



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

*Eighteenth Quarterly Environmental Monitoring
& Audit (EM&A) Report*

23 January 2019

Environmental Resources Management

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Ref.: HYDZHMBEEM00_0_7134L.19

24 January 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
Eighteenth Quarterly EM&A Report (March 2018 – May 2018)**

Reference is made to the Eighteenth Quarterly Environmental Monitoring and Audit (EM&A) Report (March 2018 - May 2018) (ET's ref.: "0212330_18th Quarterly EM&A_20190123.doc" dated 23 January 2019) certified by the ET Leader and provided to us via e-mail on 23 January 2019.

Please be informed that we have no adverse comments on the captioned Report.

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

c.c. HyD – Mr. Patrick Ng (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

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Contract No. HY/2012/08


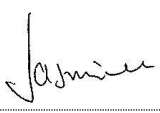


Tuen Mun – Chek Lap Kok Link – Northern Connection Sub-sea Tunnel Section

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Eighteenth Quarterly Environmental Monitoring & Audit (EM&A) Report

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Client: DBJV		Project No: 0212330			
Summary: This document presents the Eighteenth Quarterly EM&A Report for Tuen Mun – Chek Lap Kok Link Northern Connection Sub-sea Tunnel Section.		Date: 23 January 2019			
		Approved by: 			
		Mr Craig Reid Partner			
		Certified by: 			
		Dr Jasmine Ng ET Leader			
	18 th Quarterly EM&A Report	VAR	JN	CAR	23/01/19
Revision	Description	By	Checked	Approved	Date
<p>This report has been prepared by Environmental Resources Management the trading name of 'ERM Hong-Kong, Limited', with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.</p> <p>We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.</p>		<p>Distribution</p> <p><input type="checkbox"/> Internal</p> <p><input checked="" type="checkbox"/> Public</p> <p><input type="checkbox"/> Confidential</p>			
		 			

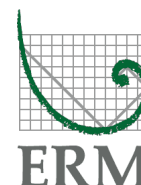


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EXECUTIVE SUMMARY

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 Ltd. 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 Project 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 Eighteenth Quarterly EM&A report presenting the EM&A works carried out during the period from 1 March 2018 to 31 May 2018 for the *Contract No. HY/2012/08 Northern Connection Sub-sea Tunnel Section* (the “Project”) in accordance with the Updated EM&A Manual of the TM-CLK Link Project. As informed by the Contractor, the major activities in the reporting quarter included:

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;
- Corbel & OVHD Construction – TBM Tunnel;
- Parapet wall and fireboard Installation – TBM Tunnel;
- Bulk Excavation – Portion S-A; and
- CSM treatment, Jet Grouting works and D-wall Construction
- Ground Freezing Works – Portion S-A

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

24-hour TSP Monitoring

31 sessions

1-hour TSP Monitoring	31 sessions
Impact Dolphin Monitoring	6 sessions
Joint Environmental Site Inspection	13 sessions

Implementation of Marine Mammal Exclusion Zone

There was no dredging, reclamation or marine sheet piling works in open waters during this reporting period. Thus, Passive Acoustic Monitoring (PAM) and the day-time monitoring of Dolphin Exclusion Zone (DEZ) by dolphin observers were not in effect during the reporting period.

Summary of Breaches of Action/Limit Levels

Breaches of Action and Limit Levels for Air Quality

Three (3) Action Level exceedances of 1-hour TSP were recorded in the air quality monitoring of this reporting period. Investigation report is provided in Appendix I.

Dolphin Monitoring

Whilst one (1) Limit Level exceedance was observed for the quarterly dolphin monitoring data between March and May 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 the dolphin monitoring in this reporting quarter.

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.

No environmental complaint was received in this reporting period.

No environmental summons was received in this reporting period.

Reporting Change

There was no reporting change required in the reporting period.

Upcoming Works for the Next Reporting Period

Works to be undertaken in the coming quarterly period include the following:

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;
- Excavation of Sub-sea Tunnel – TBM tunnel;

- Parapet wall and fireboard Installation – TBM Tunnel
- Corbel Construction – TBM Tunnel;
- Bulk Excavation – Portion S-A;
- TBM Excavation – Portion S-A; and
- CSM treatment, Jet Grouting works and D-wall Construction

Future Key Issues

Potential environmental impacts arising from the above upcoming construction activities in the coming quarterly period are expected to be mainly associated with dust, marine ecology and waste management issues.

1.1

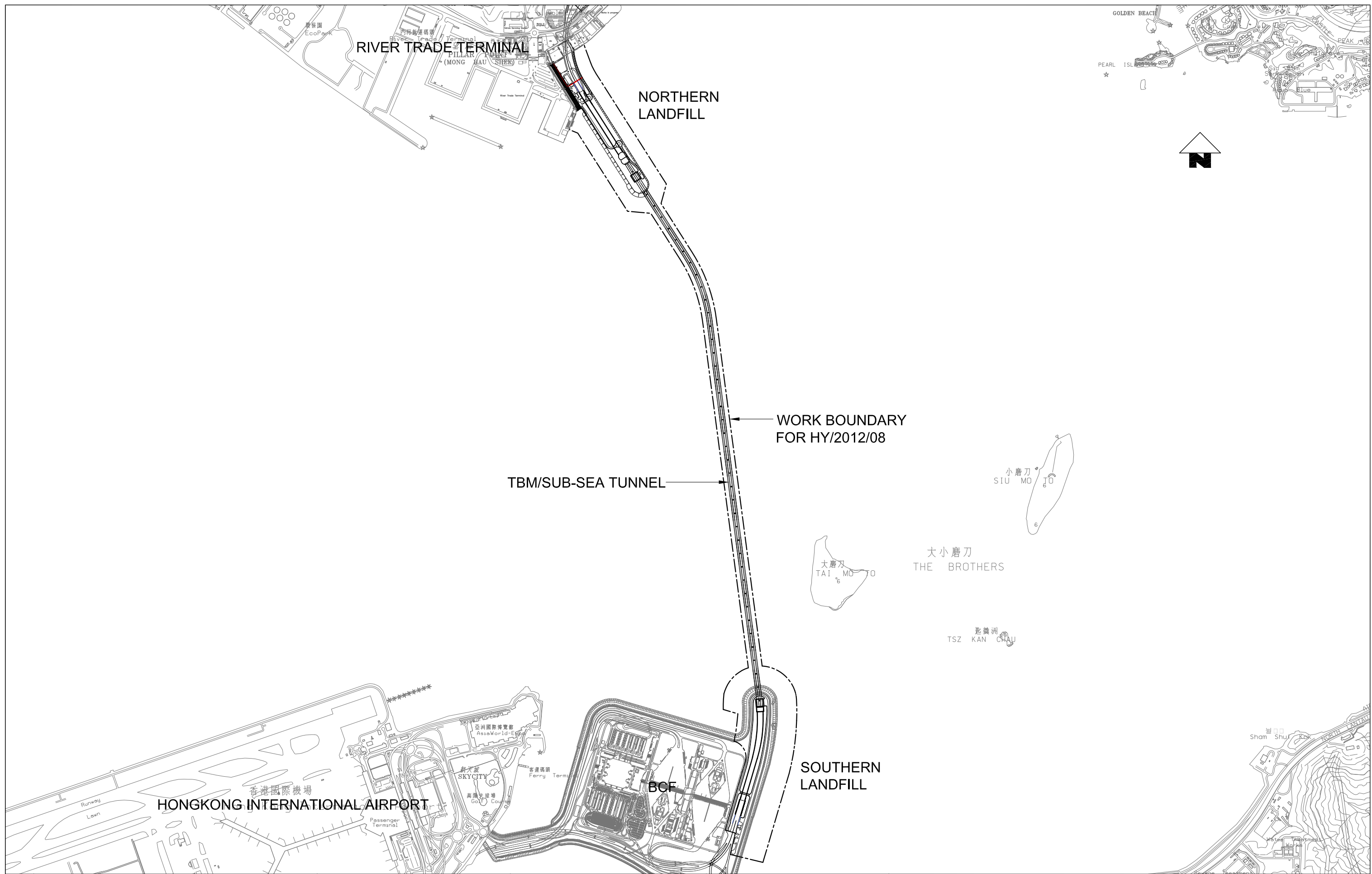
BACKGROUND

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-354/2009/A) 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) in accordance with Environmental Permit No. EP-354/2009/A. Ramboll Hong Kong Ltd. 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*.



Designed By	PKV
Drawn By	DAI
Approved By	SPo
Date	11SEP2013
Rev.	Description
A	FIRST ISSUE
	11SEP13
	PKV
	Checked

Main Contractor	 
Client	
Contractor's Designer	




 A member of the Bouygues Construction group
Dragages - Bouygues Joint Venture 寶嘉 - 布依格聯營



HIGHWAYS DEPARTMENT



 Ove Arup & Partners
 Hong Kong Limited

Project Contract No. HY/2012/08
 Tuen Mun - Chek Lap Kok Link -
 Northern Connection Sub-Sea Tunnel Section
 Drawing Title **Figure 1.1**

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

The construction phase of the Contract commenced on 1 November 2013 and will tentatively be completed by the end of 2019. 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.

1.2 SCOPE OF REPORT

This is the Eighteenth Quarterly 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 March 2018 to 31 May 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)	Environmental Officer	Bryan Lee	2293 7323	2293 7499
		24-hour complaint hotline	Rachel Lam	2293 7330
ET (ERM-HK)	ET Leader	Jovy Tam	2271 3113	2723 5660

1.4 SUMMARY OF CONSTRUCTION WORKS

The construction phase of this Contract was commenced on 1 November 2013. The construction programme is shown in *Appendix B*.

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

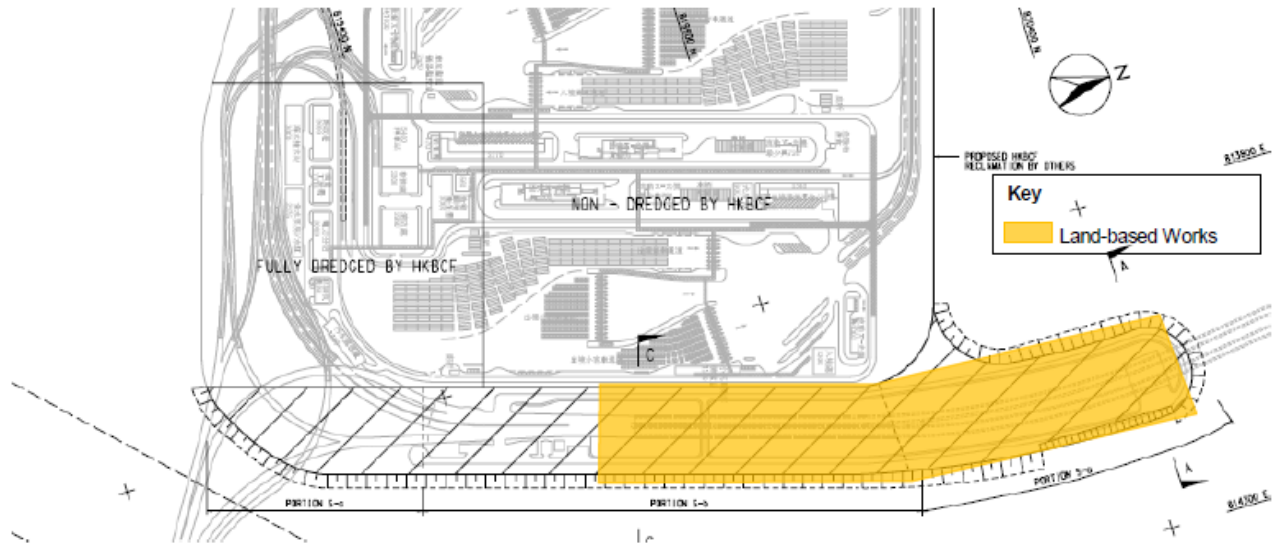
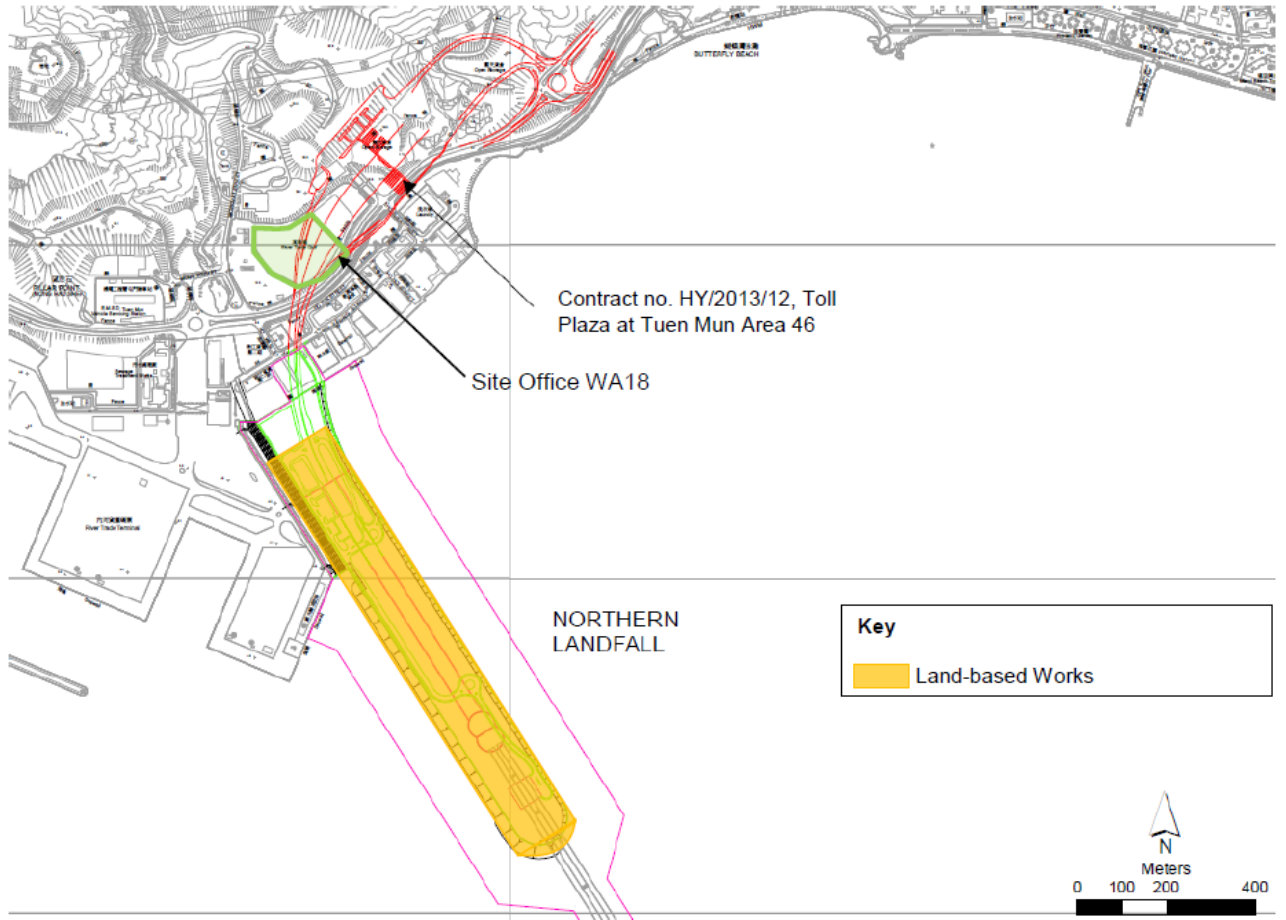
The general layout plan of the site showing the detailed works areas is shown in *Figure 1.2*. The Environmental Sensitive Receivers in the vicinity of the Project are shown in *Figure 1.3*.

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

Table 1.2 *Summary of Construction Activities Undertaken during the Reporting Period*

Construction Activities Undertaken
<i>Land-based Works</i>
<ul style="list-style-type: none">• 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;• Corbel & OVHD Construction – TBM Tunnel;• Parapet wall and fireboard Installation – TBM Tunnel;• Bulk Excavation – Portion S-A; and• CSM treatment, Jet Grouting works and D-wall Construction• Ground Freezing Works – Portion S-A

Figure 1.2 Locations of Construction Activities – March to May 2018



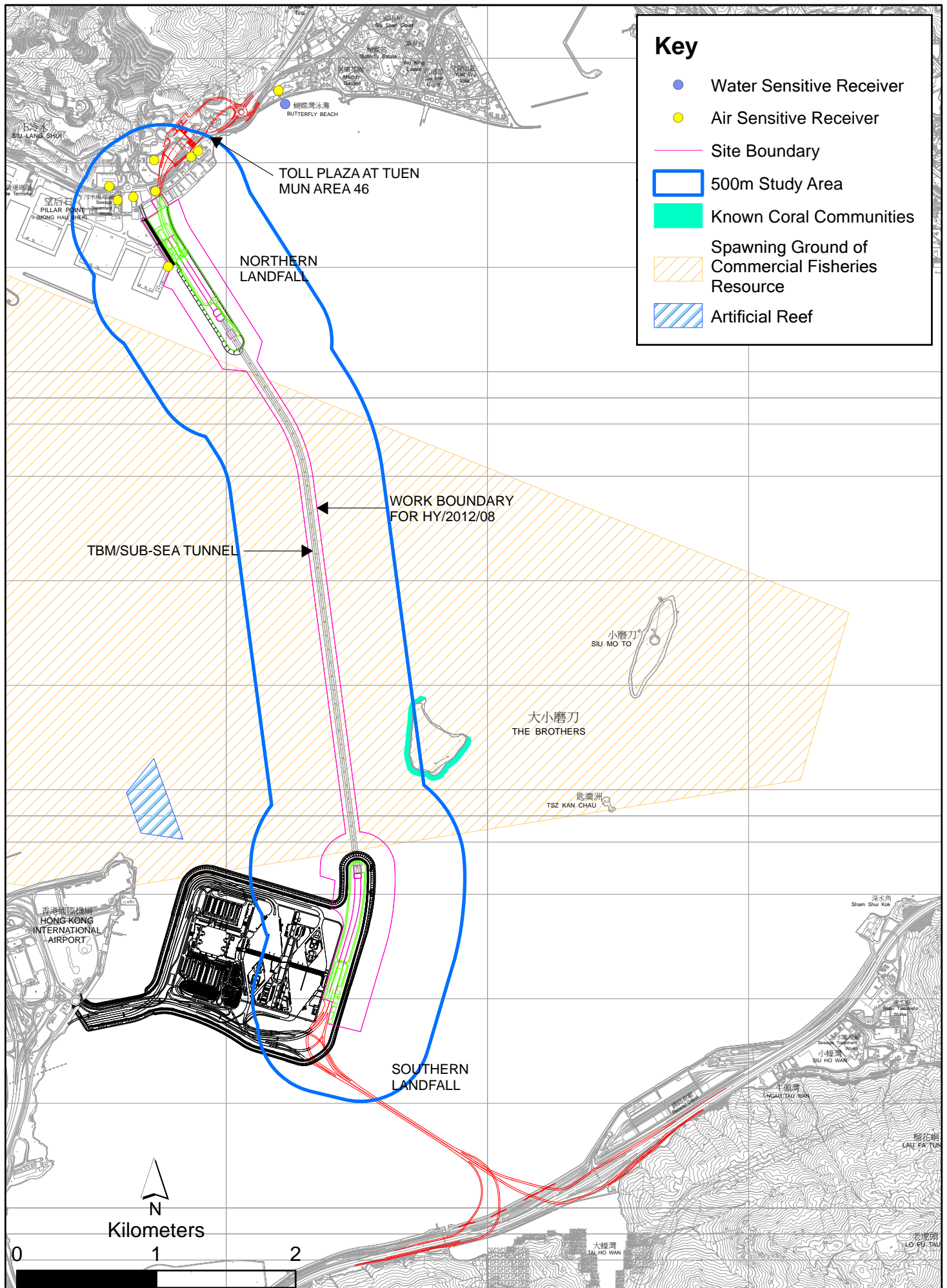


Figure 1.3 Environmental Sensitive Receivers in the vicinity of Contract No. HY/2012/08 Tuen Mun - Chek Lap Kok Link - Northern Connection Sub-Sea Tunnel Section

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Date: 15/4/2014

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

As per the requirements under *Condition 2.4* of *EP-354/2009/D*, the Enhanced TSP Monitoring Plan has been prepared under *Contract No. HY/2012/08*. Details of the monitoring plan are presented in the *Enhanced TSP Monitoring Plan* ⁽¹⁾.

2.1.1 Monitoring Requirements and Equipment

In accordance with the Updated EM&A Manual and the *Enhanced TSP Monitoring Plan*, 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 quarter 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*.

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

Monitoring Station	Monitoring Dates	Location	Description	Parameters & Frequency
ASR1	2, 5, 8, 11, 14, 17, 20, 23, 26 and 29 March 2018	Tuen Mun Fireboat Station	Office	TSP monitoring
ASR5	1, 4, 7, 10, 13, 16, 19, 22, 25 and 28 April 2018	Pillar Point Fire Station	Office	<ul style="list-style-type: none"> 1-hour Total Suspended Particulates (1-hour TSP, $\mu\text{g}/\text{m}^3$), 3 times in every 6 days 24-hour Total Suspended Particulates (24-hour TSP, $\mu\text{g}/\text{m}^3$), daily for 24-hour in every 6 days
AQMS1	1, 4, 7, 10, 13, 16, 19, 22, 25, 28 and 31 May 2018	Previous River Trade Golf	Bare ground	Enhanced TSP monitoring (commenced on 24 October 2014)
ASR6		Butterfly Beach Laundry	Office	<ul style="list-style-type: none"> 1-hour Total Suspended Particulates (1-hour TSP,

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

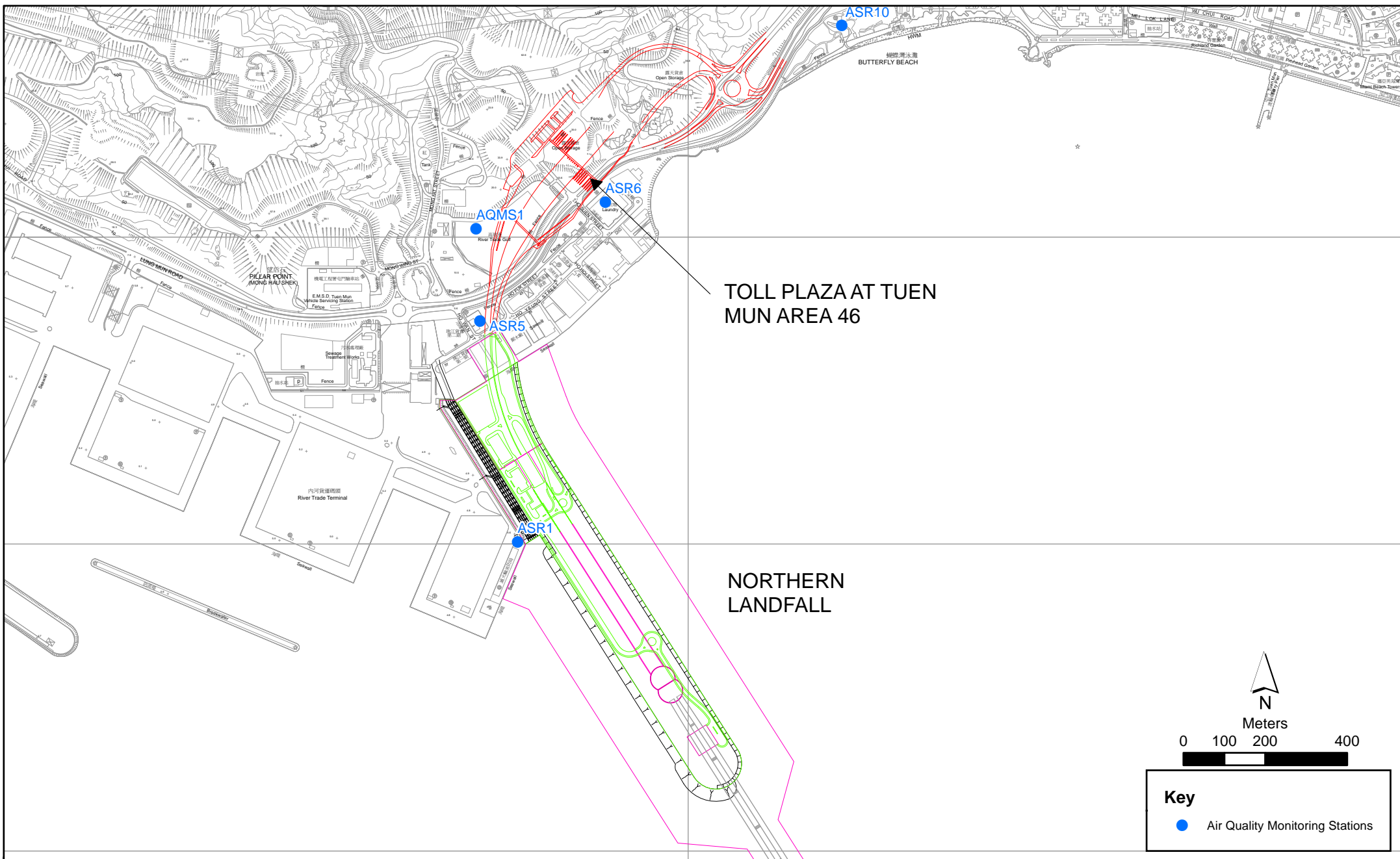


Figure 2.1

Air Quality Monitoring Stations for the Enhanced TSP Monitoring

Monitoring Station	Monitoring Dates	Location	Description	Parameters & Frequency
ASR10		Butterfly Beach Park	Recreational uses	$\mu\text{g}/\text{m}^3$, 3 times in every 3 days • 24-hour Total Suspended Particulates (24-hour TSP, $\mu\text{g}/\text{m}^3$), daily for 24-hour in every 3 days

Table 2.2 *Air Quality Monitoring Equipment*

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

2.1.2 *Action & Limit Levels*

The Action and Limit Levels of the air quality monitoring is provided in *Appendix D*. The Event and Action plan is presented in *Appendix H*.

2.1.3 *Monitoring Schedule for the Reporting Quarter*

The schedules for air quality monitoring in the reporting quarter are provided in *Appendix E*.

2.1.4 *Results and Observations*

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

The monitoring results for 1-hour TSP and 24-hour TSP are summarized in *Tables 2.3* and *2.4*, respectively. Monitoring results are presented graphically in *Appendix F* and detailed impact air quality monitoring data were reported in the *Fifty-third to Fifty-fifth Monthly EM&A Report*.

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

Month/Year	Station	Average ($\mu\text{g}/\text{m}^3$)	Range ($\mu\text{g}/\text{m}^3$)	Action Level ($\mu\text{g}/\text{m}^3$)	Limit Level ($\mu\text{g}/\text{m}^3$)
March to May 2018	ASR 1	127	39 - 460	331	500
	ASR 5	162	57 - 389	340	500
	AQMS1	95	22 - 197	335	500
	ASR6	116	33 - 295	338	500
	ASR10	75	28 - 196	337	500

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

Month/Year	Station	Average ($\mu\text{g}/\text{m}^3$)	Range ($\mu\text{g}/\text{m}^3$)	Action Level ($\mu\text{g}/\text{m}^3$)	Limit Level ($\mu\text{g}/\text{m}^3$)
March to May	ASR 1	86	30 - 176	213	260

Month/Year	Station	Average ($\mu\text{g}/\text{m}^3$)	Range ($\mu\text{g}/\text{m}^3$)	Action Level ($\mu\text{g}/\text{m}^3$)	Limit Level ($\mu\text{g}/\text{m}^3$)
2018	ASR 5	94	62 - 179	238	260
	AQMS1	63	36 - 124	213	260
	ASR6	75	43 - 164	238	260
	ASR10	54	24 - 132	214	260

Three (3) Action Level exceedances of 1-hour TSP were recorded in the air quality monitoring of this reporting period. Summary of Exceedances for Air Quality Impact Monitoring in this Reporting Quarter is detailed in *Table 2.13*.

2.2 WATER QUALITY MONITORING

Seawall Enhancement Works at Northern Landfall has been completed on 31 December 2017. Notification of suspension of water quality monitoring has been approved by EPD on 2 March 2018. Water Quality Monitoring will be resumed prior to the start of Seawall Modification Works at Southern Landfall in January 2019.

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 is adopted to avoid duplicates of survey effort.

2.3.2 Monitoring Equipment

Table 2.5 summarizes the equipment used for the impact dolphin monitoring.

Table 2.5 *Dolphin Monitoring Equipment*

Equipment	Model
Global Positioning System (GPS)	Garmin 18X-PC
Camera	Geo One Phottix
	Nikon D90 300m 2.8D fixed focus
Laser Binoculars	Nikon D90 20-300m zoom lens
Marine Binocular	Infinitor LRF 1000
Vessel for Monitoring	Bushell 7 x 50 marine binocular with compass and reticules
	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 2.2*. The co-ordinates of all transect lines are shown in *Table 2.6* below.

