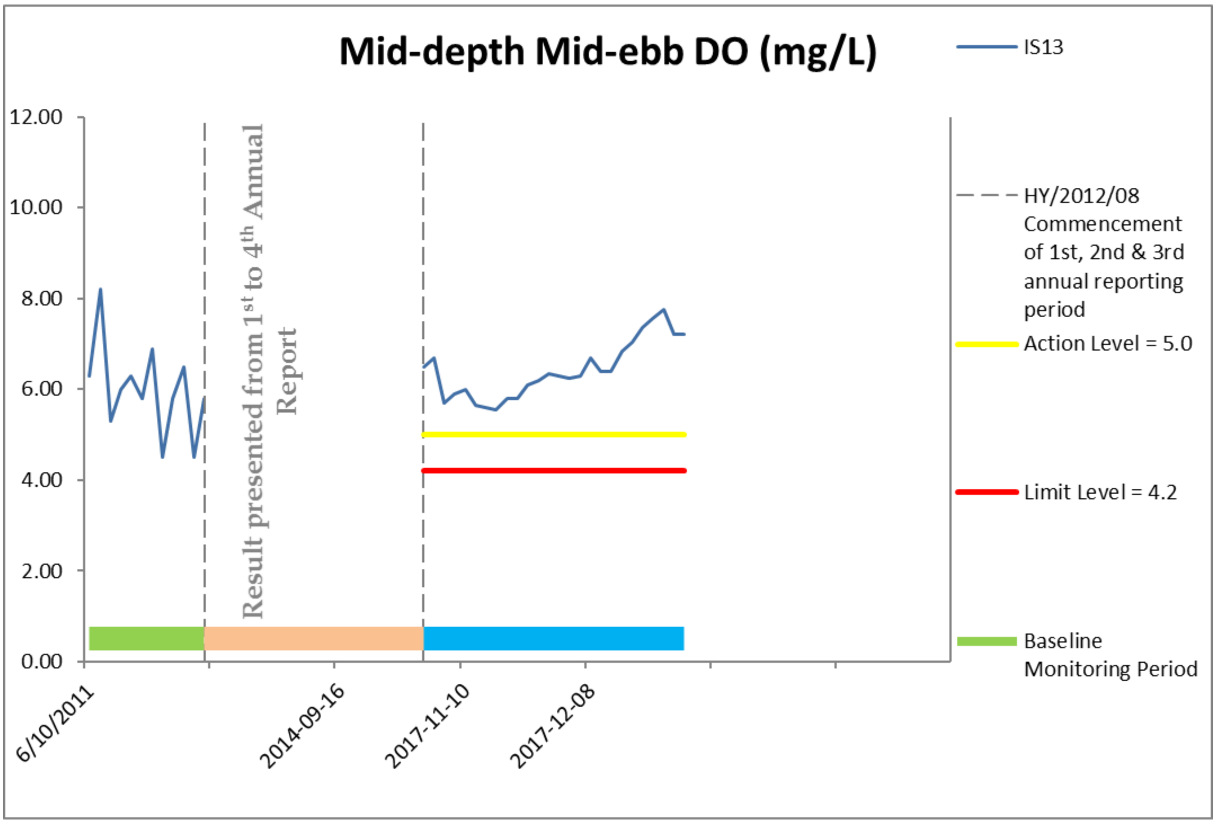


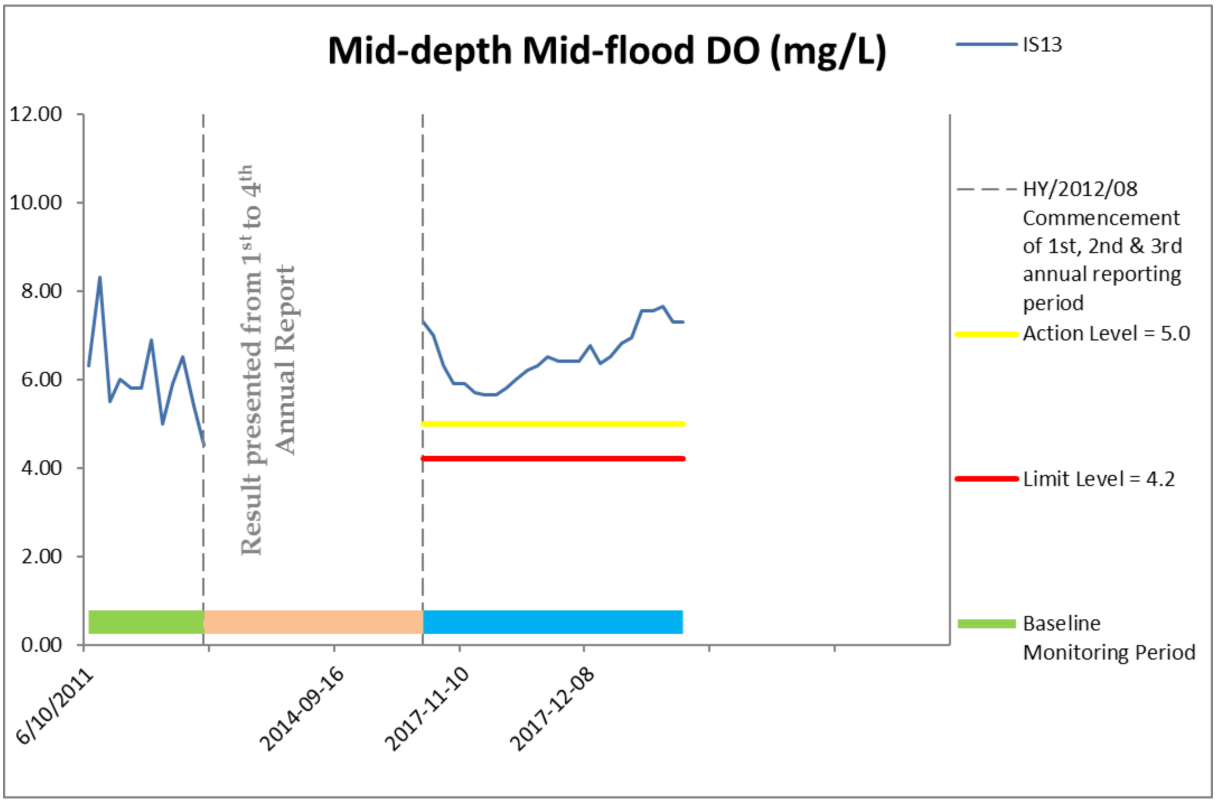
*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E12 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS12. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



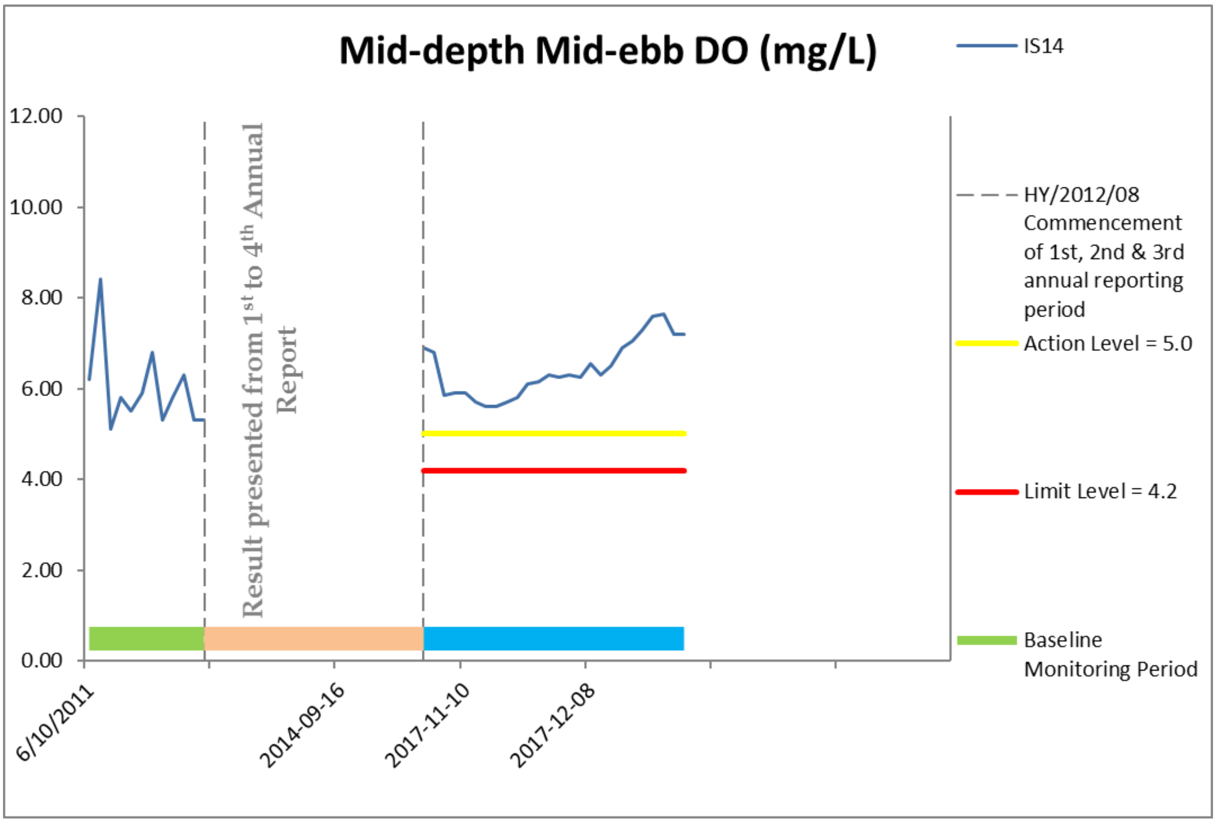


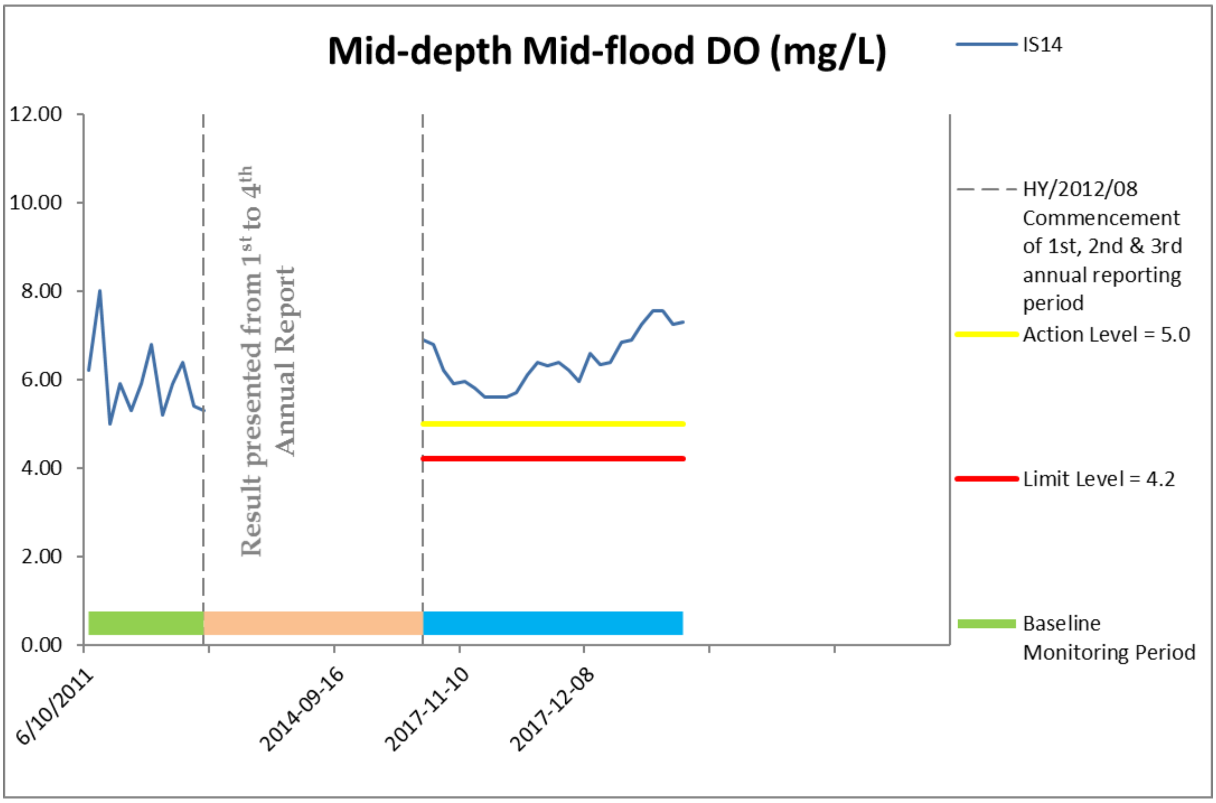
*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E13 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS13. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



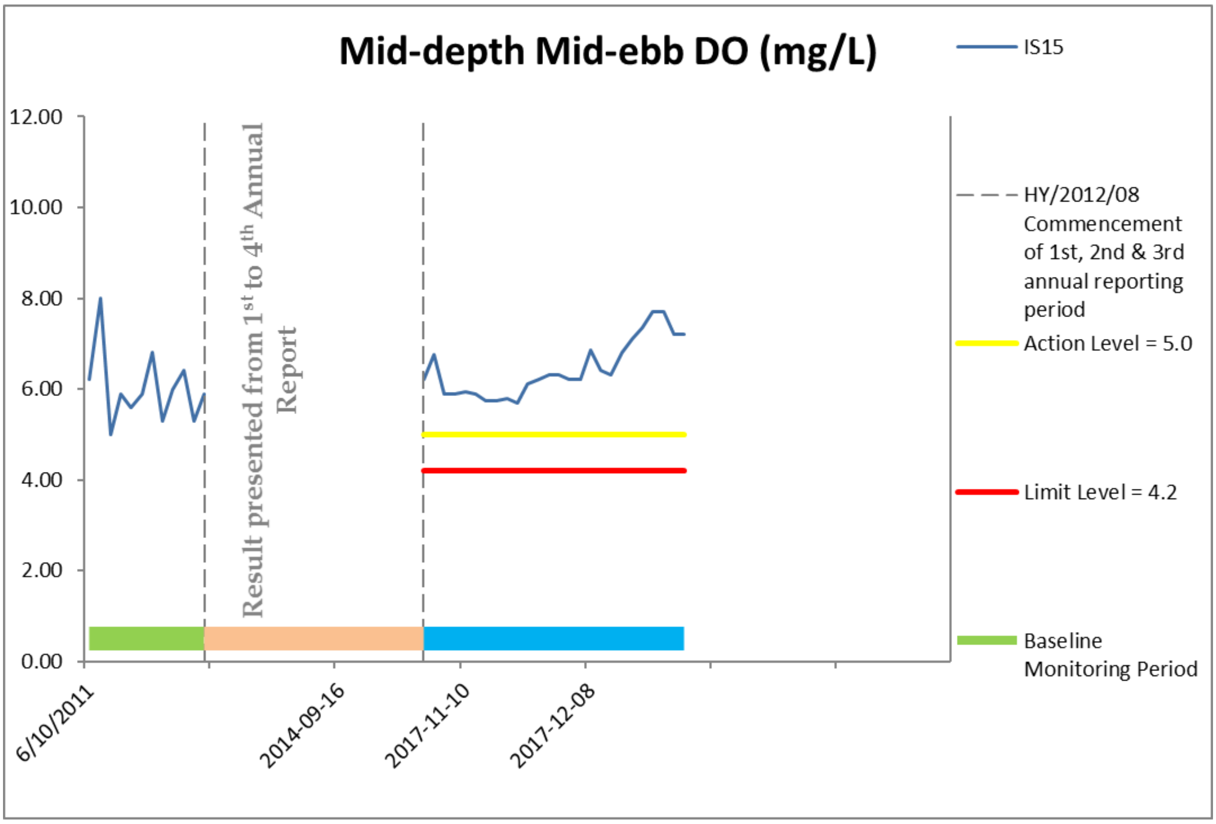


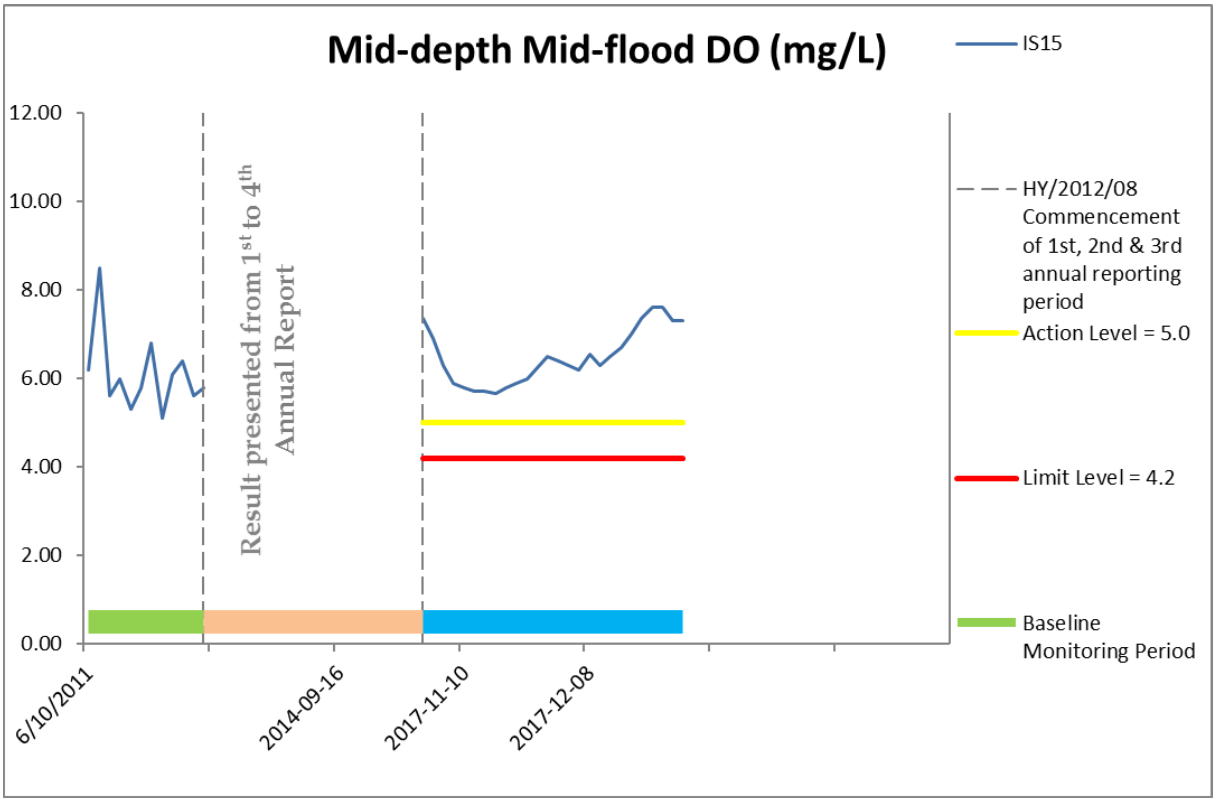
*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E14 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS14. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



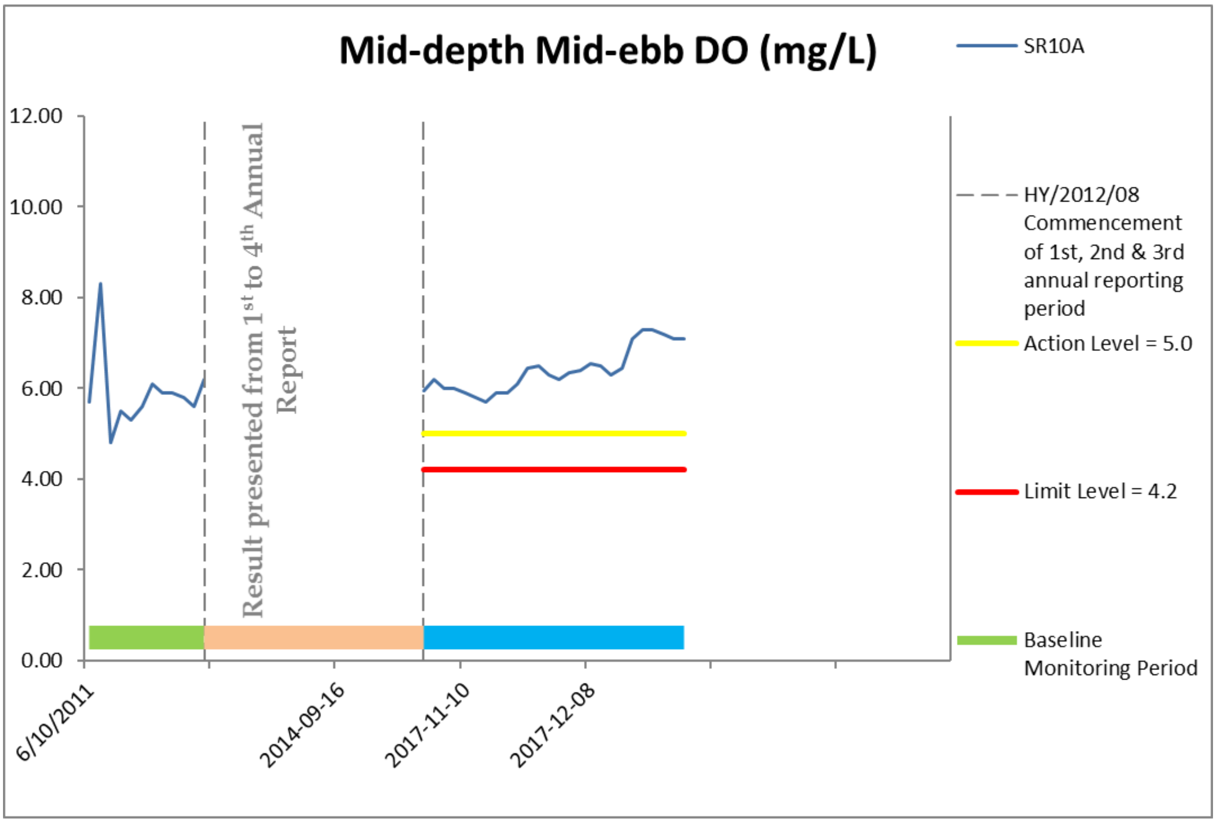


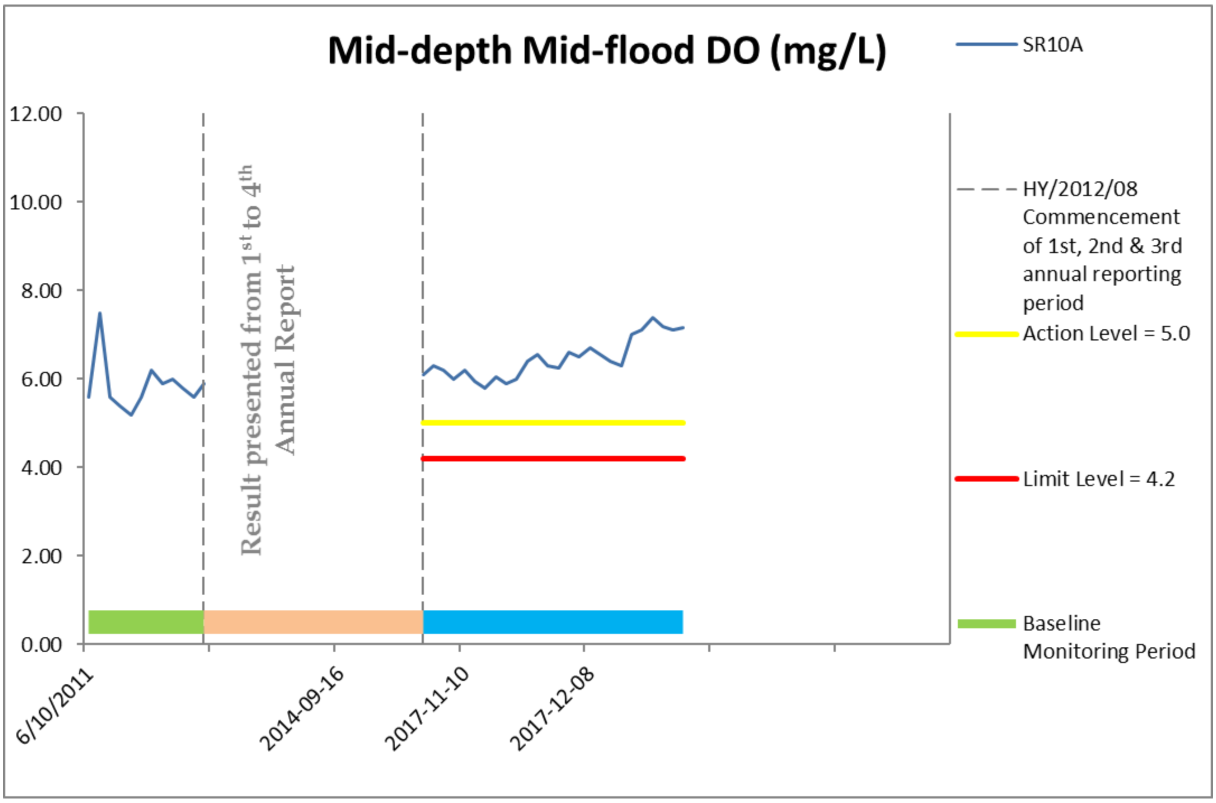
*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E15 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS15. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



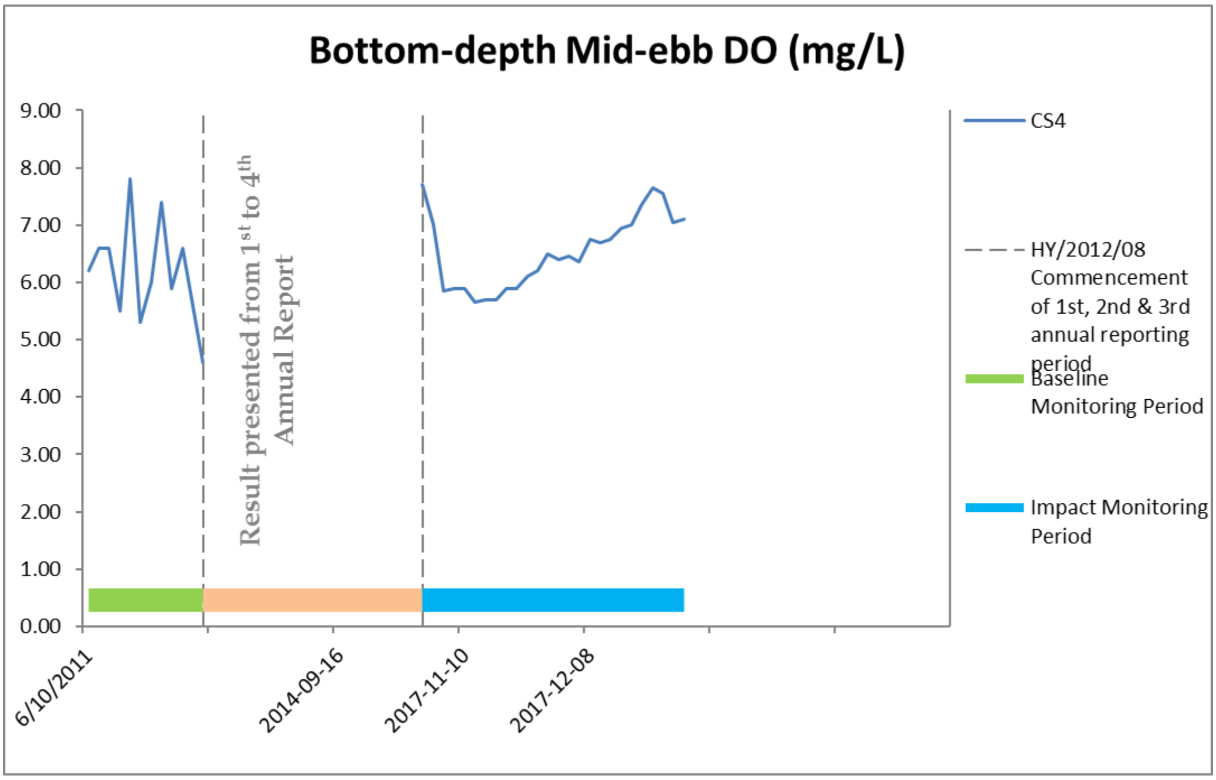


*No data for Stations SR8 and SR9 due to shallow water depth (< 6m).

Figure E16 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in mid-depth waters between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR10A. 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 Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



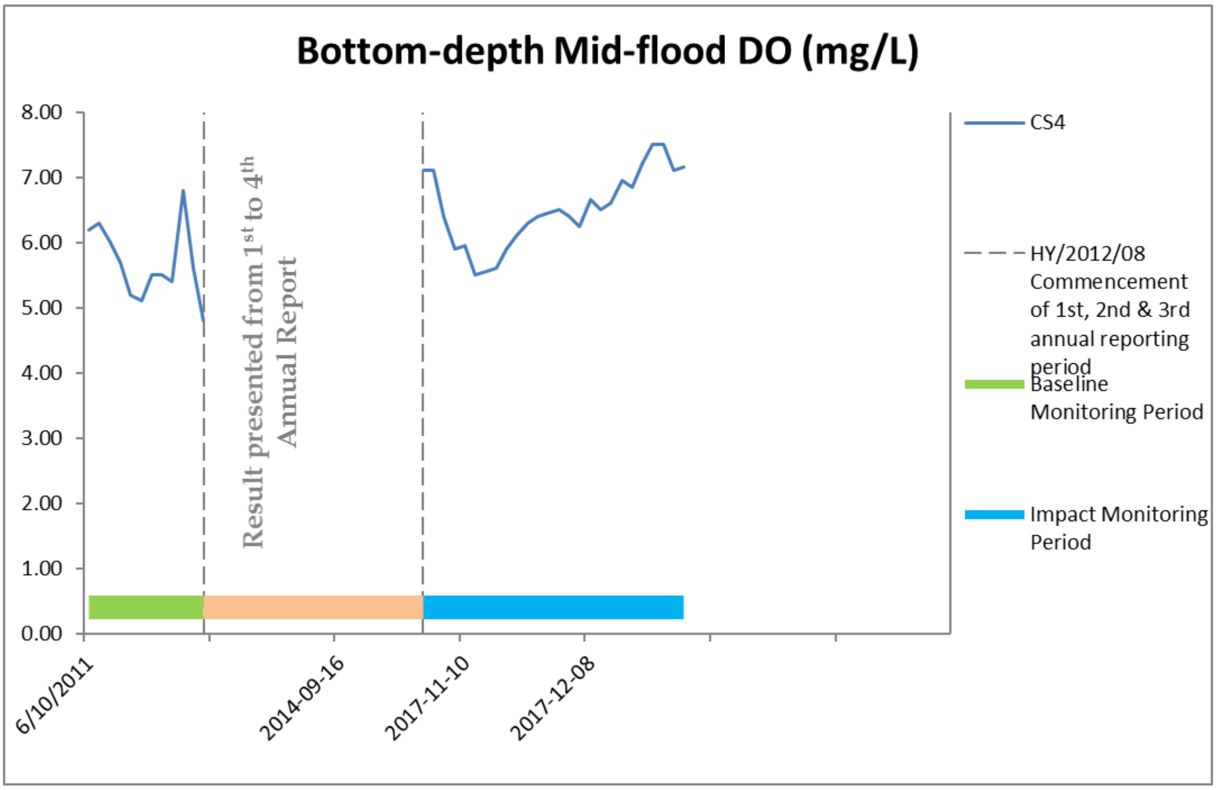
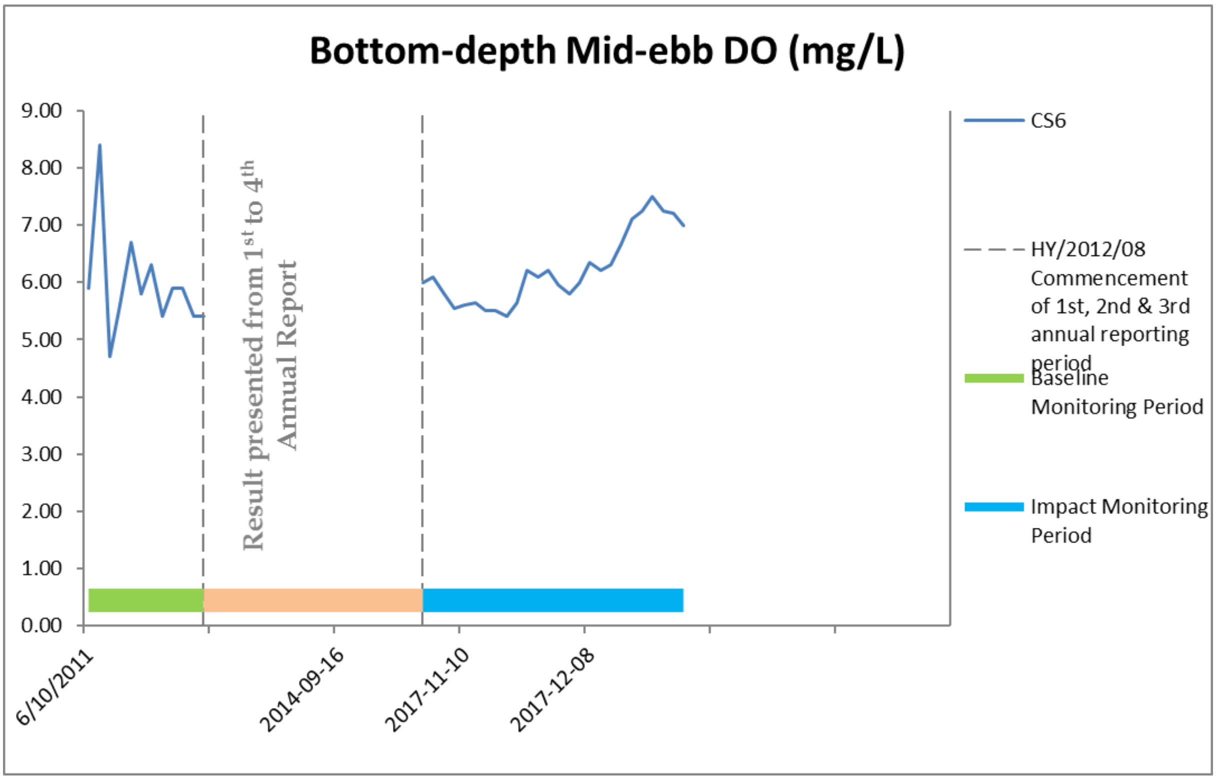


Figure E17 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS4. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



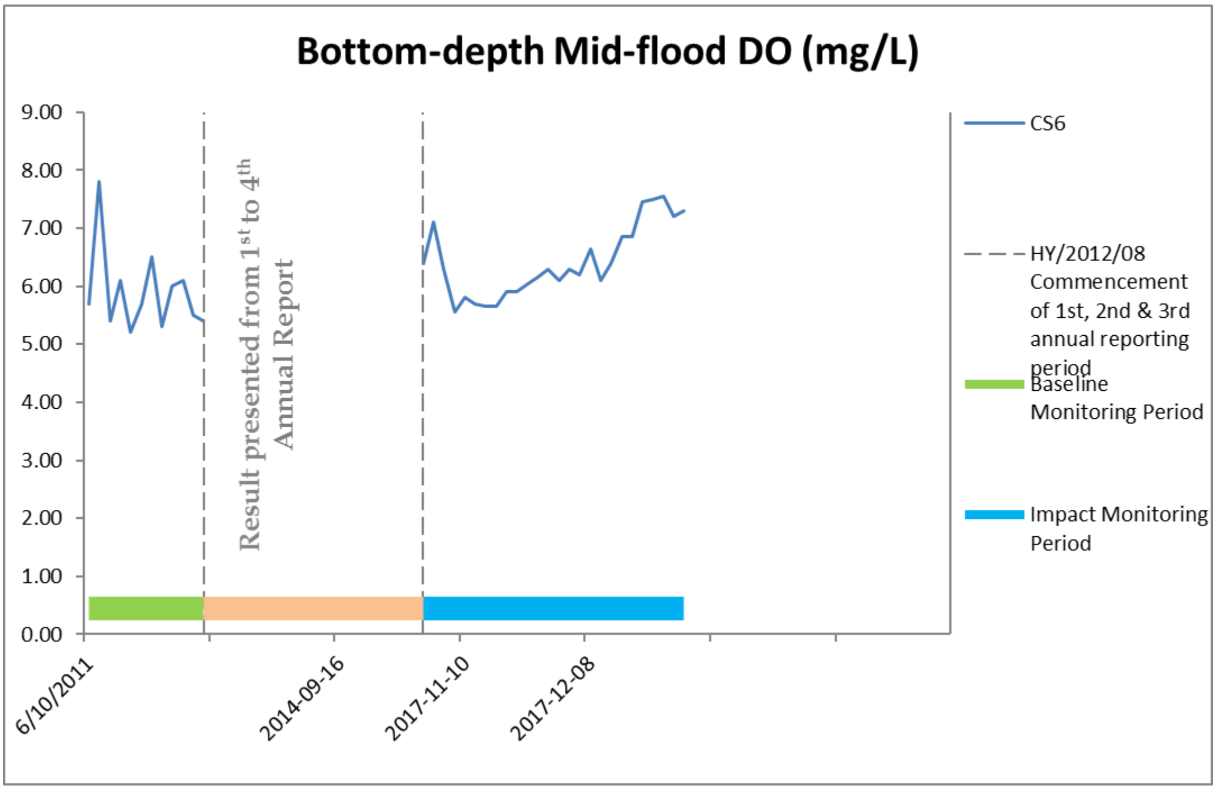
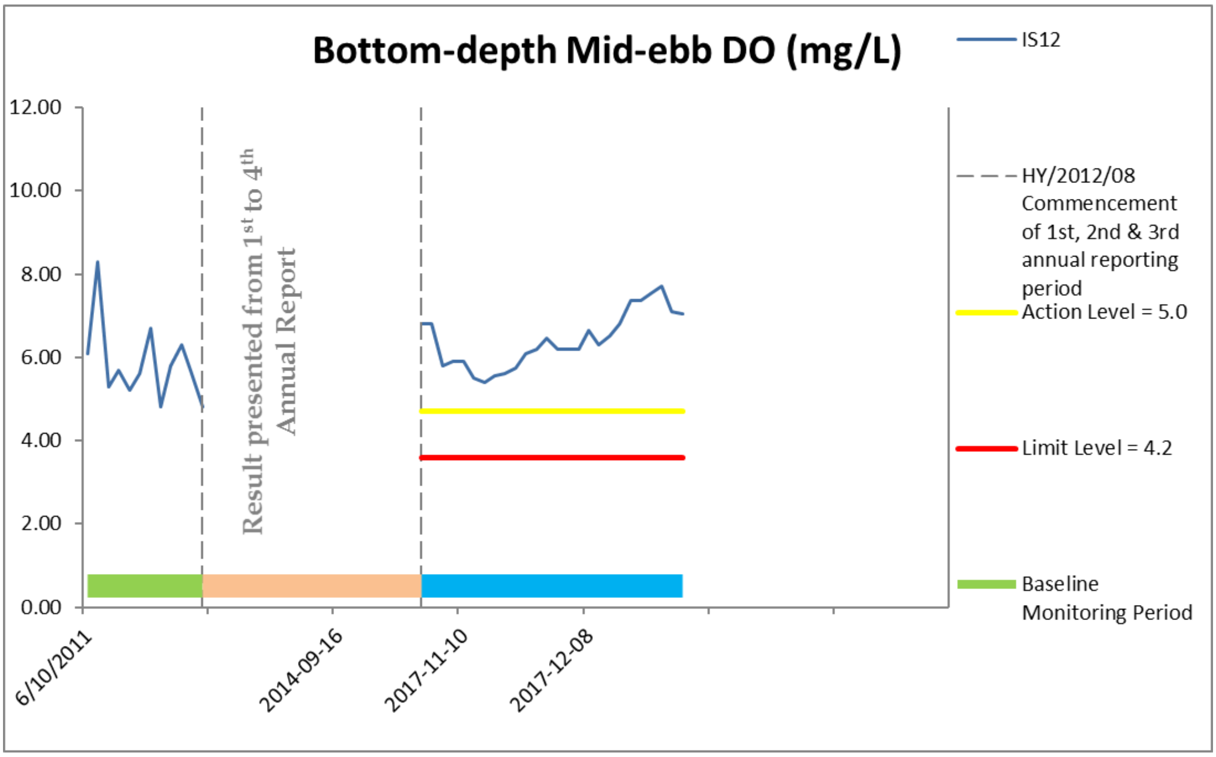


Figure E18 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS6. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



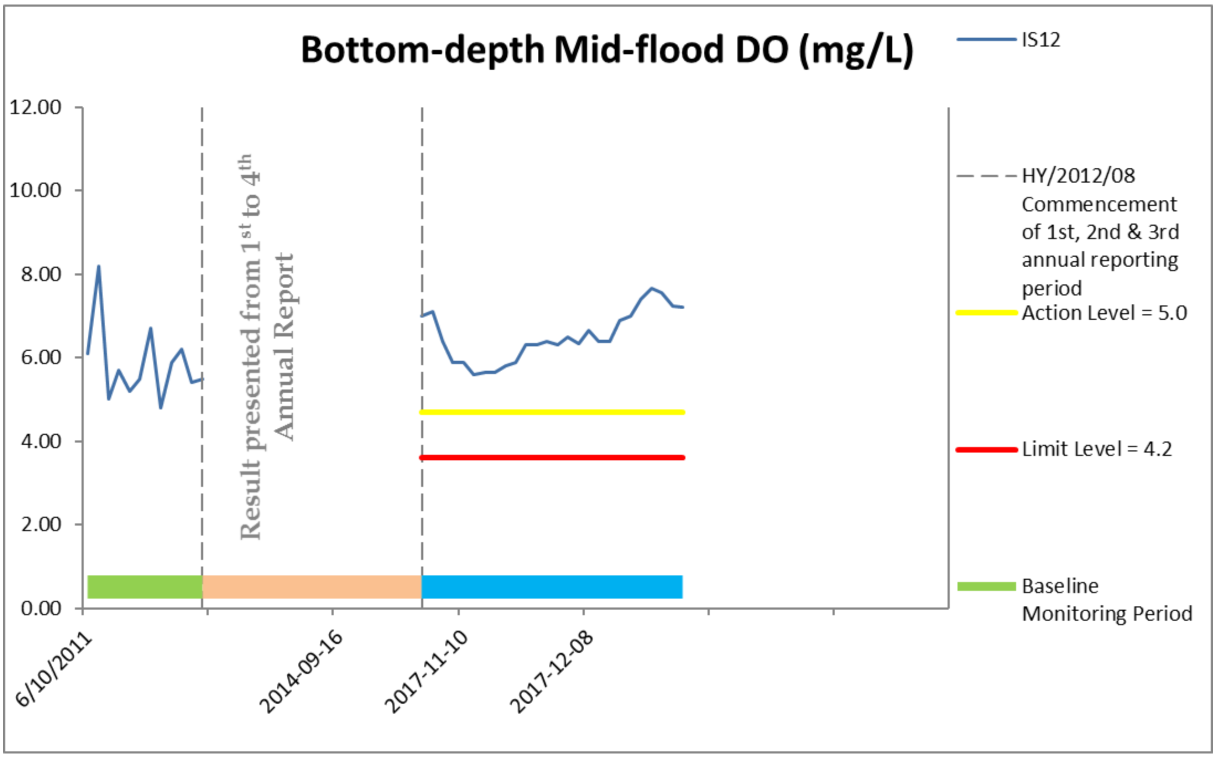
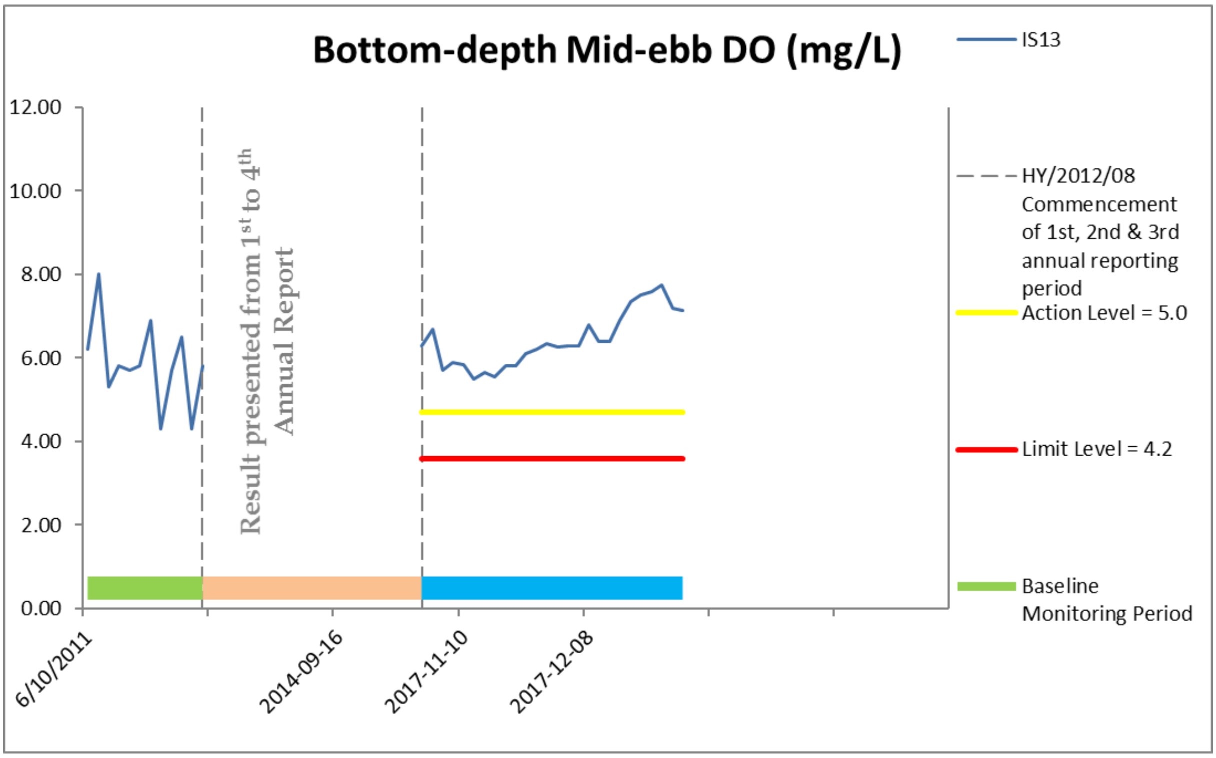


Figure E19 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS12. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



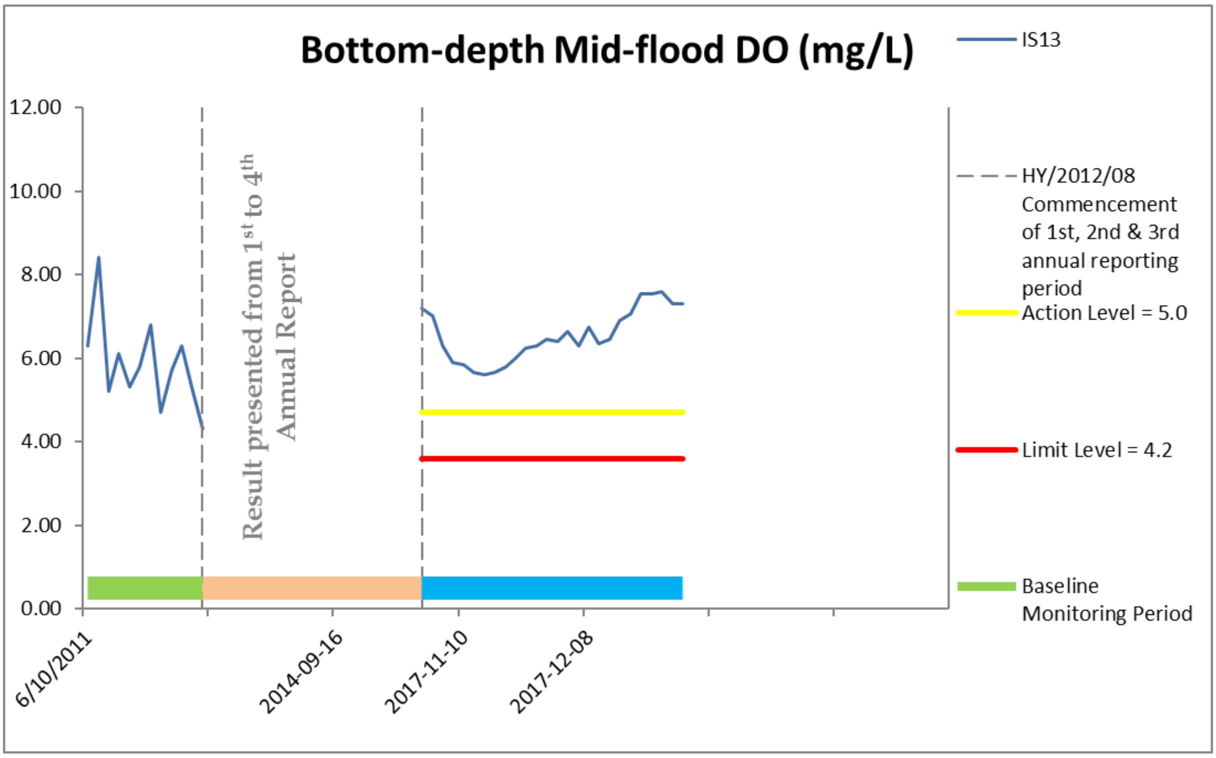
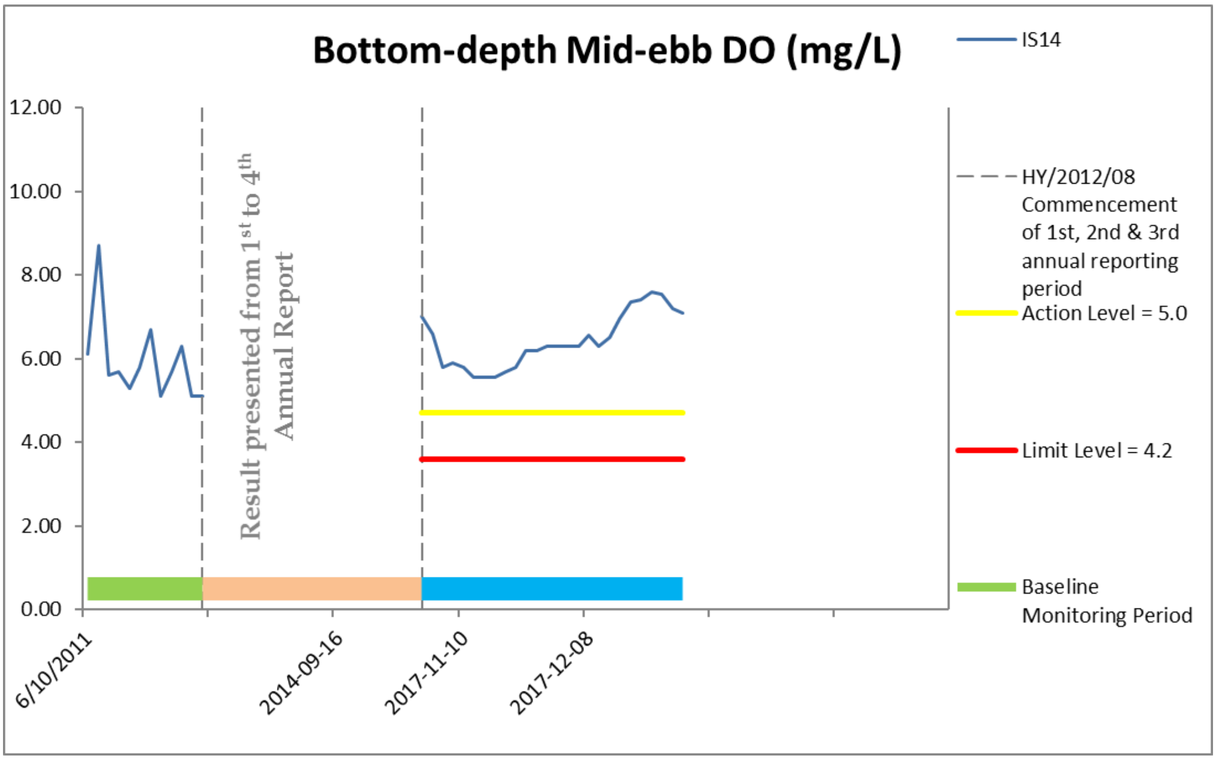


Figure E20 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS13. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



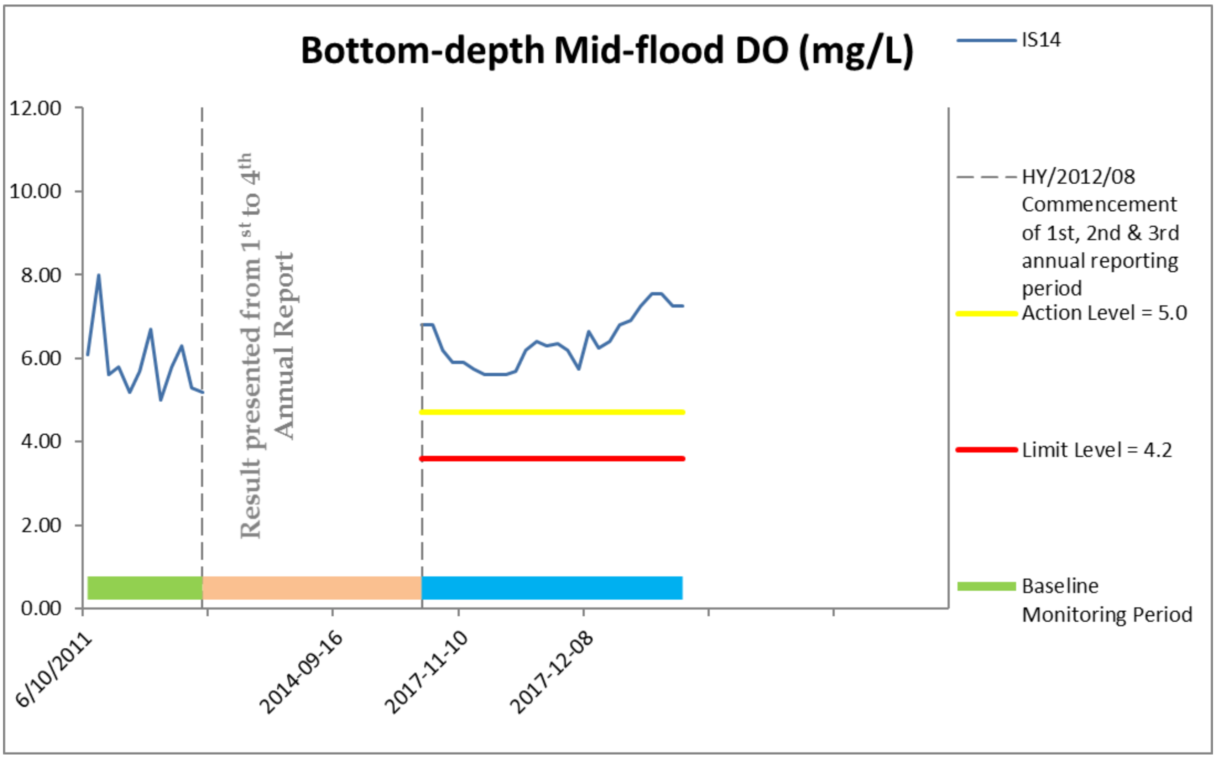


Figure E21 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS14. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

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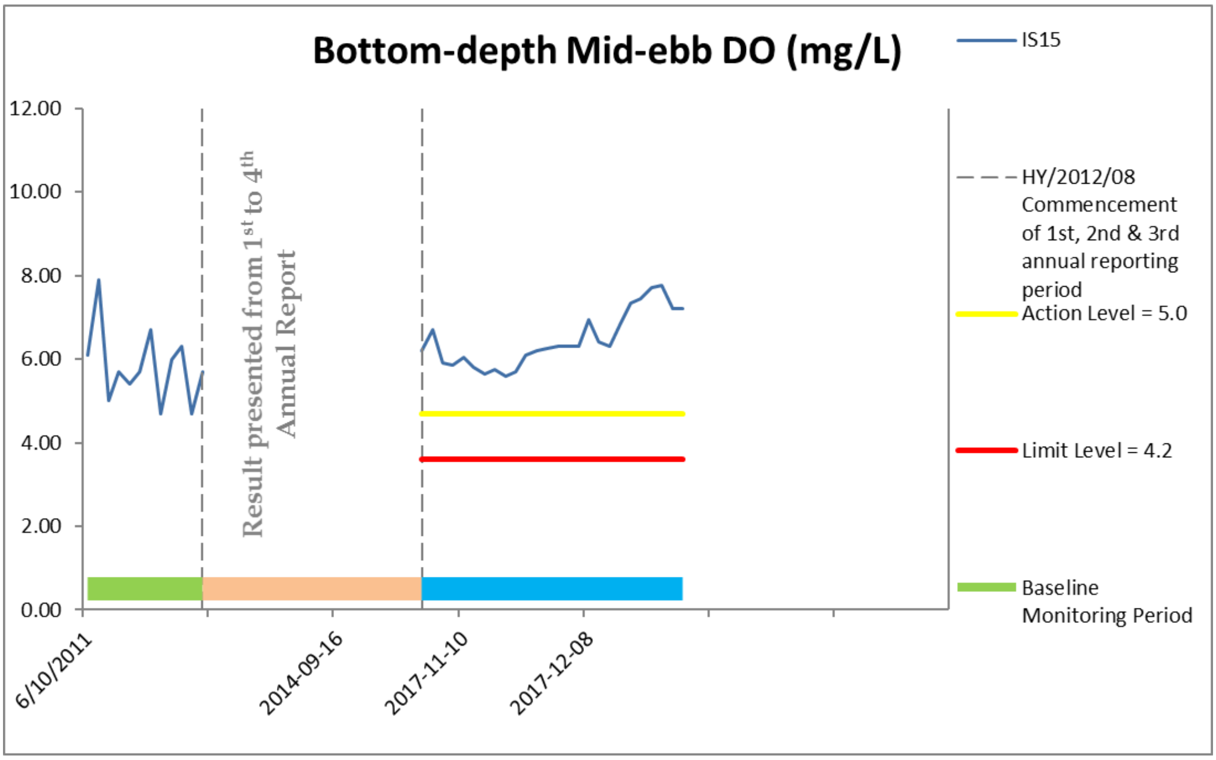


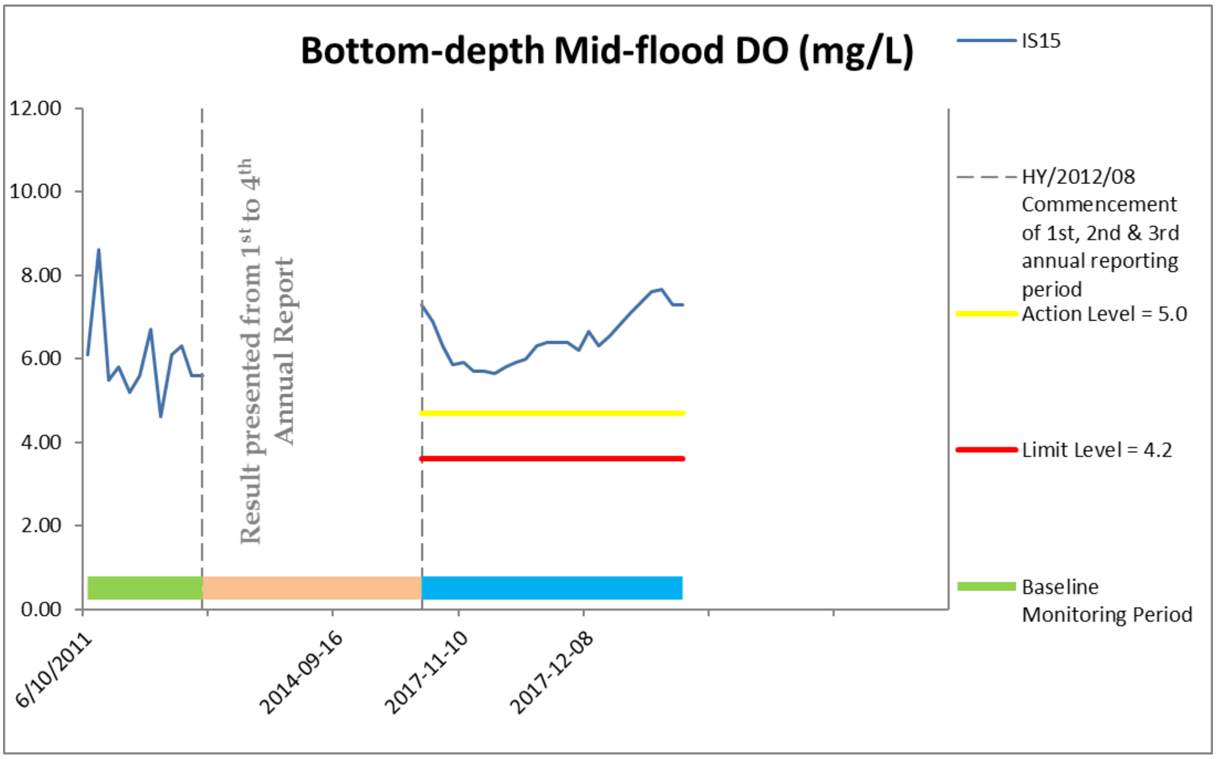
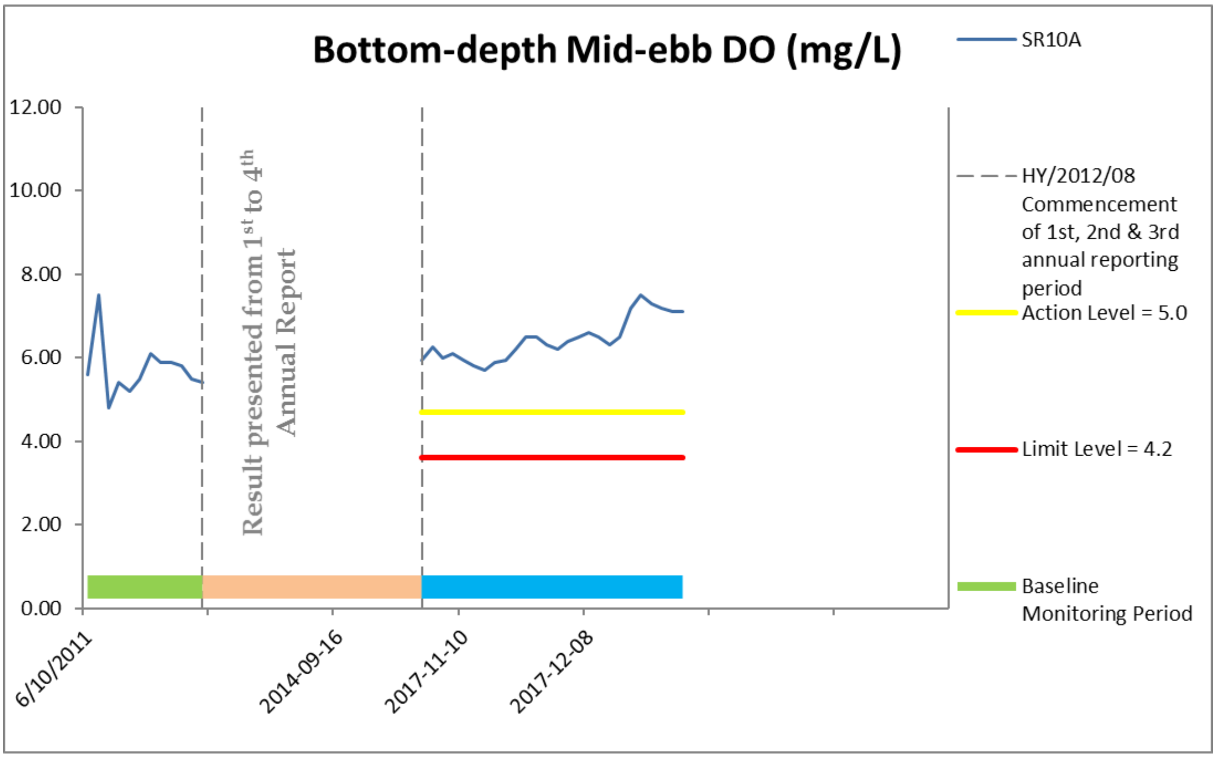


Figure E22 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS15. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



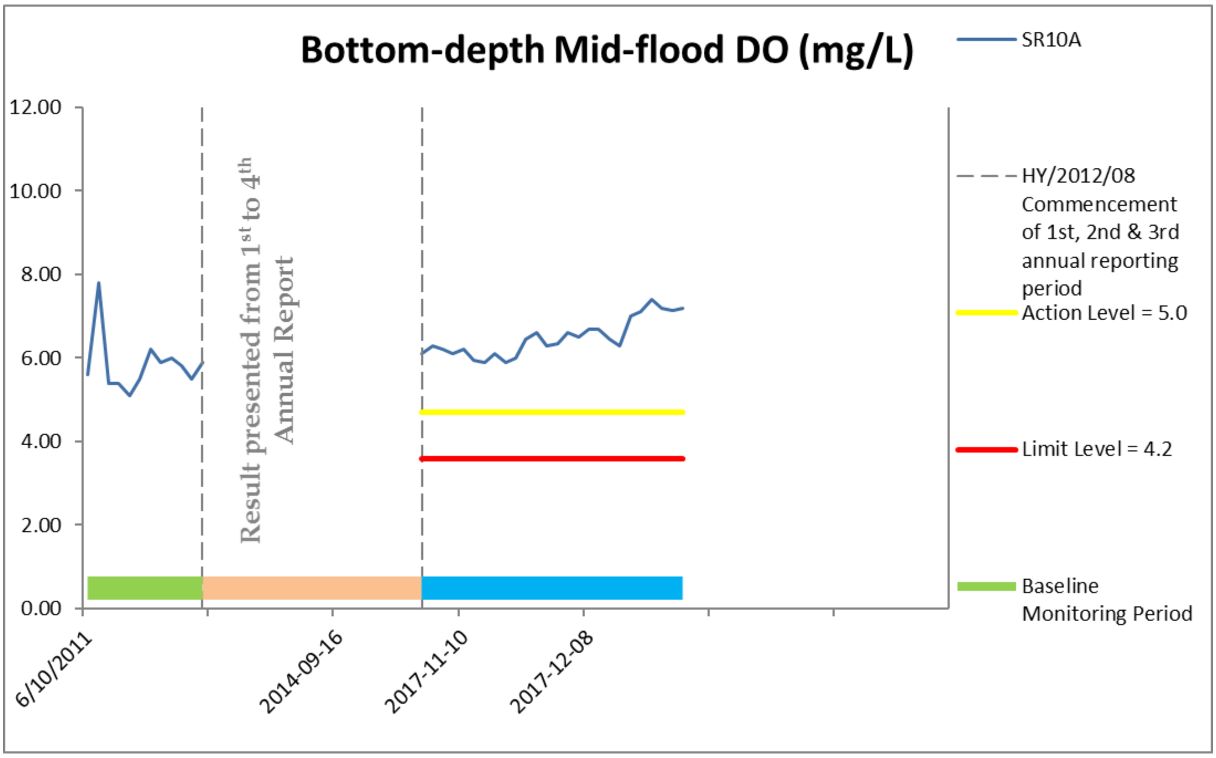
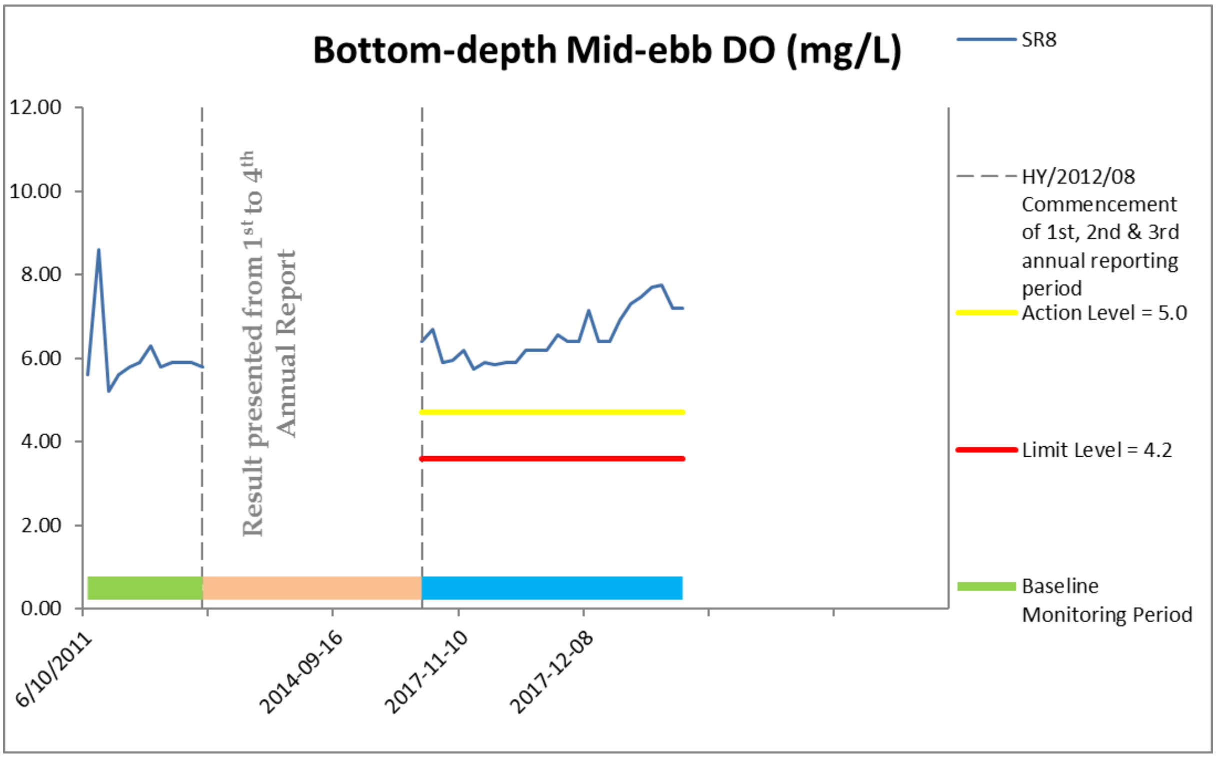


Figure E23 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR10A. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



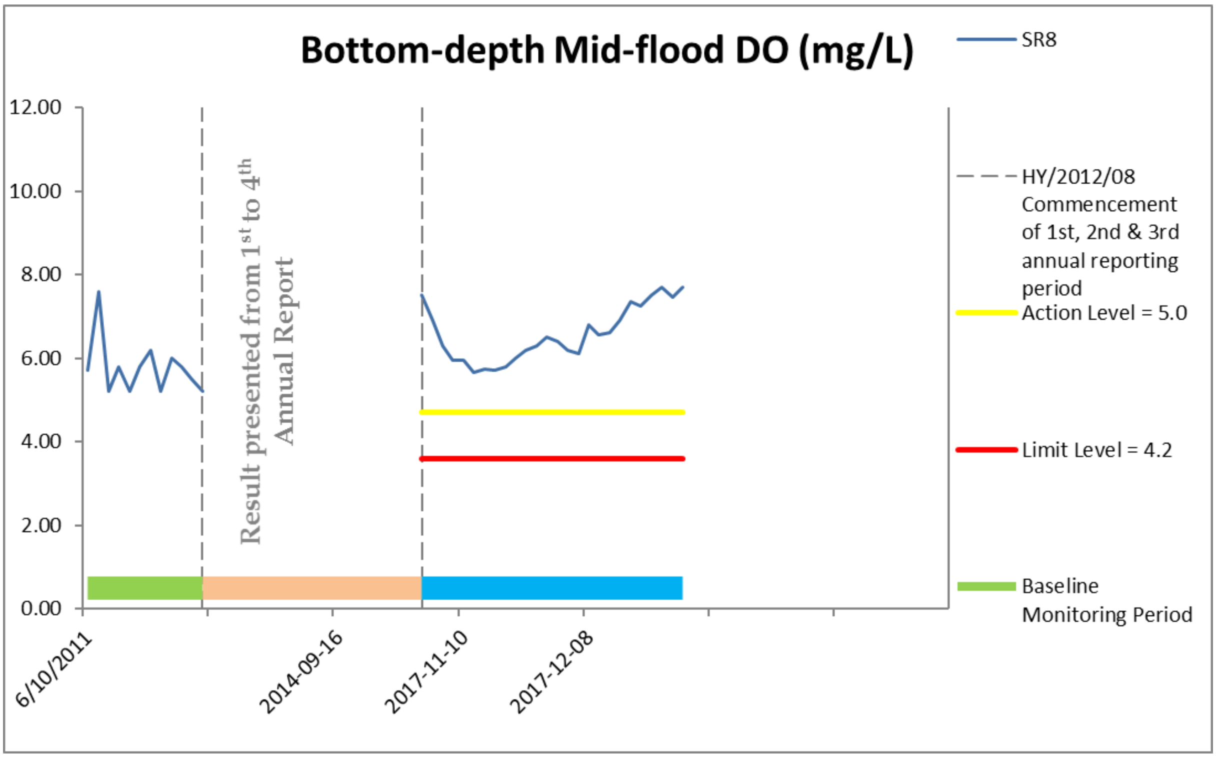


Figure E24 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR8. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

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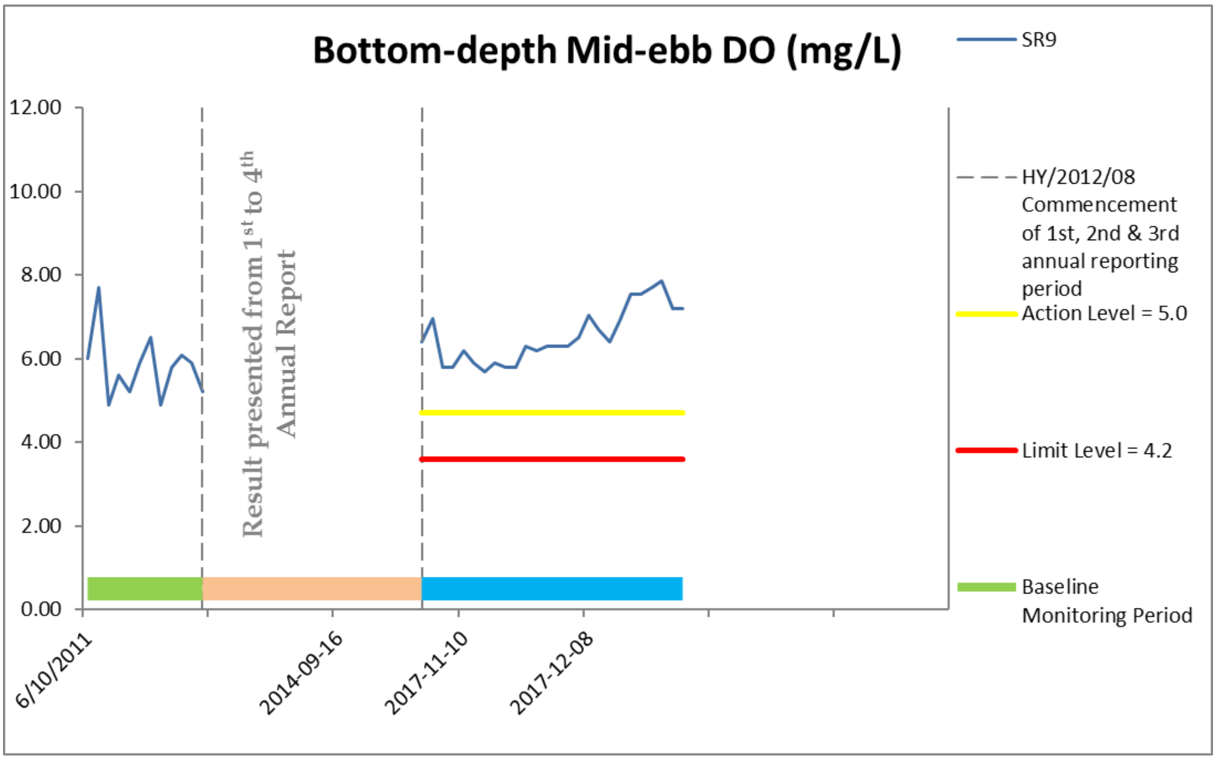


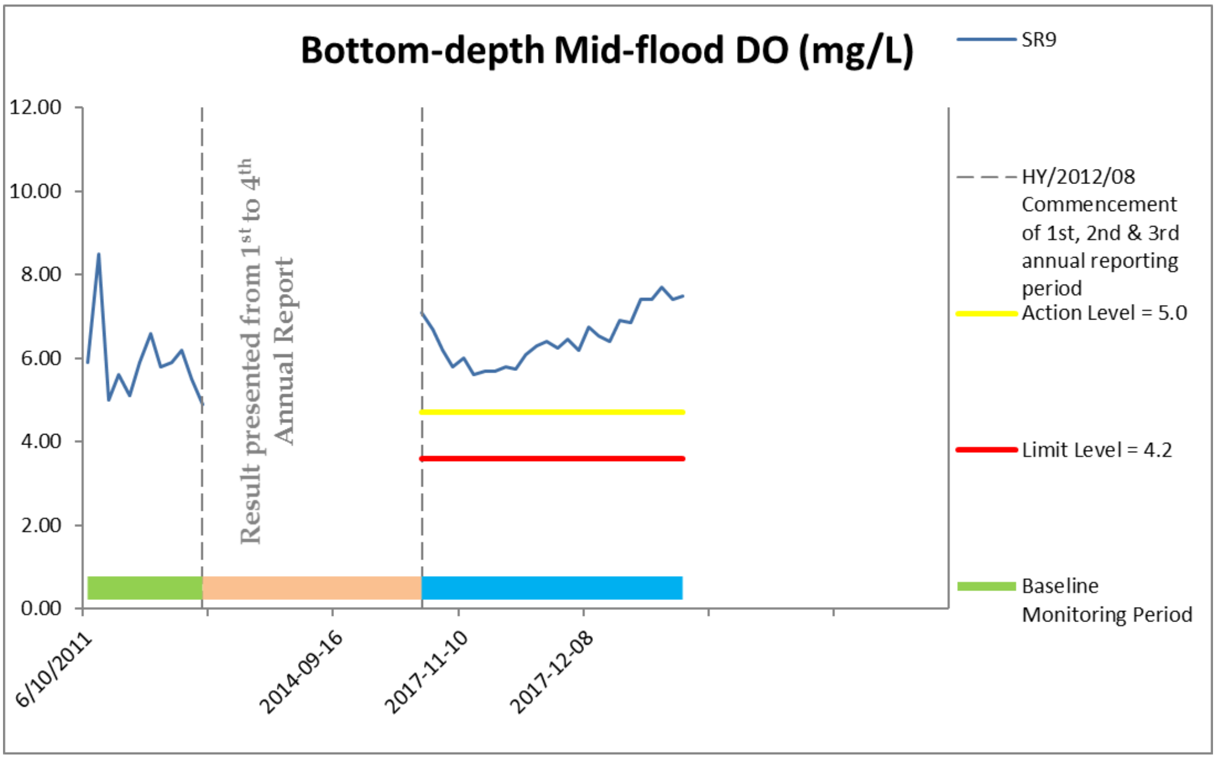
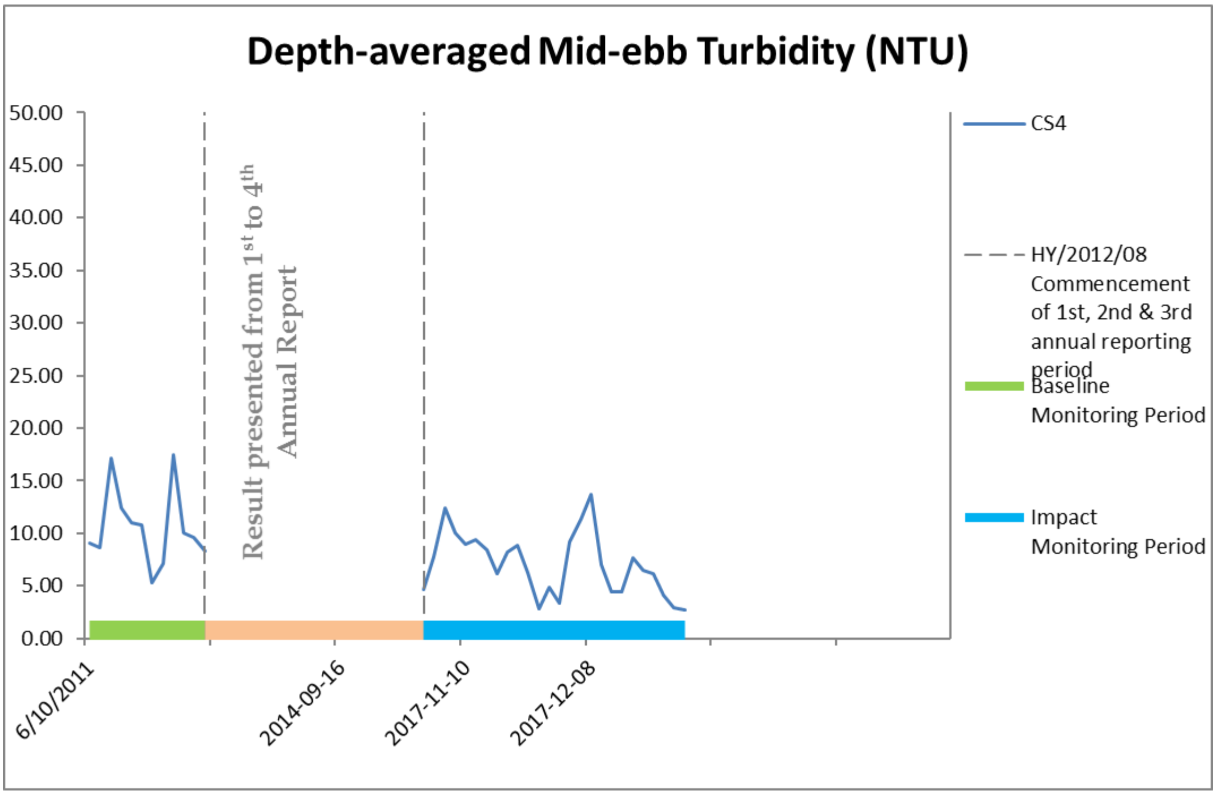


Figure E25 Baseline & Impact Monitoring – Mean Level of Dissolved Oxygen (mg/L) in bottom water between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



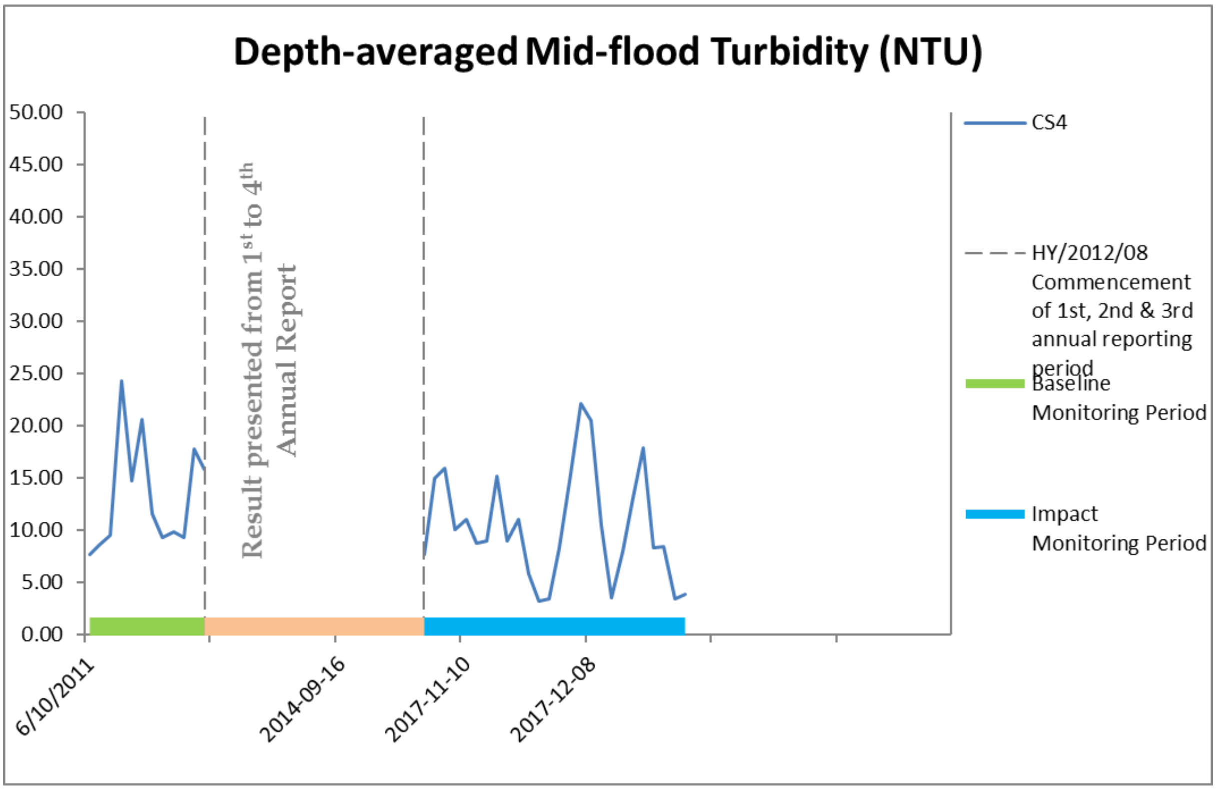


Figure E26 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS4. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