Table 2.6 *Impact Dolphin Monitoring Line Transect Co-ordinates*

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

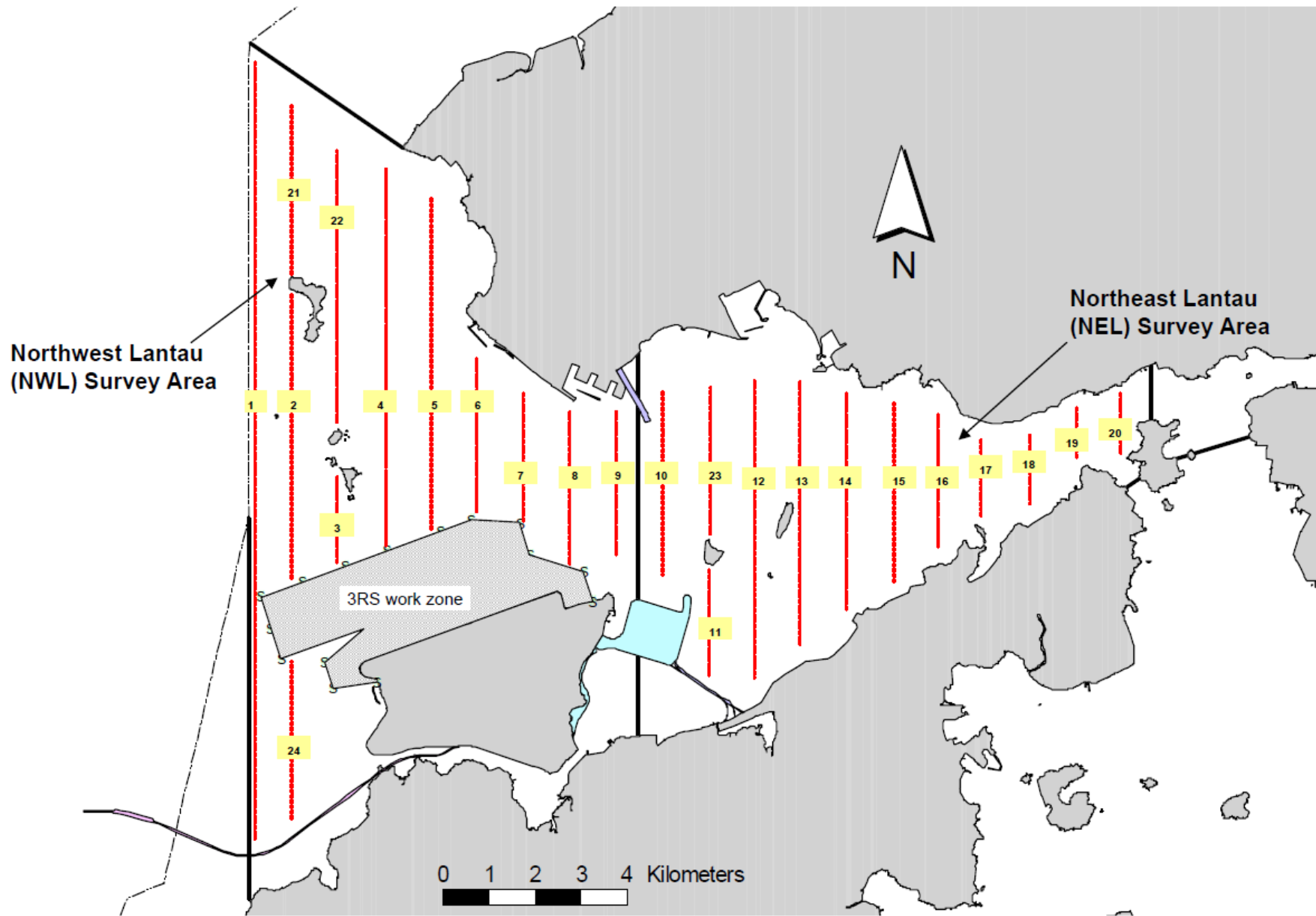


Figure 2.2

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

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 D*. The Event and Action plan is presented in *Appendix H*.

2.3.6 *Monitoring Schedule for the Reporting Period*

The dolphin monitoring schedules for the reporting period are shown in *Appendix E*.

2.3.7 *Results & Observations*

A total of 791.83 km of survey effort was conducted, with 89.8% of the total survey effort being conducted under favourable weather conditions (ie Beaufort Sea State 3 or below with good visibility) in this reporting quarter. Amongst the two areas, 290.90 km and 500.93 km of survey effort were conducted from NEL and NWL survey areas, respectively. The total survey effort conducted on primary and secondary lines were 576.61 km and 215.22 km, respectively. The survey efforts are summarized in *Appendix G*.

A total of 9 groups of 30 Chinese White Dolphins sightings were recorded during the six sets of surveys in this reporting quarter. All dolphin sightings were made during on-effort search, and eight of the nine on-effort dolphin sightings were made on primary lines. During this reporting quarter, all dolphin groups were sighted in NWL, while no dolphin was sighted in NEL.

Encounter rates of Chinese White Dolphins are deduced from the survey effort and on-effort sighting data made under favourable conditions (Beaufort 3 or below with good visibility) in the reporting quarter with the results and comparison with baseline results present in *Tables 2.7* and *2.8*.

Table 2.7 *Individual Survey Event 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)
		Primary Lines Only	Primary Lines Only
NEL	Set 1 (8 & 12 Mar)	0.00	0.00
	Set 2 (20 & 23 Mar)	0.00	0.00
	Set 3 (10 & 17 Apr)	0.00	0.00
	Set 4 (19 & 25 Apr)	0.00	0.00
	Set 5 (7 & 10 May)	0.00	0.00
	Set 6 (16 & 30 May)	0.00	0.00
NWL	Set 1 (8 & 12 Mar)	1.73	5.19
	Set 2 (20 & 23 Mar)	12.32	56.69
	Set 3 (10 & 17 Apr)	0.00	0.00
	Set 4 (19 & 25 Apr)	3.24	4.87
	Set 5 (7 & 10 May)	0.00	0.00
	Set 6 (16 & 30 May)	0.00	0.00

Note: Dolphin Encounter Rates are deduced from the Two Sets of Surveys (Two Surveys in Each Set) in the reporting quarter in Northeast (NEL) and Northwest Lantau (NWL)

Table 2.8 *Quarterly 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)	
	March - May 2018	September - November 2011	March - May 2018	September - November 2011
Northeast Lantau	0.0	6.00 ± 5.05	0.0	22.19 ± 26.81
Northwest Lantau	2.88 ± 4.81	9.85 ± 5.85	11.12 ± 22.46	44.66 ± 29.85

Note: Encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions.

Group size of Chinese White Dolphins ranged from 1 - 8 individuals per group in North Lantau region during March to May 2018. The average dolphin group sizes from these three months were compared with the ones deduced from the baseline period in September to November 2011, as shown in *Table 2.9*.

Table 2.9 *Average Dolphin Group Size*

	Average Dolphin Group Size	
	March - May 2018	September - November 2011
Overall	3.33 ± 3.39 (n = 9)	3.72 ± 3.13 (n = 66)
Northeast Lantau	---	3.18 ± 2.16 (n = 17)
Northwest Lantau	3.33 ± 3.39 (n = 9)	3.92 ± 3.40 (n = 49)

Whilst one limit level exceedance was observed for the quarterly dolphin monitoring data between March and May 2018, no unacceptable impact from the construction activities of this Contract was recorded from the general observations.

Although the dolphins infrequently occurred along the alignment of TM-CLKL Northern Connection Sub-Sea Tunnel Section in the past and during the baseline monitoring period, it is apparent that dolphin usage has been significantly reduced in NEL.

It is critical to monitor the dolphin usage in North Lantau region in the upcoming quarters 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.

2.3.8 *Implementation of Marine Mammal Exclusion Zone*

There was no dredging, reclamation or marine sheet piling works in open waters during this reporting period. Thus, Passive Acoustic Monitoring (PAM) and the day-time monitoring of Dolphin Exclusion Zone (DEZ) by dolphin observers were not in effect during the reporting period.

2.4 *EM&A SITE INSPECTION*

Site inspections were carried out on a weekly basis to monitor the implementation of proper environmental pollution control and mitigation measures under the Contract. Thirteen (13) site inspections were carried out in the reporting quarter on 7, 14, 21 and 28 March 2018; 4, 11, 18 and 25 April 2018; 2, 9, 16, 23 and 30 May 2018.

Key observations during the site inspections in this reporting period are summarized in *Table 2.10*.

Table 2.10 *Specific Observations and Recommendations during the Weekly Site Inspection in this Reporting Period*

Inspection Date	Environmental Observations	Recommendations/ Remarks
7 March 2018	<p>Works Area – Portion N-C</p> <ul style="list-style-type: none"> Accumulated waste in the waste container should be removed. Drip tray should be provided for the oil drum. Cement bags should be covered with tarpaulin sheeting. <p>Works Area – Portion S-A</p> <ul style="list-style-type: none"> U-channel should be installed for collection of rainwater. <p>Reminder from SOR</p> <p>Works Area – Portion S-A</p> <ul style="list-style-type: none"> The tip of excavator should be mounted with noise absorbent. 	<p>Works Area – Portion N-C</p> <ul style="list-style-type: none"> The Contractor was reminded to remove the accumulated waste in the waste container. The Contractor was reminded to provide drip tray for the oil drum. The Contractor was reminded to cover the cement bags with tarpaulin sheeting. <p>Works Area – Portion S-A</p> <ul style="list-style-type: none"> The Contractor was reminded to install U-channel for collection of rainwater. <p>Reminder from SOR</p> <p>Works Area – Portion S-A</p> <ul style="list-style-type: none"> The Contractor was reminded to mount the tip of excavator with noise absorbent.
14 March 2018	<p>Works Area – TBM tunnel</p> <ul style="list-style-type: none"> Drip tray should be provided for the chemical containers. Cement bags should be covered with tarpaulin sheeting. <p>Works Area –Portion S-B</p> <ul style="list-style-type: none"> Cement bags should be covered with tarpaulin sheeting. Drip tray should be provided for the chemical containers. Drip tray should be provided for the chemical containers. 	<p>Works Area – TBM tunnel</p> <ul style="list-style-type: none"> The Contractor was reminded to provide drip tray for the chemical containers. The Contractor was reminded to cover the cement bags with tarpaulin sheeting. <p>Works Area –Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to cover the cement bags with tarpaulin sheeting. The Contractor was reminded to provide drip tray for the chemical containers. The Contractor was reminded to provide drip tray for the chemical containers.

Inspection Date	Environmental Observations	Recommendations/ Remarks
21 March 2018	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> • Drip tray should be provided for the chemical containers. • Cement bags should be covered with tarpaulin sheeting. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> • Drip tray should be provided for the chemical containers. <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> • The top and 3 sides of the grout mixer should be enclosed with impervious sheeting. • Drip tray should be provided for the oil drums. 	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> • The Contractor was reminded to provide drip tray for the chemical containers. • The Contractor was reminded to cover the cement bags with tarpaulin sheeting. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> • The Contractor was reminded to provide drip tray for the chemical containers. <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> • The Contractor was reminded to enclose the top and 3 sides of the grout mixer with impervious sheeting. • The Contractor was reminded to provide drip tray for the oil drums.
28 March 2018	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> • Drip tray should be provided for the chemical containers. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> • Dusty material should be covered with tarpaulin sheets. • Proper NRMM label should be displayed. <p>Works Area - Portion S-C</p> <ul style="list-style-type: none"> • The cement bags should be covered with impervious sheeting. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> • Drip tray should be provided for the chemical containers. • Drip tray should be provided for the chemical containers. • The chemical should be stored properly.. 	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> • The Contractor was reminded to provide drip tray for the chemical containers. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> • The Contractor was reminded to cover the dusty material with tarpaulin sheetings. • The Contractor was reminded to display proper NRMM label. <p>Works Area - Portion S-C</p> <ul style="list-style-type: none"> • The Contractor was reminded to cover the cement bags with impervious sheeting. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> • The Contractor was reminded to provide drip tray for the chemical containers. • The Contractor was reminded to provide drip tray for the chemical containers. • The Contractor was reminded to store the chemical properly.
4 April 2018	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> • The cement bags should be covered with impervious sheeting. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> • Stagnant water should be pumped off to avoid mosquito larva breeding. 	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> • The Contractor was reminded to cover the cement bags with impervious sheeting. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> • The Contractor was reminded to pump off the stagnant water to avoid mosquito breeding.

Inspection Date	Environmental Observations	Recommendations/ Remarks
11 April 2018	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> Drip tray should be provided to the chemical containers. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> Stagnant water should be pumped off to avoid mosquito larva breeding. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> Proper NRMM label should be displayed. <p>Reminder from SOR</p> <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The broken water barriers should be replaced. 	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to provide drip tray to the chemical containers. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> The Contractor was reminded to pump off the stagnant water to avoid mosquito breeding. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> The Contractor was reminded to display proper NRMM label. <p>Reminder from SOR</p> <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to replace the broken barriers.
18 April 2018	<p>Works Area - TBM tunnel</p> <ul style="list-style-type: none"> Drip tray should be provided for the chemical containers. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> NRMM label should be displayed on the generator. 	<p>Works Area - TBM tunnel</p> <ul style="list-style-type: none"> The Contractor was reminded to provide drip tray to the chemical containers. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to display NRMM label on the generator.
25 April 2018	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> Proper NRMM label should be displayed on the excavator. Drip tray should be provided for the chemical containers <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> Faded NRMM label should be replaced by standard NRMM label. 	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to display proper NRMM label on the excavator. The Contractor was reminded to provide drip tray for the chemical containers. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> The Contractor was reminded to replace the faded NRMM label with standard NRMM label.
2 May 2018	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> Stagnant water on the oil drum should be removed. <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> Drip tray should be provided for the oil drums. <p>Works Area - TBM tunnel</p> <ul style="list-style-type: none"> Cement bags should be covered with impervious sheeting. Drip tray should be provided for the chemical containers. Drip tray should be provided for the chemical containers. 	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to remove stagnant water on the oil drum. <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> The Contractor was reminded to provide drip tray for the oil drums. <p>Works Area - TBM tunnel</p> <ul style="list-style-type: none"> The Contractor was reminded to cover the cement bags with impervious sheeting. The Contractor was reminded to provide drip tray for the chemical containers. The Contractor was reminded to provide drip tray for the chemical containers.

Inspection Date	Environmental Observations	Recommendations/ Remarks
9 May 2018	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> General refuse should be removed. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> Drip tray should be provided for the chemical containers. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> The faded NRMM should be replaced by the standard NRMM label. 	<p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to remove the general refuse. <p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> The Contractor was reminded to provide drip tray for the chemical containers. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> The Contractor was reminded to replace the faded NRMM label with the standard NRMM label.
16 May 2018	<p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> Stagnant water in the drip tray should be removed. <p>Reminder from the SOR</p> <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> The tip of the excavator should be enclosed with noise abatement material. 	<p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> The Contractor was reminded to remove the stagnant water in the drip tray. <p>Reminder from the SOR</p> <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> The Contractor was reminded to enclose the tip of the excavator with noise abatement material.
23 May 2018	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> Drip tray should be provided to the chemical containers. Cement bags should be covered with tarpaulin sheets. <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> Stagnant water in the drip tray should be removed. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> Accumulated rubbish in the skip should be removed. 	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> The Contractor was reminded to provide drip tray to the chemical containers. The Contractor was reminded to cover the cement bags with tarpaulin sheets. <p>Works Area - Portion S-A</p> <ul style="list-style-type: none"> The Contractor was reminded to remove the stagnant water in the drip tray. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to remove the accumulated rubbish in the skip.
30 May 2018	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> Cement bags should be covered with tarpaulin sheets. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> Water spraying should be applied more frequently during dry conditions. The slope surface should be covered with impervious sheeting. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> Cement bags should be covered with tarpaulin sheets. Stagnant water should be removed. Water spraying should be applied more frequently during dry conditions. The slope surface should be covered with impervious sheeting. <p>Reminder from the SOR:</p> <p>Works Area - Portion S-B</p> <p>The breaker tip should be wrapped with soundproof mat.</p>	<p>Works Area - Portion N-C</p> <ul style="list-style-type: none"> The Contractor was reminded to cover the cement bags with tarpaulin sheets. <p>Works Area - Portion N-A</p> <ul style="list-style-type: none"> The Contractor was reminded to apply water spraying more frequently during dry conditions. The Contractor was reminded to cover the slope surface with impervious sheeting. <p>Works Area - Portion S-B</p> <ul style="list-style-type: none"> The Contractor was reminded to cover the cement bags with tarpaulin sheets. The Contractor was reminded to remove the stagnant water. The Contractor was reminded to apply water spraying more frequently during dry conditions. The Contractor was reminded to cover the slope surface with impervious sheeting. <p>Reminder from the SOR:</p> <p>Works Area - Portion S-B</p> <p>The Contractor was reminder to wrap the breaker tip with soundproof mat.</p>

The Contractor has rectified all of the observations as identified during environmental site inspections in the reporting quarter.

2.5 WASTE MANAGEMENT STATUS

The Contractor had submitted application form for registration 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 chemical wastes. Reference has been made to the waste flow table prepared by the Contractor (*Appendix J*). The quantities of different types of wastes are summarized in *Table 2.11*.

Table 2.11 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)	Imported Fill (tonnes) ^(d)	Recyclable Materials ^(c) (kg)	Chemical Wastes (kg)	Marine Sediment (m ³)	
							Category L	Category M (M _p & M _f)
March 2018	66,457	62,247	459	0	229,360	2,000	0	6,195
April 2018	123,942	50,648	281	56,192.51	195,550	8,600	0	1,957
May 2018	127,964	62,822	686	13,289	93,310	0	0	177

Notes:

- (a) Inert construction wastes include hard rock and large broken concrete, and materials disposed as public fill.
- (b) Non-inert construction wastes include general refuse disposed at landfill.
- (c) Recyclable materials include metals, paper, cardboard, plastics, timber and others.
- (d) The origin of imported fill is from *Contract No. HY/2013/03*.

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 2.12* below.

Table 2.12 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 April 2018	17 July 2018	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/19-001	24 April 2018	23 May 2018	DBJV	Type 1 (Dedicated site) and Type 2 (Confined Marine Disposal)
Marine Dumping Permit	EP/MD/18-125	21 February 2018	20 March 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 (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)
Construction Noise Permit	GW-RW0538-17	16 April 2018	15 October 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	3 April 2017	31 July 2018	DBJV	Southern Landfall (Percussive Piling)
Construction Noise Permit	GW-RS0878-17	11 October 2017	2 April 2018	DBJV	Southern Landfall

License/ Permit	License or Permit No.	Date of Issue	Date of Expiry	License/ Permit Holder	Remarks
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

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 site audit findings, the Contractors carried out all corrective actions.

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

2.8 **SUMMARY OF EXCEEDANCES OF THE ENVIRONMENTAL QUALITY PERFORMANCE LIMIT**

For air quality impact monitoring, a total of thirty-one monitoring events for both 1-hour TSP and 24-hour TSP were undertaken in which three (3) Action Level exceedances of 1-hour TSP were recorded in the air quality monitoring of this reporting period. (*Table 2.13*).

Table 2.13 Summary of Exceedances for Air Quality Impact Monitoring in this Reporting Quarter

Station	Exceedance Level	Date of Exceedances		Number of Exceedances	
		1-hr TSP	24-hr TSP	1-hr TSP	24-hr TSP
AQMS1	Action Level	-	-	-	-
	Limit Level	-	-	-	-
ASR1	Action Level	2018-03-02	-	1	-
		2018-03-20	-	1	-
	Limit Level	-	-	-	-
ASR5	Action Level	2018-04-13	-	1	-
	Limit Level	-	-	-	-
ASR6	Action Level	-	-	-	-
	Limit Level	-	-	-	-
ASR10	Action Level	-	-	-	-
	Limit Level	-	-	-	-
Total number of Action level Exceedances:				3	0
Total number of Limit level Exceedances:				0	0

One (1) Limit Level exceedance was observed for the quarterly dolphin monitoring data between March and May 2018, whilst 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.

Cumulative statistics are provided in *Appendix I*.

2.9 **SUMMARY OF COMPLAINTS, NOTIFICATION OF SUMMONS AND SUCCESSFUL PROSECUTIONS**

The Environmental Complaint Handling Procedure is provided in *Figure 2.3*.

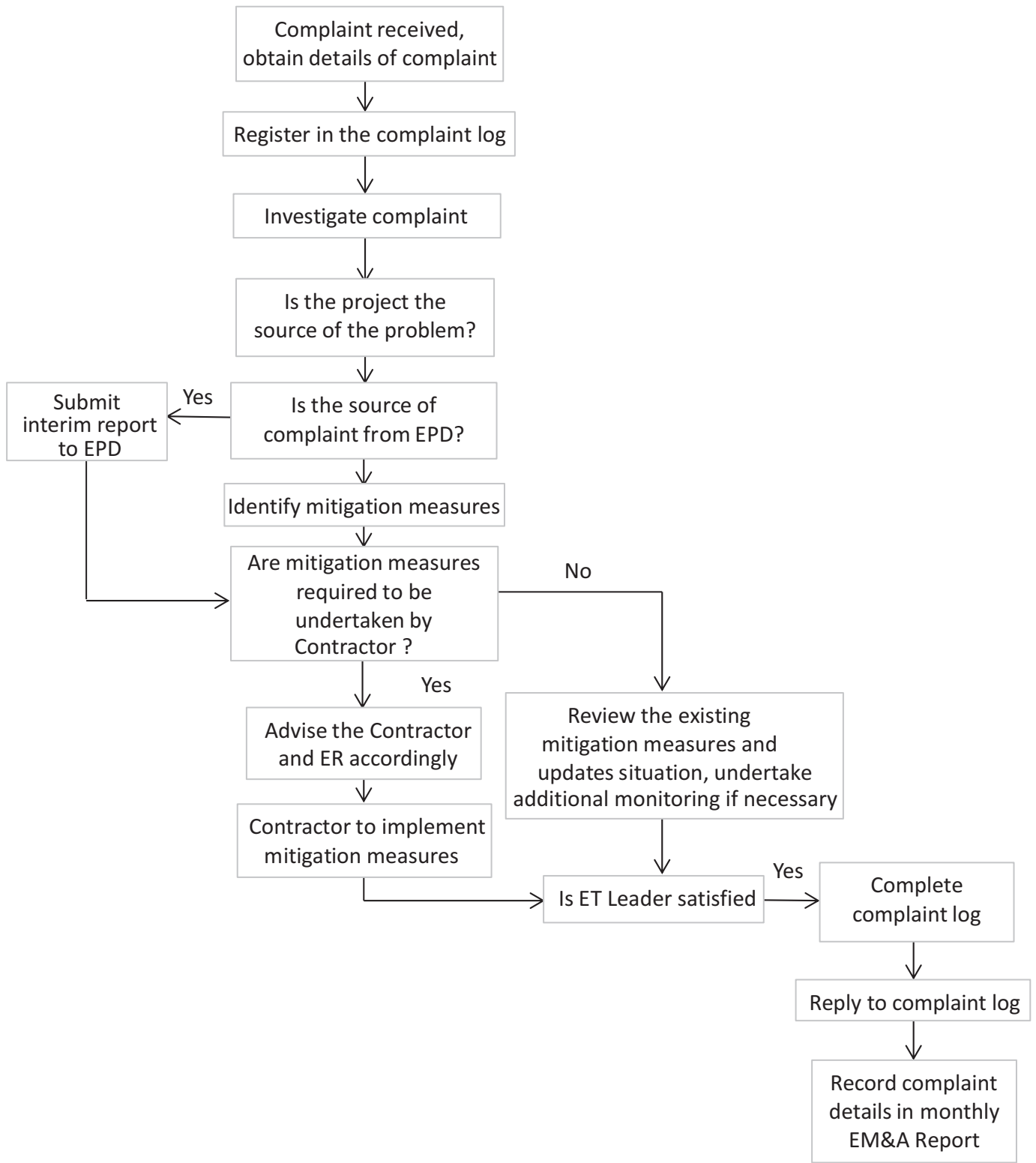


Figure 2.3

Environmental Complaint Handling Procedure

No environmental complaint was received in this reporting period.

No environmental summons was received in this reporting period.

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

3 FUTURE KEY ISSUES

3.1 CONSTRUCTION ACTIVITIES FOR THE COMING QUARTER

As informed by the Contractor, the major works for the Project in the coming quarter are summarized in *Table 3.1*.

Table 3.1 Construction Works to Be Undertaken in the Coming Quarter

Works to be undertaken
<i>Land-based Works</i>
<ul style="list-style-type: none">• 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;• Excavation of Sub-sea Tunnel – TBM tunnel;• Parapet wall and fireboard Installation – TBM Tunnel• Corbel Construction – TBM Tunnel;• Bulk Excavation – Portion S-A;• TBM Excavation – Portion S-A; and• CSM treatment, Jet Grouting works and D-wall Construction

3.2 KEY ISSUES FOR THE COMING QUARTER

Potential environmental impacts arising from the above upcoming construction activities in the coming quarterly period are expected to be mainly associated with dust, marine ecology and waste management issues.

3.3 MONITORING SCHEDULE FOR THE COMING QUARTER

Impact monitoring for air quality and marine ecology (include dolphin monitoring) are scheduled to continue for the next 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 considered to be necessary at this stage. The monitoring programme will be evaluated as appropriate in the next reporting period.

This Eighteenth Quarterly EM&A Report presents the findings of the EM&A activities undertaken during the period from 1 March 2018 to 31 May 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. Three (3) Action Level exceedances of 1-hour TSP were recorded in the air quality monitoring of this reporting period.

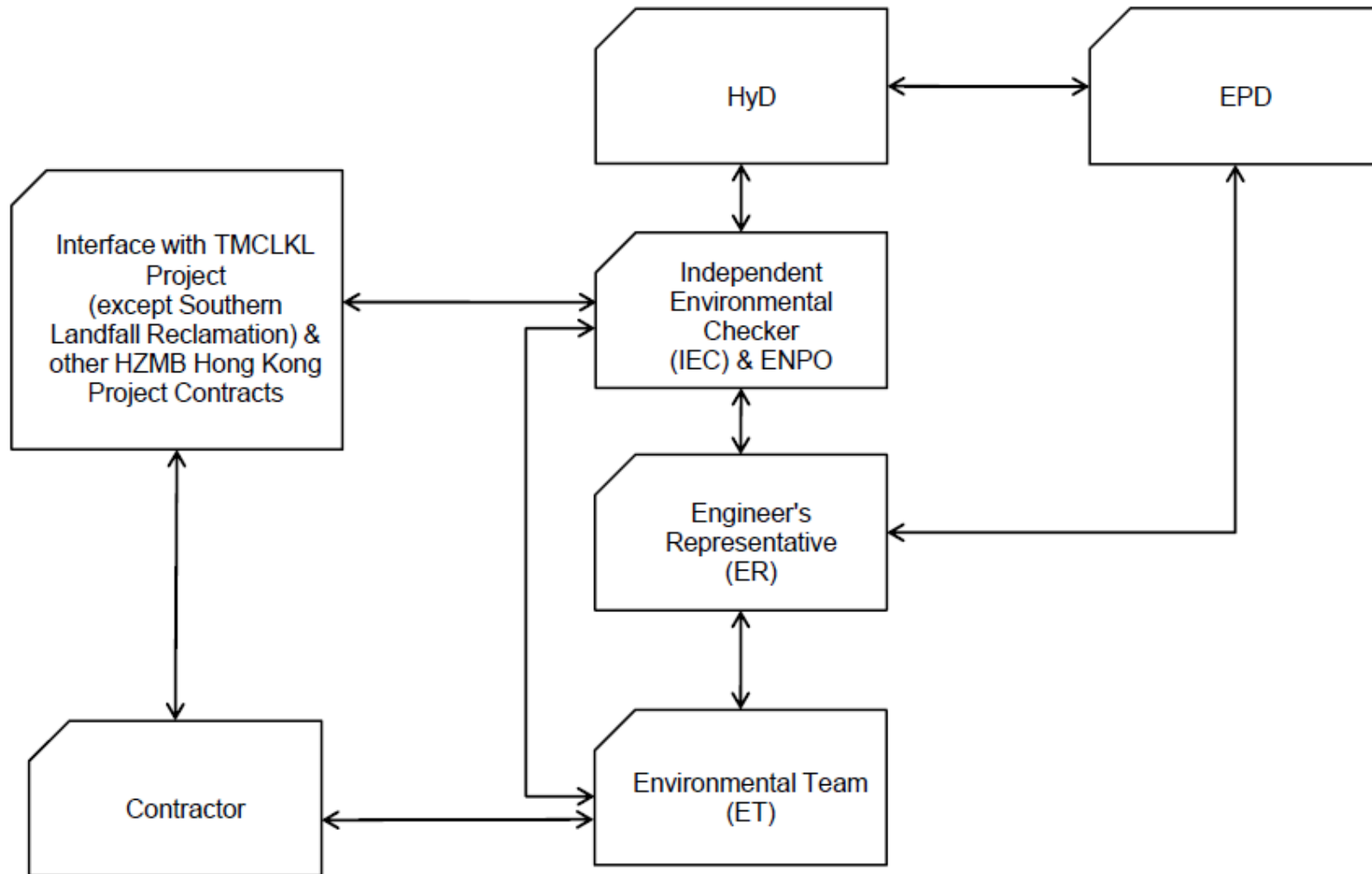
A total of 9 groups of 30 Chinese White Dolphins sightings were recorded during the six sets of surveys in this reporting quarter. All dolphin sightings were made during on-effort search, and eight of the nine on-effort dolphin sightings were made on primary lines. Whilst one limit level exceedance was observed for the quarterly dolphin monitoring data between March and May 2018, no unacceptable impact from the construction activities of this Contract was recorded from the general observations. Although the dolphins infrequently occurred along the alignment of TM-CLKL Northern Connection Sub-Sea Tunnel Section in the past and during the baseline monitoring period, it is apparent that dolphin usage has been significantly reduced in NEL. It is critical to monitor the dolphin usage in North Lantau region in the upcoming quarters, to determine whether the dolphins are continuously affected by the various construction activities in relation to the construction works of the Contract, and whether suitable mitigation measure can be applied to improve the situation.

Thirteen 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.

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 monitoring programme will be evaluated as appropriate in the next reporting period. 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

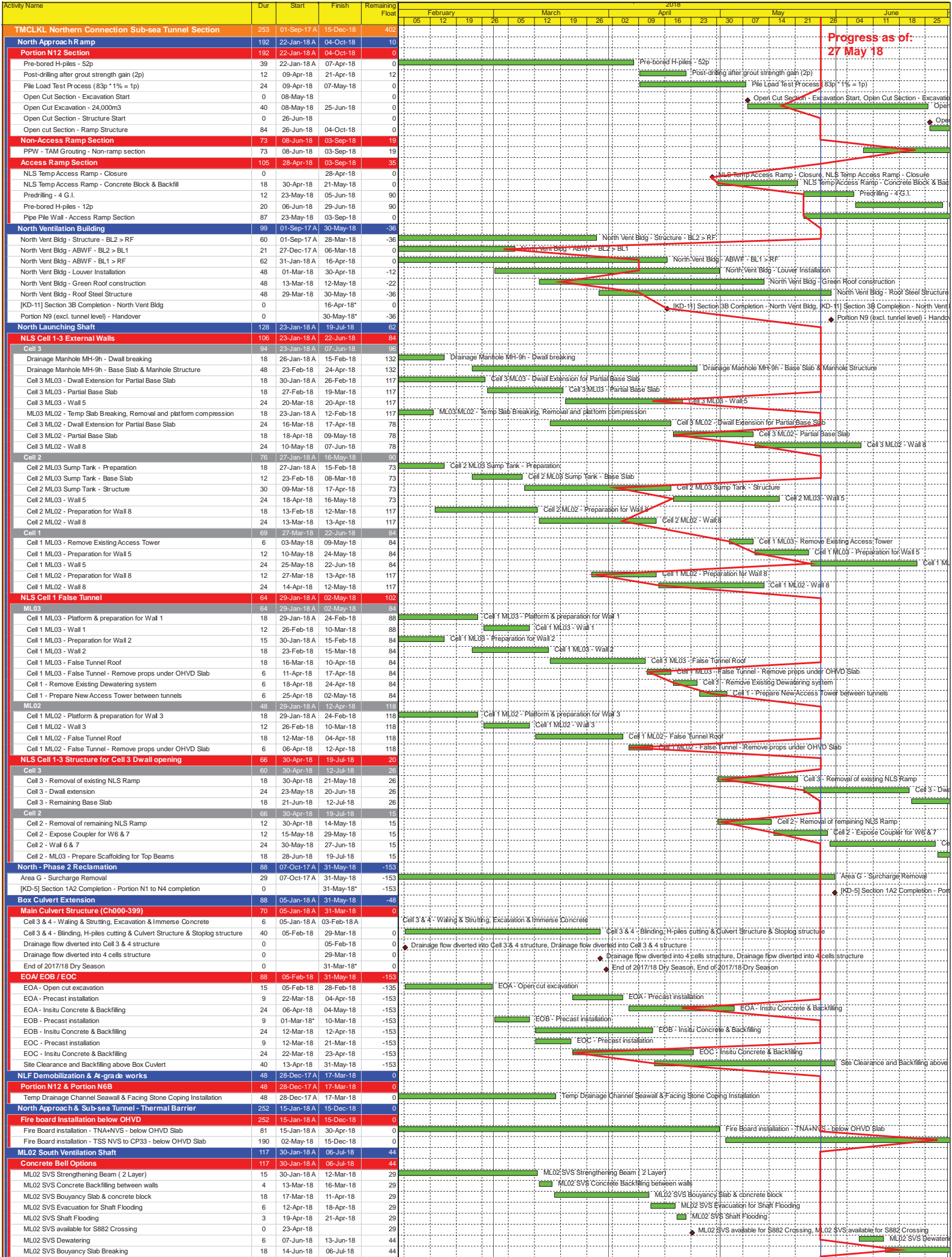
Project Organization for Environmental Works



↔ Line of Communication

Appendix B

Construction Programme



Progress as of:
27 May 18

Appendix C

Environmental Mitigation
and Enhancement Measure
Implementation Schedules

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

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
Air Quality									
4.8.1	3.8	An effective watering programme of twice daily watering with complete coverage, is estimated to reduce by 50%. This is recommended for all areas in order to reduce dust levels to a minimum;	All areas / throughout construction period	Contractor	TMEIA Avoid smoke impacts and disturbance		Y		✓
4.8.1	3.8	Watering of the construction sites in Lantau for 8 times/day and in Tuen Mun for 12 times/day to reduce dust emissions by 87.5% and 91.7% respectively and shall be undertaken.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	The Contractor shall, to the satisfaction of the Engineer, install effective dust suppression measures and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver, dust levels are kept to acceptable levels.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	The Contractor shall not burn debris or other materials on the works areas.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	In hot, dry or windy weather, the watering programme shall maintain all exposed road surfaces and dust sources wet.	All unpaved haul roads / throughout construction period in hot, dry or windy weather	Contractor	TMEIA Avoid smoke impacts and disturbance		Y		✓
4.8.1	3.8	Where breaking of oversize rock/concrete is required, watering shall be implemented to control dust. Water spray shall be used during the handling of fill material at the site and at active cuts, excavation and fill sites where dust is likely to be created.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	Open dropping heights for excavated materials shall be controlled to a maximum height of 2m to minimise the fugitive dust arising from unloading.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓
4.8.1	3.8	During transportation by truck, materials shall not be loaded to a level higher than the side and tail boards, and shall be dampened or covered before transport.	All areas / throughout construction period	Contractor	TMEIA Avoid dust generation		Y		✓

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						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									
<i>Marine Works (Sequence A)</i>									
6.1	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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						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	Annex A Figure 6.2b Appendix D6b	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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Northern Connection Sub-sea Tunnel Section
Environmental Mitigation and Enhancement Measure Implementation Schedule*

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						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		✓
<i>General Marine Works</i>									
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 conditions.		Y		✓

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						D	C	O	
6.1	-	Barges and hopper dredgers shall have tight fitting seals to their bottom openings to prevent leakage of material.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Any pipe leakages shall be repaired quickly. Plant should not be operated with leaking pipes.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Loading of barges and hoppers shall be controlled to prevent splashing of dredged material to the surrounding water. Barges or hoppers shall not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Excess material shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessel is moved.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		✓
6.1	-	Adequate freeboard shall be maintained on barges to reduce the likelihood of decks being washed by wave action;	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		N/A
6.1	-	All vessels shall be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash.	All areas/ throughout construction period	Contractor	Marine Fill Committee Guidelines. DASO permit conditions.		Y		N/A

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						D	C	O	
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		✓
<i>Land Works</i>									
6.1	-	Wastewater from temporary site facilities should be controlled to prevent direct discharge to surface or marine waters.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Sewage effluent and discharges from on- site kitchen facilities shall be directed to Government sewer in accordance with the requirements of the WPCO or collected for disposal offsite. The use of soakaways shall be avoided.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		<>
6.1	-	Silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically at the onset of and after each rainstorm.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓
6.1	-	Temporary access roads should be surfaced with crushed stone or gravel.	All areas/ throughout construction period	Contractor	TM-EIAO		Y		✓

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						D	C	O	
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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						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		✓
<i>Water Quality Monitoring</i>									
6.1	Section 5	Water quality monitoring shall be undertaken for suspended solids, turbidity, and dissolved oxygen. Nutrients and metal parameters shall also be measured for Mf sediment operations (only HKBCF and HKLR required handling of Mf sediment) during baseline, backfilling and post construction period. One year operation phase water quality monitoring at designated stations.	Designated monitoring stations as defined in EM&A Manual, Section 5/ Before, through-out marine construction period, post construction and monthly operational phase water quality monitoring for a year.	Contractor	EM&A Manual		Y	Y	N/A

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						D	C	O	
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		N/A
8.15	6.3, 6.5	Specification and deployment of an artificial reef of an area of 3,600m2 in an area where fishing activities are prohibited.	Area of prohibited fishing activities/Detailed Design/towards end of construction period	TM-CLKL/ HKBCF Design Consultant/TM-CLKL/ HKBCF Contractor	TMEIA	Y		Y	N/A. To be implemented by AFCD.
8.14	6.3, 6.5	Specification and implementation of marine vessel control specifications	All areas/Detailed Design/during construction works	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.14	6.3, 6.5	Design and implementation of acoustic decoupling methods for dredging and reclamation works	All areas/ Detailed Design/during dredging and reclamation works	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.15	6.3, 6.4	Pre-construction phase survey and coral translocation	Detailed Design/Prior to construction	Design Consultant/ Contractor	TMEIA	Y	Y		✓
8.15	6.5	Audit coral translocation success	Post translocation	Contractor	TMEIA		Y		✓
7.13	6.5	The loss of habitat shall be supplemented by enhancement planting in accordance with the landscape mitigation schedule.	All areas / As soon as accessible	Contractor	TMEIA		Y		N/A.
7.13	6.5	Spoil heaps shall be covered at all times.	All areas / Throughout construction period	Contractor	TMEIA		Y		✓
7.13	6.5	Avoid damage and disturbance to the remaining and surrounding natural habitat	All areas / Throughout construction period	Contractor	TMEIA		Y		✓
7.13	6.5	Placement of equipment in designated areas within the existing disturbed land	All areas / Throughout construction period	Contractor	TMEIA		Y		✓

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						D	C	O	
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									
12.6		The Contractor shall identify a coordinator for the management of waste.	Contract mobilisation	Contractor	TMEIA		Y		✓

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						D	C	O	
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		✓
12.6	8.1	The site and surroundings shall be kept tidy and litter free.	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

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

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

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

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

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
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: <i>f</i> suitable for the substance to be held, resistant to corrosion, maintained in good conditions and securely closed; <i>f</i> Having a capacity of <450L unless the specifications have been approved by the EPD; and <i>f</i> Displaying a label in English and Chinese according to the instructions prescribed in Schedule 2 of the Regulations. <i>f</i> Clearly labelled and used solely for the storage of chemical wastes; <i>f</i> Enclosed with at least 3 sides; <i>f</i> 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; <i>f</i> Adequate ventilation; <i>f</i> Sufficiently covered to prevent rainfall	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

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

EIA Reference	EM&A Manual Reference	Environmental Protection Measures	Location/Timing	Implementation Agent	Relevant Standard or Requirement	Implementation Stages			Status *
						D	C	O	
		entering (water collected within the bund must be tested and disposed of as chemical waste, if necessary); and f 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

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

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

Summary of Action and Limit Levels

Table D1 Action and Limit Levels for 1-hour and 24-hour TSP

Parameters	Action	Limit
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	ASR1 = 213 ASR5 = 238 AQMS1 = 213 ASR6 = 238 ASR10 = 214	260
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	ASR1 = 331 ASR5 = 340 AQMS1 = 335 ASR6 = 338 ASR10 = 337	500

Table D2 Action and Limit Levels for Water Quality

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

Notes:

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

- (a) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (b) "Depth-averaged" is calculated by taking the arithmetic means of reading of all three depths
- (c) For turbidity and SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
- (d) All figures given in the table are used for reference only, and EPD may amend the figures whenever it is considered as necessary
- (e) The 1%-ile of baseline data for surface and middle DO is 4.2 mg/L, whilst for bottom DO is 3.6 mg/L.

Table D3 *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 D4 *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 E

EM&A Monitoring Schedules

**HY/2012/08 - Tuen Mun - Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Air Quality Impact Monitoring Schedule - March 2018**

Air quality monitoring stations: ASR1, ASR5, ASR6, ASR10, AQMS1

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1-Mar	2-Mar	3-Mar
					1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM	
4-Mar	5-Mar	6-Mar	7-Mar	8-Mar	9-Mar	10-Mar
	1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM		
11-Mar	12-Mar	13-Mar	14-Mar	15-Mar	16-Mar	17-Mar
1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM
18-Mar	19-Mar	20-Mar	21-Mar	22-Mar	23-Mar	24-Mar
		1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM	
25-Mar	26-Mar	27-Mar	28-Mar	29-Mar	30-Mar	31-Mar
	1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM		

**HY/2012/08 - Tuen Mun - Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Air Quality Impact Monitoring Schedule - April 2018**

Air quality monitoring stations: ASR1, ASR5, ASR6, ASR10, AQMS1

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1-Apr	Public Holiday 2-Apr	3-Apr	4-Apr	Public Holiday 5-Apr	6-Apr	7-Apr
1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM
8-Apr	9-Apr	10-Apr	11-Apr	12-Apr	13-Apr	14-Apr
		1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM	
15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	20-Apr	21-Apr
	1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM		
22-Apr	23-Apr	24-Apr	25-Apr	26-Apr	27-Apr	28-Apr
1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM
29-Apr	30-Apr					

**HY/2012/08 - Tuen Mun - Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Air Quality Impact Monitoring Schedule - May 2018**

Air quality monitoring stations: ASR1, ASR5, ASR6, ASR10, AQMS1

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		Public Holiday				
		1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM	
6-May	7-May	8-May	9-May	10-May	11-May	12-May
	1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM		
13-May	14-May	15-May	16-May	17-May	18-May	19-May
1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM
20-May	21-May	Public Holiday	23-May	24-May	25-May	26-May
		1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM	
27-May	28-May	29-May	30-May	31-May		
	1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM			1-hour TSP - 3 times 24-hour TSP - 1 time Impact AQM		

**HY/2012/08 - Tuen Mun - Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Impact Dolphin Monitoring Survey Monitoring Schedule - March 2018**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1-Mar	2-Mar	3-Mar
4-Mar	5-Mar	6-Mar	7-Mar	8-Mar	9-Mar	10-Mar
				Impact Dolphin Monitoring		
11-Mar	12-Mar	13-Mar	14-Mar	15-Mar	16-Mar	17-Mar
	Impact Dolphin Monitoring					
18-Mar	19-Mar	20-Mar	21-Mar	22-Mar	23-Mar	24-Mar
		Impact Dolphin Monitoring			Impact Dolphin Monitoring	
25-Mar	26-Mar	27-Mar	28-Mar	29-Mar	Public Holiday 30-Mar	Public Holiday 31-Mar

**HY/2012/08 - Tuen Mun - Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Impact Dolphin Monitoring Survey Monitoring Schedule - April 2018**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1-Apr	Public Holiday 2-Apr	3-Apr	4-Apr	Public Holiday 5-Apr	6-Apr	7-Apr
8-Apr	9-Apr	10-Apr	11-Apr	12-Apr	13-Apr	14-Apr
		Impact Dolphin Monitoring				
15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	20-Apr	21-Apr
		Impact Dolphin Monitoring		Impact Dolphin Monitoring		
22-Apr	23-Apr	24-Apr	25-Apr	26-Apr	27-Apr	28-Apr
			Impact Dolphin Monitoring			
29-Apr	30-Apr					

**HY/2012/08 - Tuen Mun - Chek Lap Kok Link
Northern Connection Sub-sea Tunnel Section
Impact Dolphin Monitoring Survey Monitoring Schedule - May 2018**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
		Public Holiday	1-May	2-May	3-May	4-May	5-May
6-May	7-May	8-May	9-May	10-May	11-May	12-May	
	Impact Dolphin Monitoring			Impact Dolphin Monitoring			
13-May	14-May	15-May	16-May	17-May	18-May	19-May	
			Impact Dolphin Monitoring				
20-May	21-May	Public Holiday	22-May	23-May	24-May	25-May	26-May
27-May	28-May	29-May	30-May	31-May			
			Impact Dolphin Monitoring				

Appendix F

Impact Air Quality Monitoring Results

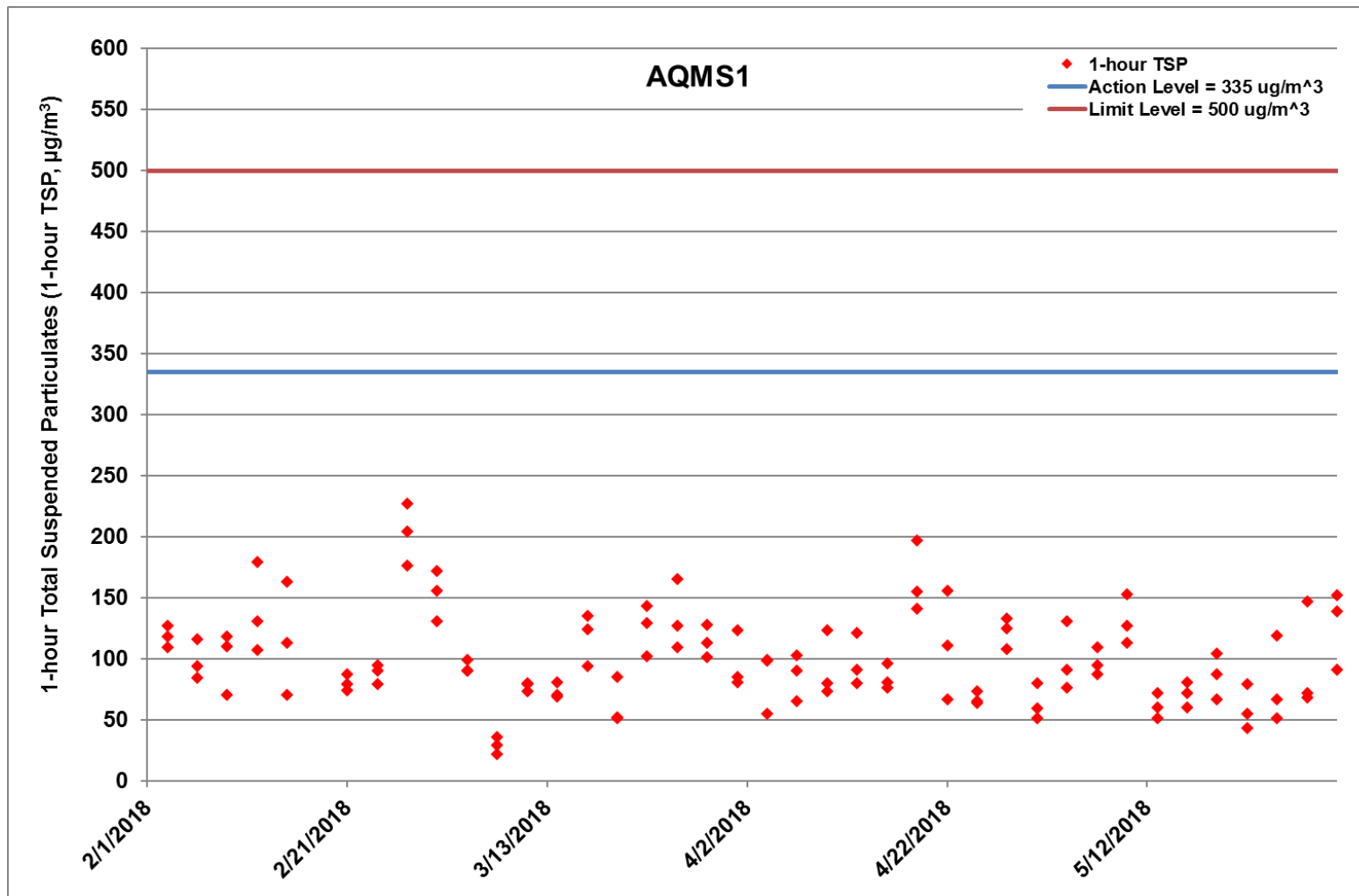


Figure G.1 Impact Monitoring – 1-hour Total Suspended Particulates (µg/m³) at AQMS1 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 – 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



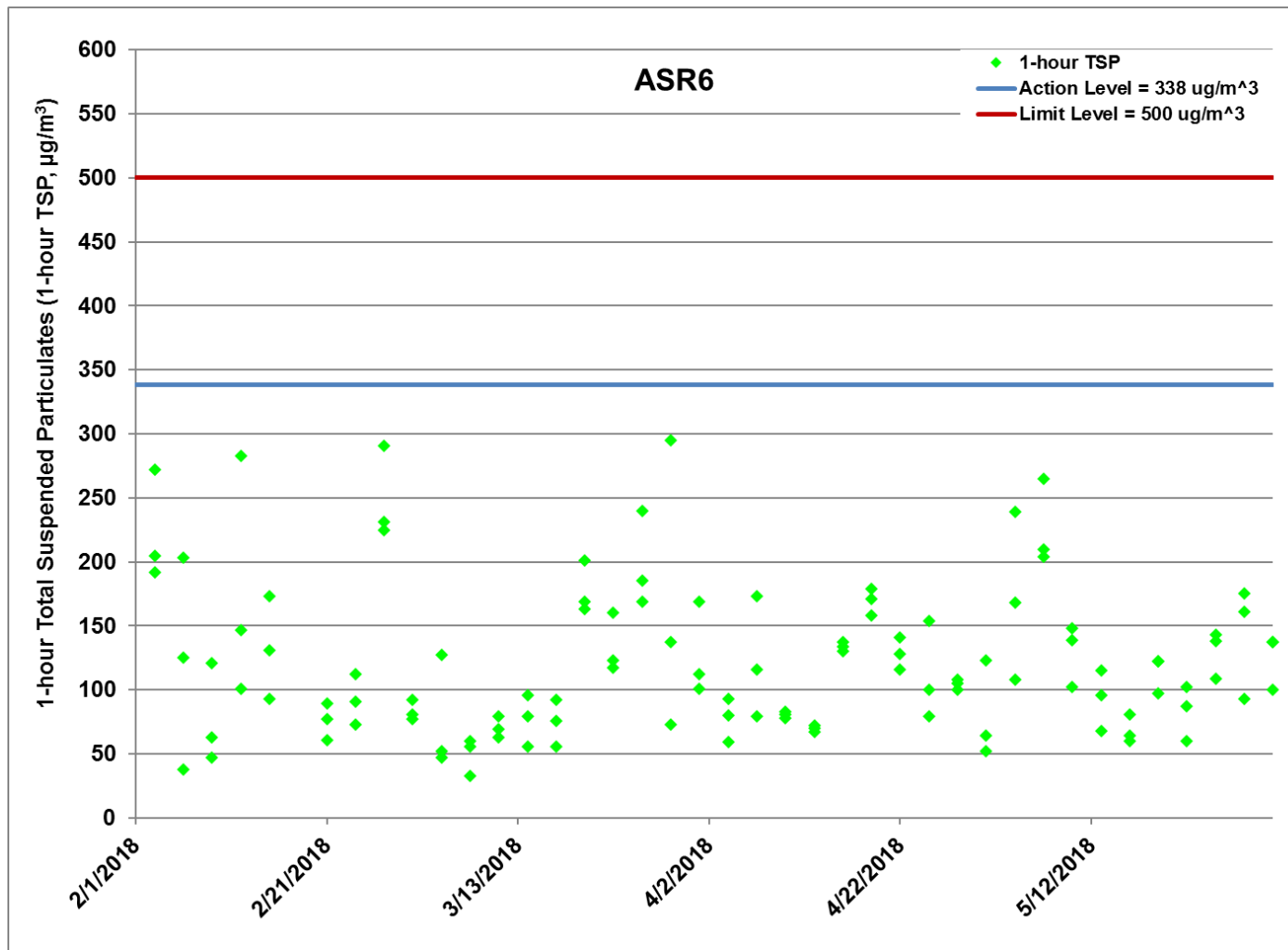


Figure G.2 Impact Monitoring – 1-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR6 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 – 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



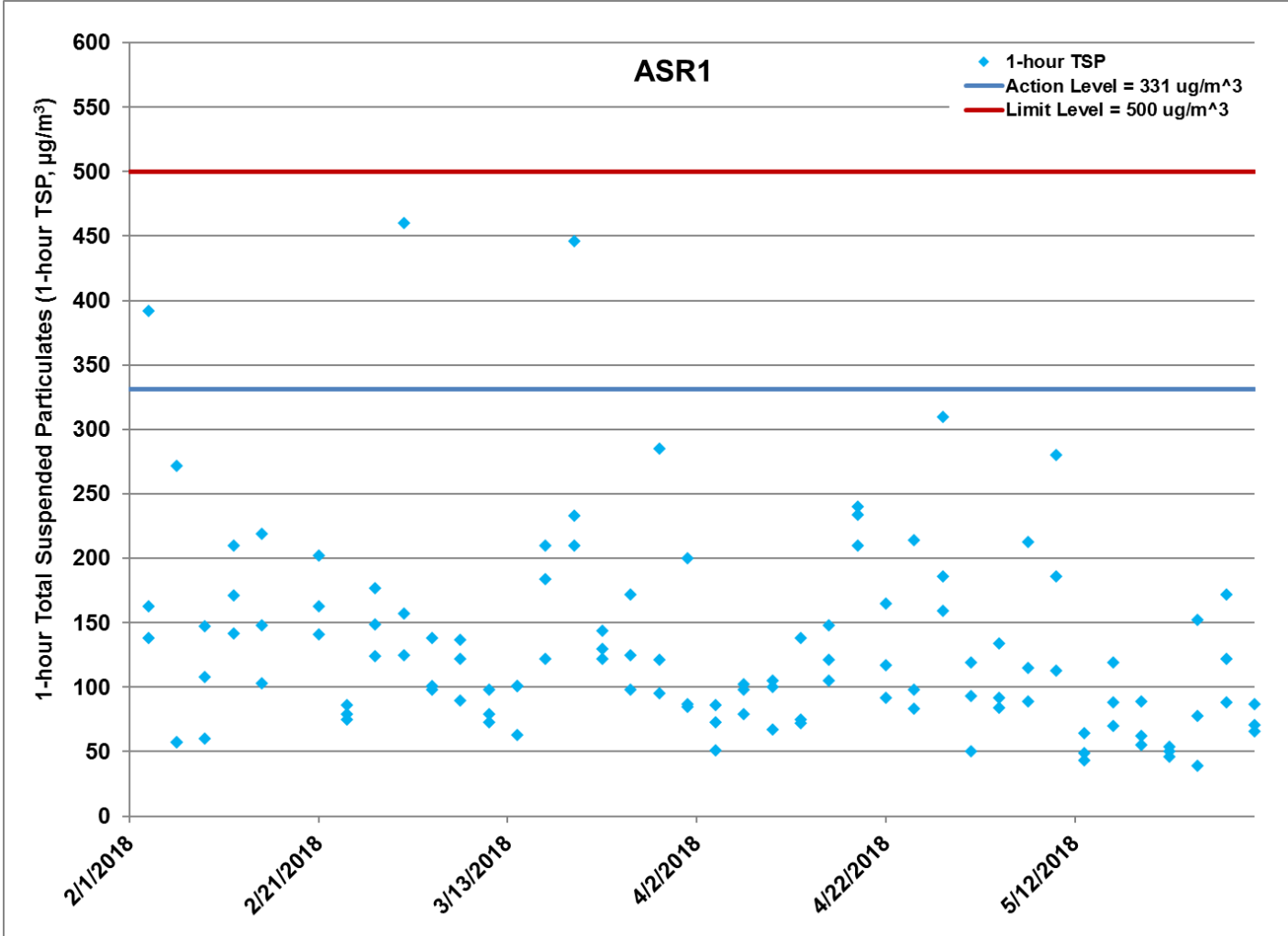


Figure G.3 Impact Monitoring – 1-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR1 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 – 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