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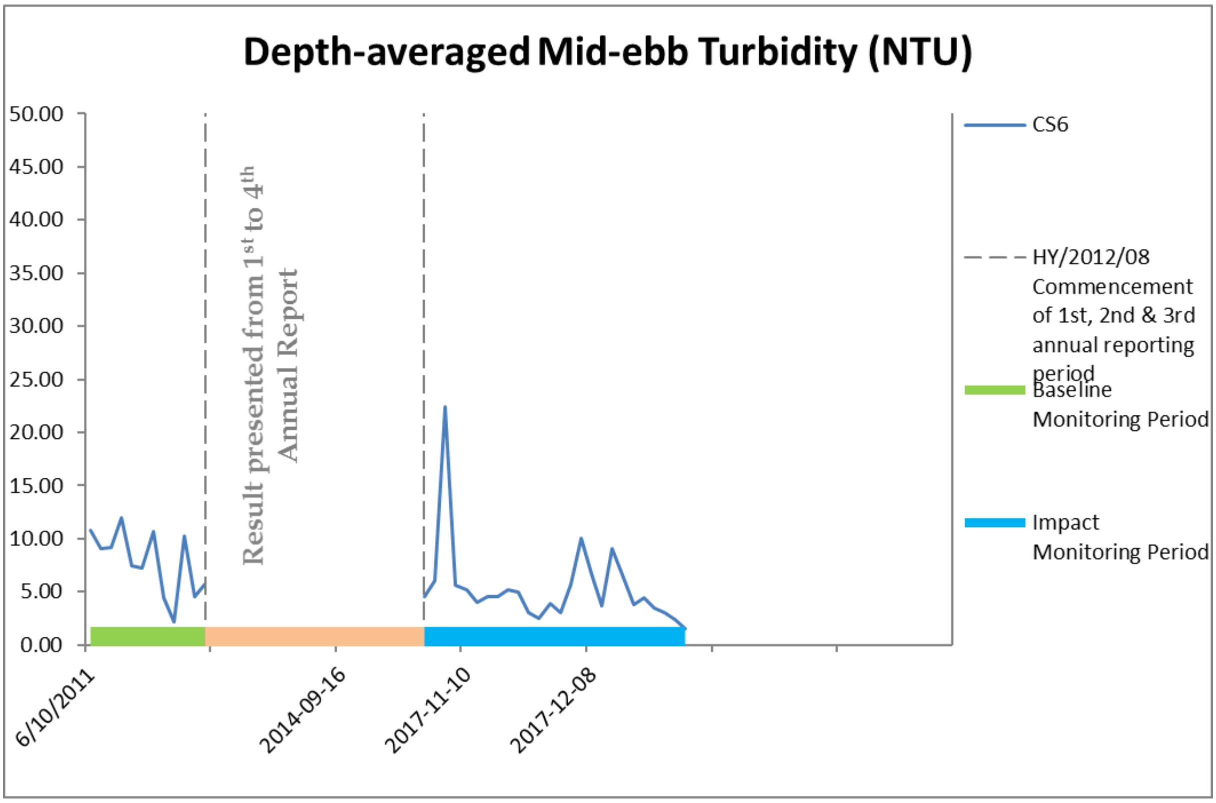


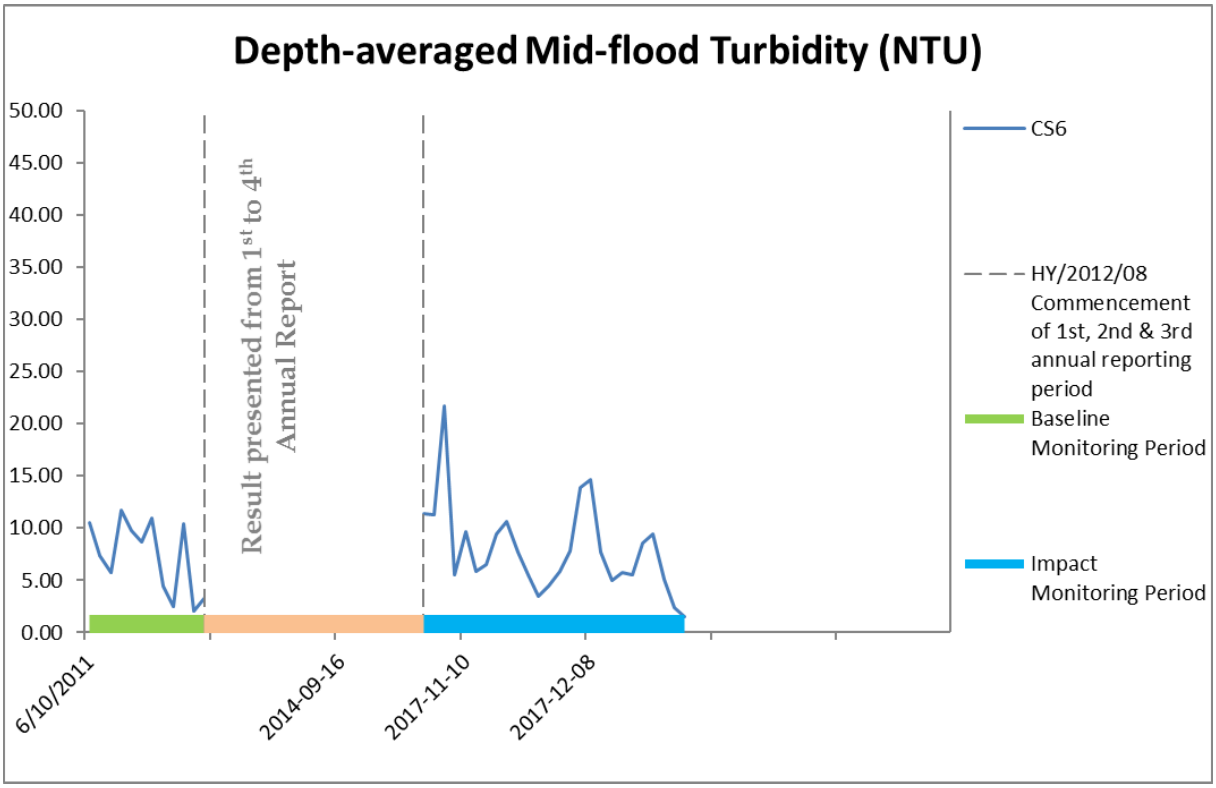
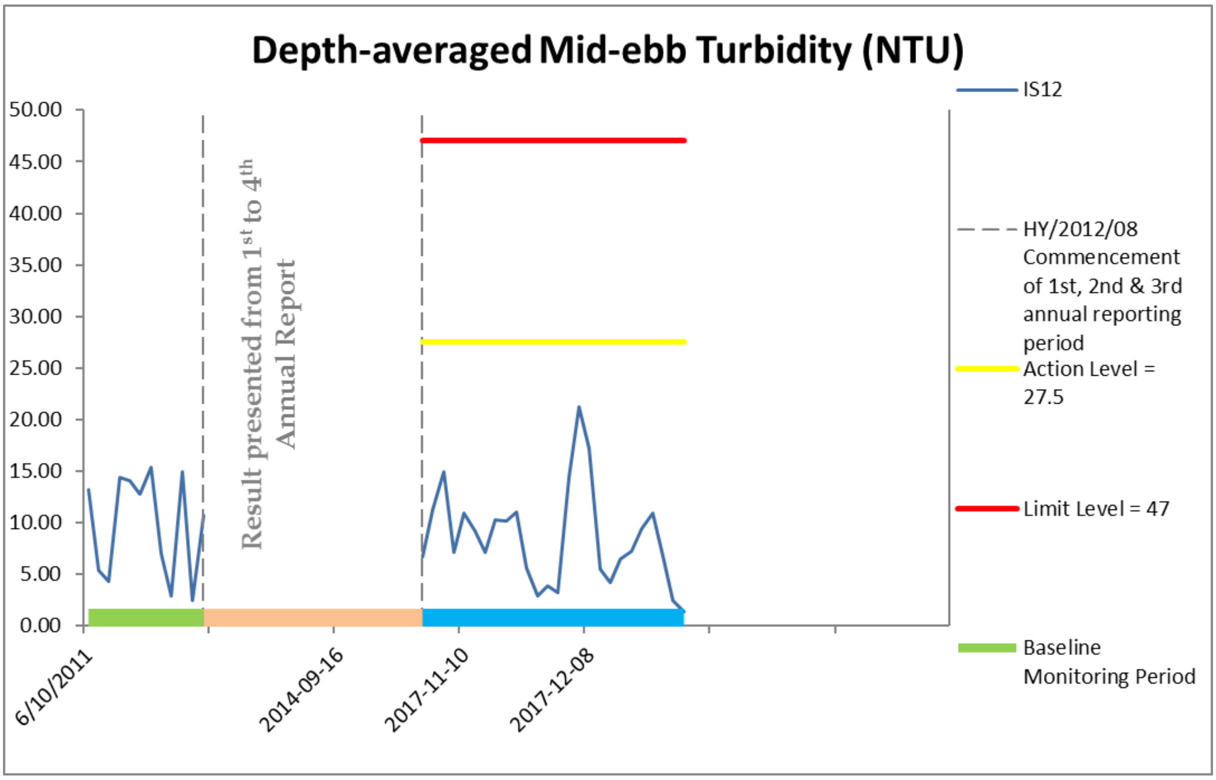


Figure E27 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS6. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



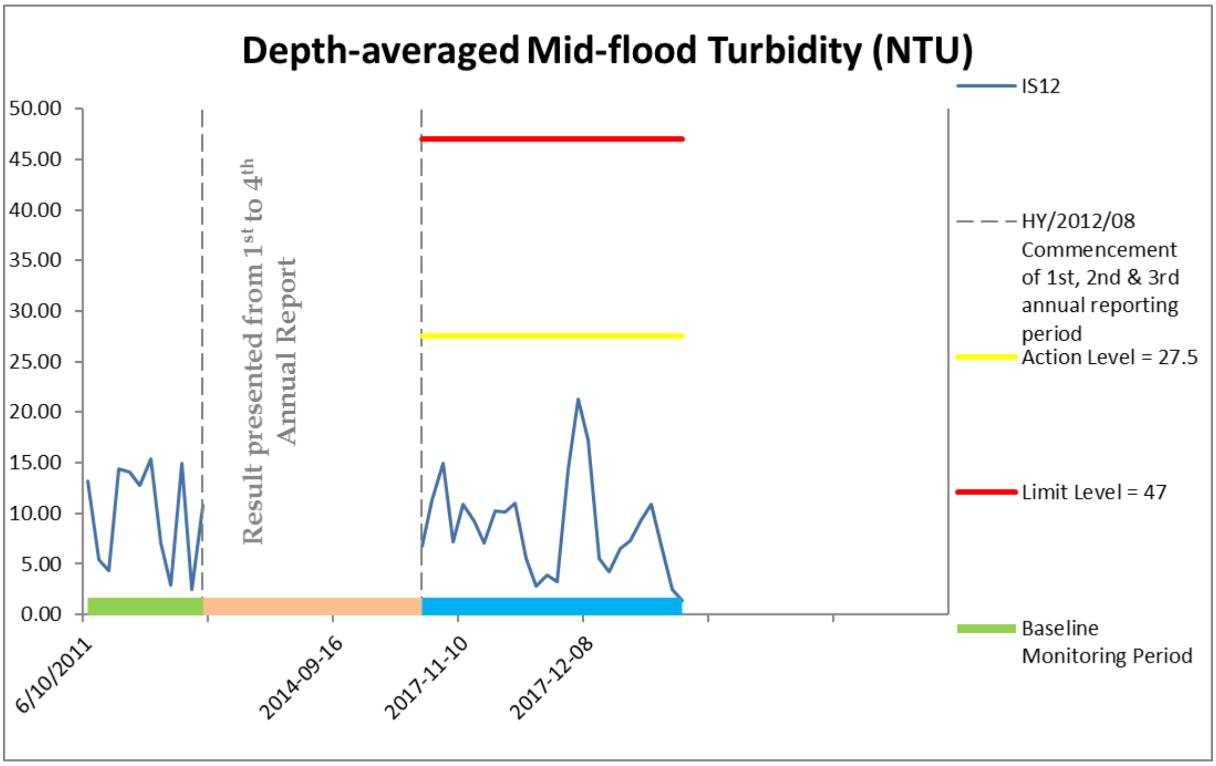
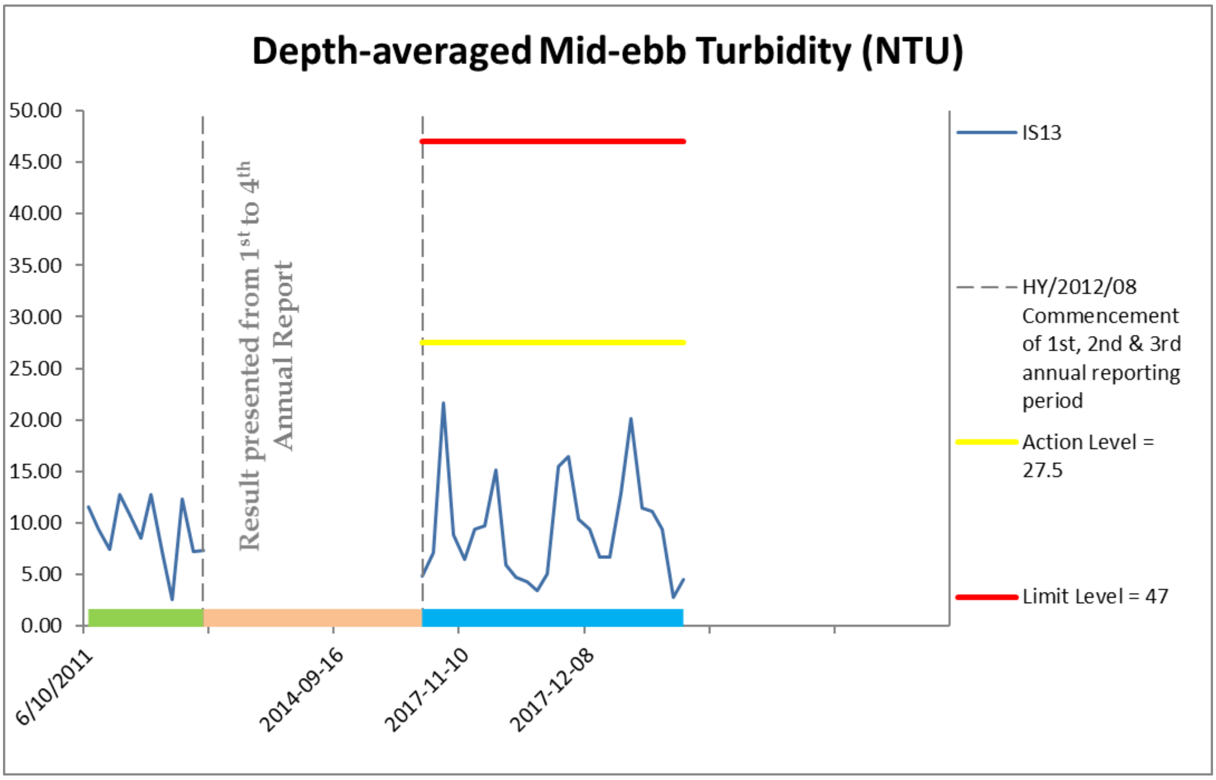


Figure E28 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS12. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



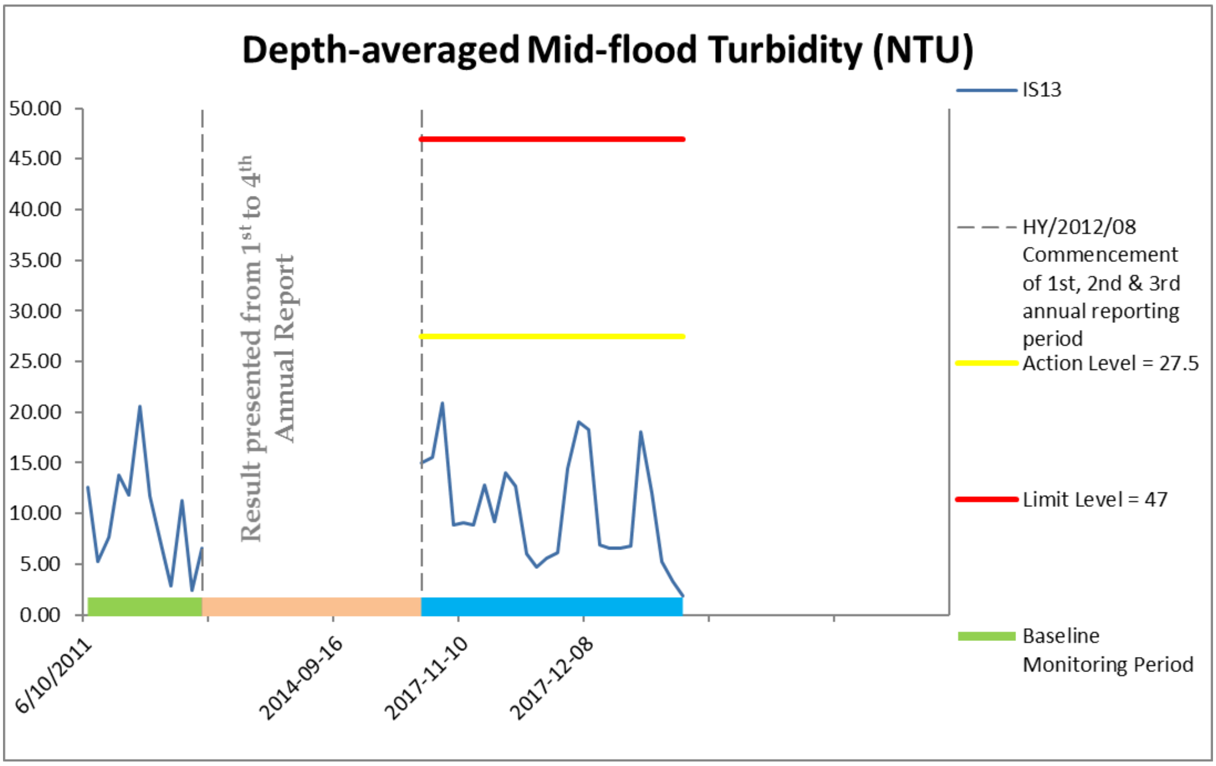
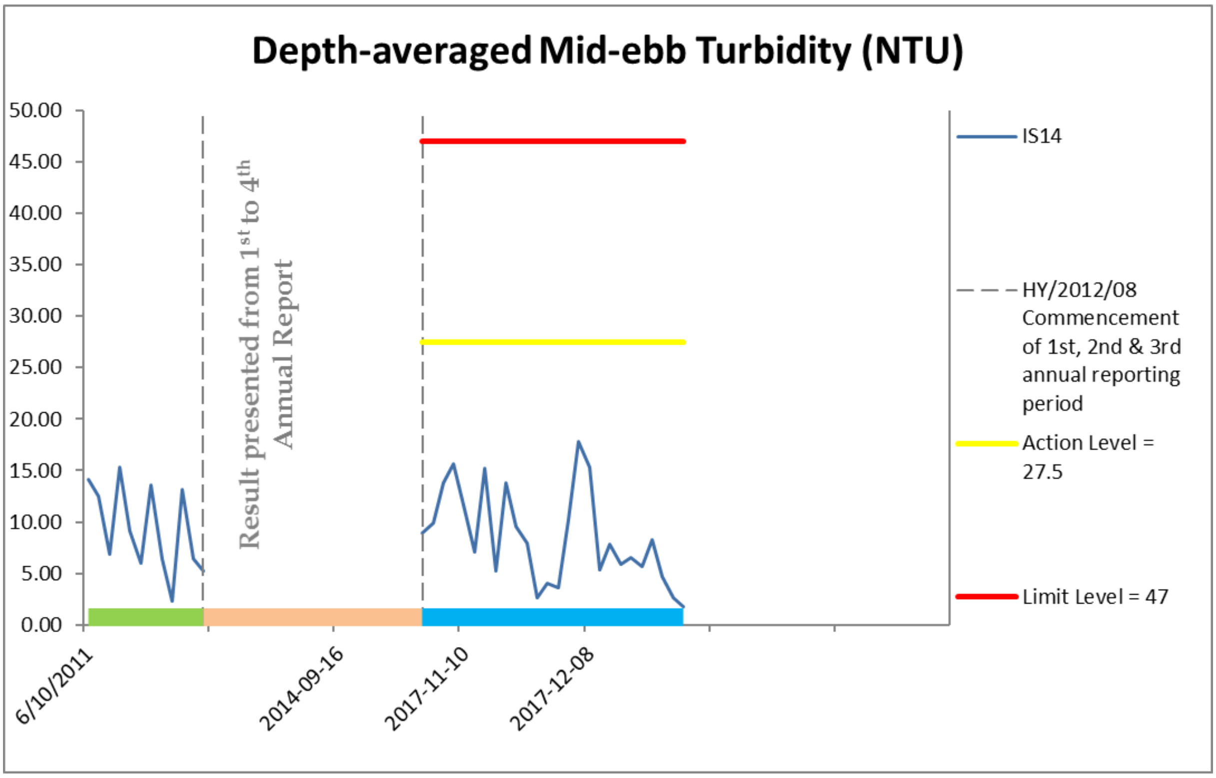


Figure E29 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS13. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



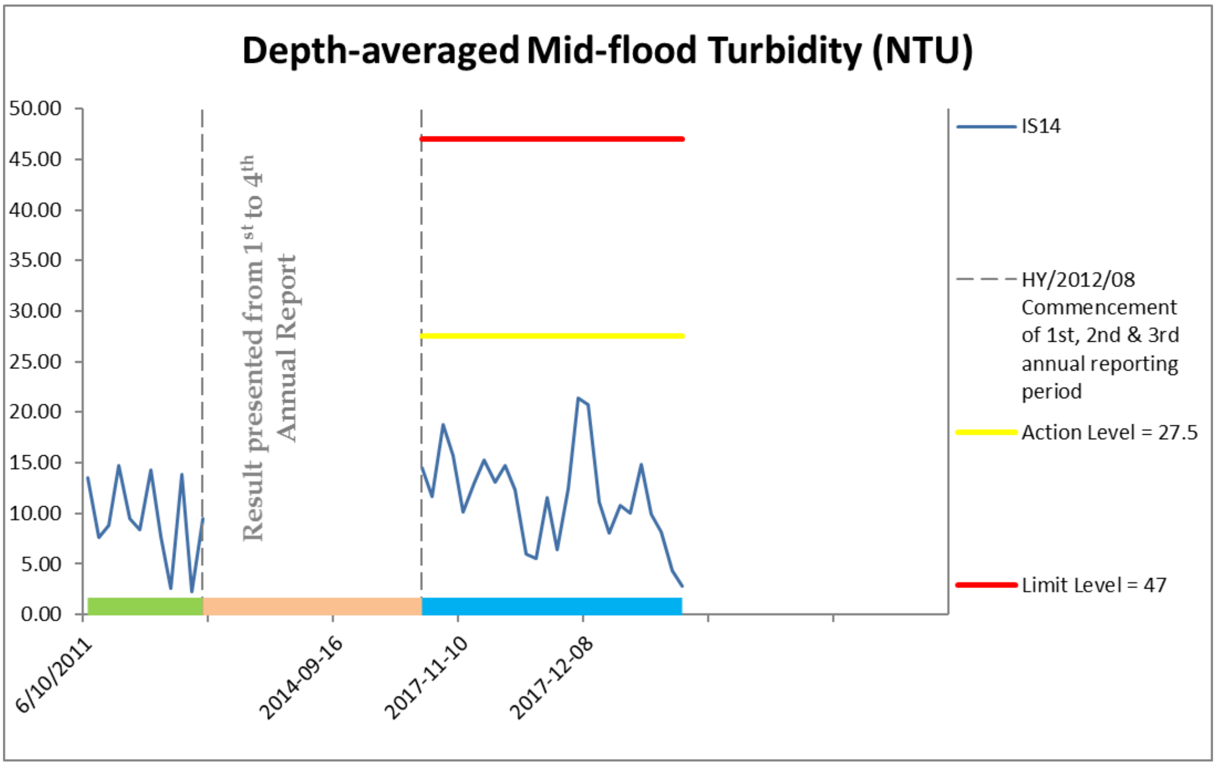
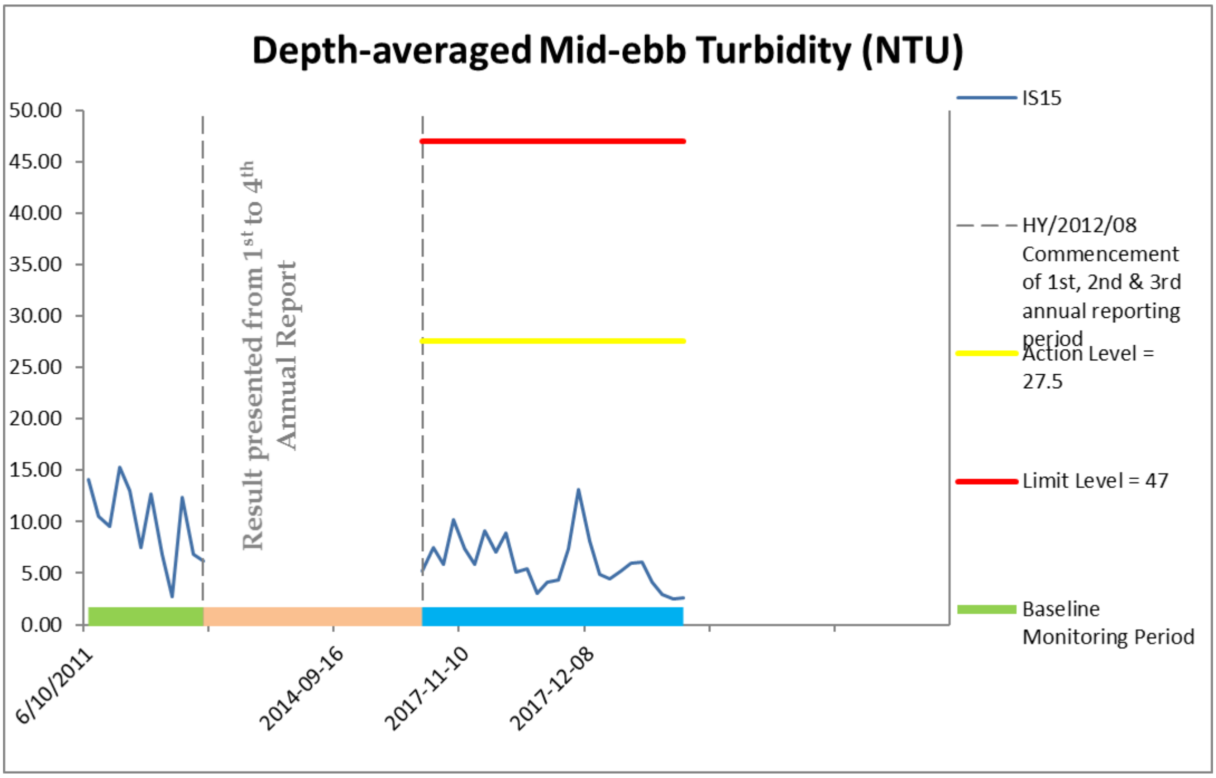


Figure E30 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS14. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



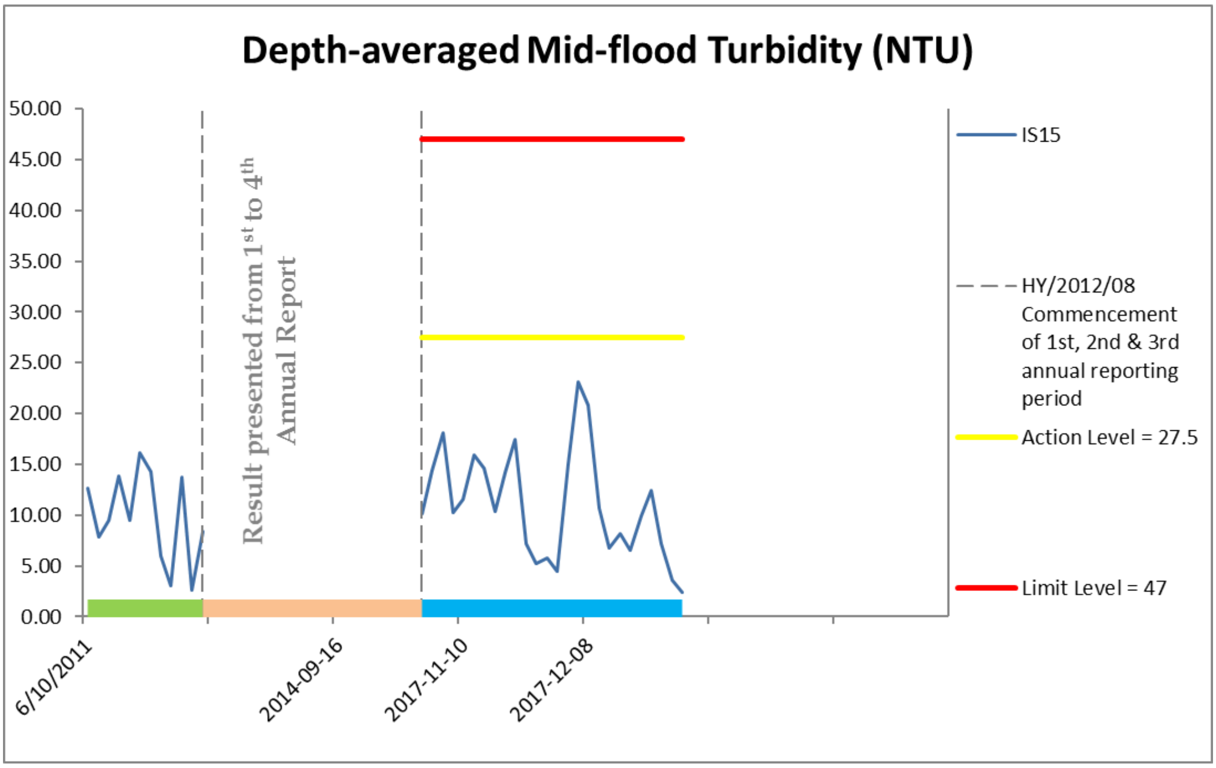
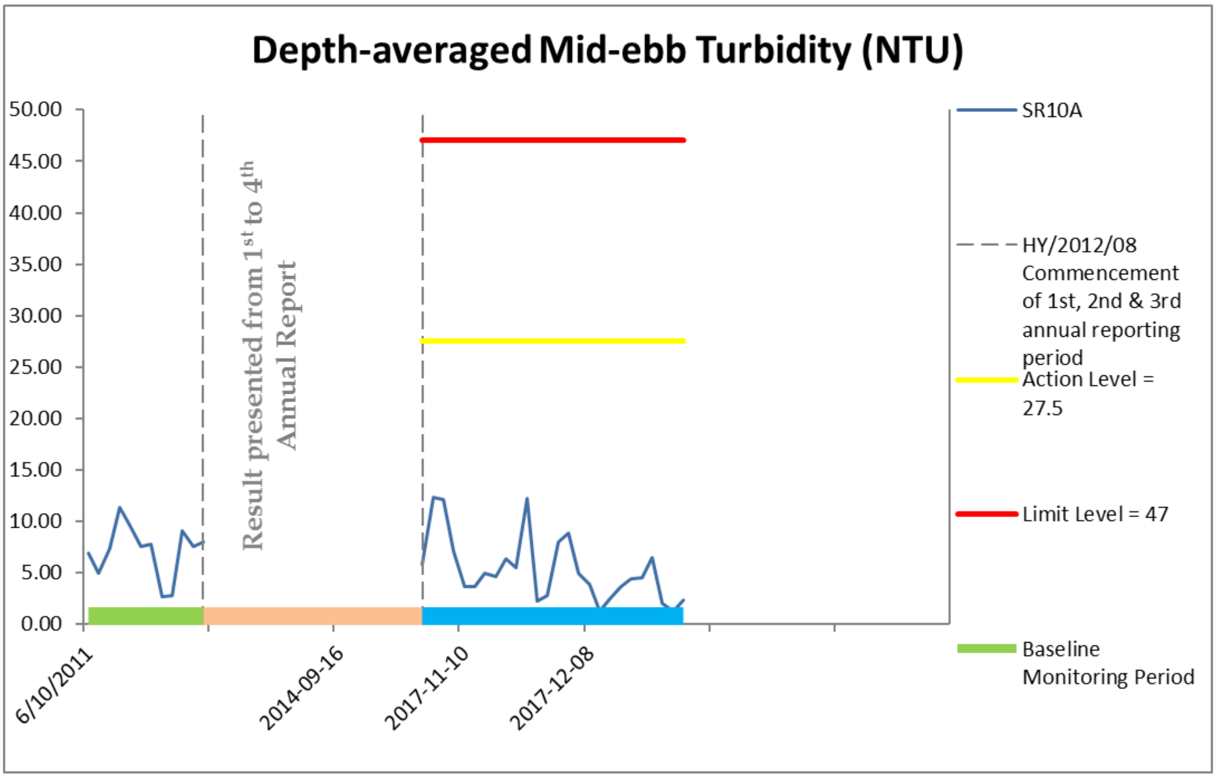


Figure E31 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS15. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

Ref: *0212330_Impact-WQM_5th annual.xlsx*



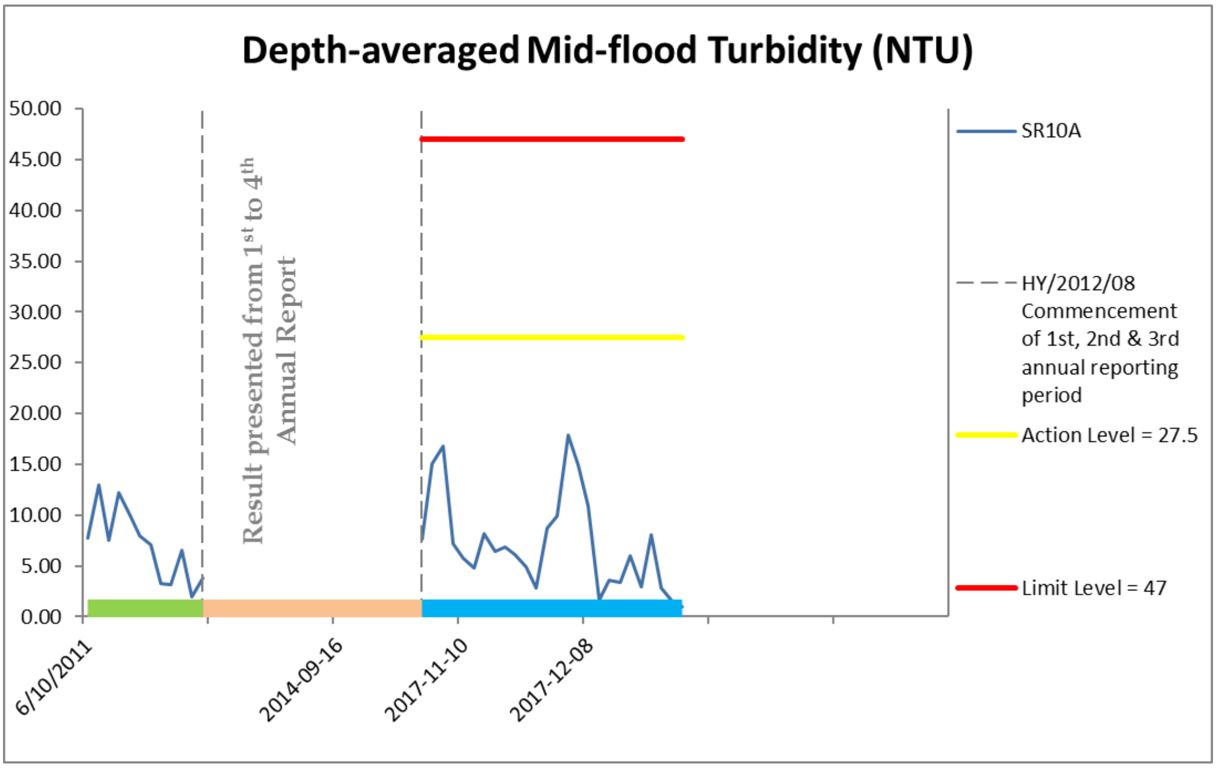
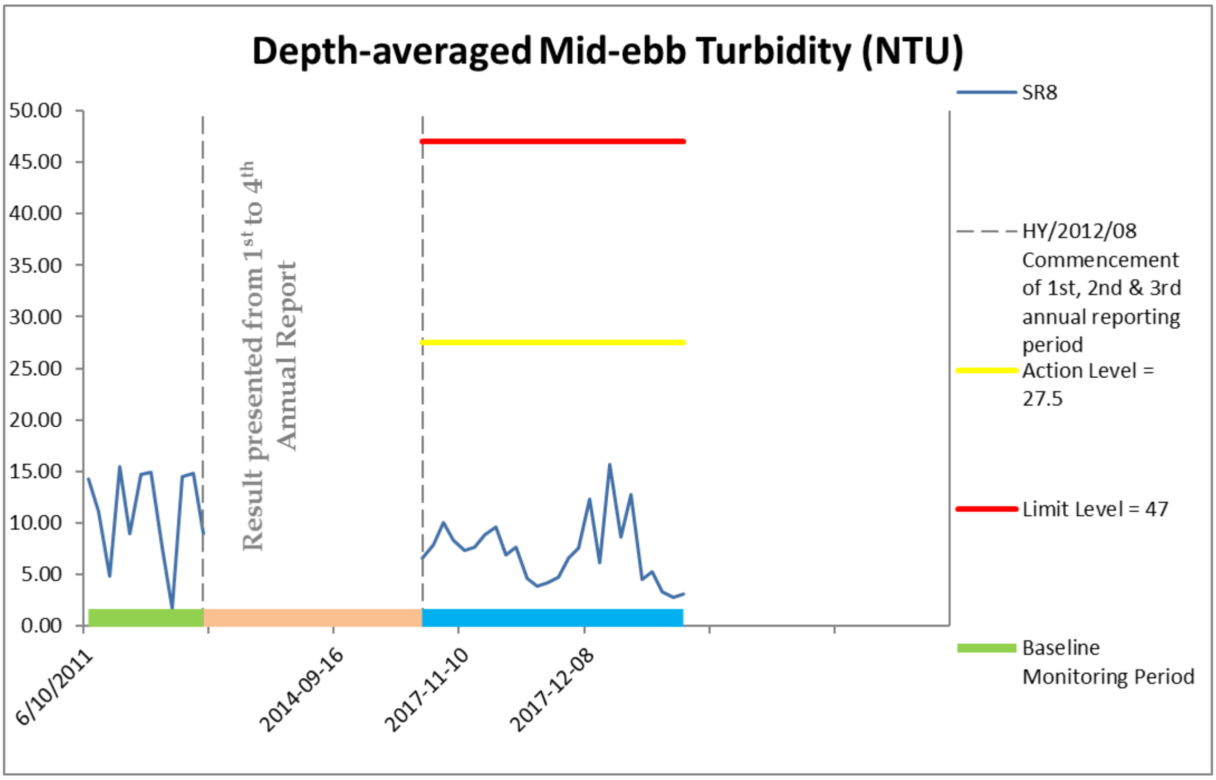


Figure E32 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR10A. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