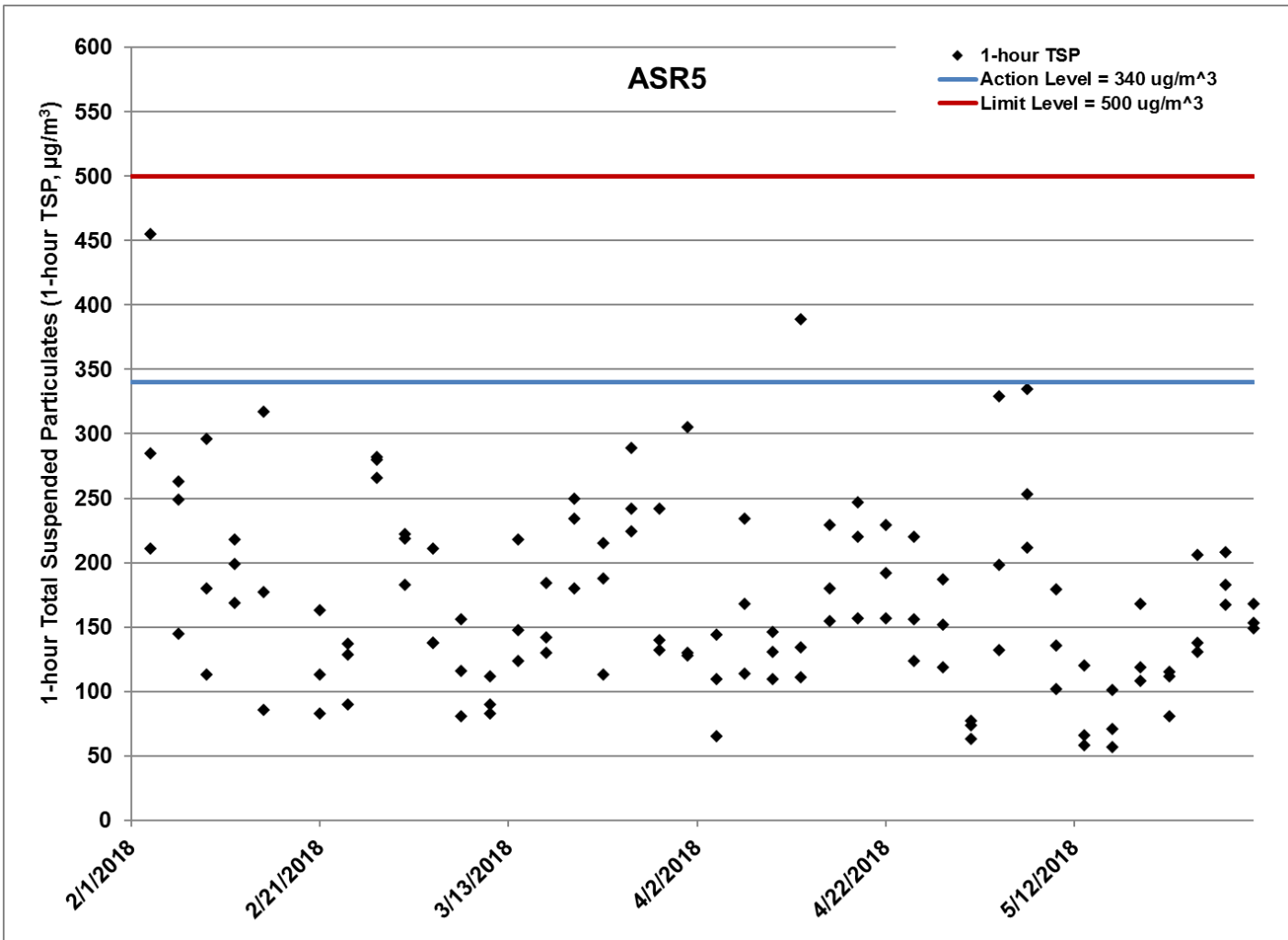


Figure G.4 Impact Monitoring - 1-hour Total Suspended Particulates (µg/m³) at ASR5 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 - 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



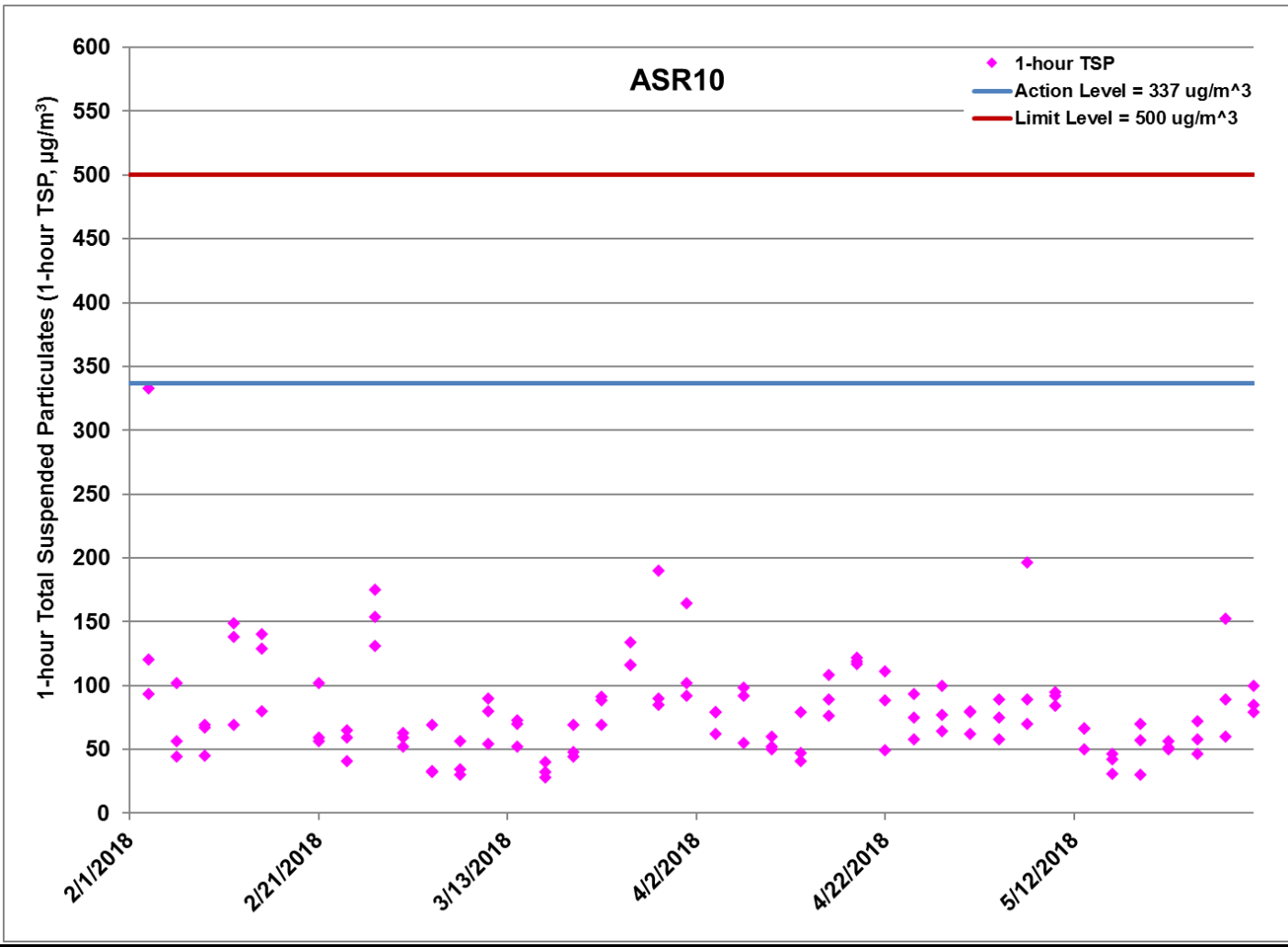


Figure G.5 Impact Monitoring – 1-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR10 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 – 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



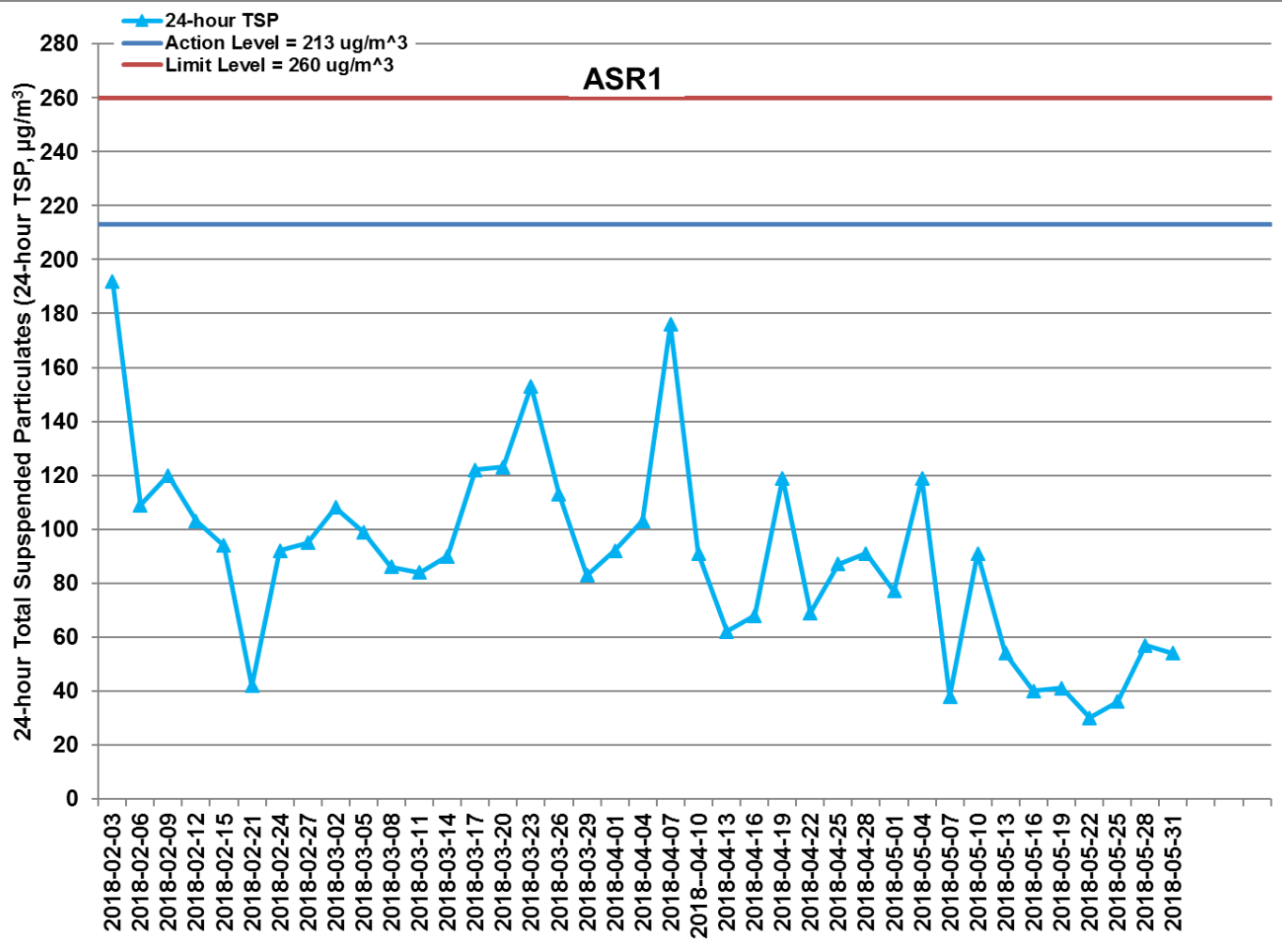


Figure G.6 Impact Monitoring - 24-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR1 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 - 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



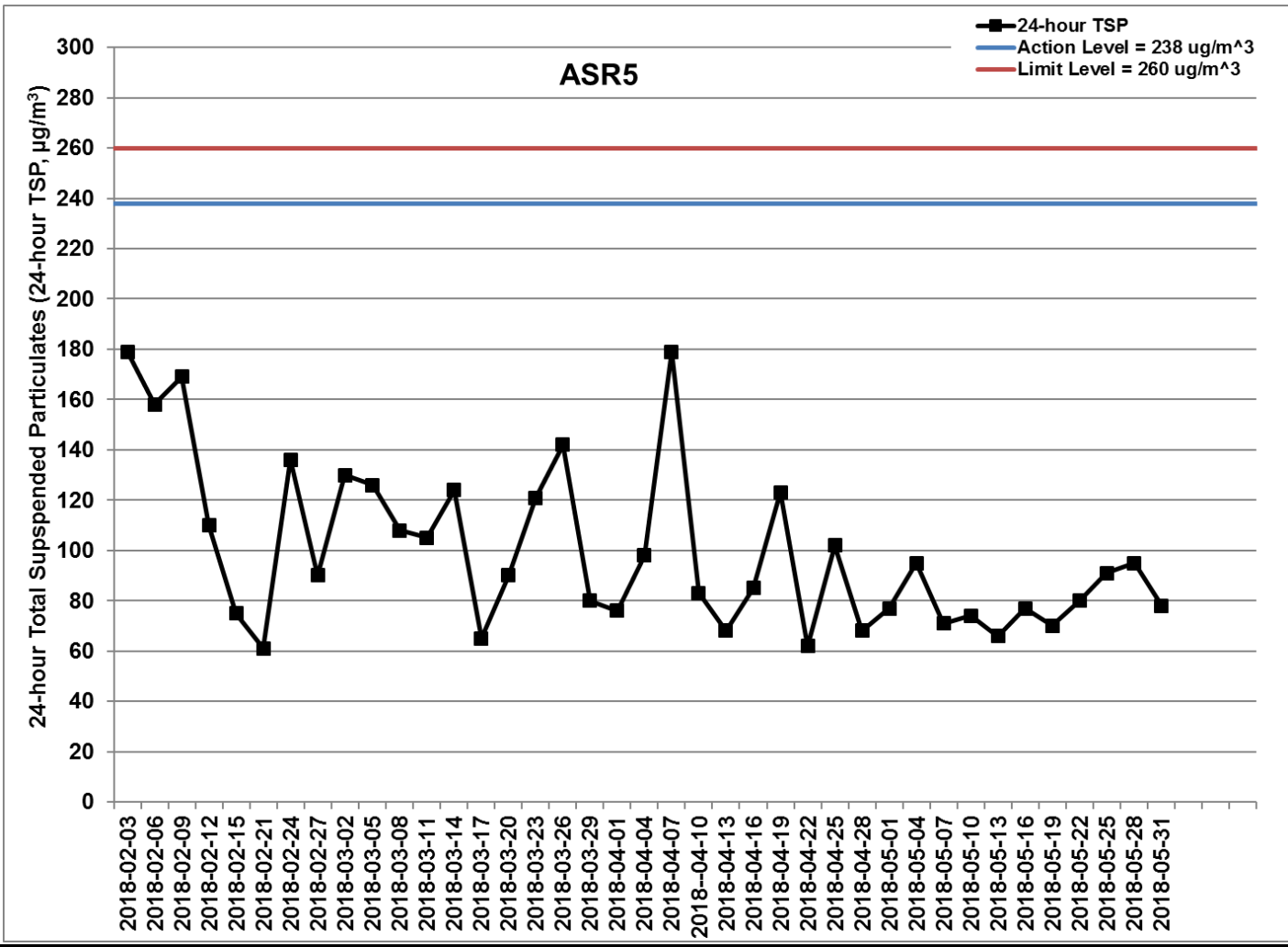


Figure G.7 Impact Monitoring - 24-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR5 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 - 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



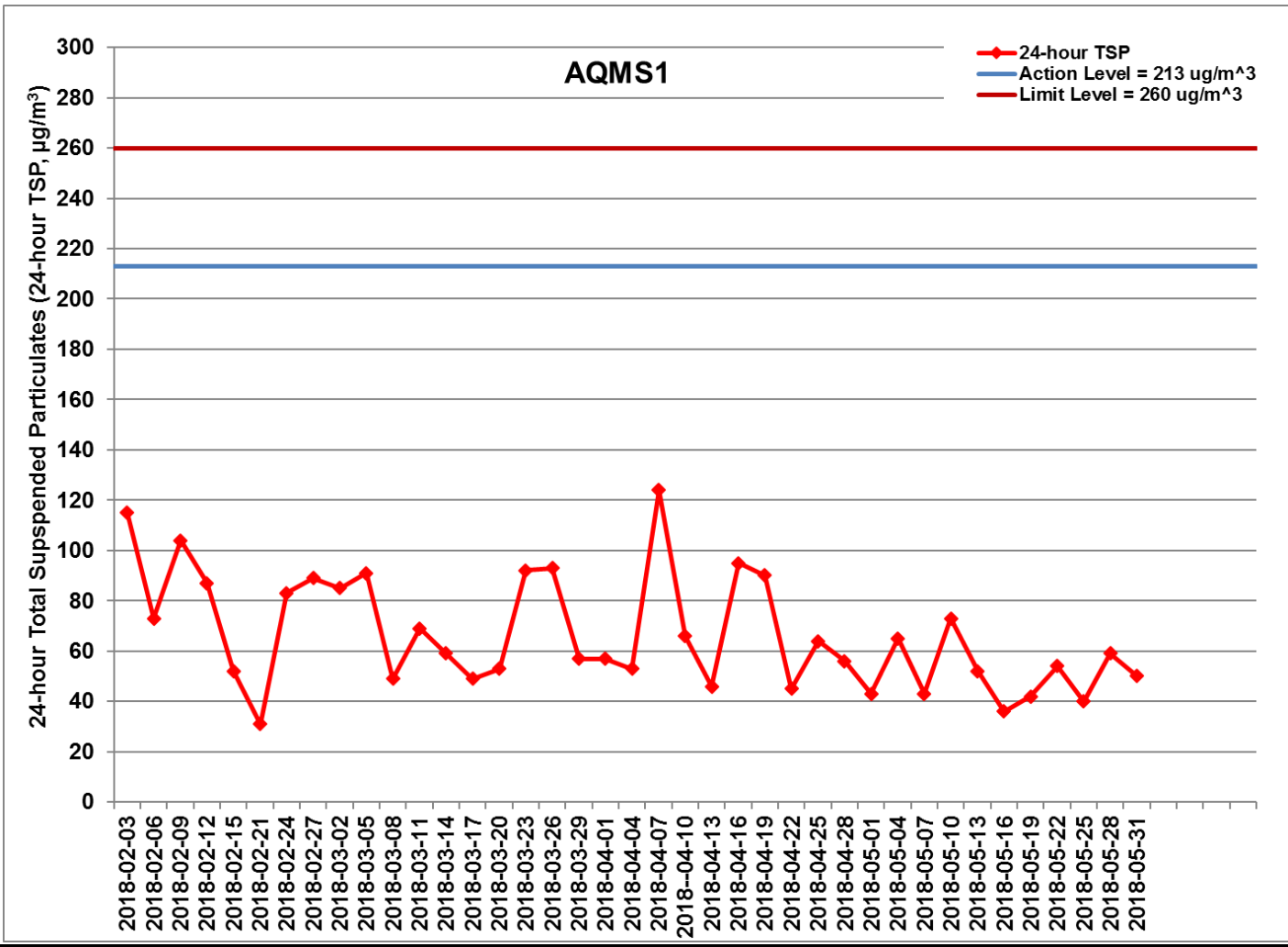


Figure G.8 Impact Monitoring - 24-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at AQMS1 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 - 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



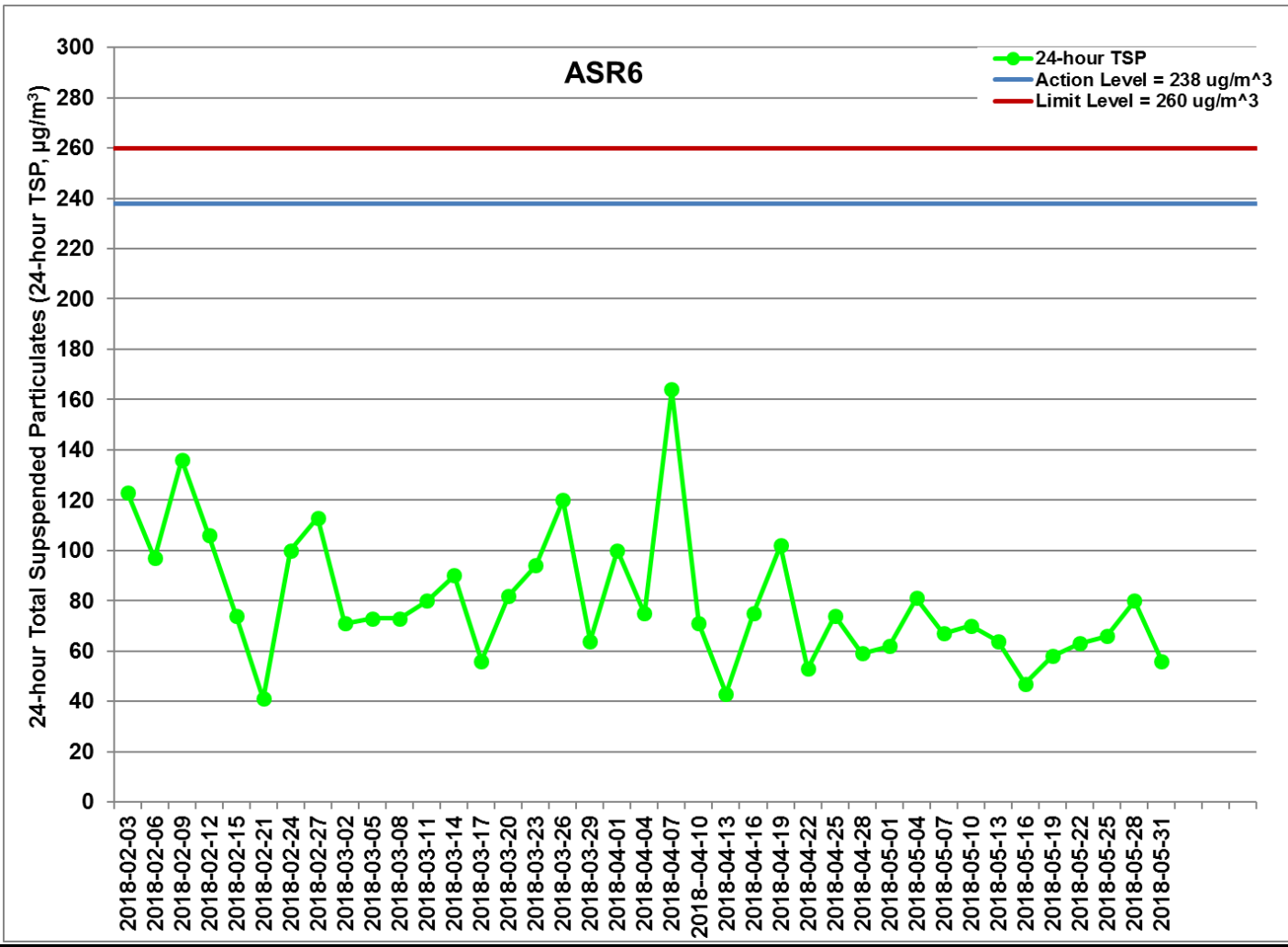


Figure G.9 Impact Monitoring - 24-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR6 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 - 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



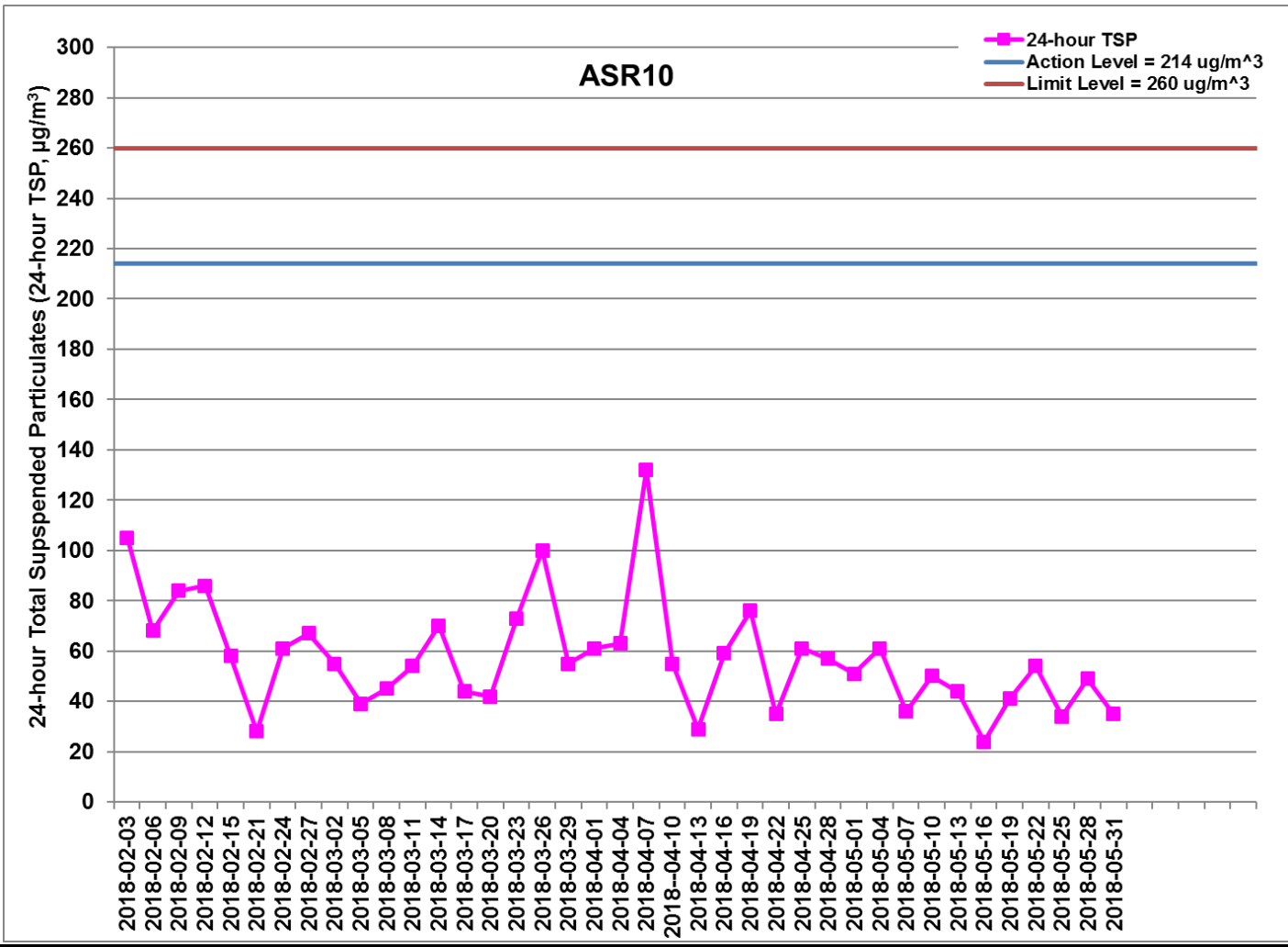


Figure G.10 Impact Monitoring - 24-hour Total Suspended Particulates ($\mu\text{g}/\text{m}^3$) at ASR10 between 1 February 2018 and 31 May 2018 during impact monitoring period. The weather conditions during the monitoring period varied from sunny to cloudy. Major land-based construction activities included: Box Culvert Extension, Construction of North Ventilation Building (1/2/2018 - 31/5/2018)

Ref: 0212330_Impact AQM graphs_May 2018_REV a.xlsx



Appendix G

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)
Dolphin Quarterly Monitoring**

18th Quarterly Progress Report (March-May 2018)

submitted to Dragages – Bouygues Joint Venture & ERM Hong Kong Ltd.

Submitted by

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

August 24, 2018

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 18th quarterly 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 March to May 2018, utilizing the survey data collected by HKLR03 impact phase monitoring 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. The co-ordinates of all transect lines 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	816506 819480
1	End Point	804671	831404		13	End Point	816506 824859
2	Start Point	805476	820800		14	Start Point	817537 820220
2	End Point	805476	826654		14	End Point	817537 824613
3	Start Point	806464	821150		15	Start Point	818568 820735
3	End Point	806464	822911		15	End Point	818568 824433
4	Start Point	807518	821500		16	Start Point	819532 821420
4	End Point	807518	829230		16	End Point	819532 824209
5	Start Point	808504	821850		17	Start Point	820451 822125
5	End Point	808504	828602		17	End Point	820451 823671
6	Start Point	809490	822150		18	Start Point	821504 822371
6	End Point	809490	825352		18	End Point	821504 823761
7	Start Point	810499	822000		19	Start Point	822513 823268
7	End Point	810499	824613		19	End Point	822513 824321

8	Start Point	811508	821123		20	Start Point	823477	823402
8	End Point	811508	824254		20	End Point	823477	824613
9	Start Point	812516	821303		21	Start Point	805476	827081
9	End Point	812516	824254		21	End Point	805476	830562
10	Start Point	813525	821176		22	Start Point	806464	824033
10	End Point	813525	824657		22	End Point	806464	829598
11	Start Point	814556	818853		23	Start Point	814559	821739
11	End Point	814556	820992		23	End Point	814559	824768
12	Start Point	815542	818807		24	Start Point	805476	815900
12	End Point	815542	824882		24	End Point	805476	819100

- 2.1.2. The HKLR03 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 2017). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.
- 2.1.3. Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). 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 (*Garmin eTrex Legend*).
- 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* 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. Distribution Analysis – 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.