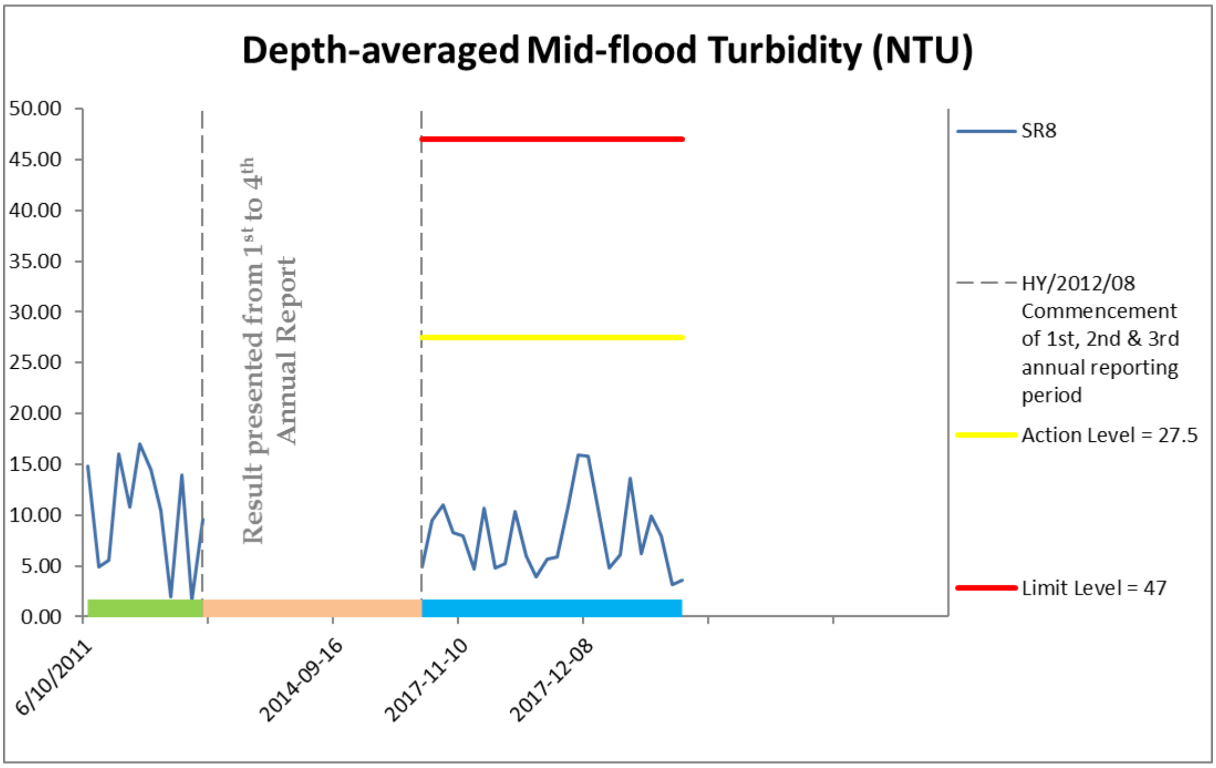
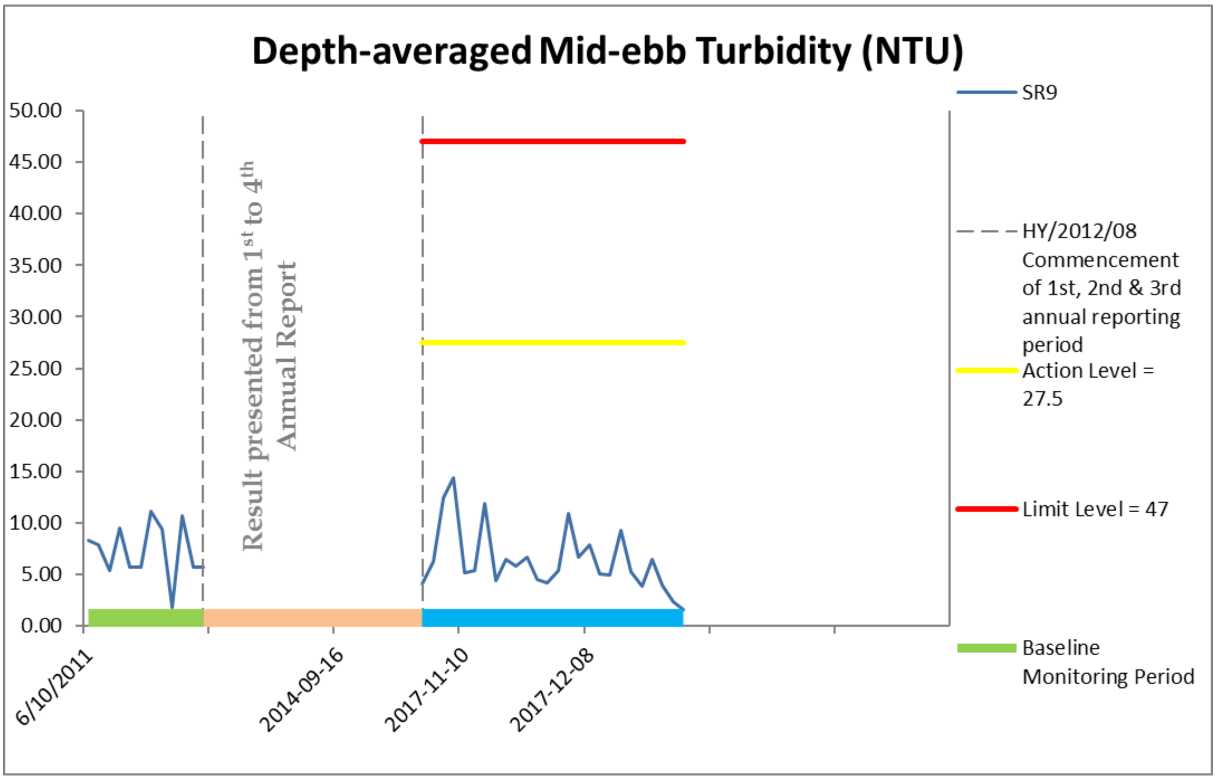


Figure E33 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR8. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



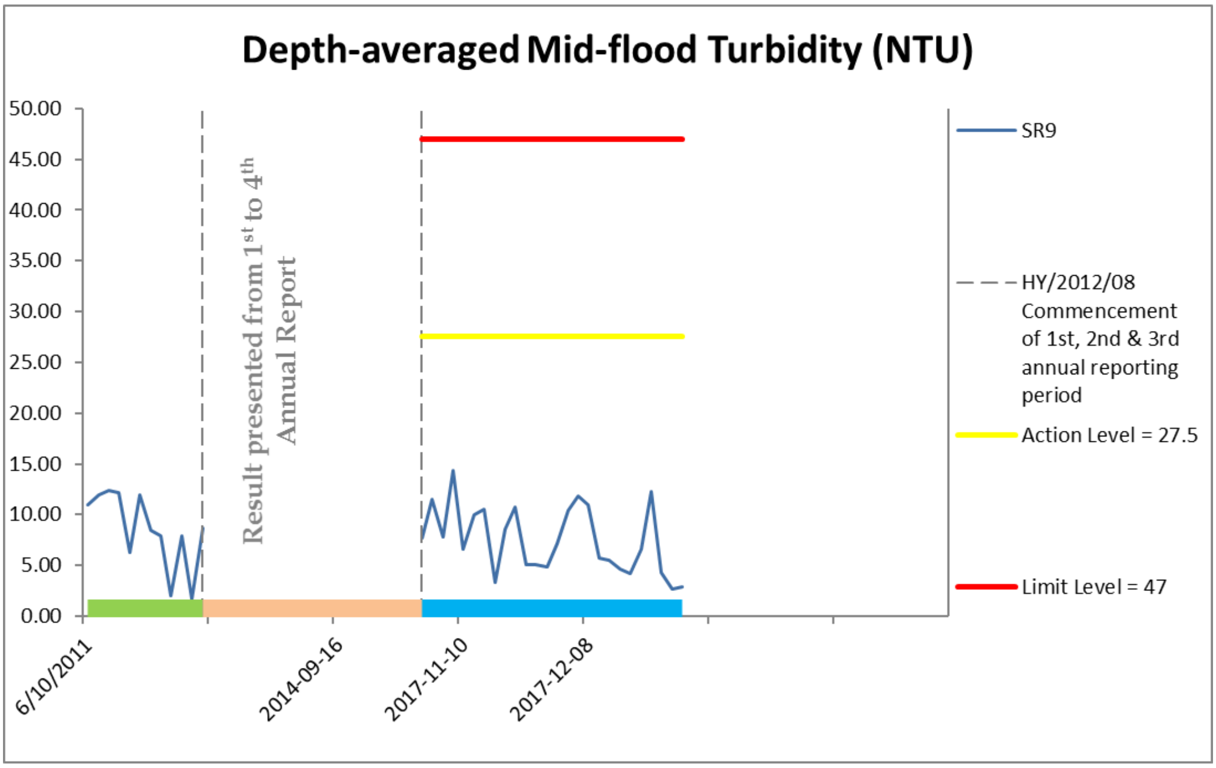
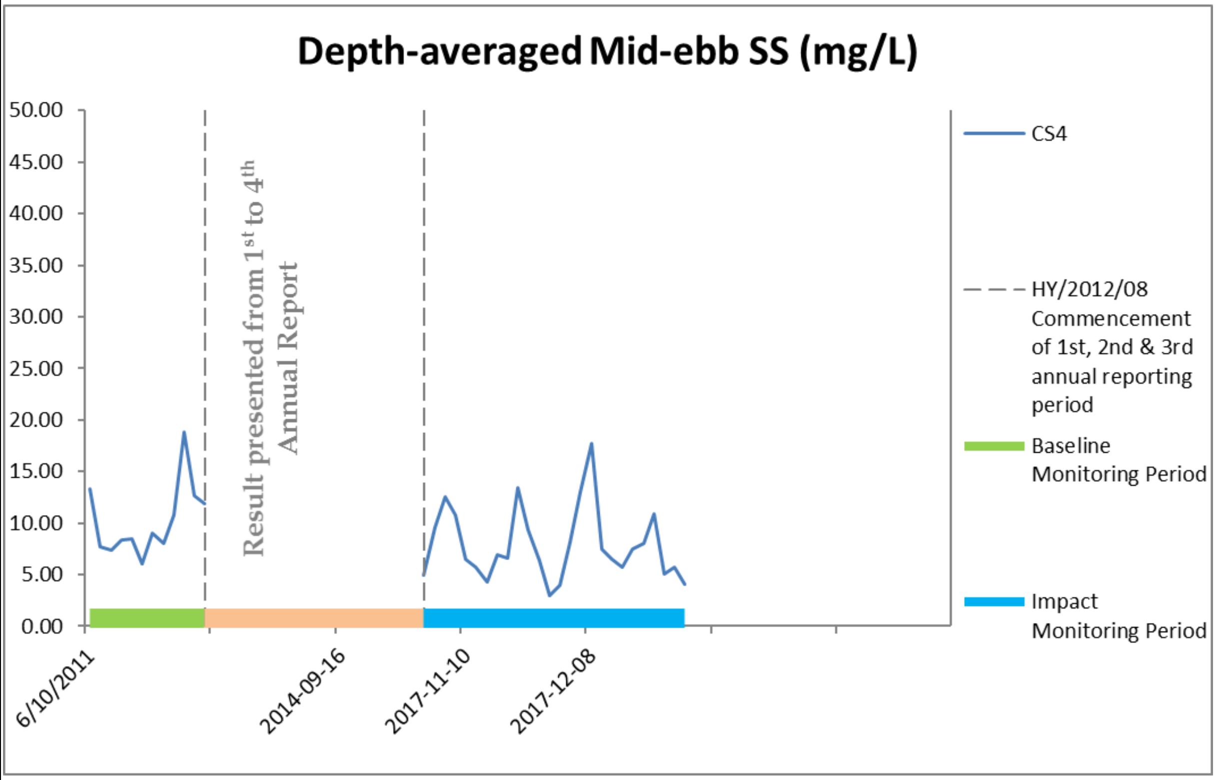


Figure E34 Baseline & Impact Monitoring – Mean Depth-averaged Level of Turbidity (NTU) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



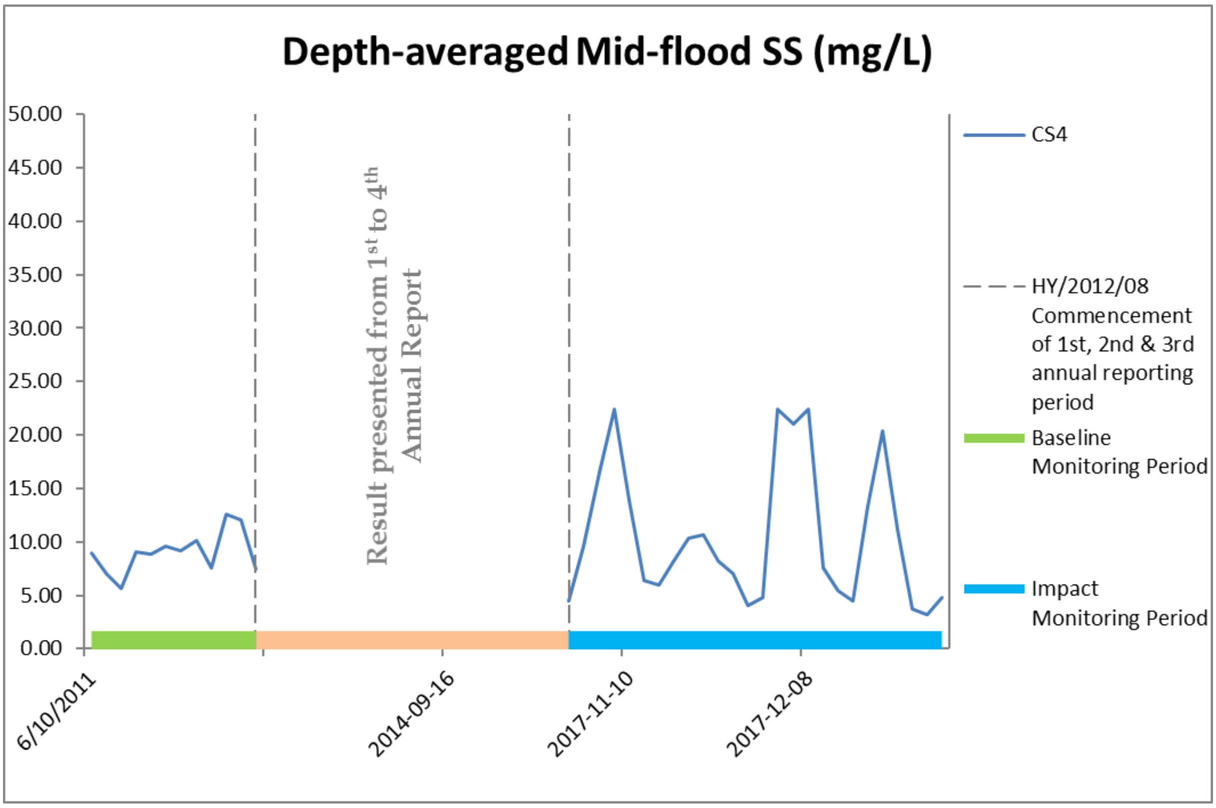
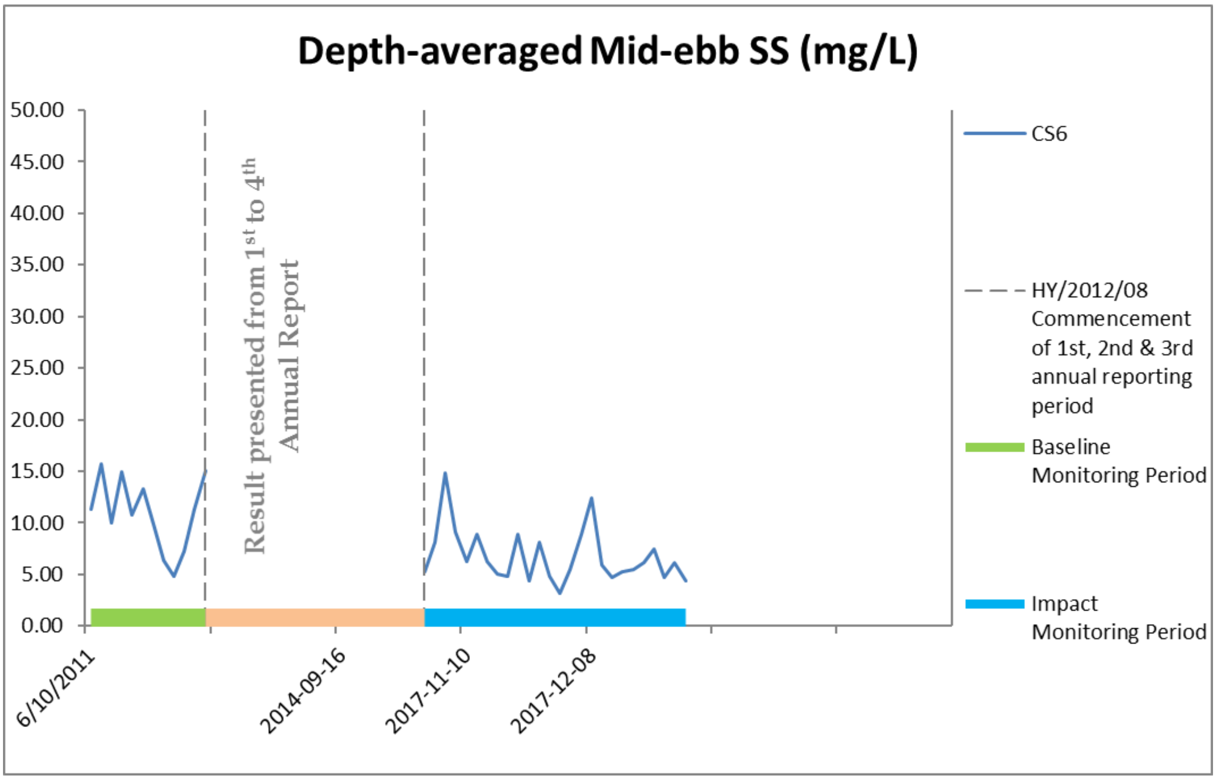


Figure E35 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS4. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



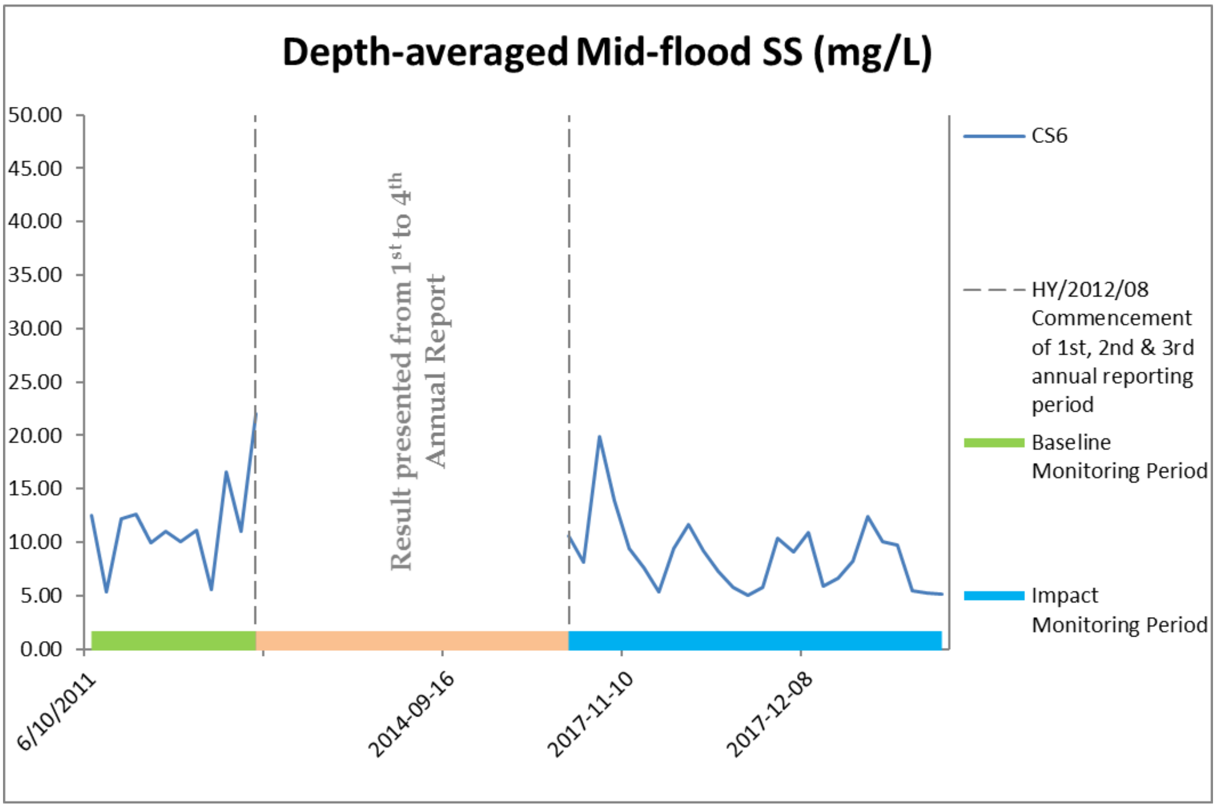
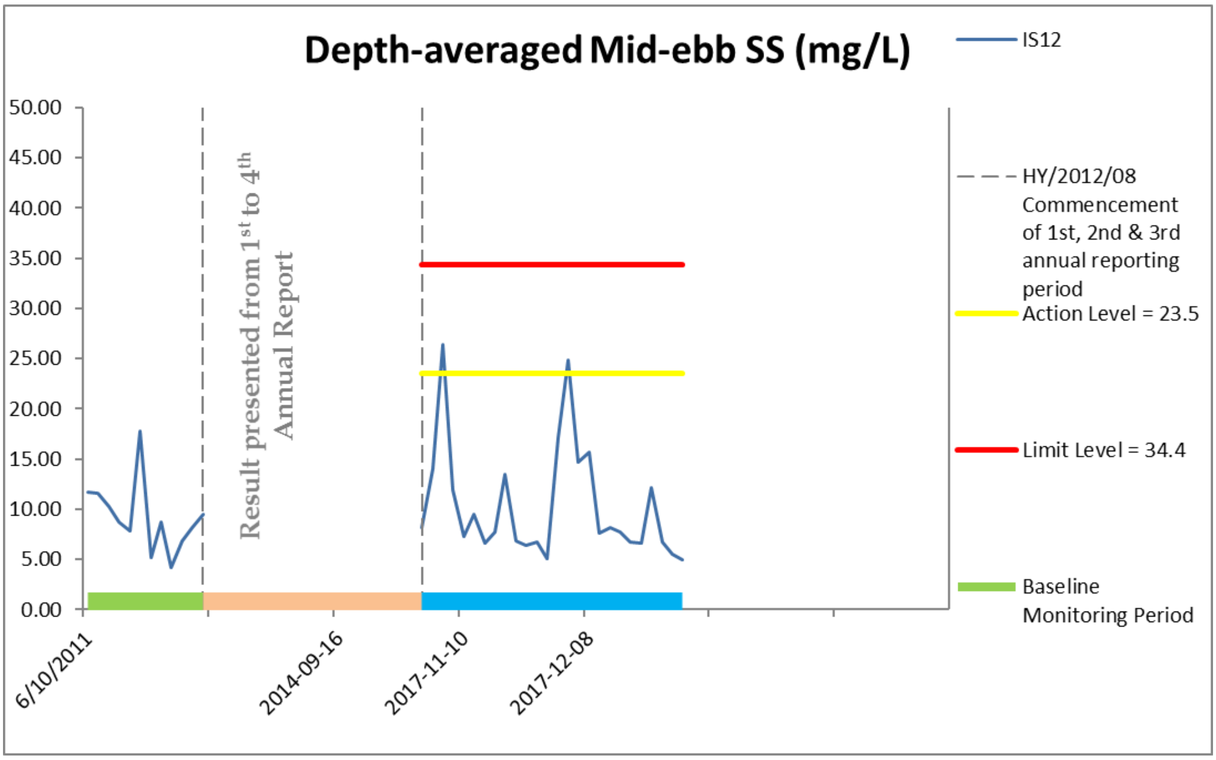


Figure E36 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at CS6. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



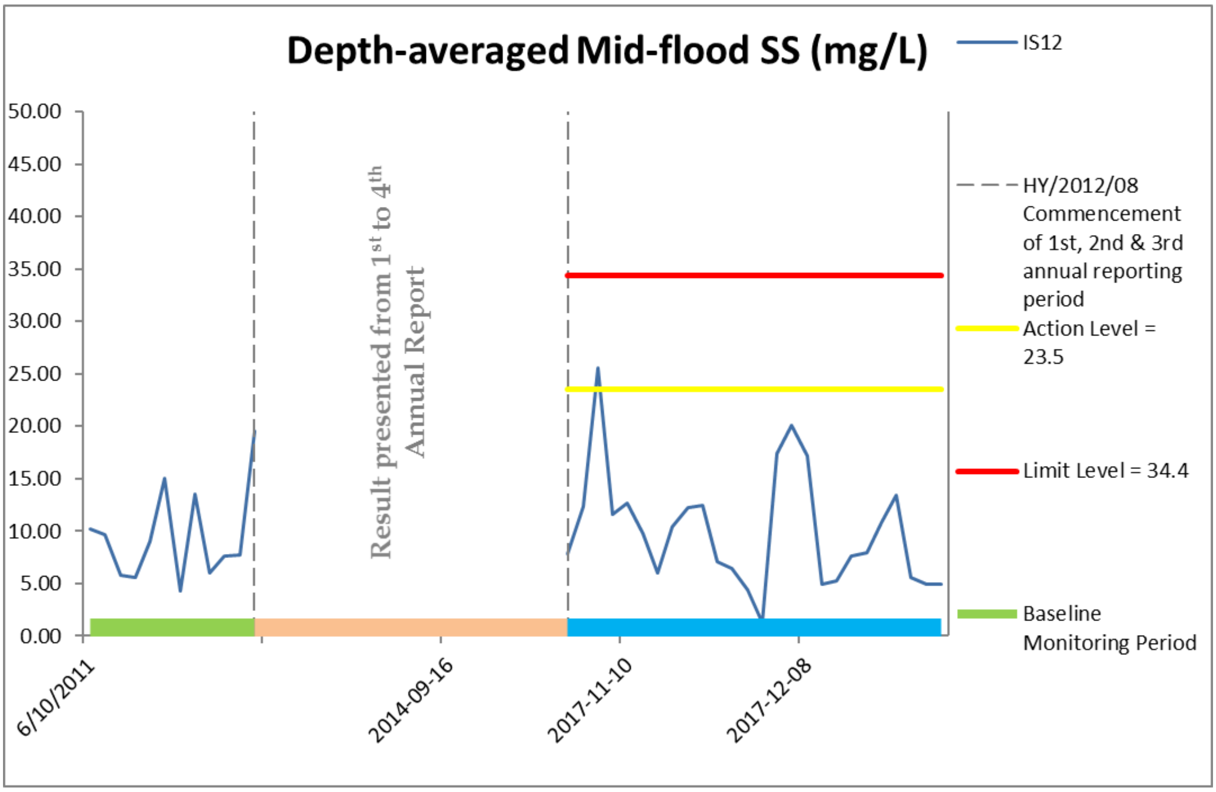
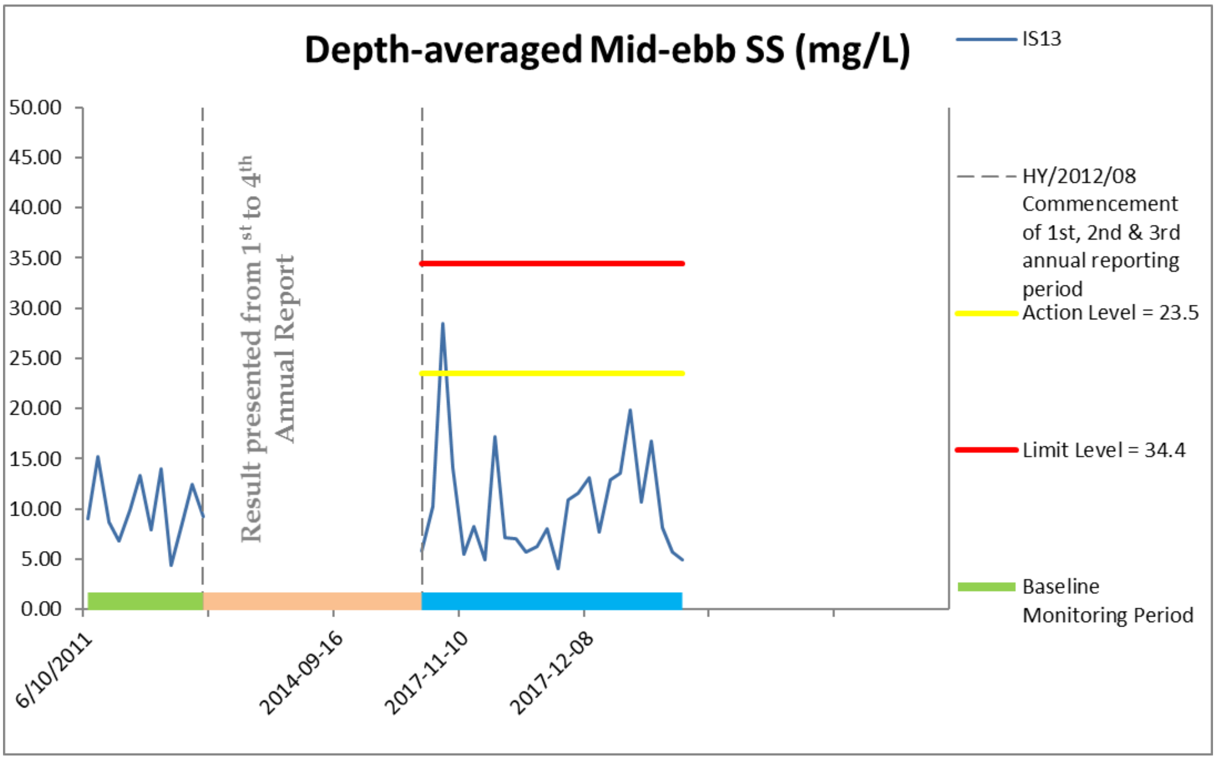


Figure E37 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS12. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



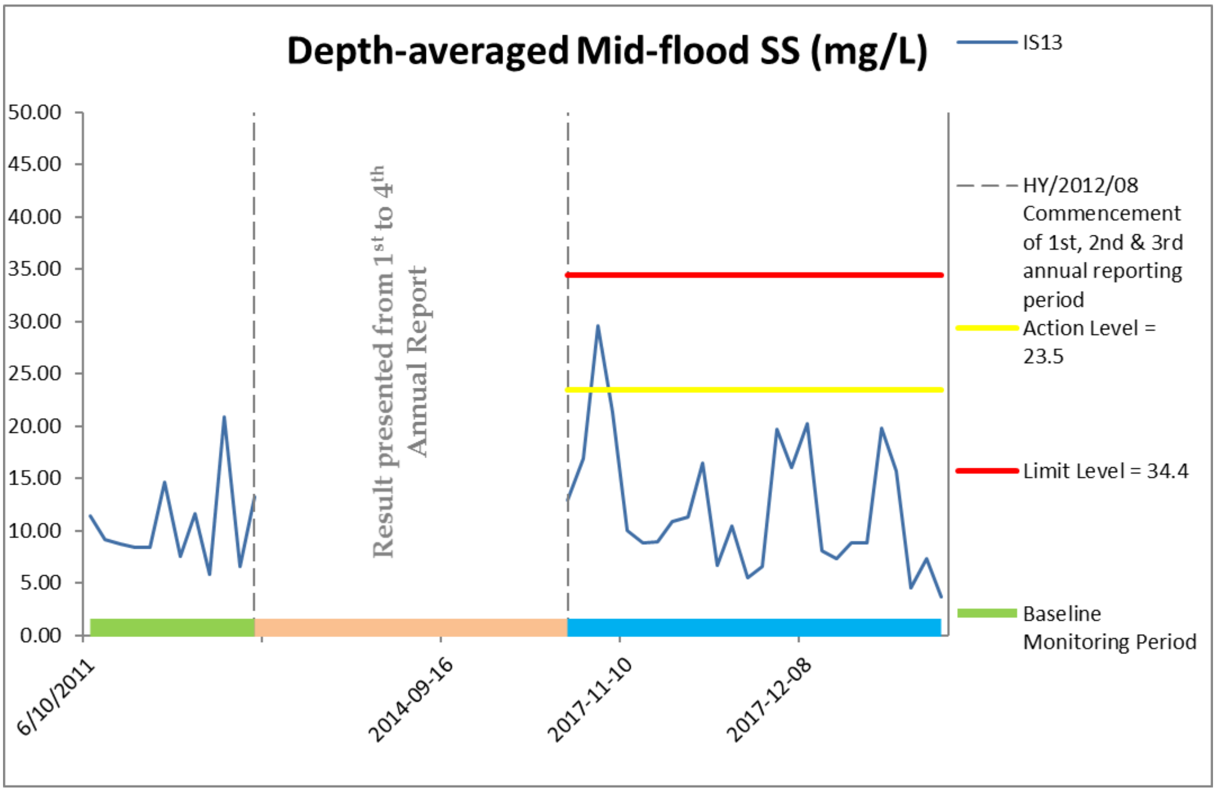
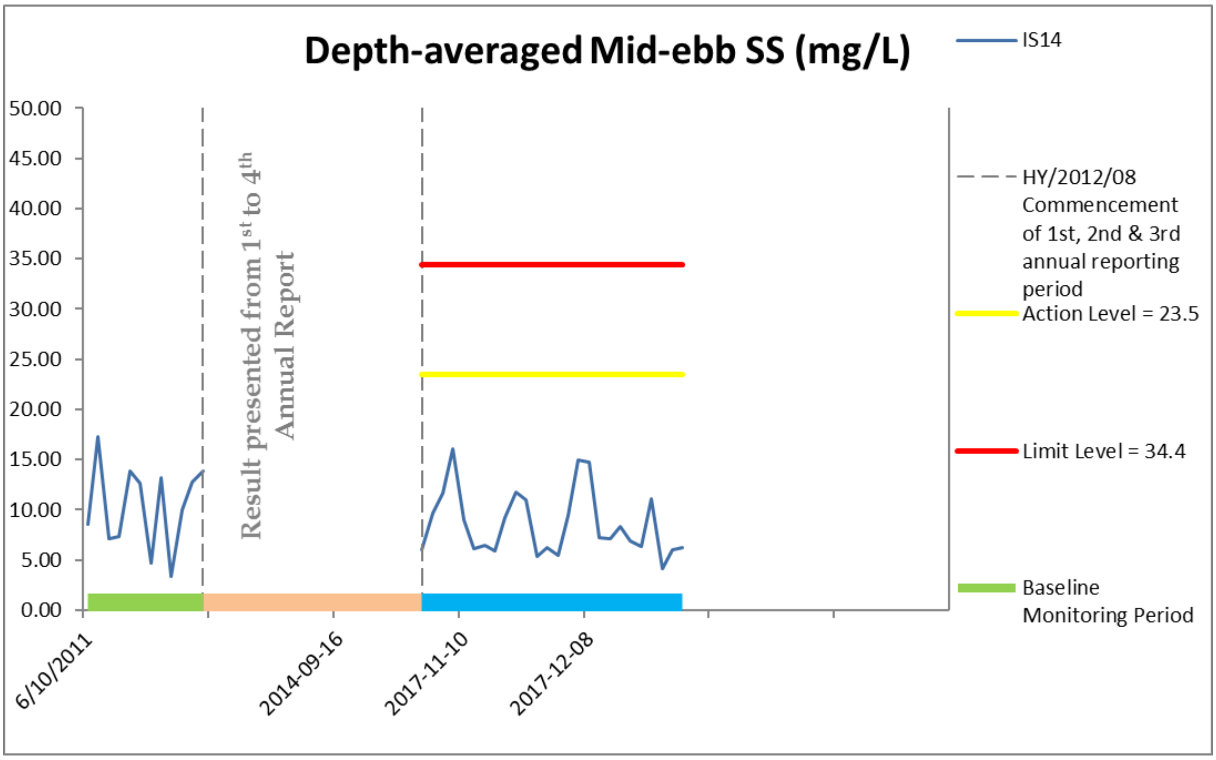


Figure E38 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS13. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



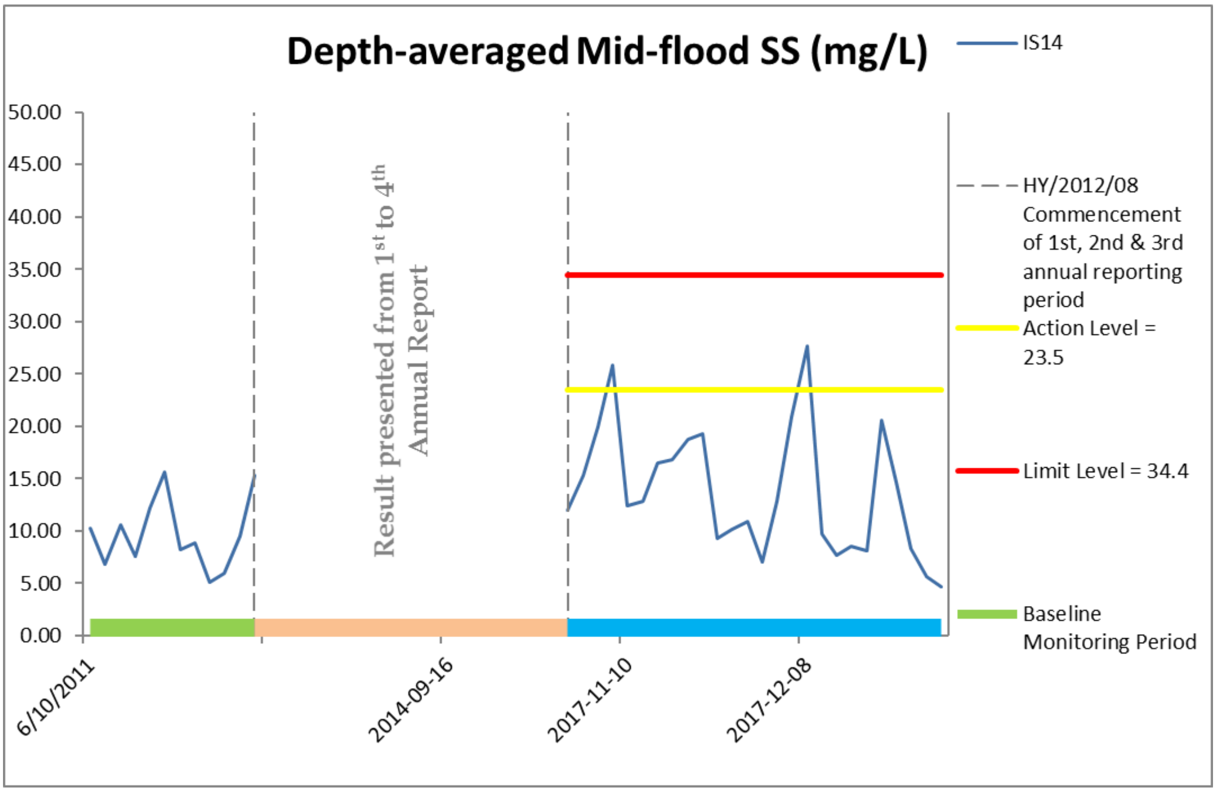
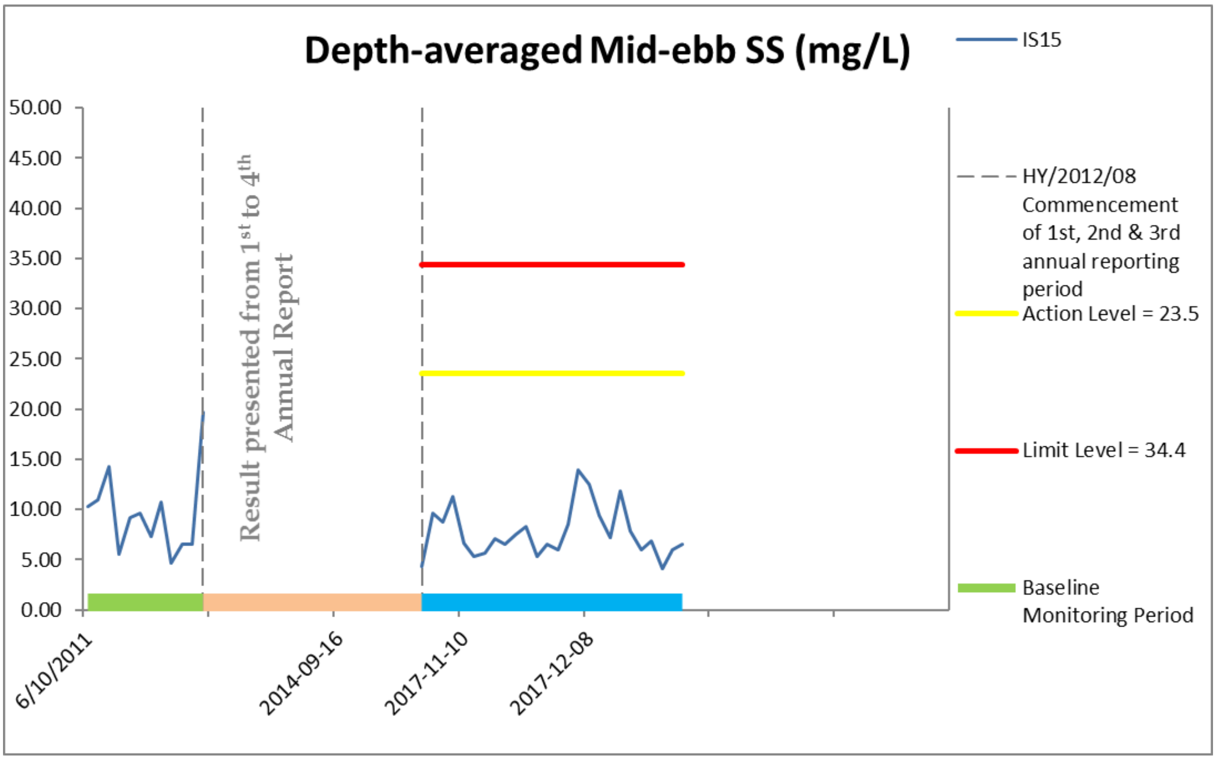


Figure E39 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS14. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



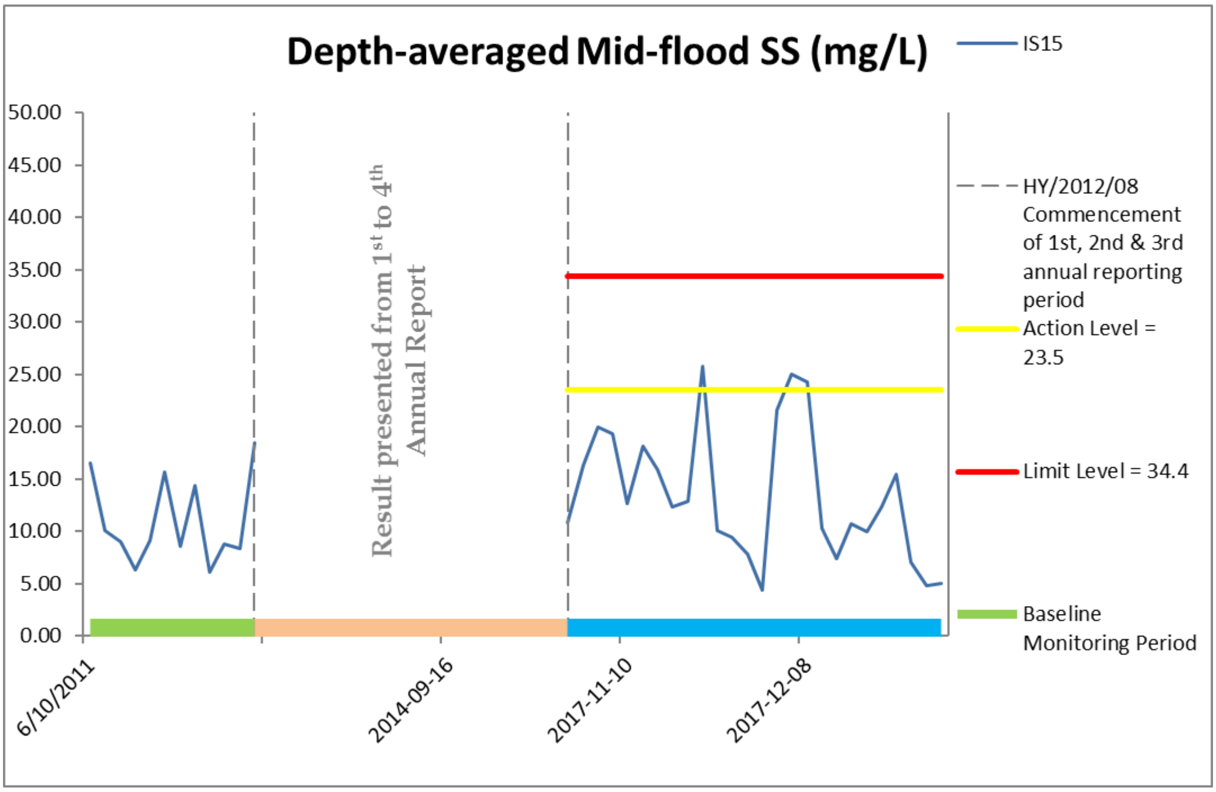
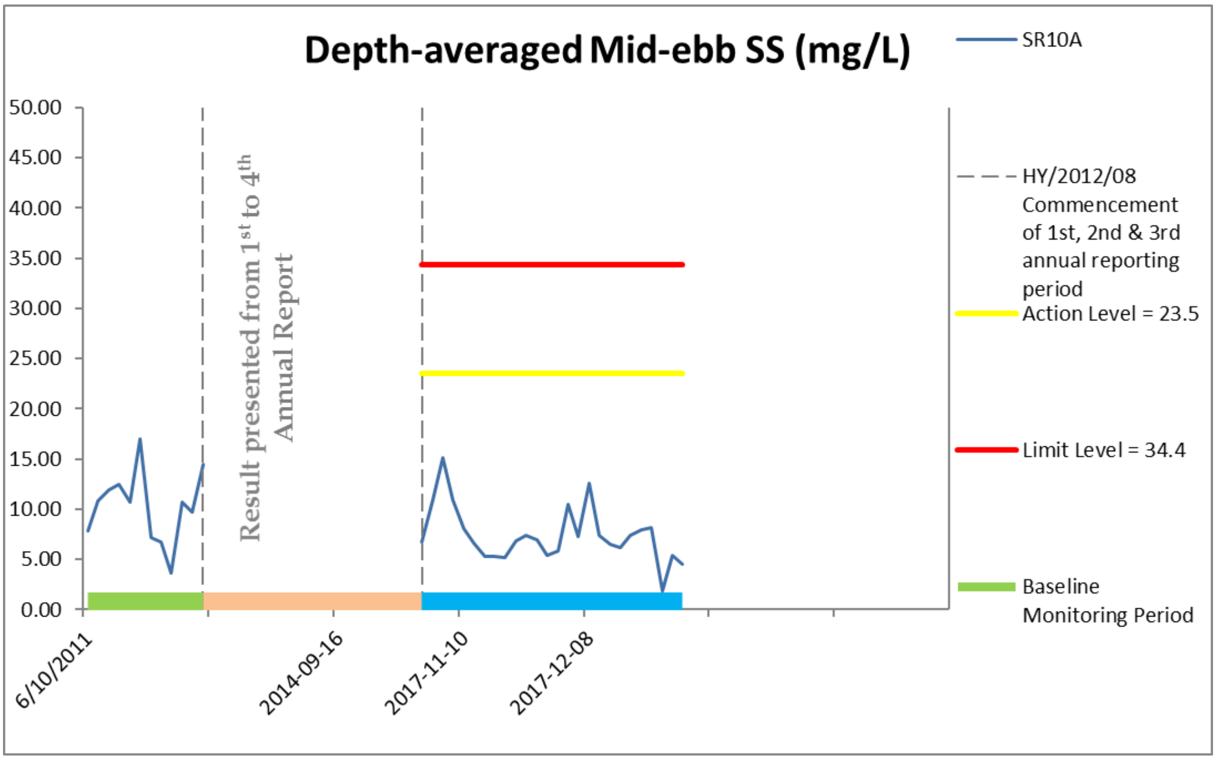


Figure E40 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at IS15. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*



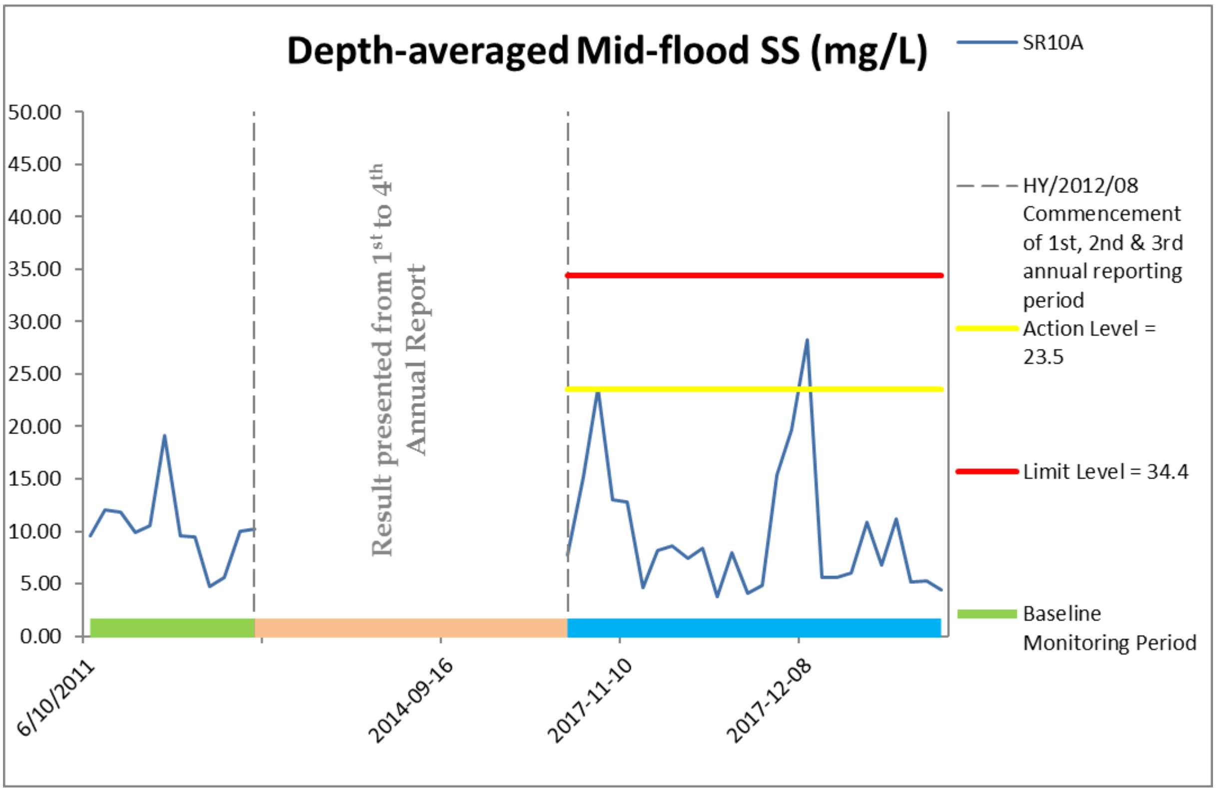


Figure E41 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR10A. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

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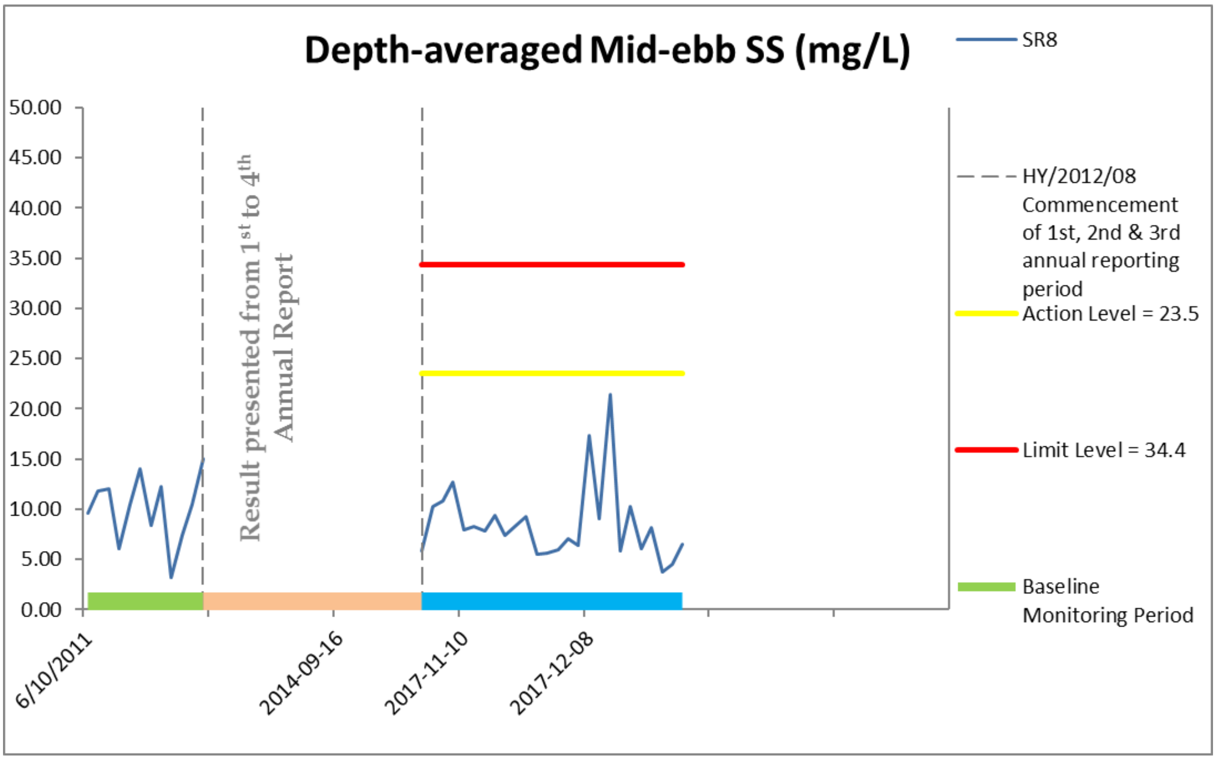


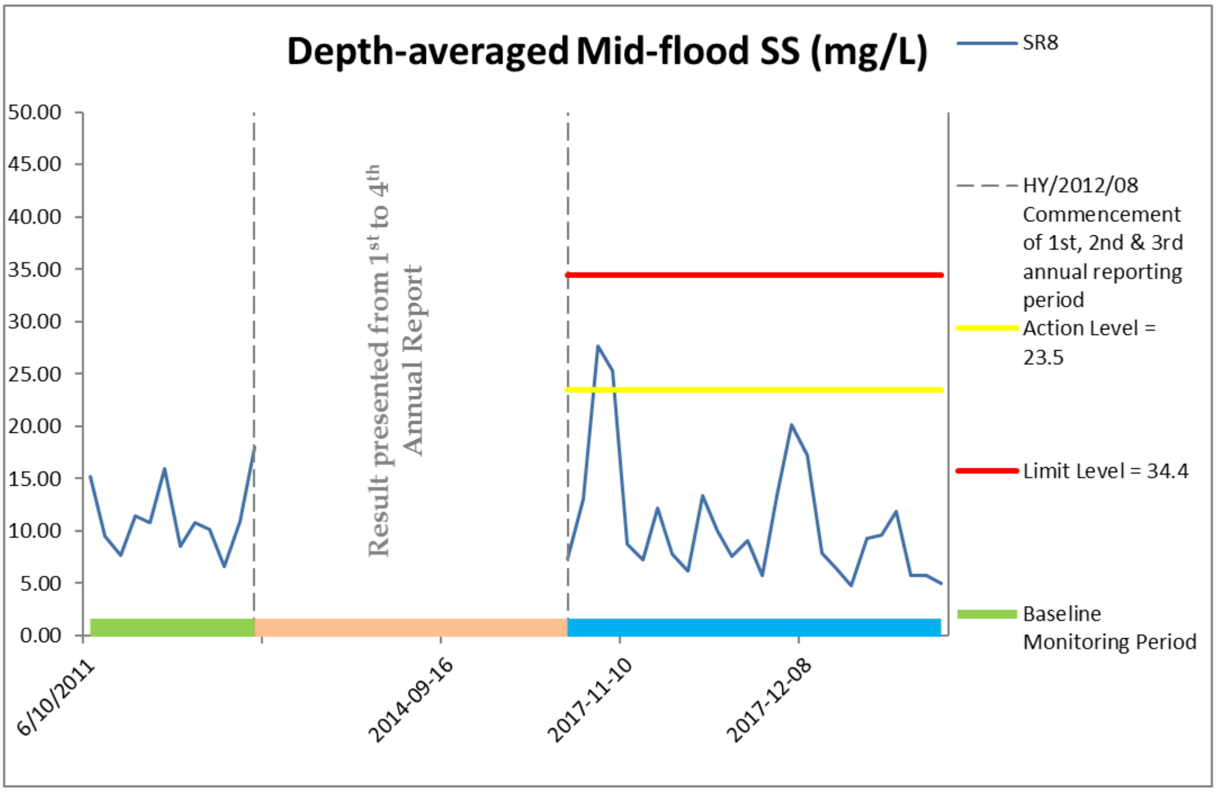
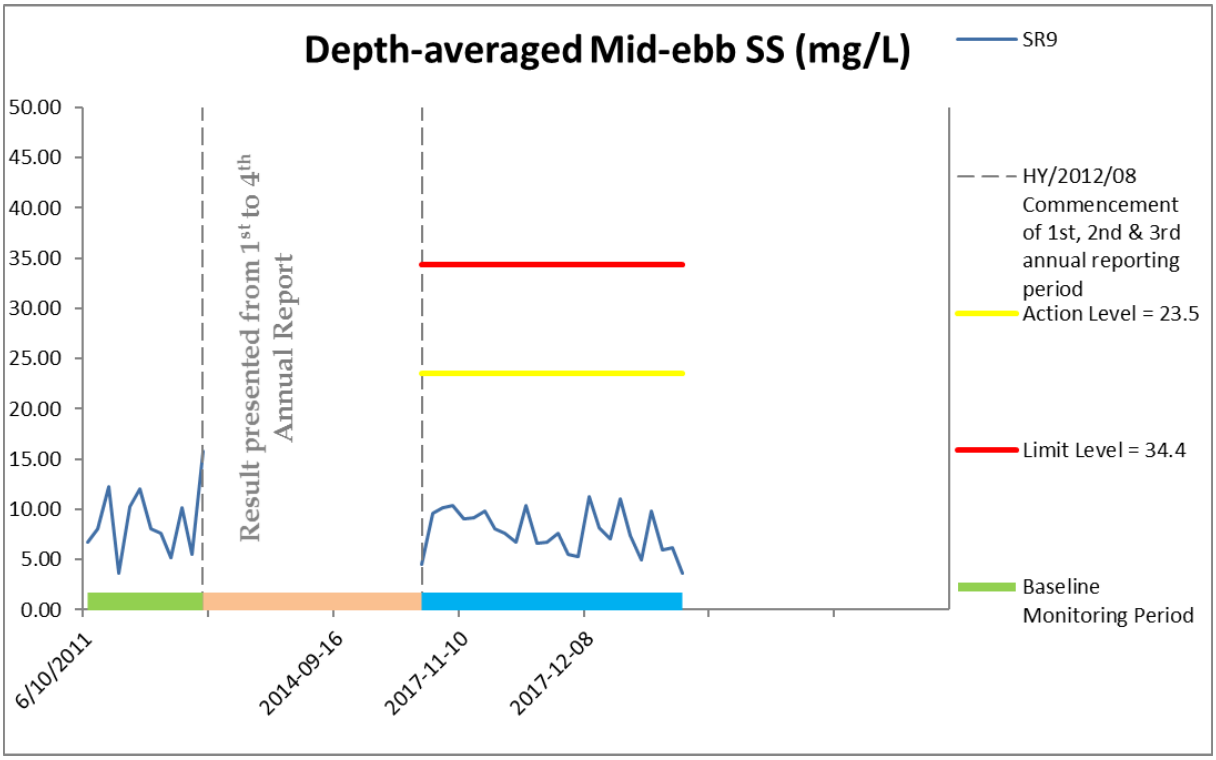


Figure E42 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR8. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: 0212330_Impact-WQM_5th annual.xlsx



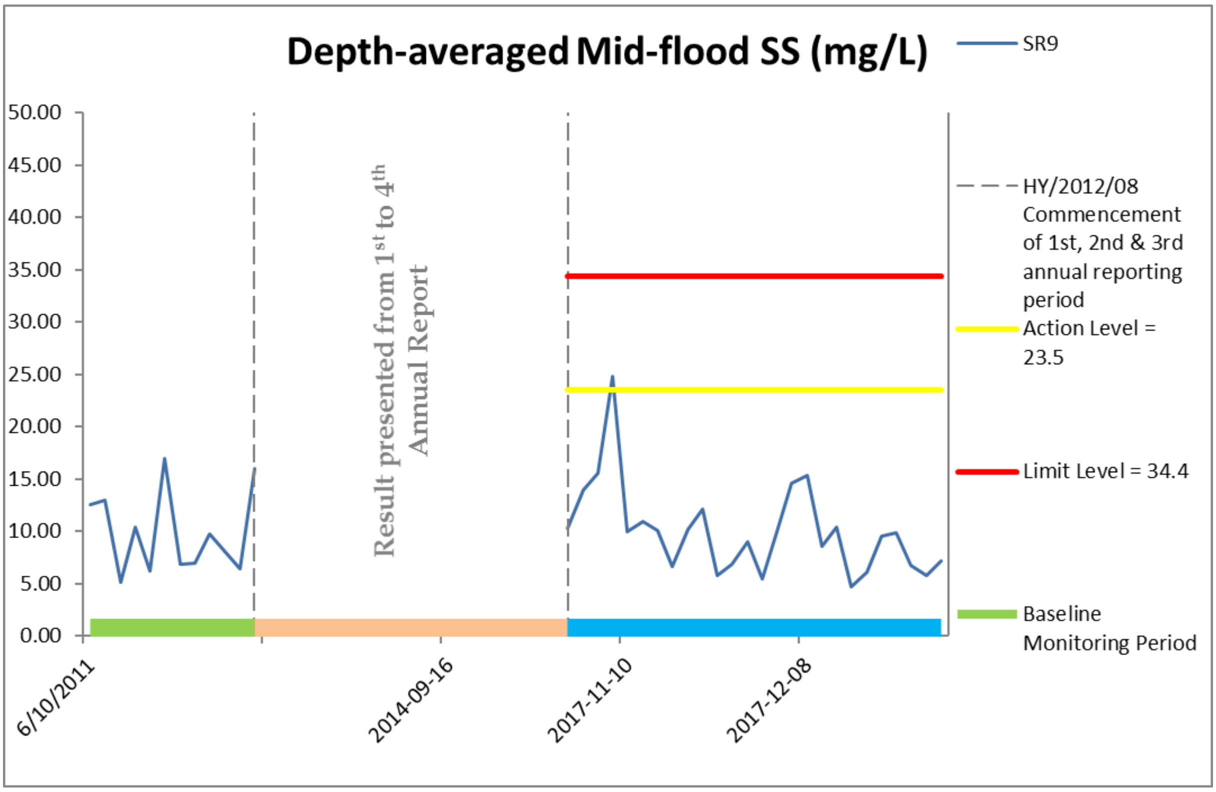


Figure E43 Baseline & Impact Monitoring – Mean Depth-averaged Level of Suspended Solids (mg/L) between Baseline monitoring period: 6/10/2011 to 31/10/2011 and Impact monitoring period: 1/11/2017 to 31/12/2017 at SR9. Weather condition within the reporting period varied between sunny to rainy. The overall monitoring results were not affected by weather conditions. Major marine construction activities included: Seawall Construction and Filling works at Portion N-A, Seawall Enhancement Works at Portion N-C

ERM

Ref: *0212330_Impact-WQM_5th annual.xlsx*

Appendix E

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

Fifth Annual Progress Report (November 2017 - October 2018)
submitted to Dragages – Bouygues Joint Venture & ERM Hong Kong Ltd.

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

30 June 2019

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 TM-CLKL project in Northwest Lantau (NWL) and Northeast Lantau (NEL) survey areas.

1.4. During the construction period of HKLR, the dolphin specialist would be in charge of reviewing and collating information collected by HKLR03 dolphin monitoring programme to examine any potential impacts of TM-CLKL construction works on the dolphins.

1.5. 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.

1.6. This report is the fifth annual progress report under the TM-CLKL construction phase dolphin monitoring programme submitted to the Contractor, summarizing the results of the surveys findings during the period of November 2016 to October 2017, utilizing the survey data collected by HKLR03 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 dolphin monitoring surveys are shown in Table 1.

Table 1 Co-ordinates of transect lines conducted by HKLR03 project

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	804671	815456		13	Start Point	1	Start Point
1	End Point	804671	831404		13	End Point	1	End Point
2	Start Point	805476	820800		14	Start Point	2	Start Point
2	End Point	805476	826654		14	End Point	2	End Point
3	Start Point	806464	821150		15	Start Point	3	Start Point
3	End Point	806464	822911		15	End Point	3	End Point
4	Start Point	807518	821500		16	Start Point	4	Start Point
4	End Point	807518	829230		16	End Point	4	End Point
5	Start Point	808504	821850		17	Start Point	5	Start Point

5	End Point	808504	828602		17	End Point	5	End Point
6	Start Point	809490	822150		18	Start Point	6	Start Point
6	End Point	809490	825352		18	End Point	6	End Point
7	Start Point	810499	822000		19	Start Point	7	Start Point
7	End Point	810499	824613		19	End Point	7	End Point
8	Start Point	811508	821123		20	Start Point	8	Start Point
8	End Point	811508	824254		20	End Point	8	End Point
9	Start Point	812516	821303		21	Start Point	9	Start Point
9	End Point	812516	824254		21	End Point	9	End Point
10	Start Point	813525	821176		22	Start Point	10	Start Point
10	End Point	813525	824657		22	End Point	10	End Point
11	Start Point	814556	818853		23	Start Point	11	Start Point
11	End Point	814556	820992		23	End Point	11	End Point
12	Start Point	815542	818807		24	Start Point	12	Start Point
12	End Point	815542	824882		24	End Point	12	End Point

2.1.2. The HKLR03 survey team 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* or *Steiner* marine binoculars. 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.

2.1.4. 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.

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

2.1.6. 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.

2.1.7. 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 survey team 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 or 60D 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 dolphin monitoring data collected under the present impact phase (the fifth year of TMCLKL construction; i.e. November 2017 to October 2018). 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, second, third, fourth and 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; November 2017 to October 2018).

2.3.2. Along with the analyzed results from the baseline and transitional as well as the first four years of impact phase, results from the fifth 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, both of which only HKLR03 monitoring data were included for the various analyses.

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 four 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 quarterly 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) x 100) / SA%
DPSE = ((D / E) x 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 fifth year of TMCLKL impact phase monitoring (i.e. November 2017 to October 2018), a total of 24 sets of systematic line-transect vessel surveys were conducted under the HKLR03 monitoring works to cover all transect lines in NWL and NEL survey areas twice per month.

3.1.2. From these HKLR03 surveys, a total of 3,152.08 km of survey effort was collected, with 93.6% 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, 1,160.48 km and 1,991.60 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 2,300.78 km, while the effort on secondary lines was 851.30 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 monitoring surveys from November 2017 to October 2018, a total of 42 groups of 131 Chinese White Dolphins were sighted. All except two dolphin groups were sighted during on-effort search. Among the 40 on-effort sightings, 33 of them were made on primary lines, while the other seven 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 monitoring surveys in

November 2017 to October 2018 is shown in Figure 1.

3.2.2. The majority of dolphin sightings made during the fifth year of impact phase were concentrated at the northwestern portion of the North Lantau region, mainly in the waters around Lung Kwu Chau (Figure 1). Several dolphin sightings were also made near Black Point, Pillar Point and Sha Chau, while some were sighted near the juncture of Northwest and West Lantau survey areas, or just to the north and south of 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 or the reclamation sites of HKLR03 and HKBCF (Figure 1). As mentioned above, several sightings were made adjacent to the HKLR09 alignment near 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 four years of impact phase.

3.2.4. Dolphin sighting distribution of the present impact phase monitoring period (November 2017 to October 2018) was compared to the ones during the baseline phase (February 2011 to January 2012), the transitional phase (November 2012 to October 2013) and the first four years of impact phase (November 2013 to October 2017) (Figure 2).

3.2.5. During the present impact phase period in 2017-18, dolphin distribution was quite similar to the previous three impact phase periods in 2014-15, 2015-16 and 2016-17, 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 five periods of impact phase of TMCLKL construction (Figure 2).

3.2.6. The only area where dolphin occurrence was consistently high across the seven periods was around the Lung Kwu Chau area, but even so such occurrence there was progressively diminishing in past four monitoring periods (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 four 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 present 12-month study period using both primary and secondary survey effort. The encounter rates of sightings (STG) and dolphins (ANI) in NWL were 2.17 sightings and 7.06 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 2017-18.

Table 2. Comparison of average daily dolphin encounter rates from the first five years of impact phase, transitional phase and baseline phase monitoring periods (Note: encounter rates deduced from the five 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 (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) in the fifth year of TMCLKL impact monitoring period were nil as in the previous two periods in 2015-16 and 2016-17, 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 (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 monitoring periods of TMCLKL construction works, and then to complete absence in the third, fourth and fifth monitoring 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 65.4% and 69.5% respectively) than the ones recorded in the baseline period, indicating a dramatic decline in dolphin usage of this survey area during the fifth year of TMCLKL impact phase monitoring period (Table 2). Moreover, those encounter rates consistently remained at a low level in the four consecutive monitoring periods between 2014-18.

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 following 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 of the marine works of 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 five 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 one to 12 individuals per group in North Lantau region during November 2017 – October 2018. The average dolphin group sizes from the 12-month impact phase monitoring period were compared with the ones deduced from baseline, transitional and first four years of impact phases, as shown in Table 3.

Table 3. Comparison of average dolphin group sizes from the first five 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 (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 was the lowest among all five impact phase monitoring periods as well as the baseline and transitional phases (Table 3).

3.4.3. Among the 42 dolphin groups sighted during the impact phase, 33 of them were composed of 1-4 individuals only, while there were nine groups with more than 5 animals and only two groups with more than 10 individuals (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 four years of impact phase, transitional phase and baseline phase. During the impact phase in 2017-18, distribution of the larger dolphin groups were mainly concentrated around and to the north of Lung Kwu Chau, while the two very large groups with 12 animals each were sighted at the mouth of Deep Bay and between Sha Chau and Lung Kwu Chau respectively (Figure 3).

3.4.5. Throughout the five impact phases, distribution of these larger groups has been largely 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 2017-18, the most heavily utilized habitats by Chinese White Dolphins were only found to the northeast of Lung Kwu Chau (Figures 4a and 4b). For the rest of North Lantau region, only a handful of grids between Sha Chau and Lugn Kwu Chau, near Pillar Point, Black Point, at the mouth of Deep Bay, and adjacent to the HKLR09 alignment have recorded low to moderately low dolphin 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 2017-18 (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 four 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 two 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 2017-18), with the only 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 four years of the impact monitoring periods.

3.6. Mother-calf pairs

3.6.1. During the present 12-month impact phase monitoring period, no young calf was sighted at all in North Lantau waters. Notably, the extremely low occurrence of young calves have been persistent in recent monitoring periods between 2014-18, ranging from 0% in 2015-16 and 2017-18 to 1.3% in 2014-15, when compared to the higher percentages during the first impact phase period of 2013-14 (5.7%), transitional phase (6.7%) and baseline phase (4.5%).

3.6.2. The near absence of young calves in North Lantau region during recent monitoring periods was drastically different from the distribution patterns 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. Only three dolphin sightings were associated with feeding activities during the 12-month impact phase monitoring period. The percentage of sightings associated with feeding activities during the present impact phase (7.1%) was much lower than the impact phase periods in 2016-17 (18.6%), 2015-16 (11.1%), 2014-15 (18.5%), transitional phase (8.6%) and baseline phase (12.8%), but was slightly higher than the one during 2013-14 period (5.9%).

3.7.2. Moreover, two sightings were also associated with socializing activities in 2017-18, and the percentage of such sightings (4.8%) was lower than the previous impact monitoring periods in 2015-16 (8.9%), 2014-15 (5.5%) and 2013-14 (5.9%) as well as the transitional period (6.4%), but higher than the baseline period (3.8%) and the previous monitoring period in 2016-17 (0%). On the contrary, none of the 42 dolphin group was engaged in traveling or resting/milling activities in 2017-18.

3.7.3. Distribution of dolphins engaged in feeding and socializing activities during the present impact phase monitoring period is shown in Figure 7. Two of the three groups engaged in feeding activities were located near Lung Kwu Chau, while another group was found near HKLR09 alignment (Figure 7). On the other hand, the two groups engaged in socializing activities were found near Lung Kwu Chau and at the mouth of Deep Bay (Figure 7).

3.7.4. The comparison in distribution of dolphins engaged in different activities during different monitoring phases revealed that feeding activities were 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 in the same period (Figure 7). It is apparent that the “hotspots” where dolphins engaged in different activities were considerably different between the baseline, transitional and impact phases.

3.7.5. Notably, only one of the 42 dolphin groups sighted during the impact phase monitoring period in 2017-18 were found to be associated with an operating purse-seiner. The rare events of fishing boat associations by the dolphins during the five 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 2017-18, a total of 44 individuals sighted 96 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 44 identified individuals were sighted only once or twice, while the other 13 individuals were sighted more frequently during the 12-month period. For example, CH34 and NL286 were sighted 5-6 times, while NL136 and NL182 were sighted seven and nine times respectively in 2017-18. Their frequent occurrences during the fifth year of impact phase monitoring indicated strong reliance of NWL waters as their home ranges.

3.8.3. Notably, a total of six well-recognized females (i.e. NL33, NL202, NL233, WL28, WL145, WL179) were accompanied with their calves during their re-sightings, and most of these calves are older and already in their juvenile stage.

3.9. Individual range use

3.9.1. Ranging patterns of the 44 individuals identified during the 12-month impact phase monitoring period in 2017-18 were determined by fixed kernel method, and are shown in Appendix IV.

3.9.2. The majority of identified dolphins sighted within this 12-month period were utilizing their ranges primarily in NWL, with the exception of NL311, NL327, WL28, WL62, WL124, WL145, WL179, WL188, WL251, WL273 and WL288 that primarily utilized WL waters (Appendix IV). Moreover, 28 of the 44 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 2017-18 (Appendix IV). On the contrary, all identified dolphins have avoided the NEL waters (Appendix IV), 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 13 individual dolphins that have consistently occurred in baseline phase, transitional phase and all five periods of impact phases were examined in details (Appendix V). It is apparent that seven of them (e.g. CH34, NL33, NL136, NL182) 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 nine of them (e.g. NL98, NL123, NL210) have increased their utilization of WL waters (Appendix V). Three individuals (NL33, NL120 and NL269) have even expanded their range use to Southwest Lantau waters as well during the past several impact phase monitoring periods (Appendix V). However, it should also be noted that such range expansion or shift has been reversed for a number of individuals (e.g. NL120, NL82) in 2016-17 and 2017-18, as they have once again utilized NWL waters primarily for their range use (Appendix V).

3.9.5. On the contrary, three individuals (NL46, NL202 and NL286) have no changes in their range use throughout the different monitoring periods. Moreover, five individuals (e.g. NL104, NL210) 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, 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 fifth 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.

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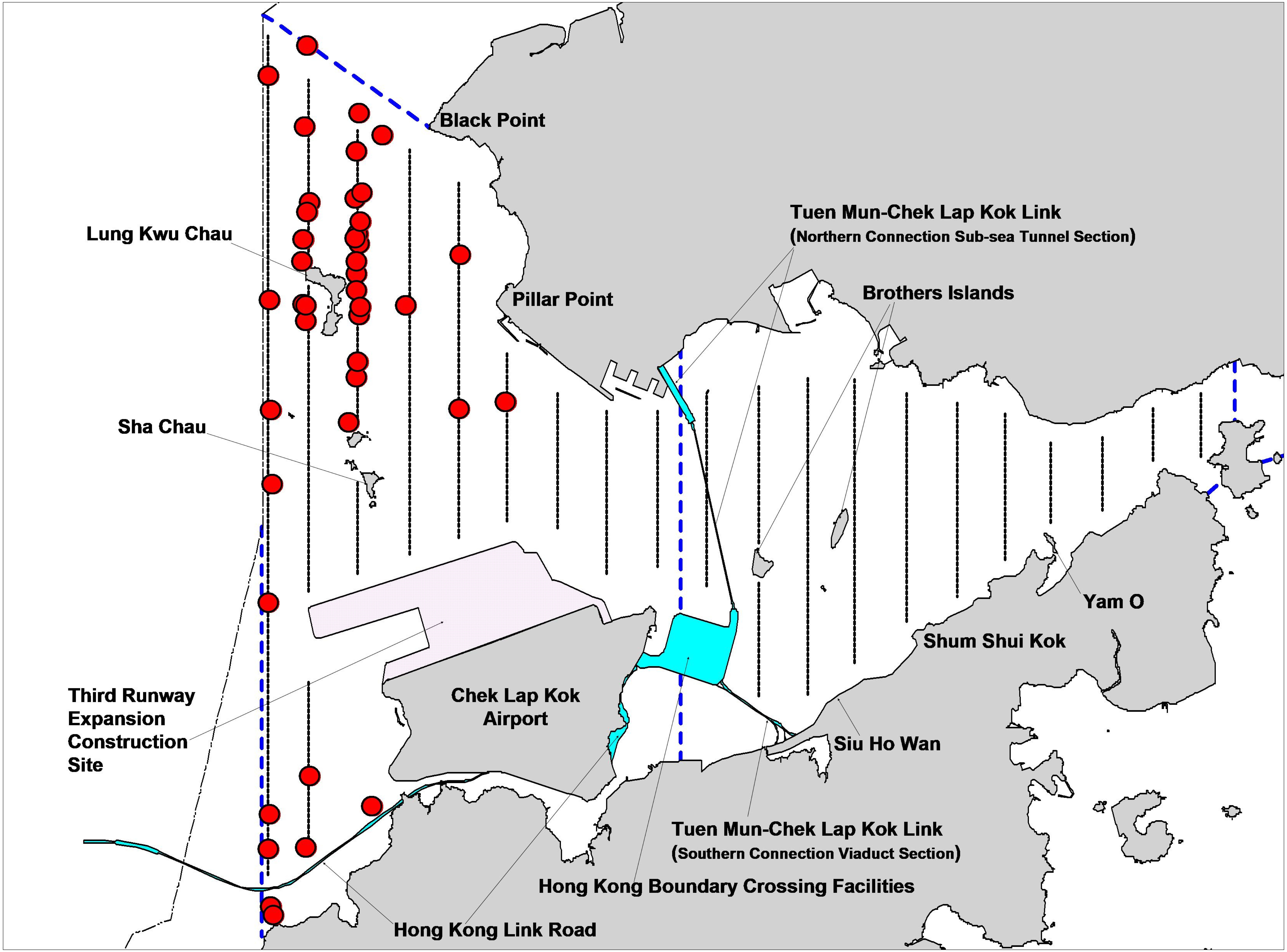


Figure 1. Distribution of Chinese white dolphin sightings in North Lantau region during the fifth year of TMCLKL construction works (November 2017 to October 2018), utilizing the HKLR03 monitoring data

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

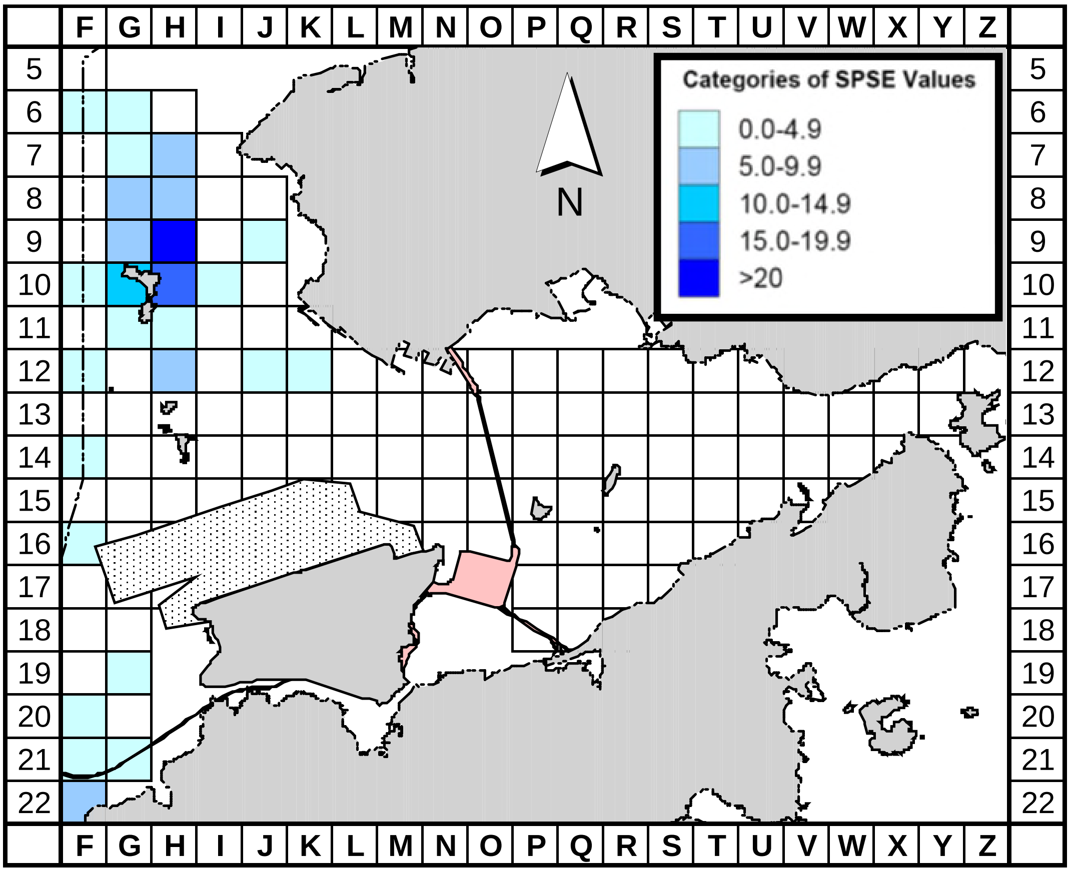


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period monitoring period (Nov17 - Oct18) (SPSE = no. of on-effort sightings per 100 units of survey effort)

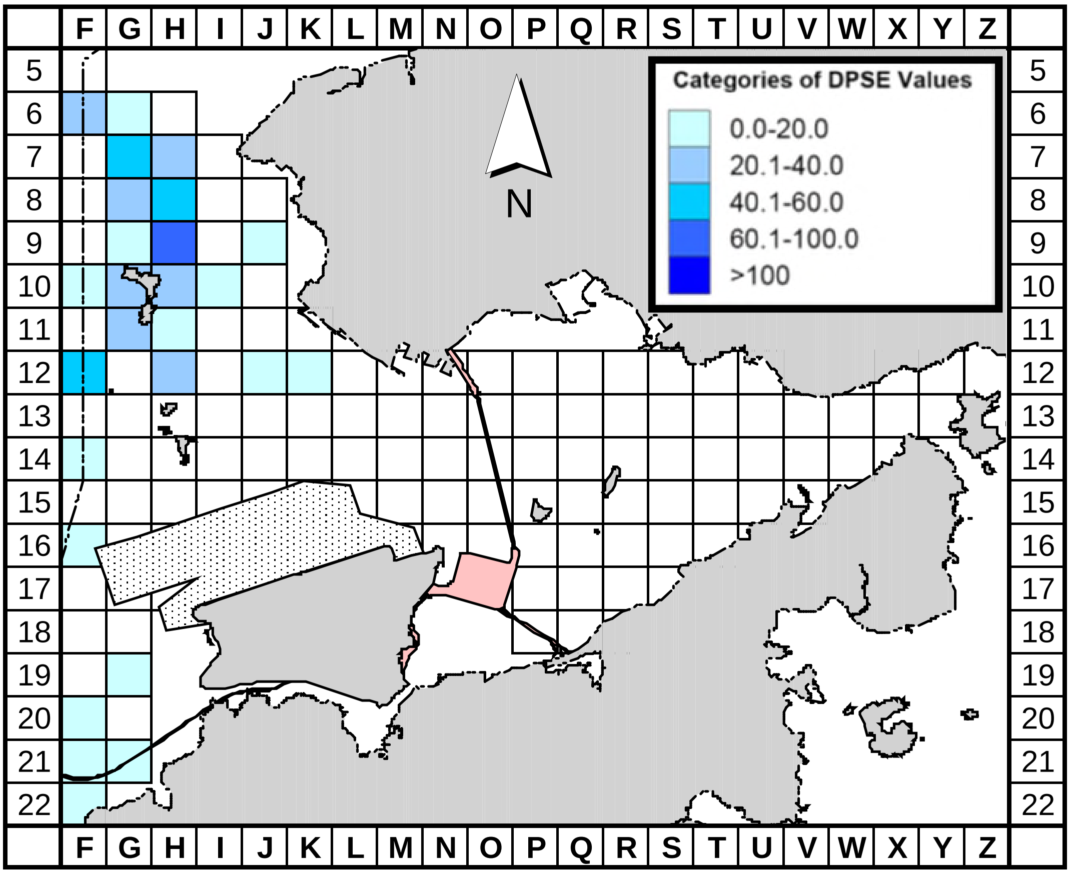


Figure 4b. Density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (Nov17 -Oct18) (DPSE = no. of dolphins per 100 units of survey effort)