2.3.2. 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 collect under Beaufort 3 or below condition would be used for the encounter rate analyses. Dolphin encounter rates were calculated in two ways for comparisons with the HZMB baseline monitoring results as well as to AFCD long-term marine mammal monitoring results.

Firstly, for the comparison with the HZMB baseline 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 six events during the present quarter (i.e. six sets of line-transect surveys in North Lantau), which was also compared with the one deduced from the six events during the baseline period (i.e. six sets of line-transect surveys in North Lantau).

Secondly, the encounter rates were calculated using both primary and secondary survey effort collected under Beaufort 3 or below condition as in AFCD long-term monitoring study. The encounter rate of sightings and dolphins were deduced by dividing the total number of on-effort sightings (STG) and total number of dolphins (ANI) by the amount of survey effort for the present quarterly period.

2.3.3. Quantitative grid analysis on habitat use – 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-km² grids among NWL and NEL survey areas on GIS. Sighting densities (number of on-effort sightings per km²) and dolphin densities (total number of dolphins from on-effort sightings per km²) were then calculated for each 1 km by 1 km grid with the aid of GIS. 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).

The newly-derived unit for sighting density was termed SPSE, representing the number of on-effort sightings per 100 units of survey effort. In addition, the derived unit for actual dolphin density was termed DPSE, representing the number of dolphins per 100 units of survey effort. Among the 1-km² 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-km² grid within the study area:

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

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

- 2.3.4. Behavioural analysis – 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. Distribution of sightings 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.
- 2.3.5. Ranging pattern analysis – Location data of individual dolphins that occurred during the 3-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 period of March to May 2018, six 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 791.83 km of survey effort was collected, with 89.8% 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, 290.90 km and 500.93 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 576.61 km, while the effort on secondary lines was 215.22 km. Survey effort conducted on both primary and secondary lines were considered as on-effort survey data. A summary table of the survey effort is shown in Appendix I.
- 3.1.4. During the six sets of HKLR03 monitoring surveys from March to May 2018, nine groups of 30 Chinese White Dolphins were sighted. All dolphin sightings were made during

on-effort search in this quarter, and eight of the nine on-effort dolphin sightings were made on primary lines. A summary table of dolphin sightings is shown in Appendix II.

3.1.5. In this quarterly period, all dolphin groups were sighted in NWL, while no dolphin was sighted at all in NEL. In fact, since August 2014, only two sightings of two lone dolphins were made respectively in NEL during HKLR03 monitoring surveys.

3.2. *Distribution*

3.2.1. Distribution of dolphin sightings made during the HKLR03 monitoring surveys from March to May 2018 is shown in Figure 1. The majority of sightings were made at the western end of the North Lantau region, with slightly higher concentration of sightings near Lung Kwu Chau (Figure 1). Several sightings were also made near Black Point as well as a few kilometres to the west of Sha Chau (Figure 1). As consistently recorded in previous monitoring quarters, the dolphins were completely absent from the central and eastern portions of North Lantau waters (Figure 1).

3.2.2. All dolphin sightings were located far away from the alignments of TM-CLKL and HKLR09, as well as the HKBCF and HKLR03 reclamation sites (Figure 1).

3.2.3. Sighting distribution of dolphins during the present impact phase monitoring period (March-May 2018) was drastically different from the one during the baseline monitoring period (Figure 1). In the present quarter, dolphins have disappeared from the NEL region, which was in stark contrast to their frequent occurrence around the Brothers Islands, near Shum Shui Kok and in the vicinity of HKBCF reclamation site during the baseline period (Figure 1). The nearly complete abandonment of NEL region by the dolphins has been consistently recorded in the past 20 quarters of HKLR03 monitoring, which has resulted in zero to extremely low dolphin encounter rates in this area.

3.2.4. In NWL survey area, dolphin occurrence was also significantly different between the baseline and impact phase periods. During the present impact monitoring period, dolphins were less frequently sighted there, and mainly at the western end of the area, which was in contrary to their frequent occurrences throughout the area during the baseline period (Figure 1).

3.2.5. Another comparison in dolphin distribution was made between the six quarterly periods of spring months in 2013-18 (Figure 2). Among the six spring periods, dolphins were sighted regularly in NWL waters in 2013 and 2014, but their usage there was dramatically reduced in the four subsequent spring periods, with their only occurrences mostly concentrated at the western end of the survey area (Figure 2).

3.3. *Encounter rate*

3.3.1. During the present quarterly period, the encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data from the primary transect lines under favourable conditions (Beaufort 3 or below) for each set of the HKLR03 surveys in NEL and NWL are shown in Table 2. The average encounter rates deduced from the six sets of HKLR03 surveys were also compared with the ones deduced from the baseline monitoring period (September-November 2011) (Table 3).

Table 2. Dolphin encounter rates (sightings per 100 km of survey effort) during March-May 2018

SURVEY AREA	DOLPHIN MONITORING DATES	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)
		Primary Lines Only	Primary Lines Only
Northeast Lantau	Set 1 (8 & 12 Mar 2018)	0.00	0.00
	Set 2 (20 & 23 Mar 2018)	0.00	0.00
	Set 3 (10 & 17 Apr 2018)	0.00	0.00
	Set 4 (19 & 25 Apr 2018)	0.00	0.00
	Set 5 (7 & 10 May 2018)	0.00	0.00
	Set 6 (16 & 30 May 2018)	0.00	0.00
Northwest Lantau	Set 1 (8 & 12 Mar 2018)	1.73	5.19
	Set 2 (20 & 23 Mar 2018)	12.32	56.69
	Set 3 (10 & 17 Apr 2018)	0.00	0.00
	Set 4 (19 & 25 Apr 2018)	3.24	4.87
	Set 5 (7 & 10 May 2018)	0.00	0.00
	Set 6 (16 & 30 May 2018)	0.00	0.00

Table 3. Comparison of average dolphin encounter rates from impact monitoring period (March – May 2018) and baseline monitoring period (September – November 2011) (Note: encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions; \pm 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)	
	March – May 2018	September – November 2011	March – May 2018	September – November 2011
Northeast Lantau	0.0	6.00 \pm 5.05	0.0	22.19 \pm 26.81
Northwest Lantau	2.88 \pm 4.81	9.85 \pm 5.85	11.12 \pm 22.46	44.66 \pm 29.85

3.3.2. To facilitate the comparison with the AFCD long-term monitoring results, the encounter rates were also calculated for the present quarter using both primary and secondary survey effort. The encounter rates of sightings (STG) and dolphins (ANI) in NWL were 2.1 sightings and 7.1 dolphins per 100 km of survey effort respectively, while the encounter rates of sightings (STG) and dolphins (ANI) in NEL were both nil for this quarter.

3.3.3 In NEL, the average dolphin encounter rates (both STG and ANI) in the present three-month impact monitoring period were both zero with no on-effort sighting being made, and such extremely low occurrence of dolphins in NEL have been consistently recorded in the past 20 quarters of HKLR03 monitoring (Table 4). This is a serious

concern as the dolphin occurrence in NEL in the past few years (0.0-1.0 for ER(STG) and 0.0-3.9 for ER(ANI)) have remained exceptionally low when compared to the baseline period (Table 4). Dolphins have been virtually absent from NEL waters since January 2014, with only three groups of six dolphins sighted there since then despite consistent and intensive survey effort being conducted in this survey area.

Table 4. Comparison of average dolphin encounter rates in Northeast Lantau survey area from all quarters of HKLR03 impact monitoring period and baseline monitoring period (September-November 2011) (Note: encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions; the encounter rates in **spring** months were highlighted in **blue**; \pm 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)
September-November 2011 (Baseline)	6.00 \pm 5.05	22.19 \pm 26.81
December 2012-February 2013 (Impact)	3.14 \pm 3.21	6.33 \pm 8.64
March-May 2013 (Impact)	0.42 \pm 1.03	0.42 \pm 1.03
June-August 2013 (Impact)	0.88 \pm 1.36	3.91 \pm 8.36
September-November 2013 (Impact)	1.01 \pm 1.59	3.77 \pm 6.49
December 2013-February 2014 (Impact)	0.45 \pm 1.10	1.34 \pm 3.29
March-May 2014 (Impact)	0.00	0.00
June-August 2014 (Impact)	0.42 \pm 1.04	1.69 \pm 4.15
September-November 2014 (Impact)	0.00	0.00
December 2014-February 2015 (Impact)	0.00	0.00
March-May 2015 (Impact)	0.00	0.00
June-August 2015 (Impact)	0.44 \pm 1.08	0.44 \pm 1.08
September-November 2015 (Impact)	0.00	0.00
December 2015-February 2016 (Impact)	0.00	0.00
March-May 2016 (Impact)	0.00	0.00
June-August 2016 (Impact)	0.00	0.00
September-November 2016 (Impact)	0.00	0.00
December 2016-February 2017 (Impact)	0.00	0.00
March-May 2017 (Impact)	0.00	0.00
June-August 2017 (Impact)	0.00	0.00
September-November 2017 (Impact)	0.00	0.00
December 2017-February 2018 (Impact)	0.00	0.00
March-May 2018 (Impact)	0.00	0.00

3.3.4. On the other hand, the average dolphin encounter rates (STG and ANI) in NWL during the present impact phase monitoring period (reductions of 70.8% and 75.1% respectively) were only small fractions of the ones recorded during the three-month baseline period, indicating a dramatic decline in dolphin usage of this survey area as well during the present impact phase period (Table 5).

Table 5. Comparison of average dolphin encounter rates in Northwest Lantau survey area from all quarters of HKLR03 impact monitoring period and baseline monitoring period (September-November 2011) (Note: encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions; the encounter rates in **spring** months were highlighted in **blue**; \pm 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)
September-November 2011 (Baseline)	9.85 \pm 5.85	44.66 \pm 29.85
December 2012-February 2013 (Impact)	8.36 \pm 5.03	35.90 \pm 23.10
March-May 2013 (Impact)	7.75 \pm 3.96	24.23 \pm 18.05
June-August 2013 (Impact)	6.56 \pm 3.68	27.00 \pm 18.71
September-November 2013 (Impact)	8.04 \pm 1.10	32.48 \pm 26.51
December 2013-February 2014 (Impact)	8.21 \pm 2.21	32.58 \pm 11.21
March-May 2014 (Impact)	6.51 \pm 3.34	19.14 \pm 7.19
June-August 2014 (Impact)	4.74 \pm 3.84	17.52 \pm 15.12
September-November 2014 (Impact)	5.10 \pm 4.40	20.52 \pm 15.10
December 2014-February 2015 (Impact)	2.91 \pm 2.69	11.27 \pm 15.19
March-May 2015 (Impact)	0.47 \pm 0.73	2.36 \pm 4.07
June-August 2015 (Impact)	2.53 \pm 3.20	9.21 \pm 11.57
September-November 2015 (Impact)	3.94 \pm 1.57	21.05 \pm 17.19
December 2015-February 2016 (Impact)	2.64 \pm 1.52	10.98 \pm 3.81
March-May 2016 (Impact)	0.98 \pm 1.10	4.78 \pm 6.85
June-August 2016 (Impact)	1.72 \pm 2.17	7.48 \pm 10.98
September-November 2016 (Impact)	2.86 \pm 1.98	10.89 \pm 10.98
December 2016-February 2017 (Impact)	3.80 \pm 3.79	14.52 \pm 17.21
March-May 2017 (Impact)	0.93 \pm 1.03	5.25 \pm 9.53
June-August 2017 (Impact)	2.20 \pm 2.88	6.58 \pm 8.12
September-November 2017 (Impact)	3.12 \pm 1.91	10.35 \pm 9.66
December 2017-February 2018 (Impact)	4.75 \pm 2.26	15.73 \pm 15.94
March-May 2018 (Impact)	2.88 \pm 4.81	11.12 \pm 22.46

- 3.3.5. However, it is noted that when the quarterly periods were compared among all spring months, the one in 2018 was much higher than the ones in the previous three years of 2015-17, even though it was still lower than the ones in 2013 and 2014. There appeared to be a rebound in dolphin occurrence in NWL waters during the spring months in 2018 from the previous several years, and it remained to be seen whether such rebound would be persistent in upcoming spring quarters and other quarters throughout the year. Such temporal trend should be closely monitored in the upcoming monitoring quarters as the construction activities of HZMB works continue to diminish in coming months.
- 3.3.6 A two-way ANOVA with repeated measures and unequal sample size was conducted to examine whether there were any significant differences in the average encounter rates between the baseline and impact monitoring periods. The two variables that were examined included the two periods (baseline and impact phases) and two locations (NEL and NWL).
- 3.3.7. For the comparison between the baseline period and the present quarter (22nd quarter of the impact phase being assessed), the p-values for the differences in average dolphin encounter rates of STG and ANI were 0.0095 and 0.0390 respectively. If the alpha value is set at 0.05, significant differences were detected between the baseline and present quarters in both the average dolphin encounter rates of STG and ANI.
- 3.3.8. For the comparison between the baseline period and the cumulative quarters in impact phase (i.e. the first 22 quarters of the impact phase being assessed), the p-values for the differences in average dolphin encounter rates of STG and ANI were 0.000000 and 0.000000 respectively. Even if the alpha value is set at 0.00001, significant differences were still detected in both the average dolphin encounter rates of STG and ANI (i.e. between the two periods and the locations).
- 3.3.9. As indicated in both dolphin distribution patterns and encounter rates, dolphin usage has been significantly reduced in both NEL and NWL survey areas during the present quarterly period, and such low occurrence of dolphins has also been consistently documented in previous quarters of the past few years.
- 3.3.10. The dramatic decline in dolphin usage of North Lantau region raises serious concern, as the timing of the decline in dolphin usage in North Lantau waters coincided well with the construction schedule of the HZMB-related projects (Hung 2017). Apparently there was little sign of recovery of dolphin usage even though almost all marine works associated with the HZMB construction have been completed.
- 3.4. *Group size*
- 3.4.1. Group size of Chinese White Dolphins ranged from one to eight individuals per group in North Lantau region during March to May 2018. The average dolphin group sizes from these three months were compared with the ones deduced from the baseline period in September to November 2011, as shown in Table 6.

Table 6. Comparison of average dolphin group sizes from impact monitoring period (March – May 2018) and baseline monitoring period (September – November 2011) (Note: \pm denotes the standard deviation of the average group size)

	Average Dolphin Group Size	
	March – May 2018	September – November 2011
Overall	3.33 \pm 3.39 (n = 9)	3.72 \pm 3.13 (n = 66)
Northeast Lantau	---	3.18 \pm 2.16 (n = 17)
Northwest Lantau	3.33 \pm 3.39 (n = 9)	3.92 \pm 3.40 (n = 49)

- 3.4.2. The average dolphin group size in NWL waters during March to May 2018 was slightly lower than the one recorded during the three-month baseline period, but it should also be noted that the sample size of nine dolphin groups in the present quarter was very small when compared to the 66 groups sighted during the baseline period (Table 6).
- 3.4.3. Notably, with the exception of a large group of twelve animals, the other eight dolphin groups were composed of 1-4 individuals only (Appendix II).
- 3.4.4. Distribution of the lone larger dolphin group with 12 individuals during the present quarter is shown in Figure 3, with comparison to the one in baseline period. That large group was located at the western territorial border between Sha Chau and Lung Kwu Chau (Figure 3). Such distribution pattern was very different from the baseline period, when the larger dolphin groups were frequently sighted and evenly distributed in NWL waters, and a few were also sighted in NEL waters (Figure 3).
- 3.5. *Habitat use*
- 3.5.1. From March to May 2018, the grids that recorded moderately high to high dolphin densities were located to the northeast of Lung Kwu Chau and west of Sha Chau (Figures 4a and 4b). The rest of the grids that recorded dolphin occurrence were low in densities, and scattered near Lung Kwu Tan as well as at the mouth of Deep Bay (Figures 4a and 4b).
- 3.5.2. Notably, all grids near TMCLKL/HKLR09 alignments as well as HKLR03/HKBCF reclamation sites did not record any presence of dolphins at all during on-effort search in the present quarterly period (Figures 4a and 4b).
- 3.5.3. It should be emphasized that the amount of survey effort collected in each grid during the three-month period was fairly low (6-12 units of survey effort for most grids), and therefore the habitat use pattern derived from the three-month dataset should be treated with caution. A more complete picture of dolphin habitat use pattern should be examined when more survey effort for each grid is collected throughout the impact phase monitoring programme.
- 3.5.4. When compared with the habitat use patterns during the baseline period, dolphin usage in NEL and NWL has drastically diminished in both areas during the present impact monitoring period (Figure 5). During the baseline period, many grids between Siu Mo

To and Shum Shui Kok in NEL recorded moderately high to high dolphin densities, which was in stark contrast to the complete absence of dolphins there during the present impact phase period (Figure 5).

- 3.5.5. The density patterns were also drastically different in NWL between the baseline and impact phase monitoring periods, with high dolphin usage throughout the area, especially around Sha Chau, near Black Point, to the west of the airport, as well as between Pillar Point and the airport platform during the baseline period. In contrast, only several grids with moderately high to high dolphin densities were located within the Sha Chau and Lung Kwu Chau Marine Park during the present impact phase period (Figure 5).
- 3.6. *Mother-calf pairs*
- 3.6.1. During the present quarterly period, no young calf was sighted at all among the nine groups of dolphins.
- 3.7. *Activities and associations with fishing boats*
- 3.7.1. Only one of the nine dolphin groups was engaged in feeding activity, while no group was engaged in socializing, traveling or milling/resting activity during the three-month study period.
- 3.7.2. The percentage of sightings associated with feeding activity (11.1%) was very similar to the one recorded during the baseline period (11.6%). However, it should be noted the sample sizes on total numbers of dolphin sightings were very different between the two periods.
- 3.7.3. Distribution of dolphins engaged in various activities during the present three-month period and baseline period is shown in Figure 6. The only dolphin group engaged in feeding activity was sighted to the east of Lung Kwu Chau (Figure 6). When compared to the baseline period, distribution of various dolphin activities during the present impact phase monitoring period was drastically different with a much more restricted area of occurrences (Figure 6).
- 3.7.4. Notably, none of the dolphin groups was found to be associated with any operating fishing vessel during the present impact phase period.
- 3.8. *Summary of photo-identification works*
- 3.8.1. From March to May 2018, over 1,000 digital photographs of Chinese White Dolphins were taken during the impact phase monitoring surveys for the photo-identification work.
- 3.8.2. In total, 14 individuals sighted 16 times altogether were identified (see summary table in Appendix III and photographs of identified individuals in Appendix IV). All of these re-sightings were made in NWL. Only two individuals (NL182 and NL226) were re-sighted twice, while the rest were re-sighted only once during the three-month period (Appendix III).
- 3.8.3. Notably, five of these 14 individuals (i.e. CH34, NL136, NL182, NL261 and NL286) were also sighted in Northwest Lantau during the HKBCF monitoring surveys under the

same three-month period. Moreover, two individuals (NL269 and WL179) were also sighted in West Lantau waters during the HKLR09 monitoring surveys from March to May 2018, showing their extensive individual movements across different survey areas.

3.9. *Individual range use*

- 3.9.1. Ranging patterns of the 14 individuals identified during the three-month study period were determined by fixed kernel method, and are shown in Appendix V.
- 3.9.2. All identified dolphins sighted in the present quarter were utilizing NWL waters only, but have completely avoided NEL waters where many of them have utilized as their core areas in the past (Appendix V). This is in contrary to the extensive movements between NEL and NWL survey areas observed in the earlier impact monitoring quarters as well as the baseline period.
- 3.9.3. On the other hand, several individuals, including WL124, WL145 and WL179, have consistently utilized WL waters in the past, but have extended their range use to NWL during the present quarter.
- 3.9.4. In the upcoming quarters, individual range use and movements should be continuously monitored to examine whether there has been any consistent shifts of individual home ranges from North Lantau to West or Southwest Lantau and vice versa, as such shift could possibly be related to the HZMB-related construction works (see Hung 2017).

4. **Conclusion**

- 4.1. During this quarter of dolphin monitoring, no adverse impact from the activities of the TMCLKL construction project on Chinese White 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 significantly reduced in NEL, and many individuals have shifted away from the important habitat around the Brothers Islands.
- 4.3. It is critical to monitor the dolphin usage in North Lantau region in the upcoming quarters, to determine whether the dolphins are continuously affected by the various construction activities in relation to the HZMB-related works, and whether suitable mitigation measure can be applied to revert the situation.

5. **References**

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Oxford University Press, London.

- Hung, S. K. 2017. Monitoring of marine mammals in Hong Kong waters – data collection: final report (2016-17). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 162 pp.
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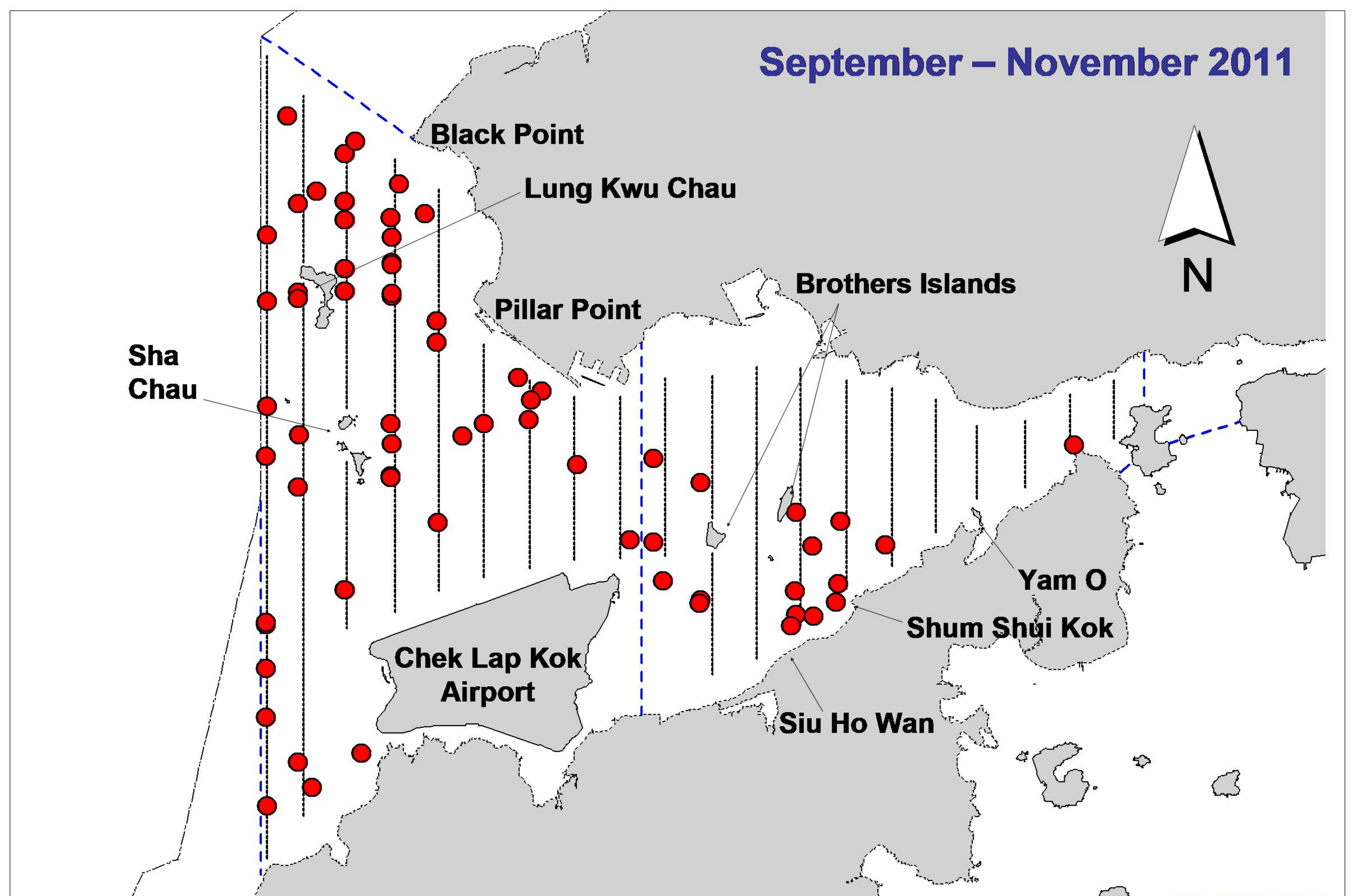
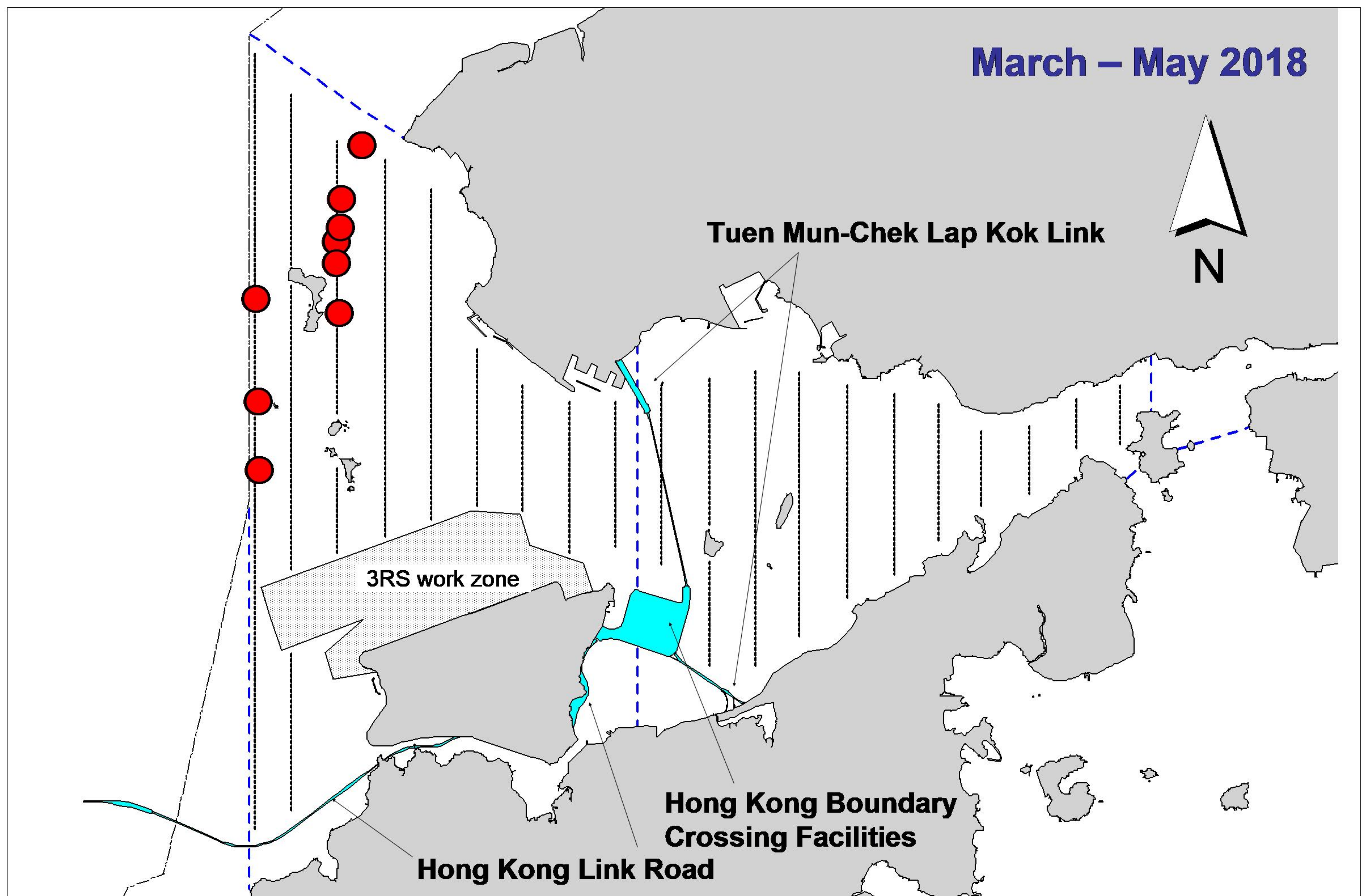


Figure 1. Distribution of Chinese white dolphin sighting in Northwest and Northeast Lantau during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