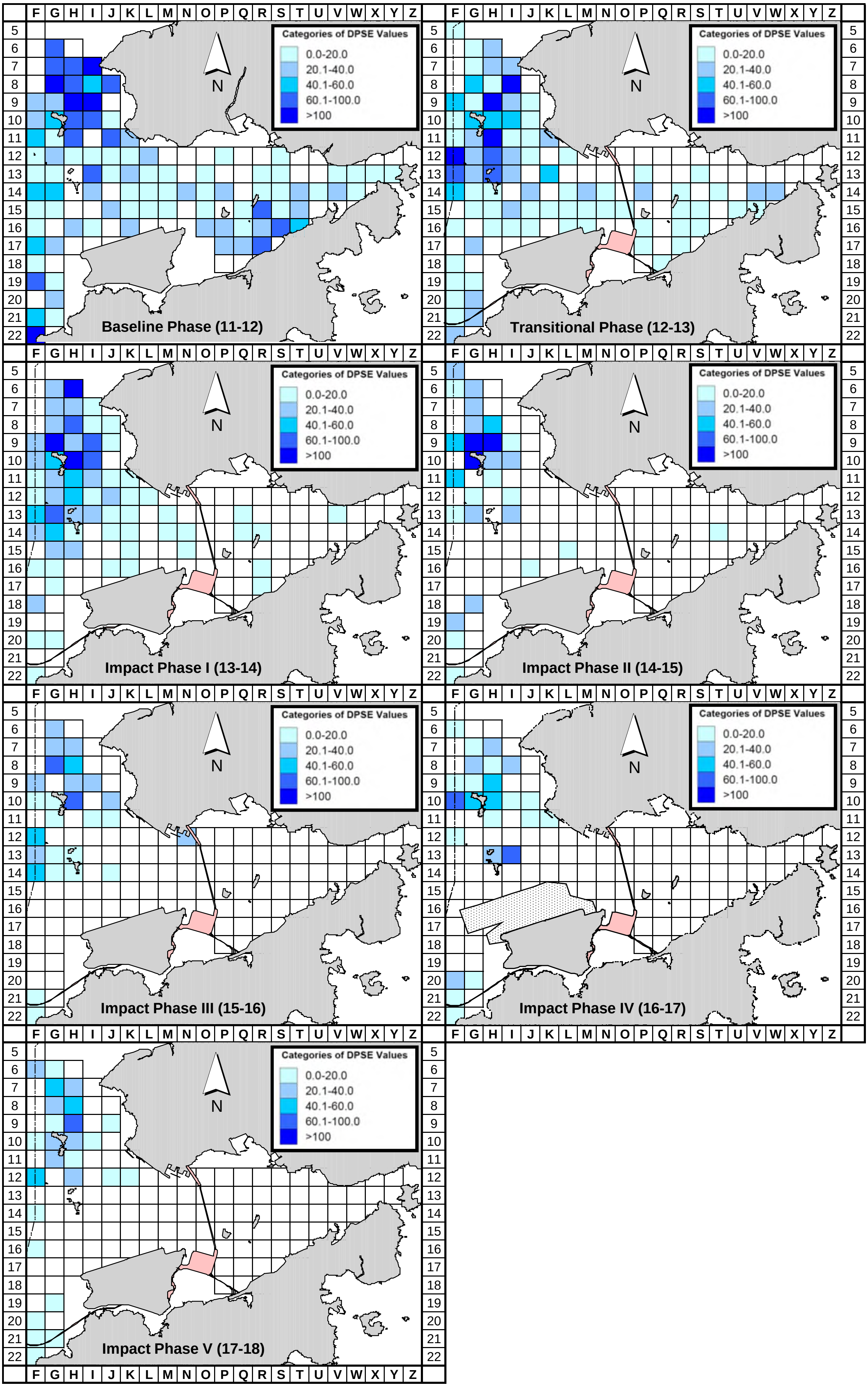


Figure 5. Comparison of density of Chinese white dolphins with corrected survey effort per km^2 in NWL and NEL survey areas between the five impact phases (2013-14, 2014-15, 2015-16, 2016-17 & 2017-18), transitional phase (2012-13) and baseline phase (Feb11-Jan12) monitoring periods (DPSE = no. of dolphins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

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
1-Nov-17	NW LANTAU	2	17.00	AUTUMN	STANDARD36826	HKLR	P
1-Nov-17	NW LANTAU	3	15.32	AUTUMN	STANDARD36826	HKLR	P
1-Nov-17	NW LANTAU	2	8.38	AUTUMN	STANDARD36826	HKLR	S
1-Nov-17	NW LANTAU	3	2.53	AUTUMN	STANDARD36826	HKLR	S
1-Nov-17	NE LANTAU	2	29.72	AUTUMN	STANDARD36826	HKLR	P
1-Nov-17	NE LANTAU	3	5.10	AUTUMN	STANDARD36826	HKLR	P
1-Nov-17	NE LANTAU	2	10.07	AUTUMN	STANDARD36826	HKLR	S
1-Nov-17	NE LANTAU	3	2.41	AUTUMN	STANDARD36826	HKLR	S
8-Nov-17	NW LANTAU	2	13.77	AUTUMN	STANDARD36826	HKLR	P
8-Nov-17	NW LANTAU	3	14.05	AUTUMN	STANDARD36826	HKLR	P
8-Nov-17	NW LANTAU	2	10.58	AUTUMN	STANDARD36826	HKLR	S
8-Nov-17	NW LANTAU	3	1.80	AUTUMN	STANDARD36826	HKLR	S
17-Nov-17	NW LANTAU	2	8.53	AUTUMN	STANDARD36826	HKLR	P
17-Nov-17	NW LANTAU	3	18.98	AUTUMN	STANDARD36826	HKLR	P
17-Nov-17	NW LANTAU	2	9.37	AUTUMN	STANDARD36826	HKLR	S
17-Nov-17	NW LANTAU	3	3.55	AUTUMN	STANDARD36826	HKLR	S
24-Nov-17	NW LANTAU	2	3.81	AUTUMN	STANDARD36826	HKLR	P
24-Nov-17	NW LANTAU	3	28.72	AUTUMN	STANDARD36826	HKLR	P
24-Nov-17	NW LANTAU	2	4.40	AUTUMN	STANDARD36826	HKLR	S
24-Nov-17	NW LANTAU	3	6.27	AUTUMN	STANDARD36826	HKLR	S
24-Nov-17	NE LANTAU	2	30.83	AUTUMN	STANDARD36826	HKLR	P
24-Nov-17	NE LANTAU	3	4.97	AUTUMN	STANDARD36826	HKLR	P
24-Nov-17	NE LANTAU	1	1.20	AUTUMN	STANDARD36826	HKLR	S
24-Nov-17	NE LANTAU	2	10.10	AUTUMN	STANDARD36826	HKLR	S
5-Dec-17	NW LANTAU	2	17.27	WINTER	STANDARD36826	HKLR	P
5-Dec-17	NW LANTAU	3	15.02	WINTER	STANDARD36826	HKLR	P
5-Dec-17	NW LANTAU	2	7.80	WINTER	STANDARD36826	HKLR	S
5-Dec-17	NW LANTAU	3	3.81	WINTER	STANDARD36826	HKLR	S
5-Dec-17	NE LANTAU	2	33.41	WINTER	STANDARD36826	HKLR	P
5-Dec-17	NE LANTAU	3	2.11	WINTER	STANDARD36826	HKLR	P
5-Dec-17	NE LANTAU	2	13.18	WINTER	STANDARD36826	HKLR	S
5-Dec-17	NE LANTAU	3	0.60	WINTER	STANDARD36826	HKLR	S
12-Dec-17	NW LANTAU	2	24.51	WINTER	STANDARD36826	HKLR	P
12-Dec-17	NW LANTAU	3	3.30	WINTER	STANDARD36826	HKLR	P
12-Dec-17	NW LANTAU	2	11.89	WINTER	STANDARD36826	HKLR	S
12-Dec-17	NW LANTAU	3	0.90	WINTER	STANDARD36826	HKLR	S
15-Dec-17	NW LANTAU	1	3.85	WINTER	STANDARD36826	HKLR	P
15-Dec-17	NW LANTAU	2	21.86	WINTER	STANDARD36826	HKLR	P
15-Dec-17	NW LANTAU	3	2.68	WINTER	STANDARD36826	HKLR	P
15-Dec-17	NW LANTAU	1	2.79	WINTER	STANDARD36826	HKLR	S
15-Dec-17	NW LANTAU	2	6.92	WINTER	STANDARD36826	HKLR	S
15-Dec-17	NW LANTAU	3	2.43	WINTER	STANDARD36826	HKLR	S
15-Dec-17	NE LANTAU	1	11.59	WINTER	STANDARD36826	HKLR	P
15-Dec-17	NE LANTAU	2	21.70	WINTER	STANDARD36826	HKLR	P
15-Dec-17	NE LANTAU	3	4.60	WINTER	STANDARD36826	HKLR	P
15-Dec-17	NE LANTAU	1	3.31	WINTER	STANDARD36826	HKLR	S
15-Dec-17	NE LANTAU	2	6.80	WINTER	STANDARD36826	HKLR	S
15-Dec-17	NE LANTAU	3	1.90	WINTER	STANDARD36826	HKLR	S
20-Dec-17	NW LANTAU	2	1.39	WINTER	STANDARD36826	HKLR	P
20-Dec-17	NW LANTAU	3	5.99	WINTER	STANDARD36826	HKLR	P
20-Dec-17	NW LANTAU	4	25.69	WINTER	STANDARD36826	HKLR	P
20-Dec-17	NW LANTAU	3	5.43	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
20-Dec-17	NW LANTAU	4	5.50	WINTER	STANDARD36826	HKLR	S
2-Jan-18	NW LANTAU	2	27.79	WINTER	STANDARD36826	HKLR	P
2-Jan-18	NW LANTAU	3	3.97	WINTER	STANDARD36826	HKLR	P
2-Jan-18	NW LANTAU	2	10.12	WINTER	STANDARD36826	HKLR	S
2-Jan-18	NW LANTAU	3	0.60	WINTER	STANDARD36826	HKLR	S
8-Jan-18	NW LANTAU	3	3.47	WINTER	STANDARD36826	HKLR	P
8-Jan-18	NW LANTAU	4	9.99	WINTER	STANDARD36826	HKLR	P
8-Jan-18	NW LANTAU	5	14.91	WINTER	STANDARD36826	HKLR	P
8-Jan-18	NW LANTAU	4	6.80	WINTER	STANDARD36826	HKLR	S
8-Jan-18	NW LANTAU	5	3.73	WINTER	STANDARD36826	HKLR	S
8-Jan-18	NE LANTAU	2	6.71	WINTER	STANDARD36826	HKLR	P
8-Jan-18	NE LANTAU	3	29.79	WINTER	STANDARD36826	HKLR	P
8-Jan-18	NE LANTAU	4	0.64	WINTER	STANDARD36826	HKLR	P
8-Jan-18	NE LANTAU	2	5.70	WINTER	STANDARD36826	HKLR	S
8-Jan-18	NE LANTAU	3	7.36	WINTER	STANDARD36826	HKLR	S
16-Jan-18	NW LANTAU	2	27.70	WINTER	STANDARD36826	HKLR	P
16-Jan-18	NW LANTAU	3	5.45	WINTER	STANDARD36826	HKLR	P
16-Jan-18	NW LANTAU	2	8.15	WINTER	STANDARD36826	HKLR	S
16-Jan-18	NW LANTAU	3	2.70	WINTER	STANDARD36826	HKLR	S
25-Jan-18	NE LANTAU	2	17.96	WINTER	STANDARD36826	HKLR	P
25-Jan-18	NE LANTAU	3	18.90	WINTER	STANDARD36826	HKLR	P
25-Jan-18	NE LANTAU	2	7.54	WINTER	STANDARD36826	HKLR	S
25-Jan-18	NE LANTAU	3	4.20	WINTER	STANDARD36826	HKLR	S
25-Jan-18	NE LANTAU	4	1.40	WINTER	STANDARD36826	HKLR	S
25-Jan-18	NW LANTAU	2	7.23	WINTER	STANDARD36826	HKLR	P
25-Jan-18	NW LANTAU	3	17.92	WINTER	STANDARD36826	HKLR	P
25-Jan-18	NW LANTAU	4	2.72	WINTER	STANDARD36826	HKLR	P
25-Jan-18	NW LANTAU	2	4.02	WINTER	STANDARD36826	HKLR	S
25-Jan-18	NW LANTAU	3	6.52	WINTER	STANDARD36826	HKLR	S
25-Jan-18	NW LANTAU	4	1.95	WINTER	STANDARD36826	HKLR	S
2-Feb-18	NW LANTAU	2	2.34	WINTER	STANDARD36826	HKLR	P
2-Feb-18	NW LANTAU	3	16.30	WINTER	STANDARD36826	HKLR	P
2-Feb-18	NW LANTAU	4	15.00	WINTER	STANDARD36826	HKLR	P
2-Feb-18	NW LANTAU	2	2.86	WINTER	STANDARD36826	HKLR	S
2-Feb-18	NW LANTAU	3	6.78	WINTER	STANDARD36826	HKLR	S
2-Feb-18	NW LANTAU	4	1.12	WINTER	STANDARD36826	HKLR	S
9-Feb-18	NE LANTAU	1	4.00	WINTER	STANDARD36826	HKLR	P
9-Feb-18	NE LANTAU	2	30.78	WINTER	STANDARD36826	HKLR	P
9-Feb-18	NE LANTAU	1	1.00	WINTER	STANDARD36826	HKLR	S
9-Feb-18	NE LANTAU	2	12.02	WINTER	STANDARD36826	HKLR	S
9-Feb-18	NW LANTAU	1	5.87	WINTER	STANDARD36826	HKLR	P
9-Feb-18	NW LANTAU	2	21.20	WINTER	STANDARD36826	HKLR	P
9-Feb-18	NW LANTAU	1	2.32	WINTER	STANDARD36826	HKLR	S
9-Feb-18	NW LANTAU	2	8.91	WINTER	STANDARD36826	HKLR	S
14-Feb-18	NW LANTAU	1	2.80	WINTER	STANDARD36826	HKLR	P
14-Feb-18	NW LANTAU	2	24.71	WINTER	STANDARD36826	HKLR	P
14-Feb-18	NW LANTAU	2	12.25	WINTER	STANDARD36826	HKLR	S
14-Feb-18	NE LANTAU	1	3.84	WINTER	STANDARD36826	HKLR	P
14-Feb-18	NE LANTAU	2	22.25	WINTER	STANDARD36826	HKLR	P
14-Feb-18	NE LANTAU	3	10.09	WINTER	STANDARD36826	HKLR	P
14-Feb-18	NE LANTAU	2	12.04	WINTER	STANDARD36826	HKLR	S
14-Feb-18	NE LANTAU	3	1.28	WINTER	STANDARD36826	HKLR	S
22-Feb-18	NW LANTAU	2	11.27	WINTER	STANDARD36826	HKLR	P
22-Feb-18	NW LANTAU	3	21.56	WINTER	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
22-Feb-18	NW LANTAU	2	5.32	WINTER	STANDARD36826	HKLR	S
22-Feb-18	NW LANTAU	3	5.45	WINTER	STANDARD36826	HKLR	S
8-Mar-18	NE LANTAU	2	21.56	SPRING	STANDARD36826	HKLR	P
8-Mar-18	NE LANTAU	3	13.44	SPRING	STANDARD36826	HKLR	P
8-Mar-18	NE LANTAU	2	6.79	SPRING	STANDARD36826	HKLR	S
8-Mar-18	NE LANTAU	3	4.71	SPRING	STANDARD36826	HKLR	S
8-Mar-18	NW LANTAU	2	5.20	SPRING	STANDARD36826	HKLR	P
8-Mar-18	NW LANTAU	3	17.08	SPRING	STANDARD36826	HKLR	P
8-Mar-18	NW LANTAU	4	2.40	SPRING	STANDARD36826	HKLR	P
8-Mar-18	NW LANTAU	2	3.42	SPRING	STANDARD36826	HKLR	S
8-Mar-18	NW LANTAU	3	1.60	SPRING	STANDARD36826	HKLR	S
8-Mar-18	NW LANTAU	4	5.60	SPRING	STANDARD36826	HKLR	S
12-Mar-18	NW LANTAU	1	4.88	SPRING	STANDARD36826	HKLR	P
12-Mar-18	NW LANTAU	2	30.68	SPRING	STANDARD36826	HKLR	P
12-Mar-18	NW LANTAU	1	1.00	SPRING	STANDARD36826	HKLR	S
12-Mar-18	NW LANTAU	2	12.34	SPRING	STANDARD36826	HKLR	S
20-Mar-18	NE LANTAU	2	7.92	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NE LANTAU	3	26.28	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NE LANTAU	4	3.00	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NE LANTAU	2	4.82	SPRING	STANDARD36826	HKLR	S
20-Mar-18	NE LANTAU	3	8.18	SPRING	STANDARD36826	HKLR	S
20-Mar-18	NE LANTAU	4	1.30	SPRING	STANDARD36826	HKLR	S
20-Mar-18	NW LANTAU	2	0.77	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NW LANTAU	3	6.09	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NW LANTAU	4	17.10	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NW LANTAU	5	2.10	SPRING	STANDARD36826	HKLR	P
20-Mar-18	NW LANTAU	3	3.40	SPRING	STANDARD36826	HKLR	S
20-Mar-18	NW LANTAU	4	4.54	SPRING	STANDARD36826	HKLR	S
20-Mar-18	NW LANTAU	5	2.60	SPRING	STANDARD36826	HKLR	S
23-Mar-18	NW LANTAU	1	4.22	SPRING	STANDARD36826	HKLR	P
23-Mar-18	NW LANTAU	2	19.38	SPRING	STANDARD36826	HKLR	P
23-Mar-18	NW LANTAU	3	10.11	SPRING	STANDARD36826	HKLR	P
23-Mar-18	NW LANTAU	2	9.28	SPRING	STANDARD36826	HKLR	S
23-Mar-18	NW LANTAU	3	1.55	SPRING	STANDARD36826	HKLR	S
10-Apr-18	NW LANTAU	2	23.74	SPRING	STANDARD36826	HKLR	P
10-Apr-18	NW LANTAU	3	1.23	SPRING	STANDARD36826	HKLR	P
10-Apr-18	NW LANTAU	2	11.73	SPRING	STANDARD36826	HKLR	S
17-Apr-18	NW LANTAU	1	2.20	SPRING	STANDARD36826	HKLR	P
17-Apr-18	NW LANTAU	2	33.50	SPRING	STANDARD36826	HKLR	P
17-Apr-18	NW LANTAU	2	14.10	SPRING	STANDARD36826	HKLR	S
17-Apr-18	NE LANTAU	1	1.20	SPRING	STANDARD36826	HKLR	P
17-Apr-18	NE LANTAU	2	34.52	SPRING	STANDARD36826	HKLR	P
17-Apr-18	NE LANTAU	1	1.10	SPRING	STANDARD36826	HKLR	S
17-Apr-18	NE LANTAU	2	12.58	SPRING	STANDARD36826	HKLR	S
19-Apr-18	NW LANTAU	1	3.85	SPRING	STANDARD36826	HKLR	P
19-Apr-18	NW LANTAU	2	8.59	SPRING	STANDARD36826	HKLR	P
19-Apr-18	NW LANTAU	3	20.48	SPRING	STANDARD36826	HKLR	P
19-Apr-18	NW LANTAU	1	2.26	SPRING	STANDARD36826	HKLR	S
19-Apr-18	NW LANTAU	2	8.21	SPRING	STANDARD36826	HKLR	S
25-Apr-18	NW LANTAU	1	10.61	SPRING	STANDARD36826	HKLR	P
25-Apr-18	NW LANTAU	2	18.13	SPRING	STANDARD36826	HKLR	P
25-Apr-18	NW LANTAU	1	1.60	SPRING	STANDARD36826	HKLR	S
25-Apr-18	NW LANTAU	2	9.66	SPRING	STANDARD36826	HKLR	S
25-Apr-18	NE LANTAU	2	36.91	SPRING	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
25-Apr-18	NE LANTAU	2	10.89	SPRING	STANDARD36826	HKLR	S
7-May-18	NW LANTAU	3	18.59	SPRING	STANDARD36826	HKLR	P
7-May-18	NW LANTAU	4	5.80	SPRING	STANDARD36826	HKLR	P
7-May-18	NW LANTAU	3	9.41	SPRING	STANDARD36826	HKLR	S
7-May-18	NE LANTAU	2	22.70	SPRING	STANDARD36826	HKLR	P
7-May-18	NE LANTAU	3	11.82	SPRING	STANDARD36826	HKLR	P
7-May-18	NE LANTAU	2	7.15	SPRING	STANDARD36826	HKLR	S
7-May-18	NE LANTAU	3	5.23	SPRING	STANDARD36826	HKLR	S
10-May-18	NW LANTAU	3	13.41	SPRING	STANDARD36826	HKLR	P
10-May-18	NW LANTAU	4	21.03	SPRING	STANDARD36826	HKLR	P
10-May-18	NW LANTAU	3	6.20	SPRING	STANDARD36826	HKLR	S
10-May-18	NW LANTAU	4	6.66	SPRING	STANDARD36826	HKLR	S
16-May-18	NE LANTAU	2	19.20	SPRING	STANDARD36826	HKLR	P
16-May-18	NE LANTAU	3	17.50	SPRING	STANDARD36826	HKLR	P
16-May-18	NE LANTAU	2	11.20	SPRING	STANDARD36826	HKLR	S
16-May-18	NE LANTAU	3	0.90	SPRING	STANDARD36826	HKLR	S
16-May-18	NW LANTAU	2	4.80	SPRING	STANDARD36826	HKLR	P
16-May-18	NW LANTAU	3	27.00	SPRING	STANDARD36826	HKLR	P
16-May-18	NW LANTAU	2	4.50	SPRING	STANDARD36826	HKLR	S
16-May-18	NW LANTAU	3	6.50	SPRING	STANDARD36826	HKLR	S
30-May-18	NW LANTAU	2	2.60	SPRING	STANDARD36826	HKLR	P
30-May-18	NW LANTAU	3	18.99	SPRING	STANDARD36826	HKLR	P
30-May-18	NW LANTAU	4	6.00	SPRING	STANDARD36826	HKLR	P
30-May-18	NW LANTAU	2	4.90	SPRING	STANDARD36826	HKLR	S
30-May-18	NW LANTAU	3	6.81	SPRING	STANDARD36826	HKLR	S
30-May-18	NW LANTAU	4	2.50	SPRING	STANDARD36826	HKLR	S
5-Jun-18	NW LANTAU	2	3.73	SUMMER	STANDARD36826	HKLR	P
5-Jun-18	NW LANTAU	3	28.14	SUMMER	STANDARD36826	HKLR	P
5-Jun-18	NW LANTAU	2	3.46	SUMMER	STANDARD36826	HKLR	S
5-Jun-18	NW LANTAU	3	6.03	SUMMER	STANDARD36826	HKLR	S
5-Jun-18	NE LANTAU	2	10.32	SUMMER	STANDARD36826	HKLR	P
5-Jun-18	NE LANTAU	3	25.47	SUMMER	STANDARD36826	HKLR	P
5-Jun-18	NE LANTAU	2	6.68	SUMMER	STANDARD36826	HKLR	S
5-Jun-18	NE LANTAU	3	3.77	SUMMER	STANDARD36826	HKLR	S
13-Jun-18	NW LANTAU	2	23.63	SUMMER	STANDARD36826	HKLR	P
13-Jun-18	NW LANTAU	3	3.34	SUMMER	STANDARD36826	HKLR	P
13-Jun-18	NW LANTAU	2	8.49	SUMMER	STANDARD36826	HKLR	S
13-Jun-18	NW LANTAU	3	2.64	SUMMER	STANDARD36826	HKLR	S
19-Jun-18	NW LANTAU	3	23.85	SUMMER	STANDARD36826	HKLR	P
19-Jun-18	NW LANTAU	4	3.40	SUMMER	STANDARD36826	HKLR	P
19-Jun-18	NW LANTAU	3	7.85	SUMMER	STANDARD36826	HKLR	S
19-Jun-18	NW LANTAU	4	3.20	SUMMER	STANDARD36826	HKLR	S
19-Jun-18	NE LANTAU	2	24.33	SUMMER	STANDARD36826	HKLR	P
19-Jun-18	NE LANTAU	3	11.62	SUMMER	STANDARD36826	HKLR	P
19-Jun-18	NE LANTAU	2	9.72	SUMMER	STANDARD36826	HKLR	S
19-Jun-18	NE LANTAU	3	1.87	SUMMER	STANDARD36826	HKLR	S
27-Jun-18	NW LANTAU	2	16.07	SUMMER	STANDARD36826	HKLR	P
27-Jun-18	NW LANTAU	3	12.56	SUMMER	STANDARD36826	HKLR	P
27-Jun-18	NW LANTAU	4	4.20	SUMMER	STANDARD36826	HKLR	P
27-Jun-18	NW LANTAU	2	10.57	SUMMER	STANDARD36826	HKLR	S
3-Jul-18	NW LANTAU	3	24.91	SUMMER	STANDARD36826	HKLR	P
3-Jul-18	NW LANTAU	4	10.69	SUMMER	STANDARD36826	HKLR	P
3-Jul-18	NW LANTAU	3	12.89	SUMMER	STANDARD36826	HKLR	S
3-Jul-18	NW LANTAU	4	0.81	SUMMER	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
3-Jul-18	NE LANTAU	2	28.85	SUMMER	STANDARD36826	HKLR	P
3-Jul-18	NE LANTAU	3	7.29	SUMMER	STANDARD36826	HKLR	P
3-Jul-18	NE LANTAU	2	13.36	SUMMER	STANDARD36826	HKLR	S
3-Jul-18	NE LANTAU	3	0.80	SUMMER	STANDARD36826	HKLR	S
9-Jul-18	NW LANTAU	2	4.62	SUMMER	STANDARD36826	HKLR	P
9-Jul-18	NW LANTAU	3	17.99	SUMMER	STANDARD36826	HKLR	P
9-Jul-18	NW LANTAU	4	0.98	SUMMER	STANDARD36826	HKLR	P
9-Jul-18	NW LANTAU	2	0.90	SUMMER	STANDARD36826	HKLR	S
9-Jul-18	NW LANTAU	3	7.21	SUMMER	STANDARD36826	HKLR	S
12-Jul-18	NW LANTAU	2	19.42	SUMMER	STANDARD36826	HKLR	P
12-Jul-18	NW LANTAU	3	15.11	SUMMER	STANDARD36826	HKLR	P
12-Jul-18	NW LANTAU	2	3.70	SUMMER	STANDARD36826	HKLR	S
12-Jul-18	NW LANTAU	3	7.80	SUMMER	STANDARD36826	HKLR	S
12-Jul-18	NW LANTAU	4	1.30	SUMMER	STANDARD36826	HKLR	S
12-Jul-18	NE LANTAU	2	15.65	SUMMER	STANDARD36826	HKLR	P
12-Jul-18	NE LANTAU	3	18.42	SUMMER	STANDARD36826	HKLR	P
12-Jul-18	NE LANTAU	2	10.66	SUMMER	STANDARD36826	HKLR	S
12-Jul-18	NE LANTAU	3	2.77	SUMMER	STANDARD36826	HKLR	S
20-Jul-18	NW LANTAU	1	1.50	SUMMER	STANDARD36826	HKLR	P
20-Jul-18	NW LANTAU	2	18.66	SUMMER	STANDARD36826	HKLR	P
20-Jul-18	NW LANTAU	3	4.88	SUMMER	STANDARD36826	HKLR	P
20-Jul-18	NW LANTAU	1	0.90	SUMMER	STANDARD36826	HKLR	S
20-Jul-18	NW LANTAU	2	2.82	SUMMER	STANDARD36826	HKLR	S
20-Jul-18	NW LANTAU	3	4.14	SUMMER	STANDARD36826	HKLR	S
1-Aug-18	NW LANTAU	2	28.28	SUMMER	STANDARD36826	HKLR	P
1-Aug-18	NW LANTAU	3	5.46	SUMMER	STANDARD36826	HKLR	P
1-Aug-18	NW LANTAU	2	7.13	SUMMER	STANDARD36826	HKLR	S
1-Aug-18	NW LANTAU	3	5.60	SUMMER	STANDARD36826	HKLR	S
1-Aug-18	NE LANTAU	2	34.52	SUMMER	STANDARD36826	HKLR	P
1-Aug-18	NE LANTAU	1	0.70	SUMMER	STANDARD36826	HKLR	S
1-Aug-18	NE LANTAU	2	11.98	SUMMER	STANDARD36826	HKLR	S
8-Aug-18	NW LANTAU	1	3.60	SUMMER	STANDARD36826	HKLR	P
8-Aug-18	NW LANTAU	2	14.70	SUMMER	STANDARD36826	HKLR	P
8-Aug-18	NW LANTAU	3	7.46	SUMMER	STANDARD36826	HKLR	P
8-Aug-18	NW LANTAU	2	5.34	SUMMER	STANDARD36826	HKLR	S
8-Aug-18	NW LANTAU	3	2.30	SUMMER	STANDARD36826	HKLR	S
21-Aug-18	NW LANTAU	1	1.50	SUMMER	STANDARD36826	HKLR	P
21-Aug-18	NW LANTAU	2	33.50	SUMMER	STANDARD36826	HKLR	P
21-Aug-18	NW LANTAU	2	13.30	SUMMER	STANDARD36826	HKLR	S
21-Aug-18	NE LANTAU	1	4.50	SUMMER	STANDARD36826	HKLR	P
21-Aug-18	NE LANTAU	2	27.89	SUMMER	STANDARD36826	HKLR	P
21-Aug-18	NE LANTAU	3	2.50	SUMMER	STANDARD36826	HKLR	P
21-Aug-18	NE LANTAU	1	1.10	SUMMER	STANDARD36826	HKLR	S
21-Aug-18	NE LANTAU	2	12.41	SUMMER	STANDARD36826	HKLR	S
28-Aug-18	NW LANTAU	2	21.50	SUMMER	STANDARD36826	HKLR	P
28-Aug-18	NW LANTAU	3	2.69	SUMMER	STANDARD36826	HKLR	P
28-Aug-18	NW LANTAU	2	7.60	SUMMER	STANDARD36826	HKLR	S
28-Aug-18	NW LANTAU	3	2.45	SUMMER	STANDARD36826	HKLR	S
4-Sep-18	NW LANTAU	1	7.70	AUTUMN	STANDARD36826	HKLR	P
4-Sep-18	NW LANTAU	2	24.60	AUTUMN	STANDARD36826	HKLR	P
4-Sep-18	NW LANTAU	3	3.00	AUTUMN	STANDARD36826	HKLR	P
4-Sep-18	NW LANTAU	1	4.20	AUTUMN	STANDARD36826	HKLR	S
4-Sep-18	NW LANTAU	2	7.80	AUTUMN	STANDARD36826	HKLR	S
4-Sep-18	NW LANTAU	3	1.30	AUTUMN	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
18-Sep-18	NE LANTAU	3	34.10	AUTUMN	STANDARD36826	HKLR	P
18-Sep-18	NE LANTAU	4	1.10	AUTUMN	STANDARD36826	HKLR	P
18-Sep-18	NE LANTAU	2	2.50	AUTUMN	STANDARD36826	HKLR	S
18-Sep-18	NE LANTAU	3	13.40	AUTUMN	STANDARD36826	HKLR	S
18-Sep-18	NW LANTAU	2	3.50	AUTUMN	STANDARD36826	HKLR	P
18-Sep-18	NW LANTAU	3	17.73	AUTUMN	STANDARD36826	HKLR	P
18-Sep-18	NW LANTAU	4	3.97	AUTUMN	STANDARD36826	HKLR	P
18-Sep-18	NW LANTAU	2	4.10	AUTUMN	STANDARD36826	HKLR	S
18-Sep-18	NW LANTAU	3	5.90	AUTUMN	STANDARD36826	HKLR	S
20-Sep-18	NW LANTAU	2	21.14	AUTUMN	STANDARD36826	HKLR	P
20-Sep-18	NW LANTAU	3	6.75	AUTUMN	STANDARD36826	HKLR	P
20-Sep-18	NW LANTAU	2	7.28	AUTUMN	STANDARD36826	HKLR	S
20-Sep-18	NW LANTAU	3	2.01	AUTUMN	STANDARD36826	HKLR	S
26-Sep-18	NE LANTAU	2	33.45	AUTUMN	STANDARD138716	HKLR	P
26-Sep-18	NE LANTAU	3	11.25	AUTUMN	STANDARD138716	HKLR	S
26-Sep-18	NW LANTAU	2	13.12	AUTUMN	STANDARD138716	HKLR	P
26-Sep-18	NW LANTAU	3	20.65	AUTUMN	STANDARD138716	HKLR	P
26-Sep-18	NW LANTAU	2	10.51	AUTUMN	STANDARD138716	HKLR	S
26-Sep-18	NW LANTAU	3	2.62	AUTUMN	STANDARD138716	HKLR	S
4-Oct-18	NW LANTAU	2	19.20	AUTUMN	STANDARD36826	HKLR	P
4-Oct-18	NW LANTAU	3	12.68	AUTUMN	STANDARD36826	HKLR	P
4-Oct-18	NW LANTAU	4	0.62	AUTUMN	STANDARD36826	HKLR	P
4-Oct-18	NW LANTAU	2	6.10	AUTUMN	STANDARD36826	HKLR	S
4-Oct-18	NW LANTAU	3	5.60	AUTUMN	STANDARD36826	HKLR	S
4-Oct-18	NE LANTAU	2	19.33	AUTUMN	STANDARD36826	HKLR	P
4-Oct-18	NE LANTAU	3	15.44	AUTUMN	STANDARD36826	HKLR	P
4-Oct-18	NE LANTAU	2	8.06	AUTUMN	STANDARD36826	HKLR	S
4-Oct-18	NE LANTAU	3	5.07	AUTUMN	STANDARD36826	HKLR	S
11-Oct-18	NW LANTAU	2	15.31	AUTUMN	STANDARD36826	HKLR	P
11-Oct-18	NW LANTAU	3	12.41	AUTUMN	STANDARD36826	HKLR	P
11-Oct-18	NW LANTAU	2	4.07	AUTUMN	STANDARD36826	HKLR	S
11-Oct-18	NW LANTAU	3	9.41	AUTUMN	STANDARD36826	HKLR	S
16-Oct-18	NW LANTAU	2	23.58	AUTUMN	STANDARD36826	HKLR	P
16-Oct-18	NW LANTAU	3	5.15	AUTUMN	STANDARD36826	HKLR	P
16-Oct-18	NW LANTAU	2	10.36	AUTUMN	STANDARD36826	HKLR	S
16-Oct-18	NW LANTAU	3	2.11	AUTUMN	STANDARD36826	HKLR	S
18-Oct-18	NW LANTAU	2	32.45	AUTUMN	STANDARD36826	HKLR	P
18-Oct-18	NW LANTAU	2	11.05	AUTUMN	STANDARD36826	HKLR	S
18-Oct-18	NE LANTAU	2	34.26	AUTUMN	STANDARD36826	HKLR	P
18-Oct-18	NE LANTAU	3	2.27	AUTUMN	STANDARD36826	HKLR	P
18-Oct-18	NE LANTAU	2	11.07	AUTUMN	STANDARD36826	HKLR	S

Appendix II. HKLR03 Chinese White Dolphin Sighting Database (November 2017 - October 2018)

(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
1-Nov-17	1	1126	6	NW LANTAU	3	371	ON	HKLR	830641	804652	AUTUMN	NONE	P
1-Nov-17	2	1152	8	NW LANTAU	2	529	ON	HKLR	827437	806499	AUTUMN	NONE	P
8-Nov-17	1	1129	2	NW LANTAU	2	317	ON	HKLR	826272	807434	AUTUMN	NONE	P
17-Nov-17	1	1155	12	NW LANTAU	2	627	ON	HKLR	829665	805381	AUTUMN	NONE	S
24-Nov-17	1	1023	2	NW LANTAU	3	21	ON	HKLR	816588	804674	AUTUMN	NONE	P
24-Nov-17	2	1155	1	NW LANTAU	3	0	ON	HKLR	826850	806436	AUTUMN	NONE	P
5-Dec-17	1	1150	5	NW LANTAU	3	155	ON	HKLR	824890	806432	WINTER	NONE	P
15-Dec-17	1	1011	1	NW LANTAU	2	7	ON	HKLR	815955	805415	WINTER	NONE	P
15-Dec-17	2	1106	6	NW LANTAU	2	151	ON	HKLR	825966	805414	WINTER	NONE	P
15-Dec-17	3	1242	1	NW LANTAU	1	176	ON	HKLR	824441	809449	WINTER	NONE	P
2-Jan-18	1	1141	8	NW LANTAU	2	93	ON	HKLR	827614	806458	WINTER	PURSE-SEINE	P
2-Jan-18	2	1204	8	NW LANTAU	2	285	ON	HKLR	828301	806418	WINTER	NONE	P
8-Jan-18	1	1105	2	NW LANTAU	5	42	ON	HKLR	827107	805345	WINTER	NONE	P
16-Jan-18	1	1137	1	NW LANTAU	2	309	ON	HKLR	825178	806453	WINTER	NONE	P
25-Jan-18	1	1440	1	NW LANTAU	3	237	ON	HKLR	827516	805356	WINTER	NONE	P
2-Feb-18	1	1134	1	NW LANTAU	3	33	ON	HKLR	824048	806286	WINTER	NONE	S
9-Feb-18	1	956	1	NW LANTAU	1	ND	OFF	HKLR	816739	806756	WINTER	NONE	
9-Feb-18	2	1013	1	NW LANTAU	1	99	ON	HKLR	817306	805490	WINTER	NONE	P
9-Feb-18	3	1031	2	NW LANTAU	2	687	ON	HKLR	820619	804662	WINTER	NONE	P
9-Feb-18	4	1116	2	NW LANTAU	1	387	ON	HKLR	828225	805491	WINTER	NONE	S
14-Feb-18	1	1052	1	NW LANTAU	2	55	ON	HKLR	826276	805353	WINTER	NONE	P
14-Feb-18	2	1107	3	NW LANTAU	2	1047	ON	HKLR	828037	805429	WINTER	NONE	P
22-Feb-18	1	1040	1	NW LANTAU	3	137	ON	HKLR	827222	808537	WINTER	NONE	P
12-Mar-18	1	1207	3	NW LANTAU	1	149	ON	HKLR	827547	806417	SPRING	NONE	P
23-Mar-18	1	1046	4	NW LANTAU	3	705	ON	HKLR	822867	804739	SPRING	NONE	P
23-Mar-18	2	1055	12	NW LANTAU	2	96	ON	HKLR	824284	804721	SPRING	NONE	P
23-Mar-18	3	1122	2	NW LANTAU	2	251	ON	HKLR	826377	804684	SPRING	NONE	P
23-Mar-18	4	1322	2	NW LANTAU	1	515	ON	HKLR	828400	806542	SPRING	NONE	P
23-Mar-18	5	1328	3	NW LANTAU	2	486	ON	HKLR	827846	806510	SPRING	NONE	P
10-Apr-18	1	1125	1	NW LANTAU	2	24	ON	HKLR	829507	806966	SPRING	NONE	S
19-Apr-18	1	1133	2	NW LANTAU	3	363	ON	HKLR	826075	806486	SPRING	NONE	P
19-Apr-18	2	1146	1	NW LANTAU	3	208	ON	HKLR	827093	806426	SPRING	NONE	P

Appendix II. (cont'd)

(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
13-Jun-18	1	1123	5	NW LANTAU	2	83	ON	HKLR	829917	806493	SUMMER	NONE	S
27-Jun-18	1	1144	2	NW LANTAU	2	73	ON	HKLR	826551	806435	SUMMER	NONE	P
12-Jul-18	1	1125	4	NW LANTAU	3	156	ON	HKLR	829186	806430	SUMMER	NONE	P
1-Aug-18	1	1009	1	NW LANTAU	2	55	ON	HKLR	814838	804712	SUMMER	NONE	P
1-Aug-18	2	1015	3	NW LANTAU	2	234	ON	HKLR	815923	804662	SUMMER	NONE	P
1-Aug-18	3	1131	1	NW LANTAU	2	79	ON	HKLR	831204	805435	SUMMER	NONE	S
21-Aug-18	1	1012	1	NW LANTAU	1	ND	OFF	HKLR	814661	804753	SUMMER	NONE	
26-Sep-18	1	1433	2	NW LANTAU	2	258	ON	HKLR	826241	806517	AUTUMN	NONE	P
11-Oct-18	1	1222	4	NW LANTAU	3	362	ON	HKLR	826265	805415	AUTUMN	NONE	S
18-Oct-18	1	1232	2	NW LANTAU	2	145	ON	HKLR	824310	808501	AUTUMN	NONE	P

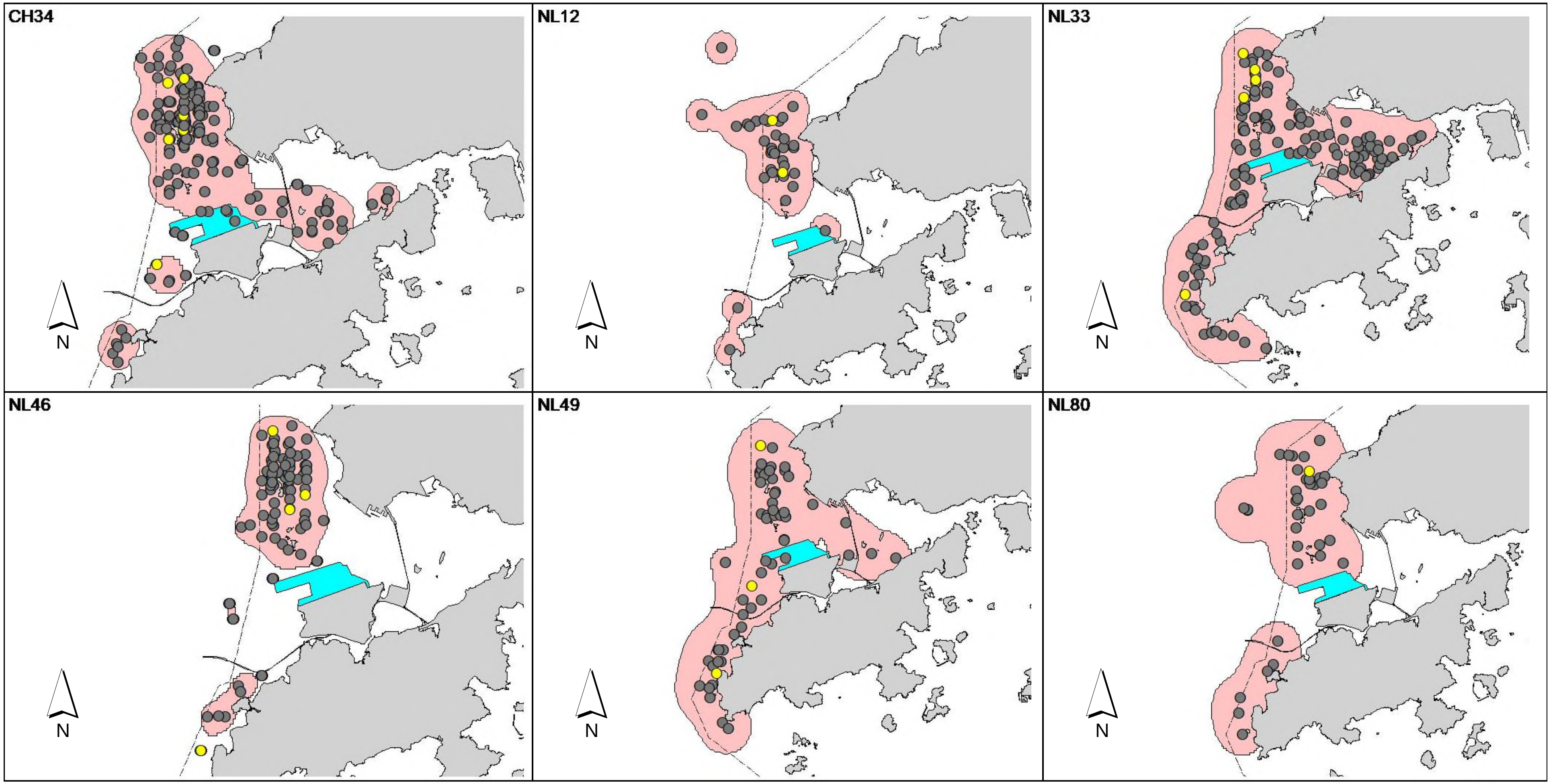
Appendix III. Individual dolphins identified during HKLR03 monitoring surveys in November 2017-October 2018

ID#	DATE	STG#	AREA
CH34	01/11/17	2	NW LANTAU
	17/11/17	1	NW LANTAU
	15/12/17	2	NW LANTAU
	12/03/18	1	NW LANTAU
	13/06/18	1	NW LANTAU
	27/06/18	1	NW LANTAU
NL12	27/06/18	1	NW LANTAU
	01/08/18	3	NW LANTAU
NL33	01/11/17	2	NW LANTAU
	17/11/17	1	NW LANTAU
	15/12/17	2	NW LANTAU
	02/01/18	2	NW LANTAU
NL46	17/11/17	1	NW LANTAU
	05/12/17	1	NW LANTAU
NL49	17/11/17	1	NW LANTAU
NL80	13/06/18	1	NW LANTAU
NL98	02/01/18	1	NW LANTAU
	23/03/18	2	NW LANTAU
NL104	01/08/18	2	NW LANTAU
NL120	23/03/18	2	NW LANTAU
NL123	02/01/18	2	NW LANTAU
	25/01/18	1	NW LANTAU
NL136	01/11/17	2	NW LANTAU
	08/11/17	1	NW LANTAU
	15/12/17	2	NW LANTAU
	02/01/18	1	NW LANTAU
	12/03/18	1	NW LANTAU
	11/10/18	1	NW LANTAU
	18/10/18	1	NW LANTAU
NL145	17/11/17	1	NW LANTAU
	01/08/18	1	NW LANTAU
	21/08/18	1	NW LANTAU
NL182	01/11/17	2	NW LANTAU
	24/11/17	2	NW LANTAU
	15/12/17	2	NW LANTAU
	02/01/18	1	NW LANTAU
	22/02/18	1	NW LANTAU
	12/03/18	1	NW LANTAU
	19/04/18	2	NW LANTAU
	26/09/18	1	NW LANTAU
	11/10/18	1	NW LANTAU
NL202	01/11/17	2	NW LANTAU
	09/02/18	4	NW LANTAU
	13/06/18	1	NW LANTAU
NL210	01/11/17	2	NW LANTAU
NL226	02/01/18	1	NW LANTAU
	23/03/18	2	NW LANTAU
	19/04/18	1	NW LANTAU
NL233	12/07/18	1	NW LANTAU
NL242	05/12/17	1	NW LANTAU
NL261	17/11/17	1	NW LANTAU
	15/12/17	2	NW LANTAU
	19/04/18	1	NW LANTAU
	11/10/18	1	NW LANTAU
NL269	05/12/17	1	NW LANTAU
	02/01/18	1	NW LANTAU
	23/03/18	2	NW LANTAU
NL272	17/11/17	1	NW LANTAU
	02/01/18	1	NW LANTAU
	16/01/18	1	NW LANTAU
	11/10/18	1	NW LANTAU
NL286	01/11/17	2	NW LANTAU
	17/11/17	1	NW LANTAU
	02/01/18	2	NW LANTAU
	09/02/18	4	NW LANTAU
	10/04/18	1	NW LANTAU

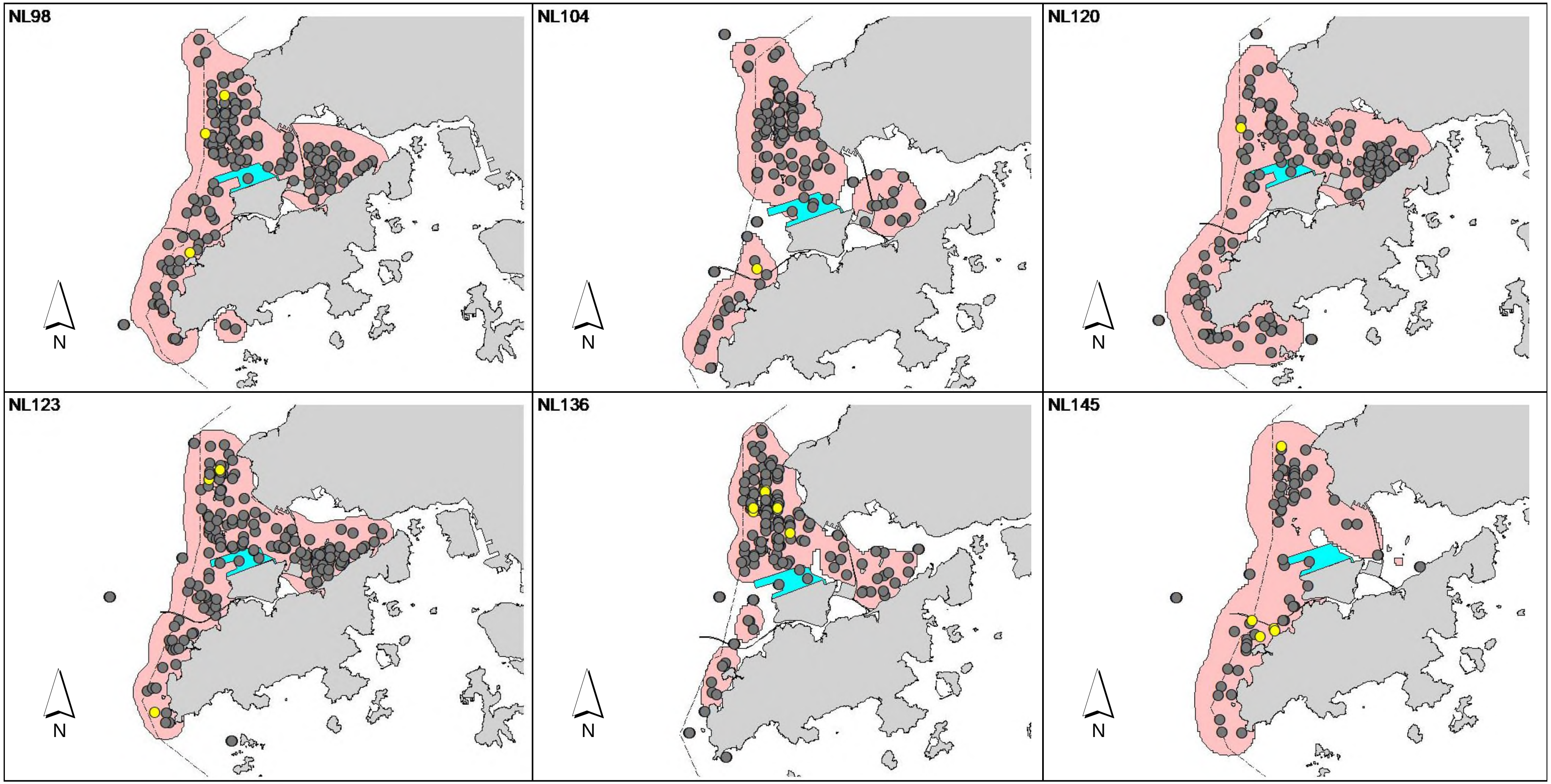
Appendix III. (cont'd)

ID#	DATE	STG#	AREA
NL296	05/12/17	1	NW LANTAU
NL301	13/06/18	1	NW LANTAU
NL302	01/08/18	2	NW LANTAU
NL311	02/01/18	1	NW LANTAU
NL317	12/07/18	1	NW LANTAU
NL320	01/11/17	2	NW LANTAU
	17/11/17	1	NW LANTAU
NL322	01/11/17	2	NW LANTAU
	17/11/17	1	NW LANTAU
	15/12/17	2	NW LANTAU
	02/01/18	2	NW LANTAU
NL327	01/08/18	2	NW LANTAU
NL328	08/11/17	1	NW LANTAU
	17/11/17	1	NW LANTAU
	18/10/18	1	NW LANTAU
NL329	23/03/18	2	NW LANTAU
	12/07/18	1	NW LANTAU
WL05	17/11/17	1	NW LANTAU
WL11	14/02/18	1	NW LANTAU
WL28	09/02/18	3	NW LANTAU
WL62	15/12/17	3	NW LANTAU
WL124	23/03/18	2	NW LANTAU
WL145	24/11/17	1	NW LANTAU
	23/03/18	2	NW LANTAU
WL179	23/03/18	2	NW LANTAU
WL188	12/07/18	1	NW LANTAU
WL251	02/01/18	2	NW LANTAU
WL273	05/12/17	1	NW LANTAU
WL276	23/03/18	2	NW LANTAU
WL288	09/02/18	3	NW LANTAU

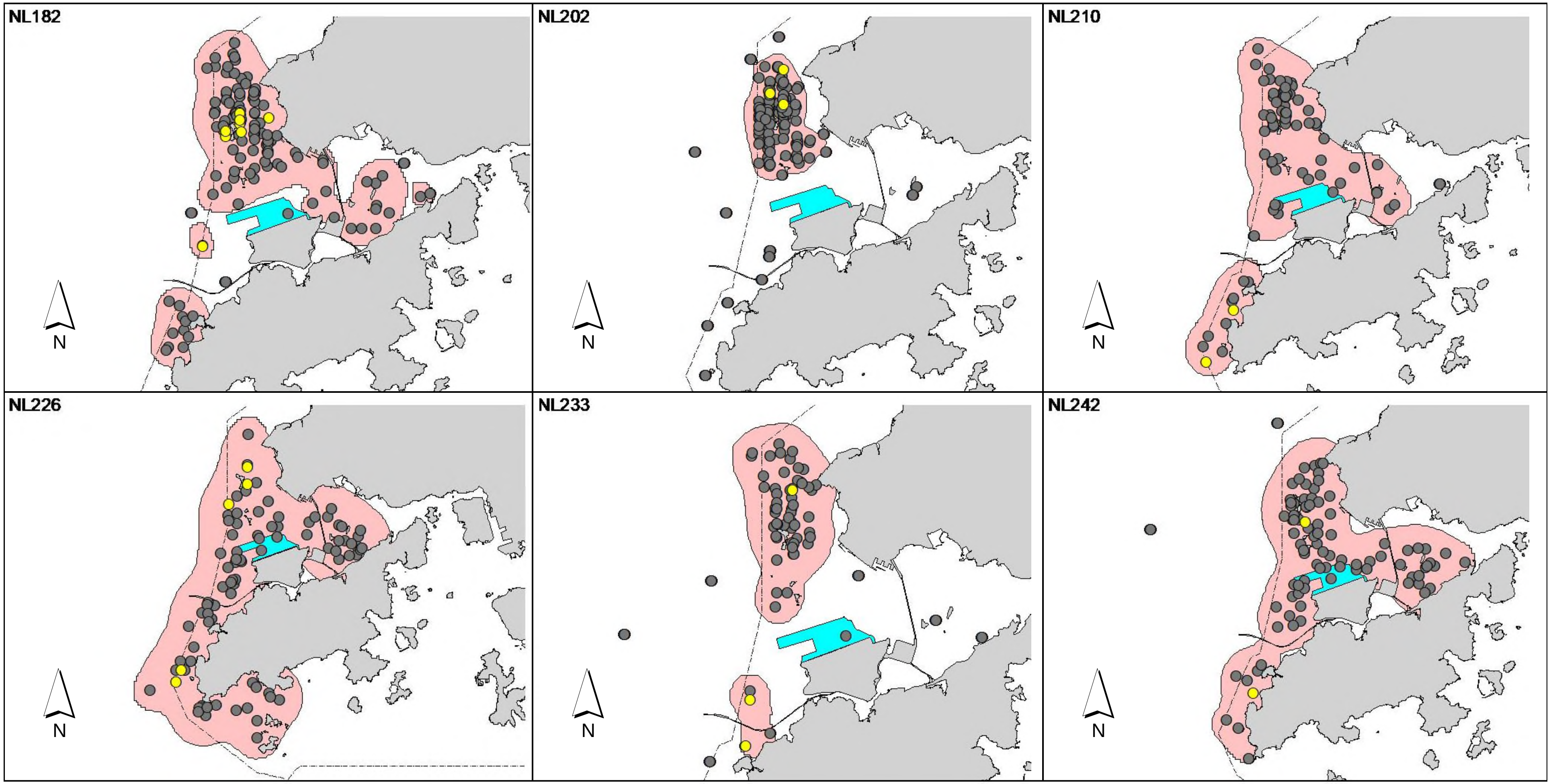
Appendix IV. Ranging patterns (95% kernel ranges) of 44 individual dolphins that were sighted during the fourth year of TMCLKL construction works, utilizing the HKLR03 monitoring data with supplement of HKLR09 monitoring data in West Lantau (note: yellow dots indicates sightings made in November 2017 to October 2018)



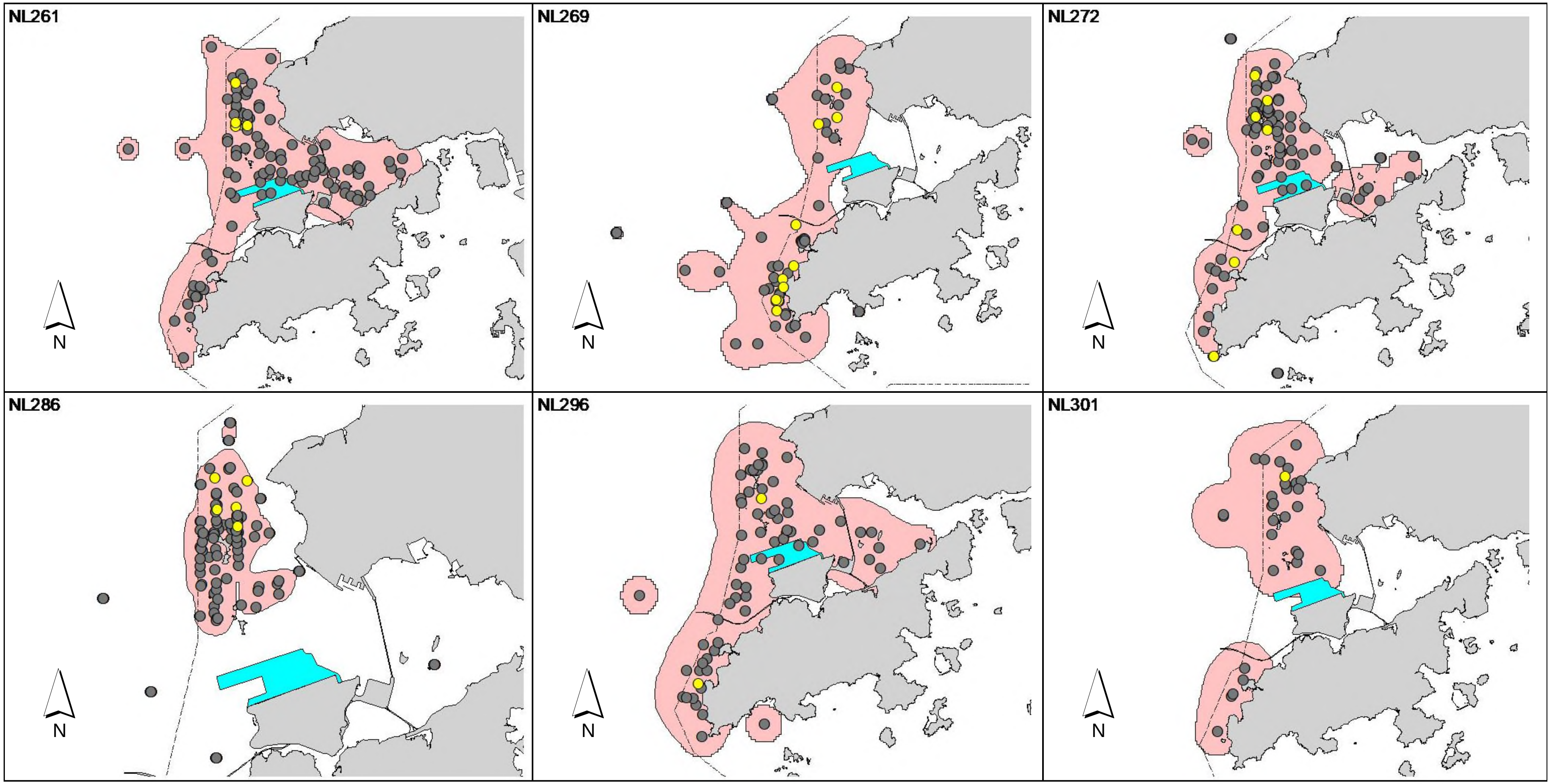
Appendix IV. (cont'd)



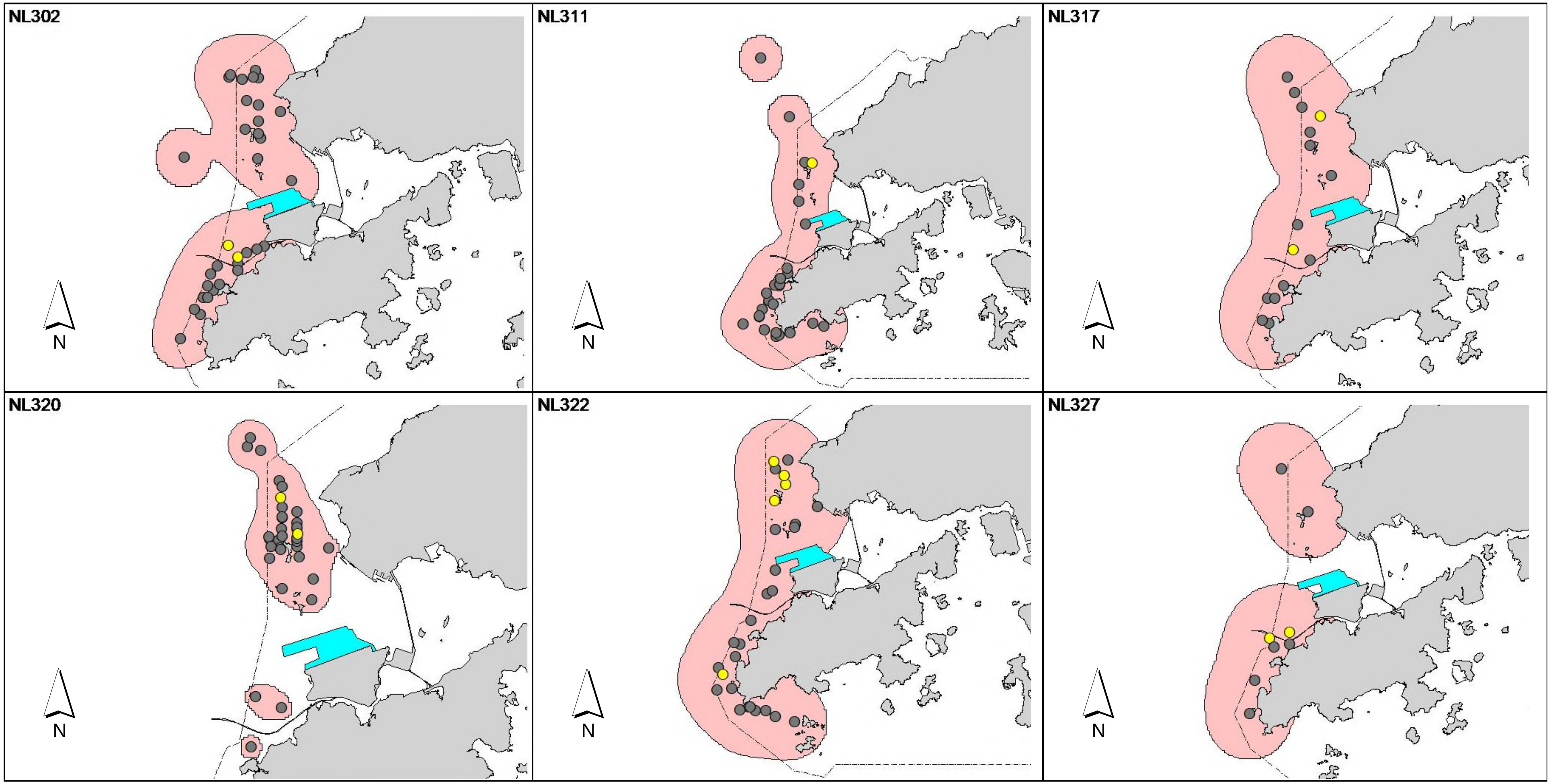
Appendix IV. (cont'd)



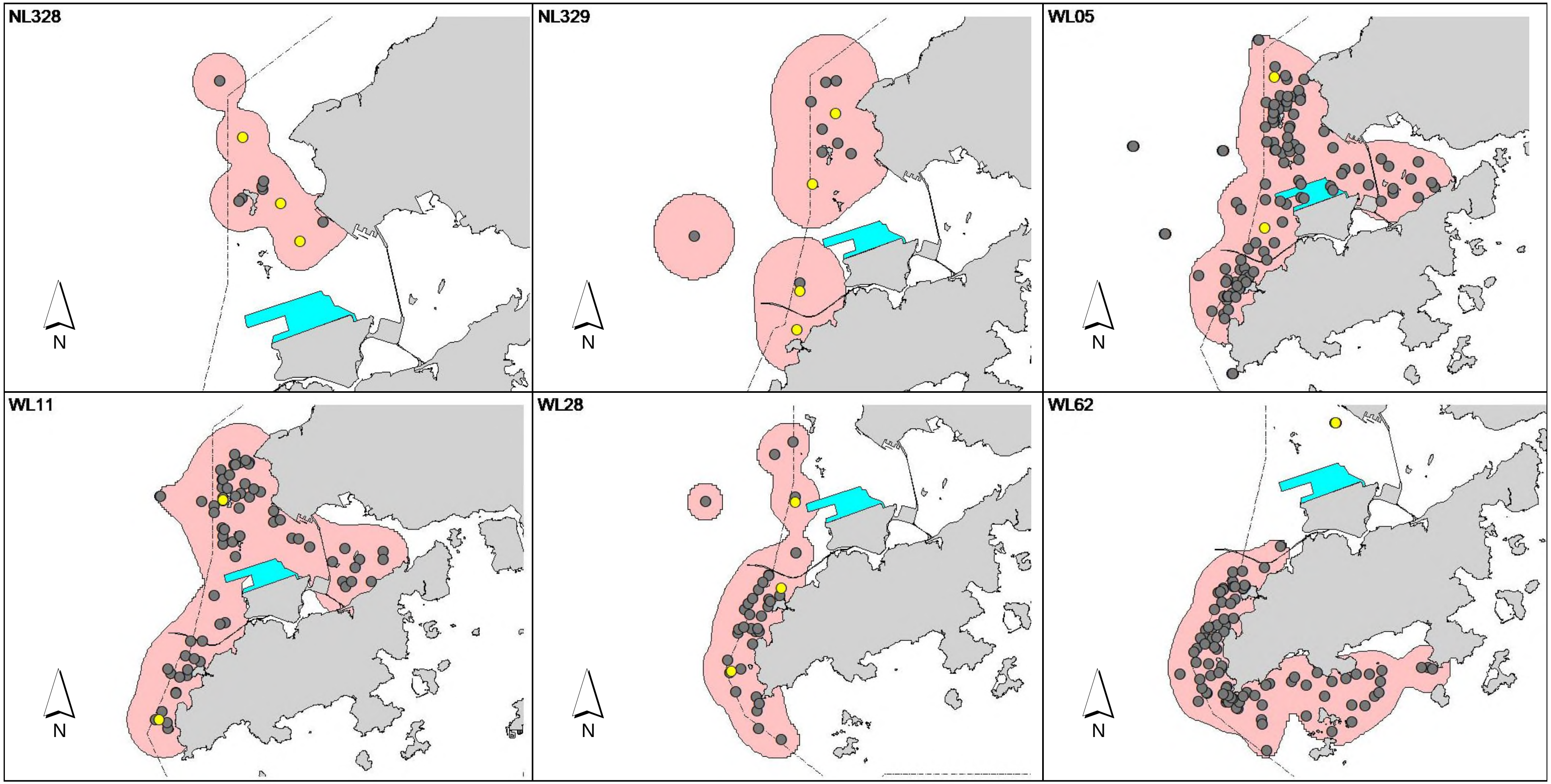
Appendix IV. (cont'd)



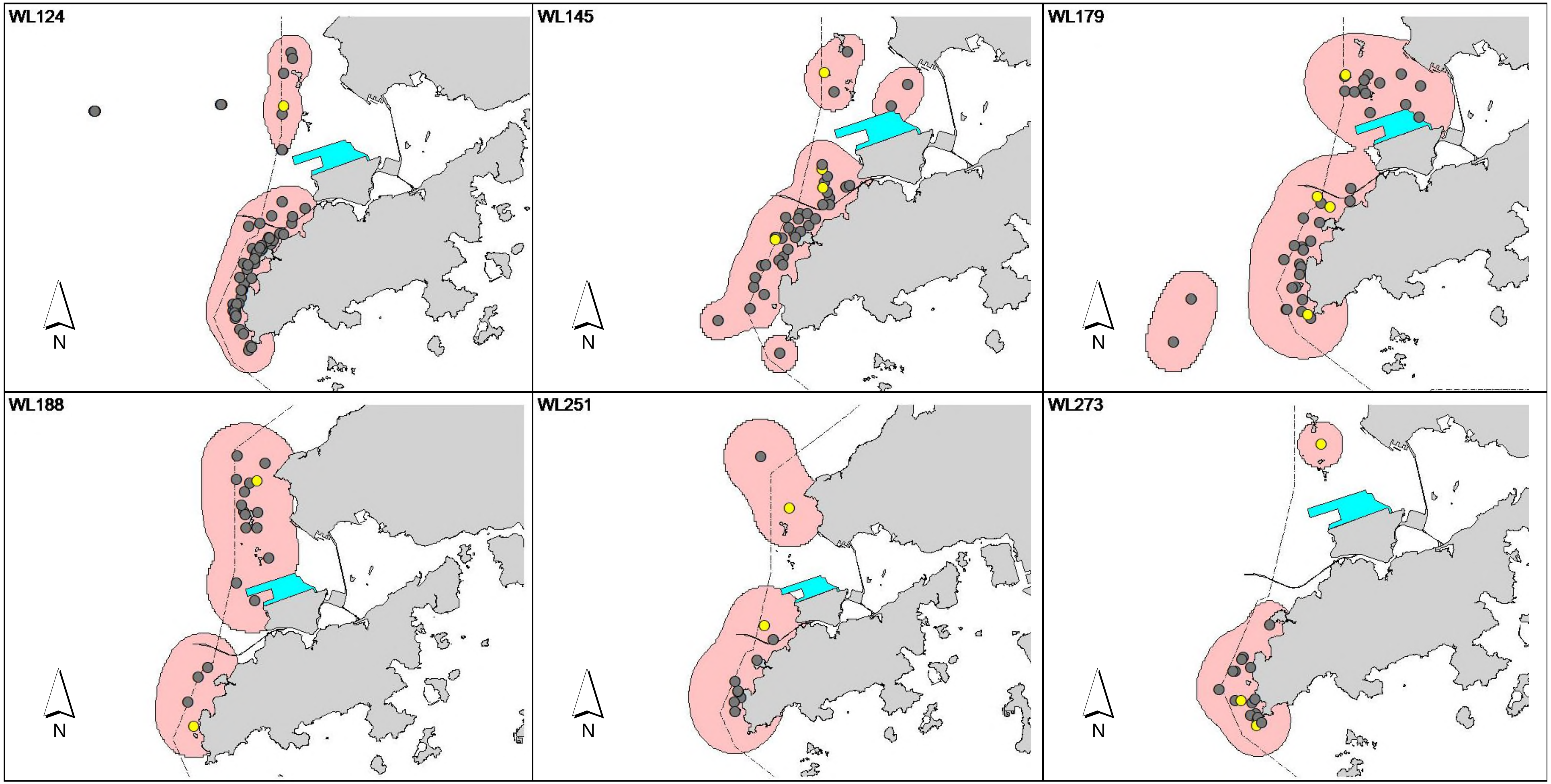
Appendix IV. (cont'd)



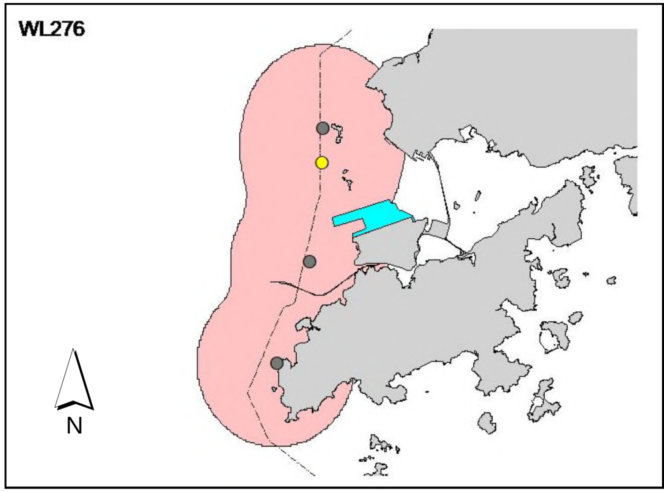
Appendix IV. (cont'd)

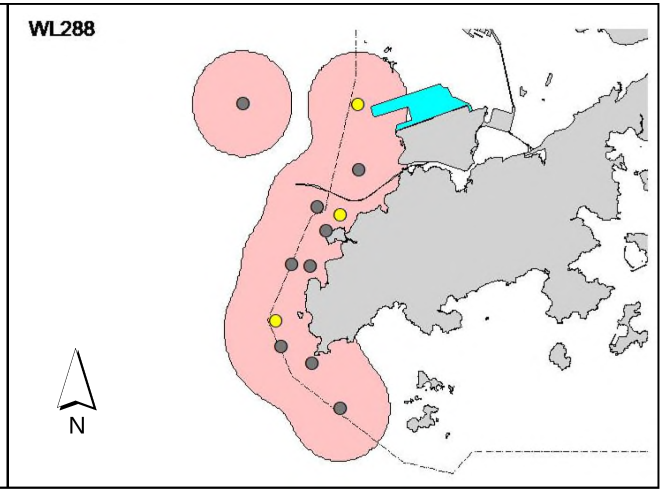


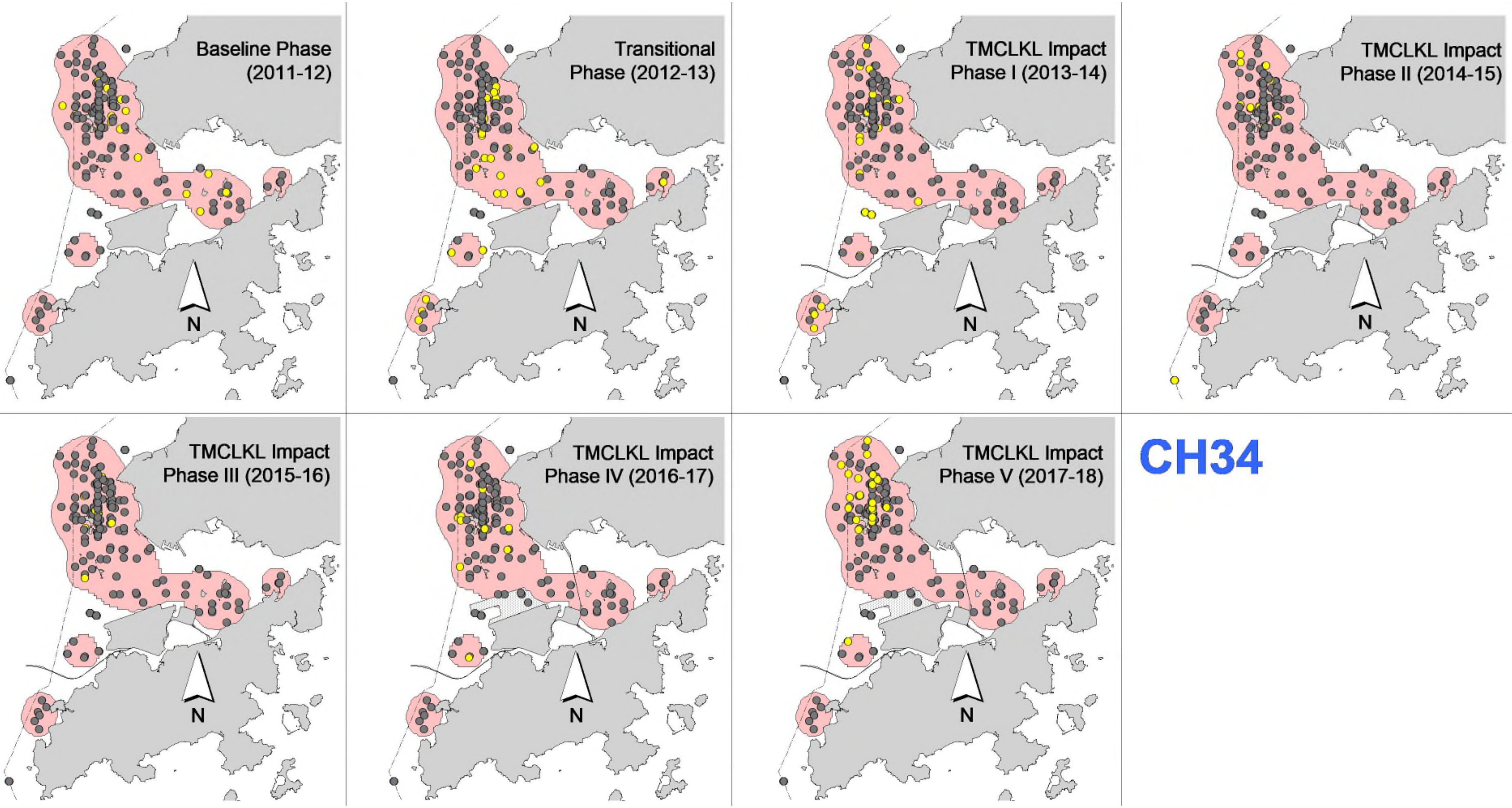
Appendix IV. (cont'd)



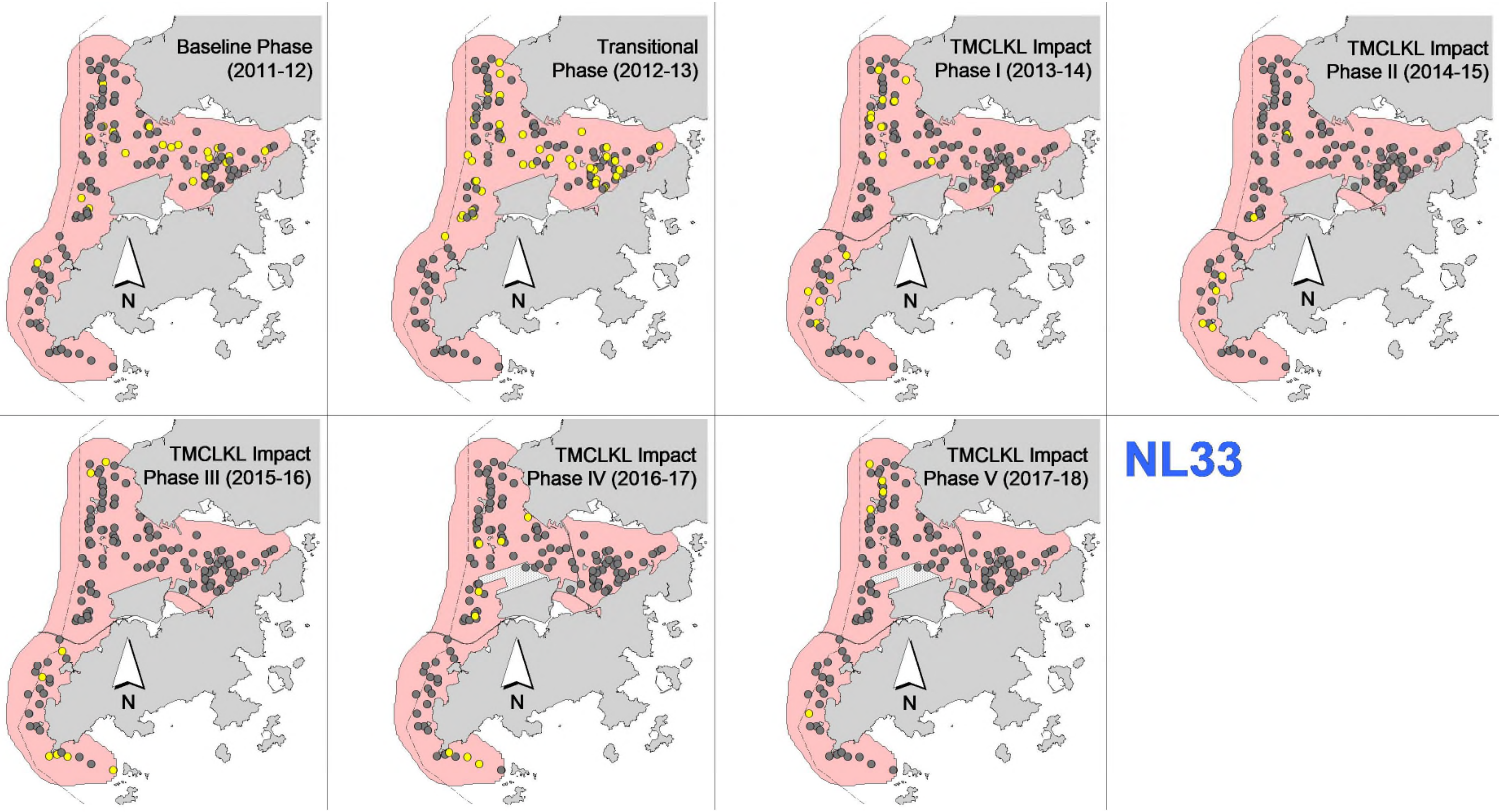
Appendix IV. (cont'd)



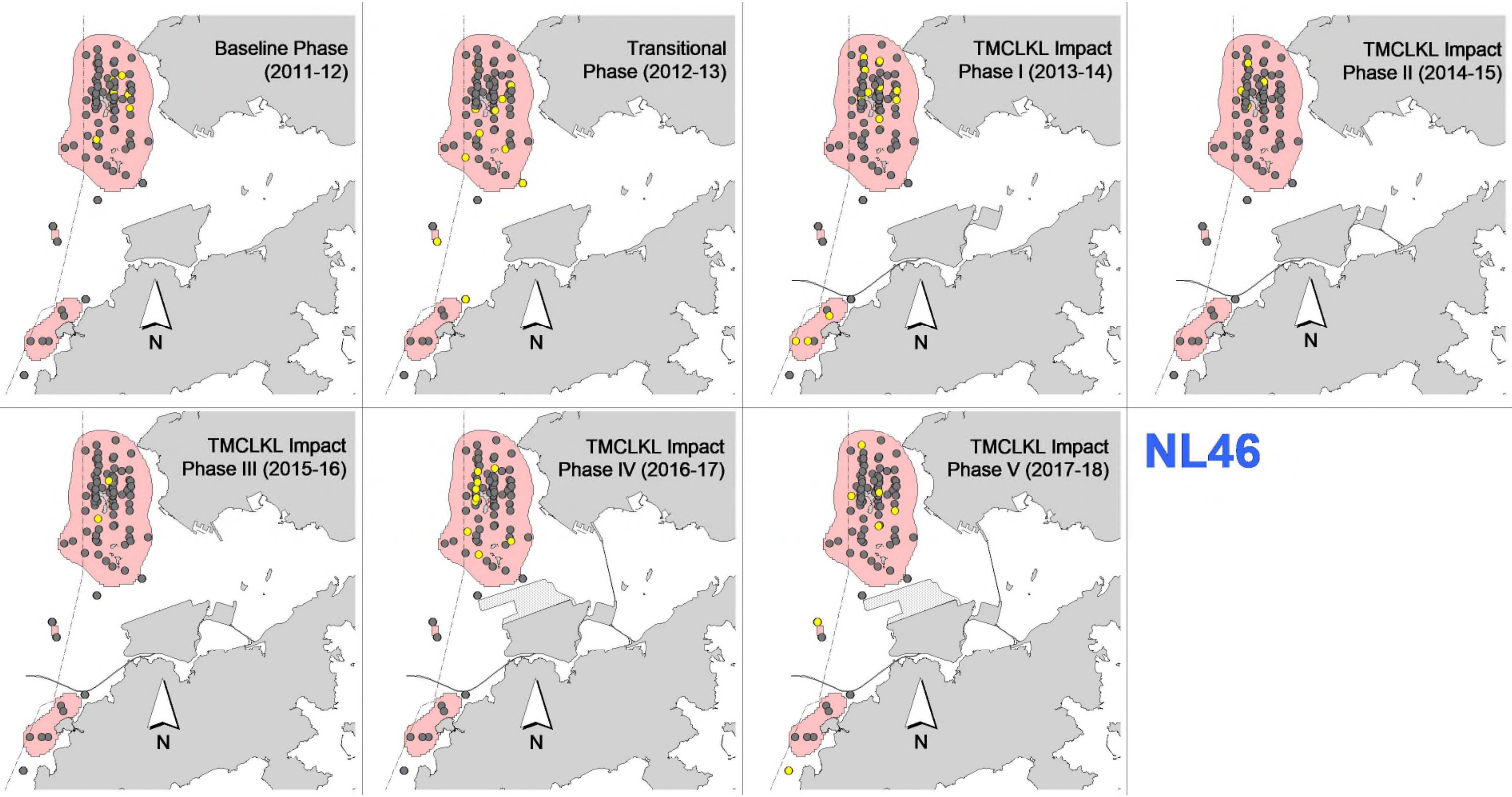




Appendix V. Temporal changes in range use patterns of 13 individual dolphins during baseline, transitional & five impact phases of TMCLKL construction (note: yellow dots indicates sightings made in corresponding period)