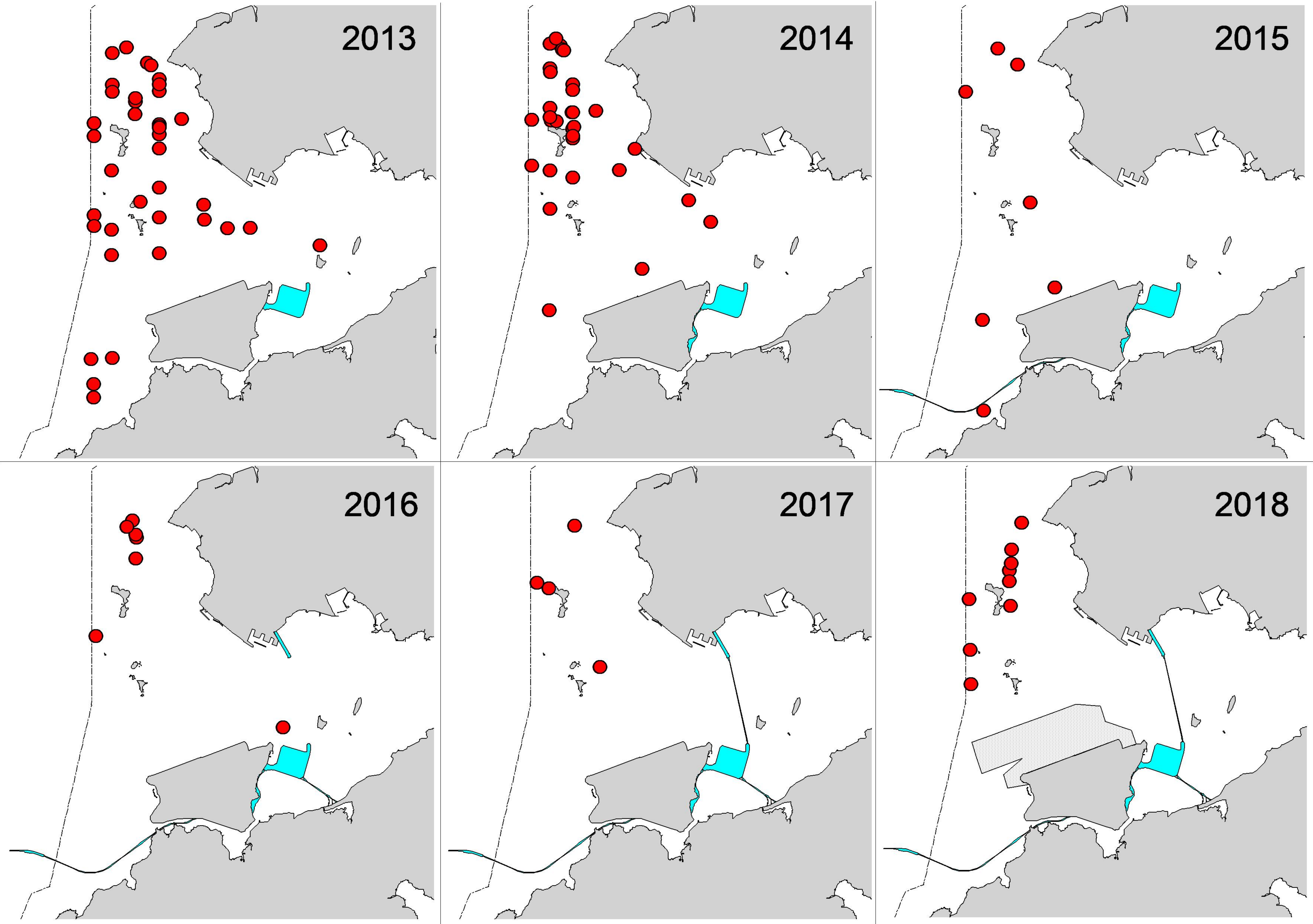


Figure 2. Distribution of Chinese white dolphin sightings in Northwest and Northeast Lantau during the past six spring quarters (March-May) of HKLR03 impact phase in 2013-18

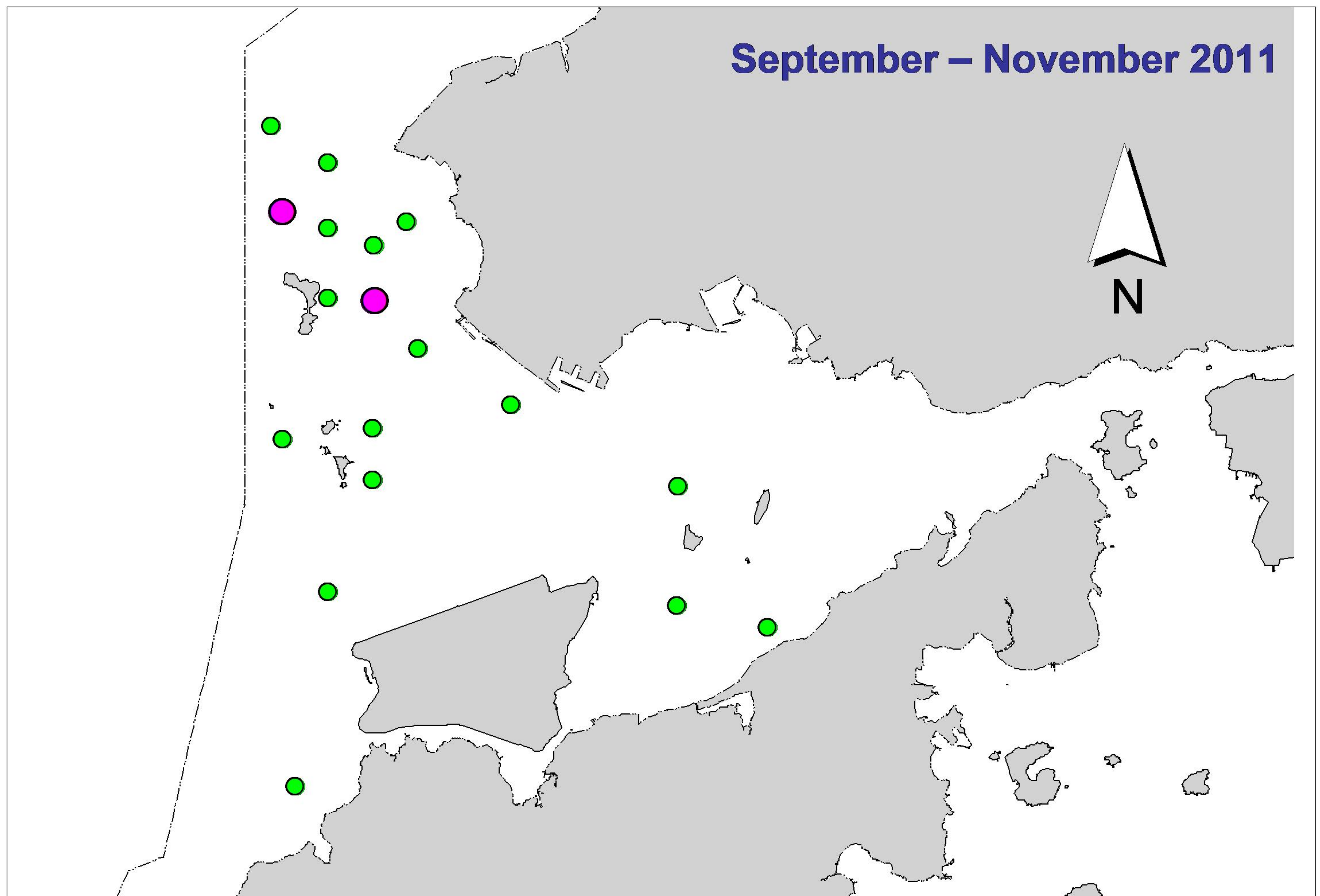
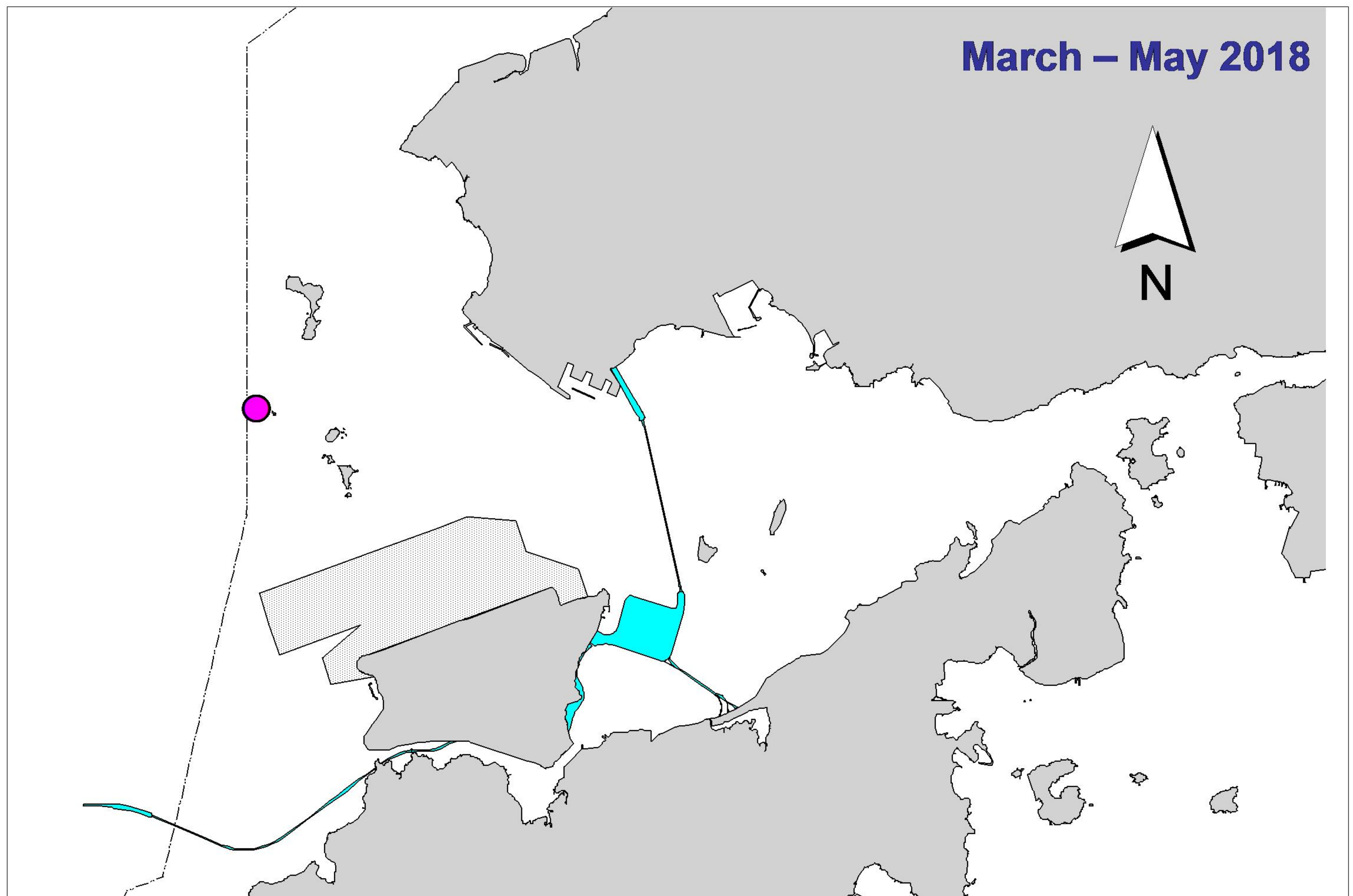


Figure 3. Distribution of Chinese white dolphins with larger group sizes during HKLR03 impact phase (top) and baseline monitoring surveys (bottom) (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more)

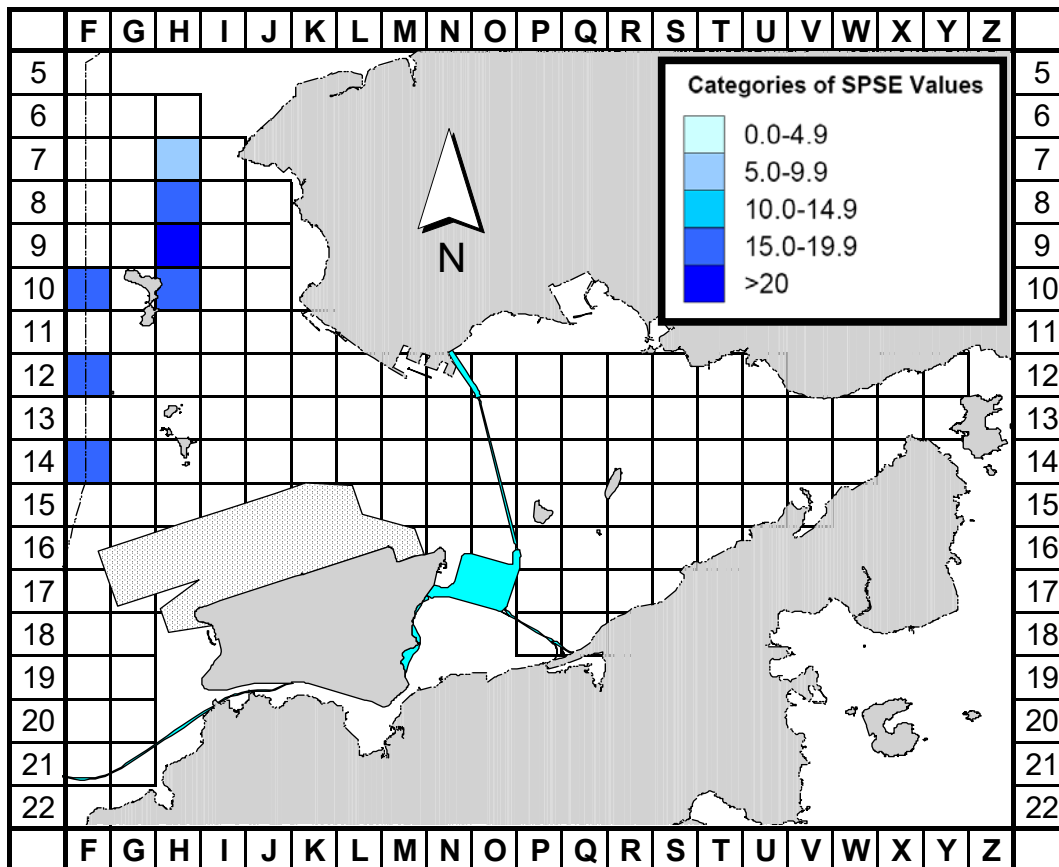


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km² in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (March-May 18) (SPSE = no. of on-effort sightings per 100 units of survey effort)

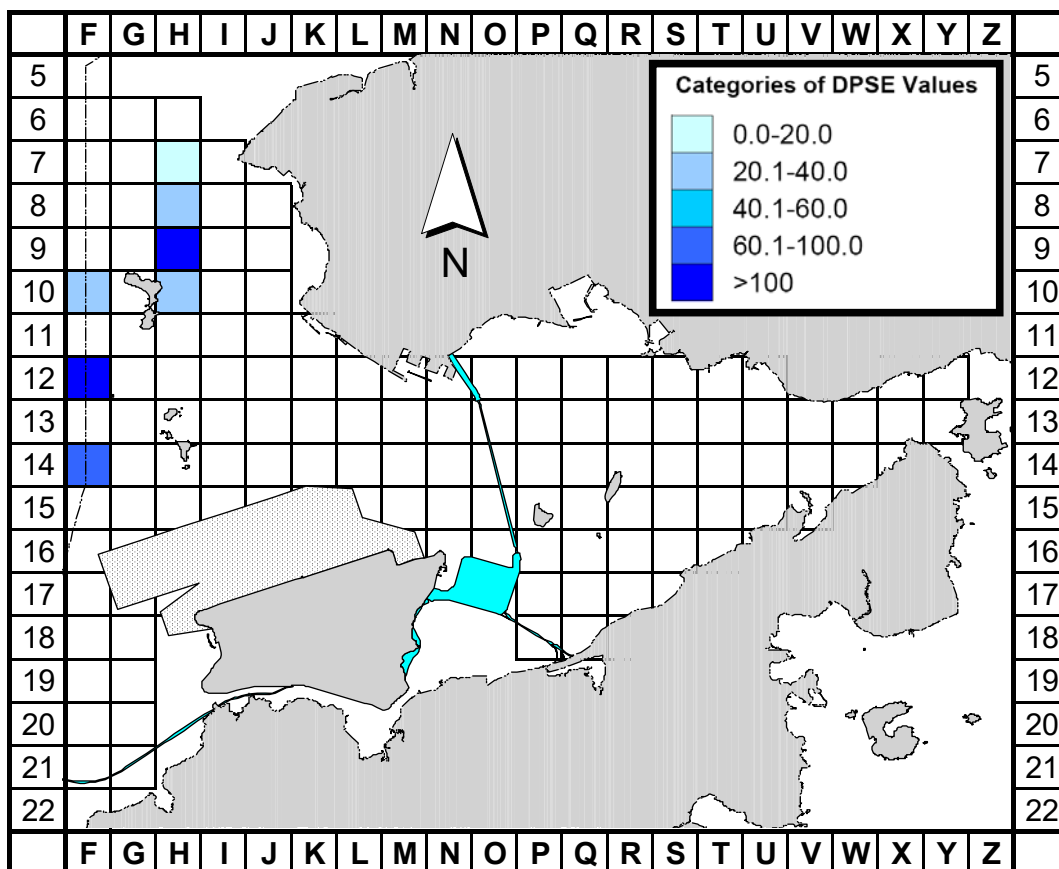


Figure 4b. Density of Chinese white dolphins with corrected survey effort per km² in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (March-May 18) (DPSE = no. of dolphins per 100 units of survey effort)

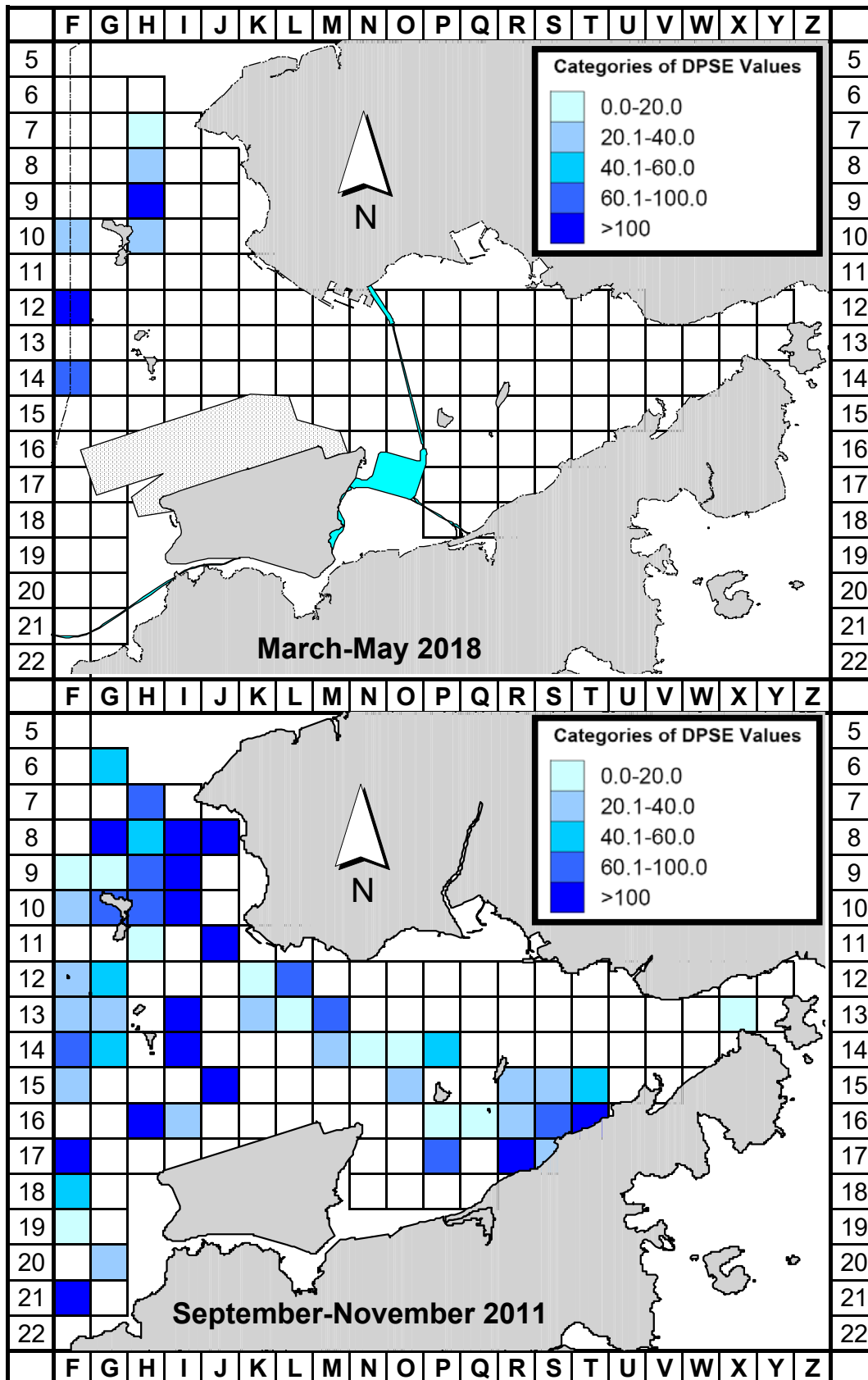


Figure 5. Comparison of density of Chinese white dolphins with corrected survey effort per km² in Northwest and Northeast Lantau survey area between the impact monitoring period (March - May 2018) and baseline monitoring period (September-November 2011) (DPSE = no. of dolphins per 100 units of survey effort)

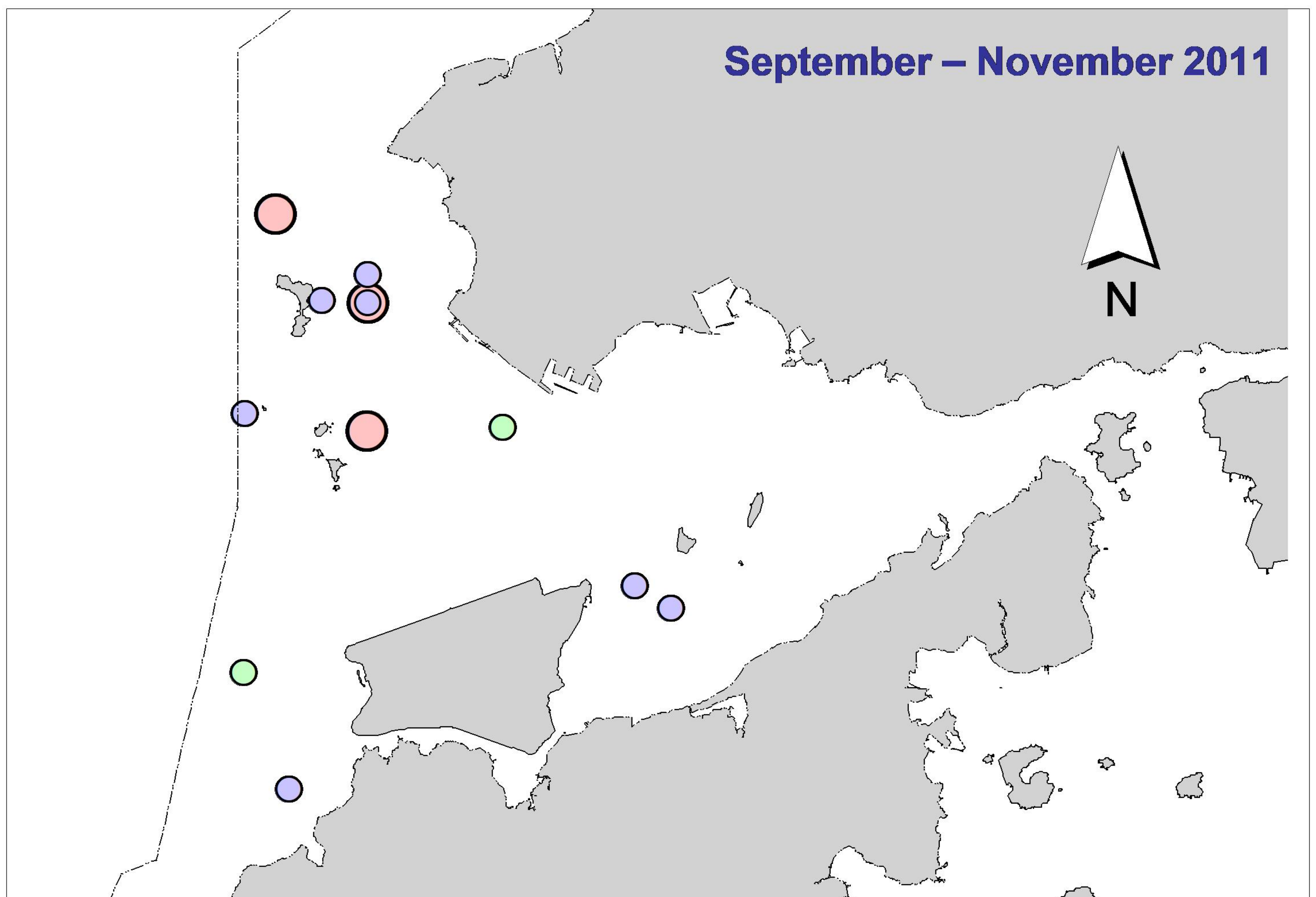
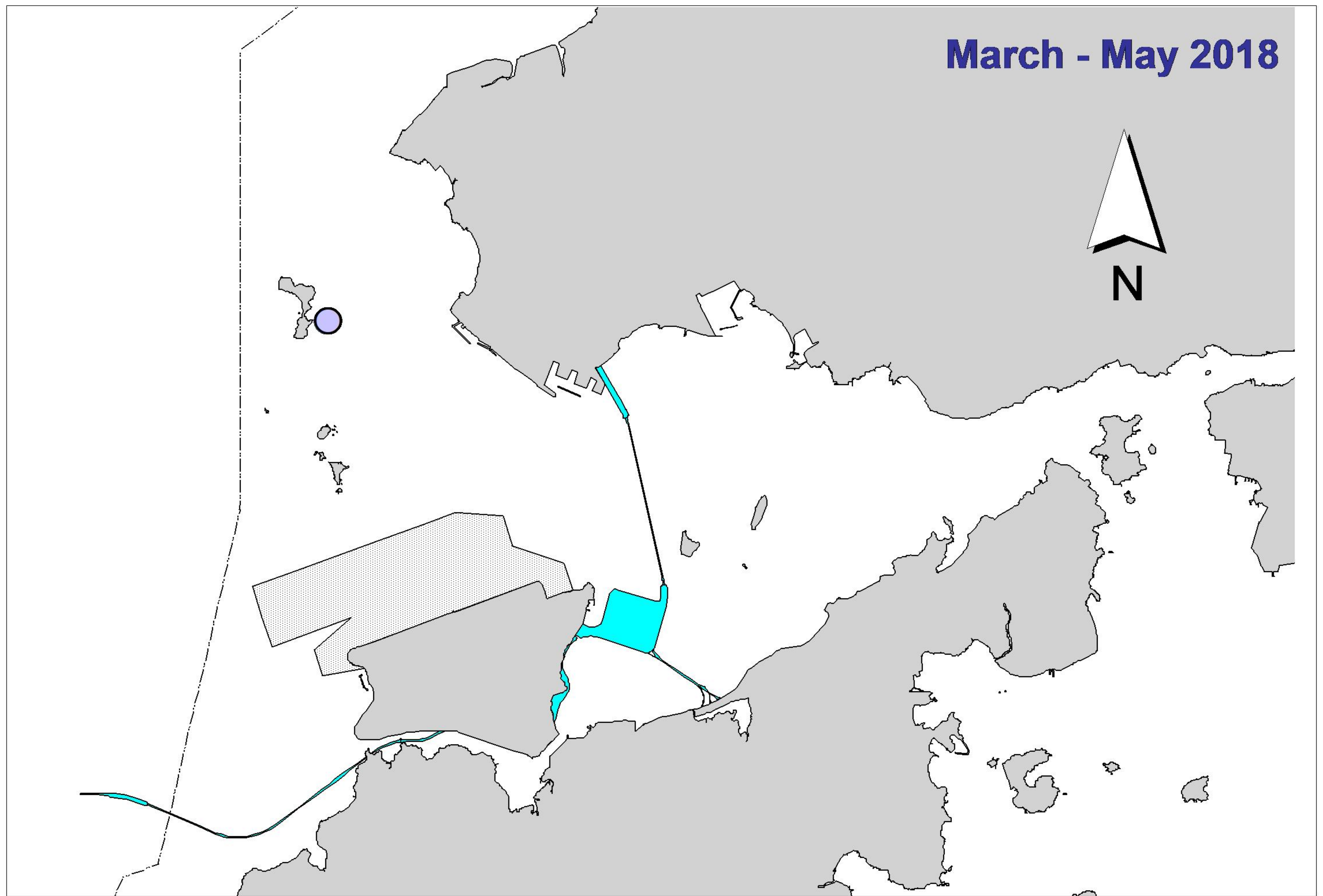