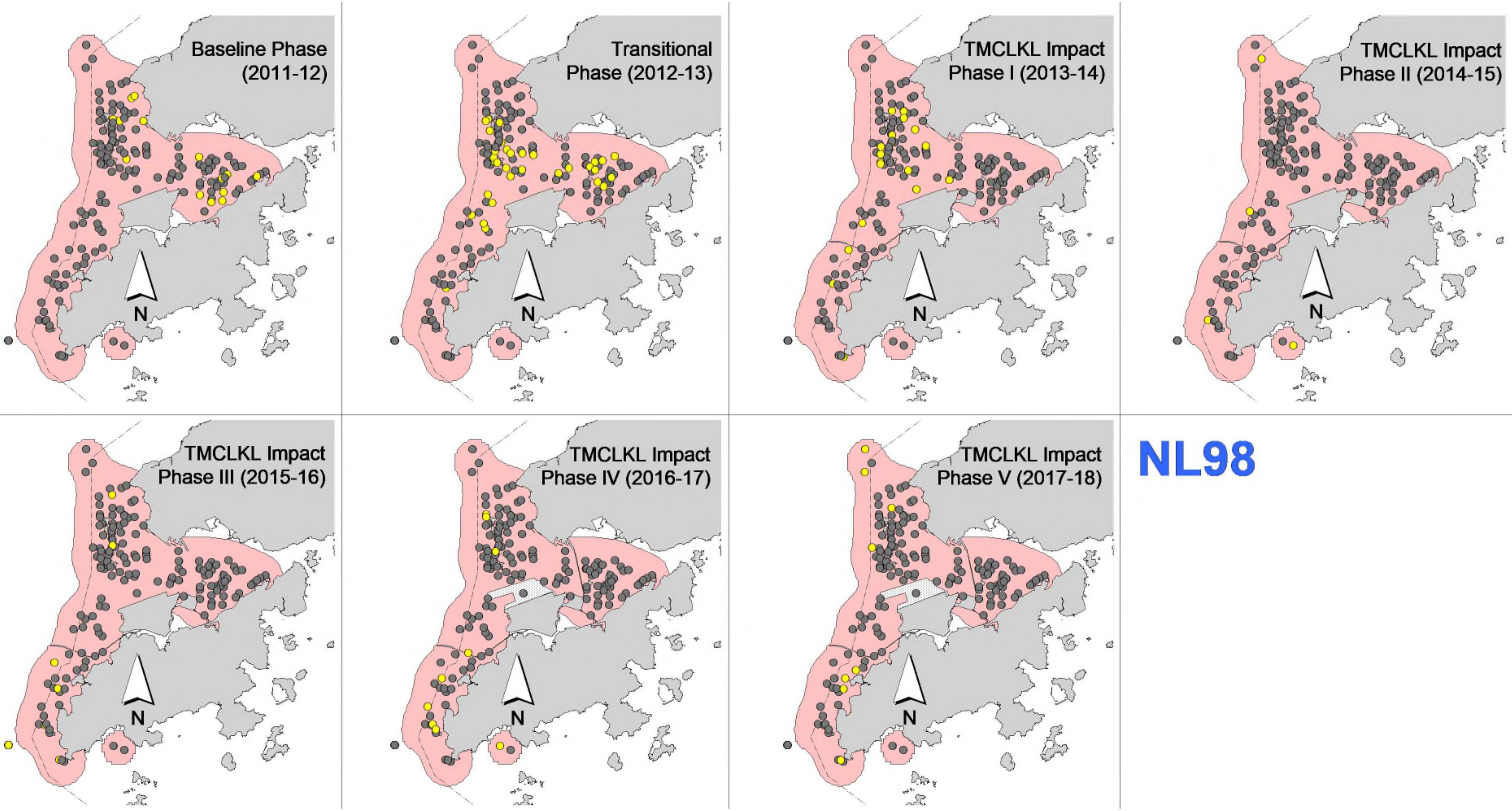


Appendix V. (cont'd)

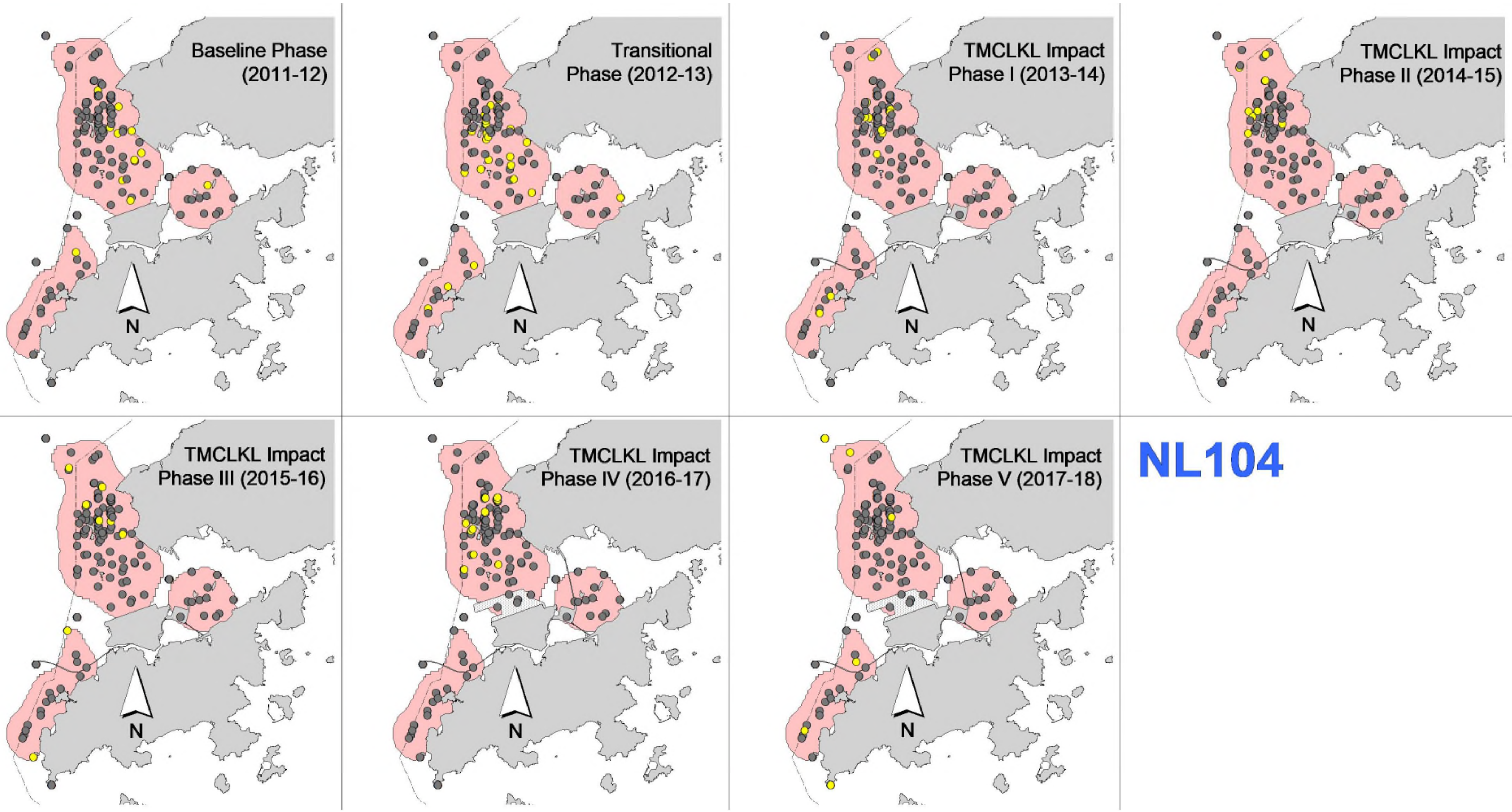


NL46

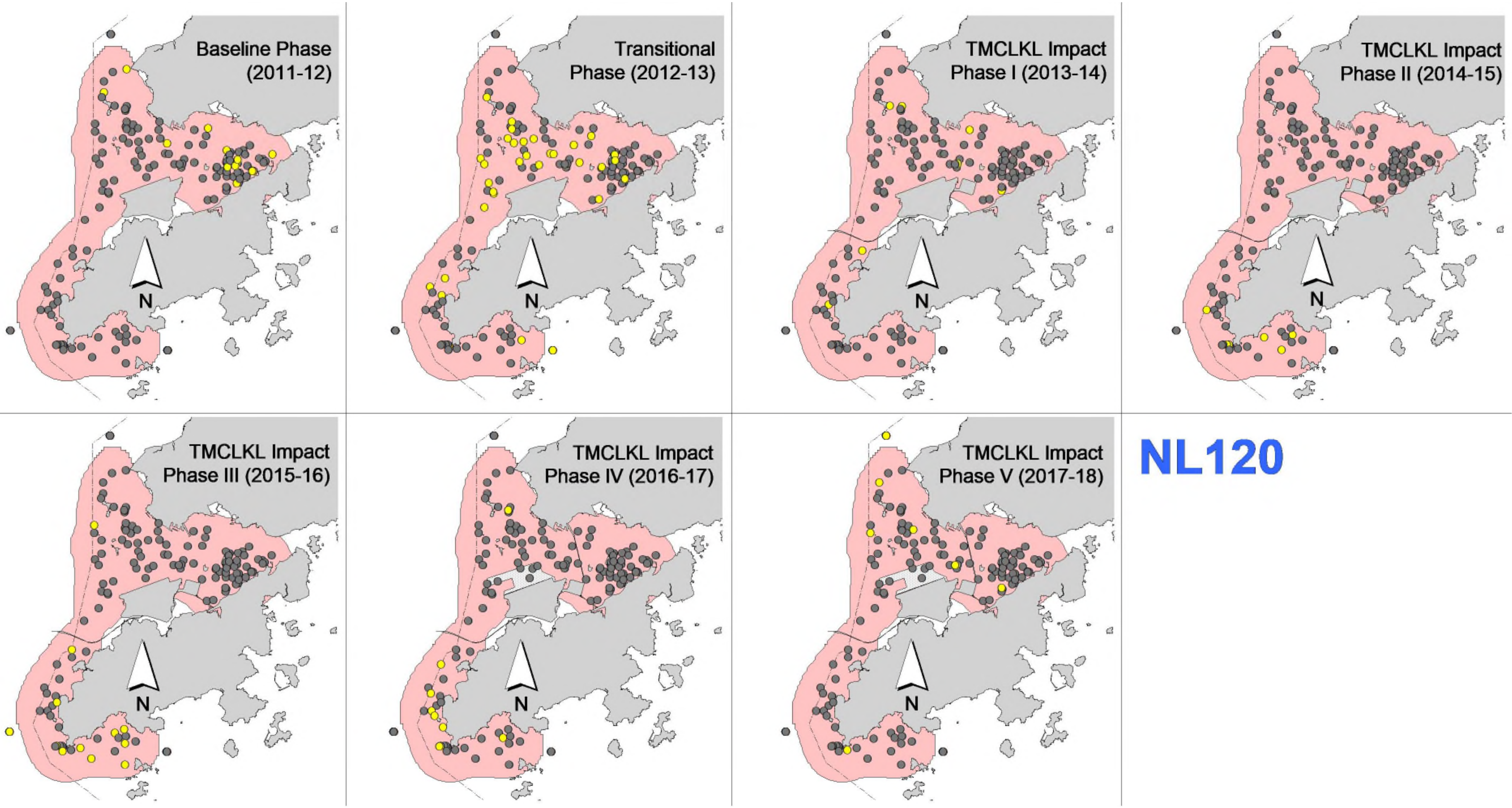
Appendix V. (cont'd)



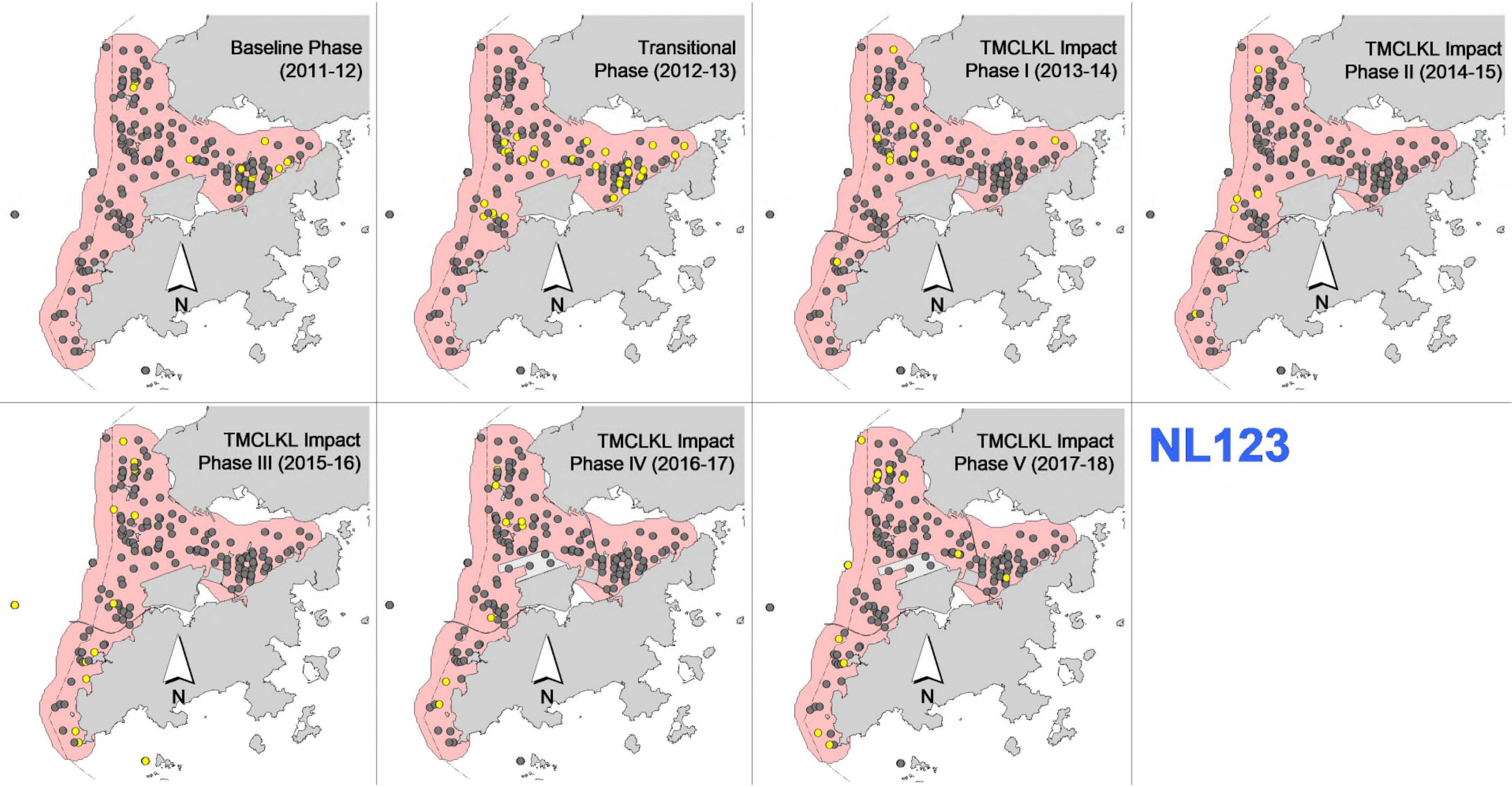
Appendix V. (cont'd)



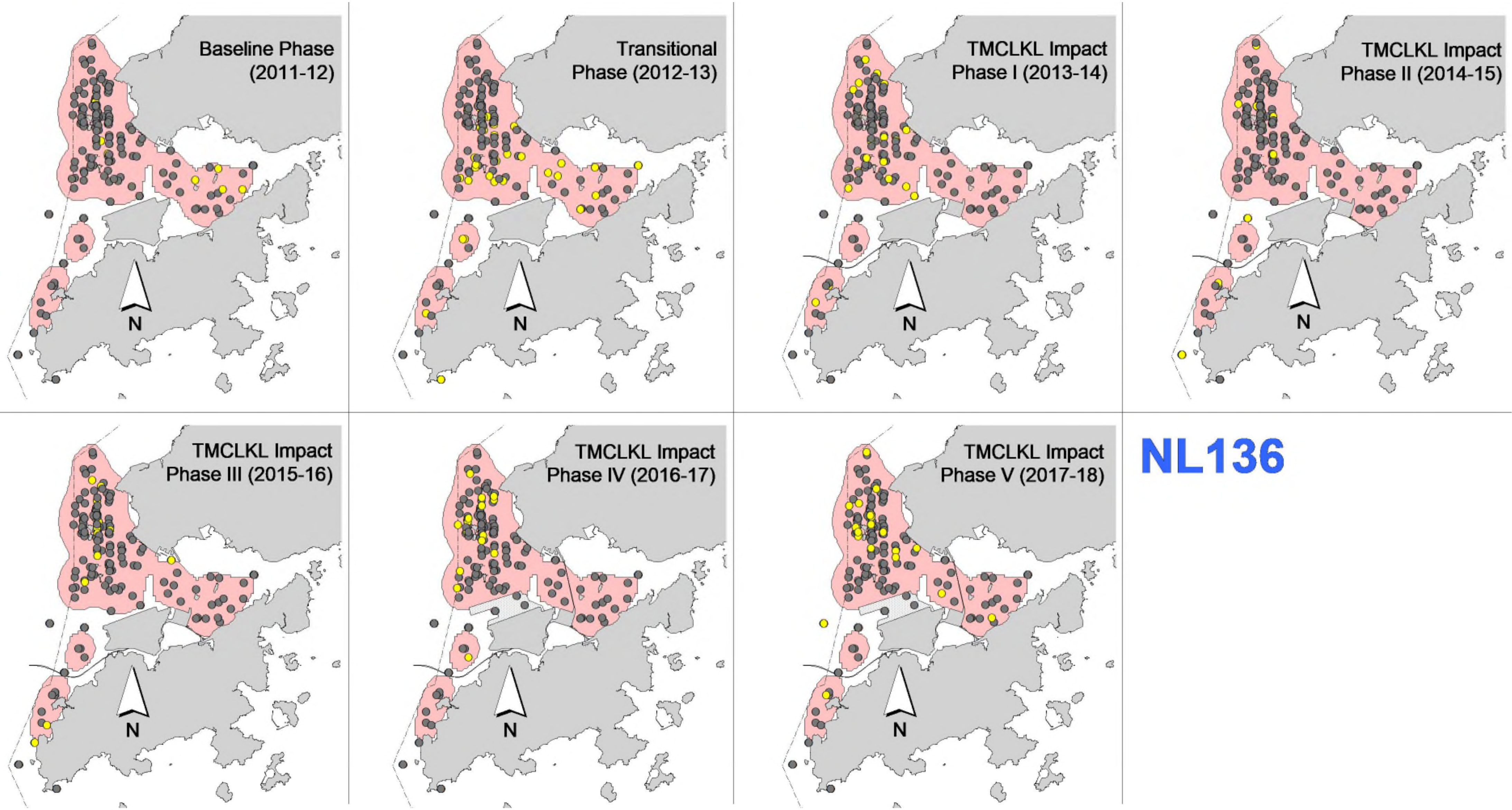
Appendix V. (cont'd)



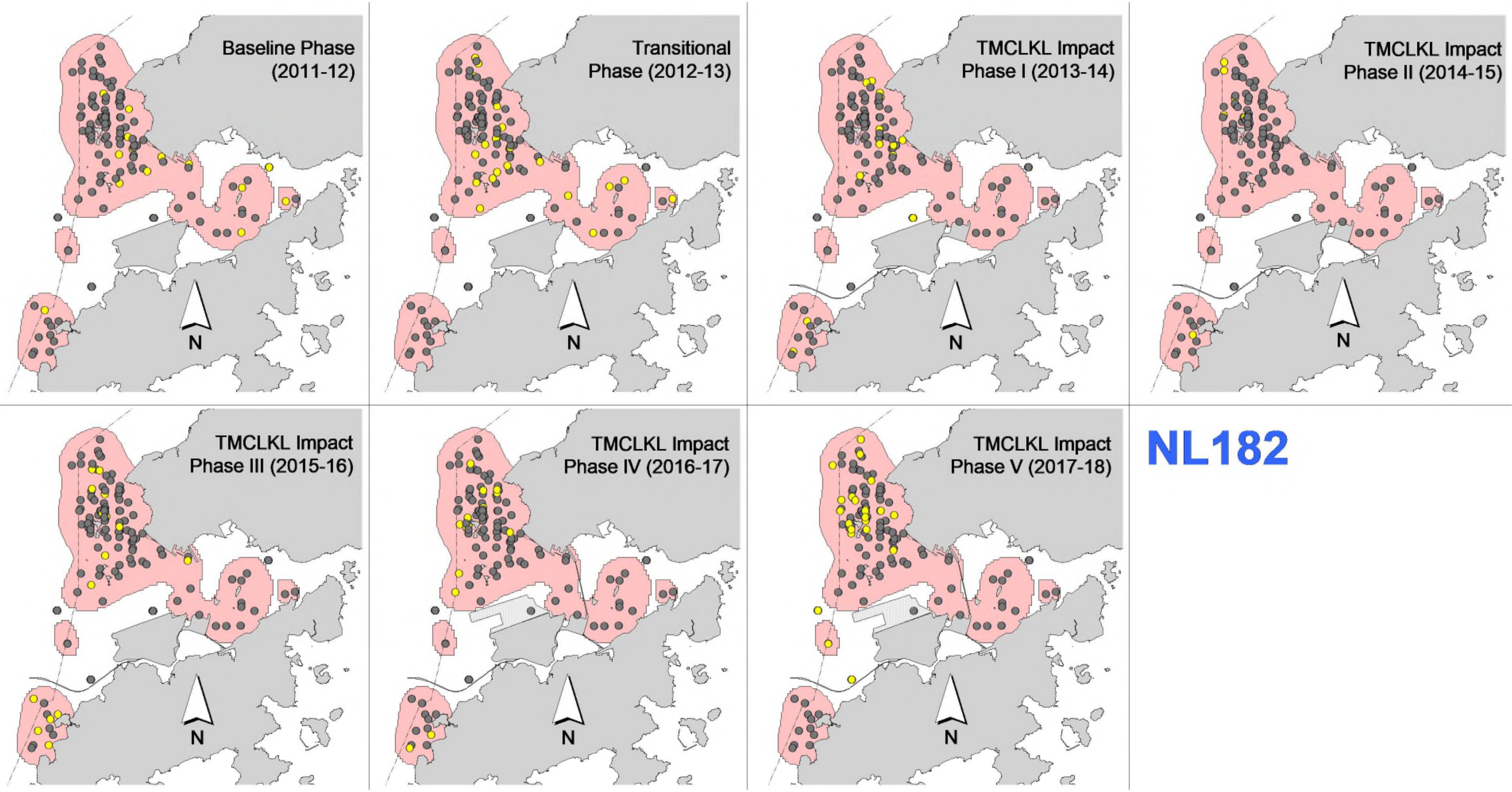
Appendix V. (cont'd)



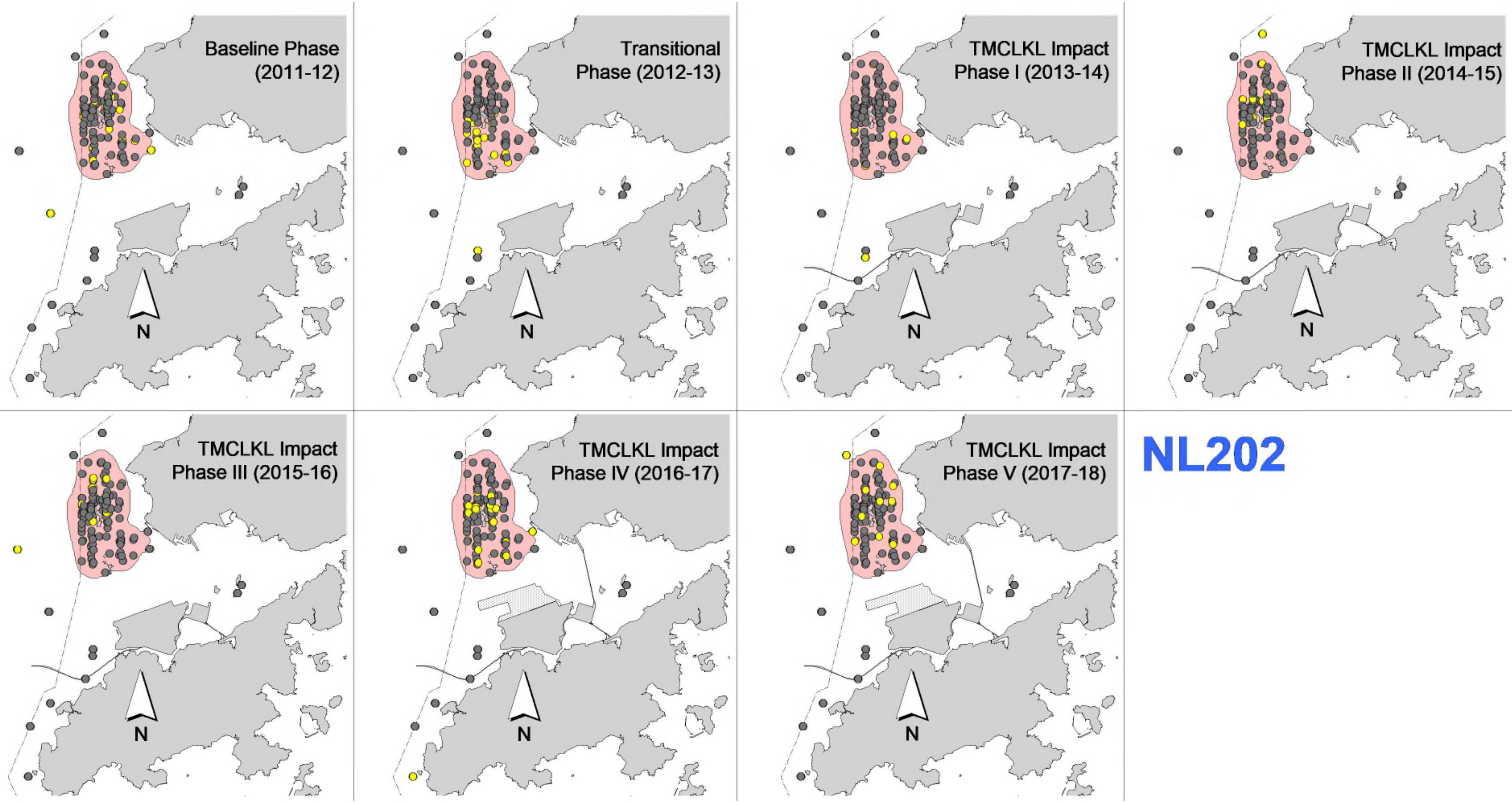
Appendix V. (cont'd)



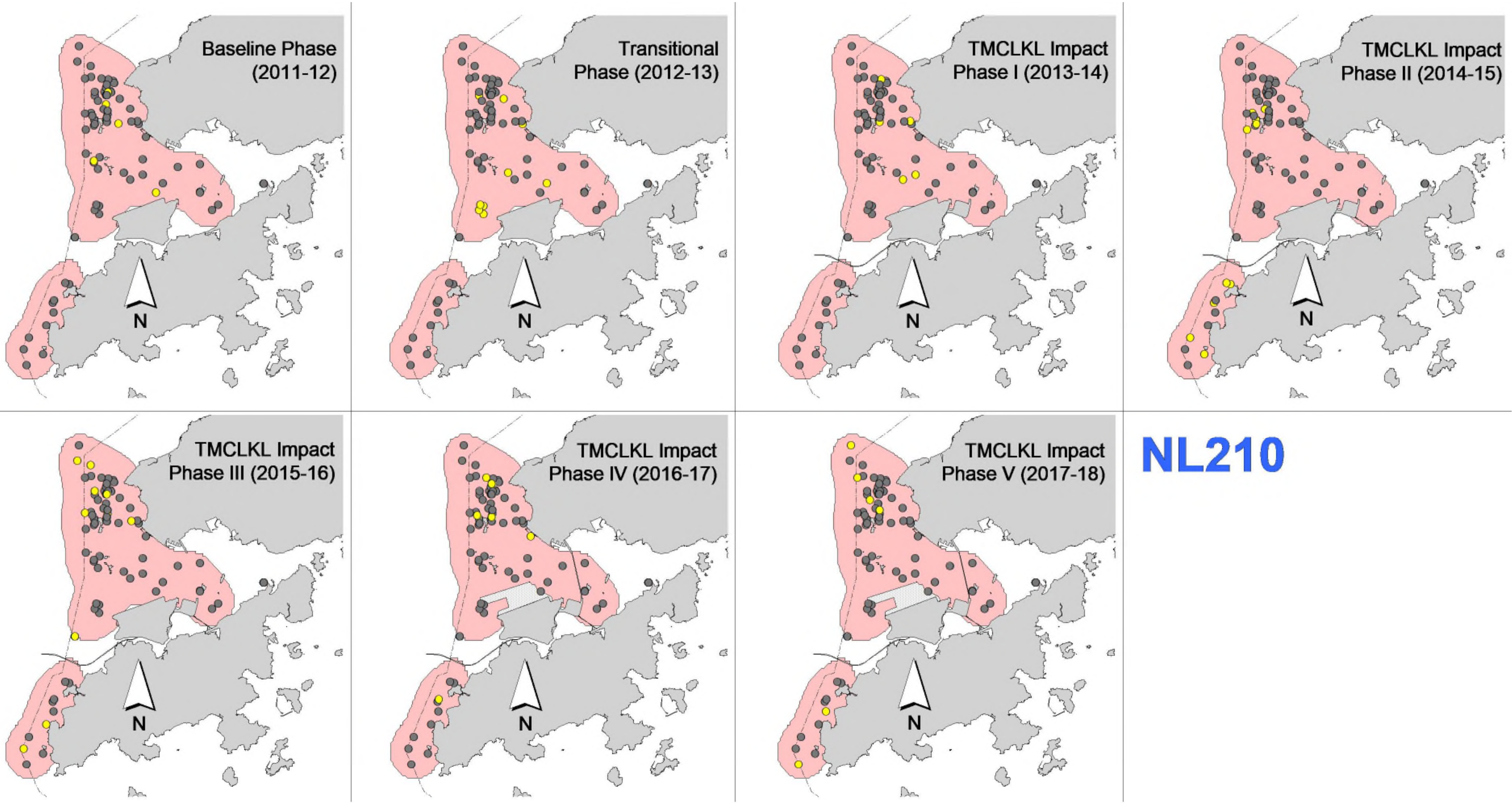
Appendix V. (cont'd)



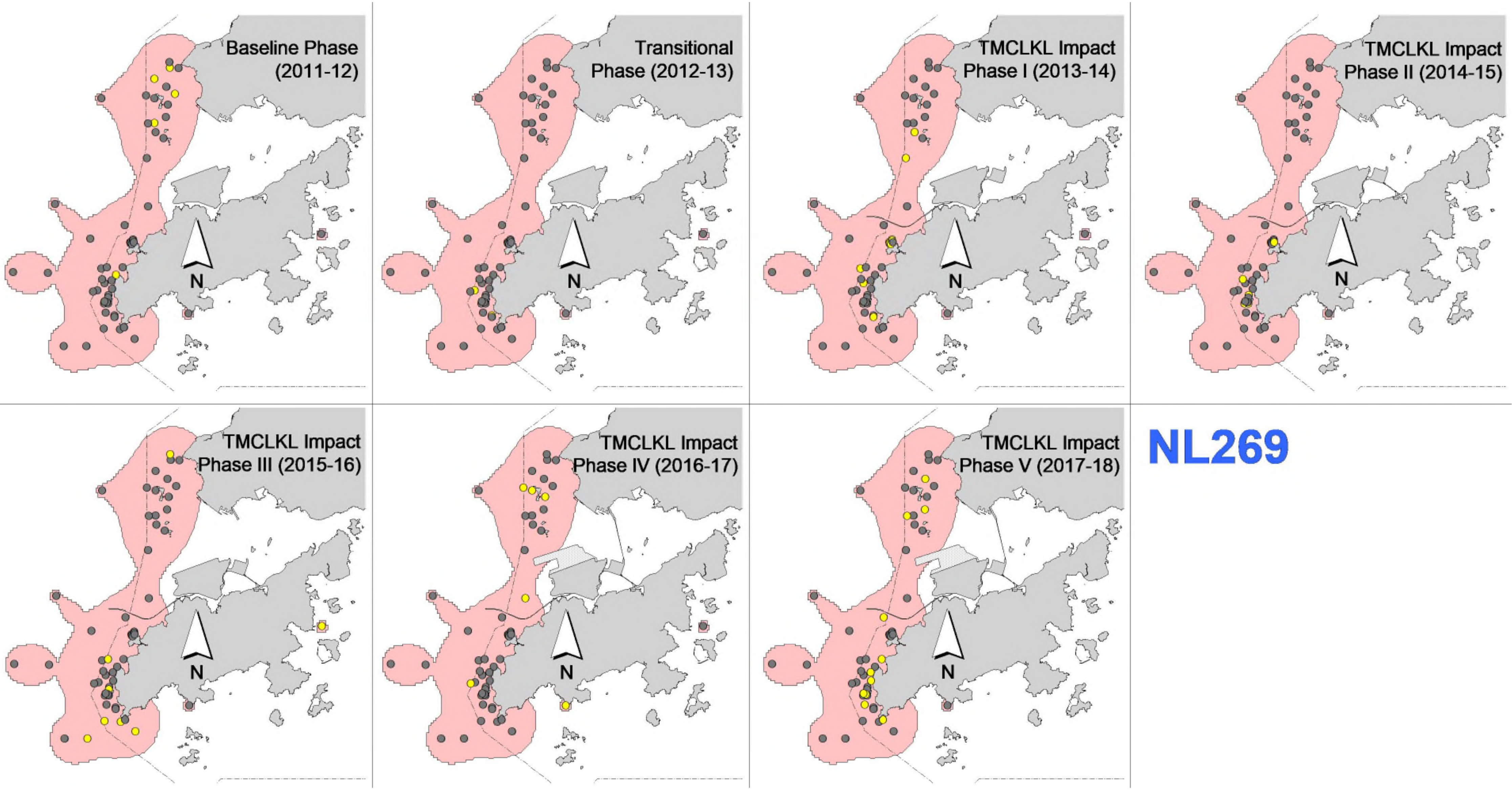
Appendix V. (cont'd)



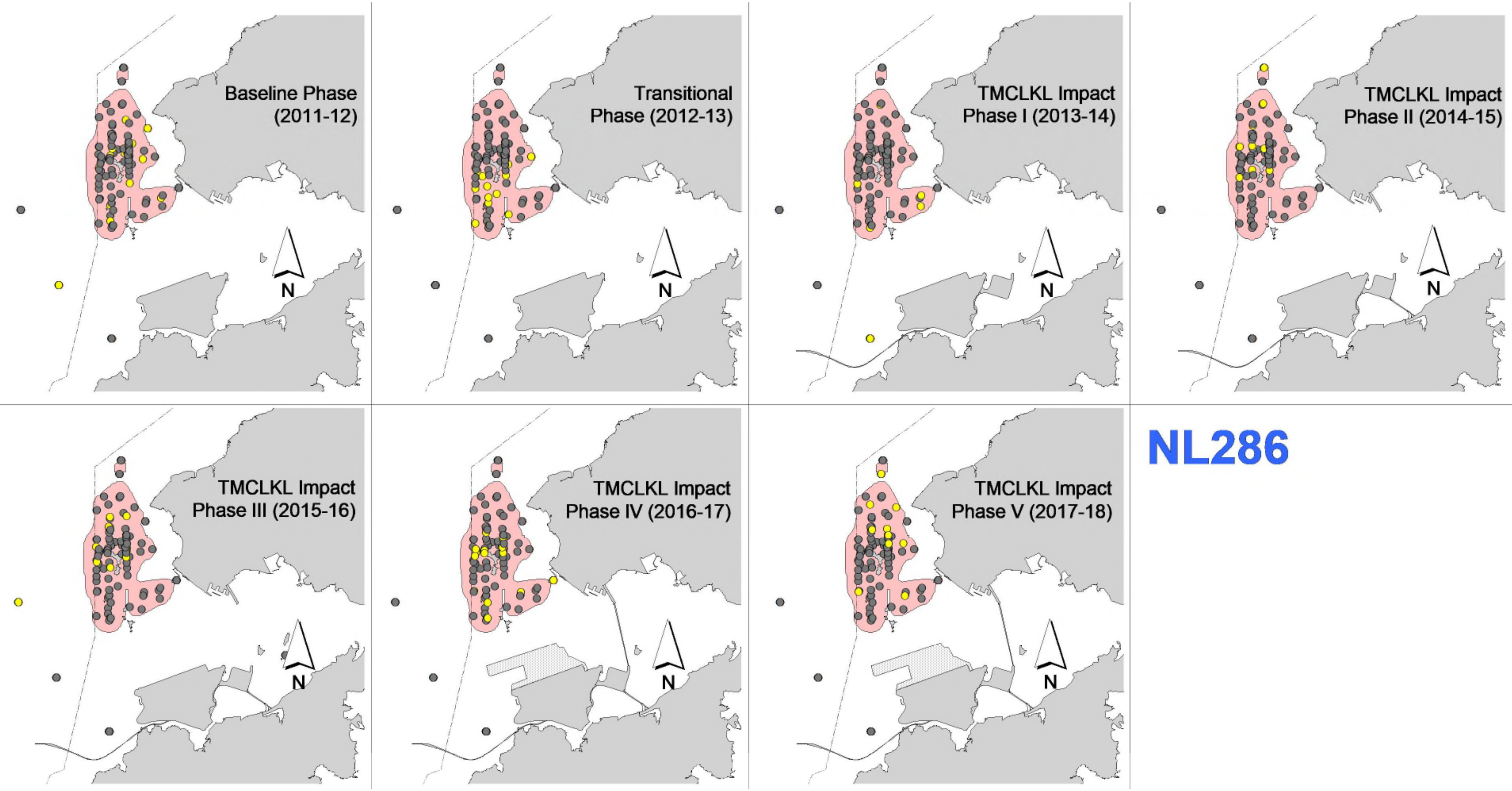
Appendix V. (cont'd)



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 2017 to Oct 2018)**	**Total No. recorded since Contract commencement**
1-Hr TSP	Action	29	73
	Limit	2	5
24-Hr TSP	Action	2	8
	Limit	3	4
Water Quality	Action	14	20
	Limit	0	1
Impact Dolphin	Action	2	11
Monitoring	Limit	3	13

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 2017 to Oct 2018)	1	0	0
Total No. received since Contract commencement	16	1	0

Appendix I

Waste Flow Table

Monthly Summary Waste Flow Table

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

Monthly Summary Waste Flow Table for December 2017 [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	1097.465	0.000	0.000	0.000	1097.465
Jan-2017	60.781	0.000	0.000	0.000	60.781
Feb-2017	17.367	0.000	0.000	0.000	17.367
Mar-2017	7.508	0.000	0.000	0.000	7.508
Apr-2017	15.603	0.000	0.000	0.000	15.603
May-2017	12.358	0.000	0.000	0.000	12.358
Jun-2017	0.194	0.000	0.000	0.000	0.194
Half Year Sub-total	113.811	0.000	0.000	0.000	113.811
Jul-2017	0.652	0.000	0.000	0.000	0.652
Aug-2017	1.624	0.000	0.000	0.000	1.624
Sep-2017	0.886	0.000	0.000	0.000	0.886
Oct-2017	0.706	0.000	0.000	0.000	0.706
Nov-2017	3.259	0.000	0.000	0.000	3.259
Dec-2017	3.574	0.000	0.000	0.000	3.574
Project Total Quantities	1221.977	0.000	0.000	0.000	1221.977

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	1.850	1.850	3.150	3.150	6.870	6.870	9.450	9.450	4.935
Jan-2017	0.000	0.000	0.000	0.000	0.000	0.000	3.400	3.400	0.257
Feb-2017	0.000	0.000	0.200	0.200	0.000	0.000	0.000	0.000	0.340
Mar-2017	0.000	0.000	0.000	0.000	0.000	0.000	6.100	6.100	0.286
Apr-2017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.237
May-2017	0.000	0.000	0.000	0.000	0.000	0.000	10.400	10.400	0.300
Jun-2017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.317
Half Year Sub-total	0.000	0.000	0.200	0.200	0.000	0.000	19.900	19.900	1.737
Jul-2017	0.000	0.000	0.200	0.200	0.000	0.000	0.000	0.000	0.272
Aug-2017	141.990	141.990	0.200	0.200	0.000	0.000	0.000	0.000	0.305
Sep-2017	0.000	0.000	0.200	0.200	0.000	0.000	0.000	0.000	0.300
Oct-2017	132.270	132.270	0.000	0.000	0.000	0.000	0.000	0.000	0.244
Nov-2017	343.270	343.270	0.200	0.200	0.000	0.000	3.800	3.800	0.345
Dec-2017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.121
Project Total Quantities	619.380	619.380	4.150	4.150	6.870	6.870	33.150	33.150	7.914

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)
3.000	0.000	0.000	0.000	3.000

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)
50.000	0.000	0.000	0.000	0.200

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 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	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	0.653	79.694	28.342
Nov-2018					
Dec-2018					
Project Total Quantities	1902.283	0.000	0.653	362.821	1538.807

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	619.380	619.380	4.150	4.150	6.870	6.870	33.150	33.150	8.259
Jan-2018	241.500	241.500	0.200	0.200	0.000	0.000	2.800	2.800	0.272
Feb-2018	256.940	256.940	0.200	0.200	0.000	0.000	0.000	0.000	0.258
Mar-2018	229.360	229.360	0.000	0.000	0.000	0.000	2.000	2.000	0.459
Apr-2018	195.550	195.550	0.000	0.000	0.000	0.000	8.600	8.600	0.281
May-2018	93.010	93.010	0.300	0.300	0.000	0.000	10.400	10.400	0.686
Jun-2018	0.000	0.000	0.000	0.000	1.060	1.060	0.000	0.000	0.408
Half Year Sub-total	1016.36	1016.36	0.700	0.700	1.060	1.060	23.800	23.800	2.364
Jul-2018	0.000	0.000	0.000	0.000	0.770	0.770	0.000	0.000	0.768
Aug-2018	573.96	573.96	0.300	0.300	0.000	0.000	0.000	0.000	0.749
Sep-2018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.445
Oct-2018	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.437
Nov-2018									
Dec-2018									
Project Total Quantities	2209.70	2209.70	5.150	5.150	8.700	8.700	58.950	58.950	13.022

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)
2300.000	0.000	0.000	300.000	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)
2000.000	6.000	8.500	50.000	12.000

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).