Figure 6. Distribution of Chinese white dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

Appendix I. HKLR03 Survey Effort Database (March-May 2018)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/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

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	NW LANTAU	2	9.66	SPRING	STANDARD36826	HKLR	S
25-Apr-18	NE LANTAU	2	36.91	SPRING	STANDARD36826	HKLR	P
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

Appendix II. HKLR03 Chinese White Dolphin Sighting Database (March-May 2018)

(Abbreviations: 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
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 III. Individual dolphins identified during HKLR03 monitoring surveys in March - May 2018

ID#	DATE	STG#	AREA
CH34	12/03/18	1	NW LANTAU
NL98	23/03/18	2	NW LANTAU
NL120	23/03/18	2	NW LANTAU
NL136	12/03/18	1	NW LANTAU
NL182	12/03/18	1	NW LANTAU
	19/04/18	2	NW LANTAU
NL226	23/03/18	2	NW LANTAU
	19/04/18	1	NW LANTAU
NL261	19/04/18	1	NW LANTAU
NL269	23/03/18	2	NW LANTAU
NL286	10/04/18	1	NW LANTAU
NL329	23/03/18	2	NW LANTAU
WL124	23/03/18	2	NW LANTAU
WL145	23/03/18	2	NW LANTAU
WL179	23/03/18	2	NW LANTAU
WL276	23/03/18	2	NW LANTAU

Appendix IV. Fourteen individual dolphins that were identified during March to May 2018 under HKLR03 impact phase monitoring surveys



Appendix IV. (cont'd)

NL182



NL226



NL261



NL269



Appendix IV. (cont'd)



NL286



NL329



WL124

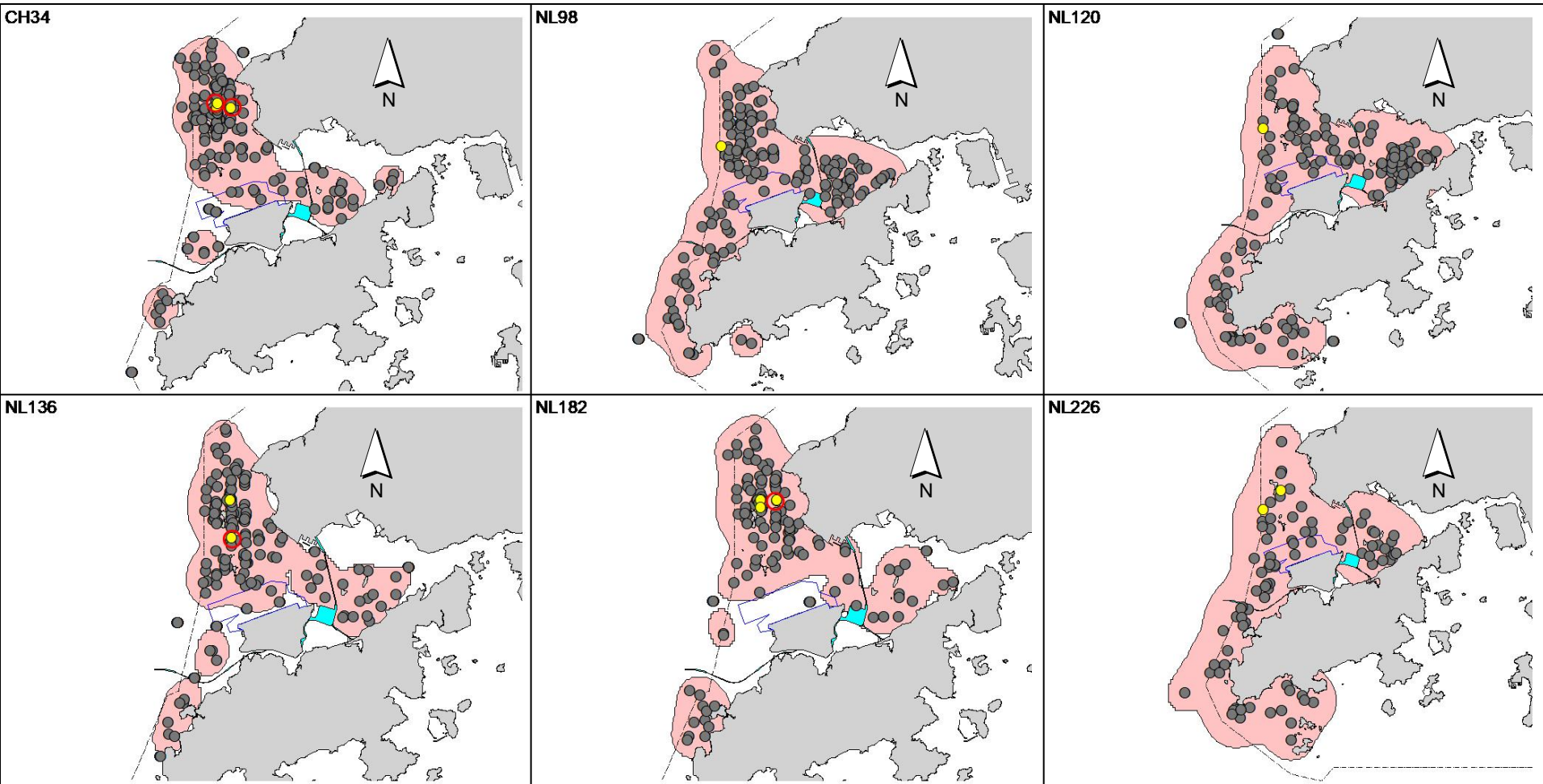


WL145

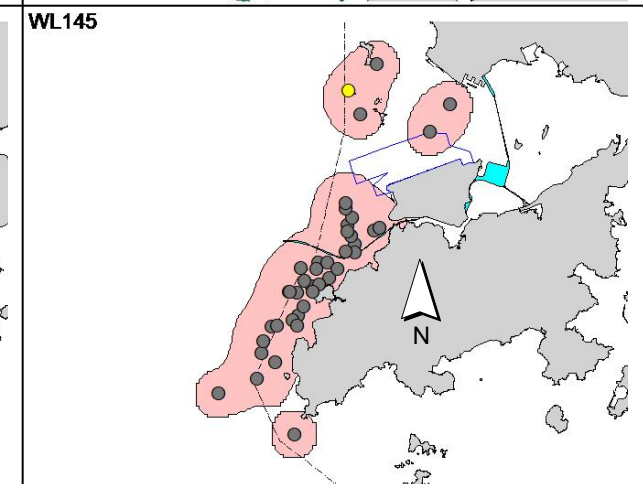
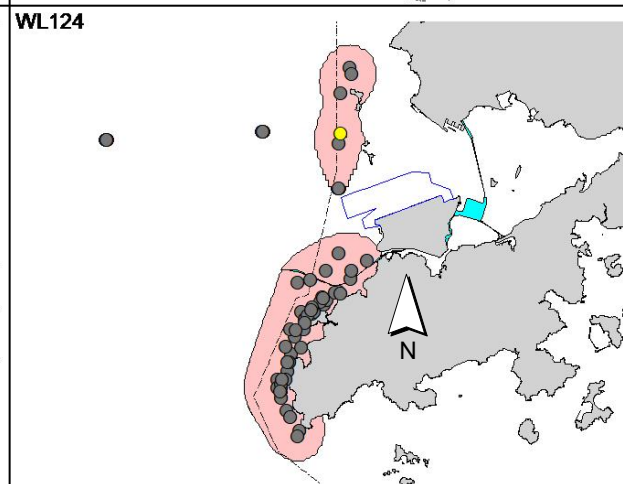
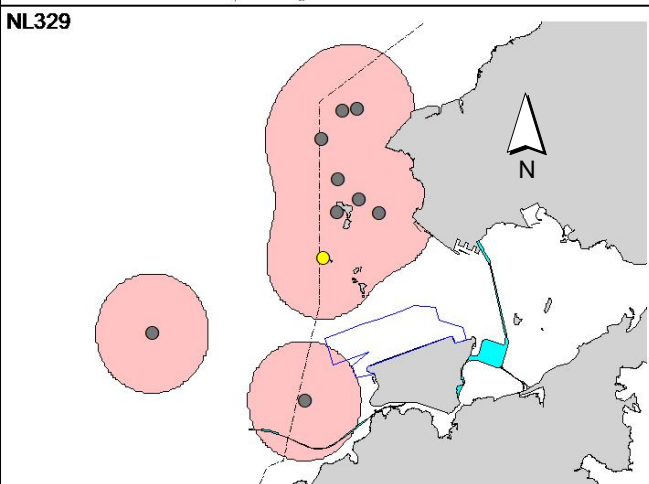
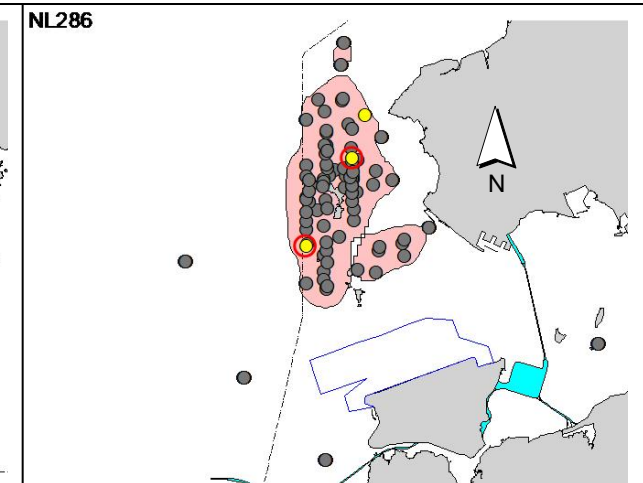
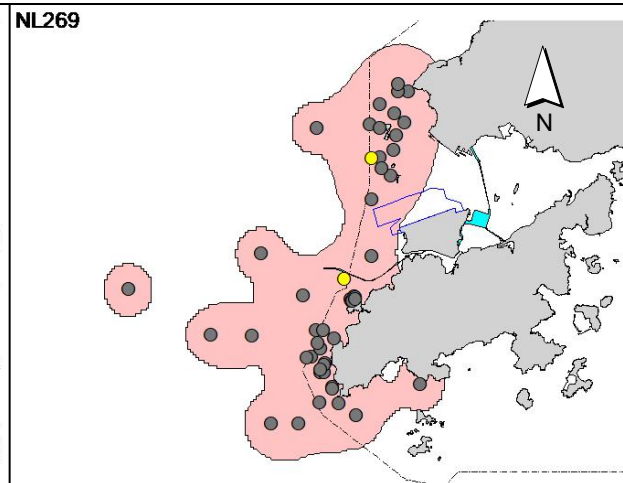
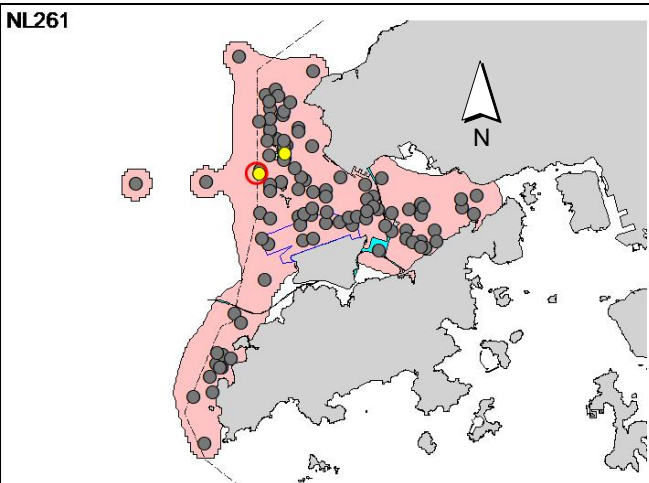
Appendix IV. (cont'd)



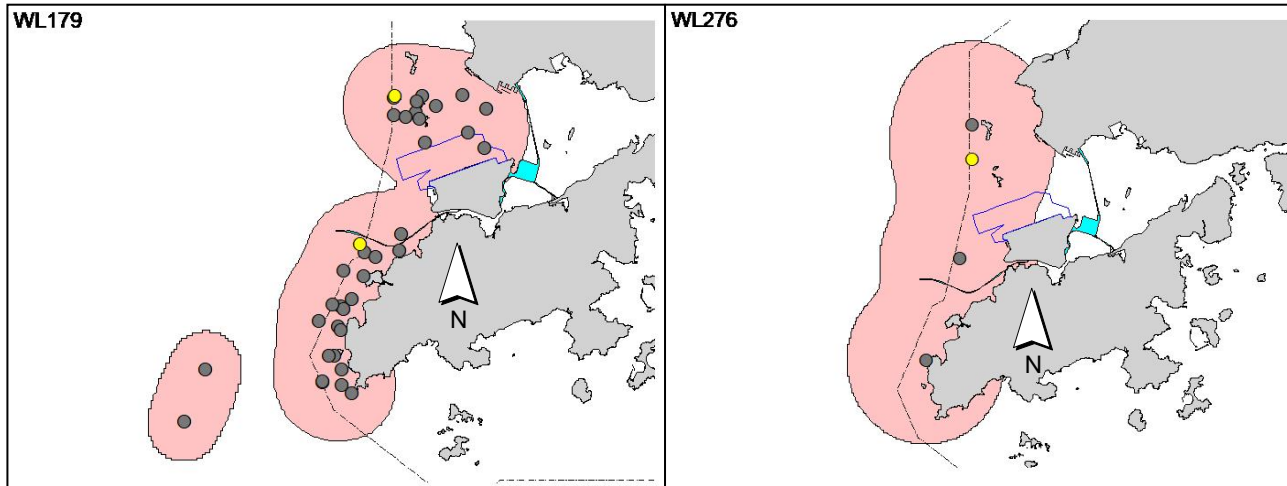
Appendix V. Ranging patterns (95% kernel ranges) of 14 individual dolphins that were sighted during HKLR03 impact phase monitoring period (note: yellow dots indicate sightings made in March-May 2018 during HKLR03 and HKLR09 monitoring surveys; the yellow dots with the red circles indicate the ones made during HKBCF monitoring surveys)



Appendix V. (cont'd)



Appendix V. (cont'd)



Appendix H

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

	Action			
	ET (a)	IEC (a)	SOR (a)	Contractor(s)
Limit Level Exceedance				
	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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 Dolphin Monitoring

EVENT	ACTION			
	ET	IEC	SOR	Contractor
Action Level	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET and Contractor; 2. Discuss monitoring results and finding with the ET and the Contractor. 	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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; 	<ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 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
	<ol style="list-style-type: none"> 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. 	<p>Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures.</p> <ol style="list-style-type: none"> 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. 	<p>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.</p> <ol style="list-style-type: none"> 3. Supervise the implementation of additional monitoring and/or any other mitigation measures. 	<p>potential mitigation measures.</p> <ol style="list-style-type: none"> 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 I

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

Table I1 *Cumulative Statistics on Exceedances*

Monitoring Parameters	Action/Limit Level	Total No. recorded in this reporting quarter	Total No. recorded since project commencement
1-Hr TSP	Action	3	66
	Limit	0	4
24-Hr TSP	Action	0	8
	Limit	0	4
Water Quality	Action	0	20
	Limit	0	1
Impact Dolphin Monitoring	Action	0	11
	Limit	1	12

Table I2 *Cumulative Statistics on Complaints, Notifications of Summons and Successful Prosecutions*

Reporting Period	Cumulative Statistics		
	Complaints	Notifications of Summons	Successful Prosecutions
This Reporting Period (March 2018 to May 2018)	0	0	0
Total No. received since project commencement	16	1	0

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To Ramboll Hong Kong, Limited (ENPO)

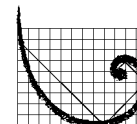
From ERM- Hong Kong, Limited

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

Subject Notification of Exceedance for Air Quality
Impact Monitoring

Date 16 March 2018

16/F Berkshire House,
25 Westlands Road
Quarry Bay, Hong Kong
Telephone: (852) 2271 3113
Facsimile: (852) 2723 5660
E-mail: jovy.tam@erm.com



ERM

Dear Sir or Madam,

Please find attached the Notification of Exceedance (NOE) of the following
Log no.:

0212330_2March2018_1hrTSP_Station ASR1

One Action Level Exceedance was recorded on 2 March 2018.

Regards,

A handwritten signature in black ink, appearing to be 'Jovy Tam', written in a cursive style.

Mr Jovy Tam
Environmental Team Leader

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ERM-Hong Kong, Limited

CONTRACT NO. HY/2012/08
 TUEN MUN – CHEK LAP KOK LINK –
 NORTHERN CONNECTION SUB-SEA TUNNEL SECTION

Air Quality Impact Monitoring
 Notification of Exceedance

Log No.	0212330_2March2018_1hrTSP_Station ASR1 [Total No. of Exceedances = 1]	
Date	2 March 2018 (Measured) 16 March 2018 (Laboratory results received by ERM)	
Monitoring Station	ASR1, ASR5, ASR6, ASR10 and AQMS1	
Parameter(s) with Exceedance(s)	1-hr TSP	
Action Levels	24-hr TSP ($\mu\text{g}/\text{m}^3$)	ASR1 = 213 ASR5 = 238 AQMS1 = 213 ASR6 = 238 ASR10 = 214
	1-hr TSP ($\mu\text{g}/\text{m}^3$)	ASR1 = 331 ASR5 = 340 AQMS1 = 335 ASR6 = 338 ASR10 = 337
Limit Levels	1-hr TSP ($\mu\text{g}/\text{m}^3$)	500
	24-hr TSP ($\mu\text{g}/\text{m}^3$)	260
Measured Levels	Action Level Exceedance for 1-hr TSP is observed at ASR1 ($460 \mu\text{g}/\text{m}^3$) during 0957 - 1057 hrs.	
Works Undertaken (at the time of monitoring event)	On 2 March 2018, box culvert extension was carried out at Works Area Portion N-A and Construction of Ventilation Building at Portion N-C.	
Possible Reason for Action or Limit Level Exceedance(s)	<p>The exceedance is unlikely to be due to the Project, in view of the following:</p> <ul style="list-style-type: none"> According to the construction information provided by the Contractor, the majority of ground construction works on 2 March 2018 were box culvert extension at Works Area Portion N-A and Construction of Ventilation Building at Portions N-C. During the period of the land-based construction works, the Contractor has implemented the required mitigation measures as per the EP, approved EIA and Updated EM&A Manual (e.g. water spraying on exposed soil within the Project site and associated works areas; exposed soil covered by tarpaulin sheets). The exceedances are unlikely to be due to the project as dust suppression measures were implemented properly on site. Water spraying was applied. Exposed soil at Portion N-A was also covered by tarpaulin sheets. <p>Based on the above, the exceedances are unlikely to be due to the project.</p>	

Actions Taken/ To Be Taken	<p>According to the photo record on 2 March 2018, the Contractor has properly implemented dust suppression measures on site. Follow up site inspection was carried out on 19 March 2018. Box culvert extension was carried out at Works Area Portion N-A and Construction of Ventilation Building was carried out at Portion N-C. Water spraying was applied to prevent dust. Photo record is provided in Annex A. Photos taken during AQM were also provided. No significant dust impact was observed at ASR1. Dust suppression measures were properly implemented during the site inspections.</p> <p>The Contractor has been reminded to implement the required mitigation measures as per the EP, approved EIA and Updated EM&A Manual including watering to maintain all exposed road surfaces and dust sources wet, use of sprinklers for water spraying, covering the materials having the potential to create dust by clean tarpaulin, use of water truck and watering on all exposed soil within the Project site) throughout the construction period. The Contractor was also reminded to ensure all dust mitigation measures are provided at Portion N-A and Portion N-C, where the construction works are carried out.</p> <p>As occasional exceedances were observed at ASR1, the Contractor has been reminded to enhance their dust mitigation measures at the works area, especially Portion N-A, which is closest to ASR1. Water spraying should be applied more frequently to prevent dust. The Contractor should also ensure that the exposed soil at Portion N-A was covered by tarpaulin sheets.</p>
Remarks	<p>The monitoring results and the locations of air quality monitoring stations are attached.</p>



Annex A Photos provided by the Contractor

*Note: Photos taken on 2/3/2018



Water spraying was applied frequently on site.
(Works Area Portion N-A)



Exposed soil at Portion N-A was covered by tarpaulin sheets. (Works Area Portion N-A)



Annex A Photos taken during site inspection

*Note: Photos taken on 19/3/2018



Water spraying was applied frequently on site.
(Works Area Portion N-C)



Water spraying was applied frequently on site.
(Works Area Portion N-B)



Annex A Photos taken during AQM monitoring

*Note: Photos taken on 2/3/2018



ASR1

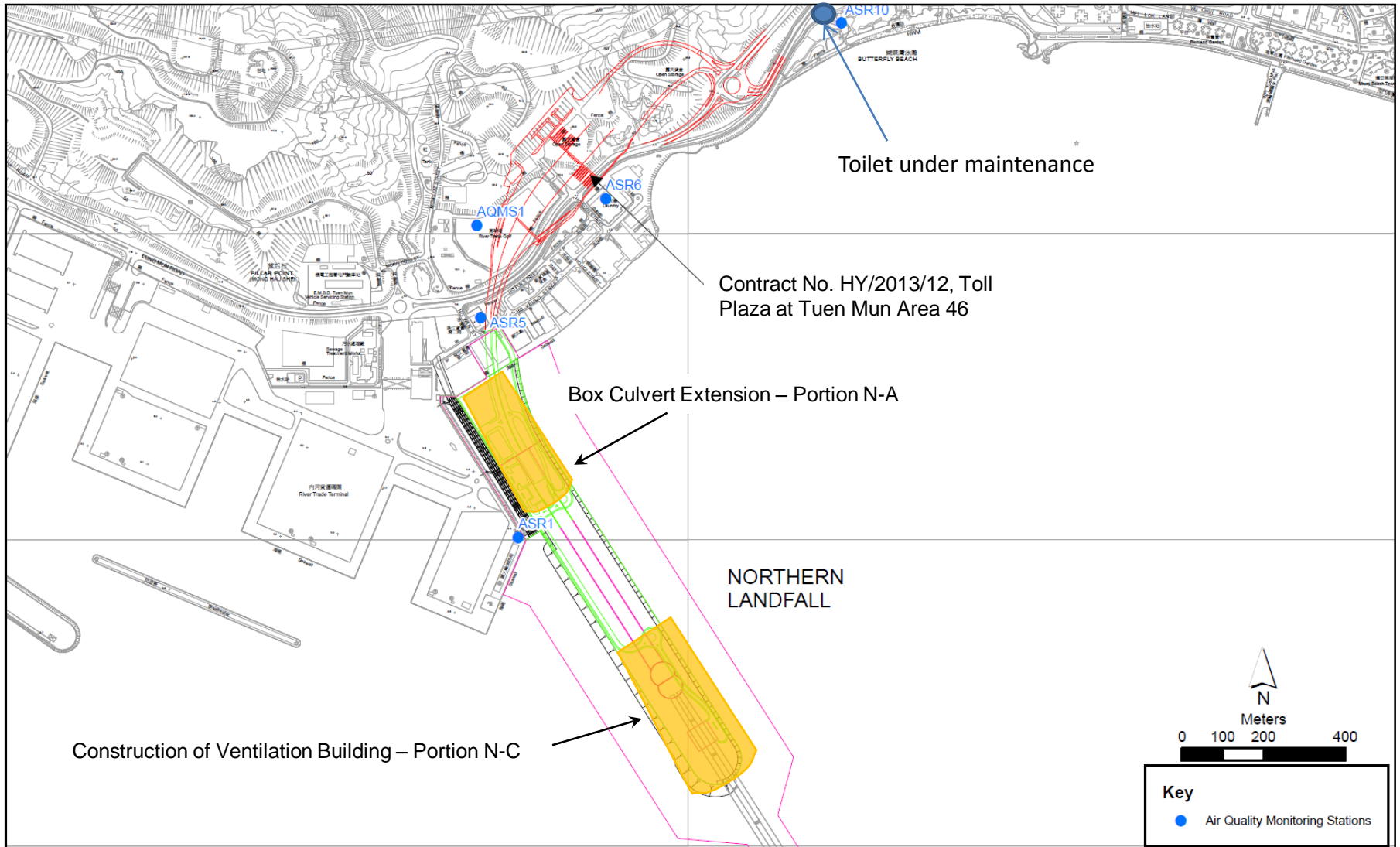


Figure 1

Indicative Construction Works Area on 2 March 2018

TMCLKL	HY/2012/08	2/3/2018	AQMS1	Sunny	9:07	1-hour TSP	156	ug/m3
TMCLKL	HY/2012/08	2/3/2018	AQMS1	Sunny	10:09	1-hour TSP	172	ug/m3
TMCLKL	HY/2012/08	2/3/2018	AQMS1	Sunny	11:11	1-hour TSP	131	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR1	Sunny	8:55	1-hour TSP	125	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR1	Sunny	9:57	1-hour TSP	460	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR1	Sunny	10:59	1-hour TSP	157	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR10	Sunny	8:22	1-hour TSP	63	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR10	Sunny	9:24	1-hour TSP	52	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR10	Sunny	10:26	1-hour TSP	59	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR5	Sunny	8:44	1-hour TSP	222	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR5	Sunny	9:46	1-hour TSP	183	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR5	Sunny	10:48	1-hour TSP	219	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR6	Sunny	8:32	1-hour TSP	92	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR6	Sunny	9:34	1-hour TSP	77	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR6	Sunny	10:36	1-hour TSP	81	ug/m3
TMCLKL	HY/2012/08	2/3/2018	AQMS1	Sunny	12:13	24-hour TSP	85	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR1	Sunny	12:01	24-hour TSP	108	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR10	Sunny	11:28	24-hour TSP	55	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR5	Sunny	11:50	24-hour TSP	130	ug/m3
TMCLKL	HY/2012/08	2/3/2018	ASR6	Sunny	11:38	24-hour TSP	71	ug/m3

Meteorological Data for Impact Monitoring in the reporting period			
Date (yy-mm-dd)	Time (24hrs)	Average of Wind Speed (m/s)	Average of Wind Direction(degree)
18/03/02	0:00	1.8	92
18/03/02	1:00	1.8	95
18/03/02	2:00	1.3	70
18/03/02	3:00	1.3	46
18/03/02	4:00	1.3	92
18/03/02	5:00	1.3	44
18/03/02	6:00	1.8	93
18/03/02	7:00	1.3	65
18/03/02	8:00	2.2	92
18/03/02	9:00	2.2	81
18/03/02	10:00	2.7	93
18/03/02	11:00	2.7	96
18/03/02	12:00	1.8	97
18/03/02	13:00	1.8	75
18/03/02	14:00	1.3	70
18/03/02	15:00	1.8	93
18/03/02	16:00	1.8	71
18/03/02	17:00	1.3	46
18/03/02	18:00	1.8	50
18/03/02	19:00	1.8	42
18/03/02	20:00	1.8	43
18/03/02	21:00	1.3	52
18/03/02	22:00	1.3	51
18/03/02	23:00	1.8	93

Email
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Environmental
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To Ramboll Hong Kong, Limited (ENPO)

From ERM- Hong Kong, Limited

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

Subject Notification of Exceedance for Air Quality
Impact Monitoring

Date 3 April 2018

16/F Berkshire House,
25 Westlands Road
Quarry Bay, Hong Kong
Telephone: (852) 2271 3113
Facsimile: (852) 2723 5660
E-mail: jovy.tam@erm.com



ERM

Dear Sir or Madam,

Please find attached the Notification of Exceedance (NOE) of the following
Log no.:

0212330_20March2018_1hrTSP_Station ASR1

One Action Level Exceedance was recorded on 20 March 2018.

Regards,

A handwritten signature in black ink, appearing to be 'Jovy Tam'.

Mr Jovy Tam
Environmental Team Leader

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ERM-Hong Kong, Limited

CONTRACT NO. HY/2012/08
 TUEN MUN – CHEK LAP KOK LINK –
 NORTHERN CONNECTION SUB-SEA TUNNEL SECTION

Air Quality Impact Monitoring
 Notification of Exceedance

Log No.	0212330_20March2018_1hrTSP_Station ASR1 [Total No. of Exceedances = 1]	
Date	20 March 2018 (Measured) 1 April 2018 (Laboratory results received by ERM)	
Monitoring Station	ASR1, ASR5, ASR6, ASR10 and AQMS1	
Parameter(s) with Exceedance(s)	1-hr TSP	
Action Levels	24-hr TSP ($\mu\text{g}/\text{m}^3$)	ASR1 = 213 ASR5 = 238 AQMS1 = 213 ASR6 = 238 ASR10 = 214
	1-hr TSP ($\mu\text{g}/\text{m}^3$)	ASR1 = 331 ASR5 = 340 AQMS1 = 335 ASR6 = 338 ASR10 = 337
Limit Levels	1-hr TSP ($\mu\text{g}/\text{m}^3$)	500
	24-hr TSP ($\mu\text{g}/\text{m}^3$)	260
Measured Levels	Action Level Exceedance for 1-hr TSP is observed at ASR1 (446 $\mu\text{g}/\text{m}^3$) during 1552 - 1652 hrs.	
Works Undertaken (at the time of monitoring event)	On 20 March 2018, box culvert extension was carried out at Works Area Portion N-A and Construction of Ventilation Building at Portion N-C.	
Possible Reason for Action or Limit Level Exceedance(s)	<p>The exceedance is unlikely to be due to the Project, in view of the following:</p> <ul style="list-style-type: none"> According to the construction information provided by the Contractor, the majority of ground construction works on 20 March 2018 were box culvert extension at Works Area Portion N-A and Construction of Ventilation Building at Portions N-C. During the period of the land-based construction works, the Contractor has implemented the required mitigation measures as per the EP, approved EIA and Updated EM&A Manual (e.g. water spraying on exposed soil within the Project site and associated works areas; exposed soil covered by tarpaulin sheets). The exceedances are unlikely to be due to the project as dust suppression measures were implemented properly on site. Water spraying was applied on site to prevent dust. <p>Based on the above, the exceedances are unlikely to be due to the project.</p>	

Actions Taken/ To Be Taken	<p>Follow up site inspection was carried out on 5 April 2018. Box culvert extension was carried out at Works Area Portion N-A and Construction of Ventilation Building was carried out at Portion N-C. Water spraying was applied to prevent dust. Photo record is provided in Annex A. Photos taken during AQM were also provided. No significant dust impact was observed at ASR1. Dust suppression measures were properly implemented during the site inspections. Based on the above, no additional action is required.</p> <p>The Contractor has been reminded to implement the required mitigation measures as per the EP, approved EIA and Updated EM&A Manual including watering to maintain all exposed road surfaces and dust sources wet, use of sprinklers for water spraying, covering the materials having the potential to create dust by clean tarpaulin, use of water truck and watering on all exposed soil within the Project site) throughout the construction period. The Contractor was also reminded to ensure all dust mitigation measures are provided at Portion N-A and Portion N-C, where the construction works are carried out.</p>
Remarks	<p>The monitoring results and the locations of air quality monitoring stations are attached.</p>



Annex A Photos taken during site inspection

*Note: Photos taken on 5/4/2018



Water spraying was applied frequently on site.
(Works Area Portion N-A)



Water spraying was applied frequently on site.
(Works Area Portion N-C)



Annex A Photos taken during site inspection

*Note: Photos taken on 5/4/2018



Water spraying was applied frequently on site.
(Works Area Portion N-C)



Water spraying was applied frequently on site.
(Works Area Portion N-C)



Annex A Photos taken during AQM

*Note: Photos taken on 20/3/2018



ASR1

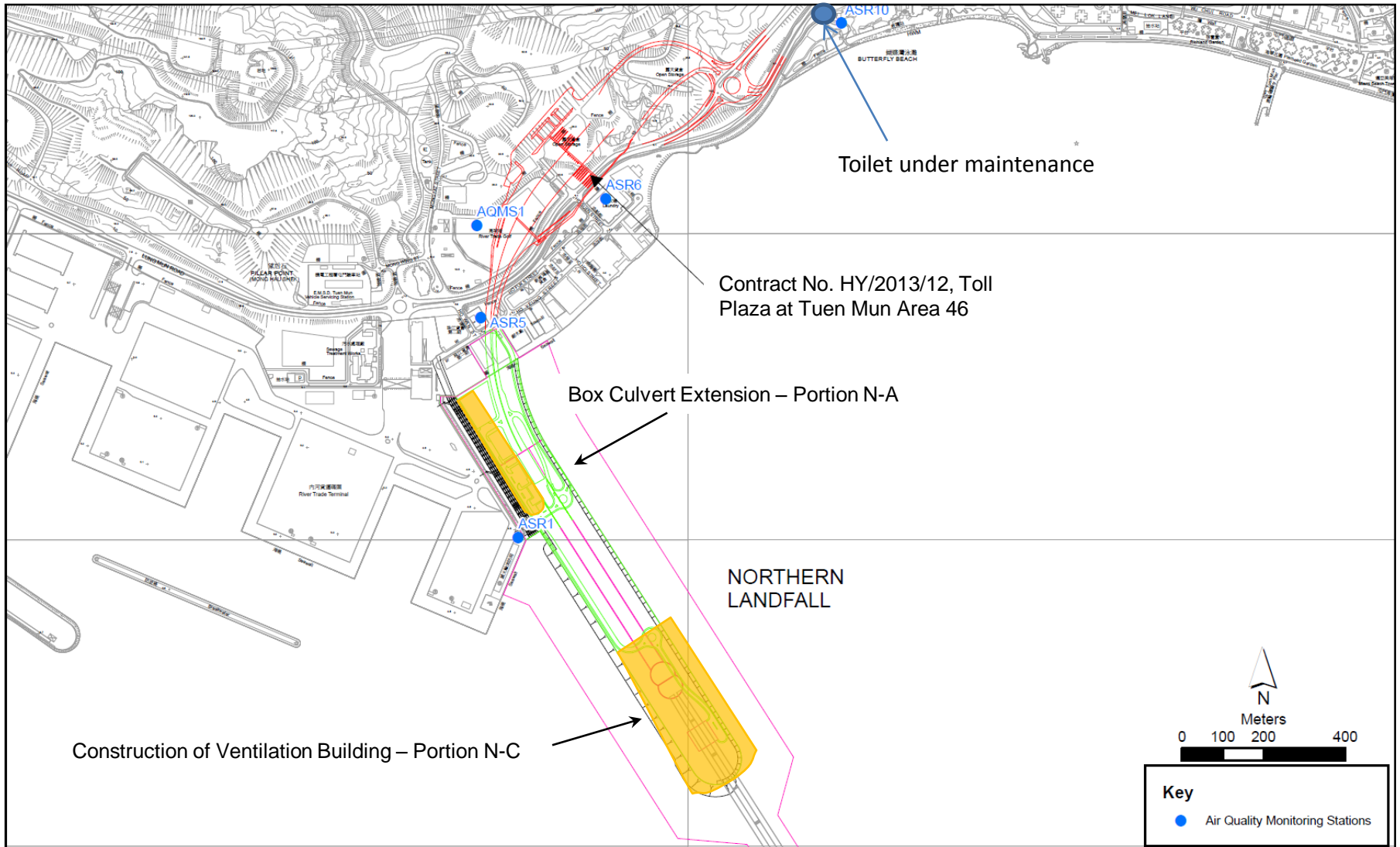


Figure 1

Indicative Construction Works Area on 20 March 2018

TMCLKL	HY/2012/08	20/3/2018	AQMS1	Sunny	14:00	1-hour TSP	85	ug/m3
TMCLKL	HY/2012/08	20/3/2018	AQMS1	Sunny	15:02	1-hour TSP	52	ug/m3
TMCLKL	HY/2012/08	20/3/2018	AQMS1	Sunny	16:04	1-hour TSP	51	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR1	Sunny	13:48	1-hour TSP	210	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR1	Sunny	14:50	1-hour TSP	233	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR1	Sunny	15:52	1-hour TSP	446	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR10	Sunny	13:16	1-hour TSP	69	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR10	Sunny	14:18	1-hour TSP	44	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR10	Sunny	15:20	1-hour TSP	48	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR5	Sunny	13:37	1-hour TSP	234	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR5	Sunny	14:39	1-hour TSP	180	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR5	Sunny	15:41	1-hour TSP	250	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR6	Sunny	13:27	1-hour TSP	169	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR6	Sunny	14:29	1-hour TSP	201	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR6	Sunny	15:31	1-hour TSP	163	ug/m3
TMCLKL	HY/2012/08	20/3/2018	AQMS1	Sunny	17:06	24-hour TSP	53	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR1	Sunny	16:54	24-hour TSP	123	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR10	Sunny	16:22	24-hour TSP	42	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR5	Sunny	16:43	24-hour TSP	90	ug/m3
TMCLKL	HY/2012/08	20/3/2018	ASR6	Sunny	16:33	24-hour TSP	82	ug/m3

Meteorological Data for Impact Monitoring in the reporting period			
Date (yy-mm-dd)	Time (24hrs)	Average of Wind Speed (m/s)	Average of Wind Direction(degree)
18/03/20	0:00	0	-
18/03/20	1:00	0.4	194
18/03/20	2:00	1.3	312
18/03/20	3:00	1.3	311
18/03/20	4:00	2.2	310
18/03/20	5:00	1.8	284
18/03/20	6:00	0.9	277
18/03/20	7:00	2.2	294
18/03/20	8:00	1.8	291
18/03/20	9:00	1.3	274
18/03/20	10:00	1.8	349
18/03/20	11:00	2.7	351
18/03/20	12:00	2.7	339
18/03/20	13:00	3.1	345
18/03/20	14:00	3.1	351
18/03/20	15:00	3.6	339
18/03/20	16:00	3.6	350
18/03/20	17:00	2.7	354
18/03/20	18:00	1.3	352
18/03/20	19:00	1.3	305
18/03/20	20:00	1.3	314
18/03/20	21:00	1.3	311
18/03/20	22:00	1.3	352
18/03/20	23:00	0.9	350

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**Environmental
Resources
Management**

To Ramboll Hong Kong, Limited (ENPO)

From ERM- Hong Kong, Limited

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

Subject Notification of Exceedance for Air Quality
Impact Monitoring

Date 27 April 2018

16/F Berkshire House,
25 Westlands Road
Quarry Bay, Hong Kong
Telephone: (852) 2271 3113
Facsimile: (852) 2723 5660
E-mail: jovy.tam@erm.com



ERM

Dear Sir or Madam,

Please find attached the Notification of Exceedance (NOE) of the following
Log no.:

0212330_13April2018_1hrTSP_Station ASR5

One Action Level Exceedance was recorded on 13 April 2018.

Regards,

A handwritten signature in black ink, appearing to be 'Jovy Tam'.

Mr Jovy Tam
Environmental Team Leader

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ERM-Hong Kong, Limited

CONTRACT NO. HY/2012/08
 TUEN MUN – CHEK LAP KOK LINK –
 NORTHERN CONNECTION SUB-SEA TUNNEL SECTION

Air Quality Impact Monitoring
 Notification of Exceedance

Log No.	0212330_13April2018_1hrTSP_Station ASR5 [Total No. of Exceedances = 1]	
Date	13 April 2018 (Measured) 27 April 2018 (Laboratory results received by ERM)	
Monitoring Station	ASR1, ASR5, ASR6, ASR10 and AQMS1	
Parameter(s) with Exceedance(s)	1-hr TSP	
Action Levels	24-hr TSP ($\mu\text{g}/\text{m}^3$)	ASR1 = 213 ASR5 = 238 AQMS1 = 213 ASR6 = 238 ASR10 = 214
	1-hr TSP ($\mu\text{g}/\text{m}^3$)	ASR1 = 331 ASR5 = 340 AQMS1 = 335 ASR6 = 338 ASR10 = 337
Limit Levels	1-hr TSP ($\mu\text{g}/\text{m}^3$)	500
	24-hr TSP ($\mu\text{g}/\text{m}^3$)	260
Measured Levels	Action Level Exceedance for 1-hr TSP is observed at ASR5 (389 $\mu\text{g}/\text{m}^3$) during 1438 – 1538 hrs.	
Works Undertaken (at the time of monitoring event)	On 13 April 2018, box culvert extension was carried out at Works Area Portion N-A and Construction of Ventilation Building at Portion N-C.	
Possible Reason for Action or Limit Level Exceedance(s)	<p>The exceedance is unlikely to be due to the Project, in view of the following:</p> <ul style="list-style-type: none"> According to the construction information provided by the Contractor, the majority of ground construction works on 13 April 2018 were box culvert extension at Works Area Portion N-A and Construction of Ventilation Building at Portions N-C. During the period of the land-based construction works, the Contractor has implemented the required mitigation measures as per the EP, approved EIA and Updated EM&A Manual (e.g. water spraying on exposed soil within the Project site and associated works areas; exposed soil covered by tarpaulin sheets). The exceedances are unlikely to be due to the project as dust suppression measures were implemented properly on site. Water spraying was applied on site to prevent dust. <p>Based on the above, the exceedances are unlikely to be due to the project.</p>	

Actions Taken/ To Be Taken	<p>According to the construction information provided by the Contractor, box culvert extension was carried out at Works Area Portion N-A and Construction of Ventilation Building was carried out at Portion N-C. Water spraying was applied to prevent dust. Photo record is provided in Annex A. Photos taken during AQM were also provided. No significant dust impact was observed at ASR5. Dust suppression measures were properly implemented during the site inspections. Based on the above, no additional action is required.</p> <p>The Contractor has been reminded to implement the required mitigation measures as per the EP, approved EIA and Updated EM&A Manual including watering to maintain all exposed road surfaces and dust sources wet, use of sprinklers for water spraying, covering the materials having the potential to create dust by clean tarpaulin, use of water truck and watering on all exposed soil within the Project site) throughout the construction period. The Contractor was also reminded to ensure all dust mitigation measures are provided at Portion N-A and Portion N-C, where the construction works are carried out.</p>
Remarks	<p>The monitoring results and the locations of air quality monitoring stations are attached.</p>



Annex A Photos provided by the Contractor

*Note: Photos taken on 13/4/2018



Water spraying was applied frequently on site.
(Works Area Portion N-B)



Water spraying was applied frequently on site.
(Works Area Portion N-C)



Annex A Photos provided by the Contractor

*Note: Photos taken on 13/4/2018



Water spraying was applied frequently on site.
(Works Area Portion N-A)



Water spraying was applied frequently on site.
(Works Area Portion N-C)



Annex A Photos taken during AQM

*Note: Photos taken on 13/4/2018



ASR5



ASR5

TMCLKL	HY/2012/08	13/4/2018	AQMS1	Sunny	13:59	1-hour TSP	121	ug/m3
TMCLKL	HY/2012/08	13/4/2018	AQMS1	Sunny	15:01	1-hour TSP	91	ug/m3
TMCLKL	HY/2012/08	13/4/2018	AQMS1	Sunny	16:03	1-hour TSP	80	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR1	Sunny	13:48	1-hour TSP	138	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR1	Sunny	14:50	1-hour TSP	72	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR1	Sunny	15:52	1-hour TSP	75	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR10	Sunny	13:14	1-hour TSP	79	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR10	Sunny	14:16	1-hour TSP	47	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR10	Sunny	15:18	1-hour TSP	41	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR5	Sunny	13:36	1-hour TSP	134	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR5	Sunny	14:38	1-hour TSP	389	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR5	Sunny	15:40	1-hour TSP	111	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR6	Sunny	13:25	1-hour TSP	67	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR6	Sunny	14:27	1-hour TSP	72	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR6	Sunny	15:29	1-hour TSP	70	ug/m3
TMCLKL	HY/2012/08	13/4/2018	AQMS1	Sunny	17:05	24-hour TSP	46	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR1	Sunny	16:54	24-hour TSP	62	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR10	Sunny	15:18	24-hour TSP	29	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR5	Sunny	16:42	24-hour TSP	68	ug/m3
TMCLKL	HY/2012/08	13/4/2018	ASR6	Sunny	16:31	24-hour TSP	43	ug/m3

Meteorological Data for Impact Monitoring in the reporting period			
Date (yy-mm-dd)	Time (24hrs)	Average of Wind Speed (m/s)	Average of Wind Direction(degree)
18/04/13	0:00	2.2	94
18/04/13	1:00	2.2	86
18/04/13	2:00	1.8	88
18/04/13	3:00	1.3	78
18/04/13	4:00	1.8	100
18/04/13	5:00	2.7	90
18/04/13	6:00	2.7	93
18/04/13	7:00	2.7	89
18/04/13	8:00	2.2	92
18/04/13	9:00	3.1	84
18/04/13	10:00	3.1	88
18/04/13	11:00	3.1	84
18/04/13	12:00	3.6	88
18/04/13	13:00	3.6	108
18/04/13	14:00	3.6	135
18/04/13	15:00	3.6	135
18/04/13	16:00	4	130
18/04/13	17:00	3.1	124
18/04/13	18:00	2.7	143
18/04/13	19:00	2.2	123
18/04/13	20:00	2.2	81
18/04/13	21:00	1.8	100
18/04/13	22:00	1.8	87
18/04/13	23:00	0.9	49

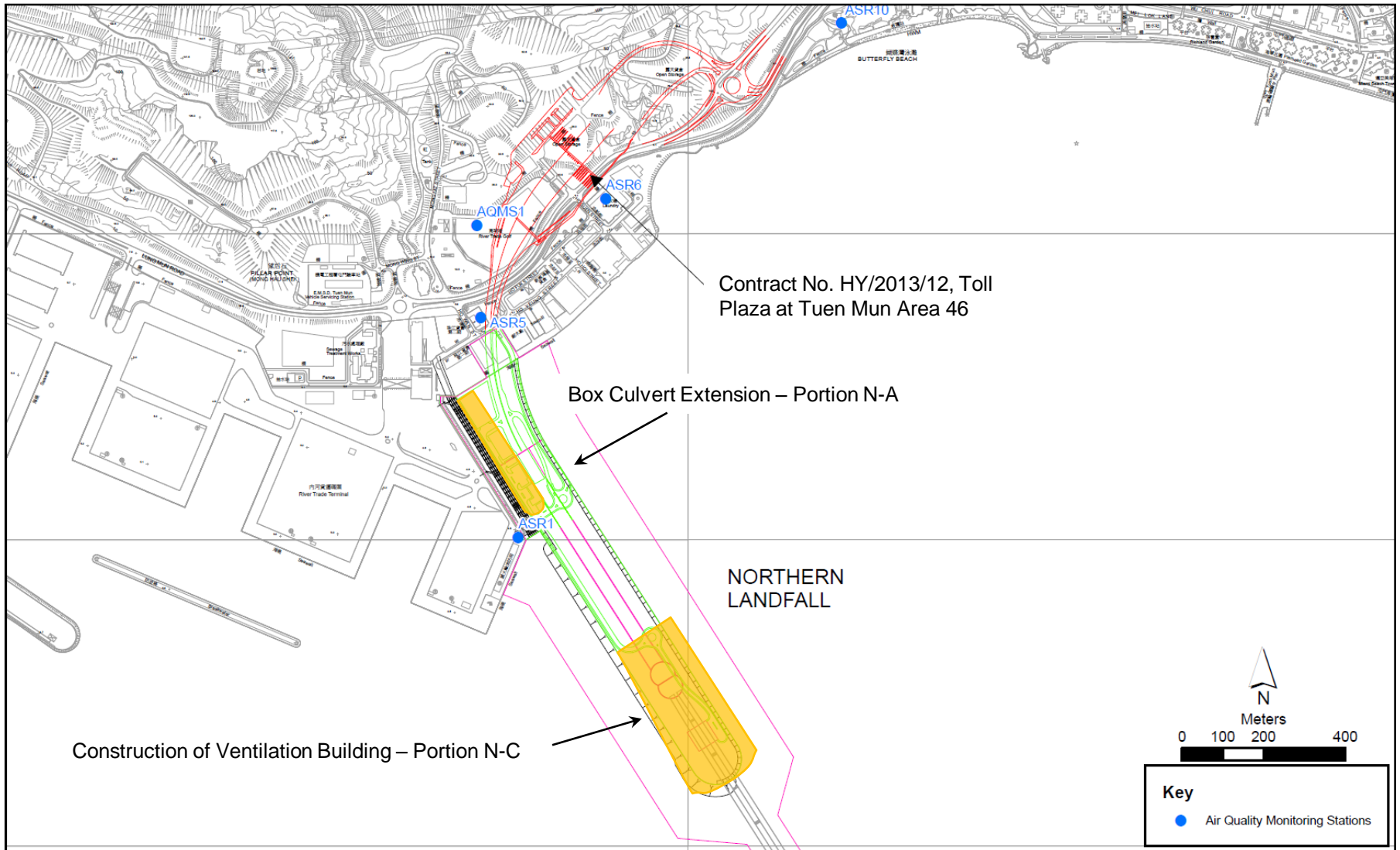


Figure 1

Indicative Construction Works Area on 13 April 2018

Email
message

Environmental
Resources
Management

To Ramboll Hong Kong, Limited (ENPO)

From ERM- Hong Kong, Limited

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

Subject Notification of Exceedance for Impact Dolphin
Monitoring

Date 13 June 2018

16/F Berkshire House,
25 Westlands Road
Quarry Bay, Hong Kong
Telephone: (852) 2271 3113
Facsimile: (852) 2723 5660
E-mail: jovy.tam@erm.com



ERM

Dear Sir or Madam,

Please find attached the Notification of Exceedance (NOE) of the following
Log no.:

0212330_Mar2018/May2018_dolphin_STG&ANI_NEL&NWL

A total of one limit level exceedance was recorded in the quarterly impact
dolphin monitoring data between March 2018 and May 2018.

Regards,



Mr Jovy Tam
Environmental Team Leader

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ERM-Hong Kong, Limited

CONTRACT NO. HY/2012/08

TUEN MUN – CHEK LAP KOK LINK –

NORTHERN CONNECTION SUB-SEA TUNNEL SECTION

**Impact Dolphin Monitoring
Notification of Exceedance**

Log No.	0212330_Mar/May2018_dolphin_STG&ANI_NEL&NWL [Total No. of Exceedances = 1 Limit Level Exceedance]	
Date	March to May 2018 (monitored) 23 August 2018 (results received by ERM)	
Monitoring Area	Northeast Lantau (NEL) and Northwest Lantau (NWL)	
Parameter(s) with Exceedance(s)	Quarterly encounter rate of dolphin sightings (STG) Quarterly encounter rate of total number of dolphins (ANI)	
Action Levels	North Lantau Social cluster	NEL: STG < 4.2 & ANI < 15.5 or NWL: STG < 6.9 & ANI < 31.3
Limit Levels		NEL: STG < 2.4 & ANI < 8.9 and NWL: STG < 3.9 & ANI < 17.9
Recorded Levels	NEL	STG = 0 & ANI = 0
	NWL	STG = 2.88 & ANI = 11.12
	One Limit Level Exceedance was recorded in the quarterly impact dolphin monitoring at NEL and NWL between March and May 2018. The exceedance was reported in the approved <i>Fifty-fifth Monthly EM&A Report</i> dated 13 June 2018.	
Statistical Analyses	<p>Further to the review of the available and relevant dolphin monitoring data in the EM&A programme by this Contract, statistical analyses were conducted as follows:</p> <ul style="list-style-type: none"> • A two-way ANOVA with repeated measures and unequal sample size was conducted using Period (2 levels: baseline vs impact – present impact quarter, March to May 2018) and Location (2 levels: NEL and NWL) as fixed factors to examine whether there were any significant differences in the average encounter rates between the baseline and present impact monitoring quarter. By setting $\alpha = 0.05$ as the significance level in the statistical tests, significant differences in STG ($p = 0.0095$) and ANI ($p = 0.0390$) were detected between Periods. • A two-way ANOVA with repeated measures and unequal sample size was conducted using Cumulative Period (2 levels: baseline vs impact – cumulative quarters, December 2012 to August 2017) and Location (2 levels: NEL and NWL) as fixed factors to examine whether there were any significant differences in the average encounter rates between the baseline and cumulative impact monitoring quarter. By setting $\alpha = 0.00001$ as the significance level in the statistical tests, significant difference in STG ($p = 0.000000$) and in ANI ($p = 0.000000$) between Cumulative Period and Location were detected. <p>*Note: The commencement date under <i>Contract No. HY/2012/08</i> is 1 November 2013.</p>	
Works Undertaken (in the monitoring quarter)	In the quarter between March and May 2018, no marine works was undertaken under Contract No. HY/2012/08.	

<p>Possible Reason for Action or Limit Level Exceedance(s)</p>	<p>The potential factors that may have contributed to the observed exceedance are reviewed below:</p> <ul style="list-style-type: none"> • Blocking of CWD travelling corridor: The <i>Monitoring of Marine Mammals in Hong Kong Waters (2017 – 18)</i> ⁽¹⁾ reported that dolphin usage and traveling activities to the northern side of the airport (dolphin traveling corridor) are affected by frequent high-speed ferry traffic from Sky Pier (not related to this Contract), which is likely a major factor resulting in the decrease in dolphin abundances in North Lantau. • Marine works of the Contract: As per the findings from the EIA report (<i>Section 8.11.9</i>), the major influences on the Chinese White Dolphin (CWD) <i>Sousa chinensis</i> under this Contract are marine traffics, reclamation and dredging works. The Contractor implemented the marine traffic control in the reporting period as per the requirements in the <i>EP-354/2009/D</i> and the updated <i>EM&A Manual</i>. Most of the vessels of this Contract also worked within the site boundary, in which the area is seldom used by CWD. Disturbance from vessels of this Contract is considered minor. Seawall enhancement works and the seawall construction and filling works were completed on 19 December 2017. During this quarter of dolphin monitoring, no adverse impact on CWD due to the activities under this Contract was observed. <p>In view of the above, marine ecological mitigation measures were considered properly implemented, and thus no unacceptable impact on CWD or its habitat was associated with this Contract in this quarter.</p>
<p>Actions Taken/ To Be Taken</p>	<p>In the quarter between March and May 2018, no marine based works were carried out.</p> <p>The existing mitigation measures are recommended to be continuously implemented. Furthermore, it is also recommended to reduce the vessels for marine works as much as possible. The ET will monitor for future trends in exceedance(s).</p> <p>A joint team meeting was held on 4 September 2018 for discussion on CWD trend, with attendance of ENPO, Representatives of Resident Site Staff (RSS), Representatives of Environmental Teams (ETs) for Contract No. HY/2013/01, HY/2011/03, HY/2012/07 and HY/2012/08. The discussion/recommendation as recorded in the minutes of the meeting, which might be relevant to this Contract are summarized below. It was concluded that the HZMB works is one of the contributing factors affecting the dolphins. It was also concluded the contribution of impacts due to the HZMB works as a whole (or individual marine contracts) cannot be quantified or separate from the other stress factors. ENPO presented the interim CWD survey results in mainland waters obtained from Hong Kong-Zhuhai-Macao Bridge Authority that some CWDs that previously more often sighted in Hong Kong waters have expanded their ranges into mainland waters, and some with reduced usage in Hong Kong waters, while they are partially accounted for the local decline. It was reminded that the ETs shall keep reviewing the implementation status of the dolphin related mitigation measures and remind the contractors to ensure the relevant measures are fully implemented. The ETs were also reminded to update the Brothers Marine Park (BMP) boundary in the Regular Marine Travel Route Plan. It was recommended that the marine works of HZMB projects should be completed as soon as possible to reduce the overall duration of impacts and allow the dolphins population to recover as early as possible. The participants were also reminded that the protection measures (e.g. speed limit control) for the BMP shall be implemented so as to provide a better habitat for dolphin recovery. It is noted that even though marine vessels may moor within the mooring site of BMP, commercial activities including loading / unloading / transshipment are not allowed except a permit is obtained. The HZMB works vessels were recommended to avoid the BMP. It was also recommended that the marine works footprint and vessels for the marine works should be reduced as much as possible, and vessels idling / mooring in other part of the North Lantau shall be avoided whenever possible.</p> <p>Dolphin specialists of the Projects confirmed that the CWD sighting nearby north of Sha Chau and Lung Kwu Chau Marine Park has significantly declined. The reason for the decline was likely related to the re-routing of high-speed ferry from Sky Pier. The CWDs in the area should be closely followed.</p>
<p>Remarks</p>	<p>The results of impact dolphin monitoring, the status of implemented marine ecological mitigation measures are documented in the approved <i>Fifty-third to Fifty-fifth Monthly EM&A Reports</i>.</p>

(1) Hung S K Y (2017). Prepared for AFCD. Available at: https://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/files/Final_Report_2016_17.pdf

Appendix J

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 May 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 <u>Inert</u> 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					
Half Year Sub-total					
Jul-2018					
Aug-2018					
Sep-2018					
Oct-2018					
Nov-2018					
Dec-2018					
Project Total Quantities	1549.267	0.000	0.000	175.744	1373.521

Month	Actual Quantities of <u>Non-inert</u> 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	0.000	0.000	0.686
Jun-2018									
Half Year Sub-total									
Jul-2018									
Aug-2018									
Sep-2018									
Oct-2018									
Nov-2018									
Dec-2018									
Project Total Quantities	1635.740	1635.740	4.850	4.850	6.870	6.870	46.550	46.550	10.215

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)
50.000	0.000	0.000	30.000	50.000

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)
150.000	0.000	0.000	5.000	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 m³. (**ER Part 8 Clause 8.8.5 (d) (ii)** refers).